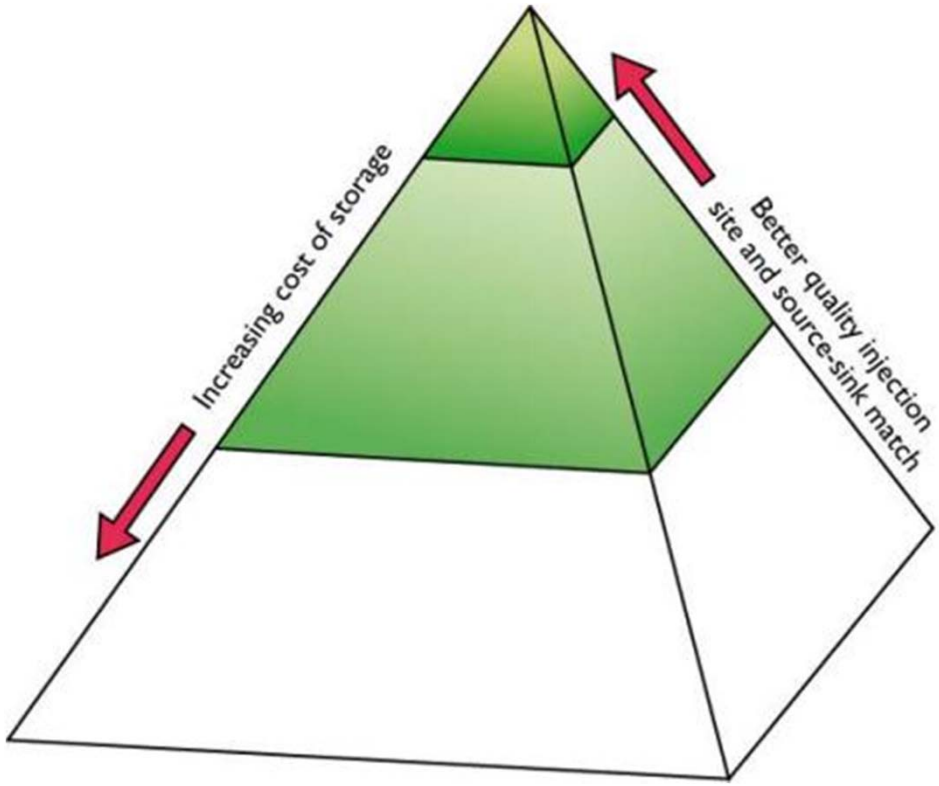
Session 3. Open discussion - Sharing experience on the CCS Directive transposition process in Europe
Session 3a. Transposition of CCS Directive: the most problematic issues

Assessment of storage capacity: organization and standardization

Niels Poulsen - GEUS

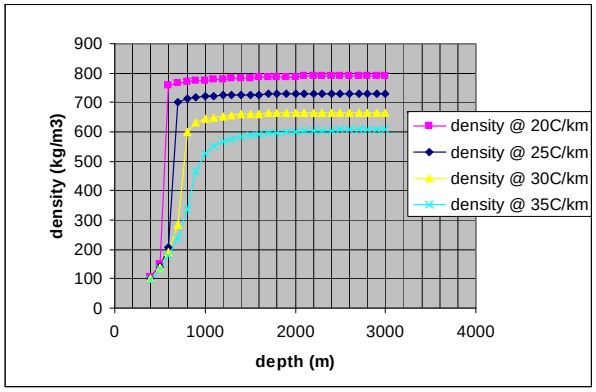
Agenda

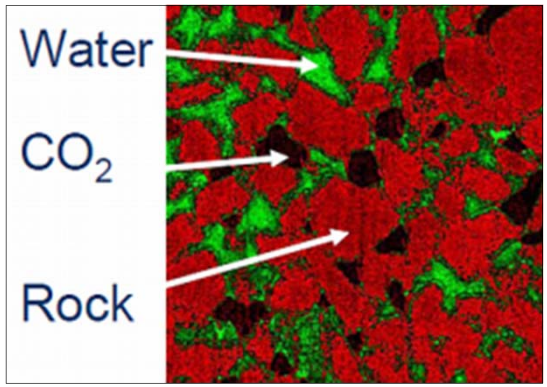
- Site selection and characterization
  - Basic criteria
- Organisation
  - Storage capacity
  - Geocapacity



Criteria for selection of CO_2 storage structures

- Sealed (cap rock)
- Non faulted, both structure and seal
- Top of reservoir situated below 800 m to ensure storage of super critical CO_2
- Reservoir situated less than 2500 m, to ensure enough preserved porosity and permeability
- Be within reasonable distance from a CO_2 source



