Unlocking remaining potential on a field with world-class recovery

Øyvind Kvam, OKEA ASA

Technology priorities in OKEA

- Optimise tie-backs
- Reduce cost for decomissioning
- Increase production and optimise maintenance
- Cost-efficient D&W operations and extended reach wells
- Improve reservoir characterisation and modelling
- Reduce environmental footprint
- Improve QHSSE performance including major accident risk

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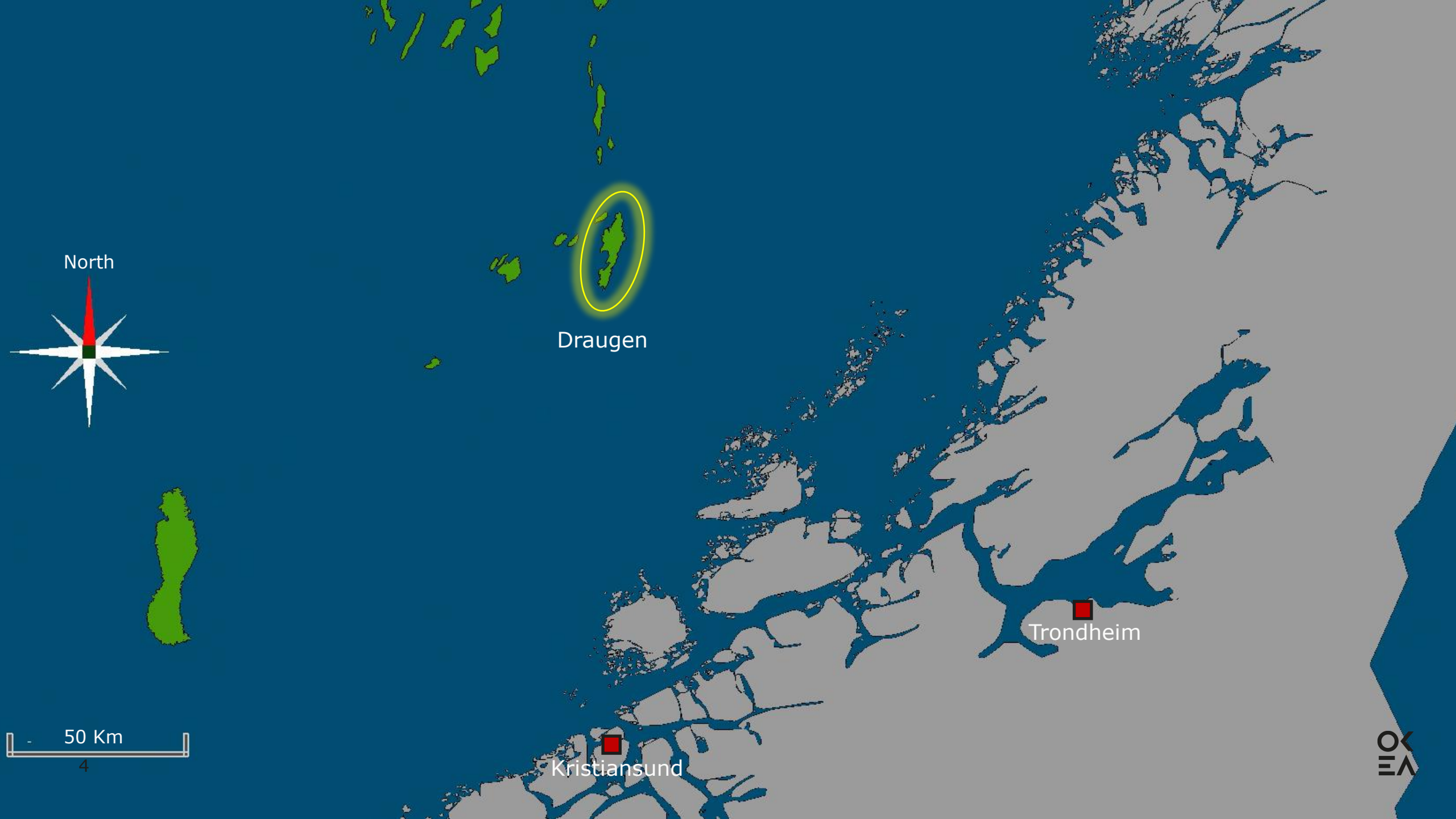
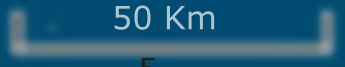
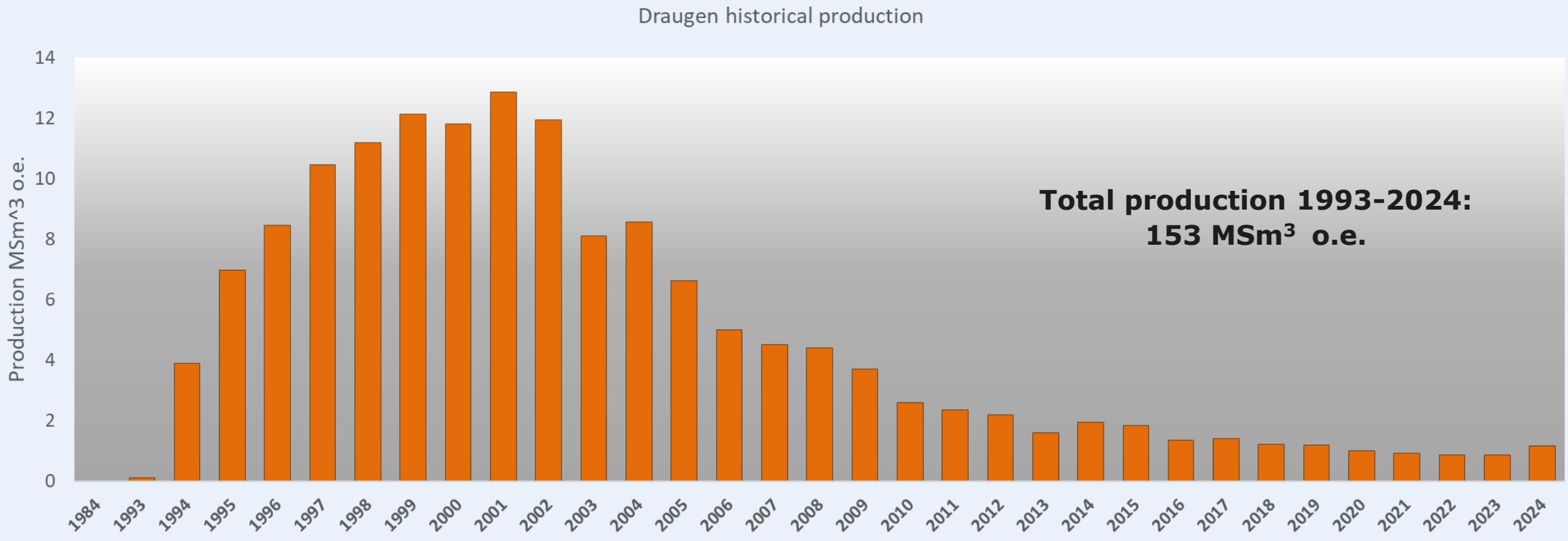

