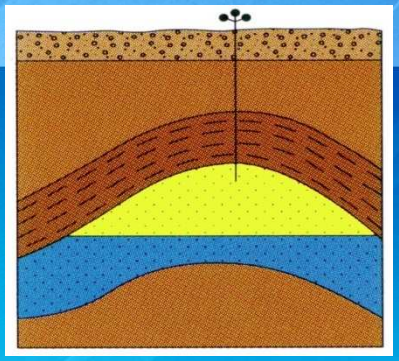
Berlin Seminar on
Energy and Climate Policy

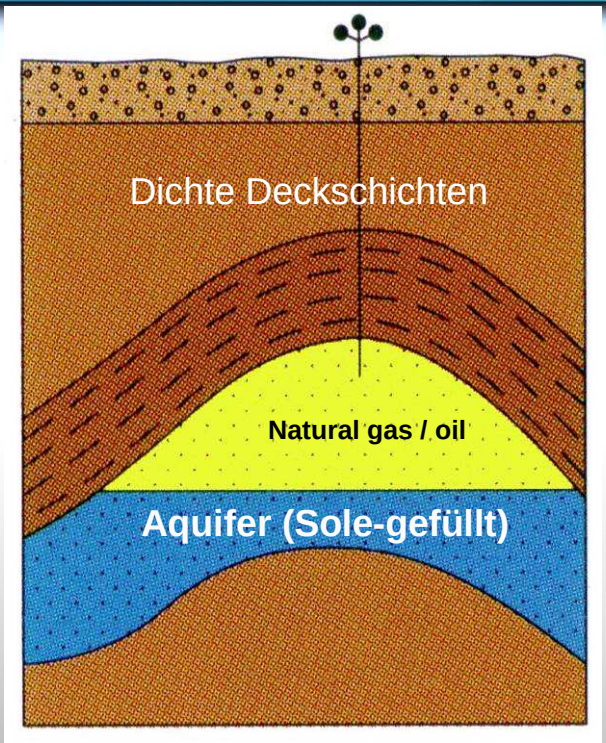


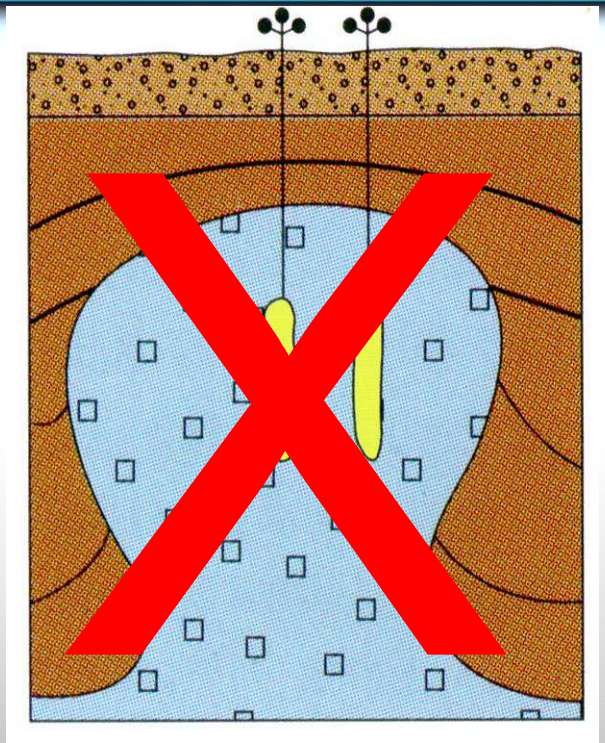
CO_2-Storage –
German and International Perspective

Berlin, 03. Juni 2010

Johannes Peter Gerling
BGR – Bundesanstalt für Geowissenschaften und Rohstoffe

Underground gas storage: basics of classical storage typs





- Aquifere, 600-1000 m (Erdgas)
- Öl & Gasfelder, 650-2900 m poröse Sand/Kalksteine

