

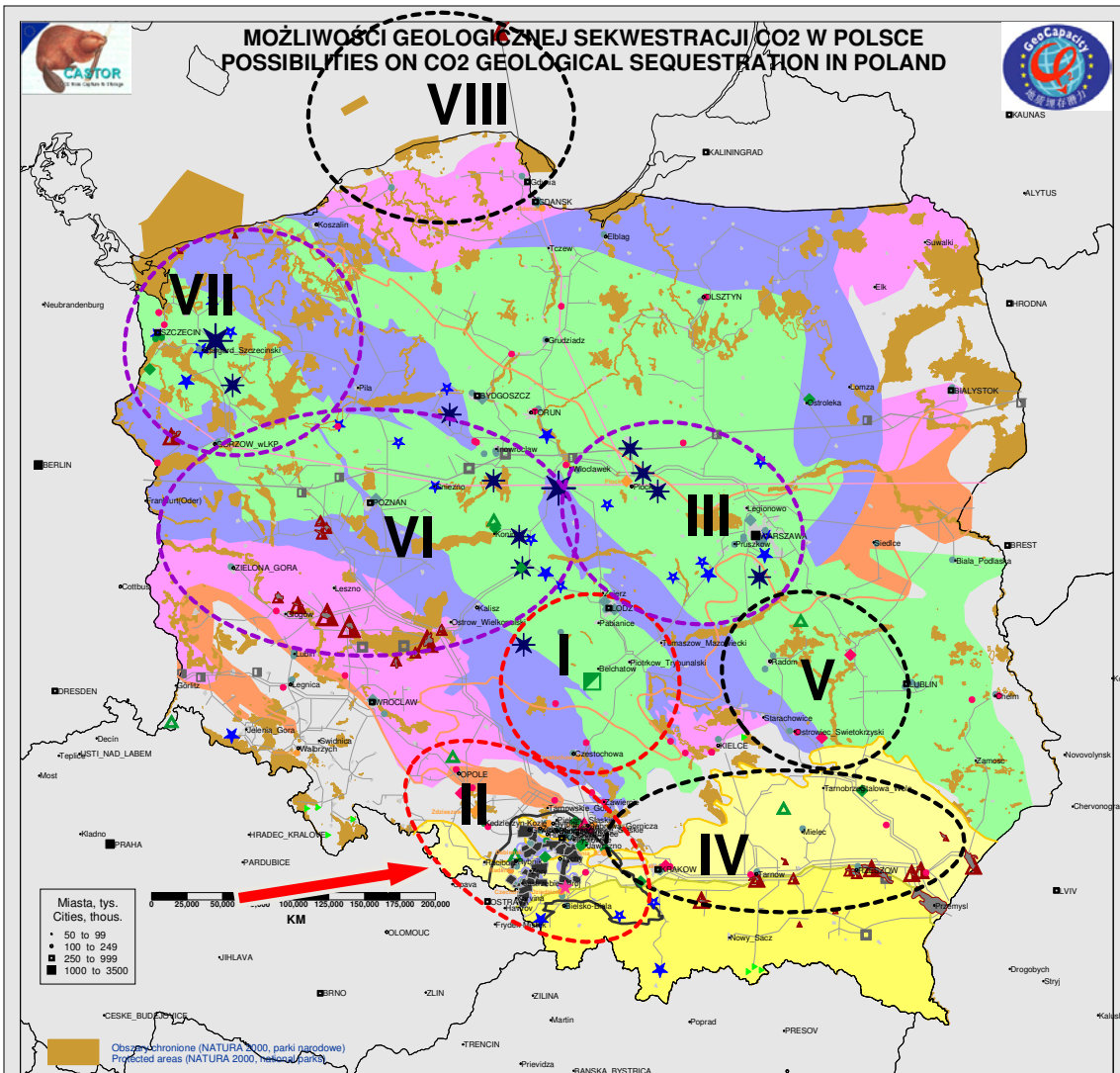


¹ Polish Geological Institute National Research Institute Upper Silesian Branch
² Central Mining Institute Katowice



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**Preliminary characterization of perspective
CO₂ storage with enhanced coal bed methane
recovery in the Upper Silesian Coal Basin
(Poland)**



Area II – USCB

Polish Geological Institute
National Research Institute
Upper Silesian Branch in Sosnowie

Central Mining Institute
in Katowice

AGH University of Science
And Technology in Krakow

PBG Geophysical
Exploration Ltd.
in Warsaw

source: skladowanie.pgi.gov.pl

LEGENDA LEGEND

Elektrownie zawodowe, emisja w kt (KPAU)
Power plants, emission in kt

- 100 to 1000
- 1000 to 5000
- 5000 to 10000
- 10000 to 33000

Elektrociepłowne i ciepłowne, emisja w kt (KPAU)
CHP and heating plants, emission in kt

- 100 to 1000
- 1000 to 5000

Przemysł wydobywczy, emisja w kt (KPAU)
Manufacturing industries, emission in kt

- 100 to 1000
- 1000 to 5000
- 5000 to 10000

Przemysł i kokosownie, emisja w kt (KPAU)
Conversion plants emission in kt

- 100 to 1000
- 1000 to 6000

Zasięg dolnej kredy (W. Górecki, 1995)
Lower Cretaceous extent

Zasięg dolnej jury (W. Górecki, 1995)
Lower Jurassic extent

Zasięg dolnego triasu (pasirego piaskowca)
Lower Triassic (Bunter Sa.) extent (R. Dadlez, S. Marek, J. Pokorski, 1998)

★ **Planowane lokalizacje geotermalne**
Planned geothermal localities

★ **Instalacje i uźdrowiska geotermalne**
Geothermal installations and spas

★ **100 to 500**

★ **500 to 1100**

Potencjal magazynowania struktur hydrogeologicznych (Cr1, J1, T1), Mt
Storage capacity of aquifer structures (Cr1, J1, T1 - R. Tarkowski, 2005), Mt

- 100 to 500
- 500 to 1100

Gazociągi (P. Karkowski, 1993; www.rynekgazu.pl)
Gas pipelines

1 **Terminalne gazowe (st. kompresorów, przesyłowe)**
Gas pipelines (compressor & transfer stations)

2 **„Ropociąg” „Przyssaki”**
Drumline oil pipeline

3 **Ważniejsze podziemne magazyny gazu i paliw**
Major underground gas and fuel storages

4 **Wybrane złoża gazu i ropy (P. Karkowski, 1993; Intergooskard)**
Selected gas and oil fields

Potencjal magazynowania struktur naftowych (gaz i ropa), Mt
Storage capacity of hydrocarbon structures, Mt

- 0.4 to 5
- 5 to 10
- 10 to 50
- 50 to 150

Obszary górnicze (w tym MPW)
Mining areas (including CBM - Intergooskard)

GZW (zasięg karbonu produktywnego)
Silesian Coal Basin (Carboniferous range)

★ **Eksperyment Racpol/MovsCBM (ECSBM)**
ECBM Racpol/MovsCBM experiment

Zasoby MPW
CBM fields (S. Przenosiło, 2005)

- 2 to 10
- 10 to 25
- 25 to 50

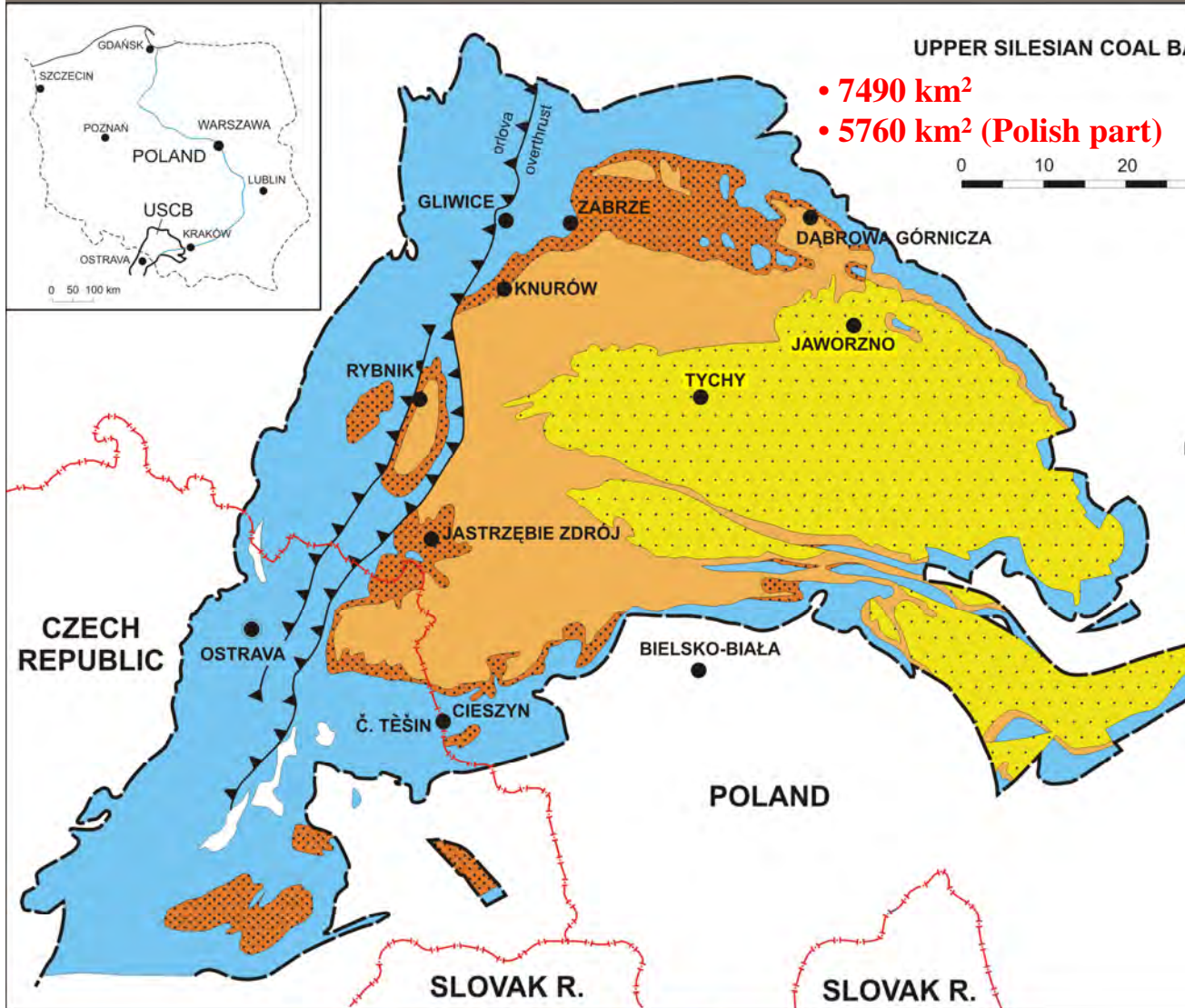
Zasięg Zapadlika Przecarpackiego
Carpathian Foredeep extent (P. Karkowski, 1993)

