ŽEMĖS ŪKIO MOKSLAI. 2008. T. 15. Nr. 3. P. 36–41

Causes and consequences of the vertical migration of fine soil fractions

Jonas Mažvila[1],

Mečislovas Vaičys,[2]

Ričardas Beniušis[2]

[1] Agrochemical Research Centre of the Lithuanian Institute of Agriculture, Savanorių 287, LT-501270 Kaunas, Lithuania
E-mail: mazvila@agrolab.lt

[2] Lithuanian Forest Institute, Liepų 1, LT-53101 Girionys, Kaunas distr., Lithuania
E-mail: dirvo@mi.lt

Generalized data on the granulometric composition of 564 soil samples taken from different soil layers have shown that the smaller soil particles the faster under the same conditions they are leached by precipitation into deeper soil horizons. Our research has shown that *Luvisols* are formed in friable rocks in which from the upper layers carbonates and Ca ions have been leached out and the environment becomes less acid. A gradual shift from El horizons to Bt is characteristic of *Luvisols*, while in case of *Albeluvisols* and *Podzols* this process is most distinct. In sandy *Luvisols*, thin curvy or straight so-called pseudofibri are formed in which fractions of clay and silt, iron compounds and orientated clays accumulate. In calcaric *Cambisols* and in carbonate-horizons of other soils dispersion fractions coagulate and hardly migrate within the boundaries of a profile.

Studies of the vertical migration of fractions of granulometric texture and a comparison of data from elluvic, illuvic and carbonate-rich horizons have shown that transportation of clay fractions from elluvic to illuvic and carbonate-rich horizons is the most vivid in sandy loam soils and not so vivid in loamy sand. In sands, sandy clay loam, sandy clay and clay soils, the leaching of the fine-dispersion fraction is weak.

Key words: soils, texture, soil horizons, fine dispersion fraction, vertical migration

INTRODUCTION

Soil is a constantly developing and changing natural body. It is an extremely complex ecosystem. Various processes take place in the soil: accumulation of organic materials and their decomposition and mineralization, gleyification, weathering of minerals, leaching of carbonates, formation and destruction of structures, brunisolization and podzolization. An important role is played by microbiological activity. Lithuanian soils have undergone a rather long way of development. Soil is formed by several indispensable factors: time, climate, vegetation, relief, soil forming rocks and even the main user – man. One of the most important processes closely related to soil formation is the translocation of fine soil particles or leaching of clay particles from the upper soil horizons and their accumulation in deeper layers. Our conditions are favourable for this because of a sufficient amount of precipitation and rather loose soils. In the post-glacial period, this process left a deep imprint in the development of soils: it changed their genesis, physical, chemical properties, soil hydrological regime, soil fertility and even stand species composition, as well as their stability against winds.

When Lithuania has become a EU member and is being integrated into the science and economy of West European and other countries, thus carrying out international research programs, it is urgent to have native soils classified according to international standards.

The new classification of Lithuanian soils was based on expeditions of soil specialists, during which profiles were discussed and new taxonomic units were adjusted according to the previously used systematic list of soils for the Baltic countries, compiled in 1953 (Систематический список..., 1953). The latter list of soils was constantly improved and supplemented depending on the needs of agriculture and forestry (Вайчис, 1975). The first variant of soil classification was worked out in 1997 and coordinated with the legend of the World Soil Map FAO–UNESCO–ISRIC (FAO–UNESCO..., 1990; FAO–UNESCO..., 1997; Buivydaitė et al., 2001). The Lithuanian soil classification LTDK-99, harmonized with the FAO–UNESCO–ISRIC, had to be verified under field conditions, describing macromorphological properties of different soils of the country based on the previous and current soil classifications, to elucidate the principal diagnostic traits of each systematic soil unit, to determine equivalents of the previous and the LTDK-99 classification as well as correlations of granulometric texture (by Kachinski and FAO–UNESCO methods), other important agrochemical properties studied by methods previously applied and currently used in Europe, to trace the vertical migration of fine dispersion particles within soil profiles (Качинский, 1965; ISSS–ISRIC–FAO..., 1998; Guidelines..., 2006; Mažvila et al., 2006).

