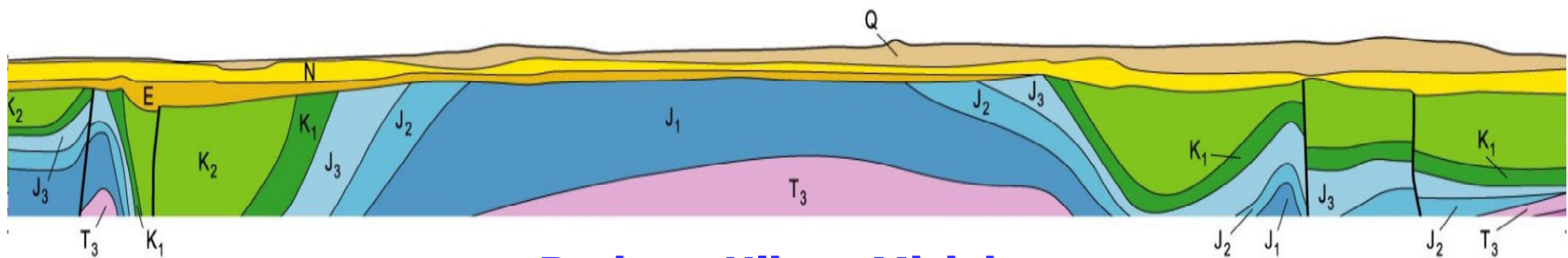


Estimation of CO₂ storage capacity at the regional scale in Mesozoic aquifers in Poland



Barbara Uliasz-Misiak
Mineral and Energy Economy Research Institute
Polish Academy of Sciences

Geology of Poland



The East European Platform and Sudetes Mts. are not suitable locations for CO₂ storage (built of crystalline and metamorphic rocks with small thickness of sedimentary rock cover).

Carpathian sedimentary rocks are strongly tectonized with no thick impermeable caprock, so prospects of this area are limited.

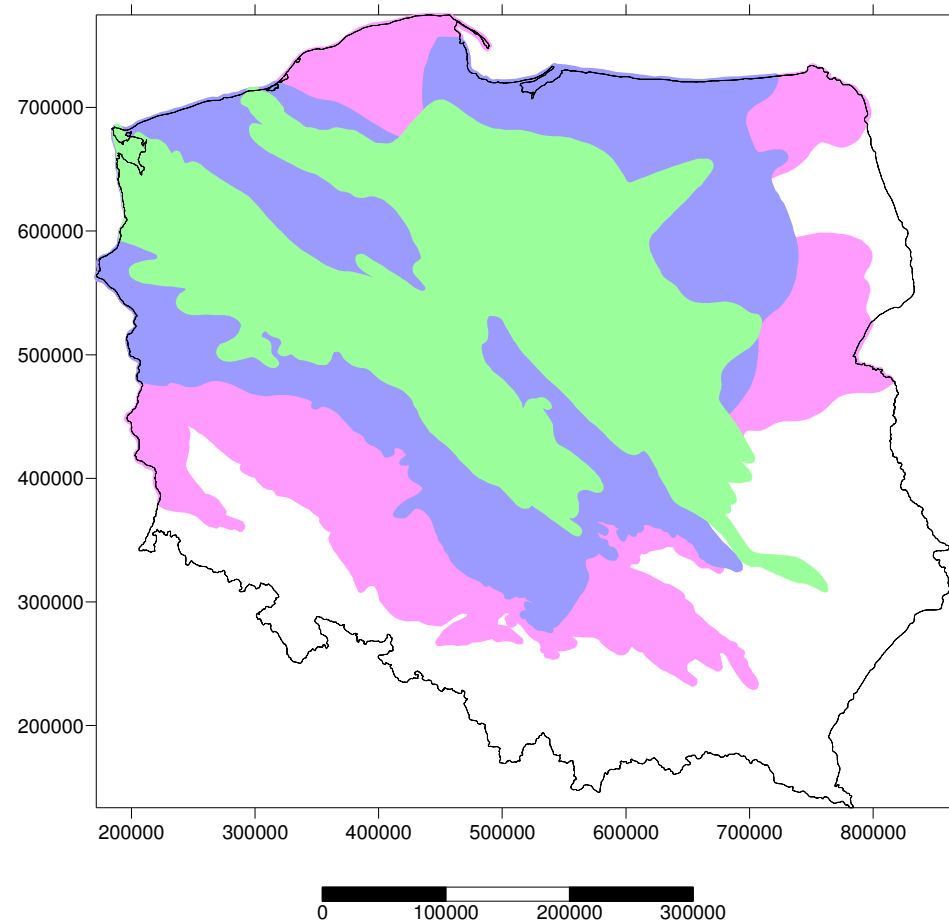
The best conditions for geological CO₂ storage occur within significant part of the Polish Lowlands.



