Marathon Petroleum Company (Norway)

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Marathon Petroleum Company (Norway)

FINAL GEOLOGICAL REPORT

for

APPRAISAL WELL

HAMSUN

24/9 – 7

&

RELATED SIDETRACK WELLS

24/9 - 7A, 7B AND 7C

October 2004

DISTRIBUTION MATRIX

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Originator: Philip S. Leighton, Operations Geologist — 28th October 2004

Approved By: Peter B. Rawlinson, Project Geologist — 5 November 2004

Approved By: Mark A. Stephenson, Exploitation Manager — 15 November 2004

Authorised By: Richard J. Lewis, Asset Manager — 15 November 2004

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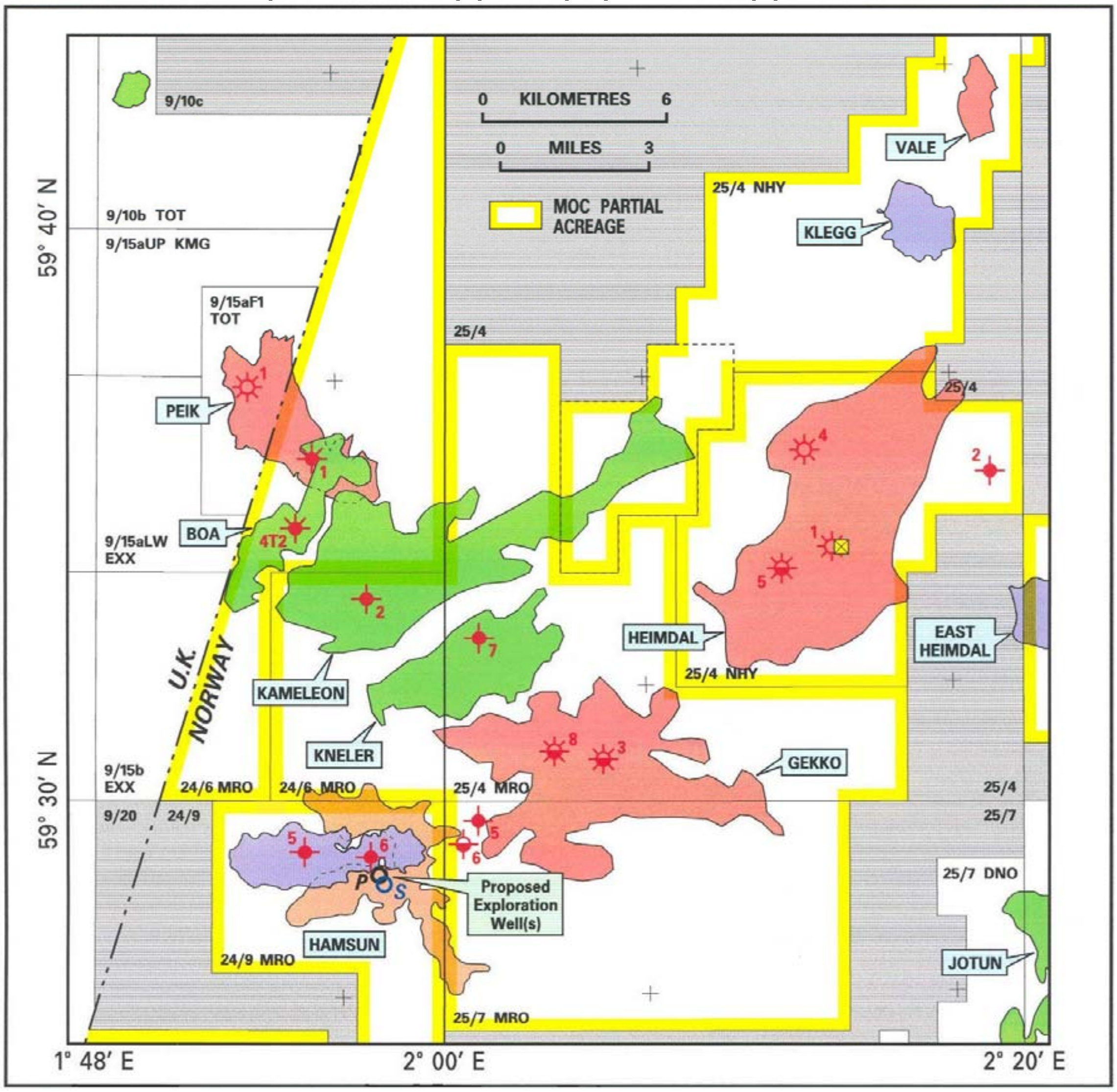
1. Summary

Original Prospect Definition and Well Objectives

The Hamsun prospect lies within PL150 and is located immediately to the west and south west of the Gekko structure in PL203 (Figure 1). The prospect forms a “horse-shoe” shape around the Grieg structure, identified and drilled by Fina in 1993 and 1994. Hydrocarbons were discovered in intra-Balder Formation sands (wells 24/9-5 and 24/9-6). The Hamsun prospect was defined by the recognition and interpretation of a series of distinct seismic anomalies and mapped as a sandstone injection complex, sourced from early Eocene Hermod Formation sands. These anomalies were manifested by bright seismic amplitude reflectors, markedly discordant to the general structural trend and were interpreted to represent oil-filled, highly porous sandstone dykes and sills. The implied trapping mechanism is via the abrupt passage to impermeable lithofacies at the contact of the sand injectites with the post-Balder Formation mudstones.

The proposed prime vertical well was planned to intersect the thickest part of the injection complex to test bright amplitude, low acoustic impedance seismic reflectors interpreted to represent major sandstone dyke complexes. A secondary directional well was planned to be drilled, upon successful discovery of hydrocarbons in the prime well, to target the elevated fringe component of the complex.

Figure 1 – Location Map showing proposed prime, vertical (P) and updip sidetrack (S) locations.



General Well Data 24/9-7

Prospect Name	**Hamsun**			Well Classification	Appraisal
Lease/License	**PL 150**			State / Country	Norway
Well Name / No.	**24/9-7**			County/Province	West of Heimdal
Surface Location: UTM.	441211.94m E	6593950.00m N		Partner Group	MPC(N) 65% Lundin 35%
Lat. / Long.	59º 28' 42.7010" N	001º 57' 44.4221" E		Rig Contractor	Odfjell Drilling AS
Source	Fugro TGS Norge AS, Final Position Fix – Differential GPS			Rig Name	Deepsea Delta
Ref. Datum	ED1950, UTM Zone 31, CM 3º East			Perm. Datum	LAT
RT Elevation	29 m	Water Depth	124.2 m	AFE/SAP WBS Nº	DE.03.09715.CAP.DRL
On contract	17:00, 28 Feb 2004	On location (24/9-7)	19:00, 01 Mar 2004		
Spud date	14:30, 02 Mar 2004	Reached TD	08:30, 17 Mar 2004	Formation at TD	Heimdal Fm., sandstone.
TD (m MD) (m TVDSS)	2280.0m -2249.9m			Formation age at TD	Tertiary, Late Paleocene
Bottom hole Location: UTM.	441238.82m E	6593916.70m N		Source	MWD surveys
Lat. / Long.	59º 28' 41.638" N	001º 57' 46.165" E			
Status	Plugged back and sidetracked as 24/9-7A				
Well Name / No.	**24/9-7A**				
Plug back date (24/9-7)	24 Mar 2004	Sidetrack depth (m MD)	1500m	Formation at kick-off depth	Undiff'd Hordaland Group claystone.
Sidetrack date	06:00, 25 Mar 2004	Reached TD (24/9-7A)	09:30, 26 Mar 2004	Formation at TD	Heimdal Fm., sandstone.
TD (m MD) (m TVDSS)	2277m -2187.9m			Formation age at TD	Tertiary, Upper Paleocene
Bottom hole Location: UTM.	441227.33m E	6594197.84m N		Source	MWD surveys
Lat. / Long.	59º 28' 50.719" N	001º 57' 45.157" E			
Status	Plugged back and sidetracked as 24/9-7B				
Well Name / No.	**24/9-7B**				
Plug back date (24/9-7A)	28 Mar 2004	Sidetrack depth (m MD)	1060m	Formation at kick-off depth	Undiff'd Hordaland Group clays/silts.
Sidetrack date	11:30, 29 Mar 2004	Reached TD (24/9-7B)	14:30, 01 Apr 2004	Formation at TD	Lista Fm. claystone.
TD (m MD) (m TVDSS)	2230m -2091.1m			Formation age at TD	Tertiary, Lower Eocene
Bottom hole Location: UTM.	441435.12m E	6593524.42m N		Source	MWD surveys
Lat. / Long.	59º 28' 29.058" N	001º 57' 59.024" E			
Status	Plugged back and sidetracked as 24/9-7C				

Well Name / No.	**24/9-7C**				
Plug back date (24/9-7B)	02 Apr 2004	Sidetrack depth (m MD)	1000m	Formation at kick-off depth	Undiff'd Hordaland Group clays/silts.
Sidetrack date	21:00, 04 Apr 2004	Reached TD (24/9-7C)	18:30, 06 Apr 2004	Formation at TD	Sele Fm. claystone.
TD (m MD) (m TVDSS)	2363m -2049.5m	Off location / contract	19:45, 11 Apr 2004	Formation age at TD	Tertiary, Lower Eocene
Bottom hole Location: UTM.	441722.18m E	6594552.35m N		Source	MWD surveys
Lat. / Long.	59º 29' 02.420" N	001º 58' 16.237" E			
Status	Plugged and suspended				

Executive Summary of Well Results

A total of four wells were drilled from the surface location for 24/9-7 (the planned vertical well, an unplanned down-dip sidetrack 24/9-7A, the planned updip sidetrack 24/9-7B and a further unplanned lateral sidetrack 24/9-7C). Taken as a whole, wells 249-7, 24/9-7A, 24/9-7B and 24/9-7C took a total of 43.11 days to drill, evaluate and temporarily abandon against an AFE time of 56 days. The prime well and three sidetracks cost an estimated NOK 127.0 million against an AFE of NOK149.8 million (inclusive of additional AFE amounts for the two unplanned sidetracks – 24/9-7A and 24/9-7C).

The 24/9-7 vertical well encountered hydrocarbons in two injected sandstone dyke complexes (“upper” and “lower”), together with numerous thin injectites distributed throughout the country rock in proximity to the main dyke features. Thin injectite sands were first noted at –1793.6m TVDSS, ~54m TVD shallower than the main injection feature. The upper, gas-bearing complex was penetrated at –1847.9m TVDSS and the lower oil-bearing complex was penetrated at –1932.8m TVDSS. Together, these complexes totalled an overall thickness of 40.2m TST. Preliminary log interpretation indicated a total of 37.2m AVT gas pay and an average porosity of 31.7% in the upper complex and 8.4m AVT oil pay and an average porosity of 31.3% in the lower complex. A gas-oil (GOC) was not seen directly on wireline logs or in core but was interpreted at –1891m TVDSS, based on formation pressure gradients. An oil-water (OWC) was not seen directly on wireline or LWD logs but was interpreted at –1995.8m TVDSS, again based on formation pressure gradients. Reservoir gas samples analysed showed a gas gravity of 0.679sg while the oil samples analysed showed a density of 858.3kg/m^3, viscosity of 0.75cp and a gas/oil ratio (GOR) 104.5 m^3/m^3.

Based on these results, a sidetrack location was rapidly permitted to evaluate the upper dyke complex down-dip in the oil leg with the intention of encountering an OWC in the lower complex. This sidetrack – 24/9-7A – encountered the upper and lower complexes, approximately 126m to the north of the original well, at –1898.6m TVDSS and –2003.4m TVDSS respectively. Approximately 6m AVT of gas-bearing pay was encountered distributed in thin breccia injectite intervals above the upper complex, which was oil-bearing throughout with 31.6m AVT oil pay and an average porosity of 32.2%. The lower complex was entirely water bearing as it was penetrated below the previously noted OWC. A total of 41.9m TST was penetrated in both complexes. Wireline log interpretation and formation pressure analysis confirmed the oil column data and results recorded in 24/9-7 and the well was plugged back for the programmed updip sidetrack.

Well 24/9-7B was drilled to the planned target location updip of the main dyke feature but at –1765m TVDSS encountered only thin, sporadic, gas-bearing injectites in the fringe complex. These sands totalled 5.8m AVT within an interval of 120m TVD and had an average porosity of 24.9%.

Well 24/9-7C was rapidly permitted and drilled with LWD tools to a tight target 728m north-east of the initial vertical well. The well encountered 44.3m TST of oil-bearing injected sandstone with a clearly demonstrable OWC at –1995.3m TVDSS. Confirmation of the OWC was obtained through formation pressure analysis and a total of 29m AVT of oil pay was recognized with an average porosity of 33.5%.

It was concluded that well 24/9-7 and the three sidetracks 7A, 7B and 7C had provided good characterisation of the southern and eastern injectite sandstones of the Hamsun prospect. An oil column of ~105m and a gas column of ~116m were proven and the wells confirmed the Hamsun prospect to have potentially commercial reserves of oil.

Rig operations were completed with the well temporarily suspended on 11th April 2004.

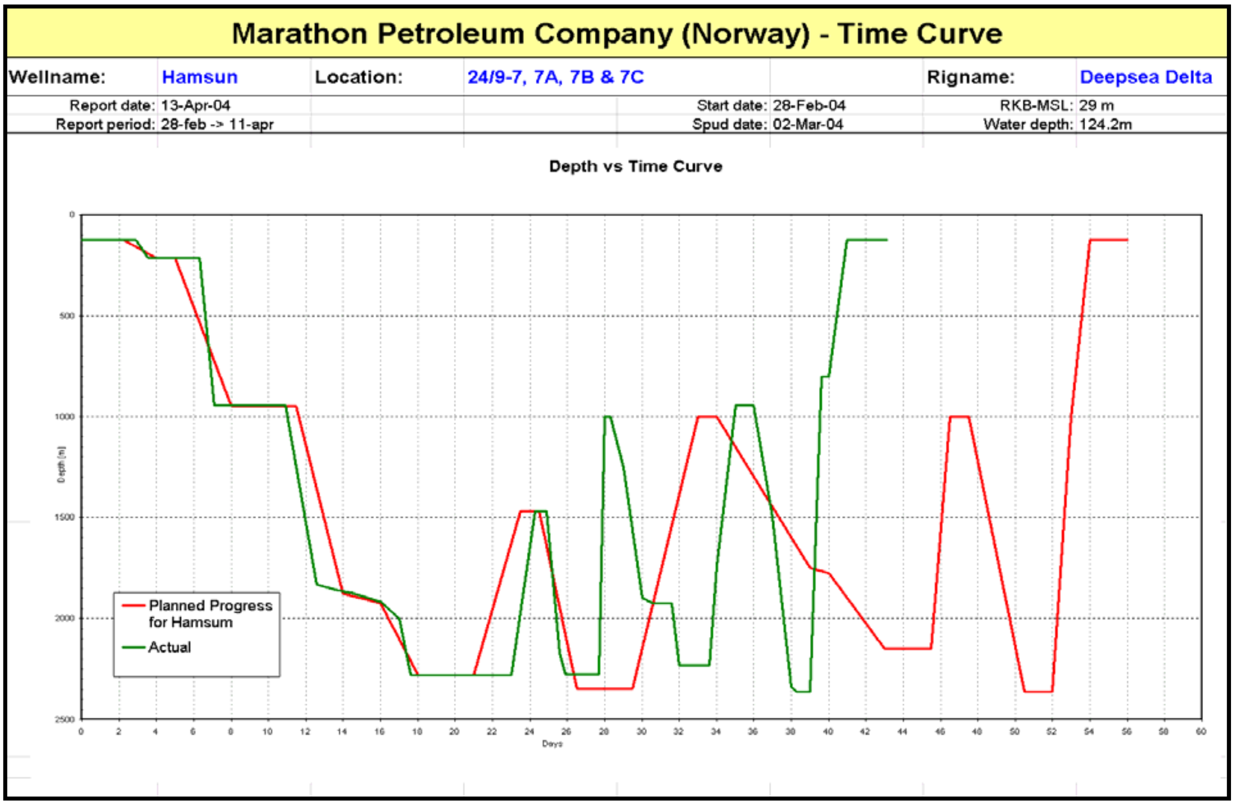
2. Drilling and Engineering Summary

Taken as a whole, wells 249-7, 24/9-7A, 24/9-7B and 24/9-7C took a total of 43.11 days to drill, evaluate and temporarily abandon against an AFE time of 56 days. Estimated cost was NOK 127.0 million against an AFE of NOK 149.8 million. Rig was taken on hire at 17:00 hrs on 28th February 2004 at start of tow from Stavanger and well 24/9-7 spudded at 14:30 hrs on 2nd March 2004. Operations ceased at 19:45 on 11th April 2004 when the rig was released after pulling anchors. Drilling operations are summarised in Table 1 below and presented in more detail in the drilling End of Well Report. A progress plot is presented below in Figure 2.

