

INEOS UK SNS Limited

P2109 Relinquishment Report

June 2018

TABLE OF CONTENT

Contents	Page No.
FIGURES AND TABLES	2
1. LICENCE INFORMATION	3
2. LICENCE SYNOPSIS.....	3
3. WORK PROGRAMME SUMMARY.....	5
4. DATABASE	7
4.1 SEISMIC DATABASE.....	7
4.2 WELL DATABASE	9
5. PROSPECTIVITY UPDATE	10
6. FURTHER TECHNICAL WORK UNDERTAKEN	14
7. RESOURCE AND RISK SUMMARY	14
8. CONCLUSIONS	14
9. CLEARANCE	14

FIGURES AND TABLES**List of Figures**

1. P2109 Licence location map
2. Comparison between original and reprocessed seismic
3. Reprocessed 2D seismic dataset
4. Comparison of Base Permian depth structure maps
5. Comparison of seismic cross sections illustrating velocity models
6. Geoseismic cross section of reprocessed PreSDM 2D line (AUK85b-596)

List of Tables

1. Summary of reprocessed seismic lines
2. Well database used in seismic interpretation
3. Prospective resource estimate

1. LICENCE INFORMATION

Licence Number:	P2109
Licence Round:	27 th (2013)
Licence Type:	Traditional
Block Numbers:	42/22b & 42/23a
Licensees:	INEOS UK SNS Limited (100%, operator)
Work Programme:	(a) Reprocess 475km of 2D seismic data and (b) Carry out Geoscientific Studies

2. LICENCE SYNOPSIS

Licence P2109 was located in the northern part of the UK Southern North Sea, approximately 30 km to the northeast of Flamborough Head on the Yorkshire coast and 30km to the south of the Breagh field (Figure 1). The Licence was awarded to RWE Dea UK SNS Limited (now INEOS UK SNS Limited) as the sole licensee during the UKCS 27th Licensing Round, with a work commitment to reprocess 475km of 2D seismic data. The licence was awarded with effect from 20th December 2013.

At the time of application a structural closure at the Base Permian Unconformity (BPU), known as the Kenny lead, had been identified within the licence area. The Kenny lead was considered to be a look-a-like and possible follow up opportunity to the Lochran lead on the adjacent P1741 licence (Blocks 42/17 & 42/18, see Figure 4a) that had been awarded to RWE Dea during the previous licensing round. Both the Kenny and the Lochran leads relied on the interpretation over a broad grid of post-stack time migrated 2D seismic.

Concurrent with the P2109 application, a new proprietary 3D survey, which had been acquired over the Lochran area in 2012, was processed to Pre-SDM in 2013. Interpretation of the new survey led to a re-evaluation of the Lochran lead and the relinquishment of the P1741 licence. This in turn adversely affected the likely validity of the Kenny structure.

In order to honour the work programme however, and to assess the remaining prospectivity of the P2109 licence, 505km of legacy 2D seismic was reprocessed to full Pre-SDM by DownUnder GeoSolutions (DUG) between December 2015 and May 2016. The reprocessed 2D seismic links up the Lochran 3D, which extends into the northern part of P2109, and the PGS MegaSurvey to the south (Figure 1).

Interpretation of the reprocessed 2D seismic confirmed the absence of any drillable structures within the licence, with only marginal closure at BPU level at the Kenny lead. In addition, reservoir quality of any Carboniferous sandstones are predicted to be poor due to depth of burial. It was also noted that the larger structures to the West and South have been drilled by 44/22-1 and 42/28a-6 respectively without any significant accumulations of gas being discovered.

Further work was undertaken looking at regional presence, thickness and quality of Permian aged Leman Sandstones but these are predicted to be thin or absent within the licence area and only marginal structures evident at Permian level.

The licence had a 'drill-or-drop' option and, in the absence of any significant leads, the licence was relinquished towards the end of the Initial Term, effective 15th December 2017.

