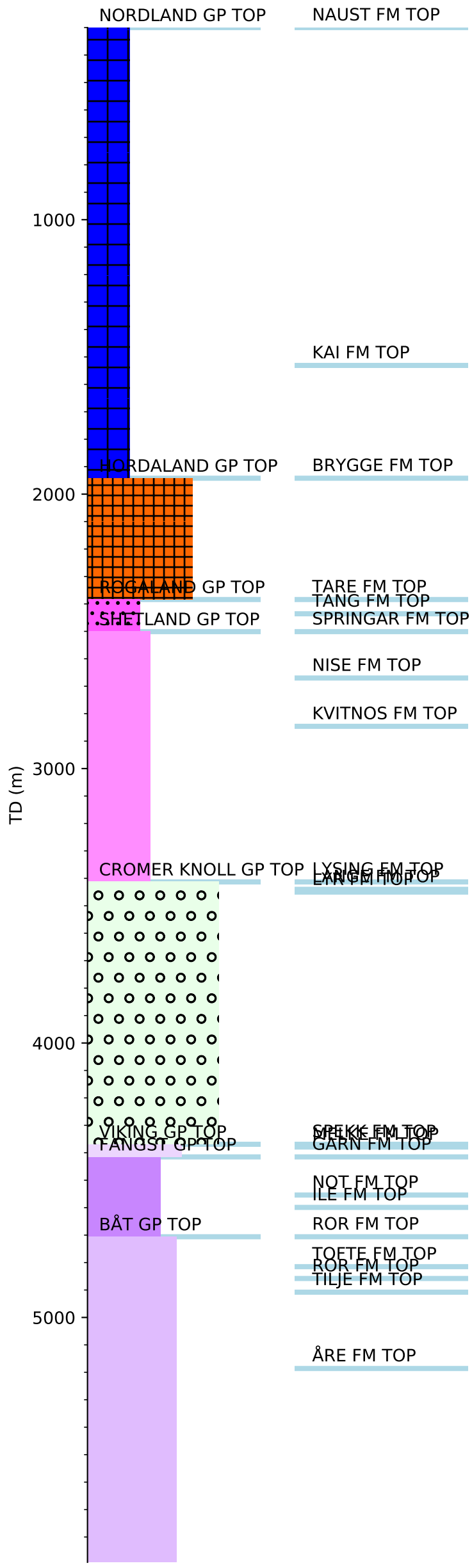

LITHOSTRATIGRAPHY & HISTORY FOR WELL: 6406/2-1 R

Wellbore History

GENERAL

Exploration well 6406/2-1 was drilled on the B-prospect east in the block 6406/2, south of the Smørbukk Field and west of the Trestakk Field on Haltenbanken. The main purpose was to test the B-prospect sandstones of Middle to Early Jurassic age and the presence of hydrocarbons. Further, the reservoir quality at great depth (prognosed TD 5200 m) was to be tested. The main reservoir zones were prognosed to be the Ile and Tilje Formations, both prognosed to consist of mica-bearing sandstones with thin shale layers. The Garn and Tofte Formations, expected to be purer quartz-sandstones and more susceptible to diagenetic quartz cementation, were considered as additional potential.
Possible sandstones were also prognosed at three different levels within the Cromer Knoll Group (in the Lysing and Lange Formations, of Turonian and Cenomanian age), and the well 6406/2-1 was aimed to test these levels within structural closure.

OPERATIONS AND RESULTS

Well 6406/2-1 was spudded on 31 October 1994 with the semi-submersible "Ross Rig" . Due to environmental restrictions in the area, the drilling operations was stopped on 1 April 1995, and the well was temporarily plugged and abandoned on 9 April 1995 at a preliminary TD of 5295 m. Total non-productive time (NPT) for the well was 49,3 days. The reasons for lost time were mainly:
- Core barrel stuck when attempting to pull out of hole with core no. 7
- Leakages on hose between yellow pod and shuttle valve for MPR
- Stuck with 2 radioactive logging tools
- Unsuccessful attempts to log with RCI / FMT tools

The well 6406/2-1 R was reentered 21 August 1995 and reached TD 20 September at 5892 m (5790 mTVD). The production testing of seven Jurassic reservoir levels was started 28 September 1995, and was completed 1 January 1996. The planned TD for the reentry was changed during drilling to 5800 m or 100 m below the Intra Åre Coal Sequence, in order to investigate the reservoir potential of the underlying sandstones.
Well 6406/2-1 was drilled with a spud mud down to 1236 m and KCl mud with ANCO 208 glycols to 5295 m. The 6406/2-1 Re-entry (5295 m - 5892 m) was drilled water based without ANCO 208.
The combined well bore 6406/2-1 + 6406/2-1 R was a record well on the Norwegian sector both as the deepest TD to date and with the longest cored section to date (692.5 m gross, 625 m recovered).
In the Nordland and Hordaland Groups, the well penetrated mainly clay/claystones with some thin sand beds, predominantly non-calcareous. The Rogaland Group comprised tuffaceous claystones with local carbonate cement in the upper part (Tare Formation), and claystones with thin limestone beds in the lower part (Tang Formation). In the Shetland Group, silty claystones with occasional thin beds of sandstone and limestone were drilled in the Springar Formation, whereas the Nise and Kvitnos Formations consisted of silty and sandy claystones with thin beds of sandstone and limestone.
In the Cromer Knoll Group, two of the prognosed sandy intervals were identified; the Lysing Formation of Late Turonian age and an Intra Lange Sandstone close to the Cenomanian - Albian boundary. Weak oil stain as well as hydrocarbon fluorescence and cut reactions could be traced in cuttings and sidewall cores within these two sandstone intervals. However, the individual sand beds are too thin to constitute any significant reservoir. In addition a sandy interval (Intra Lange Sandstone) was identified in Upper Cenomanian - Lower Turonian sediments. No shows were observed in this interval.
The Upper Jurassic Viking Group was penetrated at 4371 m. It consisted of dark shales, rich in organic content typical for the Spekk Formation, and paler gray mudstones of the Melke Formation
The well proved good reservoir quality in mica-bearing sandstones of the Ile, Tofte, Tilje and the upper part of the Åre Formations, and marginal porosities in the Garn Formation which contained more quartz rich, mature sand. Hydrocarbons were discovered in all reservoir units, and no hydrocarbon contacts were encountered.
Pressure points were measured in the Garn, Ile and Tofte Formations. The formation pressures were slightly higher than hydrostatic. An FMT fluid sample was collected from 4435 m in the Garn Formation. It contained only filtrate and some gas. Two FMT- fluid samples were collected at 4687 m and 4700 m in the Ile Formation. Both contained gas and oil in addition to filtrate. No FMT results were obtained from the Tilje and Åre Formations.
In well 6406/2-1 684.5 m was cored (616.6 m recovered) in the Middle and Lower Jurassic. One core was sampled in well 6406/2-1 R in the lower part of the Åre Formation at 5643-5651.65 m (later log shifted 11 m