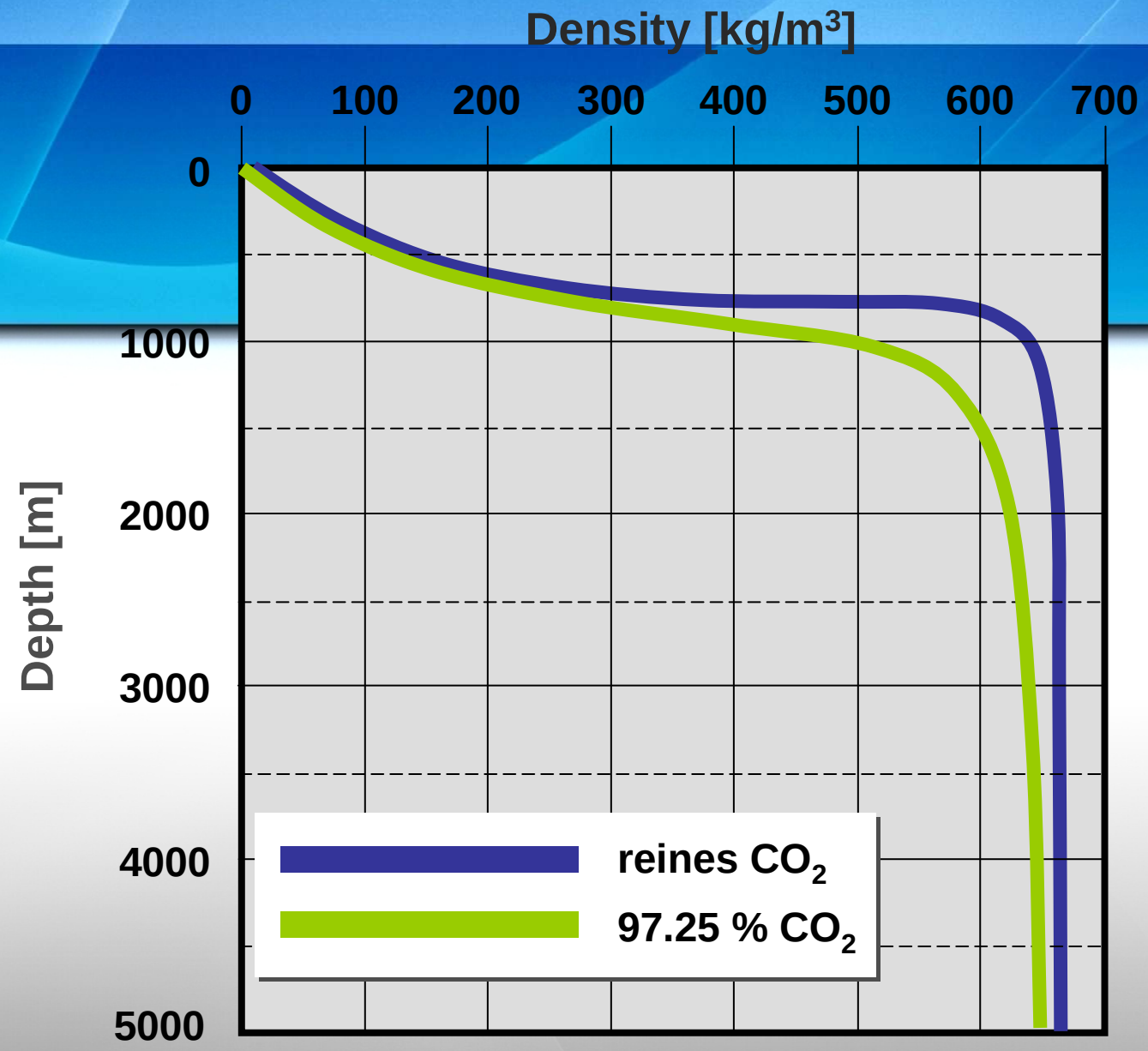
gesolte Salzkavernenspeicher 400-1800 m

Nachnutzung von Bergwerksgebäuden (hier: Rammelsberg)

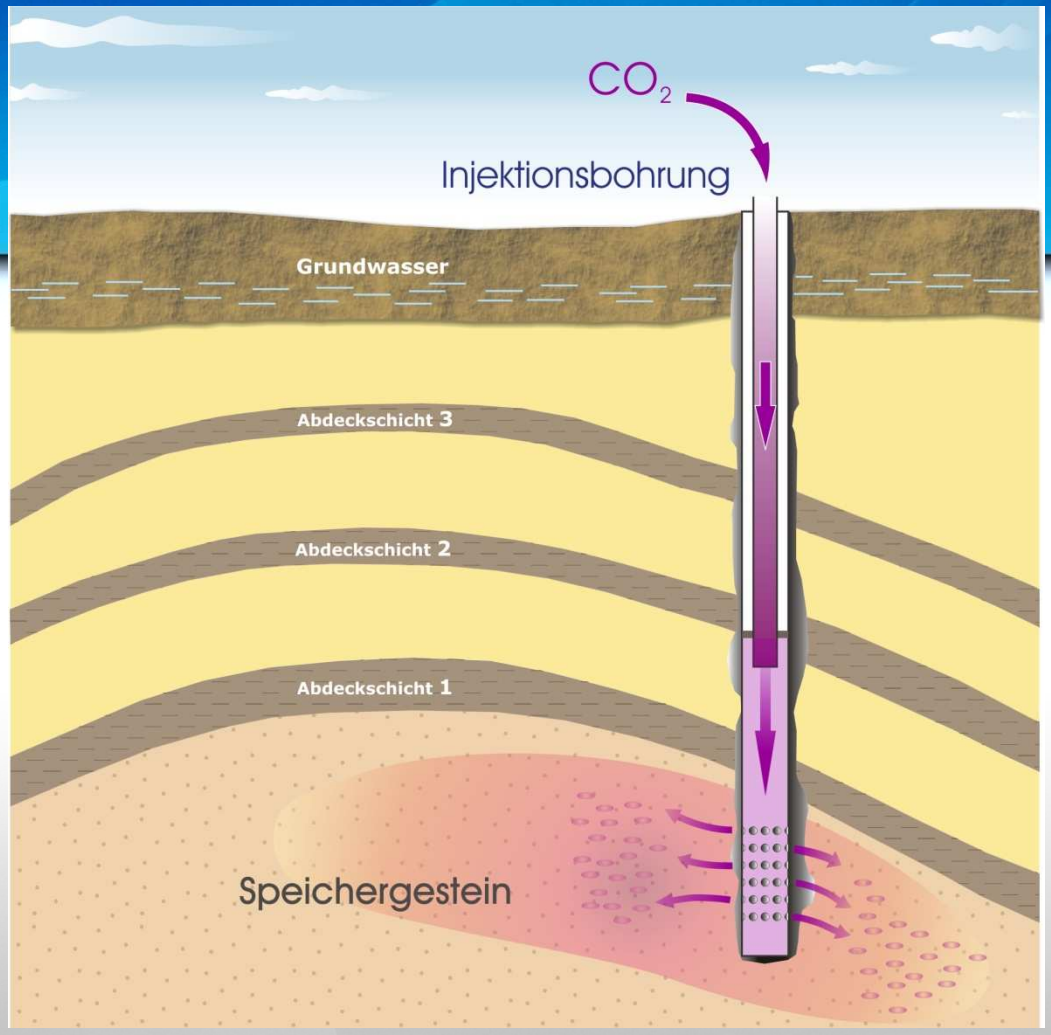
Quellen: Sedlacek 2007; Holland (Foto)

Condition I:

