



Don't Abandon Geophysics

The Value of Seismic Data for
Decommissioning & Restoration

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Agenda

- The big picture – decommissioning in the UKCS
- What we are trying to do – Legislation, guidelines and strategy
- Subsurface Isolation Strategy – How we decide where to isolate and the seismic contribution
- Gannet C Case Study

- I will not talk about :
 - Assessment for 'Cessation of Production'

Decommissioning in the UKCS

Cost estimates increasing but
£18 BILLION
by 2025
£47 BILLION
by 2050 (today's money)

Total spend

2010: 2%
2015: 5%

2017: 12%
(£2 BILLION)

Wells
(P&A)
47%
of total
costs

OGA target
35%
cost reduction
by 2020

Over
500
Installations
(>100 platforms
by 2025)

3650 wells
1470 by 2025 | 180 per year
3000 pipelines
across 7130km

Cost per
well
£2 Million
(platform)
£8 Million
(subsea)
Despite low rates

Long expected
but
94%
of projects in
early
planning

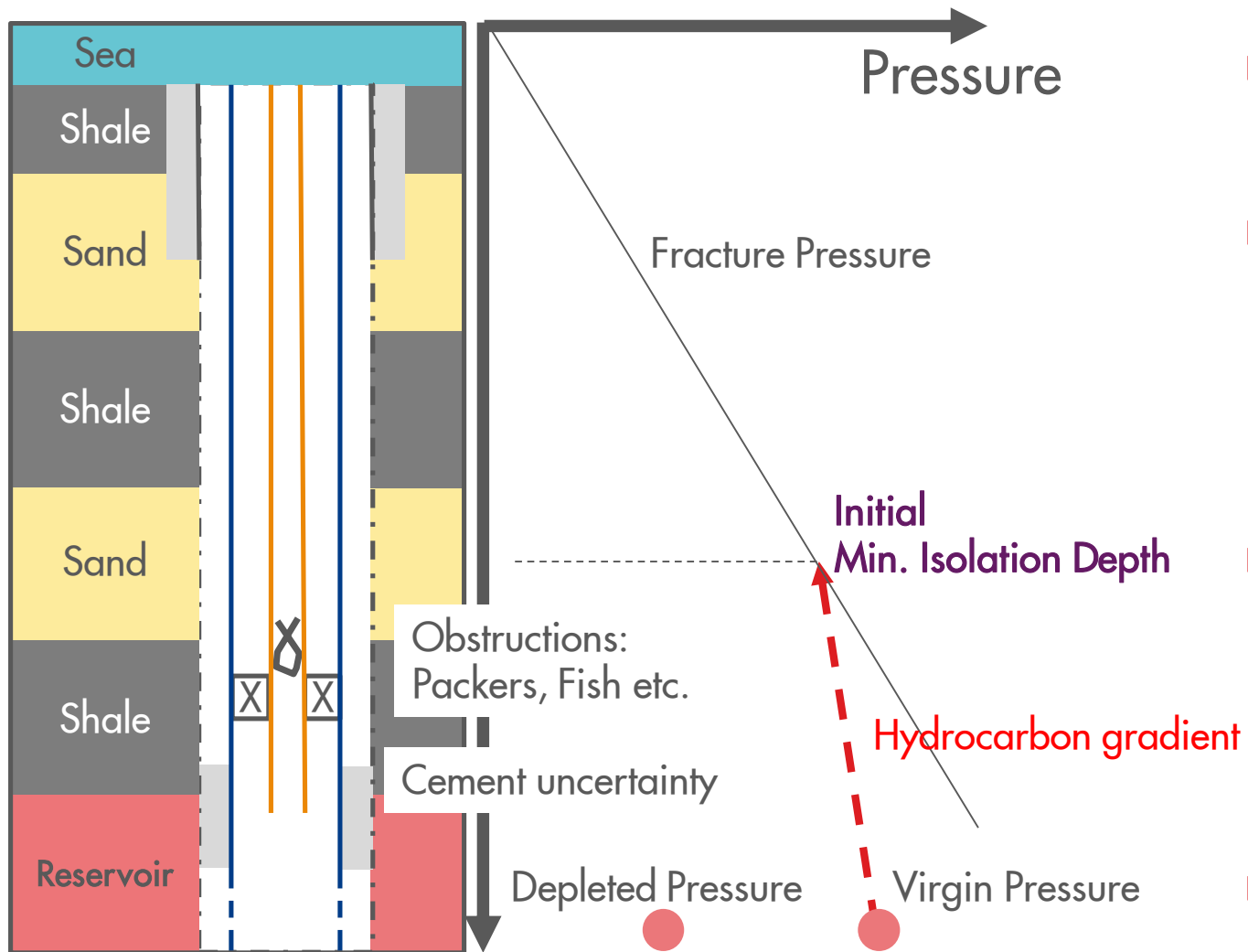
Legislation, Guidelines and Strategy – For ‘Perpetuity’