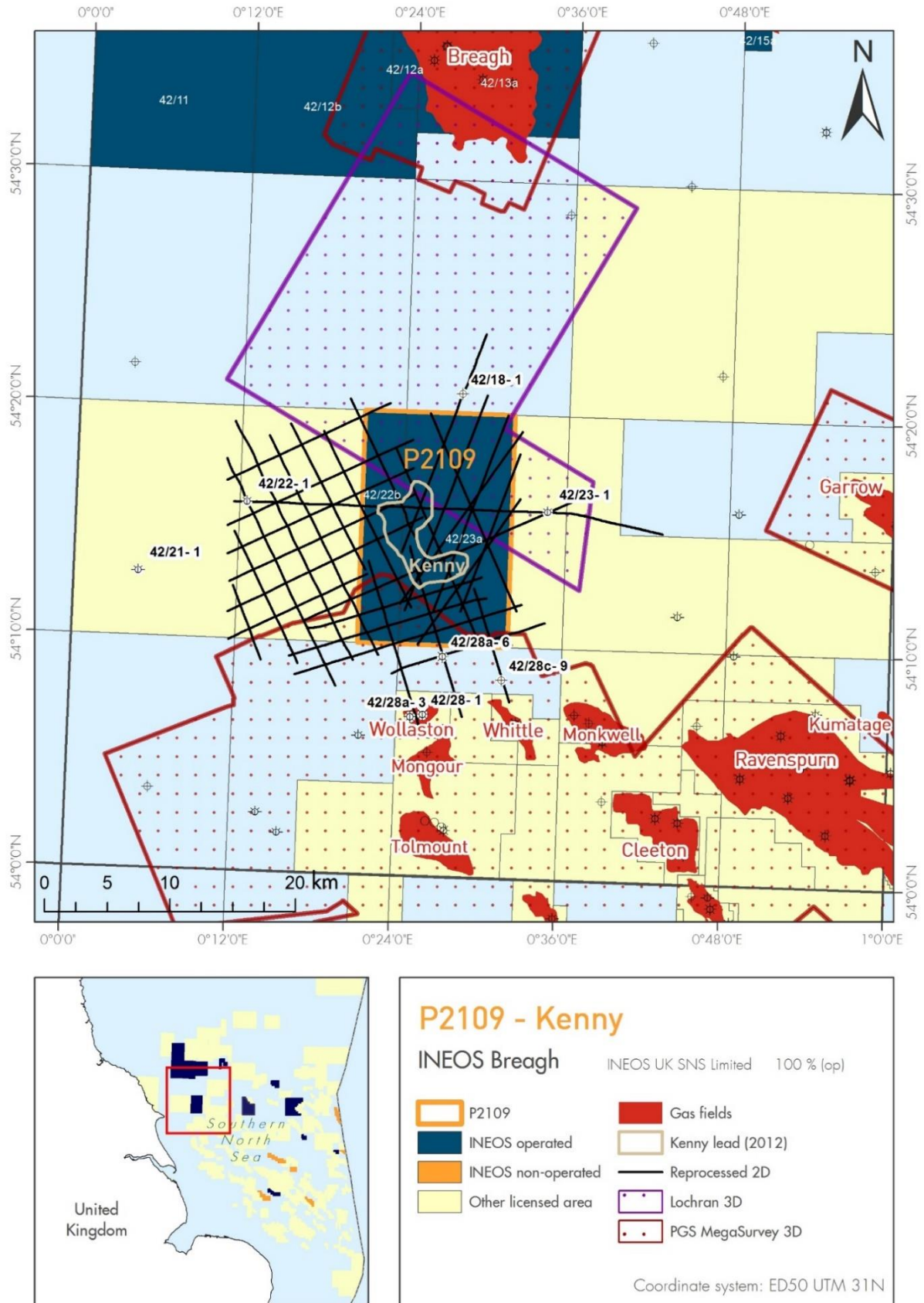


Figure 1. Location map showing seismic dataset, neighbouring wells, gas fields and original Kenny lead outline

3. WORK PROGRAMME SUMMARY

The committed work programme for licence P2109 comprised:

- Reprocessing 475km of 2D seismic data (exceeded: 505km reprocessed) and
- Carry out Geoscientific Studies (Completed)

A total of 505km of 2D seismic was reprocessed from copies of the original field tapes (SEGD), through to a full Pre-Stack Depth Migration (Pre-SDM) by DUG between December 2015 and May 2016.

The reprocessing had three main objectives:

- Provide a reliable and consistent 2D dataset from a collection of different surveys (e.g., phase, polarity, gain and residual matching etc);
- Improve the signal to noise ratio by applying modern multiple elimination techniques;
- Produce a reliable depth conversion through a comprehensive pre-stack depth migration workflow (the DUG Workflow also incorporated a three-dimensionally consistent anisotropic velocity model).

INEOS were pleased with the results of the reprocessing (Figure 2). Uplifts in seismic image quality included:

- Improved imaging of post salt/Mesozoic section, particularly across the Dowsing Fault Zone graben;
- Much sharper resolution of fault planes within the fault zone / graben;
- Reduced multiples in the Carboniferous section (improved signal to noise);
- Improved detail in the Carboniferous section below the fault zone / graben;
- A reliable depth conversion allowing mapping of sub Zechstein horizons. (Note also the elimination of the velocity push down effects below the graben (where Zechstein is thinned) on depth migrated section in Figure 2).