Leaching of fine soil particles is mostly influenced by climate, relief, vegetation, especially woody plants, the form of humus, mesofauna, basic cations, as well as on the granulometric composition of soil groups and soils from which they are leached out (Вайчис, 1975). The vertical migration of clayey particles under podzolization was studied in the late 19th and early 20th century by V. Amalicki, K. Glinka, E. Wollny, G. Tumin,

K. Gedroic, A. Rode et al. (Eidukevičienė, Vaičys, 2001). Leaching of clay particles from the upper soil horizons was considered by K. Glinka as the initial stage of podzolization, because at that time there were no other considerations concerning migration of dispersion particles within a soil horizon.

Among the first ones to describe the presently well known lessivage mechanism was the German soil scientist W. Kubiena (1938) who pointed out that this process is taking place under the impact of precipitation only in the case when mineral particles are protected against chemical decomposition by humus and phosphoric acid. If fine particles migrate chemically decomposed, then podzolization process is taking place (Eidukevičienė, Vaičys, 2001).

The aim of this article is to discuss the migration of fine dispersion particles in a soil profile, as well as their influence on soil macro- and micromorphology.

MATERIALS AND METHODS

Supported by the Lithuanian State Science and Studies Foundation, experts of soil science from the LUA, Agrochemical Research Centre of LIA, LFI and SILR, including authors of the article, in 2001–2003 analysed the macromorphological, physical and agrochemical properties of different soils of the country. In the whole territory of Lithuania, 131 soil profiles were described, while 564 soil samples were taken from different genetic horizons to analyse their granulometric texture by the Kachinski and FAO methods. Data on the soil texture of 41 soil profiles (22 *Luvisols* profiles and 19 *Albeluvisols*) were investigated for leaching of fine soil particles. The majority of *Luvisol* profiles were selected in Eastern Lithuania and others in Western Lithuania. The majority of *Albeluvisol* profiles were selected in Western Lithuania and others in Eastern Lithuania (Fig. 1).

Fine dispersion particles are those that fail to exceed 0.05 mm. According to the previous Kachinski classification of granulometric composition it could be grouped as follows: coarse (0.05–0.01 mm), medium course (0.01–0.005), fine (0.005–0.001) dust, silt (0.001–0.0005 and 0.0005–0.0001) as well as colloids (<0.0001 mm). According to the FAO classification of granulometric texture, they would be distributed as follows: coarse (0.05–0.02 mm), medium (0.02–0.002), dust and clay fraction (<0.002 mm). If the soil is highly porous and contains a lot of vertical cracks and large pores, then heavy rain or shower may lead to mechanical migration also of larger soil particles, for example, physical sand (1.0–0.01 mm), while according to the new FAO classification 2.0–0.05 mm size particles would migrate as well. However, this should not be considered as *lessivage*.

The discussion of the intensity of leaching of clay particles may be based on the differentiation of granulometric texture (GSD), i. e. the ratio of the maximum amount of clay in the Bt horizon and its minimum amount in the leachable El horizon.

To ascertain the micromorphology of the above mentioned soils, below we present their studies in forest soils based on soil analysis using a DRON-05 polarized microscope.

RESULTS AND DISCUSSION

Lithuanian soils develop under conditions of an impermacidic water regime. Under the effect of precipitation, not only soluble chemical elements (calcium, magnesium, iron, oxides, etc.), but also fine mineral and organic particles are leached out from the upper soil layers.

In the soils of Western, Eastern and Southeastern Lithuania, due to a higher amount of precipitation (700–800 mm), leaching processes are most intensive. Therefore, in these soils, below

Fig. 1. The study site of *Albeluvisols* and *Luvisols* in Lithuania

the humus layer, E and El horizons are distinguished, and here *Luvisols* and *Albeluvisols* prevail.

In general, the finer are soil particles the more intensively under the same conditions under the effect of precipitation they are leached into deeper soil horizons. However, this is also dependent on the level of soil porosity and the amount of precipitation, its intensity and duration.