- **Industry Legislation***: “so far as is reasonably practicable, there can be no unplanned escape of fluids”
- **Industry Guidelines**** (Good Practice)
 - 2015 update: Isolate “flow potential” not “permeable zones”
 - Formations can be grouped if crossflow acceptable, allowing fewer isolations

* (The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996)
** (Oil & Gas UK Guidelines for the Abandonment of Wells (Issue 5, July 2015))

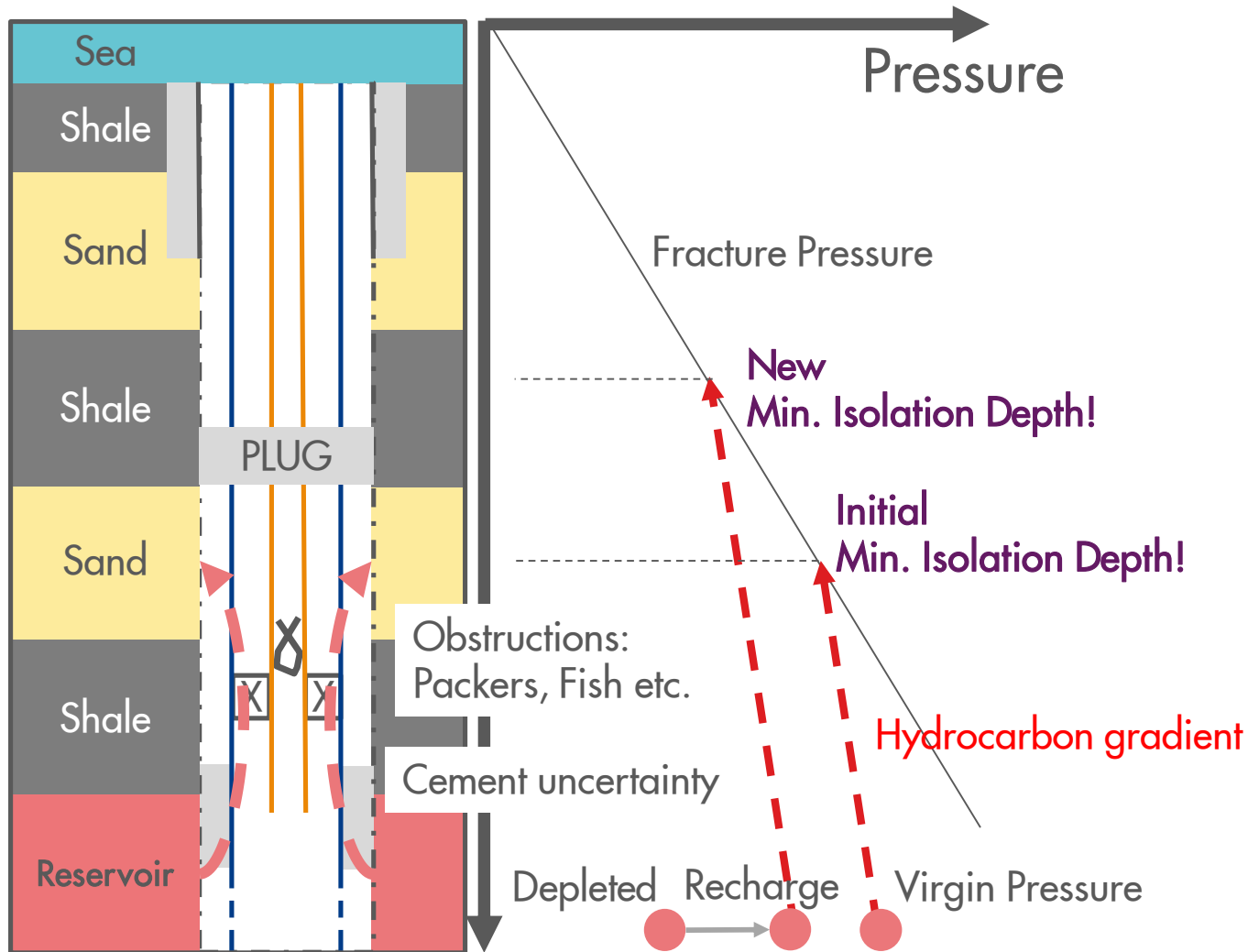
- An integrated **Subsurface Isolation Strategy (SIS)** is created to address:
 - Which formations to isolate
 - Which depth range isolations can be placed
- Integrated SISs reduced **300days scope and >350,000hrs** exposure from Shell UK subsea abandonment portfolio with significant additions from an optimised execution strategy.