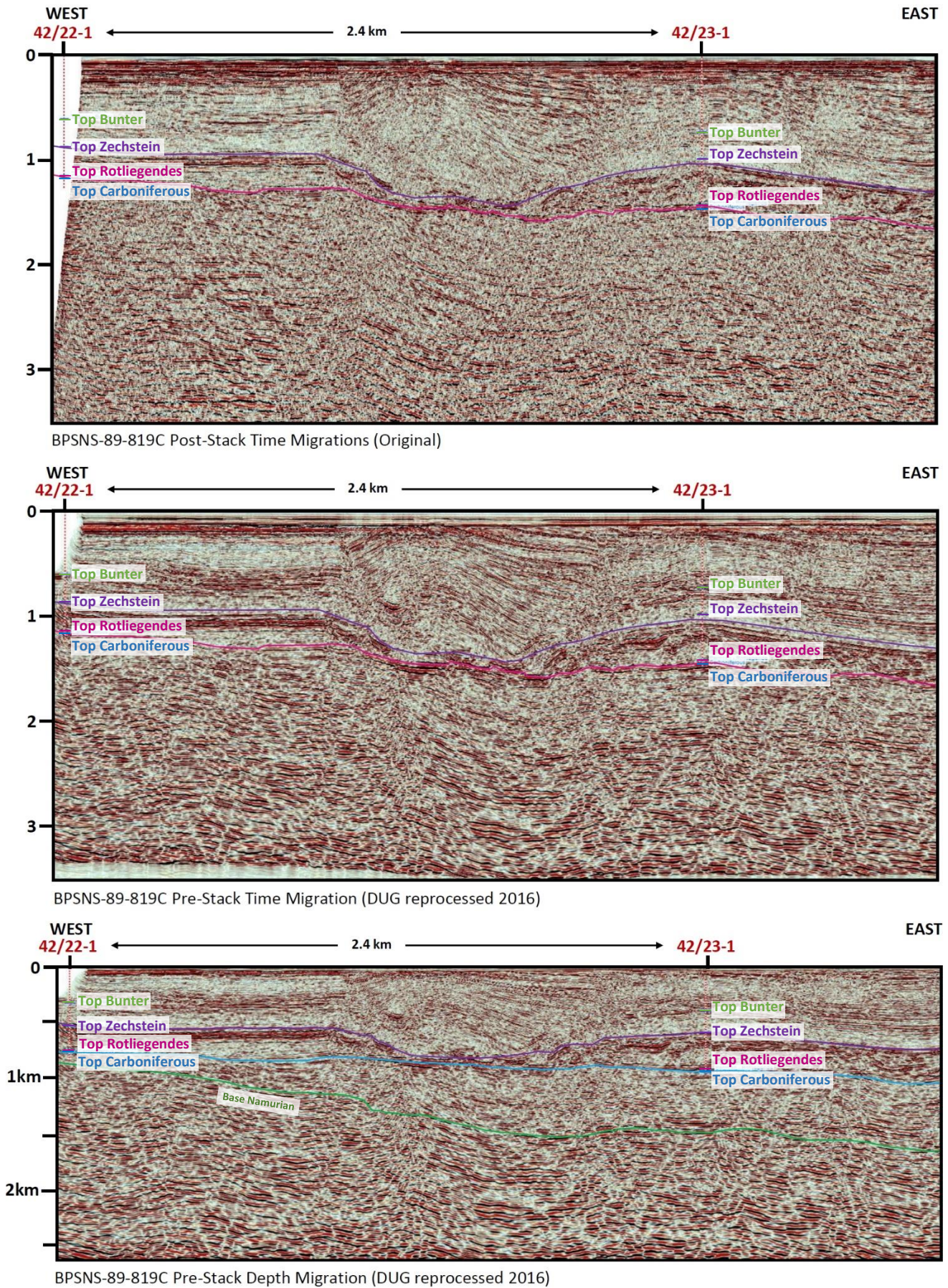


Figure 2. Comparison between original and reprocessed seismic

4. DATABASE

The seismic and wells database used in the licence assessment is illustrated in Figure 3.

4.1 SEISMIC DATABASE

The seismic database comprised 31 reprocessed 2D seismic lines from 6 surveys, which are listed in Table 1, plus the Lochran 3D survey and the PGS MegaSurvey. The Lochran and reprocessed 2D, which were both processed to PreSDM, allowed contiguous depth interpretation, whilst the time migrated PGS MegaSurvey allowed tie-in with Permian gas fields of Wollaston, Whittle, Mongour and Tolmount to the south.

