

# Redevelopment of Buchan Field

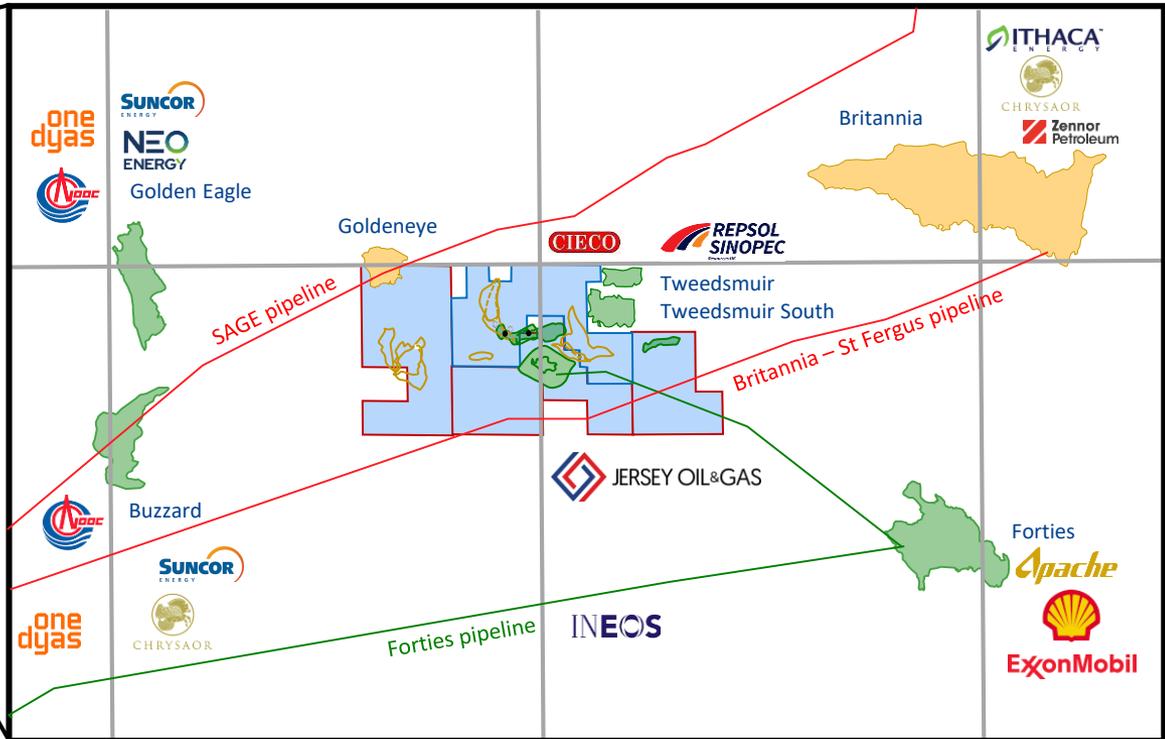
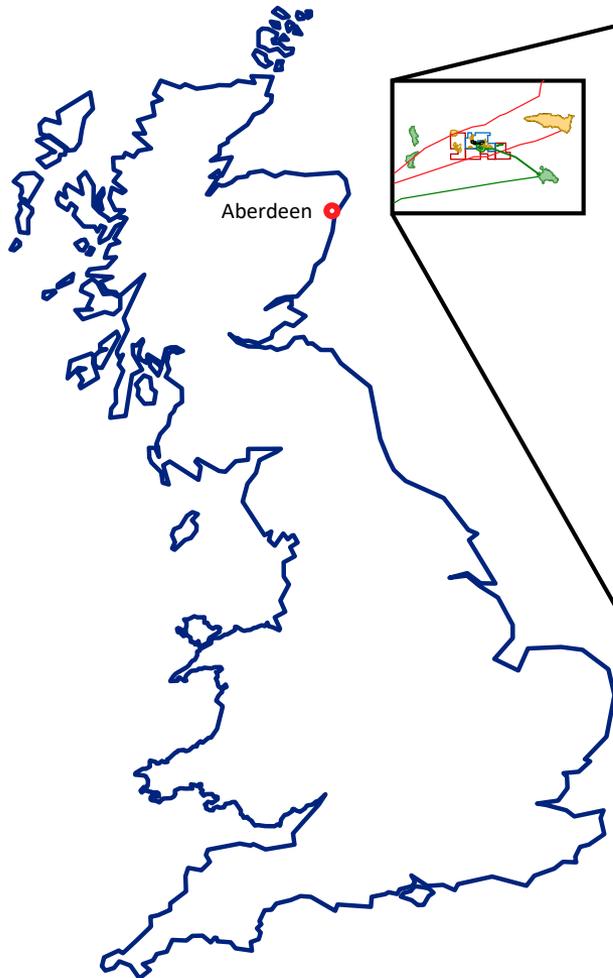
Mohit Khanna

Subsurface Manager



JERSEY OIL&GAS

Skellig Michael – Fluvial & Aeolian Old Red Sandstone, Western Ireland



- Multiple large companies, major developments and established infrastructure surrounds the GBA
- The GBA volumes are highly attractive to:
  - Companies with portfolios in need of growth
  - Infrastructure in need of additional throughput



Field production 1981-2017, 147Mmbbls produced

Reservoir: Devonian age Buchan Group sandstones. Dual porosity system

Seal: Lower Cretaceous mudstones

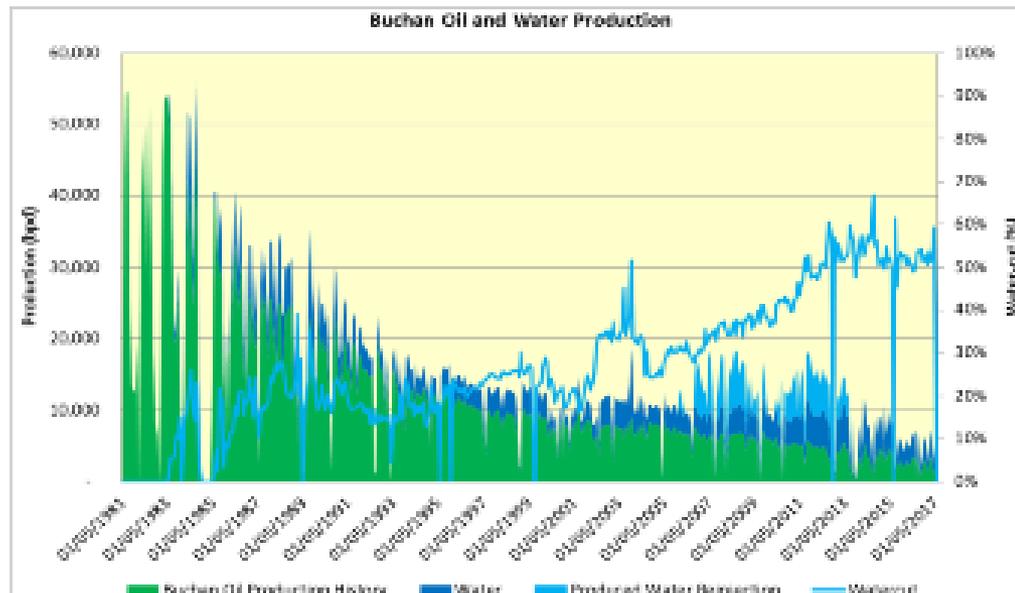
Production via FPV Buchan Alpha, taken off station 2017 due to failed safety case

Producing 3500 BOPD at COP with 50% WC

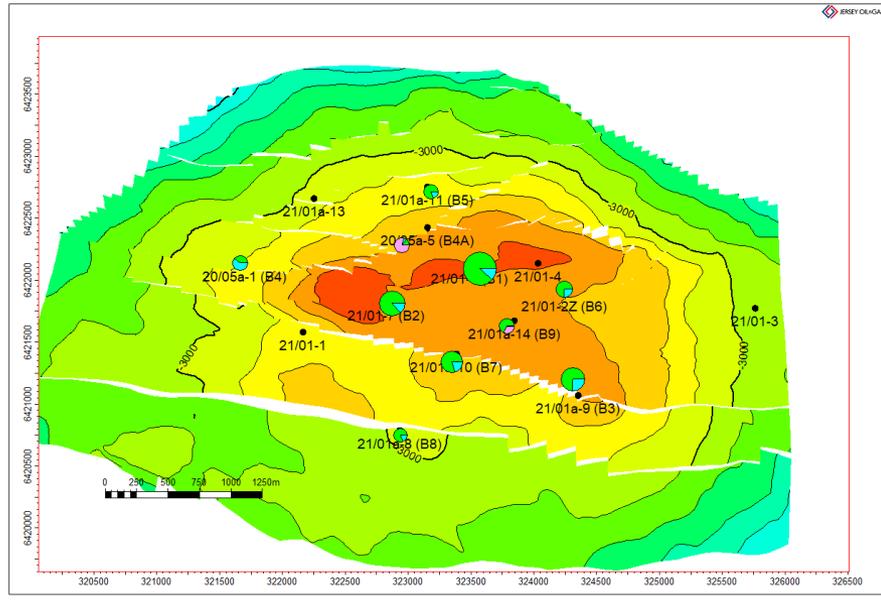
Solid production history allows DCA for remaining resource estimation, independent of STOIP and recovery factor based estimates

Open fracture system provides flow to well bores but volumetrically insufficient for recovered volumes implying substantial matrix contribution

New seismic data has resulted in a revision to the view of the field structure and origin with positive implications for more accurate dynamic modelling