Considerations for the SIS



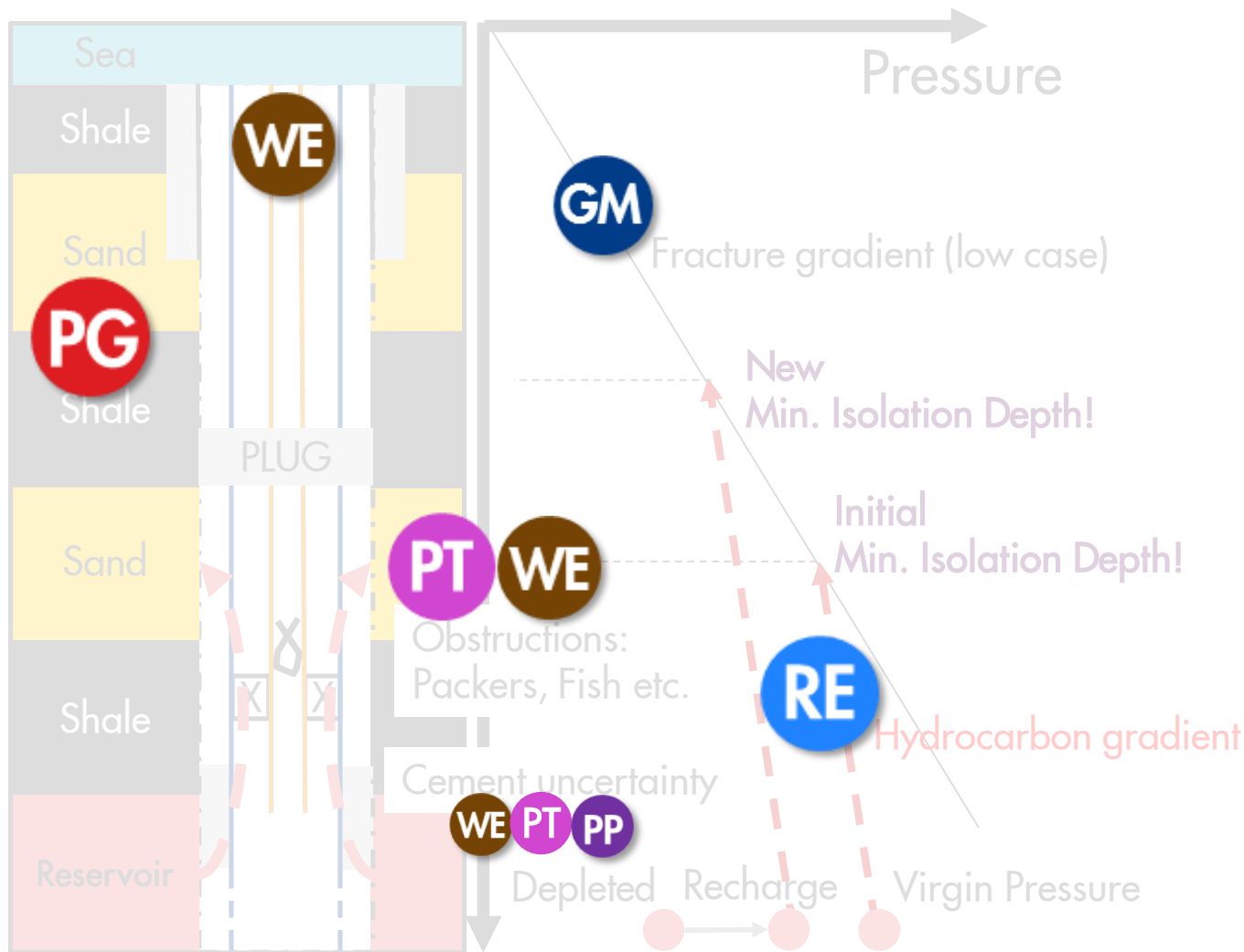
- Aim to isolate flow potential from surface
- However, obstructions make it difficult (costly!) to reach some depths and set plugs
- Avoiding obstructions with shallower isolations can create pressure/cross-flow risks
- Data mining is a key challenge

