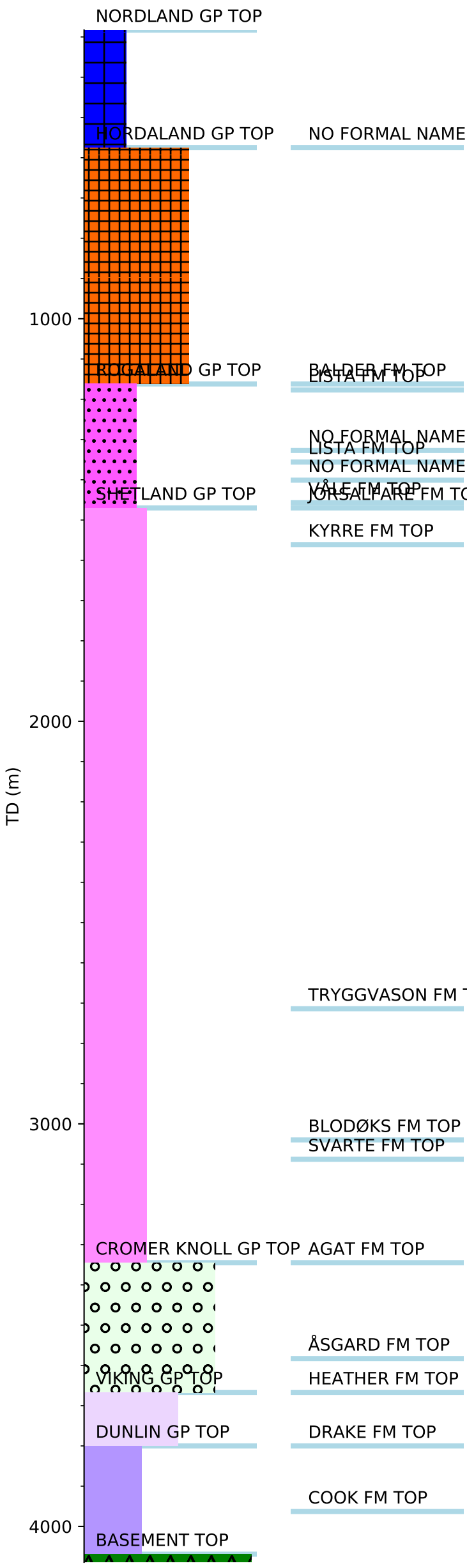

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 35/3-4

Wellbore History

GENERAL

Wildcat wells 35/3-3 and 35/3-4 were drilled in the Norwegian sector of the North Sea approximately 50 km west of MålØy, Norway. The primary target was to test the possible extension of Lower Cretaceous sandstones to the east of those encountered in wells 35/3-1 and 35/3-2. A stratigraphic trap was thought to exist in these sandstones. A secondary target was possible sandstones of Early Jurassic age with a possible pinch-out trap.

Well 35/3-3 was spudded with the semi-submersible installation Byford Dolphin on 30 October 1980. It was drilled and logged to 900 m, then junked because of technical problems running the 20" casing. The rig was moved about 20 meters, and the well was respudded as 35/3-4.

OPERATIONS AND RESULTS

Well 35/3-4 was spudded with the semi-submersible installation Byford Dolphin on 30 November 1980 and drilled to TD at 4089 m in Basement rocks (Caledonian age). A sidetrack was drilled from 3768 m. The well was drilled with seawater and gel down to 457m, with seawater/gel/lignosulfonate from 457 m to 879 m, with lignosulfonate/gypsum/gel mud from 879 m to 2388 m, and with gel/lignosulfonate/PAC mud from 2388 m to TD.

The well penetrated strata from Tertiary through Jurassic before reaching basement rocks-of Caledonian age.

Hydrocarbon shows were encountered in Lower Cretaceous and Lower-Middle Jurassic sand. The Lower Cretaceous sediments were interpreted as submarine fans. RFT measurements in Lower Cretaceous indicate an upper zone with a gas gradient of 0.4 psi/m, and a deeper zone with a water gradient of 1,54 psi/m. There seem to be no pressure communication between these two zones. Log evaluation indicate 13 m net thickness in the interval 3445 m to 3471 m, with an average porosity of 19 % and an average water saturation of 52 %.

Organic geochemical analyses showed poor, immature to marginally mature source rocks with limited potential for gas/condensate down to ca 3200 m. At 3200 m to ca 3650 metres zones of medium to dark grey shales have useful TOC (up to ca 3%) but are effectively immature in well position and have a negligible potential for gas (hydrogen index from 50 to 150 mg HC/g TOC).

Abundant medium to dark grey and dark olive grey shales occur in zones from 3650 m to TD. Although they are generally poor source rocks scattered fair and good to very good interbeds are also present, notably in the Heather Formation and below 4000 m (base of Cook). The best interval was found in the interval 3695 m to 3725 m in the Heather Formation (TOC from 3.1 % to 3.8 % and hydrogen index from 260 mg/g to 360 mg/g). Their marginal maturity will, however, limit hydrocarbon generation on-structure to minor volumes of gas and associated liquids. Ten cores were cut in the Agat Formation from 3400.6 m to 3543 m and one core was cut in basement at TD from 4087 m to 4088.8 m.

The well was plugged and abandoned on 6 June 1981 as a gas/condensate appraisal of the 35/3-2 Agat Discovery.

TESTING

Three drill stem tests were performed in the Lower Cretaceous sequence. In DST1 the intervals 3488.50 m to 3495.00, 3498.25 m to 3503.25, and 3504.50 m to 3507.75 were perforated, but no fluids were produced. In DST2 the intervals 3445.00 m to 3447.5, 3449.25 m to 3453.5, 3454.5 m to 3459.5, and 3464.0 m to 3471.5 were perforated, but due to technical problems the test was abandoned. The final test, named DST 2A the same perforation intervals as in DST2 were used. Final gas flow rate under the first main flow period was 688000 Sm3/day and the corresponding condensate flow rate was 84 Sm3/day on a 36/64" choke. This correspond to a GOR of 8200 Sm3/Sm3. The gas gravity was 0.62 (air = 1) and condensate gravity was 50.3 °API.

Based on the test results from both 35/3-2 and 35/3-4 the reservoir encountered in 35/3-2 was interpreted as close to its dew point, while the 35/3-4 reservoir may not be. The reservoir penetrated by 35/3-4 is in a different pressure regime showing the two reservoirs to be different.