REGIONAL DATABASE OF ANTHROPOGENIC MINERAL FORMATIONS AS THE BASIS OF CADASTRAL ESTIMATION OF TECHNOGENIC OBJECTS

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Abstract

In this geoecological study of the Starooskolsko-Gubkin district of Belgorod, Russia, a large amount of data was collected regarding the area's anthropogenic mineral formations and their impact on the natural environment. For clearer presentation and for use in further work, a database entitled 'Geoinformation provision for the rational use of technogenic mineral formations at the Starooskolsko-Gubkinsky mining complex' was created, consisting of 20 tables containing topical information regarding the complex's technological facilities and the degree of their influence on the natural environment. The subject area and functional purpose of this database is to further study the impact of mining production on the environment, as well as the automation of the monitoring system.

Key words: database, technogenic mineral formations, monitoring, environment and geoinformation support

Introduction

Technogenic mineral formations represent mixtures of raw materials, materials and/or semi-finished products formed to produce goods or for industrial purposes that have lost, either fully or partially, their initial consumer properties [1].

The Belgorod region, and the Starooskolsko-Gubkinsky mining complex (SGMC) in particular, possesses significant reserves of iron ore raw materials, with the territory amassing an enormous amount of wastes from the mining and processing, metallurgical, energy and other industries. According to V.F. Schupanovsky and A.M. Babec, in 2012 the Starooskolsko-Gubkinsky mining area had accumulated more than 1.1 billion m^3 of rock in external dump sites, with more than 800 million m^3 of rock strippings and more than 260 million m^3 stored in tailings [6].

The environmental impact of technogenic mineral formations manifests both on individual environmental components and on the wider environment as a whole. This often includes a negative effect on human health and activities, as well as on the flora and fauna of an area. In this regard, it is essential to develop an automated environmental monitoring plan for the Starooskolsko-Gubkinsky area of Belgorod in order to organize further measures to improve the quality of the local environment, as well as to design an environmental management system with the aim of smoothing the conflict between natural and man-made environmental factors [2, 3, 4].

Material and methods

On the basis of the above information, a database was created entitled ‘Geoinformation provision for the rational use of technogenic mineral formations at the Starooskolsko-Gubkinsky mining complex’ (Figs. 1, 2).

The creation of this database began with its design, which comprised the following stages:

1. Study of subject area;
2. Analysis of data (entities and their attributes);
3. Definition of relationships between entities, and the definition of primary and secondary (external) keys.

During the design process, the structure of the relational database was established (i.e. the tables, their structure and logical connection). Table structure

was determined by the composition of column data type, column size, and table keys.

Such a system of information processing should:

- provide both general and detailed reports regarding the results of the work;
- easily determine tendencies of change in the most important indicators;
- provide critical information on time, without material delay;
- be able to carry out accurate and comprehensive data analysis [5].

The developed database is a Windows application, as this environment was considered to allow the user to more fully exploit the opportunities provided by the automated system. The most prominent database management systems, including Lotus Approach, Microsoft Access, Borland dBase, Borland Paradox, Microsoft Visual FoxPro and Microsoft Visual Basic, as well as the Microsoft SQL Server and Oracle databases, are used in applications built on client-server technology. In fact, almost every modern database management system has an analogue (produced by another company) with similar scope and possibilities; almost any application can work with many of the available formats for the presentation of data, or to carry out the export and import of data, thanks to the presence of a large number of converters.