The three Mesozoic aquifers:

- Lower Cretaceous
- Lower Jurassic
- Lower Triassic

are the most adequate locations to look for reservoirs and geological structures suitable for underground carbon dioxide storage.



Storage capacity of CO₂ in aquifers

$$C = A \cdot h \cdot \varphi \cdot \rho_{CO_2} \cdot S_w$$

where:

- A – aquifer area,
- h – aquifer thickness,
- φ – average porosity,
- ρ_{CO_2} – average in-reservoir CO₂ density,
- S_w – storage efficiency.



Theoretical CO₂ storage capacity in aquifers of Poland

Aquifer	Area [km ²]	Total volume pore [km ³]	Storage capacity [Mt]
Lower Cretaceous	102 118.0	1 286.7	1 029 342.4
Lower Jurassic	158 114.0	6 231.3	4 985 071.4
Lower Triassic	217 060.6	3 995.1	3 196 114.0

Uliasz-Misiak B. (2008) - CO₂ storage capacity in selected Mesozoic aquifers and hydrocarbon deposits in Poland. *Studia Rozprawy Monografie, nr 142, Krakow 2008.*



Effective CO₂ storage capacity in aquifers of Poland

Aquifer	Area [km ²]	Total volume pore [km ³]	Storage capacity [Mt]		
			low	best	high
Lower Cretaceous	24 712.0	510.9	4 087.3	16 349.3	32 698.5
Lower Jurassic	73 956.0	3 343.6	26 748.9	106 995.6	213 991.2
Lower Triassic	147 528.0	3 205.9	25 647.4	102 589.7	205 179.5

Uliasz-Misiak B. (2008) - CO₂ storage capacity in selected Mesozoic aquifers and hydrocarbon deposits in Poland. *Studia Rozprawy Monografie, nr 142, Krakow 2008.*

It was assumed that the storage will be done within area where the sink aquifer occurs below 1000 m deep.

Assumed storage efficiency is 1%, 4% and 8%.



Practical CO₂ storage capacity in aquifers in Poland

Aquifer	Area [km ²]	Total volume pore [km ³]	Storage capacity [Mt]		
			low	best	high
Lower Cretaceous	24 692.0	510.4	4 083.3	16 333.4	32 666.8
Lower Jurassic	70 308.0	3 200.4	25 603.1	102 412.5	204 825.1
Lower Triassic	112 974.0	2 221.4	17 771.4	71 085.4	142 170.9

Uliasz-Misiak B. (2008) - CO₂ storage capacity in selected Mesozoic aquifers and hydrocarbon deposits in Poland. *Studia Rozprawy Monografie, nr 142, Krakow 2008.*

It was assumed that the storage will be done within area where the sink aquifer occurs at a depth interval of -1000 m – -3000 m.

Assumed storage efficiency is 1%, 4% and 8%.

