



Wellbore History

GENERAL

The main objective of well 6406/2-3 was to test the hydrocarbon potential of the Kristin structure with respect to Middle and Lower Jurassic sandstones, and to test the reservoir qualities at great depths (prognosed TD 5600 m). The secondary target for the well was the seismically prognosed Aptian sandstone, which was interpreted to form either a stratigraphic trap or a structural closure above the crest of the Kristin structure. The Kristin structure is a fault bounded horst block, somewhat eroded in the western part, with only minor internal faulting. The Kristin structure extends into PL 134 area, and the well location was agreed between PL 199 and PL 134. PL 134 contributed with 20% of the expenses to the joint well. Hydrocarbon leakage due to the prognosed high pore pressure in the Kristin structure was regarded the primary risk for the trap, knowing that all high pressured wells drilled in this area had been dry.

OPERATIONS AND RESULTS

Wildcat well 6406/2-3 was spudded 24 August 1996 with the semi-submersible rig "Transocean Arctic", and reached TD 47 m into the Åre Formation at 5258 m on 26 January 1997. Due to well control problems starting 23 September a technical side-track was started 23 October from the 13 3/8" casing shoe at 2834 m, and the suffix T2 was added to the well designation (6406/2-3T2). During intermediate logging in 8 1/2" section a FMT tool got stuck, and a second sidetrack had to be done from the 9 5/8" casing shoe at 4538 m. The second sidetrack, 6406/2-3T3, was started 6 December 1996. Shallow gas caused no operational problems. The well was drilled with seawater swept with high viscosity mud down to 1413 m. ANCO 2000 water based mud with ANCO 208 glycol additive was used from 1413 to 2848 m, while ANCOVERT oil based mud was used from 2848 m to TD.

The main result of well 6406/2-3 was the discovery of gas/condensate in Garn and Ile Formations as proven by production tests, fluid samples, cores and logs. Both Garn and Ile Formations were filled with gas/condensate throughout the units in the well position. Tofte, Tilje and Åre Formations were water bearing, except for a possible hydrocarbon-water transition zone in the uppermost parts of the Tofte Formation. The prognosed Lower Cretaceous Aptian sandstone was not encountered in the well. The well also penetrated Cretaceous sandstones (Lysing and Lange sandstones) that were interpreted to be water bearing with some shows and with poor reservoir qualities. Reservoir qualities of the Middle Jurassic sandstones of the Garn and Ile Formations are in general very good, ranging from fair to excellent. The reservoir properties of the Garn Formation are best in the upper part, with porosities up to 20% and permeabilities up to 1 Darcy. The properties of the Ile Formation are best in the lower part and in one central zone of the unit, with porosities up to 30% and permeabilities up to 12 Darcy. The reservoir qualities of the Tofte, Tilje and Åre Formations are more variable, with Tofte Formation ranging from fair to good, Tilje Formation ranging from poor to good, and Åre Formation having poor reservoir qualities. Pore pressures of the Jurassic units were very high, reaching a maximum gradient of 1.97 g/cc EMW in upper part of the Garn Formation. Ten cores were cut from Lange, Garn, Ile, Tofte and Tilje Formations, totaling 202.95 m, with a recovery of 198.35 m. Two cores were cut in the Cretaceous Lange Formation. Fluid samples containing gas and condensate were collected in the Garn and Ile Formations, whilst water samples were collected in the Tofte, Tilje and Åre Formations. The well was plugged and abandoned as a gas/condensate discovery.

TESTING

Two zones in the well were successfully production tested. Test # 1 in lower Ile Formation (4806 - 4832 m) produced 892 000 Sm³/D gas and 890 Sm³/D condensate (GOR: 1003 Sm³/Sm³). Test # 2 in upper Garn Formation (4629 - 4654.4 m) produced 777 000 Sm³/D gas and 1048 Sm³/D condensate (GOR: 744 Sm³/Sm³).

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 6406/2-3