Table 1 – 24/9-7& 7A, 7B and 7C Hamsun Chronological Drilling Data

Date	Days Since Spud	06:00 Depth (m)	Daily Progress (m)	Operation
28 Feb	-	-		Rig on contract 17:00, 28 Feb 2004. Tow out from Stavanger to location.
29 Feb	-	-		Rig under tow to location.
01 Mar	-	-		Commence anchor handling 17:30, run 12 anchors.
02 Mar	-	-		Pick up 5" DP & 36" BHA. Spud well 14:30 02 Mar 2004. Drill to 205m.
03 Mar	0.6	212	59	Drill to 212m, POOH for conductor, run and cement 30" at 212m.
04 Mar	1.6	212	-	Pick up 5"DP, WOW, RIH 17½" BHA, drill cement, shoe & 1m formation, WOW
05 Mar	2.6	213	1	WOW, drill 17½" hole to 550m (LWD failure at 590m, continue drilling).
06 Mar	3.6	725	512	Drill to 953m, POOH, rig up and run 13$^3/_8$" csg.
07 Mar	4.6	953	228	Run 13$^3/_8$" csg and cement same at 947m, R/U and run BOPE.
08 Mar	5.6	953	-	Run and test BOPE
09 Mar	6.6	953	-	RIH 12¼" BHA, drill cement, shoe, 3m formation, perform LOT (1.41sg), POOH.
10 Mar	7.6	956	3	RIH 8½" BHA, drill to 1100m.
11 Mar	8.6	1223	267	Drill 8½" hole to 1685m.
12 Mar	9.6	1824	601	Drill 8½" hole to 1824m, CBU, drill to 1830m, CBU, POOH, RIH core barrel.
13 Mar	10.6	1857	33	Cut core#1 1830 – 1857m, POOH, RIH, cut core#2 1857 – 1876m, CBU.
14 Mar	11.6	1876	19	POOH, RIH, cut core#3 1876 – 1907m, POOH.
15 Mar	12.6	1907	31	RIH and cut core#4 1907 – 1916m, POOH.
16 Mar	13.6	1916	9	RIH 8½" drilling BHA, ream cored section, drill 8½" hole to 2081m.
17 Mar	14.6	2216	300	Drill 8½" hole to 2280m, CBU, POOH, Run Slam log GR-ZDL-CNL-HDIL-XMAC.
18 Mar	15.6	2280	64	Wireline logging, Run 2 RCI-GR.
19 Mar	16.6	2280	-	Wireline logging, Run 3(re-run 2) RCI-GR.
20 Mar	17.6	2280	-	Wireline logging, Run 4 RCI-GR.
21 Mar	18.6	2280	-	Wireline logging, Run 5 VSP.
22 Mar	19.6	2280	-	Wireline logging, Run 6 CBIL-EART-GR.
23 Mar	20.6	2280	-	Wireline logging, Run 7 RCI-GR, R/D wireline, RIH cement stinger, set plug.
24 Mar	21.6	2280	-	Set cement plug to 1488m, test BOPE.
25 Mar	22.6	1500	-	RIH 8½" BHA, commence 24/9-7A at 06:00 25 Mar 2004, drill to 2007m.
26 Mar	23.6	2170	670	Drill to 2277m, CBU, CPOH, run Slam log GR-ZDL-CNL-HDIL-XMAC.
27 Mar	24.6	2277	107	POOH wireline run 1, RIH run 2 RCI-GR, POOH, RIH run 3 EART-GR.
28 Mar	25.6	2277	-	Complete wireline logging, RIH cement stinger and set plugs.
29 Mar	26.6	1060	-	WOC, RIH 8½" BHA, commence 24/9-7B at 11:30 29 Mar 2004, drill to 1423m.
30 Mar	27.6	1634	626	Drill to 1893m, CBU, drill to 2003m, CBU, drill to 1922m, CBU, POOH.
31 Mar	28.6	1922	288	RIH core barrel, cut core #1 1922 – 1978m, POOH, RIH 8½" BHA.
01 Apr	29.6	1978	56	RIH 8½" BHA, ream cored section, drill to 2230m, CBU, POOH.
02 Apr	30.6	2230	252	Wireline run 1 GR-ZDL-CNL-HDIL-XMAC, RIH cement stinger, set plugs.
03 Apr	31.6	947	-	Test BOPE, RIH 8½" BHA, poor cement, POOH, RIH cement stinger, set plug.
04 Apr	32.6	947	-	POOH, WOW, RIH 8½" BHA, commence 24/9-7C at 21:00 04 Apr 2004.
05 Apr	33.6	1268	321	Drill 8½" hole to 1830m.
06 Apr	34.6	2017	749	Drill 8½" hole to 2363m, CBU, POOH, lay out LWD.
07 Apr	35.6	2363	346	Wireline run 1 RCI-GR, RIH cement stinger and set plugs.
08 Apr	36.6	2363	-	Continue suspension operations.
09 Apr	37.6	200	-	Continue suspension operations, retrieve PGB, prepare CART.
10 Apr	38.6	200	-	Install overtrawlable structure, commence deballasting rig 21:30 10 Apr 2004.
11 Apr				Complete deballasting to transit draft, rig released 19:45 11 Apr 2004.

Figure 2 – Well Operations Progress Plot



2.1 Drilling Operations by Hole Section

Detailed treatment of drilling operations, together with contractor's reports, can be found in report 24/9-7 "Hamsun" End of Well Report, document 3150/M/MPC/D/RA/10. An abbreviated account is presented below for reference when considering material in this report.

36" Hole Section: 24/9-7

Well 24/9-7 Hamsun was spudded from seabed at 14:30 hrs on 2nd March 2003 and was drilled to 212.5m with cuttings returned to seabed. A 30"/20" casing was run and cemented at 212.5m without incident.

17½" Hole Section: 24/9-7

This section of the well was drilled riserless to 953m in one bit run with varying parameters and cuttings returns to seabed. The LWD tools stopped pulsing at 590m MD, despite repeated efforts to restart. Drilling continued with only MWD data to section TD. A 30 m3 hi-vis bentonite pill was used to sweep the hole clean prior to displacement with 155m3 of 1.3 SG Glydril WBM. A $13^{3}/_{8}$" casing was run and cemented at 947m without incident. A BOP stack and riser were run and tested without incident.

12¼" Hole Section: 24/9-7

This was a very short 3m section designed around displacing the well to oil-based mud, drilling out the shoe and performing an FIT to 1.42 SG.

8½” Hole Section: 24/9-7

This section was drilled to TD at 2280m in three bit and four coring runs. The well was drilled to core point at 1830m MD using a rotary BHA. Coring point was determined by cuttings, LWD response, ditch gas shows and drilling parameter changes. A total of 86m of core was cut within both the country rock and injection complex, with recovery of 99.0%. Two core heads were used, both Security DBS FC274, with the first graded 1-2-CT-A-X-I-CT TQ and the second graded 1-1-BT-A-X-I-PN-TQ. Following coring, a new bit and LWD tools were run and the well was drilled to ensure sufficient penetration of the Heimdal. A total of nine wireline runs were made to evaluate the reservoir intervals and details of these are found in section 5, Wireline logging.

8½” Hole Section: 24/9-7A

Following discussions with the project geologist and Exploration Department, Houston, the originally planned updip sidetrack was postponed in favour of a downdip sidetrack to evaluate the upper dyke complex in the oil leg. A sidetrack location was rapidly determined and permitted and the prime vertical well was plugged back to 1388m MD on 24th March 2004. Sidetrack well 24/9-7A kicked-off in Hordaland claystones at 1500m MD (-1470.6m TVDSS) and was directionally drilled, using a rotary steerable BHA, to a target ~100m north of the original penetration of the dyke complex before being extended to 2277m MD (-2187.9m TVDSS) in the Heimdal formation. This well was wireline logged in three runs before being plugged back to 980m for sidetracking to the originally planned updip target location.

8½” Hole Section: 24/9-7B

Sidetrack well 24/9-7B was directionally drilled to the pre-planned target in two bit runs using rotary steerable BHAs and one core run. A total of 55m core was cut with 100% recovery using a rerun Security DBS FC274 corehead which was graded 3-3 WT-A-D-I-PN-BHA. At TD the well was wireline logged in one run before being plugged back to 940m for an additional sidetrack to another previously unplanned target location.

8½” Hole Section: 24/9-7C

Sidetrack well 24/9-7C was directionally drilled laterally to TD at 2363m MD (-2049.5m TVDSS) in one bit run using a rotary steerable BHA, together with a quad-combo LWD suite. One wireline run was made at TD before the well was plugged and suspended, the BOPE recovered and the wellhead covered with an overtrawlable structure. The rig deballasted and moved off location at 19:45 on 11th April 2004.

Table 2 – Hole Size and Casing:

Hole Size	Depth (m)	Casing Size	Casing Grade, Weight, Thread Type	Shoe depth (m)
36”	212.5	30”/20”	X56, 309.7lb/ft	212.5
17½”	953	13⅜”	L80, 72lb/ft	947
12¼”	956 [1]	9⅝”	L80, 47lb/ft	987
8½”	2280	TD: 24/9-7		
8½”	2277	TD: 24/9-7A		
8½”	2230	TD: 24/9-7B		
8½”	2363	TD: 24/9-7C		

1 A short section of 12¼” hole was drilled for an LOT before drilling 8½” hole to TD

<u>Deviation Surveys:</u>

Surveys in 24/9-7 and related sidetracks were taken using MWD services and the complete list of deviation surveys are presented in Appendix A.

3. Geological Summary

3.1 Lithostratigraphy

The lithology encountered in 24/9-7, and associated sidetrack wells, has been defined both biostratigraphically and chronostratigraphically in offset wells (24/9-5, 24/9-6, 25/7-5, 25/7-6). Drilled cuttings samples were collected in the 24/9-7 and sidetrack wells to determine the correspondence of the exploration well to the regional lithologies. Summary descriptions of the lithostratigraphic units encountered in the wells are presented using the nomenclature of Isaksen and Tonstad (1993) with minor amendments and that of Robertson Research (1989).

Well 24/9-7 spudded in seabed sand and clays corresponding to Quaternary deposits. The well was drilled with seawater and returns to seabed in the 26" section and 17½" section to 953m MD. Oil based mud was used to drill the 8½" section to TD in the vertical and three sidetrack wells. Ditch cuttings were collected in all four 8½" wellbores and were used to confirm the interpreted stratigraphy from offset wells (e.g. 24/9-6 and 25/7-5) as well as confirming real-time LWD interpretation, wireline log interpretation and coring point selection. No detailed descriptions for lithologies shallower than 960m MD are available for this report and interpretation relies solely upon log data.

A summary of the lithostratigraphy encountered in the wells is presented and the lithostratigraphic succession is presented in Tables 3 through 3c. Formation tops and thickness were defined from wireline and LWD logs in 24/9-7 and subsequent sidetracks 24/9-7A, 24/9-7B and 24/9-7C (correct as of 15th May 2004 with TVDSS calculations based on the definitive survey data). Thickness is presented as Approximate Vertical Thickness (AVT) where no allowance for formation dip is made and as True Stratigraphic Thickness (TST), calculated for the injectite sands in the upper and lower main injection features. Dip values for TST calculations were taken from penetration points of the dykes in 24/9-7 and 24/9-7A and seismic evidence.

3.1.1 Sample Integrity

Drilled cuttings were adversely affected by the use of PDC bits, especially in the sandstone intervals but no problems were noted with drilled cuttings sampling other than some under-representation of sand from the extremely friable injectite sandstones. Hydrocarbon shows were affected by the use of oil-based mud in the 8½" hole section and the c. 800psi overbalance required for hole stability through the Hordaland section.

Table 3

Formation Tops in 24/9-7

AGE / *GROUP* FORMATION	**INJECTION COMPLEX "Hamsun Sands"**	**DEPTH (m MD)**	**DEPTH (m TVDSS)**	**AVT (m) *TST (m)***	**UTM (m E)**	**UTM (m N)**
Undiff'd Late Tertiary *Nordland Group*						
Utsira		460.0	-431.0	261.9	441210.68	6592948.35
Base Utsira		722.0	-692.8		441207.38	6592941.21
Lower to Middle Eocene *Hordaland Group*						
Grid Sands		1149.0	-1119.8	119.0	441204.62	6593935.85
Base Grid Sands		1268.0	-1238.8	–	441206.80	6593933.52
Belton Mbr. Equivalent		1305.2	-1276.0	23.5	441207.91	6593932.69
Base Belton Mbr. Equivalent		1328.9	-1299.5	–	441208.63	6593932.19
	Top Uppermost Injectite (UMI)	1823.0	-1793.6	–	441225.08	6593927.68
	"Upper Dyke Complex" (UDC)	1877.5	-1847.9	33.4 ***29.2***	441226.97	6593927.95
	Base "Upper Dyke Complex"	1911.0	-1881.3	–	441228.06	6593928.15
Rogaland Group						
Balder Claystone		1946.5	-1916.8		441229.21	6593928.32
	"Lower Dyke Complex" (LDC)	1962.5	-1932.8	12.1 ***11.0***	441229.80	6593928.29
	Base "Lower Dyke Complex"	1975.0	-1944.9	–	441230.28	6593928.18
	Base Lowermost Injectite (LMI)	2008.9	-1979.0	–	441231.51	6593927.95
Balder Tuff		2017.5	-1987.8	56.4	441231.82	6593927.88
Sele		2074.0	-2044.2	41.0	441233.97	6593926.65
Upper Paleocene		2106.0	-2076.3	173.6+	441235.10	6593925.67
Lista		2115.0	-2085.2	53.9	441235.41	6593925.35
Heimdal Sandstone: Z1		2169.0	-2139.1		441237.00	6593923.15
Z2			-			
T.D. (Driller) (Logger)		2280.0 2280.0	-2249.9 -2249.9	–	441238.82	6593916.70
	- SLM confirmation of drillers depth made before wireline logging. - TVDSS values calculated using the Radius of Curvature method.					

Table 3a
Formation Tops in 24/9-7A

AGE / *GROUP* FORMATION	**INJECTION COMPLEX "Hamsun Sands"**	**DEPTH (m MD)**	**DEPTH (m TVDSS)**	**AVT (m) *TST (m)***	**UTM (m E)**	**UTM (m N)**
Lower to Middle Eocene *Hordaland Group*						
Kick-off point for 24/9-7A		1500.0	-1470.8		441214.44	6593929.47
	Top Uppermost Injectite (UMI)	1864.5	-1823.0	–	441221.81	6594008.51
Rogaland Group						
Balder Claystone		1941.0	-1889.2	91.9	441222.66	6594046.28
	"Upper Dyke Complex" (UDC)	1952.0	-1898.6	46.3 ***29.8***	441222.91	6594052.59
	Base "Upper Dyke Complex"	2006.5	-1944.9	–	441223.86	6594081.29
Balder Tuff		2049.0	-1981.1	73.0	441224.90	6594103.45
	"Lower Dyke Complex" (LDC)	2075.0	-2003.4	18.2 ***12.1***	441225.49	6594116.88
	Base "Lower Dyke Complex"	2096.0	-2021.6	–	441226.01	6594127.36
	Base Lowermost Injectite (LMI)	2130.0	-2051.4	–	441226.80	6594143.64
Sele		2133.0	-2054.1	53.2	441226.87	6594144.99
Upper Paleocene		2183.5	-2099.8	88.0+	441227.55	6594166.30
Lista		2191.5	-2107.3	52.6	441227.59	6594170.66
Heimdal Sandstone: Z1		2247.5	-2159.9	27.9+	441227.44	6594188.40
T.D. (Driller) (Logger)		2277.0 2277.0	-2187.9 -2187.9	–	441227.33	6594197.84
	- SLM confirmation of drillers depth made before wireline logging. - TVDSS values calculated using the Radius of Curvature method.					

Table 3b
Formation Tops in 24/9-7B

AGE / ***GROUP*** FORMATION	**INJECTION COMPLEX "Hamsun Sands"**	**DEPTH (m MD)**	**DEPTH (m TVDSS)**	**AVT (m)** ***TST (m)***	**UTM (m E)**	**UTM (m N)**
Lower to Middle Eocene ***Hordaland Group***						
Kick-off point for 24/9-7B		1060.0	-1030.8		441205.00	6593937.32
Grid Sands		1150.5	-1120.4	136.9	441209.52	6593926.69
Base Grid Sands		1293.0	-1257.3		441224.86	6593890.90
Belton Mbr. Equivalent		1327.1	-1288.8	13.2	441229.91	6593878.87
Base Belton Mbr. Equivalent		1341.6	-1302.0		441232.27	6593873.30
	* Top Uppermost Injectite (UMI)	1876.5	-1769.7	–	441364.10	6593650.27
	* Base Lowermost Injectite (LMI)	1954.0	-1837.7		441382.90	6593618.21
Rogaland Group						
Balder Claystone		2053.0	-1925.7	54.7	441406.12	6593579.36
Balder Tuff		2113.0	-1980.4	53.2	441418.87	6593558.26
Sele		2170.0	-2033.7	41.0	441428.45	6593540.42
Upper Paleocene		2204.0	-2066.0	25.1+	441432.63	6593530.96
Lista		2213.0	-2074.7	16.4+	441433.61	6593528.57
T.D. (Driller) (Logger)		2230.0 2230.0	-2091.1 -2091.1	–	441435.12	6593524.42
	- SLM confirmation of drillers depth made before wireline logging. - TVDSS values calculated using the Radius of Curvature method.					

Table 3c
Formation Tops in 24/9-7C

AGE / *GROUP* FORMATION	**INJECTION COMPLEX "Hamsun Sands"**	**DEPTH (m MD)**	**DEPTH (m TVDSS)**	**AVT (m)** ***TST (m)***	**UTM (m E)**	**UTM (m N)**
Lower to Middle Eocene ***Hordaland Group***						
Grid Sands		1151.5	-1117.7	143.5	441226.91	6593964.756
Base Grid Sands		1320.0	-1261.2	–	441286.42	6594028.55
Belton Mbr. Equivalent		1371.1	-1300.6	6.4	441309.00	6594051.92
Base Belton Mbr. Equivalent		1379.4	-1307.0	–	441312.67	6594055.79
Lower Belton Mbr.		1407.0	-1328.2	19.0	441324.77	6594068.72
Base Lower Belton Mbr.		1431.8	-1347.2	–	441335.45	6594080.57
Rogaland Group						
Balder Claystone		2147.0	-1883.1	55.2	441630.75	6594449.32
Balder Tuff		2217.5	-1938.3	91.4	441659.46	6594482.50
	"Dyke Complex" (Hamsun Sands)	2250.5	-1963.6	59.5 ***44.3***	441673.67	6594497.24
	Base "Dyke Complex"	2309.0	-2008.0	–	441699.79	6594525.82
Sele		2338.5	-2029.7	19.8+	441711.91	6594540.10
T.D. (Driller)		2363.0	-2049.5		441722.18	6594552.35
	- SLM confirmation of drillers depth made before wireline logging. - TVDSS values calculated using the Radius of Curvature method.					

3.1.2 Nordland Group

The Nordland Group lithology has been interpreted from LWD and cased/open hole wireline logs, with the Utsira formation interpreted as composed predominantly of sandstone.