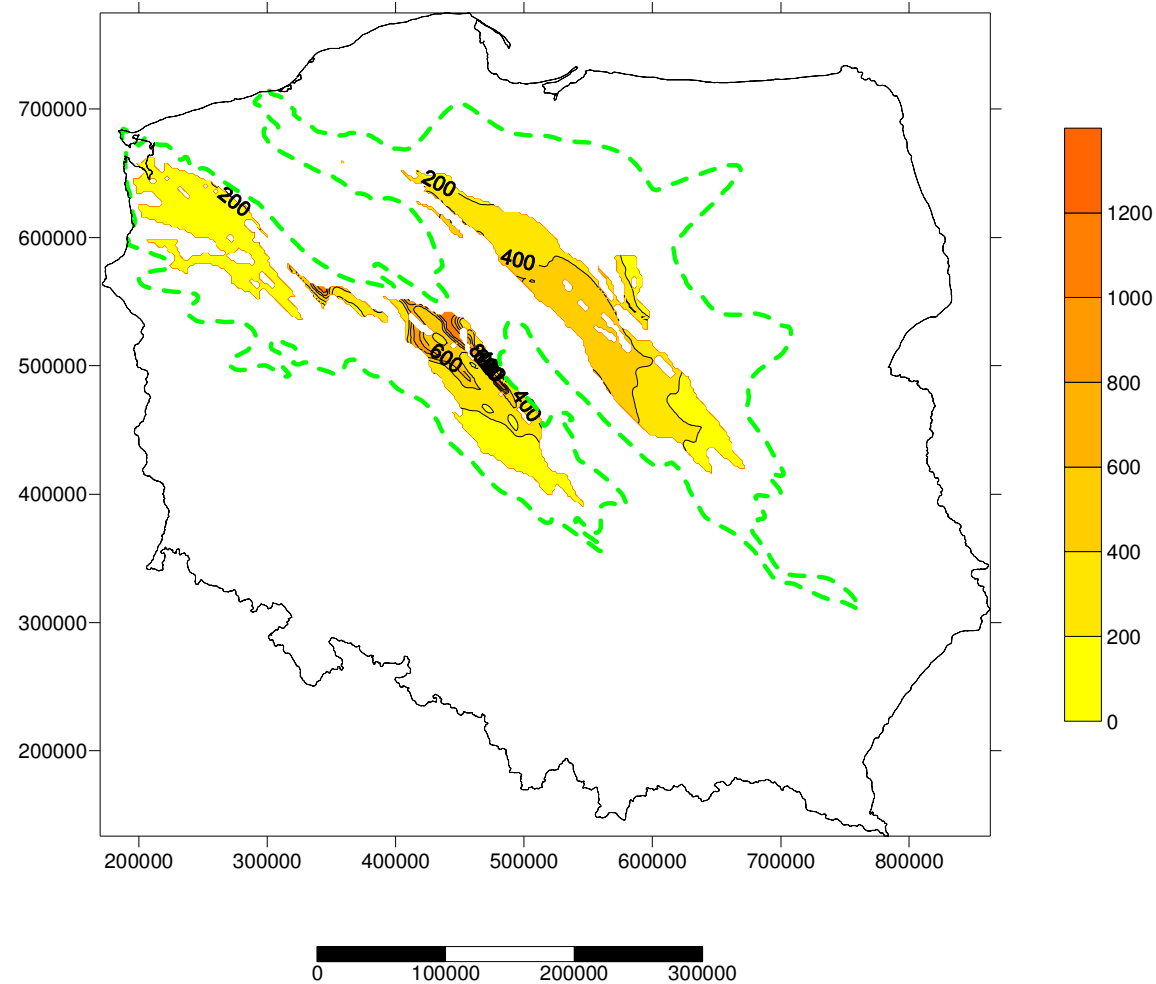


Maps of regional storage potential - saline aquifers in Poland

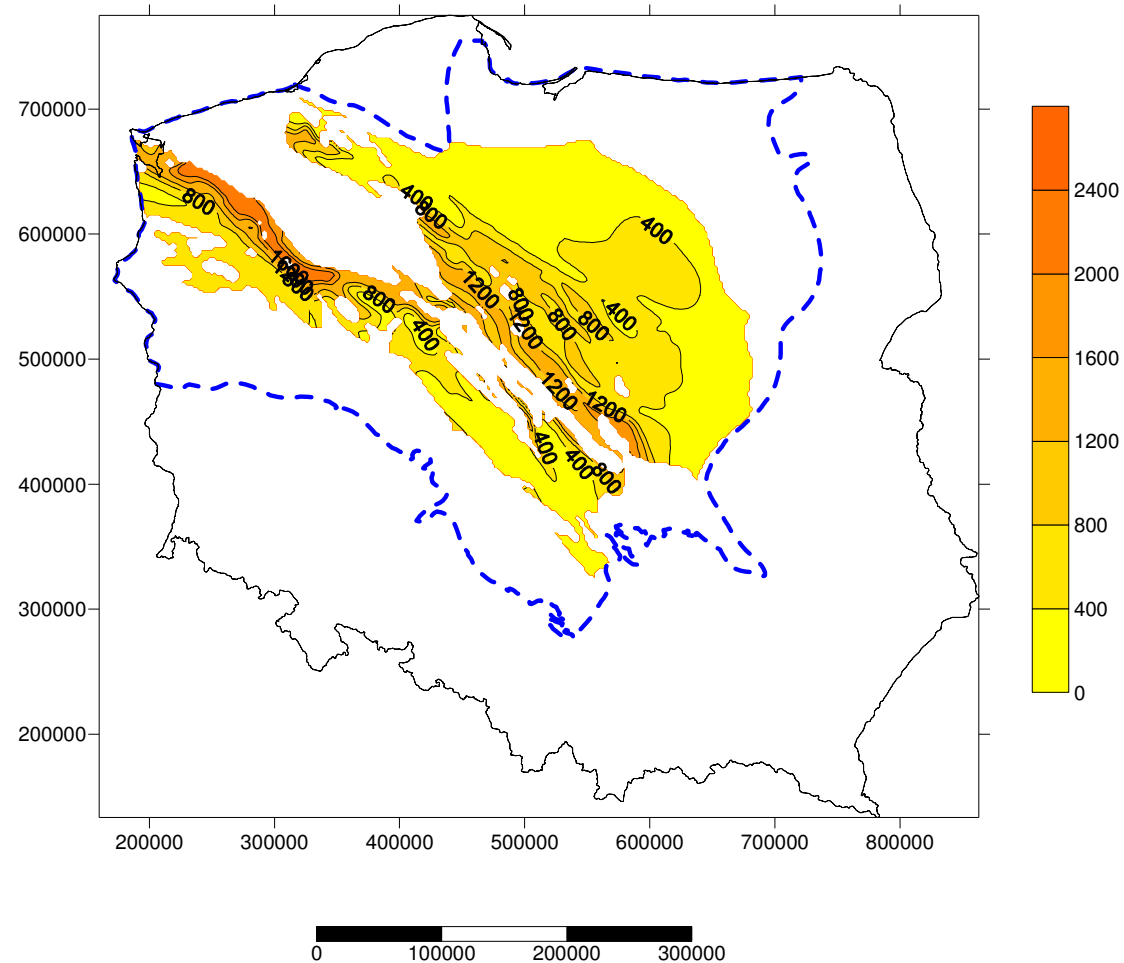
- Transformation of the digital models as maps and application of constant parameters enabled the construction of the CO₂ storage capacity maps.
- These maps present amount of tonnes of CO₂ storable per 1 square meter of rock.
- Storage capacity maps were constructed for Lower Cretaceous, Lower Jurassic and Lower Triassic deposits.



