ESEARCH CONCERNING THE ESTIMATION METHODS OF THE PARENT MATERIAL STRATIFICATIONS

CERCETĂRI PRIVIND METODELE DE ESTIMARE A STRATIFICĂRII MATERIALULUI PARENTAL

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Abstract: *In this paper we studied the methods of the parent material stratification. Soil profiles from different regions and different soil types were investigated. The majority of the soil profiles with stratified parental materials and even the eolian materials deposited continuously during a long time.*

Rezumat: *În această lucrare sunt studiate metode de estimare a stratificării materialului parental. Au fost cercetate diverse tipuri de soluri din diferite regiuni. Majoritatea solurilor au profilele cu materiale parentale stratificate reprezentate prin depozite eoliene depuse continuu în timp.*

Key words: *soil profiles, parental material, index of textural differentiation*
Cuvinte cheie: *profile de sol, material parental, indice de diferențiere texturală*

INTRODUCTION

Soil profiles from diverse regions of our country and different soil types were investigated. The parent material stratifications do not determine the successive deposits accumulated in the time but only the texture variation of the parent materials.

In order to estimate these variation were used the fraction ratios (0.2.-0.02mm)/ (2-0.2 mm), (0.2-0.02mm)/ (0.2-0.05 mm) and (0.2-0.02 mm)/ (0.02/0.002 mm) noted by nf/ng, nf/nm and nf/p respectively. The nf/ng ratio does not prove useful because of absence of the coarse sand fraction in many profiles or its values are in the limits of determination method errors (0.5%). The nf/p ratio has frequently limits with small amplitudes difficult to interpret and in addition it can be altered during the pedogenetical processes. The nf/nm ratio appears to be preferable although it requires in addition the determination of (0.2-0.05 mm) fraction.

The limits of parental strata were considered the inflexion points on the curve nf/nm - depth. Generally the majority of the soils have their profiles with stratified parental materials and even the eolian materials deposited continuously during a long time.

MATERIAL AND METHODS

It has been selected from guides of Romanian National Soil Sciences Society excursion, granulometric analyses effectuated through Kacinski methods and through dispersion with hexametafosfat. Cautions change capacity it has through CERNESCU (1939) method and pH was electrometric determined. It has been calculated ratio fractions (0.2-0.02 mm)/(2-0.2 mm) noted with nf/ng, that we named stratification report.

For results comparison was calculated stratifications index through horizon individual report division with average value of report profile sample. Also it has calculated textural differentiations index corrected through division of the textural differentiations index with nf/nm report.

RESULTS AND DISCUSSION

Stratifications report of the parental material

In pedology soil profiles is defined after there genetic horizon and generally it has précised parental material (loess, alluvia, eluvial-iluvial deposit, etc). But parental materials are deposits there formed under water action (alluvia), wind (loess), ramp trickling (colluviums, delluviums), or consolidate rocks alteration. Thus deposits it has formed through cvasi-continuous deposited (loess, detritus) or through repeated accumulations (alluvium). For parental material definition it has shall utilize these soil properties that is not little changed or modifying as result as soil formation processes. Because soil particles have less altered if their dimension were bigger was used ratio of such fractions for parental material characterization. For verifying values of such criteria was calculated fractions report (0.2-0.02 mm)/(2-0.2 mm), (0.2-0.02 mm)/(0.2-0.05 mm) and (0.2-0.02 mm)/(0.02-0.002 mm) noted with nf/ng, nf/nm and respectively nf/p.

At profile 1 fluvi-eutric cambisol from Cheveres (Timis), pH, alkali saturation degree V%, change calcium expressed in % from T (fig. 1) decline with deep from At horizon (0-15 cm) until Ao_2 (30-40 cm) then grow with deep until C_{n2} (160-200 cm). For to be able to represented the four properties in one single diagram and make in evidence oscillation of their analytic value, pH values was multiplying with four, and saturation degree V% was divided at two. In chart have elapsing principal values of two modified properties like values. In change clay content oscillating between 42.5% and 40.9% between At (0-15 cm) and AB (44-60 cm) and then grow with deep until Cn_1 (125-140 cm) then decline again in Cn_2 (160-200 cm).

