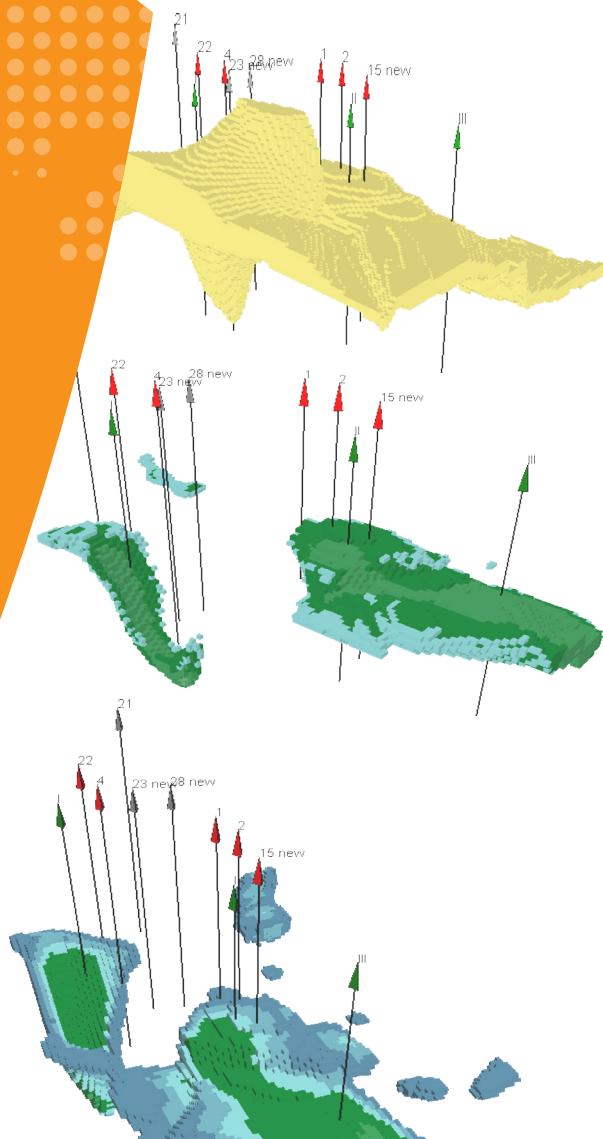




DEPROIL

DETAILED OIL & GAS PROSPECTING

- ✔ Commercial wells within the pools: 3
- ✔ Commercial success rate 100%
- ✔ Dry holes outside the pools: 1
- ✔ Dry hole prediction probability: 100%



THE ACCURATE SHAPE OF SALT DIAPIR AND NEAR-SALT COMMERCIAL HYDROCARBON POOLS AS A RESULT OF A 3D JOINT GRAVITY, WELL-LOG, AND SEISMIC INVERSION

30+ YEARS OF EXPERIENCE IN MAPPING COMMERCIAL HYDROCARBON POOLS



DISCOVERY OF THE NEW OIL FIELD NAMED AFTER ACADEMICIAN P. F. SHPAK AND NEW COMMERCIAL GAS POOLS OF THE RUNOVSCHYNA GAS FIELD

Dnipro-Donets Basin, Ukraine, 2012

STUDY OBJECTIVES

By the start of the study above the Runovschyna salt diapir there was known Runovschyna gas field in Triassic, shown in yellow in Figure II-2a. Exploration project by 2011 foreseen new hydrocarbon pools in the Upper Carboniferous – under the salt wing and beside the salt wall (Figure II-2d), as well as within tectonic blocks neighboring the known pool in Triassic. The main risks consisted of the absence of commercial hydrocarbon saturation.

High-precision gravity data were used in 2012 to refine the shape of the Runovschyna salt diapir and to identify commercial hydrocarbon pools beside and above the salt dome.

3D MODELLING TECHNIQUE

The structural framework was built using 3D seismic data interpretation results for target horizons in the Carboniferous. A structural model of the underlying Devonian sequence (including mother-salt) and basement was built using regional 2D seismic lines. Wells from nearby fields were used to define the density model of the target Carboniferous interval. Generalized petrophysical density relations derived for the Dnieper-Donets Basin were used for deeper horizons.

