# Geological storage

- **What learnings are happening ?**

  - **Are the uncertainties & problems being resolved ?**
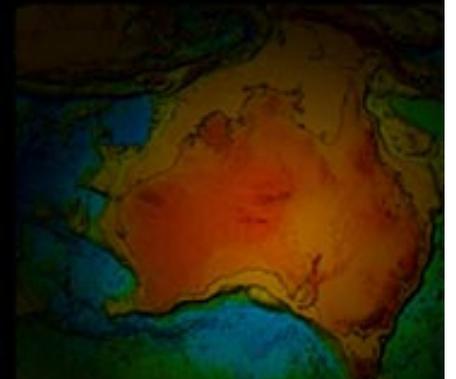
The Sleipner CO2-injection into the Utsira Formation at 1000 Meters Below Sea Bottom
- About 1 million tons/yr -

Geography of Sleipner

Utsira Formation

NORWAY

Sleipner License

Stavanger

SCOTLAND

NORTH SEA
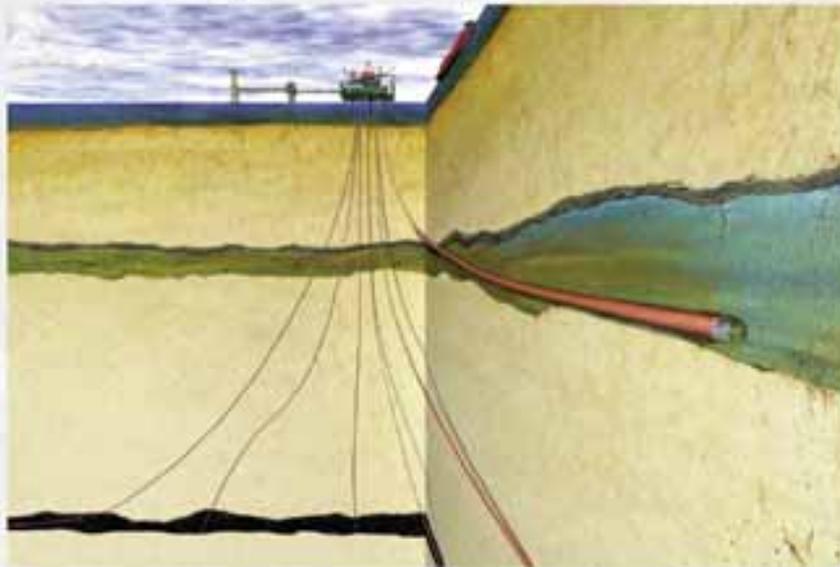
Permeability

- 1621 to 3252 mD (locally)
- 1100 to 8140md regionally

Porosity

- 36 to 40%

Reservoir model of CO$_2$ after 3 years
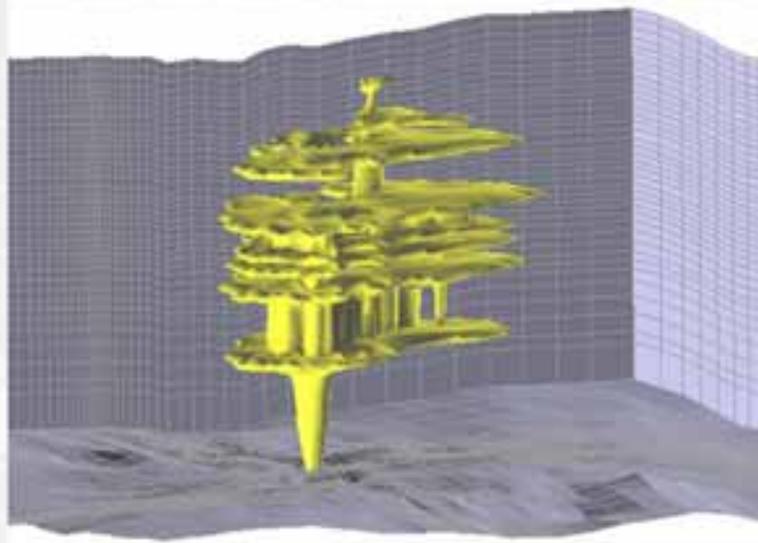
Source: SACS, Best Practise manual 2003