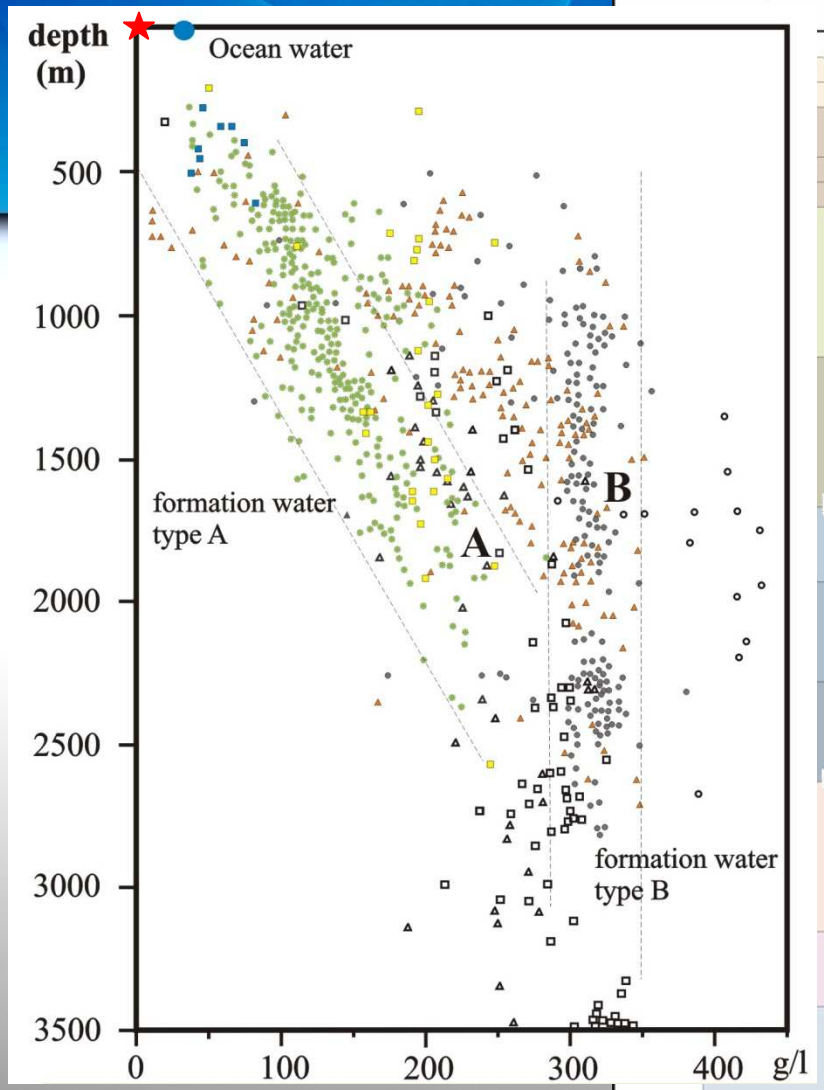
Storage depth
> 800-1000 m

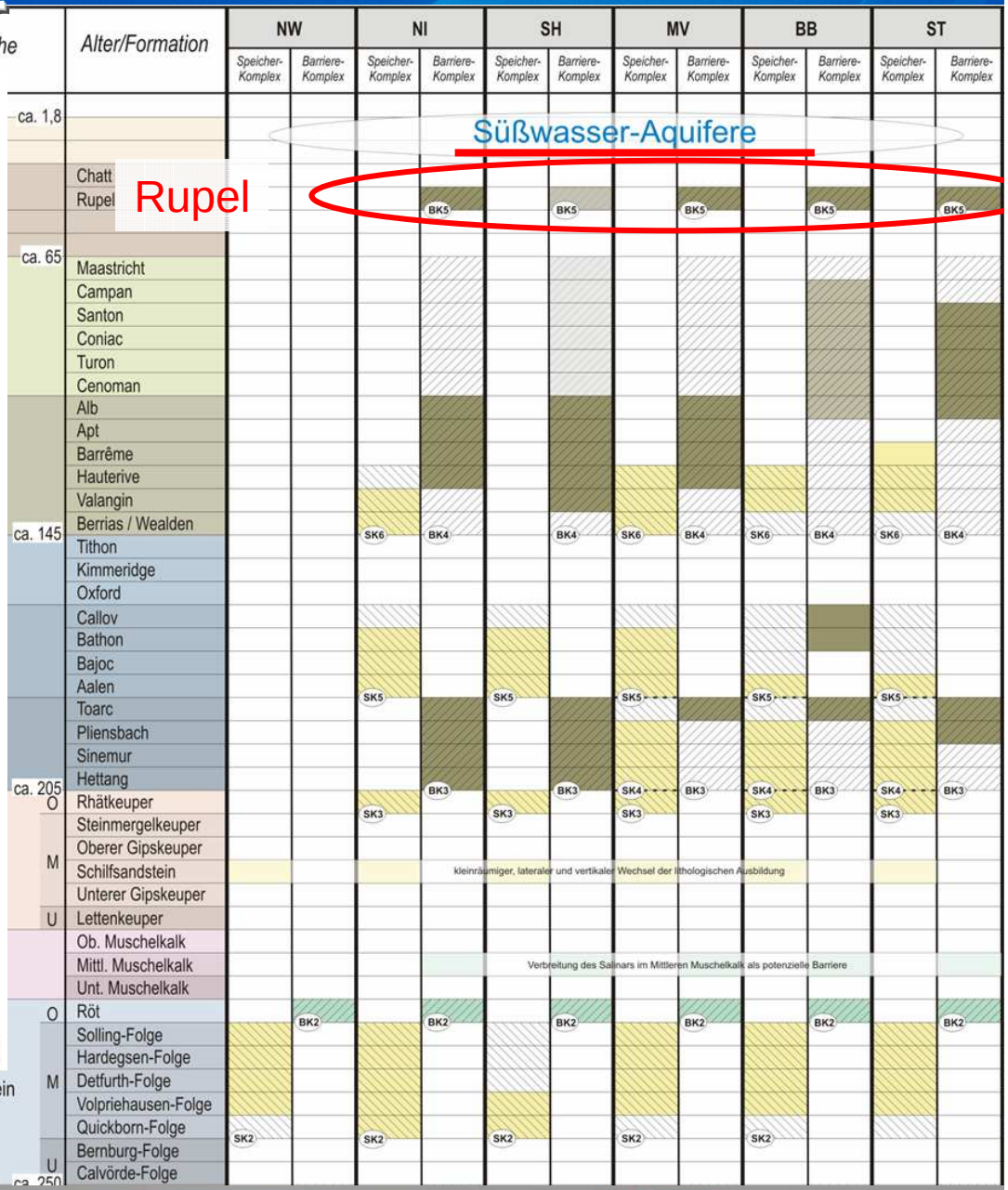


Condition II:
Long-term security – multi-barrier concept



Condition III:
no damage to fresh water





Quellen: Müller & Papendieck 1975, GTN, BGR,

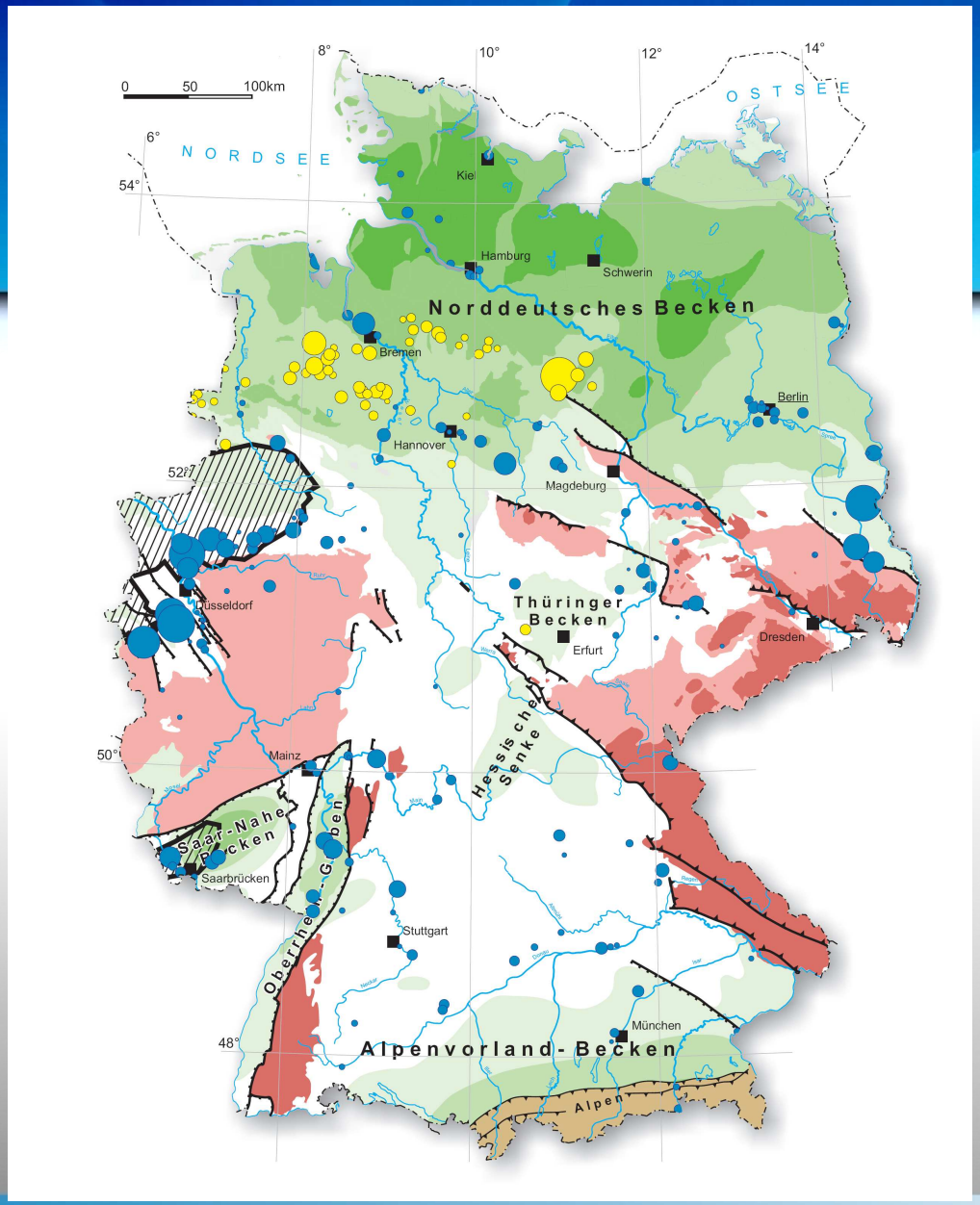
CO_2-storage options & -potential in DE

According to current knowledge …

- **natural gas fields : 2,75 Gt**
- **saline aquifers : 6,3 – 12,8 Gt***

* Aquifer anticlines in ca. 75 % of area of:
North German basin, Upper Rhine valley, Molasse basin
[*Knopf et al., et 4/2010*]

Where do we find storage space ?



Bedeutende CO_2 - Quellen