Considerations for the SIS



- Geophysics contributions:
 - Permeable/flow potential identification
 - Aquifer size
 - Connected reservoirs (+ aquifer)
 - 'Thief' sand extent & traps
 - Fault mapping (reactivation)
 - Connection to other wells
 - Introducing hydrocarbons/pressure to previously benign formations
- Repeat for the overburden!

Considerations for the SIS

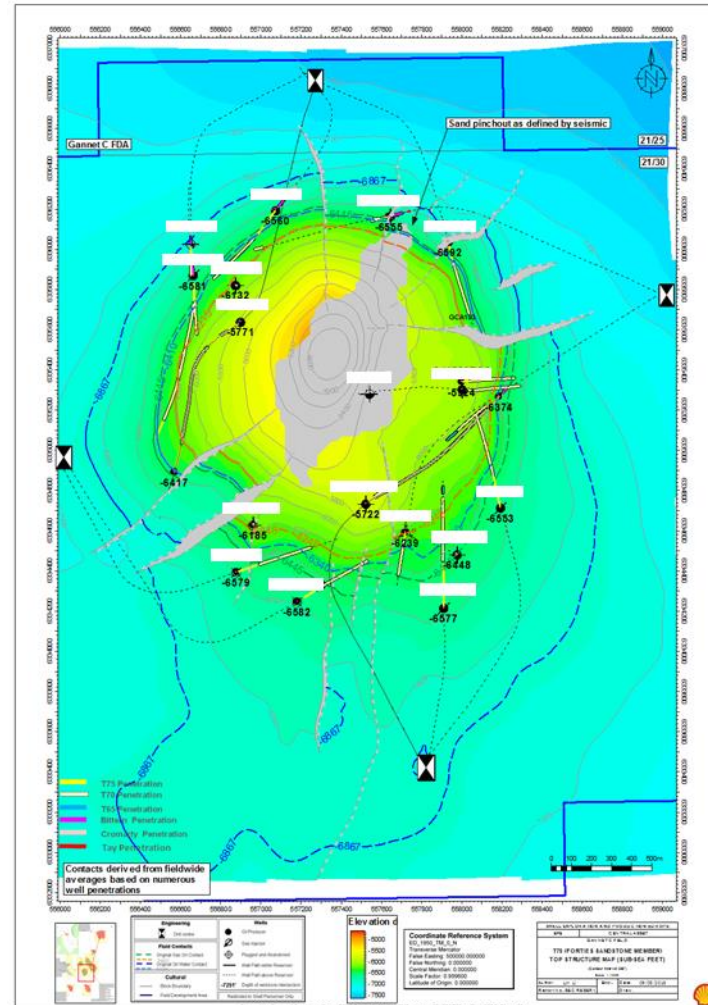
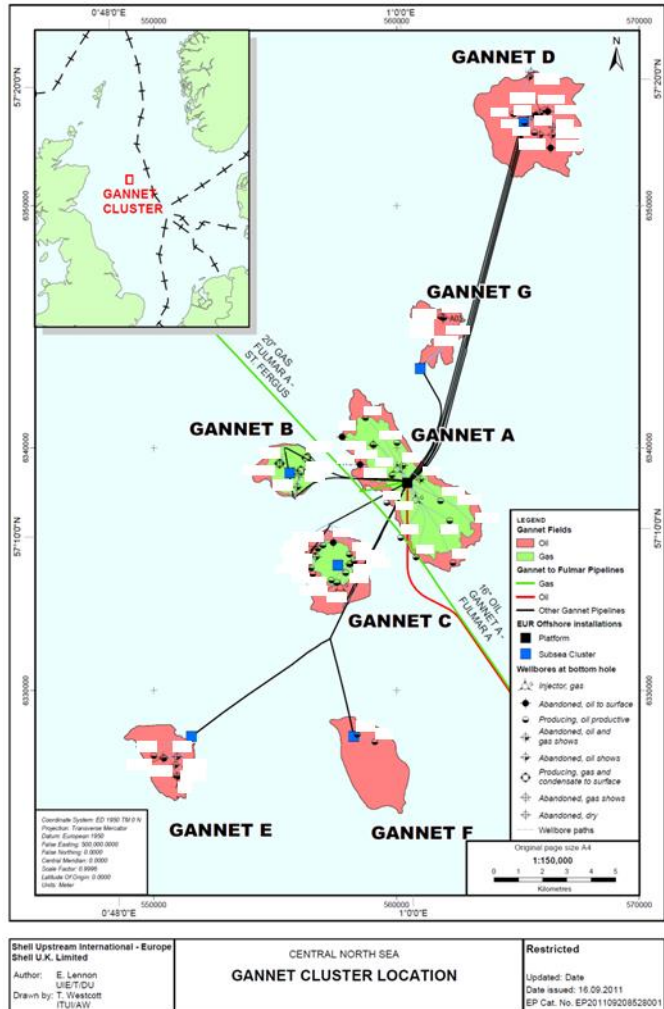


