## General information

| | |
|---|---|
| Wellbore name | 16/2-21 |
| Type | EXPLORATION |
| Purpose | APPRAISAL |
| Status | P&A |
| Press release | link to press release |
| Factmaps in new window | link to map |
| Main area | NORTH SEA |
| Field | JOHAN SVERDRUP |
| Discovery | 16/2-6 Johan Sverdrup |
| Well name | 16/2-21 |
| Seismic location | LN0902-inline 2351 & xline 6672 |
| Production licence | 501 |
| Drilling operator | Lundin Norway AS |
| Drill permit | 1441-L |
| Drilling facility | BREDFORD DOLPHIN |
| Drilling days | 34 |
| Entered date | 05.05.2013 |
| Completed date | 07.06.2013 |
| Release date | 07.06.2015 |
| Publication date | 07.06.2015 |
| Purpose - planned | APPRAISAL |
| Reentry | NO |
| Content | OIL |
| Discovery wellbore | NO |
| 1st level with HC, age | LATE JURASSIC |
| 1st level with HC, formation | INTRA DRAUPNE FM SS |
| Kelly bushing elevation [m] | 25.0 |
| Water depth [m] | 112.0 |
| Total depth (MD) [m RKB] | 2070.0 |
| Final vertical depth (TVD) [m RKB] | 2070.0 |
| Maximum inclination [°] | 1.4 |
| Oldest penetrated age | LATE TRIASSIC |
| Oldest penetrated formation | SKAGERRAK FM |
| Geodetic datum | ED50 |
| NS degrees | 58° 46' 40.76'' N |
| EW degrees | 2° 36' 38.77'' E |
| NS UTM [m] | 6515546.49 |
| EW UTM [m] | 477492.98 |

| | |
|---|---|
| UTM zone | 31 |
| NPDID wellbore | 7169 |

## Wellbore history

**General**

Well 16/2-21 was drilled to appraise the central part of the Johan Sverdrup discovery on the Utsira high in the North Seas. The hydrocarbon column height was predicted to be 14 m in the well location. The main objectives of the well were to investigate the reservoir sequence, facies and thickness in the central part of the discovery and to find the free water level (FWL).

**Operations and results**

Appraisal well 16/2-21 was spudded with the semi-submersible installation Bredford Dolphin on 5 May 2013 and drilled to TD at 2070 m in the Late Triassic Skagerrak Formation. A 9 7/8" pilot hole was drilled from the seabed to 706 m due to slight shallow gas warnings. No shallow gas was seen. Drilling was efficient with little NPT. The NPT was caused mostly by mud losses in the Skagerrak Formation reservoir section. The well was drilled with seawater and hi-vis pills down to 706 m and with Performadril water based mud from 76 m to TD.

The top of the reservoir came in as prognosed at 1935 m, overlain by a 4 m thick Draupne Formation shale. An oil column of 12 meter entirely within the late Jurassic Intra-Draupne sandstones was proven. The well proved excellent development of these sandstones in the central part of the Johan Sverdrup discovery. The total thickness of the Intra-Draupne Formation sandstone was 12 m. No sediments of middle Jurassic age were found, but 17 m of water filled early Jurassic Eriksson Formation was encountered below the Draupne Formation. The well results show an oil water contact at 1947 m, but with residual oil saturations of 20-30% down to ca 1955 m.

Above the reservoir, increasing amounts and wetness of mud gas down through the lowermost part of the Cromer Knoll Group suggested the possibility of leakage from the reservoir. However, no oil shows were observed in the Cromer Knoll Group; the only oil shows in the well were recorded on the cores from 1935 to 1945 m, and 1953 to 1955 m, within the Intra-Draupne and Eriksson Formation sandstones.

Three cores were cut in the interval 1907 m in the Cromer Knoll Group to 1976.6 m in the Skagerrak Formation with close to 100% total recovery. MDT fluid samples were taken at 1937.02 m (oil), 1946.62 m (oil), 1947.11 m (oil), 1947.71 m (water), 1953.79 m (water), and 1975.55 m (water).

The well was permanently abandoned on 7 June 2013 as an oil appraisal well.

**Testing**

No drill stem test was performed.

