



## Wellbore History

### GENERAL

Well 1/9-3 is located in the Feda Graben, close to the UK border southwest in the Norwegian North Sea. The primary objective of the well was to evaluate the Jurassic sandstones. The secondary objective was to appraise and test the hydrocarbon bearing zones of Danian and Maastrichtian age (Shetland Group) encountered in 1/9-1. The well was drilled in two phases, of which Phase I is named 1/9-3 and Phase II is named 1/9-3 R. This procedure was a requirement from the Norwegian Petroleum Directorate since Dyvi Gamma came directly from the yard and had therefore not accumulated the experience needed to drill the high pressure Jurassic well to a planned TD of 5000 m. The re-entry 1/9-3 R was to be drilled with the rig Dyvi Beta.

### OPERATIONS AND RESULTS

Well 1/9-3 was re-entered (1/9-3 R) with the semi-submersible installation Dyvi Beta on 27 May 1978 and drilled to TD at 4570 m in the Late Jurassic Haugesund Formation. When running the 9 5/8" casing problems occurred with stuck pipe. This resulted in severe delays, but the casing was landed at planned depth. In the 8 1/2" hole the progress was delayed due to hole problems with high pressure and mud weight combined with lost returns. Tight hole and stuck pipe occurred on several occasions. Max mud weight was 2.04 g/cm. The well was drilled water based, but with several additions of diesel from 9 5/8" casing depth and downwards, resulting in 1 - 12 % diesel in the mud at all times below 3835 m.

Several problems arose during the logging operations, which in the end resulted in a poor suit of logs over the reservoir.

In summary the problems were due to uncontrolled stretch in the logging cable, generally poor log quality, especially for FDC/CNL logs, and difficult hole conditions with high pressure/temperature and excessive sticking. Logs that normally are run in combination had to be run separately. This made petrophysical evaluation difficult, and several logs had to be disregarded due to the poor quality.

The well penetrated a typical stratigraphy for the area with a 2754 m thick Tertiary sequence down to top Rogaland Group (the 1/9-3 well bore), a 215 m thick Rogaland Group, a 709 m thick Shetland Group, and a 475 m thick Early Cretaceous Cromer Knoll Group. The well was terminated 305 m into the Late Jurassic Tyne Group. The Tyne Group contained a sand/shale sequence (Eldfisk Formation), but the sand beds were water bearing without shows.

Live hydrocarbons were encountered and proved by testing in the Ekofisk and Tor Formations, but only the Ekofisk Formation had good reservoir properties. Petrophysical evaluation showed 36 m net pay in the upper part of the Ekofisk Formation and only 1.75 m net pay in the Tor Formation.

A total of 100 m core was recovered in eight conventional cores in the interval from 3053 m in the Early Paleocene Maureen Formation to 3234 m in the Late Cretaceous Tor Formation. No fluid samples were taken on wire line.

The well was permanently abandoned on 30 September 1978 as a gas/condensate appraisal.

### TESTING

Four drill stem tests were conducted in the Shetland Group chalks. DST 1 from 3205 m to 3214 m in the Tor Formation produced only water. Maximum temperature recorded at the end of the 12 hours main flow was 124.8 deg C. DST 2 from 3157 m to 3180 m in the Tor Formation produced 7175 m3 water together with 7.9 Sm3 oil and 4800 Sm3 gas per day through a 9.5 mm choke. Maximum temperature recorded at the end of the 10 hours main flow was 122.6 deg C. DST 3 from 3126 m to 3135 m in the Ekofisk Formation produced only water with traces of oil and gas. DST 4 from 3094 m to 3112 m in the Ekofisk Formation was a good producer with a maximum flow of 397 Sm3 oil and 648400 Sm3 gas per day on a 19 mm choke. The gravity of the oil was 50 deg API. The maximum temperature recorded in this test was 120.1 deg C.

## LITHOSTRATIGRAPHY & HISTORY FOR WELL 1/9-3 R