3.1.3 Hordaland Group

The dominant lithology of the Hordaland Group is massive grey claystone with siltstone and sand prone intervals occurring at three levels in the Hamsun area. The uppermost interval of the Horda Formation from 960mMD down to the Grid Sand at 1149m MD is predominantly siltstone with minor intercalations of limestone. This siltstone is dark grey to olive black, moderately calcareous, variably sandy and locally very argillaceous grading to silty claystone. Glauconite and micro-pyrite are trace accessories throughout. Cryptocrystalline lime mudstone occurs as both minor interbeds and also as discrete nodules.

The major sand-prone intervals within the Hordaland Group sediments were a 119m AVT thick occurrence of the Grid Sands (1149m to 1301.4m MD / –1122.6m to –1274.0m TVDSS) and 23.5m AVT of Belton member equivalent sandstone. The Grid Formation comprises three sandstone packages with interbedded silty claystones typical of the over- and underlying Horda formation. The uppermost, thinner quartzose sandstone is characteristically light grey, moderately hard to very hard and composed of well sorted, rounded, very fine to fine grained quartz that is extensively calcite cemented. Glauconite is a common accessory, visible porosity is nil and no shows were recorded. Both of the remaining sandstones are similar but with significantly less calcite cementation except towards the base of each interval. Visible porosity in these sands is good and no shows were recorded. The Belton Member Equivalent is a quartzose sandstone that is olive grey to light grey and composed of loose, very fine to coarse predominantly fine quartz grains. Sorting of the subangular to subrounded grains is moderate and the matrix rarely argillaceous/silty. Glauconite and carbonaceous fragments are rare, visible porosity is fair to locally good though no shows were recorded.

The interval between the base of the Belton member equivalent sandstone and the first occurrence of the injected sandstones of the Hamsun sands comprises a monotonous sequence of Eocene age claystone with minor intercalations of limestone/calcitic nodules and rare siltstones. Claystones of the Upper Eocene are typically olive black to dark grey/greenish grey, firm to moderately hard, sub-blocky to blocky, locally silty, rarely microcarbonaceous and micromicaceous and predominantly non calcareous. Toward the base of the interval, the Lower Eocene claystones are typically bluish grey, firm to moderately hard, blocky to platy in part, rarely glauconitic and non calcareous. Intercalated lime mudstones are predominantly pale orange to yellowish grey, firm to hard, cryptocrystalline, locally argillaceous and have rare floating quartz sand grains. Loose, very fine grained quartz sand was noted in the interval. The argillaceous limestones become increasingly marly and locally very silty towards the base. No visible porosity or hydrocarbon shows was noted from this interval.

3.1.4 Rogaland Group

Balder Formation age claystones are encountered in all well penetrations and are typically olive grey to olive black, firm, subblocky, silty, carbonaceous in part with locally abundant disseminated micropyrite and are non calcareous. Tuffaceous claystones of the Balder Tuff are medium grey to bluish grey, moderately hard, blocky, silty in part, speckled black and white and predominantly non-calcareous. The Lower Eocene / Upper Paleocene Sele Formation was penetrated in the prime and sidetrack wells at the Hamsun location and is composed of claystone with rare limestone nodules/interbeds. The claystone is predominantly olive black to dark olive grey, moderately hard, blocky, micromicaceous and non- to slightly calcareous while the limestones are mudstone, pale yellowish brown, moderately hard, microcrystalline and argillaceous.

Upper Paleocene Lista Formation claystones at the Hamsun location were drilled in wells 24/9-7, 24/9-7A and 24/9-7B. These claystones are predominately dark grey and also olive black to dark greenish black, firm, subblocky to subplaty, rarely silty and non calcareous. Glauconite was present as an accessory, more commonly towards the top of the interval. The Upper Paleocene Heimdal Formation sandstone was penetrated by two wells, 24/9-7 and 24/9-7A. Within the Heimdal Formation, an upper, thin, more claystone rich interval overlies a more typical sand-dominated sequence. The sandstone is predominantly disaggregated light grey coloured loose quartz sand, very fine to coarse but predominately fine to medium grained, subrounded, spherical, moderately sorted with abundant argillaceous / Kaolinitic matrix. The sandstone is rarely carbonate cemented and is friable with very poor visible porosity. No shows were recorded from the Heimdal interval.

3.1.5 Injected Hamsun Sands

The injected sands of the Hamsun prospect are treated separately as they significantly cross-cut the Rogaland Group sediments and continue upwards into the lowermost Hordaland Group sediments (refer to Figures 3a – 3c). In well 24/9-7, coring commenced within discrete sands in the country rock above the main dyke feature and the main Upper Dyke Complex (UDC) was encountered in core at 1877.5m MD (–1847.9m TVDSS). A total of four cores were cut from 1830m to 1916m MD (refer to core description attached to Appendix F, 24/9-7 Completion Log).

The Lower Dyke Complex (LDC) was encountered at 1962.5m MD (–1932.8m TVDSS) but not cored. In drilled cuttings it appears as sandstone composed of loose quartz, predominantly fine to rarely medium grained, angular to subrounded, subspherical and well sorted. This interval is inferred to possess similar whole-core features as noted for the Upper Dyke Complex (UDC). The base of the LDC in 24/9-7 is within the Balder Formation claystones described above.

One core from 1923m to 1977m was cut in well 24/9-7B (refer to core description attached to Appendix F, 24/9-7B Completion Log). At this sidetrack location, the injected sands are present as thin, rope-like, veins and discrete injection masses within the lowermost Hordaland Group claystones. Where drilled, these sands appeared in ditch cuttings as loose quartz sand, predominantly fine to rarely medium grained, angular to subrounded, subspherical and well sorted.

In wells 24/9-7A and 24/9-7C, where no coring was performed, the Hamsun Sands were seen in ditch cuttings as loose quartz sand, predominantly fine to rarely medium grained, angular to subrounded, subspherical and well sorted. No estimate of visible porosity was made as a result of disaggregation of the sandstone but was inferred to be good. Carbonate cementation is rarely noted and where present visible porosity was reduced to very poor to nil. Oil and gas shows in both these sidetrack wells were masked by the OBM mud used and details of the shows noted are presented in Table 5.

Detailed Biostratigraphy was performed on core material taken in 24/9-7 and 24/9-7B, together with ditch cuttings samples. The key element of the biostratigraphical interpretation was to define the age of the brecciated mud clasts entrained within the injectite sandstone and to constrain the age of the country rock at the well locations.

3.1.6 Prognosis versus Actual for 24/9-7 and 24/9-7B

The prognosed structural and lithostratigraphic setting of the Hamsun prospect is presented in Figures 3a and 3b and the current post-drilling correlation is presented in Figure 3c. Note that as sidetracks 24/9-7A and 24/9-7C were not originally planned, no similar diagrams or tabulation was formally issued before operations commenced.

Figure 3a – Prognosed Hamsun Correlation

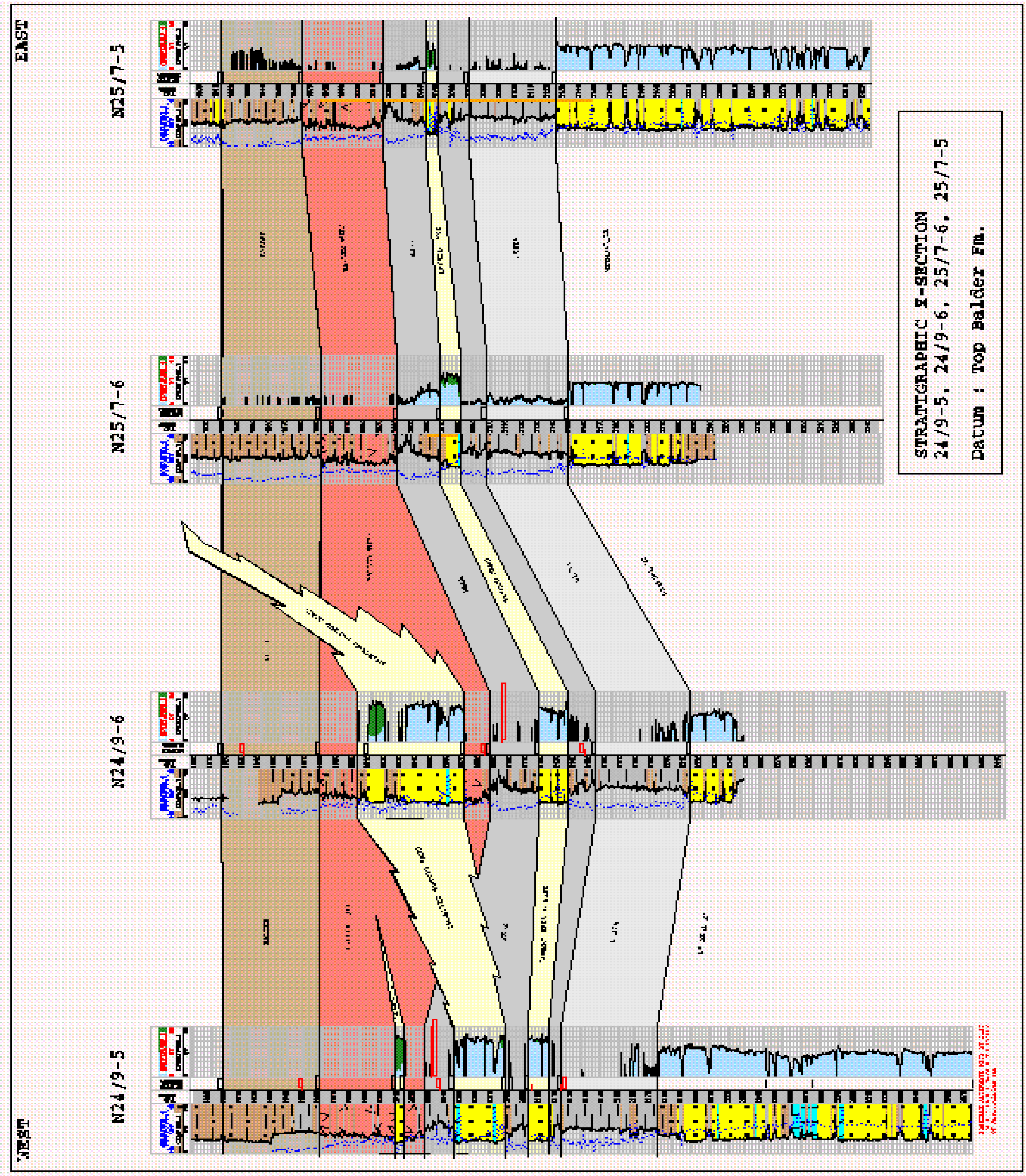


Figure 3b – Prognosis versus Actual

All depths m MD, DF elevation 29m.

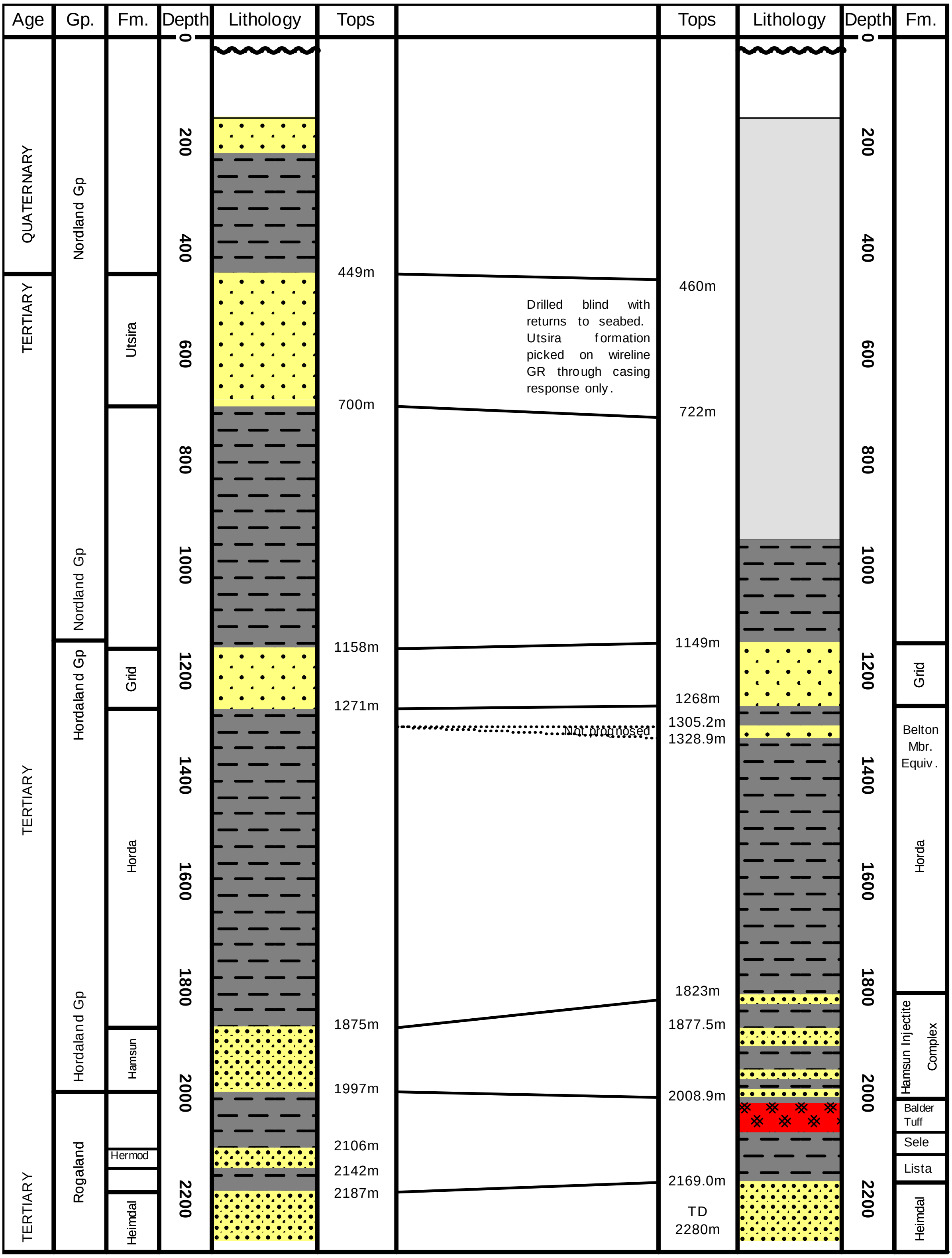
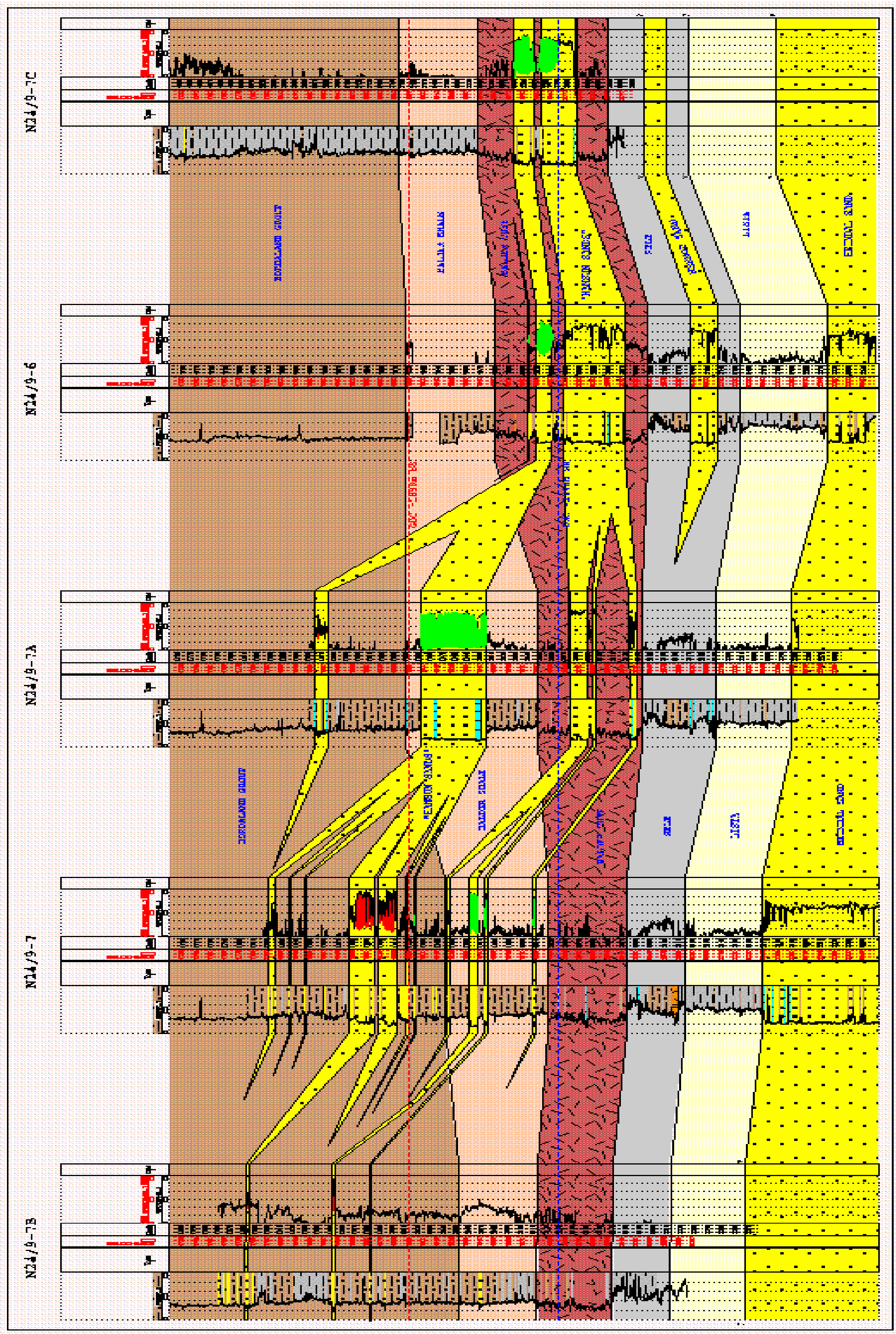


