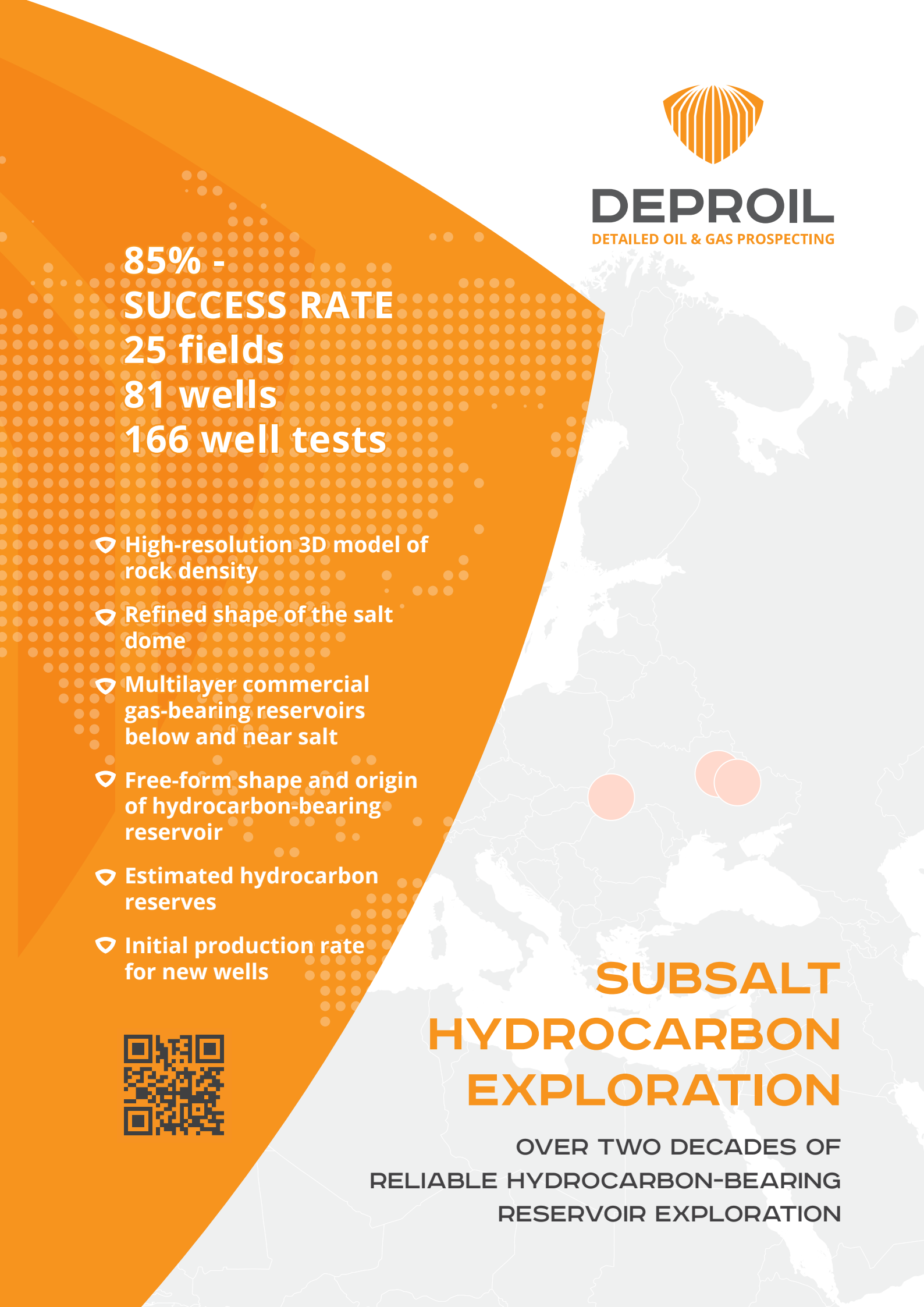
DEPROIL

DETAILED OIL & GAS PROSPECTING

85% - SUCCESS RATE
25 fields
81 wells
166 well tests

- High-resolution 3D model of rock density
- Refined shape of the salt dome
- Multilayer commercial gas-bearing reservoirs below and near salt
- Free-form shape and origin of hydrocarbon-bearing reservoir
- Estimated hydrocarbon reserves
- Initial production rate for new wells



SUBSALT HYDROCARBON EXPLORATION

OVER TWO DECADES OF RELIABLE HYDROCARBON-BEARING RESERVOIR EXPLORATION

ATTENTION! 7 YEARS OF DRILLING CONFIRMS 100% RATE OF SUCCESS IN MAPPING SUBSALT GAS-BEARING RESERVOIRS!