North
Draugen
Trondheim
Kristiansund
50 Km

Draugen Fact Sheet

- **Discovered 1984, PDO 1988**
- **Fixed concrete platform**
- **Production Startup 1993 (A/S Norske Shell)**
- **OKEA Operator from 2018**
- **License Owners: Petoro (47.88%)**
  OKEA ASA (44.56 %)
  M Vest Energy AS (7.56%)
- **Reservoir: Rogn and Garn Fms. (Late Jurassic)**
- **Hasselmus tie-in from 2023 (Mainly Gas)**



Historical production



Operator

Towards 2040 and beyond..

2018 OKEA operator

2019 Appraisal well drilling Skumnisse and infill Ø

2023 Apraisal well drilling Garn West South and Springmus

2023 New subsea booster pumps (IOR)

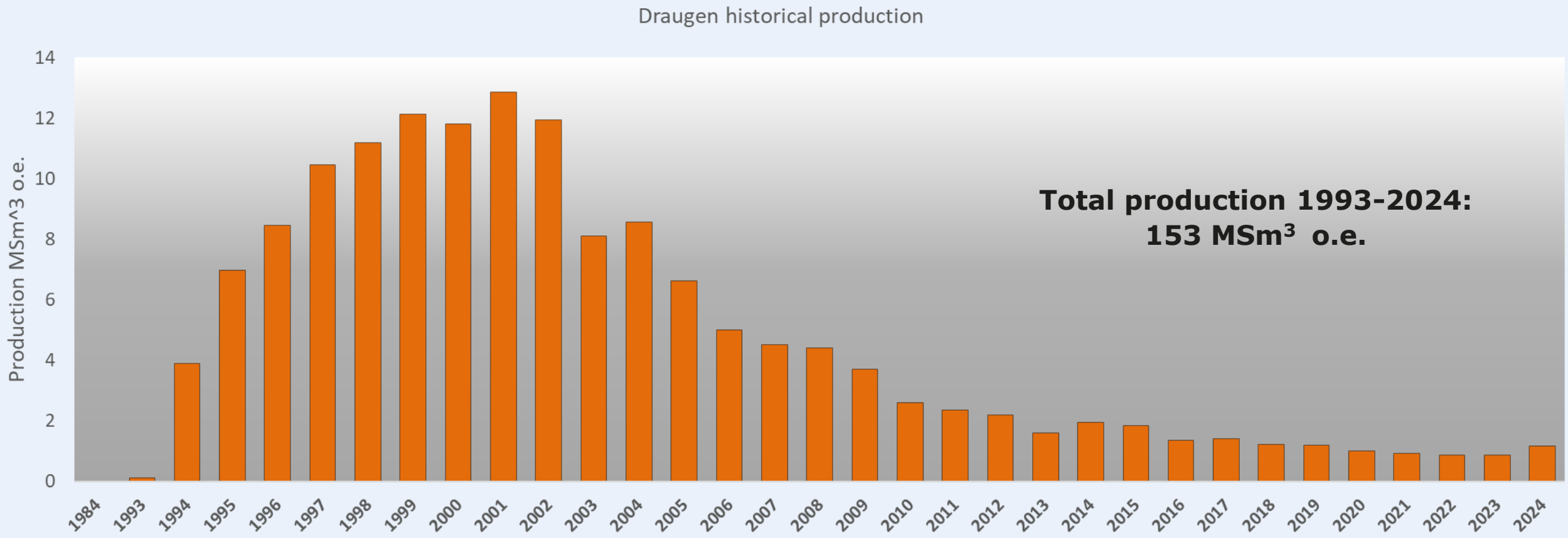
2023 Hasselmus first gas (subsea tie-back)