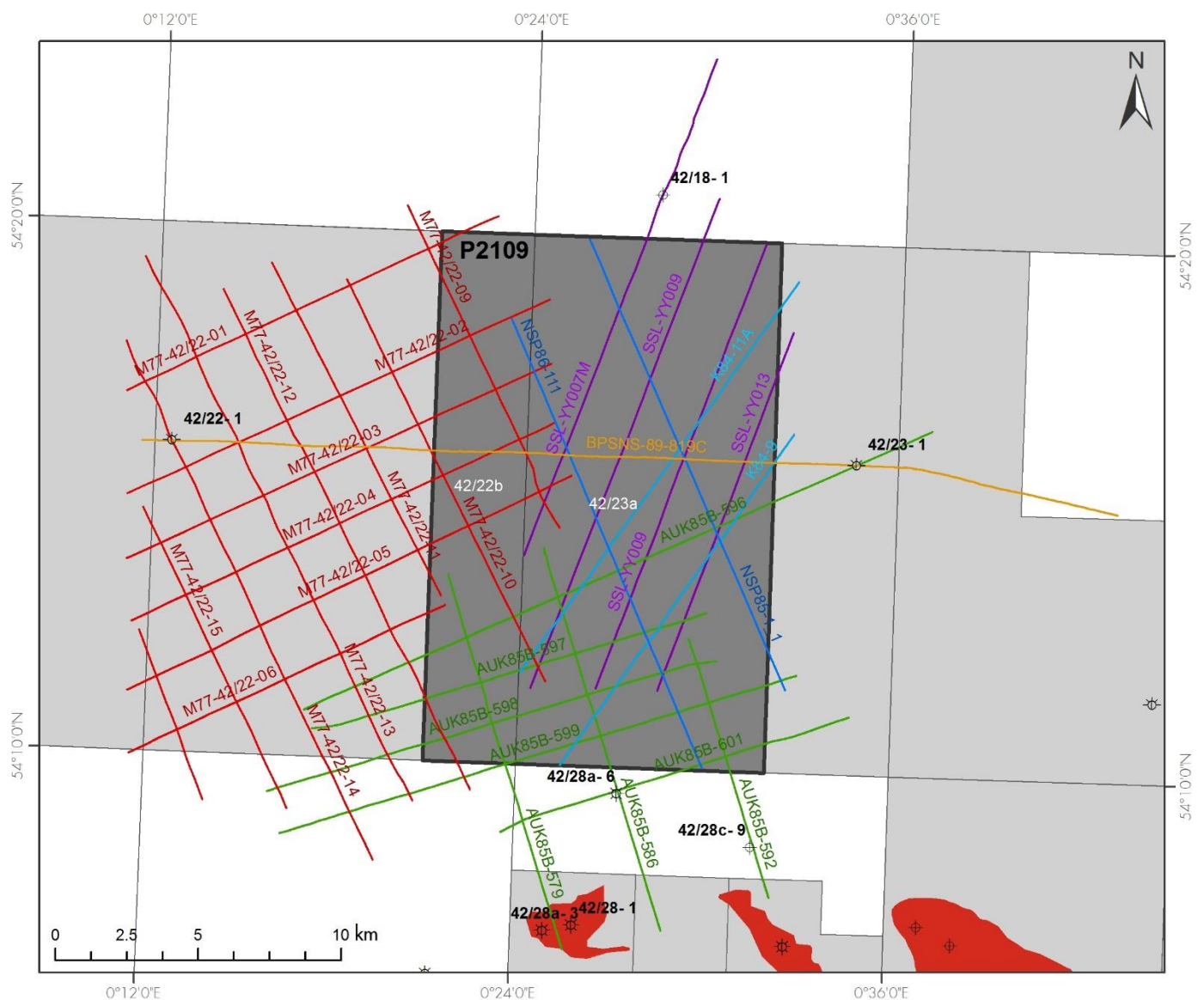


Figure 3. Reprocessed 2D seismic dataset

Line Name	First SP	Last SP	First CMP	Last CMP	Line Length (km)
BP; Southern North Sea regional 1989 (BP/SNS-89-) [BP892D1009]					
BPSNS89-819-C	1	1316	1	5500	34.4
BP; Amoco 42/28A survey 1985 (AUK-85B-) [AM862D1003]					
AUK85B-579	1	761	1	3288	13.7
AUK85B-586	1	795	1	3420	14.3
AUK85B-592	720	1290	3120	5400	9.5
AUK85B-596	1	1383	1	5774	24.1
AUK85B-597	1	794	1	3418	14.2
AUK85B-598	1	923	1	3934	16.4
AUK85B-599	1	1075	1	4542	18.9
AUK85B-601	1	712	1	3090	12.9
Apache; Mobil 42/22 survey 1977 (M42/22 77-) [MB772D1005]					
M42/22 77-01	1	568	41	1192	14.4
M42/22 77-02	7	632	13	1320	16.3
M42/22 77-03	1	633	1	1322	16.5
M42/22 77-04	1	632	1	1320	16.5
M42/22 77-05	1	673	1	1402	17.5
M42/22 77-06	1	464	1	984	12.3
M42/22 77-09	1	470	1	996	12.4
M42/22 77-10	1	602	1	1260	15.7
M42/22 77-11	1	500	1	1056	13.2
M42/22 77-12	1	752	1	1560	19.5
M42/22 77-13	1	824	1	1704	21.3
M42/22 77-14	5	797	9	1619	20.1
M42/22 77-15	1	440	1	936	11.7
M42/22 77-16	1	227	1	510	6.4
Schlumberger; Quads 41, 42 & 47 (K84-) [GP842D1014]					
K84-9	1	527	1	1148	14.3
K84-11A	1	626	1	1346	16.8
Schlumberger; Offshore Yorkshire I (SSL-Y-) [SS852D1002]					
SSL-YY-007 (merged)	1	717	109	2334	18.5
SSL-YY-009	1	674	1	2205	18.4
SSL-YY-011	1	606	1	2001	16.7
SSL-YY-013	1	476	1	1611	13.4
Schlumberger; North Sole Pit Phase I (NSP85-) & Phase II (NSP86-) [SF852D1006]					
NSP-85-1	1	629	1	1376	17.2
NSP-86-111	1	625	1	1368	17.1
Total reprocessed line length (km)					505

**Table 1. Summary of reprocessed seismic lines. Current owner; Survey Alias (Prefix)
[CS9 Survey Name]**

4.2 WELL DATABASE

Although no wells have been drilled to date within the P2109 licence area, a number of wells surrounding the licence were used for seismic well ties. These well are summarized in Table 2 below.