Front nasunięcia Karpat
Carpathian front (P. Karkowski, 1993)

Zasięg czerwonego słałowca
Rotliegend range (P. Karkowski, 1993)

▶ **Naturalne ekshalacje CO₂**
Natural CO₂ seeps

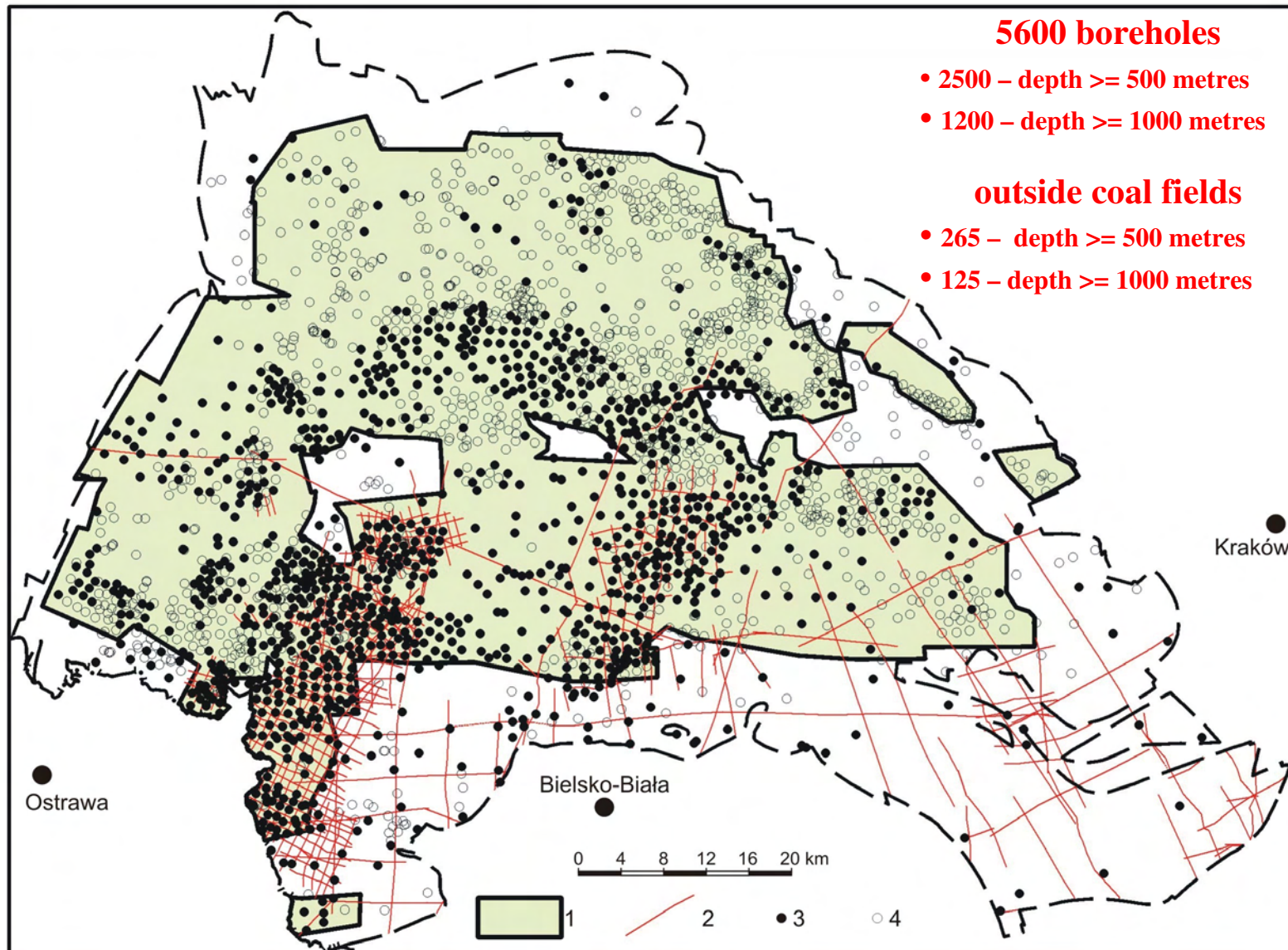
Geological sketch map of the USCB



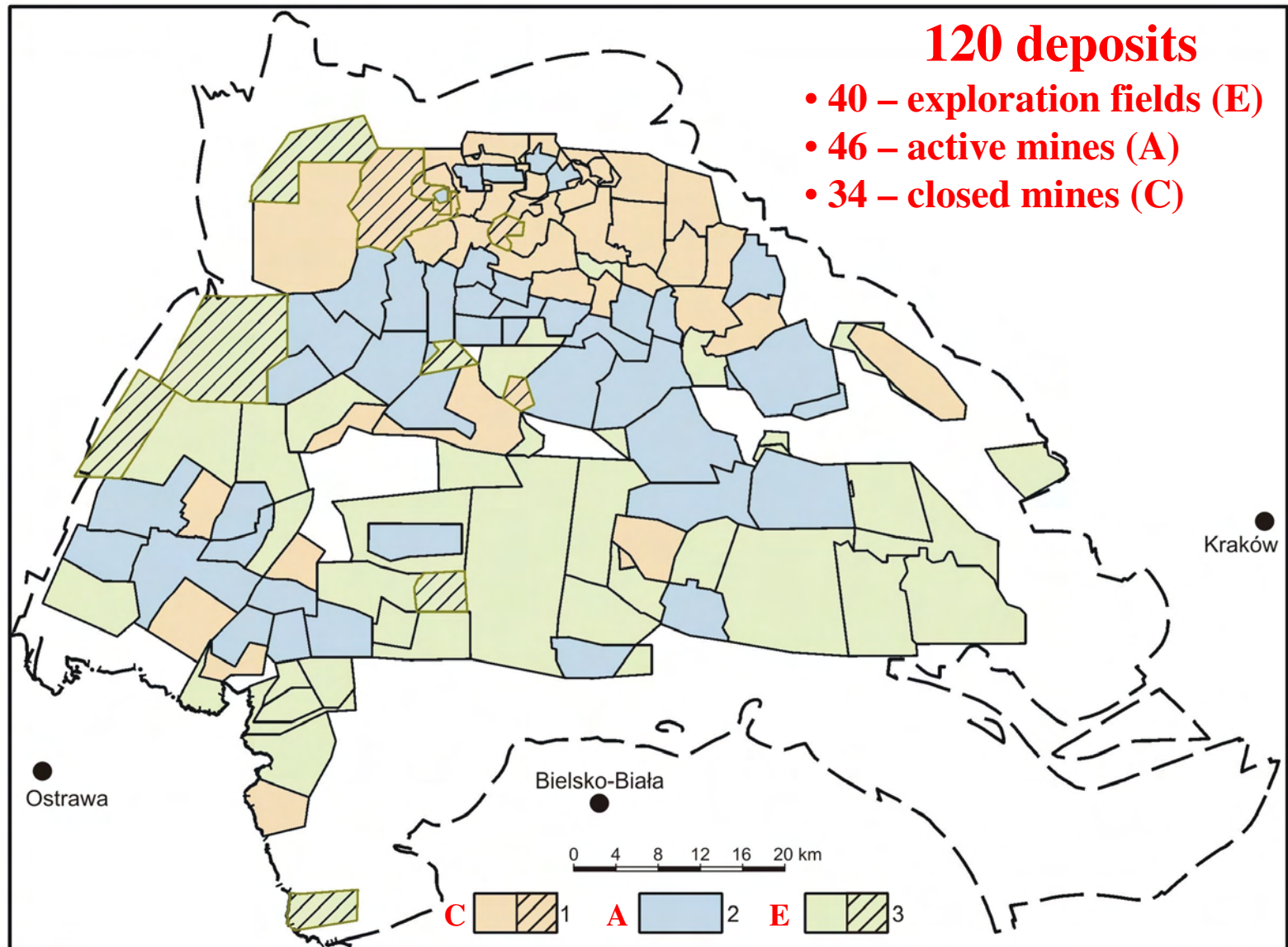
CHRONO-STRATIGRAPHY		LITHOSTRATIGRAPHY		
		western part		
WESTPHALIAN	D	CRACOV SANDSTONE SERIES	HIATUS	
			Libiąż Beds	
			HIATUS	
			Łaziska Beds	
	C	SILTSTONE SERIES	Orzesze Beds	
			Załęże Beds	
	B	UPPER SILESIAN SANDSTONE SERIES	Hubert fresh water fauna horizon s. 407	
			Ruda Beds	
	NAMURIAN	A	PARALIC SERIES	Anticlinical Beds = Zabrze Beds
				HIATUS
Jejkowice Beds				
HIATUS				
Grodziec Beds				
Flora Beds				
UPPER VISEAN	FLYSCH ASSOCIATION	MALINOWICE BEDS = ZALAS BEDS	Stur (XVI) m.b. s. 915	
			upper	
			lower	

