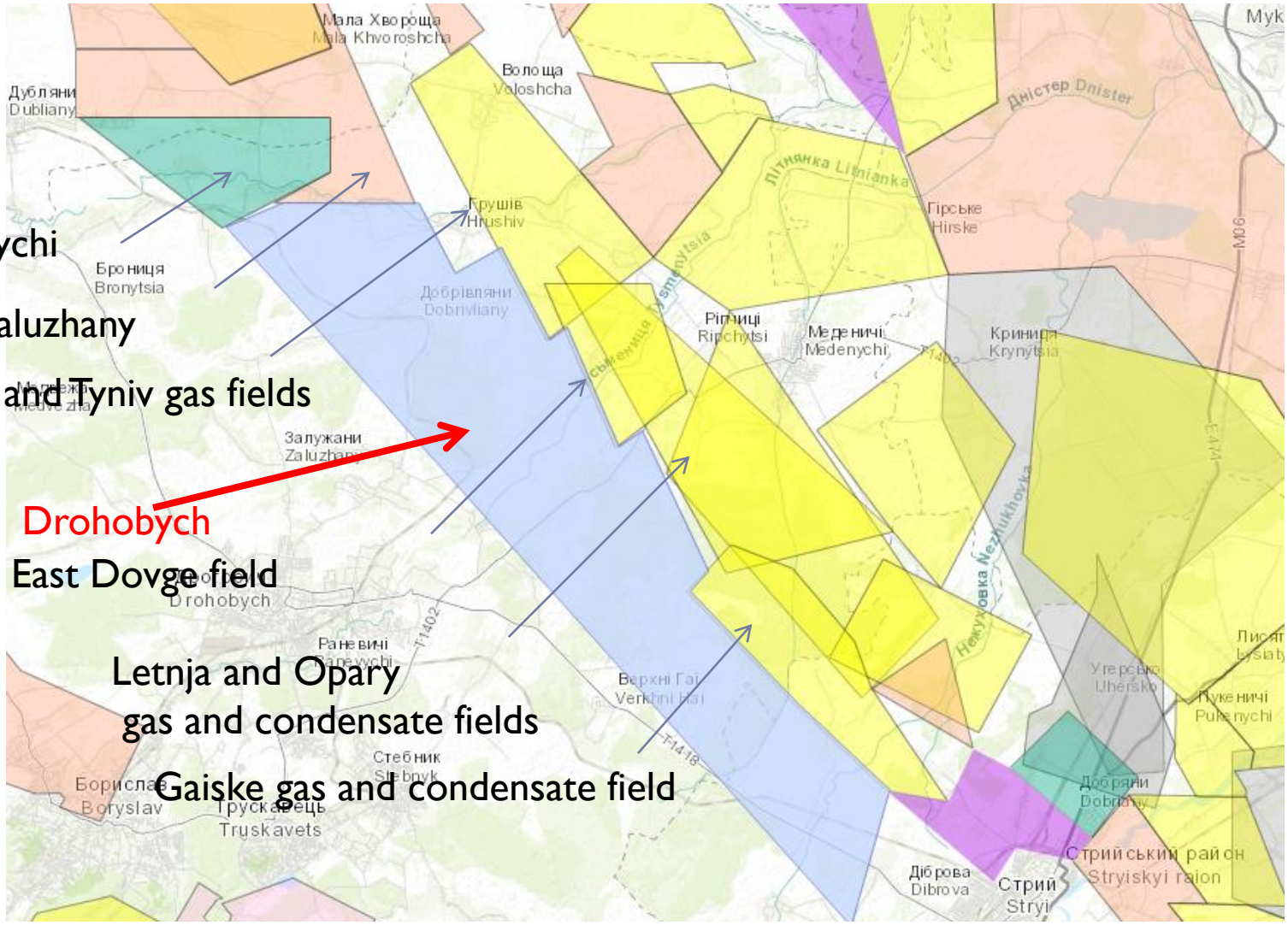
Drohobych area

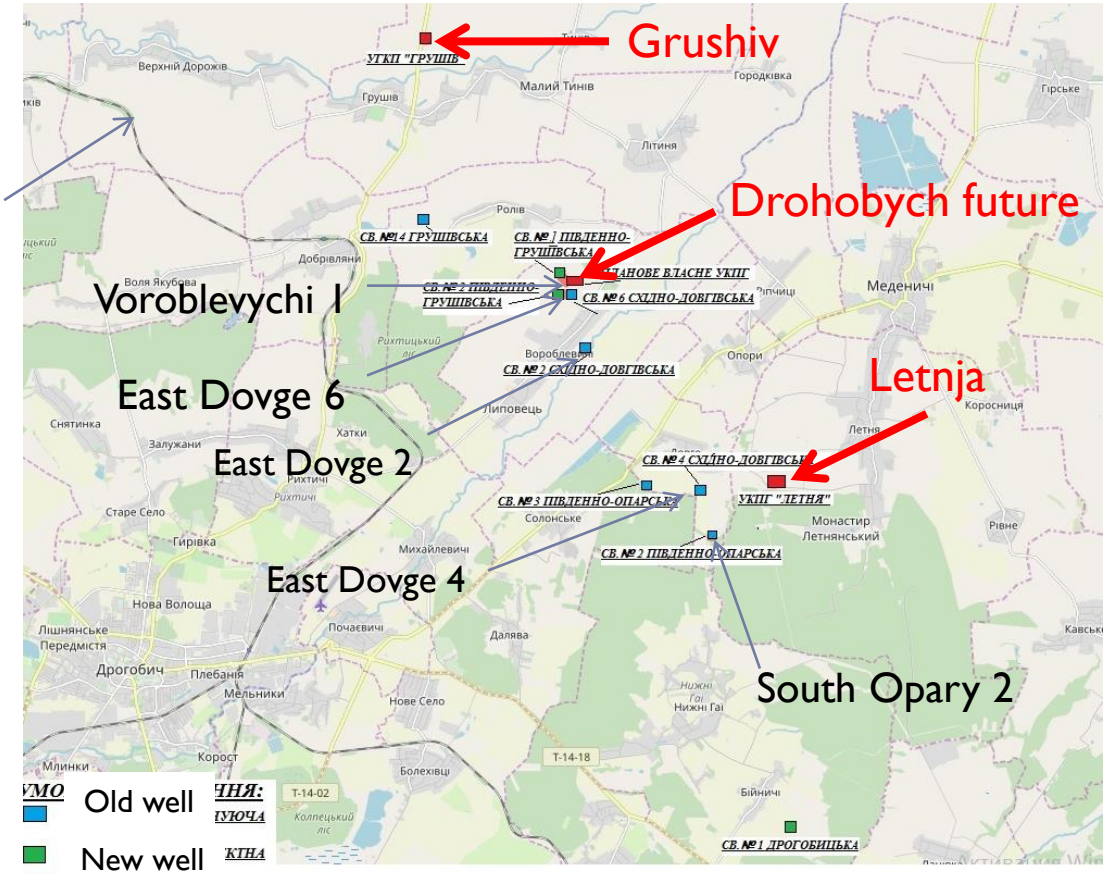
Situation

The license area is 140 km2. Located in the Lviv region, Drohobych and Stryi districts.

Drohobych area bordered by gas fields on the north and northwest: Grushiv, Tyniv, East Dovge, Opary, Letnja, Gaiske. Analogues of traps in Drohobych area is Susoliv and Mainych gas fields, which are located in Tyniv and South Zaluzhany areas.



Map of wells and gas transportation to the system



Working program completed

- Well logg interpretation
- Interpretation seismic data past years
- A three-dimensional geological model is built
- Prediction of reservoirs distribution and their porosity in the Lower Dashava sediments
- The resource base of gas and condensate in the Lower Dashava sediments, some in the Badenian sediments and oil in the Mesozoic sediments were calculated
- The working program of restoration old wells and drilling new wells
- The economic indicators of the development of the Drohobych area have been calculated

Well logging interpretation

The gas content of the collectors has been determined

- LD-3: South Opary 1 (100 m near Drohobych area, at the East Dovge area)
- LD-5: East Dovge 4, South Opary 1, Grushiv 13 (50 m near Drohobych area, at the Grushiv area)
- LD-7: Grushiv 13
- LD-8: East Dovge 4
- LD-9: South Opary 1
- LD-11: East Dovge 4 and 6, Grushiv 13
- LD-12: East Dovge 2 and 6, South Opary 1, Grushiv 13
- LD-13: East Dovge 4, Grushiv 12, South Opary 1, Grushiv 13
- LD-14: South Opary 1, Grushiv 13
- LD-16: South Opary 1 та South Opary 2
- Jurassic sediments, probably Middle Jurassic: South Opary 2
- Badenian sediments of Sambir zone: Roliv 1, Grushiv 13 та 12, Dorozhiv 1, South Opary 2 та 3, East Dovge 2, 4 та 6

Wells Grushiv 12 (LD-13), East Dovge 2 and 6, South Opary 1 result of test collectors more than 10 thousand m3 per day.

Geological structure and oil and gas saturation

In the sedimentary strata involved:

- Paleozoic deposits that are exposed by the well Roliv 1 at a depth of 4200 m
- Mesozoic deposits that are explosed by the wells Grushiv 12 and 13, South Opary 1 and 2, Dovga 1 and Nezhukhiv 1
- Cenozoic formations are exposed by all wells

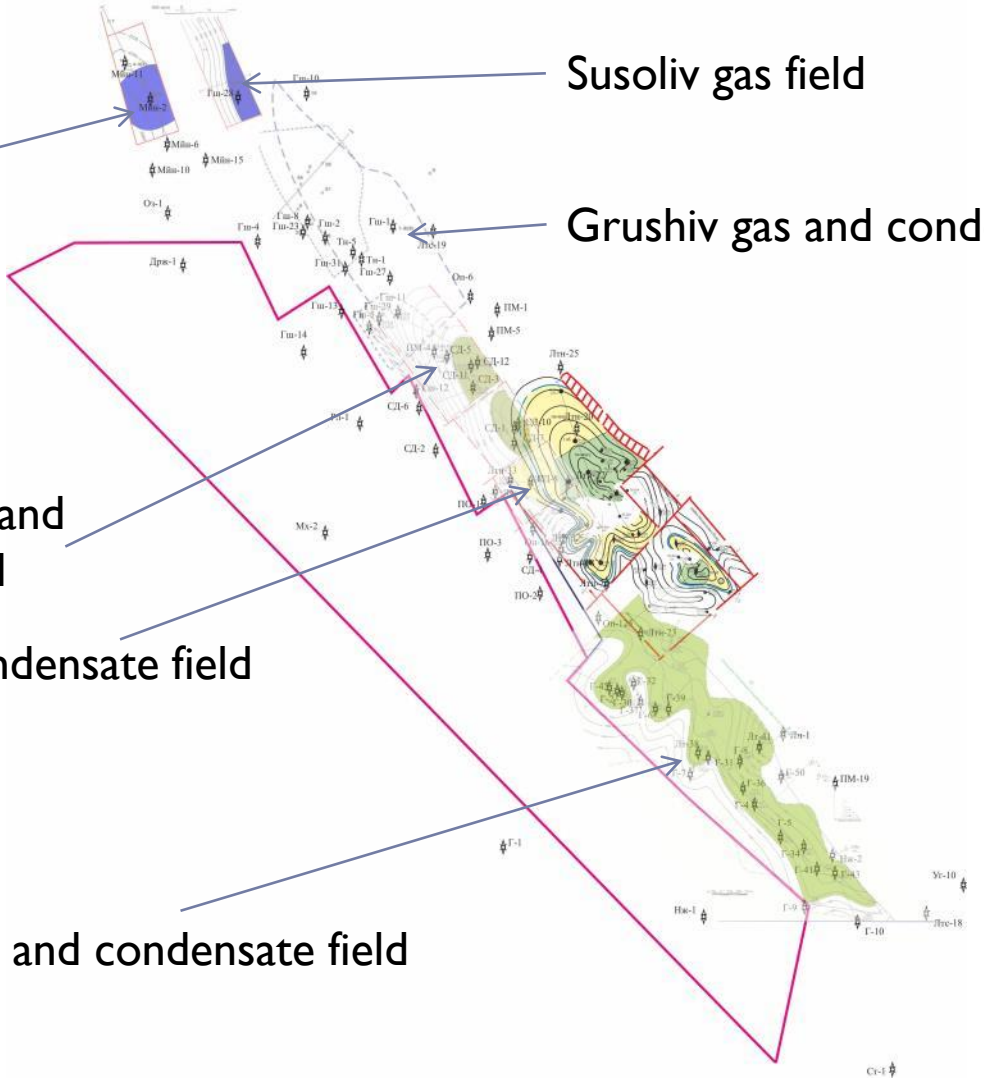
Promising complexes for hydrocarbon accumulation :

- the first, according to the rating, the Lower Dashava Miocene
- he second, by rating, is the Mesozoic complex, the Upper and Middle Jurassic deposits
- the third, the least studied, and therefore the least perspective, is the Sambir zone Lower Baden complex

The results of reinterpretation of seismic and well data have been specified :

- stratigraphic division of wells within the area with wells outside (Grushiv, Letnja, East Dovge, Gaivske)
- tectonic structure
- structural maps by LD-3, LD-5, LD-7, LD-8, LD-9, LD-12, LD-13, LD-14, LD-15, LD-16, LD-17
- sequence conditions of Lower Dashava sediments. Sequence analysis shows that transgressive sandstones in the top of each LD horizon are potential traps of hydrocarbons (LD-3 and 5 in South Opary 1, LD-7 in Grushiv 13, LD-8 in East Dovge 4, LD-9 in South Opary 1)
- carbonate formations of the Upper Jurassic age are a lateral screen for from LD-13 lower to LD-17 on South Opary, Voroblevycka and Nyzhniogaivska structures. Gas flow from LD-12 and LD-13 10-30 th.m3/day in wells of South Opary and Voroblevycka structures
- found perspective traps of hydrocarbons on Roliv, South Roliv, Nyzhniogaivska, Nezhukhivska, South Nezhukhiv and South Gaivske structures at depth interval 2000-3500 m
- Found in the northwestern part of the area South Ortynytsia structure at depths interval 4500-5500 m
- the perspective of the Lower Baden sediments of the Sambir zone near the well Dorozhiv 1

Geological models of adjacent deposits are involved in studying the formation of the geological structure



Susoliv gas field

Mainych gas field

Grushiv gas and condencate field

East Dovge gas and condensate field

Letnja gas and condensate field

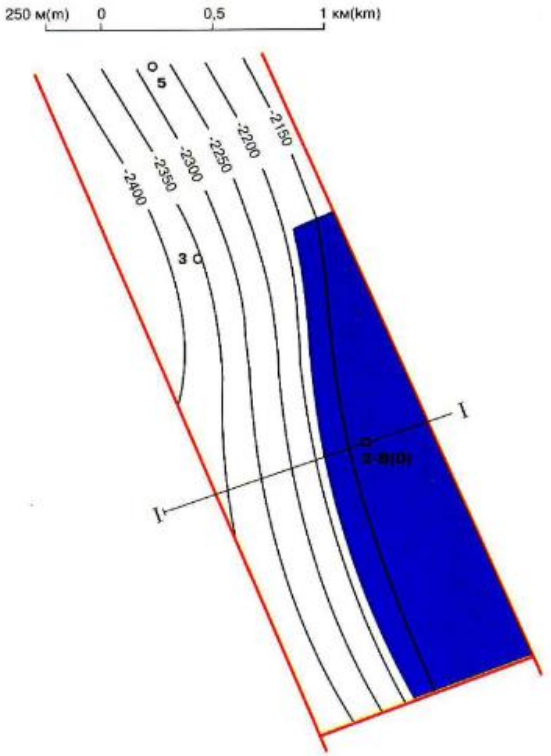
Gaivske gas and condensate field

Geological model

- The Lower Dashava sediments are sedimentary and submerged in the southwestern direction
- Two regional faults extending from the northwest to the southeast: Krakoveckiy, Rolivski or Mainycki. For each of them Sarmatian deposits are immersed.
- Susoliv and Grushiv gas and condensate fields is analogue at the first (highest) step (near Krakoveckiy fault) in Drohobych area – two blocks of South Opary structure, Voroblevycka, Nyzhniogaiska and South Nezhukhiv structures. These lateral traps are screened by Mesozoic carbonate deposits. Depth of target interval is 570-3010 m (LD-3 – LD-16).
- At the second step (near Roliv fault) is Mainych gas field in northwestern direction. Two productive well from eight are in the gas field. This indicates the difficulty of distributing industrial collectors.
- This gas field is the prototype for all perspective traps in this step – Roliv and South Roliv structures. Two wells Roliv 1 and Grushiv 14 are in this step. According to the well logging interpretation in the wells Grushiv 14 and Roliv 1 gas-saturated layers in the LD-13, LD-15 and LD-16. Nothing was obtained during the test in Grushiv 14. The well Roliv 1 no tested.
- The low density of wells and insufficient geological exploration within this block indicate the possibility of opening perspective hydrocarbon traps. Depth of target interval is 2500-4500 m (LD-12 – LD-17). Seismic exploration should be used for the study.
- In the southern part of the area is the Laniv-Nezhukhiv tectonic unit. Two wells were drilled within this block, which revealed the Upper Jurassic deposits at depths of 1820-1850 m.
  According to the results of seismic interpretation, several traps were identified in the LD-15-17. Their resource base is negligible. Seismic studying these traps may increase your attractiveness for search.
- In the northwestern part of the special permit, the South Ortynitska hemiantycline structure was discovered. Perspective deposits of Sarmat of LD-15-17 lie at a depth of 4500-5500 m. Seismic exploration should be used for the study. Initial reserves gas **3751** mln.m^3

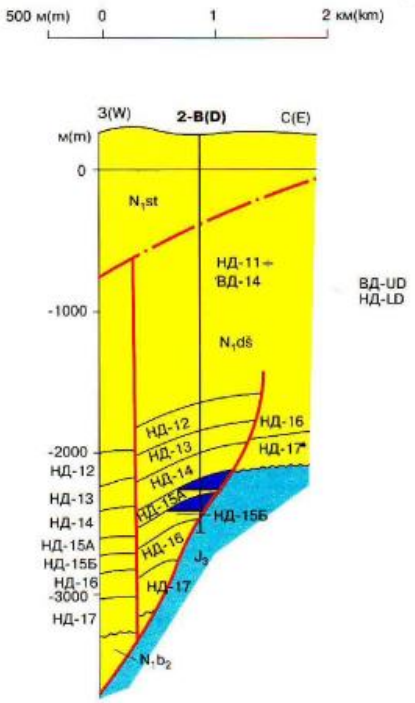
Susoliv gas field is analogue of South Opary, Voroblevycka, Nyzhniogaiska and South Nezhukhiv structures.

Two reservoirs are laterally screened Upper jurassic carbonate deposits. Gas flow from
LD-15A 37,6 th.m3/day (int. 2425-2475 m) and
from LD-15B 44 th.m3/day (int. 2495-2530 m).
Initial gas reserves 1100 mln.m3.
Well Grushiv-2a was in operation, which opened the Susoliv field. It produced 3.5 million m3 of gas from LD-15.



СТРУКТУРНА КАРТА
покрівлі горизонту НД-15А
за Б.К. Музикою, 1989 р.