Figure 3c – Post-drilling Hamsun Correlation



4. Hydrocarbon Shows

Gas and Shows Record

Table 4 – Significant Gas Peaks

MD mRKB	Total Gas	Bckgd.	Net Gas	Type	C1	C2	C3	iC4	nC4	iC5	nC5
	%	%	%		ppm	ppm	ppm	ppm	ppm	ppm	ppm
24/9-7											
955	0.2	0	0.2	TG	23	3	5	2	7		
1830	1.0	0.2	0.8	P	No analysis available						
1832	1.2	0	1.2	TG	10500	382	81	8	13	4	6
1857	1.0	0.1	0.9	P	9468	336	71	7	12		
1869	0.39	0.1	0.29	P	3774	153	35	3	6		
1876	0.45	0.1	0.35	P	5348	169	35	3	5		
1890	2.19	0.1	2.09	P	24941	856	187	17	28	6	7
1906	4.27	0	4.27	TG	59205	1814	330	26	41	7	9
1909	1.03	0.1	0.93	P	9941	441	112	10	19	4	6
1971	0.65	0.1	0.55	P	6135	482	171	25	48	12	13
2010	0.60	0.1	0.5	P	5426	334	111	24	24	12	12
2012	0.47	0.1	0.37	P	4498	283	98	21	37	11	11
2280	64.9	1.0	63.9	TG	713156	54786	11372	1174	1922	330	290
Trip gas at TD measured on circulation prior to cementing after RCI sampling gas and oil (with by-passing to annulus during sample clean-up).											
24/9-7A											
1834	0.24	0.05	0.19	P	1842	54	12	0	4	2	3
1847	0.28	0.05	0.23	P	2178	67	16	2	5	2	3
1890	2.31	0.15	2.16	P	20954	688	163	17	28	6	6
1958	1.23	0.15	1.08	P	10309	631	237	32	66	17	17
1986	1.84	0.2	1.64	P	15221	1070	418	62	125	31	31
2277	4.3	0	4.3	TG	53239	1959	513	53	125	25	29
Trip gas at TD measured on circulation prior to cementing after RCI sampling gas and oil (with by-passing to annulus during sample clean-up).											
24/9-7B											
1871	0.2	0.07	0.13	P	2018	63	13				
1879	0.5	0.09	0.41	P	5475	198	48	4	8		
1885	0.9	0.03	0.87	P	9523	359	91	9	16	3	3
1901	0.43	0.05	0.38	P	4182	162	43	4	8	0	2
1909	0.79	0.05	0.74	P	8284	300	73	7	12	2	3
1978	0.55	0.1	0.45	TG	4980	149	36	3	6		
2098	0.22	0.1	0.12	P	1868	65	16				
24/9-7C											
1009	0.05	0.01	0.04	P	402	17	6				
1756	0.21	0.04	0.17	P	2058	22	2				
1901	0.28	0.09	0.19	P	2556	49	6				
1988	0.75	0.1	0.65	P	7125	247	77	14	0	4	4
2158	0.67	0.25	0.42	P	7213	219	47	5	10	0	2
2256	2.1	0.15	1.95	P	21726	1254	313	89	156	45	44
2263	2.7	0.15	2.55	P	28072	1590	382	111	192	56	54

Types: TG=Trip Gas, STG=Short Trip Gas, CG=Conn. Gas, BG= BG Chrom. Gas, P=Gas Peak (from drilled formation).

Table 5 – Shows while drilling / coring

24/9-7

Depth (m) from - to	Formation / Lithology	Show description
1824.5-1830	Sandstone	No-dull yel dir Fluor, slo-fast strmng, loc slow shooting blu-wh fluor cut, no vis cut, dull bl-wh fluor res ring, no vis res.
1830 - 1847	Sandstone	No-v wk HC od, loc lt brn oil stain, dull yel – brt blu wh dir fluor, slo-fast strmng - blm dull blu wh- brt blu wh fluor cut, no vis cut, dull - brt blu wh fluor res ring, no vis res.
1899	Sandstone	Dull yelsh brnsh dir Fluor, v slo strmng dull blu-wh flour cut, no vis cut, dull yel-wh flour res, no vis res.
1906-1911	Sandstone	No vis oil stn, gd HC od, brt bl wh dir flu, inst-fst strm brt bl wh cut flu, no vis cut, brt bl wh flu res, no res.
1964-1971	Sandstone	Shows in v few sst agr: brt bl wh dir flu, inst-slo strm brt bl wh cut flu, dull wh res flu.

24/9-7A

Depth (m) from - to	Formation / Lithology	Show description
1880-1890	Sandstone	No Pet Od, no O stn, v slo strmng bl wh fluor cut, no vis cut, dull bl wh fluor res ring, no vis res.
1970-2008	Sandstone	No Pet Od, no O stn, pl yelsh dir fluor, mod strmng-shooting bl wh fluor cut, no vis cut, pl bl wh fluor res ring, no vis res.
2077-2097	Sandstone	Pl yelsh dir fluor, inst strmng-shooting bl wh fluor cut, no vis cut.

24/9-7B

Depth (m) From - to	Formation / Lithology	Show description
1954	Sandstone	Gd pet od, v dull yel dir fluor w/ Tr bri yel pp Fluor, v slo blmg bl wh-yel fluor cut, no vis cut, Tr wk yel fluor Res, no vis Res.
2206-2210	Sandstone	No dir fluo above bkgd, wk bl wh cut fluor, ncc.

24/9-7C

Depth (m) From - to	Formation / Lithology	Show description
2251-2309	Sandstone	Pr pl yelsh brn O? stn, dull-pl-mod dir yelsh wh dir Fluor, slo-fast loc strmng bri bl wh fluor cut, no vis cut, pl bl wh fluor res ring, lt brn - lt brnsh yel vis res

Petrophysical Interpretation

Petrophysical interpretation (preliminary CPI) of wireline and LWD logs acquired in each of the wellbores are presented below in Figures 4a through 4d. These are included for guidance and the final definitive interpretations will be issued under separate cover once the special core analysis has been completed and available for inclusion.

24/9-7

A gas-oil contact (GOC) was not directly observed in well 24/9-7 but was inferred at 1921m MD / –1891.3m TVDSS, based on CPI of logs and formation pressure data (Figure 3a). A gas-down-to (GDT) was observed at 1919.6m MD / –1889.9m TVDSS and an oil-up-to (OUT) at 1923.2m MD / –1893.5m TVDSS. An oil-water contact (OWC) was similarly not directly observed but inferred at 2025.6m MD / –1995.8m TVDSS with an oil-down-to (ODT) at 2009m MD / –1979.1m TVDSS. These depths are consistent with those reported by Fina for the offset Grieg wells 24/9-5 and 24/9-6 (OWC at –1996m TVDSS).

The interval from 1823.0m to 1877.5m MD is predominantly claystone country rock with a network of sand veins, representing the uppermost expression of the injection complex. It has a gross thickness of 54.5m, a net thickness of 9.75m and net:gross of 0.179 with average porosity of 26.0% and S_w 0.48. The Upper Dyke Complex (UDC) from 1877.5 to 1911.0 has a gross thickness of 33.5m, a net thickness of 27.7m (net:gross 0.827) with average porosity of 31.7% and average S_w of 20.1%.

Separating the Upper and Lower Dyke Complexes is an interval of Lower Horda and uppermost Balder Formation claystones with a gross thickness of 51.5m. Interpretation of this interval indicates numerous thin sandstones are present having a net thickness of 7.45m (net:gross 0.145) and average porosity of 28.8% and average S_w of 56.8%.

The Lower Dyke Complex (LDC) has a gross interval of 12.5m with a net thickness of 7.93m giving a net:gross of 0.634. Average porosity in this interval is 32.3% and average S_w is 19.7%. Two thin sandstones are noted between the base of the LDC and the base of the lowermost injectite at 2008.9m, all within Balder Formation claystone. 1.98m of net thickness is interpreted, giving a net:gross of 0.058, with average porosity of 31.3% and average S_w of 57.7%.

24/9-7A

The downdip sidetrack well 24/9-7A encountered both oil and water in distinct sands with a GDT considered to be at 1940m MD / –1888.3m TVDSS and an ODT inferred at 2008.9m MD / –1947.0m TVDSS. These depths are inferred from formation pressure data (Figure 5). The 81m interval of Horda claystone penetrated by thin injection sandstones above the main dyke feature has a net thickness of 6.25m giving a net:gross of 0.077 with average porosity of 23.2% and average S_w of 51.6%. The Upper Dyke Complex (UDC) was seen as oil-bearing with a gross thickness of 54.4m, a net thickness of 53.80m (net:gross 0.989) and average porosity of 32.2% and average S_w of 7.1%. No sandstones were noted in the lower Balder Formation Claystone /Balder Tuff between the UDC and the LDC. The Lower Dyke Complex is a 21m gross thickness water-bearing sandstone with a net interval of 17.83m giving a net:gross of 0.848. Average porosity in the LDC is 34.2% and average S_w is 93.2%.

24/9-7B

Updip sidetrack well 24/9-7B encountered only thin sandstones within the lower Horda claystone and no GOC was observed (Figure 4c). As the well results were conclusive from standard wireline logs and core, no formation pressure data was acquired. A total of 4.72m net thickness of gas-bearing sandstones was interpreted with an average porosity of 24.9% and average S_w of 31.9%.

24/9-7C

Lateral sidetrack well 24/9-7C encountered an OWC in reservoir quality sands at 2292.0m MD / –1995.3m TVDSS (Figure 4d) which is entirely consistent with offset data and was confirmed by formation pressure data acquired. The dyke complex comprises a gross interval of 59.0m, a net thickness of 54.1m (net:gross 0.917) and average porosity of 33.5% with an average S_w of 34.1%.

