Relinquishment Report

Licences P.012 and P.227

Blocks 29/8a South, 29/8b, 29/9a South and 29/9b

Acorn and Beechnut Discoveries

Ventures North Sea Oil Ltd.

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Introduction

This document describes work carried out on Blocks 29/8a South (P.012), 29/8b (P.227), 29/9a South (P.012) and 29/9b (P.227) which together contain the Acorn and Beechnut discoveries. The licences are located at the southern end of the West Central Graben, in the Central North Sea. The blocks were held 100% by Venture, and relinquished in 2010 following the drilling of an Acorn appraisal well designed to establish commercial productivity in the Triassic Skagerrak reservoir. This report documents the key results of integrated subsurface studies on the main Skagerrak reservoir in Acorn, and Fulmar reservoir in Beechnut.

Figure 1. Location map
Regional Geology
The Acorn and Beechnut discoveries are located on the margin of the West Central Graben and Western Platform, within the transfer zone of a graben bounding fault (Figure 2).

Figure 2. Structural elements in the Acorn and Beechnut area (source; Mill. Atlas).

The broad anticline upon which Acorn lies can be seen continuing to the north-northwest of well 29/8a-3, towards the 29/8a-4 discovery and the Fram diapir (Figure 3). The structural high continues south towards Beechnut, where an east-west trend is established, parallel with the main graben structure margin. The Curlew field lies directly to the west of Acorn, on a structural high.

The principal reservoirs in the Acorn and Beechnut area are sands of the Triassic Skagerrak Formation and Upper Jurassic Fulmar Formation. These are typically sealed by Upper Jurassic shales of the Heather Formation. Overlying the Heather Formation is the Kimmeridge Clay Formation which provides the source rock for the hydrocarbons in the area and often provides top-seal where the Heather is absent (Figure 4).
Figure 3. Base Cretaceous Unconformity two-way time structure.

Figure 4. Generalised stratigraphic column.
Acorn Skagerrak Reservoir Evaluation

The Acorn Discovery is located in Block 29/8a(S) and 29/8b in the Central North Sea, 8 km due west of the Beechnut discovery, and 15 km east of the Shell operated Curlew field (Figure 1). Acorn is a robust, high relief, 4-way dip closed structure induced by underlying Zechstein salt movement.

The discovery well 29/8b-2Z was drilled by Union Oil in 1983, and encountered oil in the Upper Jurassic. Shell drilled well 29/8a-3 on the northern extension of the field in 1985, and discovered oil in the Triassic Skagerrak. The well was tested in three separate intervals with a combined potential flow rate of around 4500 bbl/day of low GOR 35° API oil.

The Triassic STOIIP is estimated at 100 MMstb, whilst the Jurassic accumulation has been remapped and STOIIP is estimated to be 13 MMstb.

The Skagerrak discovery was appraised in 2009/10 with the 29/8a-6 well and extended well-test results do not support a further development decision. The Jurassic and Triassic pools are not thought to be linked.

The Skagerrak comprises low net-to-gross Triassic Skagerrak Formation sands and silts. Both the original 29/8a-3 discovery well and the 29/8a-6 well encountered a similar oil-bearing section. The 29/8a-3 tests were of insufficient duration (a few hours) to resolve the long-term productivity of the reservoir which critically depended on the connectivity of sands away from the wellbore. Consequently an extended well test was designed and implemented in the 29/8a-6 well in which the full section was perforated in a 60° hole, and 50,000stb withdrawn. The 29/8a-6 well data are not released and consequently no further data is presented in this document.

Figure 5 is a W-E seismic line through well 29/8a-3, the black horizon is the Top Kimmeridge, the pink horizon is the Top Heather and the blue horizon is the Top Skagerrak. The horizons in the interval are continuous reflectors with minimal faulting. To the south of the well, there is an increase in the amount of faulting rising up to the high at well 29/8b-2st. To the north of well 29/8a-3, the horizons become discontinuous and faulted as uplifting occurs. The Acorn structure at Skagerrak level is a broad anticlinal feature, with the main axis positioned NNW-SSE (Figure 6). The anticline is faulted on either side of the main axis, with faults dipping down to the southwest and to the northeast. Well 29/8a-3 is drilled on the crest of the anticline. The Acorn area contains several uplifted areas which could contain possible Fulmar sands.
Figure 5. Acorn structural configuration. Data courtesy of CGGVeritas.
Intra-Triassic picks are fairly unequivocal and divide the reservoir into Joanne Sandstone, Julius Mudstone and Judy Sandstone units. Figure 7 shows the Triassic correlation across the block. The Skagerrak reservoir in Acorn is interpreted to have been deposited in an ephemeral fluvio-lacustrine environment (Figure 8). The upper part of the section appears to be dominated by channel deposits, features such as coarse grained lags and cross bedding are apparent (Figure 9). Four clear fining upwards sequences can be seen in the log and core character (Figure 10). The lower interval within the Joanne Sandstone contains smaller channel deposits and possible small lacustrine deltas. Thinner net pay intervals associated with lacustrine deposits are also apparent.