STRUCTURAL MAP
The top of horizon LD-15A
by B.K. Muzyka, 1989



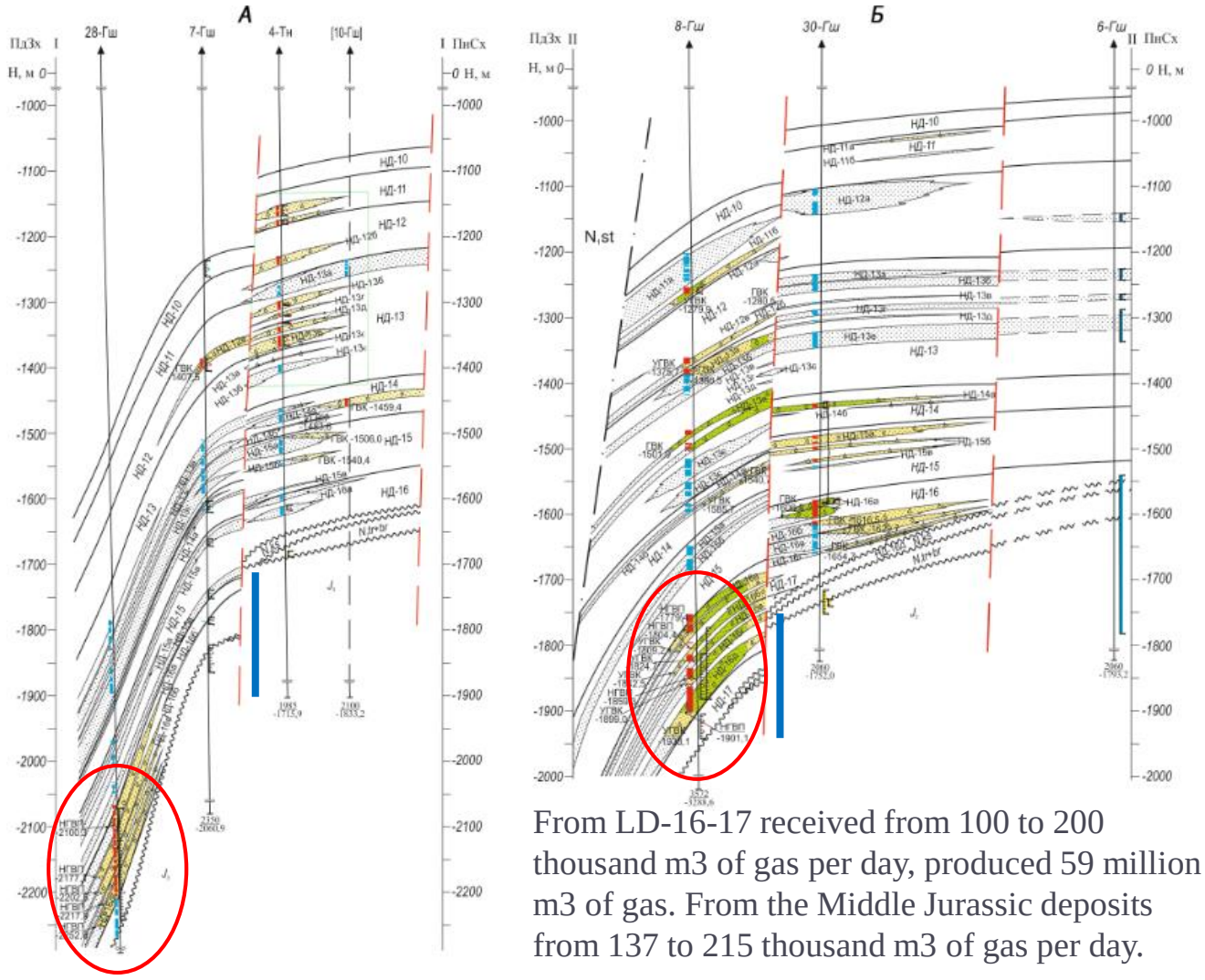
ГЕОЛОГІЧНИЙ РОЗРІЗ ПО ЛІНІЇ I–I
за Б.К. Музикою, 1989 р.

GEOLOGICAL SECTION ALONG I–I LINE
by B.K. Muzyka, 1989

Geological sections through the wells of Grushiv structure

1 – Grushiv 28 located at Susoliv gas field

2 – Grushiv 8 located at Grushiv gas and condensate field



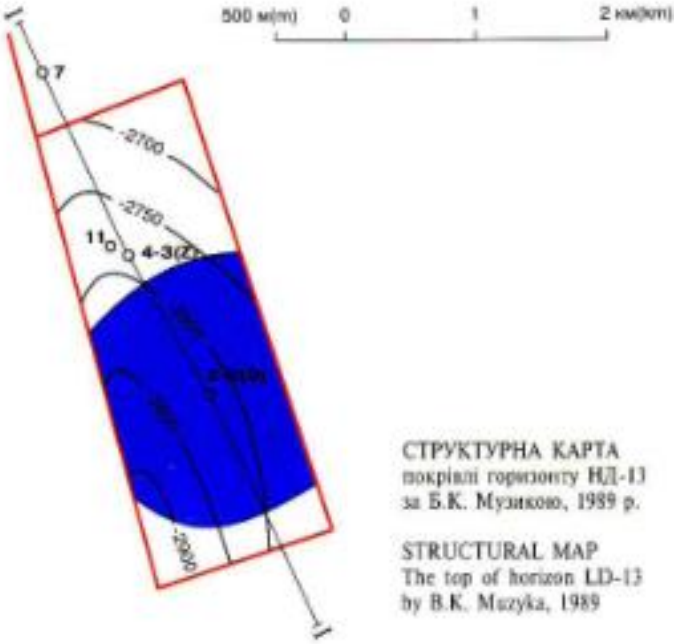
Reservoirs LD-16-17 don't testing.
Gas flow from Middle Jurassic deposits 10 th. m3 per day.

From LD-16-17 received from 100 to 200 thousand m3 of gas per day, produced 59 million m3 of gas. From the Middle Jurassic deposits from 137 to 215 thousand m3 of gas per day.

- The lateral screen is carbonate deposits of Jurassic age and shale of Badenian age

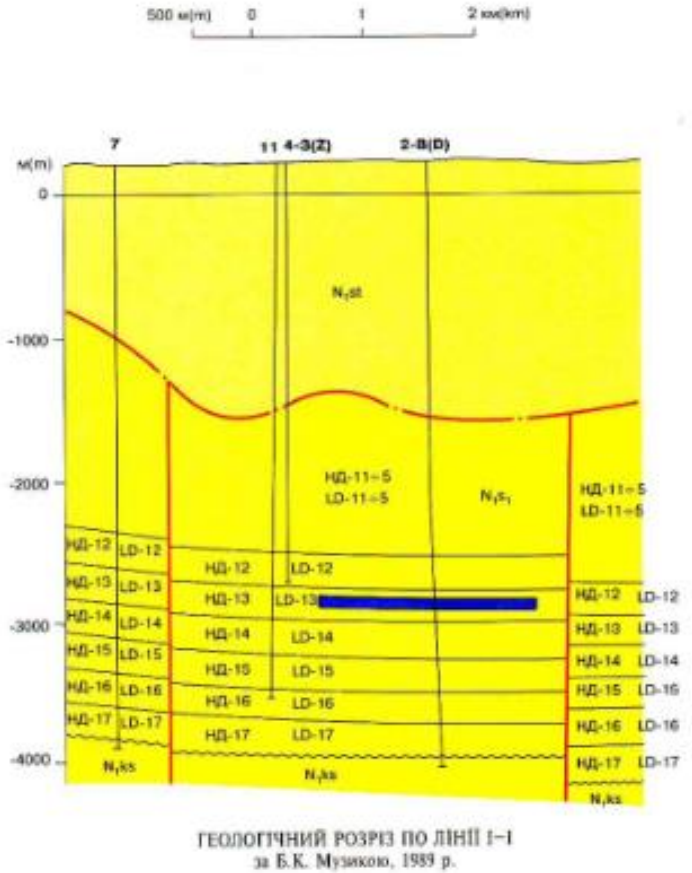
Mainych gas field in northwestern direction is analogue of Roliv structure.

Reservoir is laterally screened Sarmat shale deposits. Gas flow from LD-13 10,9 th.m3/day (int. 3120-3215 m). Initial gas reserves 1000 mln.m3.
Today, a new well with a flow gas rate of 50 th.m3/day has been drilled on the South Zaluzhany area using modern drilling technology.



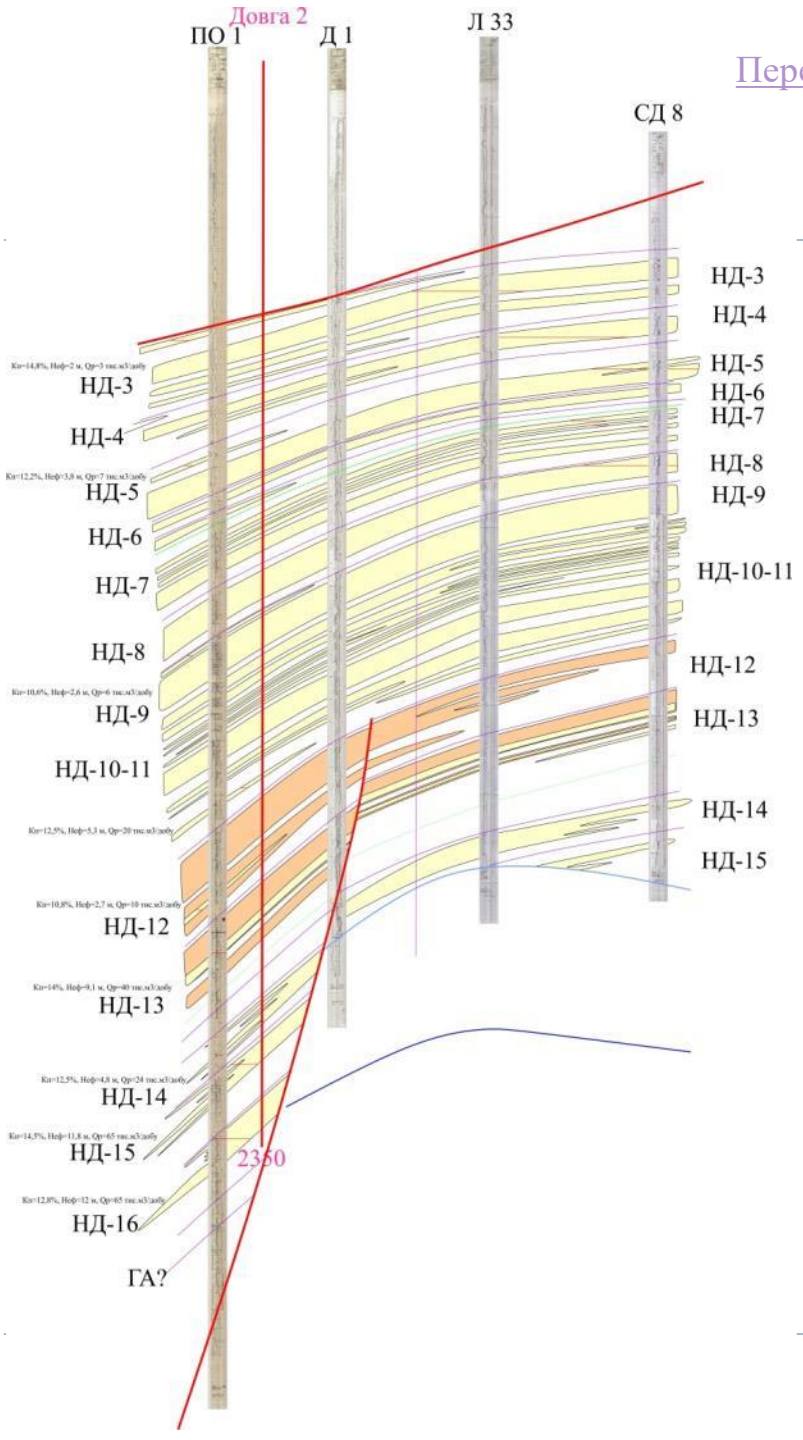
СТРУКТУРНА КАРТА
покрівлі горизонту НД-13
за Б.К. Музикою, 1989 р.

STRUCTURAL MAP
The top of horizon LD-13
by B.K. Muzyka, 1989



ГЕОЛОГІЧНИЙ РОЗРІЗ ПО ЛІНІЇ I–I
за Б.К. Музикою, 1989 р.

Перегляд сейсміки



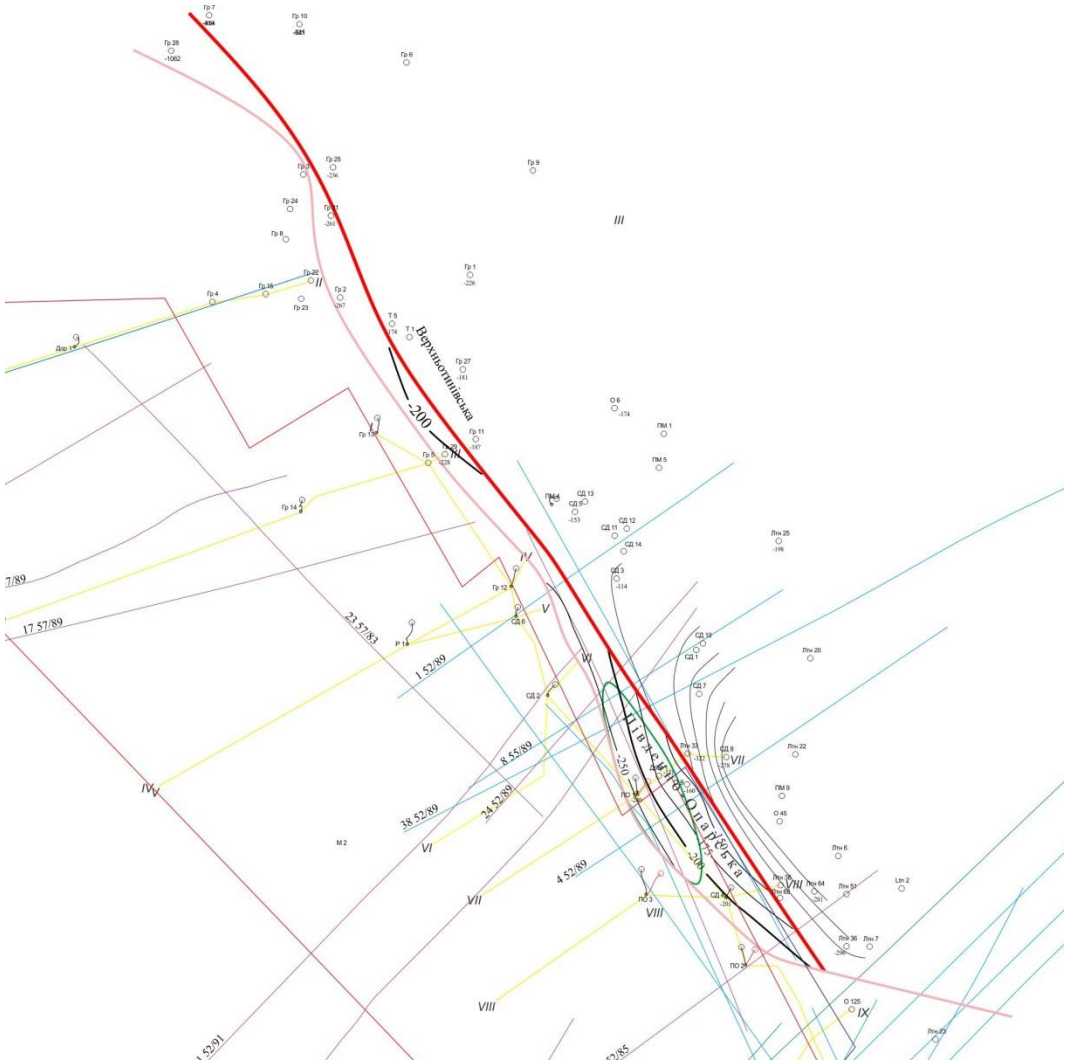
Stratigraphic division of wells within Drohobych area and beyond.

(on the picture НД in Cyrillic identical LD, ПО1 – SO1, Д1 - Dovga 1, Л33 - Letnja 33, СД8 - East Dovge 8)

Перегляд сейсміки

Interpretation. Top of LD-3.

Gas as a result of interpretation logging data in wells South Opary 1 and Dovga 1

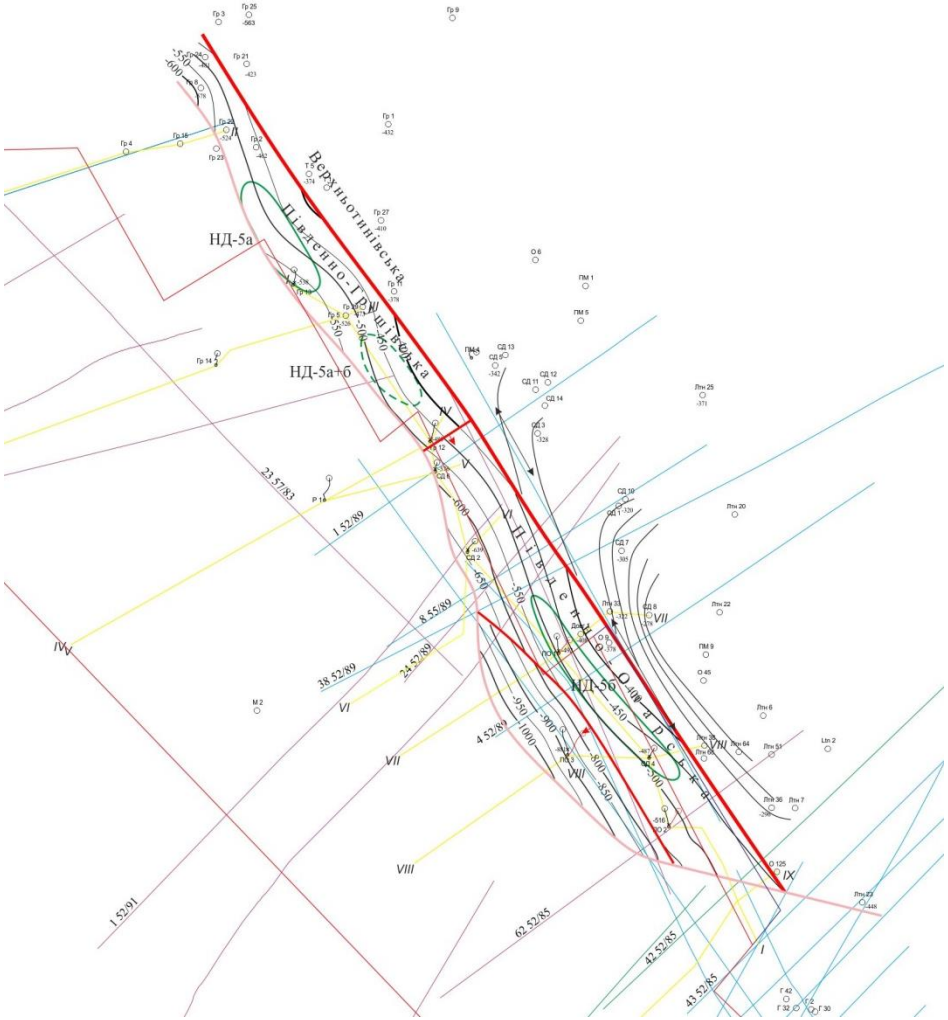


- Initial gas reserves **10** mln.m^3

Перегляд сейсміки

Interpretation. Top of LD-5.

