

The first step to a 3D model of the North German Basin

The „Pilotregion“

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Project: Subsurface potentials for storage and economic use in the North German Basin (TUNB)

TUNB

Tieferer Untergrund Norddeutsches Becken

Overview:



▪ TUNB: 3D-Model of the North German Basin

- Development of a structural 3D-model
- Harmonized with the neighboring countries (NL, DK, PL)
- Collaboration with the state geological survey organisations (GSO) of the north German federal states (SH, MV, BB, ST, NI)
- The GSO are fully responsible for their part of the model

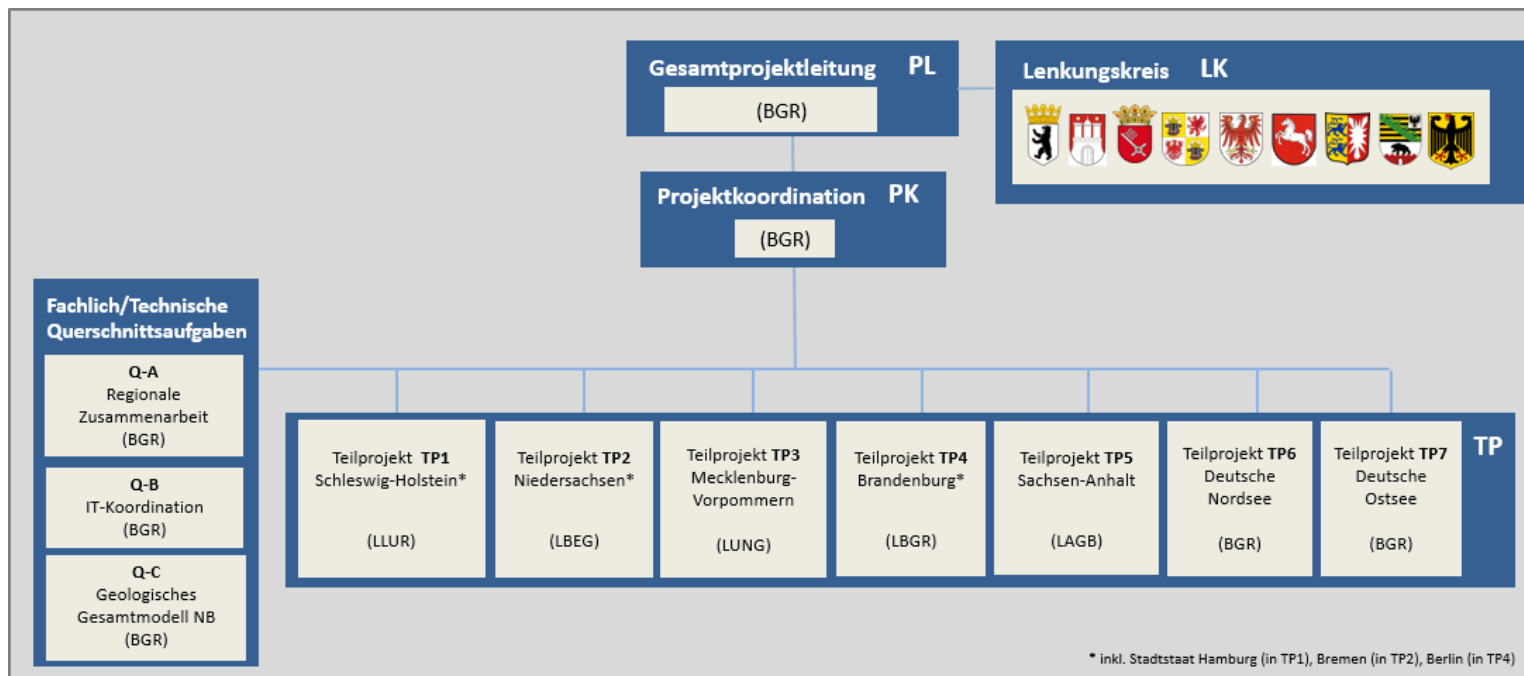
Legal foundation: §5 KSpG (Analyse und Bewertung der Potenziale für die dauerhafte Speicherung)

„BGR erarbeitet die für die Bewertung erforderlichen Grundlagen im Benehmen mit der jeweils zuständigen Landesbehörde.“

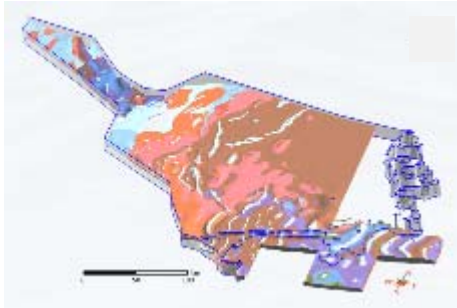
Struktur



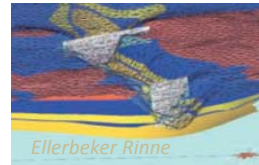
- **Partner:** SGD von SH, HH, MV, NI, HB, BB, BE, ST, BGR
- **Laufzeit:** 6 Jahre (Beginn 01/2014 – 01/2016) bis Ende 2021



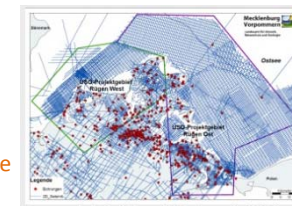
Existing 3D-Models:



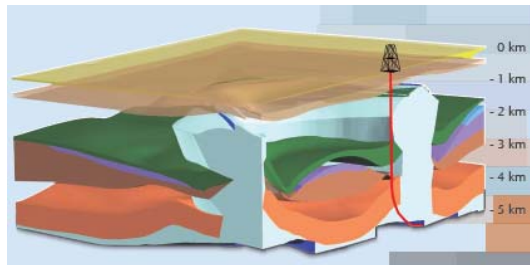
Source: BGR GPDN



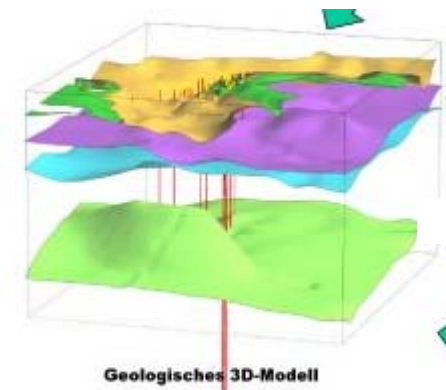
Source: Jahresbericht Landesamt für Natur und Umwelt des Landes Schleswig-Holstein 2006/07