Fine dispersion particles migrate unevenly, while in cracks and pores of different dimensions they migrate along with mineral and organic solutions of different chemical composition and concentration. The most favourable for vertical migration of fine soil particles is a slightly acid soil reaction (pH 4.8–6.5). To make clay particles or colloids migrate into deeper layers, they should be in the form of sol or heavily swelled gel. Frozen or dry soil stimulates the increment of ions-coagulants in soil solution, decreases the load of colloids and their hydration, which in turn reduces the vertical migration of clay and silt particles within the boundaries of a soil profile. Leaching of fine dispersion particles from the soil may be undifferentiated when fine particles of different sizes are leached out, and differentiated when selectively dispersoid ions, as well as Fe^{++}, Fe^{+++}, Al^{+++} and other cations that appear in soil solution in the course of weathering are leached.

In the first millennia of the Holocene, leaching of fine dispersion particles was very slow because of the high carbonaceousness of the soil-forming rocks, the low porosity of primary soils and the poorly developed pedofauna. In the long run, the climate became warmer, the influence of forest became more intensive, the level of soil leaching increased. In the current epoch, silt from the upper soil horizons is usually unleachable, or the leaching is minimum. The process of lessivage is gradually occupying deeper soil horizons where the medium is less acid. It may be proved by tongue-type insertions developing from the middle part of a soil profile to its deeper layers. Such soils are now called *Albeluvisols*. Earlier they were called *Podzoluvisols*, later *Glossisols*. Soil acidification hinders the migration of clay particles within a soil profile, because they are flocculated by Al^{+++}ions; however, clay dispergation is taking place in the acid medium. Therefore, the leaching index of clay particles in acid *Albeluvisols* is always higher than in slightly acid ones. Exchange Al^{+++} and clay mineral Al hinder the peptization of clay particles as well as their migration.

An important criterion distinguishing lessivage from podzolization is the amount of non-silicate SiO_2, Al_2O_3 and Fe_2O_3 oxides in the illuviasl horizon (or their clay fraction) as compared to soil forming rock and its silt fraction. The sum of the mentioned oxides in the illuvial horizon shows the general decomposition of primary and secondary minerals.

It is known that clay particles in a soil profile are carried in the absence of free carbonates and under a medium base saturation degree. In carbonaceous soils, oriented clay soils are usually absent.

The migration intensity of clay and silt particles is highly affected by silicon acid, organic colloids and chelating compounds. The migration of fine-dispersion particles in a soil profile may be discussed according to the accumulation of oriented clays in cracks, pores, tracks of former roots. The appearance of such clays is highly influenced by the variable soil humidity and drying. In the presence of free salts, unoriented clayey material is sometimes accumulated in the illuvial horizon. Salts quickly coagulate clay particles and hinder the formation of oriented aggregates.

The more intensive precipitation the more of fine-dispersion particles are leached by precipitation into deeper soil horizons. On the other hand, the more particles are present in the soil, the less they are affected by precipitation.

The most intensive vertical migration of fine-dispersion particles is observed in *Albeluvisols* and less intensive in *Luvisols*.

The profile structure of *Luvisols* is simpler than that of *Albeluvisols*. The capacity of exchange cations in *Luvisols* should be higher than 24 $cmol^+/kg$, while the content of free irons (Fe_2O_3) lower than 3% (Жамань, 2000). The following sequence of genetic horizons is observed in *Luvisols* (excluding forest litter): A–El–Bt–C, while in *Albeluvisols*: A–El–ElBt–C. *Albeluvisols* are degraded *Luvisols*. According to M. Zhamanis, three degradation forms may be distinguished: glossic, planosolic and diffusion.

The Bt horizons of the soils contain by 10% more clay than do the A or El horizons. The El – leached – horizon gradually, contrary to *Podsols*, passes into the Bt horizon rich in clay particles. Only in *Albeluvisols* the leached El horizon in the form of a 'tongue' passes into the Bt. Besides, in *Albeluvisols* there appear cracks of different shapes and depths, which are filled with a light grey material – sand. Firstly, a hardly skeletal "powder" made of sand and silt particles accumulates in cracks of the Bt horizons. Gradually, affected by soil-forming processes, these 'tongues' become deeper and wider. Finally, in the upper part of the Bt horizon they widen and overlap, meanwhile their points penetrate deeper into the Bt horizon.