Well	Spud Year	Operator	TD (Age)	Result	Notes
Seismic well ties					
42/18-1	1991	Lasmo	Triassic	Dry	Bunter Sandstone target. Drilled on crest of a salt anticline.
42/22-1	1987	Amoco	Carboniferous	Gas Shows	Leman Sandstone target overlaying a Carboniferous horst block (Prometheus discovery)
42/23-1	1966	Burmah Oil	Carboniferous	Gas Shows	Leman Sandstone and Zechstein Carbonate targets. Drilled on crest of a salt anticline.
42/28-1	1969	Amoco	Carboniferous	Gas	Leman Sandstone reservoir (Wollaston field)
42/28a-3	1989	Amoco	Carboniferous	Gas	Leman Sandstone reservoir (Wollaston field)
42/28a-6	1992	Amoco	Carboniferous	Gas Shows	Leman Sandstone target similar to Wollaston and Whittle fields
42/28c-9	2006	Centrica	Carboniferous	Gas Shows	Leman Sandstone target (Watling prospect)

Table 2. Well database used in seismic interpretation

In addition to the wells listed in Table 2 the following wells were used for regional Leman sandstone well correlations: 41/10-1, 41/14-1, 41/15-1, 42/18-2, 42/21-1, 42/24-1, 42/27b-2, 42/28d-12 (Tolmount field).

A number of additional Quad 41 and 42 well were also used to produce regional Leman sandstone thickness and porosity maps, these included: 41/20-1, 41/20-2, 41/24a-2, 41/25a-1, 42/16-1, 42/19a-1, 42/26-1, 42/27a-1, 42/27a-3, 42/28-2, 42/28a-4, 42/28a-10, 42/28b-5, 42/29-1, 42/29-2, 42/29-3, 42/29-6, 42/29-8, 42/29-9, 42/30-3, 42/30-6, 42/30-8.

5. PROSPECTIVITY UPDATE

At the time of application the Kenny lead comprised a Base Permian closure (Figure 4a) with Upper Carboniferous (Namurian) and Permian (Leman) sandstone reservoir targets. The structure was mapped on a patchwork of vintage 2D seismic, and was only identified after an in-house depth conversion of the seismic, with no structural closure visible on the time migrated data. This was due to the modelled velocity effects of a Mesozoic graben and fault system (the Dowsing Fault Zone) that trends North-South across the licence (Figure 5a). It was believed that the displacement of faster Lower Triassic (Bunter) and Permian (Zechstein) by slower Jurassic and Cretaceous sediments was creating a velocity push down on time migrated seismic that was masking a Base Permian structure.

To have economic potential it was considered that a valid trap would require a vertical closure of at least 100m to ensure reservoir presence. The validity of the structure was therefore particularly sensitive to the methodology and parameters used in our in-house depth conversion, with work on the Lochran lead suggesting that the velocity effects of the fault system were over estimated at the time of Licence award.

In addition, the dataset of predominantly 1980's 2D seismic was neither shot nor processed with pre-Zechstein imaging in mind; therefore the Carboniferous section was poorly imaged and it was assumed to broadly reflect that of the Base Permian.

To address these concerns a work program (the 'work commitment') was devised to reprocess the legacy 2D from the original tape data, using a modern Pre-Stack Depth Migration (Pre-SDM) workflow.

This comprehensive depth conversion provided more confidence in mapped surfaces and although imaging of the Carboniferous remains relatively poor, improvements in imaging allowed for an intra Carboniferous horizon (a Base Namurian marker, Figure 6) to be mapped for the first time in the area.

Interpretation of the reprocessed seismic confirmed that there is no significant Kenny structure at Base Permian level. It appears now to form two much smaller, low relief features that do not warrant further investigation (Figure 4b).

A new feature was identified on the North Western edge of the licence extending into Centrica's P2108 licence, which although high relief, is aurally quite small (<10km², versus the Breagh Field which is >100km²). In addition, reservoir quality of any Carboniferous sands are predicted to be poor due to depth of burial, which is a fundamental problem for the area in general. It was also noted that the larger structures to the West and South have been drilled by 42/22-1 and 42/28a-6 respectively without any commercial accumulations of gas being discovered.

Further consideration was also given to a possible northern extension of the Permian Leman Sandstone Formation (i.e., the Tolmount play) but well correlations and regional thickness and quality studies suggest that the Leman Sandstone is likely to be thin and, if present, of very poor reservoir over the licence area.

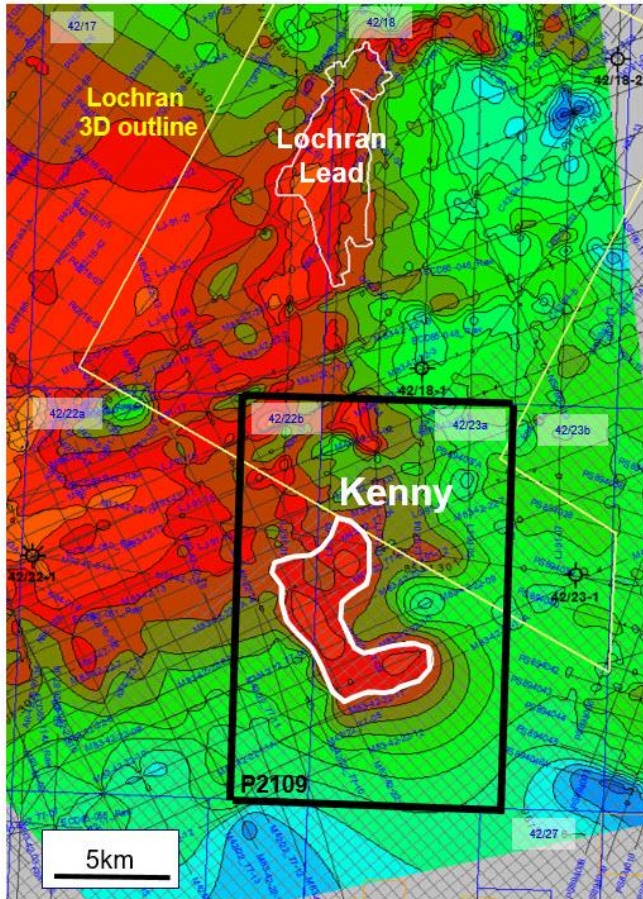


Figure 4a. 2012 Base Zechstein depth structure map from 27th Licensing Round application document.
Note.: Contour interval = 200ft, warm colours high.

