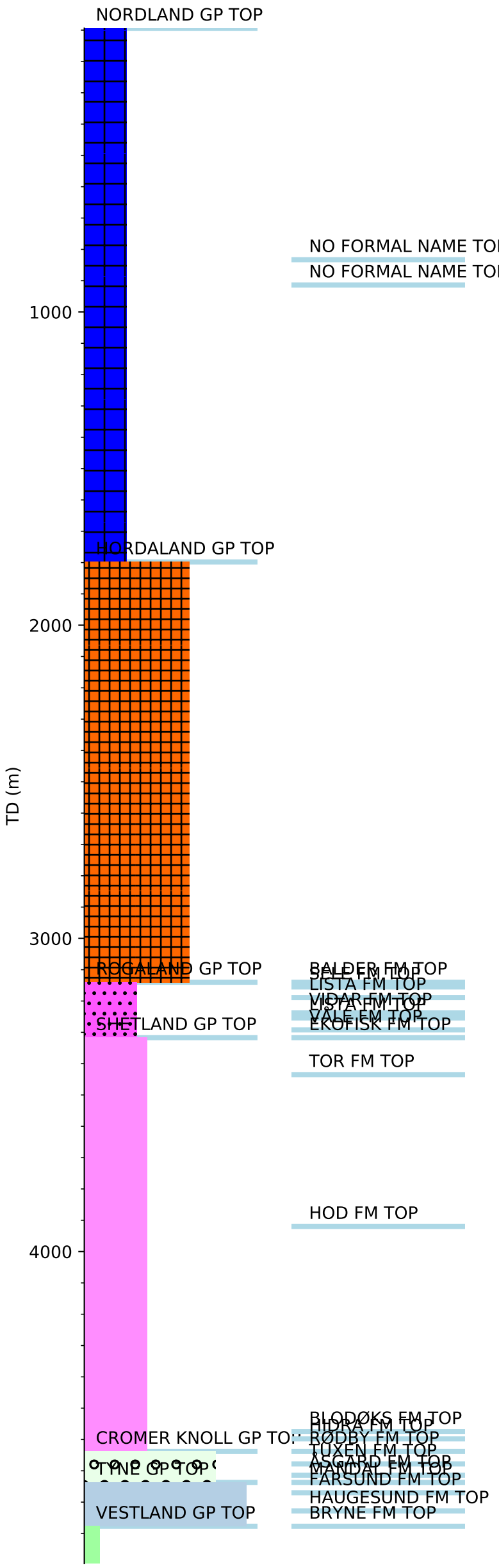

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 2/4-16

Wellbore History

GENERAL

Well 2/4-16 was drilled on the eastern margin of the Feda Graben North of the Albuskjell and Ekofisk Fields in the North Sea. Geologically the area consists of three sub-platforms. These are separated by large NW-SE striking normal faults down-faulted to the southwest and stepping down to the Feda Graben in the southern part of the block. The 2/4-16 well is located in the centre of the licence area on the same down faulted segment as the blowout wells 2/4-13, -14 and -15. Shallow gas was predicted from seismic anomalies at 10 different levels, and several precautions and actions were carried out to be able to handle potential gas-charged shallow gas.

The main objective for the well was to test the Late Jurassic, expected to contain a thick sand resting unconformable on the Middle Jurassic. This objective was the basis also for the 2/4-14 well. A secondary objective for the well was to penetrate the Middle Jurassic and 150 m into the Triassic sequence to test for possible hydrocarbon bearing sandstones sequences.

OPERATIONS AND RESULTS

Wildcat well was spudded with the semi-submersible installation Treasure Saga on 7 May 1991 and drilled to TD at 4996 m in the Middle Jurassic Bryne Formation. Shallow gas was detected at 522, 606, 628 and 675 m during drilling of 9 7/8" pilot hole. While drilling through very hard chalk rocks in the 12,6" section severe problems with the drilling equipment was experienced. The hard rocks also caused 8.5 days of delay due to ten washouts and fishing jobs. In addition the vibration together with high temperature caused twelve failures to the MWD tools, and also problems related to equipment deliveries. When drilling down to 4996 m the top drive saver sub had to be changed out due to a washout. During change of saver sub, the well started flowing uncontrolled up through the drill string, and the drill pipe was cut with the shear ram. Fifty-eight days were spent from shearing the pipe until temporary abandoning the well was decided. The well was drilled with spud mud down to 424 m, with gel mud from 424 m to 951 m, with KCl mud from 951 m to 4726 m, with a reduced ph water based mud from 4726 m to 4910 m, and with HI TEMP Polymer mud from 4910 m to TD.

A detailed study of the logs indicated no gas in the sand beds at 497 m and 832 m. Gas peaks were observed only on the MWD in the following thin sand beds from: 520.8 - 521.5 m, 604.5 - 606.2 m, 625 - 626 m and 675.5 - 676.1 m. This was later verified on the wire line logs, with a 3 m depth shift. This was interpreted as "original" gas, as similar observations were experienced at similar depths (520, 605 and 625 m in wells 2/4-13, 14 and 15).

There were no hydrocarbon indications from the logs in the well. The only indications from sidewall cores were some very weak shows in 3140 to 3155 m in the Balder Formation. Post-well organic geochemical analyses also reported migrant hydrocarbons in the interval 4638 to 4737 m in the Cromer Knoll Group.

The 2/4-16 well consisted of a 3341 m thick Cenozoic sequence. The Late Miocene to Pliocene Nordland Group was mainly composed of sand and clay down to 900 m. The rest of the Nordland Group and the Hordaland Group was dominated by claystones with thin beds of sandstone and limestone. The Late Paleocene Rogaland Group at 3140 m consisted of the characteristic tuffaceous claystone in the upper part. The middle part was dominated by claystone with traces of limestone/dolomite becoming claystone interbedded with limestone and marl downwards. The 1321 m thick chalk sequence of the Shetland Group rested unconformable on claystone and marl of the Early Cretaceous Cromer Knoll Group. The 140 m thick Tyne Group was dominated by claystones and siltstones with thin beds of limestone/dolomite. The final section above TD was 119 m of Vestland Group siltstones and shales with minor sand and coal beds.

No conventional cores were cut and no wire line fluid samples taken. A total of 371 sidewall cores were attempted, of which 147 were recovered.

Due to the gas kick at 4996 m the well was terminated without having reached the Triassic target. The well was suspended on 4 November as a dry well with shows.

TESTING

No drill stem test was performed