The generalized abundant (*Luvisols* 22 and *Albeluvisols* 19) data on the granulometric texture have shown that in the profile of both soils the sand (2.0–0.05 mm) fraction obviously prevails: in *Luvisols* it makes 49.1–58.8% and in *Albeluvisols* 51.6–59.4% (Table 1). The finest sand fractions are found in Bt horizons, because they accumulate leached clay particles. The Bt horizon of *Albeluvisols* contains by 2.5% more sand fractions than that of *Luvisols*. The Bt horizons of *Luvisols* contain more silt fractions than those of *Albeluvisols*, and the difference comprises 2.6%. The amount of clay particles in these soils is the lowest – they accumulate in Bt horizons. The A and E horizons in *Luvisols* are slightly less leached, thus they contain more (1.2%) clay particles as compared to *Albeluvisols*.

In *Cambisols*, and in carbonaceous horizons in general, oriented clay particles are absent, because under the effect of carbonates dispersion particles coagulate and fail to migrate within the boundaries of a soil profile.

Studies of the vertical migration of fractions within a soil profile and a comparison of data on elluvic and illuvic horizons have shown that the transportation of clay and silt particles from elluvic to illuvic horizons is most obvious in light clay loams and less obvious in sandy loams and sandy loams on sands. In medium-heavy clay loams or loams, the leaching of fine fractions is weak or absent.

Analysis of the properties of individual typical profiles of *Luvisols* and *Albeluvisols* has shown that Bt horizons in them are clearly distinguishable, which is testified by an increased amount of clay particles. In humus, elluvic and deeper horizons below the Bt horizon, the amount of clay particles is significantly lower (Table 2, Fig. 2).

In *Luvisols* sand fractions prevail, while in *Albeluvisols* sand particles are distributed unevenly, and dust prevails at a depth of 34–44 cm and 180–190 cm. It is related to the unhomogeneity of soil-forming rocks. In *Luvisols*, the average amount of sand particles comprises 71.59%, while in *Albeluvisols* 49.51%, dust comprising respectively 12.67% and 39.60%. The average content of clay particles in *Luvisols* comprises 15.93%, while in *Albeluvisols* 26.8%. In *Luvisols*, clay particles accumulate mostly in the Bt horizon at a depth of 40–90 cm and reach 27.92%, while in *Albeluvisols* in the Bt horizon at a depth of 90–100 cm their content is slightly less – 22.75%, probably because of a deeper leaching of the particles.

The leaching of clayey particles is easiest in porous, skeletal sand. It is far more difficult in gravel, while in heavy clay loam and loam soils these particles completely fail to migrate. Our research confirmed investigations by А. Роде (1955), P. Duchaufour (1963), J. Fiedler, H. Reissig (1964), В. В. Пономарёва (1964), М. Жамань (2000), Guidelines... (2006).

Micromorphology of orthy-haplic *Luvisols*. The micromorphology of this soil was discussed upon taking soil samples from boulder-rich morainic clay loam in a 75-year-old pure pine stand of Alytus Forest Enterprise, on the Ncs growth site of Pox. forest type.

At a depth of 10–15 cm the background consists of basalt cement, while terrigenic material comprises about 25%. Among minerals, there prevails corroded quartz, slightly weathered feldspars (10%). The remains of weathered carbonates were detected, while iron hydroxides were not found.

At a depth of 15–25 cm, the grains of terrigenic material are rather polished, while smaller ones are corroded. Quartz comprises even 75%. Corroded and kaolinized feldspars, mica and rotten remains of carbonates were found. Clay is unoriented here.

Table 1. **Distribution of sand, silt and clay particles in *Luvisols* and *Albeluvisols***

Soil group	Horizon	Sand (2.0–0.05)	Silt (0.05–0.002)	Clay (<0.002)	n
		%			
Luvisols (LV)	A	58.8 ± 9.5	30.2 ± 10.6	11.0 ± 3.0	22
	E	56.5 ± 8.9	30.0 ± 9.4	13.5 ± 5.2	22
	Bt	49.1 ± 11.5	28.3 ± 10.3	22.6 ± 6.2	22
	C	55.9 ± 16	28.2 ± 13.7	15.9 ± 6.3	22
Albeluvisols (AB)	A	59.0 ± 9.0	30.3 ± 6.6	10.7 ± 3.1	19
	E	59.4 ± 7.1	28.0 ± 4.9	12.6 ± 3.6	19
	Bt	51.6 ± 11.3	25.7 ± 5.8	22.7 ± 6.1	19
	C	57.4 ± 7.8	25.2 ± 5.2	17.4 ± 4.6	19