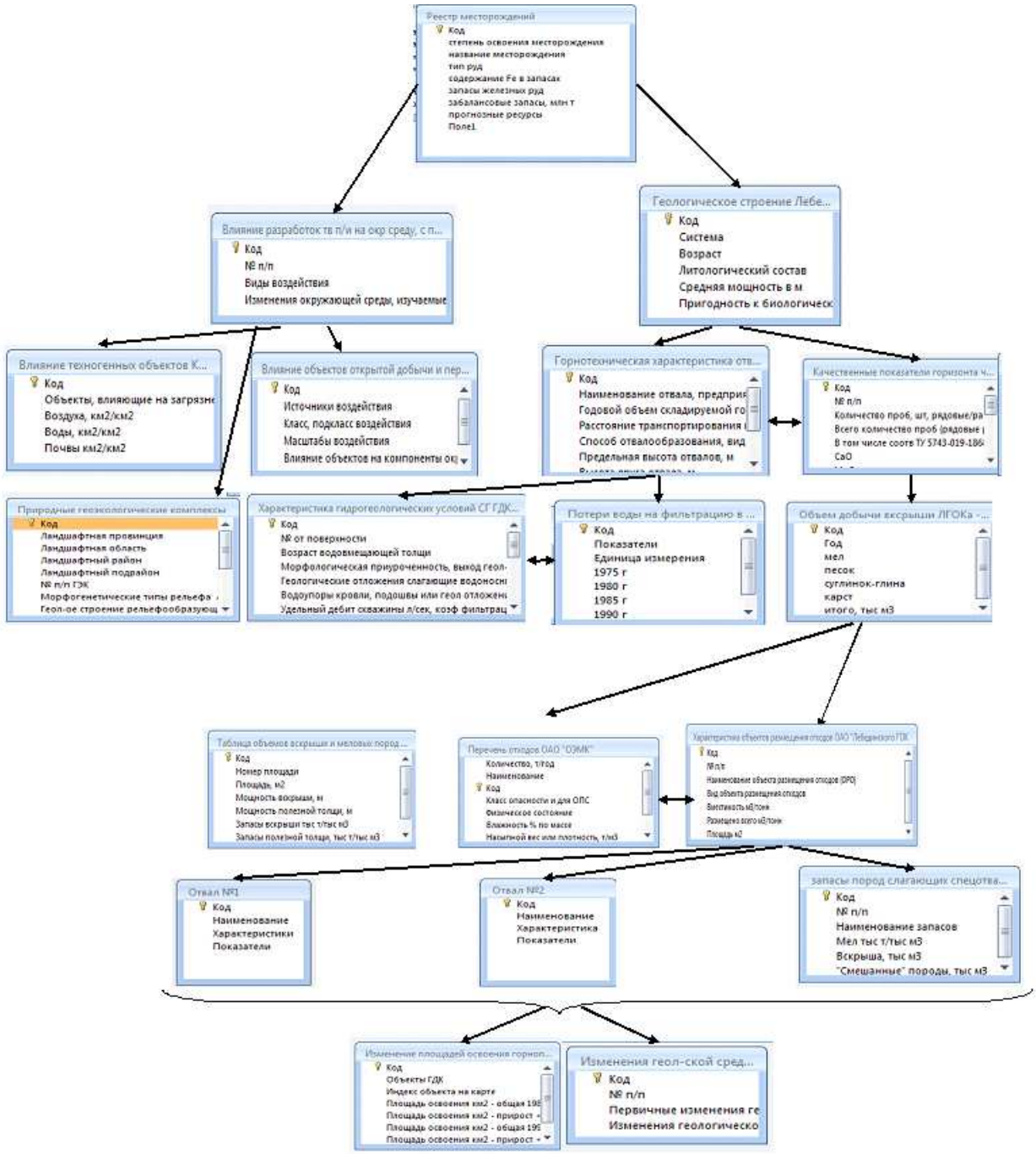

Fig. 1 Structure of the ‘Geoinformation provision for the rational use of technogenic mineral formations at the Starooskolsko-Gubkinsky mining complex’ database

