

Properties of ancient deeply transformed man-made soils (cultural layers) and their advances to classification by the example of Early Iron Age sites in Moscow Region



A. Golyeva*, E. Zazovskaia, I. Turova

Institute of Geography RAS, Moscow, Russia

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ABSTRACT

The Central part of European Russia has been inhabited for several thousands of years, its population being rather large in number. By way of example, we consider the Dyakovo archeological culture dated to the Early Iron Age. Numerous sites and settlements attributed to that culture are noted for the presence of typical Anthrosols and Technosols – deeply transformed man-made soils (cultural layers).

In the course of the work we investigated thoroughly two soils related to settlements of the Early Iron Age. Archeological excavations yielded numerous artifacts in situ; this proves that the sites have been inhabited in the past, though abandoned long since. The cultural layers, however, have not been buried under later sediments. Far from it, they stayed exposed and subjected to transformations by soil-forming processes. At present the sites are not in any use and are mostly overgrown with modern vegetation. Aside from the morphological description, chemical analyses of the soils at the archeological sites have been performed, a proportion of organic and inorganic matter, total phosphorus, pH being defined. It should be noted that no typical zonal soils have been found at the sites, in spite of the zonal vegetation overgrowing the areas. Instead, there appeared soils of a peculiar kind showing specific properties. When studying them, the background soils were used as a reference. So, it seems that the time lapse between the Early Iron Age and the present days – a millennium and a half – was insufficient for a complete transformation of the man-made soils (cultural layers). It is rather difficult to choose a proper name of those soils. The term “Technosol” is hardly applicable, as there are no human settlements there at present. Neither can the soils be considered as “natural”, because they are radically different from the latter in characteristics and contain artificial materials in abundance.

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1. Introduction

In the process of colonization, humans exert a profound – and occasionally irreversible – effect on the environments, such as deforestation, tilling virgin lands, and in some cases replacing an original vegetation with newly introduced plants. The most drastic changes occur within the limits of human settlements themselves. In the course of constructing and repairing human dwellings and in other household activities specific deposits are formed known as cultural layers (Gribchenko, 2006; Kulkova et al., 2012; Ranov et al., 2012; Sedov et al., 1999; Sycheva et al., 2008; Trinkaus et al., 2000; Yang et al., 2007; and others). The layers are divers in composition depending, in particular, on the kind of the construction material (stone, wood, adobe, etc.). At the same time, different cultural layers have much in common, such as an alkaline reaction of solutions, high concentration of total phosphorus, organic carbon, and carbonates. The phosphorus comes into soil with domestic waste and household garbage and forms extremely stable

organic-mineral compounds with organic matter and ash. Apart from the phosphorus, cultural layers of human settlements are often enriched in limestone, gypsum, and other mineral salts, specially brought in and used for constructing walls, floors, ceilings, and so on. The appearance of the horizons bearing traces of man's presence (cultural layers) depends directly on the land use type and intensity. The most stable and morphologically significant elements (most suitable for the subsequent analysis using methods of natural sciences) develop in places of productive activity and dwellings, while in the streets, lanes between huts, yards etc. the cultural layer is of small thickness and limited information capacity.

After people had left the habitable site the constructions were destroyed, the surface was overgrown with grass and trees, the soil formation processes set in, and a new soil started to form. These soils differ from their natural analogues and hardly can be properly named according to modern classification.

Variou problems directly related to cultural layers of settlements, their specific features and the rates of development have been comprehensively covered in the modern soil literature (Angelucci, 2003; Engovatova and Golyeva, 2012; He and Zhang, 2009; Modelski, 2003).

* Corresponding author.

E-mail address: golyevaaa@yandex.ru (A. Golyeva).

Taking into account the fact well-known from history – that “sizeable areas on terraces and even on watersheds were populated in the past” (Graves et al., 2009; Holliday and Gartner, 2007; Miller, 1988), it seems to be of interest to know more about the properties of the soils newly formed on those surfaces.

With regard to all those mentioned above, the principal purpose of the work is to show original properties of such new soils formed in places of the former human habitation and profoundly altered by the human impact. In this connection it would be also important to discuss the advances in classification of such objects.

2. Objects of study

We studied soils on 2 settlements dated to the Early Iron Age. This historical period was chosen because, according to Certini and Scalenghe (2011), the Anthropocene starts at approximately 2000 yr BP, “when the natural state of much of the terrestrial surface of the planet was altered appreciably by organized civilizations”.

In the central part of European Russia there are numerous settlements of the Dyakovo Culture (Finno-Ugric peoples). The settlements were located mostly along rivers and were deserted around 1500 yr BP.

Specific features of the cultural layer transformation by soil-forming processes were studied on two ancient settlements in the Moscow region (Central Russia) (Fig. 1). The investigated objects, both dated to the Early Iron Age, have two features in common, namely: a humid climate and the leading role of the anthropogenic factor in the past.

The climate of the region is of temperate continental type, with mean annual temperature of +3 °C, and annual precipitation about 550–600 mm. It belongs to the natural zone of southern taiga.

