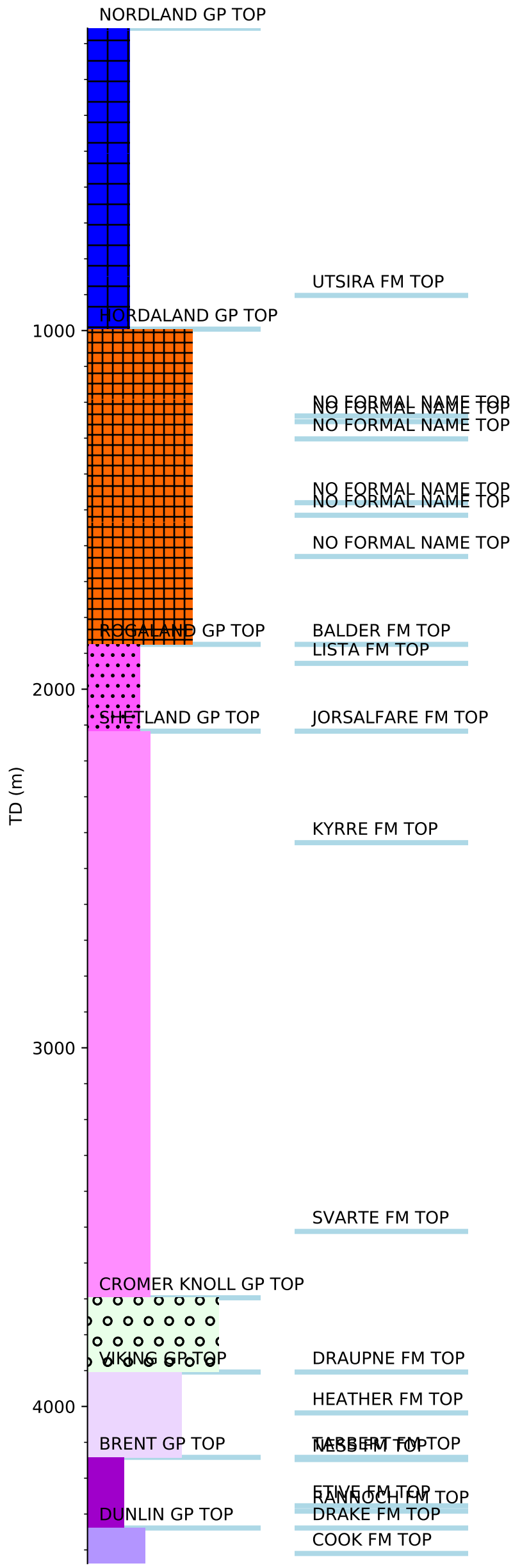

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 34/11-4

Wellbore History

GENERAL

Block 34/11 is geographically located in the eastern part of the Tampen Spur, adjacent to the western controlling fault of the North Viking Graben. Structurally 34/11 is situated over a large, complex fault terrace down thrown to the south east of the Tampen Spur. The Mats Segment, which was tested with this well, is situated in the southwest part of block 34/11, and represents an easterly extension of the Gullfaks Gamma discovery in block 34/10. The Brent Group reservoir within the Gullfaks Gamma structure is within a high pressure, high temperature geological environment being at over 4000 m depth, with temperatures of 150 deg C. The main objective of the appraisal well 34/11-4 was to appraise additional hydrocarbon reserves in the Brent Group. Secondary objectives were to improve the geological / geophysical engineering parameter database, provide a key velocity calibration point to aid depth conversion, and to give a better understanding of the hydrocarbon characteristics, fluid contacts and distribution within the southern part of the 34/11 block.

OPERATIONS AND RESULTS

Appraisal well 34/11-4 was spudded on 9 December 1998 with the semi-submersible installation "Transocean Arctic" and drilled to 3938 m. An unsuccessful cement job on the 9 7/8" casing resulted in backing off several joints of the casing. The casing was cut and retrieved from below the 13 3/8" shoe. The well was then sidetracked (34/11-4 T2) from 3580 m on 7 February 1999 and the 9 7/8" casing was successfully run and cemented at 3939 m. The T2 track was drilled to TD at 4438 m in the Early Jurassic Cook Formation, then logged and sampled (water and hydrocarbon samples). The initial well track was drilled with water based "Quadrill" mud containing 2 & 5 % polyols, a glycol-additive. The T2 track was drilled oil-based. Finally, an 8 1/2" sidetrack, 34/11-4 T3, was kicked-off at 4098 m on 31 March 1999 and drilled to 4210 m. This track was drilled water based to obtain high quality hydrocarbon samples as an alternative to a DST. The well was planned to take 86 days without the sidetrack, 94.5 days including the sidetrack. A total of 129.5 days was used to finish the well, including 43.4 days downtime and 6.6 days waiting time. The major contribution to the downtime was the poor cement job with the 9 7/8" casing. Further operational problem was caused by the crossover in 14 x 13 3/8" casing string had an ID less than 12 l/4"due to a mistake during fabrication. It was not drifted on board before going in the hole. The result was that 12" bits had to be used, but the availability of 12" bits was very limited, resulting in slow drilling progress.

The top of the Brent Group was penetrated at 4142 m and was proven to be gas/condensate bearing. Two different gas/condensate accumulations were encountered, at slightly different GOR's. The upper gas leg goes down to a shale unit at 4173.5 m TVD within the Ness Formation. PVT analysis of wire line samples showed that the GOR of this upper gas was about 4000 m3/m3. A lower gas leg extends down to another intra-Ness Formation shale al 4207.5 m TVD. This lower gas had a GOR at about 1200 m3/m3 and is one of the richest gasses proven in the area. Two hydrocarbon pressure gradients, separated by approximately 0.3 bar, were established for the two pools. No clear contacts could be defined for either gas pool and the pressure gradients showed that the lower gas is not in communication with the water leg. No visual shows were detected down to the top Jurassic except for one sample at 3210 m where traces of weak to moderate yellow fluorescence were logged. The sample did not give any cut fluorescence. This corresponds to the depth of the sudden increase in background gas to a maximum 57.45% observed from a limestone/dolomite/sandstone sequence between 3201- 3204 m. A distinct change in the amount of all the gas components occurred at this level. The gas peak represents the maximum gas readings in the well. No direct fluorescence was logged in the Viking Group. The very carbonaceous claystone of the Draupne Formation showed only a blooming to very slow streaming blue white to white cut fluorescence. The Heather Formation showed a similar cut fluorescence locally in the most carbonaceous parts. Good gas shows were logged when drilling and coring the hydrocarbon bearing intervals of the Brent Group. The sandstone showed an orange to yellow orange fluorescence in the cored section. The water bearing part of the Brent Formation did only show a weak cloudy blue white cut fluorescence. No shows were encountered in the Drake Formation and only weak cloudy blue white cut fluorescence was recorded in the Cook Formation. Two cores were cut in well track 34/11-4 T2 in the interval 4150 to 4204 m in the Ness Formation. Four FMT runs were performed and three segregated samples were taken during the TD logging of the 8 1/2" hole section in well 34/11-4T2. One water sample was taken