2024 Licence and lifetime extension to 2040

2026 Garn West South (extended reach well)

2028 Power from shore

2028-2040+ Future asset and area development



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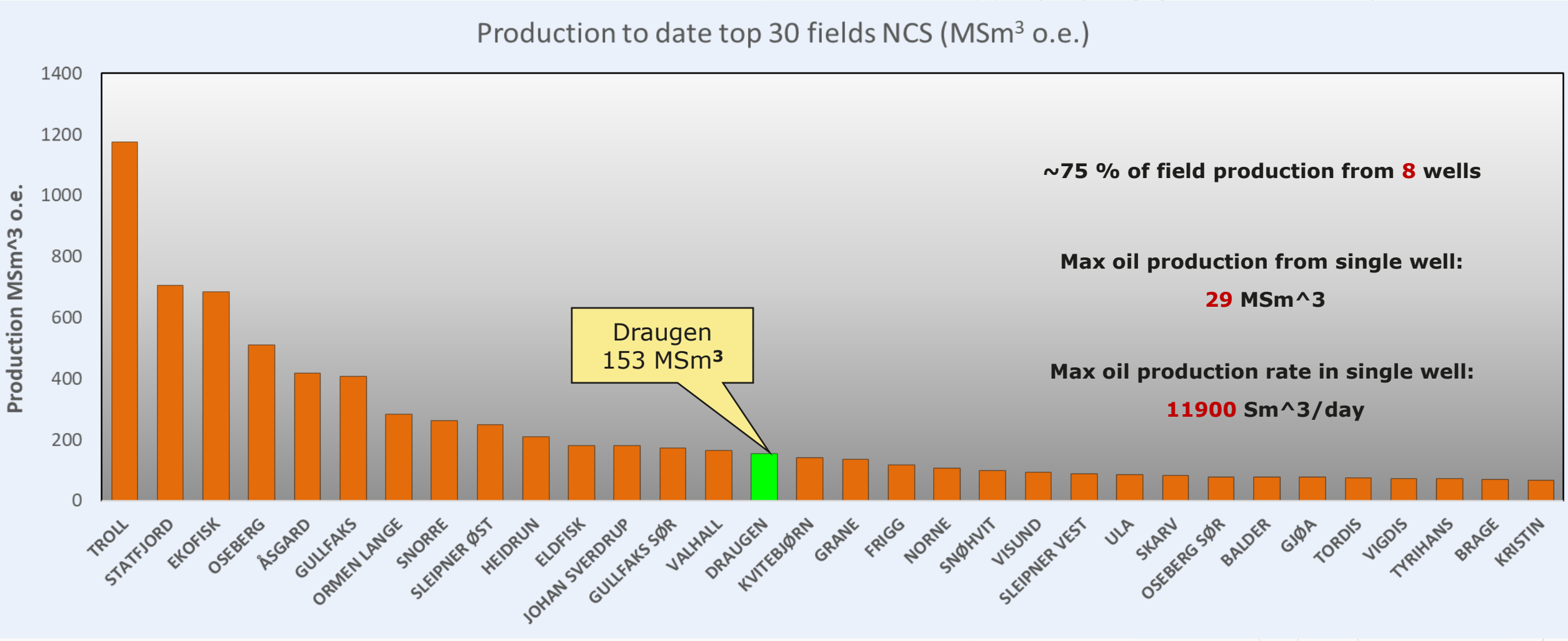
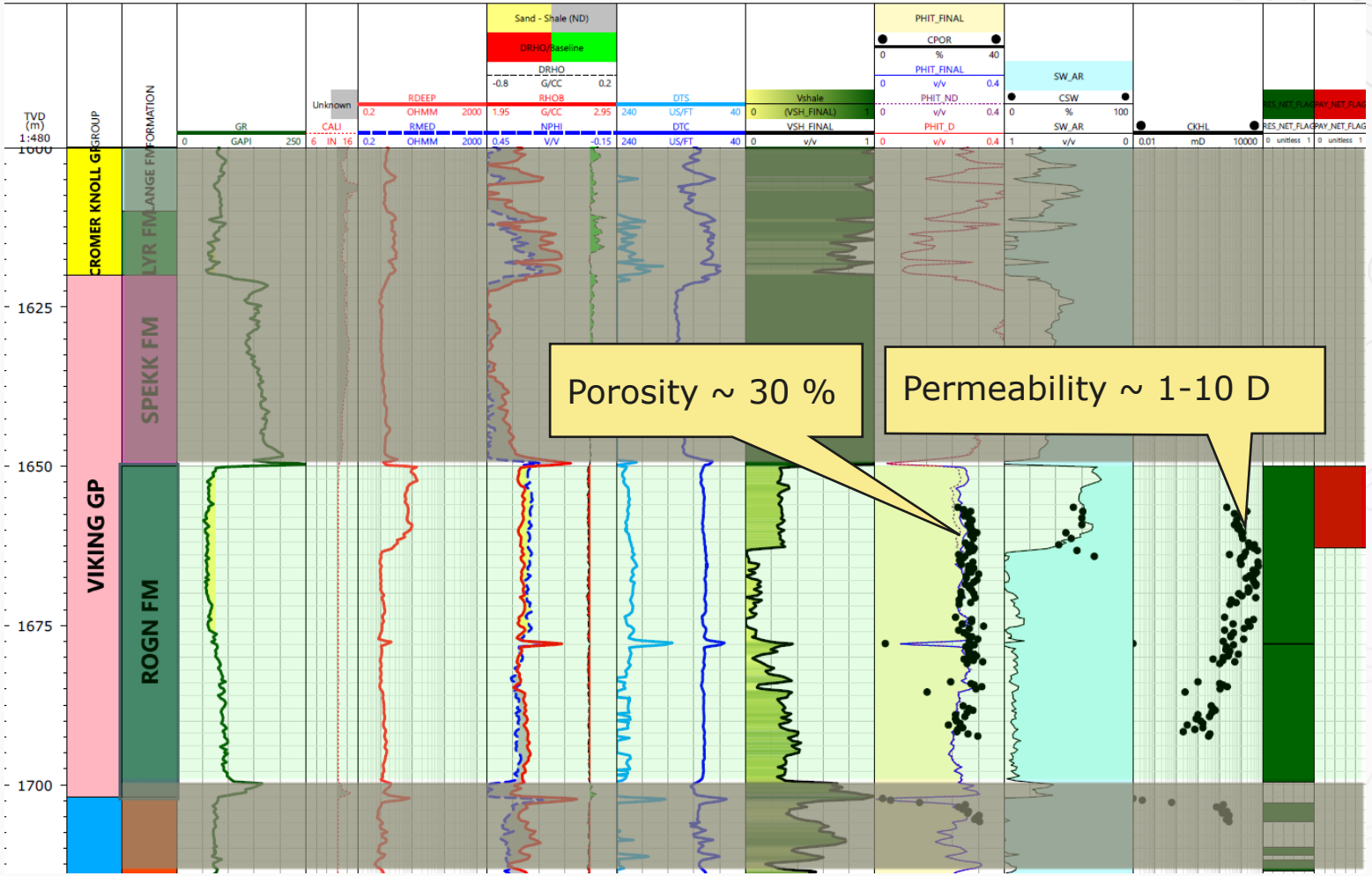
Draugen in NCS context