3D Seismic survey at Sleipner

1996   1999   2001
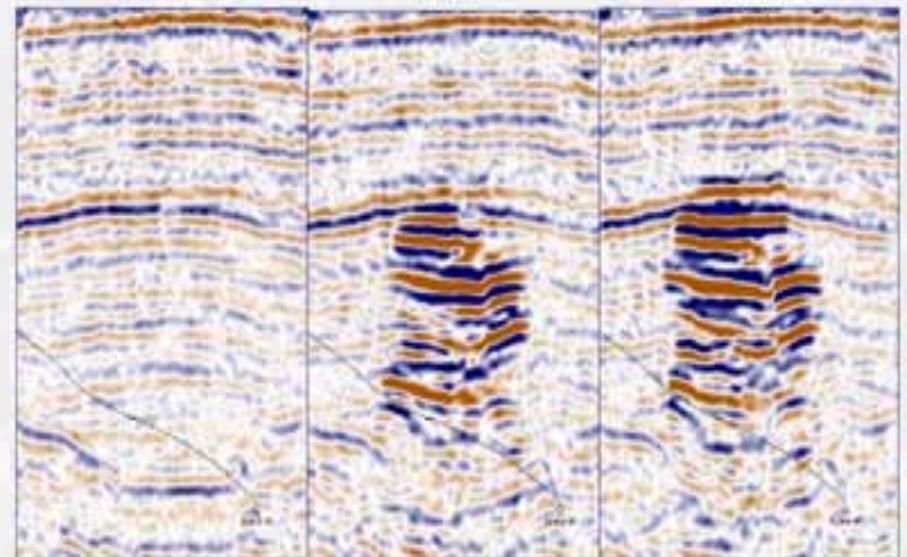
Source: SACS, Best Practise manual 2003