The structural 3D model consisted of 16 surfaces. The 3D voxel density model was constructed down to a depth of 20 km. Dimensions of the 3D density model were 43x25.5 km. Voxel property model discretization (cell size) was 100x100x50 m.

The standard deviation (SD) between observed and modeled gravity from the initial 3D density model was 7.154 mGal; between observed and modeled gravity from the final 3D density model, 0.219 mGal. Relatively the gravity field, the initial 3D density model was improved by 33 times.

GEOLOGICAL RESULTS

3D joint inversion of gravity, seismic, and well data revealed that the salt dome shape, as determined by 3D seismic data interpretation, overlaps with that obtained from inversion results; however, there were still areas of significant difference. The low-density area associated with known Runovschyna gas fields was clearly identified in the 3D density model (Figure II-3). Apart from that, near the south-western wall of the salt dome and under the salt wing, there was mapped a new oil pool, which is controlled by a localized low-density zone with a cut-off value of 2.36 g/ccm (Figures II-1, II-2e, II-4). In 2013 well #110 was drilled and discovered a commercial oil pool in Lower Permian – Upper Carboniferous. It obtained 106.8 m³/day of oil and proved the discovery of a new oil field named after Academician P. F. Shpak (Figures II-2d,e, II-4).

In Triassic–Jurassic sequence overlaying the Runovschyna salt diapir, to the northeast of the known Runovschyna gas-condensate field in the neighboring tectonic block a new commercial gas pool was mapped (Figures II-2b, c). In 2013 two wells, #100 and #101, were drilled within the mapped new gas pool yielding 19.5 and 12.5 thousand m³ of gas/day, respectively. Outside the outline of the pool the “dry” (water-producing) hole #102 was drilled. Thus a 100% success rate was achieved in mapping of commercial oil and gas pools (Figure II-3b).

