

PECULIARITIES OF THE STRUCTURE OF SOIL COVER IN THE INDUSTRIAL ZONE OF THE MINING ENTERPRISES OF THE BELGOROD REGION

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Abstract

Conducted large-scale soil survey in the industrial zone of the mining enterprises of the Belgorod region. It is shown, that there is the radical restructuring of the structure of soil cover on such areas: widespread anthropogenically transformed soils and non-soil formation, forming complexes and mosaics.

Keywords: KMA, the structure of soil cover, agrochemozems, technolits, screenzems, spot, variation, complexes, mosaics.

Introduction

To the fields of specialization of the Belgorod region are mining industry, ferrous metallurgy, machine building and food industry. Especially stands out area for the extraction of iron ore: it produces over 35 % of the iron ore of Russia [1]. The basic enterprises of the mining activities are concentrated in the Starooskolsko - Gubkinskiy iron ore district, where the extraction of ore is done by the open way. Not far from Belgorod the Yakovlevsky mine is situated, where there are underground mining. In the course of development of the enterprises, there arises a problem of their expansion, i.e., design and construction, which requires the implementation of engineering survey. An important part of such investigations are ecological engineering survey including, among others, and soil studies.

Mining is a violation of the land, so it requires a subsequent recultivation, which begins with the removal of the fertile and potentially fertile soil layers. Under the potentially fertile layer of soil, in accordance with [2], is defined the lower part of the soil profile, with favourable to the growth of plants physical, chemical and limited agrochemical properties. The power of the removed soil layers is established on the basis of the evaluation of the level of soil fertility and structure of soil cover, as well as the evaluation of the fertility of individual genetic horizons of the soil profile of the main types and subtypes of soils.

Thus, the study of soil cover structure in the industrial zone of the mining enterprises is a problem; therefore it was the objective of our research. The work was carried out in the industrial zone of the leading mining companies of the Belgorod region, mentioned above.

Materials and methods

The Structure of the Soil Cover (SSC) is a certain type of its structure, i.e. the configuration and position relative to each other its territorial units of different taxonomic level. Theoretical foundations of the theory of SSC were developed by the renowned Russian soils scientists: N.M. Sibirtsev, G.N. Vysotsky, S.A. Zakharov, S.S. Neystryev, V.M. Friedland [3, p. 172]. SSC includes the regularities of the spatial location of soil on the small areas and fully revealed only during the detailed mapping of soil cover. The heterogeneity of the soil cover is characterized by sustainable soil composition and pattern of soil associations. They arise as a result of the multiple repetitions in the space of Elementary Soil Areas (ESA).

V.M. Friedland [4, p.54] has identified the following main groups of soil combinations: chain (with a distinct genetic communications components) and rows (in their genetic relationship

between the components is missing or it is very weak). Both those and others are characterized by varying degrees of contrast soil combinations. The first are micro - and mezo combinations. Micro combinations contrasting components are called soil complexes, and non-contrast - spottiness. Mezo combinations, respectively, are called combinations and variations.

Mosaics and tashets (rows) are also divided according to the contrast of forming their components: the first are - contrast, their diversity is attributable to the mixed nature of soil forming rocks; the second are light contrast, their occurrence is often associated with biological factors. Among the microstructures of soil series allocate micromosaics and microtashets.

It is known that in the Belgorod region there are five types of terrain. Review of the literature shows that the different types of areas correspond to different SSC, among which are dominated by low-contrast combinations (Table. 1).

Table 1: The structure of the soil covers in the Belgorod region [5]

The type of terrain	Dominant soil combinations
Plax	Spots, less complexes
Zandr	Variations
Slope	Spottiness and combinations
Over the floodplain - terraced	Spottiness and complexes
Floodplain	Variation and leaf spot

During the field geoecological research in 2010-2012 we carried out soil surveys in the industrial zone of the mining enterprises on the territory of Yakovlevsky, Starooskolskiy and Gubkinskiy districts. Some of the features of a soil cover of industrial zone of Yakovlevsky district were observed by us in [6]. Large-scale soil survey was carried out in [7]. In connection with the fact that some of the features of a soil cover is impossible to be described on the basis of the above-mentioned instructions due to significant changes in the structure of the classification of soils of Russia, in the course of soils study also were used next sources [8-10].

Results and their discussion

One of the main treasures of the Belgorod region are its soils: about 2/3 of the territory of the region is covered with black earth [5], it is therefore not surprising that in all studied areas as background soil we have selected the black earth area. However, the region has long been mastered, so undisturbed soils in the area is a unique phenomenon. The studied soils for a long time are subjected to cultivation; on the classification of soils of Russia 2004. [10]. We carried them out into two types: clay-illuvial agrochernozems and agrochernozems.