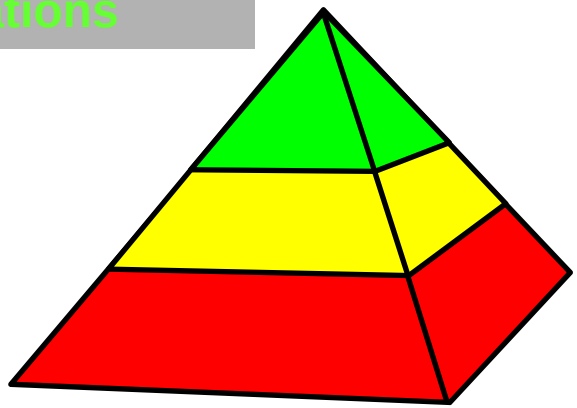


Level of potential storage estimations

Top:
Practical capacity with economic and regulatory barriers applied to effective capacity and with matching of sources and sinks: **Site specific efficiency factor from reservoir simulations**

Middle:
Effective capacity with technical/geological cut off limits applied to theoretical capacity: **Detailed estimates with evaluated efficiency factor**

Bottom:
Theoretical capacity including large uneconomic/unrealistic volumes: **Estimates without efficiency factor**



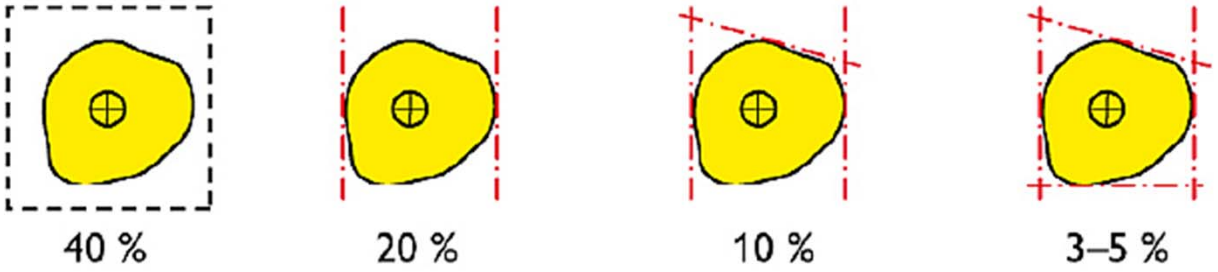
Deep saline aquifers

$$M_{CO2e} = A \times h \times \phi \times \rho_{CO2r} \times S_{eff}$$

- M_{CO2e} : effective storage capacity
- A : area of trap or regional aquifer
- h : average height of aquifer × average net to gross ratio
- ϕ : average reservoir porosity
- ρ_{CO2r} : CO_2 density at reservoir conditions
- S_{eff} : sweep efficiency (estimated)

Typical S_{eff} ranges for structures: 5 – 40 %

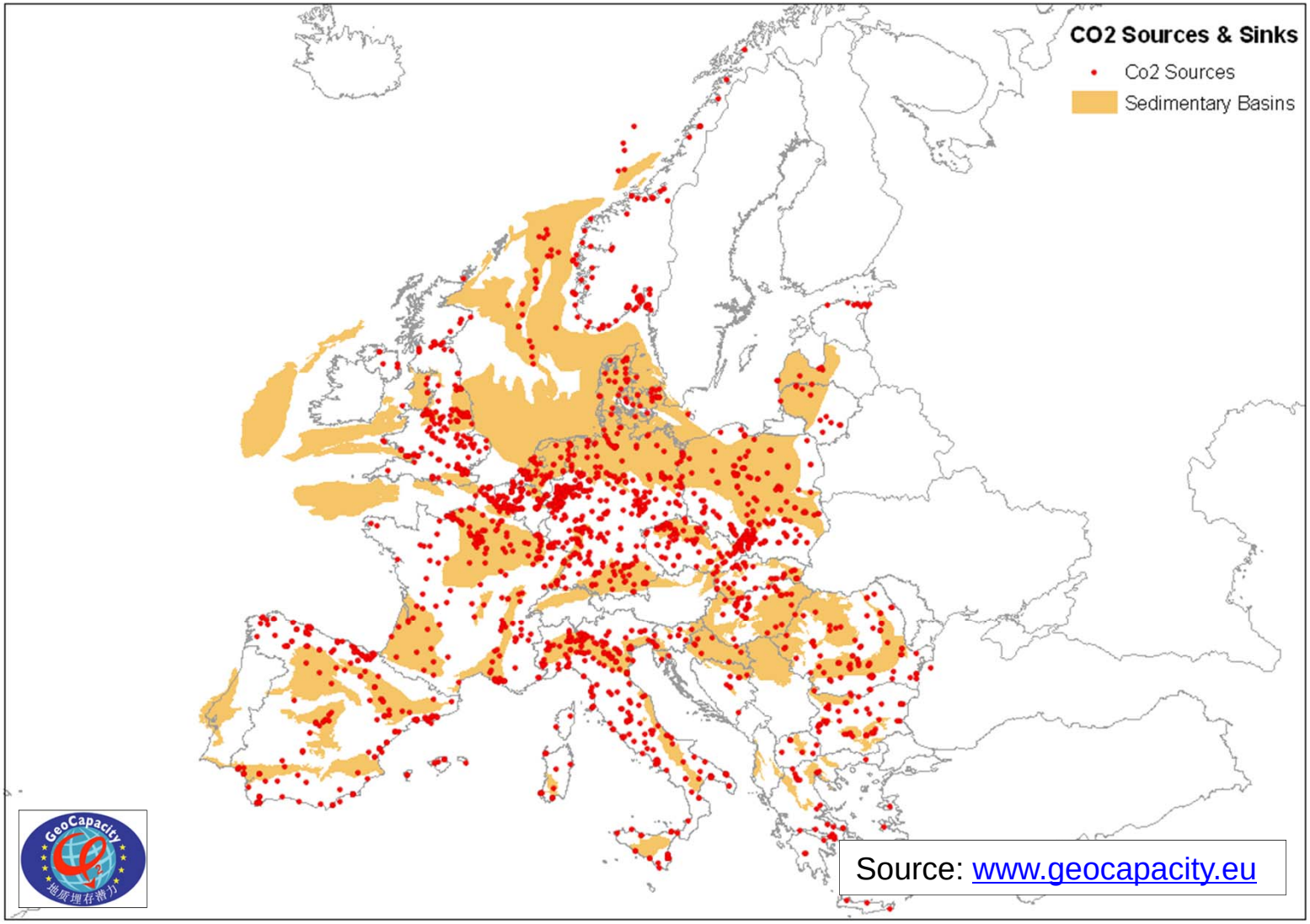
Suggested S_{eff} for regional aquifers: 2 %