## Cuttings at the Norwegian Offshore Directorate

| Cutting sample, top depth [m] | Cutting samples, bottom depth [m] |
|---|---|
| 720.00 | 2070.00 |

| | |
|---|---|
| Cuttings available for sampling? | YES |

### Cores at the Norwegian Offshore Directorate

| Core sample number | Core sample - top depth | Core sample - bottom depth | Core sample depth - uom |
|---|---|---|---|
| 1 | 1907.0 | 1922.3 | [m ] |
| 2 | 1922.6 | 1949.5 | [m ] |
| 3 | 1949.6 | 1976.2 | [m ] |

| | |
|---|---|
| Total core sample length [m] | 68.8 |
| Cores available for sampling? | YES |

### Oil samples at the Norwegian Offshore Directorate

| Test type | Bottle number | Top depth MD [m] | Bottom depth MD [m] | Fluid type | Test time | Samples available |
|---|---|---|---|---|---|---|
| MDT | | 1946.60 | 0.00 | OIL | 27.05.2013 - 00:00 | NO |
| MDT | | 1937.00 | 0.00 | OIL | 27.05.2013 - 00:00 | NO |

### Lithostratigraphy

| Top depth [mMD RKB] | Lithostrat. unit |
|---|---|
| 137 | NORDLAND GP |
| 795 | UTSIRA FM |
| 870 | UNDIFFERENTIATED |
| 912 | HORDALAND GP |
| 912 | SKADE FM |
| 1048 | NO FORMAL NAME |
| 1396 | NO FORMAL NAME |
| 1424 | ROGALAND GP |
| 1424 | BALDER FM |
| 1446 | SELE FM |
| 1456 | LISTA FM |
| 1532 | VÅLE FM |
| 1542 | SHETLAND GP |

| | |
|---|---|
| 1542 | EKOFISK FM |
| 1553 | TOR FM |
| 1641 | HOD FM |
| 1755 | BLODØKS FM |
| 1769 | SVARTE FM |
| 1806 | CROMER KNOLL GP |
| 1806 | RØDBY FM |
| 1895 | SOLA FM |
| 1906 | ÅSGARD FM |
| 1932 | VIKING GP |
| 1932 | DRAUPNE FM |
| 1935 | INTRA DRAUPNE FM SS |
| 1948 | STATFJORD GP |
| 1948 | EIRIKSSON FM |
| 1965 | HEGRE GP |
| 1965 | SKAGERRAK FM |

## Logs

| Log type | Log top depth [m] | Log bottom depth [m] |
|---|---|---|
| CMR XPT | 1885 | 2051 |
| FMI PPC MSIP PPC GR | 1355 | 2063 |
| LS ADT HRLA PEX HNGS | 1876 | 2060 |
| MDT | 1953 | 1937 |
| MDT PACKER | 0 | 0 |
| MWD - ARC PUP SON | 130 | 701 |
| MWD - ARC PUP SON SADN GVR | 695 | 1882 |
| MWD - ECO PUP SON | 1876 | 2065 |
| MWD - GVR PUP | 1880 | 1910 |
| VSP | 200 | 2040 |
| WI-ROCK | 1944 | 2013 |
| XI-ROCK | 1888 | 1999 |

## Casing and leak-off tests

| Casing type | Casing diam. [inch] | Casing depth [m] | Hole diam. [inch] | Hole depth [m] | LOT/FIT mud eqv. [g/cm3] | Formation test type |
|---|---|---|---|---|---|---|
| CONDUCTOR | 30 | 215.0 | 36 | 215.0 | 0.00 | |
| INTERM. | 20 | 698.0 | 26 | 706.0 | 1.60 | FIT |

| | | | | | | |
|---|---|---|---|---|---|---|
| PILOT HOLE | | 706.0 | 9 7/8 | 706.0 | 0.00 | |
| INTERM. | 9 5/8 | 1876.0 | 12 1/4 | 1882.0 | 1.72 | LOT |
| OPEN HOLE | | 2070.0 | 8 1/2 | 2070.0 | 0.00 | |

**Drilling mud**

| Depth MD [m] | Mud weight [g/cm3] | Visc. [mPa.s] | Yield point [Pa] | Mud type | Date measured |
|---|---|---|---|---|---|
| 450 | 1.41 | 28.0 | | Water Based | |
| 1907 | 1.20 | 34.0 | | Water Based | |
| 2070 | 1.15 | 36.0 | | Water Based | |
| 2070 | 1.41 | 27.0 | | Water Based | |