INFORMATION SUPPORT OF INVENTORY DEVELOPMENT OF THE MINING TERRITORIES

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Ensuring the safety and well-being of the population when using the territories, especially in the interests of future generations, is a priority aspect of sustainable development of the territory. Mineral extraction is accompanied by a rapid transformation of the lithosphere and changes in the earth's surface and the seabed, water bodies and watercourses on site, subject to the influence of the mining industry, leading to the disruption of natural landscapes and formation of a new, anthropogenic forms of relief, i.e. the formation of specific industrial landscapes - mining landscapes, which has a significant impact on the sustainable development of such areas. In this study, the information support of sustainable development of landscapes of mining areas on the basis of the formation of a special inventory is considered.

Based on the object of study – mining landscapes (ML) organised by the accounting subsystem and observing the state change of the objects of ML namely, the inventory of objects of the mining complex (MC) and monitoring of the ML, is characterized as complex, combining the local level MC at the mining site (MS)) and the impact character, i.e. the locking process the changes to the GPL, depend on anthropogenic factors, often acquires an extraordinary character, and having the timing and frequency of observations from basic to retrospective. Such infor-

mation subsystem must be accompanied by control over compliance with the current legislation, as well as the ability to display the information obtained using GIS technologies [5, 9].

On the other hand, taking into account that complex long-term observations should be carried out for objects, firstly, which are hazardous production facilities, secondly, which are structural buildings and structures and, thirdly, are sources of pollutants, monitoring of ML should, in fact, be engineering and environmental monitoring, combining in the functional composition of its two independent varieties: environmental and geotechnical monitoring.

Objects of ML involved in the production process of mineral extraction and primary processing, must also be considered as technological objects of civil procedure, requiring special accounting.

Usually, the development of mineral deposits is associated either with the violation of large areas (water areas), which are technological objects of MC (open and underwater methods of mining), in this case, the objects of ML mainly formed on the earth's surface, or with areas that are subject to the harmful influence of mining (underground and downhole methods of mining), in this case, the objects of ML, mainly formed in the depths. In both cases, it is necessary to take into account the natural location and boundaries of mineral deposits and the use of land of different categories on which the objects of the ML are located.

The specificity of natural and technological objects of ML and MC, the impact of such objects on the earth's surface, the periodic movement of land occupied by the objects of ML and MC, in the development and operation of mineral deposits put forward, in our opinion, special requirements:

- to accounting of real estate objects and technological objects;

- to the formation of the boundaries of land plots under the objects of ML and MC, territorial zones and zones with special conditions of use of territories;

- to the formation of a spatially defined information retrieval system on the location, composition and condition of real estate and technological objects, including ML objects, in the territory of the MC.

