The Benefit of Seismic Re-processing to Identify Late Life Opportunities in the Buckland Field

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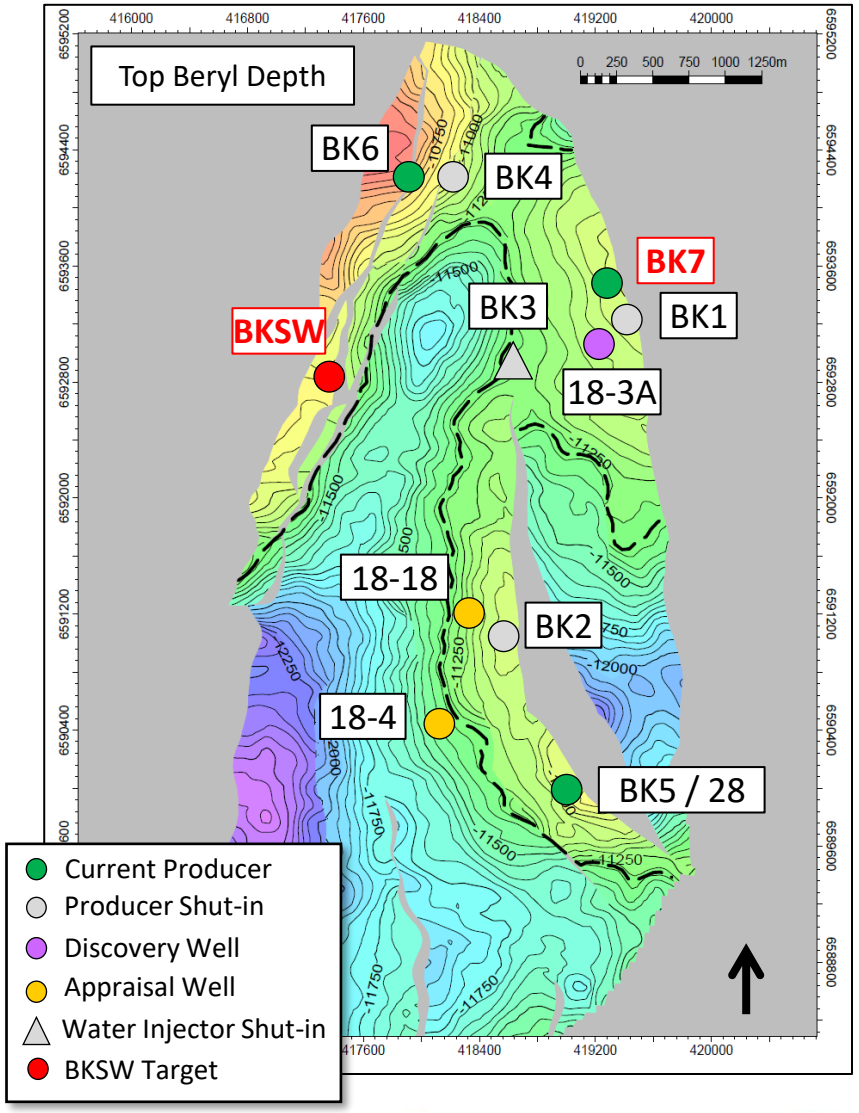
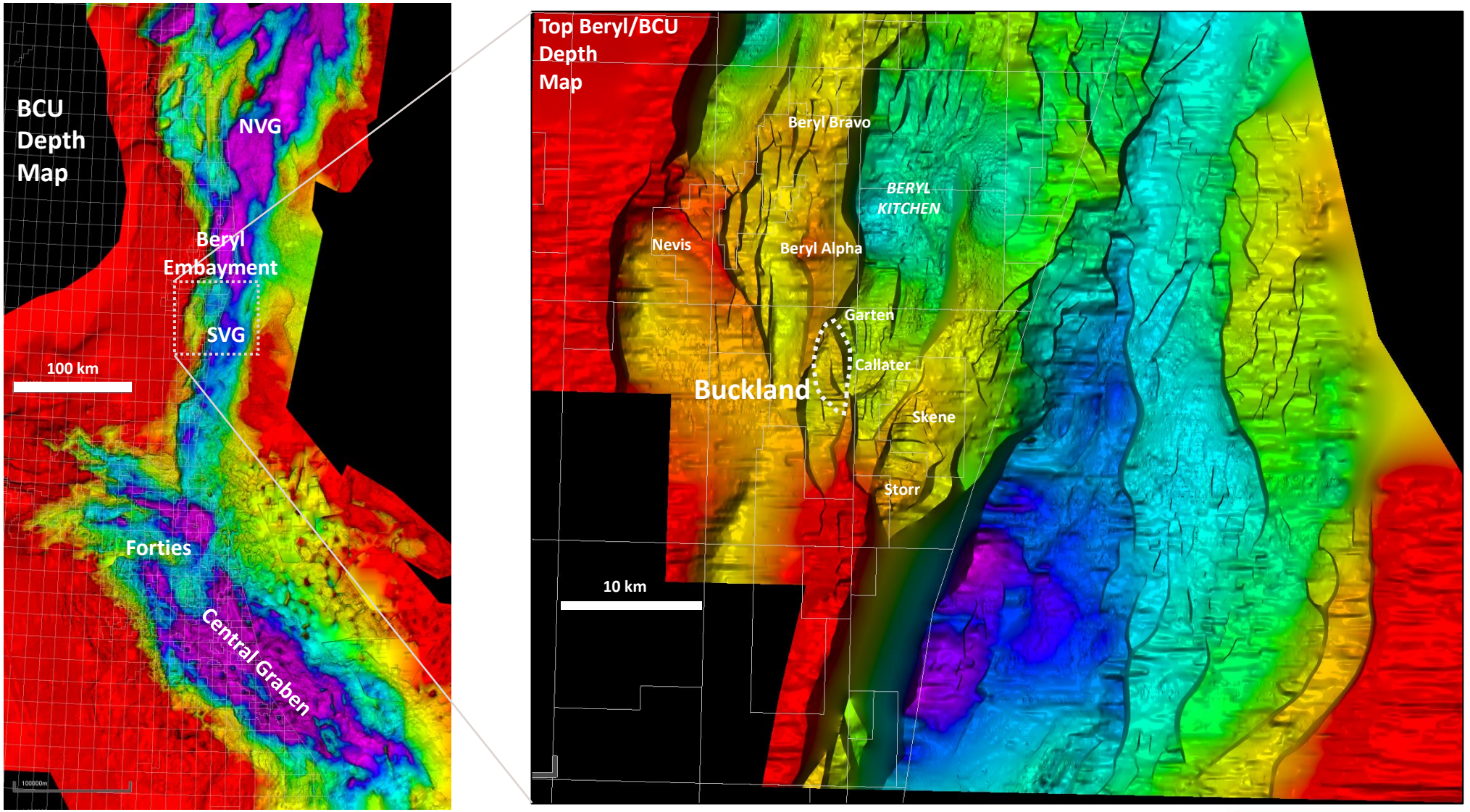
Apache

Summary

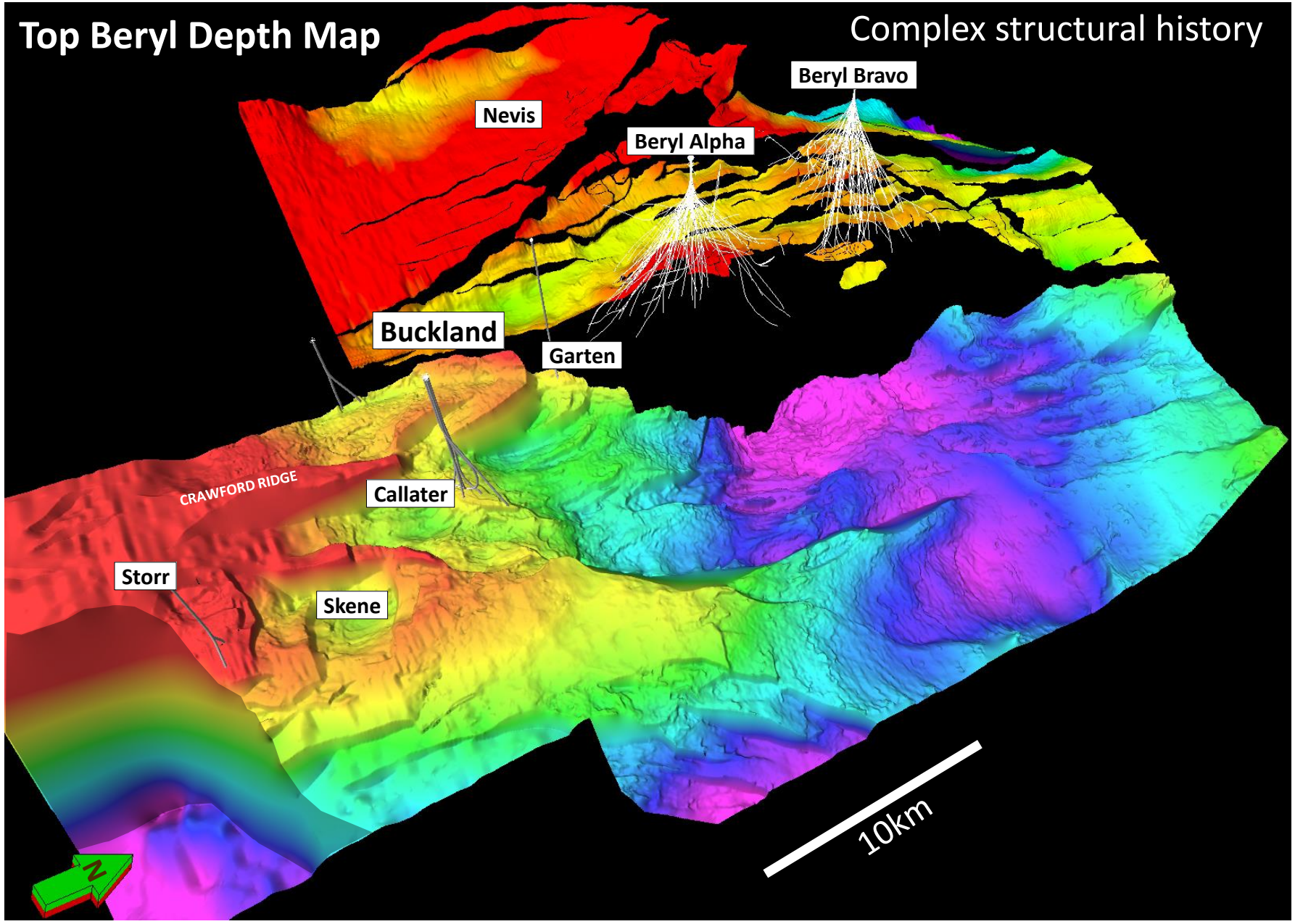
- Introduction to the Buckland Field
- BK7 Producer – Successful Buckland well drilled in 2018 (last year's focus)
- Seismic re-processing
- BKSW pre-drill interpretation
- BKSW result