These soils differ from natural analogues of the presence in the upper part of the humus profile - agrodarkhumus horizon, formed as a result of prolonged use of agricultural - PU. Agricultural impacts led to the re-building of soil and the disintegration of the natural structure. According to characteristics of the horizon, dispersed soil weight is consolidated into solid blocks, which are crushed in the process of processing on the individual, unstable to wetting and practically devoid of within the aggregate pores.

In connection with the presence of the slope relief is the formation of the background spottiness of agrochernozems varying degrees of the washness, because of the manifestation of the erosion processes.

Figure 1 presents fragments of the skeleton map of the investigated plots, which illustrate the typical soil of the situation, and here also the total legend to them is given. Draws the attention of the domination in the legend are not separate soil differences, and soil combinations. They all belong to the micro combinations, most of them are contrasting.

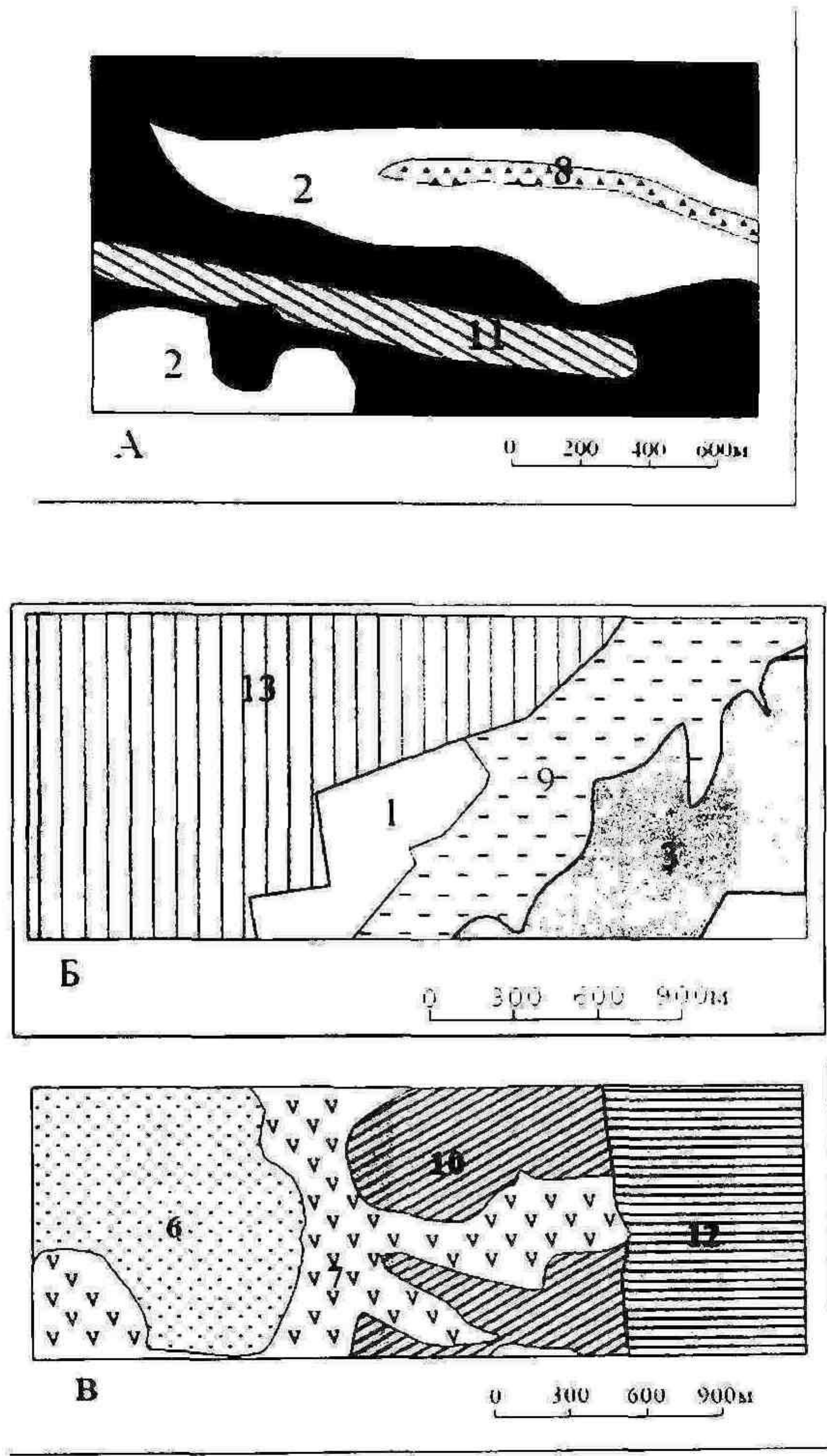





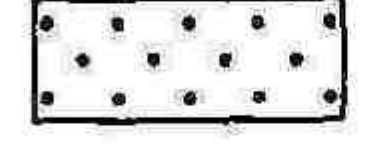
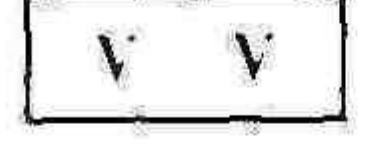
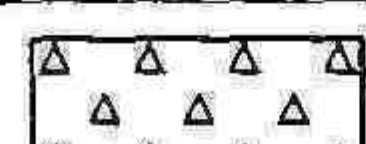