Objects of MC which are subject to the state cadastral accounting and registration of the rights to real estate, and also technological accounting for management of production process, including objects of ML, are given in figure 1.
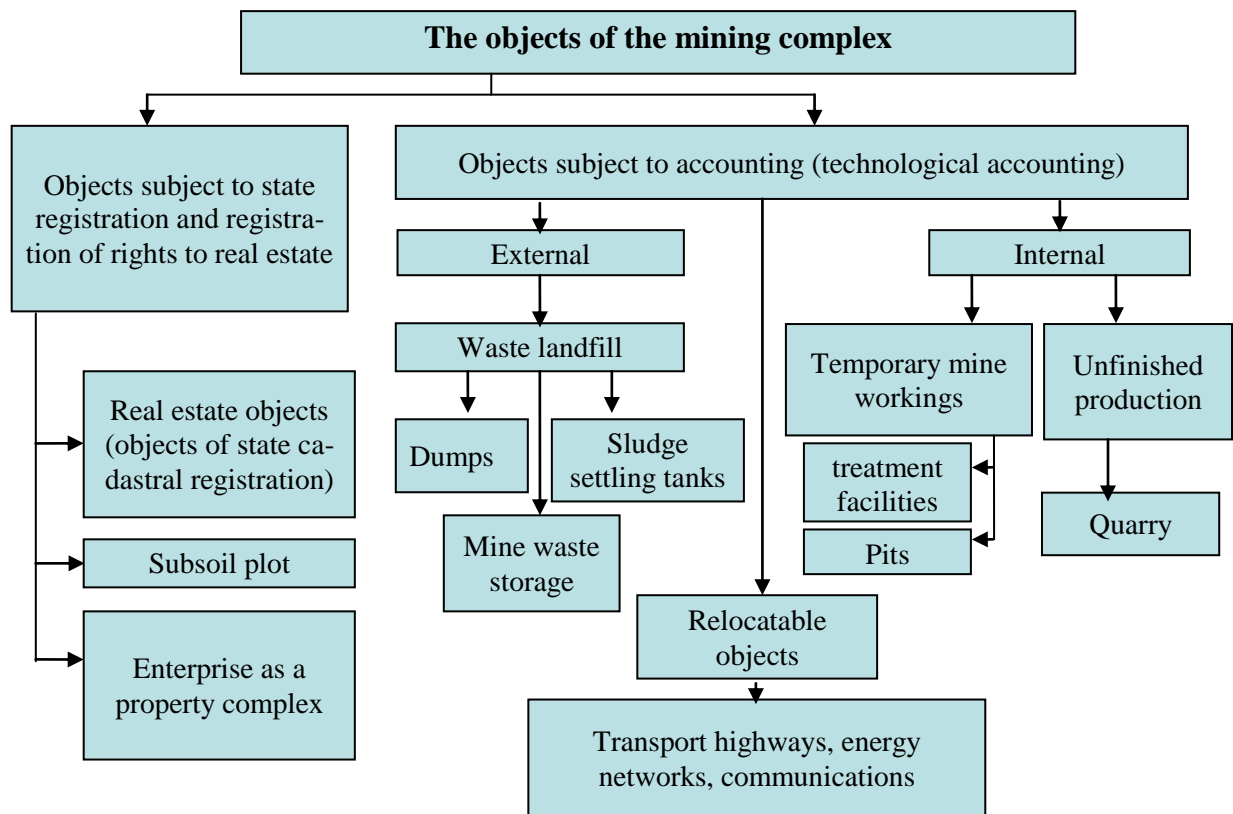
Fig. 1 - MC Objects, including ML objects subject to technological, cadastral accounting and registration of rights

Analysis of the territory of the earth's surface and subsoil, within the boundaries of which the development of mineral deposits is realized, shows that the formation of a space-oriented information retrieval subsystem-cadastre of objects of MC-technological processes on the earth's surface and in the depths should be considered in close relationship.

In contrast to the existing state accounting systems, the formed subsystem has certain features:

First, in the structure of the cadastre of MC objects should be included subsoil – mining allotment, with information characterizing the mineral deposits and host rocks.

Secondly, it is necessary to take into account the time factor that characterizes the constant change in the characteristics of individual objects of MC.

Third, it is necessary to form and implement the principle of identifying real estate objects among the objects of the ML.

Fourth, the impact of mining on the environment should be taken into account.

Then the inventory of objects of MC can be defined as the systematized set of the documented data on technological and other appointment, natural, technical, economic, ecological and legal condition and spatial position of objects of MC which represents, generally the following

groups of objects and the phenomena of MC: a subsoil, a terrestrial surface, engineering infrastructure and the technological, ecological and economic aspects accompanying them [2; 10; 11].

The peculiarity of the cadastre of MC objects is the dynamism of the described objects. Taking into account the instability of the state of ML objects during their formation and functioning, including the development in the post-development period, as well as the fact that most of the ML objects are dangerous, their state is subject to technological control and supervision aimed at preventing emergencies and mitigating their consequences on the earth's surface and in the subsoil within the mining allotment and the sphere of influence of ML objects.

According to the rule of law, it is possible to freely dispose, use and own real estate only after the state registration of rights to it [1]. Registration of rights to real estate is possible only with its allocation and description, information about which must be complete, objective, relevant, all this is achieved with the passage of the state cadastral registration, which confirms the existence of such real estate.

Objects arising in the development of mineral deposits have a different nature of formation (formation or creation). A significant part is formed in the traditional way (land, subsoil, buildings), the other has specific principles of formation (quarries, dumps, sludge storage, etc.). In the latter case, at first glance, it is difficult to attribute objects to real estate, it is necessary to check them for compliance with all the features that are endowed with the property (table. (1) [1].

Table 1 - main features of real estate

Traits	Content (state)
Essential (generic)	
Degree of mobility	Absolute stillness. No displacement in space (without prejudice to the purpose), stationarity.
Relationship to land	Strong
	● physical;
	● legal (rights).
Form of operation	Natural-material.
	Value-only.
The state of the consumer form in the process of use	Not consumed (settings are retained). The natural form is kept during the whole period of operation.
Durability (duration of the circuit)	Reuse (land –indefinitely with proper use).
Public value (utility)	The use of an object often affects the interests of many persons. Liquidity.