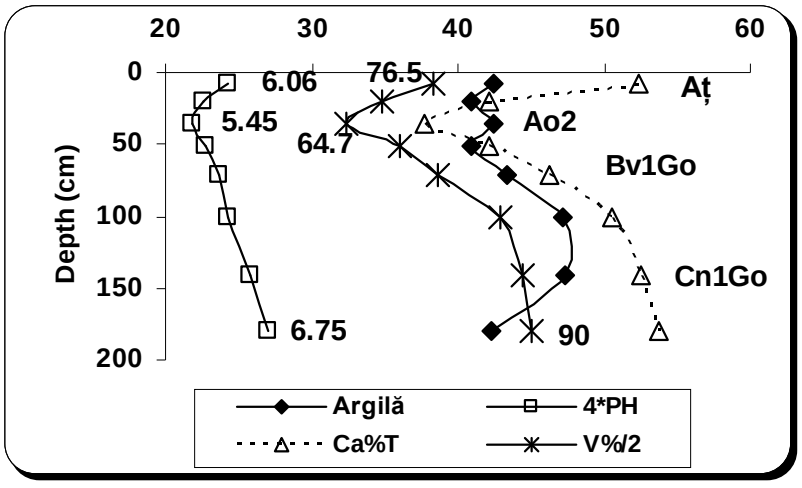

Figure 1. Variation with the depth of some properties of the soil profile 1 at Cheveres

Clay content variation in function with deep and harsh fractions report (fig. 2) is giving back by irregular trajectories with break in a curve points. Fractions report grows then when grow deep. If is considered conventional that direction change has corresponded with parental batch limit, then soil profile has four parental batches with limit in Ao_2, between AB and Bv_1 and in Bv_2 for nf/ng report, between Ao_1 and Ao_2, between AB and Bv_1, and between Bv_2 and Cn_1 for nf/nm report, and in Ao_1, in Bv_1, and under Bv_2, for nf/p report. In change clay may be considered that has one batch with fluctuated texture from At until AB and a limit between Bv_2 and Cn_1. Direction changes amplitude decline in order of nf/p, nf/ng and nf/nm.

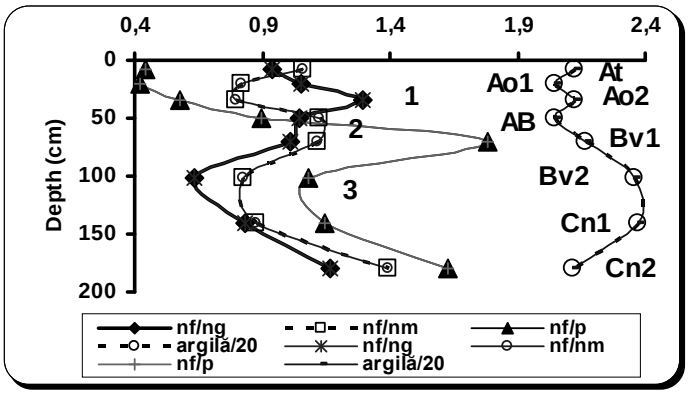

Figure 2. Repartition with the depth of clay content and stratification ratios at profile 1 Cheveres

Compared result of the three reports it can say that limit of the four parental batches are between Ao_1 (10-26 cm) and Ao_2 (26-40 cm), between AB (44-61 cm) and Bv_1 (61-81 cm) and between Bv_2 (1-120 cm) and Cn_1 (120-160 cm). It has observed that little differences at determined limits by reports especially in surface horizons when these not coincide, been Ao_1 - Ao_1/Ao_2 and Ao_2 for nf/ng, nf/nm and nf/p reports. The other two limits can be appreciated at Bv_1 surface horizon and at Bv_2 base horizon.