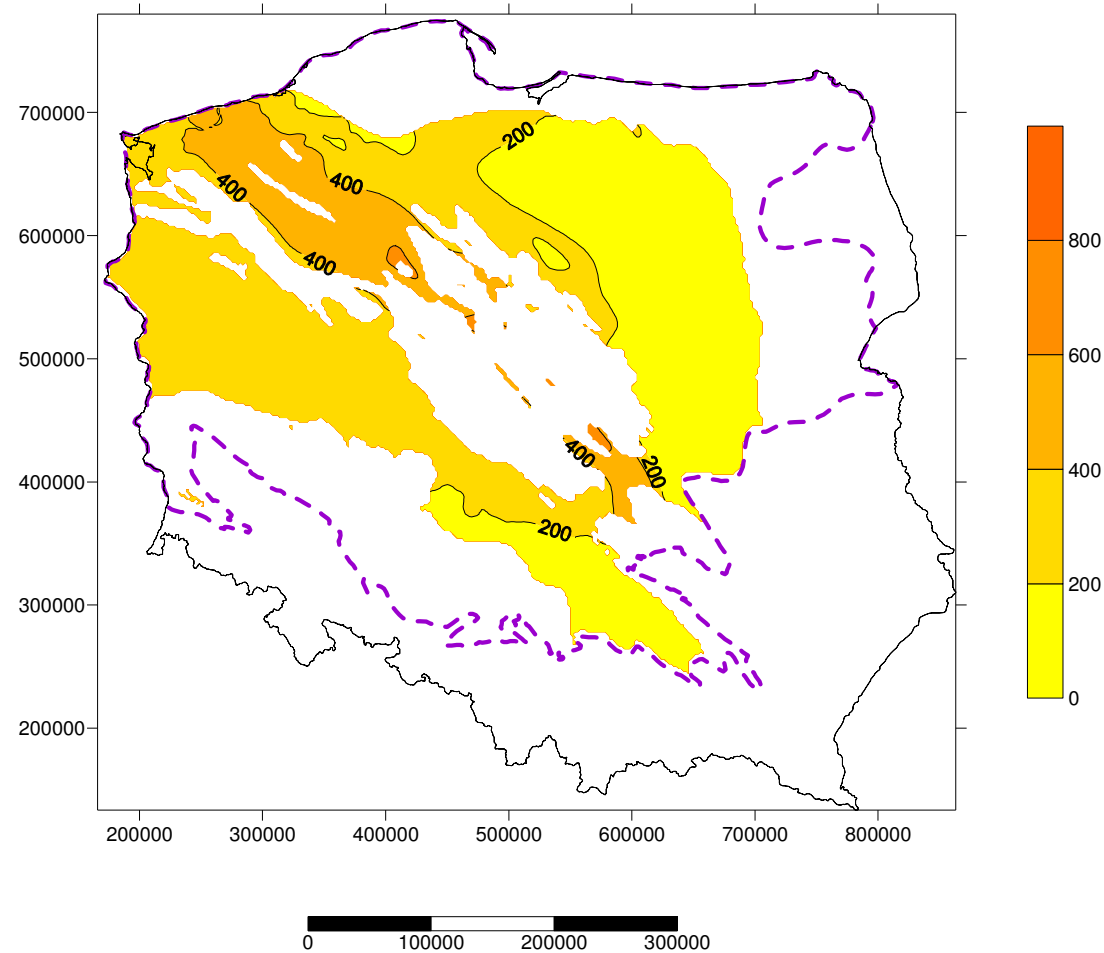
Storage capacity of CO₂ per area unit for Lower Cretaceous deposits