Principal questions connected with organisation of CO_2 storage capacity in Europe

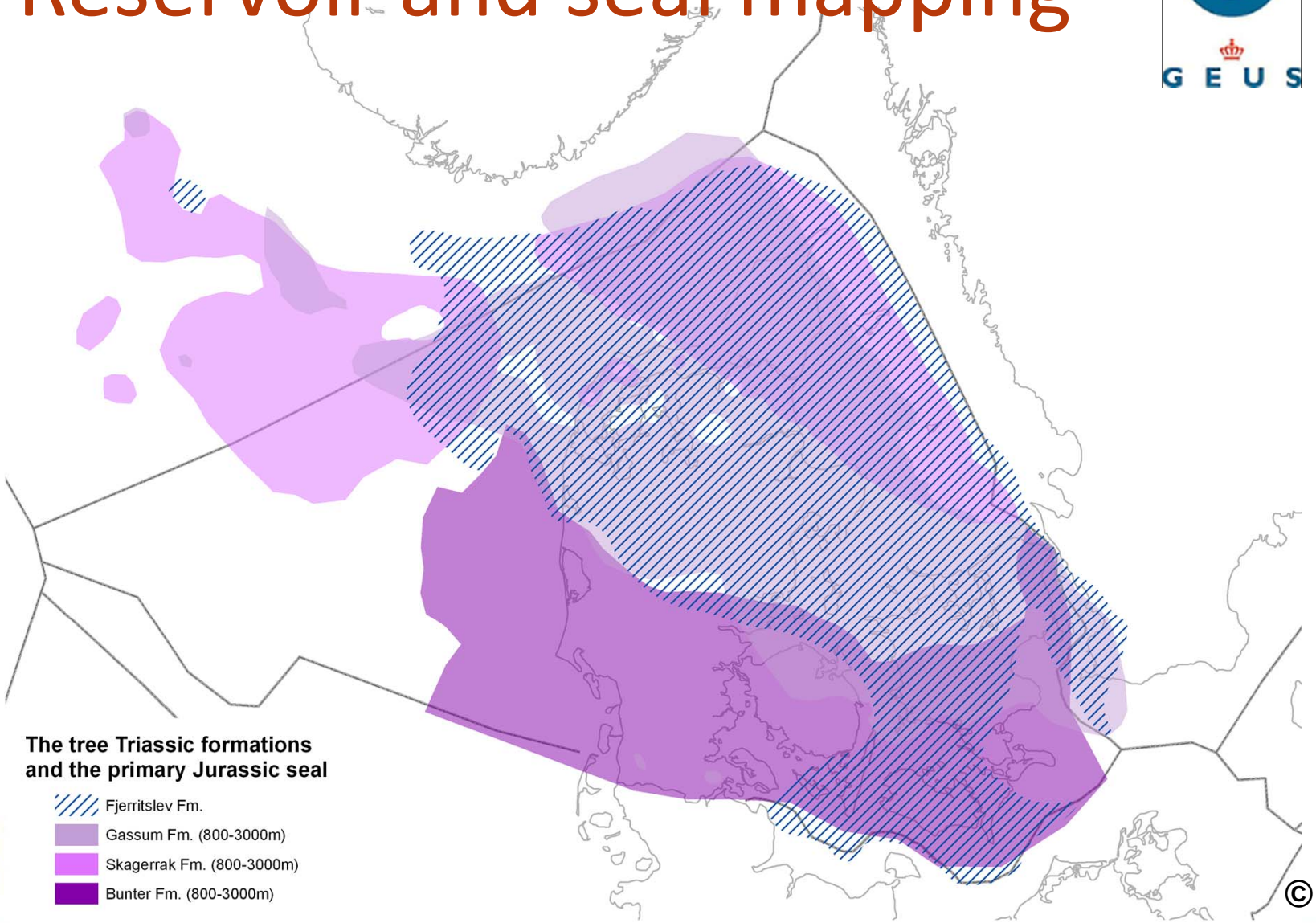
- How critical is the availability of storage capacity?
- Is the capacity estimates comparable?
  - conservative estimates included in the final EU GeoCapacity report
  - **storage capacity in aquifers**
  - **storage capacity only in structures**

