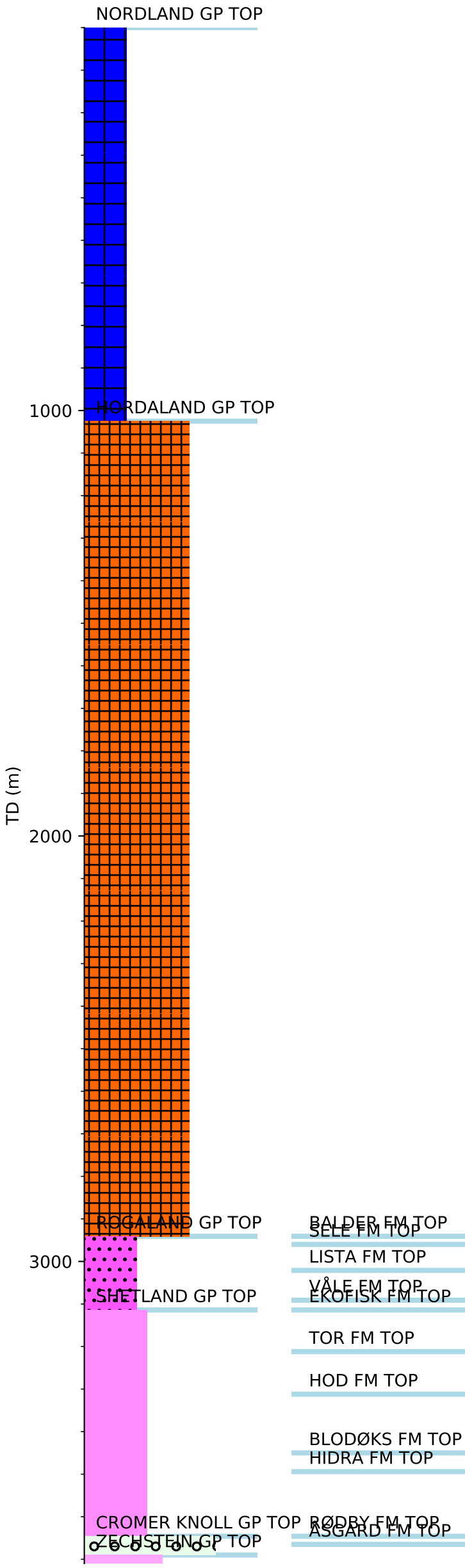
Groups

Formation Tops



Wellbore History

GENERAL

Well 1/9-4 was drilled on a salt diapir structure in the Central Graben in the neighbourhood of the Norwegian - UK median line. The primary purpose was to test the Ekofisk and Tor formations of Danian and Maastrichtian age. Lower possible porous zones in chalk and Jurassic sands, if present, were secondary objectives.

OPERATIONS AND RESULTS

Wildcat well 1/9-4 was spudded with the semi-submersible installation Ross Rig on 13 August 1977 and drilled to TD at 3710 m in Late Permian Zechstein salt. There were no serious drilling problems down to a depth of 3100 m. At 3100 m the bit-junksub assembly was lost in the hole. The hole was cemented back and sidetracked after the fishing attempts proved unsuccessful. After one unsuccessful sidetrack attempt the hole was sidetracked again from 3041 m and drilled on to core point at 3122 m. When cutting core no 10 the bottom hole assembly got stuck and a long section of the BHA had to be left in the hole. After some unsuccessful attempts on jarring, the hole was cemented and sidetracked again, from 3059 m in the first sidetrack hole. This second sidetracked hole was drilled to a measured depth of 3353 m. At this point 7" liner was run. 6" hole was drilled to a total measured depth of 3710 m with only minor problems and top of the salt was found at 3650 m. The 6" hole was logged and plugged back. It was found necessary to perform a squeeze job around the 7" liner shoe, but when attempting to pull out after this operation, the BHA stuck just above the cementing stinger. Jarring did not free the pipe, and a cement plug was set above the fish. The well was drilled with high viscosity spud mud of pre-hydrated bentonite, lime, and caustic soda down to 437 m and with Drispac/lime mud from 437 m to 2580 m. From 2580 m the lime was phased out and the remaining well to TD was drilled with a lignite/lignosulphonate gel mud. During abandonment an anchor chain broke in severe weather. The well was plugged back while a supply boat pulled on the anchor chain. A cap was installed on the well head and the well was suspended.

No significant reservoir rock was penetrated above Danian level. The Early Cretaceous Valhall Formation was found resting directly on the salt. No Jurassic sediments were penetrated by the well. Hydrocarbons were encountered and tested in the Ekofisk and Tor Formations from 3114 m down to top Hod Formation at 3312 m. Above the reservoir shows in the form of cut and fluorescence was recorded on occasional shale/limestone/silty cuttings was seen from 1990 to 2733 m. More continuous shows were seen on limestone/shale cuttings in the interval 2808 to 2991 m in the Lower Hordaland Group, through the Balder Formation and into the Sele Formation.

Nine cores were cut from - 3123 m to - 3273 m with close to 100% recovery. No RFT surveys were run and no wire line fluid samples were taken.

The well was suspended on12 January 1978 as a dry well.

TESTING

Four drill stem tests to evaluate productivity and fluid composition were carried out. Hydrocarbons were produced during all the tests. Weather conditions and operational problems interfered with the designed test program.

DST 1 tested the Tor Formation in from interval 3292 to 3296 m. The second flow produced 30582 Sm3 of gas and in the range of 16 Sm3 oil /day. There was no water production. The oil produced had a gravity of 46 deg API and the gas gravity (air = 1) was 0.68. GOR varied in the range 890 to 14000 Sm3/Sm3. Maximum recorded down hole temperature was 136 deg C but the temperature readings were not stable.

DST 2 tested the Tor Formation from the interval 3235 to 3255 m. After acid stimulation the well flowed 673940 Sm3 of gas and 592 Sm3 oil /day on a 48/64" choke. The oil gravity was 48-49 deg API at separator conditions and the gas gravity (air = 1) was 0.67 with 2 - 3 % CO2. The GOR was in the range 890 to 1160 Sm3/Sm3. No representative temperature reading is available from this test.

DST 3 tested the Ekofisk Formation from the interval 3176 to 3198 m. After acid stimulation the well flowed 32000 Sm3 of gas and 17 Sm3 oil /day with a bottom hole flowing pressure 750 psig at depth 3154 m. This test also produced some emulsion and water. The gas and oil gravities

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 1/9-4