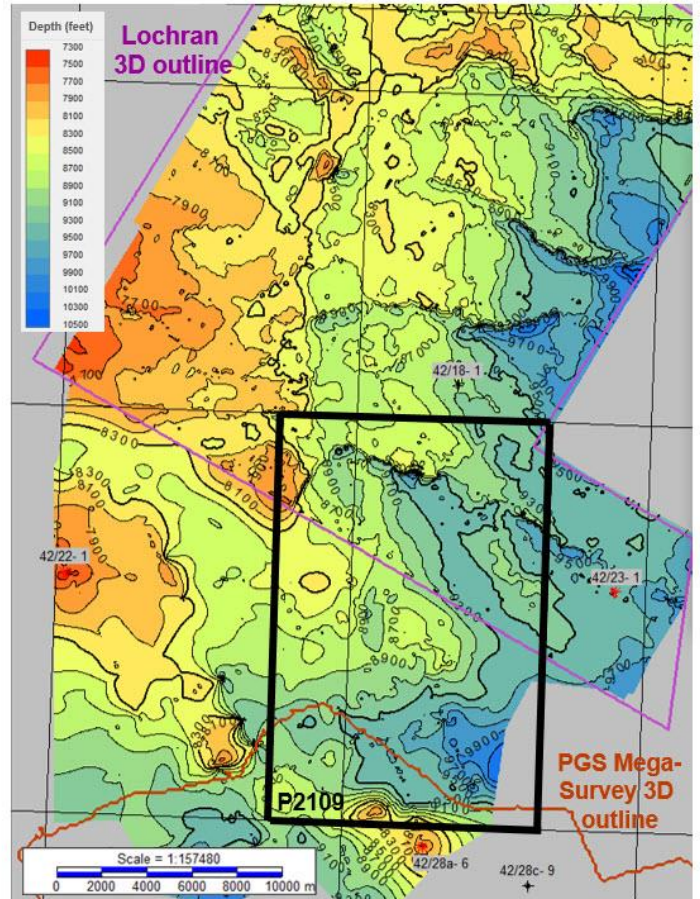


Figure 4b. 2017 Base Permian depth structure map from PreSDM mapping of reprocessed 2D seismic and Lochran 3D.
Note.: Contour interval = 200ft, warm colours high.

Figure 4. Comparison of Base Permian depth structure maps. Note Kenny structure no longer present in latest interpretation.