Kraftwerke, Hütten- und Zementwerke, Raffinerien u. a.

0,2 → 20 Mt/a

Regionen mit Speichermöglichkeiten

zunehmende Mächtigkeit der Beckenfüllung: 1km, 3km, 5km, 7km, 9km

tiefliegende und Salzwasser führende Speichergesteine (Aquifere)

Steinkohle - Flöze

Erdgas - Felder

Regionen ohne bedeutende Speichermöglichkeiten

metamorphe Gesteine

magmatische und hoch-metamorphe Gesteine

Speichergesteine nicht oder in zu geringen Tiefen vorhanden

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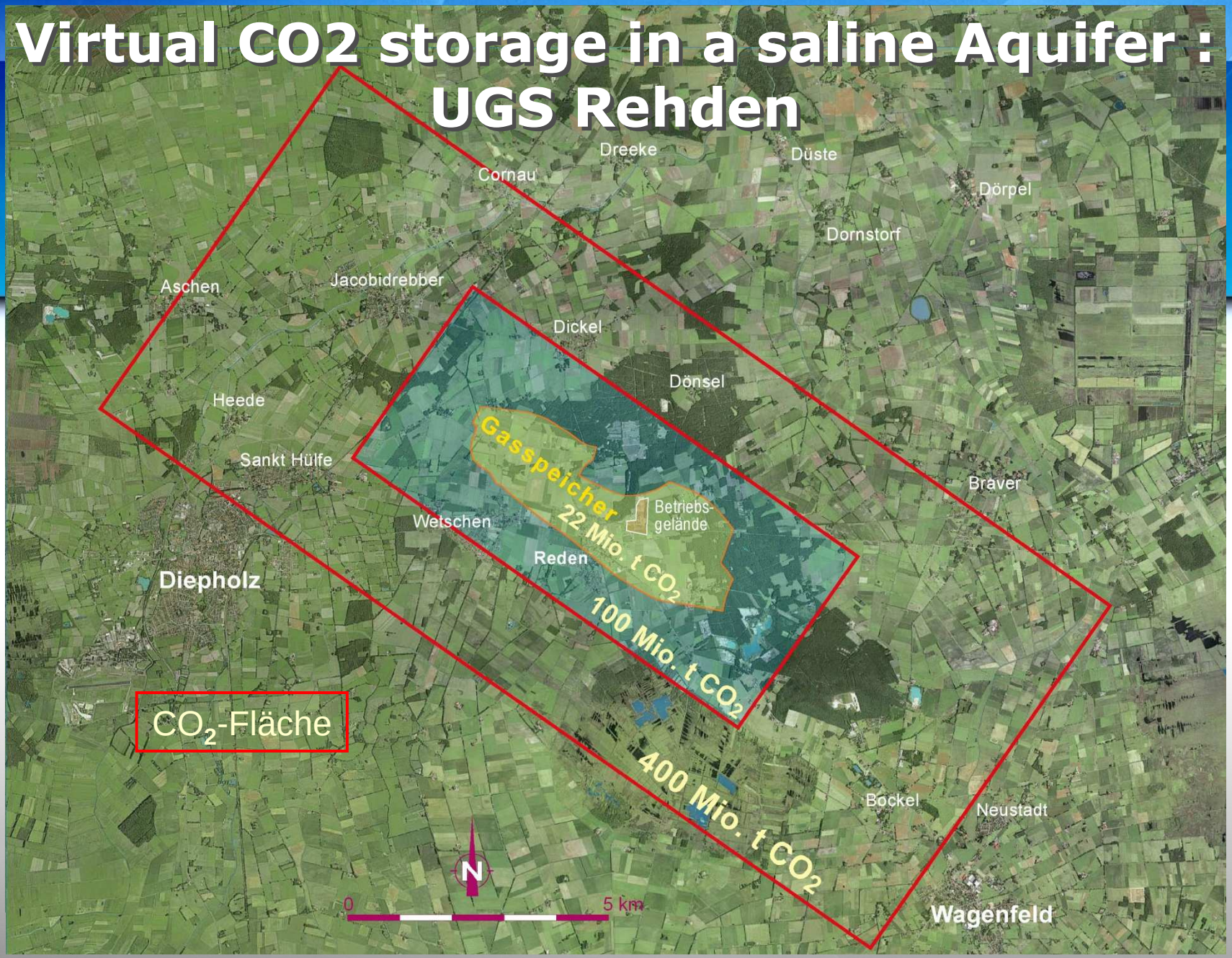
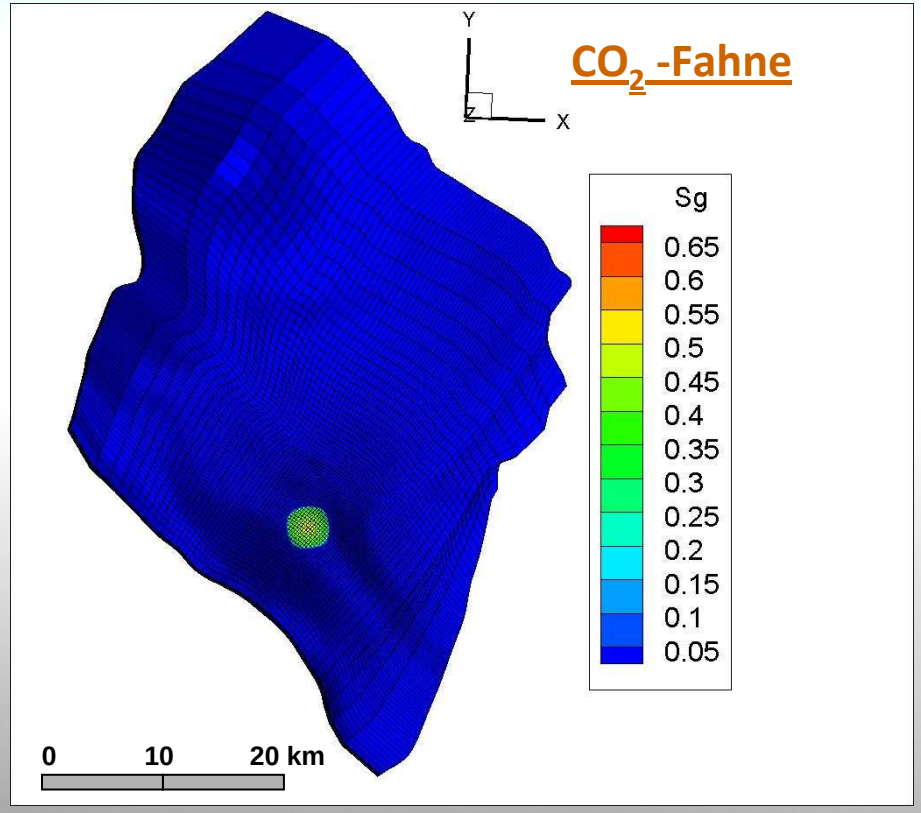
Virtual CO2 storage in a saline Aquifer : UGS Rehden

