Relinquishment Report for Licence P222

4th Licence Round, Traditional, Block 16/2a

Operator: Marathon Oil UK LLC (50%)

Partners: BP Exploration Operating Company Limited (9.625%)
Centrica Resources Limited (10.0%)
JX Nippon Exploration and Production (U.K) Limited (7.875%)
TAQA Bratani Limited (17.5%)
TAQA Bratani LNS Limited (5%)

Introduction / History

The current area of Licence P222 (Block 16/2a, Fig. 1) is the remnant of a larger area of Block 16/2 that was awarded to Marathon and Partners in 1972 as part of the 4th Round of Licensing. Well 16/2a-2 was drilled by Marathon in 1990 in the original licence area as an appraisal of Marathon’s 16/3a-11 (Cairngorm, 1989-90) oil discovery within fractured Silurian granite. Well 16/2a-2 was dry, the well being terminated in tight Devonian sandstones.

The northern part of the licence was subsequently relinquished in March 2003, with the retained portion bordering Block 16/7a covering an area of 8.3 sq km. Within this retained area an un-drilled structural high at the Base Cretaceous level had been mapped, which was interpreted as a possible extension of the Upper Jurassic North Brae gas condensate field. Well 16/7a-B28 and its sidetrack 16/7a-B28Z were subsequently drilled (in 1998) into this structure from the Brae B Platform, 4.5 km to the south, and oil was produced from the B28Z well until 2000 when the well was shut in and subsequently sidetracked to a production location in Block 16/7a (Licence P108). A summary of the regional setting, the stratigraphy and structure of the block and details of wells 16/7a-B28 and B28Z are provided below. No further prospectivity is recognised within the block, and therefore this remaining area of Licence P222 has been relinquished (February 2013).

In 2007, a proprietary 3D seismic survey was acquired across 16/2a by Marathon and Partners as part of an extensive survey that covered all the Brae fields, from East Brae in the northeast to South Brae in the south (Fig. 1). These seismic data have been interpreted across the block as part of regional investigations and have formed an integral part in the re-evaluation of the area.
Regional setting of Licence P222

A regional evaluation of the area around the Brae fields, including Block 16/2a, has been undertaken by Marathon over the last few years in an effort to determine remaining prospectivity in the area. Block 16/2a lies at the margin of the South Viking Graben (Fig. 2) on a NE-SW trending offset to the main N-S graben margin trend. Here, thick Jurassic and Cretaceous sequences of the graben are juxtaposed against the eroded faulted margin of the Fladen Ground Spur, where a thin sequence of
Cretaceous strata overlies basement rocks of Devonian or older age (Fig. 3). The Cretaceous is overlain both in the graben and on the Fladen Ground Spur by a thick sequence of Cenozoic sandstones and mudstones which form the reservoirs and seals for the West Brae Field, some 10 km south-west of Block 16/2a.

Figure 2  Two-way time structure map of Top Kimmeridge Clay Formation (to east of KCF on-lap line) and Top Devonian Basement (to west of KCF on-lap line), showing location of Block 16/2a (P222), well 16/7a-B28Z and the Brae B Platform in Block 16/7a.

**Middle Jurassic**

The Beinn Field is located on a Middle Jurassic structural high within 16/7a that underlies the northern flank of the North Brae structure and is immediately south of Block 16/2a (Fig. 3 and 4). The principle reservoir of the field is the Callovian Hugin Formation that directly overlies the Bathonian Sleipner Formation, from which minor production has also taken place. Beinn development wells were drilled from the Brae B Platform. Both the Hugin and Sleipner formations terminate against the eroded footwall of the Viking Graben, and only thin units of these Middle Jurassic formations are present in the southeast corner of Block 16/2a (Fig. 4). The Beinn hydrocarbons do not extend into the block, and no other Middle Jurassic prospectivity is recognised within Block 16/2a.
Figure 3  S-N seismic cross section (location shown on Figs 2 and 4) through Block 16/2a, the Beinn Field and the North Brae Field. Horizon picks are; red – Top Balder Fm; light blue – Top Ekofisk Fm; mid blue – Top Rødby Fm (Top L. Cretaceous); pink – Top Kimmeridge Clay Fm; yellow – Top Brae Fm (Top reservoir); green – Top Sleipner Fm (M. Jurassic); and dark blue – Top Basement (Devonian or older rocks).

Figure 4  Two-way time structure map of Top Sleipner Fm (to east of Sleipner on-lap line) and Top Basement (to west of Sleipner on-lap line).
Upper Jurassic

An Upper Jurassic Brae Formation reservoir target mapped within a small four-way closed anticline at the southern margin of Block 16/2a was drilled from the Brae B Platform in 1998. Well 16/7a-B28 (Fig. 5a) penetrated approximately 360 ft (measured depth) of conglomeratic Brae Fm, at the top of which 90 ft of core were cut (65 ft recovered). An oil column in excess of 100 ft was penetrated, however, the well encountered mechanical difficulties and no logs were taken below this depth (approx. 12,650 ft TVDSS). The well was sidetracked a short distance to provide production well 16/7a-B28Z (Fig. 5b). An approximate 450 ft (TVD) section of oil-bearing conglomerate was encountered, with no clear oil-water contact; the well terminated in Upper Jurassic shale.

