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Specialized GIS for construction and analysis of digital models of regional line geological objects. Visualization means.

*I. P. Dolinskiy *(SE «Naukanaftogaz»)*, **A. P. Lobasov** *(-)*, **A. A. Haharin** *(National Technical University of Ukraine "Igor Sikorsky Kyiv Politechnic Institute")*

SUMMARY

The article presents the subsystem of visualization of geoinformation system for construction and processing of 2-D - 3-D geological models, first of all regional ones, in the field of oil and gas geology. The system has been investigated at the geological sites of the main oil and gas province of Ukraine - Donetsk-Dnipro Basin (DDZ), the information on which is in the database of geological and geophysical information (DBGGI) of the SE Naukanaftogaz. Appropriate software was created in a GIS environment using compilers such as Delphy and Fortran. Model visualization software tools are demonstrated on the example of a structural model of oil and gas strata at one of the sections of DDz.

Introduction

The regional reservoir geological objects are characterized by not regular data distribution. Primarily all the information is associated with the local objects within the regional one.

The bed properties change in lateral and are the constant in bed thickness. Taking into account this assumption the 3-D model of regional object can be changed by so called 2D+ model. If the bed isn't homogeneous it can be divided in two or more homogeneous layers.

The regional modeling has specific features and based on the wide using of a priori information, theoretical and practical.

The modeling system belongs to desktop system class and was developed in GIS ArcView 3.n environment. It integrates the methods, developed in other environment as DLL-libraries and is intended for oil&gas data exploration. The system is open for new methods and technologies.

The work is devoted to model visualization.

The subsystem of the model visualization.

The visualization subsystem based on the three main principles.

1. Intuitive interface in terms of geology
2. Full set of the visualization methods for geology
3. Easy data preparation, efficiency use

For now, the subsystem of model visualization includes the next functionalities

1. Vertical sections building along the routes of any configuration
2. Horizontal slices building on any rectangular areas
3. Map building on any surfaces within the object
4. Axonomic projection building on any rectangular areas
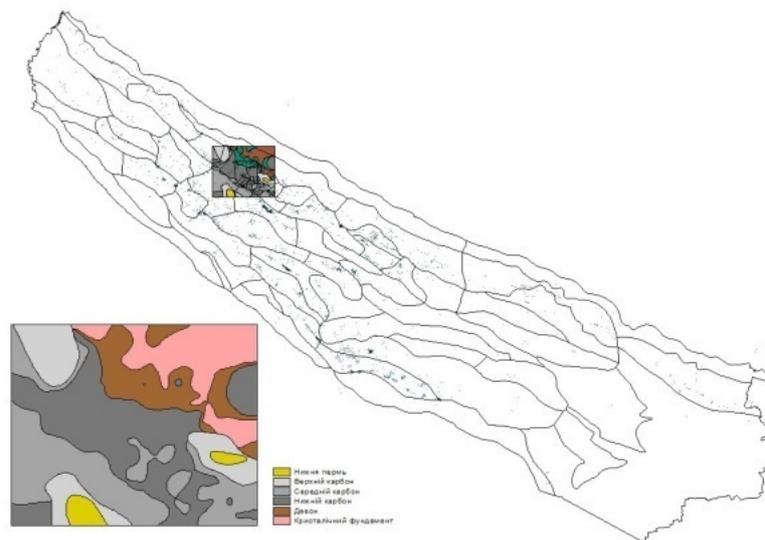5. 3D stratigraphy (lithological) cubes building

Figure 1. Modelling area within the oil&gas thickness in Dnipro-Donetsk depression

The model consists of 2D geological surfaces (grids):

- Top border of lower perm
- Bottom border of lower perm
- Bottom border of upper carbon
- Bottom border of middle carbon
- Bottom border of lower carbon

