

## 4CASTING<sup>©</sup>

### new method for oil-and-gas deposits exploration

The method for great oil and gas fields forecasting is based on the following milestones.

- All giant and great oil and gas deposits are confined to the deep faults – migration channels which are tectonically active
- The method of morphostructural zoning is used for the modeling of the modern block structure of the crust. The main elements of modeling are the blocks of different hierarchical levels. Elements of the block structure connect each other: blocks determine position of linear zones between blocks or in geophysical terms, morphostructural lineaments. Intersections of lineaments form disjunctive (morphostructural) knots.
- Elements of the block structure differ in tectonic activity: lineaments are more tectonically active than blocks; morphostructural knots are more tectonically active than lineaments.
- We have developed algorithms for determination of the morphostructural knots connected with migration channels. These algorithms are based on the specific geomorphologic and geological characteristics of these knots. The procedures of modeling of the block structure of the crust and recognition of the morphostructural knots connect each other.

The method could be used on the regional stage of exploration for evaluation of possible zones of oil and gas accumulation. The method helps to solve the following tasks:

- 1) to recognize in the crust of the potential petroleum basins the modern block structure of different hierarchical levels and to find in this structure tectonically active morphostructural knots – the main forecasting objects;
- 2) to find among these morphostructural knots the knots reflecting in relief the migration channels responsible for formation of large zones of oil and gas accumulation.

*The first step* deals with modeling a recent block structure of a basin in order to recognize blocks of different hierarchical levels, linear zones between blocks (morphostructural lineaments) and areas of intersection or attachment of lineaments (morphostructural knots). The morphostructural knots are treated as forecasting objects.

*The second step* deals with recognition of the most prospective morphostructural knots reflecting in relief the migration channels and allocation of their conventional borders.

*The third step* consists of modeling the real borders of the recognized morphostructural knots (or their groups) as potential zones of large oil and gas accumulation.

*The fourth step* is a modeling and allocation of the morphostructural knots inside of the potential zones of large oil and gas accumulation.

Further, the traditional geophysical and geochemical investigations could be carried out in the recognized morphostructural knots inside of the potential zones of large oil and gas accumulation.

The main advantages of the new method are as follows:

- significant (3-4 times) increase in the efficiency of hydrocarbon deposits forecasting, especially for giant deposits
- possibility of evaluating areas for which there are no geophysical and geochemical data available or where it is difficult to arrange these kinds of investigation (Arctic, Far North, offshore zones, etc.)
- significant (3-4 times) cost reduction for very expensive geophysical investigations. Contrary to the traditional methods, the new method does not demand such investigations for the whole surface of a selected terrain. The investigations should be performed only for 10-15% of the area.

### Method application

All giant oil-and-gas deposits are located in the areas of disjunctive knots – the areas of interference of deep faults zones, which **keep their tectonic activity** at present. Using 'informative relief characteristics' **4CASTING®** allows us to recognize the most prospective for oil-and-gas accumulation objects in the investigated area.

The method has been tested for different regions all over the world. The result of this test is shown in Table below.

Basin	Western Siberia	Northern Andes	Alberta (Canada)	Northern See
Basin area, km <sup>2</sup>	1,900,000	800,000	11,500,000	600,000
Number of giant fields discovered	30	15	8	21
Number of giant fields predicted by the method	26	15	6	19
% predicted	87	100	75	90

Commercial application of the method was used for recognition of the promising areas for oil and gas exploration in Texas (fig. 1) and in Sweden (Siljan Ring structure – fig. 2).