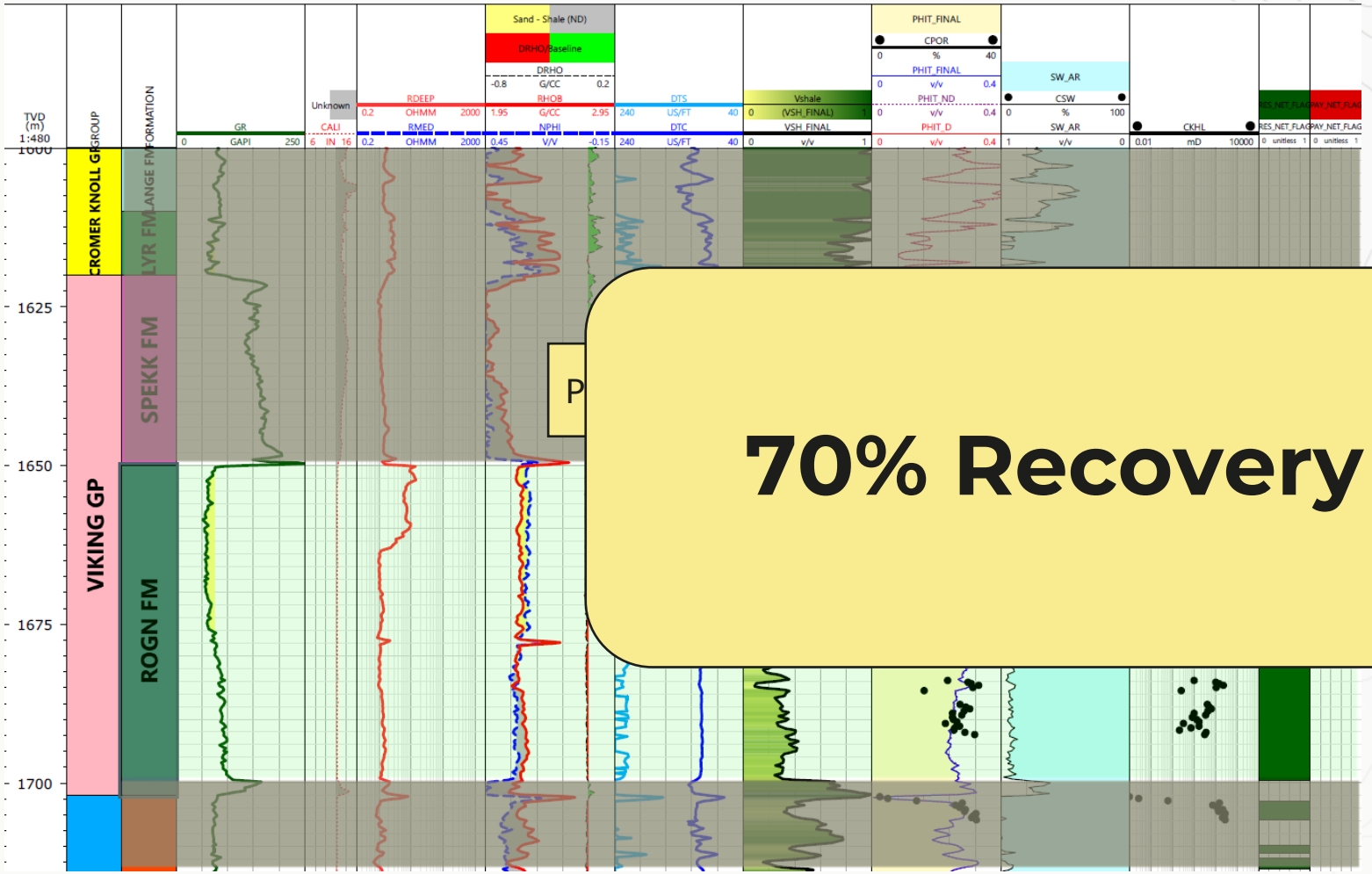


- Source: Norwegian Offshore Directorate

World Class Reservoir Properties…



… and World Class Recovery



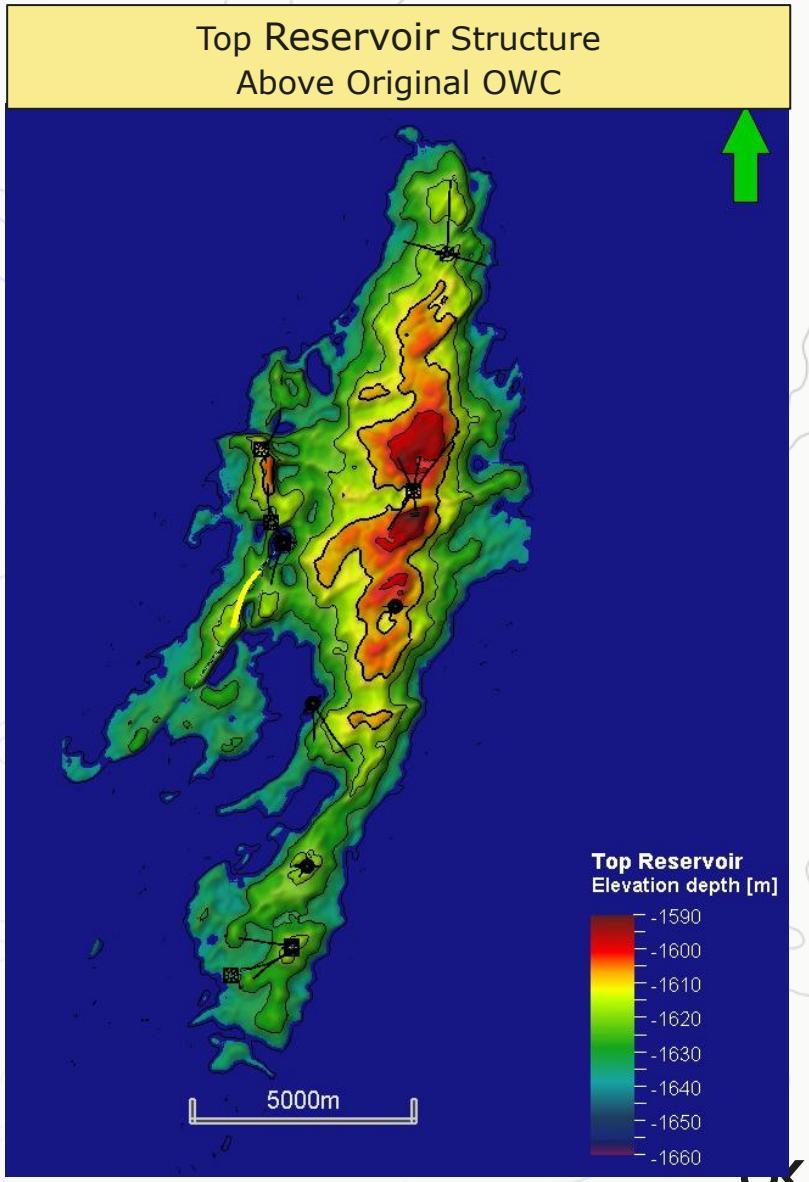
70% Recovery

Challenging barrels on Draugen

- Main goal
  - Extend the field life to 2040 and beyond

- Some key challenges:
  - Identifying and developing robust drilling targets
    - Marginal targets
    - Reservoir mapping
    - Drilling extended reach wells (no platform drilling)
  - Managing aging infrastructure
  - Limited gas capacity (tie-ins)