- Geophysics contributions: **GP**
 - Permeable/flow potential identification **PG PP**
 - Aquifer size **RE PG**
 - Connected reservoirs (+ aquifer) **RE PG**
 - 'Thief' sand extent & traps **PG**
 - Fault mapping (reactivation) **GM**
 - Other wells **WE**
 - Introducing hydrocarbons/pressure to previously benign formations

■ Repeat for the overburden!

■ **Discipline integration is key!**

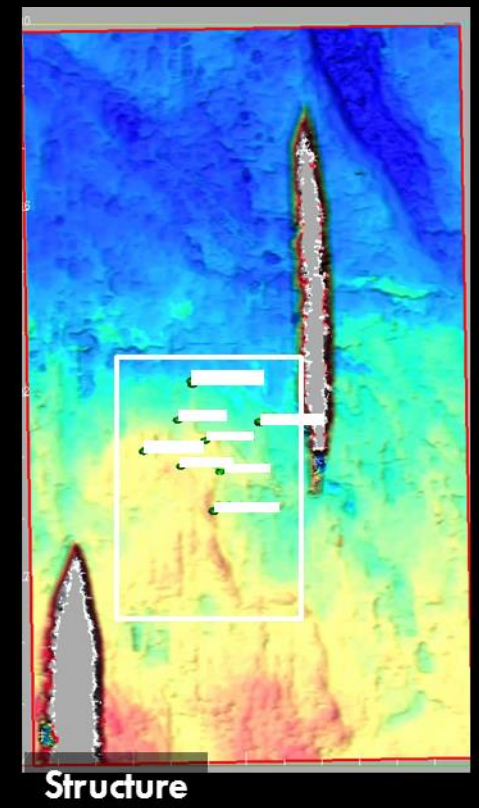