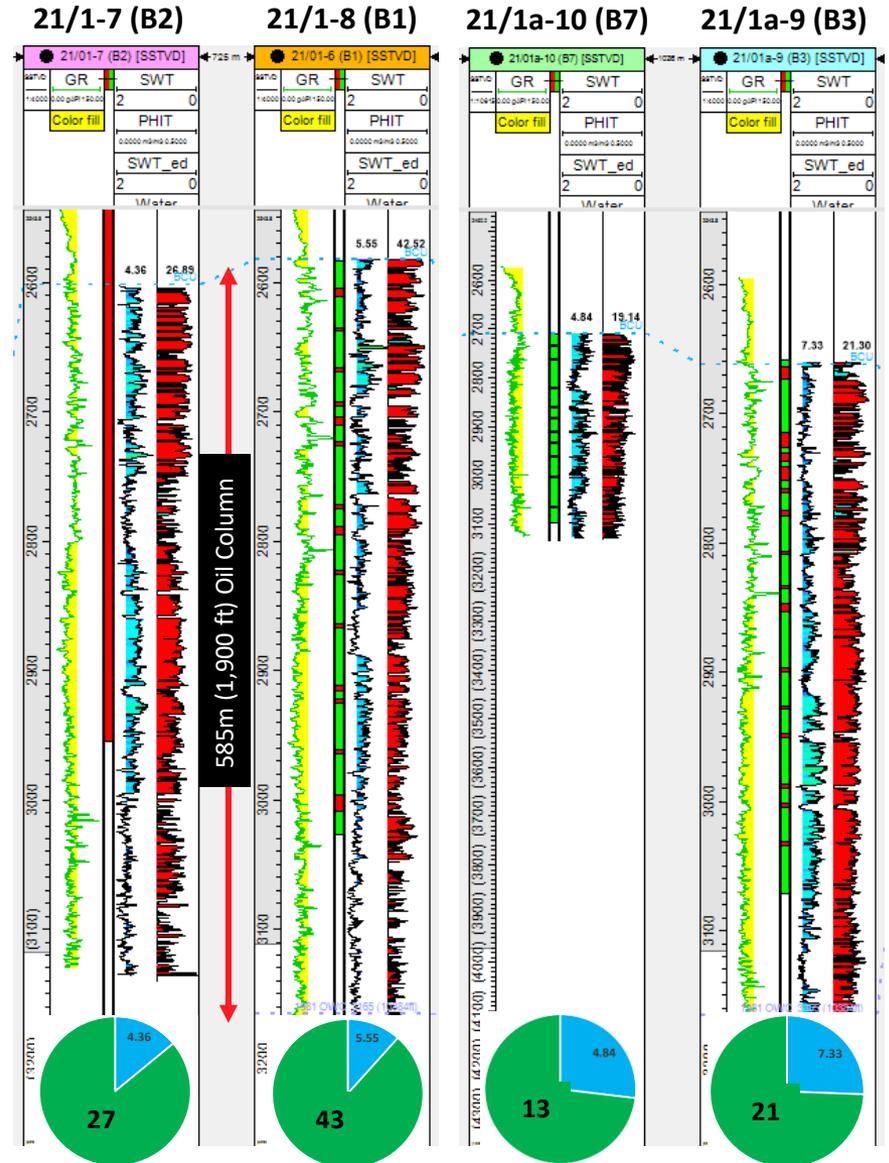


| Property                | Units   | Value | Comments            |
|-------------------------|---------|-------|---------------------|
| Oil gravity             | °API    | 33.5  |                     |
| Formation Volume Factor | rb/stb  | 1.205 | At 222°F, 7506 psig |
| Initial GOR             | scf/stb | 285   |                     |
| Bubble point pressure   | psig    | 1271  | At 222°F            |
| Oil viscosity           | cP      | 1.025 | At 222°F, 7506 psig |

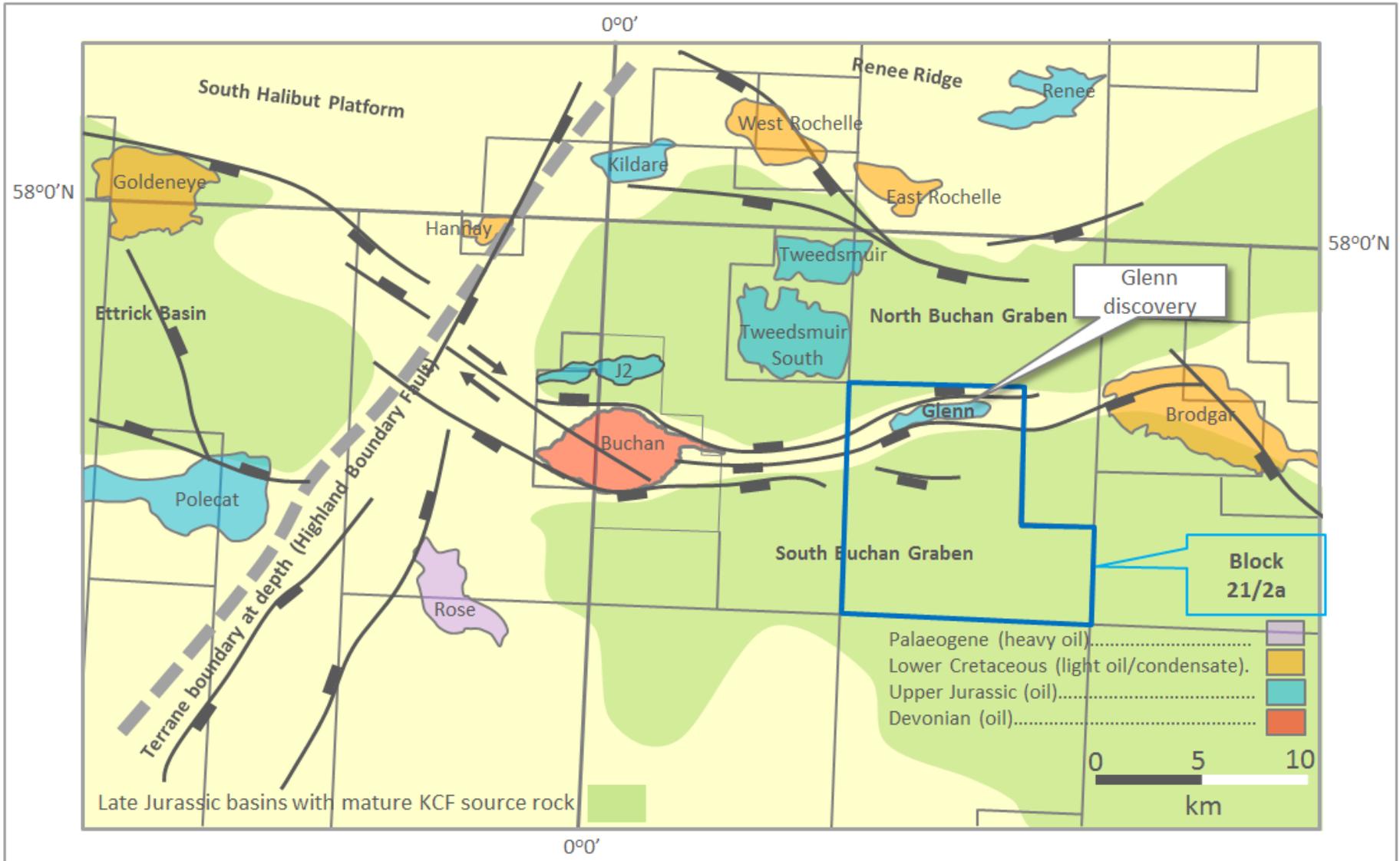


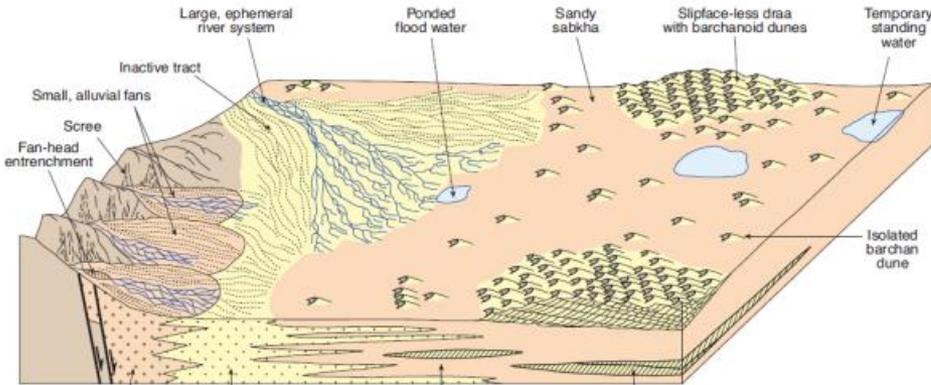
**Key Reservoir Parameters**

- Oil Column: 585m (1900ft)
- NTG: >70%
- Porosity: <15% (up to 28%)
- Perm: <20mD ( 0.02-200 mD)
- Sw: 50-70%
- Fm Water Salinity: 180000 ppm NaCl
- OODT: 3155m
- OWUT: 3173m
- OOWC: 3164m