Sedimentary basins

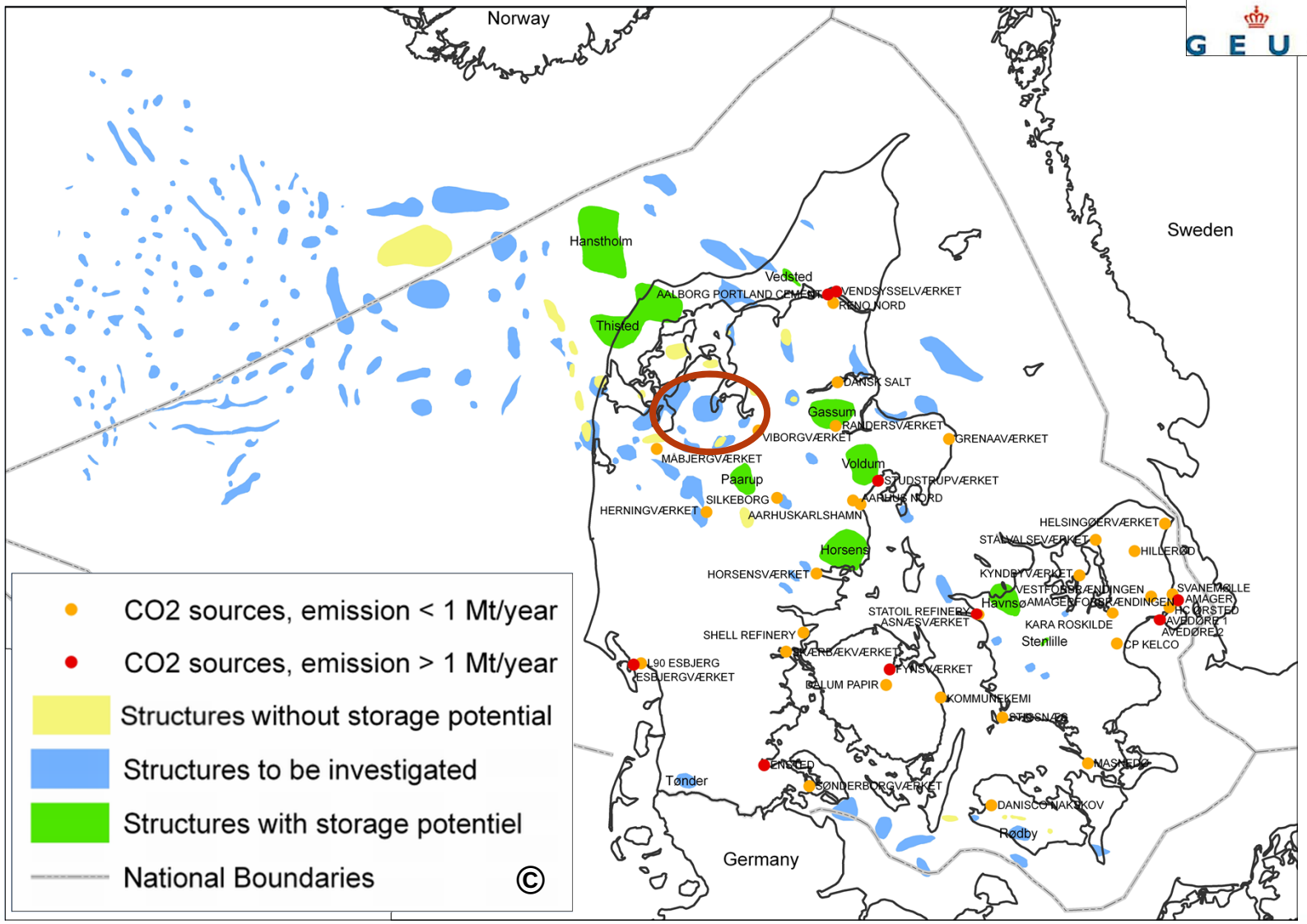


Source: www.geocapacity.eu

Reservoir and seal mapping

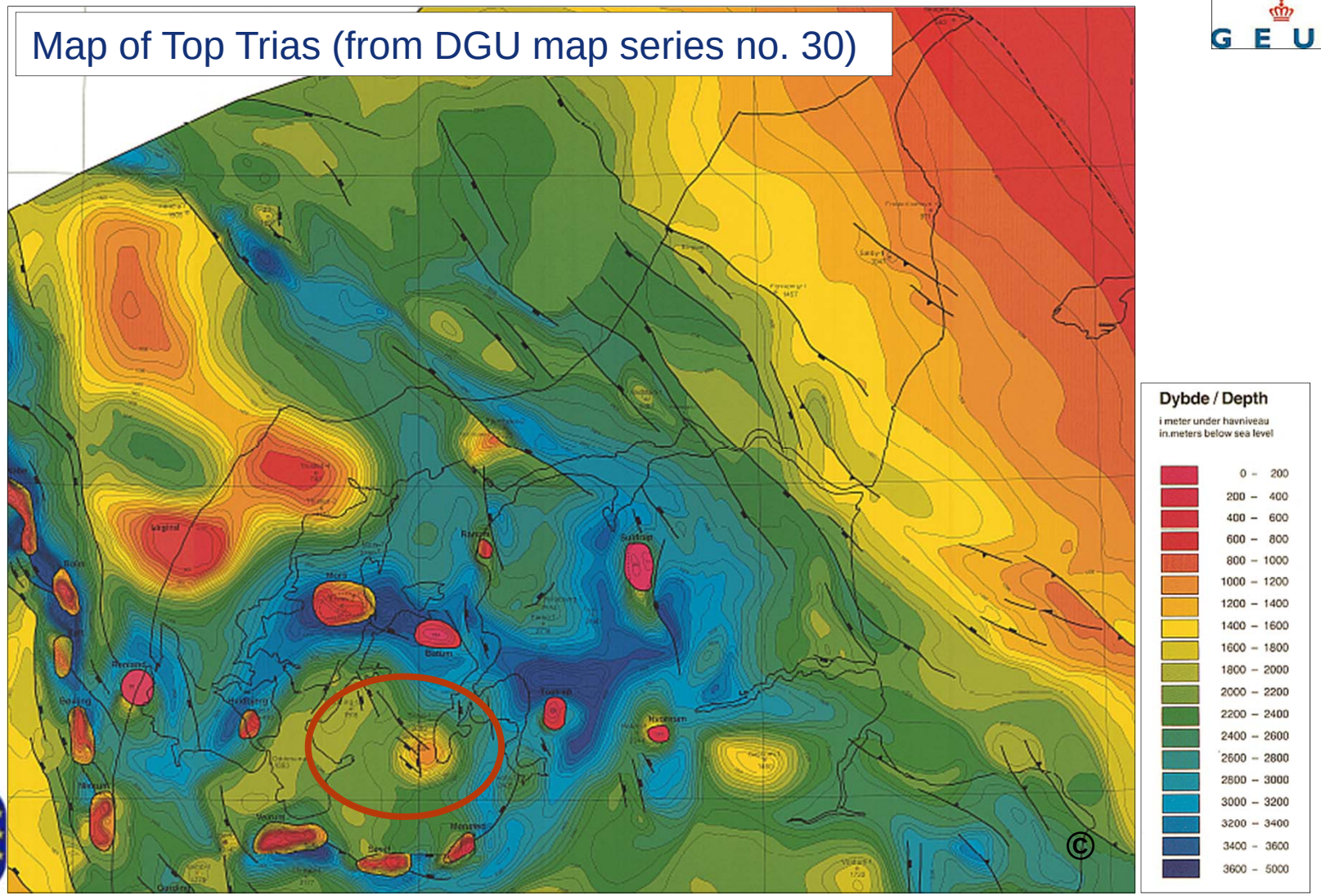