Table 2. **Distribution of sand, silt and clay particles in *Luvisol* and *Albeluvisol***

Soil group	Horizon	Sand (2.0–0.05)	Silt (0.05–0.002)	Clay (<0.002)
		%		
* *Luvisols* (LV)	A3–11	80.08	12.42	7.50
	El11–16	78.93	15.54	5.53
	Bt20–30	62.60	13.64	23.76
	Bt40–50	58.40	13.68	27.92
	$B_2$90-100	73.81	11.84	15.35
	Ck120–130	73.30	10.39	16.31
	Ck140–150	73.65	11.16	15.19
** *Albeluvisols* (AB)	AE5–15	53.45	37.66	8.89
	E20–30	61.06	24.78	14.16
	EBt_g34–44	40.97	44.98	14.05
	B2tg60–70	59.72	20.72	19.56
	B_3t_g90–100	37.34	36.91	25.75
	C_2kg180–190	43.93	48.18	7.89

* *Luvisol* profile from Alytus forest enterprise.

** *Albeluvisol* profile from Kretinga forest enterprise.

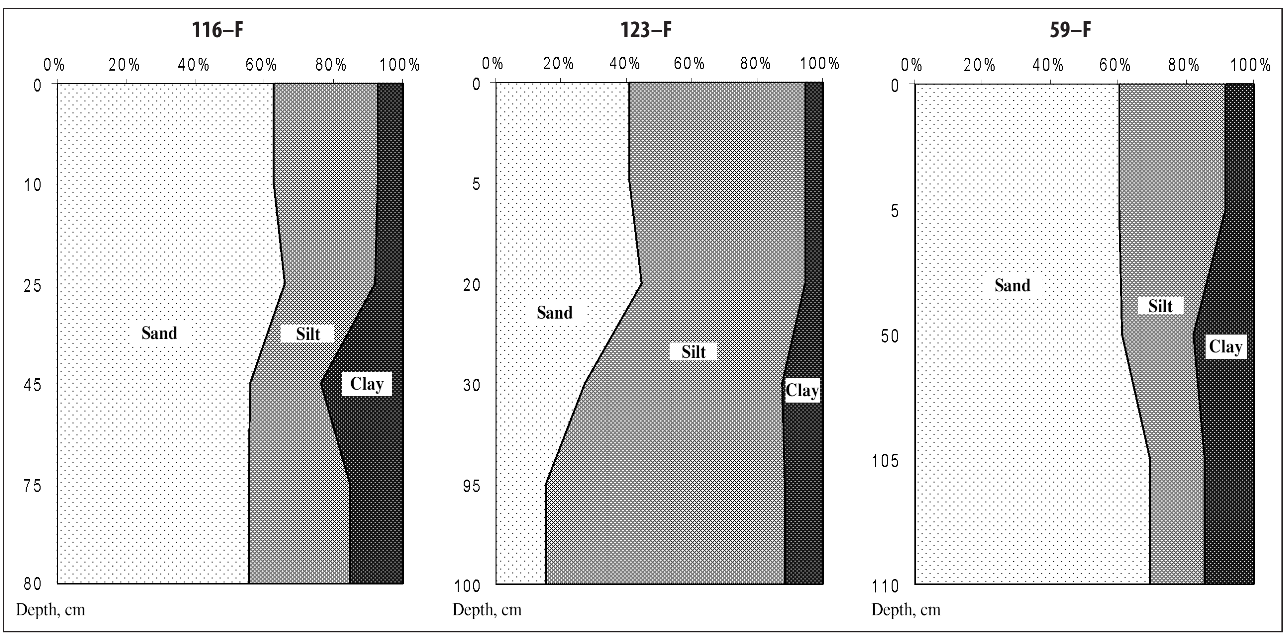

Fig. 2. Distribution of sand, silt and clay fraction in *Calc (ar) i-Epihypogleyic Luvisols* (116–F), *Albi-Endohypogleyic Luvisol* (123–F) and *Bathihypoglei Dystric Albeluvisol* (59–F)

At a depth of 35–45 cm there prevail (85%) quartz and rotten feldspars. Carbonates were not found, but collections of oriented clay are obvious.