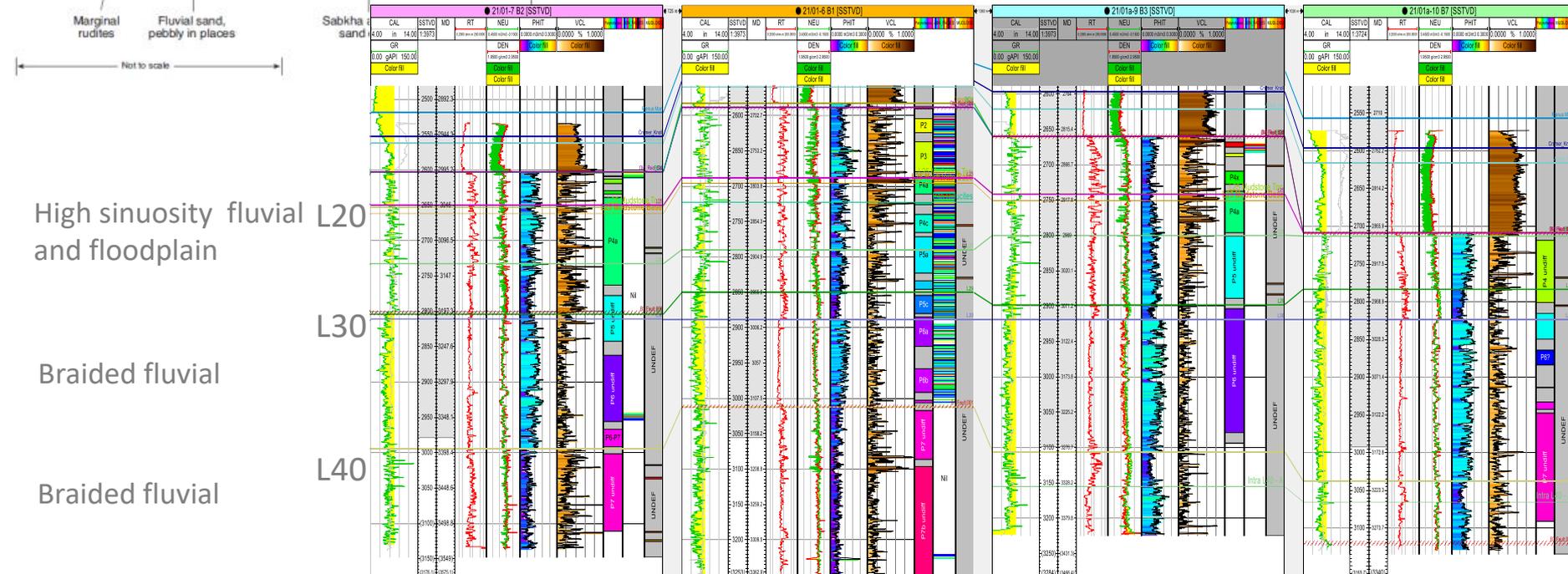
Significant oil production from core area

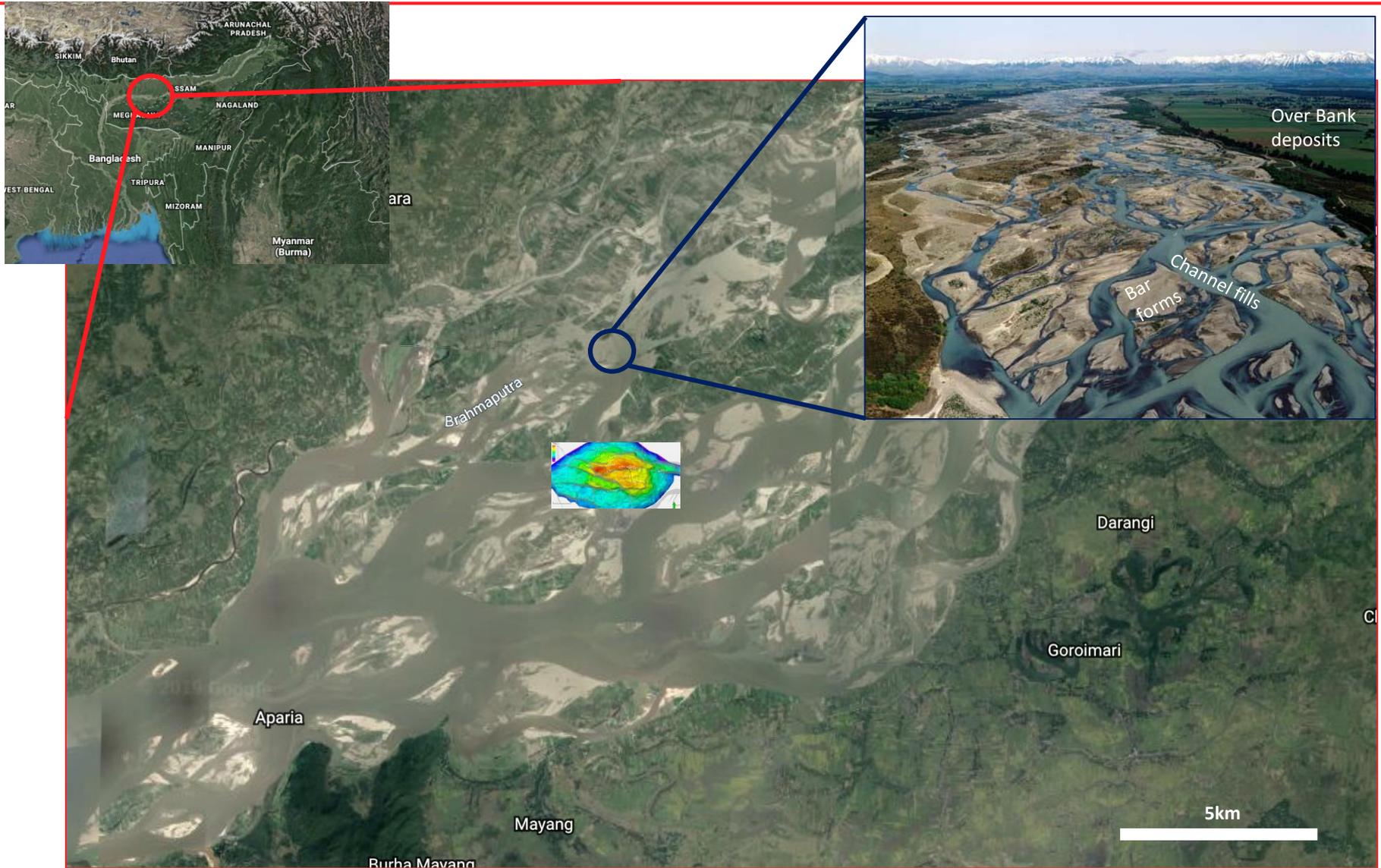


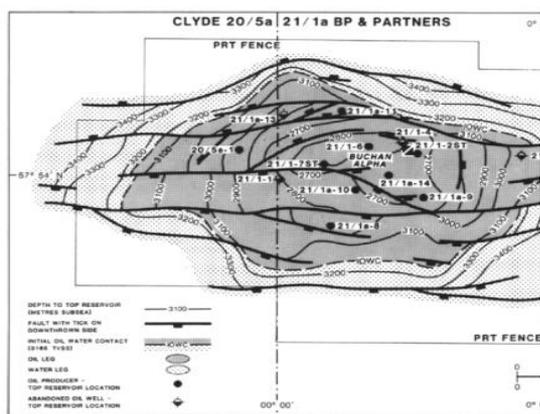


## Depositional Environments

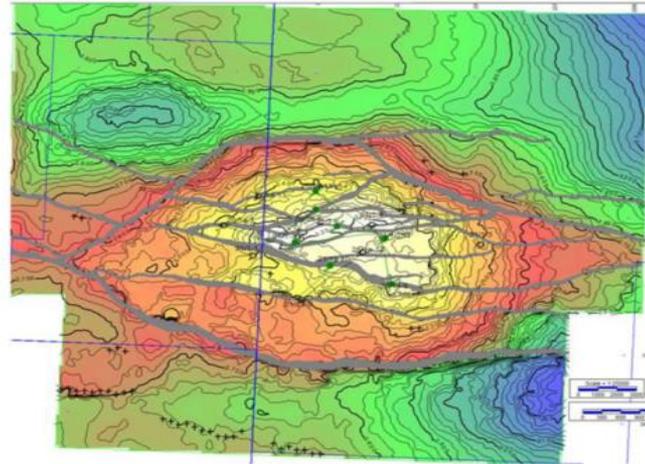
- Arid fluvial
- Mostly braided and low sinuosity channels from Caledonian uplifts
- Axial or an alluvial fan system
- Predominantly subarkosic sandstones and siltstones with occasional thin shales and calcrete conglomerates.



