Final reporting results for “Express Analysis”

Price of “Full scale analysis” is higher, also it requires more time. Therefore detailed “Full scale analysis” of discovered prospective zones is a subject of subsequent studies, when a Client can choose the most important ones from among discovered prospective zones.

1) We would like to note once again that “Express analysis” is not a «Full scale analysis» that is done in shorter period of time.

2) Express analysis means that in short time period and with many times smaller price, in comparison with Full scale analysis, we provide a Client with a map of his block with a layout of prospective and not prospective zones, including depths of occurrences.

3) We will provide a Client with geographical coordinates of prospective zones and depths of occurrences; it will be clearly seen on horizontal and vertical profiles and sections of Thermovision Tomography. (Examples are below)

4) For further detailed «Full scale analysis»: scale and resolution need to be changed, additional algorithms of analysis and interpretation need to be used. Final result of «Full scale analysis»: 3d analysis of prospective zone, boundaries of deposits, estimation of geometric volume, calculation of commercial hydrocarbon reserves and GPS coordinates for well drilling.
Express Analysis - Expected Results And Materials:

a) To provide the Client with a scheme of formation of tectonic structures within a studied territory (faults, geo-blocks, intrusive formations);

Regional study (express) is executed using Thermovision images of a block within large territories (hundreds of kilometers in length) and depths (dozens of kilometers) with the main goal of studying principles and scheme of formation of tectonic structures of the territory and detecting number of signs of large hydrocarbon deposits. For example, within a chosen territory we outline location of Thermovision Tomography vertical profile (Picture 1).

Picture 1. Scheme of licensed blocks in Equatorial Guinea and Thermovision Tomography profile.

Then we build Thermovision Tomography profile, capturing wide length and depth scale. After that we form a grid of profiles with necessary range.

(Picture 2 - Example of profile)
Picture 2. Thermovision Tomography profile (regional study). Faults (blue color) form regional zone of fracturing of crust’s blocks. Favorable zones for hydrocarbon search are shown by triangles.

On this profile we see blocks and faults of the Earth’s crust, fracture zones and outcomes of deep geothermal crust decompression zones (blue color), which is one of the obvious signs of large hydrocarbon occurrences.

Then discovered favorable zones are studied using larger resolution and scale.

Faults (blue color) form regional zone of fracturing of crust’s blocks. Favorable zones for hydrocarbon search are shown by triangles.
b) To define, whether there are signs of favorable structures for hydrocarbon formation within the studied territory;

Numerous studies of different regions of the world revealed signs of conditions for the accumulation of hydrocarbons in sedimentary cover. They are:
- Formation of regional and local thermal field;
- Consistent changes of intensity of cold local zones;
- Features of formation of deep structures;
- Characteristic of block-and-fault tectonics (ranking feather joints on active zones of fluid flow and accumulation).

**Thermodynamic criteria of selection of prospective zones:**
- Outcomes of deep geothermal crust decompression zones is a sign of large hydrocarbon deposits;
- Geological objects are located near ascending thermal linear flows but beyond geothermal mounts, where safety of traps is unlikely (picture 3);
Thermovision Tomography express analysis is made for 1750 depth section of productive layer. “Shoe strings” deposits are discovered (red color) in volumetric block-and-fault model (a) and in model of structure homogeneity (b).

- presence of asymmetrical “peaks” on models of thermal fields for a range of potential oil & gas depths; “peaks” overset the general plan of horizontally layered section and represent a structure of cover rocks, in which local sites of cold zones are formed, blocked by warmer sediments;
- situation of counter direction of positive and negative vectors of thermal flow;
- significant lateral deviation of thermal flows from vertical direction due to geological objects;
- geological objects are located beyond geothermal holes (blue color) and negative linear flows (red color) (picture 4);
- abnormal spatial and temporal dynamic of normalized spectral parameters of vegetation and soil condition;
- relatively higher hypsometric position of projected geological object.

Based on features of 3d models we assess a condition of geothermal hydrocarbon traps, define a quality of impervious traps and fluid accumulation zones and determine the presence of disruptions through tracing of deep water discharge zones and how it affects the safety of deposit.

Taken together all our Thermovision Tomography researches and interpretation of materials allow to determine the most probable contours and depths of hydrocarbon deposits and to recommend a pilot well drilling.
c) To provide a Client with a prospectivity map for HC search, focusing on prospective zones with their analysis and explanation of signs of prospectivity. The final result of the «regional level of study» (“express”) - providing a Client with forecast maps marking prospective and not prospective zones, and recommendations for further works.

Below is the series of maps we get during sequential execution of Thermovision Tomography express analysis (Picture 5).
Picture 6 shows final results of the hydrocarbon prospectivity research of the territory.

In addition to maps we provide detailed description of prospective zones, including:
- list of objective signs of prospectivity;
- depths of prospective hydrocarbon deposits;
- coordinates of angle points of prospective objects on geological map;
- Thermovision Tomography vertical profiles and horizontal sections of prospective zones;
- interpretations of results;
- etc.

Legend:
- **Green objects** – Prospective areas;
- **Blue objects** – Uncertain prospects;
- **Red objects** – not prospective areas.
d) Apart from the examples mentioned above, we also build more detailed profiles, sections and block-and-fault models for given depths (Picture 7 and 8).

We execute this detailization of selected objects for convincing demonstration of our recommendations (Picture 7) and for analysis of previously chosen by a Client tactic of drilling according to results of other methods of geophysical research. Particularly for analysis of reasons of low-production situations and recommendations for hydrocarbon production increase (Picture 8).

Picture 7. Marievsky structure of Zhigulevsko- Pugachevskiy arch, Russia.
(a) Horizontal section of local thermal field, 1km depth (with the contour of oil-bearing zone and the location of the well);
(b) Model of Block-and-fault structure (with the structure, the trap and the location of the well, including its depth);
(c) Model of homogeneity zone (reassurance of prospective structure`s localization).

Map legend:
1 - Geothermal profile;
2 - Location of well;
3 - Contour of oil-bearing zone.

Picture 8. Recommendation for hydrocarbon production increase.
The vertical Thermovision Tomography profile is laid through low production well (red line). Prospective structure is clearly seen (green color) under the trap (red color). The well was drilled in the edge of the structure. Relocation of this well 1,5 km left will significantly increase its production.
TVT technology advantages

Short execution period: 1 000 sq.km. — 3-6 months; 5 000 sq.km. and above — 7 months
More economical vs. traditional methods
Physical presence is not required
Regardless to relief, terrain and seabed conditions (inc. complex fault structures)
TVT has no problem identifying oil reserves even due to interference from gas clouds
Enables possibility to build vertical and horizontal profiles of block-and-fault structures
at any given depth and in any direction
Maximal Depth: up to 100 km
Zero environmental impact
8-hour seminar for clients specialists:

“Reading and interpretation of TVT materials”
Thank you