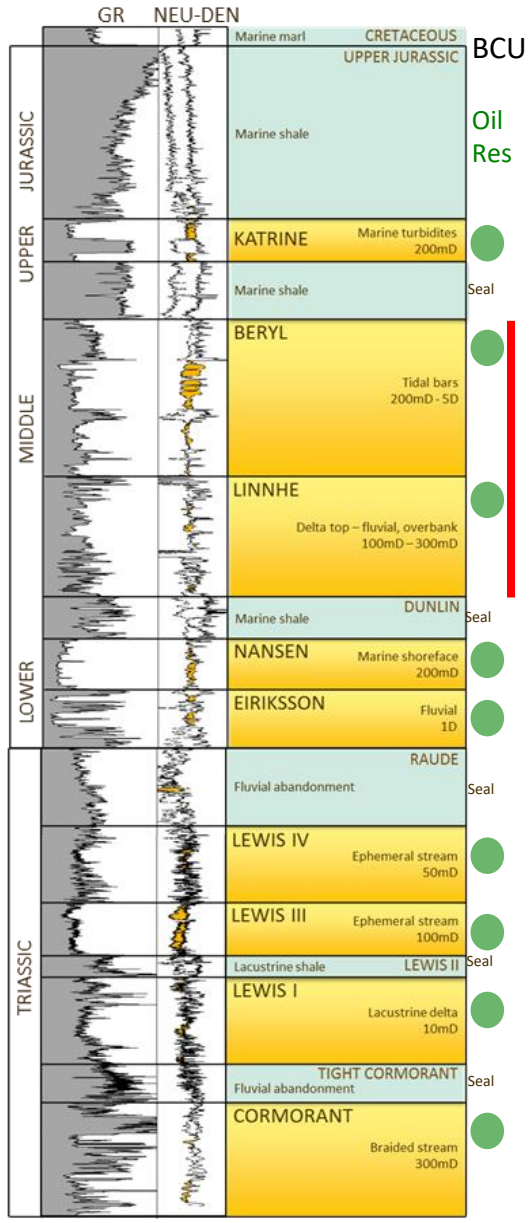


Beryl Embayment Relay Ramp

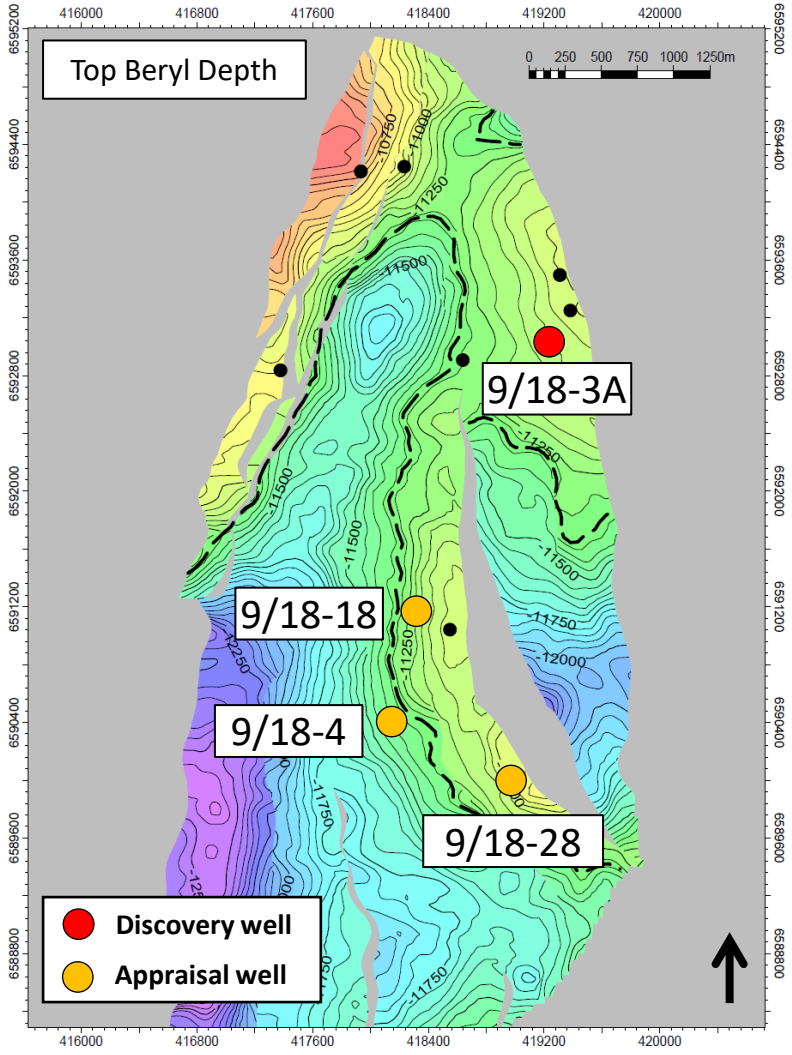


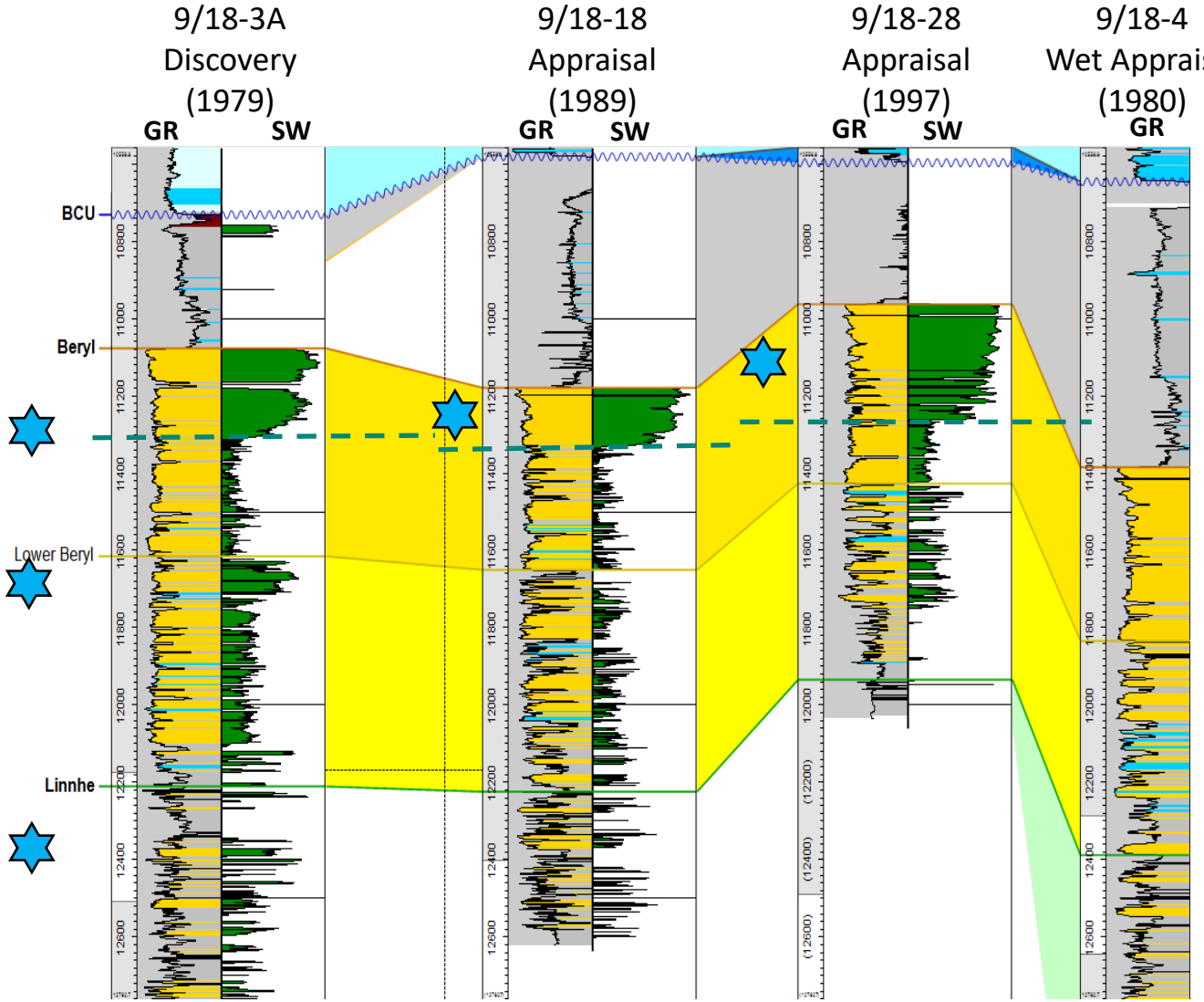
Top Beryl Semi Regional Depth





Buckland Discovered 1979 – 1 Exploration, 3 Appraisal Wells





Flattened on depth

High perm Upper Beryl pay
Complex contact distribution

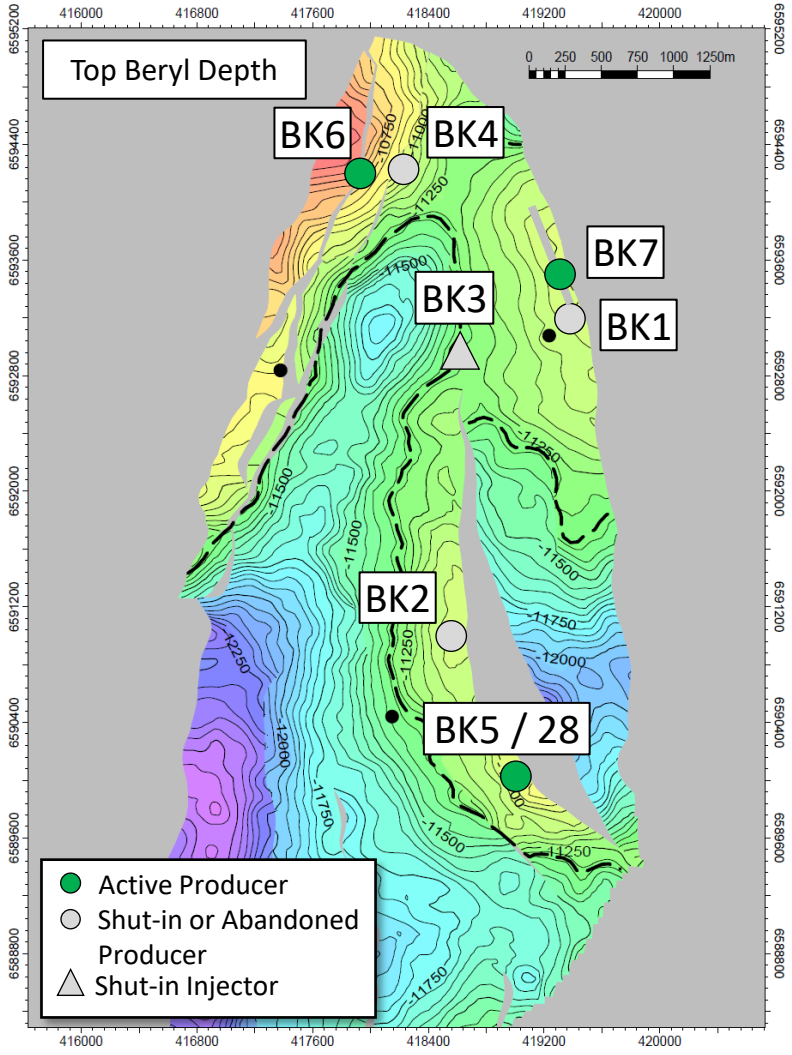
200 ft

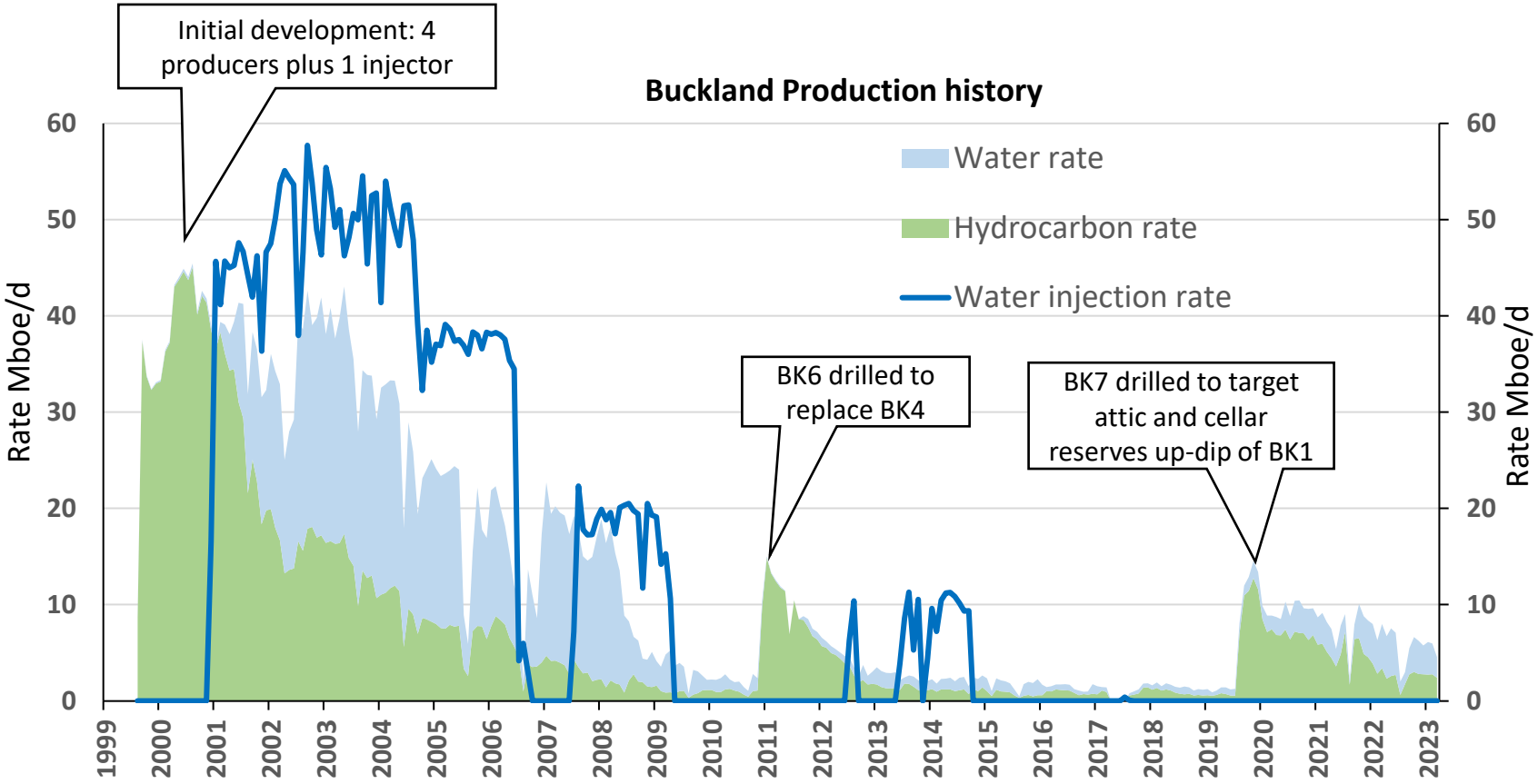
Upper Beryl

Lower Beryl

Tested pay

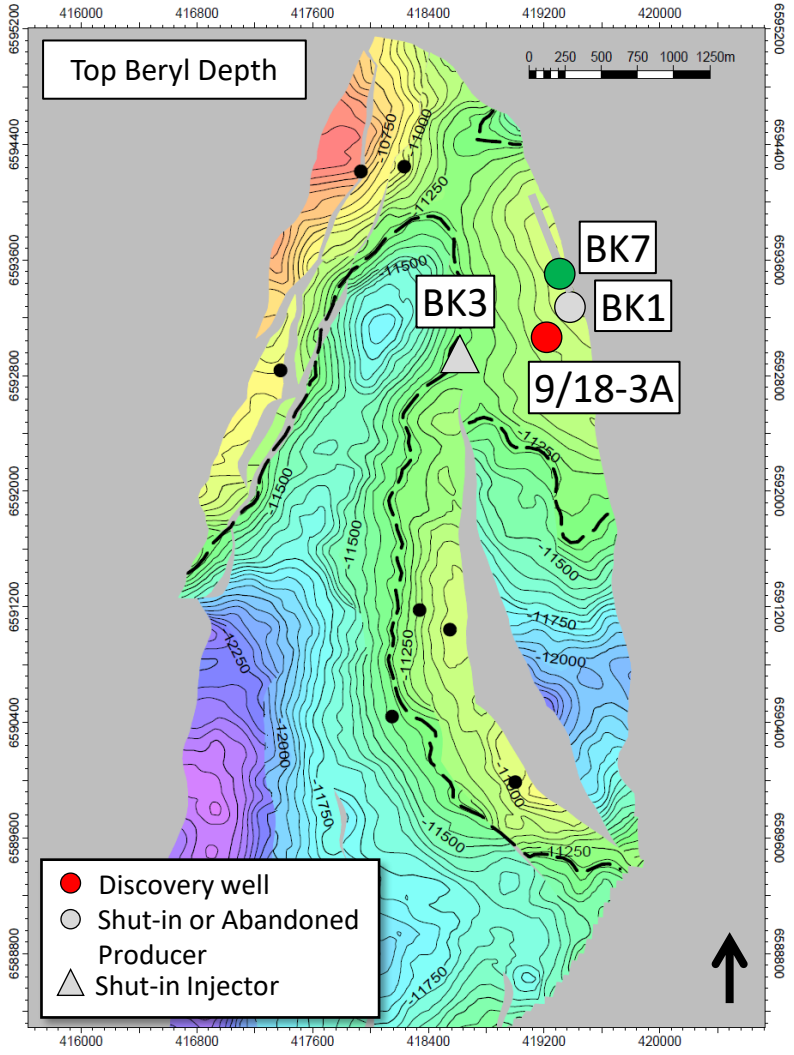
Buckland Field – 6 Producers 1 Injector, 3 Producers Online 2022

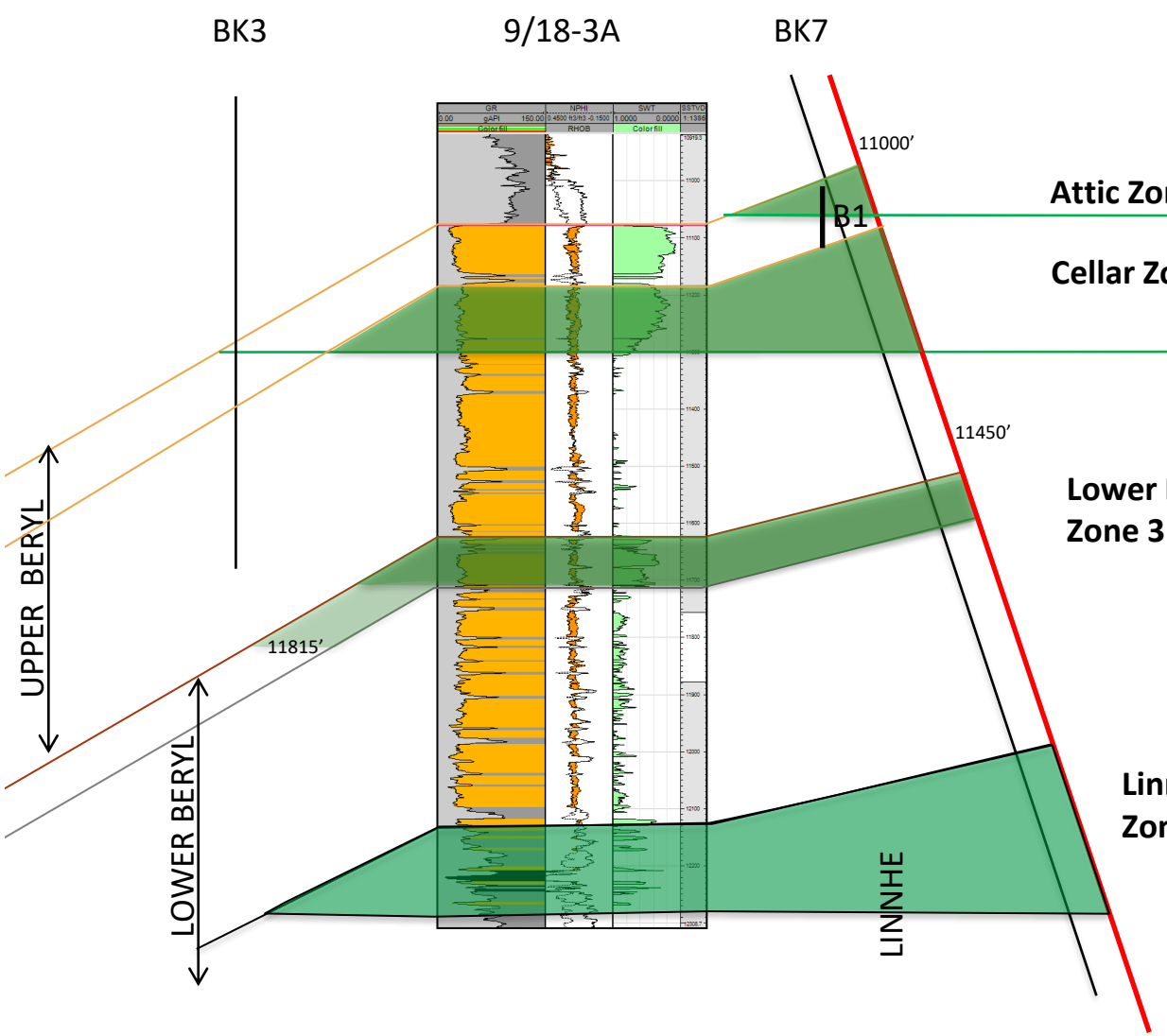


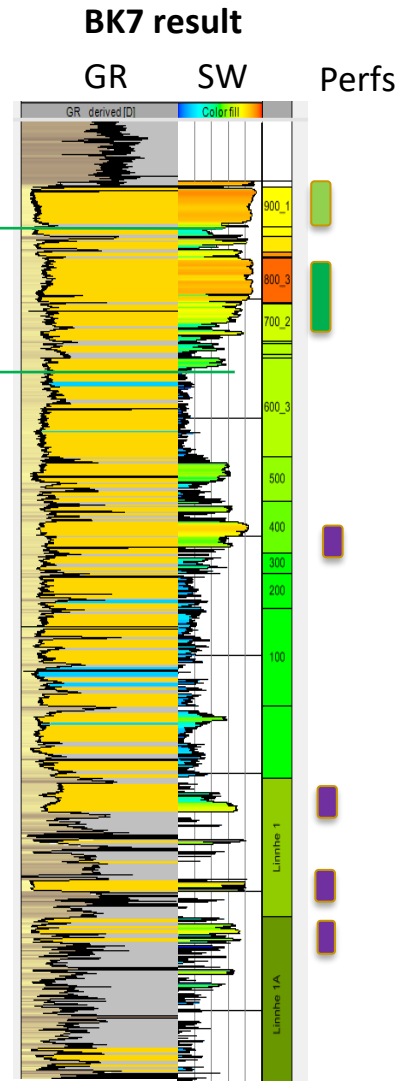


First oil 1999
Infill drilling BK6 2011; BK7 2019

2019: BK7 Successful at all 4 Primary Targets







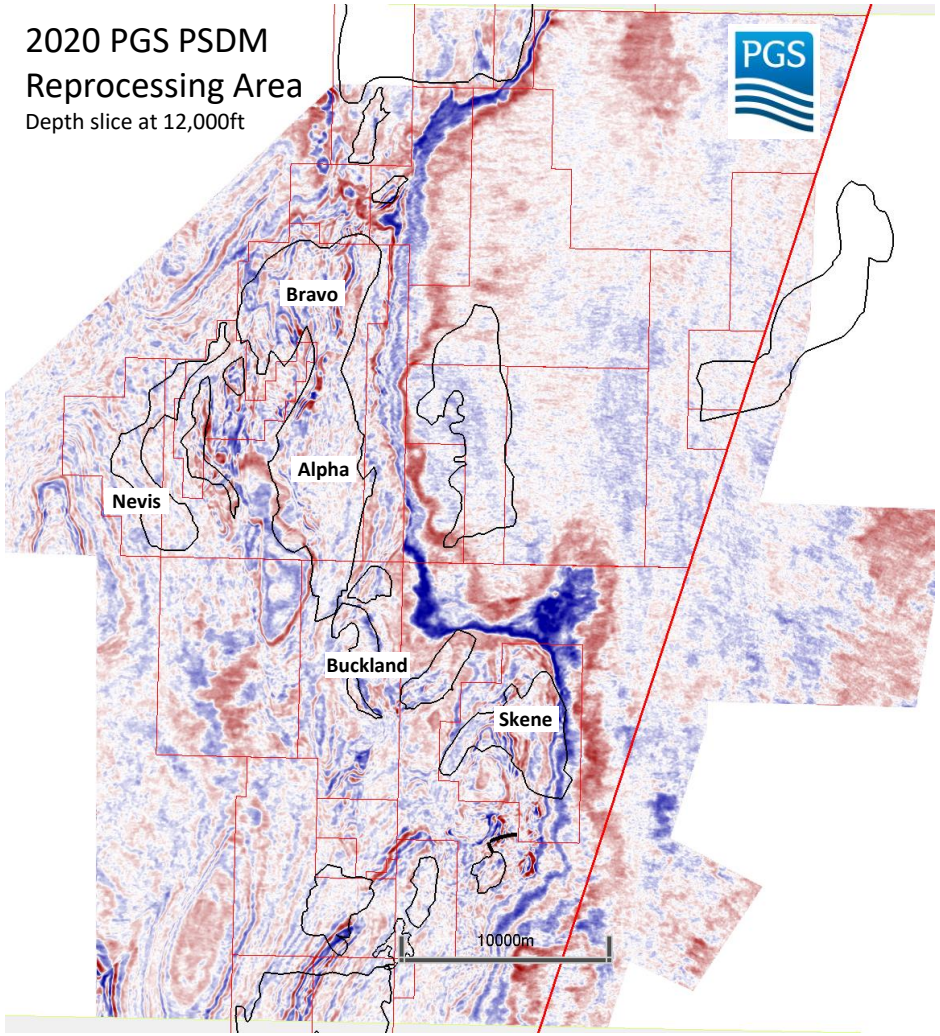
Beryl 2020 Seismic Reprocessing

Acquisition

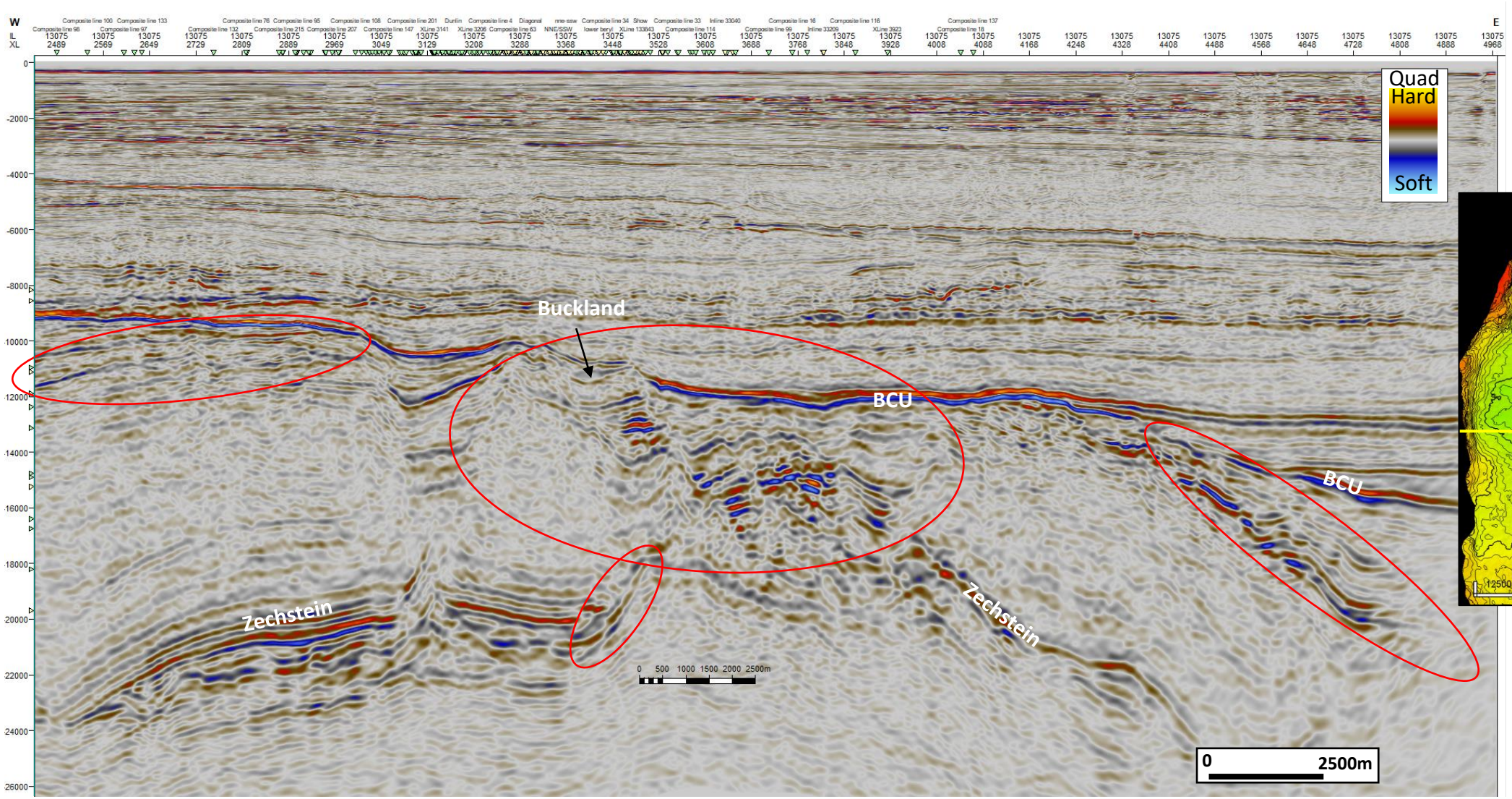
- PGS Geostreamer 2012-13

Reprocessing

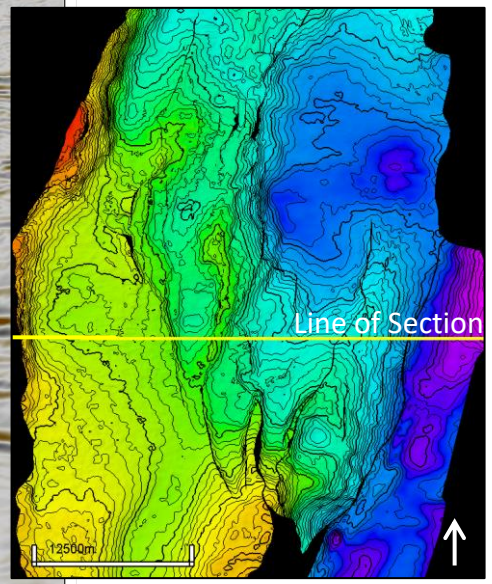
- Initial PSDM – 2014, Reprocessing PSDM – 2020
- Improvements:
  - Increased frequency content
  - Reflector resolution
  - Reflector continuity
  - Sharper horizon terminations
  - Fault imaging
- **Key reprocessing flow elements creating improvements**
  - Denoise (regeneration of P-UP & deghosting with 3D directivity)
  - Demultiple (algorithm improvements)
  - Full Waveform Inversion velocity model (2014 – tomographic)
- **Result**
  - Improved Buckland structural interpretation and top Beryl reflector over BKSW
  - Provided confidence for well approval