Storage capacity of CO₂ per area unit for Lower Jurassic deposits



Storage capacity of CO₂ per area unit for Lower Triassic deposits



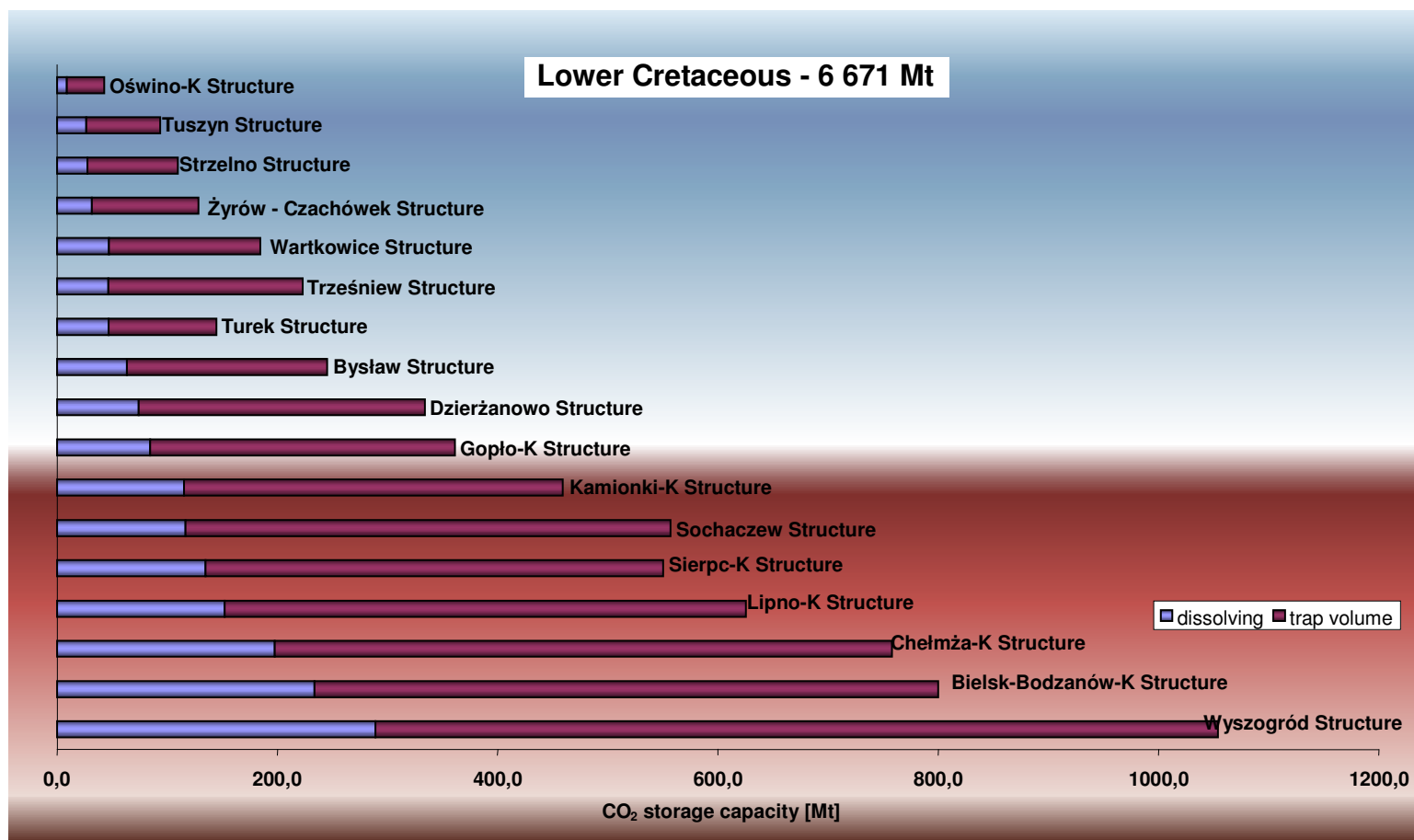
Selected geological structures in aquifers to store CO₂



Tarkowski R. (2008) - CO₂ storage capacity of geological structures located within Polish Lowlands' Mesozoic formations. *Gospodarka Surowcami Mineralnymi*, t. 24, nr 4/1