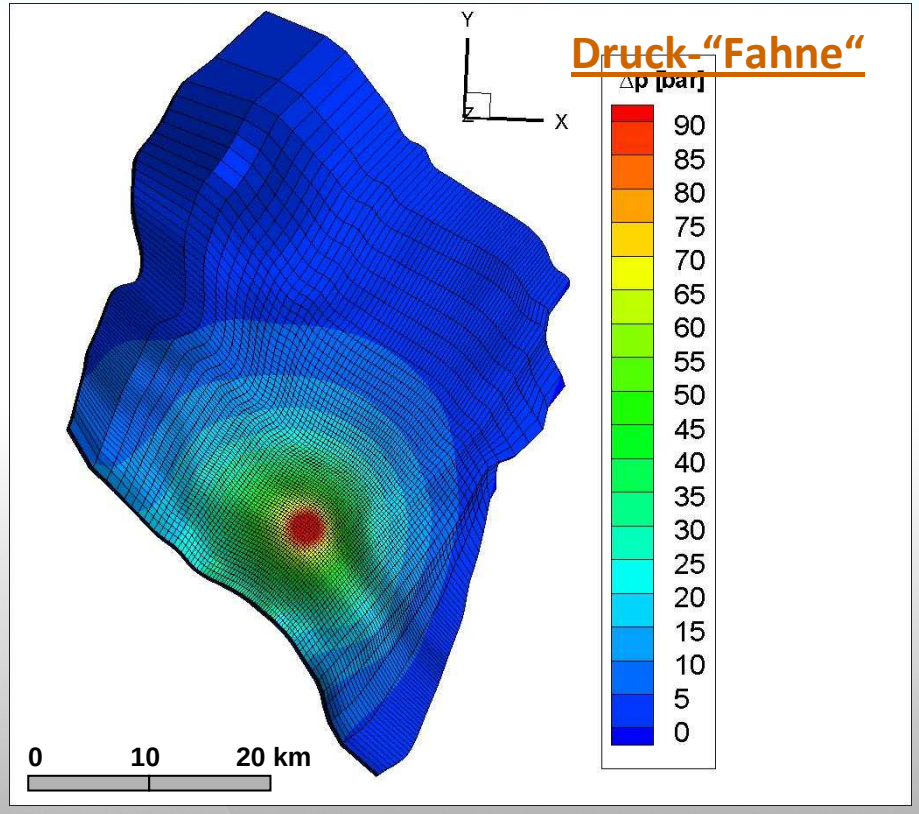


Quelle: Sedlacek 2007

CO2-saturation and pressure (after 10 years)



CO_2 -Fahne



Druck-"Fahne"

Quelle: Schäfer et al. 2010

Competing interest in storage space

- Mining- „waste“ (HC, salt) → aquifer (reservoir)
- UGS → cavern, aquifer
- waste in containments → mine
- strategic oil reserve → cavern
- renewable energy
  - compressed air → cavern
  - hydrogen → cavern
  - water → mine
- geological CO_2-storage → aquifer, (gas field)
- deep geothermal energy ? → aquifer, solid rock