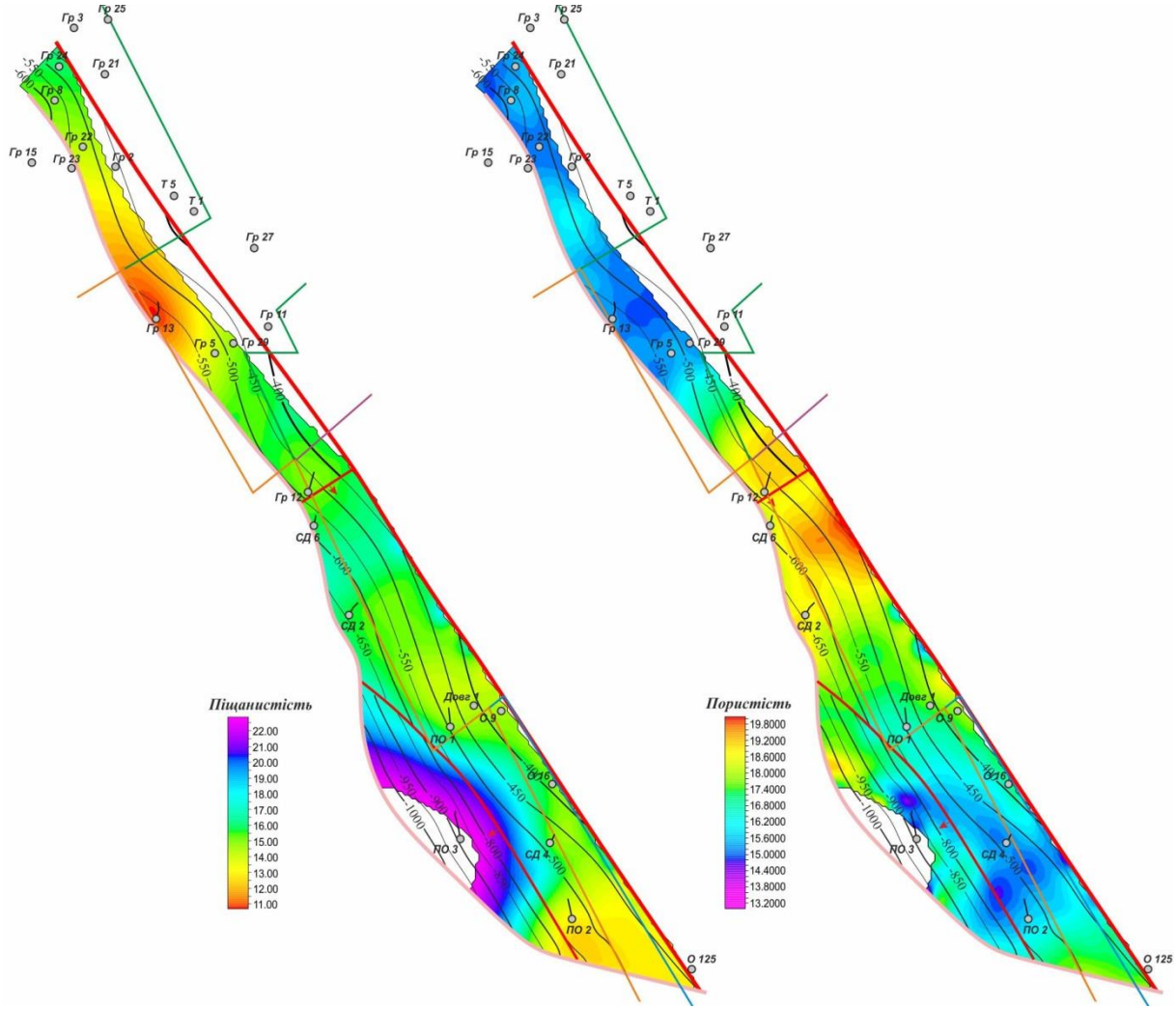
Gas as a result of interpretation logging data in wells South Opary 1 and East Dovge 4



- Initial gas reserves **24** mln.m^3

Geological prediction

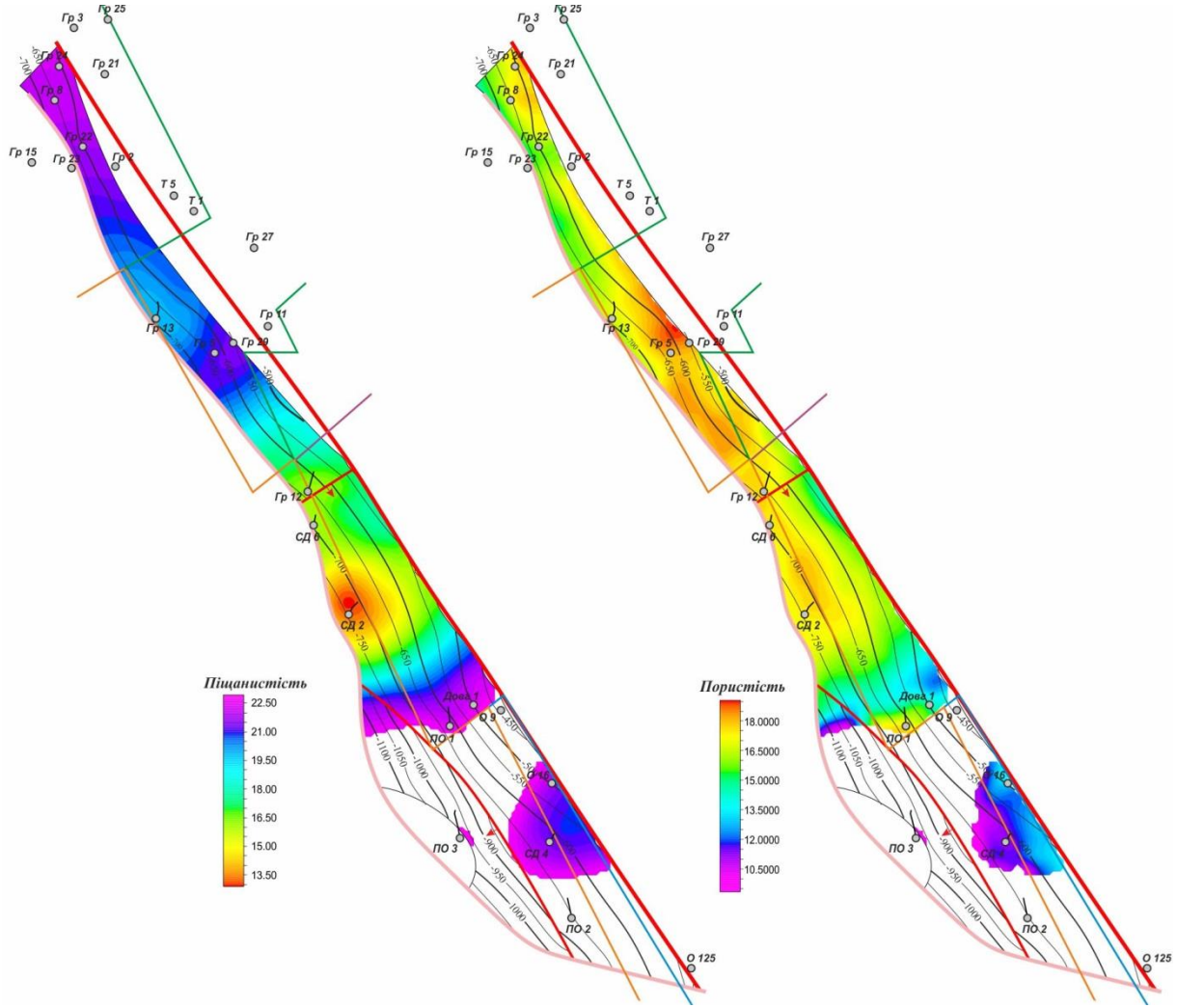
Sandiness and porosity of LD-5



- Initial gas reserves **24** mln.m^3

Geological prediction

Sandiness and porosity of LD-6

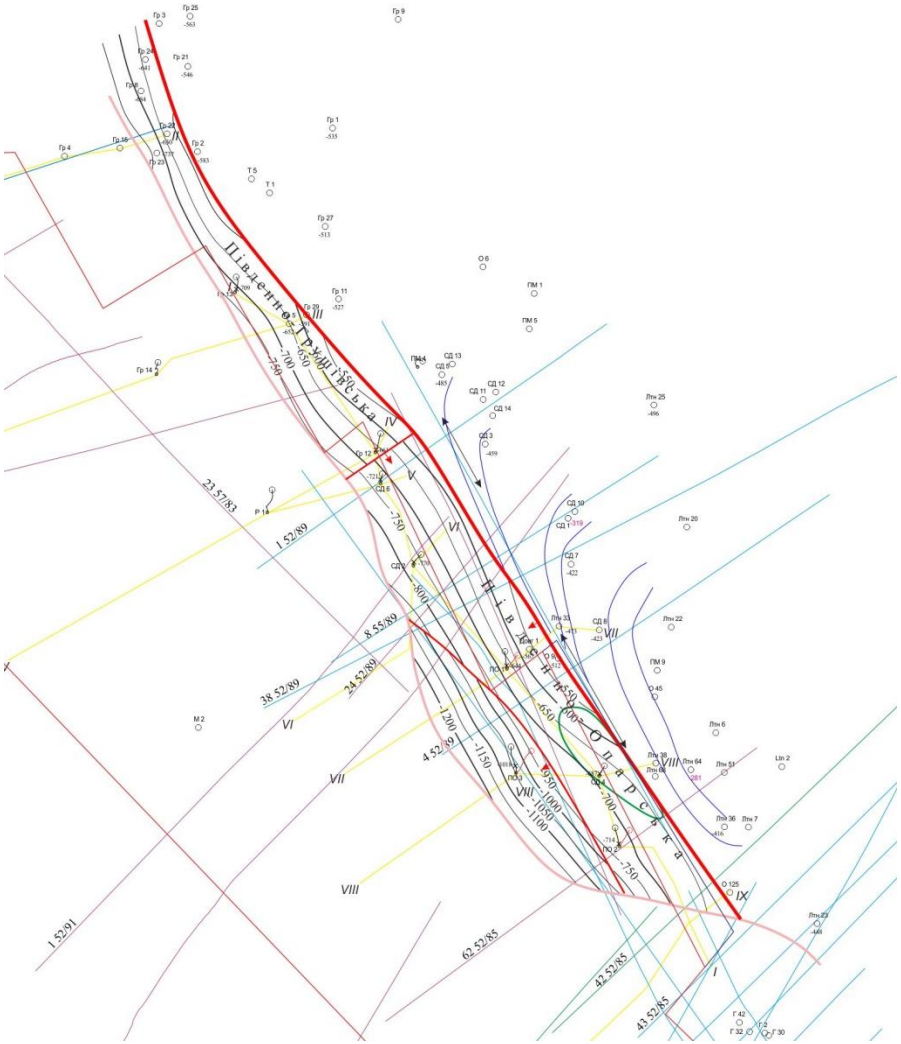


- Initial gas reserves at LD-6 **7** mln.m^3

Перегляд сейсміки

Interpretation. Top of LD-7.

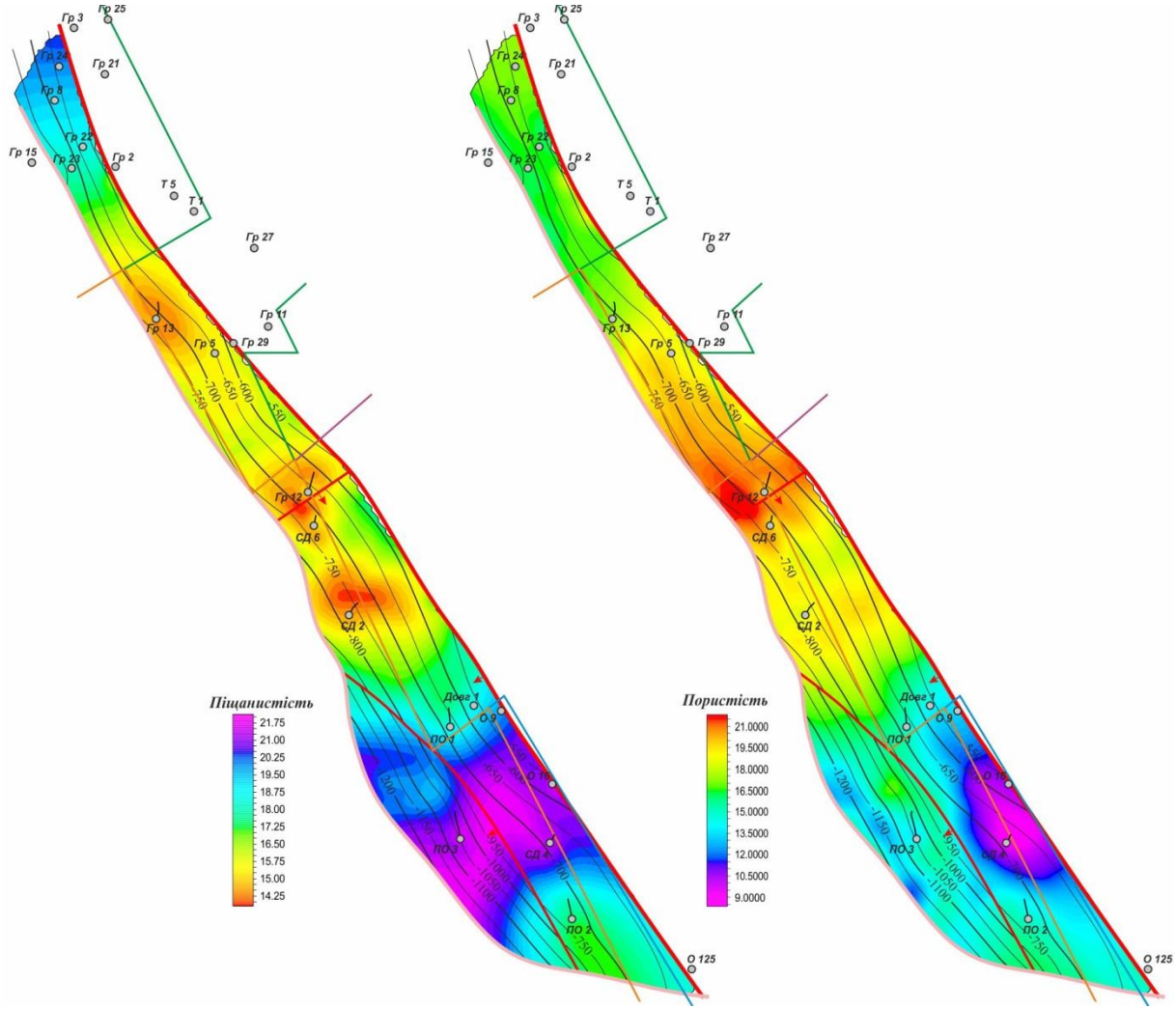
Gas as a result of interpretation logging data in wells South Opary 2 and Grushiv 13 at LD-7, East Dovge 4 at LD-6.



- Initial gas reserves at LD-6 **7** mln.m^3, at LD-7 out of Drohobych area.

Geological prediction

Sandiness and porosity of LD-7



Перегляд сейсміки

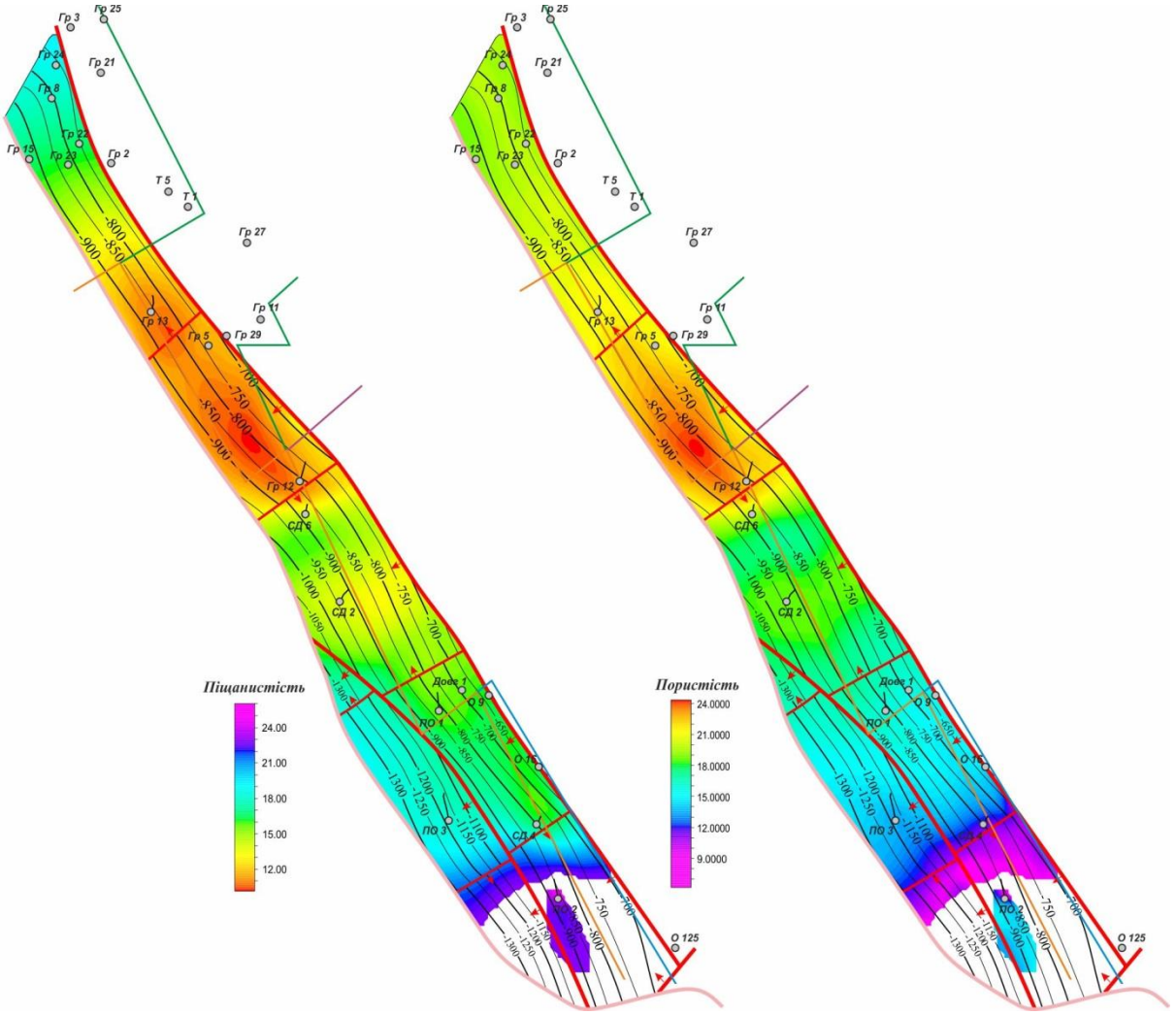
Interpretation. Top of LD-8.