Source: LUNG M-V



Source: LBEG 3D-Modell_2012-09.pdf

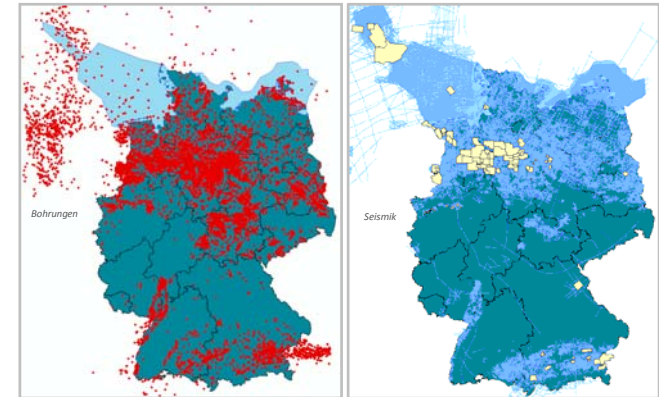


Source: LBGR

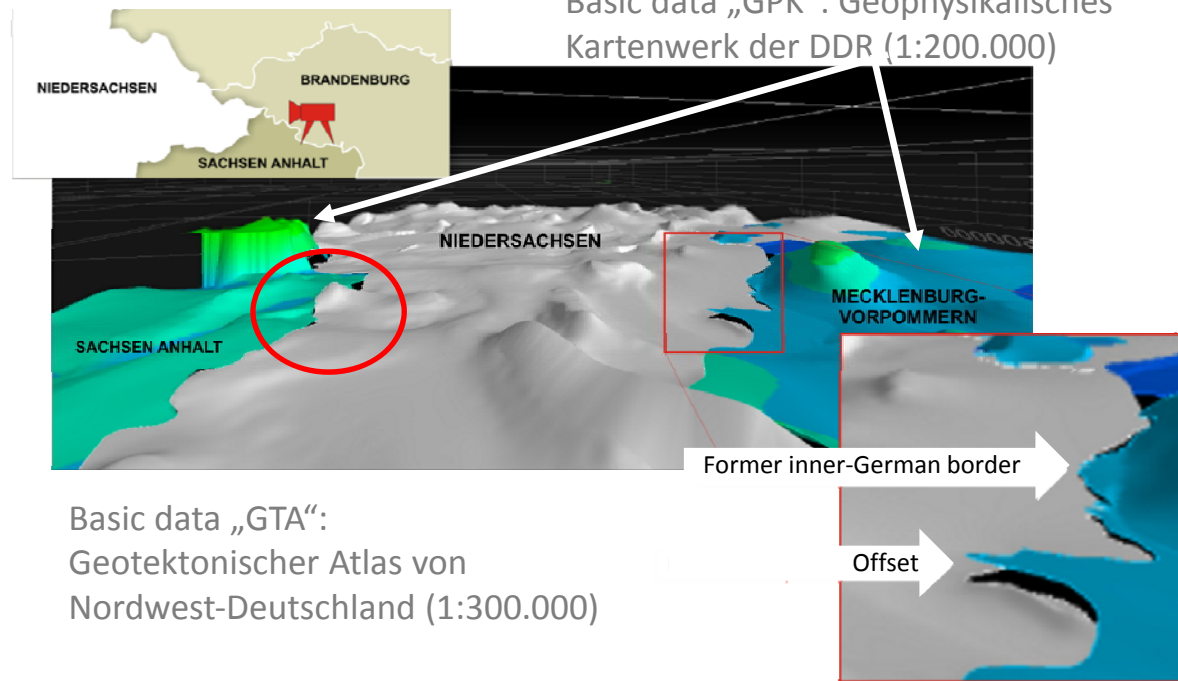
Full state model – Partial state model – No model

Different existing data:

- GPK: Mapping of seismic reflectors
- GTA: Fitting to stratigraphic markers
- Different velocity models
- Different structural interpretation
- Different stratigraphic assignment



Basic data „GPK“: Geophysikalisches Kartenwerk der DDR (1:200.000)



Basic data „GTA“:
Geotektonischer Atlas von
Nordwest-Deutschland (1:300.000)

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Necessary adjustments:

- Definition of 13 horizons
- Compilation of existing stratigraphic definitions/information for every horizon by every GSO
- Harmonization of definitions for every modeled horizon
- Two additional horizons (13+2): „Top Zechstein“ und „Top Prä-Zechstein“
- One additional horizon „DEM“ (Earth’s surface)

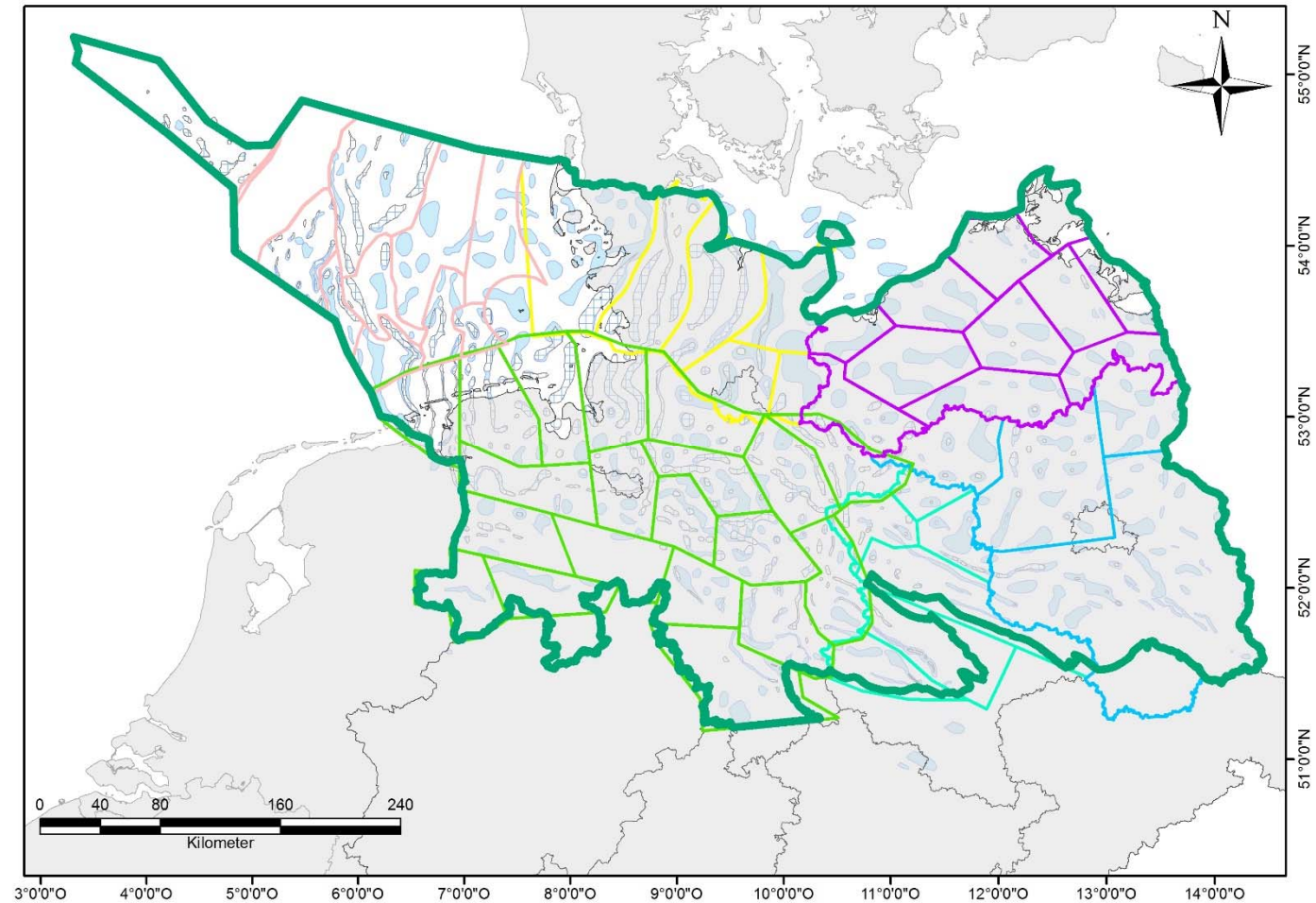
Used software: GoCAD.

Alter der Basis	Epoche	Stratigraphische Einheit Menning (1997)	GTA	GPK	TUNB
1.8 Ma	Quartär	Quartär			Erdoberfläche
		Pliozän			
		Miozän	tmiR-q		
24 Ma			tmiu		
		Oligozän	tolm+tolo	A1	Basis Rupelium
		Eozän	teom+tolu	A2	
	Paläogen (Alttertiär)	Oberpaläozän	tpao +teou	T1	Basis Tertiär
65 Ma		Dan			
		Maasticht			
		Campan		T2'	
		Santon			
		Coniac		B1	
		Turon			
99 Ma		Senoman	kro	B2	Basis Oberkreide
		Alb			
		Apt		T2	
		Barrême			
		Hauterive		T3	
		Valangin	kru	T4	
144 Ma		Bernias = Wealden			Basis marine Unterkreide
		Serpült			
		Münder Mergel			
		Einbeckhäuser P.-K.			
		Gigas-Schichten	jo + Wd	E1	
		Krimmerdige		E2	
		Konstanzoolith			
159 Ma		Heersumer Sch.			
		Callovium		T5	Basis Malm
		Balthonium	jutco-jmcl		
		Bajocium			
180 Ma		Aalenium		L1	Basis Dogger
		Toarcium			
		Pliensbachium	juhe-jutcu		
		Sinemurium		L4	Basis Lias
201.5 Ma		Hettangium			
		Rhät		K1	Basis Rhät
		Steinmergelkeuper		K2	
		Oberer Gipskeuper			
		Schiffsandstein		K3	
239.5 Ma		Unterer Gipskeuper	k		Basis Unterer Keuper
		Lettenkeuper		M1	
		Ob. Muschelkalk	so + m		
246.5 Ma		Mittl. Muschelkalk			
		unt. Muschelkalk			
		Ob. Buntsandstein		S1	Basis Oberer Buntsandstein
		Röt			
		Solling-Folge			
		Hardeggen-Folge		S3	
		Detfurth-Folge			
		Volpriehausen-Folge			
		Bernburg-Folge	su + sm	S4	Basis Mittlerer Buntsandstein
252.5 Ma		Calvörde-Folge		X1'	Basis Unterer Buntsandstein
		Möln-Zyklus			
		Friesland-Zyklus		X1	Top Zechstein
		Ohre-Zyklus			
		Alter-Zyklus			
		Lerne-Zyklus			
		Stalfurt-Zyklus		Z1	
258 Ma		Werra-Zyklus	z	Z3	Basis Zechstein
		Oberrotliegend			
		Unterrotliegend			Top Prä-Zechstein
300 Ma					
		Stefan			
		Westfal			
326.3 Ma		Namur			
		Vise			
353.8 Ma		Tournai			
		Devon			