2014 Initial PSDM Seismic Data

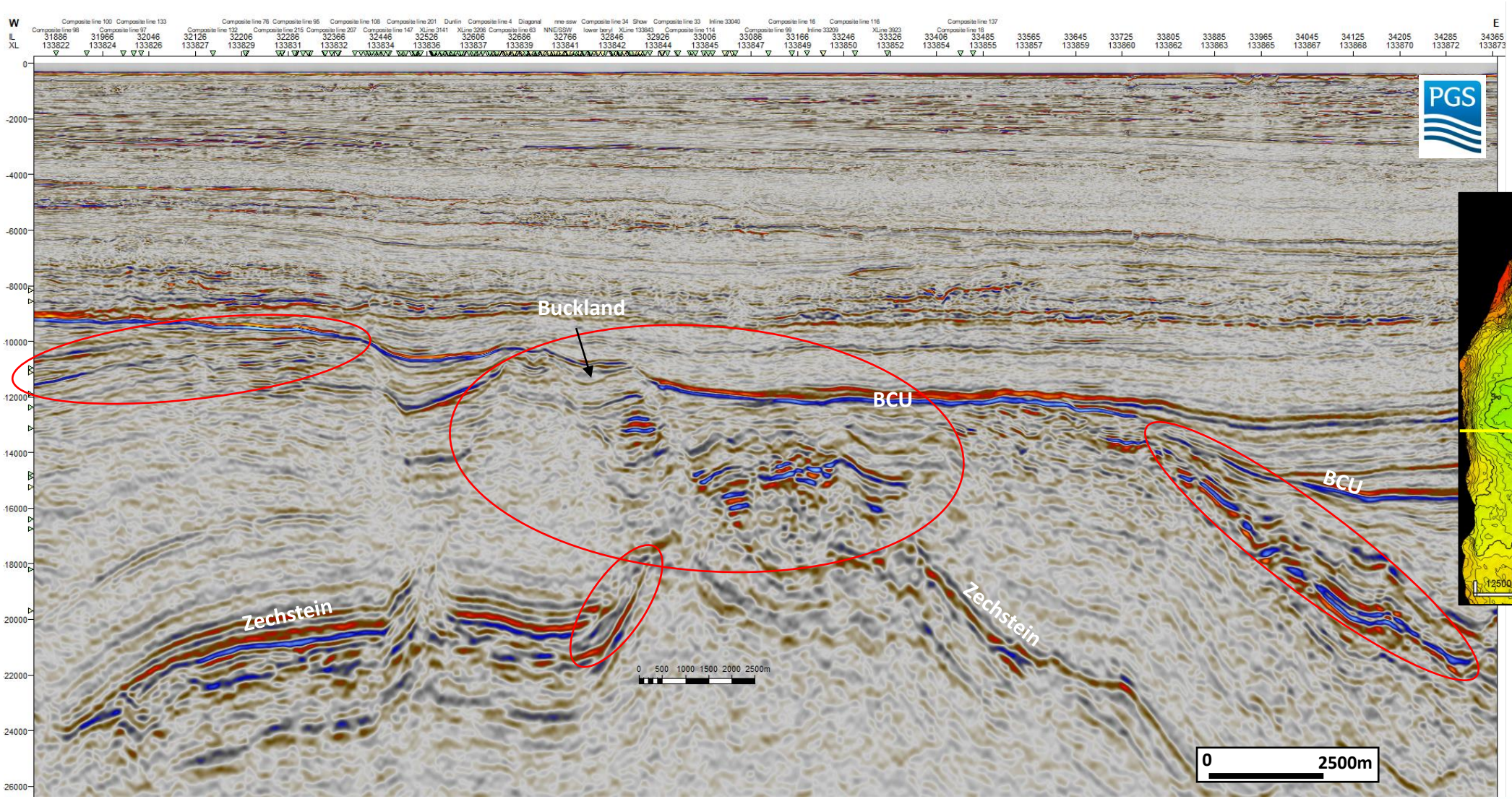


Top BCU Map over the Beryl Embayment



3D Broadband Acquisition (MC3D-BYL2012/13) - Courtesy PGS

PGS 2020 PSDM Re-processed Seismic



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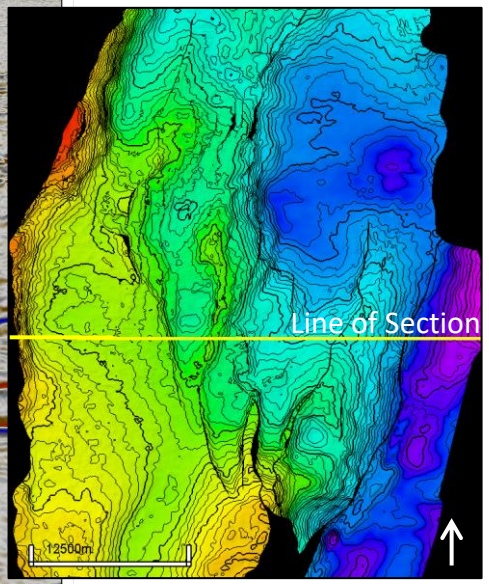

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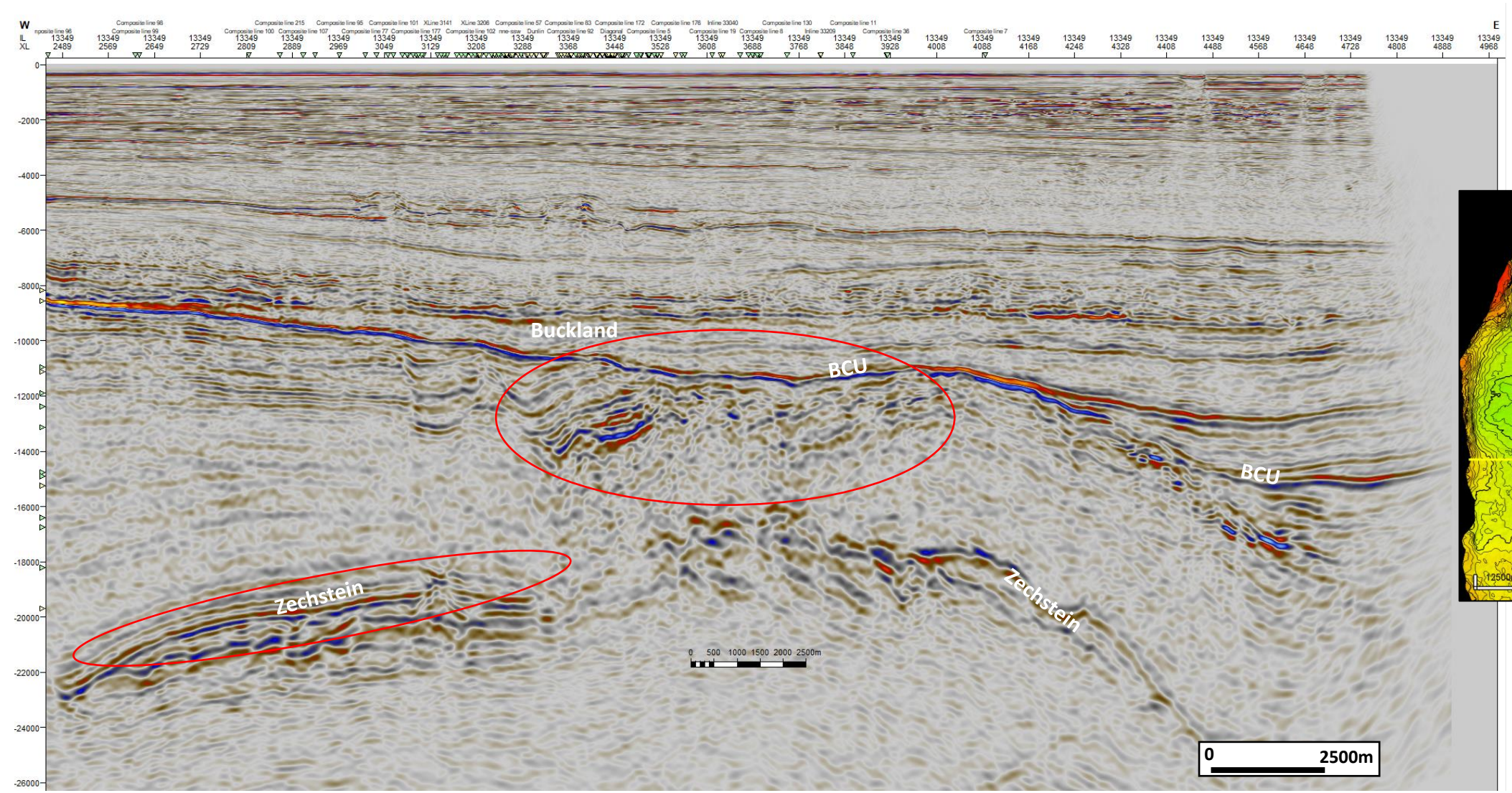

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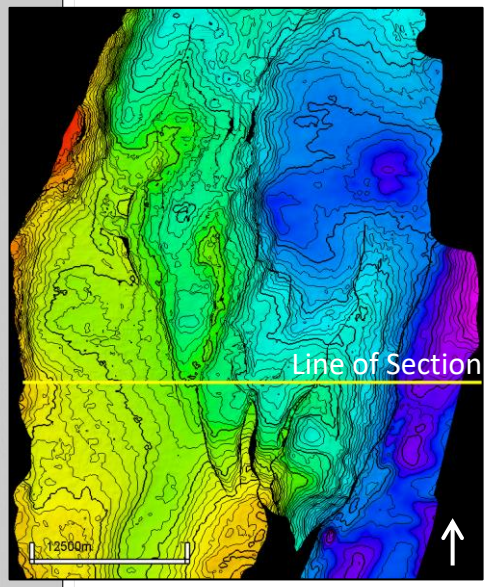

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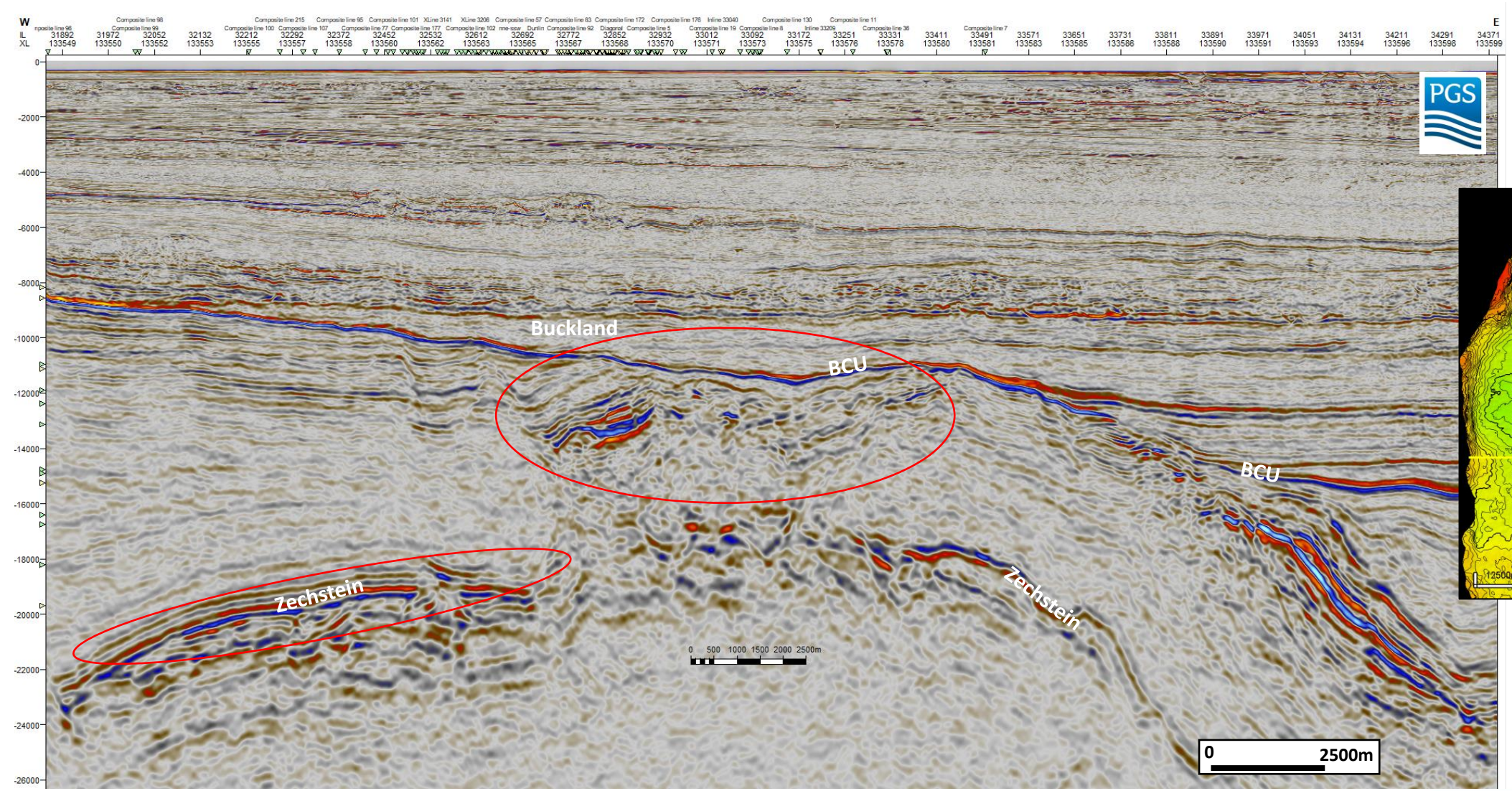

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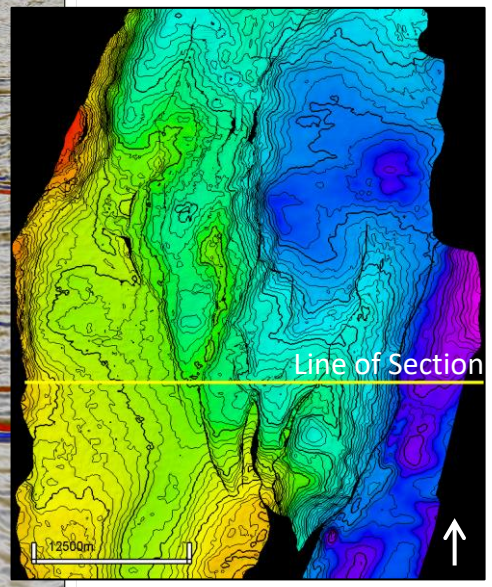