Gas as a result of interpretation logging data in wells East Dovge 4

- Initial gas reserves **25** mln.m^3

Geological prediction

Sandiness and porosity of LD-8



- Initial gas reserves **25** mln.m^3

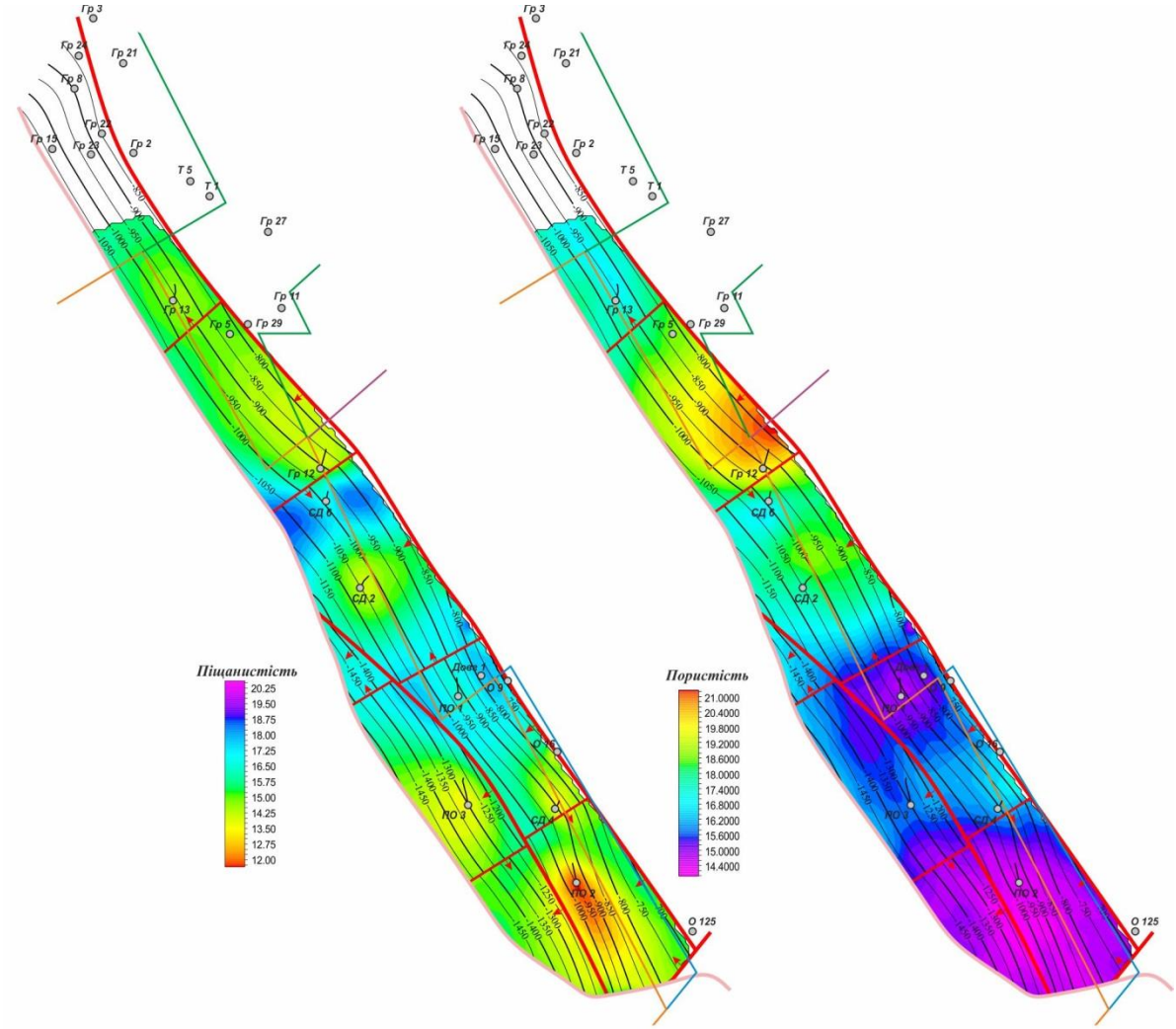
Перегляд сейсміки

Interpretation. Top of LD-9.
Gas as a result of interpretation logging data in wells South Opary 1

- Initial gas reserves at LD-9 **7** mln.m^3, at LD-10 – **15** mln.m^3

Geological prediction

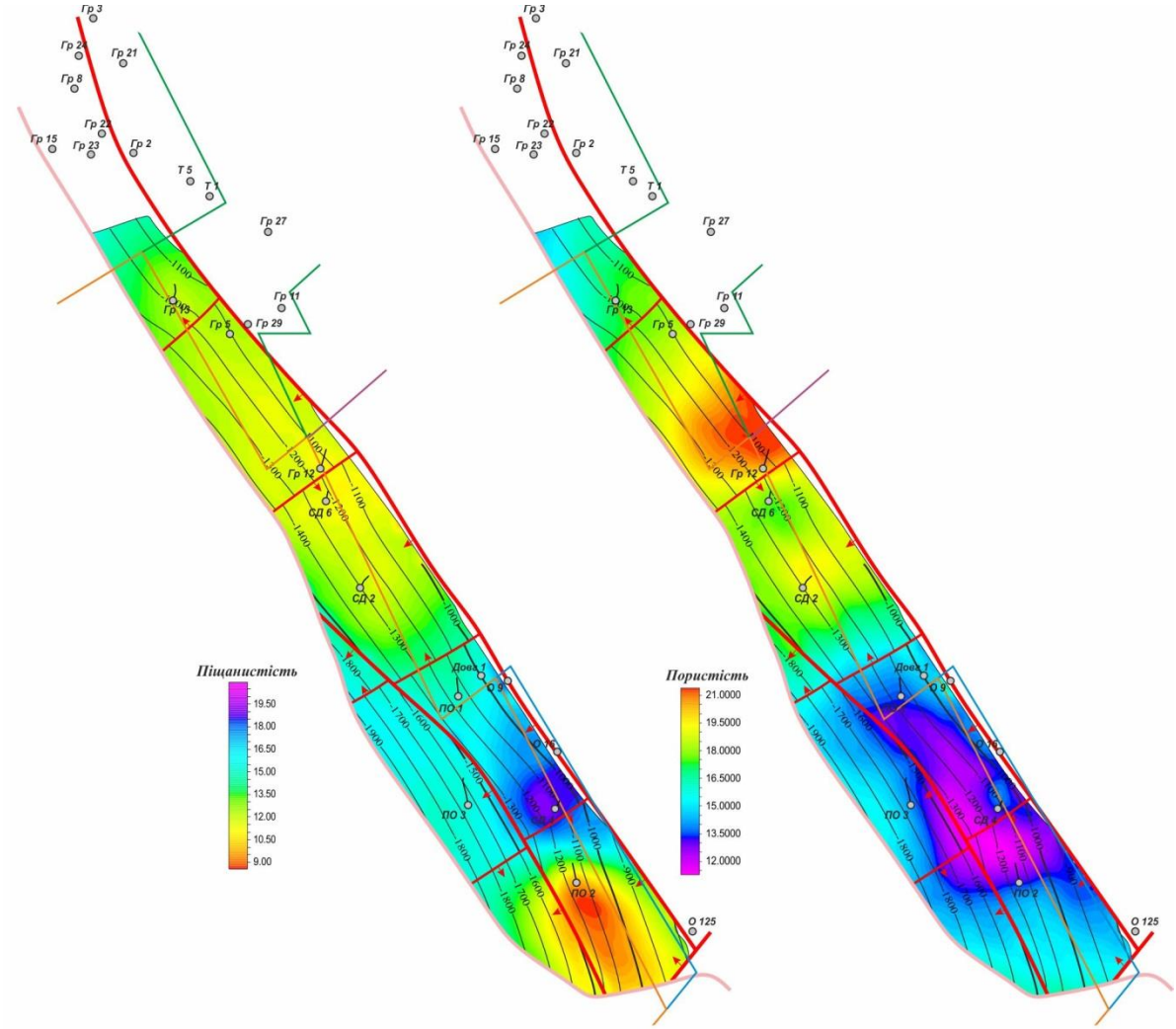
Sandiness and porosity of LD-9



- Initial gas reserves at LD-9 **7** mln.m^3

Geological prediction

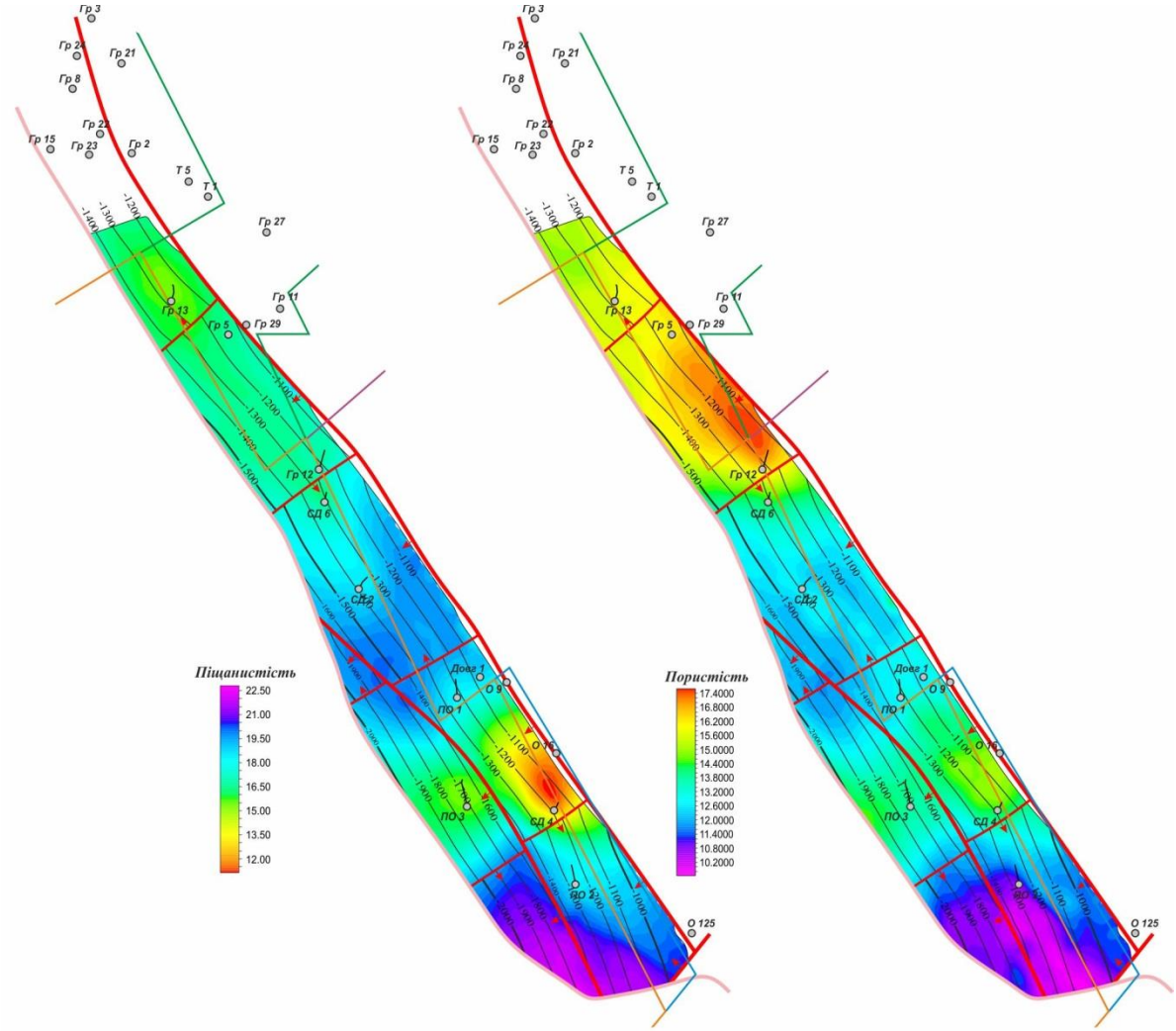
Sandiness and porosity of LD-10



- Initial gas reserves at LD-10 **15** mln.m^3

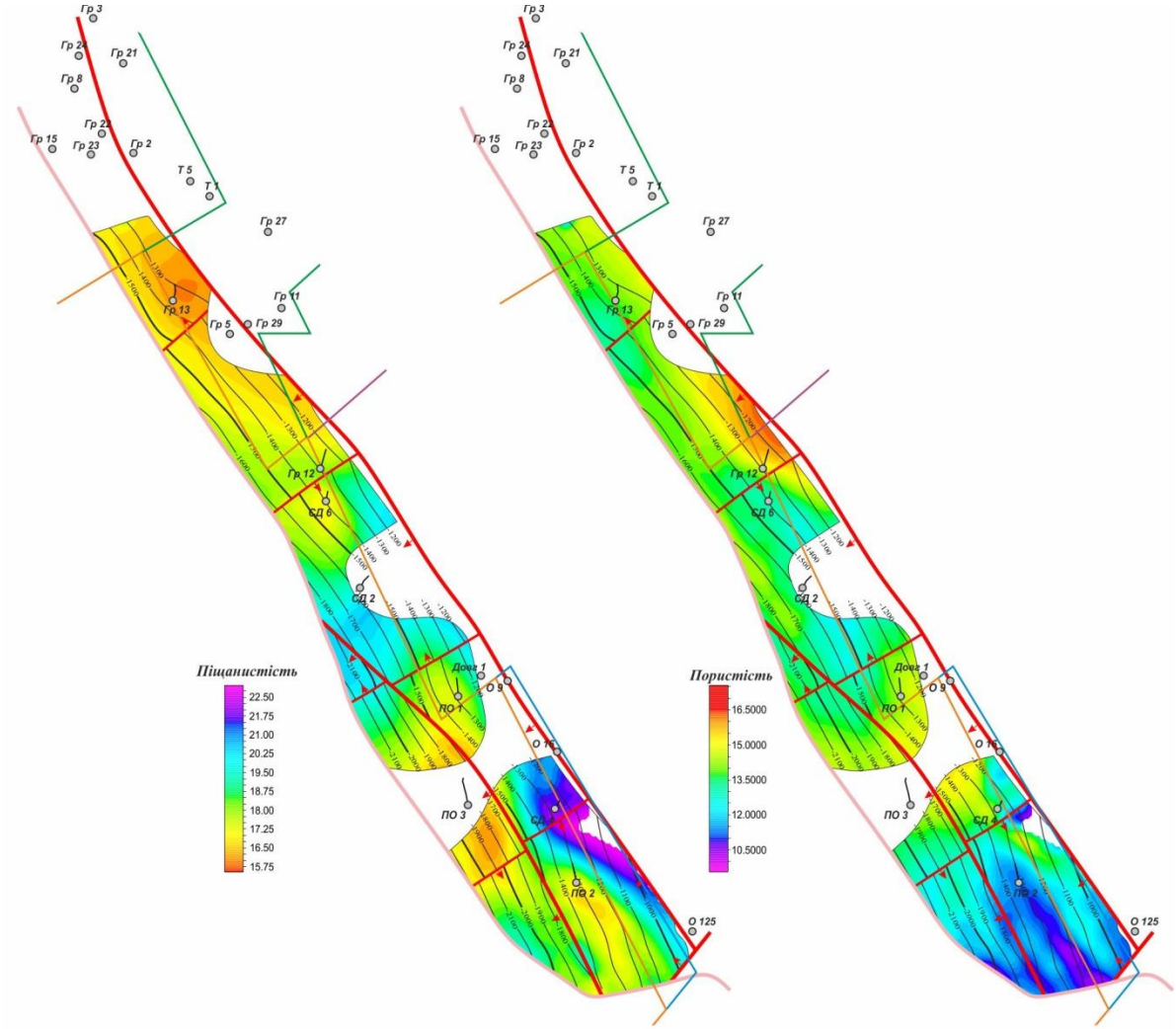
Geological prediction

Sandiness and porosity of LD-11 upper



Geological prediction

Sandiness and porosity of LD-11 lower

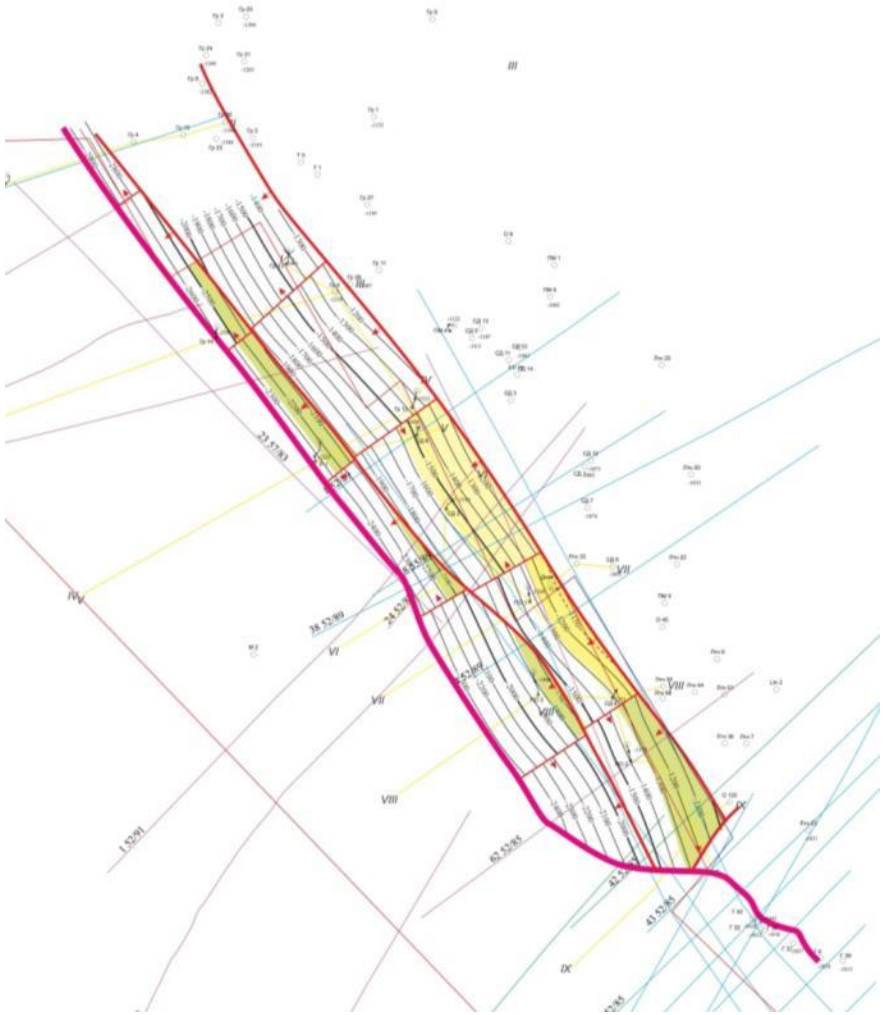


- LD-11. Resources of gas **5** mln.m^3 - C2 and initial reserves gas – **109** mln.m^3.

Перегляд сейсміки

Interpretation. Top of LD-12.

Gas flow in East Dovge 2, 6, 4 and South Opary 1

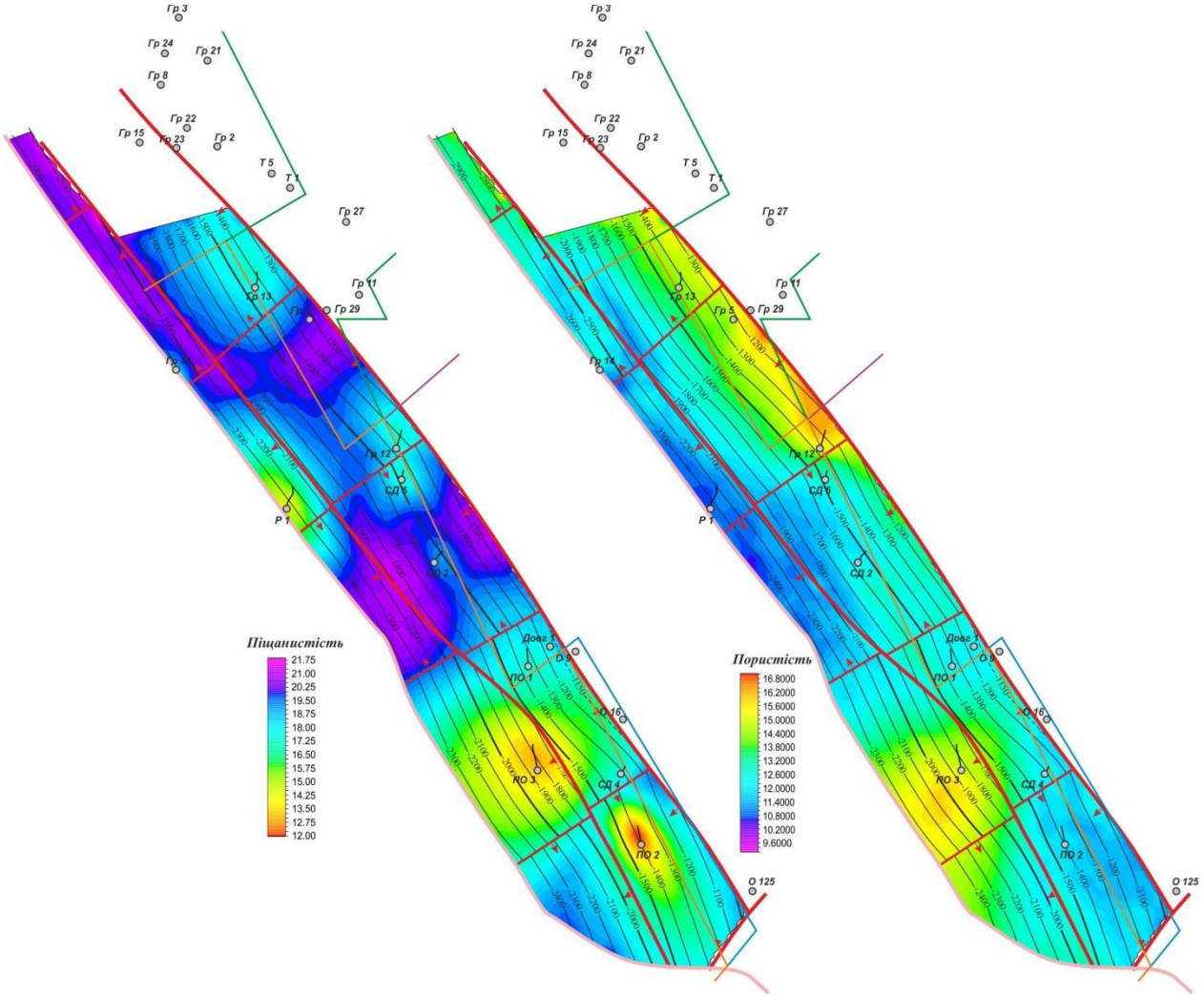


LD-12. Resources of gas **59** mln.m^3 – C2 and initial reserves gas – **172** mln.m^3.