Figure 4a – 24/9-7 Hamsun Preliminary Petrophysical Interpretation

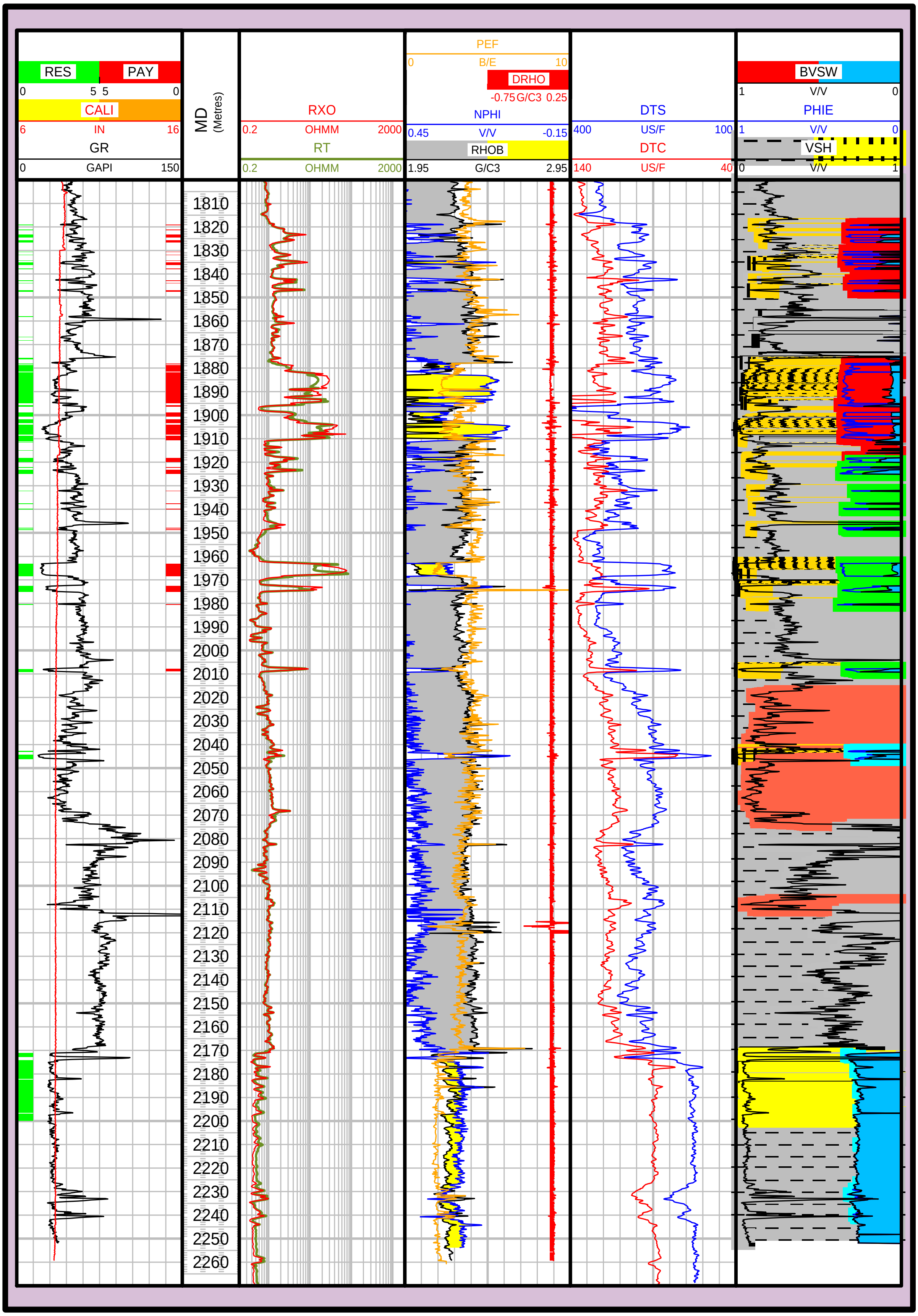


Figure 4b – 24/9-7A Hamsun Preliminary Petrophysical Interpretation

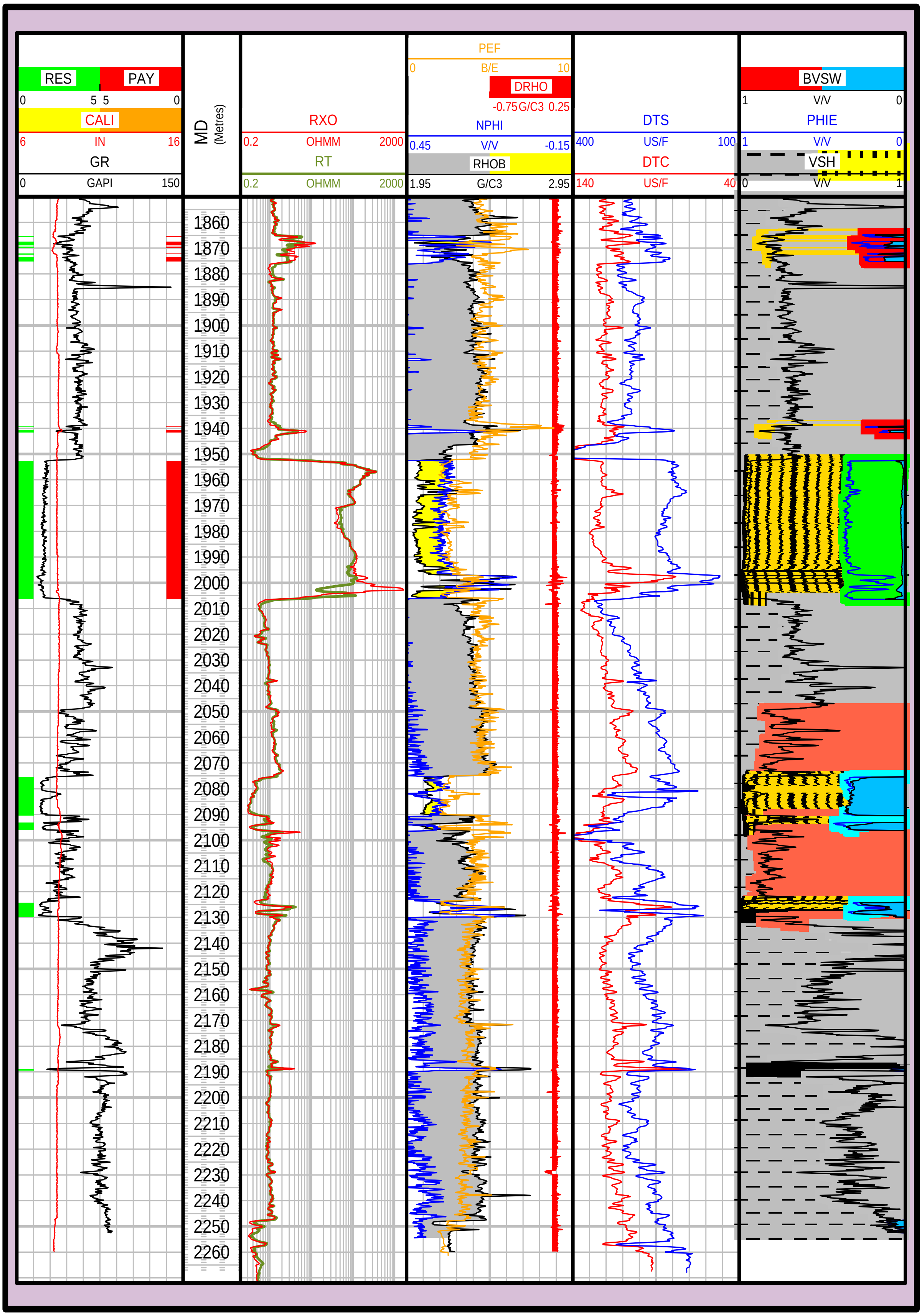


Figure 4c – 24/9-7B Hamsun Preliminary Petrophysical Interpretation

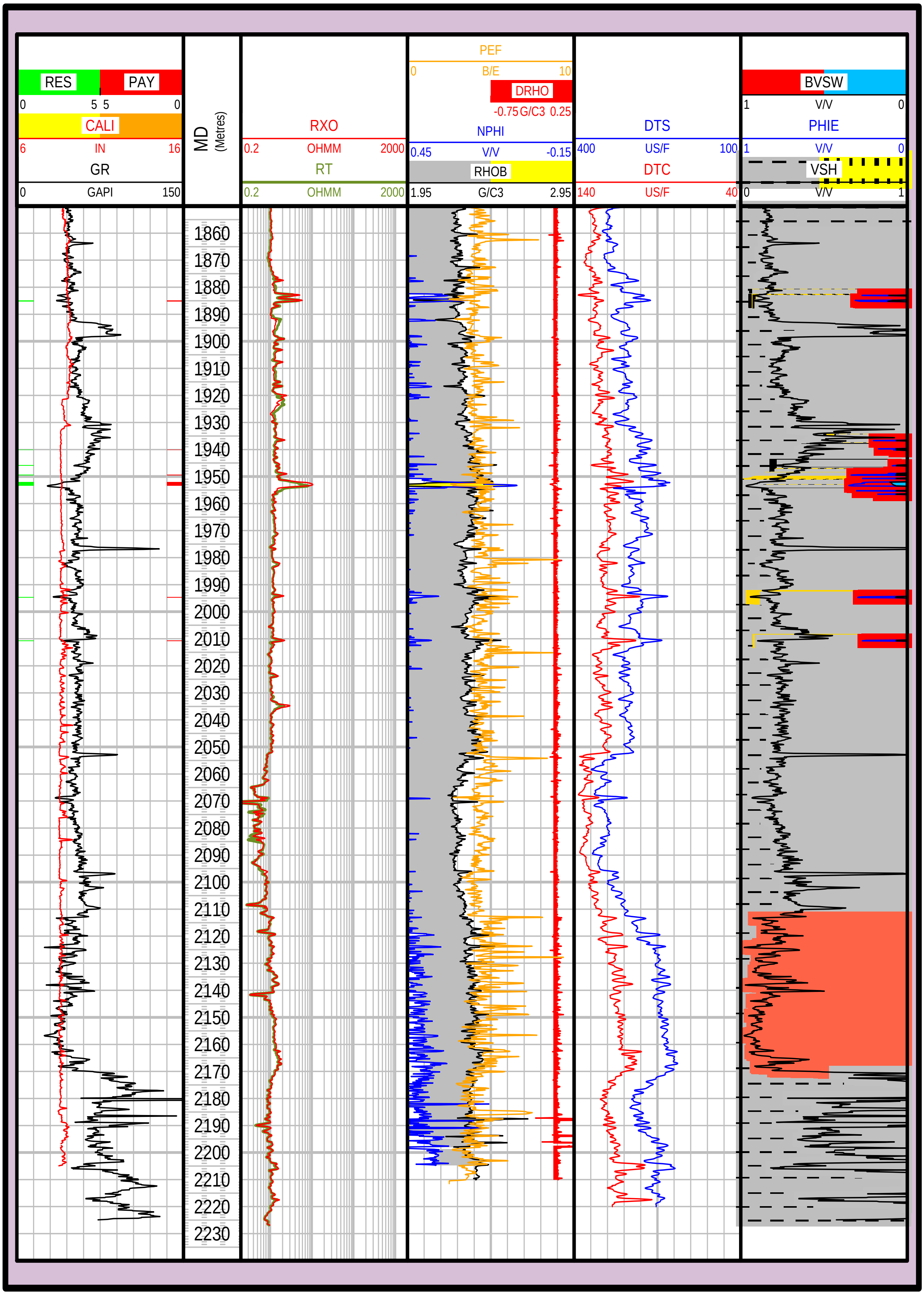
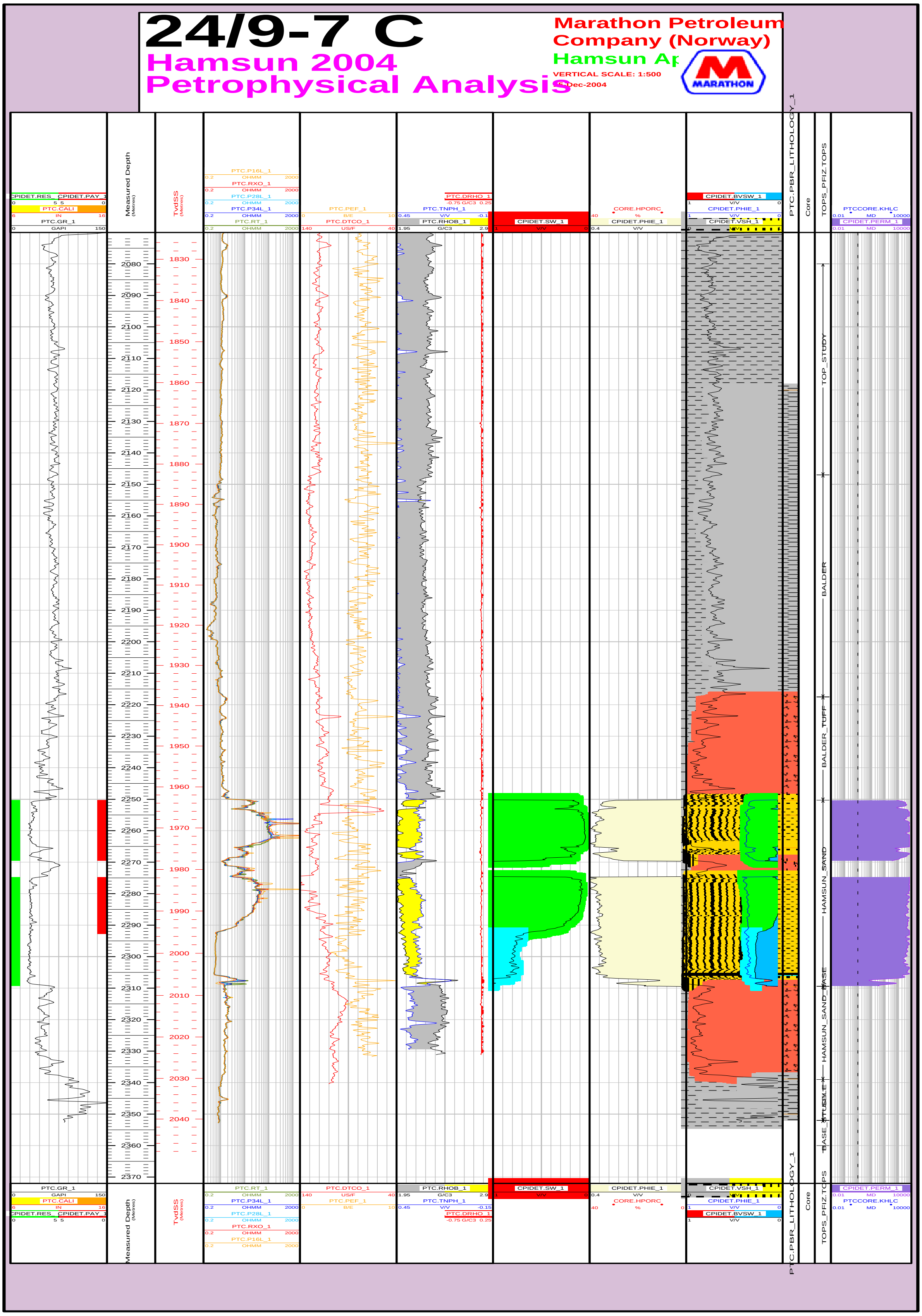


Figure 4d – 24/9-7C Hamsun Preliminary Petrophysical Interpretation



5. Formation Evaluation

Formation evaluation was provided on wells 24/9-7, 7A, 7B and 7C by Baker Hughes INTEQ (BHI) using a standard computerized mudlogging unit, Schlumberger D&M provided LWD services and wireline logs were run by Baker Atlas at TD on each well. Datalog Technology provided quantitative gas-in-mud analysis, using membrane transfer technology, on each well as part of a trial to determine the suitability of the technique for geosteering assistance.

Mudlogging and Sampling

Baker Hughes INTEQ (BHI) provided reports, paper and digital log data files as specified and at the request of the wellsite geologist. The mudlogging unit provided 24 hour monitoring of the drilling operation and recorded all drilling parameters on a real time basis. Drilling support using standard computer packages was provided as requested. Formation and mud samples were collected as per the Geological Program and samples were shipped from location at the end of the well programme.

Performance Evaluation

The BHI unit had been partially rigged down while the Deepsea Delta had been warm stacked in harbour. BHI considered the 7 days notice to mobilise the unit as insufficient to eliminate all teething problems associated with a restart. The BHI unit was used to house Schlumberger LWD surface equipment and engineers as well as the Datalog technician and computer equipment. As a result, and despite its size, the unit became quite ‘busy’ during critical operations. A number of issues required to be addressed by BHI during the course of drilling operations, the most significant of which related to gas equipment operation and personnel awareness of operations.

A thorough prepped meeting was conducted with local BHI operations managers and key crew members, where it was emphasised that open and quick communication of problems to Marathon’s wellsite geologists was required. Unfortunately this was not always the case and led directly to poor performance evaluation of the gas chromatographic equipment. A non-standard wellsite chromatograph was supplied by BHI to meet the requirements of the Marathon contract and it became obvious that the crew were not fully trained in its operation. Poor crew vigilance during cementing operations resulted in a leaking spacer passing unnoticed until too late, ultimately a second cement job was required. The mudlogging final report required extensive operator input and reworking to be of acceptable standard. Onshore support of the drilling operations was good and all issues raised offshore were resolved timeously. Personnel offshore participated well in the introduction by Marathon of a STOP safety programme.

LWD (Logging While Drilling)

Schlumberger D&M services on 24/9-7 and the related sidetrack wells are summarised in Table 6 below. Real-time and in memory mode data was acquired and additional information is presented in Appendix C.

Table 6 – Summary of LWD Runs

Log Run	Driller's TD (m)	Logged Interval (m)	Hole size (in)	Bit - sensor offset (m)
24/9-7				
ARC-GR	953	212-953	17½	D&I 11.89,
RAB6/ARC6/GR	1830	940-1829	8½	RAB 4.83m; GR 10.18; ARC5 14.85
RAB6/ARC6/GR	2280	1810-2275	8½	RAB 4.83m; GR 10.18; ARC5 14.85
24/9-7A				
RAB6/ARC6/GR	2277	1490-2271	8½	RAB 4.83m; GR 10.18; ARC5 14.85
24/9-7B				
RAB6/ARC6/GR	1923	1055-1918	8½	RAB 4.83m; GR 10.18; ARC5 14.85
ARC6/GR	2230	1918-2219	8½	GR 10.18; ARC5 14.85
24/9-7C				
ARC6/GR/ADN/Isonic	2363	980-2357	8½	GR 6.23; ARC5 8.63; ADN 33.5; Ison 23.2

LWD operations commenced in the 17½" hole section of 24/9-7 but the tools failed completely at 590m MD, neither transmitting real-time data nor recording data. This failure was analysed by Schlumberger at their base and was considered to result from excessive shocks transmitted through the BHA leading combined with a seal failure and flooding of the tools. The 8½" section was drilled with a "resistivity-at-bit" type tool and was used to assist in geo-stopping for core point. The cored interval was GR-resistivity wipe logged and used down to TD to confirm core observations and to assist in finalising the wireline programme. The sidetrack 24/9-7A was LWD logged from kick-off to TD using GR-resistivity to give an early indication of rock quality and fluid content and to assist in finalising the wireline log programme.

Performance Evaluation

The major issues offshore surrounded poor depth control with discrepancies between the rig and Schlumberger depths up to 2m but were resolved on site with input from the wellsite geologists. Final logs from the 24/9-7C well were delayed to allow for reprocessing to account for an incorrect bit-sensor offset on the density and neutron tools. Overall, Schlumberger's performance was good and met Marathon's standards for data acquisition and data quality. All LWD operations were performed in a safe manner and personnel offshore participated well in the introduction by Marathon of a STOP safety programme.

Wireline Logging

Baker Atlas provided the wireline logging service on 24/6-7, 7A, 7B and 7C. Four suites of logs were run in 24/9-7 with formation sampling at different depths within the reservoir. Three suites of logs were acquired in 24/9-7A, again with formation sampling in the reservoir section. A single suite of logs was acquired in each of 24/9-7B and 24/9-7C. Table 7 presents an overview of the logs run with a detailed breakdown of wireline operations timing and operational problems presented in Appendix D. Details of the formation samples taken are presented in Appendix E.

Table 7 – Summary of Wireline Logging Runs

Log Run	Logger's TD (m)	Logged Interval (m)	Max. T(°C)	Comments
24/9-7	2280			
GR-HDIL-ZDL-CNL-XMAC		2280 - 125	68	GR/CNC through casing
RCI-GR	Did not tag TD	Micron	n/a	
RCI-GR	Did not tag TD	2195 - 1883	70.8	Pressures and samples
RCI-GR	Did not tag TD	2195 - 1883	70	Pressures and samples
VSP-GR		2265 - 600	n/r	Poor data above 965m.
CBIL-EART-GR		2113 - 1799		
RCI-GR	Did not tag TD	1966.5 – 1843.5	71	Samples only
24/9-7A	2277			
GR-HDIL-ZDL-CNL-XMAC		2271.0 – 1450.0	65.0	Tie to 24/9-7 at 1500m
RCI-GR	Did not tag TD	2126.3 – 1865.3	67.5	Pressures and samples
EART-GR				
24/9-7B	2230			
GR-HDIL-ZDL-CNL-XMAC		2227.5 - 940		
24/9-7C	2363			
RCI-GR	Did not tag TD	2305 - 2262	67	Pressures only

Logging operations on 24/9-7 commenced on the 17th March 2004, lasted 79.58 hours and were completed on 22nd March 2004. A total of 7 log runs were made, inclusive of a misrun RCI-GR. The RCI was configured for pretest pressures, gas and oil sampling and a total of 36 formation pressures were obtained from 43 attempts (with 60 repeats and 27 samples) between 2195.0m to 1843.5m MD, following Marathon standard procedures. The RCI sampling program was also completed satisfactorily with a total of 27 samples, 6 gas samples and 21 oil samples were obtained.

A total of three wireline log runs were made on 24/9-7A with logging operations commencing on 26th March and completed on 27th March 2004. The RCI was configured for pretest pressures, gas and oil sampling and a total of 24 formation pressures were obtained between 2126.3m and 1865.3m MD, following Marathon standard procedures. The RCI sampling program was also completed satisfactorily and a total of 7 oil samples were obtained.

Logging operations on 24/9-7B were restricted to one run with operations completed on 1st April 2004. No formation pressure or samples were required in this sidetrack.

Only one wireline log was run in well 24/9-7C, an RCI run configured for formation pressures only. This run was completed within 9½ hours on 7th April 2004 and a total of 8 good formation pressures were obtained.

Performance Evaluation

A number of problems were encountered during the initial wireline operations and detailed failure and root cause analyses relating to the lost time incurred on 24/9-7 can be found in Appendix D of the Baker Atlas End of Well Report and in Appendix D of this report. Despite such initial difficulties, the data acquisition program on 24/9-7 was completed successfully and all data met Marathon's quality standards. The three sidetrack wells were of the standard of performance normally expected of Baker Atlas with operating efficiencies of 98%, 100% and 100% respectively. All data on these sidetracks was acquired successfully, again of excellent quality. The overall Operating Efficiency for Baker Atlas on the 4 wells of the Hamsun project was 84%.

Baker Atlas carried out all operations in a safe manner and without incident.

Membrane-Transfer Gas Chromatograph Technology Evaluation

Datalog Technology provided a separate, stand-alone ChromatWizard membrane-type chromatographic gas analysis system as part of a trial to determine the suitability of such sensors/detectors for gas ratio analysis geosteering. In addition, total gas detectors of the same type were used on both the suction and return systems to cancel out recycled gas effects. The gas data acquired was not used in real-time for the operational safety of the wells (this was handled by BHI) and processing/interpretation of the results is currently being undertaken. The equipment proved easy to install and was robust with only one failure reported (sample pump) which was quickly resolved. Comparison of the data sets (conventional gas trap system versus membrane-type system) suggests that the sensitivity of the latter to longer chain hydrocarbons is greater. A benefit of the system is its continuous immersion in the drilling fluid with no susceptibility to flow rates as seen in conventional gas traps.

Coring Operations

Halliburton provided the coring services on 24/9-7 and 24/9-7B and ResLab provided surface core handling operators prior to transport and core analysis in Stavanger. Details of core depth and recoveries are shown in Table 8 below.

Table 8 – Summary of Core Information

Core N^{o}.	From (m)	To (m)	Cut (m)	Rec. (m)	%	Core-Log shift	Corehead / TFA / Grading
24/9-7							
1	1830	1857	27	26.75	99.1	-0.65	FC274 / 1.5025 / 1-1-PN-A-D-I-NO-CP
2	1857	1876	19	19	100	-0.65	FC274 / 1.5025 / 1-2-BT-A-D-I-CT-TQ
3	1876	1906.9	30.9	30.9	100	-0.35	FC274 / 1.5025 / 1-1-PN-A-D-I-NO-TQ
4	1906.9	1916	9.1	8.5	93.8	-0.35	FC274 / 1.5025 / 1-1-BT-C-D-I-PN-TQ
24/9-7B							
1	1922.5	1978	55.5	55.5	100	-	FC274 / 1.5025 / 3-3-WT-A-D-I-PN-BHA

Performance Evaluation

Coring operations were carried out in a safe and efficient manner and core recovery was excellent in the very porous, permeable and friable brecciated sandstone of the Hamsun Sands. Surface handling by the Halliburton personnel using the cradle recovery system was performed well (despite adverse weather conditions during recovery of core 1) and core damage was minimal during surface operations. The core was stabilized before transport using Reslab's proprietary Gypsum Stabilisation technique. The excellent recovery factors were a tribute to Halliburton's and Reslab's overall performance.

Conventional Core Analysis, Special Core Analysis Performed

Reservoir Laboratories AS performed conventional core analysis (CCA) and special core analysis (SCAL) on selected plugs taken throughout the cored intervals wells 24/9-7 and 24/9-7B. A total of 59 mercury capillary measurements were taken to determine the quantity and distribution of additional CCA and SCAL plugging. Seventy three (73) horizontal and 9 vertical plugs were taken with plug orientations taken parallel and normal to dyke strike, parallel and normal to dyke margin orientation and vertically. SCAL is being performed on 4 plugs with data acquisition ongoing at time of this report preparation.