Profile morphologic description approaching clear transit between Bv_1 and Bv_2 and between Bv_2 and Cn_1. Result that clear transit between Bv_1 and Bv_2 it isn't appear in successions of the three ratio, it isn't adverting parental material and is observed in terrain through structure and colour differences, because of reduction process. Also it has observed that little accentuated limits at surface samples is in Ao_1, Ao_1/Ao_2 and Ao_2 at nf/ng, nf/nm and nf/p ratio, produced by incipient forming of one settle batches. At other two limits it is concordance between results and it has appreciated that limits are at surface at B_{v1} and B_{v2} base. Results obtained showed that not all clear limits observed in terrain are textural limit at the parental material.

At west chernozem from Urleasca (Ialomita) developed on loess, soil has formed through continuous deposit time of millennium at an eolian contribute with a rate by 2-4 cm/century (Gh. Gâță et al., 2000). Climatic and eolian contributes variations has produced fluctuation in deposited material. Indeed variation by deeper at clay content and of three harsh fractions ratio (fig. 3) present irregular trajectories with amplitude were decline in order nf/ng, nf/nm and nf/p. Clay content decline with altitude through small changes in Ap (10-20 cm), Amk (20-45 cm), Cca_1 (110-120 cm), Cca_2 (130-140 cm), Cca_3 (205-225 cm) horizons. Variations with small amplitudes show that eolian contribution varied at least once with climatic variation from last part of the holocene period.

Clay content and all three ratio has generally different limits and just three of them are common, Ap (10-20cm), Cca_1 (110-120 cm) and Cca_3 (205-225 cm). While clay and nf/ng or nr/p ratio has six limits, ratio nf/nm has five limits. More it is large differences in curve amplitudes and we tented believed the most advantage nf/ng ratio because has the bigger fluctuations. But harsh sand content (2-0.2 mm) varied between 0.1-0.3%, values in limit of the analyze method errors and can introduce false limits in parental batch appreciations. In that way can explain limit from Amk (25-40 cm). In change variation of nf/p ratio and clay witch small fluctuations can be subjective interpreted. The clearest curve appears in nf/nm-deep and conventionally must take in consideration this limit.

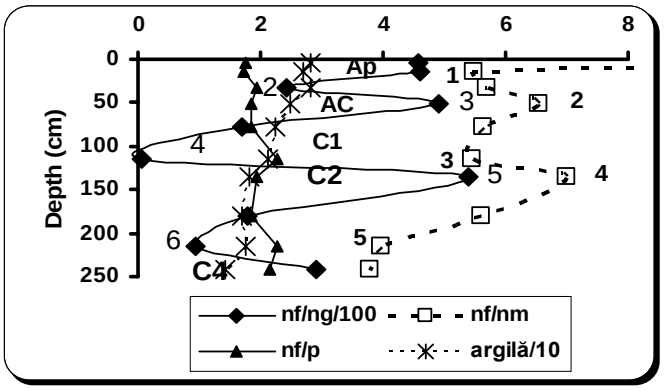

Figure 3. Repartition with the depth of clay content and stratification ratios at Urleaca chernozem

For minimize subjectivism in choosing of stratification ratio has calculated relative ratio named stratification index, idle values obtained through division of each horizon ratio with average value at entire profile samples. Clay variation chart and relative ratio (fig. 4) shows that it limits little changed for the other curves. In that case will be preferable nf/nm ratio but generally uses of the relative ratio not justify used of such diagrams.