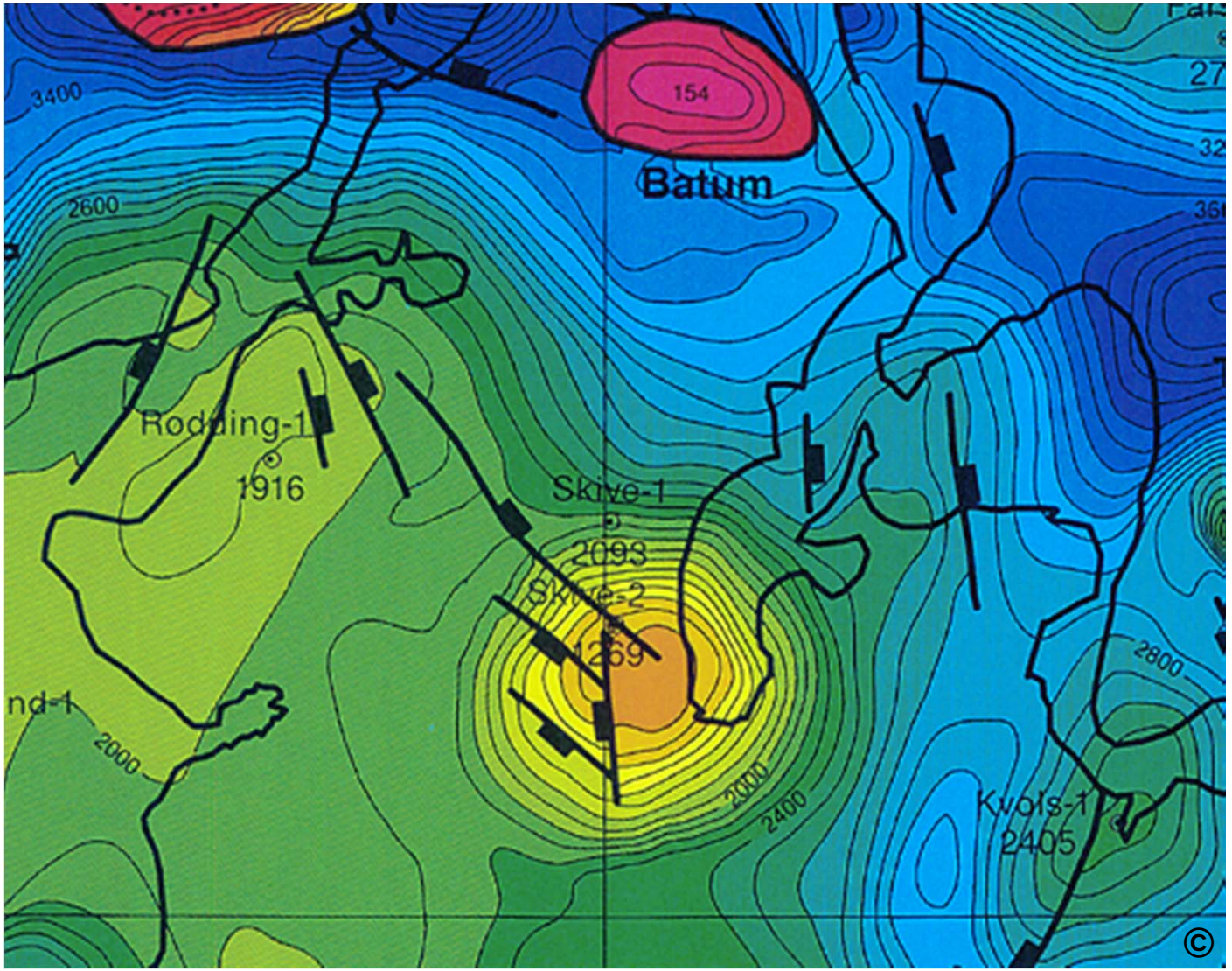
Identify reservoir potentials



Top Trias ⇔ top Gassum Formation

Map of Top Trias (from DGU map series no. 30)