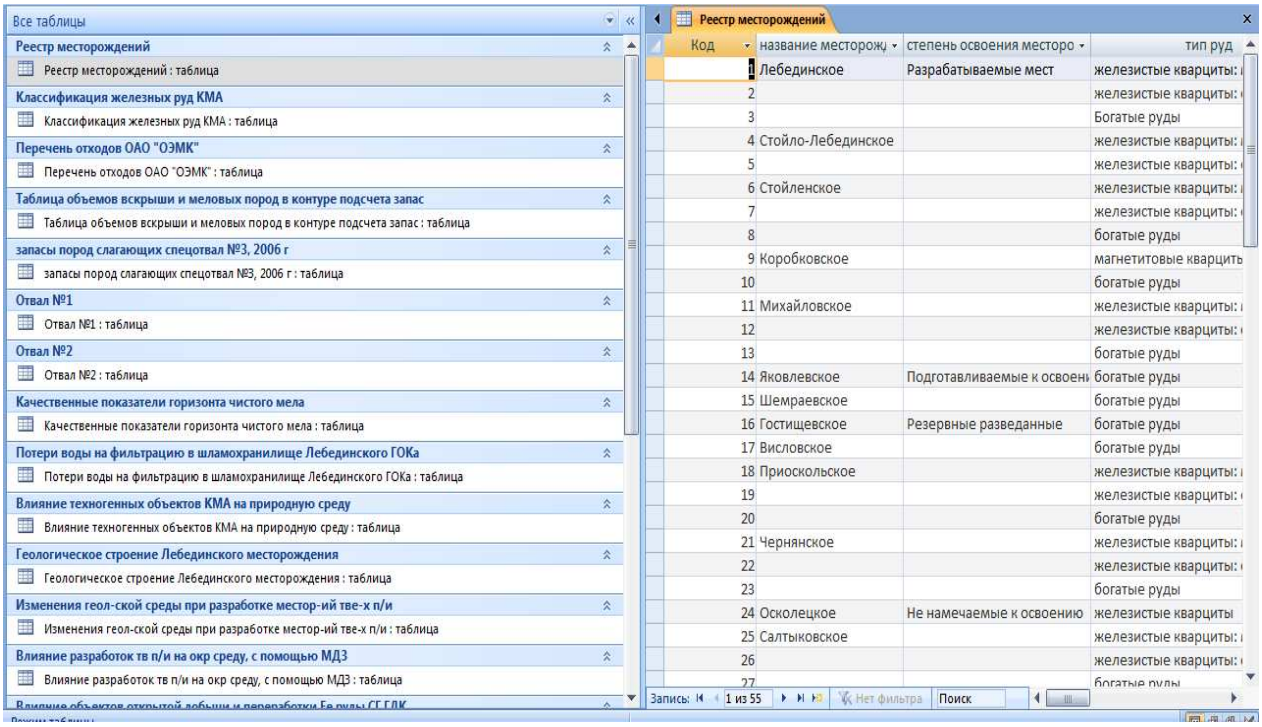

Fig. 2 Fragment of the ‘Geoinformation provision for the rational use of technogenic mineral formations at the Starooskolsko-Gubkinsky mining complex’ database

The purpose of any information system is the processing of data related to objects in the real world, with a database being a collection of information related to specific objects associated with a certain subject area. Subject areas under study are included in databases for the organization and management of collected information and, ultimately, the latter’s automated monitoring. In the case of the present study, the subject is the impact of the Starooskolsko-Gubkinsky mining node on the local environment.