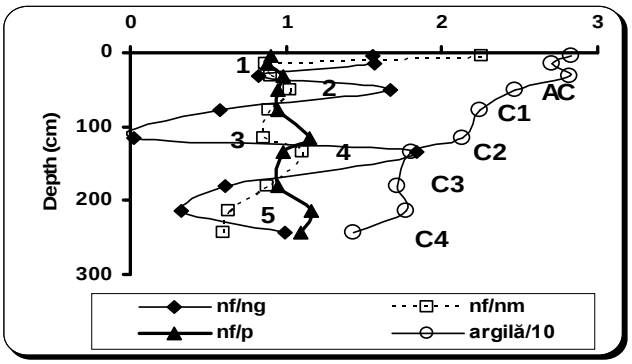

Figure 4. Variation with the depth of clay content and of the stratification indices at Urleasca chernozem

Moreover, for eliminating of the nf/ng ratio candidate, a series of profiles from south of the Muntenia and Dobrogea from Videle to Babadag where harsh sand missed and it has not calculated this ratio. In this way phaeozem from Fundulea, one typical chernozem in old soil classification (1980) pH grow continuous from 6.3 in Ap (0-15 cm) until 8.2 in Cnk_2 (185-200 cm) in same time with alkali saturation degree V% that grow from 88.7% in Aph (18-30 cm) until 100% in Cnk_1 and carbonates was leaching until a deep by 140-150 cm. Clay variation in function of deep (fig. 5) represent three inflexions in Aph (18-30 cm), Am (30-45 cm) and between Am and AB (65-85 cm) then always decline until la Cnk_2 (185-200 cm).

Nf/ng ratio it hasn't calculated because of harsh sand misses and nf/p ratio have small variations that it has not permitted uses of this. Nf/nm ratio present six limits among three are evident in Aph, Am and AB and three more attenuating in Bv_2 (85-100 cm), Bv_3 (120-1359 cm

and Cnk_1 (150-165 cm), the last appearing in chart noted with parentheses. That amplitude difference can lead to subjectivism in parental states appreciations because it make has considered that 85-200 cm deep like a single parental batch witch reduced fluctuations. From this reason for minimize the subjectivism it has needed to adopt conventionally amplitude value over that considered presence of one parental batch. More, presented data show that practically clay content decline from Ap and Aph that seems paradoxical at first view be result of parental stratification attenuated from clay migration from Ap (0-15 cm).

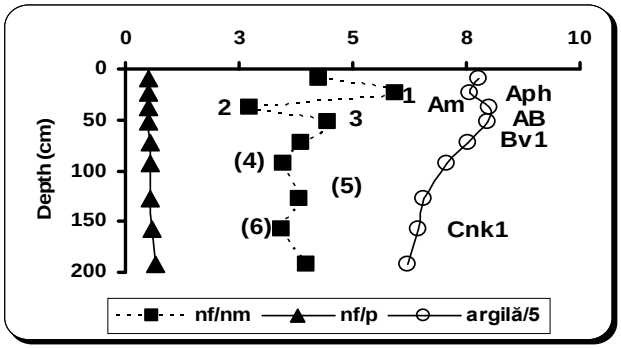

Figure 5. Distribution of clay and stratification ratios with the depth at the Fundulea phaeozem

Parental batches and textural differentiations index

Clay migration in soil formation processes was appreciating from clay concentrations ratio from B-horizon in Ap horizon named textural differentiations index. Thus in soil systematic it has appreciated that at luvic chernozem the index isn'd exceed 1.1 value and 1.3, at luvisols index exceed rare 1.2 value in case of some stratifications, at luvisols varying between 1.2-1.5 and at albic luvisols can arrived close to 3 value (N. Florea et al, 1968). In many cases these limits are exceeded at some soils type.

Result that textural differentiations index values is affected by parental batch presence. For parental material batches appreciations has calculated results of the ratio nf/nm from B and Ap horizons. Representations of the textural differentiations index in functions of this result (fig. 6) show that representative points are dispersed in chart design and it has no correlation between then (n=62, Rpower=0.174) and stratification of the parental material has an accentuate influences on textural differentiations index values.