Fig. 1: Fragments of skeleton maps of soils placement and soil-like bodies in the industrial zone of the mining enterprises of the Belgorod region (A - Yakovlevsky district, the B - Starooskolskiy district, Gubkinskiy district)

Legend of soils skeleton maps

No area	Colouring	The name of the soil (a combination of soils)
1.		Dark-grey forest thick heavy loamy
2.		Spottiness: dark-grey forest powerful heavy loamy or from low thickness to high thickness with varying degrees of washness (from non-washed out to the middle washed out soils)
3.		Spottiness: clay-illuvial agrochernozem of low and middle thickness non-washed out and lightly washed out
4.		Clay-illuvial agrochernozem middle thick heavy loamy
5.		Agrochernozem middle thick heavy loamy
6.		Spottiness: agrochernozem of low and middle thickness low- and middle washed out middle- and heavy loamy
7.		Complex gully soils: chernozem typical light- and middle washed out, low thickness and middle thickness middle loamy and sod-washed up humus middle loamy
8.		Complex gully soils: meadow-chernozem leach middle thickness middle loamy low washed up and sod washed up thick middle loamy gleyly
9.		Complex gully and anthropogenic soils: urbochernozem podzoled middle-and low- thickness light- and middle- washed out, culturezem, urbo-dark - grey forest middle- and low- thickness, sod-washed up soil
10.		Complex technochernozems, agrochernozems, chernozems typical low - and moderately thick lightly washed out
11.		Complex of technogenic disturbed soils: technochernozem typical, technozem, technogenic soil
12.		Mosaic: hemozems и technozem-constructozems
13.		Mosaic: rezectoizems, screenzems, hemozems, soils sealed, technozems, abralits, stratalits

Let us explain some of the names of soils and soil-like bodies, represented in the figure. So, among the investigated soils we met urbo-soils (urbo-chernozem, urbo-dark-grey forest) and culturezems (area 9). Urbo-soils are presented in the settlements and are characterized by the presence of anthropogenic inclusions in the upper layers. Soil plots, which are characterized by high culture agriculture, are referred to culturezems [9]. In the study area they are represented by soils in orchards and cultivated arable land, which is characterized by the increased capacity of the humus horizon. It is obvious that the presence of Urbo-soil and culturezems are not connected with the activity of mining enterprises, but depends on the location in the industrial area of the settlements or suburban areas.

Under the influence of industrial activity of the person are formed man-made soils [9]. Technochnozems are presented in the complexes of habitats 10-11. They are characterized by the violation of the soil profile in the upper 5-50 cm thicker. The middle and lower soil horizons are similar to the natural soils, which allow you to take studied technochnozems to typical.

Technozem - is artificial soil-like body, consisting of one or several layers of natural or technogenic ground surface fertile layer, which functioned as the soil. The emergence of technozems on the investigated territory is connected with focused their creation in the remediation of, in connection with what they often called «constructurezems». On the territory of the industrial zone of the Yakovlevsky district techno-soil and technozems are rare; a different picture is in the places of open-cut mining of iron ore.

In the 11 technogenic soil is presented. There are so-called technogenic uncovered and bulk natural breed.

Natural soil covered with asphalt and lost the ability to produce biological products, have received the name «screenzems». According to its properties close to them soils sealed - it rocks, also covered with asphalt. Such formations are typical for human settlements and industrial sites (area of 13).

Under rezectozems we understand soils, deprived of the upper type diagnostics horizons due to a mechanical cutting. Hemozems - general name for all of soils and surface formations, which are of chemically polluted. These formations are also presented in the form of mosaics in the territory of the Gubkinsko-Staroosolsky region.

Conclusion

The study showed that the notion of the soil cover of the industrial zone» requires clarification, since a large part of the territory of the natural soil cover is absent, and the surface is covered with non-soil formations. According to the results made the following major conclusions:

1. In the industrial zone of the mining enterprises is the radical restructuring of the structure of soil cover, because the replacement of the non-contrast combinations of soils, typical for the territory of the Belgorod region, becomes contrast - complexes and mosaics, which is especially typical for the regions with open mining iron ore raw materials.
2. Most of the soil combinations do not consist of elementary soil habitats, and non-soil entities, for the classification which is necessary to attract other sources of information, not provided for in the SNIIP.
3. The diversity of the mosaics is traditionally associated with the mixed nature of soil forming rocks. However, for a number of technogenic formations of the concept of «soil forming rock type» lost its meaning. Thus, require the further development of the issues of a conceptual framework and practical application of the teachings of SSC for the regions, substantially transformed mining activities.

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