The first object studied is the settlement “Dunino” (excavated by archeologist A.A. Alekseev), the second one – settlement “Rostislavl” (archeologist V. Yu. Koval). In both places archeological excavations

revealed the presence of ancient artifacts occurring in situ at a depth of 65 cm at the first site, and up to 100 cm at the second one. The background soils studied simultaneously at both sites were used for reference.

The Dunino settlement (55°43′20,7″ N, 36°55′35,1″ E). Dominant modern vegetation is pine forest with some small-leaved species and shrubs in the undergrowth. The herbaceous layer is well-developed, rich in species composition; it includes a number of plants typical for nemoral flora (*Aconitum* L., *Convallaria majalis* L., *Lamium album* L., *Veronica* L., *Paris quadrifolia* L., *Aegopodium podagraria* L.). Two areas were studied within the site limits, one on the cultural layer itself, and another one at the place of ancient household pit. The parent rock is coarse and medium-grained cohesive sand. The zonal soil is Podzol with typical properties (Sauer et al., 2007). Geomorphologically, this site is located on the 1st terrace composed of ancient fluvial deposits.

The second object of the study was the Rostislavl settlement (54°52′33,3″ N, 38°37′59,6″ E). Dominant modern vegetation is birch–aspen forest (*Betula pendula* Roth., *Populus tremula* L., *Sorbus aucuparia* L., *Padus racemosa* (Lam.) Gilib.) with shrubs (*Euonymus verrucosa* Scop., *Corylus avellana* L., *Frangula alnus* Mill.) in the undergrowth. The herbaceous layer is well-developed, rich in species composition; it includes a number of plants typical of nemoral and ruderal flora (*Centaurea* sp. L., *Calamagrostis Adans.*, *Veronica* L., *Urtica* L., *Rumex* L., *Plantago* L.). The zonal soil (Retisol) (World Reference base for soil resources, 2014) and the soil at the place of ancient household pit were studied. The parent rock is loamy silt. Geomorphologically, the site is located on the 3rd terrace of the Oka River.

Both ancient settlements were abandoned long ago. The ancient cultural layers, however, have not been overlain with younger sediments; so they were exposed to soil-forming processes and, as a result, have been noticeably altered, a new, morphologically different soil being formed. The duration of the new soil formation was about 1500–2000 years in both objects of study.

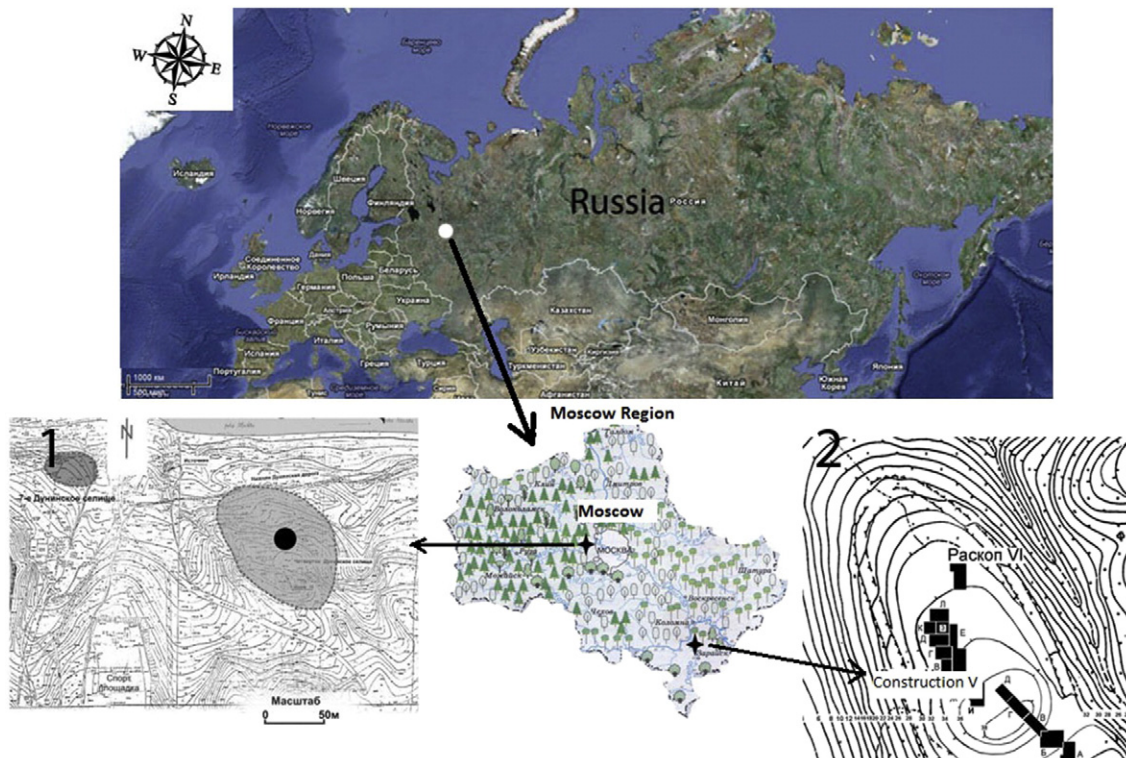


Fig. 1. Study sites location.

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