**Figure 6.** Acorn top Skagerrak two-way time map.

**Figure 7.** Acorn NW-SE Triassic correlation panel.
Figure 8. Sedimentological and depositional models for Acorn Triassic.

Figure 9. 29/8a-3 Core and log expression of channel interval.
Ephemeral fluvial section. Thicker (6 – 15”) channel sections with fining upwards trends. Overbank silts. Reasonable lateral connectivity hypothesised towards base of fining up cycles, but contradicted by DST3.

Lacustrine and small deltas building into lakes. Minor channels. Thinner pay intervals with poorer reservoir quality.

Background is not a true mudstone, no clays apparent. Fine grained material, silts etc. Potential for slow, long term fluid contribution to system?

Figure 10. Log expression and sedimentological summary of 29/8a-3.

Porosity and permeability data from 29/8a-3 core is shown in Figure 11. Average air permeability from core is 21mD (arithmetic) and 8.4mD (geometric). Petrophysical averages for the main Joanne reservoir are shown in Table 1. The following cuts offs were applied for the well:

- Porosity <0.125 v/v based on porosity permeability transform
- Vsh > 0.5 v/v (xplot)

<table>
<thead>
<tr>
<th>Interval</th>
<th>Top</th>
<th>Base</th>
<th>Gross</th>
<th>Net Sand</th>
<th>Net/Gross</th>
<th>Av. Ø</th>
<th>Av. VSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Sand in Joanne Sandstone Fm</td>
<td>12,992</td>
<td>13,609</td>
<td>617</td>
<td>206.5</td>
<td>0.34</td>
<td>0.17</td>
<td>0.21</td>
</tr>
<tr>
<td>Net Sand to OWC of 13228 ft TVDSS</td>
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<td>13,318</td>
<td>326</td>
<td>139.5</td>
<td>0.43</td>
<td>0.18</td>
<td>0.30</td>
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</table>

Table 1. Acorn Triassic reservoir petrophysical averages
Fluid contacts are not clearly established in 29/8a-3 from either RFT or log data. An ODT and WUT were determined using oil staining from core and retort measurement from core plug samples. They indicate an ODT at 13,212 feet TVDSS and a WUT at 13,245 feet TVDSS.

The lower part of the 29/8a-3 DST1 interval (deeper DST interval) showed high water saturation on the logs and core analysis (retort analysis) but no water production was observed during the test. Based on this, a free water level of 13,228 ft TVDSS, at the base of the DST1 interval, is assumed.

**Figure 11. Core porosity and permeability data for 29/8a-3.**
Beechnut Fulmar Reservoir Evaluation

The Beechnut discovery lies around 8km east of Acorn and its proximity links the two accumulations in terms of future appraisal and development.

Beechnut can be divided into a structural high, Beechnut North, and stratigraphic extension, Beechnut South. Beechnut North has a number of well penetrations which have established a significant STOIIP volume in the Fulmar of around 50 MMstb, and which have tested oil at rates of up to 5,000 bopd. However fault compartmentalisation and variable reservoir development has led to the accumulation remaining undeveloped. Beechnut South is de-risked by the 29/9b-9 well which proves trap presence, and is estimated to contain a STOIIP of around 60 MMstb which requires further appraisal.

At present Venture does not regard Beechnut as a stand-alone development candidate.

Beechnut was discovered in 1985 with the 29/9b-2 well which was drilled on the crest of a structural high at BCU and Fulmar level. The well tested oil from three separate intervals; the Upper Jurassic Fulmar Formation sands, the Middle Jurassic Ron Volcanic Member, and the Pentland/Gassum Formations (Figure 12). An oil-down-to of -14,030 feet TVDSS was established, and the well reached TD in the Triassic before being suspended.

During the late 1980’s the structure was appraised down-dip by 29/9b-3 and 29/9b-6. 29/9b-3 was drilled in 1986/7 and reached TD at 14,500 feet in Ron volcanics having encountered a thin silty unit at the base of the Heather Formation, ascribed to Fulmar equivalent, and containing good shows. 29/9b-6 was drilled in 1989/90 and reached TD at 15,216 in the Zechstein having tested oil in a thin Fulmar sandstone section (Figure 12). The Fulmar is interpreted as being faulted out on the basis of dip-meter and seismic evidence. The oil gravity is different to the 29/9b-2 discovery, and reservoir pressure is 190psi higher, indicating a separate compartment.