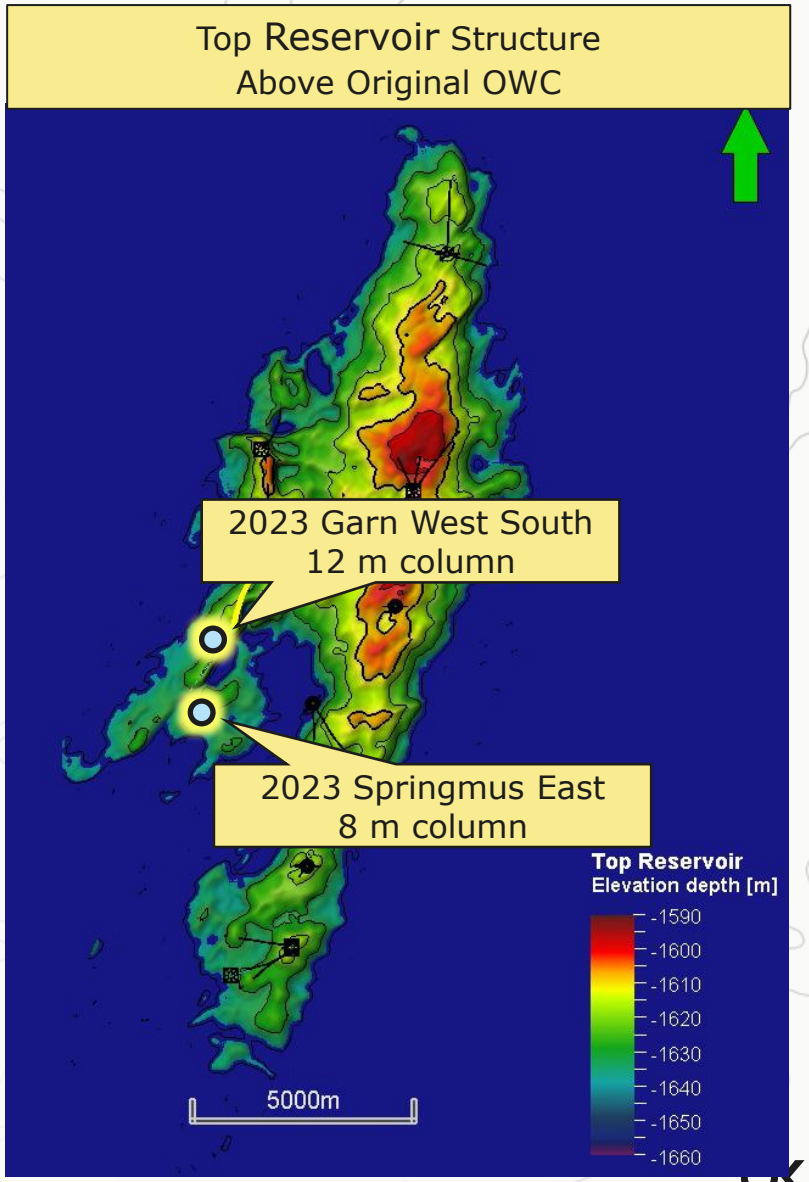
- Next: Springmus East case study



Observation well campaign 2023

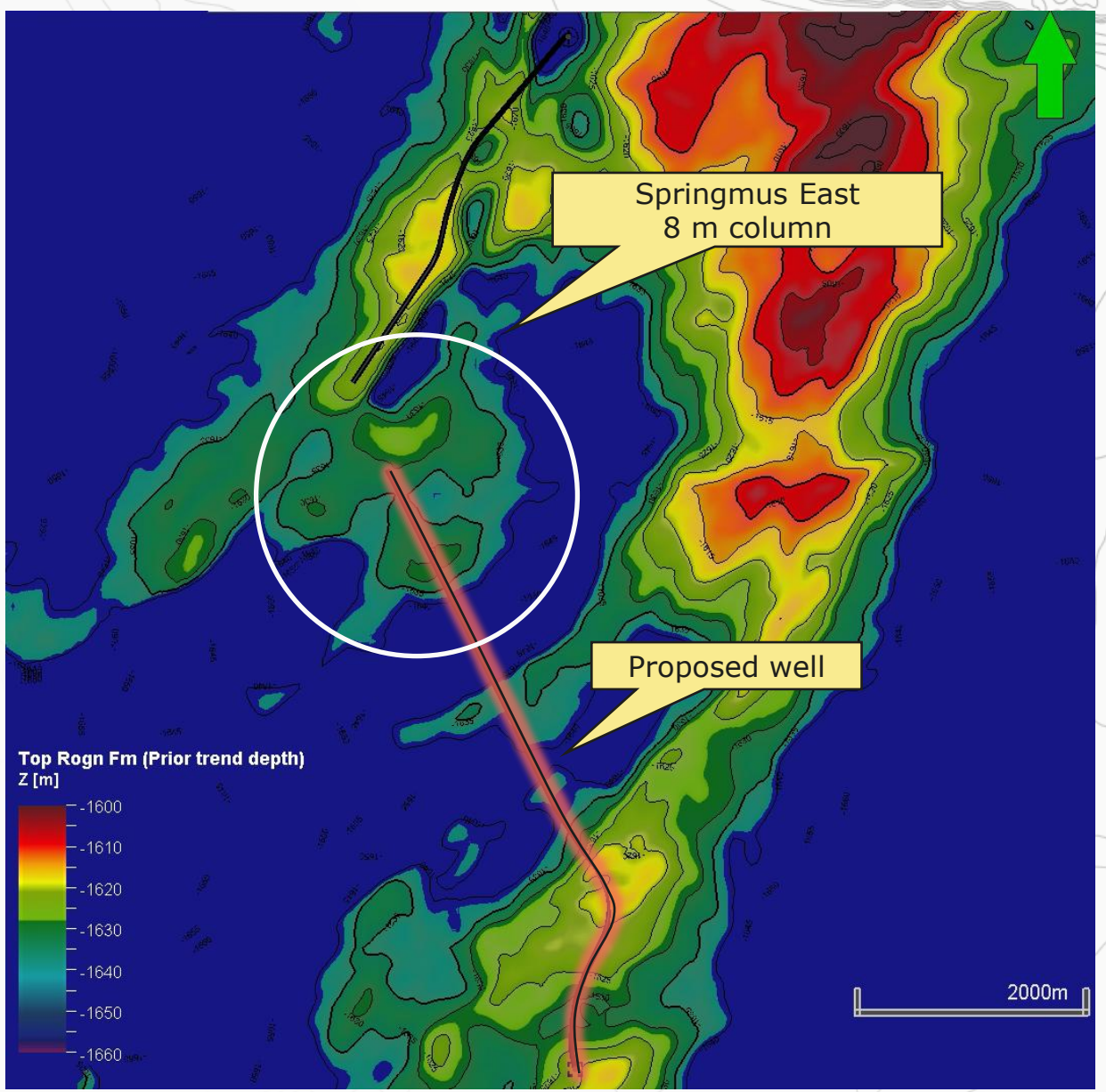
- Observation wells drilled to confirm targets

1. Garn West South
   - 12 m Column
   - Producer to be drilled this year (sidetrack from existing well).
2. Springmus East
   - 8 m column
   - Target maturation ongoing