— coal-bearing m.b. - marine band s. - seam

Geological and mining exploration of USC'B



USCB – hard coal deposits



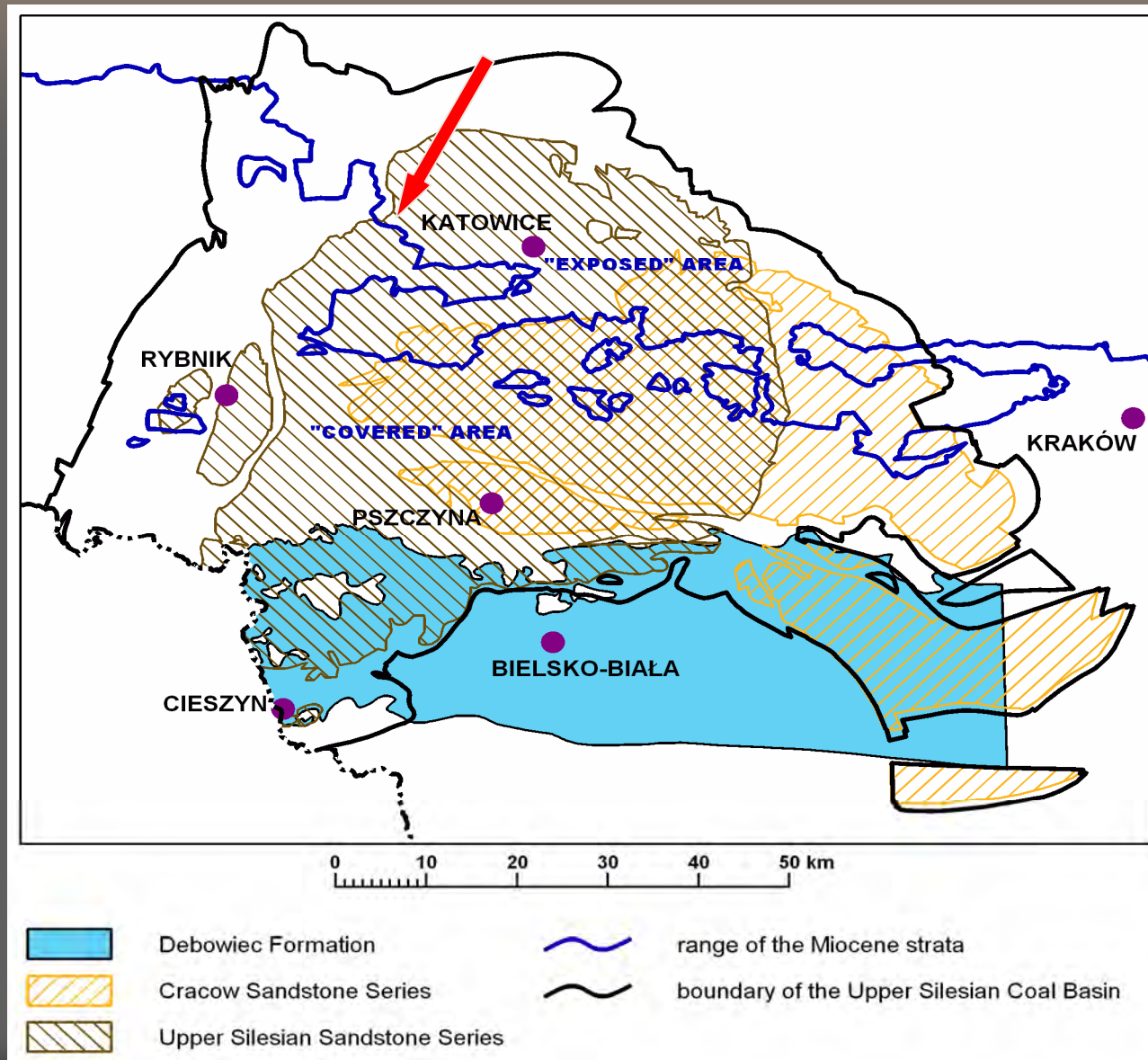
Fundamental parameters of geological structures useful for Carbon Capture and Storage (CCS)

- top of the collector: **at depth beneath 800 metres**
- thickness of sealing deposits: **> 50 metres (the best ≥ 100 m)**
- thickness of collector (reservoir): **≥ 50 metres**
- effective porosity: **up 10% (the best around 20%)**
- permeability: **> 200 – 300 mD**
- mineralisation of subterranean waters: **> 30 g/dm³**
- capacity of the reservoir: **at least 20–30 Mt**

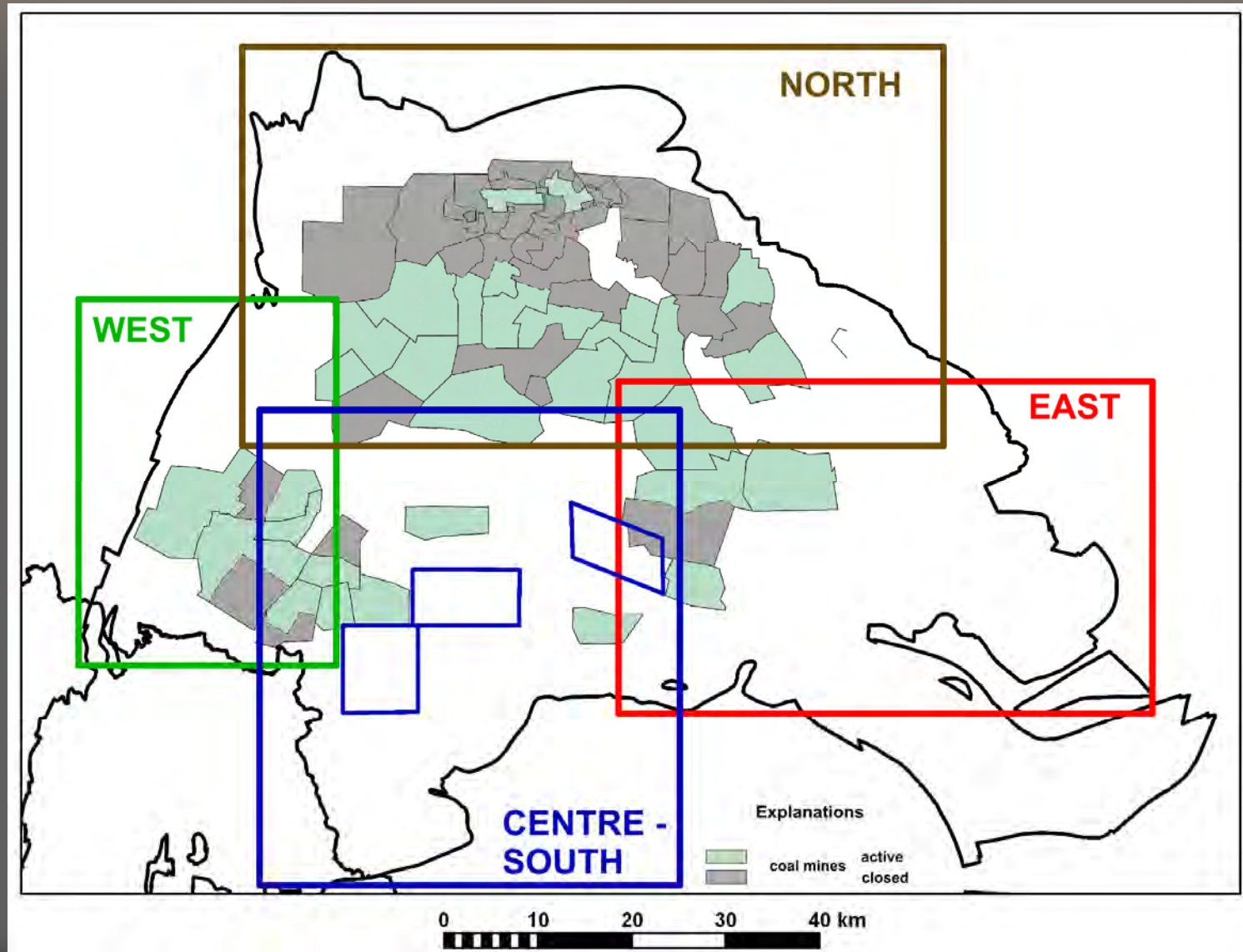
USCB (active hard coal mines):

- beneath current and planned depth of exploitation: **1250/1300 metres**
- the best outside of areas of the active hard coal mines