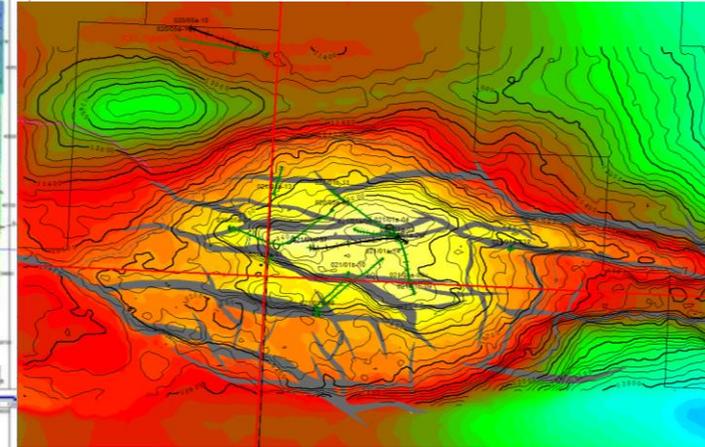




1991

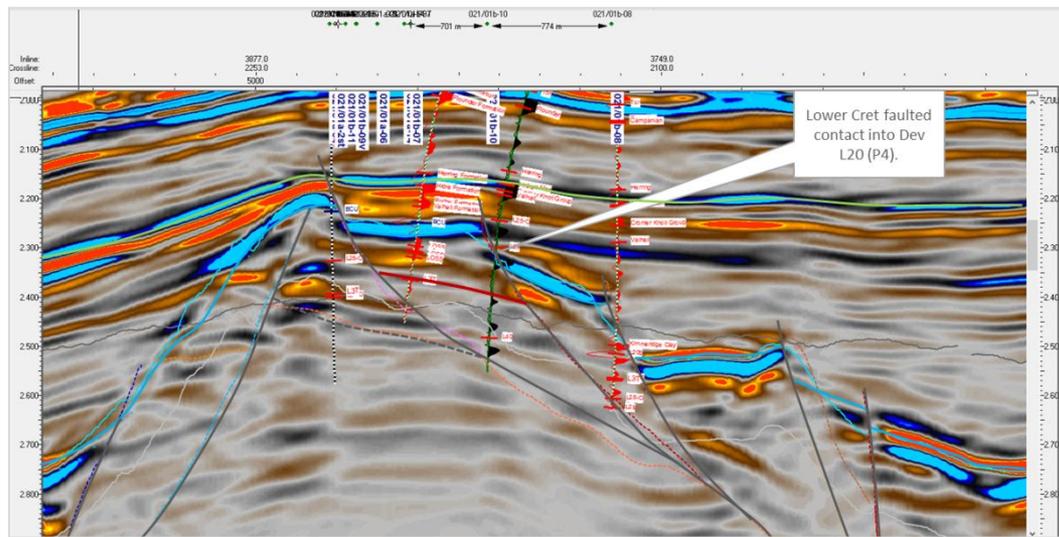


2014



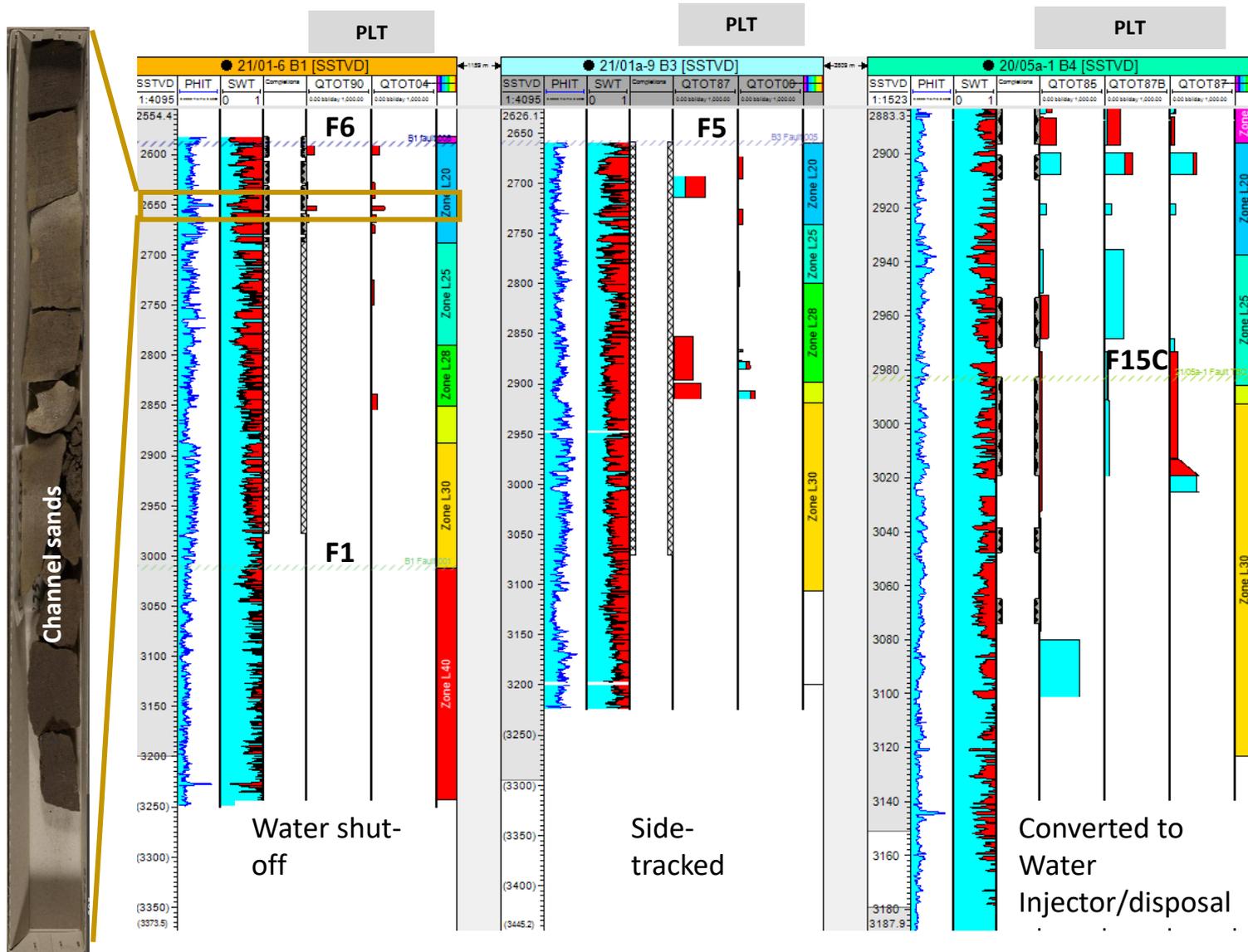
2020

- Earlier mapping only recognised E-W faulting
- New seismic data has identified a secondary suite of N-S faults