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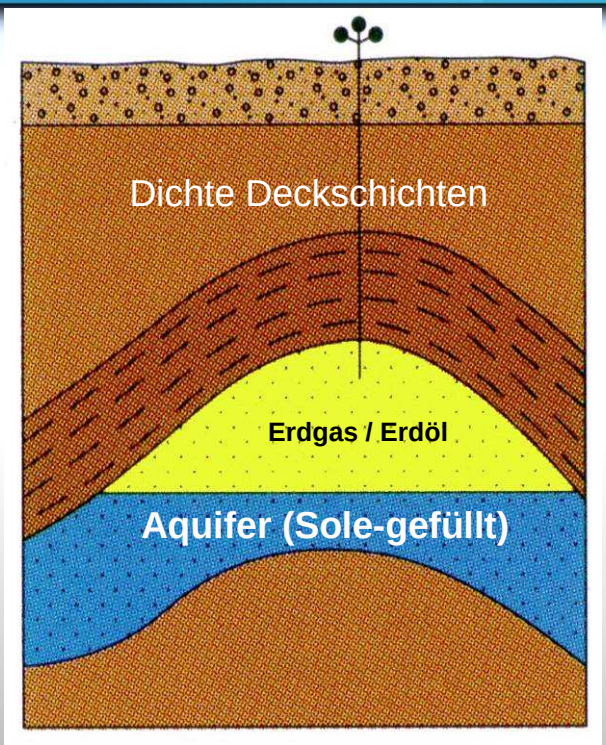

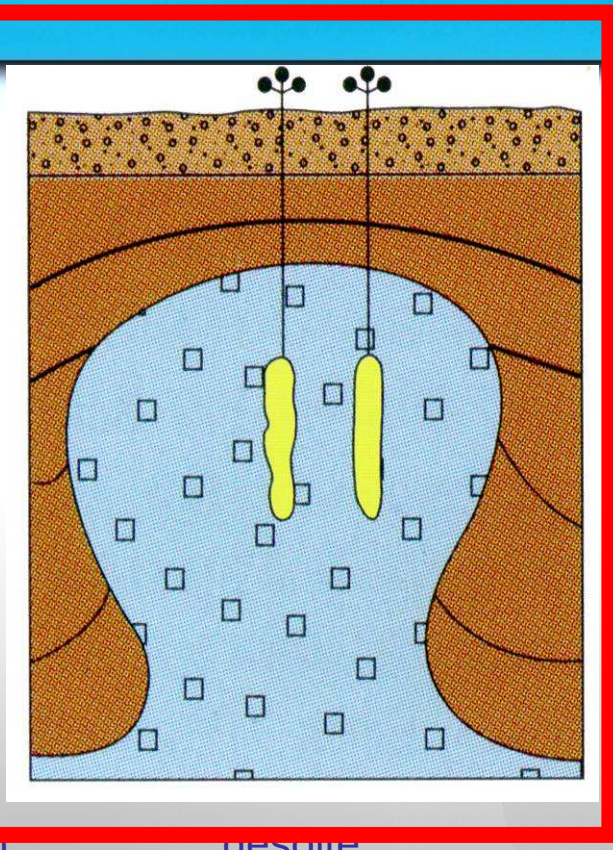

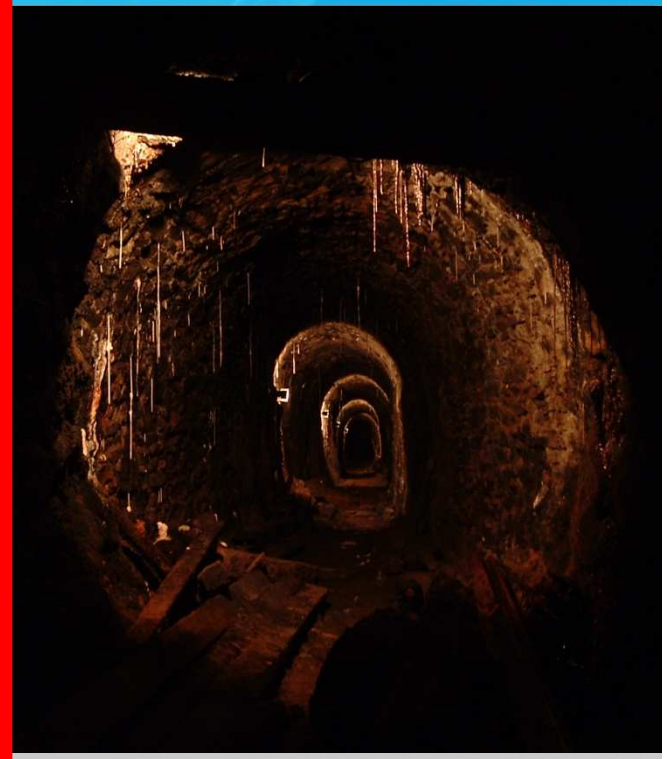

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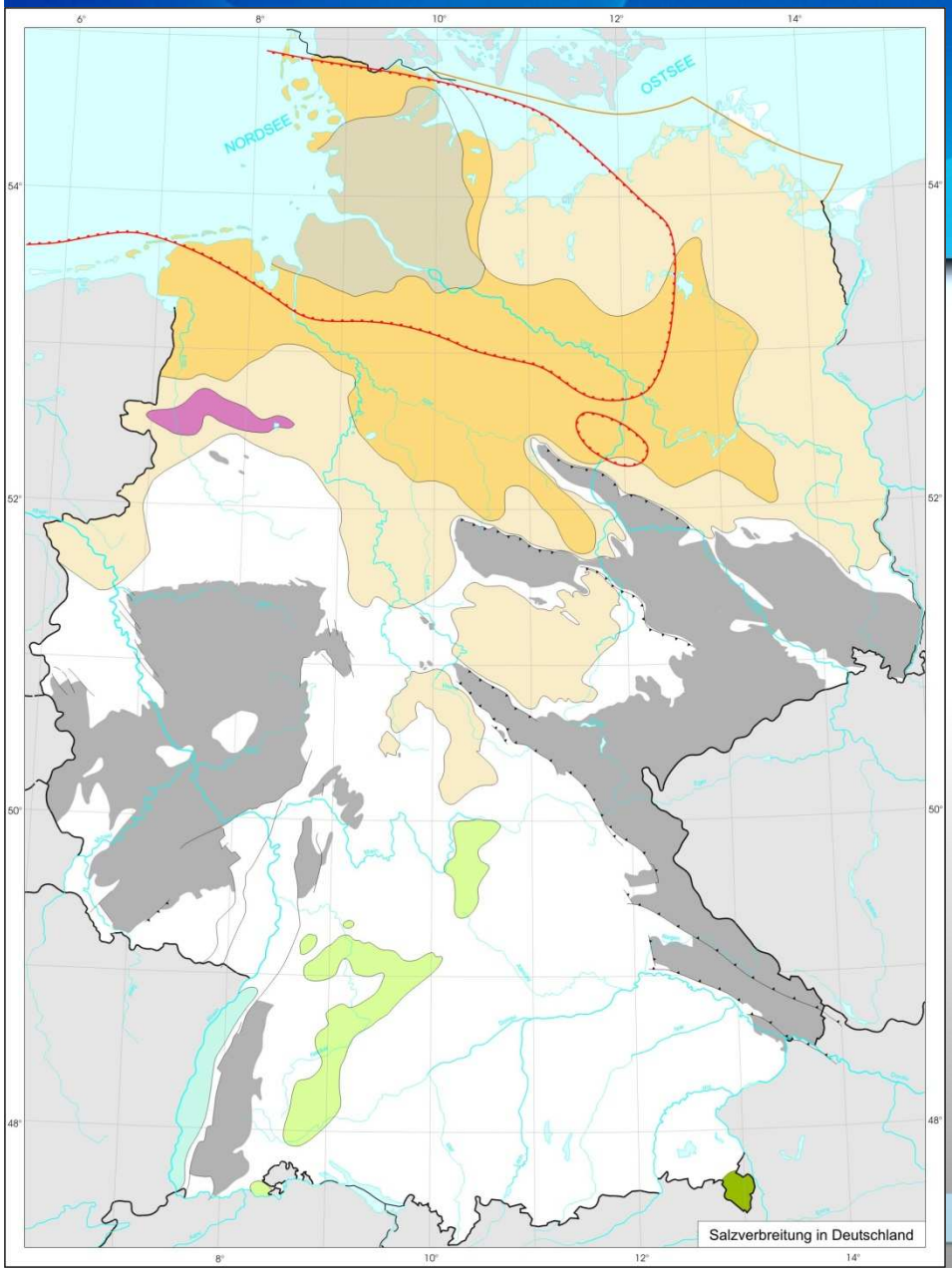
Nachnutzung von Bergwerksgebäuden (hier: Rammelsberg)