At a depth of 75–85 cm, terrigenic material and cement comprise 70%. Quartz makes up 80%. Feldspars are heavily rotten and insignificantly corroded. Some glauconite and kalcite are found. The cement is dark brownish, oriented, with individual spots of iron.

At a depth of 130–145 cm, terrigenic material and cement prevail (70%). Cement comprises about 30%. Large terrigenic particles are polished, almost untouched by corrosion. Undecomposed carbonates comprise about 5–10%. Some limestone and sandstone are found along with individual grains of glauconite and mica. Cement is clayey. Some accessory minerals are found. Feldspars are heavily rotten and comprise sericite.

At a depth of 170–180 cm, more calcite crystals and individual amphiboles, pyroxenes and mica are found.

Micromorphology of dystri-epihypogleyic *Albeluvisols.* Studies were conducted in the Kretinga Forest Enterprise. The object of studies was chosen in a 65-year-old spruce stand. Growth site – Lcs, forest type – Pc ox-m.

At a depth of 8–18 cm, heavily corroded quartz and oligoclase prevail. At a depth of 18–28 cm quartz comprises 70%, followed by microcline and orthoclase. The content of biotite was low, still lower was that of granates.

At a depth of 40–50 cm, corroded quartz and oligoclase prevail; a very low amount of amphiboles was found.

At a depth of 65–75 cm, large collections of iron compounds and fine organic matter were detected. In some places, collections of oriented clay are observed. Quartz and feldspars prevailed, some microcline and orthoclase were found.

In the 95–105 cm deep layer, oriented clay particles are abundant. Insignificantly corroded quartz prevails, some orthoclase, biotite and individual granates are detected.

At a depth of 170–180 cm, the content of calcite greatly increases, thus no oriented clay is found here.

In sandy and sandy loam soils, the so-called pseudofibers are sometimes formed (Greek *pseudo* – unreal, Latin *fibra* – fibre), i. e. threads of different thickness, usually curved, less frequently smooth, porous, repleted with clay particles. They increase soil water capacity, fertility and even stand productivity.

Sandy soils with pseudofibers were called "gebanderte lessive Braunerde" by the German scientist P. Kundler (Kundler, 1965), while the Hungarian scientist P. Stefanovits (Eidukevičienė, Vaičys, 2001) calls them "kovarvany". Analogous structures are found also in Lithuania. In dune sands, pseudofibers are found as well, however, there they are by far thinner – hardly 0.5–1 cm thick. When the threads of pseudofibers approach the bottom of the profile, they gradually become thicker and sometimes are even 20–30 cm thick. Closer to soil surface they become thinner and at a depth of 50–70 cm usually are not found. The depth of pseudofibers depends on the content of clay particles in the soil.

A very interesting soil profile was described in the Vai vydava forest district of the Dubrava Experimental Forest Enterprise (limnoglacial plain) (Fig. 3).

In the front wall of the soil profile, there are not very clearly uncarbonaceous (visually carbonates were not seen) vertical layers of sand. In the uncarbonaceous side of the wall, vivid pseudofibers were observed, while on the right side they were not detected. Here, pseudofibers were formed directly on the carbonaceous layer. This shows that carbonaceous sand performed the role of a geochemical barrier. It was clearly seen that the brownish pseudofiber had "surrounded" the carbonaceous sand layer and descended down to the bottom of the profile. In uncarbonaceous sand, starting with the depth of 90 cm, obvious pseudofibers increasing with depth were formed. We have never seen such a profile in Lithuania. The distribution of sand, dust and clay particles in it is presented in Fig. 3.

The leaching of mechanically fine dispersion fractions has not only causes, but also leads to some consequences. The following can be mentioned among them:

1. Gradual degradation of the upper portion of the profile: particles of carbonaceous clay are leached out, a Bt horizon less permeable for water and roots of trees is formed, moisture accumulation on its surface usually leads to waterlogging and gleyzation.