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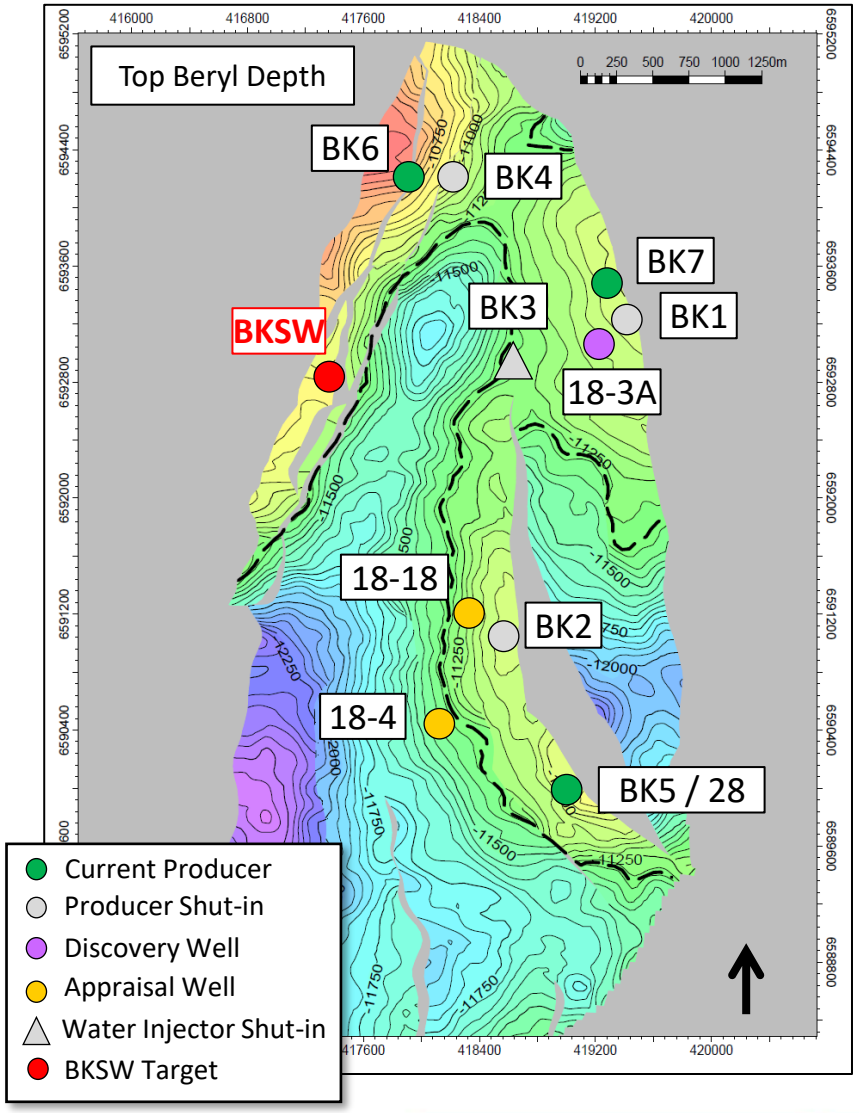
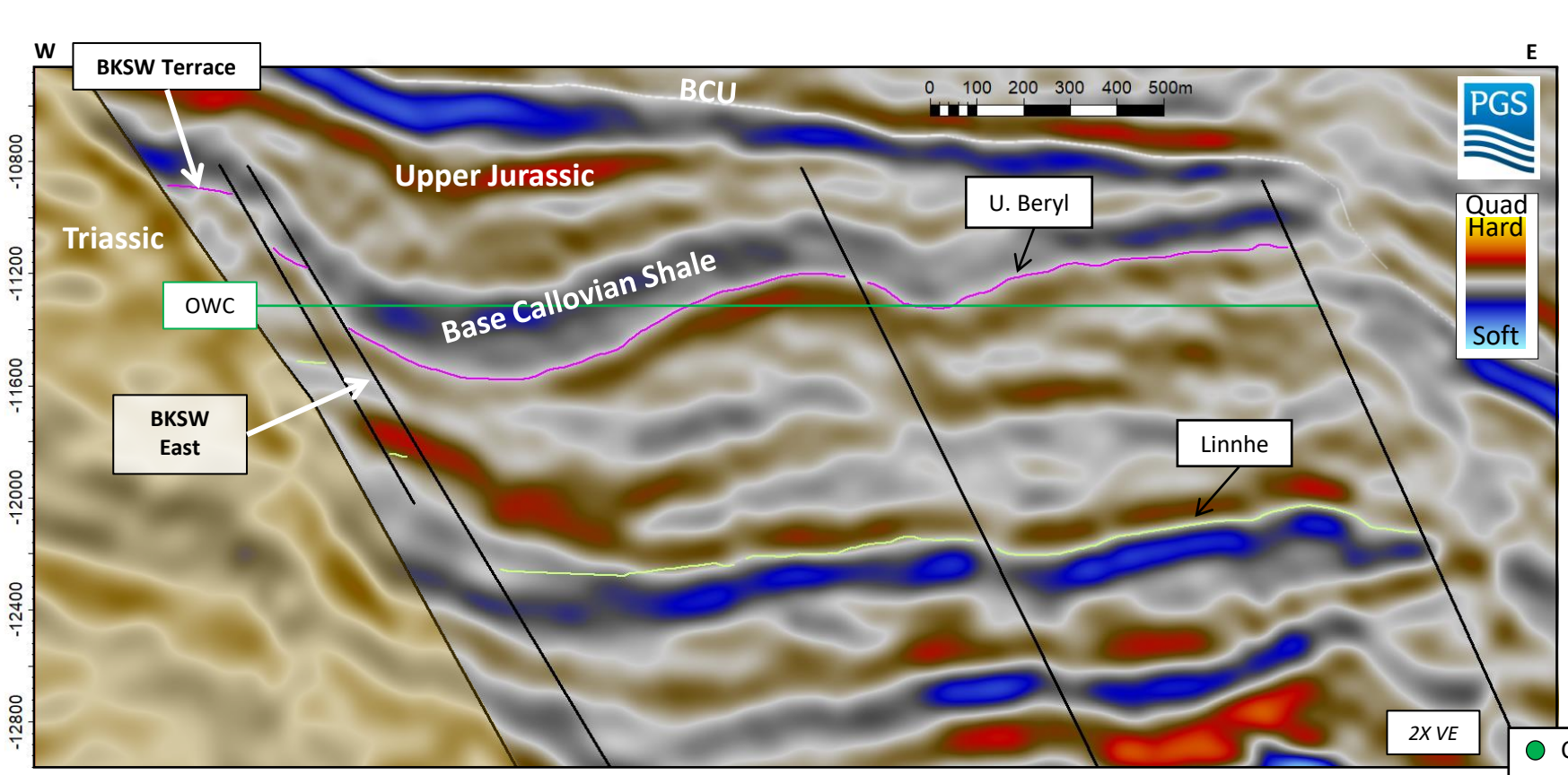
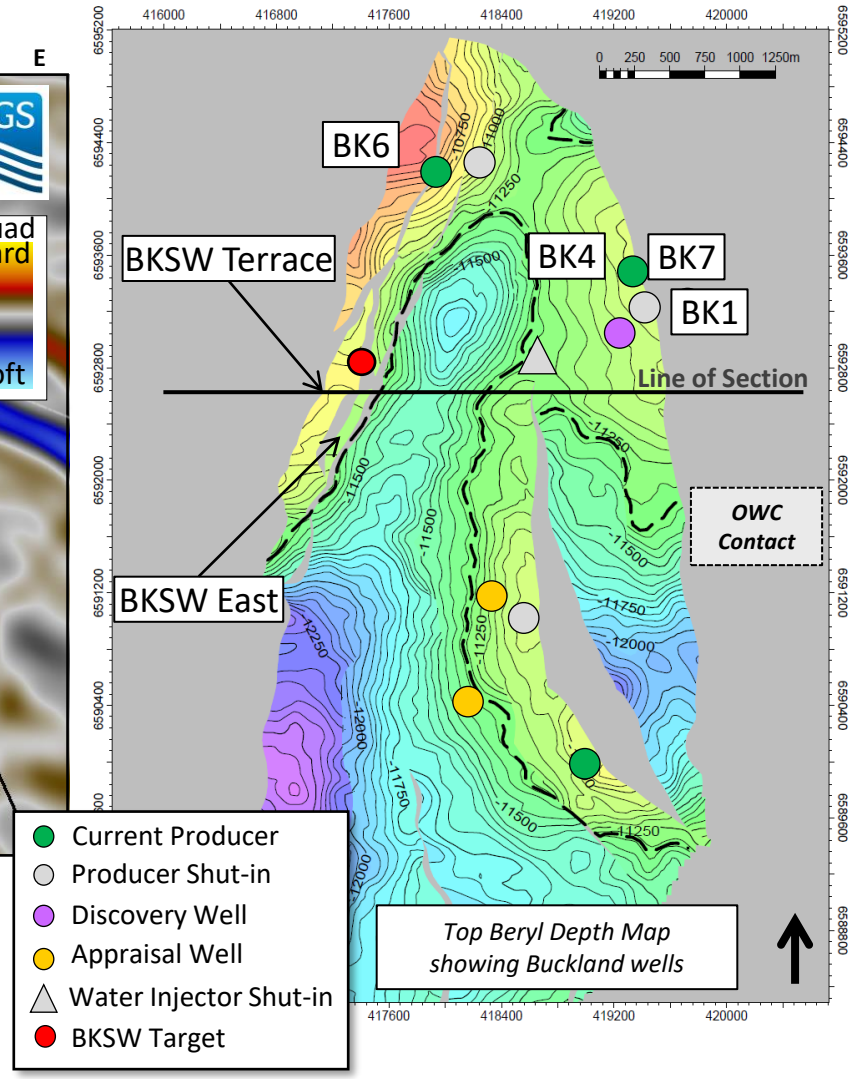


BKSW Pre-drill Summary





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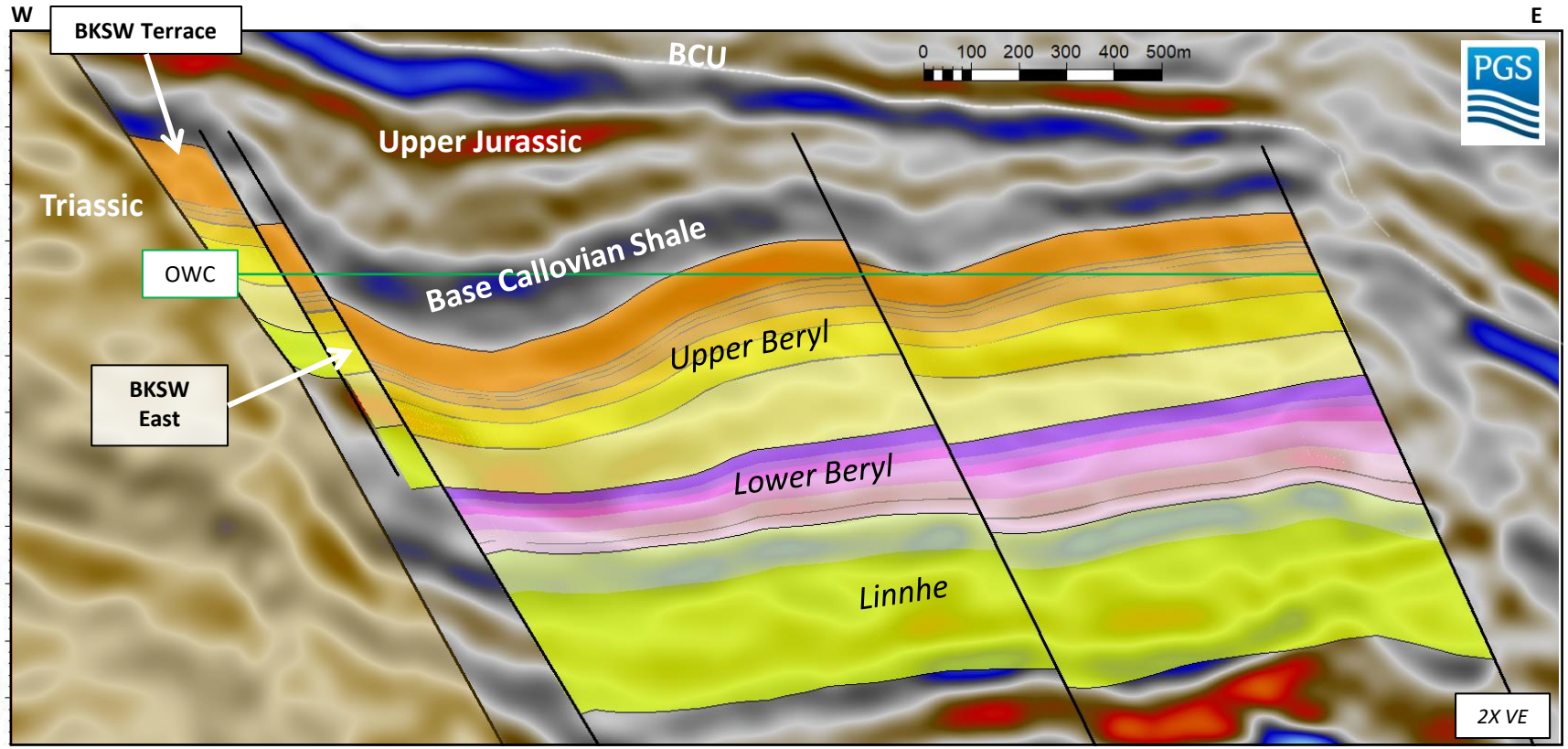
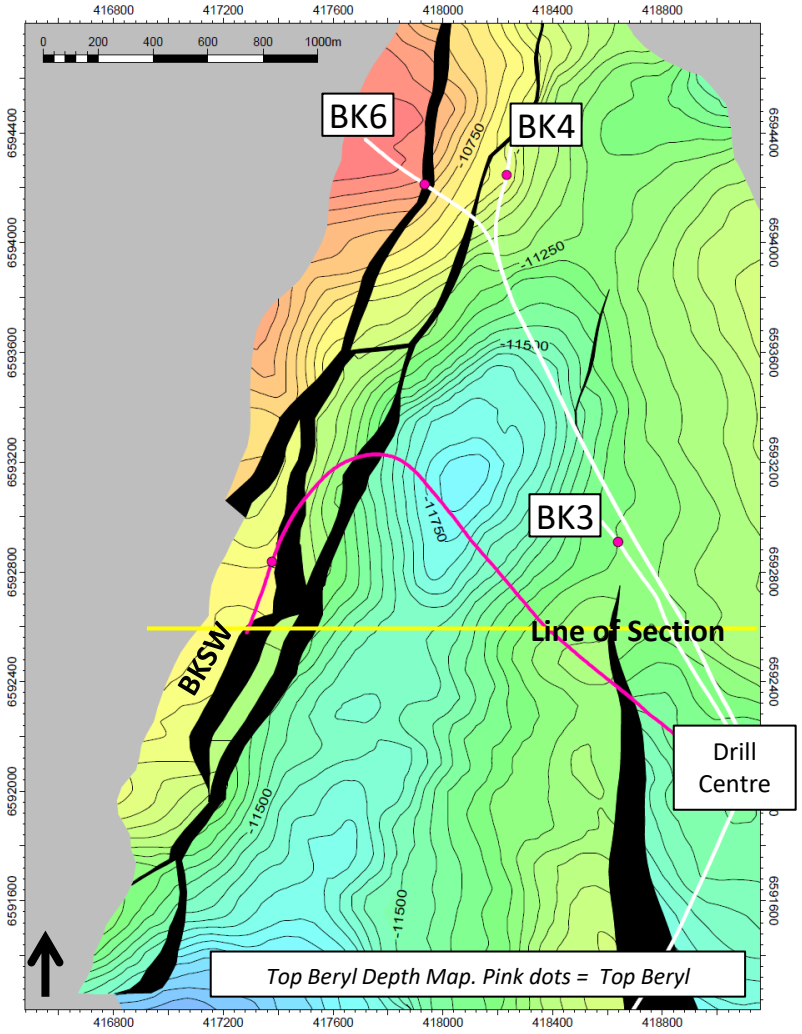
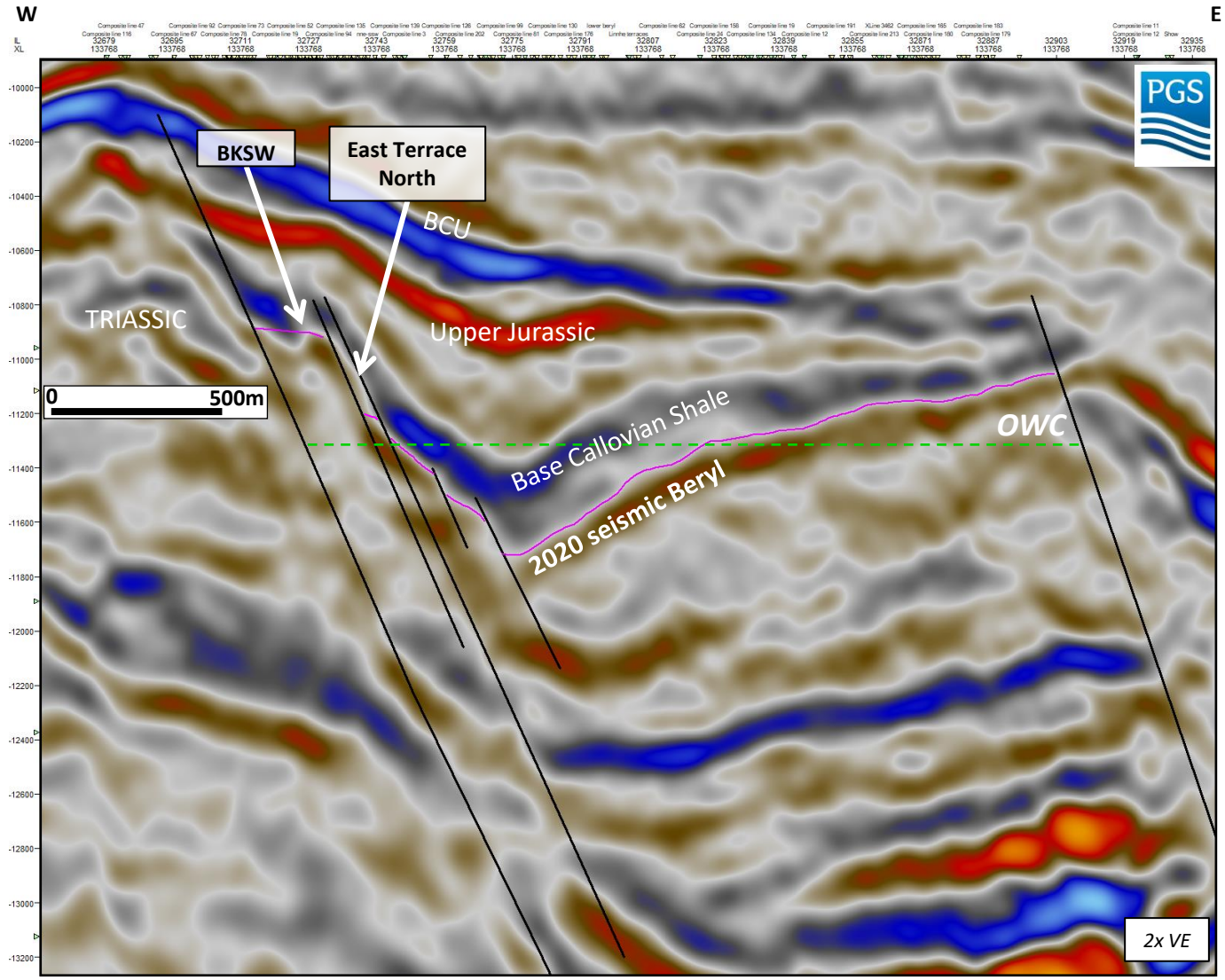
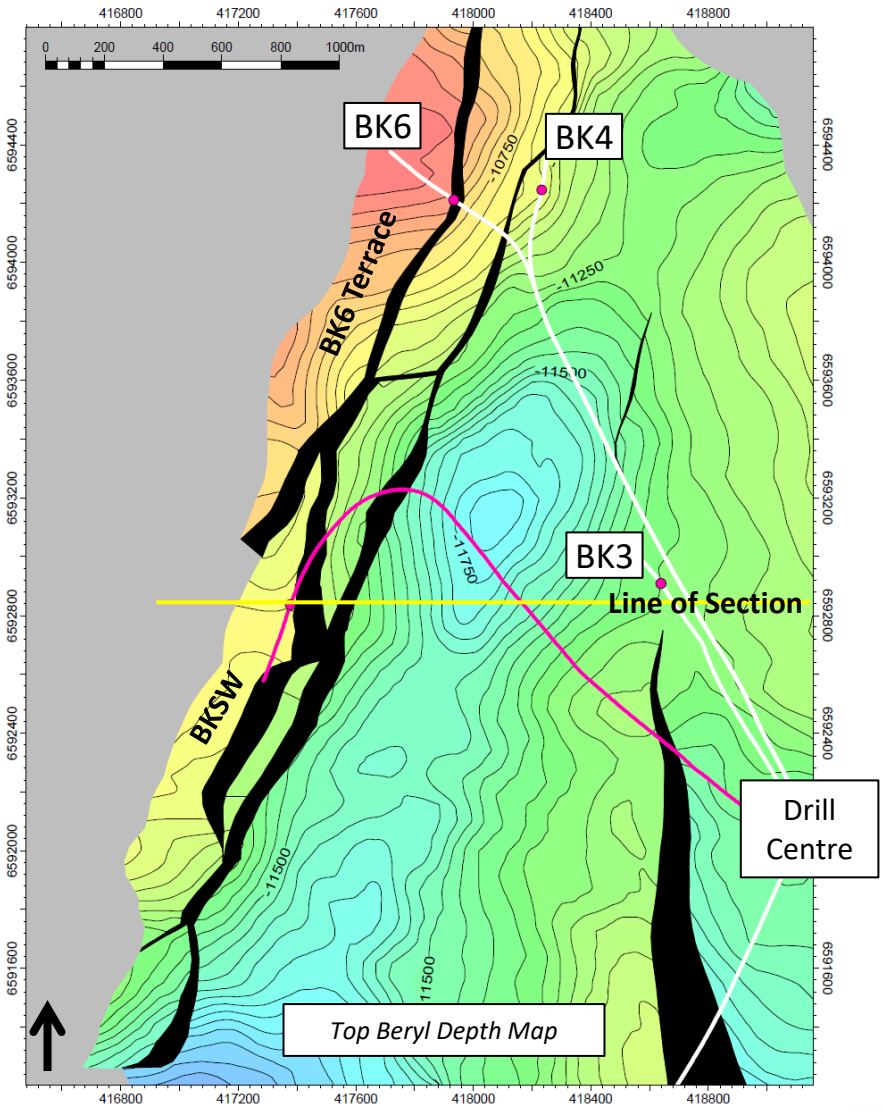




Seismic Comparison: 2020 Re-processed Seismic Data





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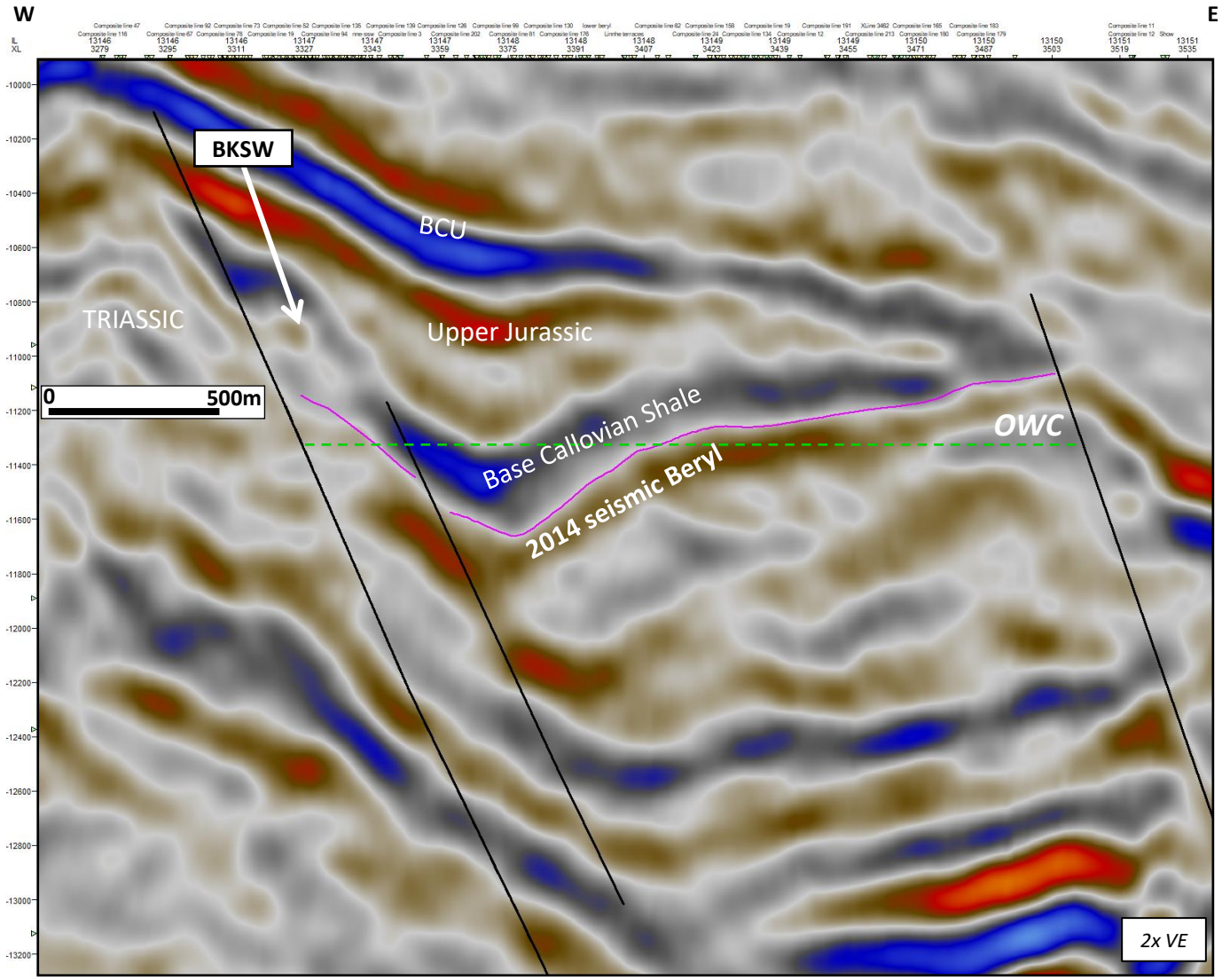