Quellen: Sedlacek 2007; Holland (Foto)

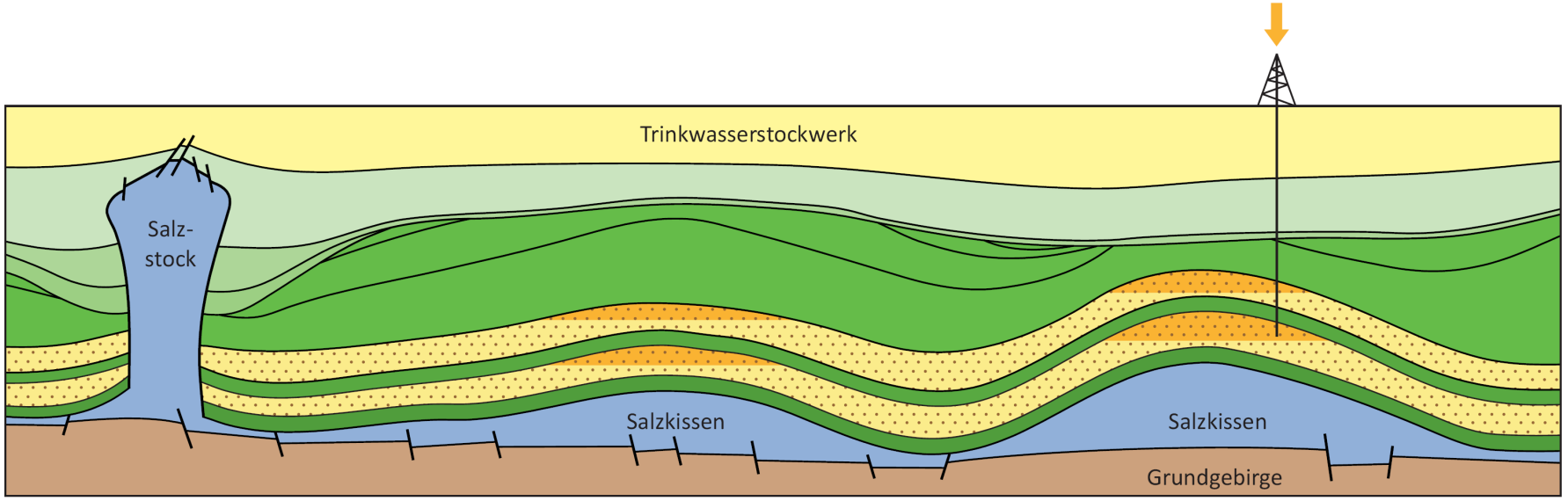
Where can salt caverns be established?



- Verbreitung von Zechsteinsalz (meist mit überlagernden Triassalzen)
- Verbreitung von Zechsteindiapiren
- Verbreitung von Zechstein- und Rotliegenddiapiren (Doppelsalinar)
- Tertiärsalz im Oberrhein-Graben
- Alpines Triassalz
- Triassalz in Süddeutschland
- Malmsalz
- Grundgebirge
- Verbreitungsgrenze der Rotliegendsalze
- Aufschiebung
- Abschiebung

Quelle: Krull, 2004

Salt structures



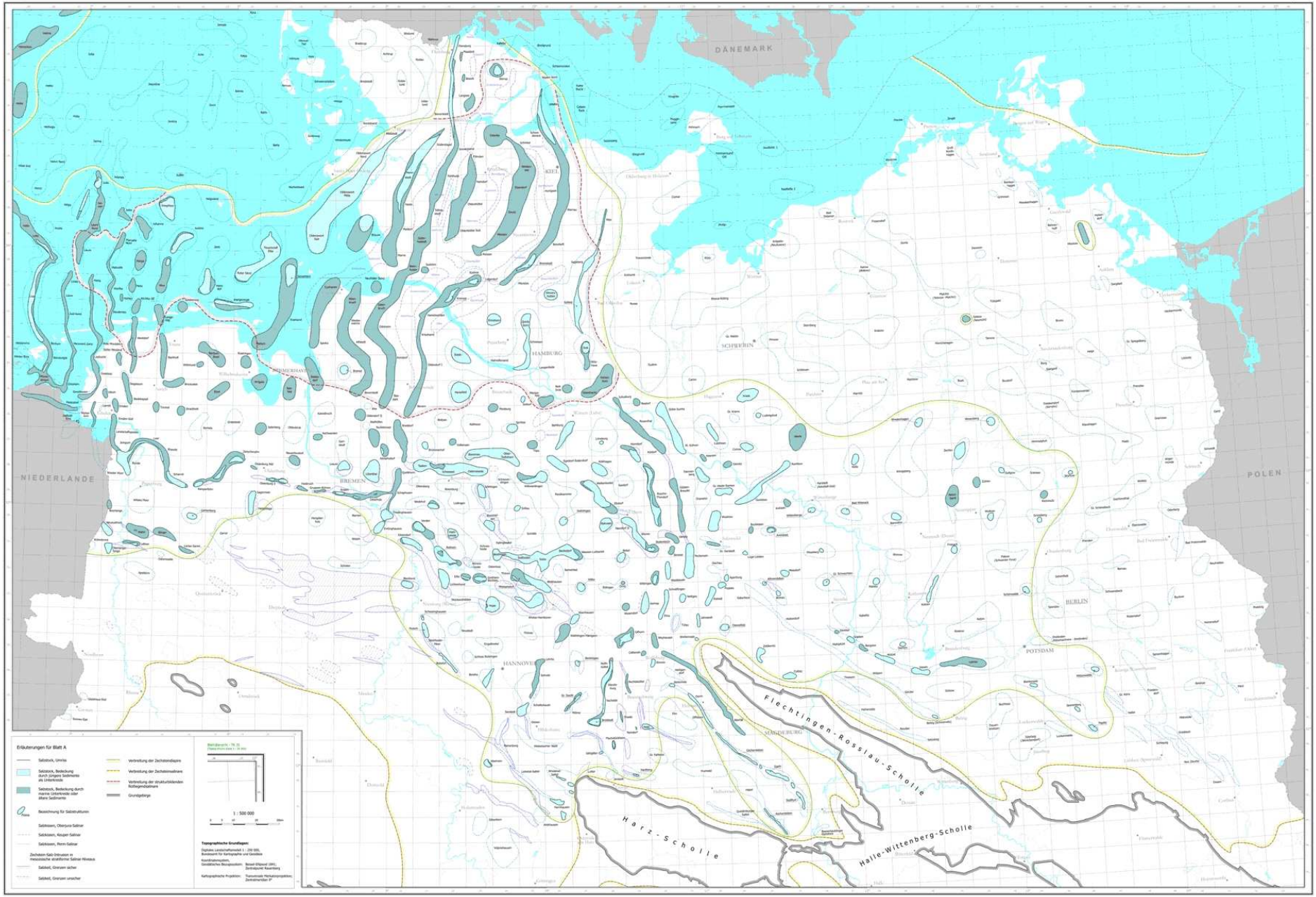
Bundesanstalt für Geowissenschaften und Rohstoffe