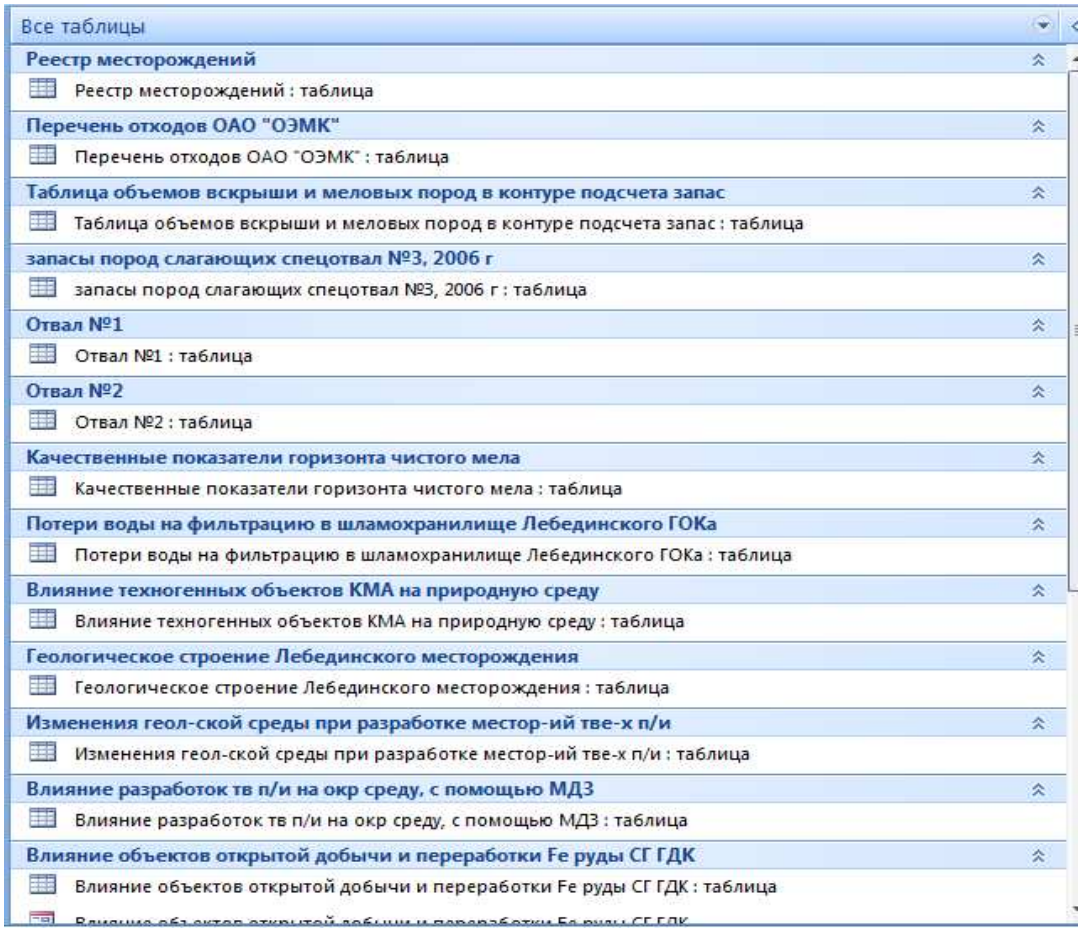

Fig. 3 Table belonging to the ‘Geoinformation provision for the rational use of technogenic mineral formations at the Starooskolsko-Gubkinsky mining complex’ database

The finished database is an integrated set of structured data related to the study area’s environment and technogenic mineral formations, organized according to certain rules which provide for the general description, storage and processing of received data. The database is composed of 20 tables that contain topical information regarding the complex’s technological facilities and the degree of their influence on the natural environment (Fig. 3). The subject area and functional purpose of the database is to further study the impact of mining production on the environment, as well as the automation of the monitoring system.

Results

The present research enabled a large amount of information to be obtained regarding a variety of subjects, including the ecological state of natural objects located in the Starooskolsko-Gubkinsky area, the impact of the region's technogenic material on the natural environment, and the status of local mining production. In order for adequate visual presentation and further work to be carried out, these data can now be arranged in any way and processed, thus making it possible to obtain either summary data or more detailed specific information.

Conclusions

The developed database contains information obtained via the monitoring of the natural environment, including the characteristics of dumped material produced by mining enterprises and quarries, among other industries, over the past 20 years, taking into account the influence of the components of the geoecological environment. Other data include those related to changes in the geological environment and the development of mining facilities as a result of quarrying, the geological structure of these quarries, and formed registered deposits. The functional purpose of the database is that it should act as an automated system which can be used for the monitoring and forecasting of changes in environmental conditions, as well for educational and research purposes.

The database can be used practically in a wide range of scientific fields, including ecology, geoecology, geology and natural resource management. As a result, it is not linked to a specific package, but depending on the task can be used in a variety of applications. The most important aspect of the present work is thus the overall direction of the database and the basis formed for further application development tools.

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