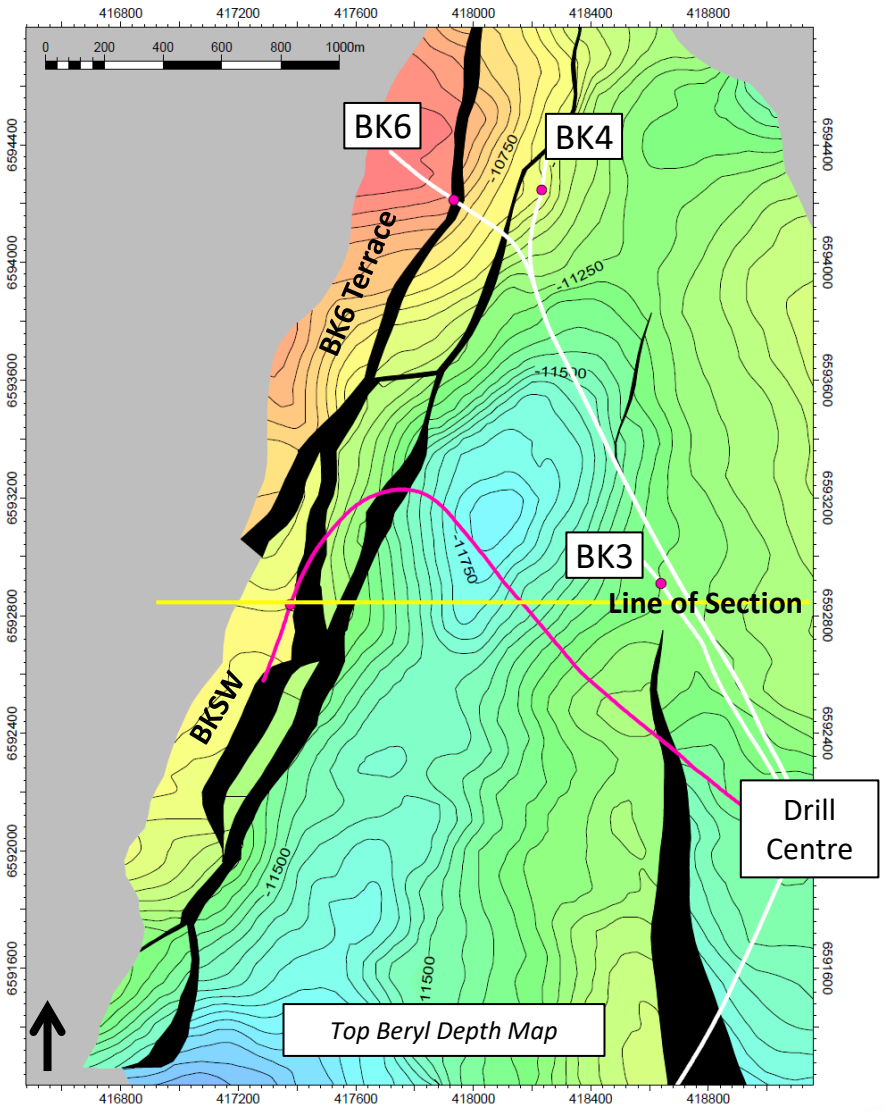

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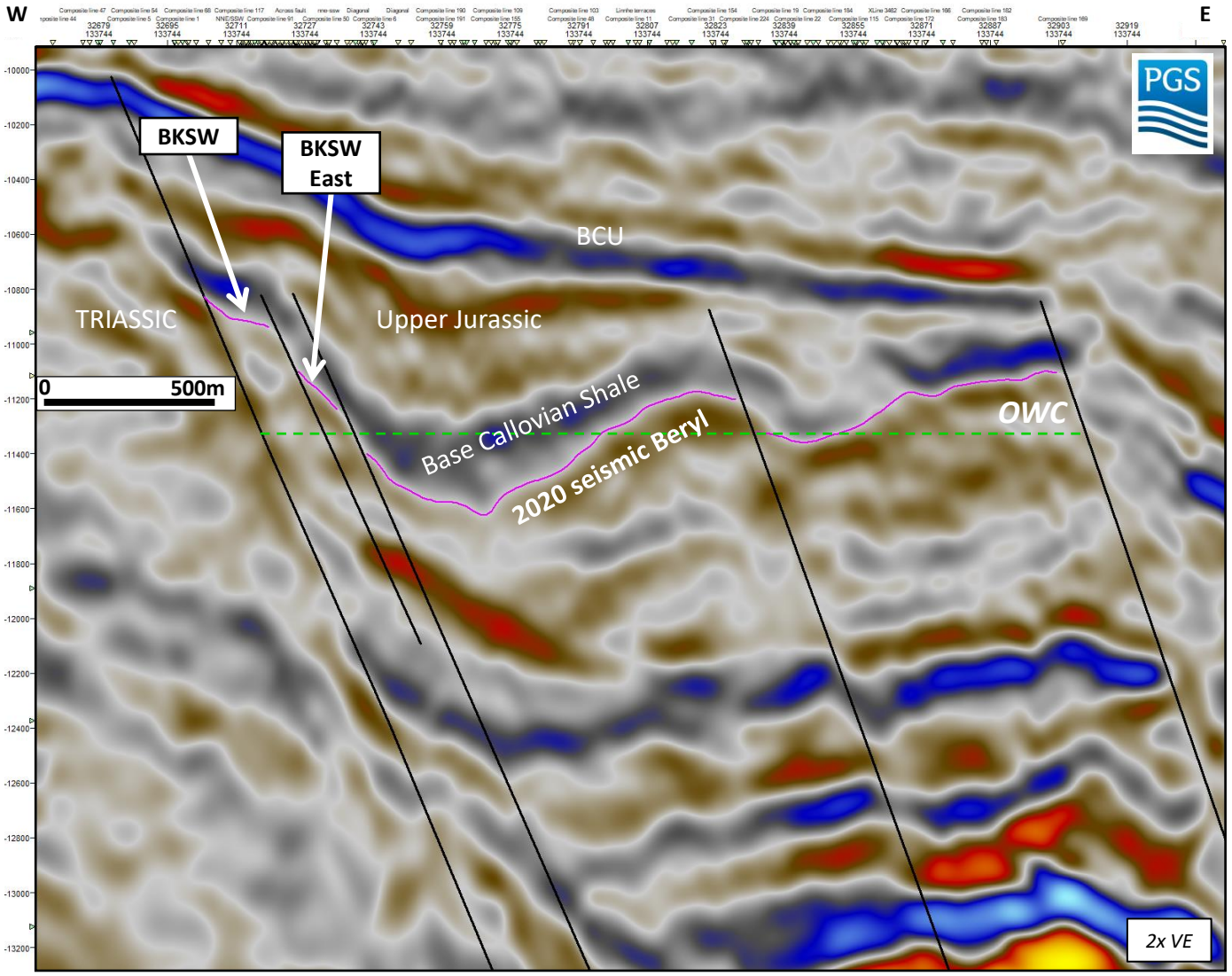

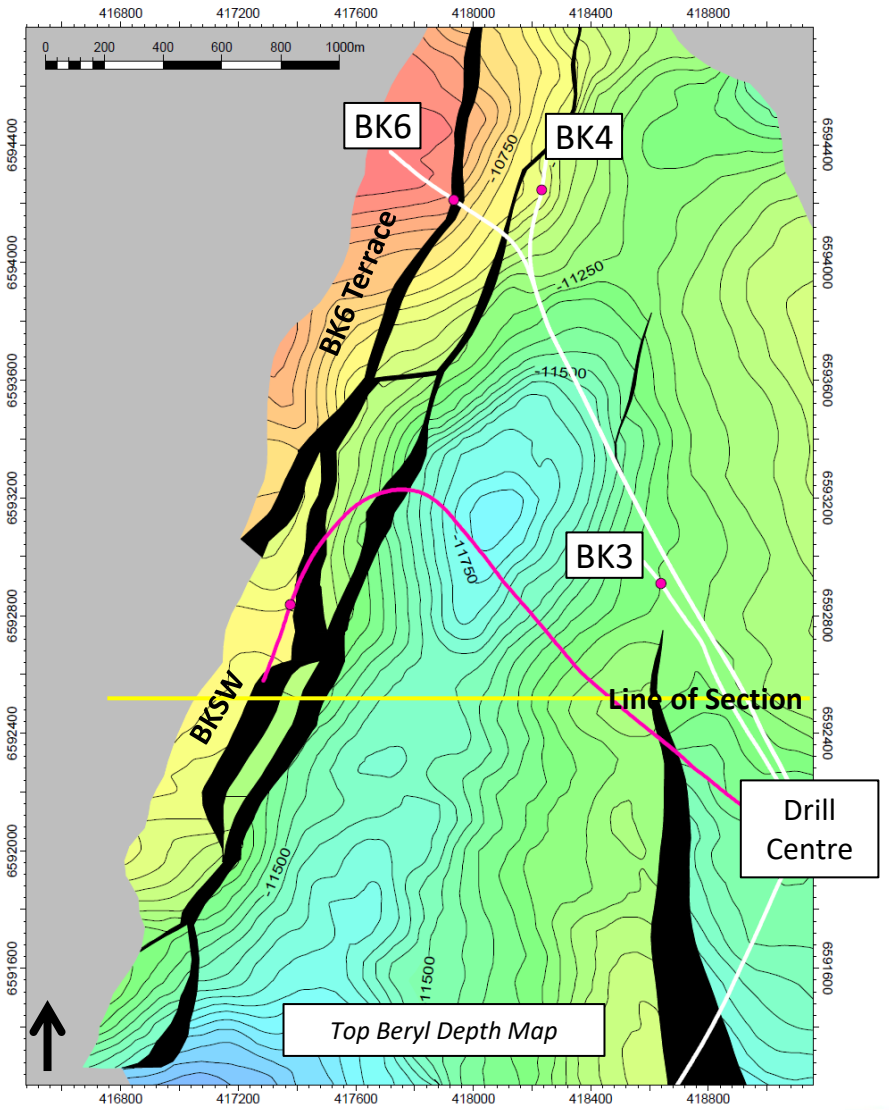

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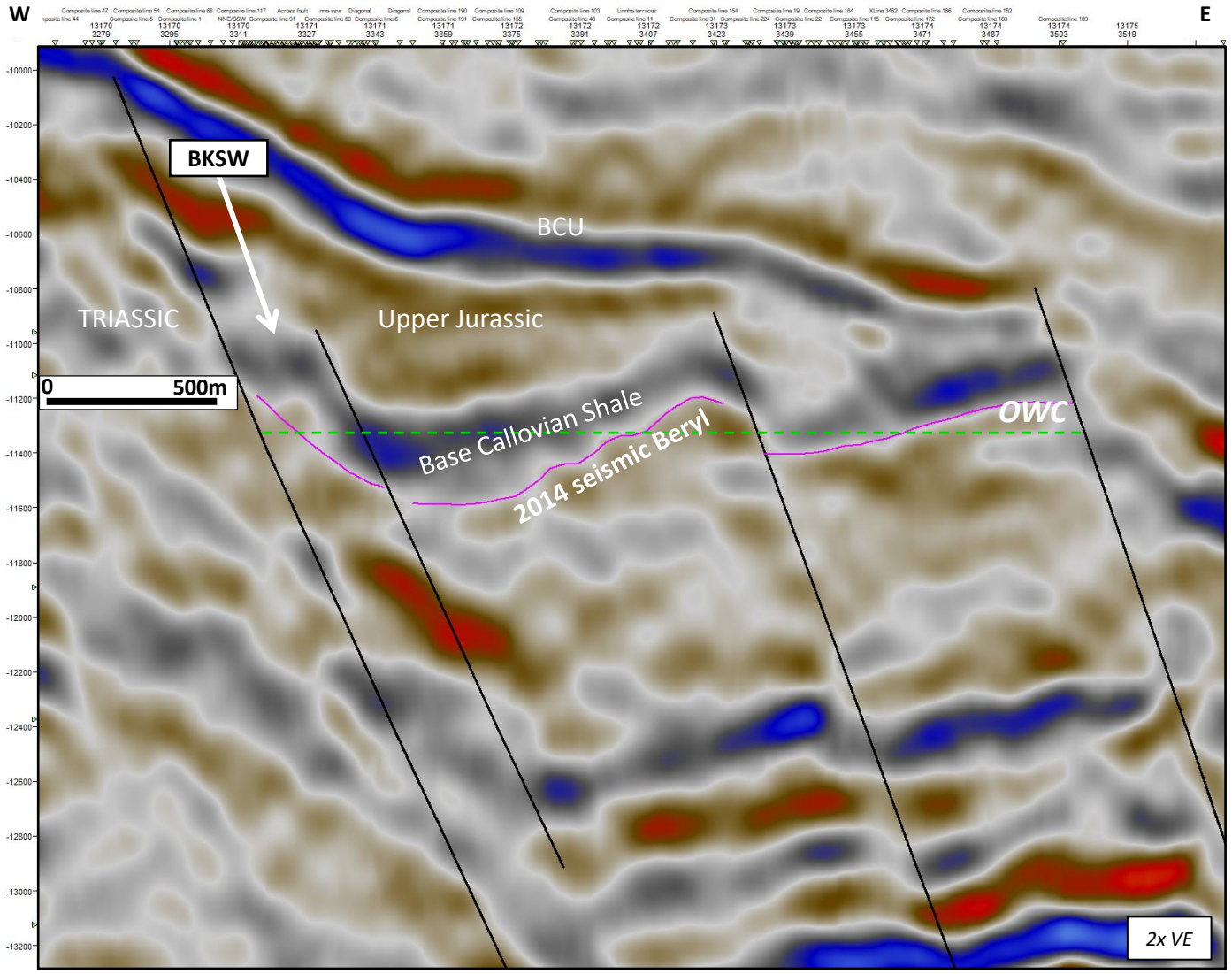

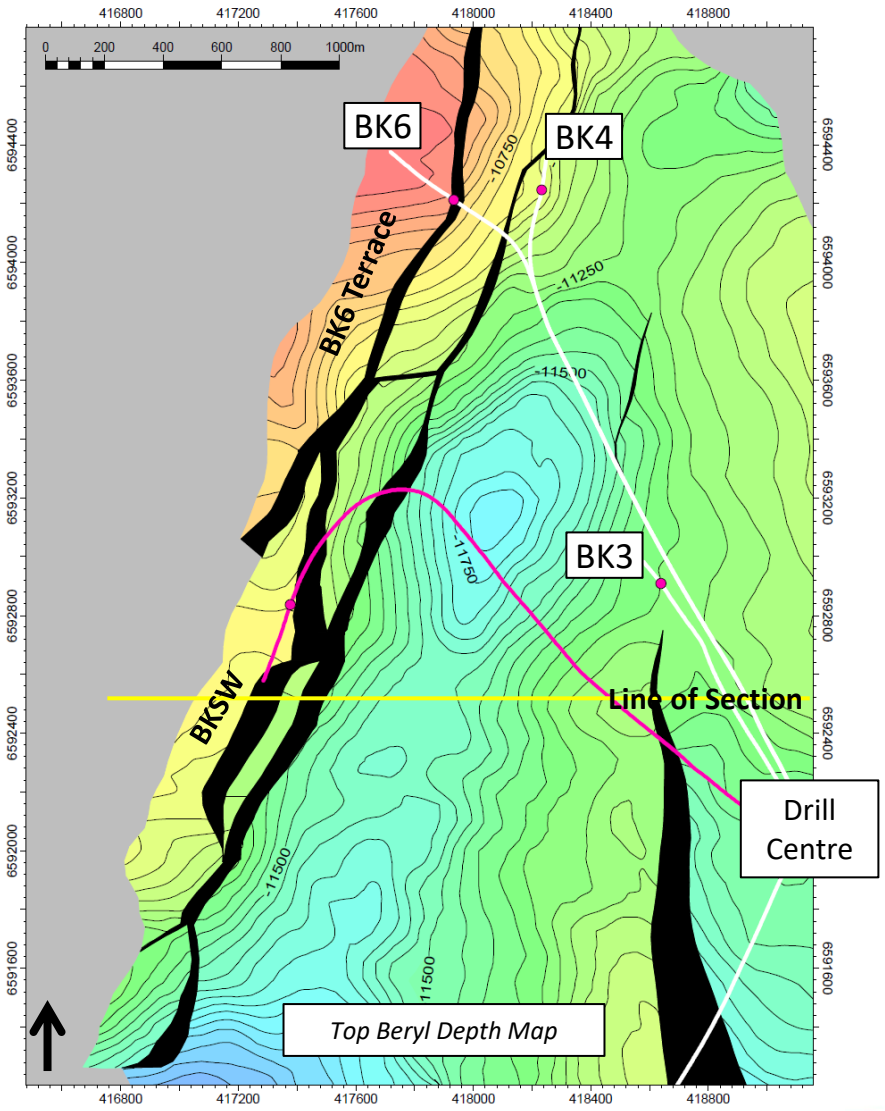

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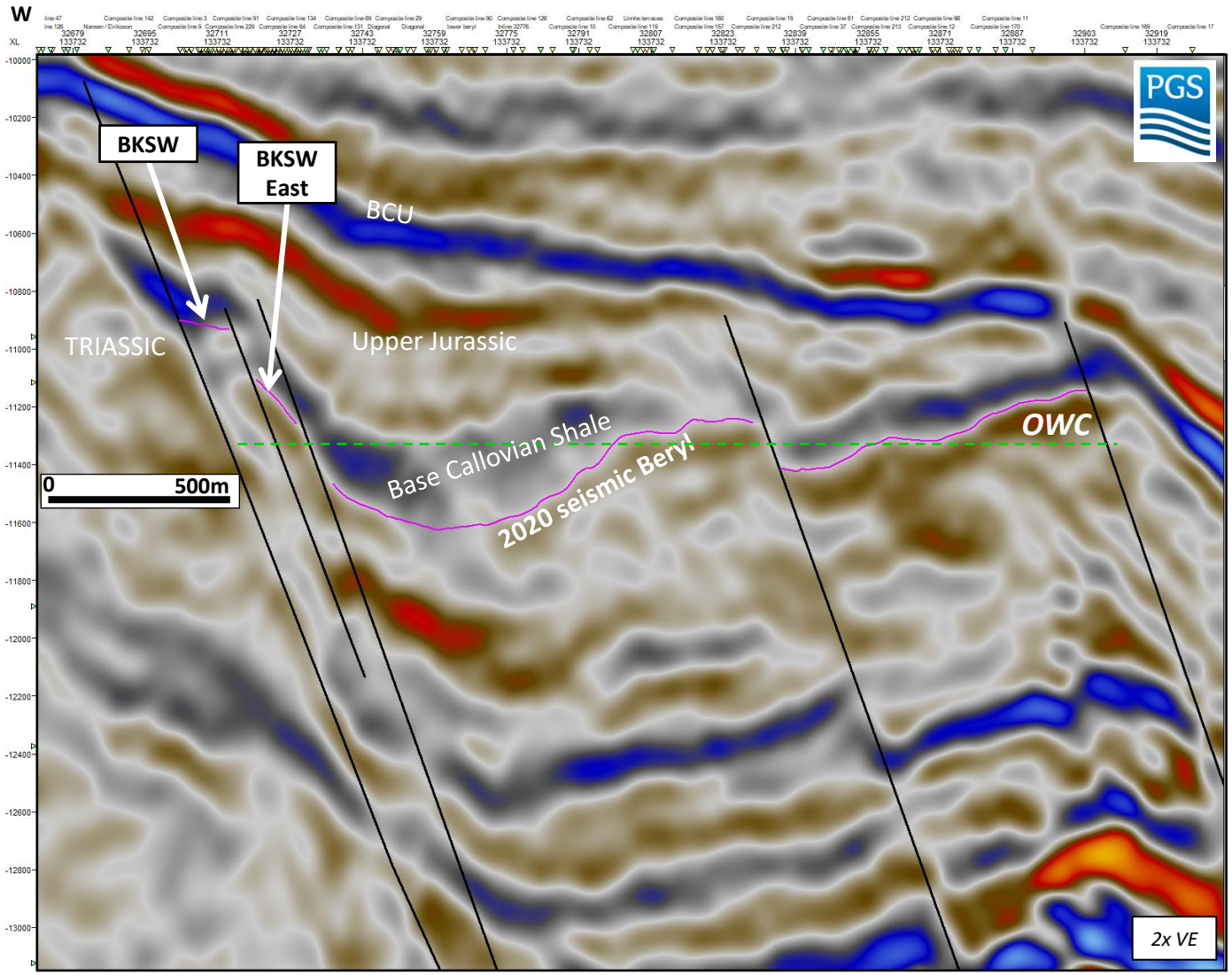