- LD-11. Resources of gas **5** mln.m^3 - C2 and initial reserves gas – **109** mln.m^3.

Geological prediction

Sandiness and porosity of LD-12



- LD-12. Resources of gas **59** mln.m^3 – C2 and initial reserves gas – **172** mln.m^3.

Перегляд сейсміки

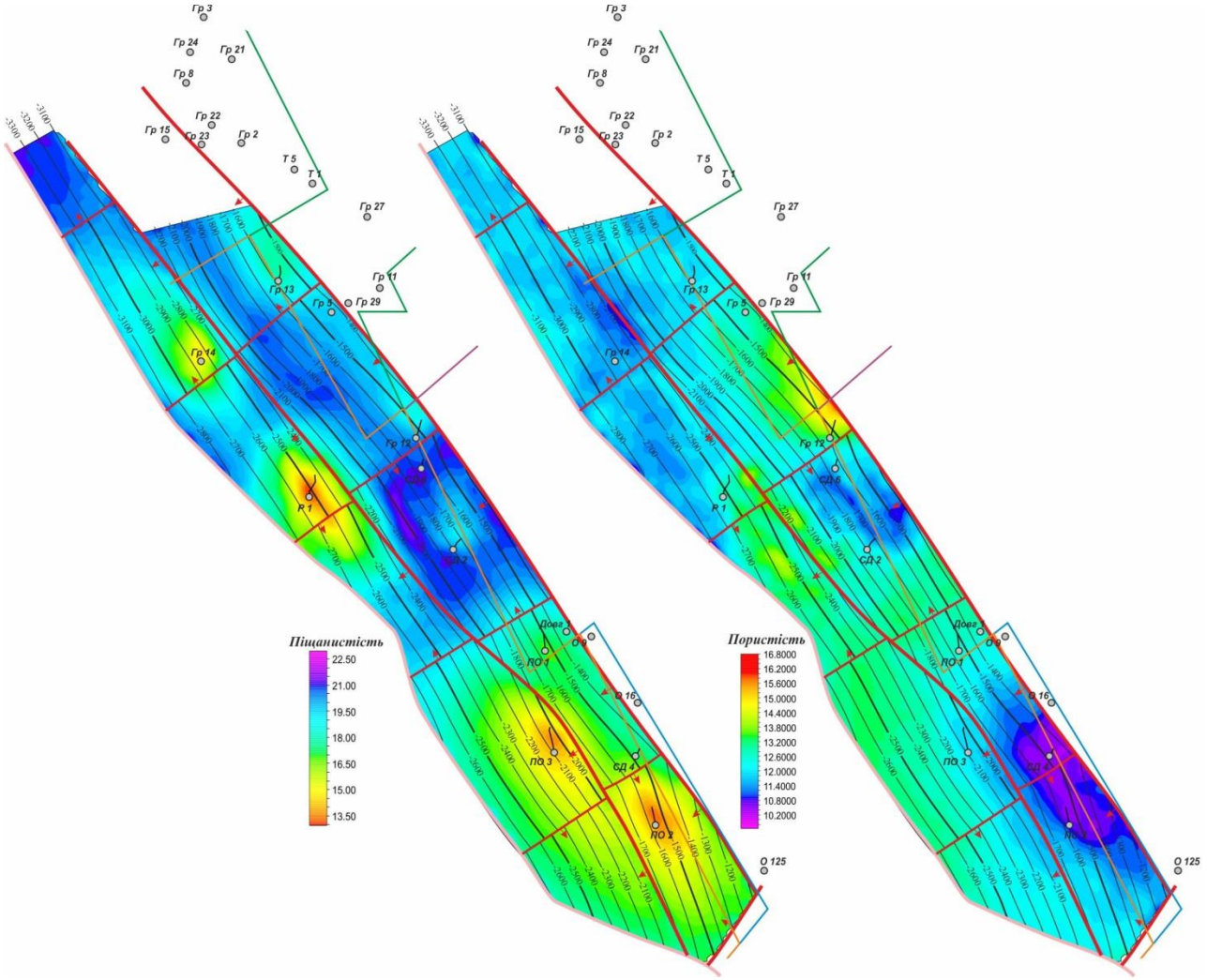
Interpretation. Top of LD-13.

Gas flow from LD-13 in Grushiv 12

- LD-13. Resources of gas **10** mln.m^3 – C2 and initial reserves gas – **327** mln.m^3

Geological prediction

Sandiness and porosity of LD-13

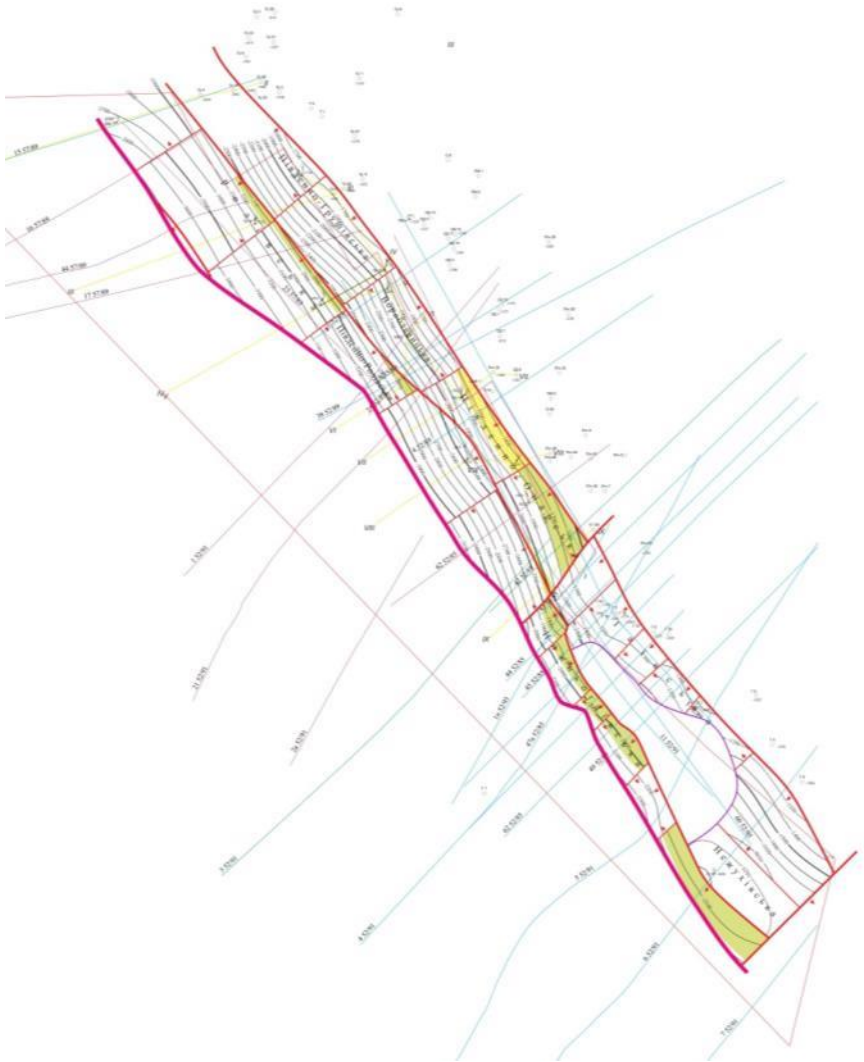


- LD-13. Resources of gas **10** mln.m^3 – C2 and initial reserves gas – **327** mln.m^3

Перегляд сейсміки

Interpretation. Top of LD-14.

Gas as a result of interpretation logging data in wells South Opary 1

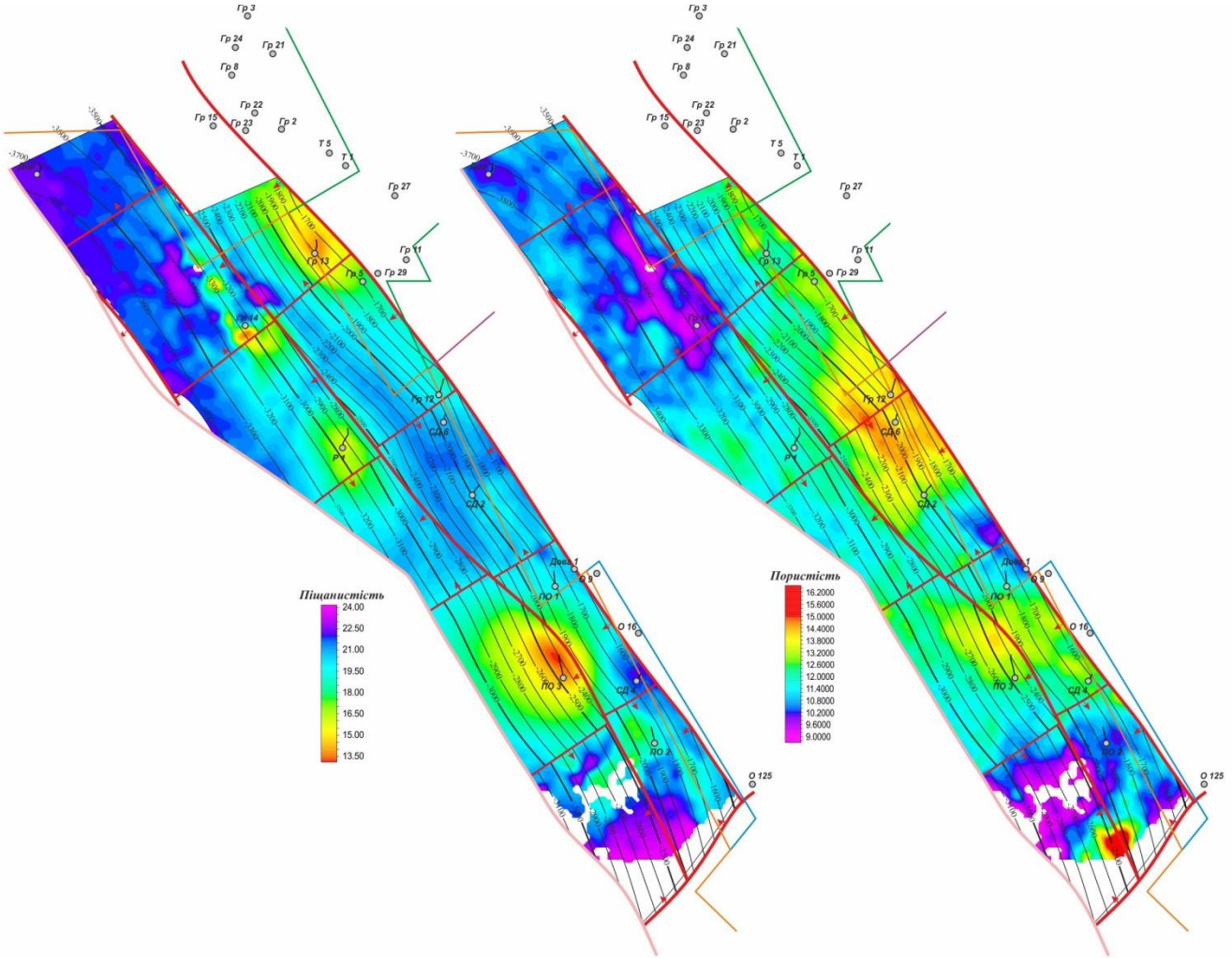


- Initial reserves gas **210** mln.m^3

Перегляд сейсміки

Geological prediction

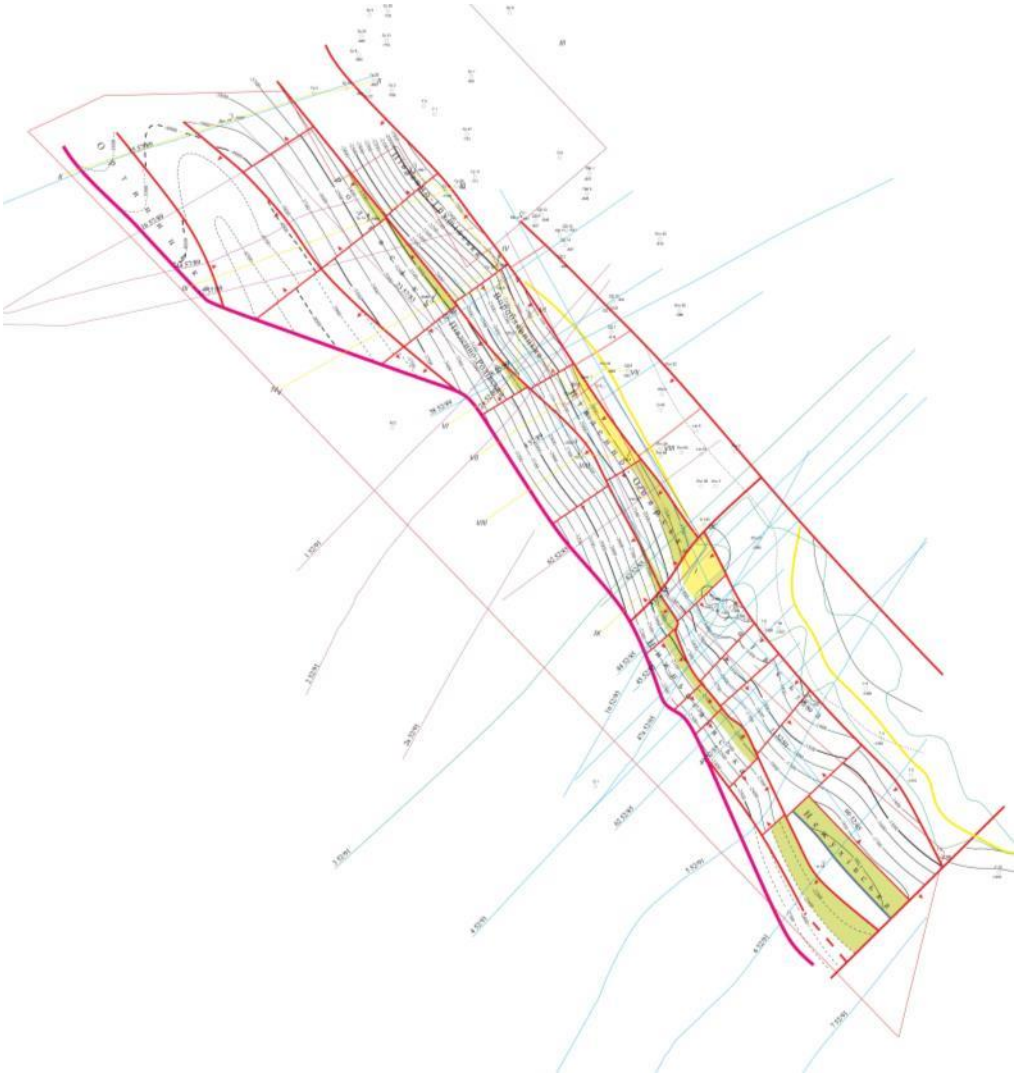
Sandiness and porosity of LD-14



- Initial reserves gas **210** mln.m^3

Перегляд сейсміки

Interpretation
Top of LD-15

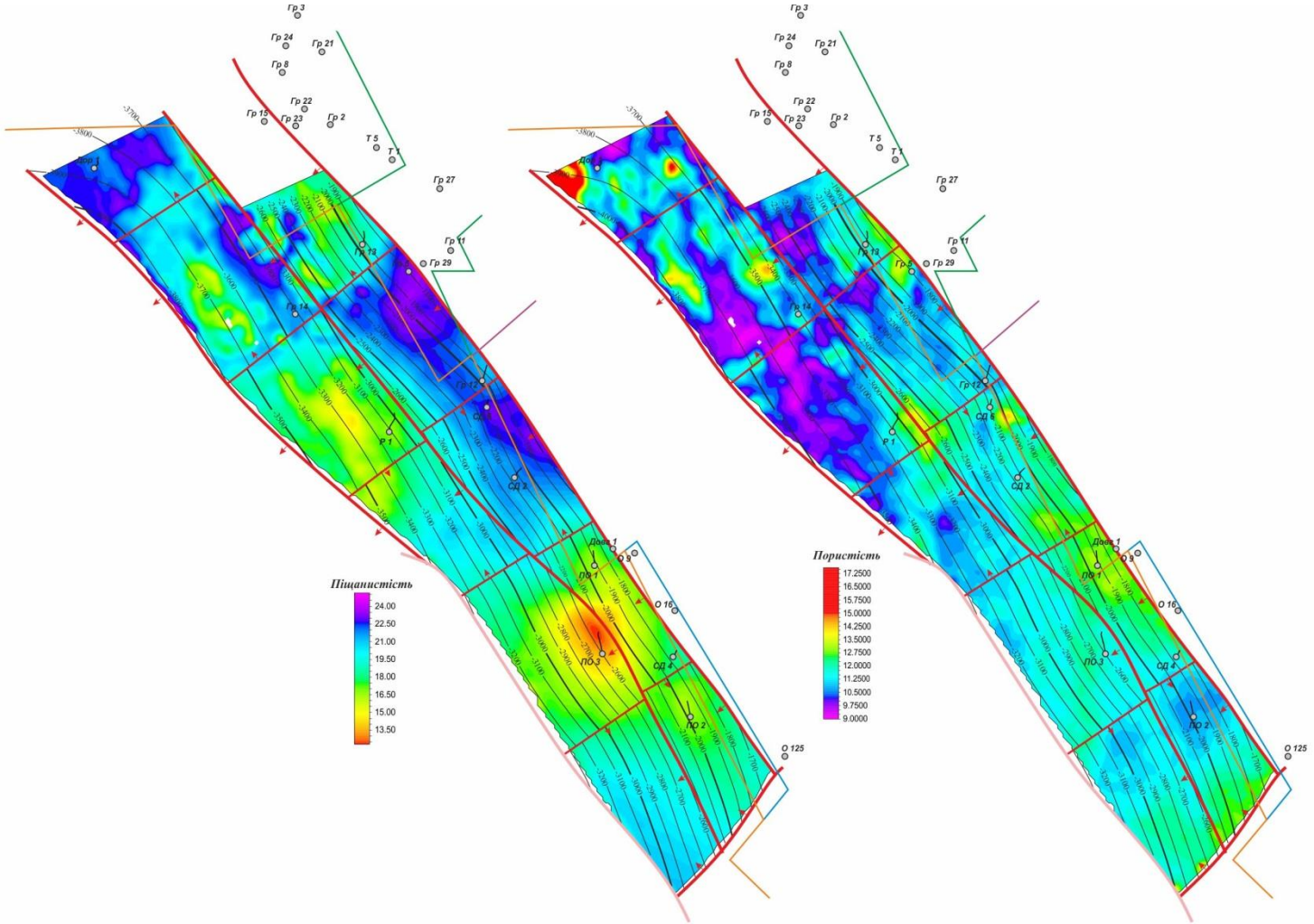


- Initial reserves gas **436** mln.m^3

Перегляд сейсміки

Geological prediction

Sandiness and porosity of LD-15

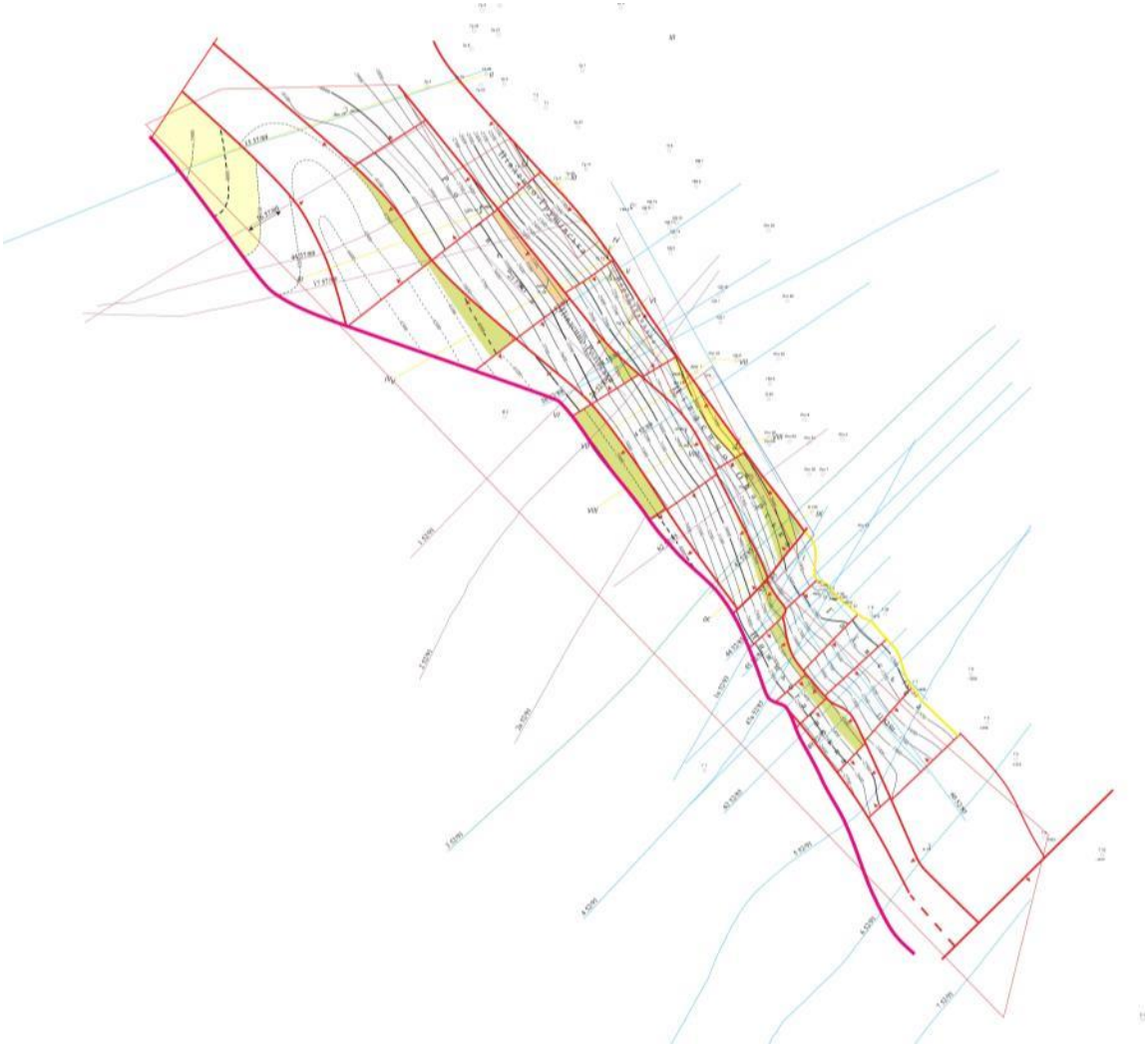


- Initial reserves gas **436** mln.m^3

Перегляд сейсміки

Interpretation. Top of LD-16.