MAPPING TOP AND BOTTOM OF THE SALT DIAPIR, COMMERCIAL GAS-BEARING RESERVOIRS WITHIN TWO OVERLAPPING STRATGRAPHIC LEVELS BELOW THE SALT

Solotvyno and Dibrova gas fields,
Transcarpathian Trough, Ukraine, 2005

GEOLOGICAL PROBLEM

The study area belongs to Transcarpathian Trough which is Miocene molasse basin, underlayed by Paleogene-Mezozoic basement. In the south-eastern part of the study area salt pierces Neogene clastic sequence and forms Solotvyno salt diapir. The top and the bottom of salt diapir can not be mapped by seismic methods due to alteration of salty and clastic beds.

Solotvyno gas field is situated in the eastern part of the study area. Gas pools were discovered by wells #1 and #2 and are confined to Lower Badenian tuffs of Novoselytsya formation N_1nv. Dibrova gas field is situated in the central part of the study area. Gas pools were discovered by wells #4 and #22 and are confined to Paleogene sediments P_3gr. Both fields are located near Solotvyno salt diapir and are overlaid by salty beds of Tereblya formation.

By 2D seismic data, Solotvyno and Dibrova gas pools occure in Neogene and Paleogene anticlinal structures respectively. Wells #4 and #22 of Dibrova field were placed in northern pericline of Dibrova anticline; wells #1 and #2 - in western pericline of Solotvyno anticline.

The main objective of the study was to refine the shape of Solotvyno salt diapir and to delineate distribition of gas-saturated reservoirs, discovered by producing wells of Solotvyno and Dibrova fields.

3D GRAVITY INVERSION WORKFLOW

3D structural framework was built using 20 2D seismic lines, as well as stratigraphic well tops from different wells including #4 and #22 of Dibrova field and #1 and #2 of Solotvyno field. Structural model consisted of 7 surfaces, featuring the structure of Neogene and Paleogene. The initial 3D density model (Figure 9, a) was built using generalized petrophysical relations. Dimensions of the 3D density model were 14.4x10x7 km. Voxel property model discretization (cell size) - 100x100x50 m. Total number of cells – 2 million.

Sandard deviation (SD) between observed gravity and gravity calculated from the initial 3D density model was 3.792 mGal (Figure 8, d). The first stage of applied algorithm-3D non-linear gravity inversion led to refining the shape of salt diapir and reducing deviation between observed and calculated gravity to 1.5 mGal (initial 3D density model was improved by 2.5 times). The next stage - 3D linear gravity inversion led to refining 3D density model and reducing deviation between observed and calculated gravity to 0.316 mGal (relative to the gravity field, the initial 3D density model was improved by 12 times) (Figure 8, e).

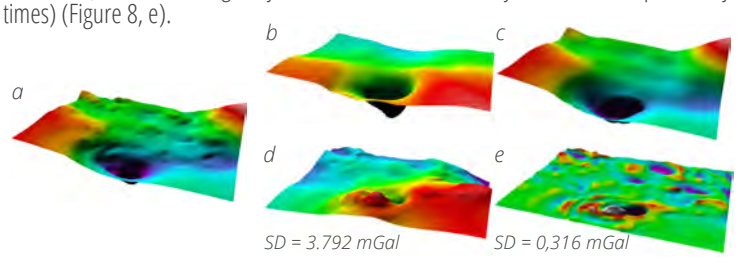


Figure 8. Observed (a) and calculated gravity fields in case of initial (b) and resulting (c) 3D density models and gravity misfit in case of initial (d) and resulting (e) 3D density models

