Relinquishment Report

Licence P1888
(Block 12/21b)

June 2017
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1. **Licence Information**

   Licence Number: P1888  
   Licence Round: 26\textsuperscript{th}  
   Licence Type: Traditional  
   Blocks: 12/21b

   All third party permissions have been obtained and the OGA are free to publish this report.

2. **Licence Synopsis**

   Licence P1888 was awarded to Sendero Petroleum Limited in the 26\textsuperscript{th} Licensing Round on 1\textsuperscript{st} February 2012. Zennor purchased Sendero’s North Sea assets in 2015 and as the new operator of P1888, the expiry date of the initial four year term of the licence was extended to 31\textsuperscript{st} October 2016.

   Block 12/21b is located in the Inner Moray Firth Northern Basin, approximately 20kms to the northeast of the Beatrice, Polly and Jacky oil fields (Figure 1). These fields produced from a stacked sequence of Beatrice Sands within the Middle Jurassic. The Lybster Field located in block 11/24 lies 20kms to the west, and also produced from Beatrice Sands.

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**Figure 1. P1888 Location Map.** Highlights nearby fields and shows prospects and leads.
3. **Work Programme Summary**

Firm commitment
- Obtain 300kms of 2D seismic data

Drill-or-Drop commitment
- drill one well to 2500m to evaluate the base Beatrice sandstone, whichever is the shallower or allow the licence to automatically cease

**Work Undertaken – seismic data**

Although a large amount of 2D data has been shot across the Inner Moray Firth most of it was acquired in the 1970’s and 80’s. Sendero regarded any data acquired pre-1990 of insufficient quality for a state of the art stratigraphic interpretation and consequently when awarded the licence restricted the 2D seismic they obtained to 1990’s vintage data. On taking over the licence, Zennor added older 2D data, in particular the BN/12-81 survey, which provides the most comprehensive set of dip lines and strike lines over block 12/21b. The 2D coverage used in the evaluation of 12/21b amounts to 380 line kilometres, thereby fulfilling the seismic element of the work programme on the licence.

4. **Database**

The well penetrations relevant to the P1888 licence are listed in Table 1 below.

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Operator</th>
<th>Year</th>
<th>TD Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/24-1</td>
<td>Premier</td>
<td>1996</td>
<td>6,300 ft</td>
<td>TD Triassic at 6,300 ft. P&amp;A Lybster Discovery. Tested 2040 bopd &amp; 0.975 mmstcf/ld from M Jurassic Beatrice Sands. 36º API oil. 19% wax.</td>
</tr>
<tr>
<td>12/21-1</td>
<td>Total</td>
<td>1969</td>
<td>6,338 ft</td>
<td>TD Middle Jurassic at 6,338 ft. P&amp;A Dry.</td>
</tr>
<tr>
<td>12/21-3</td>
<td>Britoil</td>
<td>1984</td>
<td>13,896 ft</td>
<td>TD granite Basement at 13,896 ft. P&amp;A Oil. Scarlellt Discovery. Alness Spiculite tested - estimated flow from rate 200 bopd</td>
</tr>
<tr>
<td>12/21-5</td>
<td>Britoil</td>
<td>1987</td>
<td>9,055 ft</td>
<td>TD Triassic at 9,055 ft. P&amp;A Dry.</td>
</tr>
<tr>
<td>12/22-1</td>
<td>Total</td>
<td>1969</td>
<td>3,361 ft</td>
<td>TD Jurassic at 3,361 ft. P&amp;A Dry.</td>
</tr>
<tr>
<td>12/22-2</td>
<td>ARCO</td>
<td>1982</td>
<td>6,902 ft</td>
<td>TD Permian at 6,902 ft. P&amp;A Dry. Shows in M Jurassic.</td>
</tr>
<tr>
<td>12/22-3</td>
<td>ARCO</td>
<td>1986</td>
<td>8,594 ft</td>
<td>TD Triassic at 8,594 ft. P&amp;A Dry. Trace shows in Alness</td>
</tr>
</tbody>
</table>
Table 1: Key Wells used in P1888 Evaluation.

<table>
<thead>
<tr>
<th>Well</th>
<th>Company</th>
<th>Year</th>
<th>Formation and Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/22a-4</td>
<td>Talisman</td>
<td>2002</td>
<td>TD Jurassic Heather Formation at 9,234 ft. P&amp;A Dry. Shows in U Jurassic Kimmeridge Sands.</td>
</tr>
</tbody>
</table>

The seismic data used in the Zennor evaluation of block 12/21b is summarised in Figure 2. The 2D data was complimented by the Fugro TerraCube 3D coverage over adjacent blocks which allowed ties to surrounding wells and set block 12/21b into a regional structural context.
5. **Prospectivity Update**

At the time of the application and based on a limited amount of seismic data, Sendero had identified two areas with potential trapping structures:

1) Sarclet Discovery, a Jurassic structure drilled by the 12/21-3 well
2) Jacky North, an extension of the Jacky Field into block 12/21

The primary reservoirs are the Middle Jurassic Beatrice Sands and the younger Upper Jurassic Alness Spiculite Sands as shown in the well correlation in Figure 3. The seal for both the Beatrice and Alness Spiculite reservoirs are marine shales in the Heather Formation. In addition, Zennor evaluated the potential for late Jurassic Burns Sands development in the area.

![Figure 3: Well Correlation for Alness Spiculite Sands.](image)

Isolated structural closures associated with normal faulted anticlines provide the principle trapping mechanism for the Jurassic fields in the area. In Beatrice, structural deformation and faulting occurred in the late Jurassic and to a lesser degree early Cretaceous time. Dip reversal associated with the trap is due to drape over an underlying basement block.