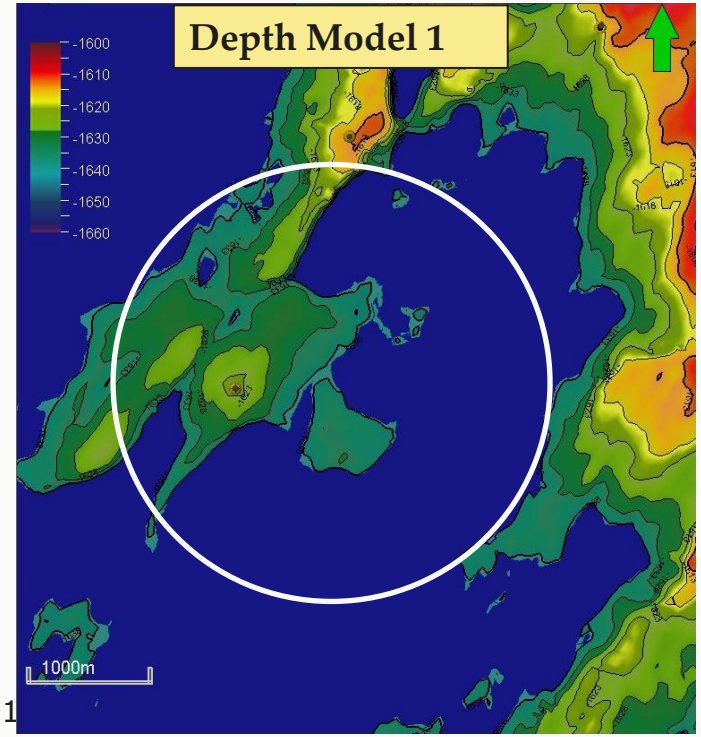
Springmus East

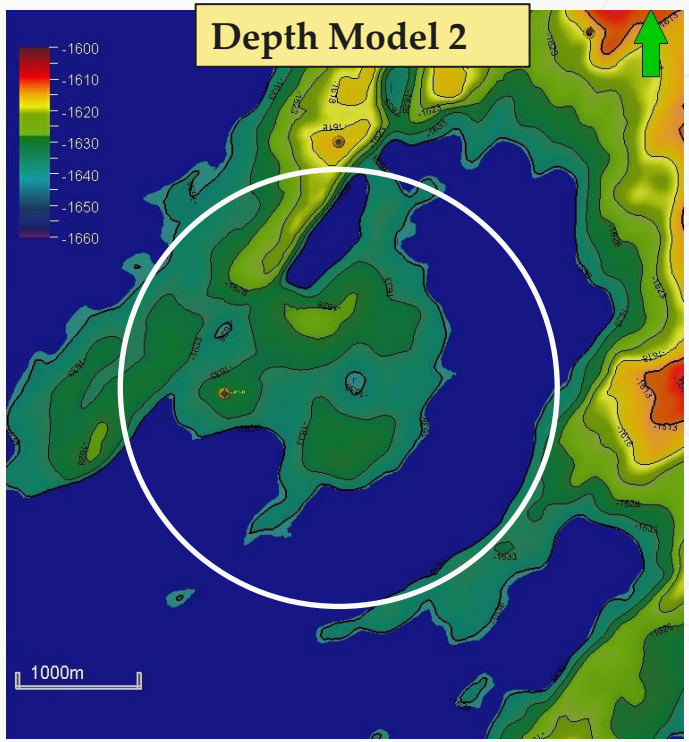
- Structural high SW of Draugen platform
- Evaluating cost-efficient development options
  - Utilise subsea infrastructure
  - Side track from subsea well in south
- Challenges:
  - **4300 m** horizontal section (transport + reservoir)
  - **4 times longer** than the longest well on Draugen to date..
  - Need to stay clear of unstable shales
  - Small margins and uncertain mapping