Gas as a result of interpretation logging data in wells South Opary 1

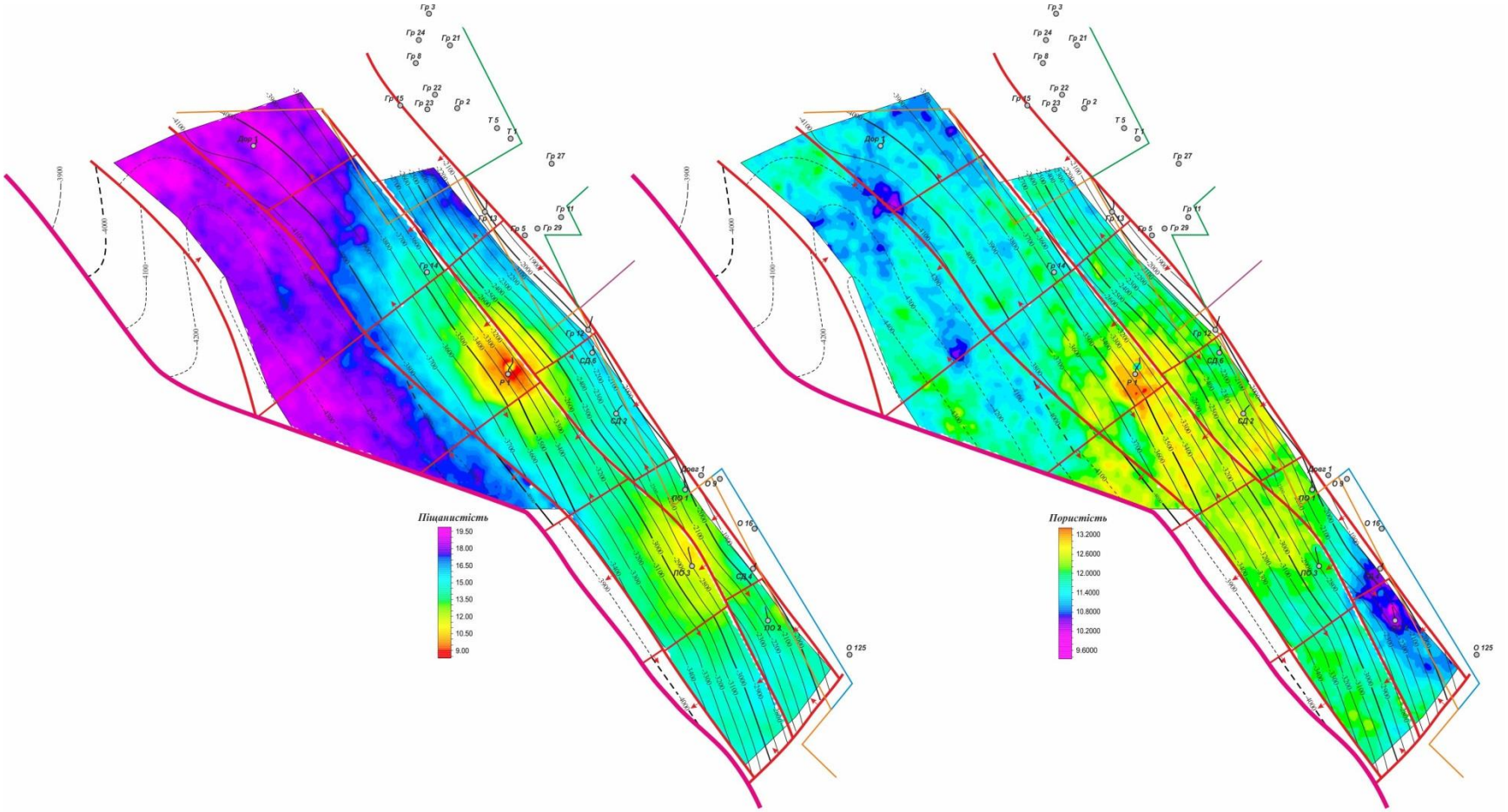


- Initial reserves gas **754** mln.m^3

Перегляд сейсміки

Geological prediction

Sandiness and porosity of LD-16



- Initial reserves gas **754** mln.m^3

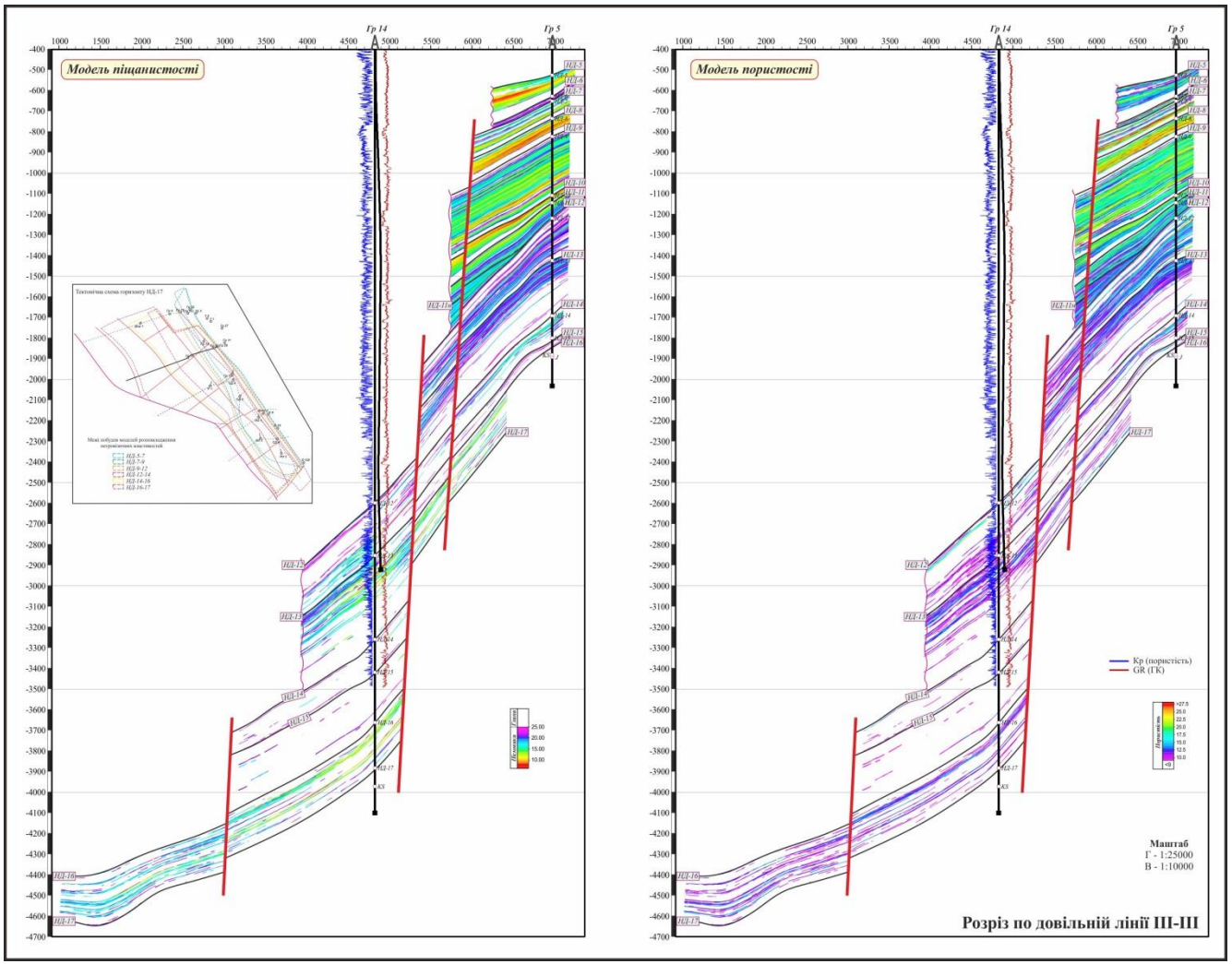
Перегляд сейсміки

Interpretation
Top of LD-17

- Initial reserves gas **3751** mln.m^3 – in South Ortynychi hemiantycline

Predicting of geological section

Section III-III. Northern block of Roliv structure, wells Grushiv 14 and 5.

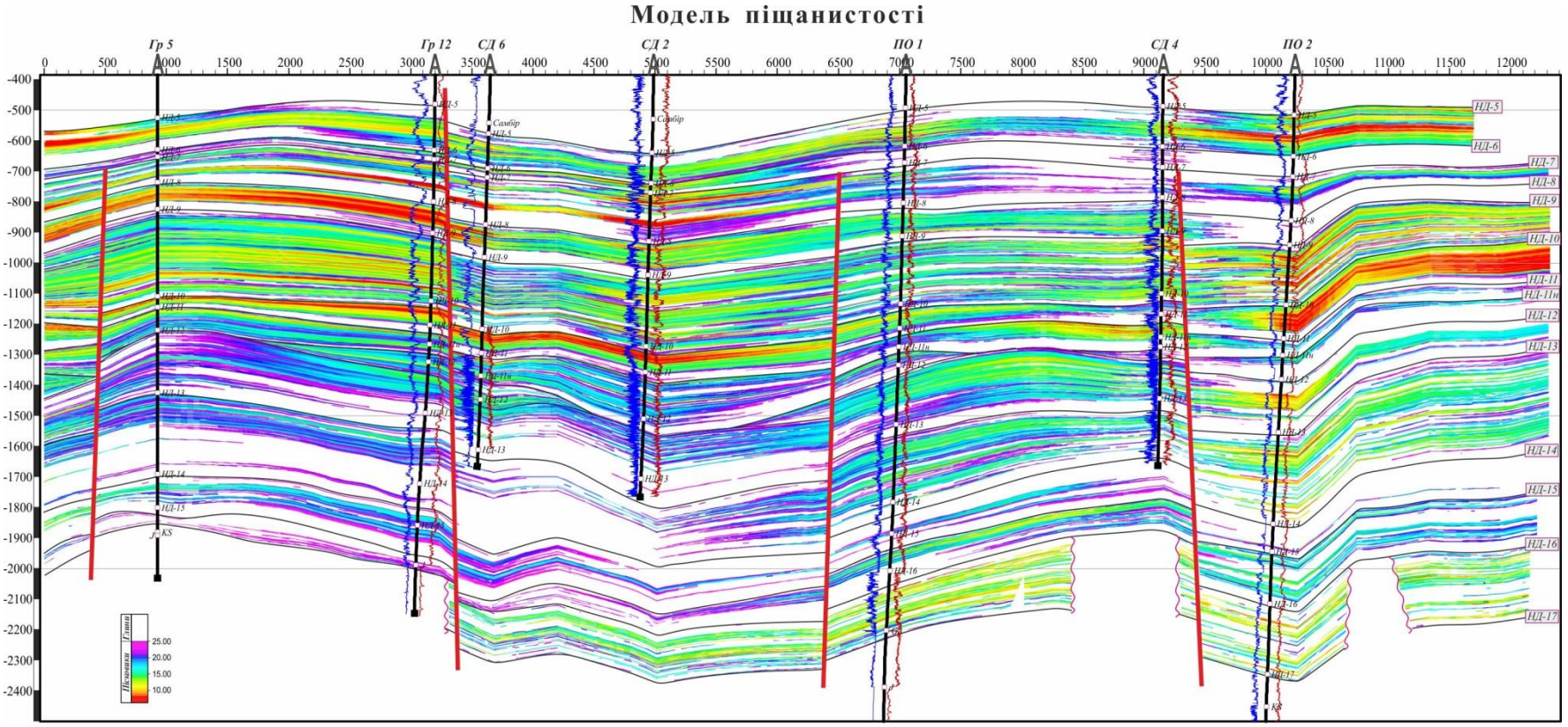


- Left side – sandiness, right side - porosity

Перегляд сейсміки

Predicting of geological section

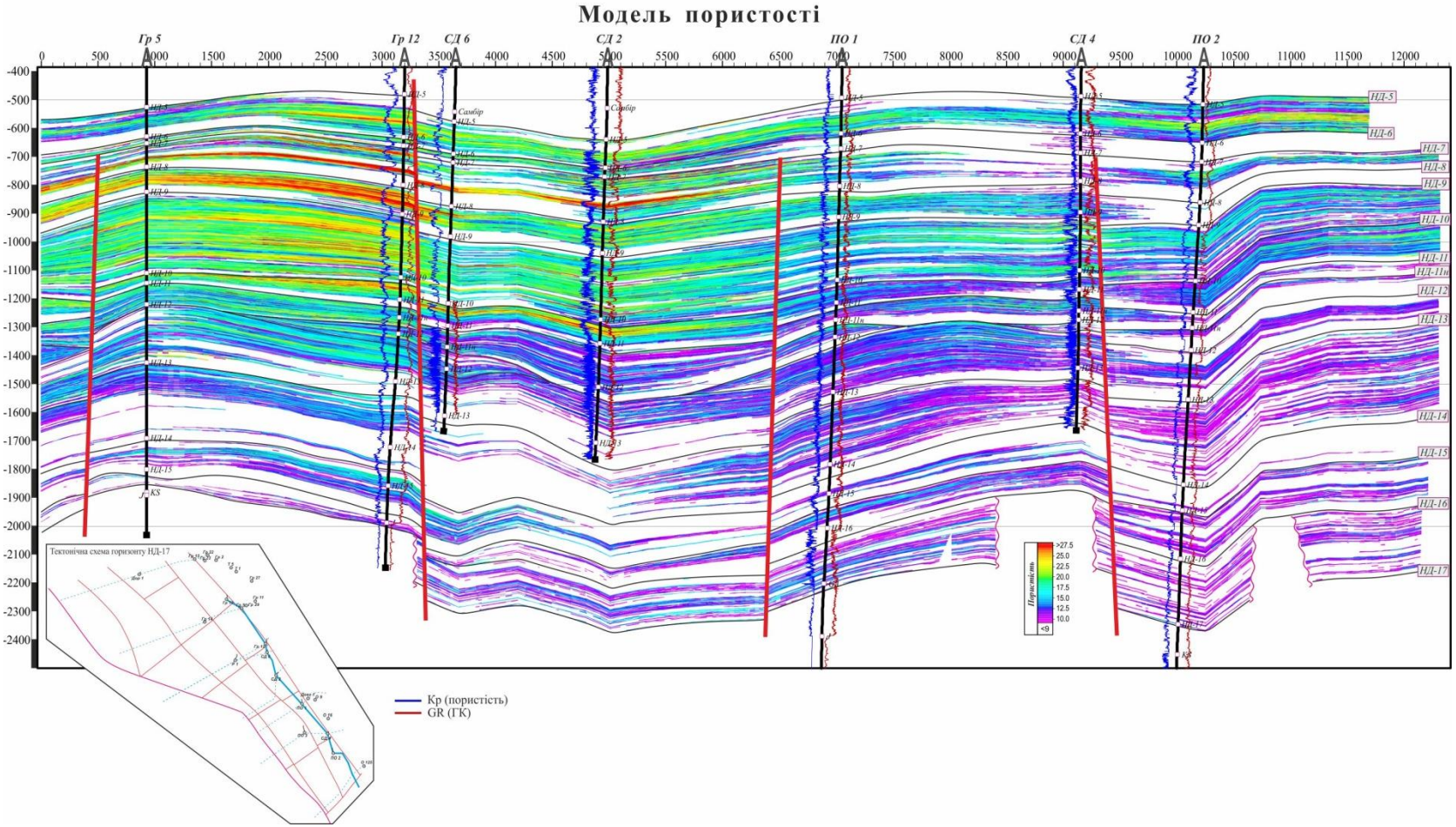
Cross section I-I through apical parts of Voroblevychi and South Opary structures.