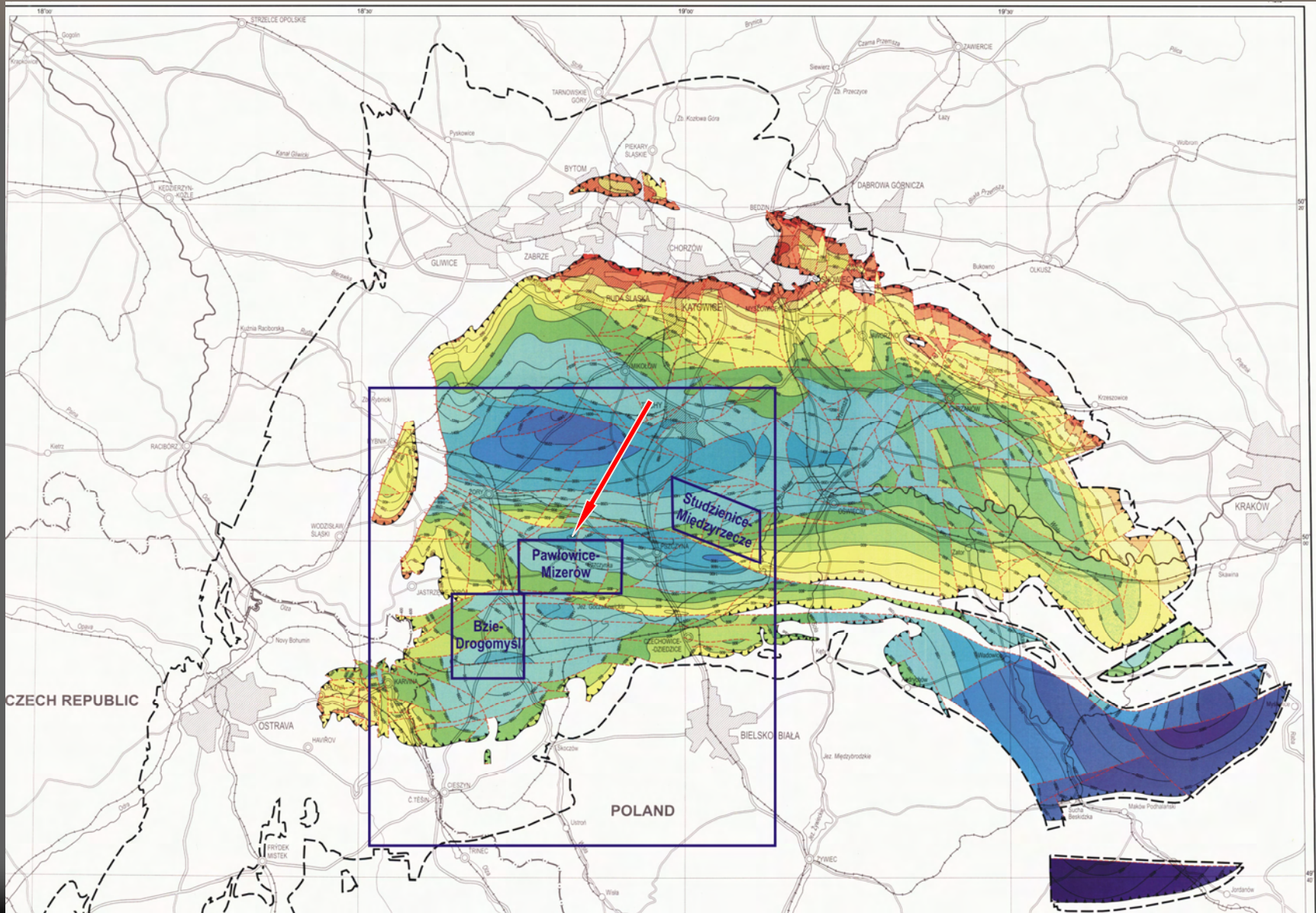
USCB – localization of the study areas



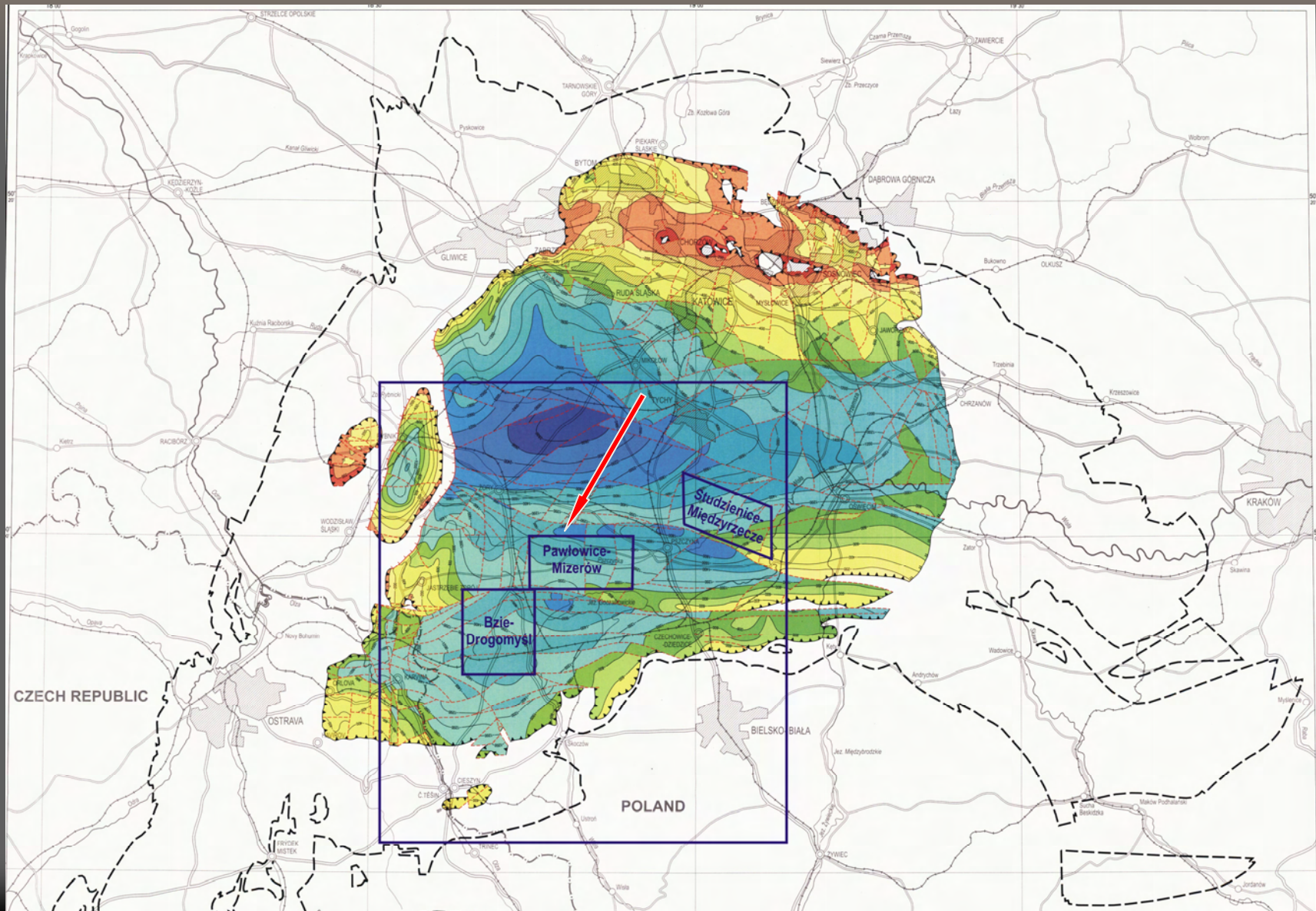
USCB – Location of the study areas



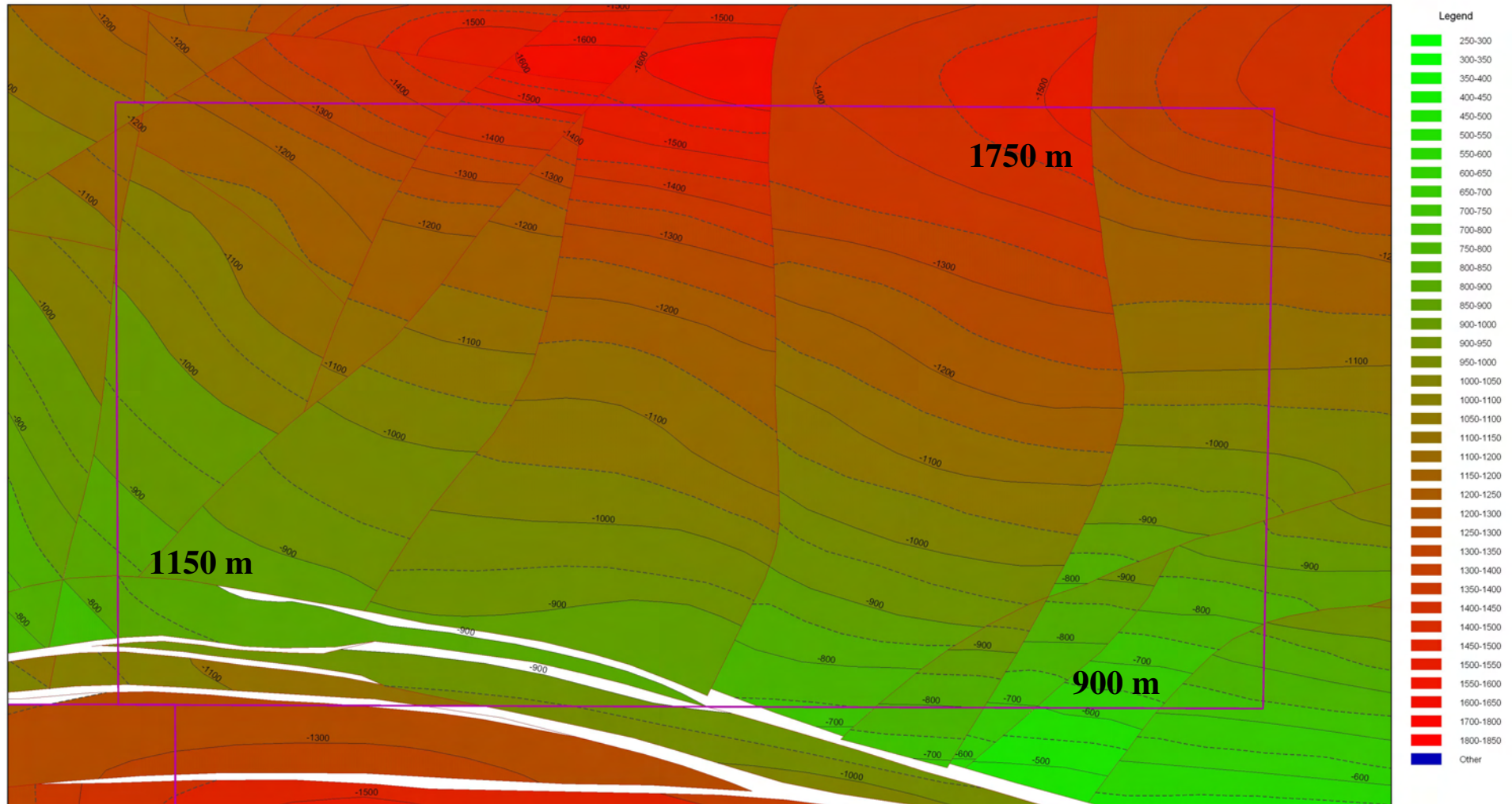
Central and southern region against a background of structural map of the base of the Mudstone Series



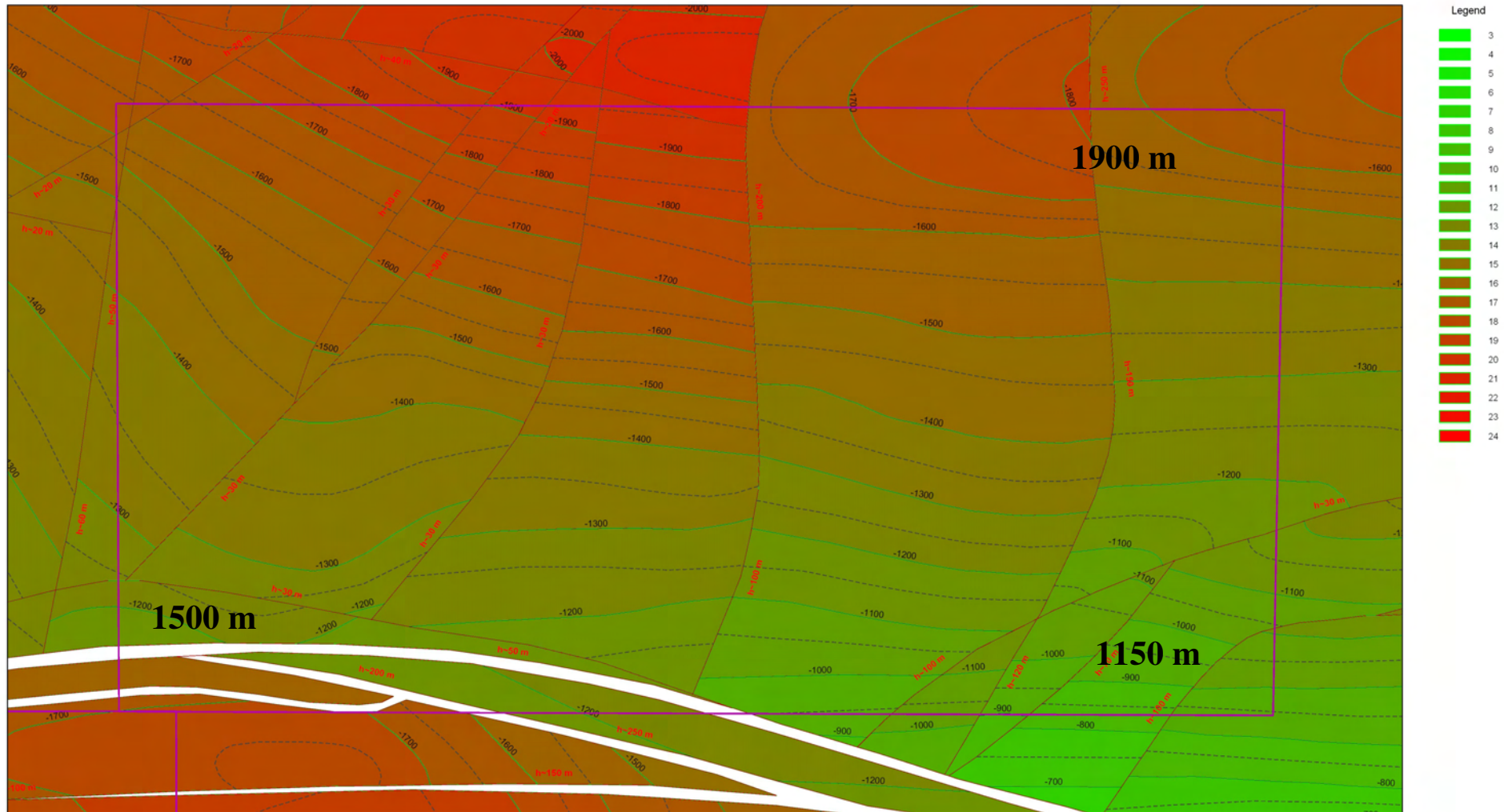
Central and southern region against a background of structural map of the base of the Upper Silesian Sandstone Series