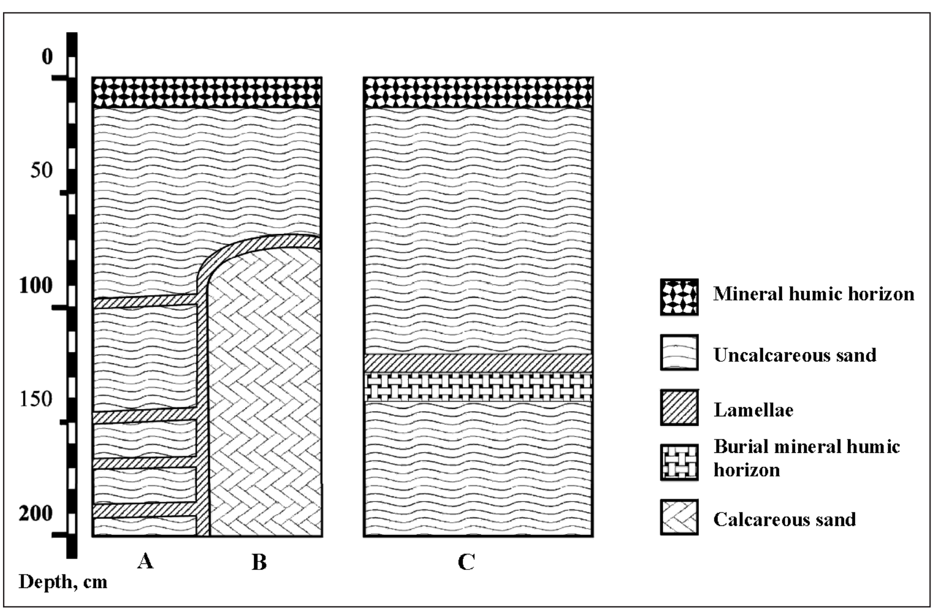

Fig. 3. Macromorphology of lamellae in calcareous (A) and uncalcareous (B) sand and lamella formation over burial mineral humic horizon (C)

2. Nutrients and base cations together with clay particles migrate to deeper layers, the soil becomes less base-saturated, undergoes acidification and degradation.

3. When Ca ions are leached out, there increases the electrokinetic potential of the sorption complex. As a result, clay and silt particles become ever more labile. In a very acid environment, in our case in *Albeluvisols*, these particles under the effect of iron become almost immobile.

4. *Luvisols* and *Albeluvisols* are characterized by a gradual transition of elluvic horizons to illuvic ones. If the transition is obvious, then we deal with rock bisequum or a pronounced podzolization process.

5. The leaching depth of clay particles is restricted also by geochemic barriers, i. e. carbonaceous layers, buried (covered) horizons, heavy soil forming rocks – heavy clay loams, loams.

6. Although vertical migration of fine dispersion particles has been known by soil scientists long ago, in soil genesis studies it was for the first time applied only in the middle of the 20th century.