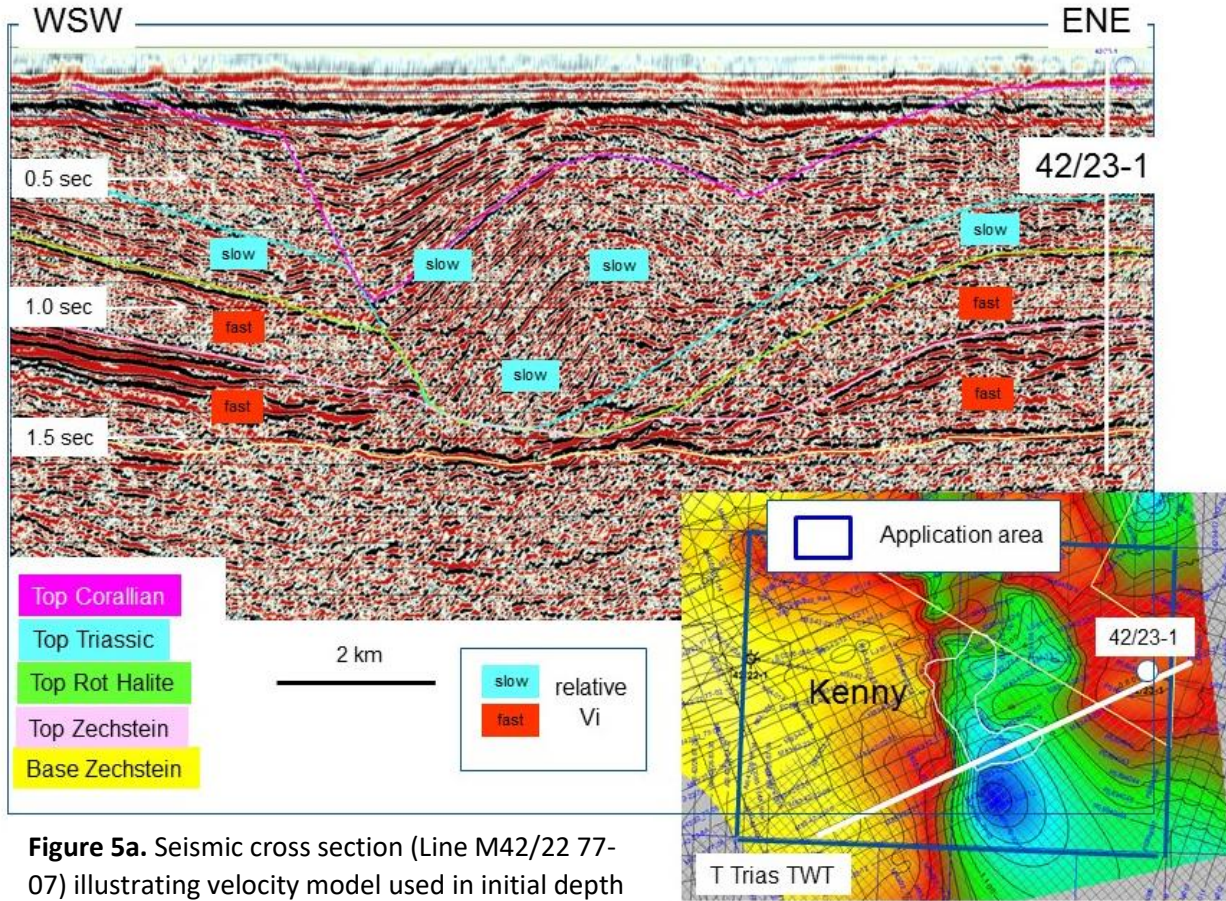


Figure 5a. Seismic cross section (Line M42/22 77-07) illustrating velocity model used in initial depth conversion (Kenny Application document, 2012).

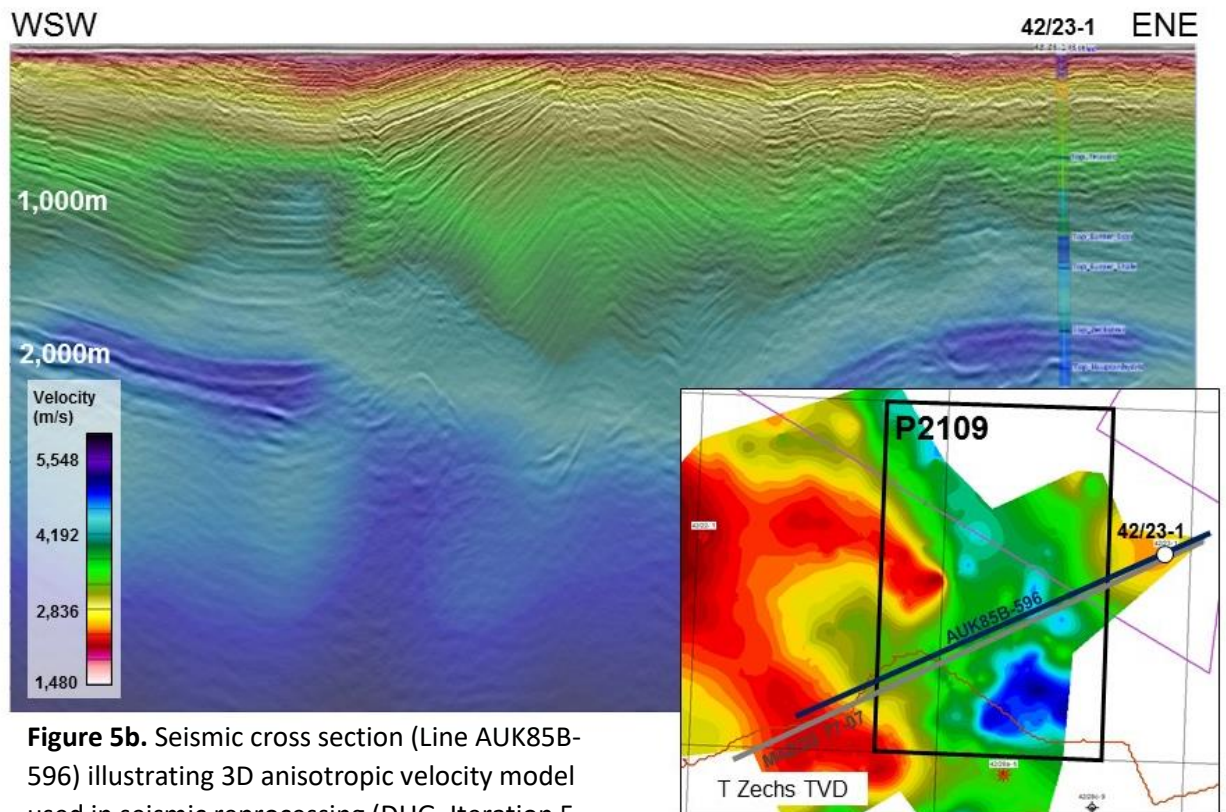


Figure 5b. Seismic cross section (Line AUK85B-596) illustrating 3D anisotropic velocity model used in seismic reprocessing (DUG, Iteration 5 Velocity Model Report, 2016).