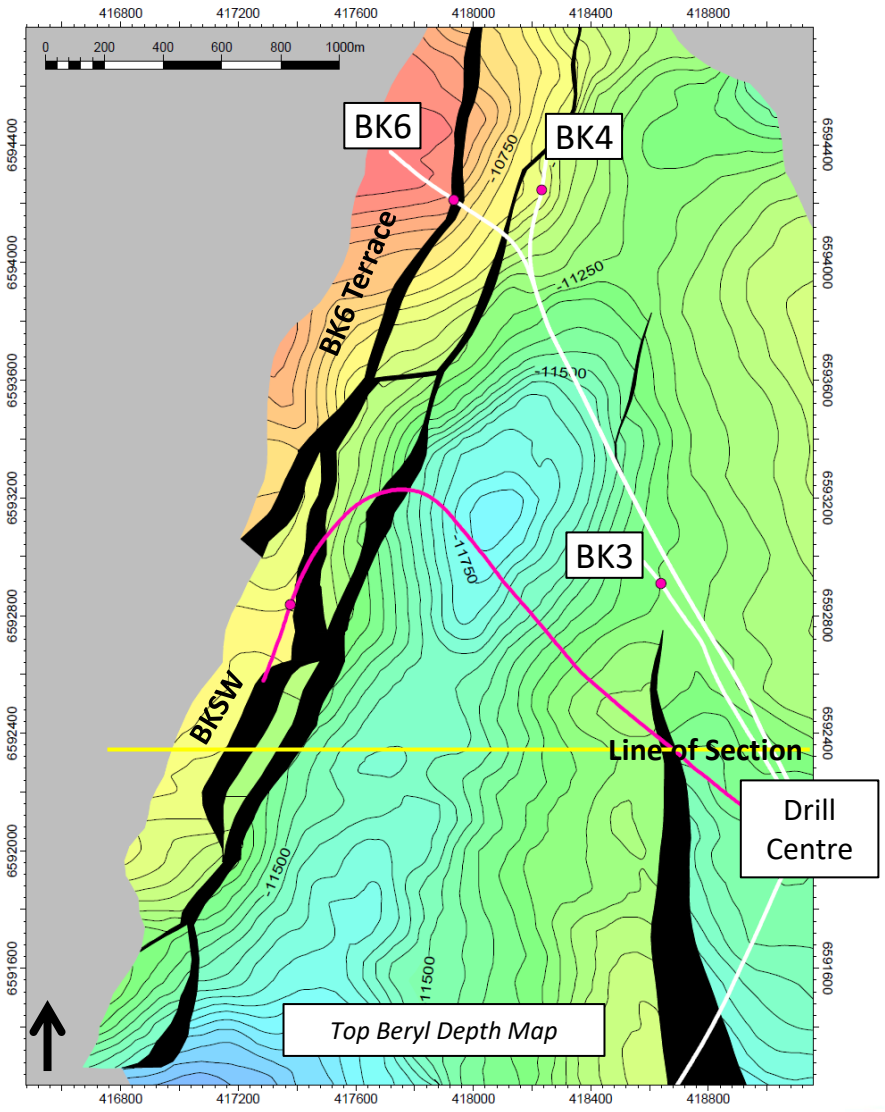

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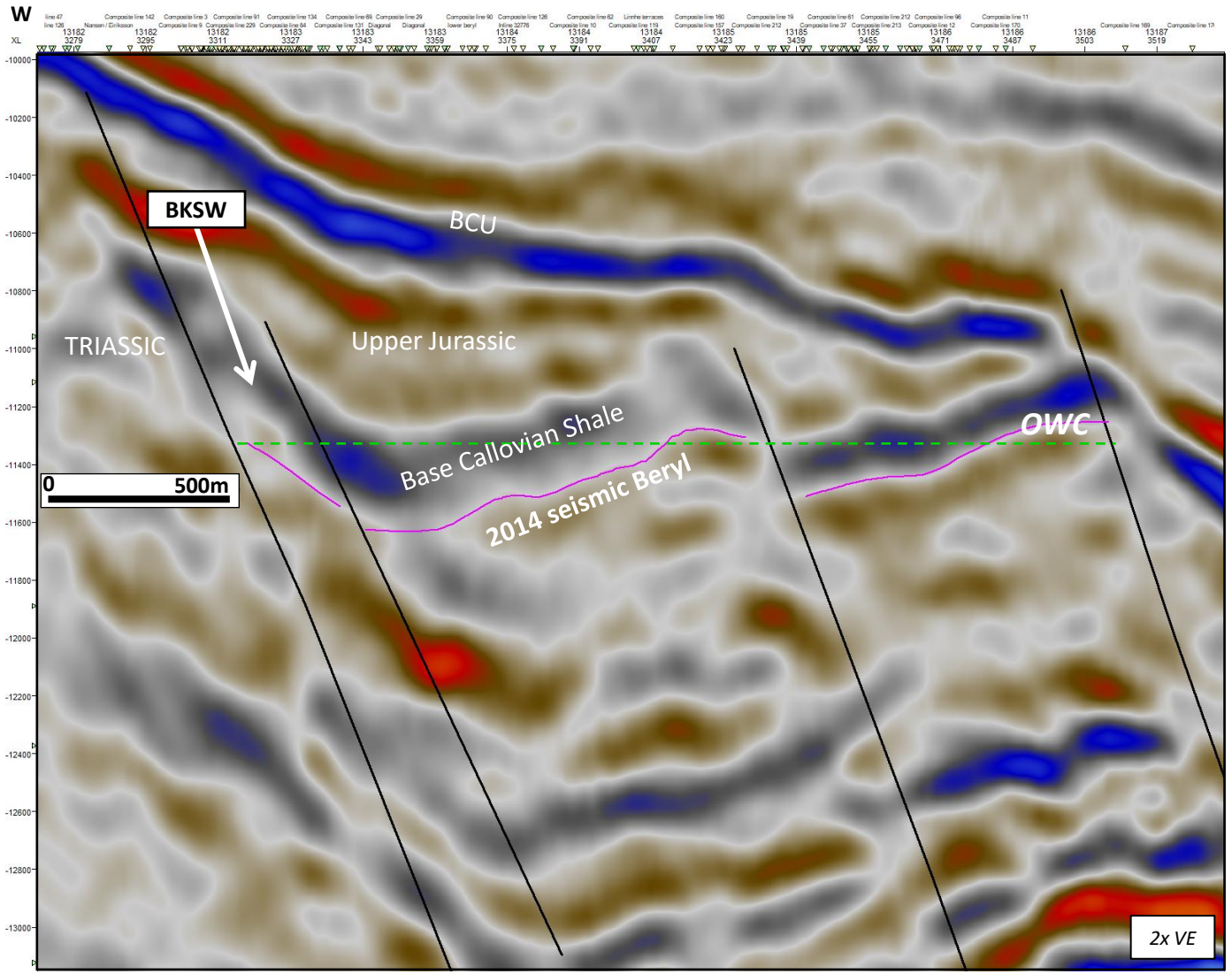

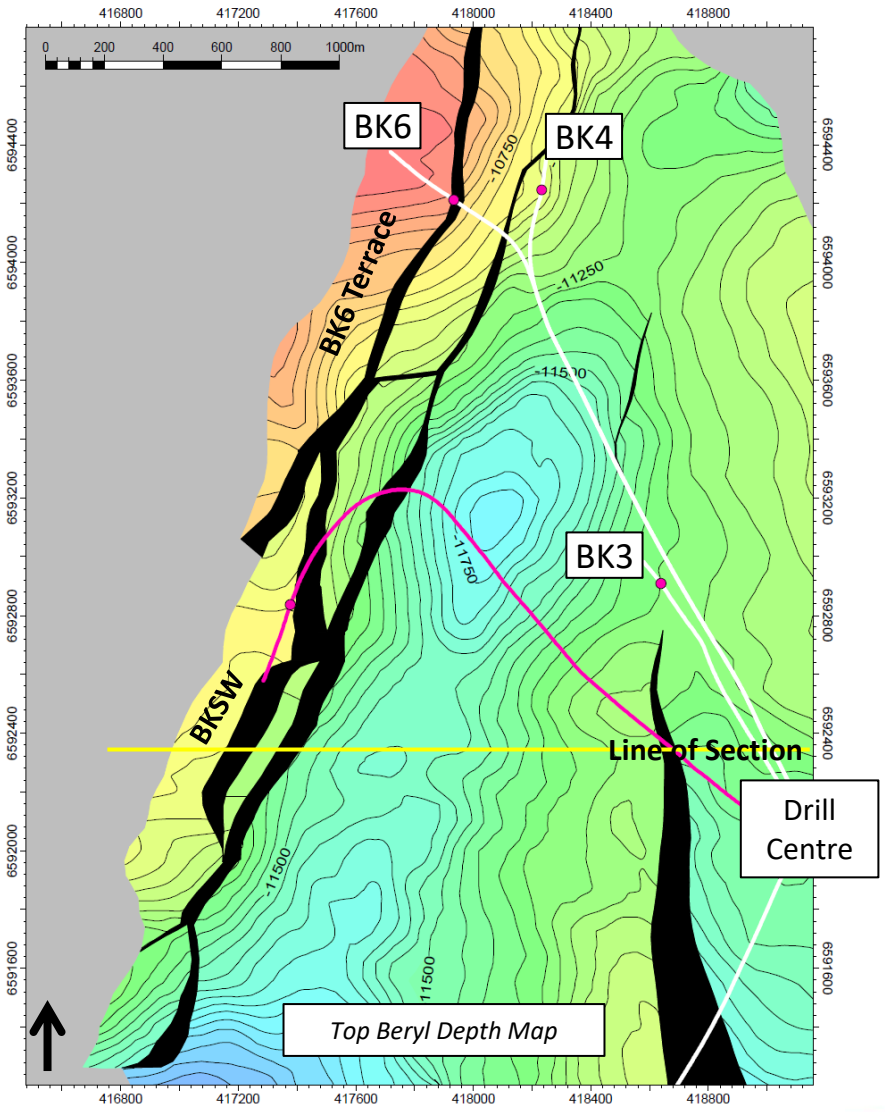

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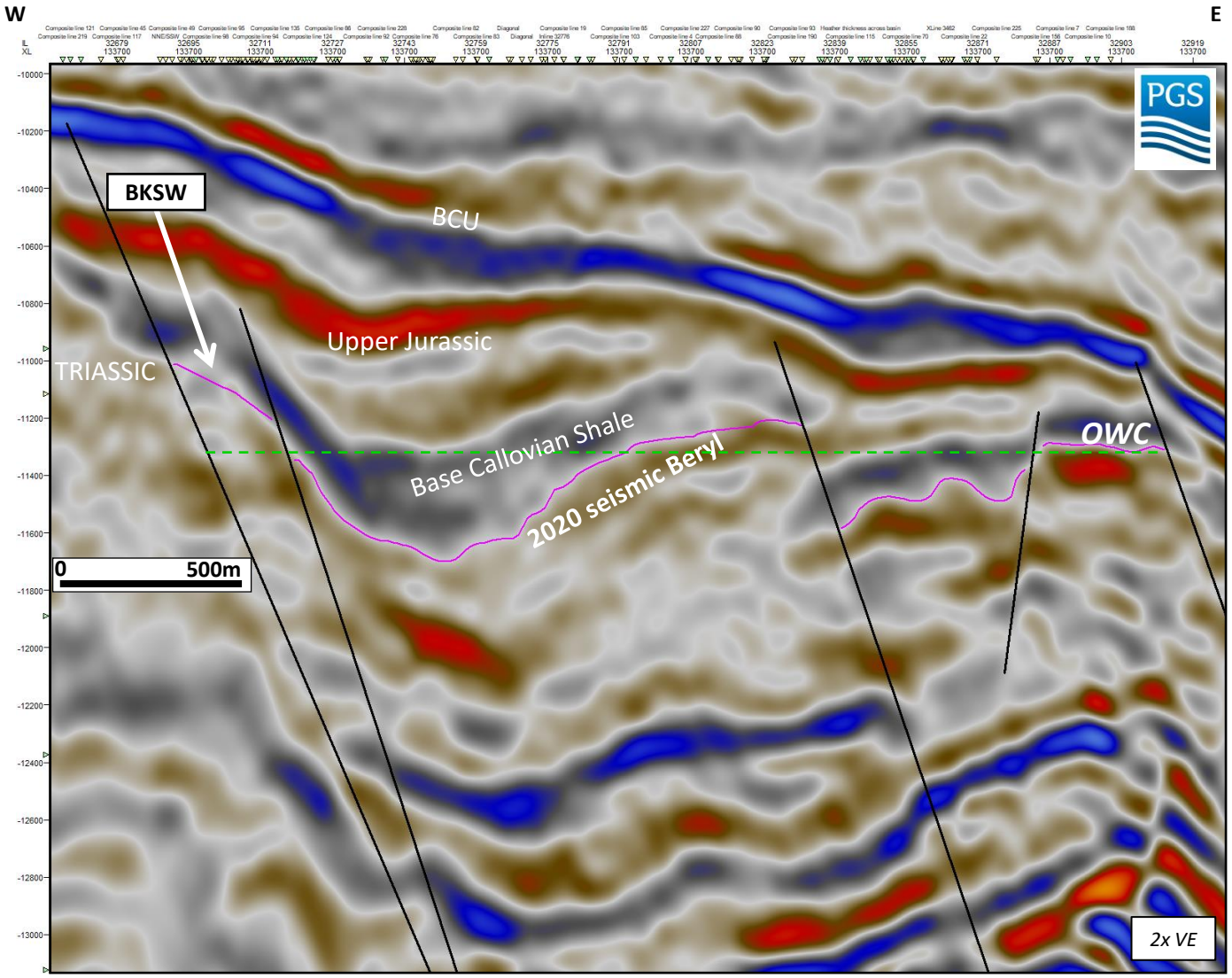

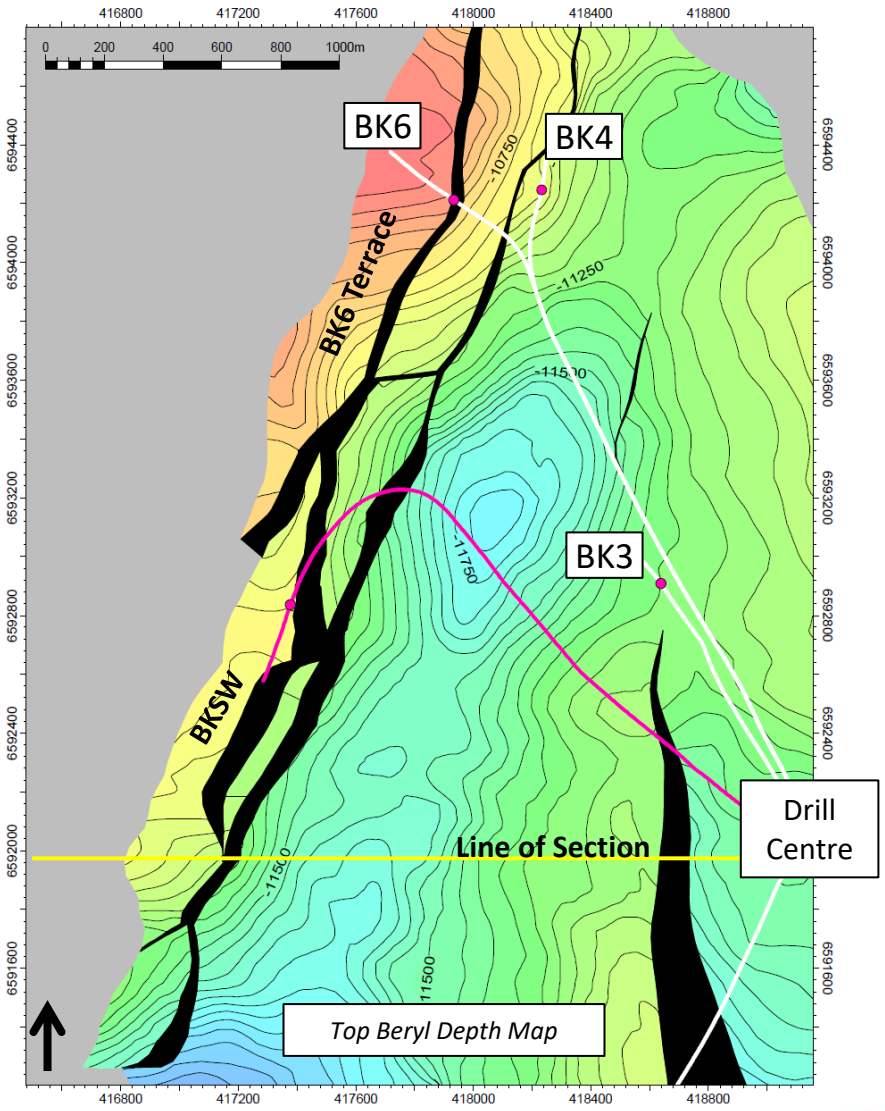

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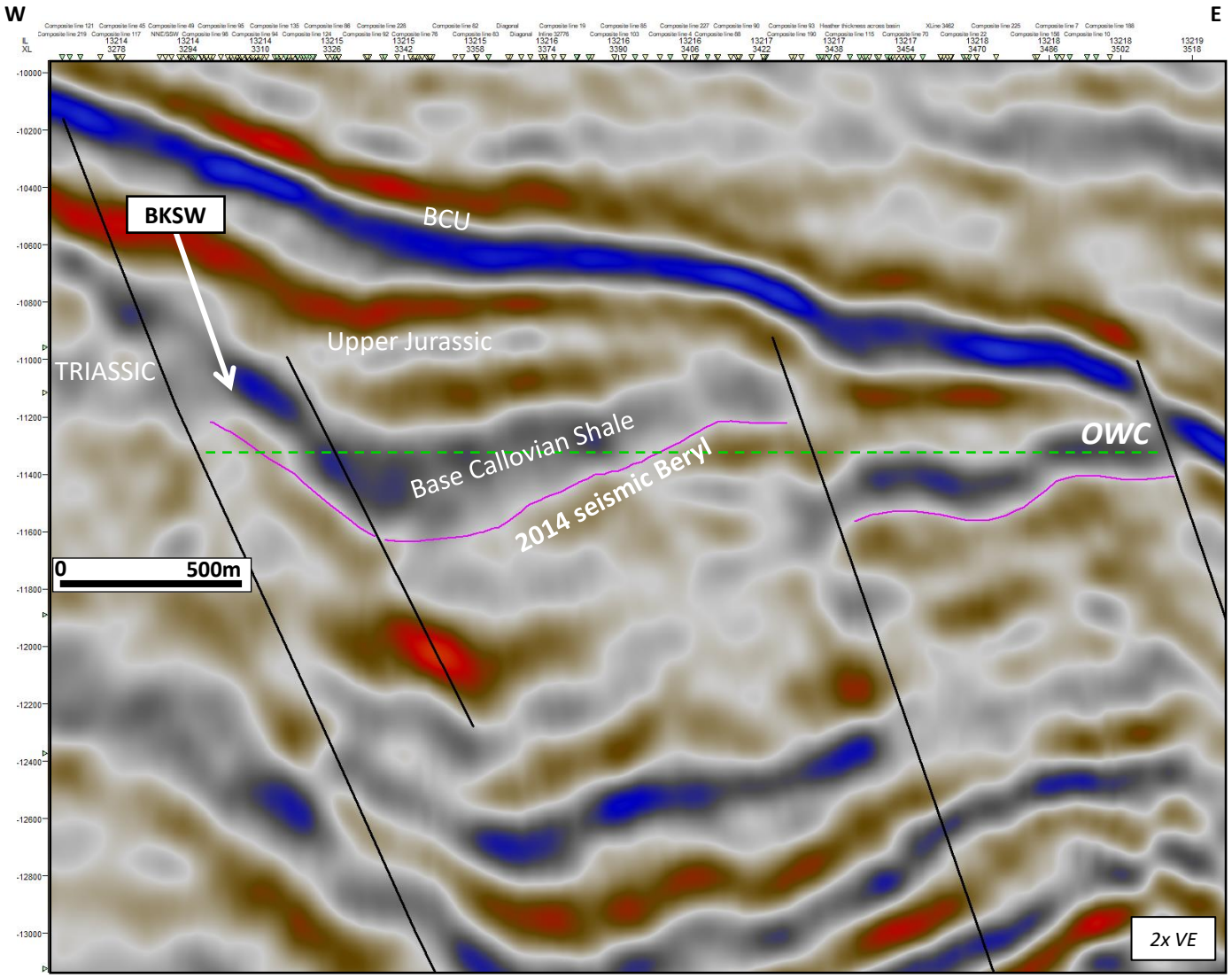