Full details of the core analysis programmes performed are available under separate cover by ResLab.

6. Pre- and Post- Well Prospect Interpretation.

6.1 Pre-Well Structural and Stratigraphic Definition / Interpretation.

There are a number of oil fields and discoveries within the general area of the Hamsun prospect where elements of sandstone injection, of varying significance, have been recognised. The Tertiary Balder and Jotun fields are examples on the Norwegian continental shelf, whilst the Harding, Gryphon and Leadon fields provide examples in UK waters. The primary causes of sand injection in each of these fields is linked fundamentally to tectonic forces leading to slumping and folding of unconsolidated, water-saturated sediments with subsequent sand re-mobilisation and intrusion to higher stratigraphic levels.

The Hamsun prospect was defined by the mapping of an injection complex considered to be sourced from the Hermod Formation. The present day elevation (in terms of height above the source sand) at Hamsun is up to 200m, considerably in excess of that observed elsewhere. Bright amplitude, relatively low acoustic impedance seismic reflectors, which extend in a “horse-shoe” shape around the Grieg discovery wells, were interpreted to represent oil-filled, highly porous sandstone dykes and sills. On the southern flank of the complex in particular, large-scale sandstone injection into the post-Balder Formation, early Eocene mudstone section was interpreted. The limits of the sand injection features were initially believed to be approximately coincident with the limits of the seismic anomalies. The implied trapping mechanism was considered to be by abrupt passage to impermeable lithofacies at the contact of the sand injectites with post-Balder Formation mudstones.

Given that none of the offset field examples demonstrate the magnitude of sand injection that appeared to characterise the Hamsun complex, the origin of sand injection was considered to be fundamentally different. It is a matter of observation that the Hamsun complex is located centrally within the Viking Graben above a very thick Mesozoic sedimentary succession. The peak period of hydrocarbon expulsion from Jurassic source rocks within the Viking Graben occurred during the Paleogene. Continuous vertical migration of oil and gas into the unconsolidated Hermod Formation sand channels - interpreted to be of limited lateral extent and probably representing the uppermost coarse-clastic sediment bodies in the basin - probably led to the generation of substantial over-pressure. This overpressure can be envisaged to have ultimately been released, perhaps finally triggered by an earthquake, resulting in a “catastrophic” injection event. A component of the flatter lying fringe areas at Hamsun, occupying the more structurally elevated parts of the complex could potentially represent extrusion of re-mobilised sand onto a palaeo-sea floor.

6.2 Post-Well Interpretation.

The drilling programme was more extensive than originally planned and the additional sidetracks permitted more detailed evaluation of the prospect. The first additional sidetrack (24/9-7A) targeted a location within the dyke complex, downdip from the vertical well. It was designed to demonstrate reservoir continuity within the oil leg, in particular within the “Upper Dyke” complex which was encountered in the gas leg in the vertical well (Figure 5). A secondary objective of this first additional sidetrack was to prove a gas-oil contact within the “Upper Dyke” complex and, if possible, an oil-water contact in sands comprising the “Lower Dyke” complex. Interpretation of wireline logs run in wells 24/9-7 and 24/9-7A confirm the Grieg OWC at –1996m TVDSS in the Hamsun dykes while a GOC was inferred at –1891m TVDSS. The Upper dyke consists of massive sand (>30m TVT) with good quality at the base but decreasing in quality somewhat up dip, due to increasing shale brecciation. The Lower dyke is thinner than prognosed but also of good quality, shares fluid and gas contacts and is in communication with the upper dyke. A third, thinner dyke above the Upper dyke and thin stray sands in all three wells suggests a pervasive network of thin injectites is present throughout the area, related to the main dyke features. These communicate pressure and appear to allow common contacts fieldwide (refer to RCI pressure plot data).

The planned updip sidetrack (24/9-7B) demonstrated that the upper wing/sill complex comprised very low quality (in terms of net:gross), multiple thin sands between 0.5 and 2m thick (core and wireline evidence). Initial interpretation suggests that these do not represent spreading of the injected sands at a paleo sea-floor. The thin sporadic sand injectites more probably represent the final loss of energy associated with the large-scale injection process.

The third and final sidetrack (24/9-7C) was designed to investigate the eastern flank of the complex. The well encountered a single major dyke injection feature and a clearly demonstrable OWC was seen on LWD logs at –1995.3m TVDSS. This additional penetration in a single dyke setting enabled further quantifying of resource estimates.

6.3 Preliminary Formation Pressure, PVT and Geochemical Interpretation.

An extensive programme of wireline formation pressure points and sampling was conducted to establish fluid gradients and infer contacts where contacts were not directly observed in sand and to establish/assess reservoir connectivity. The pressure plot, Figure 5 shows pressure data from wells 24/9-7, 24/9-7A and 24/9-7C. The OWC at 1995.8m TVDSS, inferred by the pressure data, was confirmed by direct observation of an OWC in well 24/9-7C. The GOC is inferred with an oil-up-to from well 24/9-7. Figure 5 also illustrates that the Hamsun wells all show the same pressure/gradient trends suggesting fluid communication. The data points between 2146.1m and 2165.1m in 24/-7are in the Heimdal formation and hence lie off-trend.

Figure 5 – 24/9-7, 24/9-7A and 24/9-7C Hamsun Pressure / Depth plot.

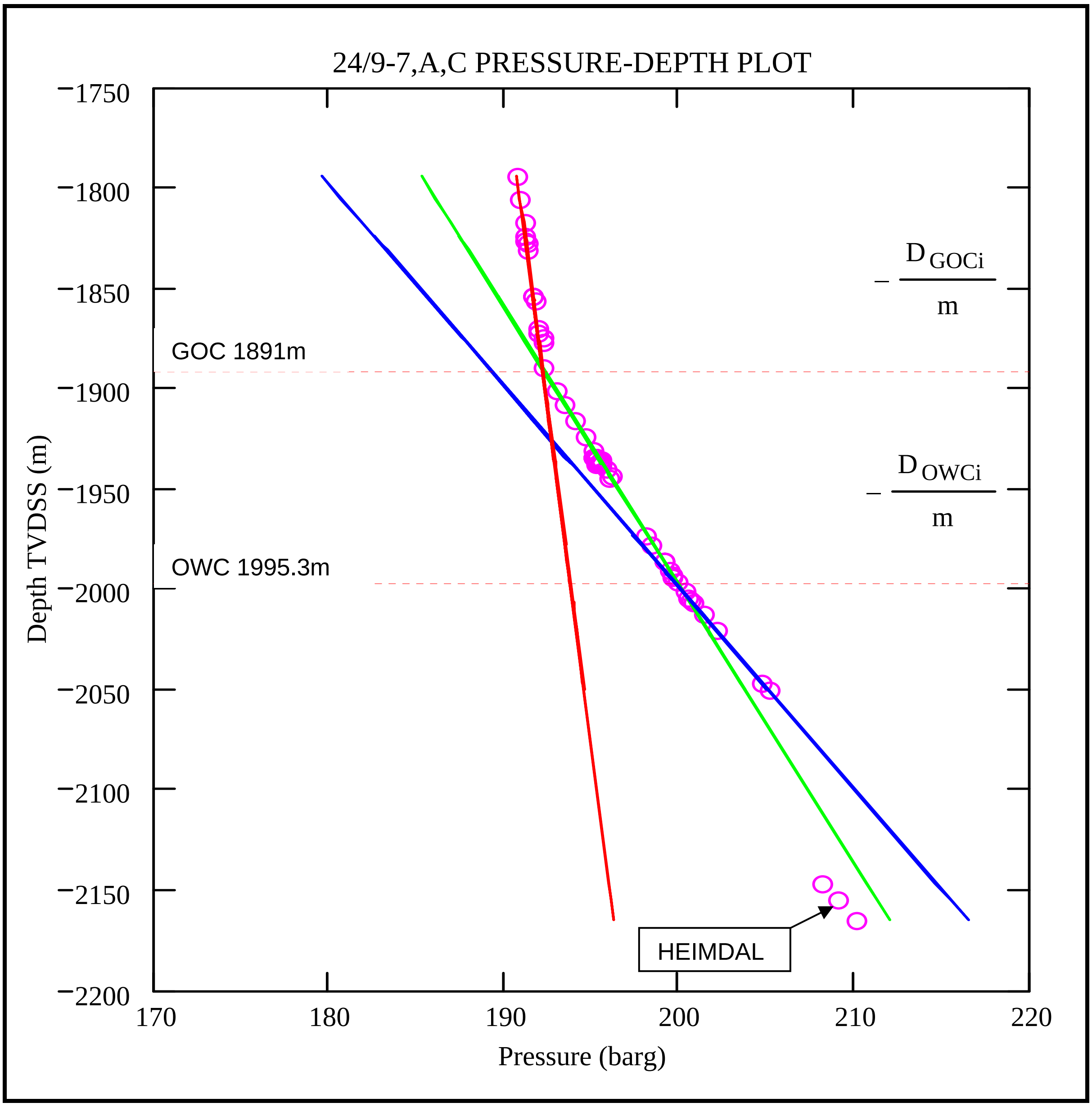
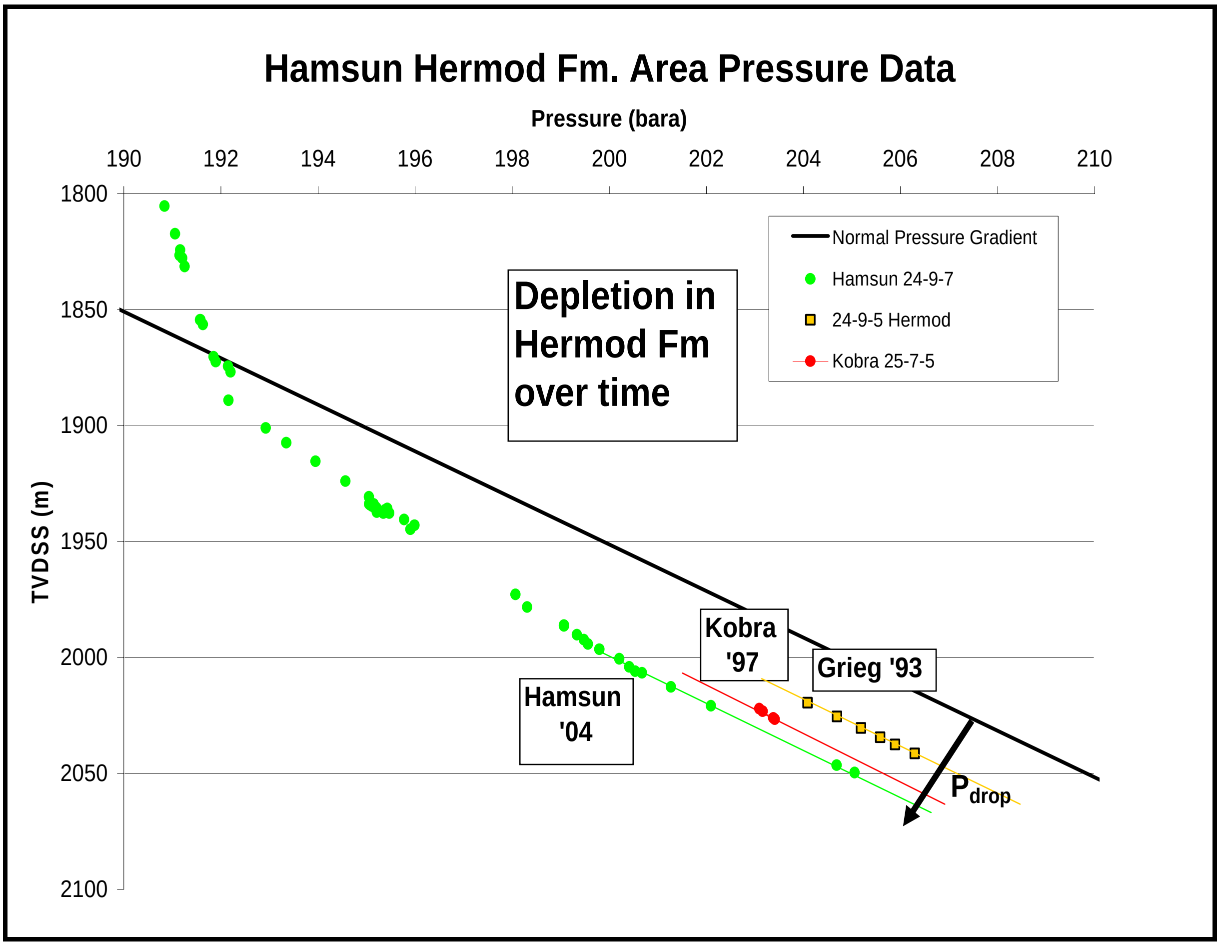


Figure 6 illustrates Hermod formation pressure data in the Hamsun area. The formation is pressure depleted when compared to the normal pressure gradient expected and this has continued from the period prior to the first Grieg well 24/9-5 in 1993 until the most recent Hamsun 24/9-7 well. The difference in pressure between the Kobra well 25/7-5 in 1997 and the Hamsun well 24/9-7 is not as great as the difference between the Grieg well 24/9-5 in 1993 and the Kobra well in 1997. This may signify that the rate of depletion is not as great in magnitude as previous or indeed that the pressure in the formation is now rebounding. This is considered to be happening locally in the Heimdal, post cessation of production at Frigg.

Figure 6 – Pressure depletion in the Hermod Formation around the Hamsun Structure.



PVT analysis is being carried out and preliminary data shows the reservoir fluid to be consistently around 33º API with a modelled GOR 110 m^3/m^3. The fluid is consistent with the 24/9-5 and 24/9-6 wells. Free gas in the reservoir is wet in nature with a SG of around 0.67; this is consistent with a lean condensate character. Geochemical analysis may further aid the understanding of source and continuity between 24/9-5, 24/9-6 and the 24/9-7 wells.

6.4 Synthesis and Conclusions.

The sandstone injection dyke feature at the Hamsun location, first identified on seismic and recognized by a number of workers, has been proven to comprise multiple dykes of varying thickness that are laterally extensive and form a distinctive 'horse-shoe' shaped structure. Previously postulated "wings" have been demonstrated to be an extensive network of thin, gas-bearing, sandstone 'veins' and thin injected sands, the net effect of which is to appear as a thicker unit on seismic. Detailed analysis is continuing into the sedimentology, structural setting, emplacement mechanisms and hydrocarbon filling history in order to fully understand this feature but these studies have not been concluded and the results are not available at the time of compiling this report.

The Hamsun prospect appears to show signs of pressure depletion in comparison with offset wells 24/9-5 and 24/9-6 (Grieg) and 25/7-5 and 25/7-6 (Kobra). This may be related to the onset of production from nearby fields which have off take points in sands of Hermod age, or equivalent. The dyke complex as a whole does not appear to be directly connected to Heimdal Formation sands although vertical connection between Hermod and Heimdal sands is considered to exist regionally, e.g. at Balder field. The Hamsun sands at this location are most probably in discrete communication with Hermod and Heimdal sands.

Appendix A – Deviation Surveys for 24/9-7, 7A, 7B and 7C

The following directional parameters were used by Anadrill Schlumberger for the wells.

Grid Coordinate System: UTM Zone 31N on ED50 Datum, Meters
Location Lat / Long: 59º 28' 42.701" N, 001º 57' 44.422" E
Location Grid Y/X: 6593950.00m N, 441211.90m E
Grid Convergence Angle: -0.89390648°
Final Coordination data from: Thales GeoSolutions, Final Position Fix – Differential GPS
Date of Survey: 02 March 2004
Survey / DLS Computation Method: Minimum Curvature
TVD Reference Datum: RTE
TVD Reference Elevation: 29.0 m relative to MSL
Sea Bed / Ground Level Elevation: -124.2m relative to MSL
Magnetic Declination: -3.047°
Declination Date: 18 March 2004
Magnetic Declination Model: BGGM 2003
North Reference: Grid North
Total Corr Mag North -> Grid North: -2.153°
Local Coordinates Referenced To: Well Head

24/9-7

Vertical Section Azimuth: 141.23º (Grid)
Vertical Section Origin: N 0.000 m, E 0.000 m