Division of the model into tiles

- Size and complexit
- Boundary of a tile
- Easier harmonizati
- Easier project mar



Importance of harmonization:

- Different ways of fault modeling
- Position and dip of cross-border faults
- Depth and dip of horizons

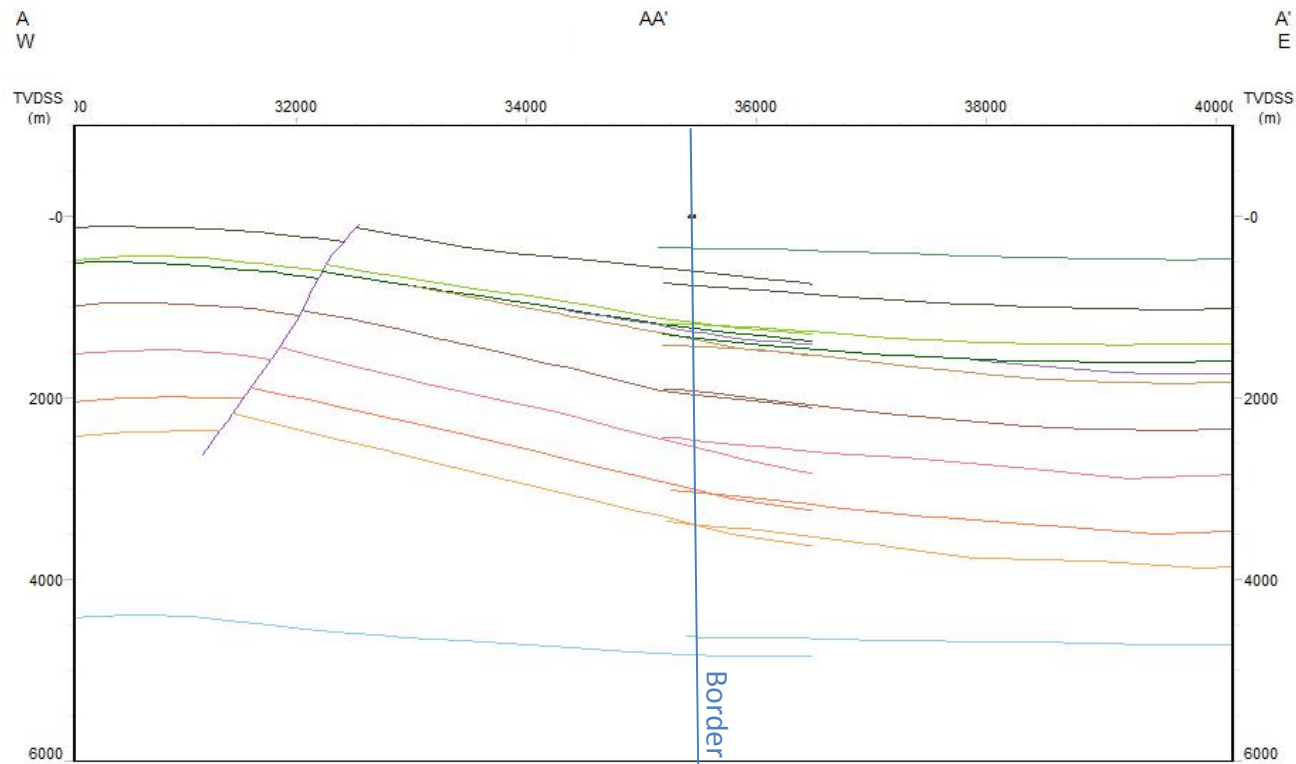


Figure from out-dated version of the model

The „Pilotregion“:

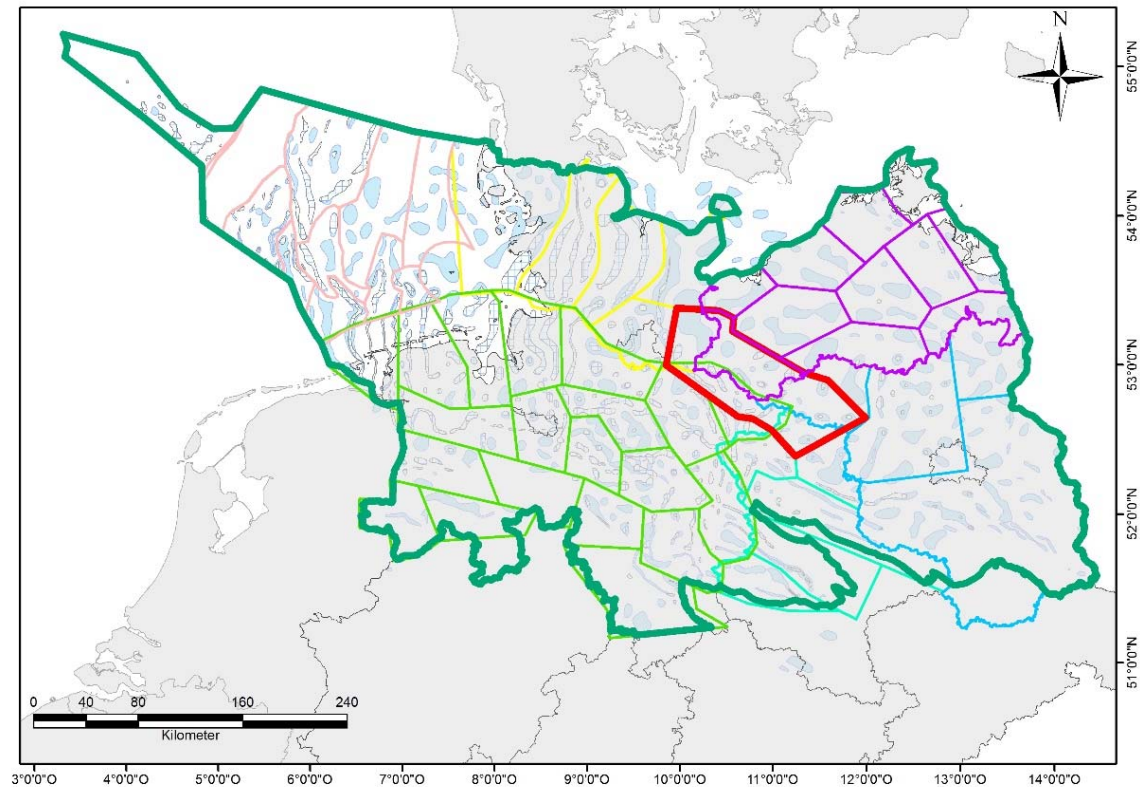
- (relatively) small area
- Comprises areas of (almost) every GSO
- Located in the area of the former inner-German border

Areal extend:
150 km x 50 km
(7.800 km²)