Species (private)	
Appointment	Functional (social and (or) technological).
Technical and technological features	Location, condition, etc. Specific private indicators depending on the type of property.

The authors analyzed the identification of the most typical objects of MC as real estate [1]. Table 2 shows an example of the analysis result.

At implementation of the state cadastral accounting, it is necessary to separate land and underground constructions.

To underground structures, as real estate objects and objects of the ML, we will include structures located below the earth's surface, more specifically, below the soil layer in the subsoil, which is regulated by the Federal law "On subsoil" [9].

At the same time, not every structure that has access to the surface can be attributed to underground structures. The criterion should be the ratio of the size of the surface part of the structure to its size below the natural earth's surface. For example, the underground can include wells, shafts, tunnels, etc., to the open-ditches, trenches, pits, etc. Pits, depending on the depth, can be attributed to both.

The corresponding dredging on the earth's surface, having a significant depth, for example, quarries reaching a depth of 350 -500 meters, can be considered a decrease in the earth's surface, in this case, underground structures in relation to them will be structures that have access to the structural elements of such excavations, for example, in the quarry Board-transport tunnels (tunnels) or in the bottom of the quarry-water-lowering wells, etc.

Table 2 - Identification of typical MC objects as real estate objects

№ п/п	Признаки недвижимости	MC facilities						
		Mining						
		Open method of development of mineral deposits		Underground method of development of mineral deposits				Primary processing of minerals
		quarry	dump	mine shaft	crosscut (major excavation)	drift (field mine work)	chamber (clearing mining)	liquid waste storage
1.	Stationarity (general location does not change)	yes	yes	yes	yes	yes	yes	yes
2.	Strong connection to the ground (sub-	yes	no	yes	yes	yes	yes	yes

	soil)							
3.	Form of operation: material value (fixed assets of the enterprise)	yes no	yes no	yes yes	yes yes	yes -	yes no	yes yes
4.	The state of con-sumption (constant parameters during operation)	no	no	yes	yes	yes / no	no	yes
5.	Durability	yes	yes	yes	yes	before work-ing off the block	no	yes
6.	Appointment (technological cycle object)	yes	yes	yes	yes	yes	yes	yes
	General conclusion	not a property	not a property	is a property	is a property	not a property	not a property	is a property
7.	May be subject to rights	no	no	yes	yes	no	no	yes

Thus, the objects of the mining complex must necessarily be identified as belonging to their real estate objects for planning the execution of cadastral works for them in order to prepare information about them for the implementation of the state cadastral registration and registration of rights to real estate.

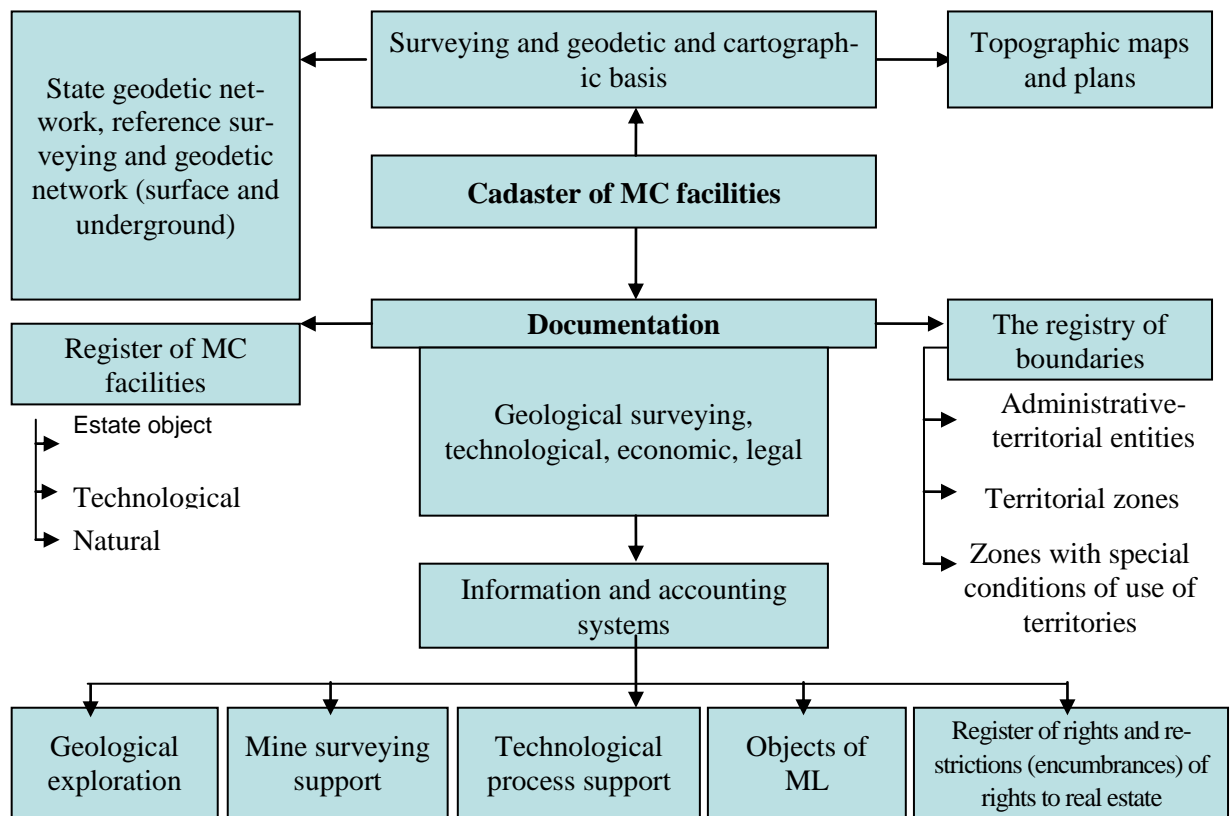The proposed structure of the inventory of MC objects is shown in figure 2.