								Grid Coordinates		Geographic Coordinates	
MD (m)	Incl (°)	Azim (°)	TVD (m)	VSec (m)	N/-S (m)	E/-W (m)	DLS °/30m	Northing (m)	Easting (m)	Latitude	Longitude
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6593950.00	441211.90	N 59 28 42.701	E 1 57 44.422
153.20	0.00	0.00	153.20	0.00	0.00	0.00	0.00	6593950.00	441211.90	N 59 28 42.701	E 1 57 44.422
171.73	0.24	200.38	171.73	0.02	-0.04	-0.01	0.39	6593949.96	441211.89	N 59 28 42.700	E 1 57 44.421
184.15	0.24	274.93	184.15	0.02	-0.06	-0.05	0.70	6593949.94	441211.85	N 59 28 42.699	E 1 57 44.419
191.81	0.14	19.26	191.81	0.00	-0.05	-0.06	1.20	6593949.95	441211.84	N 59 28 42.699	E 1 57 44.418
201.71	0.41	177.30	201.71	0.02	-0.07	-0.06	1.64	6593949.93	441211.84	N 59 28 42.699	E 1 57 44.419
249.96	0.43	231.12	249.96	0.16	-0.36	-0.19	0.24	6593949.64	441211.71	N 59 28 42.689	E 1 57 44.410
335.88	0.58	228.46	335.88	0.18	-0.85	-0.77	0.05	6593949.15	441211.14	N 59 28 42.673	E 1 57 44.374
364.23	0.26	254.28	364.22	0.16	-0.96	-0.93	0.39	6593949.04	441210.97	N 59 28 42.669	E 1 57 44.364
422.35	0.56	195.96	422.34	0.28	-1.27	-1.14	0.25	6593948.73	441210.76	N 59 28 42.659	E 1 57 44.351
450.93	0.52	195.99	450.92	0.43	-1.53	-1.21	0.04	6593948.47	441210.69	N 59 28 42.651	E 1 57 44.347
508.11	1.40	205.70	508.09	0.88	-2.41	-1.59	0.47	6593947.59	441210.31	N 59 28 42.622	E 1 57 44.324
536.13	2.23	207.55	536.10	1.25	-3.20	-1.99	0.89	6593946.80	441209.91	N 59 28 42.597	E 1 57 44.299
542.78	2.15	208.32	542.74	1.35	-3.42	-2.11	0.38	6593946.58	441209.79	N 59 28 42.589	E 1 57 44.292
551.33	1.77	207.74	551.29	1.47	-3.68	-2.25	1.34	6593946.32	441209.66	N 59 28 42.581	E 1 57 44.283
567.71	1.15	223.56	567.66	1.59	-4.03	-2.48	1.34	6593945.98	441209.42	N 59 28 42.570	E 1 57 44.269
596.61	2.25	210.19	596.55	1.83	-4.73	-2.96	1.21	6593945.28	441208.94	N 59 28 42.547	E 1 57 44.239
625.44	2.07	201.34	625.36	2.29	-5.70	-3.44	0.39	6593944.30	441208.47	N 59 28 42.515	E 1 57 44.210
653.41	2.52	206.22	653.31	2.80	-6.72	-3.89	0.53	6593943.28	441208.01	N 59 28 42.482	E 1 57 44.182
683.00	1.61	193.91	682.88	3.33	-7.71	-4.28	1.02	6593942.29	441207.62	N 59 28 42.450	E 1 57 44.158
711.85	1.73	194.37	711.72	3.84	-8.52	-4.48	0.13	6593941.48	441207.42	N 59 28 42.423	E 1 57 44.146
739.31	1.52	196.33	739.17	4.30	-9.28	-4.69	0.24	6593940.73	441207.21	N 59 28 42.399	E 1 57 44.133
768.04	1.35	193.01	767.89	4.72	-9.97	-4.87	0.20	6593940.03	441207.03	N 59 28 42.376	E 1 57 44.123
796.47	1.41	198.48	796.31	5.12	-10.63	-5.06	0.15	6593939.37	441206.84	N 59 28 42.355	E 1 57 44.111

								Grid Coordinates		Geographic Coordinates	
MD (m)	Incl (°)	Azim (°)	TVD (m)	VSec (m)	N/-S (m)	E/-W (m)	DLS °/30m	Northing (m)	Easting (m)	Latitude	Longitude
825.22	0.70	196.01	825.05	5.41	-11.13	-5.22	0.74	6593938.87	441206.68	N 59 28 42.339	E 1 57 44.102
854.10	0.84	188.90	853.93	5.66	-11.51	-5.30	0.18	6593938.49	441206.60	N 59 28 42.326	E 1 57 44.097
882.74	0.75	203.42	882.57	5.89	-11.89	-5.41	0.23	6593938.11	441206.49	N 59 28 42.314	E 1 57 44.090
911.64	0.46	222.72	911.47	5.99	-12.15	-5.56	0.36	6593937.85	441206.34	N 59 28 42.306	E 1 57 44.081
940.17	0.54	223.66	939.99	6.03	-12.33	-5.73	0.08	6593937.67	441206.17	N 59 28 42.300	E 1 57 44.070
1005.90	0.63	278.07	1005.72	5.80	-12.51	-6.30	0.25	6593937.50	441205.60	N 59 28 42.294	E 1 57 44.034
1034.85	0.80	273.50	1034.67	5.55	-12.47	-6.66	0.19	6593937.53	441205.24	N 59 28 42.295	E 1 57 44.011
1063.90	0.81	257.96	1063.72	5.32	-12.50	-7.07	0.23	6593937.50	441204.84	N 59 28 42.293	E 1 57 43.986
1092.55	1.24	190.03	1092.36	5.44	-12.85	-7.32	1.26	6593937.16	441204.58	N 59 28 42.282	E 1 57 43.970
1121.49	1.32	189.43	1121.30	5.86	-13.49	-7.43	0.08	6593936.52	441204.48	N 59 28 42.261	E 1 57 43.964
1150.43	1.63	156.91	1150.23	6.48	-14.19	-7.32	0.91	6593935.81	441204.58	N 59 28 42.239	E 1 57 43.971
1179.39	1.38	149.07	1179.18	7.22	-14.87	-6.98	0.33	6593935.13	441204.92	N 59 28 42.217	E 1 57 43.994
1208.12	1.53	134.01	1207.90	7.95	-15.43	-6.53	0.43	6593934.57	441205.38	N 59 28 42.199	E 1 57 44.023
1237.00	1.48	123.39	1236.77	8.68	-15.91	-5.94	0.29	6593934.10	441205.96	N 59 28 42.184	E 1 57 44.061
1265.94	2.14	128.31	1265.69	9.57	-16.45	-5.20	0.70	6593933.56	441206.70	N 59 28 42.167	E 1 57 44.108
1322.40	2.13	124.69	1322.11	11.60	-17.70	-3.51	0.07	6593932.31	441208.39	N 59 28 42.127	E 1 57 44.217
1351.49	2.06	117.35	1351.18	12.60	-18.25	-2.60	0.29	6593931.76	441209.30	N 59 28 42.110	E 1 57 44.275
1380.50	2.09	127.36	1380.18	13.59	-18.81	-1.72	0.38	6593931.20	441210.18	N 59 28 42.092	E 1 57 44.332
1408.91	2.02	123.47	1408.57	14.57	-19.40	-0.89	0.16	6593930.61	441211.01	N 59 28 42.074	E 1 57 44.385
1437.63	2.09	122.36	1437.27	15.54	-19.96	-0.02	0.08	6593930.05	441211.88	N 59 28 42.056	E 1 57 44.440
1466.76	2.20	112.35	1466.38	16.54	-20.45	0.94	0.40	6593929.55	441212.84	N 59 28 42.041	E 1 57 44.502
1553.74	1.97	109.80	1553.30	19.27	-21.60	3.89	0.09	6593928.41	441215.79	N 59 28 42.005	E 1 57 44.691
1582.22	2.13	105.84	1581.76	20.12	-21.91	4.86	0.23	6593928.10	441216.76	N 59 28 41.996	E 1 57 44.753
1611.27	1.97	104.73	1610.79	20.96	-22.18	5.86	0.17	6593927.83	441217.76	N 59 28 41.987	E 1 57 44.816
1667.98	1.85	94.31	1667.47	22.37	-22.50	7.72	0.19	6593927.51	441219.62	N 59 28 41.978	E 1 57 44.935
1697.14	2.00	94.53	1696.62	23.04	-22.57	8.70	0.15	6593927.44	441220.59	N 59 28 41.976	E 1 57 44.997
1754.93	2.09	87.05	1754.37	24.35	-22.60	10.75	0.15	6593927.41	441222.65	N 59 28 41.976	E 1 57 45.127
1783.75	2.02	84.45	1783.17	24.94	-22.52	11.78	0.12	6593927.49	441223.68	N 59 28 41.979	E 1 57 45.193
1868.76	2.00	79.92	1868.13	26.47	-22.12	14.74	0.06	6593927.89	441226.63	N 59 28 41.994	E 1 57 45.380
1926.04	1.82	79.17	1925.38	27.38	-21.77	16.61	0.10	6593928.24	441228.51	N 59 28 42.006	E 1 57 45.499
1954.85	1.98	86.90	1954.17	27.88	-21.66	17.56	0.31	6593928.35	441229.45	N 59 28 42.010	E 1 57 45.559
2015.00	2.45	112.27	2014.28	29.61	-22.09	19.79	0.54	6593927.92	441231.68	N 59 28 41.997	E 1 57 45.701
2043.28	2.45	118.13	2042.53	30.70	-22.60	20.88	0.27	6593927.40	441232.77	N 59 28 41.981	E 1 57 45.770
2071.07	2.68	127.21	2070.29	31.87	-23.28	21.92	0.50	6593926.73	441233.81	N 59 28 41.960	E 1 57 45.837
2101.11	2.69	132.51	2100.30	33.25	-24.18	23.00	0.25	6593925.83	441234.89	N 59 28 41.931	E 1 57 45.907
2129.79	2.82	140.07	2128.95	34.62	-25.17	23.95	0.40	6593924.84	441235.84	N 59 28 41.900	E 1 57 45.968
2157.16	2.97	146.57	2156.28	36.00	-26.28	24.77	0.40	6593923.73	441236.66	N 59 28 41.864	E 1 57 46.021
2215.44	3.38	163.79	2214.47	39.09	-29.19	26.08	0.53	6593920.82	441237.97	N 59 28 41.771	E 1 57 46.107
2243.29	3.84	169.47	2242.27	40.67	-30.90	26.48	0.63	6593919.11	441238.37	N 59 28 41.716	E 1 57 46.135
2280.00	3.84	169.47	2278.90	42.84	-33.31	26.93	0.00	6593916.70	441238.82	N 59 28 41.638	E 1 57 46.165

24/9-7A

Vertical Section Azimuth: 3.59º (Grid)
Vertical Section Origin: N 0.000 m, E 0.000 m (24/9-7)

								Grid Coordinates		Geographic Coordinates	
MD (m)	Incl (°)	Azim (°)	TVD (m)	VSec (m)	N/-S (m)	E/-W (m)	DLS °/30m	Northing (m)	Easting (m)	Latitude	Longitude
1466.76	2.20	112.35	1466.38	-20.36	-20.45	0.94	0.40	6593929.55	441212.84	N 59 28 42.041	E 1 57 44.502
1494.22	3.21	95.20	1493.81	-20.55	-20.72	2.19	1.40	6593929.28	441214.09	N 59 28 42.032	E 1 57 44.582
1522.88	5.32	45.98	1522.40	-19.59	-19.87	3.95	4.22	6593930.13	441215.85	N 59 28 42.061	E 1 57 44.693
1580.16	7.27	19.60	1579.34	-14.14	-14.61	7.08	1.80	6593935.39	441218.97	N 59 28 42.232	E 1 57 44.886
1609.13	7.71	4.94	1608.06	-10.44	-10.95	7.86	2.02	6593939.05	441219.76	N 59 28 42.351	E 1 57 44.932
1638.25	7.87	358.34	1636.92	-6.50	-7.01	7.97	0.94	6593942.99	441219.87	N 59 28 42.478	E 1 57 44.935
1666.98	9.16	0.79	1665.33	-2.25	-2.76	7.94	1.40	6593947.24	441219.84	N 59 28 42.616	E 1 57 44.929
1695.81	12.55	4.56	1693.64	3.17	2.66	8.22	3.60	6593952.66	441220.12	N 59 28 42.791	E 1 57 44.942
1724.59	15.03	5.31	1721.59	10.03	9.49	8.82	2.59	6593959.49	441220.71	N 59 28 43.012	E 1 57 44.973
1753.06	16.92	4.86	1748.96	17.86	17.30	9.51	2.00	6593967.29	441221.41	N 59 28 43.265	E 1 57 45.009
1781.58	17.18	5.51	1776.22	26.22	25.63	10.27	0.34	6593975.62	441222.16	N 59 28 43.534	E 1 57 45.049
1810.35	21.58	359.78	1803.36	35.75	35.15	10.65	4.99	6593985.14	441222.55	N 59 28 43.842	E 1 57 45.064
1839.09	25.38	356.42	1829.72	47.14	46.59	10.25	4.20	6593996.57	441222.15	N 59 28 44.211	E 1 57 45.027
1897.84	30.89	1.45	1881.51	74.73	74.26	9.84	3.06	6594024.23	441221.74	N 59 28 45.105	E 1 57 44.974
1926.63	32.03	2.88	1906.07	89.75	89.27	10.41	1.42	6594039.24	441222.31	N 59 28 45.591	E 1 57 44.995
1954.35	31.49	1.89	1929.64	104.34	103.85	11.02	0.81	6594053.81	441222.92	N 59 28 46.062	E 1 57 45.019
1983.48	31.84	1.55	1954.43	119.62	119.13	11.48	0.40	6594069.09	441223.38	N 59 28 46.556	E 1 57 45.033
2013.31	32.13	2.66	1979.73	135.41	134.92	12.06	0.66	6594084.87	441223.96	N 59 28 47.066	E 1 57 45.054
2070.70	30.61	2.61	2028.73	165.28	164.77	13.44	0.79	6594114.71	441225.33	N 59 28 48.031	E 1 57 45.112
2099.93	29.31	3.03	2054.06	179.88	179.34	14.15	1.35	6594129.28	441226.05	N 59 28 48.503	E 1 57 45.143
2127.56	28.00	2.62	2078.30	193.13	192.58	14.81	1.44	6594142.51	441226.70	N 59 28 48.931	E 1 57 45.172
2157.07	25.28	2.04	2104.68	206.35	205.80	15.35	2.78	6594155.72	441227.24	N 59 28 49.358	E 1 57 45.193
2185.42	21.73	0.58	2130.67	217.65	217.10	15.62	3.81	6594167.02	441227.51	N 59 28 49.723	E 1 57 45.199
2214.38	20.07	359.62	2157.72	227.96	227.43	15.64	1.76	6594177.35	441227.53	N 59 28 50.057	E 1 57 45.190
2242.89	18.94	358.92	2184.60	237.45	236.95	15.52	1.21	6594186.86	441227.41	N 59 28 50.364	E 1 57 45.173
2255.18	18.75	359.73	2196.23	241.41	240.92	15.47	0.79	6594190.83	441227.37	N 59 28 50.493	E 1 57 45.166
2277.00	18.75	359.73	2216.89	248.41	247.93	15.44	0.00	6594197.84	441227.33	N 59 28 50.719	E 1 57 45.157

24/9-7B

Vertical Section Azimuth: 149.68º (Grid)
Vertical Section Origin: N 0.000 m, E 0.000 m (24/9-7)

								Grid Coordinates		Geographic Coordinates	
MD (m)	Incl (°)	Azim (°)	TVD (m)	VSec (m)	N/-S (m)	E/-W (m)	DLS °/30m	Northing (m)	Easting (m)	Latitude	Longitude
1033.31	0.89	278.83	1033.13	7.38	-12.45	-6.66	0.28	6593937.55	441205.24	N 59 28 42.295	E 1 57 44.011
1061.95	1.16	196.24	1061.77	7.44	-12.70	-6.96	1.43	6593937.31	441204.94	N 59 28 42.287	E 1 57 43.992
1091.28	6.77	155.63	1091.02	9.37	-14.56	-6.33	6.07	6593935.45	441205.57	N 59 28 42.227	E 1 57 44.034
1119.89	9.37	156.78	1119.34	13.36	-18.23	-4.72	2.73	6593931.77	441207.18	N 59 28 42.109	E 1 57 44.140
1148.59	11.42	154.97	1147.57	18.51	-22.96	-2.60	2.17	6593927.05	441209.31	N 59 28 41.958	E 1 57 44.280
1178.91	13.03	155.87	1177.20	24.89	-28.80	0.07	1.60	6593921.21	441211.97	N 59 28 41.771	E 1 57 44.455
1205.94	14.36	155.75	1203.46	31.26	-34.63	2.69	1.48	6593915.38	441214.59	N 59 28 41.583	E 1 57 44.628
1235.10	16.51	157.07	1231.57	38.96	-41.75	5.79	2.24	6593908.27	441217.69	N 59 28 41.355	E 1 57 44.831
1265.27	19.20	157.95	1260.28	48.12	-50.29	9.33	2.69	6593899.72	441221.22	N 59 28 41.081	E 1 57 45.064
1293.02	20.98	157.74	1286.34	57.56	-59.12	12.92	1.93	6593890.90	441224.82	N 59 28 40.797	E 1 57 45.301
1322.65	23.31	156.90	1313.79	68.63	-69.43	17.23	2.38	6593880.60	441229.13	N 59 28 40.467	E 1 57 45.585
1350.29	25.87	157.15	1338.92	80.03	-80.01	21.72	2.78	6593870.01	441233.61	N 59 28 40.127	E 1 57 45.881
1379.01	27.25	154.21	1364.61	92.80	-91.71	27.02	1.99	6593858.32	441238.91	N 59 28 39.751	E 1 57 46.229
1408.94	29.37	151.54	1390.96	106.97	-104.33	33.49	2.47	6593845.70	441245.38	N 59 28 39.347	E 1 57 46.653
1436.64	29.65	149.15	1415.06	120.61	-116.19	40.25	1.31	6593833.85	441252.13	N 59 28 38.967	E 1 57 47.093
1465.79	29.48	147.65	1440.42	134.99	-128.44	47.78	0.78	6593821.61	441259.66	N 59 28 38.575	E 1 57 47.584
1495.11	29.22	146.78	1465.97	149.35	-140.52	55.56	0.51	6593809.53	441267.44	N 59 28 38.189	E 1 57 48.090
1523.36	29.23	147.44	1490.63	163.13	-152.10	63.05	0.34	6593797.95	441274.93	N 59 28 37.818	E 1 57 48.577
1553.13	28.89	148.37	1516.65	177.58	-164.35	70.74	0.57	6593785.71	441282.61	N 59 28 37.426	E 1 57 49.077
1580.67	29.21	148.44	1540.73	190.95	-175.74	77.74	0.35	6593774.32	441289.61	N 59 28 37.062	E 1 57 49.533
1610.22	29.37	149.37	1566.50	205.40	-188.12	85.21	0.49	6593761.95	441297.08	N 59 28 36.666	E 1 57 50.020
1638.45	29.81	149.16	1591.05	219.34	-200.10	92.33	0.48	6593749.97	441304.20	N 59 28 36.282	E 1 57 50.484
1668.60	29.61	149.06	1617.23	234.29	-212.92	100.00	0.21	6593737.15	441311.87	N 59 28 35.872	E 1 57 50.984
1696.48	29.16	149.01	1641.53	247.96	-224.66	107.04	0.48	6593725.43	441318.90	N 59 28 35.496	E 1 57 51.442
1726.11	28.72	148.52	1667.46	262.30	-236.91	114.48	0.51	6593713.17	441326.33	N 59 28 35.104	E 1 57 51.927
1754.99	28.57	148.66	1692.80	276.14	-248.73	121.69	0.17	6593701.36	441333.55	N 59 28 34.726	E 1 57 52.396
1783.70	29.12	148.13	1717.95	289.99	-260.53	128.95	0.63	6593689.57	441340.80	N 59 28 34.348	E 1 57 52.869
1812.42	29.63	148.31	1742.98	304.07	-272.50	136.37	0.54	6593677.60	441348.22	N 59 28 33.965	E 1 57 53.352
1839.77	29.48	149.81	1766.77	317.56	-284.07	143.31	0.83	6593666.03	441355.15	N 59 28 33.595	E 1 57 53.804
1871.45	29.41	151.31	1794.36	333.13	-297.63	150.96	0.70	6593652.47	441362.81	N 59 28 33.160	E 1 57 54.303
1899.82	28.75	149.16	1819.15	346.92	-309.60	157.80	1.31	6593640.51	441369.65	N 59 28 32.777	E 1 57 54.750
1918.06	28.40	149.67	1835.17	355.64	-317.11	162.24	0.70	6593633.00	441374.08	N 59 28 32.537	E 1 57 55.039
1949.85	28.45	148.91	1863.13	370.77	-330.12	169.97	0.34	6593619.99	441381.81	N 59 28 32.120	E 1 57 55.543
1975.54	28.22	149.81	1885.74	382.97	-340.61	176.18	0.57	6593609.51	441388.02	N 59 28 31.785	E 1 57 55.948
2006.51	27.35	149.76	1913.14	397.40	-353.09	183.45	0.84	6593597.04	441395.28	N 59 28 31.385	E 1 57 56.421
2036.08	26.02	147.65	1939.56	410.68	-364.44	190.34	1.66	6593585.69	441402.17	N 59 28 31.022	E 1 57 56.870
2065.19	25.33	148.83	1965.79	423.29	-375.16	196.98	0.88	6593574.97	441408.81	N 59 28 30.679	E 1 57 57.302
2094.96	23.72	148.86	1992.88	435.64	-385.73	203.37	1.62	6593564.40	441415.20	N 59 28 30.340	E 1 57 57.719
2124.06	22.21	150.04	2019.67	446.99	-395.51	209.15	1.63	6593554.63	441420.97	N 59 28 30.027	E 1 57 58.095
2152.65	20.01	152.79	2046.34	457.28	-404.54	214.08	2.53	6593545.60	441425.91	N 59 28 29.738	E 1 57 58.417
2180.21	18.05	155.71	2072.39	466.24	-412.63	218.00	2.37	6593537.52	441429.82	N 59 28 29.479	E 1 57 58.674
2209.22	16.21	158.68	2100.12	474.71	-420.50	221.32	2.11	6593529.65	441433.14	N 59 28 29.226	E 1 57 58.893
2219.05	15.45	159.42	2109.57	477.35	-423.00	222.28	2.40	6593527.15	441434.10	N 59 28 29.146	E 1 57 58.956
2230.00	15.45	159.42	2120.13	480.23	-425.73	223.30	0.00	6593524.42	441435.12	N 59 28 29.058	E 1 57 59.024