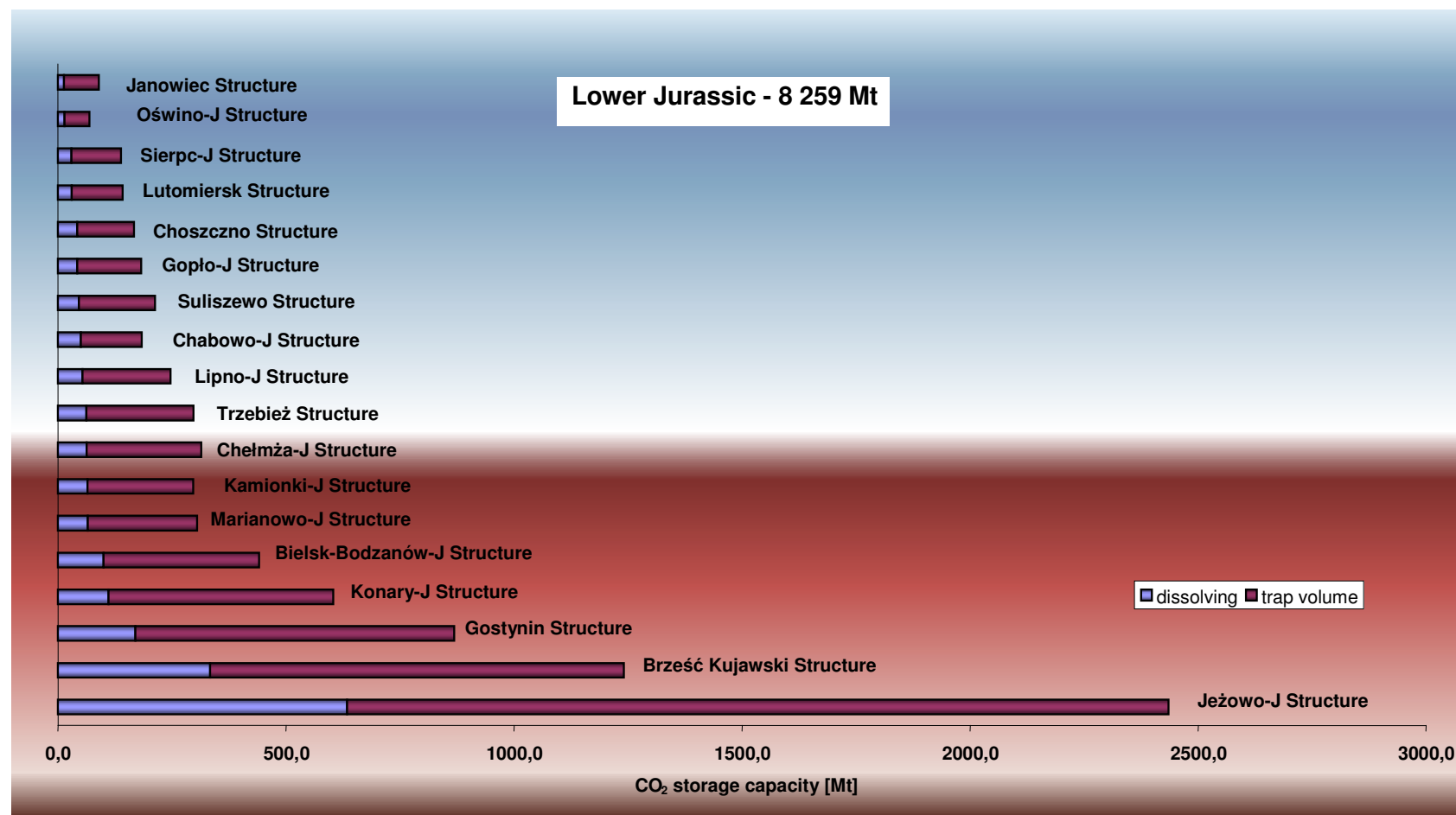
CO₂ storage capacity of the structures (K₁)



Tarkowski R. (2008) - CO₂ storage capacity of geological structures located within Polish Lowlands' Mesozoic formations. *Gospodarka Surowcami Mineralnymi*, t. 24, nr 4/1