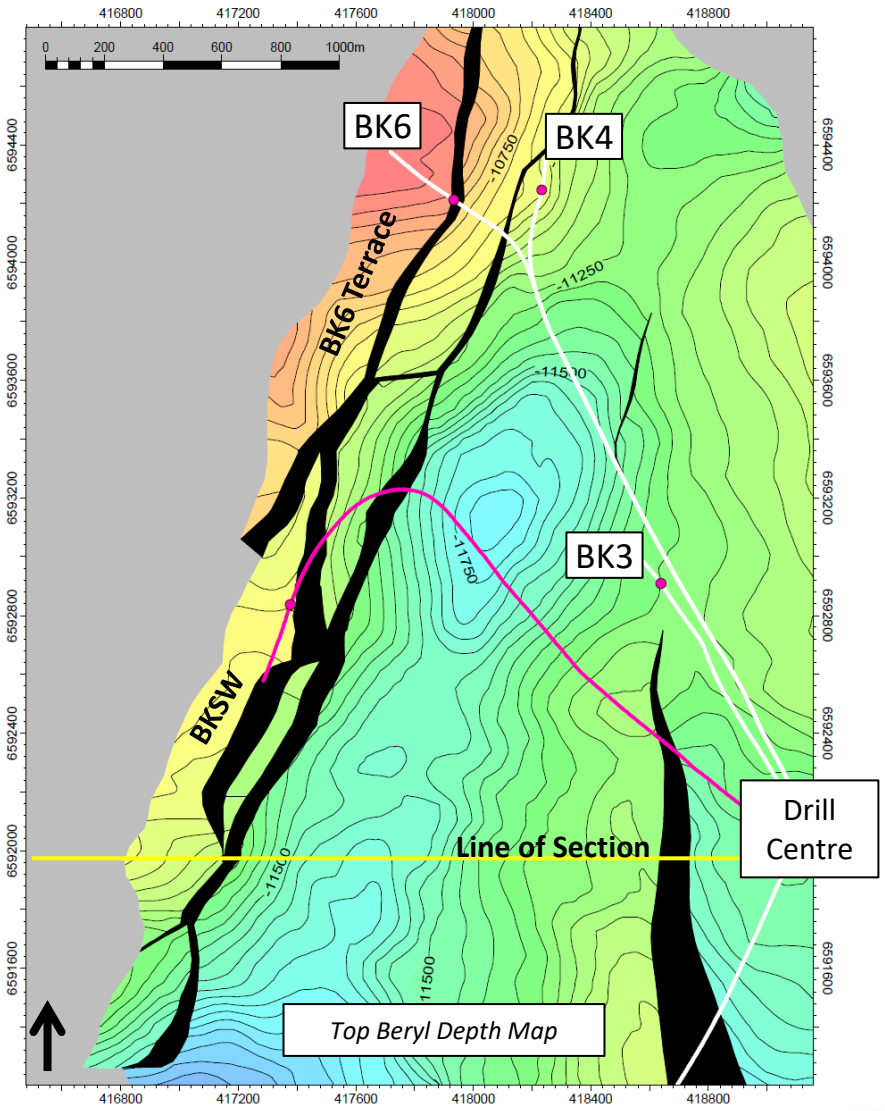

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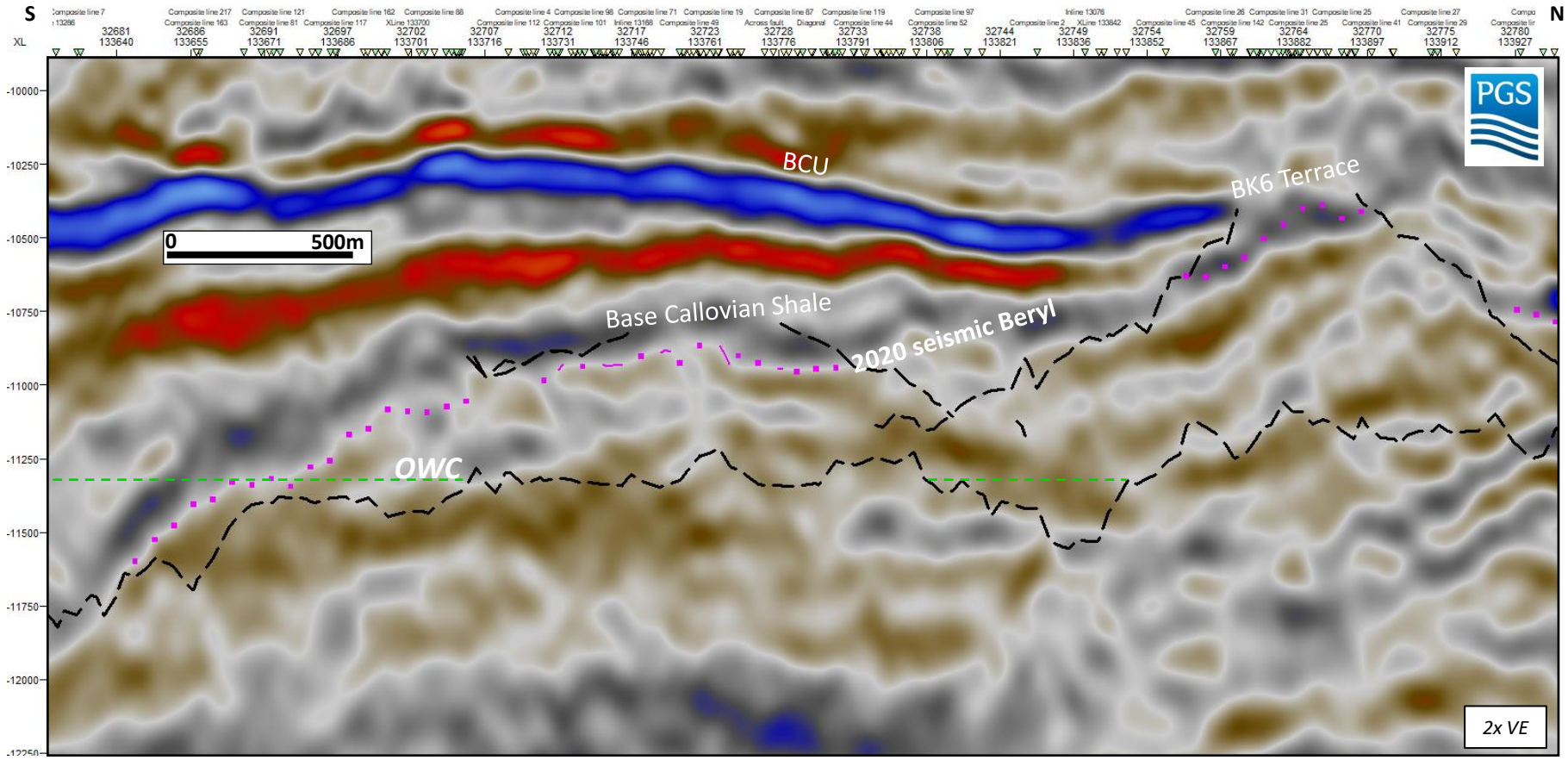

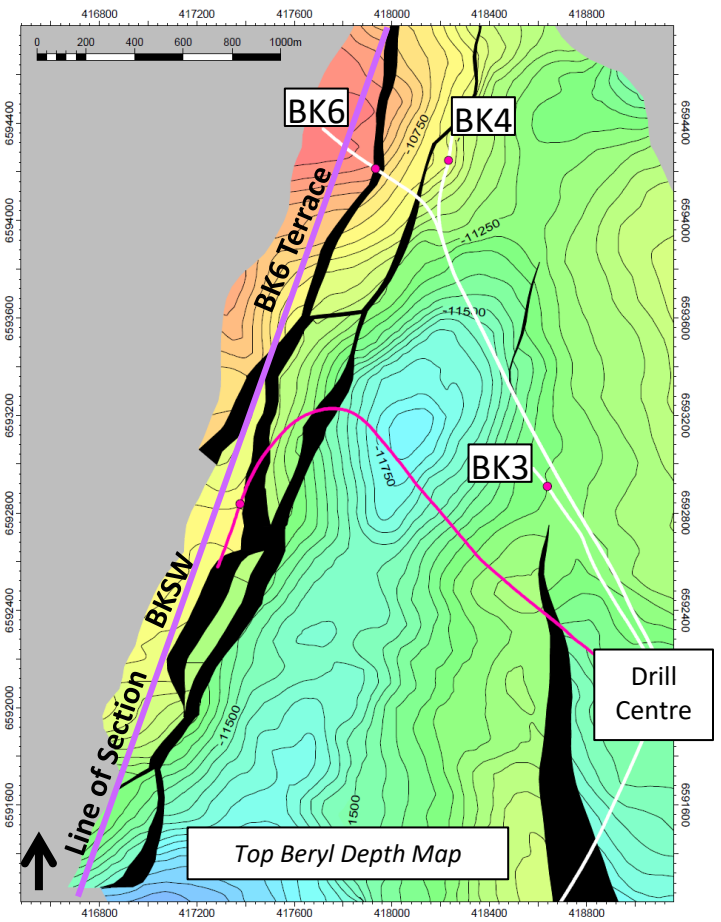

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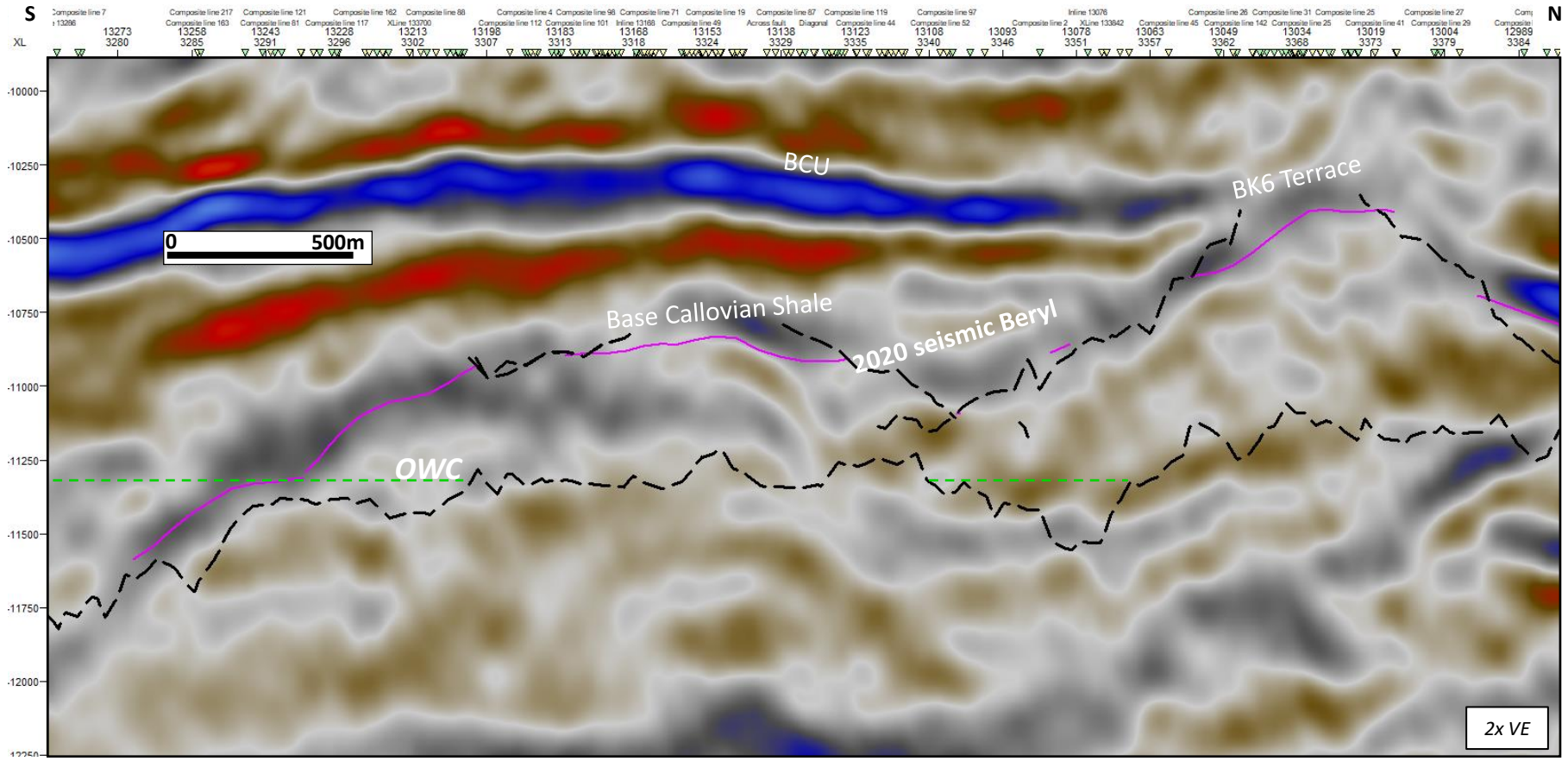

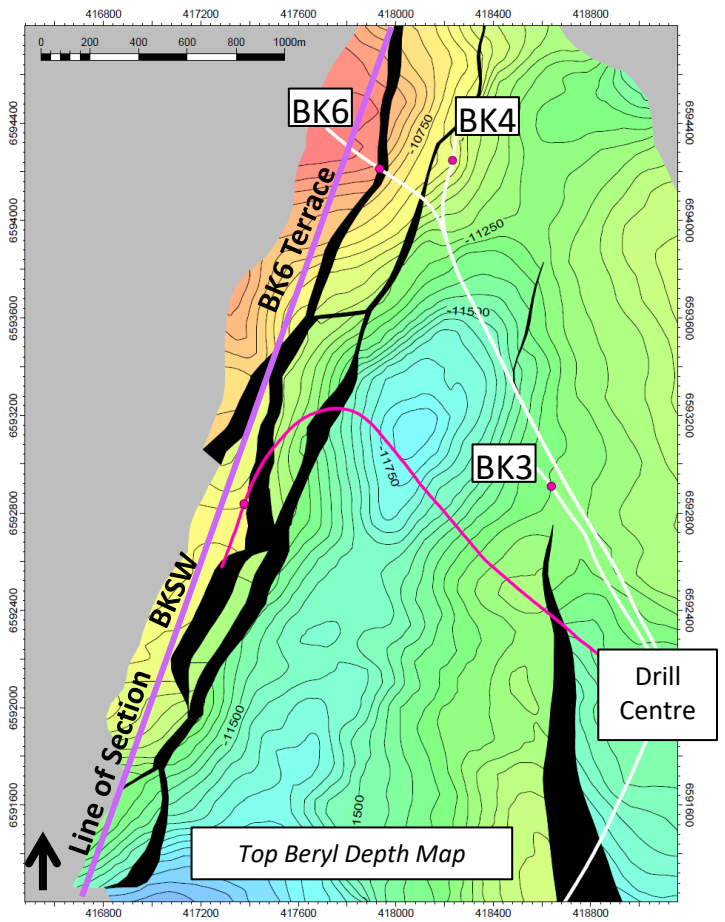

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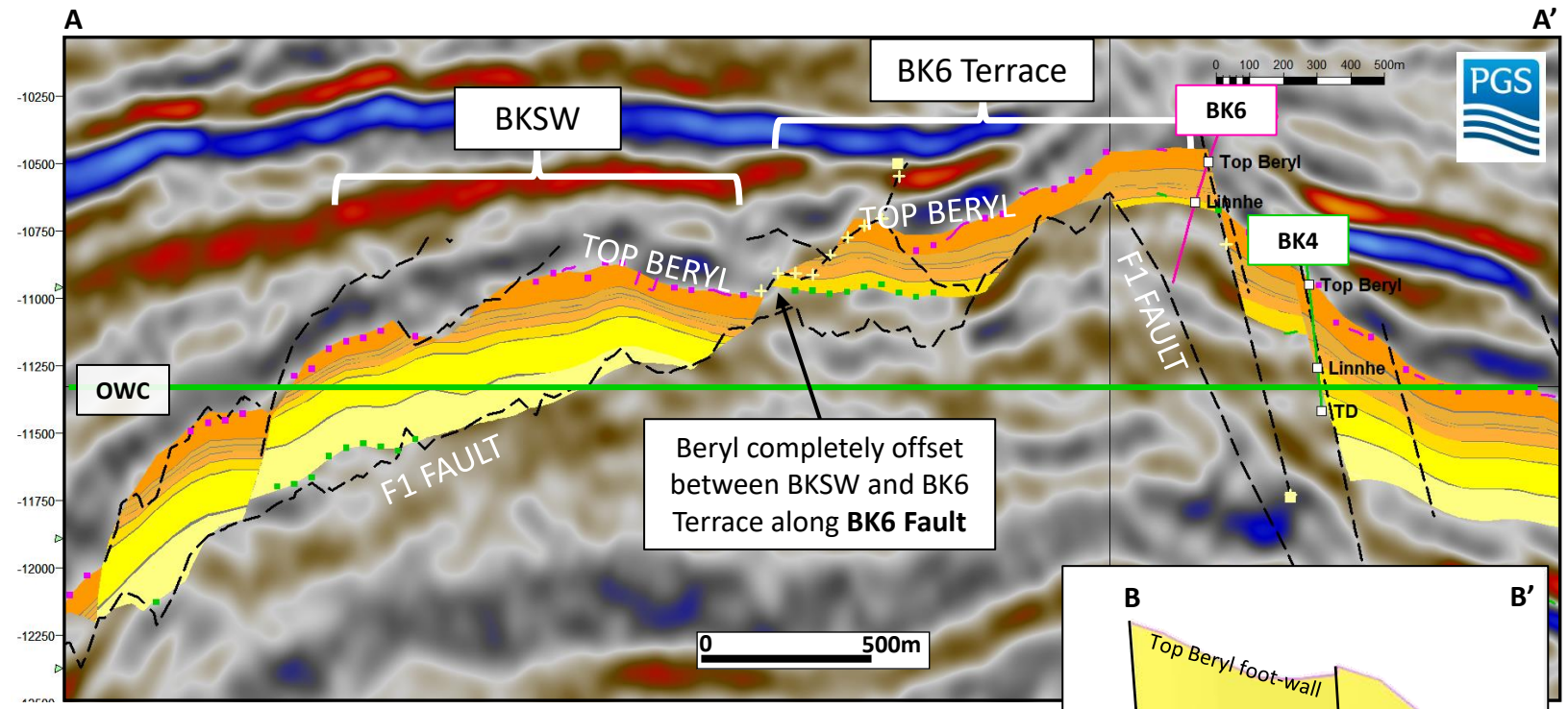
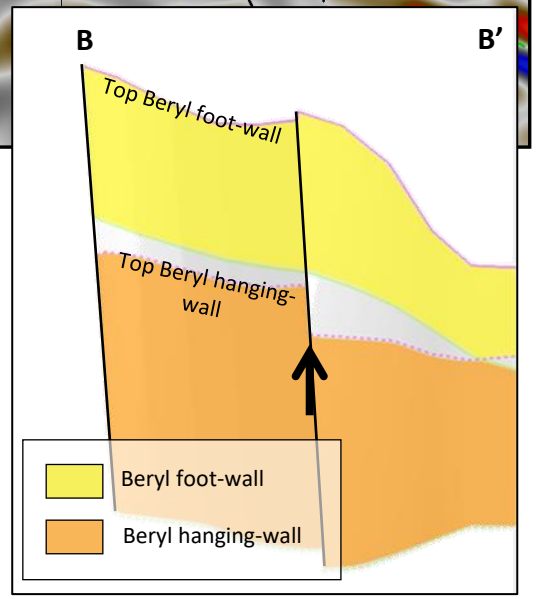
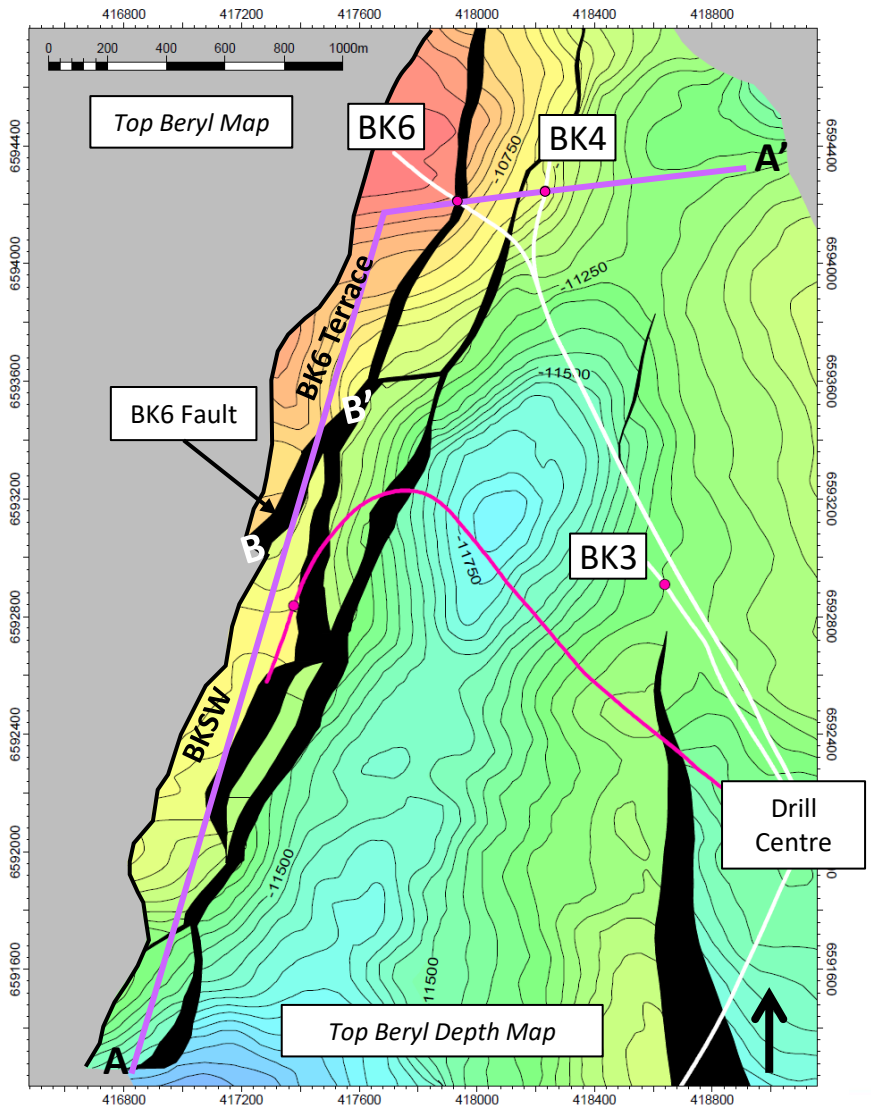
BKSW Pre-drill De-risking/Uncertainty





