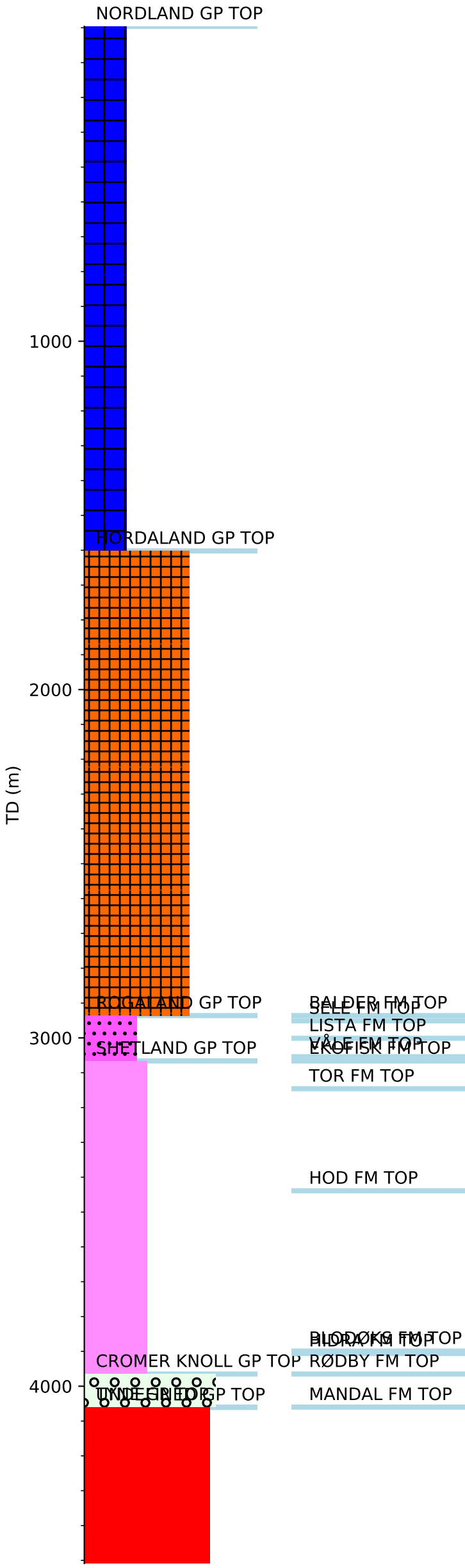
Groups

Formation Tops



Wellbore History

GENERAL

Well 2/7-20 was drilled on the "South Eldfisk structure", later called Embla. The 2/7-9 well, drilled in 1973, tested oil at uneconomic rates from a thick pre-Late ?Jurassic sand sequence on this structure. Well 2/7-9 established a 111 m pay section with average porosity of 13% and 55% oil saturation. A clear OWC was found at 4387 m MSL. Following a 1986 re-evaluation of the test it was concluded that the poor test results might have been due to mechanical problems. Subsequently the 2/7-20 well was spudded to test the previously encountered sandstones. The objectives of the well were to test "economic" flow rates from sands on the South Eldfisk structure below the Late Jurassic shales of the Mandal Formation. At the time of drilling the cost of a subsea completion had been estimated to be US$ 12 million which meant that flow rates in excess of 286 m3 oil/day were considered economic. Well 2/7-20 was placed on a separate and higher fault block in the structure than the one drilled by 2/7-9.

OPERATIONS AND RESULTS

Wildcat well 2/7-20 was spudded with the semi-submersible installation Dyvi Stena on 15 October 1987. The well was re-spudded three times because of collapsed hole problems. After drilling riserless to 608 m the lower part of the hole collapsed after encountering a gas sand that resulted in the loss of drill pipe. The well was sidetracked at 234 m, and 13 3/8" casing was set above the Eocene at 2439 m. A drilling break was encountered at 4084 m. After drilling a further 2 m, 100% sands with good shows were circulated up. High pressures together with the long section of open hole necessitated plugging back and sidetracking immediately below the 13 3/8" casing shoe. No logs were run at TD in this hole before plugging back. Drilling the sidetrack was difficult due to high pressures and gas and the coring programme above 7" casing at 4278.8 m was abandoned due to problems with balancing the well. The sidetrack was drilled to TD at 4510 m in pre-Late Jurassic sandstones that were later dated to a Devonian age.

The reservoir section in the 2/7-20, the Devonian sands, was encountered at 4061 m; 217 m higher than in 2/7-9 due to faulting. This resulted in a higher average oil saturation of 81% and might have contributed to a somewhat higher average porosity of 15%.

Detailed organic geochemical analyses found migrated live oil in the Ekofisk Formation, the Hod Formation, the Nordland/Hordaland Group formations and in the Devonian sands below 4097 m. This oil is similar in composition to oil from the surrounding Chalk fields. A biodegraded oil component was found in the Early Cretaceous and the sands from 4095 m to 4269 m. A highly mature bitumen was also found in the Lower Sands from 4397 m to 4508.6 in addition to the above mentioned live oil and biodegraded phases. This bitumen appears to reflect an early phase of migration from a different source.

One core was cut from 3070.9 m to 3080 m in the Ekofisk Formation with 100% recovery. Three further cores were cut in the Devonian sands with 100% recovery: Core 2 from 4395.5 to 4400.4 m; Core 3 from 4400.4 to 4409.5 m; and Core 4 from 4491.2 to 4509.5 m. RFT measurements showed good permeability. No wire line fluid samples were taken.

The well was suspended on 25 June 1988 as an oil discovery.

TESTING

One DST test was performed in the interval 4099.6 to 4258.1 m. Seven zones were perforated and tested at the same time.

The test produced 599 Sm3 oil and 225000 Sm3 gas /day through a 24/64" with a drawdown of over 13 MPa. The GOR in this flow was 375 Sm3/Sm3, the oil density was 0.813 g/cm3, and the gas gravity was 0.81 (air = 1). A CO2 content of 3.5% was reported. The maximum temperature measured at 4178.8 m was 160.6 deg C.

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 2/7-20

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