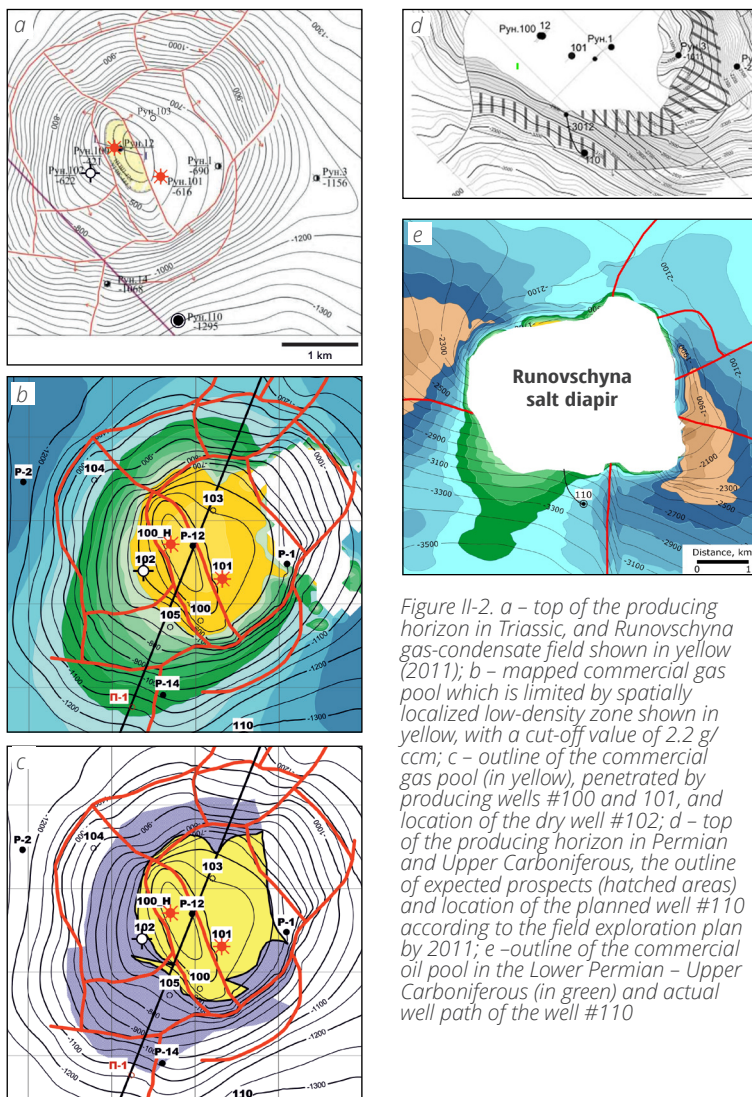


Figure II-2. a – top of the producing horizon in Triassic, and Runovschyna gas-condensate field shown in yellow (2011); b – mapped commercial gas pool which is limited by spatially localized low-density zone shown in yellow, with a cut-off value of 2.2 g/ccm; c – outline of the commercial gas pool (in yellow), penetrated by producing wells #100 and 101, and location of the dry well #102; d – top of the producing horizon in Permian and Upper Carboniferous, the outline of expected prospects (hatched areas) and location of the planned well #110 according to the field exploration plan by 2011; e – outline of the commercial oil pool in the Lower Permian – Upper Carboniferous (in green) and actual well path of the well #110

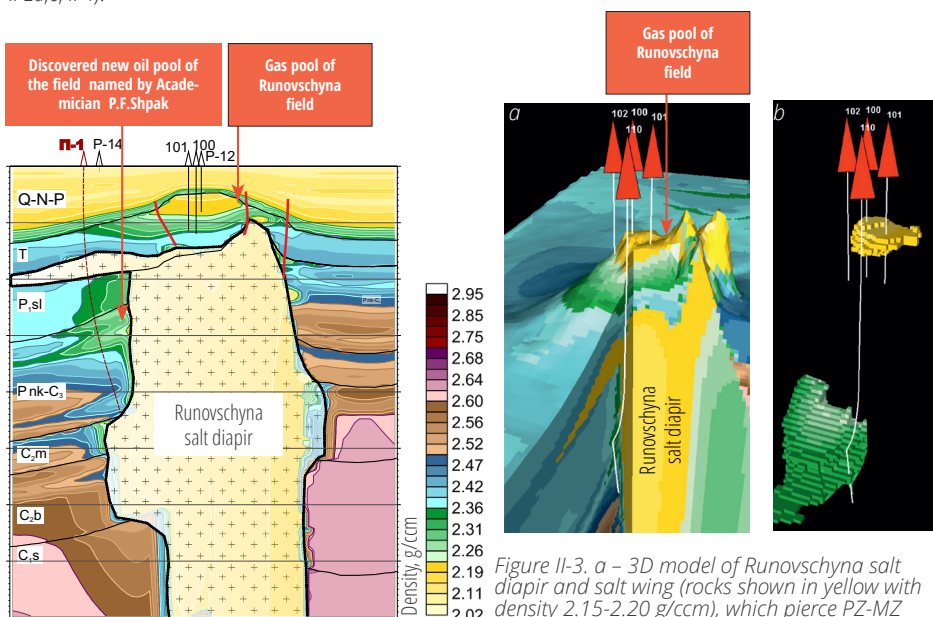


Figure II-1. Cross-section of the 3D density model across known Runovschyna gas-condensate field and newly discovered oil field named after Academician P. F. Shpak

Figure II-3. a – 3D model of Runovschyna salt diapir and salt wing (rocks shown in yellow with density 2.15-2.20 g/ccm), which pierce PZ-MZ formations (rocks shown in blue with density 2.36 - 2.5 g/ccm); b – 3D outlines of commercial hydrocarbon pools in Triassic-Jurassic (in yellow) and Lower Permian – Upper Carboniferous (in green) (2012) and new wells drilled in 2013

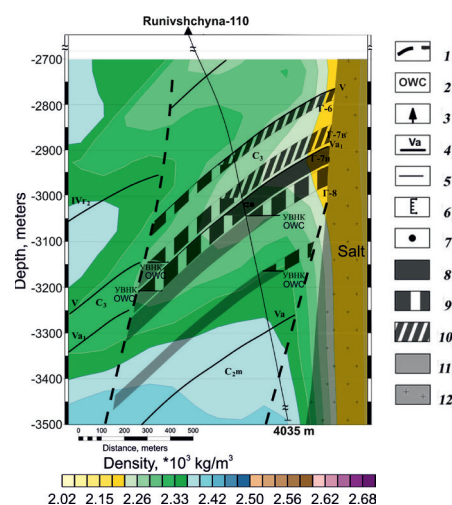


Figure II-4. Cross-section across new exploration well #110 of the oil field named after Academician P. F. Shpak