



## Wellbore History

### GENERAL

Well 9/2-1 was drilled in a new separate structure and designed to test the hydrocarbon potential of the Egersund Basin. The main target of the well was to test sandstones of middle Jurassic age. Furthermore, the well was expected to improve the paleontological, the geological and the geochemical understanding of the area.

### OPERATIONS AND RESULTS

Wildcat well 9/2-1 was spudded with the semi-submersible installation Dyvi Delta on 21 February 1987 and drilled to TD at 3756 m in the Triassic Skagerrak Formation. The well was drilled with a 36" bit down to 189 m, but the drill bit got stuck due to boulders and the string had to be blown off just above the bit. The well was respudded 23 February 1987 and this time a 17 1/2" pilot hole was drilled before opening to 36". It was drilled to 587 m without a riser. NPD gave suspension from conventional logging through this sequence because the MWD log was of good quality, with continuity and correlatable to other wells in the area. Further drilling proceeded without significant problems. The well was drilled with spud mud down to 788 m and with gypsum/polymer mud from 788 m to TD.

The top of the Jurassic sand (Sandnes Formation) was reached at 3174 m, 178 m deeper than prognosed. The oil water contact was difficult to determine exactly from logs, but was believed to be somewhere in the transition zone between 3230 and 3239 m. There were good shows down to 3240 m. Core and log analysis indicated a fairly low porosity sandstone with small amounts of silt, shale and limestone. Compaction, quartz cementation, calcite cement, and clay minerals occurring as fine-grained pore filling aggregates, are the main porosity-reducing factor in the reservoir. The core and log analysis indicate a general trend of decreasing reservoir quality with increasing depth. The Bryne Formation at 3309 m to 3601 m was water wet. Organic geochemical analyses show many intervals with good to excellent source rock potential. The best of these is the Late Jurassic shales of the Tau Formation with TOC in the range 1.0 to 4.3 % and hydrogen index from 140 to 560 mg HC/g TOC. Also coals and shales of the Bryne Formation and shales of the Fjerritslev Formation show good source potential. Analyses of the DST 3 oil indicate a maturity corresponding to a source with %Ro = 0.8 to 0.9 (peak oil window), more mature than any source horizon penetrated in the well location. The chemical and isotopic composition of the oil correlate primarily with extracts from the Tau shales, but has also some resemblance with shale extracts from the Fjerritslev Formation. The Bryne coals and shales appear to be the least likely candidate as source for the oil. The gas from DST 3 has a rather unusual isotopic composition that indicates a mixed source.

One core was cut in the interval 3113 m to 3123 m, and 4 cores in the interval 3174 m to 3287 m. Two FMT runs were performed for fluid and pressure sampling. Several of the pressure readings were affected by super charge due to low formation permeability. The poor quality of the data made it difficult to draw conclusive fluid gradients and to determine an oil/water contact. Four FMT fluid samples were taken at 3346.5 m, 3251.6 m, 3251.0 m, and 3245.0 m. All samples were drained on the rig and all contained mud filtrate.

The well was permanently abandoned on 28 April 1987 as an oil and gas discovery.

### TESTING

Three DST's were performed to test the oil and water bearing sandstones of Jurassic age. DST 1 perforated the interval from 3245 m to 3263 m, DST 2 perforated 3220 m to 3236 m, and DST 3 perforated 3177 m to 3210 m. The well response from DST 1 (water test) and DST 2 was very poor due to formations of very low permeability. No reservoir fluid was produced to surface during the tests. DST 3 was a successful oil test of the upper part of the oil-bearing reservoir. It produced during main flow 69 m3 oil and 184 m3 gas as well as 1.953 mm choke. GOR was 28 m3/m3, oil density was 0.834 g/cm3, gas gravity was 0.818 (air = 1) with 1.8 ppm H2S and 3 % CO2.

## LITHOSTRATIGRAPHY & HISTORY FOR WELL: 9/2-1