The organic rich lacustrine mudstone of the Lower Devonian Struie Formation is considered to be the primary source for the local hydrocarbon accumulations. The Struie Formation was penetrated in well 12/29-2 and frequent oil shows were observed in the 1250ft section. However, the hydrocarbons reversed out from the drill string during the 12/21-3 well test suggest that they are generated from the Jurassic, Kimmeridge Clay Formation. The well penetrated a section of good oil to mixed oil and gas source rocks within the Kimmeridge Clay and Heather Formations which were immature at the depth drilled by the well. But it would be mature for hydrocarbon generation off structure at 10,500ft.

**Sarclet Discovery**

The Sarclet discovery well 12/21-3, was drilled by Britoil in 1984 and encountered an oil down to at 8,550ft tvdss within the Alness Spiculite Sands. The well was drilled on a simple tilted fault block closure trending WSW to ENE and fault bound to the south as demonstrated

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by the seismic line and map in Figure 4. The well was targeting the deeper Beatrice Sands but these were wet.

Figure 4: Seismic Traverse through well 12/21-3 and Top Alness Sand TWT Map

The Alness Spiculite is composed of altered Rhaxella sponge spicules with dissolved spicule material occupying what was the pore space at the time of deposition. The preserved moldic porosity resulting from the dissolution of the spicules is between 20% and 30%. Despite the high porosity, the reservoir has very low permeability (typically less than 1mD). The measured low permeability in core is corroborated by the test results from offsetting wells 12/21c-6 and 12/22-2, where they recovered completion fluid only, and the lack of inflow with the test of well 12/21-3. The CPI and well test summary for well 12/21-3 is shown in Figure 5.

Well 12/21-3 CPI

- Drilled with WBM
- P&A oil. Recovered 200 barrels to surface: no flow on test.
- 27ft of net pay calculated
- Lower porosity Alness than in offset wells, but reasonable saturations
- No logs over base of Alness and interval below.
- Oil shows thought, more significant in upper section

Figure 5: Well 12/21-3 CPI and DST summary

Well 12/21-3 was tested but failed to flow to surface and an equivalent rate was calculated at c.200 bopd. Evidence from core analysis derived grain densities, porosimetry data and wireline logs supported the conclusion that logs were seeing a resistive rock plus fluid
system of poorly interconnected pores, with only part of the pore space oil saturated and that much of the porosity is ineffective. The green fill illustrated on the CPI (Figure 5) is the saturation calculated from the effective porosity, whereas the additional trace is that calculated from the total porosity.

Depth conversion was carried out using a layer cake method: one layer to BCU and second layer to the Top Alness Sand. The resulting Top Alness Sand Depth Map (Figure 6) was flexed to tie the wells in block 12/21, the ranges of misties being +120ft/-80ft.

Based on the ODT seen in well 12/21-3 at 8,550ft tvdss, the Sarclot closure is limited to an area of 320 acres around the well with a STOIIP of 5 mmbls. A study of core and cuttings from the well indicate that the FWL could be approximately 100ft deeper than the ODT and a STOIIP calculated for a FWL at 8,660ft tvdss is 13 mmbls. An upside case, based on structural spill point at 8,900ft tvdss, gives a STOIIP of 59 mmbls.

The Top Beatrice Sand depth map showed only a small 200 acre closure up-dip of well 12/21-3 in which the Beatrice Sands were wet, and therefore potential for a significant accumulation in these sands is limited.

Jacky North
The potential for normally faulted anticline on trend with the Beatrice and Jacky structures was evaluated on the acquired seismic but no prospect and was identified.

**Burns Sand Potential**

Upper Jurassic Burns Sands are developed in the area and a number of wells encountered shows in these sands (12/21-6 and 12/21-4). Seismic interpretation and mapping was completed to evaluate the Burns Sands potential on the block (Figure 9) but did not identify any significant traps.

![Figure 7: Seismic Traverse through well 12/21-4 and Top Burns Sand 2 TWT Map.](image)

## 6. Further Technical Work Undertaken

A study on reservoir quality from cuttings and core was undertaken by North Star for Zennor, this included some mercury injection capillary pressure data. It concluded that oil emplacement post-dated the porosity degradation due to spiculite dissolution. A Review of the DST and inflow performance modelling indicates that an unstimulated 1000m horizontal well may produce 4000bopd with cumulative production of 3 mmbo per well.

## 7. Reserves and Risk Summary

Table 1 below summarises the resources and risks for the Sarclet prospect in block 12/21b, based on a recovery factor of 25% on STOIIP.

<table>
<thead>
<tr>
<th>Name</th>
<th>Prospect Lead or Discovery</th>
<th>Stratigraphic Level</th>
<th>Unrisked Recoverable Resource (MMbbls)</th>
<th>Geological Chance of Success</th>
<th>Risked P50 MMbbls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarclet</td>
<td>Discovery</td>
<td>Jurassic</td>
<td>1.3 Low 3.3 Mid 14.6 High 3 Mean</td>
<td>100 %</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1. Summary of Remaining Reserves and Risks.

## 8. Conclusions

The main remaining prospectivity in block 12/21b is Sarclet. However, the detailed technical work carried out by Zennor since they became operator of the licence has
concluded that the accumulation drilled by well 12/21-3 contains sub-economic reserves and the spiculite nature of the reservoir would require hydraulic stimulation to achieve economic production rates. This lead to Zennor surrender the licence in full in October 2016

9. **Clearance**

Zennor Pathway Limited hereby gives consent to OGA to publish this document. All third party ownership rights have been considered and appropriately cleared for publication purposes.