P1884 Licence Relinquishment Report

1. Header

Licence Number: P1884
Licence Round: 26th Seaward
Licence Type: Frontier
Block Numbers: 5/1, 5/2, 5/3, 5/4, 5/5, 5/6, 5/7, 5/8, 5/9, 206/28
Licence start date: 1st February 2012
Initial term: 6 years
Operator: Hurricane Energy (100%)

Work Programme Summary:

- Firm commitment to shoot 850km of 2D seismic data
- Drill-or-drop commitment to either:
  1. Drill one well to 1220m to penetrate the Devonian or Top Metamorphic Basement, whichever is the shallower, or
  2. Elect to allow the licence to automatically cease

2. Synopsis

Hurricane Energy applied for Licence P1884 in the 26th Seaward Licensing Round with the aim of exploring the Devonian play in the Orcadian Basin to the west of Orkney and Shetland. Frontier Licence P1884 covered a ten block area (Figure 1) and had a start date of 1st February 2012, with an initial term of 6 years. The main work commitment was to shoot 850 kilometres of new 2D seismic data over and around the Licence area. The 2D seismic data was shot in July 2012 by TGS (Figure 2) as part of their North Sea Renaissance programme and processed by December 2012. After full geological evaluation of the seismic data the decision was made to relinquish the licence due to the following reasons:

- The structure of the basin was not as predicted, with no large structural traps being identified at prospective levels of either the Middle Devonian or the top Lower Devonian. Any potential closures seen were largely confined to single seismic lines or small in terms of areal extent.
- The prospective Middle Devonian interval, containing clastic reservoirs overlying the main lacustrine source rock, either outcrops at seabed or is only relatively shallowly buried (<1 sec) and as a consequence has significant seal / breach risk.

- The interpreted Middle Devonian source interval does not appear to be optimally juxtaposed across any faults against potential Lower Devonian reservoirs due to minimal offset along major faults.

Licence P1884 was fully relinquished on October 31st 2013.

3. Exploration Activities

Seismic acquisition: 753.625km of 2D long offset seismic data on a 5x5km grid shot by TGS (NB: the full 850km commitment could not be met due to restrictions on shooting within the 12 nautical mile inshore area in the north-east part of the Licence area – see Figure 2).

Wells: No wells drilled

Studies: In-house G&G evaluation conducted

4. Petroleum System

The application submitted for Licence P1884 was based on the rationale that a working petroleum system is potentially present in Devonian-aged sediments deposited in the Orcadian Basin to the west of Orkney and Shetland. Support for the concept is found on Orkney where two exhumed oil fields are found within the Devonian. In addition, initial interpretation of limited available 2D seismic data and offshore gravity data both indicated the existence of a potential sedimentary basin several kilometres in thickness in the area of interest.

Source: Based on the geology of Orkney, the principal source rocks in the licence area are considered to be the lacustrine lower Middle Devonian Rousay and Stromness Flagstones. Some source potential is also present in the Eday Flagstones, which are upper Middle Devonian in age.

Reservoir: Reservoir potential is believed to exist in the Yesnaby Sandstone at the top of the Lower Devonian and the Middle Devonian Lower Eday Sandstone, as seen in the exhumed fields on Orkney. From outcrop work carried out on Orkney, the aeolian dunes of the Yesnaby Sandstone have porosities of 13% to 25%, with permeabilities ranging from 3mD to 2000mD. The fluvial / aeolian...
Lower Eday Sandstone has a porosity range of 14% – 25% and permeabilities of 3mD to 2000mD from outcrop. The overlying Middle-?Upper Devonian sequence is also believed to be sandstone-dominated, but the lack of any significant sealing lithologies compromises potential reservoir intervals.

**Trap:** The exhumed oil fields seen on Orkney are trapped either by stratigraphic pinchout and structural closure over a basement high, or in a faulted anticline. The same trapping mechanisms were expected to be seen in the licence area with seal being provided by either the Middle Devonian Stromness Flagstones above the Lower Devonian Yesnaby Sandstone or the Middle Devonian Eday Flagstones above the Lower Eday sandstone. Trapping potential within the overlying Middle-Upper Devonian section is likely to be severely compromised by lack of sealing lithologies.

**Dynamic:** The main phase of oil generation is considered to have occurred during the Devonian – Carboniferous. A viable trap would need to have been formed before hydrocarbon expulsion and would have to survive any subsequent structural modification associated with extension or uplift.

**5. G&G Interpretation & Prospectivity Analysis**

Due to no well penetrations existing in the area, the age of sediments seen on seismic has been interpreted using a combination of seabed geology maps and outcrop geology from Orkney. Figure 3 shows the TWT structure at the interpreted Mid to Lower Eday Group level (Middle Devonian), revealing an ESE dipping basin with major parallel faults striking NNW-SSE. Although laterally extensive, the faults do not have significant throw, meaning few potential hydrocarbon-bearing traps are generated. There are indications of small, low relief 4-way dip closures in Blocks 5/4 and 5/5 although these are poorly constrained by the seismic data.

Similarly, Figure 4 demonstrates that at the interpreted top Yesnaby Sandstone level ("top Lower Devonian") the same NNW-SSE fault trend dominates with sediments dipping ESE. A potential fault bounded 3-way dip closure appears to be present in Blocks 5/9 and 5/10, however more infill seismic would be required to ascertain whether or not this closes as the mapped closing contour has an aerial extent of less than 2km².

Figure 5 is a 2D dip line illustrating a half graben with a sedimentary interval of up to 3.5 seconds. The figure demonstrates the lack of throw on the faults, which commonly terminate at the seabed
increasing the seal risk on any traps. Only subtle folding is seen and the interpreted prospective Middle Devonian interval is buried at shallow depths. At no point is the Middle Devonian source juxtaposed against the Lower Devonian. Top basement features (Moine?) are evident at around 2.5 - 3.5 seconds in the basin centre.

In summary, no significant structures or closures have been identified using the 2D seismic grid available. Potential prospectivity may still remain in the basin and could be identified through additional infill seismic data acquisition.

6. Reserves Summary

Due to no leads or prospects being identified, no reserve calculations were carried out over the licenced area.

7. Clearance

Hurricane Energy plc gives permission to DECC to publish this relinquishment report, and does not have any known third party ownership conflicts.
Maps and Figures

Figure 1: Location map showing area of relinquished licence P1884 (outlined in red)
Figure 2: Seismic basemap of 2D data shot by TGS in 2012. 12 nautical mile inshore area exclusion zone highlighted in blue.
Figure 3: Two-way time map of the Mid – Lower Eday Group (Middle Devonian)

Figure 4: Two-way time map of the top Yesnaby Sandstone (~top Lower Devonian)
Figure 5: Example long offset seismic line through the Orcadian Basin. Data courtesy of TGS.