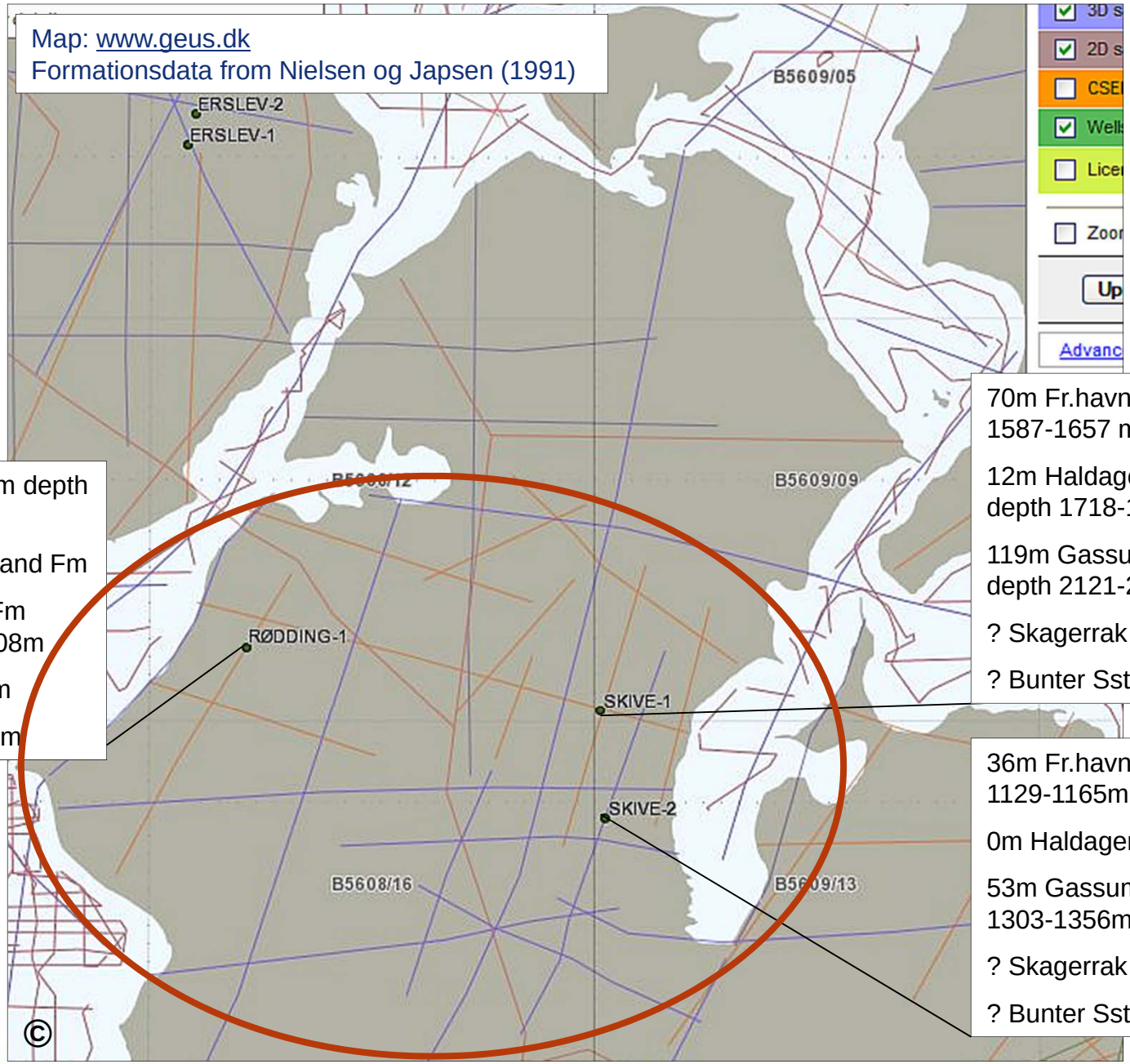
GEUS

Dybde / Depth

i meter under havniveau
in meters below sea level

0 – 200	
200 – 400	
400 – 600	
600 – 800	
800 – 1000	
1000 – 1200	
1200 – 1400	
1400 – 1600	
1600 – 1800	
1800 – 2000	
2000 – 2200	
2200 – 2400	
2400 – 2600	
2600 – 2800	
2800 – 3000	
3000 – 3200	
3200 – 3400	
3400 – 3600	
3600 – 5000	

Map: www.geus.dk
Formationsdata from Nielsen og Japsen (1991)



50m Fr.havn Fm depth 1577-1627m