Sleipner

- **Hydrodynamic / solution style trap**
- **Huge reservoir**
  - **Area – 26,000 km ^{2}**
  - **Thickness – up to 300m**
  - **Marine Depositional system**
- **Enormous storage capacity**
  - **0.135 km ^{3} (0.3% theoretical storage efficiency)**
  - **100s years of regional emissions**
- **Fantastic reservoir qualities**
  - **Permeability : 1621 to 3252 mD (locally) & 1100 to 8140md regionally**
  - **Porosity : 36 to 40 %**
- **Only 1 Injection well - @ 1 Mt CO_2 / yr**
- **In many ways "<u>unique</u>"**
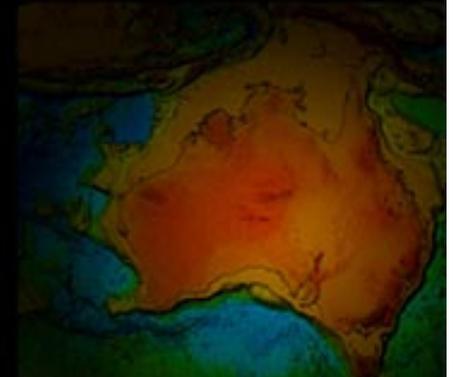
In Salah CO₂ Storage Operation
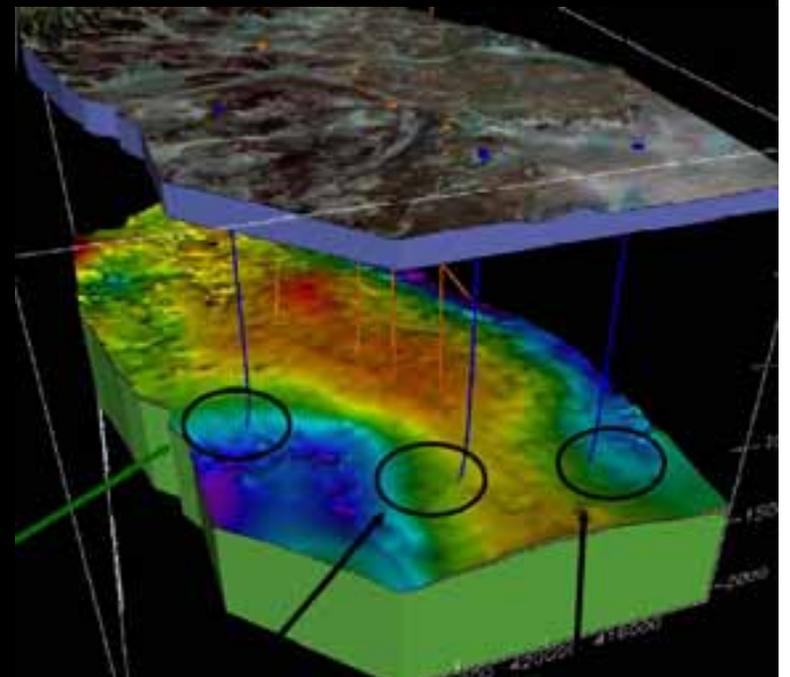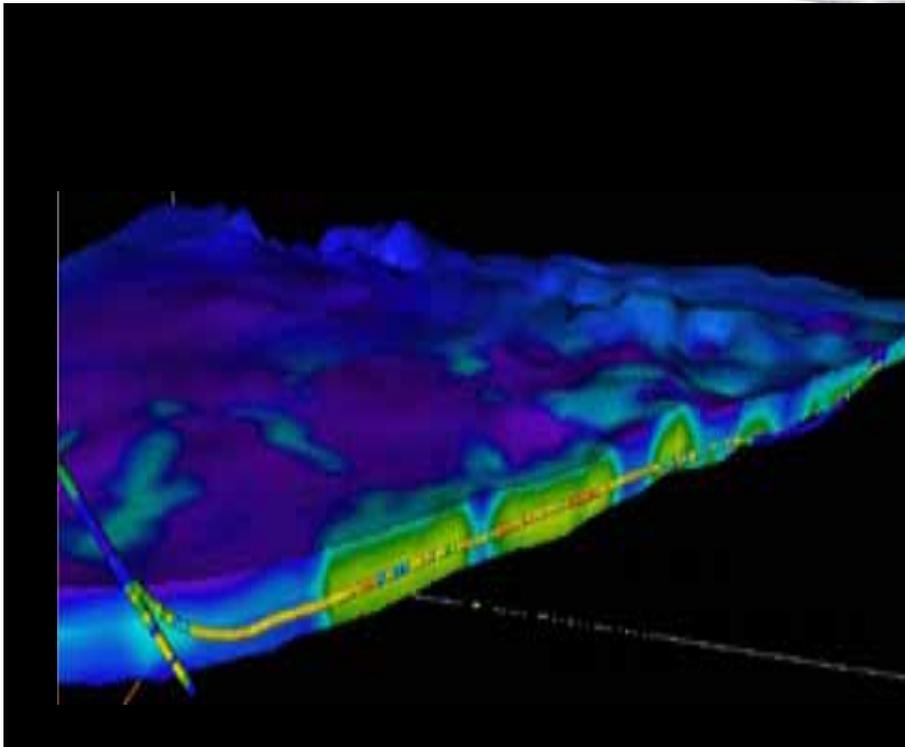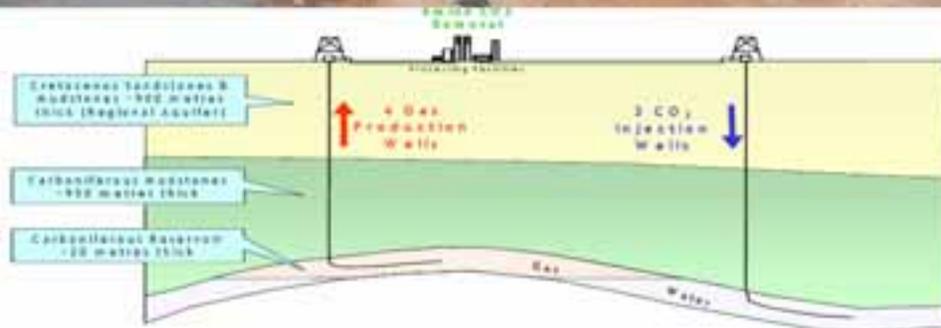
In Salah