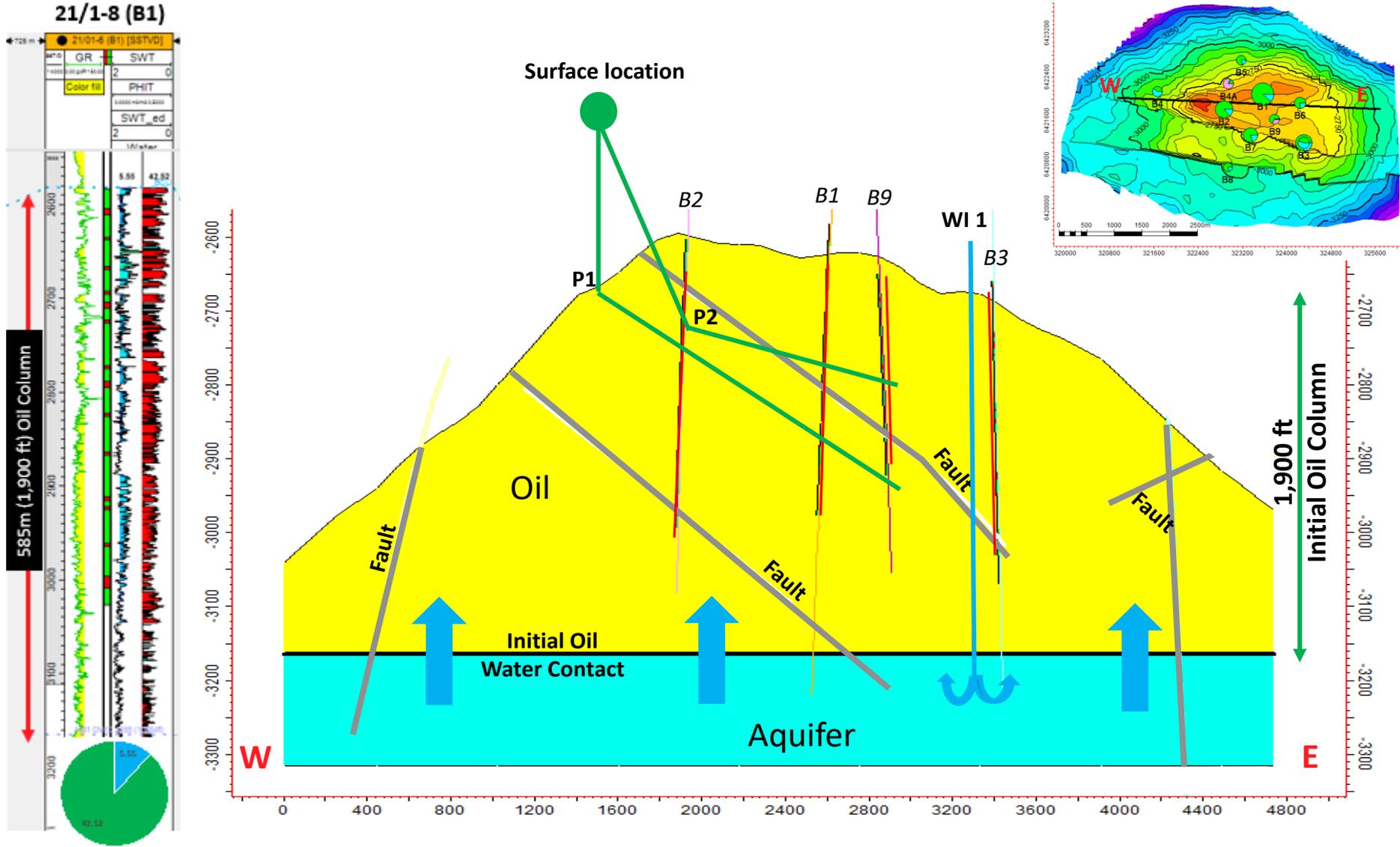


### Benefits of 2018 seismic data

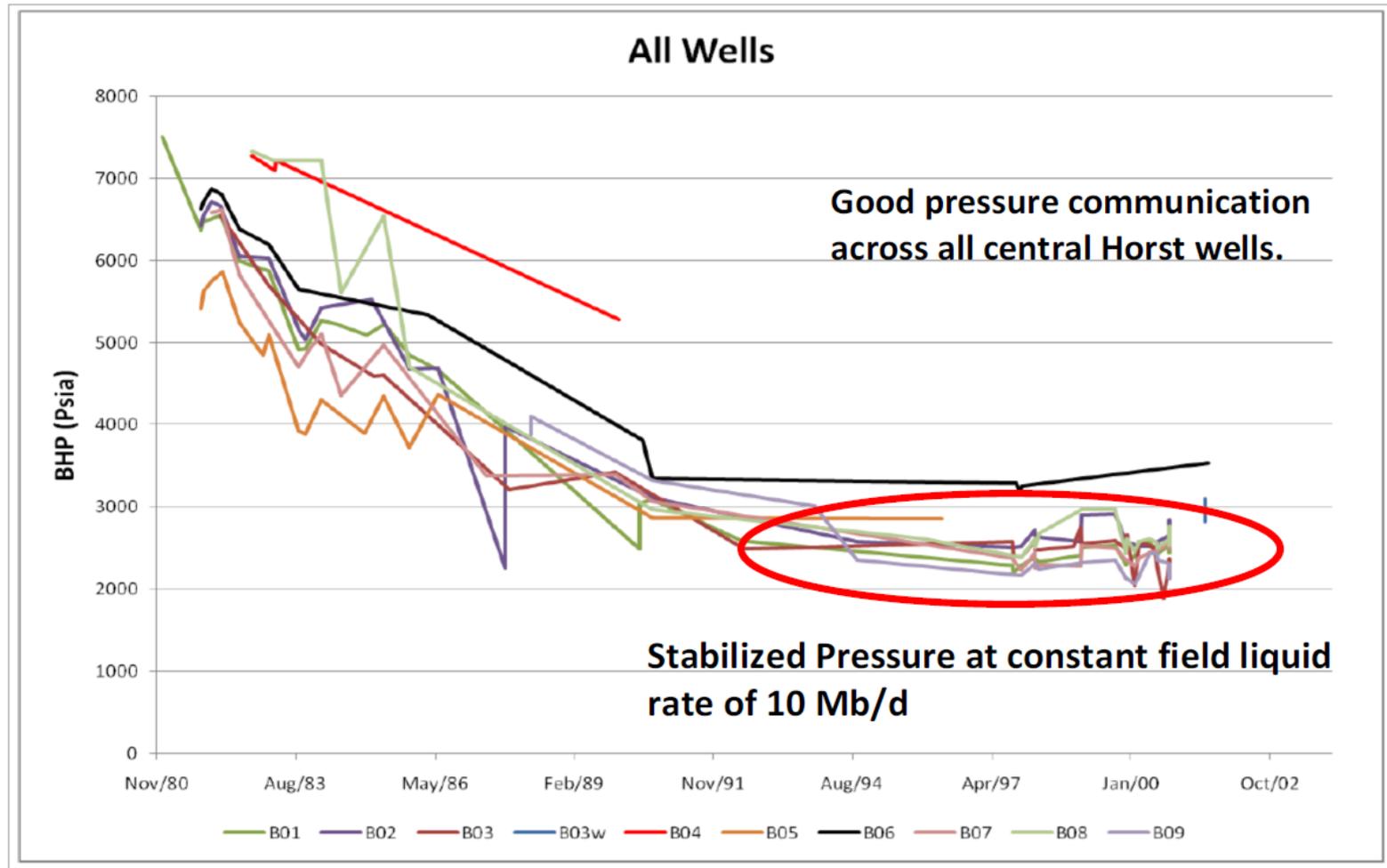
- Fault framework revision
- Fault position uncertainty
- Lost section estimation
- Field –wide correlation and zonation
- Well-bore/fault correlation
- Fault intersection and flow indicators (PLT)
- Effective fracture network



- PLT was used for surveillance, WSO and sidetrack
- Integration of PLT with interpretation shows almost all producers have been drilled through faults, which have aided production as there are fracture corridors around these faults
- Significant production has also been attributed to channel sands