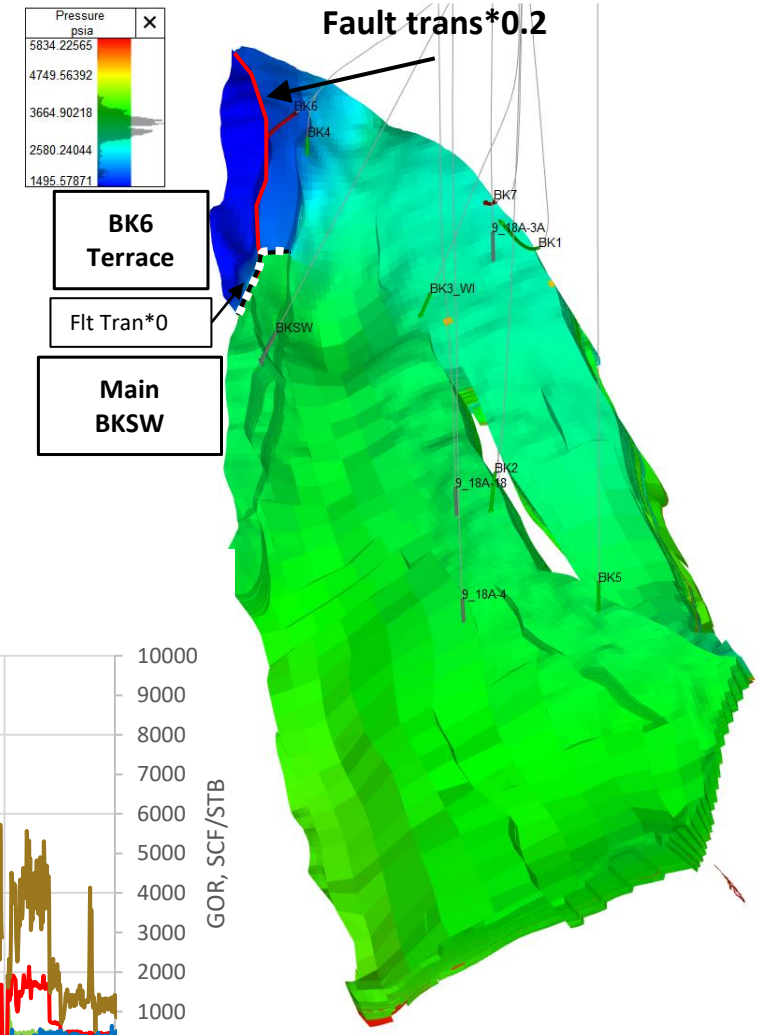
BK6 Fault-Plane Section showing no Beryl Juxtaposition along the BK6 fault plane.

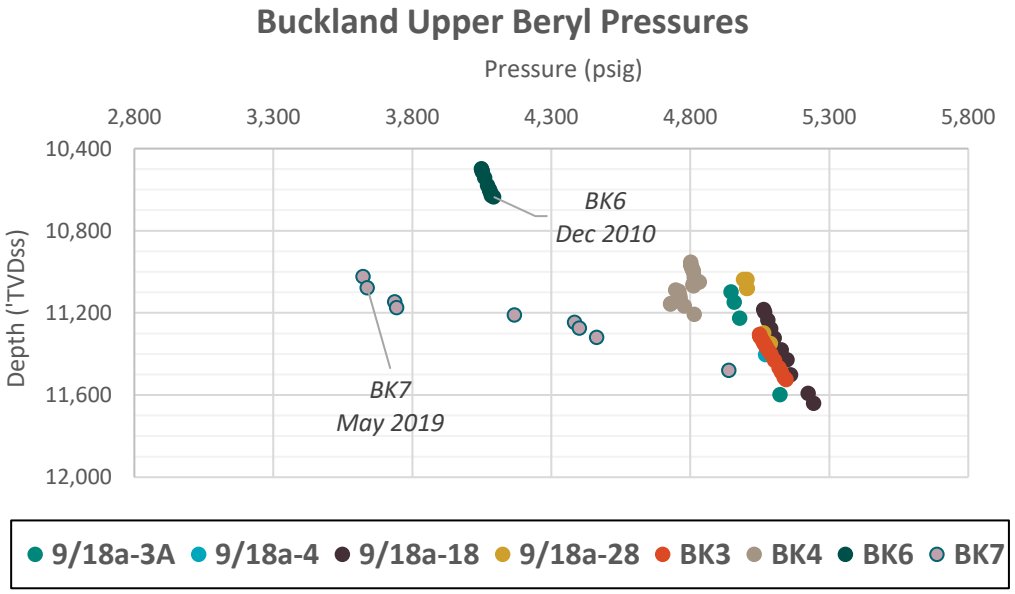


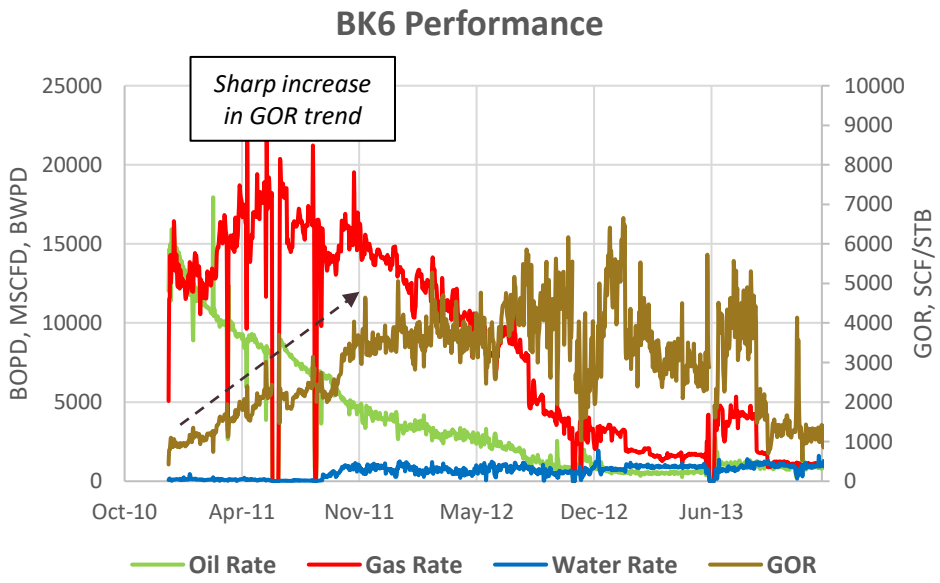
- **Seal from the BK6 terrace to the north and the BK6 producer – Simulation history match proved BK6 didn't need BKSW volumes to produce**
- Seal to the west - F1 fault. Buckland is a downthrown fault block and juxtaposes the Triassic
- Volume uncertainty
  - Depth conversion – Top Beryl and fault position
  - Contact depth
  - Pressure – connected to regional aquifer?

BK6 Performance

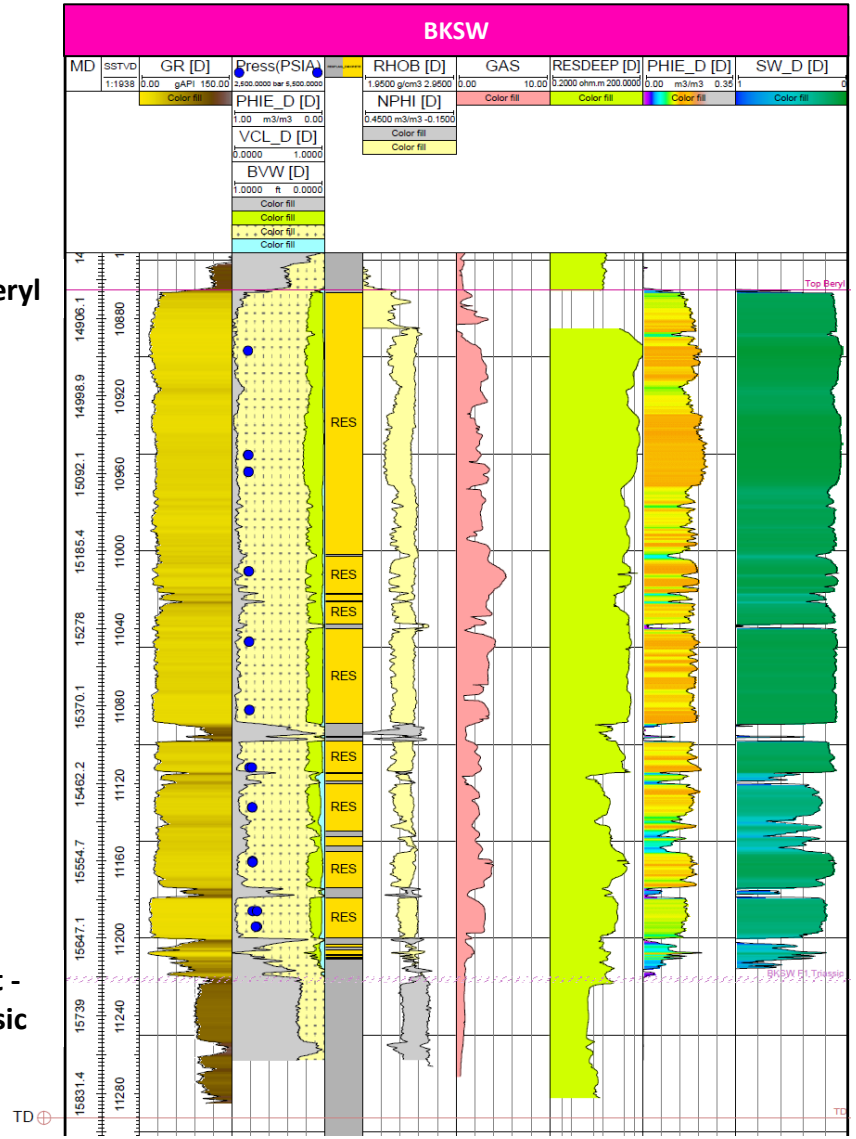
- Started production in December 2010 from the Upper Beryl and Linnhe sands
- Early performance showed sharp increase in GOR with drop in oil
  - Suggests baffled terrace with the main Buckland area - limited influx
- Model history match supports the baffled BK6 terrace with main Buckland area
  - BK6 terrace pressure is estimated <2000 psi
  - Material balance indicated no communication with BKSW terrace







BKSW Beryl Successful – Drilled Q4 2022

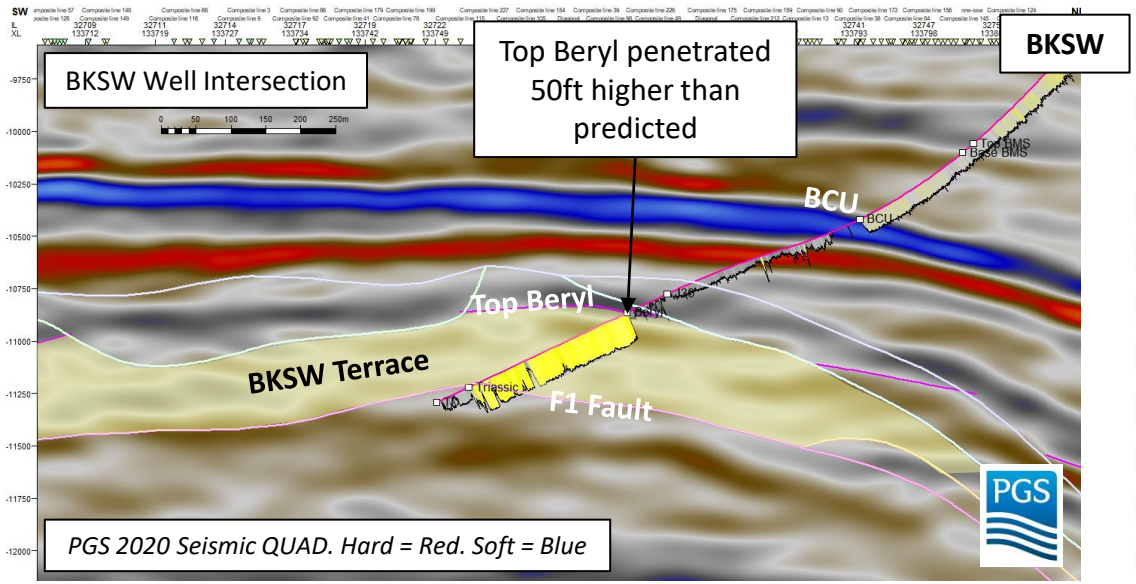


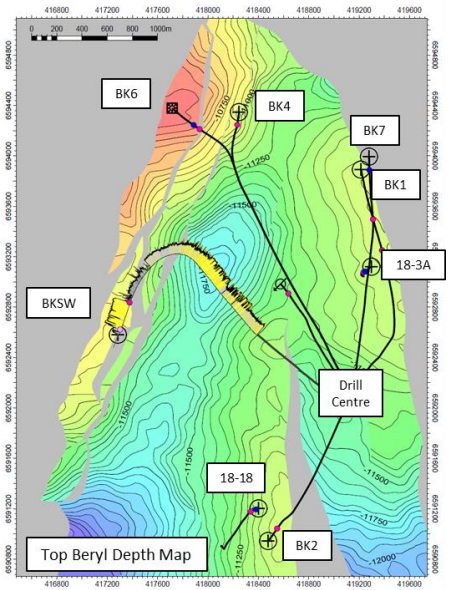
Top Beryl

Fault - Triassic

Net pay thickness:	662 ft MD, 285 ft TVD
Average porosity:	20%
Average Sw :	14%
Testrak pressure	3042 – 3316 psi - inline with current field pressure
Testrak mobilities:	2.5 – 113 mD/cP average 39 mD/Cp

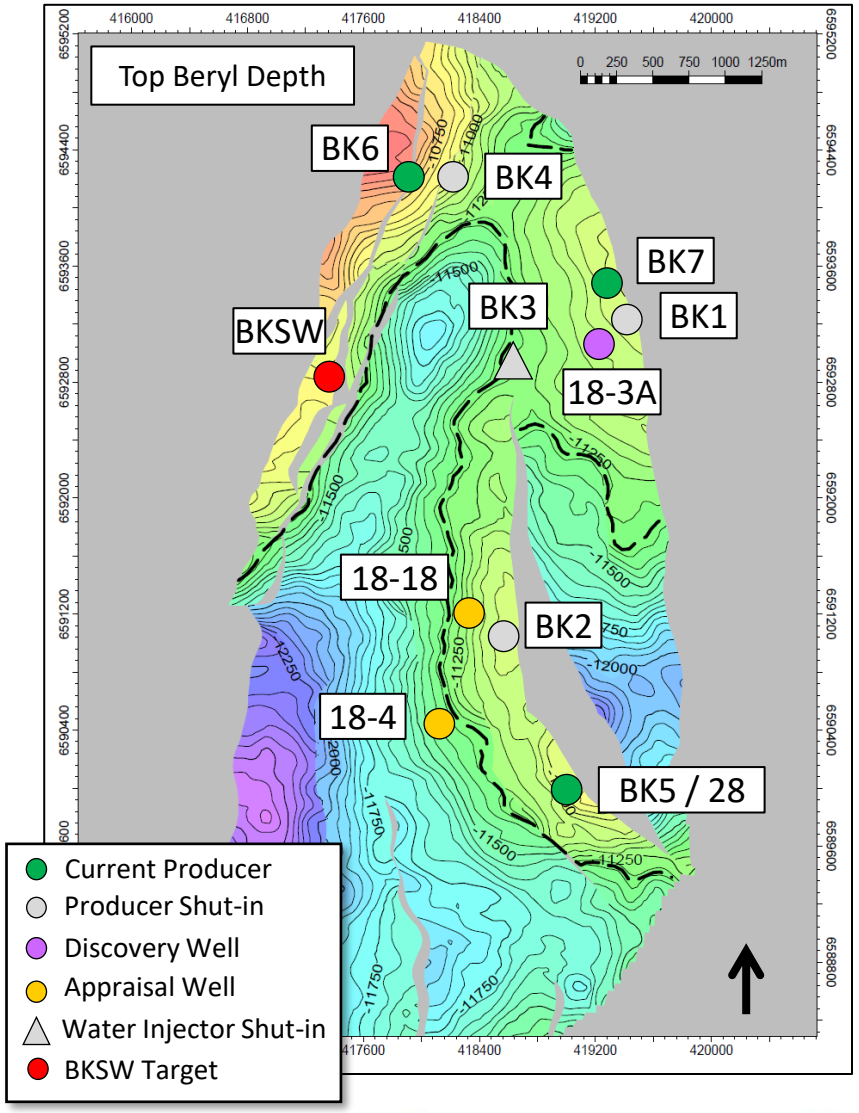
BKSW came online in March 2023 at 8 mbo/d and 7 mmscf/d





Conclusions

- 2020 re-processing facilitated BKSW detailed interpretation
- Simulation history match indicated BK6 didn't need BKSW volumes
- BKSW accessed a net pay thickness of 285 ft TVD, which would otherwise have been stranded
- BKSW came online at 8 Mbo/d and 7 MMscf/d
- Further work - reservoir simulation will investigate re-instating water injection



Acknowledgments

We would like to express our thanks to our management and our partners - Harbour Energy for permission to present at DEVEX 2023.

Thanks to PGS for permission to show seismic examples from their 2012-2013 geo-streamer acquisition.

Finally thanks are due to everyone who has had technical involvement in the Buckland Field over many years, particularly John Gibson, Andy Lind and Peter Rowbotham.

Thank You