



Wellbore History

GENERAL

Appraisal well 6406/2-4 S was drilled on the southern part of the Lavrans structure in the eastern part of block 6406/2, south of the Sørbukk Field and west of the Trestakk Field on Haltenbanken. The Lavrans structure is a rotated fault block west of the Trestakk Fault on the Halten Terrace. The purpose of the well was to appraise the southward extension of hydrocarbons in the Garn, Ile and Tofte Formations in the Lavrans structure, and to test separate closures in the Tilje and Åre formations. In addition, the well was planned to test the productivity improvement achievable by hydraulic stimulation. The well should also penetrate two sandy zones of Turonian (Lysing Formation) and Cenomanian/Albian age (Intra Lange sandstone).

OPERATIONS AND RESULTS

The deviated appraisal well 6406/2-4 S was spudded 18 January1997 with the semi-submersible installation "Deepsea Bergen". It was drilled to 4546 m (4457 m TVD) in the Melke Formation. Mainly because of the weather conditions (41 days of WOW and weather-related problems) drilling of 6406/2-4 S was significantly delayed. Due to environmental restrictions in the area the well had to be suspended on April 5 1997 before the well targets had been reached. Well 6406/2-4 S R was re-entered 12 November at depth 4534 m (4446 m TVD), below the 9 5/8" casing shoe in the initial well, and drilled to final TD at 5080 m (4969 m TVD) in Early Jurassic Åre Formation sediments. The well bores were drilled with KCl mud / spud mud down to 1110 m, with KCl mud and "ANCO 208" glycol from 1110 m to 2260 m, and with oil based "ANCOVERT" mud from 2260 m to final TD.

Down to Base Cretaceous Unconformity the stratigraphy was as expected, the prognosis matched the experienced stratigraphy well. Below ECU, 154 meters of Upper Jurassic shales were penetrated before the drilling had to be stopped. Prognosed thickness of the Upper Jurassic shales was 44 m TVD. High total gas was observed when drilling through the Cretaceous sandy intervals, the Lysing and Lange Formations, but shows were not described in the cuttings.

Well 6406/2-4 S R proved gas/condensate bearing sandstones in the Garn, Tofte and Tilje formations in hydrocarbon-down-to situations. The well penetrated a large fault within the Garn Formation, so that the Ile Formation along with parts of the Garn, most of the Not, the entire Upper Ror and the upper part of the Tofte Formation were faulted out. This fault came on depth as prognosed, but it had considerably larger throw than expected. In addition to this large fault, two smaller faults were penetrated in the Tilje Formation. The quality of the reservoir formations was somewhat lower than expected due to the tectonic influence. In the Tofte Formation, the proximity to the fault has reduced reservoir quality due to fractures and higher degree of cementation. In the Tilje Formation, the best-developed reservoir zones were either fractured or faulted out. The Garn Formation was intensively brecciated and fractured. Disregarding the faults, thickness of the formations approximates those of the neighbouring wells on Lavrans. The Åre Formation gave some gas readings during drilling but was regarded to be without hydrocarbons. No cores were cut and no wire line samples taken in well bore 6406/2-4 S. In the re-entry a total of ten conventional cores with a total length of 325.1 m were drilled, of which 322.8 m (99.3 %) were recovered. The cores were cut in the Middle Jurassic.

A total of seven fluid samples were acquired in 6406/2-4 S R. Two hydrocarbon samples were taken in the Tofte Formation at 4701 m, four hydrocarbon samples were taken in the Tilje Formation at 4945.2 m and 4881.0 m, and one water sample was acquired in the Tilje Formation at 4835 m. The mud contamination from base oil in the MDT hydrocarbon samples were analysed to be from 25 to 71 % by weight. Well 6406/2-4 S R was permanently abandoned on 15 February 1999 as a gas and condensate appraisal well.

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 6406/2-4 SR

TESTING

The Tilje (4874 m - 4904 m) and Tofte (4684 m - 4704 m) formations were production tested. Test 1 in the Tilje Formation produced 237000 m3 gas/day and 93 m3 condensate/day through a 9.53 mm choke. Test 2 in the Tofte Formation produced 42855 m3 gas/day and 18.1 m3 condensate/day through a 7.94 mm choke. The flow capacity of the test was severely influenced by fractures.