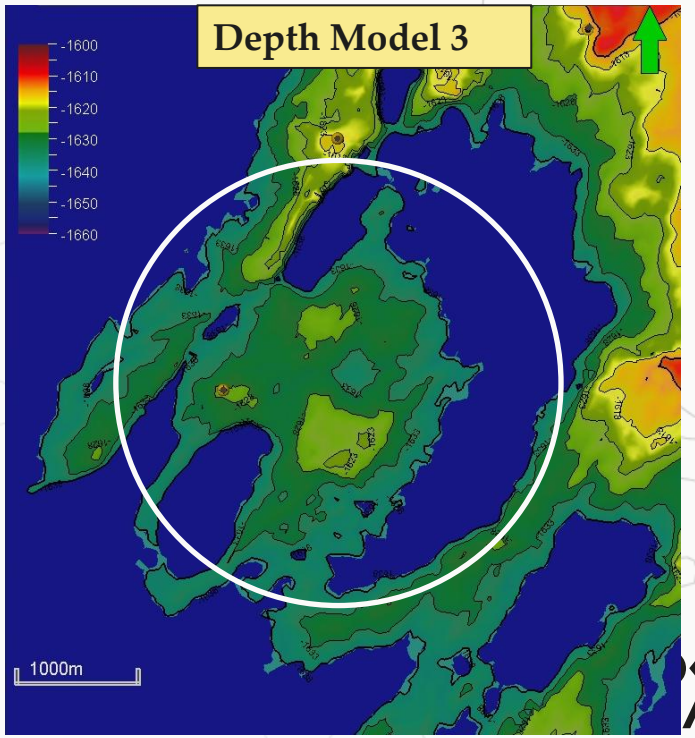


Structural uncertainty

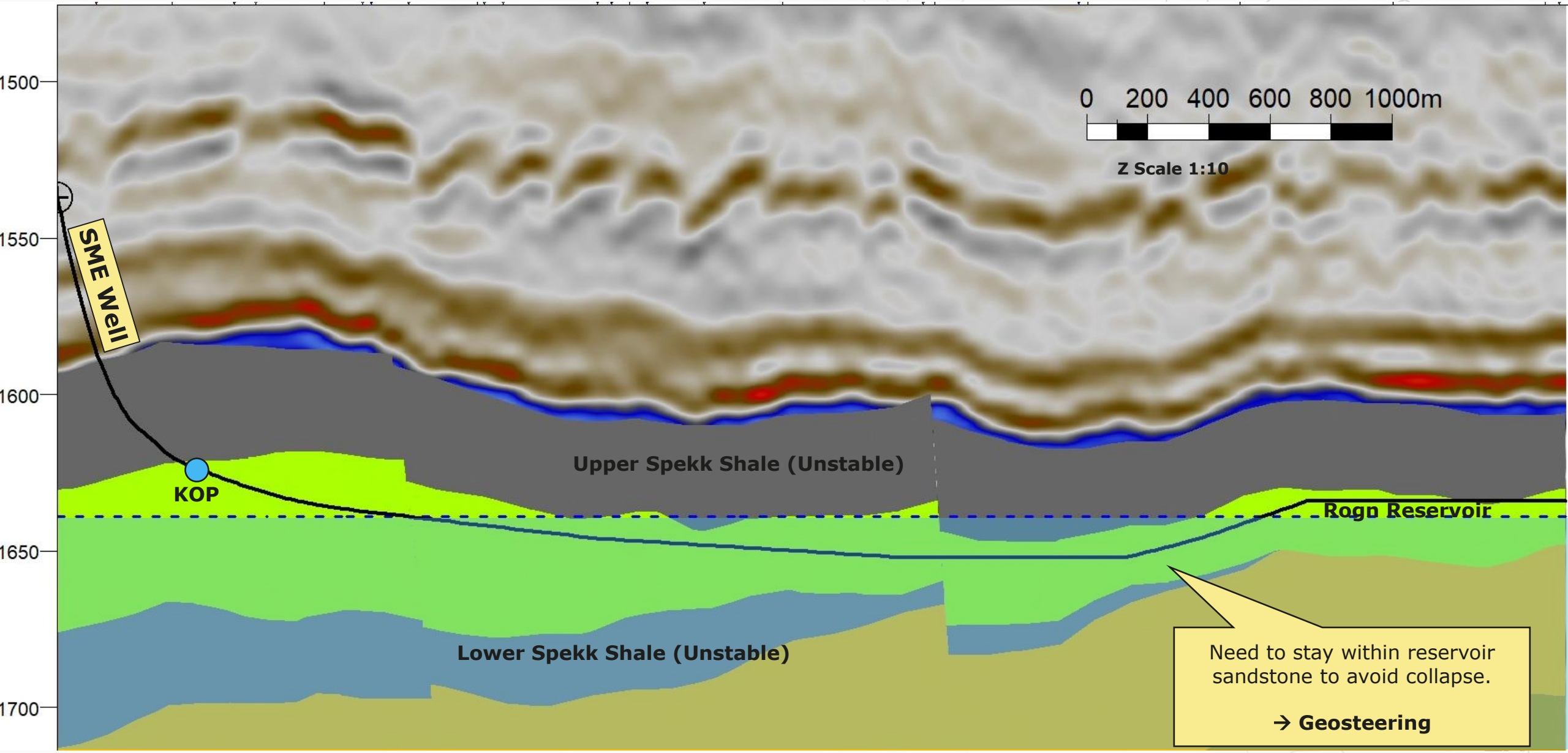
- Flat structure
- In-place volumes very sensitive to depth conversion
- Structural uncertainty is challenging for drilling.
- Continuous improvement (Data acquisiton, Seismic re-processing, modeling software ..)