0m Haldager Sand Fm

96m Gassum Fm depth 1748-2208m

? Skagerrak Fm

? Bunter Sst. Fm

70m Fr.havn Fm depth 1587-1657 m

12m Haldager Sand Fm depth 1718-1730m

119m Gassum Fm depth 2121-2240 m

? Skagerrak Fm

? Bunter Sst. Fm

36m Fr.havn Fm depth 1129-1165m

0m Haldager Sand Fm

53m Gassum Fm depth 1303-1356m

? Skagerrak Fm

? Bunter Sst. Fm

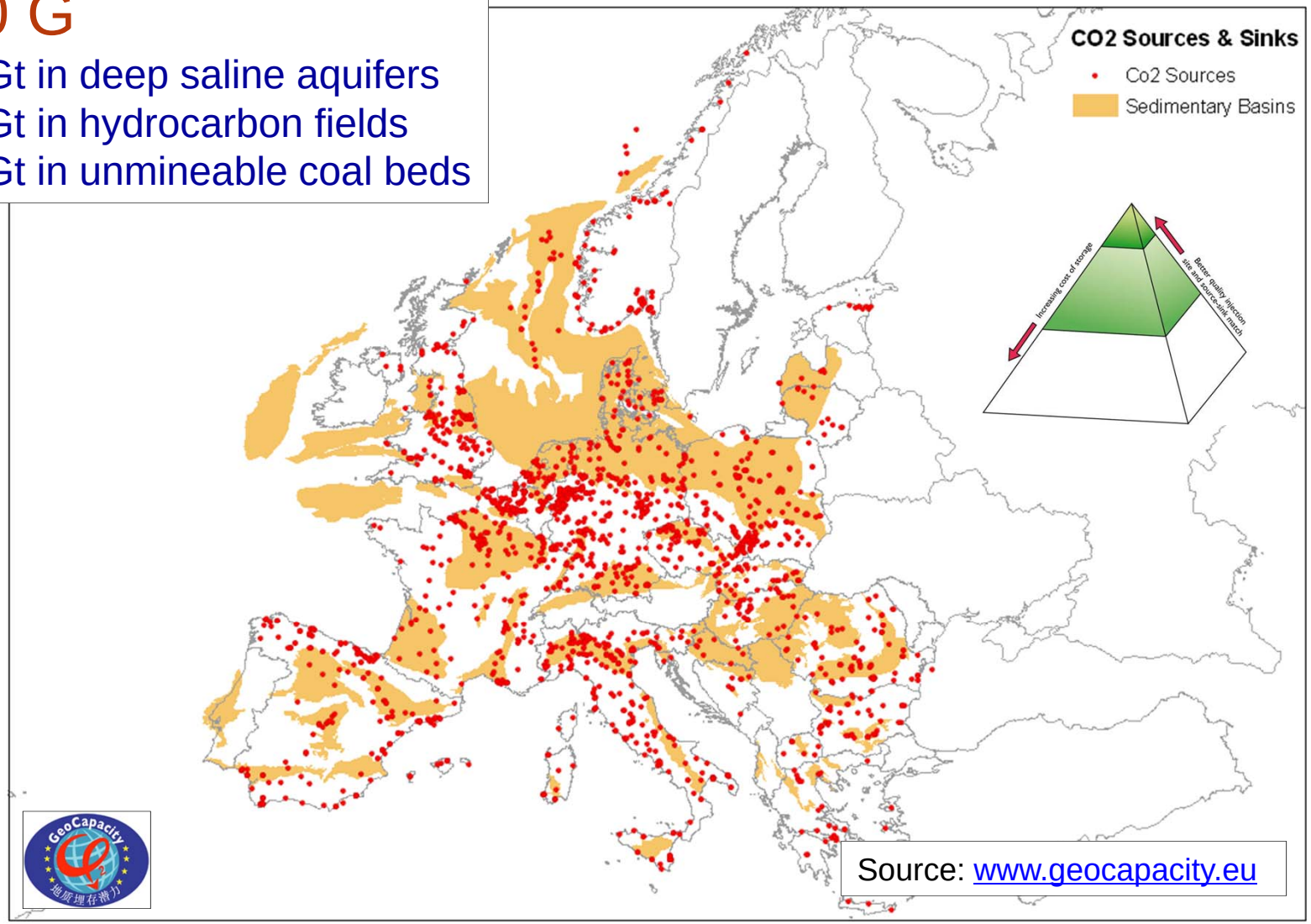
EU storage capacity (based on 20 countries)