Horizontal slices building on the rectangular areas

In order to build the horizontal slice of the model it's need to determine the elevation of slice. The grids included in model must be determine also (its must be active). The map on 2500m slice is shown on Figure 2
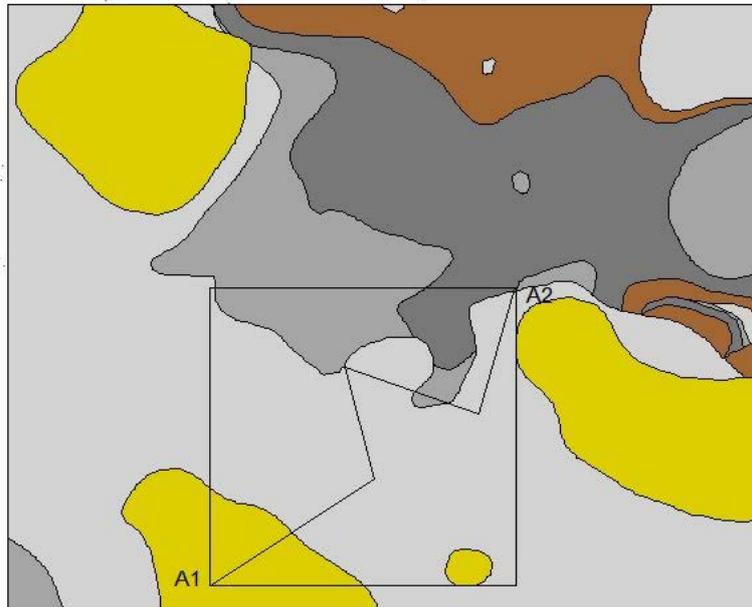

Figure 2 The model of 2500m slice. The legend is given on Figure 1

Vertical sections building along the lines of any configuration

The vertical section's line A1 – A2 (shown on Figure 2) is determined by ArcView standard graphics. The section line must be completely within the model area. All the need parameters are determined by simple dialog. The result section is shown on Figure 3.
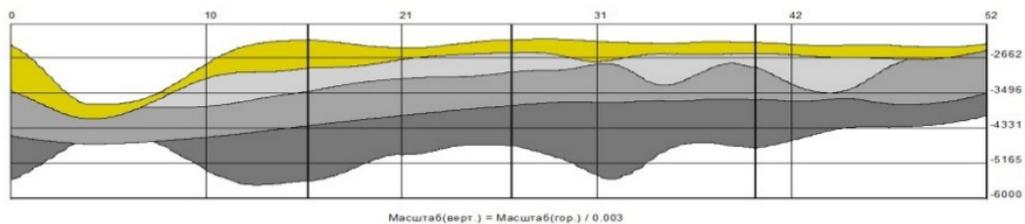

Масштаб(верт.) = Масштаб(гор.) / 0.003

Figure 3. The vertical section along the line A1 – A2 (shown on Figure 2).
The legend is given on Figure 1

The map building on any surface within the object

To build the map on some surface the first it's need to determine the surface grid in dialog list. The grids part of geological section must be active. The result map on the lower perm bottom surface is shown on Figure 4.
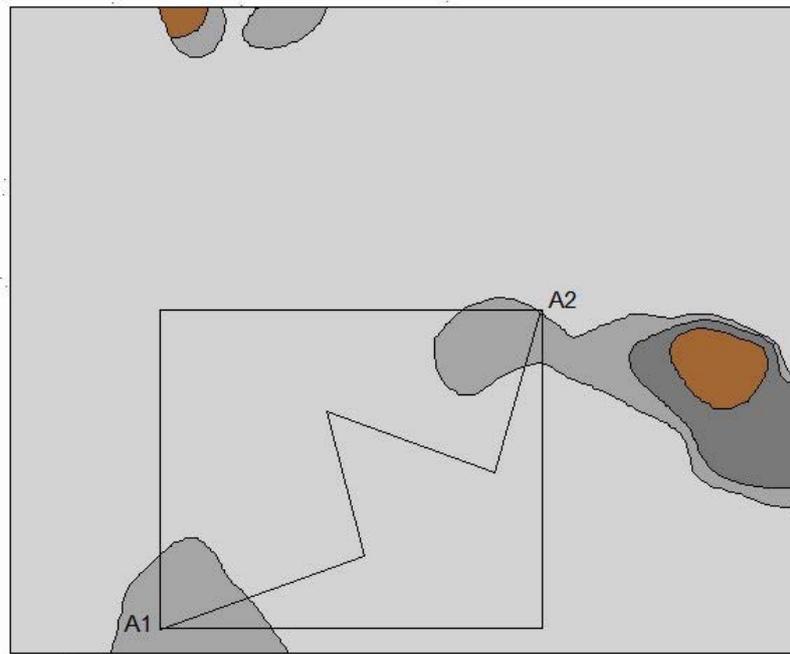
Figure 4. The geological map on the lower perm bottom surface