Wissenschaftliche Bearbeitung: K. Reinhold, P. Krull, F. Kockel
Geologische Redaktion: K. Reinhold, P. Krull

Salzstrukturen Norddeutschlands 1:500 000

Herausgegeben von der Bundesanstalt für Geowissenschaften und Rohstoffe

Kartographischer Redaktion: K. Reinhold, J. Rätz
Kartographische Bearbeitung: J. Rätz
Druck: zur Zeit keine Angaben



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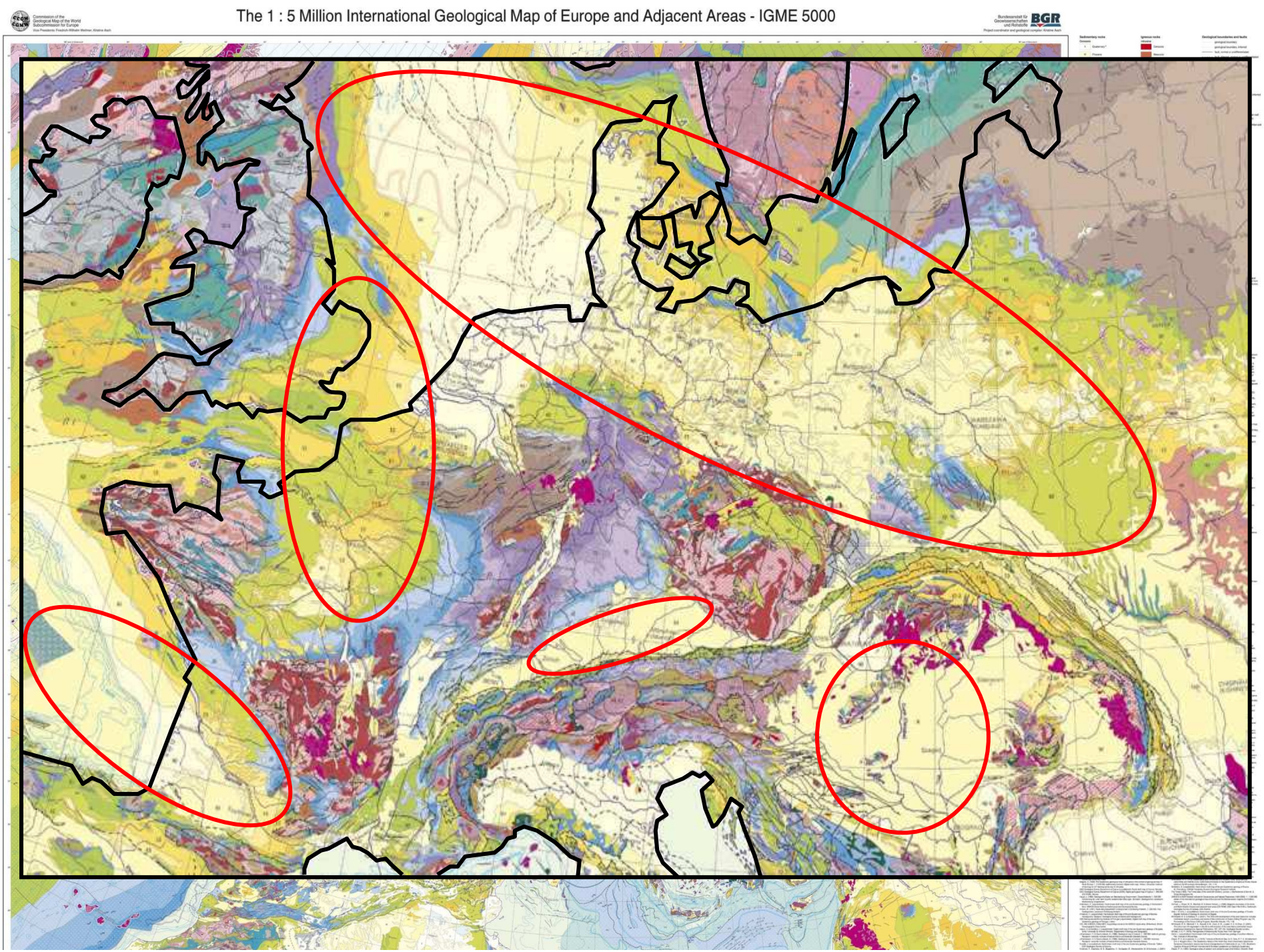
The 1 : 5 Million International Geological Map of Europe and Adjacent Areas - IGME 5000

Conclusions

- CO2-storage needs a lot of space
- Underground storage for REN can be installed in many places in DEU
- Geological conditions offer more potential in northern Germany
- Salt caverns are useful for storage of fluids and gases – but (due to large amounts) not for CO2
- Possible conflicts of interest may have to be solves by government regulations (?undergound space regulation?)

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Thanks for your attention !