Fig. 2 - Structure of the MC cadastre

In accordance with the proposed structure, the composition and content of its constituent parts should be as follows [1]:

1. The composition of information on surveying, geodetic and cartographic basis of the cadastre;

2. Structure of data on cadastral division of the territory of MC;

3. The information about the MC objects:

- about real estate objects:
- about land plots;
- about buildings, constructions, their parts (rooms);
- about objects of incomplete construction;
- about underground facilities;
- about underwater (surface) structures;
- about subsoil plots;
- about technological objects of MC;
- about landscapes:

- about natural landscapes;

- about natural and anthropogenic landscapes;

- about the objects of the mining landscape.

4. The composition of information about the objects of land management:

- about territorial zones, zones with special conditions of use of territories, including relating to objects of ML;

- about borders of the Russian Federation (including on the water area of the seas), subjects of the Russian Federation, municipalities, the settlements taking place in the territory of MC.

Thus, the initial positions have diverse, heterogeneous information about the object of research, which must be collected, systematized, stored and issued to the consumer in a convenient form.

All this gives grounds to consider a cadastre of MC objects multivariate (multi-species, multi-dimensional) spatial-oriented information retrieval subsystem, in the end who supply information for the solution of management tasks in the development of deposits of natural resources. Moreover, the composition and content of such information subsystem will depend, firstly, on the peculiarities of the development of natural resources. second, from the specific stages of work (design, construction, operation, conservation or liquidation of the enterprise) and can vary significantly.

However, from the point of view of creation of the inventory of objects of MC as system of the accounting of objects of ML, division of MC into groups United by generality of properties and signs of objects in group, uniformity of their data and existence of close connections between them is more correct if to consider that the mining complex covers the *subsoil* containing minerals - as object of application of actions and forces; *environment (soil, water bodies, vegetation, air) - as a place of functioning; engineering infrastructure (geological surveying, mining, enrichment) -* as a means of impact on the subsoil and the environment, as well as *socio-economic phenomena (ecology, safety and health, productivity and labor resources, legal support, etc*.) - as a product of impact [1]. This approach complements the composition and content of the information in the inventory of MC objects necessary for the management of MC objects.

The presence of various zones of influence of mining operations on the environment, the diversity of types and forms of ML, the stages of their formation, as well as the impact of the components of the natural and man-made environment predetermines the need to use modern GIS technologies, as an integrated system, to study the operation and development of ML and to manage them [610, 11].

Thus, taking into account the features of the life cycle of real estate in the development of mineral deposits, their temporary nature and possible changes in the situation in space, the emergence and cessation of the existence of real estate objects and objects of the ML, as well as a va-

riety of rights and restrictions (encumbrances) of rights to them, there is a need to create a special service that works with real estate in the MC-a cadastral service.

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