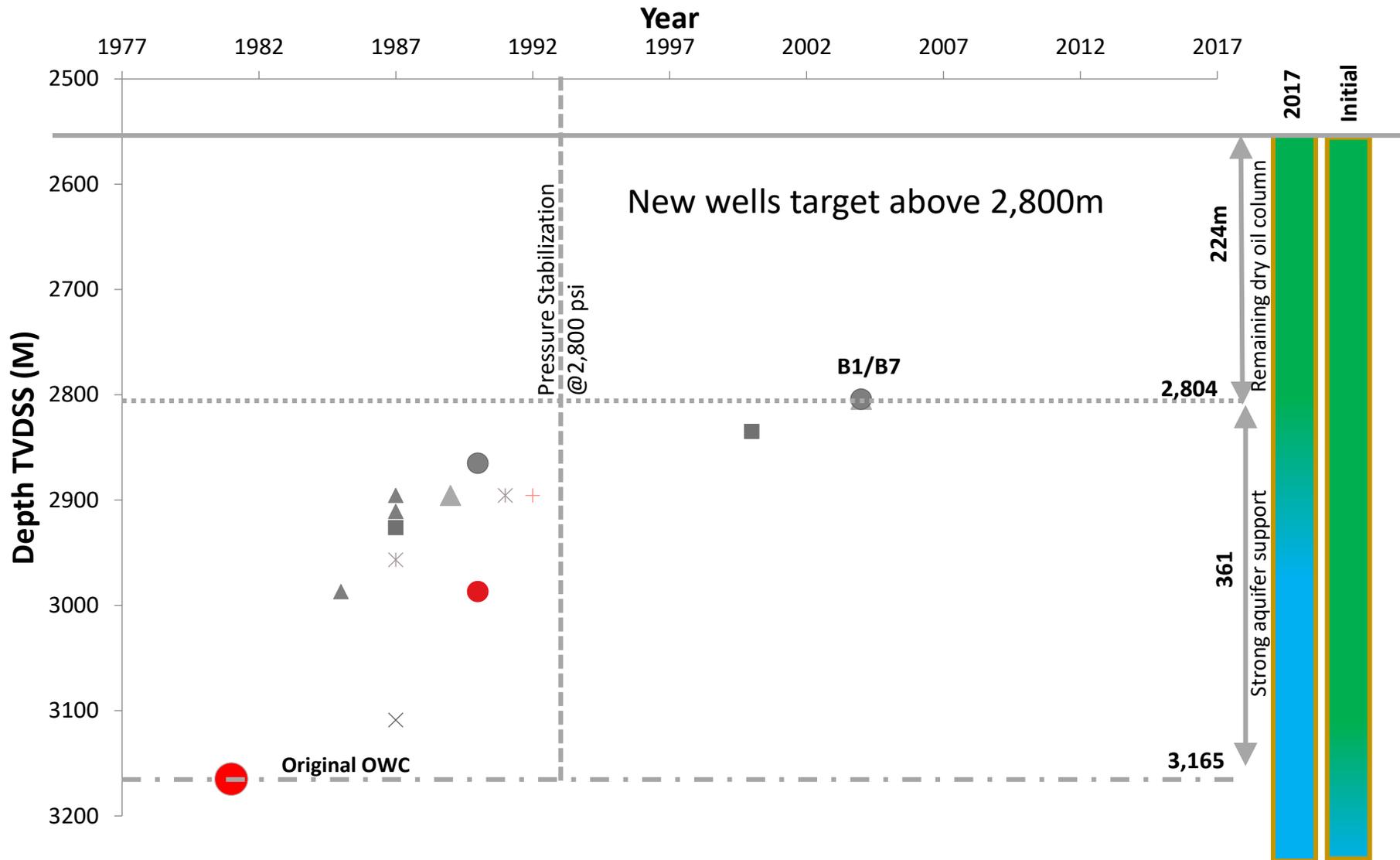


Buchan fluid contact



**Pressure Data**

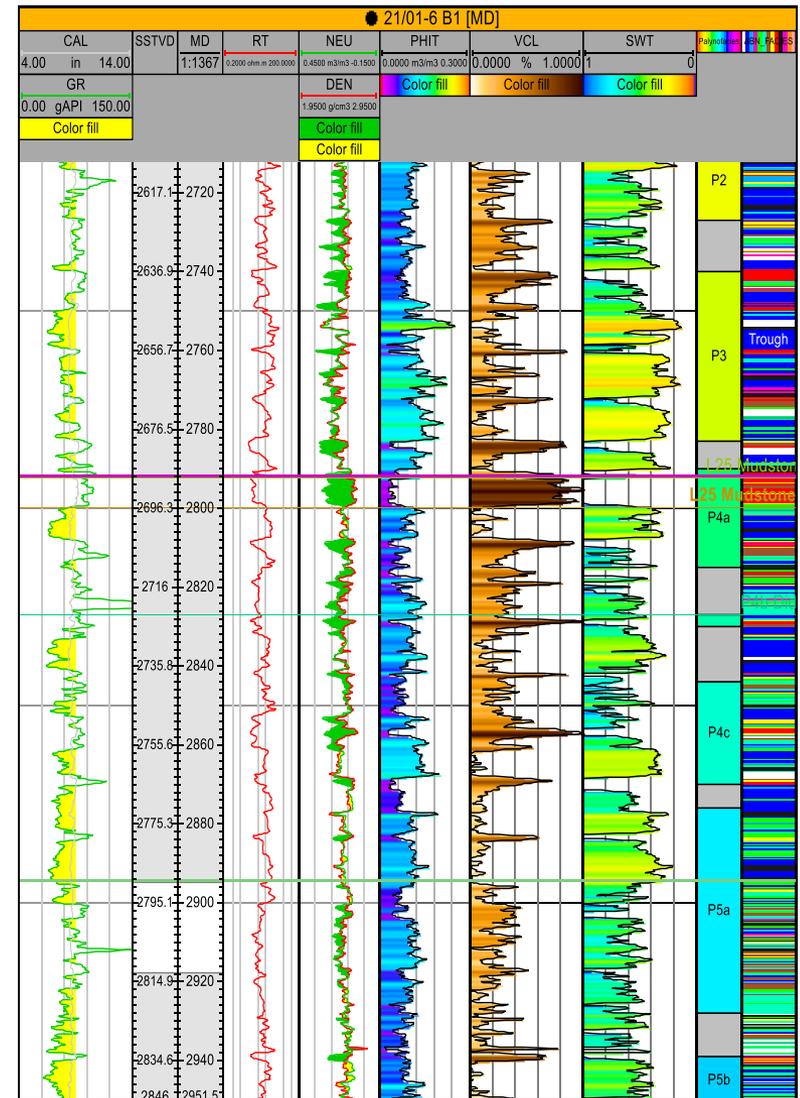
- All central horst wells on common trend (except B4 & B8)
- Pressure stabilized after ~1992



The Bubble point is 1,286 psi, while current reservoir press is above @2,500 psi; no Secondary Gas Cap

Significant column height

- Facies associations organised into a series of fining upward packages
- Floodplain
  - Mudstones
  - Finely laminated/ wave rippled siltstones
- Bar-top
  - Very fine to fine sandstones
  - Parallel laminated/wavy bedded
  - Current rippled sandstones
  - Parallel laminated sandstones
- Barform
  - Low angle plane bed stratified sandstones
  - Planar tabular cross-bedded sandstones
- Channel fill facies
  - Trough cross stratified sandstones
  - Massive sandstone
  - Intra-clast channel lag deposit / intra-formational conglomerate
  - Erosion surface





Channel basal lag 2765.5m MD

Trough cross stratified, poorly sorted, micaceous, medium to coarse grained sandstones

Often associated with conglomerates and massive ssts

Multi-storey channel fill complexes or isolated channel units



Barform to Bar top with fractures 3076.5m MD

Normally overlays channel fill

Planar tabular cross-bedded sandstones and to a lesser extent Low angle plane bed stratified sandstones

Moderately sorted fine sandstone



Bar top with calcrite 2707m MD

Overlay the barform facies and maybe overlain by the floodplain facies

Finely laminated siltstones and mudstones

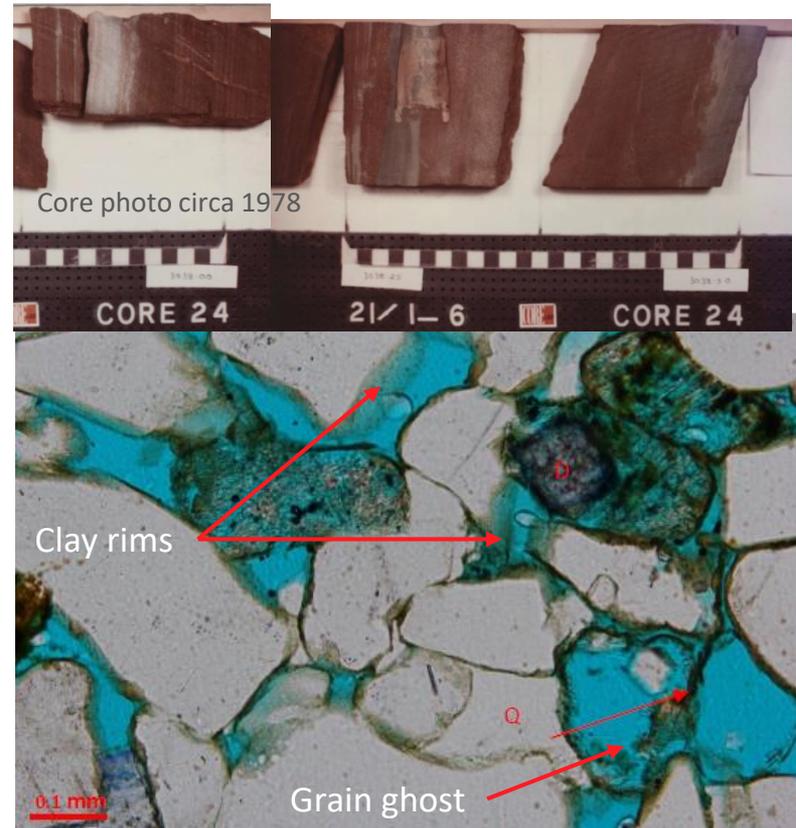
Very fine to fine sandstones Parallel laminated/wavy bedded very fine sst; Current rippled sandstones fine sandstone

Modification of exposed bartops during the low stage of the fluvial system , calcrites and occasional bioturbation



**Cross-bedded sandstone**

Sub-rounded grains; clay rims inhibit quartz cementation. Some pore filling calcite and feldspar replacing dolomite rhombi.  
Cross-cutting cemented fracture



**Cross-bedded, channel fill sandstone**

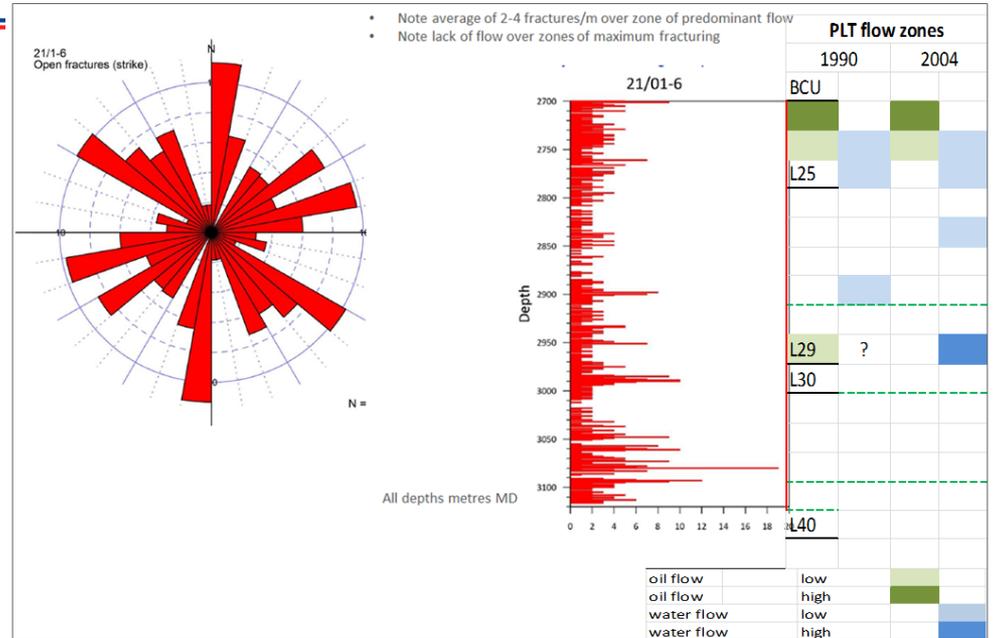
Thick authigenic clay rims surround detrital grains, occlude pores and restricts quartz overgrowth. Plagioclase dissolution leaves grain ghosting clay rims; note lack of subsequent compaction.  
Porosity – 16%



21/01-6 oil-stained fracture in channel fill sandstone with mud rip-up clasts - 2984m MD