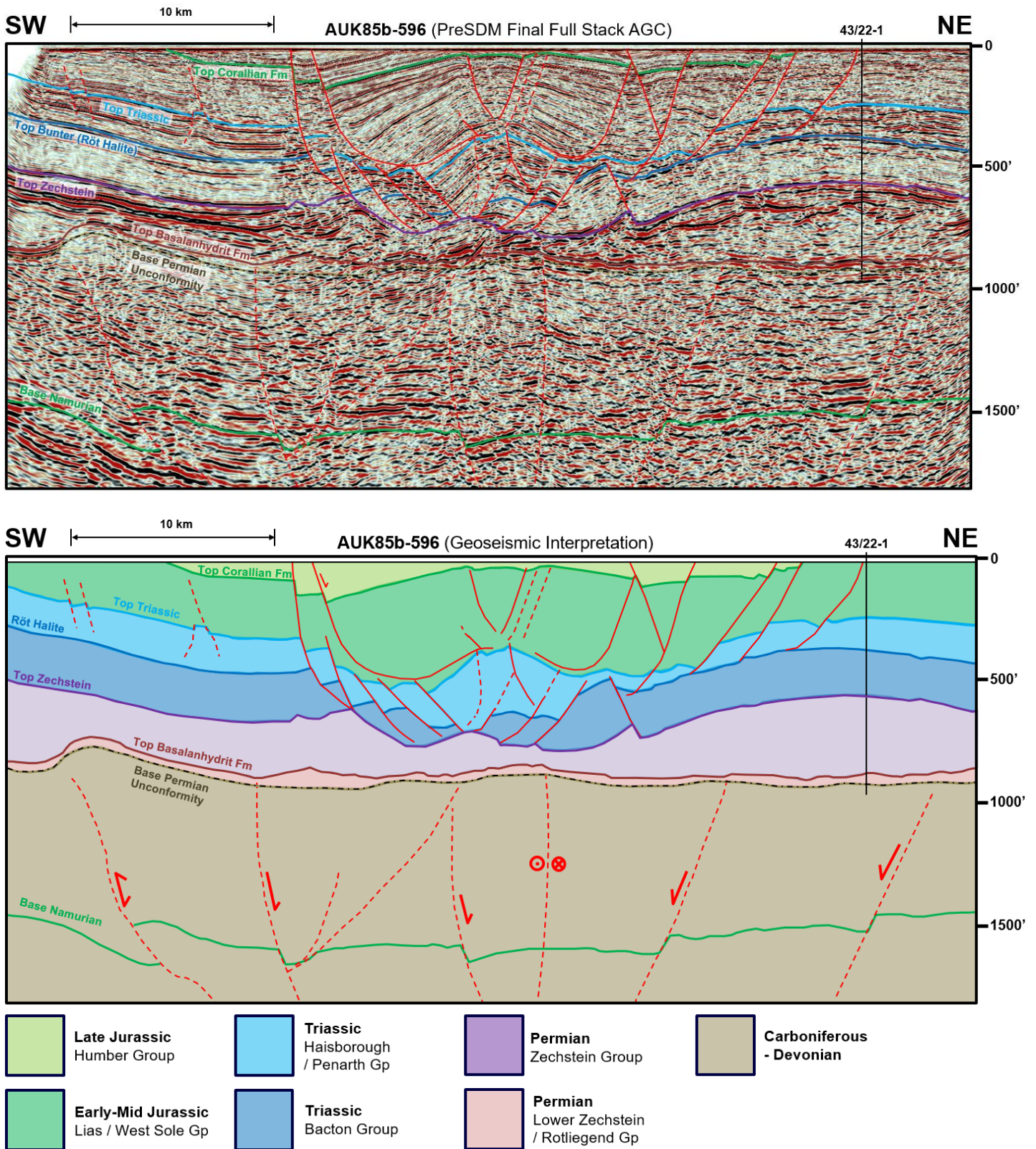


Figure 6. Geoseismic cross section of reprocessed PreSDM 2D line (AUK85b-596) with 2x vertical exaggeration

6. FURTHER TECHNICAL WORK UNDERTAKEN

In addition to a full interpretation of the reprocessed seismic, INEOS also undertook a regional well correlation and created Leman Sandstone Formation thickness and reservoir property maps to help predict likely reservoir quality over the licence area. The outcome was that 50-100ft of Leman Sandstone is predicted over the licence area with a relatively low net-to gross and average porosities <5%.

Computer processed interpretations (CPIs) were also undertaken to assess the hydrocarbon presence in the surrounding wells (42/21-1, 42/22-1, 42/23-1, 42/24-1 and 42/28a-6). Low-saturation gas was identified in a number of surrounding well in relatively low quality and thin Leman and Carboniferous sands.

7. RESOURCE AND RISK SUMMARY

The Kenny lead is no longer considered to be prospective and no resources are assigned to the P2109 licence.

P2109, Prospective Resource Estimate		
Kenny Lead	2012	2017
Estimated in-place resources, most likely (deterministic)	104	nil
CoS	0.15	Na

Table 3. Prospective resource estimate

8. CONCLUSIONS

P2109 was entered into to assess the Kenny lead, a BPU closure that was identified prior to the licence application on legacy 2D seismic.

505km of 2D seismic was reprocessed through to a Pre-SDM, producing a consistent seismic dataset, with a reliable depth conversion that allowed for an updated assessment of the Kenny lead and licence area.

Following the updated assessment, the Kenny lead is no longer considered prospective and no further leads have been identified within the licence area.

In the absence of any significant leads, the licence was relinquished on 15th December 2017.

9. CLEARANCE

INEOS UK SNS Limited confirms that the OGA has clearance to publish this report and that all third party ownership rights have been considered and appropriately cleared for publication purposes.