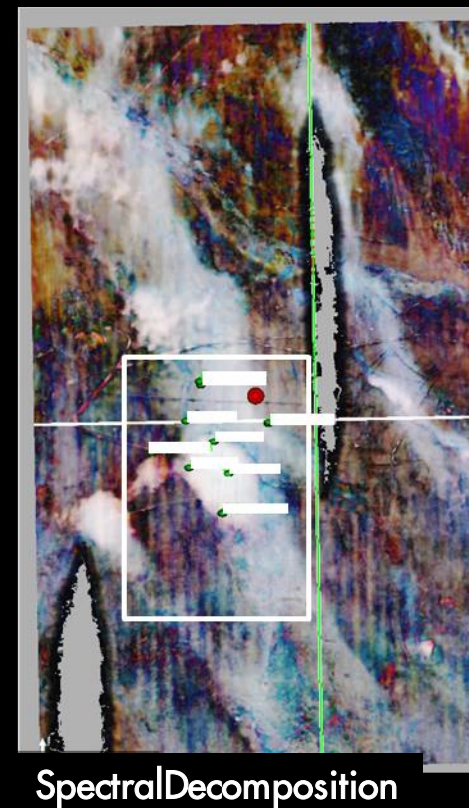
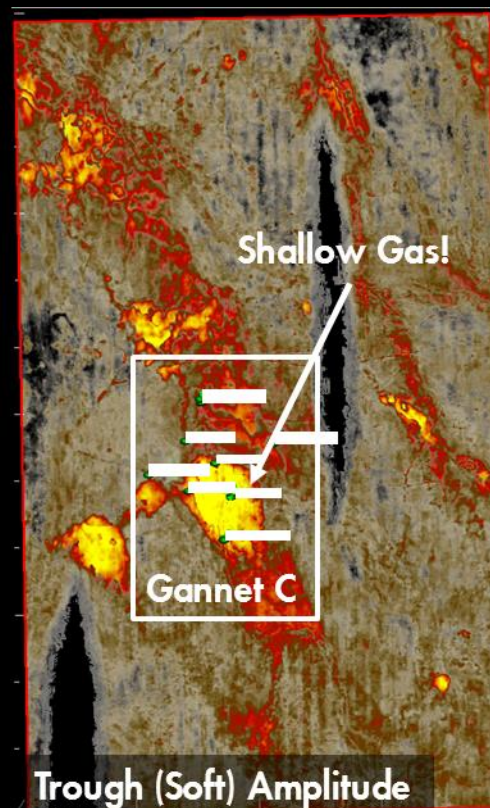
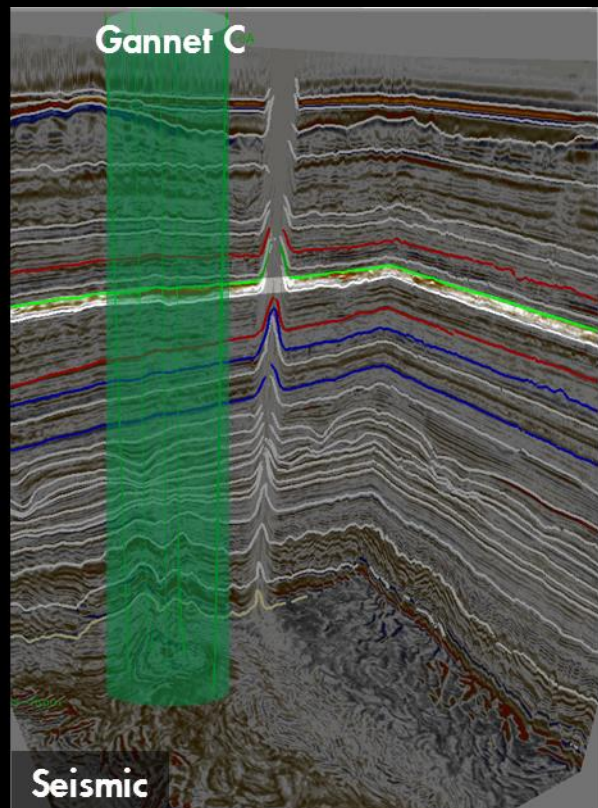
Gannet C Introduction



- Stacked Palaeocene/Eocene turbidite reservoirs encircling a salt diapir – all connected
 - Forties, Bittern, Cromarty, Gannet Tay
- Hydrostatic virgin pressure, strong aquifer support
- 4 drill centres, 11 Production wells, 4 E&A wells (plus sidetracks).
- Abandon 7/9 watered out oil rim wells.