Pawłowice – Mizerów area – structural map of the base of the Mudstone Series (coal seam 405)

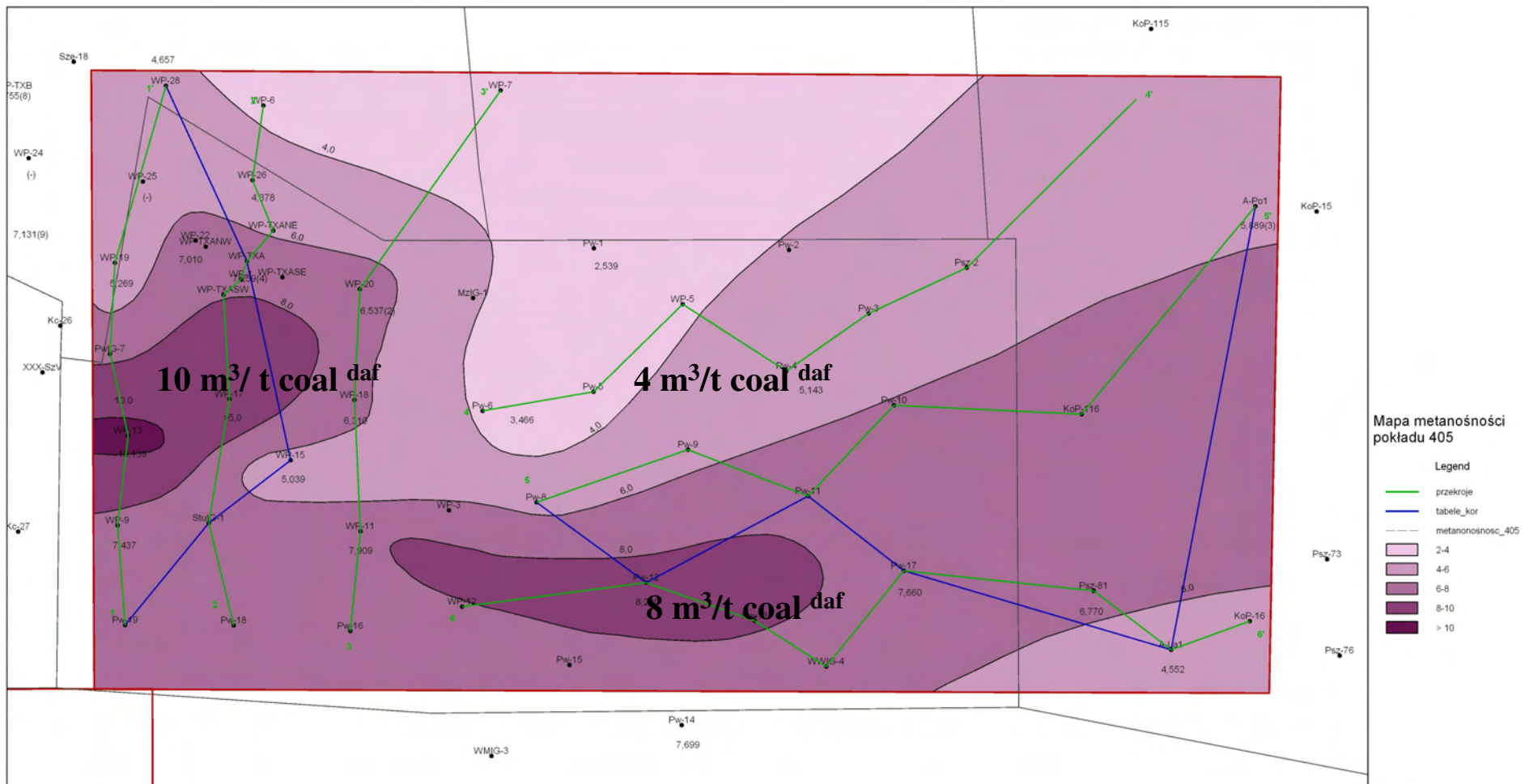


Pawłowice – Mizerów area – structural map of the base of the Upper Silesian Sandstone Series (coal seam 510)