- Sandiness

Predicting of geological section

Cross section I-I through apical parts of Voroblevychi and South Opary structures. Porosity

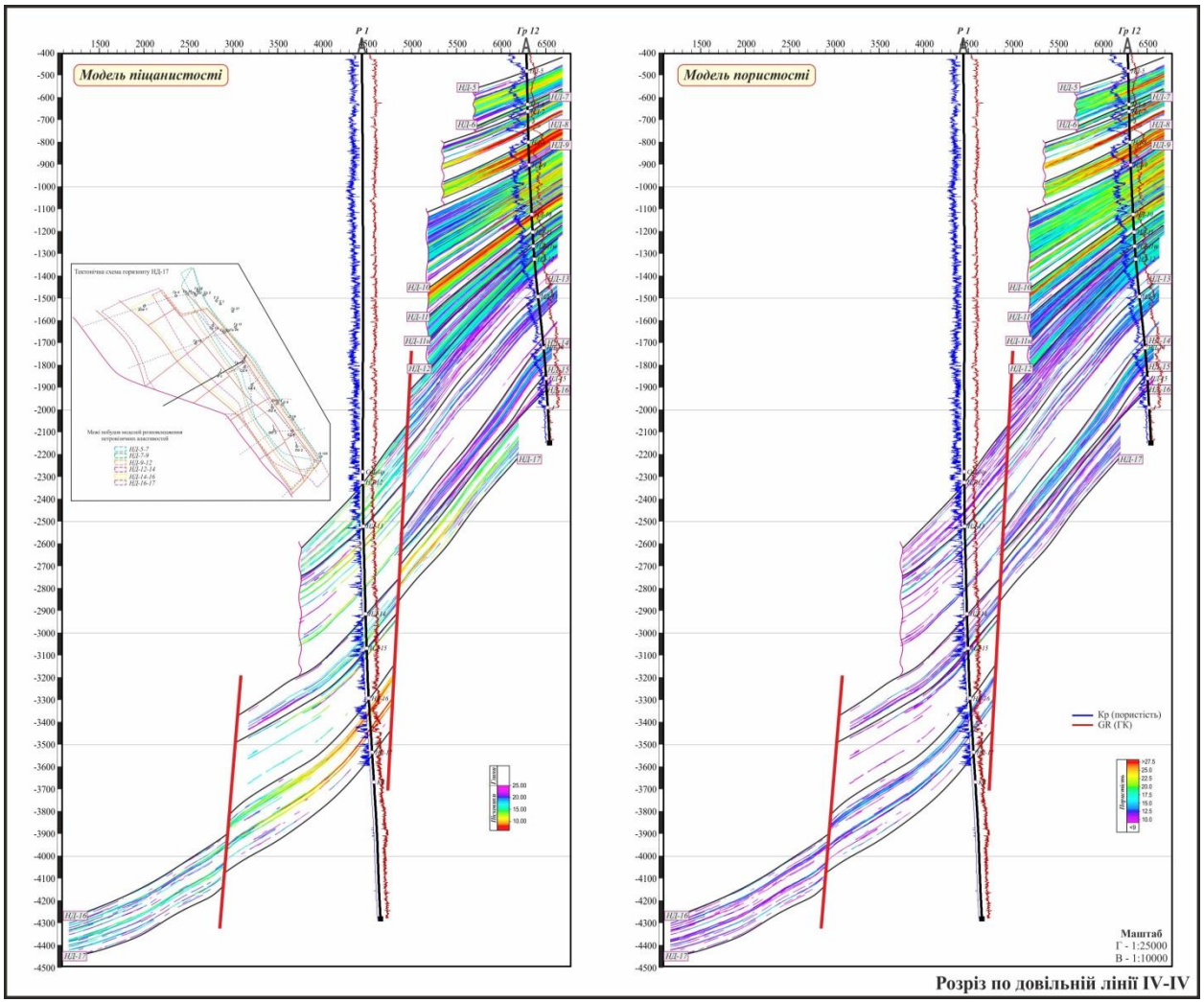


- Porosity

Перегляд сейсміки

Predicting of geological section

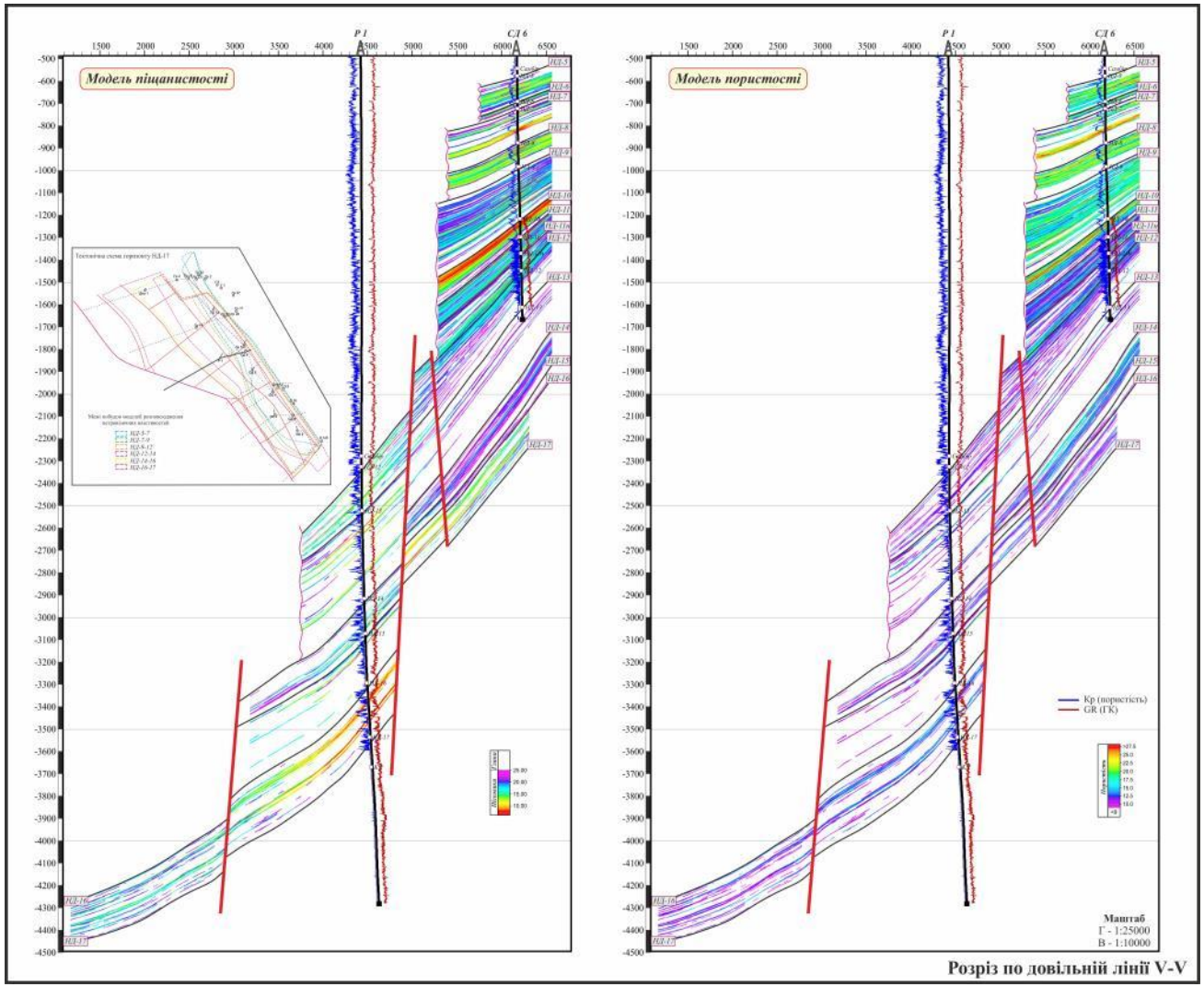
Section IV-IV. The south block of Roliv structure and wells Roliv 1 and Grushiv 12



- Left side – sandiness, right side - porosity

Predicting of geological section

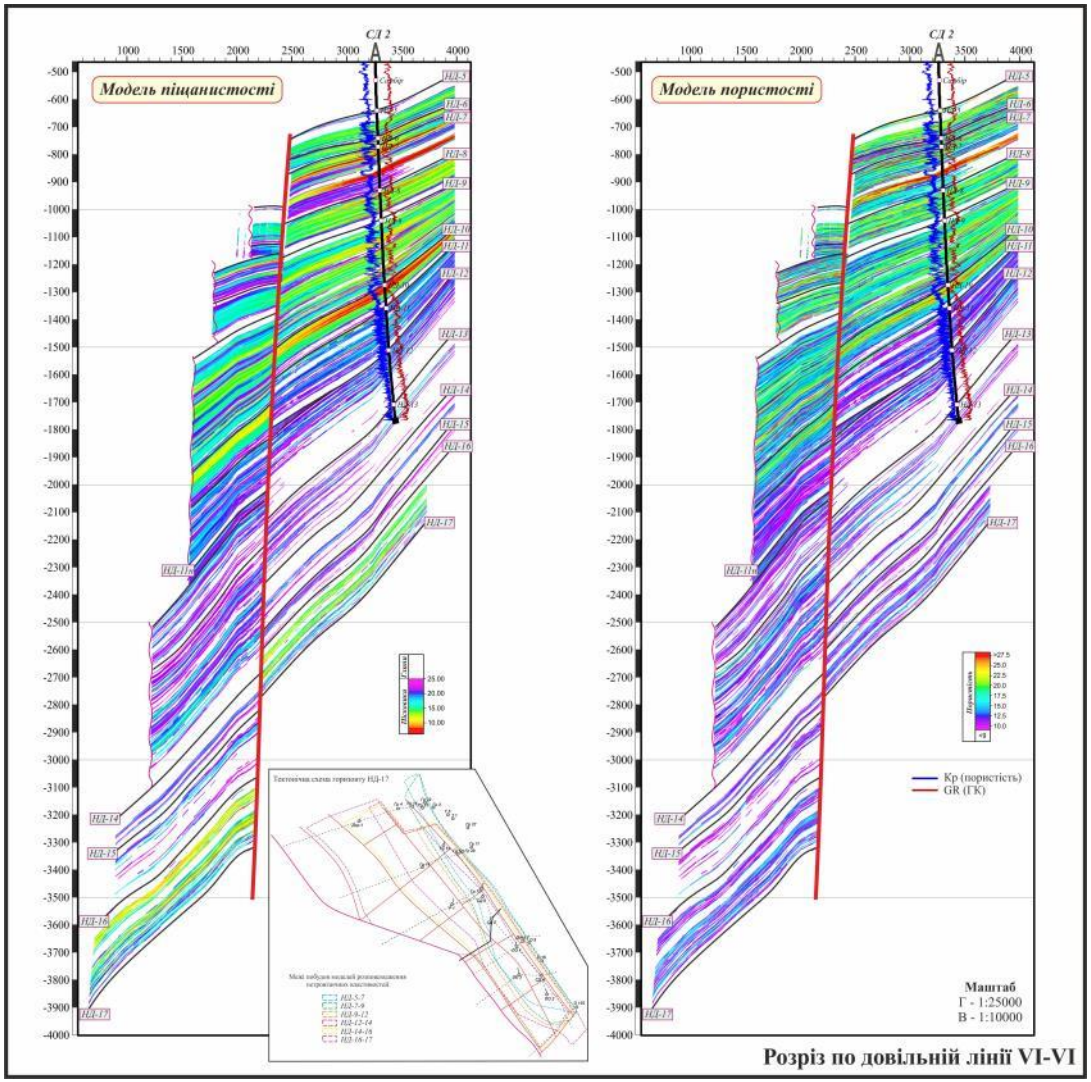
Section V-V. The south block of Roliv structure and wells Roliv 1 and East Dovge 6



- Left side – sandiness, right side - porosity

Predicting of geological section

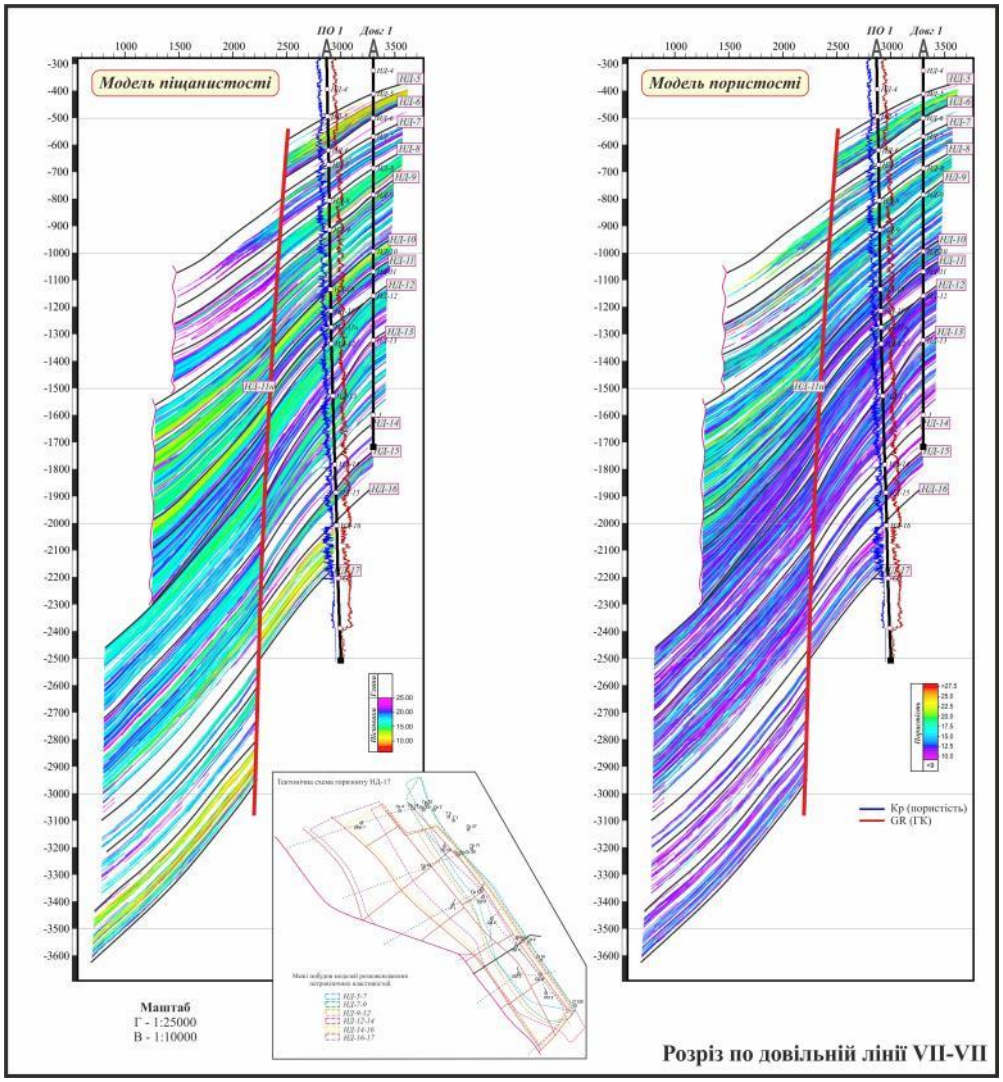
Section VI-VI. The South-Roliv structure and well East Dovge 2



- Left side – sandiness, right side - porosity

Predicting of geological section

Section VII-VII. The South Opary structure and well South Opary 1

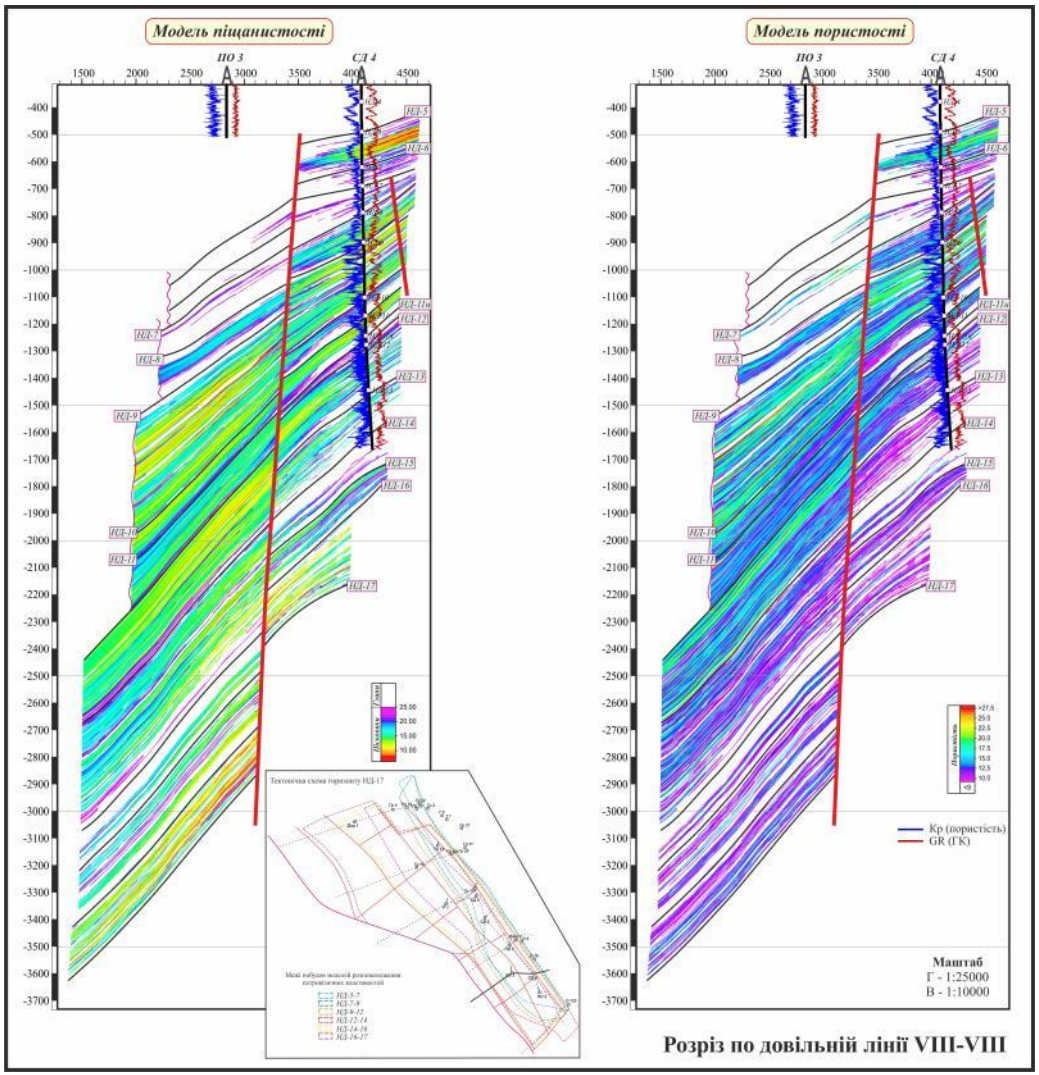


- Left side – sandiness, right side - porosity

Перегляд сейсміки

Predicting of geological section

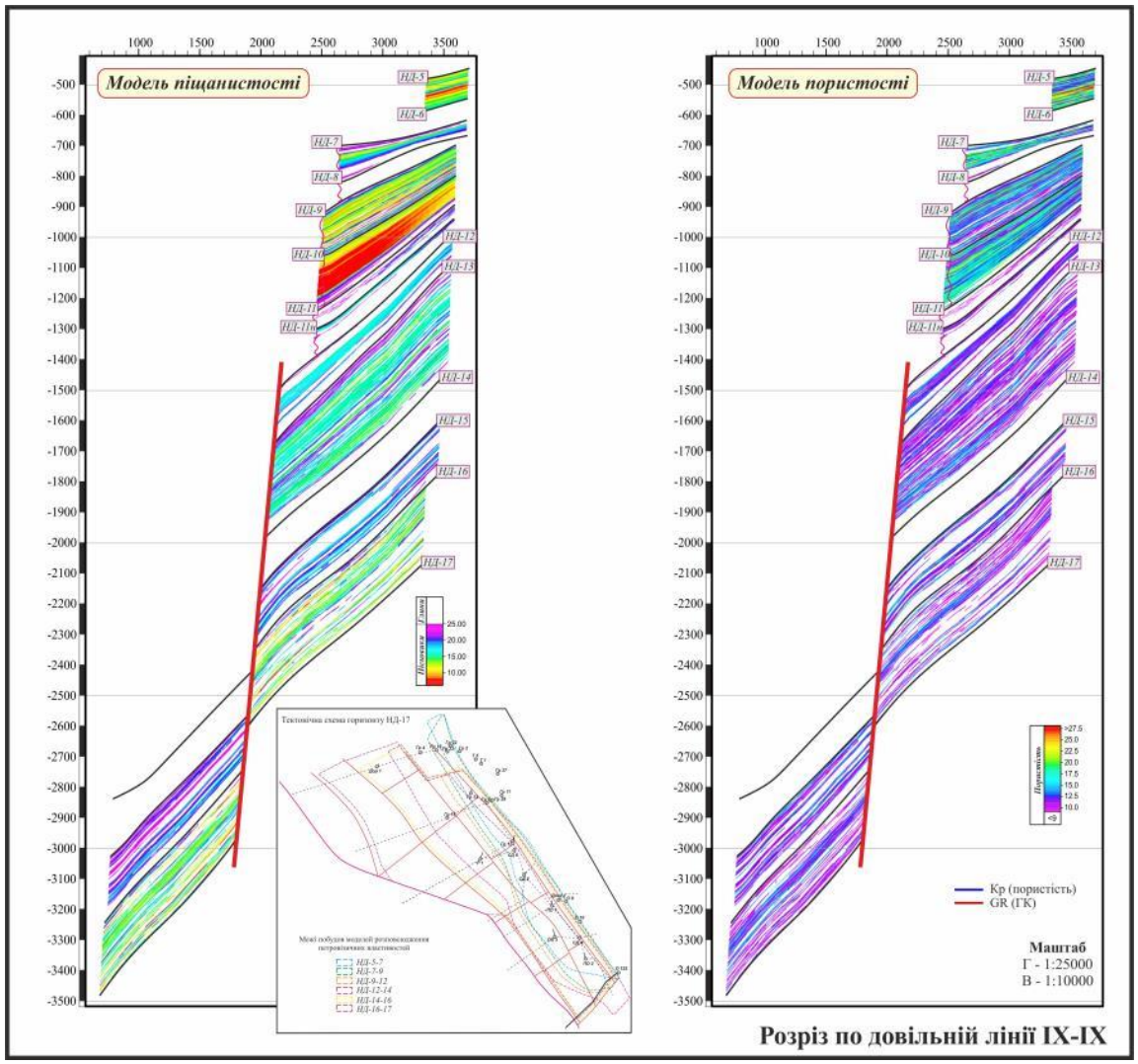
Section VIII-VIII. The South Opary structure and well East Dovge 4



