



NATURAL AND MAN-MADE LANDSCAPES AFTER SURFACE COAL MINING

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ABSTRACT

Coal mining leads to the formation of new engineering-geological, geochemical, hydrogeological and biological conditions that are irreversible environmental changes, and are expressed in the disturbance of the relief, landscape, pollution of the atmosphere, soil, groundwater and surface water. After the coal seam is mined, the removed rocks are partially or completely returned to the quarry, despite this, this type of coal mining, to the depth of development, changes the upper layer of the lithosphere and the hydrosphere (groundwater). Open-pit lignite mining creates natural and man-made areas up to 100 m deep on the surface of the lithosphere, which is reflected in changes in the relief and creation of artificial reservoirs after coal deposits are mined. The processes that occur in the natural and man-made landscapes of coal mines complement and to some extent change the course of previous geological processes, but so far their environmental impact has not been recorded. Despite this, it is the processes activated by coal mining in the upper horizons of the lithosphere that are crucial for the formation of a technologically loaded environment and have a negative impact on the environment.

Introduction.

Coal mining leads to the formation of new engineering-geological, geochemical, hydrogeological and biological conditions that are irreversible environmental changes, and are expressed in the disturbance of the relief, landscape, pollution of the atmosphere, soil, groundwater and surface water. The formation of natural and man-made landscapes in coal mining regions consists of two interrelated processes, which include the disturbance of the upper lithosphere by mining workings (quarries) and the exposure of sedimentary rocks to the surface. Changes in the geological environment caused by coal mining operations are reaching the scale of geological phenomena.

The development of the coal mining industry has resulted in a significant anthropogenic load within coal basins and coal-bearing areas, which has formed natural and man-made landscapes. Natural and man-made changes in the Earth's interior and its surface are becoming particularly widespread due to the intensification of mining operations and the deepening of the coal mining horizon.

Over a long period of coal mining, significant factual material has been accumulated on mining and geological conditions at different mining depths, tectonics, hydrogeology and mine water, which allowed us to identify the main factors of formation of the technologically loaded environment. A significant contribution to the research and development of this area was made by A. Radziwill, L. Pimonenko, V. Lukinov, M. Kovalchuk, I. Buchynska, N. Dyachenko, D. Gunia, O. Pravotorova and others [1-4].

Based on the requirements of the regulatory documents in force in the field of subsoil use: The Law of Ukraine "On Environmental Protection" and the Subsoil Code of Ukraine, the study of natural and man-made landscapes in coal mining regions is relevant [1].

The aim of the study is to determine the conditions for the formation of natural and man-made landscapes after surface coal mining and the possibility of reducing their environmental impact.



Materials and methods of the study.

The author generalizes previous and own studies of the conditions of formation of natural and man-made landscapes in the coal mining regions of Ukraine.

Field studies of lignite quarries were carried out in the Dnipro lignite basin (2008-2020) and the Transcarpathian coal-bearing area (2022). Laboratory studies of gas chromatography were carried out at the State Enterprise “Ukrnaukageocenter”, Poltava, headed by the Integrated Laboratory, Candidate of Geological Sciences N.V. Sira.

Presentation of the main material.

Currently, lignite is mined in quarries in the Dnipro lignite basin and the Transcarpathian coal area. In the Dnipro lignite basin, the depth of the pits reached: 50 m - Protopopivskiy coal mine, 80 m - Kostiantynivskiy (Fig. 1) and about 100 m - Morozivskiy (Fig. 2).



Fig. 1. Supercoal horizon composed of sands, clays, coal-bearing sands and coal-bearing clays, Kostiantynivskiy coal mine, northern wall, PC 63-27



Fig. 2. Lower (first) coal seam, almost completely watered, separated from the middle seam by sandy-clayey-coal seam, Morozivskiy section, PC 24-45



During coal mining within the Transcarpathian coal-bearing area of the Ilnytsia coal mine, the depth of the pits reaches 15-30 meters (Fig. 3). The pits are used for groundwater drainage, unlike the coal mines of the Dnipro lignite basin, where water was pumped out by pumps.

It is worth noting that the impact of the developments has also been recorded in the active release of gas mixtures from coal deposits into the atmosphere. The study recorded an increase in hydrocarbon gases (CH_4 - C_5H_{12}), nitrogen and carbon dioxide within the quarries compared to areas not affected by coal mining.



Fig. 3. Ilnytsia coal mine, Transcarpathian coal-bearing area.

After the coal seam is mined, the removed rocks are partially or completely returned to the quarry, despite this, this type of coal mining, to the depth of development, changes the upper layer of the lithosphere and the hydrosphere (groundwater) [2, 5]. Open-pit lignite mining creates natural and anthropogenic areas up to 100 m deep on the surface of the lithosphere, which is reflected in changes in the relief and creation of artificial reservoirs after coal deposits are mined (Fig. 4, 5).



Fig. 4. Kostiantynivskyi coal mine flooded after mining.



The geological process, as the main process of structure formation, has undergone significant changes due to mining operations. The newly formed natural and man-made landscapes are included in geochemical processes. Today, open-pit coal mining has irreversibly changed the upper layers of the lithosphere, in some areas, up to 100 meters. The newly formed reservoirs in coal pits can only partially address the issue of reducing environmental impact.



Fig. 5. Morozivskyi coal mine flooded after mining.

Conclusions.

The newly formed natural and man-made landscapes are included in endogenous and exogenous processes at the planetary level. The geological process of structure formation has undergone significant changes due to mining operations that affect the depth of open workings.

The processes that occur in the natural and man-made landscapes of coal mines complement and to some extent change the course of previous geological processes, but so far their environmental impact has not been recorded. Despite this, it is the processes activated by coal mining in the upper horizons of the lithosphere that are crucial for the formation of a technologically loaded environment and have a negative impact on the environment.

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