In 2001, 29/9b-9 targeted the hanging-wall of Beechnut and encountered a thicker Heather/Fulmar section. The well tested at over 2,000 bopd from the Fulmar, whilst the Pentland/Gassum was absent (Figure 13). The well was then sidetracked to target the northern flank of the footwall, but encountered thin oil-bearing sands interbedded with silts.
Figure 12. Beechnut 29/9b-2 and 29/9b-6 well results.

Figure 13. Beechnut 29/9b-9 and 29/9b-9z well results.
The Beechnut structural and depositional history is related to Zechstein salt movement, and development of Triassic “pods” and “inter-pods”. These are shown schematically in Figure 14. Triassic Smith Bank shales and silts were deposited as pods formed by movement of the underlying Zechstein salt. During the middle and late Jurassic, withdrawal of Zechstein salt highs led to accumulation of deltaic Pentland sands, Ron volcanics and subsequently Fulmar shoreface sands, before further marine transgression led to deposition of Heather and Kimmeridge silts and shales. Further movement of Zechstein salt led to early faulting of the Beechnut structure, producing a thickened hanging wall section of Heather sediments to the south. Inversion during the lower Cretaceous resulted in an over-steepened structure at Fulmar level, producing a distinct structural high termed Beechnut North, and stratigraphic pinchout, termed Beechnut South. A Top Fulmar depth map is shown in Figure 15. The Beechnut structure is clearly defined at BCU level on seismic, as is the pinch-out of the Upper Jurassic section to the south. A representative south-north seismic line running through the 29/9b-9 and 29/9b-2 wells is shown in Figure 16.

Figure 14. Beechnut structural and stratigraphic evolution.
Figure 15. Beechnut Top Fulmar depth structure map (ft).

Figure 16. Beechnut S-N seismic line. Data courtesy of
The crest of Beechnut occurs at around 13,200 feet TVDSS, and the Fulmar reservoir has an average gross thickness in the 29/9b-2, -6 and -9 wells of 70 feet, with gross average porosity of 17.6% and oil saturation of 72%. The reservoir is HPHT, with a pressure of around 11,000 psi, and temperature of 315°F.

No oil-water contact has been penetrated in the Fulmar reservoir, and the wells indicate a potential oil column of at least 775 feet if the 29/9b-9 well is connected into Beechnut North (Table 2). In addition, pressure, geochemical and PVT evidence supports a single oil column between the 29/9b-2 Fulmar and Gassum/Pentland intervals, pushing the ODT in that well down to 13,943' tvdss, and indicating a minimum oil column of 727 feet, supporting the long oil column seen in the 29/9b-9 well.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>29/9b-2</th>
<th>29/9b-6</th>
<th>29/9b-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Fulmar</td>
<td>ft tvdss</td>
<td>13,216</td>
<td>13,309</td>
<td>13,892</td>
</tr>
<tr>
<td>Gross thickness</td>
<td>ft</td>
<td>86</td>
<td>37</td>
<td>84</td>
</tr>
<tr>
<td>ODT</td>
<td>ft tvdss</td>
<td>13,301</td>
<td>13,346</td>
<td>13,975</td>
</tr>
<tr>
<td>Min Oil Column*</td>
<td>ft</td>
<td>101</td>
<td>146</td>
<td>775</td>
</tr>
<tr>
<td>Gassum ODT</td>
<td>ft tvdss</td>
<td>13943</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined oil column*</td>
<td>ft</td>
<td>727</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* assumes crest at -13,200ft tvdss

Table 2. Beechnut reservoir depths and oil-columns

Core porosity and permeability data is shown in Figure 17. The reservoir is high porosity, with moderate permeability. Average gross permeability from logs is estimated to be 10mD, consistent with DST interpretations.

![Figure 17. Core porosity and permeability for Beechnut wells.](image-url)
Regional pressures for Beechnut are shown in Figure 18, indicating different pressure regimes. Note that the 29/9b-2 DSTs in the Fulmar and Pentland/Gassum share the same pressure gradient. The fluid is an undersaturated light oil, with GOR of around 600scf/bbl and bubble-point pressure of around 2500 psi.

Figure 18. Beechnut reserve pressure depth plot.
Clearance

This Relinquishment Report is presented by Venture North Sea Oil (“Venture”) upon relinquishment of the acreage, and contains information which may be of use to companies considering the acquisition of this acreage in upcoming licensing rounds.

This Relinquishment Report does not purport to be all-inclusive or to contain all of the information that an interested party might desire. Venture has provided the information contained in this Relinquishment Report in good faith; nevertheless Venture and its affiliates, officers, directors, employees, agents, advisers and representatives make no representations or warranties, expressed or implied or accept any responsibility or liability, concerning any information in this Relinquishment Report or the omission of any information. Reliance on the information provided in this Relinquishment Report shall not give rise to any cause of action against Venture, or its affiliates, officers, directors, employees, agents, advisers and representatives, including, without prejudice to the generality of the foregoing, causes of action or claims based upon their negligence or wilful misconduct.

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