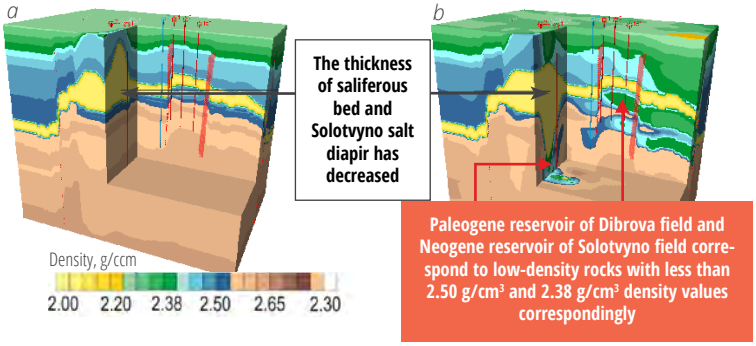


Figure 9. Initial (a) and resulting (b) 3D density models

GEOLOGICAL RESULTS

The shape of Solotvyno salt diapir was refined by results of 3D gravity inversion. It turned out that the bottom of salt body deeps over 2.5 km down while in the initial 3D model it reached only 1.3 km depth (Figure 9).

Paleogene gas pool of Dibrova field corresponds to low-density area outlined by maximum density value of 2.50 g/ccm. Producing wells #4 and #22 are located within the low-density anomaly (Figure 10). The most qualitative gas-saturated reservoirs are developed to the south from wells #4 and #22 under Solotvyno salt diapir. The rest of the anticlinal structure is characterized by dense sediments which indicates an absence of good reservoirs and hydrocarbon saturation. It was confirmed by dry wells #23 and #28 (Table 1).

Neogene gas pool of Solotvyno field corresponds to low-density area outlined by maximum density value of 2.38 g/ccm. Producing wells #1 and #2 are located within the low-density anomaly (Figure 11). Neogene gas pool is located in the apical and south-eastern part of Solotvyno anticline. Gas inflow from well #15 within the apical part of the structure (Table 1) confirms validity of the outlined contour of Neogene gas pool in Solotvyno field.

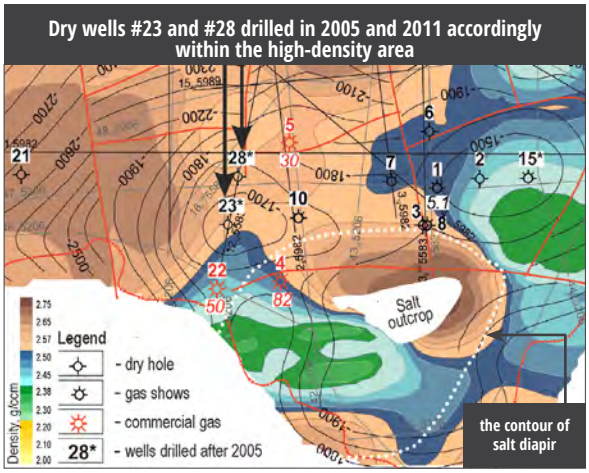


Figure 10. The contour of gas-saturated reservoir in Paleogene of Dibrova field outlined by density value of 2.50 g/ccm. Dry wells №23 and №28 discovered dense impermeable rocks

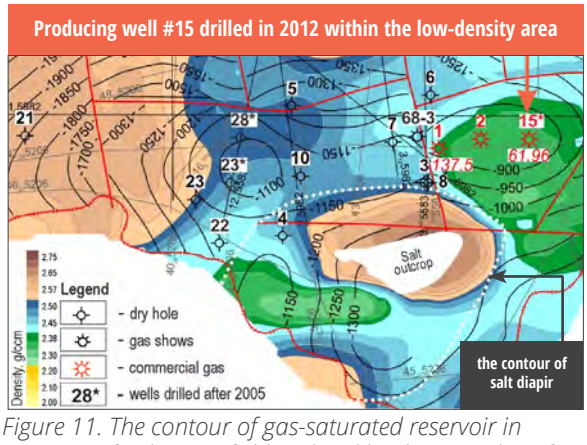


Figure 11. The contour of gas-saturated reservoir in Neogene of Solotvyno field outlined by density value of 2.38 g/ccm. Producing well №15 discovered low-density gas-saturated rocks

Table 1. Drilling history and well testing results in Dibrova and Solotvyno gas fields

Year	Well	Age	Prediction	Well test result
2005	23	P_3gr	dry	dry
2011	28	P_3gr	dry	dry
2012	15	N_1nv	gas	gas