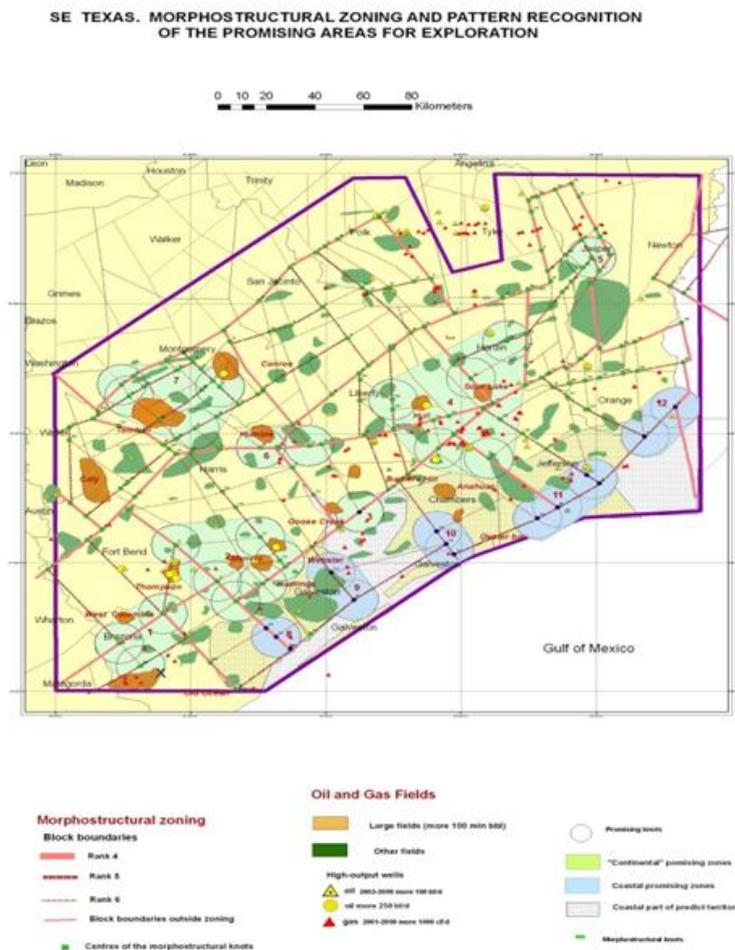


Fig. 1.

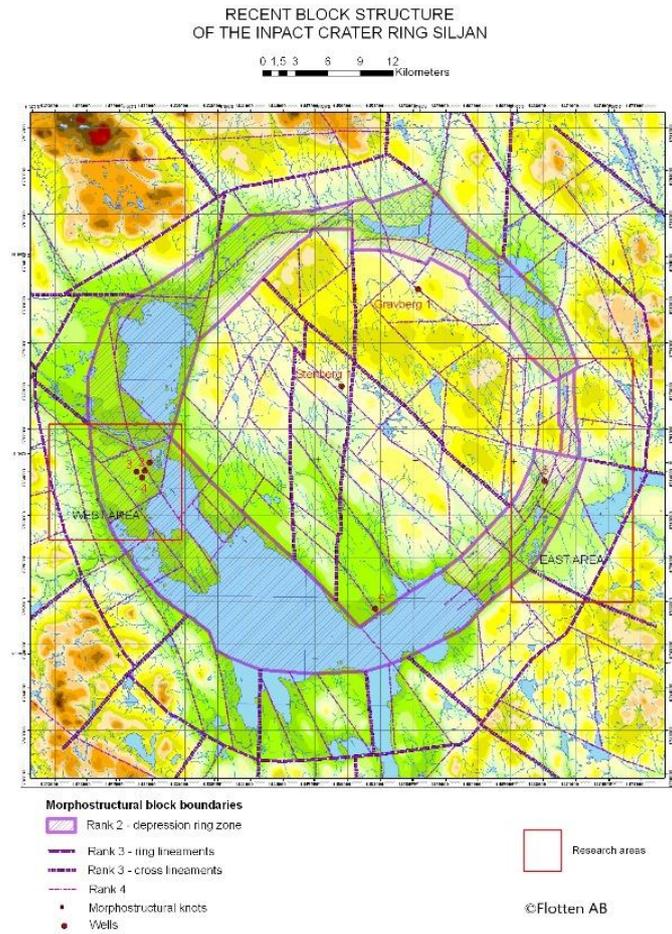


Fig. 2.

YI Pikovsky, MP Glasko, VG Kutcherov (2017). The block structure and the presence of oil and gas in the Siljan impact crater. Russian Geology and Geophysics 58 (2), 199-205.