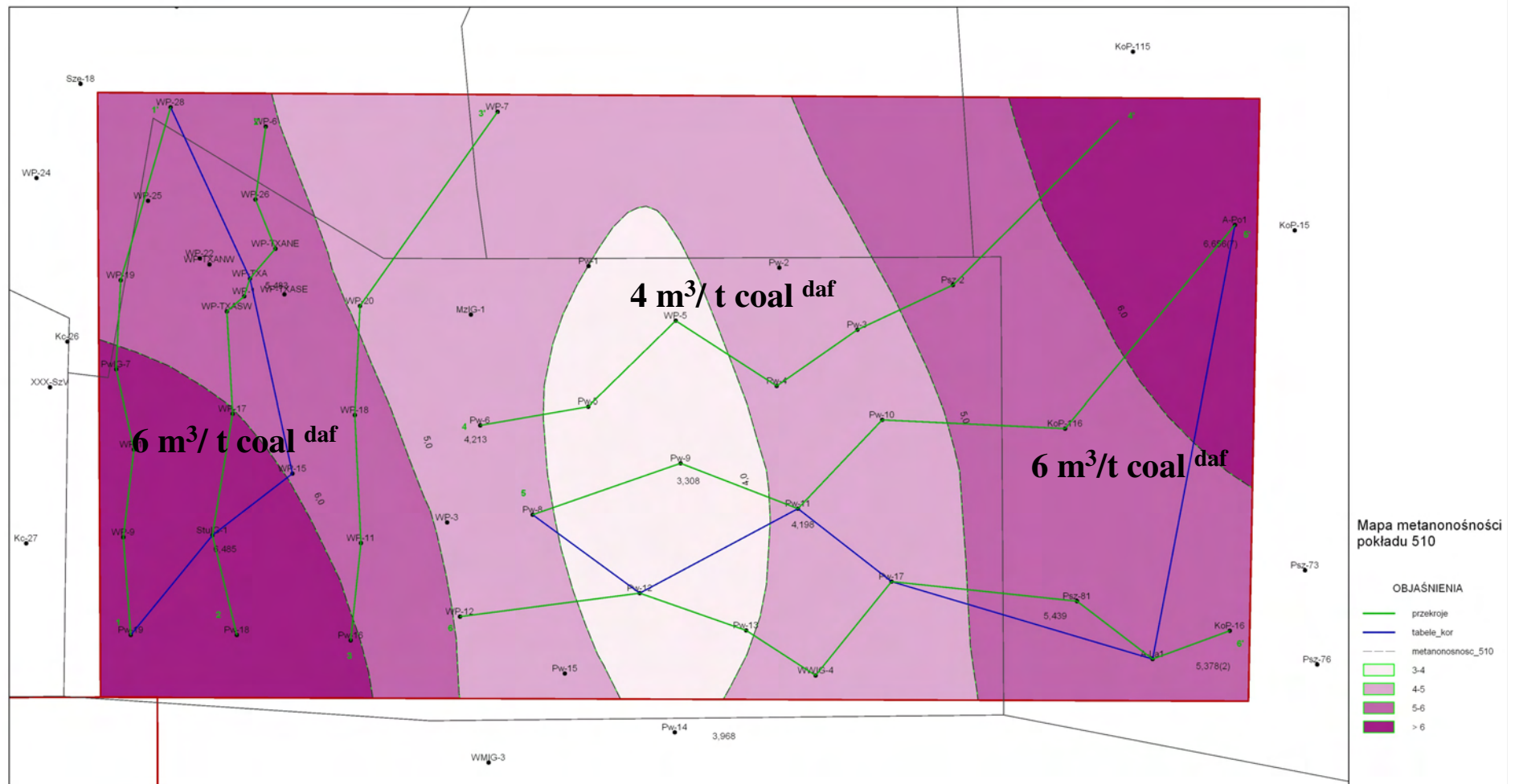
Pawłowice – Mizerów area

Coal seam 405 – coal-bed methane content



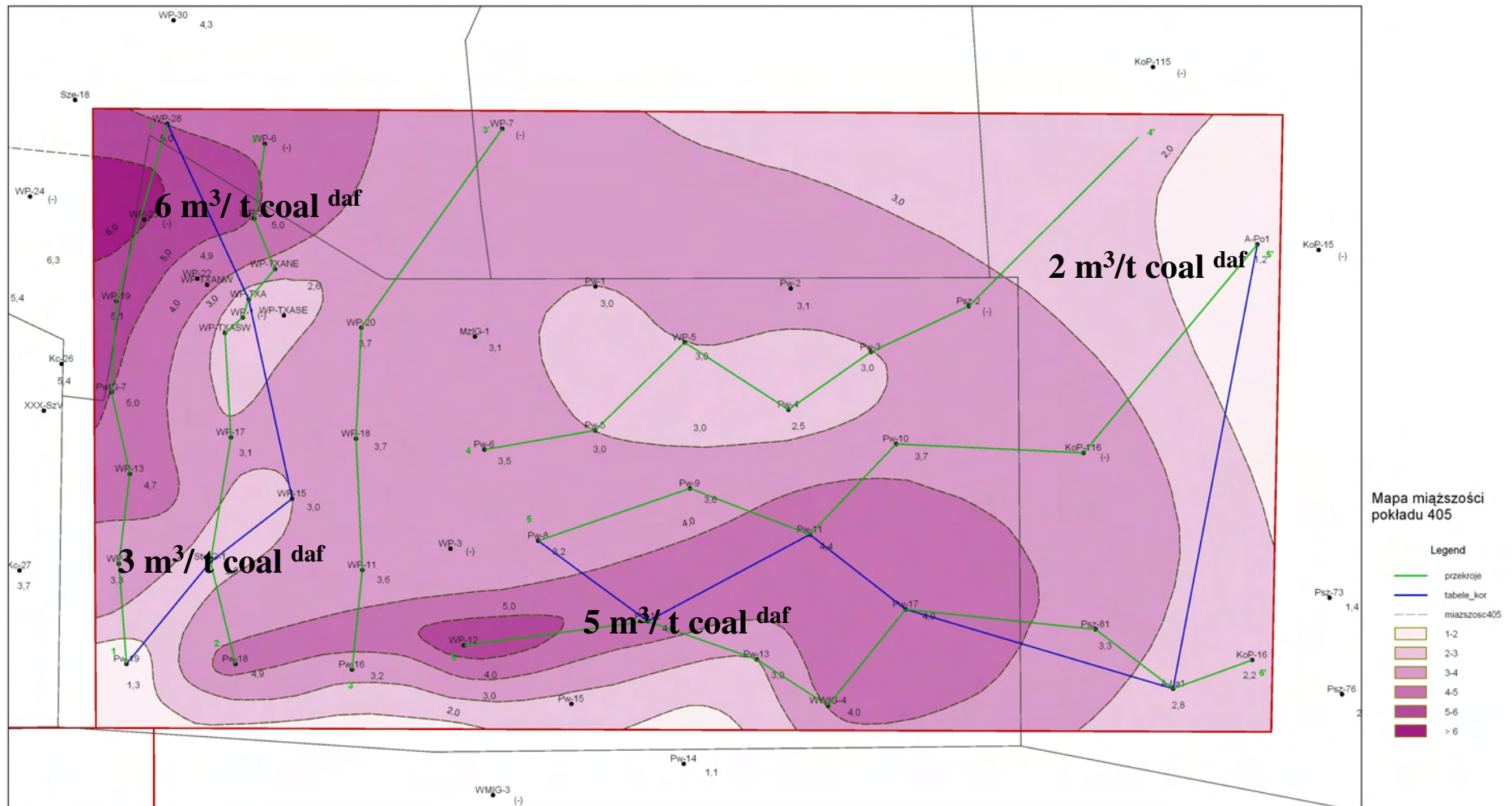
Pawłowice – Mizerów area

Coal seam 510 – coal-bed methane content



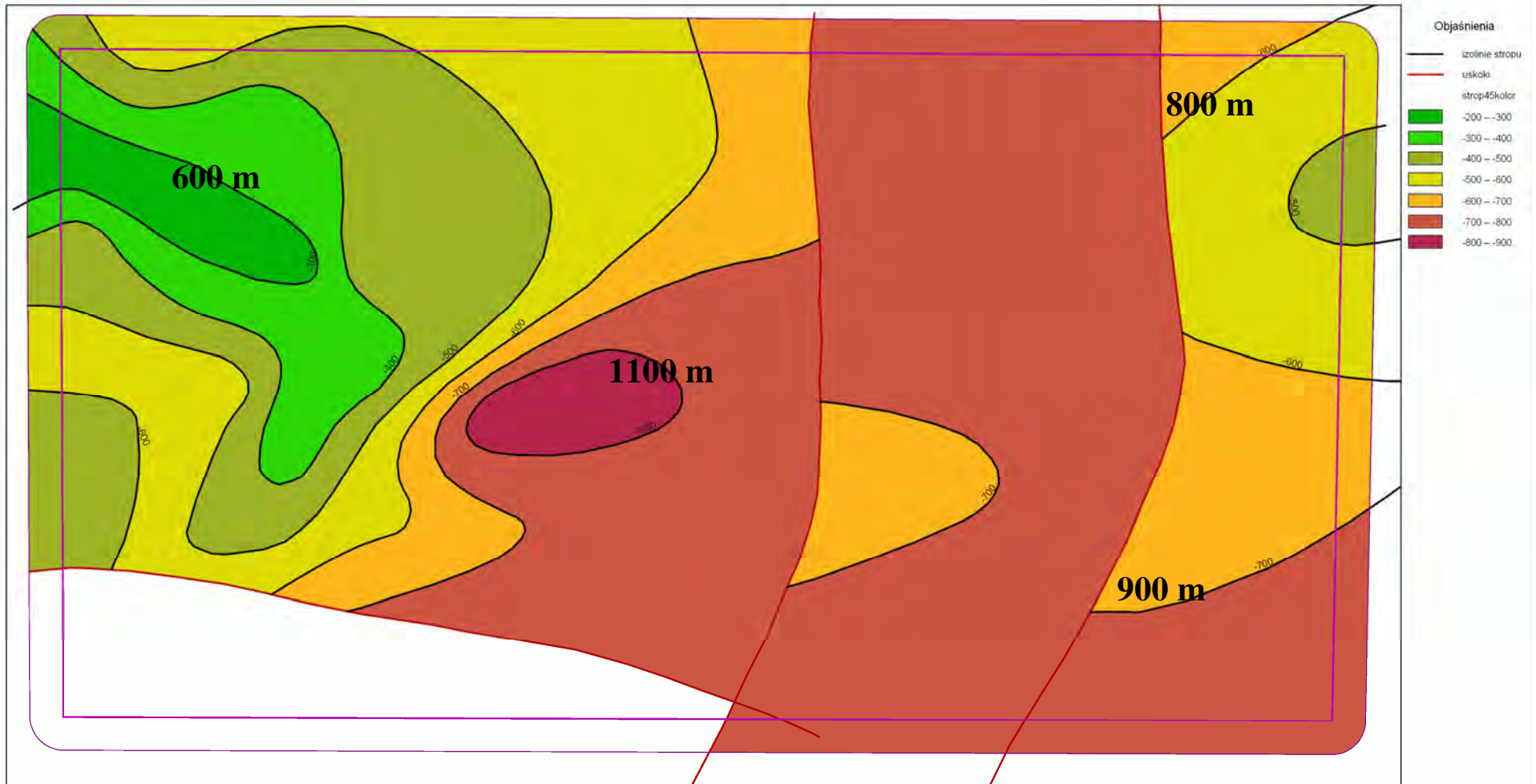
Pawłowice – Mizerów area

Thickness of the coal seam 405

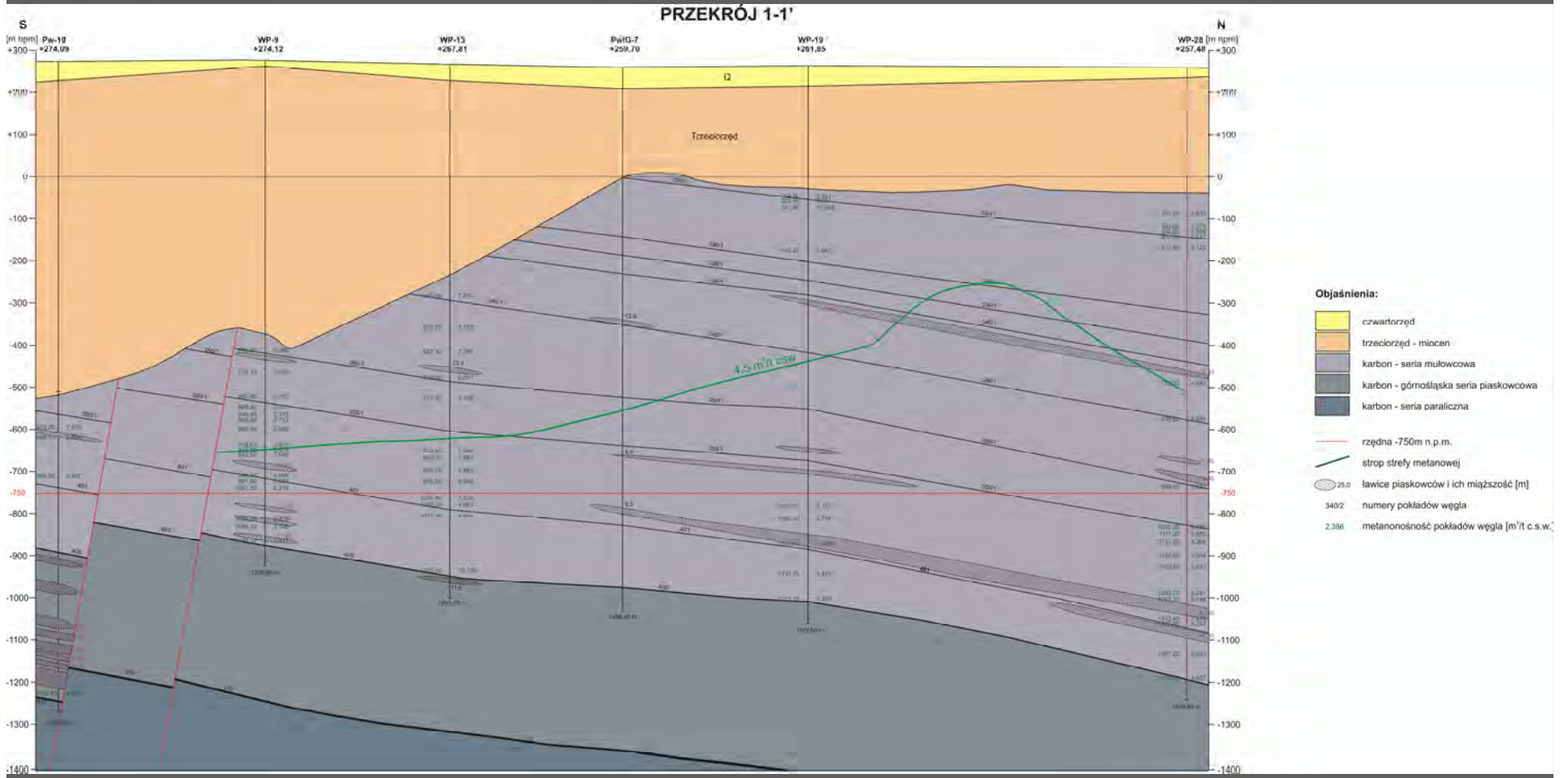