21/01-6 Deformation bands in planar bedded bar-form sandstone - 3080m MD

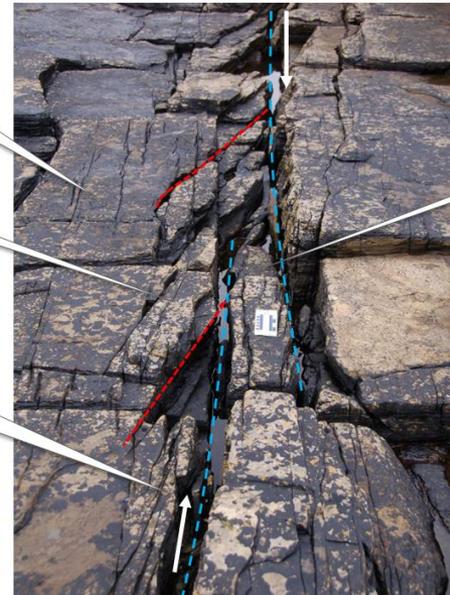


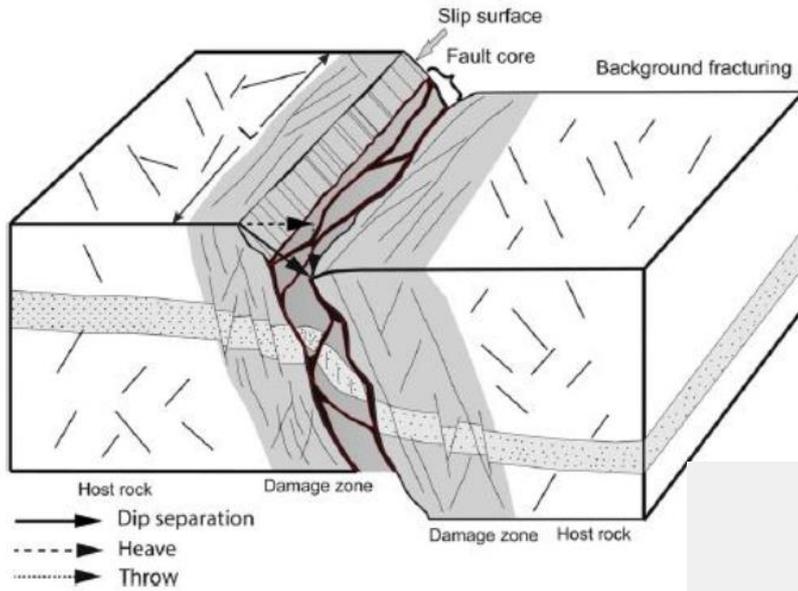
Low fracture density

High fracture density

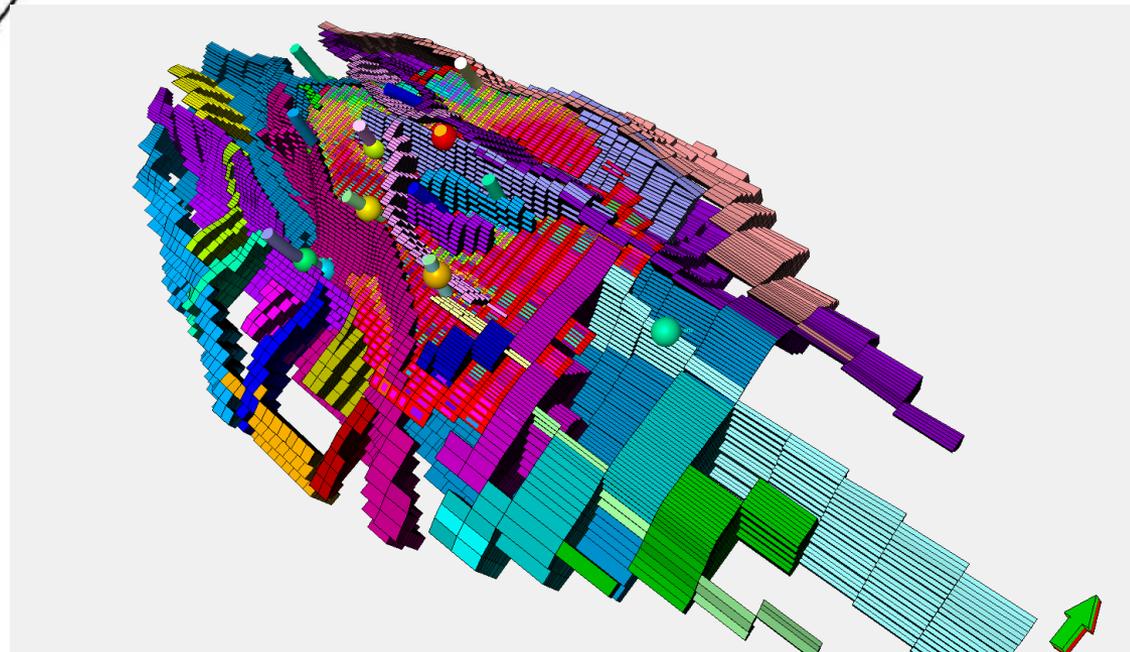
Note variable fracture orientation within damage zone around relay

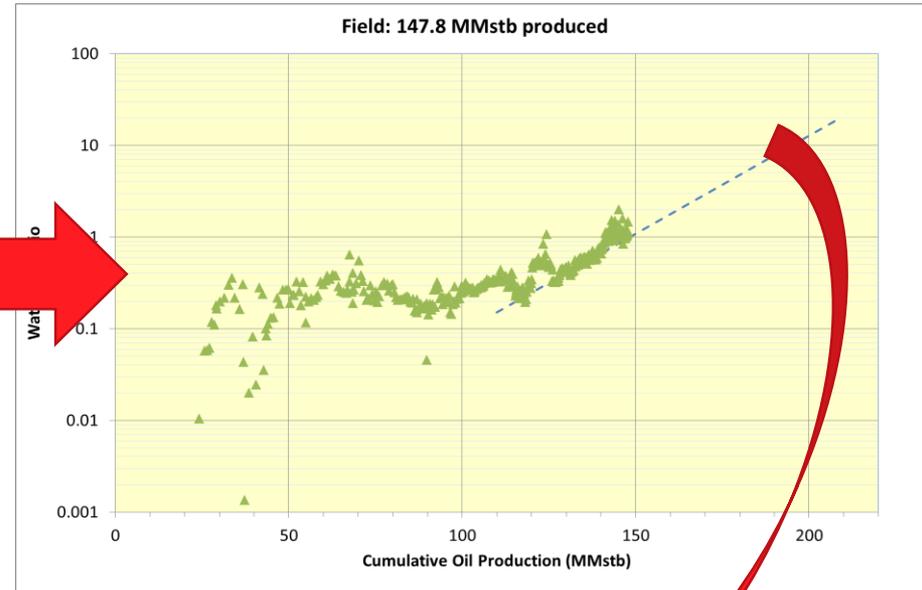
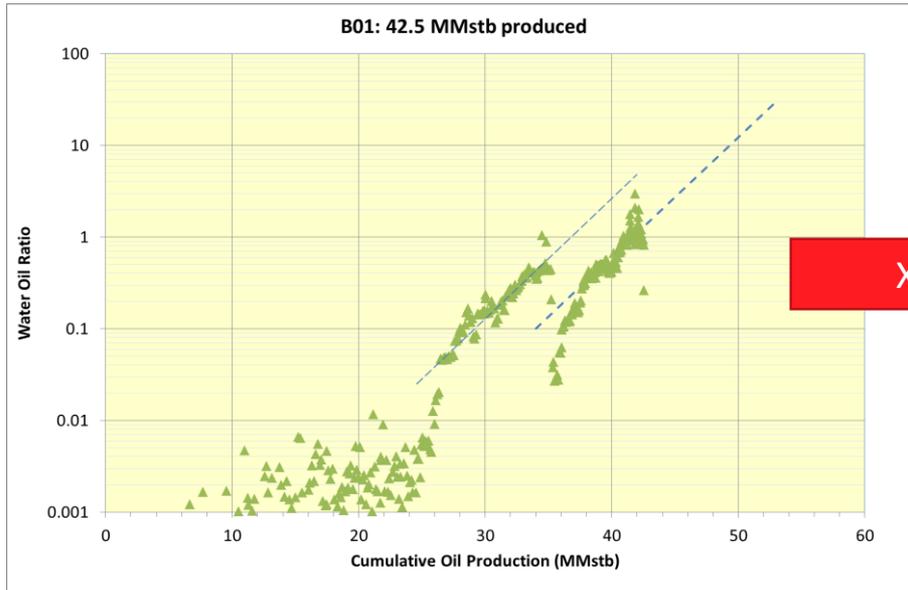
Minor fault relay





**Fault framework model with fractures distribution**





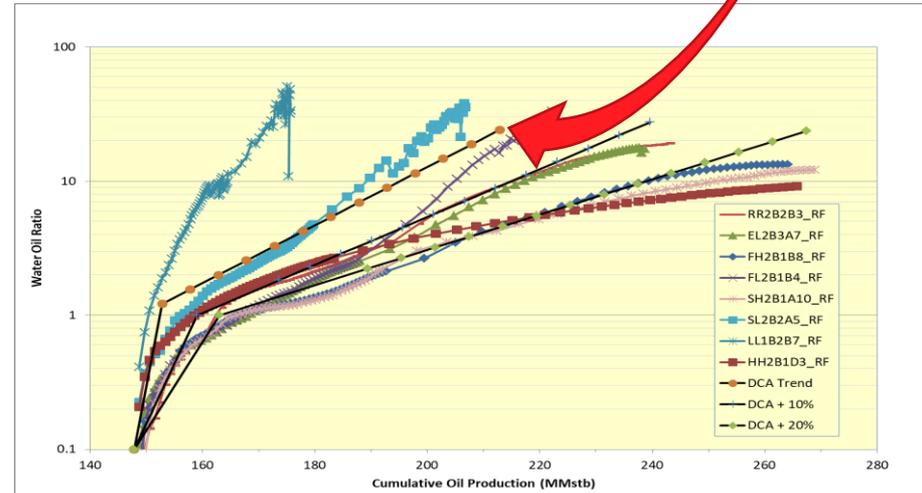
**DCA**

- DCA performed for each well
- Summed for the field
- Gives data based forecast for water cut

**Simulation**

- Earlier work in alignment with DCA

Future development with new highly deviated wells could exceed vertical well DCA trend