Received 23 May 2008
Accepted 3 July 2008

References

1. Buivydaitė V. V., Vaičys M., Juodis J. ir kt. Lietuvos dirvožemių klasifikacija. Vilnius: Lietuvos mokslas, 2001. Kn. 34. 139 p.
2. Duchaufour P. Soil classification: A comparison of the American and the French systems // Journal of Soil Science. 1963. N 14. P. 149–155.
3. Eidukevičienė M., Vaičys M. Dirvodaros procesai // Lietuvos dirvožemiai (sud. M. Eidukevičienė, V. Vasiliauskienė). Vilnius: Lietuvos mokslas, 2001. Kn. 32. P. 210–230.
4. FAO–UNESCO. Soil Map of the World. Revised legend // World Soil Resources. Report 60. FAO, Rome, 1990. 120 p.
5. FAO–UNESCO. Soil Map of the World. Revised legend with corrections and updates // ISRIC. Wageningen, 1997. 140 p.
6. Fiedler H. J., Reissig H. Lehrbuch der Bodenkunde. VGB. Jena: Gustaw Fischer Verlag, 1964. 504 S.
7. Guidelines for Soil Description. FAO of the UN. Rome, 2006. 97 p.
8. ISSS–ISRIC–FAO. World Reference Base for soil resources // World Soil Resources. Report 84. FAO, Rome, 1998. 88 p.
9. Kundler P. Waldboden Typen der Deutschen Demokratischen Republik. Leipzig: Neuman Verlag, 1965. 181 S.
10. Mažvila J., Vaičys M., Buivydaitė V. Lietuvos dirvožemių makromorfologinė diagnostika. Kaunas, 2006. 283 p.
11. Вайчис М. В. Генезис и свойства лесных почв Южной Прибалтики. Вильнюс: Минтис, 1975. 412 с.
12. Жамань М. Лювисоли. Почвенный справочник. Смоленск: Ойкумена, 2000. С. 176–183.
13. Качинский Н. А. Физика почв. Москва, 1965. С. 132–147.
14. Пономарёва В. В. Теория подзолообразовательного процесса. Москва: Наука, 1964. 379 с.
15. Роде А. А. Механический состав почв и пород // Почвоведение. 1955. С. 72–77.
16. Систематический список почв Прибалтийских республик // Почвоведение. 1953. № 3. С. 78–80.

Jonas Mažvila, Mečislovas Vaičys, Ričardas Beniušis

SMULKIAI DISPERSINIŲ DIRVOŽEMIO GRANULIOMETRINĖS SUDĖTIES FRAKCIJŲ VERTIKALIOSIOS MIGRACIJOS PRIEŽASTYS IR PASEKMĖS

Santrauka

Apibendrintais 564 dirvožemio ėminių, paimtų iš įvairių dirvožemio sluoksnių, granuliometrinės sudėties tyrimais nustatyta, kad kuo smulkesnės dirvožemio dalelės, tuo intensyviau tomis pačiomis sąlygomis jos dėl kritulių poveikio išsiplauna į gilesnius dirvožemio horizontus. Tai priklauso nuo dirvožemio purumo ir iškritusių kritulių kiekio. Dėl išsiplovimo palengvėja viršutiniai dirvožemio horizontai, pasunkėja vidurinė profilio dalis ir susiformuoja Bt horizontas. Apie smulkiai dispersinių dalelių migraciją galima spręsti pagal optiškai orientuotų molių sankaupas plyšiuose, porose, buvusiuose šaknų takuose. Jų atsiradimui didelę įtaką turi nuolat kintantis drėgnumas ir išdžiūvimas. Esant laisvų druskų iliuviniuose horizontuose, kartais kaupiasi ir optiškai neorientuota molinga medžiaga, nes druskos greitai koaguliuoja molio daleles ir neleidžia susidaryti optiškai orientuotiems agregatams. Tyrimai rodo, kad išplautžemiai vystosi puriose uolienose, iš kurių viršutinių sluoksnių yra išplauti karbonatai ir Ca jonai, o terpė tampa menkai rūgšti. Išplautžemiams būdingas laipsniškas El horizontų perėjimas į Bt, o balkšvažemiuose ir jauražemiuose pereinama staigiau. Smėlingose uolienose susidaro ploni, vingiuoti arba lygūs vadinamieji pseudofibrai, kuriuose kaupiasi molio bei dumblo dalelės, geležies junginiai ir orientuoti moliai. Karbonatinguose rudžemiuose ir kitų dirvožemių karbonatinguose horizontuose optiškai orientuotų molio dalelių beveik nebūna, nes dėl karbonatų poveikio dispersinės dalelės koaguliuoja ir sunkiau migruoja arba nemigruoja profilio ribose. Nustatyta, kad molio ar dumblo dalelių pernešimas iš eliuvinių į iliuvinius ir karbonatinguosius horizontus yra ryškiausias lengvuose priemoliuose, jis ne toks ryškus priesmėliuose ir priesmėliuose ant smėlių. Smėliuose, vidutinio sunkumo ir sunkiuose priemoliuose bei moliuose smulkesnių frakcijų išsiplovimas (išmolėjimas) labai nežymus.

Raktažodžiai: dirvožemiai, dirvožemio horizontai, granuliometrinė sudėtis, smulkiai dispersinės dalelės, vertikalioji migracija