- **Local anticline trap**
- **Reservoir distribution**
  - **Locally discontinuous - not widespread**
  - **Thickness - 20m**
  - **Non-marine depositional system**
- **Storage Capacity modest (single trap)**
  - **Local solution only**
- **Less than optimal reservoir**
  - **5 – 25 mD permeability (1 / 400th of Sleipner)**
- **3 Injection wells – 1500m of horizontal perforation @ 1 Mt CO_2 / yr**
- **But it is only 20km from emission site !**

Marine Depositional Systems

Deltas – form on continental margins

Extensive deposition – and thick

Excellent reservoir quality sands

Stacked, widespread and interconnected
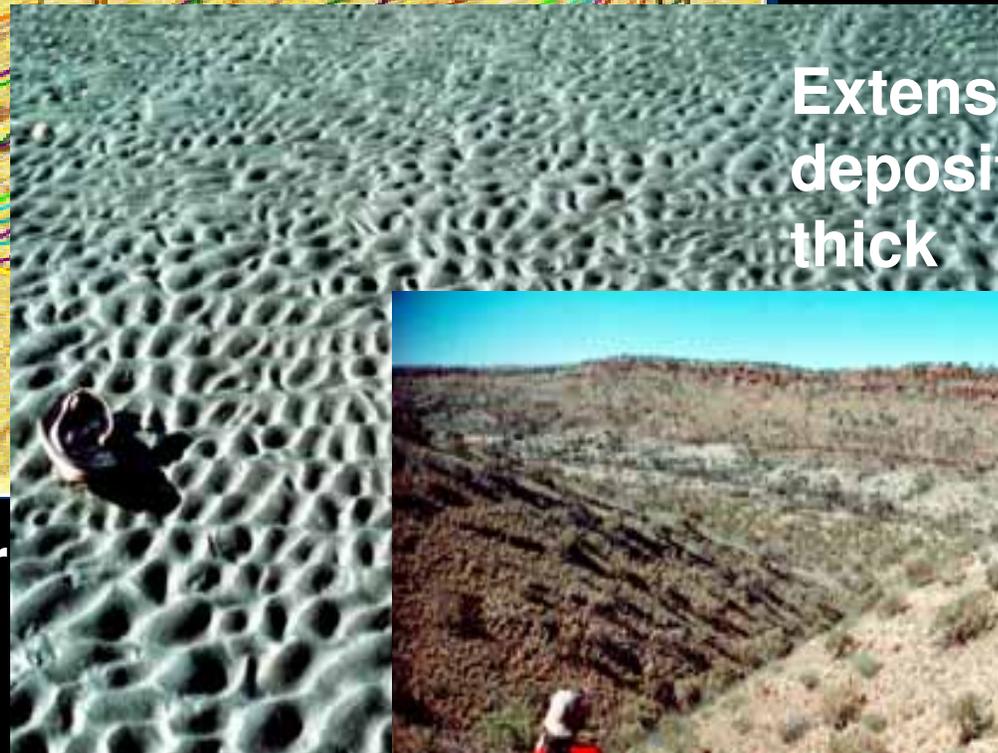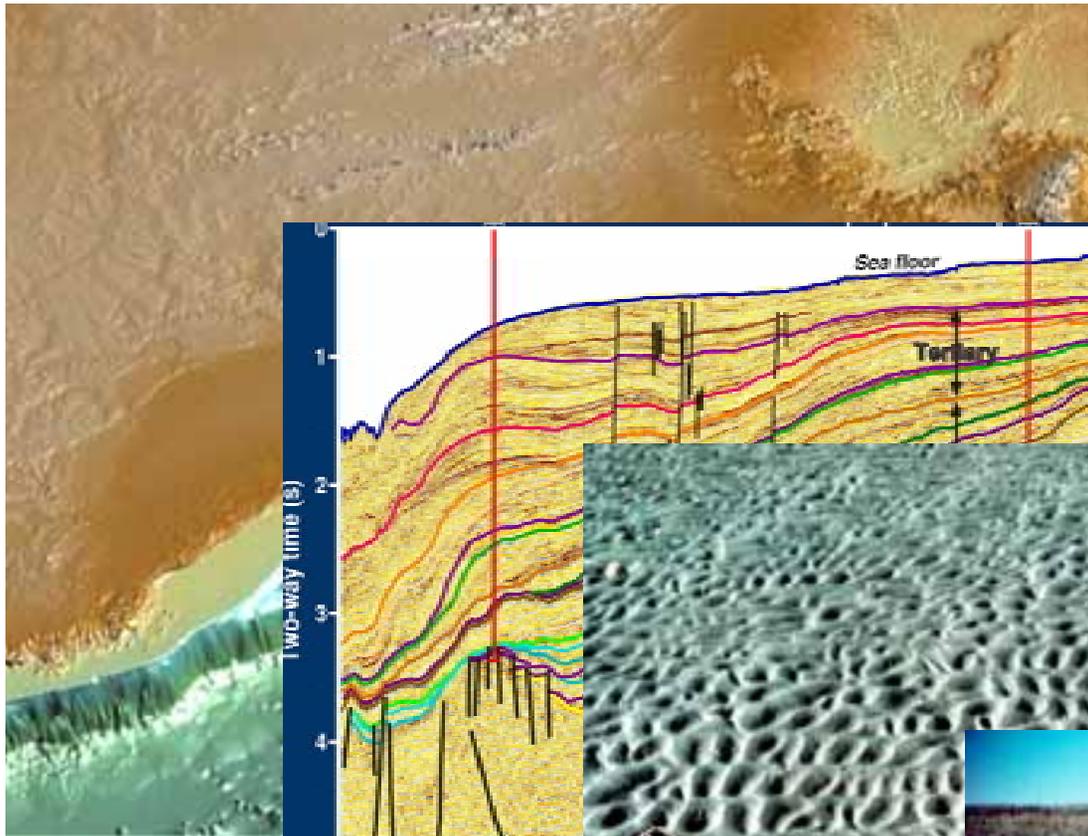
Non-Marine Depositional Systems

