Analysing Overpressure Distributions within Palaeogene Strata of the Central North Sea

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Aims

- Use available pressure data from wells to map regional variations in overpressure
- Determine directions of fluid flow and possible connectivity between Palaeogene reservoirs
- Locate areas with the potential for hydrodynamic trapping
Study Area

OUTER MORAY FIRTH

CENTRAL GRABEN
Total of 331 wells
- UK (308)
- Norway (19)
- Denmark (4)
Methodology

- UK 15/29a-9

- **Forties Sandstone Member**
  - **Balmoral Sandstone Unit**
  - **Andrew Sandstone Unit**

- Constant Hydrostatic gradient of **0.445 psi/ft**

- **16 psi Overpressure**

- **Constant Hydrostatic gradient of 0.445 psi/ft**
Methodology

Hydrocarbon down to points
- Reservoirs containing hydrocarbons only
- Provide estimate of the maximum overpressure in aquifer below

32 psi Overpressure
19 psi
Methodology

Some overpressure values were collected from within lower permeability shale units.
Reservoir Distribution

- Reservoir distribution was based on evaluation of wireline log data from 664 Central North Sea wells – calibrated where available with seismic data and biostratigraphic data.
Additionally sources such as the Ternan Ltd Reports, Millennium Atlas and various other published literature were also used.
Mey Sandstone

Laterally draining NW towards the Moray Firth

Max values of overpressure ~ 2500 psi recorded in Quad 30/8

Laterally draining NW towards the Moray Firth

Steep pressure ramp with implications for hydrodynamics – Flyndre field

111 overpressure points
Forties Sandstone

Max value of overpressure recorded is \(~1300\) psi in UK 30/8

Magnitude of overpressure not as great as the Mey Sandstone

Main flow direction SE to NW, with drainage also occurring towards the western margin
Forties Sandstone

Max value of overpressure recorded is ~1300 psi in UK 30/8

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(Dennis et al. 2000)
Upper Sele Sands

- Maximum of 336 psi
- Minimum of 29 psi

33 overpressure points
UK 21/29a-8
43 psi OP in Tay

Maximum of 72 psi
Minimum of 10 psi
**Residuals**

- Residual values of overpressure are the difference in overpressure between reservoir units.
- Residuals were calculated between each adjacent reservoir unit to help identify areas of vertical connectivity.
- Calculated using the deeper reservoir overpressure minus the shallower reservoir overpressure.

**POSITIVE RESIDUAL**

- Overpressure B > Overpressure A
- +ve overpressure difference
- Pressure Transition Zone
- **Red** colour on maps
Residuals

NEGATIVE RESIDUAL
- Overpressure A > Overpressure B
- -ve overpressure difference
- Pressure Reversal
- Blue colour on maps

ZERO RESIDUAL
- Overpressure A = Overpressure B
- Zero overpressure difference (+/- 10psi)
- Reservoir units have the same overpressure, they are in pressure connection
- Neutral colour on maps
Mey-Forties Residual

Residual (psi)

- 400

+1900

Map showing residual pressures in the Mey-Forties field with various geological formations and their respective depths.
Forties-Upper Sele Residual

Residuals range from -40 to +130 psi
Upper Sele-Tay Residual

Residuals range from -20 to +20
Conclusions

- The Mey Sandstone Member and Forties Sandstone Members are laterally draining SE – NW with additional drainage in the Forties to the western margin.

- Although only weakly overpressured the Upper Sele and Tay sandstone units also appear to be laterally draining towards the western margin.

- Residual values indicate that there is overall good connectivity between sands towards the western margin (Quad 21), which may be a result of faulting or injectites.

- Further work on structure is needed to support interpretations.
Any Questions?

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