## Initial development

### Wells

- 9 vertical producers
- 2 water disposal

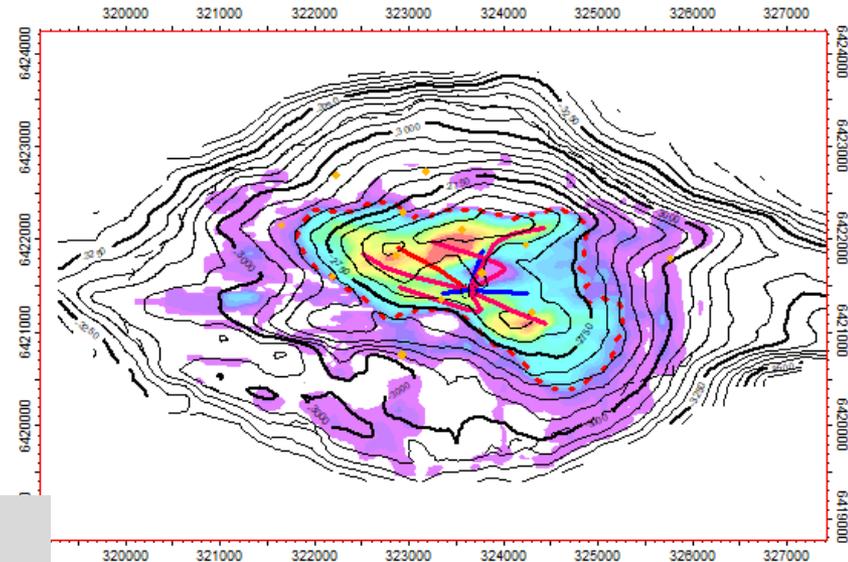
### Artificial Lift

- Gas Lift

### WSO

## Challenges

- Overpressure
- Unknown reservoir performance
- Unoptimized development
- Vertical wells
- No Pressure support
- Retrofit ALS



## Redevelopment

### Producer Wells

- 3-6 highly deviated producers

### Injector wells

- 2-3 water injectors for pressure maintenance

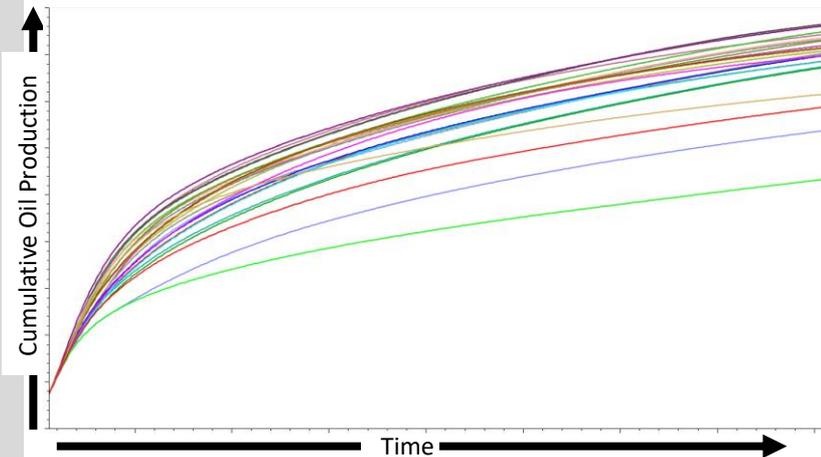
### Artificial Lift

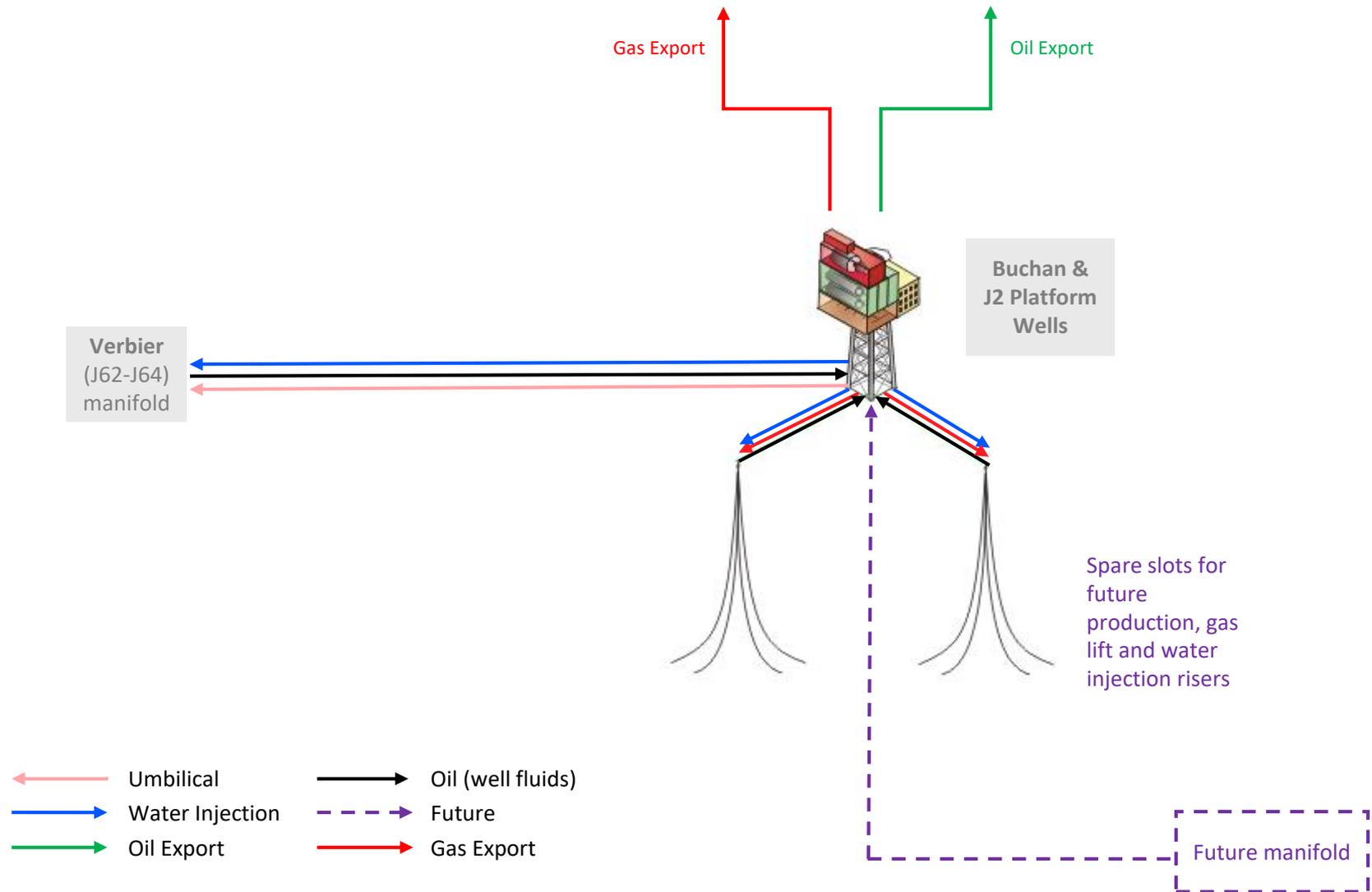
- Gas Lift
- ESP

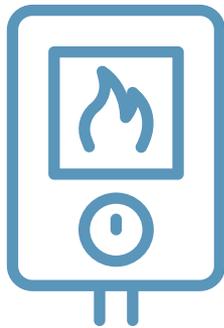
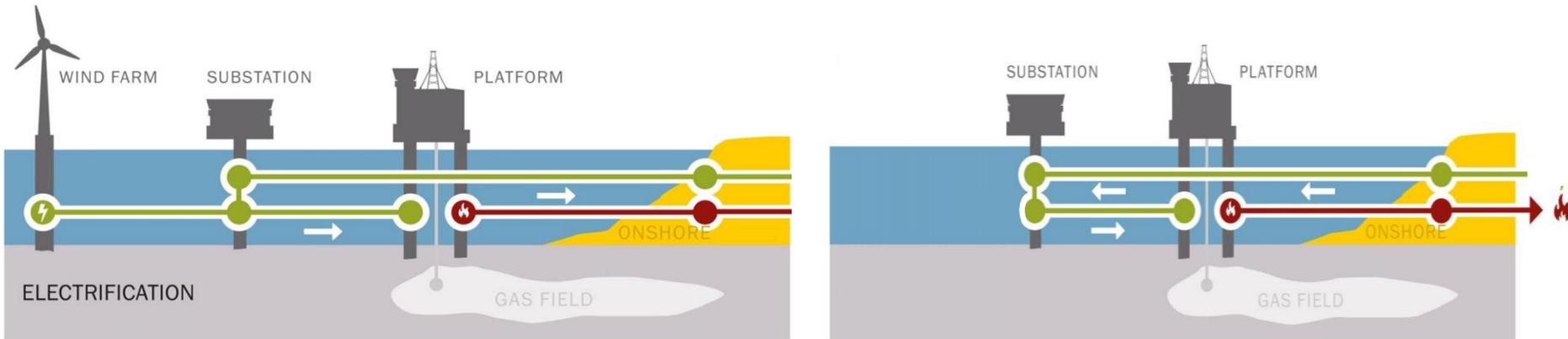
### Smart completions for WSO

## Opportunities

- 36 years of production performance
- Stabilized reservoir pressure
- Active aquifer
- Modern technology
- Maximum economic recovery
- Energy transition



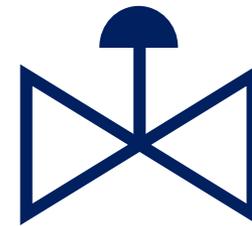




**Heating Medium System**  
270 tonnes  
15 pieces of kit



**Gas Fuel System**  
70 tonnes  
16 pieces of kit



**Instrument Air System**  
80 tonnes  
78 pieces of kit

- ✓ Buchan is a conventional clastic sandstone reservoir with oil storage in matrix
- ✓ 2018 PGS seismic has helped better structural characterization of the field
- ✓ Complex tectonics/faulting has resulted in fracture development
- ✓ Most wells have encountered fault cuts
- ✓ PLT has shown significant production from matrix dominated reservoir facies
- ✓ Fractures enhance the matrix permeability
- ✓ The GBA is a perfect candidate for regional hub development

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