Landform modification - glaciation

Receding glaciation, river erosion & deposition

Sand

Shale

Widespread river plain deposition

Disconnected reservoirs – often thin, difficult to predict & image

channels up to 5 m thick ~ 10m wide
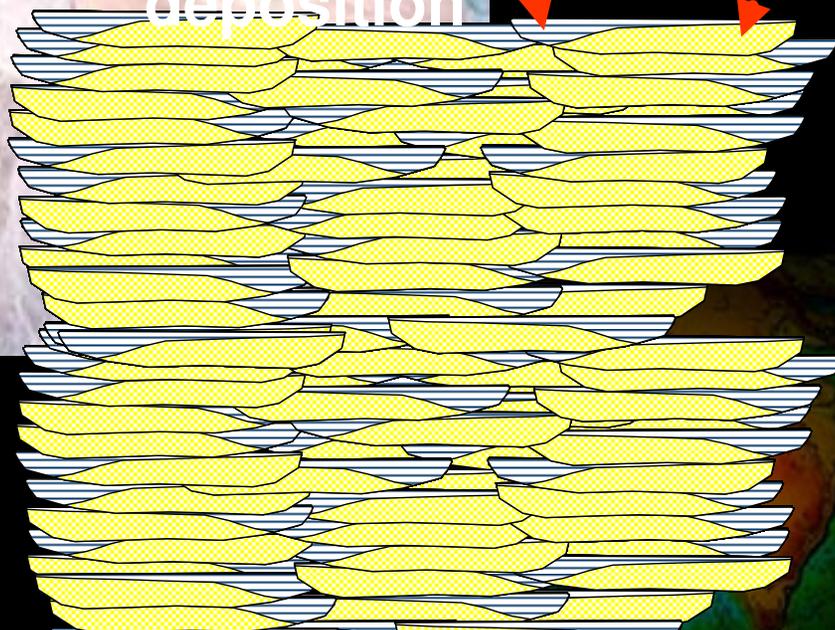
Marine vs Non-marine deposition

- **Different geological settings:**
- **Will influence reservoir quality and distribution**
- **Will influence seal quality & integrity**
  - **Regional - marine**
  - **Local – non-marine**
- **Offshore vs onshore (current day)**
  - **Development & cost issues**
- **Coal basins i.e. power stations locations**
  - **Generally non-marine – reservoirs / seals often not as optimal** (but need to do assessments to verify)