



## Wellbore History

### GENERAL

Well 31/2-3 was drilled in the Troll West area, approximately 8 km NNE of the Troll Discovery well 31/2-1. The well was drilled to appraise the Troll Discovery. It should evaluate reservoir parameters along the axis of maximum gross hydrocarbon column; prove maximum hydrocarbon reserves in the major northern fault block; confirm the significance of the seismic flatspot as a direct hydrocarbon indicator; further assess the significance of the oil shows found in 31/2-1; and evaluate the influence of earlier Kimmerian fault movements on reservoir characteristics.

### OPERATIONS AND RESULTS

Appraisal well 31/2-3 was spudded with the semi-submersible installation Borgny Dolphin on 28 March and drilled to TD at 2601 m in Late Triassic sediments in the Statfjord Formation. Drilling took 115 days. The reason for the long drilling period was safety inspection of the rig as a result of the "Alexander Kielland" accident and a strike amongst the Norwegian rig crew. The well was drilled with bentonite and seawater down to 816 m and with a gypsum/lignosulphonate mud from 816 m to TD.

No potential reservoir zones were encountered above top Jurassic. The well confirmed that the Late Jurassic sandstone reservoir encountered in wells 31/2-1 and 2 was well developed also in this more northerly part of the structure. A gross gas column of 189 m was penetrated with top at 1384 m. The uppermost 120 m was in a good clean sand (Sognefjord Formation) while the lower part of the gas column was in a micaceous and poor reservoir sand (Heather and Fensfjord Formations). Below the gas a 12 m thick oil zone was encountered, the same thickness and at the same level as in well 31/2-2. In this well however, the oil was in a very micaceous and poorly developed reservoir. The reservoir was uncomformably overlain by Palaeocene claystones, which thus act as an effective seal for the reservoir. Below the OWC at 1585 no moveable hydrocarbons were seen in the well, but shows continued down to 1612 m and isolated shows were seen at 1630 m and at 1638 m.

The seismic Flatspot did coincide with the base of the gas column in well 31/2-3, supporting that the Flatspot indeed is a direct hydrocarbon indicator over the entire prospect.

Coring was performed in the Middle to Late Jurassic interval from 1412 m to 1645.5 m. Twenty-one cores with a total recovery of 194.4 m (84%) were cut. Coring started approximately 28 m below the top reservoir and continued well below the hydrocarbon/water contact. Prior to the full scale production test programme, a series of runs were made with the Schlumberger Repeat Formation Tester (RFT). A total of 10 RFT runs were made. The first run indicated pressure gradients very similar to those obtained in Wells 31/2-1 and 31/2-2. It was, however, impossible to confirm the 12-meter oil gradient indicated by RFT's in well 31/2-2. Sampling attempts in the water zone failed as only mud filtrate was recovered. In the suspected oil zone, no samples were obtained in spite of numerous attempts as the tool probe always plugged in the relatively tight and poorly consolidated formation. Only two gas samples were obtained, at 1458 m and 1568.5 m.

The well was permanently abandoned on 20 July 1980 as a gas and oil appraisal well.

### TESTING

Four Production Tests were conducted in the Middle to Late Jurassic. PT1 tested the interval 1600.5 m to 1605.5 m in the water zone, PT2 tested the interval 1577.5 m to 1582.5 m in the oil zone, PT3 tested the interval 1520 m to 1535 m in the micaceous part of the gas bearing section, and PT4 tested 1435 m to 1460 m in the top clean sand of the gas section.

After the bottom hole test valve was opened for the test in the water zone, the well flowed for 15 minutes until it died. Some 87.5 litres of formation water (70.000 ppm NaCl equivalent) were recovered.

In the oil zone test (PT2) the well came in at a low rate and flowed at about 4.5 - 6.6 Sm<sup>3</sup>/day for four days. The oil was about 24 deg API and the GOR around 36 Sm<sup>3</sup>/Sm<sup>3</sup>. The micaceous gas zone test (PT3) stabilized at a rate of about 142000 Sm<sup>3</sup>/day on 28/64" choke during the clean up period. The produced fluids were gas of gravity 0.617 (air = 1) and condensate of 50.3 API, with some water (mostly brine) and traces of

## LITHOSTRATIGRAPHY & HISTORY FOR WELL: 31/2-3