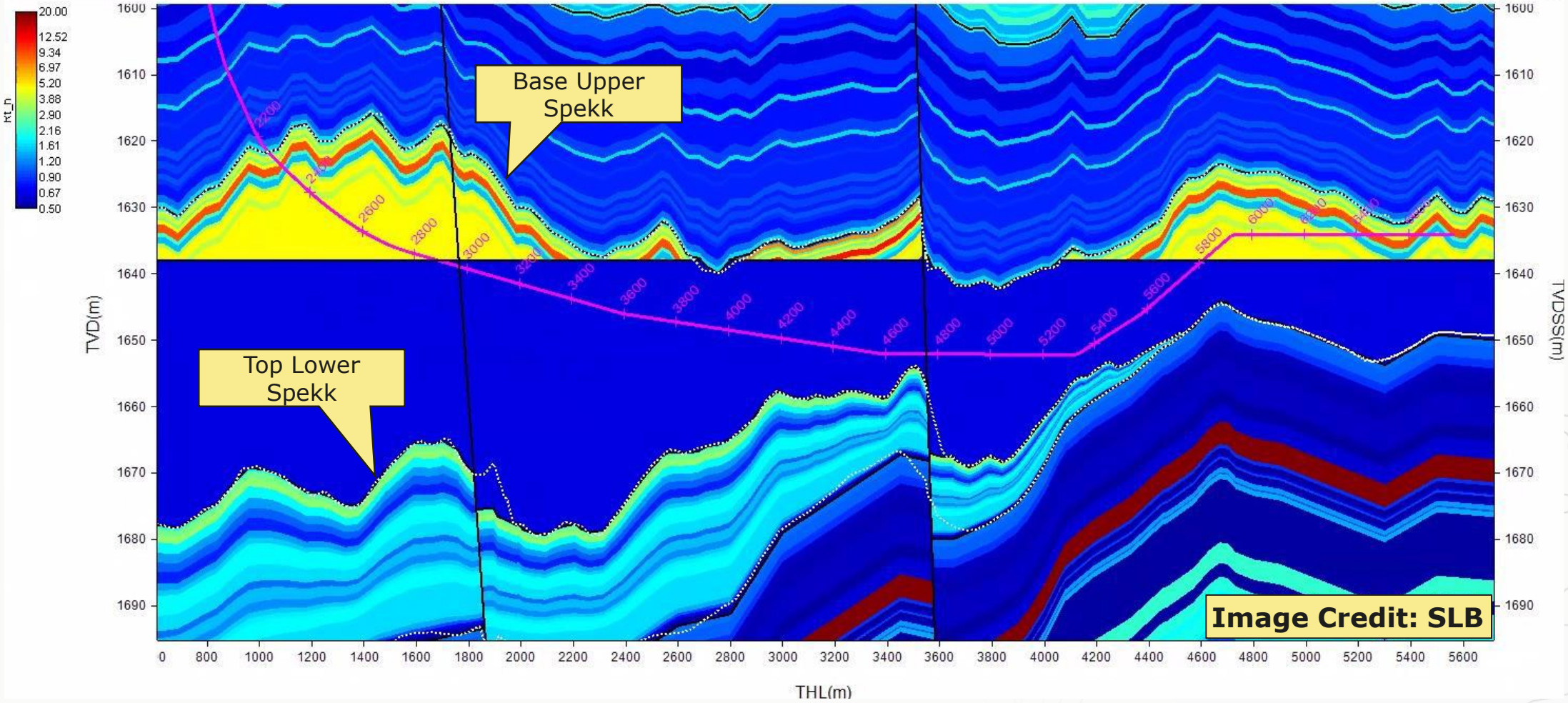




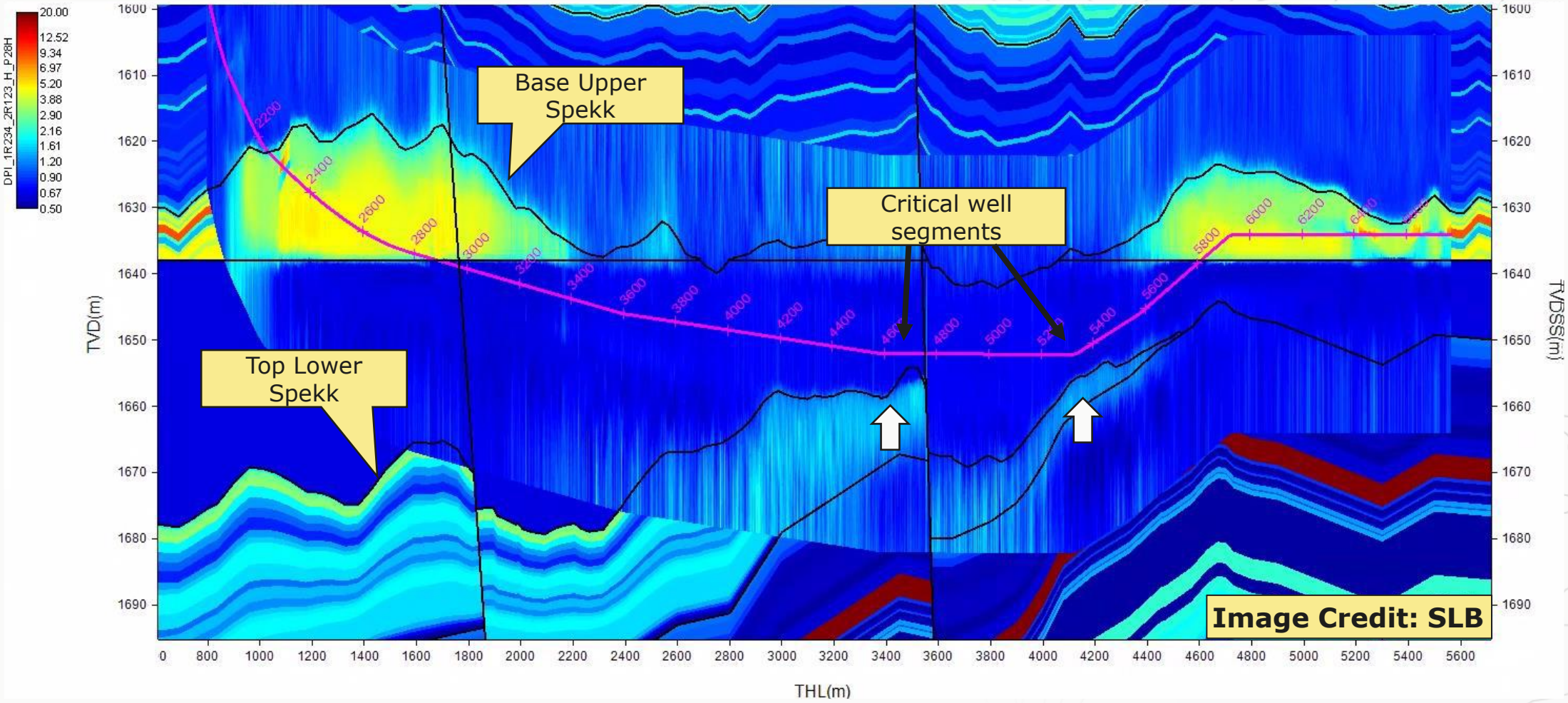
Springmus East well profile view



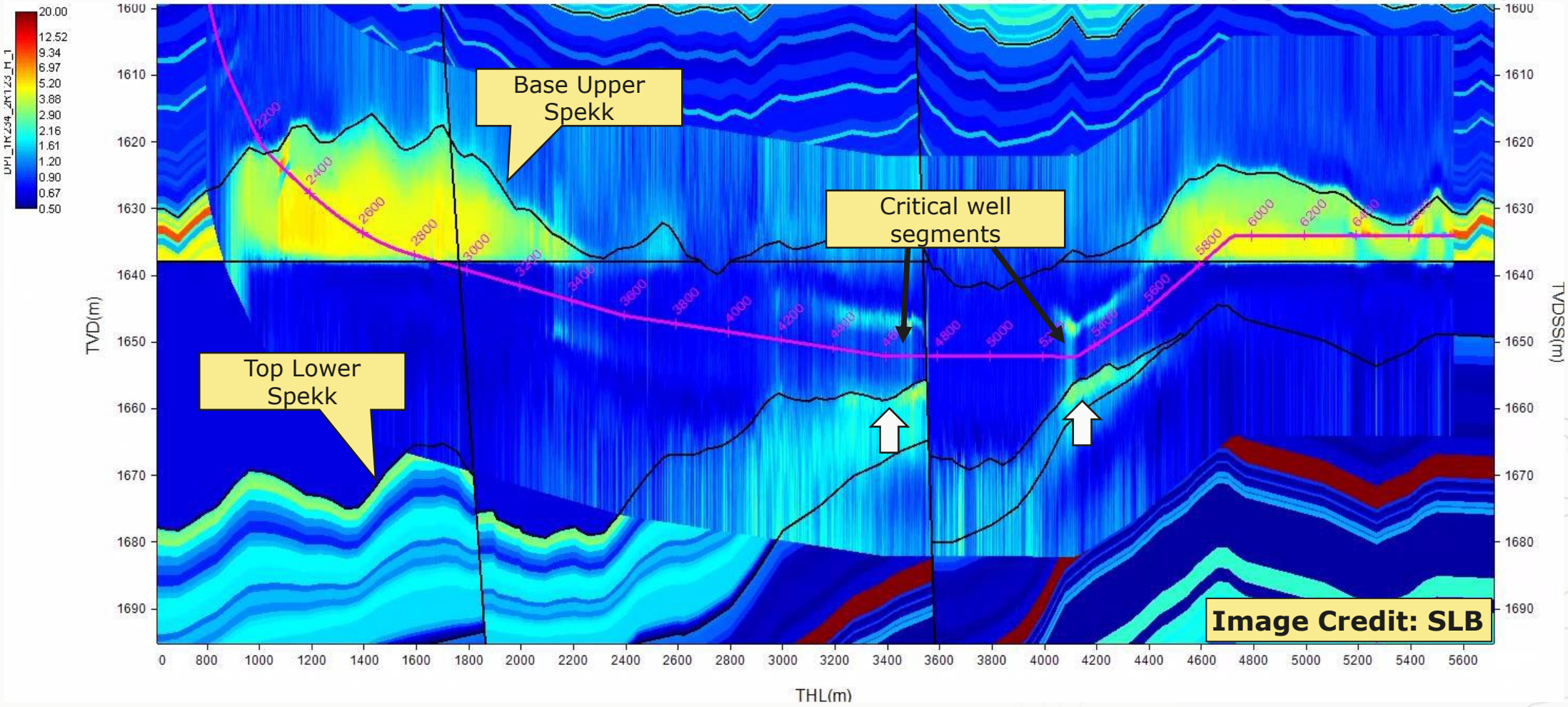
Geosteering – resistivity model



Geosteering – modelled tool response



Geosteering – modelled tool response including shale anisotropy



Summary

- Draugen is an old field with ambitions for the future
- OKEA and license partnes want to extend field life to 2040 and beyond
- Key challenges:
  - Reservoir mapping
  - Extended reach wells
- Geosteering crucial for
  - Well placement
  - Driling long reach wells
- Using anisotropic properties of Spekk shales to resolve low resisitivity contrast boundary

Thanks

Petoro

M Vest Energy AS

SLB

www.okea.no