Gannet C Overburden

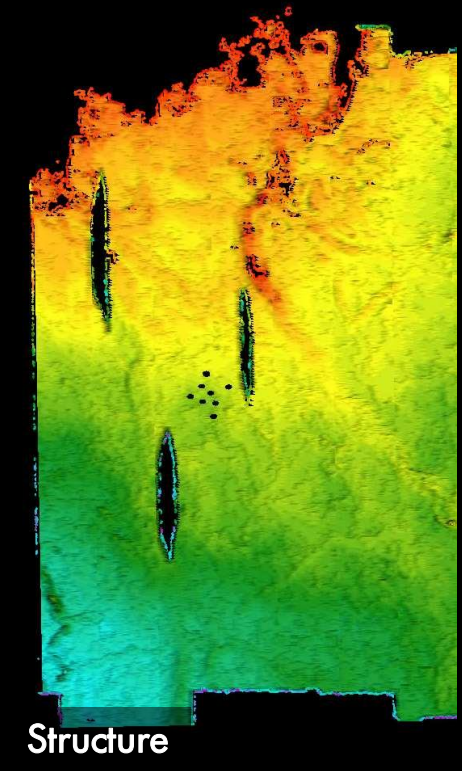
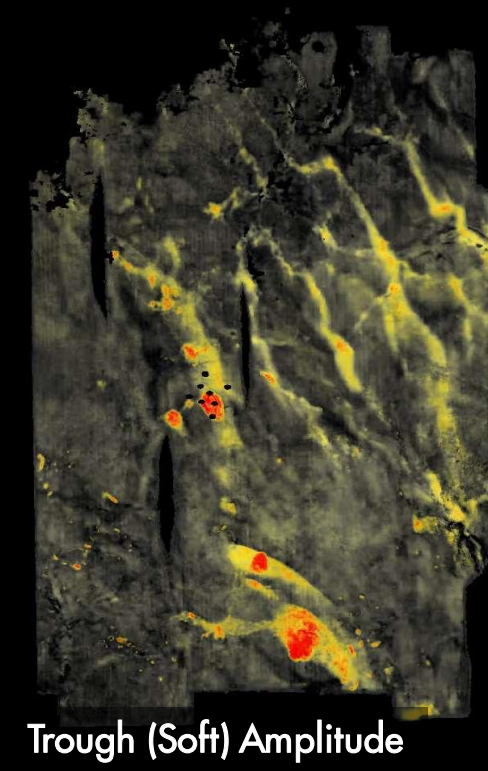
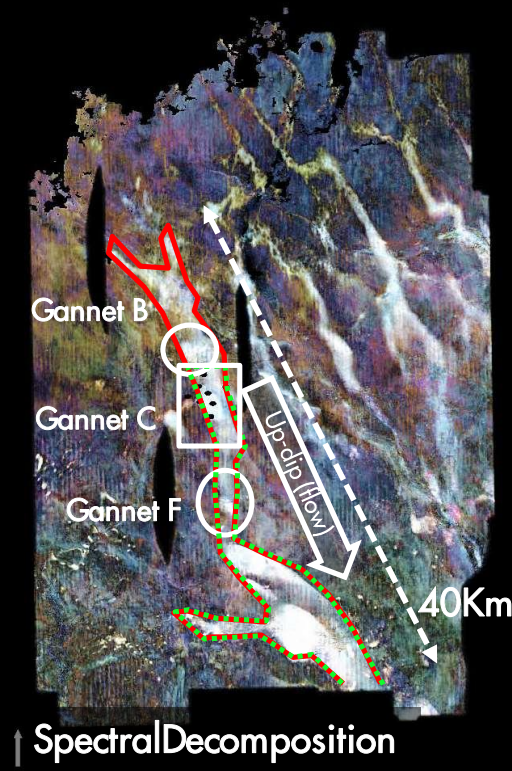
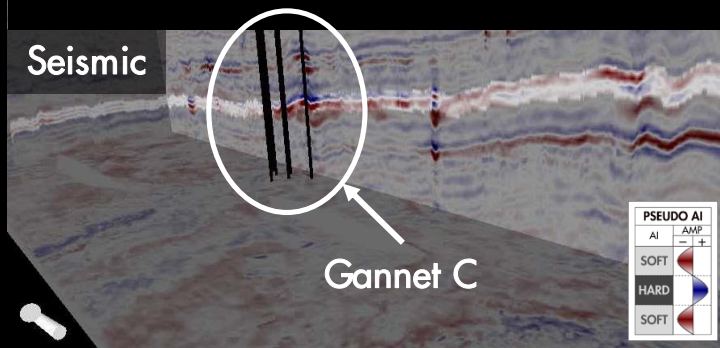
Interpretation over large areas (of no previous interest) to assess flow potential - crucial where there was no well data available. Shallow gas mapping justified removal of 5 plugs. **Saving: 3,283 man-hrs, 23days rig time**



Data courtesy of CGG

Regional Overburden Assessment

Even larger areas interpreted, mapping sand coverage and connectivity to investigate removing additional isolations. Insufficient understanding and legacy wells ultimately prevented this option.



Data courtesy of CGG

Summary

- More than ever we work with large incomplete datasets, short time frames and risk to:

Improve HSE, cost and asset value

- Seismic data is key whenever we need to see away from the well, or where there is incomplete well data to predict the subsurface properties (particularly flow potential).

- For example, for Gannet C, Geophysics is directly responsible for:

Saving 3,283man-hrs, 23 Days rig time

- We still have a lot to learn and a long way to go!

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