The conglomerate reservoir comprises angular to subangular clasts of granite set in a sandstone matrix, and has generally low porosity and permeability (Fig. 6). The upper part of the conglomerate was perforated (Fig. 5b) and initial production was around 1,500 bbl/day of 42 deg API oil, with a GOR of 2,200 scf/bbl. From a pressure transient build-up survey conducted in the well in October 1998, the STOIIP of the accumulation was estimated at 2.8 mmbbls. Total production, from August 1998 to February 2000, was 0.53 mmbbls oil and 0.75 bcf gas. A production profile is shown in Figure 7. Production rates declined to 300-400 bbls/day before the well ceased to flow and was shut in. The well was subsequently sidetracked (in 2005) as 16/7a-B33 into the Beinn Middle Jurassic Hugin Fm reservoir in Block 16/7a. The portion well 16/7a-B28Z that penetrated Block 16/2a is therefore permanently abandoned.

The conglomerates in well 16/7a-B28Z are likely to be proximal submarine fan deposits, with sediment having been derived locally from the graben margin to the north of the well. The presence of granitic clasts, which are not found in the main North Brae conglomerates, suggests that the granite drilled in well 16/3a-11 (Fig. 1) may extend as far west as the B28Z area (although detailed petrographic or geochemical comparisons have not been made). The B28Z fan system is likely to be of limited extent and is best interpreted as a thick but laterally restricted, cone-shaped deposit.
Figure 5a  Composite log for well 16/7a-B28, drilled into Block 16/2a from the Brae B Platform in Block 16/7a.
Figure 5b  CPI log for well 16/7a-B28Z, drilled into Block 16/2a from the Brae B Platform in Block 16/7a.
Figure 6  Representative 1 ft lengths of core from 16/7a-B28 and core plug analyses. Angular, light-coloured granitic clasts are evident.
Cretaceous

Approximately 450 ft (TVD) of limestone and mudstone of Lower Cretaceous age were drilled at the southern margin of Block 16/2a in well 16/7a-B28 (Top Rødby to Top Kimmeridge Clay in Fig. 3). This penetration occurs near the crest of the Upper Jurassic anticline in the block, and the Lower Cretaceous section thickens away from the anticline crest. To the north of the anticline the Lower Cretaceous section thins and pinches out against the basement towards the northern margin of the block.
The Lower Cretaceous section is not considered prospective in Block 16/2a. However, turbidite sandstones do occur within the Lower Cretaceous section to the east of the block, in Block 16/3. In well 16/3d-13, to the north of the East Brae Field, a 320 ft section of the water-bearing Skiff Sandstone Member of the Carrack Formation was drilled. This sandstone unit thins to the south, and in wells 16/3a-E22 and E22Z, drilled to the west from the East Brae Platform, oil-bearing Skiff Sandstone, approximately 60 ft thick, occurs. Well 16/3a-E22Z was tested but oil failed to flow to the surface.

Despite the local presence of Lower Cretaceous sandstones in Block 16/3, no such sandstones have been drilled in any well in Blocks 16/7 or 16/2, and the presence of such sandstones in un-drilled areas of Block 16/2a is considered very unlikely. Even if such sandstones are present in parts of the block, no trapping mechanisms have been mapped.

The Upper Cretaceous section is of more uniform thickness in Block 16/2a than the Lower Cretaceous, but thins rapidly directly north of the block at the edge of the Fladen Ground Spur (Fig. 3). The Upper Cretaceous (including the lower Palaeocene Ekofisk Fm) in Block 16/2a comprises limestones and mudstones totalling approximately 2,500 ft in thickness. No prospectivity is recognised within the Upper Cretaceous in the licence area.

**Cenozoic**

A thick sequence of Palaeocene and lower Eocene sandstones and mudstones occurs regionally in this area. For example, in the North Brae Field area, some 4 km to the south of the block, approximately 2,000 ft of sandstones and mudstones occur above the top of the Ekofisk Fm limestones and below the top of the Balder Fm. Although the upper part of this sequence (Flugga and Balder sandstones) contains oil and gas at the West Brae Field at the margin of the Fladen Ground Spur, no hydrocarbons have been encountered in this sequence in the basin area of block 16/7. The structure at Top Balder Fm level within Block 16/2a is part of a regional slope between the Fladen Ground Spur and the Viking Graben. No trapping mechanisms have been mapped within the block, and no prospectivity is recognised within the Cenozoic sequence.
Figure 6  Two-way time structure map for Top Balder Fm, showing Block 16/2a lying over the slope from the platform area (Fladen Ground Spur) to the basin overlying the South Viking Graben.

Summary

A small Upper Jurassic anticline in Block 16/2a has been penetrated by a production well from the North Brae Platform in Block 16/7a to the south. A small volume of oil (approx 0.5 mmbbls) was produced from this well over an eighteen months period at the end of the 1990s. The production well, 16/7a-B28Z, was subsequently sidetracked to another development target in Block 16/7a. No further prospectivity is recognised in Block 16/2a.