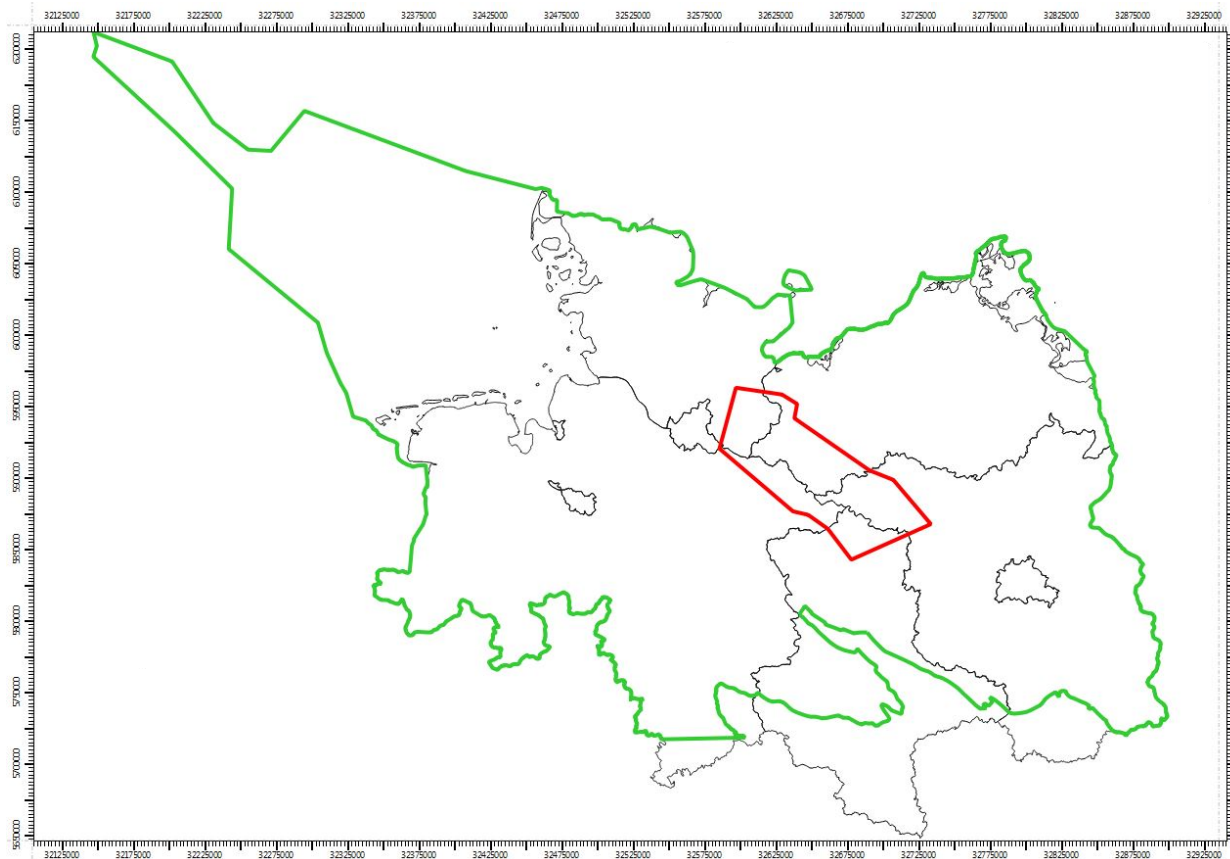
The model comprises:

- 16 horizons
- 24 Salt-diapirs
- ca. 200 faults

Modeling in 2016



The „Pilotregion“:



Pilotregion comprises:

150 km x 50 km

(7.800 km²)

The model comprises:

16 horizons

24 Salt-diapirs

ca. 200 faults

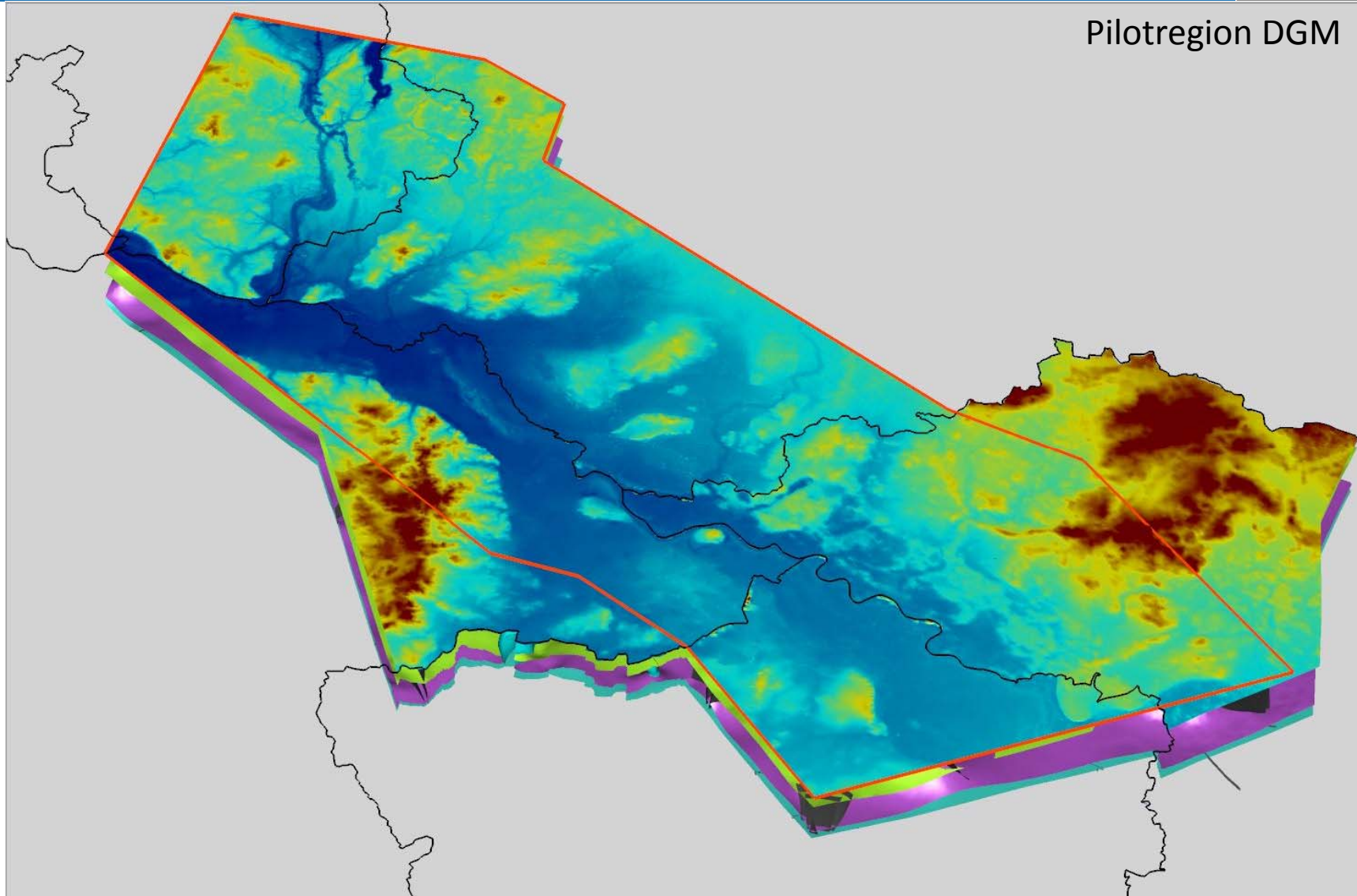
Modeling in 2016

Project TUNB - The „Pilotregion“

TUNB

Tieferer Untergrund Norddeutsches Becken

Pilotregion DGM

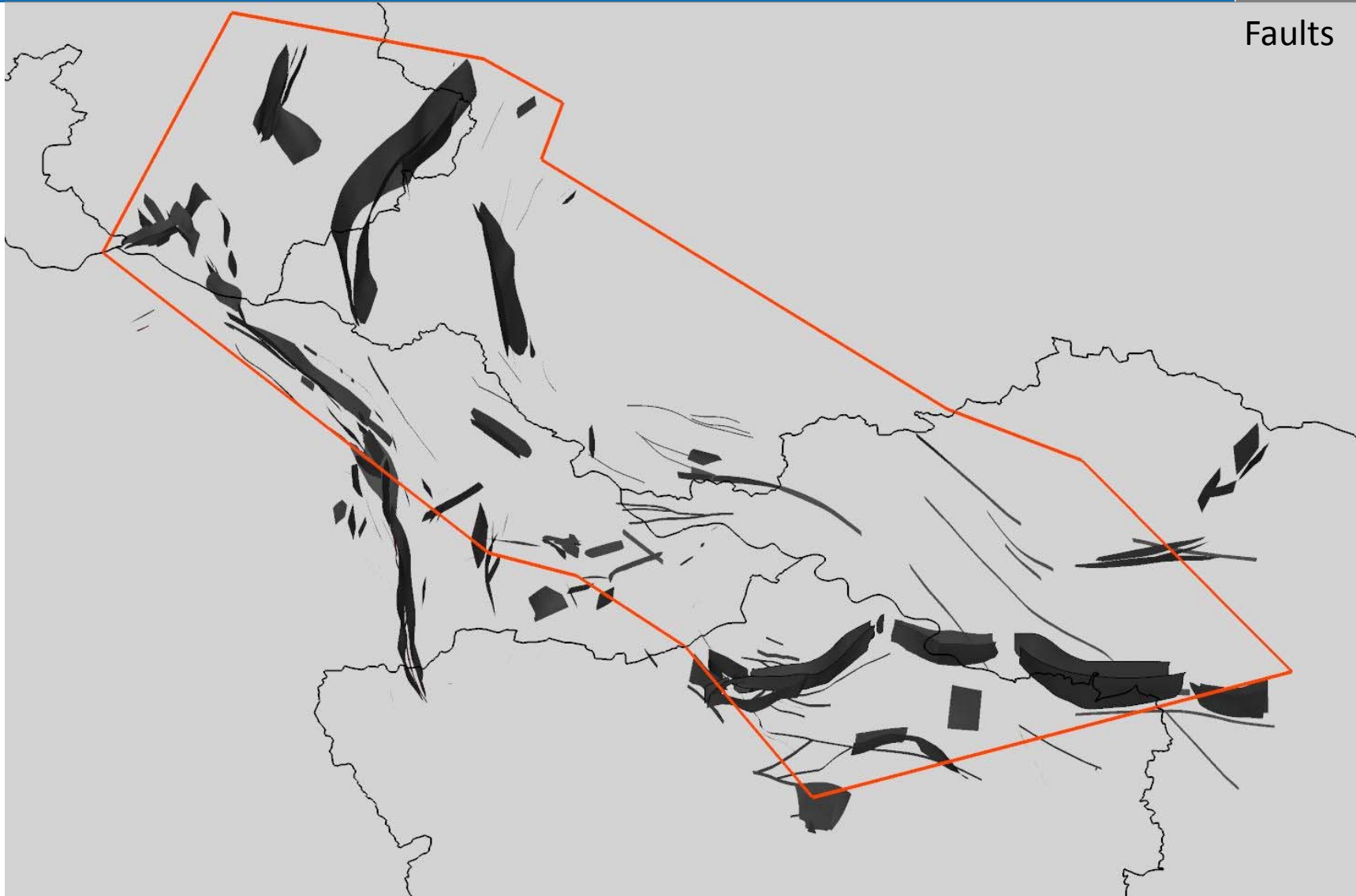


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Tieferer Untergrund Norddeutsches Becken