Axonomic projection building on any rectangular areas within the object

The dialog for axonomic projection building does not differ from the dialogs discussed above. Additionally, it's need to be determined the slice value of upper face of the cube. The cube area is created by ArcView standard graphics in any place of the model. The bottom right angle of the cube is the focus.
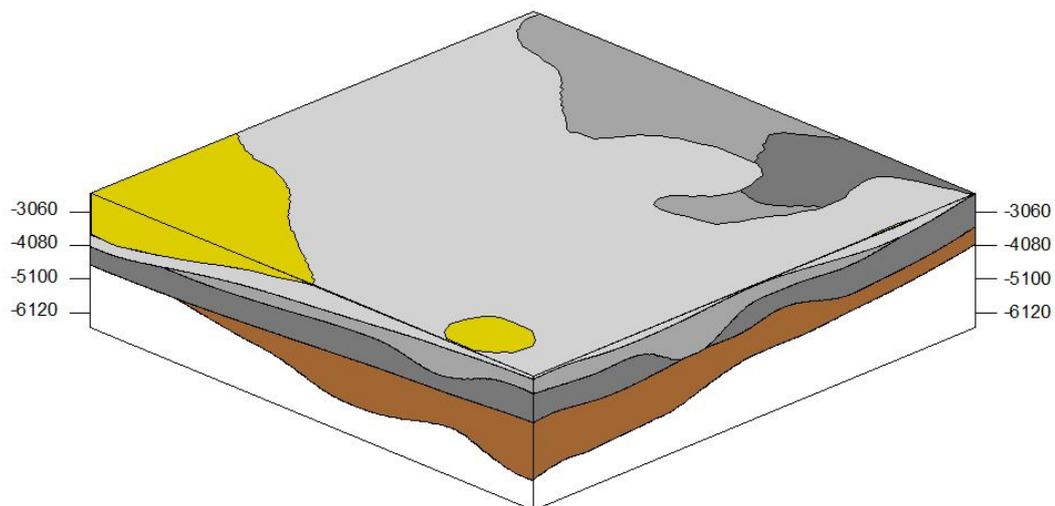

Figure 5 The axonomic projection of some part of the model. Value slice - -2500m.

3D cubes building

The stratigraphic (lithological) cube building is implemented in Delphi and integrated as DLL. The process of the area definition is the same. The input data (text file) must be prepared by special function

(accessed from system interface) preliminarily. The cube is shown in the special window with its own interface. The cube can be rotated in any directions.
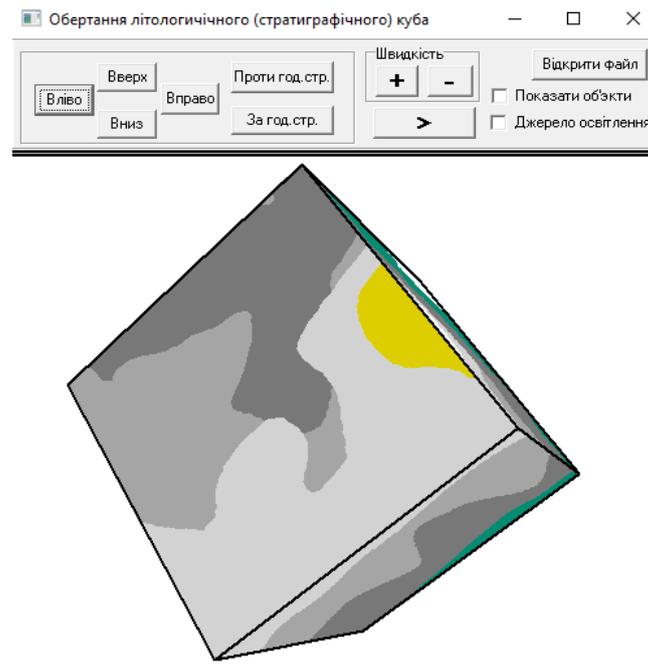

Figure 6. *The stratigraphy cube. The cube area is given on pages 2, 4.*

Conclusions

The visualization subsystem of the regional geological model includes the most tools required by geologists. All the Figures can be complemented by geological (shtocks, faults) and technological (wells, profiles) objects. Many tools for editing are also present.

The study of the system was carried out on the materials stored in the DBGGI of the SE Naukanaftogaz and proved its efficiency

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