360 G

326 Gt in deep saline aquifers

32 Gt in hydrocarbon fields

2 Gt in unmineable coal beds



Source: www.geocapacity.eu

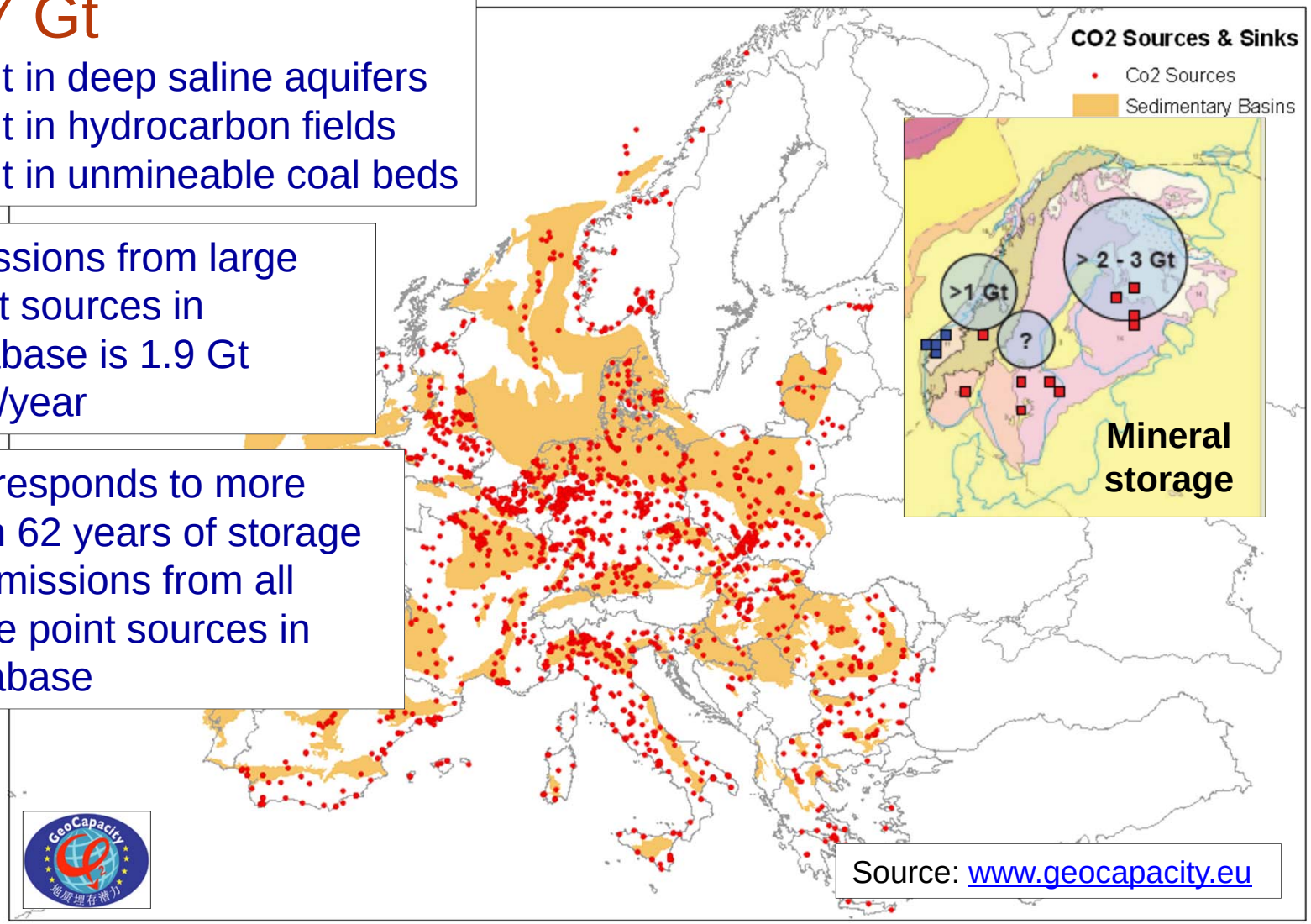
EU storage capacity (based on 20 countries)

117 Gt

96 Gt in deep saline aquifers
20 Gt in hydrocarbon fields
1 Gt in unmineable coal beds

Emissions from large point sources in database is 1.9 Gt CO_2/year

Corresponds to more than 62 years of storage of emissions from all large point sources in database



Source: www.geocapacity.eu


Thank you for your attention