Faults

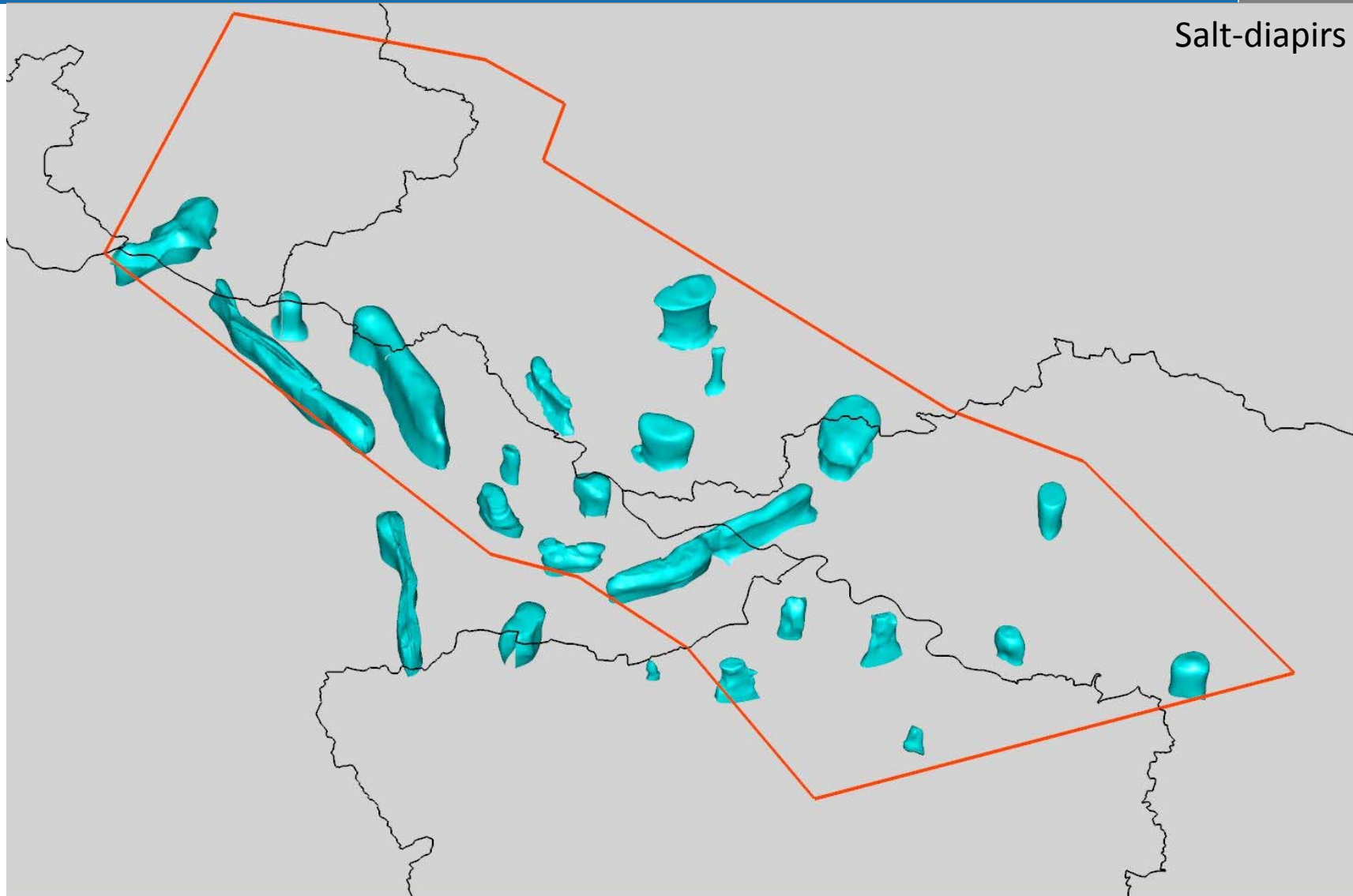


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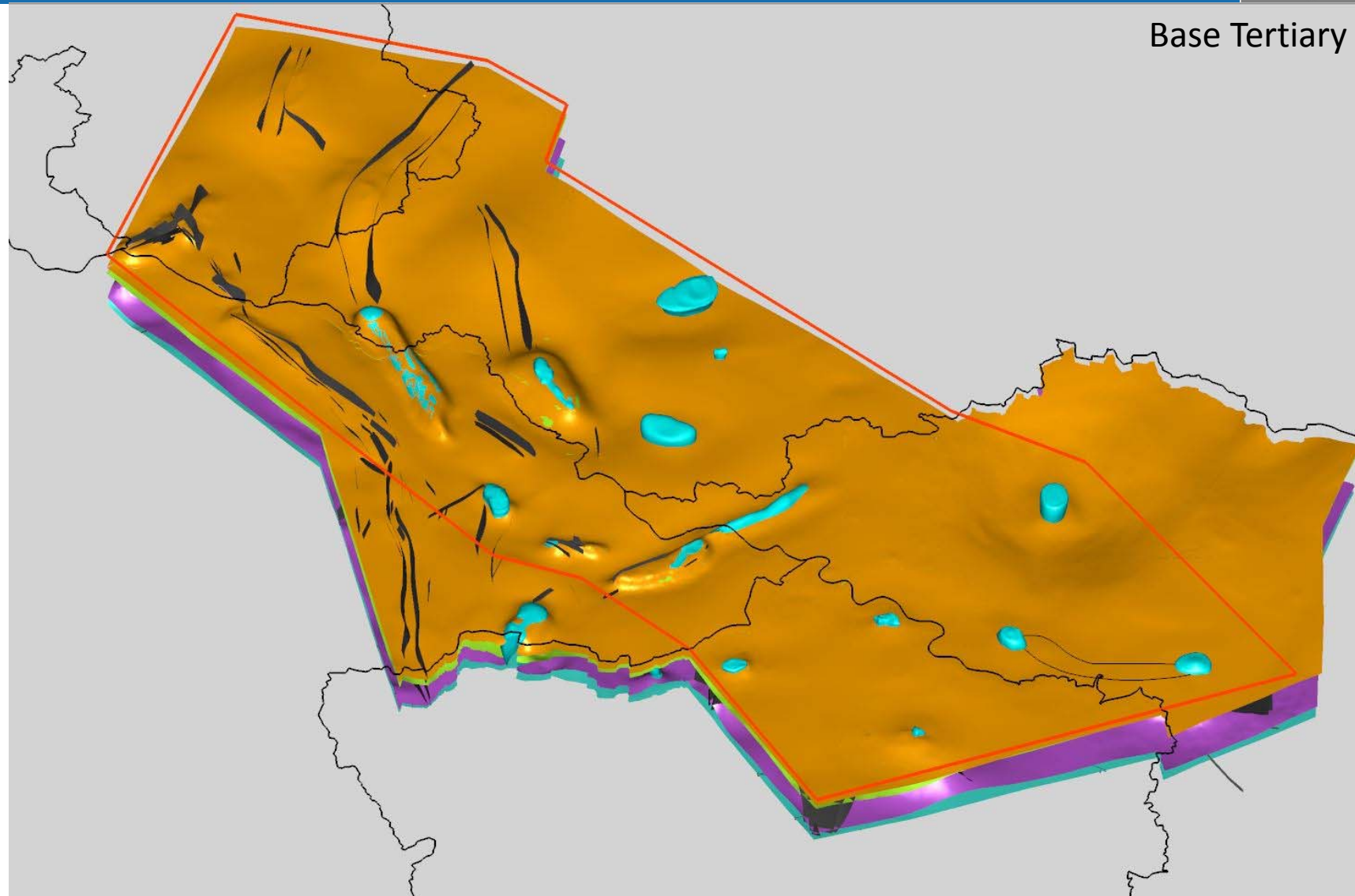
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Tieferer Untergrund Norddeutsches Becken

Salt-diapirs



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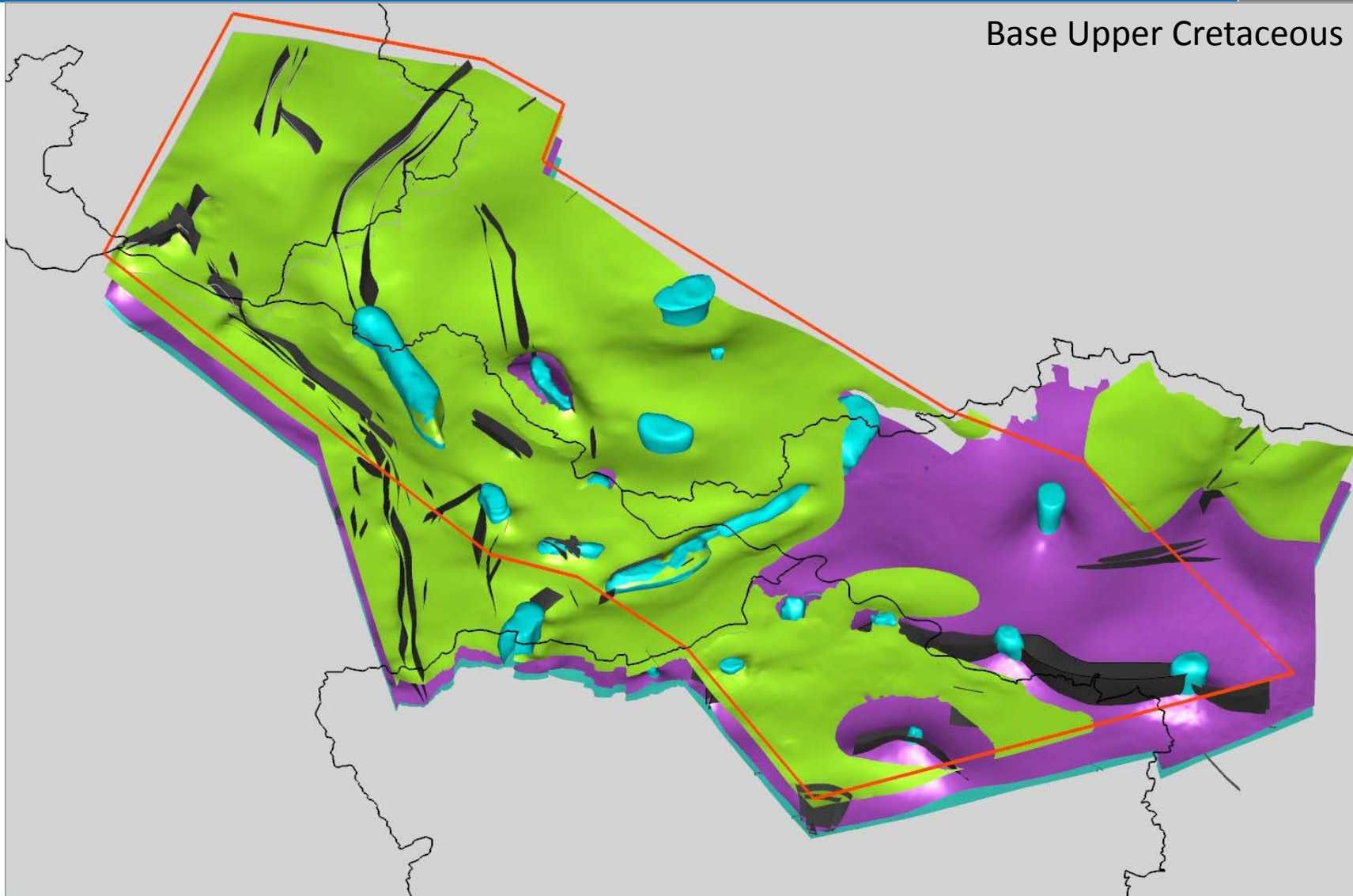


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Tieferer Untergrund Norddeutsches Becken