Pawłowice – Mizerów area

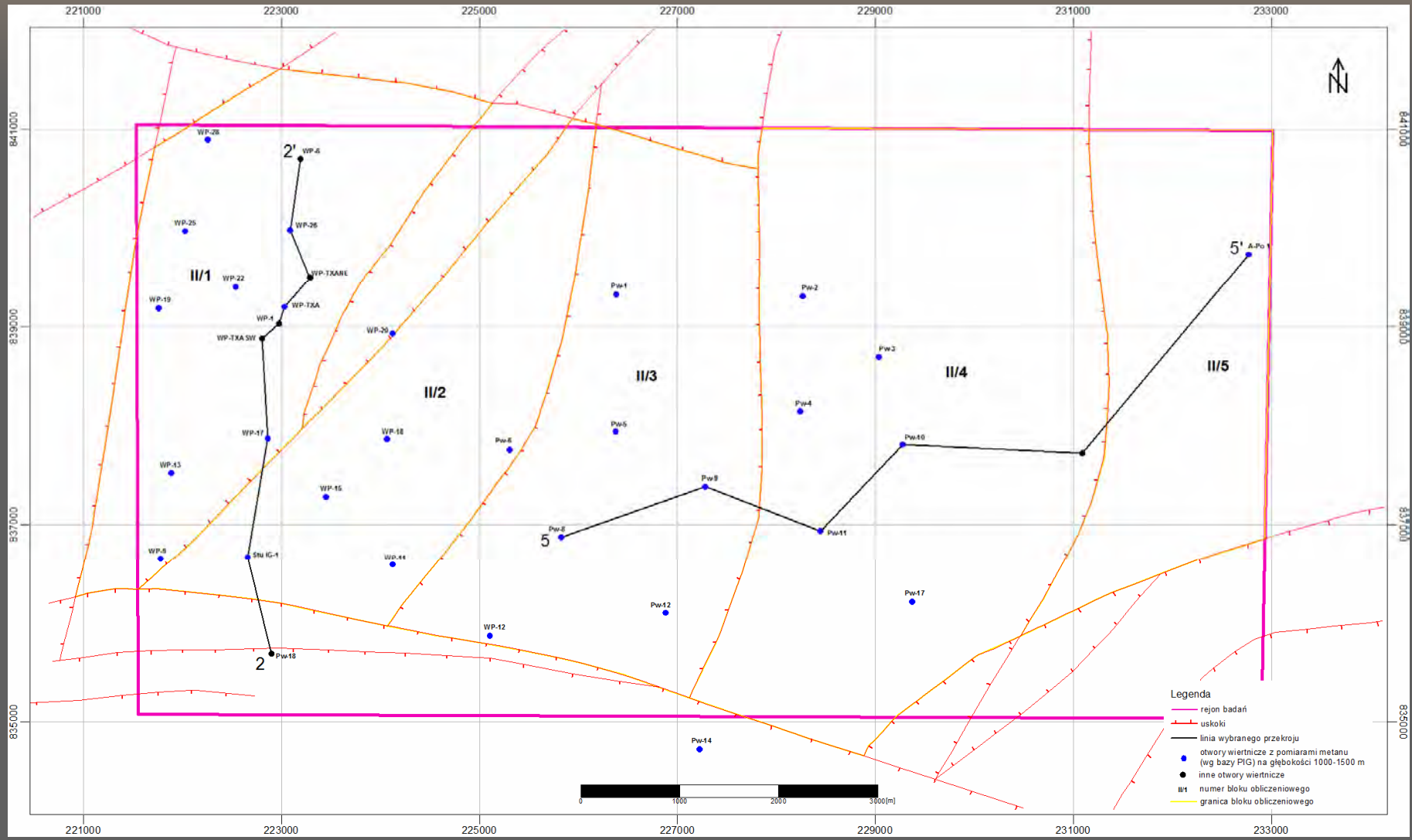
Top of the methane content 4,5 m³/t coal daf



Pawłowice – Mizerów area Geological cross-section



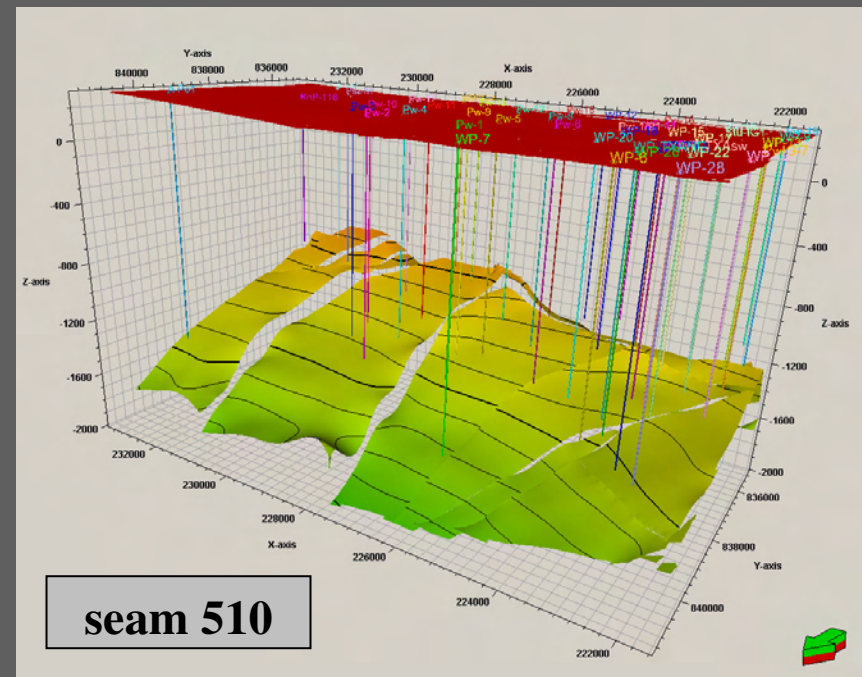
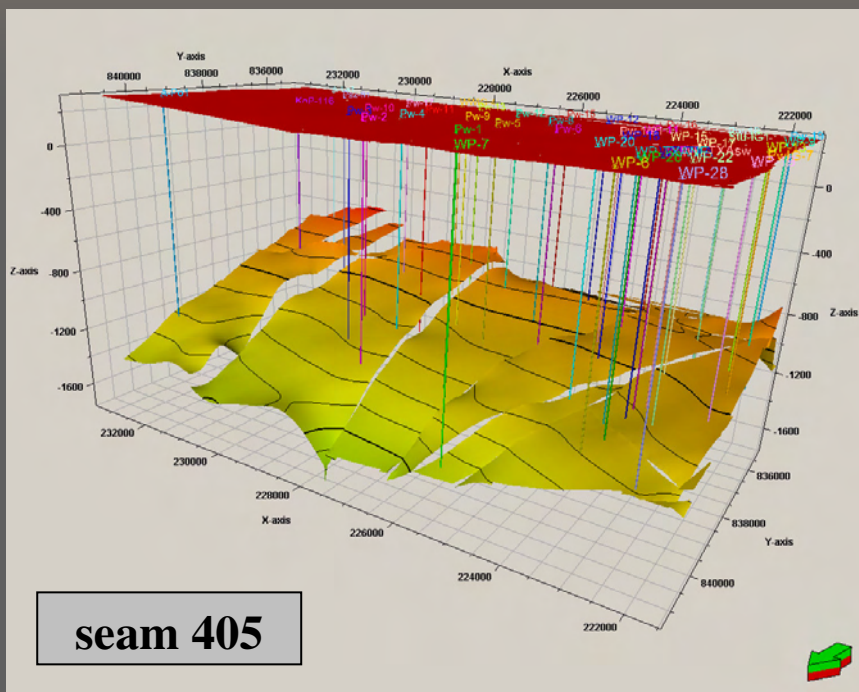
Area II – Pawłowice-Mizerów



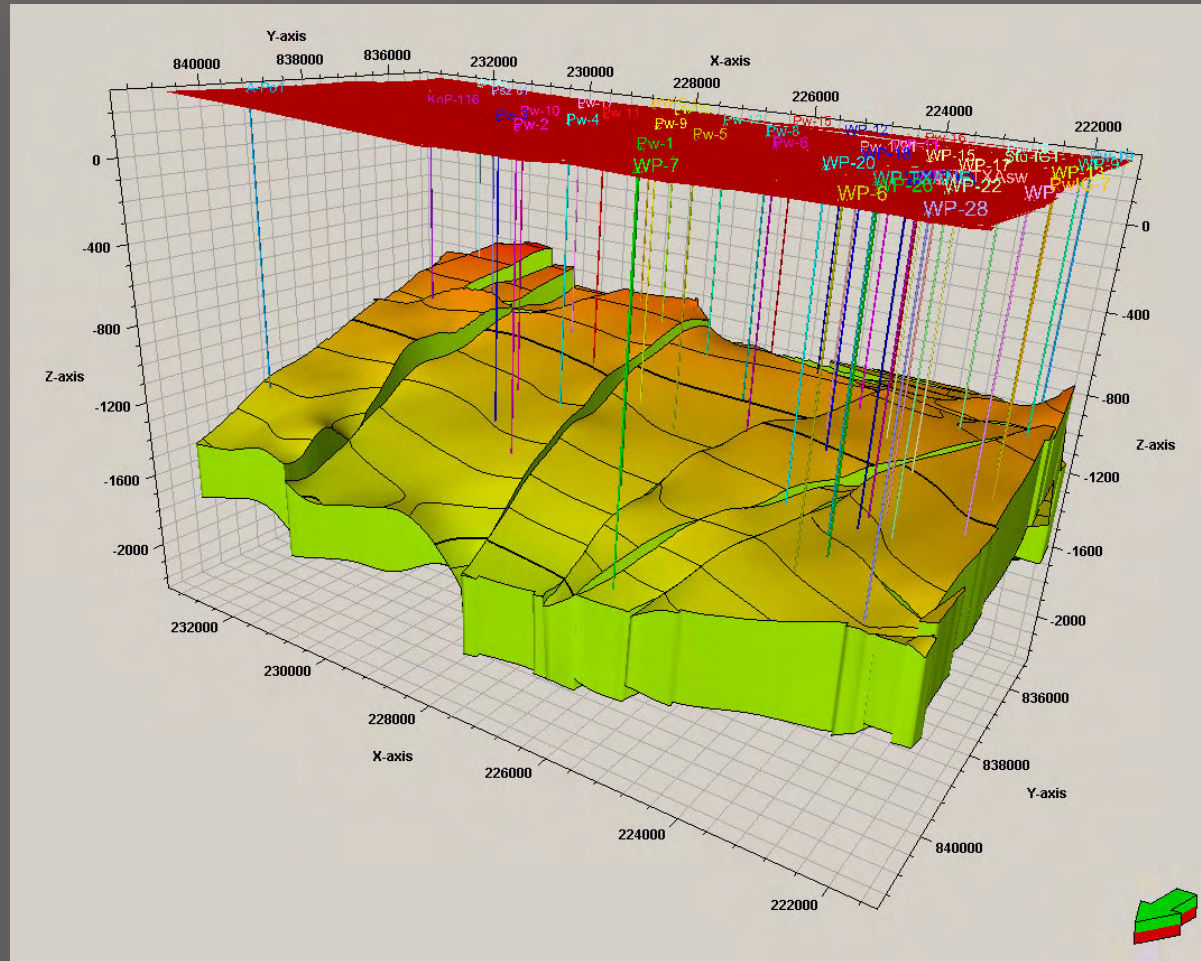
Main parameters of Pawłowice-Mizerów area

