CREATING AND VISUALIZING 3D MODEL OF THE EARTH'S CRUST, TAKING INTO ACCOUNT ITS GEOLOGICAL CHARACTERISTICS

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Abstract

Modeling is a powerful method of control over the development of a place of birth, which allows you to study the geological heterogeneity of the reservoir and predict its behavior during the development process. Over the past decade, three-dimensional modeling has become an integral part of the production process in oil and gas companies. The following article looks into how successfully managing the process.

Key words:

Modelling, three dimensional model, deposit, layer, ore.

Building a three-dimensional geological environment, modeling the processes occurring in this environment, and the ability to apply them to solve practical geological problems is the main goal of a specialist who knows geology and owns computer technologies. Modern technologies of today have gone far ahead in all areas, and the field of geology, which is developing in various directions, did not stand aside. The strategy for the development of geo-mapping is the creation of databases of digital cartographic information based on modern computer technologies. The geological map becomes a two-dimensional geoinformation model of the structure of the studied area, since in addition to information on the geological structure of the surface, databases of any useful information in digital form are attached to the map (data on geophysical research, geochemistry, hydrogeology, minerals, lithological structure, regional tectonics and seismicity, etc. etc).

The process of creating geological models consists of several stages and in depending on the object of modeling (type of mineral, structure, topology, density of the exploration network) may vary somewhat. General structure of the process of creating 3D geological models consists of the following stages :

- development of a database structure for storing primary information according to geological survey data;
- filling the database with geological and geophysical information testing;
- statistical analysis of primary geological data, correction errors, data grouping, database verification, identification of patterns;
- construction of wells in model space, grouping by profiles;
- identification and delineation of ore and non-metallic intervals along stratigraphic principle, clarification of intervals according to the values of the airborne content (interpretation of geological data);
- clarification of the boundaries of the spatial distribution of rocks, taking into account tectonic disturbances, as well as geophysical data (seismic, gravimetry, electrical exploration);
- wireframe modeling of the deposit (selection of ore bodies and rocks accompanying overburden, reservoir modeling, anomalies, traps, etc.);
- creation of empty block models;
- geostatistical analysis of exploration data, variography, definition laws of spatial variability of geological characteristics components;
- modeling the content of components by mathematical methods: nearest neighbor (polygonal method), inverse distances in power (IDW), kraiging (in modifications), etc;

- modeling of hydrodynamic systems, calculation of mass transfer, pollution, chemical composition, etc.;
- clarification of the contours of the distribution of rocks in the field along specified conditions.The sequence of formation of models of deposits of various types of minerals has significant differences at the stage interpretation of intelligence data. In all other aspects, the technique the simulation is almost identical and can vary only slightly.

Similarly, for fields that are already in operation, the simulation may differ slightly from the one presented above. For them, as a rule, have already been created and a set of mining and graphic documentation is underway(plans, sections, maps) regarding the contours of the distribution of rocks in field, refined according to the results of operational exploration, testing and actual development. Therefore, to model the contours of such ore bodies and overburden rocks, refined graphical data. At the stage of preparing the primary data, a change is taken into account distribution contours of varieties at the border between the current the position of mining and the configuration of the deposit in the exploration contours.

To work with geological testing data, a complex of procedures. For the accumulation of geological data is used central database. Access to data is carried out by client-server technology, which allows you to distribute the work on the creation, filling and analyzing data between several operators.The system contains procedures for developing the database structure, setting up table relationships, implementing relational relationships. This allows configure the base for deposits of any kind of minerals and to store in the database arbitrary sets of semantic and facto graphical well information and exploration data. The final stage for creating models of ore deposits is block modeling. This process consists of creating empty block models limited by wireframes; interpolation of content values components based on the established distribution law and refinement contours of rocks according to specified conditions.

When modeling the distribution of components, a large number of factors: the nature of the variability of geological characteristics, structure and morphology of the field, density and uniformity of exploration networks. In this regard, various methods of spatial interpolation: polygonal, inverse distances in degree IDW, kraiging (usual, indicative, polyindicative). After the formationblock structure, adjust the wireframe models by exclusion of areas with substandard rocks. The generated three-dimensional model of the field in the future can be used to calculate the reserves of a deposit or its sections, geological and economic assessment, scheduling tasks and determination of economically viable mining contours.

Modeling is currently being performed using Micromine GIS deposits of ferruginous quartzite, rich iron ore, brown iron ores, indigenous titanium ores, uranium ores, gold deposits and manganese. Deposits of nonmetallic minerals are characterized by wide variety. GIS Micromine has found its application in modeling of deposits of granites, refractory and refractory clays, quartz sands, chalk, limestone, dolomite, kaolin, raw materials for brick industry, building channel sands, etc.

When forming models of deposits of nonmetallic useful For minerals, approaches are used similar to those for ore deposits. However, the specificity of each type of raw material makes its own adjustments. So, for granites, it is very important to clearly define zones of weathering and rock contacts, radiological indicators and fracturing of the massif; for refractory clays and kaolins - spatial variability of thickness formation and separation of clays into grades according to chemical indicators of sampling forfurther selective mining; for limestone and dolomite - exact determination of zones of weathering and karst formation.

Naturally, the variety of nonmetallic minerals leaves an imprint on the functionality of the software. IN field modeling module provides procedures geometrization of deposits, layers, bodies, which have a characteristic appearance occurrence for various types of minerals. As part of the geological modeling module for nonmetallic useful Fossil Integrated Data Interpretation Unit in Exploration profiles. The block contains a set of functions for building geological cuts. Among them are geometric construction functions with modeling rocks by alternation from top to bottom, bottom up, according to the thickness of rocks, auto selection, monoclinal with the possibility of well recovery along depth based on average values of layer thickness, etc.