



## **Application of magnetic tracer method for quantification of pedoturbations in soils under different land use**

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Pedoturbations are widely known and good classified by scientists. It is known 10 types of pedoturbations, allocated by F.D. Hole (1961) and supplemented by D.L. Johnson and collaborators (1987). They influence on many soil properties and also on migration substances (including pollutants). But there is a lack of data of quantitative assessments of pedoturbations especially in soils under different land use. In this paper are shown approaches for the use of magnetic tracer method for assessments of pedoturbation processes. This method is widely spread for study lateral solid phase soil matter (soil erosion), but first use for study pedoturbations. Magnetic tracer method is based on study of spherical magnetic particles (SMP) in soils. Origin of SMP is mainly connected with atmospheric deposition of fly ash, resulting from coal burning in steam engines of locomotives and thermal electric power stations. The period of active emission of SMP is the last 150 years. Magnetic spherules are stable and resistant to soil weathering and can be preserved in soils for decades without any clear signs of destruction. In European part of Russia and Middle West USA were analyzed 63 soil profiles under virgin forest and steppe vegetation and croplands. Vertical distribution of SMP in the upper 30 cm divided into 5 types: a) residually accumulative, b) not uniform with maximum in the upper 10 cm, c) not uniform with maximum in the 10-20 cm, d) not uniform with maximum in the 20-30 cm, e) homogenous. Vertical distribution of SMP reflects intensity of pedoturbations, because SMP migrate into the soils only from the atmospheric depositions. Labeled types of SMP vertical distribution are listed in order of increasing intensity of the pedoturbation. Most intensive pedoturbations are detected in arable soils. Depending on the region arable soils characterized by highest percentage of soil profiles with homogenous type of SMP distribution (up to 17%) and lowest percentage of soil profiles with residually accumulative SMP distribution (15-75%). Revealed the important role of type of plowing. On two sites in Russia with depleted type of plowing detected very high intensity of pedoturbation - homogenous type of SMP distribution was in 8-17% of soils and accumulative type – in 15-25%. Otherwise on two sites in the Middle West USA with moldboard type of plowing, homogenous type was much less (in 0-8% of soils) and accumulative type was 2-3 times more (55-75%). In virgin soils intensity of pedoturbations is much less, homogenous type of SMP distribution is not detected in any soil profiles. Furthermore on two virgin forest sites in USA and Russia percentage of soils with initial accumulative type of SMP distribution was 100%. On site in virgin steppe region of Russia – 85% of soils characterized by initial accumulative type and other 15% by not uniform with maximum in the upper 10 cm. Only on one site in forest region of Russia percentage of initial accumulative type of SMP distribution was rather low and even less than on arable soils with moldboard type of plowing – 67%.