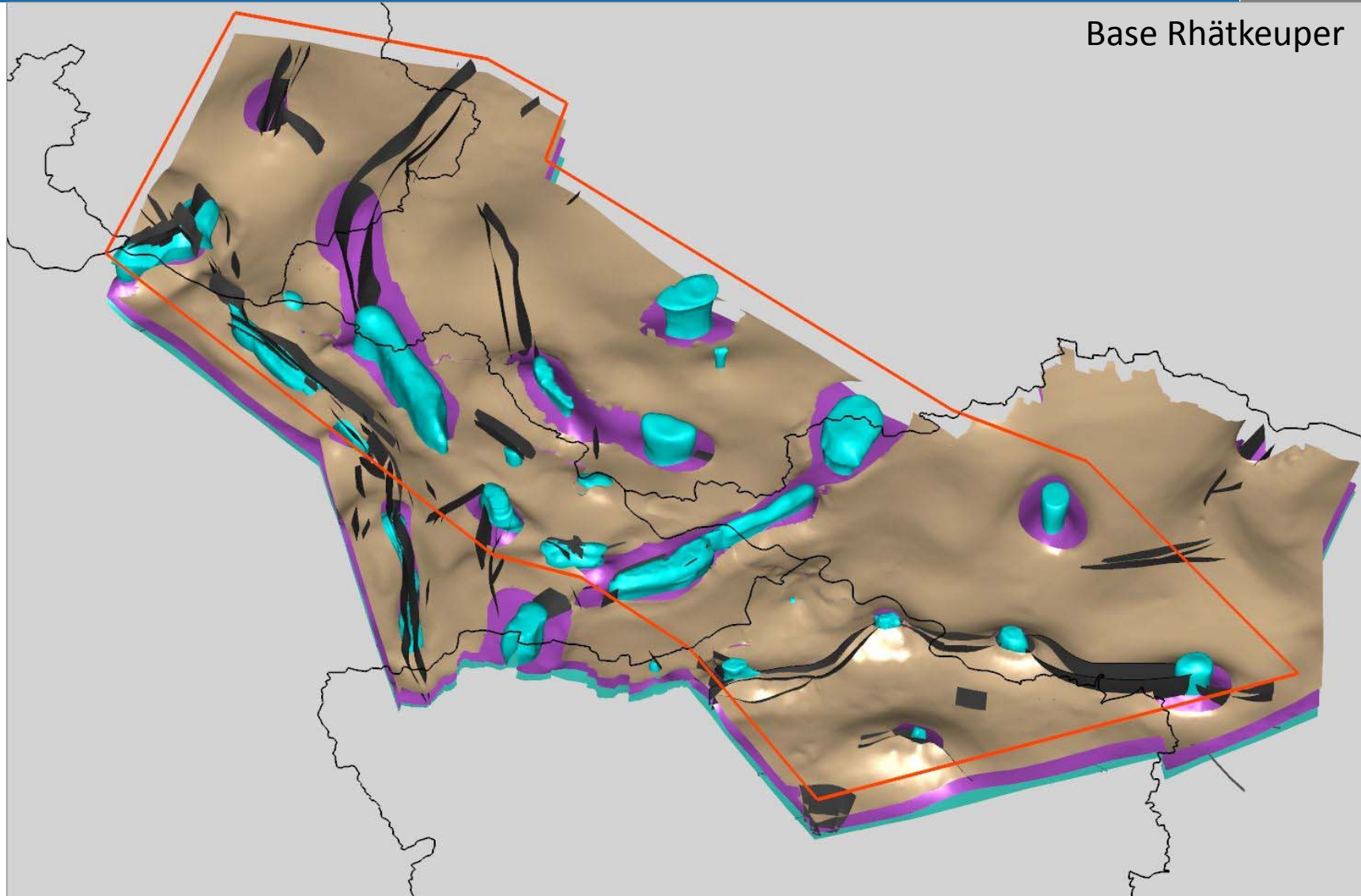
Base Upper Cretaceous



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Tieferer Untergrund Norddeutsches Becken

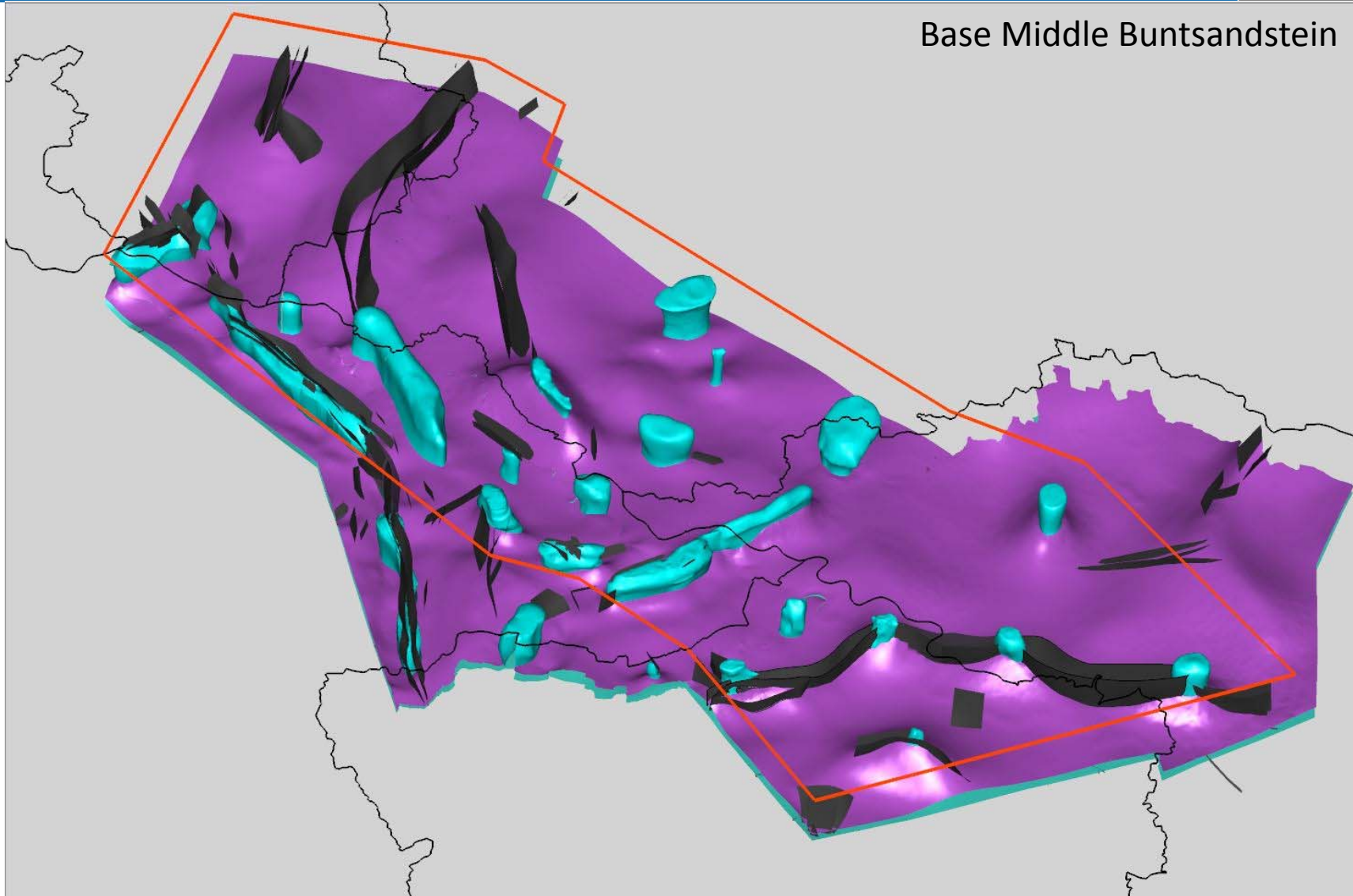


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Tieferer Untergrund Norddeutsches Becken