- Left side – sandiness, right side - porosity

Predicting of geological section

Section IX-IX. The South Opary structure and recommended well Drohobych 1

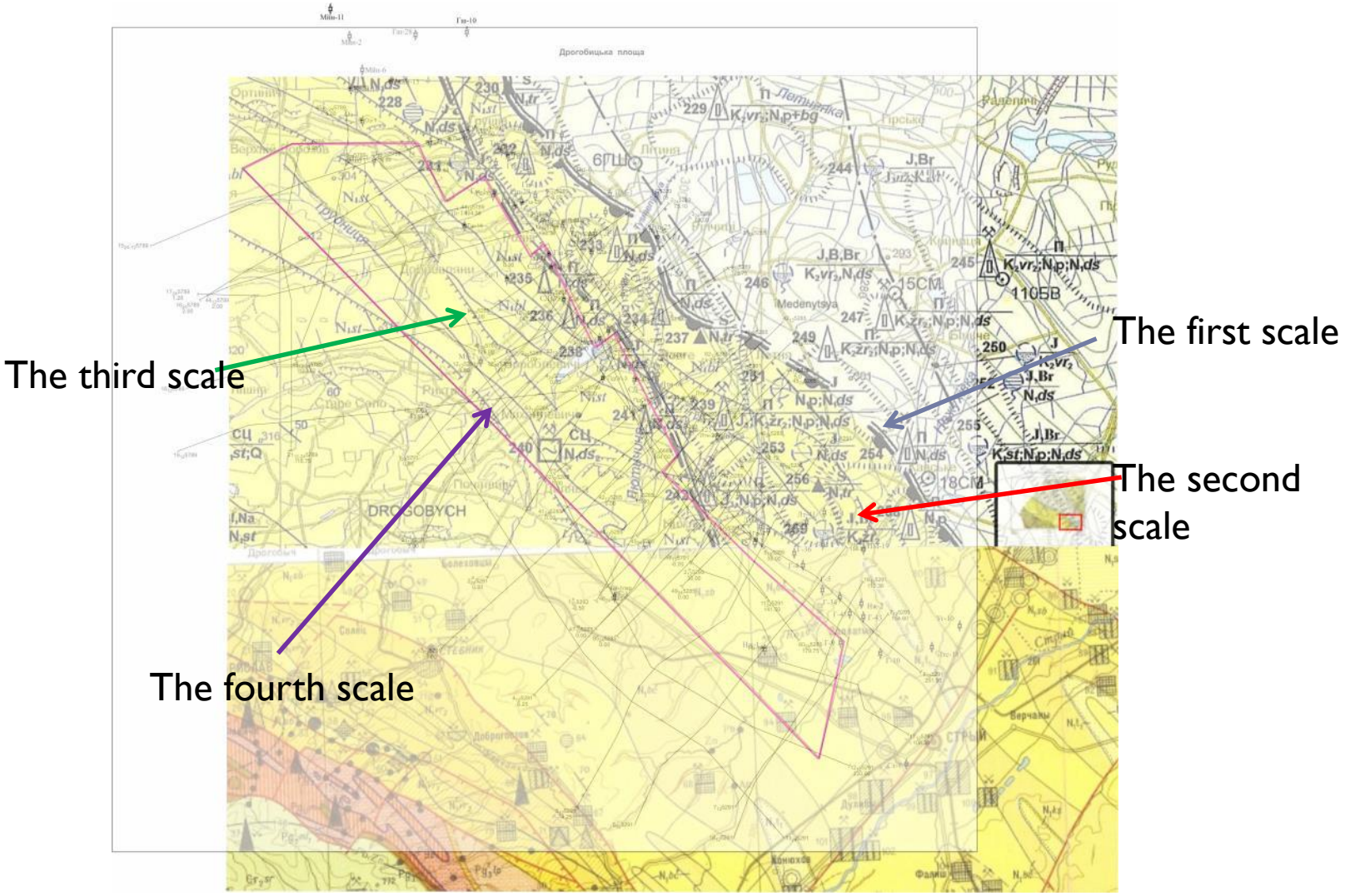


- Left side – sandiness, right side - porosity

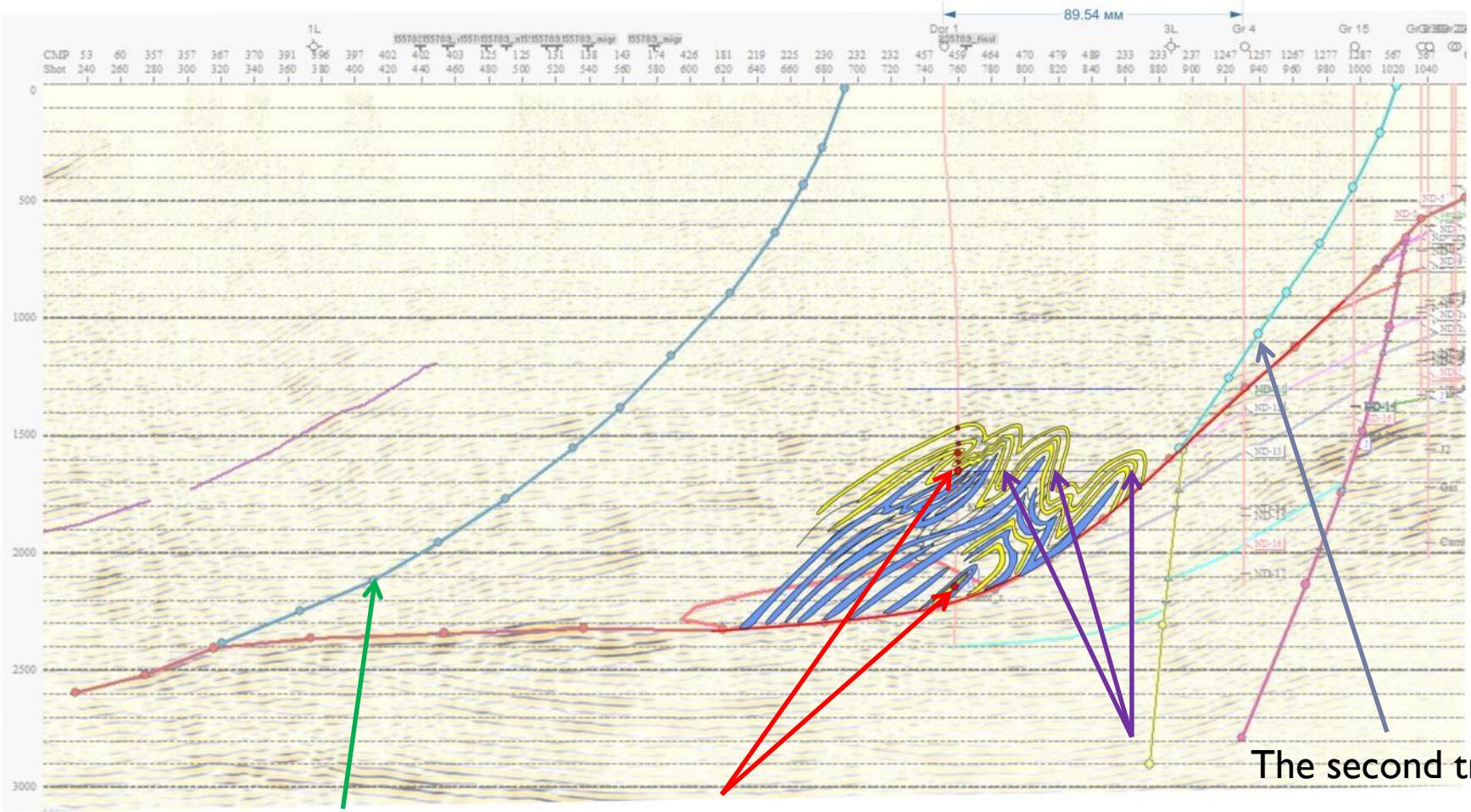
Sambir zone

- So far, it is generally believed that the Sambir zone is considered unpromising due to the lack of oil and gas rocks in its section. In several wells, industrial gas flows from Baden deposits were obtained.
- Well Pynjany 6 gas flow from 11,5 th.m^3/day in interval 257-266 m and in interval 1068-1074 m – 35,5 th.m^3/day. According to the logging data gas-saturated layers in the section of sloping rocks are allocated in other deposits of the Bilche-Volytska zone, as well as in the areas of Dorozhiv, Kalyniv, Chyzhky.
- At the Drohobych area, after interpretation the logging data, there are gas-saturated layers in these wells: Grushiv 12, 13 and 14, South Opary 2 and 3, Roliv 1, Dorozhiv 1, East Dovge 6

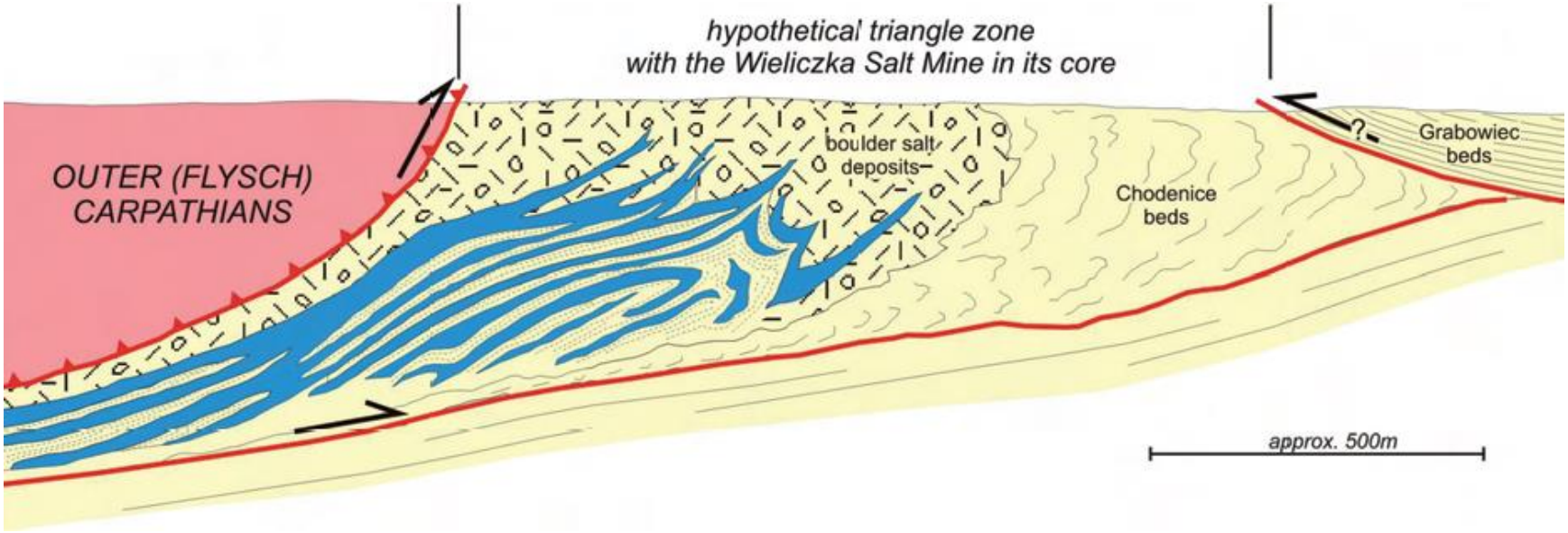
Geological map of pre-Quaternary sediments



Seismogeological section through the well Dorozhiv1 with a hypothetical geological structure of scales of the Sambir zone



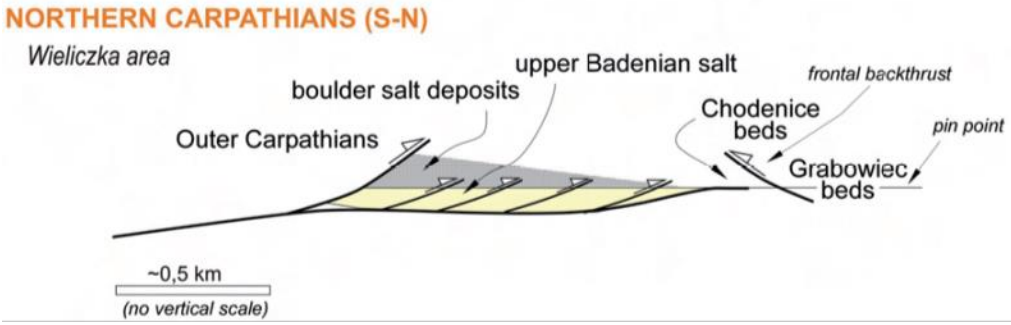
The structural prototype of the salt strata near the wells Dorozhiv1 is the salt layers near Wieliczka, Poland, Precarpathian Foredeep



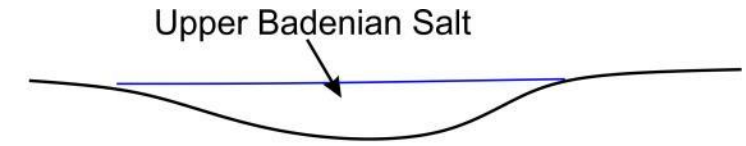
Wieliczka cross-section (redrawn from Tołwiński, 1957, slightly modified and supplemented).

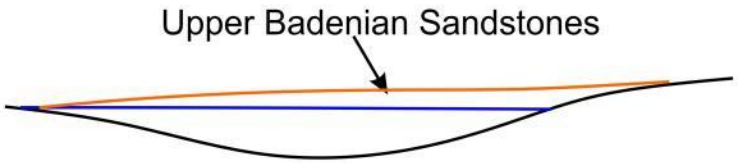
Role of the Foredeep Evaporites in Wedge Tectonics and Formation of Triangle Zones: Comparison of the Carpathian and Pyrenean Thrust Fronts

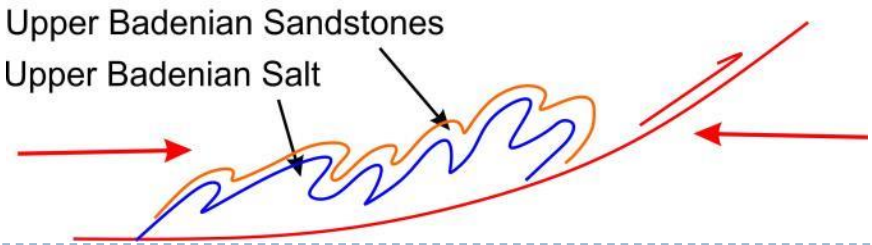
The formation Dorozhiv folds by spreading with the accumulation of salt and sand material



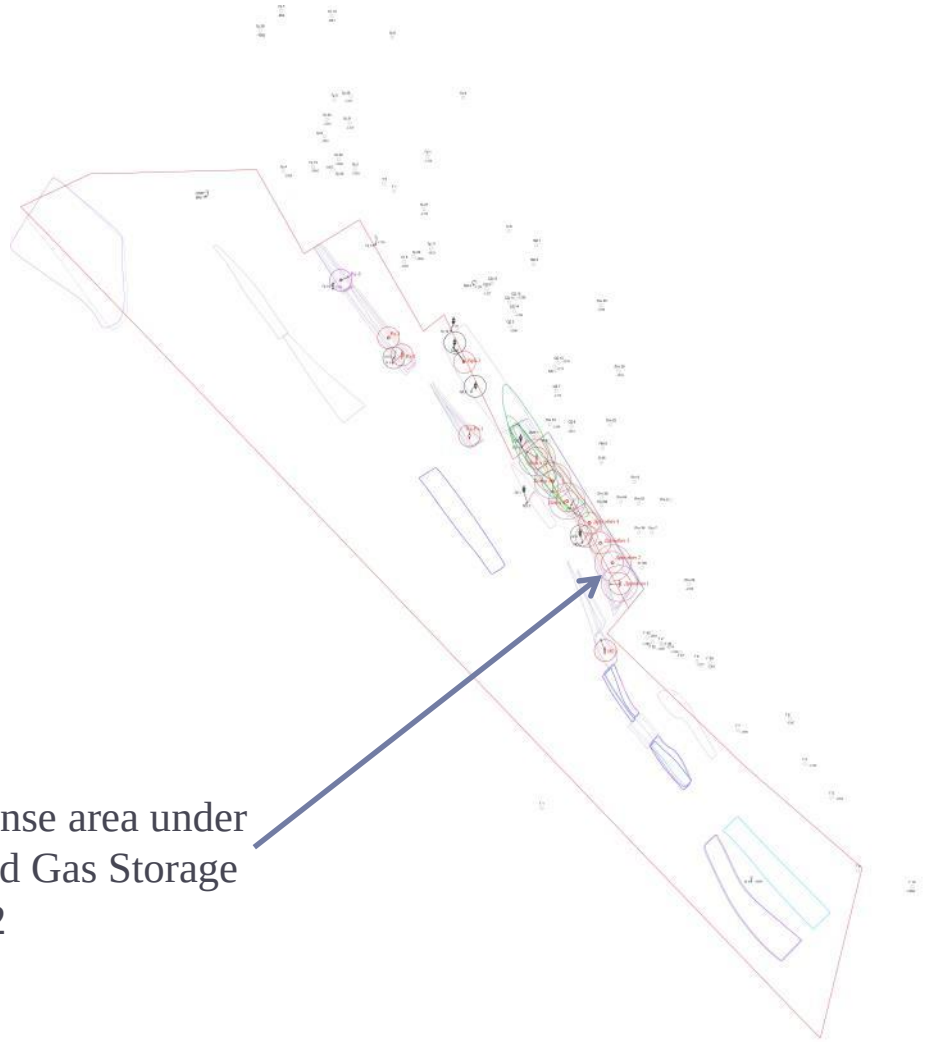
Schematic models of the frontal thrust structures and influence of evaporitic units upon their development for the Polish Carpathians Wieliczka area







Location of hydrocarbon traps and recommended wells (radius of drainage zone for Sarmatian deposits 300 m)



Expansion of the license area under Oparsky Underground Gas Storage from LD-10, 2,5 km2

Geological conclusions

- The processing and re-interpretation of logging and seismic data was carried out
- The geologic section of lithology and porosity are predicted by means of calculations of these data in deep drilling wells
- New structures are highlighted **: South Opary, Voroblevycka, Nyzhniogaivska, South Gaivska, South Nezhukhiv, Roliv, South Roliv, South Ortynychi.**
  Confirmed previously identified structure **Nezhukhiv**
- The resource base of each structure and its blocks was calculated taking into account the determined gas and oil saturation data in deep drilling wells within the Drohobych area
- Resources of gas **74** mln.m^3 – C2 and initial reserves gas – **2096** mln.m^3 and 22 th.t of condensate
- Initial reserves gas **3751** mln.m^3 – in South Ortynychi hemiantycline
- **The revised geological and geophysical information opens perspectives for hydrocarbons production in the Lower Dashava sediments, the Middle Jurassic of the Bilche-Volytsya zone and the Lower Baden Sambir zone**