Number of block	Average weighted of methane content [m ³ /t coal _{daf}]	Average total thickness of the coal seams [m]	Average weighted of density [Mg/m ³]	Average weighted of ash content [-]	Average weighted of moisture content [-]	Surface [thousand m ²]	Coal-bed methane resources [thousand m ³]	Coefficient of coal-bed methane output	Coefficient of completeness	Coefficient of replacement coal-bed methane with CO ²	CO ² density [Mg/m ³]	Storage capacity [Mg]
II/1	7.291	21.70	1.35	0.100	0.009	10 740	2 051 575	0.5	0.4	2	0.0019	1 559 197
II/2	6.197	19.90	1.39	0.126	0.008	8 631	1 285 593	0.5	0.4	2	0.0019	977 051
II/3	5.548	27.71	1.43	0.099	0.008	12 300	2 412 237	0.5	0.4	2	0.0019	1 833 300
II/4	4.856	32.47	1.41	0.128	0.008	19 520	3 753 994	0.5	0.4	2	0.0019	2 853 036
II/5	5.748	28.26	1.26	0.078	0.007	7 888	1 477 544	0.5	0.4	2	0.0019	1 122 933
Total storage capacity of block II											8 345 517	

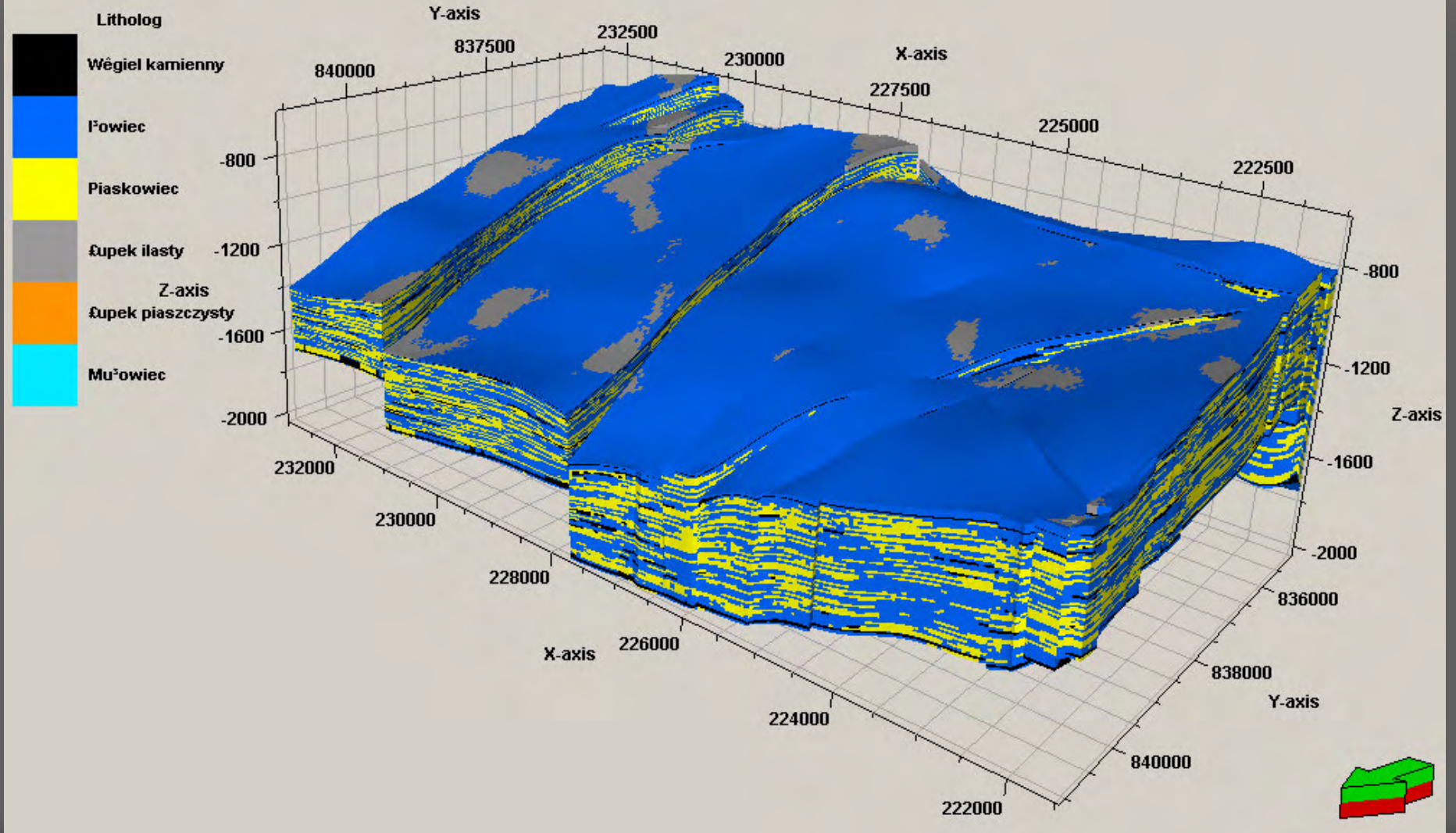
Pawłowice-Mizerów – models of spread of the coal seams 405 and 510



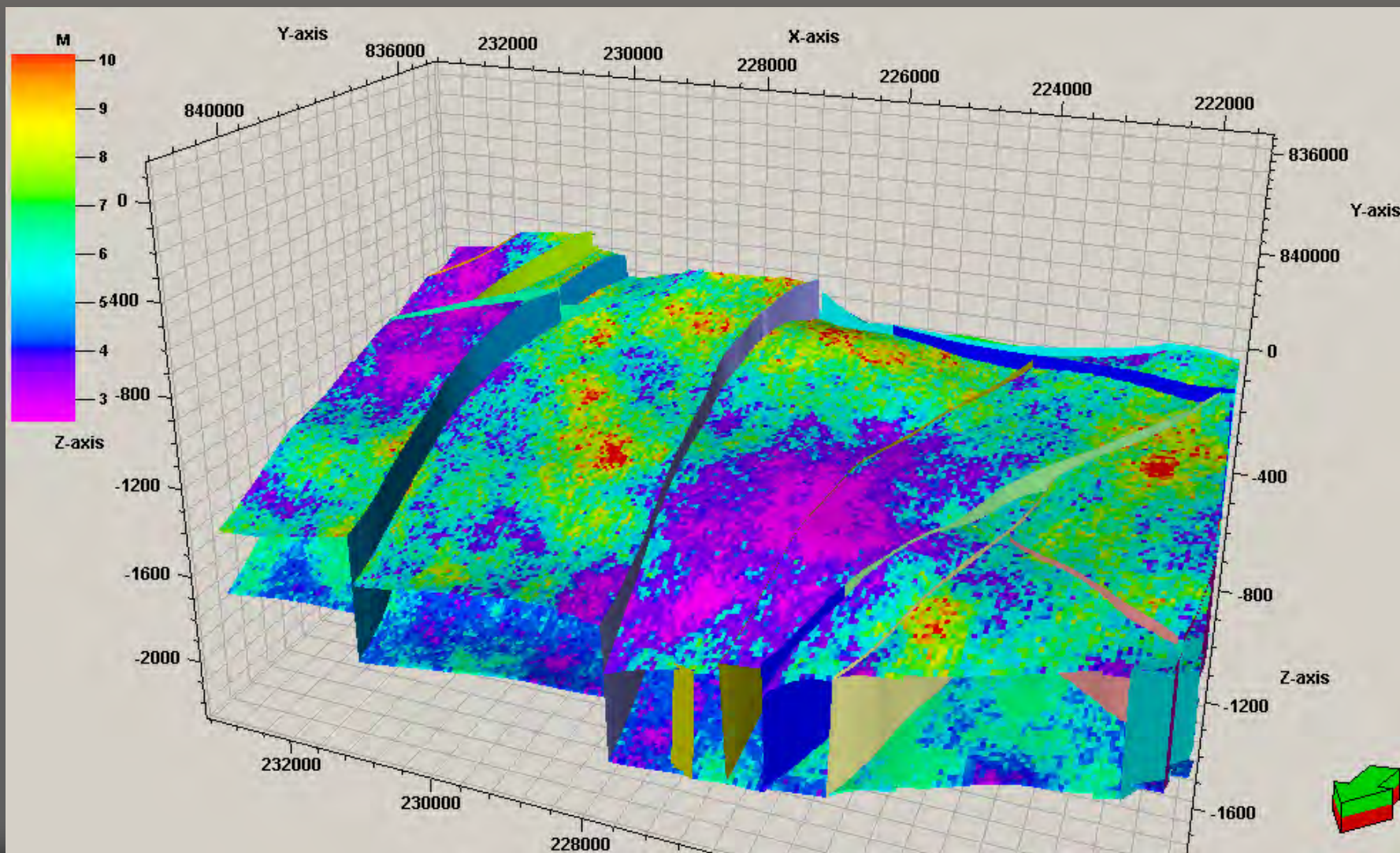
Pawłowice-Mizerów – model of spread of coal seams 405 and 510



Pawłowice-Mizerów - lithology



Pawłowice-Mizerów – methane-bearing capacity



This presentation has been work out as a part of national programme:

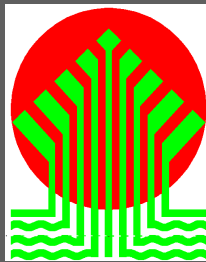
„Assessment of formations and structures for safe geological storage of CO₂ including their monitoring program ”

Ordered:



Ministry of the Environment

Funded:



**National Fund for Environmental
Protection and Water Management**

Thank you for your attention!