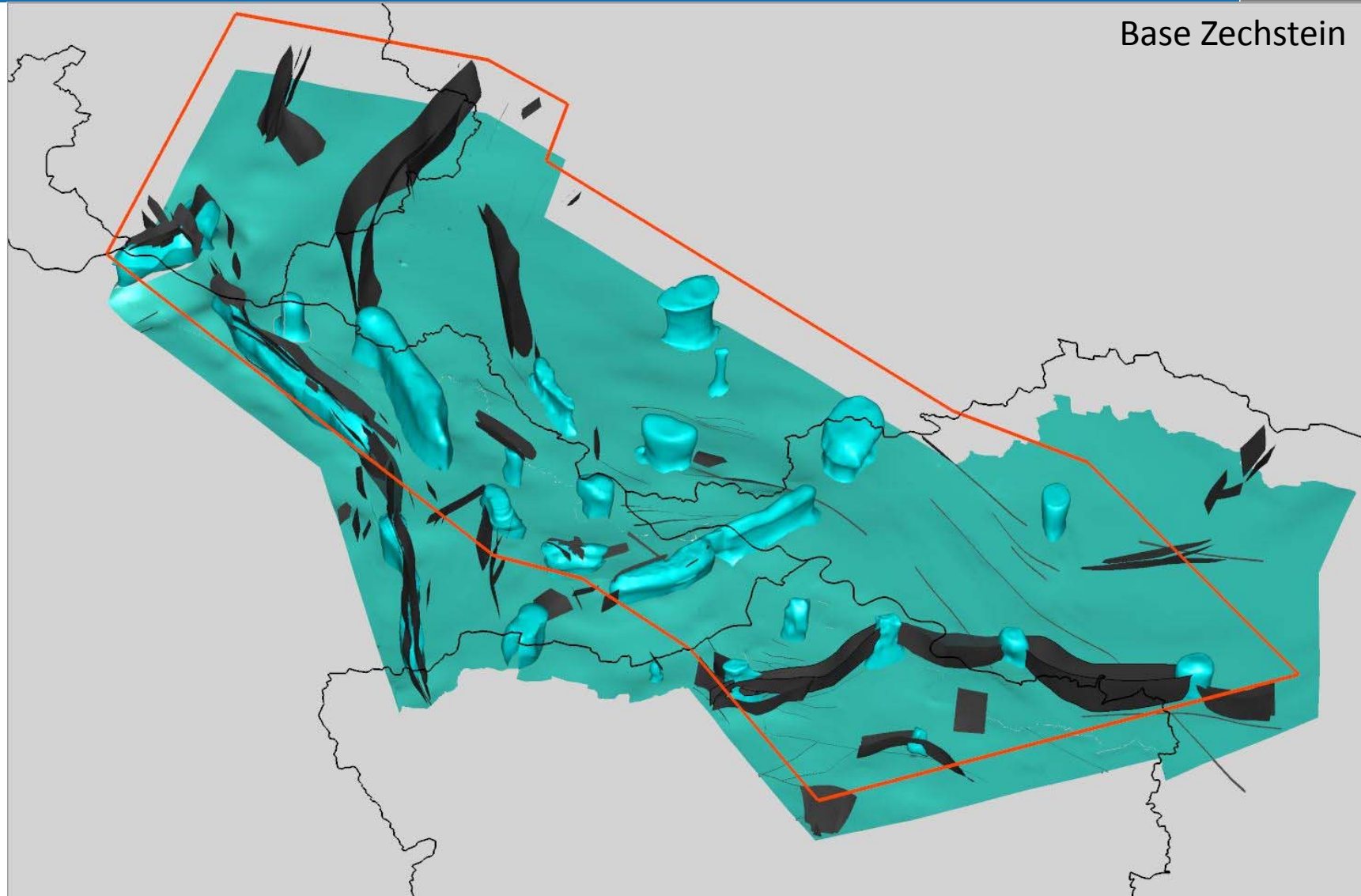
Base Middle Buntsandstein



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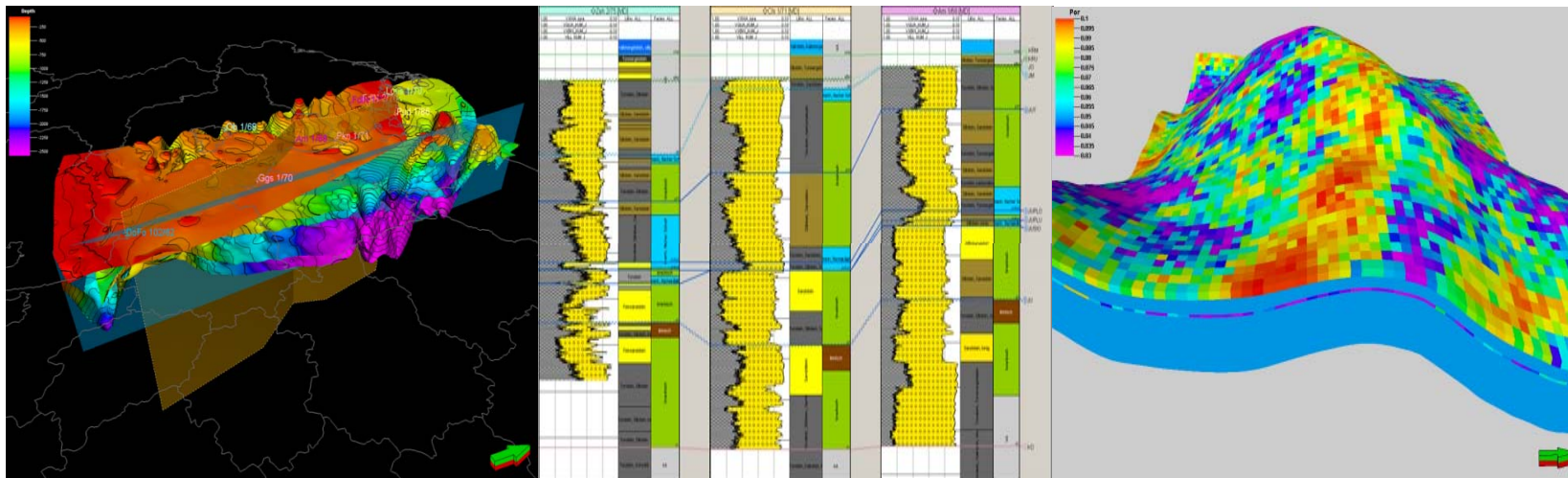
Tieferer Untergrund Norddeutsches Becken



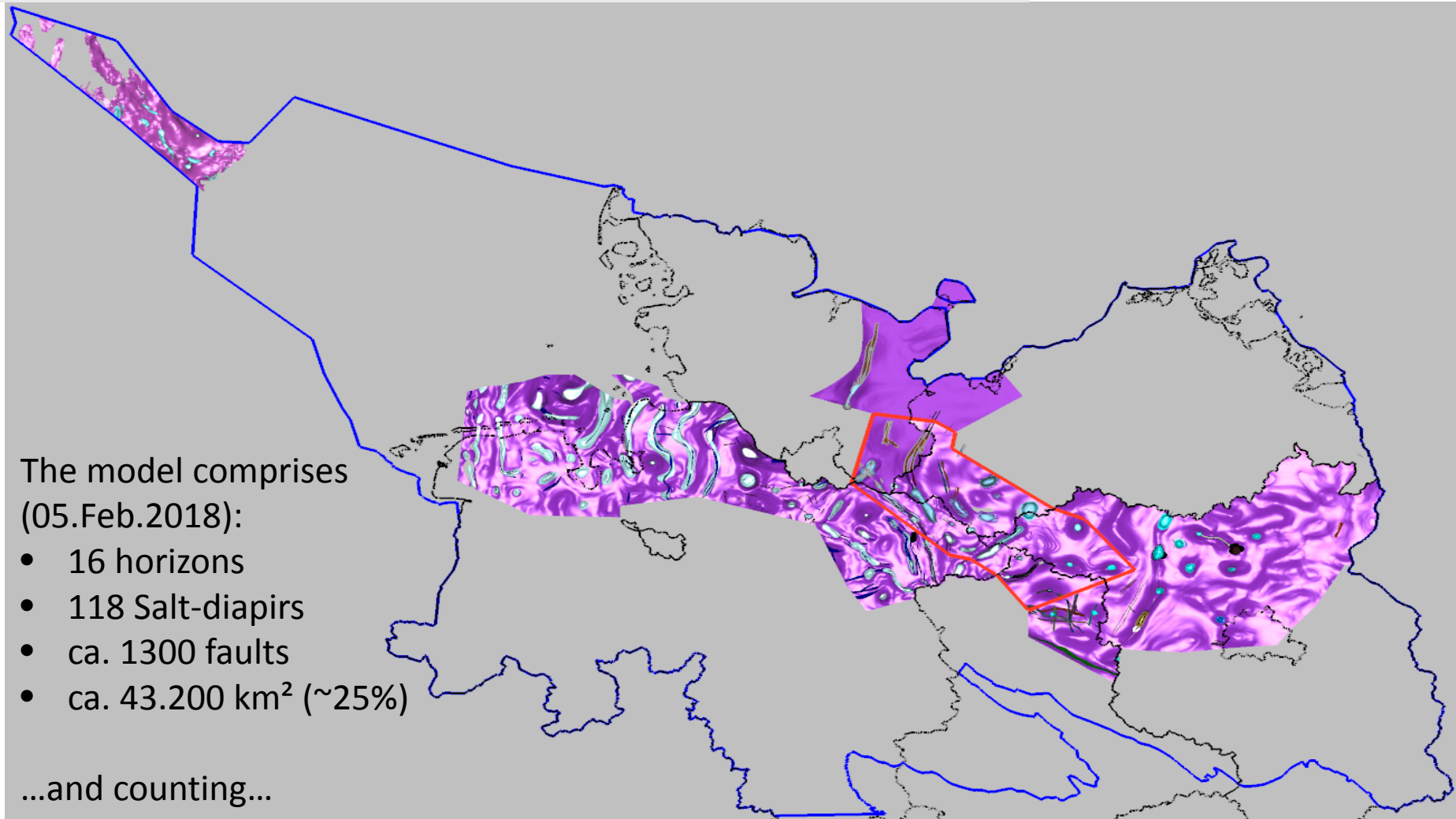
Project TUNB - The future

Outlook: ...6 years are a quite short time...

- Pilotregion: ~7.800 km², 24 Diapirs, ~200 Faults
- Full model: 170.000 km², >>100 Diapirs, ??? Faults
- Pilot-area represents ~5% of the full final model
- Pilotregion can be used to test further modeling (Volume- / Property-modeling)



Where are we now?



Thank you for your attention

3D model of the "Entenschnabel"
(German North Sea) in Minecraft.
Realized together with BGS



Thank you for your attention

3D model of caverns in a salt structure in Minecraft.