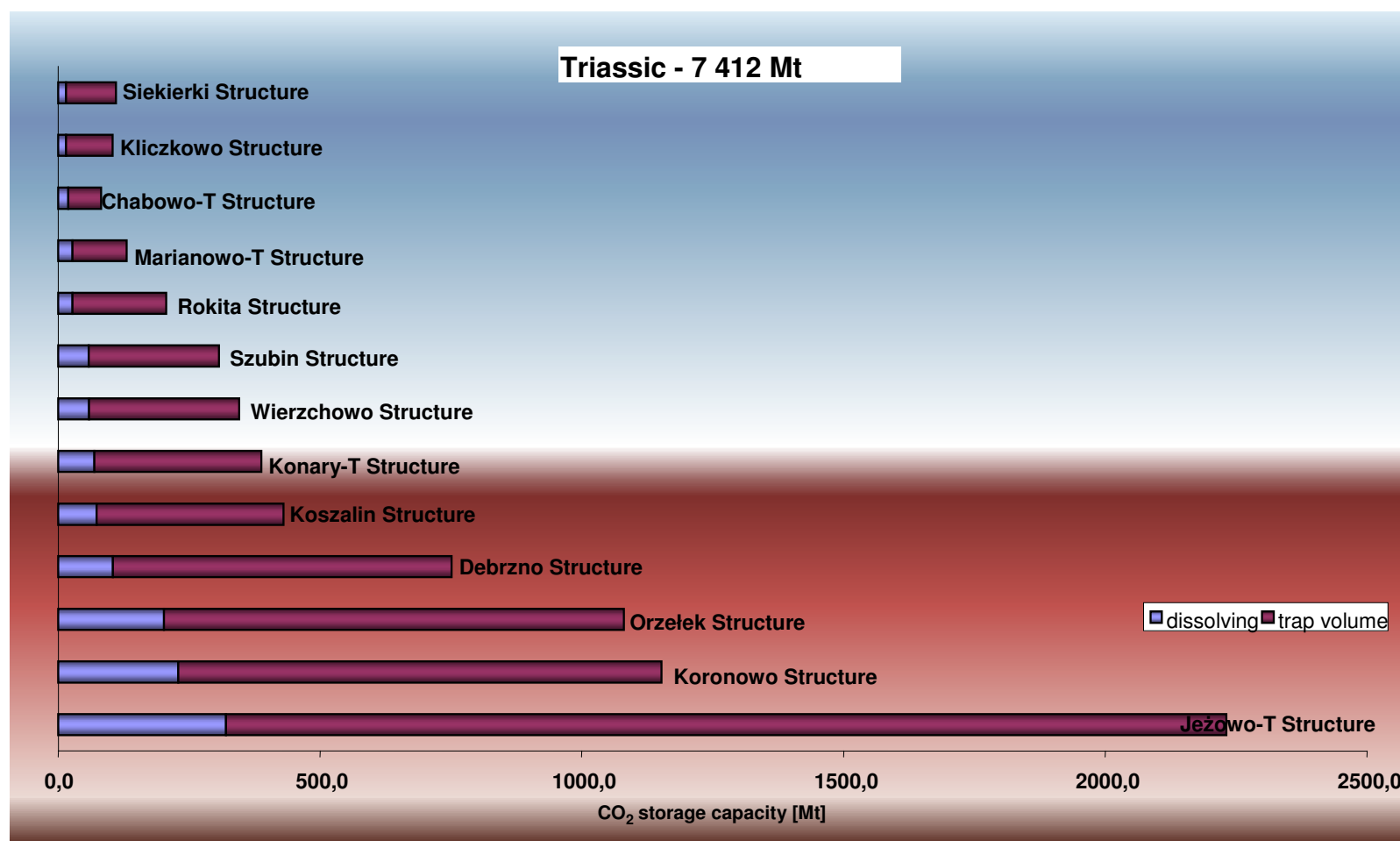
CO₂ storage capacity of the structures (J₁)



Tarkowski R. (2008) - CO₂ storage capacity of geological structures located within Polish Lowlands' Mesozoic formations. *Gospodarka Surowcami Mineralnymi*, t. 24, nr 4/1



CO₂ storage capacity of the structures (T)



Tarkowski R. (2008) - CO₂ storage capacity of geological structures located within Polish Lowlands' Mesozoic formations. *Gospodarka Surowcami Mineralnymi*, t. 24, nr 4/1



Conclusions

- Regional aquifers (K₁, J₁ and T₁) make the most of storage capacity in Poland.
- The largest CO₂ storage volume occurs in Lower Jurassic formations, less in Lower Triassic formations, the least in Lower Cretaceous formations.
- Maximum specific capacities of CO₂ storage for Lower Cretaceous formations reach the values of 0.15 – 0.30 t/m², for Lower Jurassic formations 0.9 – 1.2 t/m², for Lower Triassic 0.30 – 0.45 t/m². The areas where the highest values of specific capacity of CO₂ storage occur, correlate with the regions of the greatest thickness of aquifers.
- Total storage capacity within the structures in the Mesozoic aquifers equals 22 342 Mt of carbon dioxide.