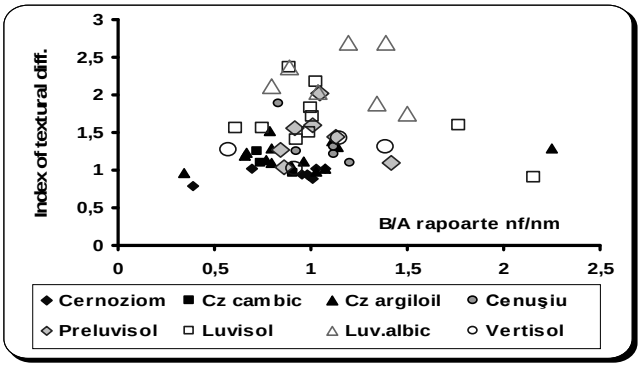

Figure 6. Relationship between the ratios of clay content and nf/p from the B and Ap horizons at investigated soils

Representative points has dense grouping in one area limited by nf/nm result ratio values between 0.6 and 1.2 and by indexes that varying between 1 and 2.36. These appear chernozems, greyish phaeozems, haplic luvisols, luvisols and one albic luvisols from Pitesti (Arges). A second group with reduced densities is situated at result ratio between 1.2-1.6 and indexes between 1.4 and 2.7 and comprises albic luvisols, luvisol from Branesti (Ilfov) and haplic luvisol from Sanandrei (Timis). Fall out of the two areas in left of the chart chernozems form Urleasca (Ialomita) and luvic chernozem from Cernat (Covasna) and on right of the diagram luvic chernozem from Videle (Teleorman) and luvisol from Tresnea (Suceava).

Although from chart clarity was used only 62 profiles it has observed that textural differentiations indexes varying in large limits from this soil type. A kind of intervals is 0.75-1.5 at chernozems, 0.97-1.52 at luvic chernozems, 1.09-1.98 at greyish phaeozem, 1.09-2.01 at haplic luvisols, 0.9-2.36 at luvisols and 1.56-2.37 at albic luvisols and 0.1-1.43 la vertisols. Generally the intervals have displaced knowing order from pedological researches.

CONCLUSIONS

Parental material stratifications in characterized by limits that not defined successive deposition of the material accumulated in time, but only textural variations at parental material. Ratio from different sand and dust fractions can appreciated these stratifications but determined limits can vary from one ratio to other.

Nf/nm ratio can be the most suitable for used like stratification criteria although demand supplementary determination of the (0.2-0.05 mm) fractions. Nf/p ratio has frequently reduce limits difficult of appreciate and, further dust fractions can be altered because has a specific surface by 1 m^2/g.

Textural differentiations index isn't correlated result of B and Ap soils horizons but allot representative points in a succession from chernozem to luvisol with numerous exceptions were make in evidence parental stratification influences.

LITERATURE

1. CERNESCU, N., *„Determinarea capacității de schimb şi a cationilor schimbabili la sol”*, Institutul Geologic al României, Studii tehnice şi econmice Nr. 8, Ed. Monitorul Oficial, Bucureşti, 1939.
2. FLOREA, N., MUNTEANU, I., RAPAPORT, C., CHIȚU, C., OPRIȘ, M., *„Geografia solurilor României”*, Ed. Ştiințifică, Bucureşti, 1968.
3.. GÂȚĂ, GH, IORDĂCHESCU, C., LAZĂR, C., *„Implicații pedogenetice ale cercetării profilelor de sol din aşezările arheologice”*, Ştiința Solului, vol. XXXIV, nr. 1, p. 111-120, 2000.
4. MAHOMED EL SEIDY, MAXIM, I., GÂȚĂ, GH., *„Contribuții la identificarea stratificațiilor în solurile aluviale cu textură fină”*, Publ. S.N.R.S.S. Craiova, nr. 16 A, p. 327-335, 1977.