24/9-7C

Vertical Section Azimuth: 40.20º (Grid)
Vertical Section Origin: N 0.000 m, E 0.000 m (24/9-7)

								Grid Coordinates		Geographic Coordinates	
MD (m)	Incl (°)	Azim (°)	TVD (m)	VSec (m)	N/-S (m)	E/-W (m)	DLS °/30m	Northing (m)	Easting (m)	Latitude	Longitude
940.17	0.54	223.66	939.99	-13.12	-12.33	-5.73	0.08	6593937.67	441206.17	N 59 28 42.300	E 1 57 44.070
1019.73	4.28	41.54	1019.49	-10.52	-10.38	-4.02	1.82	6593939.62	441207.88	N 59 28 42.364	E 1 57 44.177
1047.30	8.62	40.02	1046.88	-7.43	-8.03	-2.01	4.73	6593941.98	441209.89	N 59 28 42.441	E 1 57 44.302
1076.40	12.71	36.74	1075.47	-2.05	-3.79	1.31	4.26	6593946.21	441213.21	N 59 28 42.579	E 1 57 44.509
1105.17	16.69	35.43	1103.29	5.23	2.12	5.60	4.16	6593952.11	441217.50	N 59 28 42.772	E 1 57 44.776
1134.05	20.38	36.63	1130.67	14.38	9.53	11.01	3.85	6593959.53	441222.90	N 59 28 43.015	E 1 57 45.112
1162.91	24.22	37.79	1157.37	25.32	18.25	17.63	4.02	6593968.24	441229.53	N 59 28 43.299	E 1 57 45.524
1193.12	27.66	40.34	1184.53	38.53	28.49	25.97	3.59	6593978.48	441237.86	N 59 28 43.635	E 1 57 46.043
1220.67	30.75	43.21	1208.58	51.96	38.50	34.94	3.69	6593988.49	441246.82	N 59 28 43.963	E 1 57 46.603
1249.60	32.97	44.38	1233.15	67.20	49.52	45.51	2.39	6593999.50	441257.39	N 59 28 44.324	E 1 57 47.263
1278.03	35.08	45.03	1256.71	83.05	60.82	56.70	2.26	6594010.80	441268.58	N 59 28 44.695	E 1 57 47.963
1306.71	37.18	45.55	1279.87	99.90	72.72	68.72	2.22	6594022.69	441280.59	N 59 28 45.085	E 1 57 48.714
1335.04	39.61	43.90	1302.07	117.44	85.22	81.09	2.79	6594035.19	441292.96	N 59 28 45.495	E 1 57 49.488
1365.02	40.14	43.72	1325.08	136.62	99.09	94.40	0.54	6594049.06	441306.27	N 59 28 45.950	E 1 57 50.319
1393.39	39.75	43.17	1346.83	154.80	112.32	106.92	0.56	6594062.28	441318.79	N 59 28 46.384	E 1 57 51.102
1422.12	40.11	42.46	1368.86	173.22	125.85	119.46	0.61	6594075.80	441331.31	N 59 28 46.827	E 1 57 51.884
1450.98	40.25	39.59	1390.91	191.84	139.89	131.68	1.93	6594089.84	441343.53	N 59 28 47.287	E 1 57 52.646
1479.96	40.06	35.90	1413.07	210.50	154.66	143.11	2.47	6594104.61	441354.96	N 59 28 47.770	E 1 57 53.358
1508.82	39.90	35.37	1435.18	228.99	169.73	153.92	0.39	6594119.67	441365.76	N 59 28 48.262	E 1 57 54.029
1536.47	40.03	35.26	1456.37	246.68	184.22	164.18	0.16	6594134.16	441376.02	N 59 28 48.736	E 1 57 54.667
1565.29	39.54	35.28	1478.52	265.06	199.28	174.83	0.51	6594149.21	441386.67	N 59 28 49.228	E 1 57 55.328
1593.98	39.58	34.70	1500.64	283.25	214.25	185.31	0.39	6594164.17	441397.14	N 59 28 49.717	E 1 57 55.979
1623.99	39.50	36.54	1523.78	302.29	229.78	196.43	1.17	6594179.70	441408.26	N 59 28 50.224	E 1 57 56.670
1651.58	39.91	39.00	1545.01	319.90	243.71	207.23	1.77	6594193.62	441419.06	N 59 28 50.679	E 1 57 57.342
1680.40	40.83	42.85	1566.97	338.56	257.80	219.46	2.77	6594207.71	441431.28	N 59 28 51.141	E 1 57 58.105
1737.83	41.70	44.61	1610.14	376.36	285.17	245.64	0.76	6594235.07	441457.45	N 59 28 52.038	E 1 57 59.741
1766.49	41.57	44.94	1631.56	395.34	298.68	259.05	0.27	6594248.58	441470.86	N 59 28 52.482	E 1 58 0.579
1795.13	42.53	42.92	1652.83	414.48	312.50	272.36	1.74	6594262.39	441484.16	N 59 28 52.935	E 1 58 1.411
1825.07	43.48	42.16	1674.72	434.88	327.55	286.16	1.08	6594277.43	441497.96	N 59 28 53.428	E 1 58 2.273
1852.92	43.95	40.07	1694.85	454.13	342.05	298.82	1.64	6594291.92	441510.61	N 59 28 53.903	E 1 58 3.062
1881.38	43.97	37.73	1715.34	473.87	357.42	311.22	1.71	6594307.29	441523.01	N 59 28 54.406	E 1 58 3.835
1910.08	43.54	37.65	1736.07	493.70	373.12	323.36	0.45	6594322.99	441535.14	N 59 28 54.919	E 1 58 4.590
1939.55	43.50	37.85	1757.44	513.98	389.17	335.78	0.15	6594339.03	441547.56	N 59 28 55.444	E 1 58 5.363
1967.76	43.51	36.71	1777.90	533.37	404.62	347.54	0.83	6594354.48	441559.32	N 59 28 55.949	E 1 58 6.095
1996.32	43.28	36.83	1798.65	552.96	420.34	359.29	0.26	6594370.19	441571.06	N 59 28 56.463	E 1 58 6.826
2025.27	42.65	37.88	1819.84	572.66	436.02	371.26	0.99	6594385.87	441583.02	N 59 28 56.975	E 1 58 7.571
2053.89	41.77	35.79	1841.04	591.86	451.41	382.79	1.74	6594401.25	441594.55	N 59 28 57.478	E 1 58 8.288
2082.96	40.36	36.77	1862.96	610.91	466.81	394.08	1.60	6594416.64	441605.84	N 59 28 57.981	E 1 58 8.990
2112.20	39.76	37.05	1885.34	629.70	481.85	405.39	0.64	6594431.68	441617.14	N 59 28 58.473	E 1 58 9.693
2140.73	39.18	37.44	1907.36	647.81	496.29	416.36	0.66	6594446.11	441628.11	N 59 28 58.945	E 1 58 10.376
2170.34	38.63	40.05	1930.40	666.39	510.79	428.00	1.75	6594460.61	441639.74	N 59 28 59.419	E 1 58 11.101
2197.93	38.20	42.19	1952.02	683.53	523.71	439.27	1.52	6594473.52	441651.01	N 59 28 59.842	E 1 58 11.804
2227.61	38.32	44.34	1975.33	701.88	537.09	451.86	1.35	6594486.89	441663.60	N 59 29 0.281	E 1 58 12.591
2255.55	40.09	44.16	1996.98	719.50	549.74	464.18	1.90	6594499.54	441675.92	N 59 29 0.696	E 1 58 13.361

								Grid Coordinates		Geographic Coordinates	
MD (m)	Incl (°)	Azim (°)	TVD (m)	VSec (m)	N/-S (m)	E/-W (m)	DLS °/30m	Northing (m)	Easting (m)	Latitude	Longitude
2284.58	41.69	42.12	2018.92	738.47	563.61	477.17	2.15	6594513.40	441688.90	N 59 29 1.150	E 1 58 14.172
2313.26	41.93	40.30	2040.30	757.59	577.99	489.77	1.29	6594527.78	441701.49	N 59 29 1.621	E 1 58 14.958
2340.29	39.08	39.96	2060.85	775.14	591.41	501.08	3.17	6594541.20	441712.80	N 59 29 2.061	E 1 58 15.664
2363.00	39.08	39.96	2078.48	789.46	602.38	510.28	0.00	6594552.35	441722.18	N 59 29 2.420	E 1 58 16.237

Appendix B – Mudlogging Details

For complete details of the equipment and service provided please refer to the Mudlogging Contractors Contract.

Mudlogging Company	Baker Hughes INTEQ	
Personnel		
Data Engineers	D. Vagnby, J. Sisniegas, C. Siad, E. Andresen, S. Lupton	
Mudloggers	M. Farooqui, A.E. Wathne, J. Ivarsson, K. Mikkelsen, K. Øksnes, S. Svensen.	
Operations Managers	Frank Johnsen, Svein Kårtveit	
Sampling		
Unwashed	1 set (1kg): MPC(N) for split to partners and NPD	
Washed and Dried	1 set (envelope)	
Intervals of collection		
24/9-7	10 meter intervals from 960 to 1750m	
	3 meter intervals from 1750 to 2100m	
	5 meter intervals from 2100 to 2280m	
24/9-7A	10 meter intervals from 1450 to 1800m	
	3 meter intervals from 1800 to 2100m	
	5 meter intervals from 2100 to 2277m	
24/9-7B	10 meter intervals from 1040 to 1800m	
	3 meter intervals from 1800 to 2100m	
	5 meter intervals from 2100 to 2230m	
24/9-7C	10 meter intervals from 1000 to 2100m	
	5 meter intervals from 2100 to 2300m	
	5 meter intervals from 2300 to 2363m	
Logs produced		
	Formation Evaluation Log (mud log)	Scale 1: 500
	Engineering Log	Scale 1: 500
	Pressure Evaluation Log	Scale 1: 1000
	Gas Ratio Log	Scale 1: 5000

Appendix C – LWD and Directional Details

For complete details of the equipment and service provided please refer to the LWD Service Company Contract.

LWD Company	Schlumberger D&M
Personnel	
MWD Engineers	Grant Skinner, Irfan Parvez, Maarten Middleburg, Eivind Hinna, Carlos Venegas, Paal Rune Groenaas
LWD Engineer	Dag Hinnaland
Field Service Manager	Tarjei Johansen
Logs produced	
24/9-7	1:200 & 1:500 GR (MD), 205m – 590m MD
	1:200 & 1:500 GR/ARC/RAB6 resistivity, plus RAB images (MD), 940m – 2274m MD
24/9-7A	1:200 & 1:500 GR/ARC/RAB6 resistivity, plus RAB images (MD+TVD), 1485m – 2271m MD
24/9-7B	1:200 & 1:500 GR/ARC/RAB6 resistivity, (MD+TVD), 1050m – 2219m MD
24/9-7C	1:200 & 1:500 GR/ARC/ADN, (MD+TVD), 975m – 2353m MD

Appendix D – Wireline Logging Time Breakdown

Baker Atlas provided wireline logging services on rig Deepsea Delta (for complete details of the equipment and service provided please refer to the Wireline Service Company Contract). A base support operations manager was provided to Marathon, Jan Eric Sele, and the manager in overall charge of Marathon's account was Nick Beeson. The logging time breakdown is shown below with a summary comments section regarding problems encountered in each tool run included.

24/9-7

Date	Time	Lost Time	Operation
			Run 1A: GR-HDIL-ZDL-CND-XMAC
17.3.04	17:00		Start RU
	19:50		Install sources
	20:00		RIH
	21:05		Go into open hole, acquire safety log while RIH.
	22:40		At 2250m, set up for repeat section over top of Heimdal sand.
	22:57		Cont RIH
	23:00		Start repeat section from 2270m. Logging speed <5m/min.
	23:30		Stop repeat with all curves to 2150m. RIH to TD
17.3.04	23:45		Start main log up (from provisional logger's TD of 2280m).
18.3.04	00:15		Logging speed limited to under 5 m/min due to data acquisition speed of hardware. Several times had to slow down due to buffer overrun while trying to print repeat section – decided to wait until cased hole for print.
			Large Dens/neutron separation in main reservoir – check for gas separation?
			High neutron por readings (>50pu) in Hordaland
			Grid sands partially washed out up to 11.5".
	04:40		Top of tool in shoe. 6m rathole under shoe with Cal readings up to 21".
	04:50		Stop with all toolstring inside shoe. Close Cal and drop 50m to set up for logging inside casing.
	05:00		Restart up log from 963m and log GR sonic and neutron inside casing.
	06:40		Finished logging, POOH
	08:10		OOH, start rigging down
	10:00		Finish R/D
			Total operating time: 17 hrs 0 min
			Lost time: nil
			Run 2: RCI-GR, run # 1A
	10:00		Start RU
	12:00		Tool failure on surface, trouble shoot and changed electronics cartridge
	13:45		Failure in depth system, troubleshoot
	16:00		Depth system OK, but tension system not OK. Trouble shooting. Had to bypass filter junction box.
	19:20		RIH
	19:40		Set compensator. Cont RIH
	20:10		At shoe. Stop for temperature stabilization (20 min)
	20:30		Move into open hole and first pressure test level.
	21:15		Tie in from 1850m – add 3m. Move to first level and yoyo cable while waiting for tool stabilization.
	21:40		Start first test – bad seal. The Linear Motion Potentiometer (LMP) on the drawdown pump was unstable from the start and this is needed for accurate mobility readings.
	22:15		Discussion with town - decided to continue with logging program using large drawdown pump as mobility can be calculated later using onshore facilities.
	22:20		Reconfigure software
	22:35		Recommenced logging at 1825.5m.

			Problems with seal failures on highest levels. Suspected supercharging at 1879m
18.3.04	23:50		Took a second drawdown during testing at 1880m which resulted in a lower formation pressure. -
19.3.04	00:00		Retry 1878.5m – drew down 3 times, started with 196bar and ended with 200bar.
	00:13		First test in good sand at 1883m. Prior to this had speculated that anomalous results could be due to thin isolated sands. Now expected to obtain a consistent fluid gradient.
	00:30		Tool crashed during test – restarted tool OK within 7 min (tool still set) but lost data. Abandoned level.
	00:45		Continue at 1886m
	01:45		After 1891m had data set over upper sand which showed considerable scatter but also indicated 2 parallel trends separated by a possible pressure barrier at 1889.5m. However the gradient was totally unrealistic (22-35), consulted town and decided to move to oil leg to see if possible to get data from there prior to possible POOH for troubleshooting.
	02:22		Moved back and repeated 1891m obtaining Fm press increase from 217.2 to 222.3 bar.
	02:30		Move to oil zone at 1963.5m. To save time attempt test without checking depth but had no seal.
	02:45		Tie in at 1985m – 1m shallow.
	03:20		First test in oil sand at 1963.5 gave 195bar – more like expected values. Atlas now suspects that there may be gas trapped inside the tool - continued with periodic flushing of the flowlines but results still inconsistent (could not establish good gradient in "oil sand")
	04:17		Atlas concluded that there was gas in the tool.
	04:32		After consultation, instructed Atlas to abandon logging and POOH.
	05:50		Tools at surface.
	08:30		Finish rig down
			Total operating time: 22 hrs 30 min
			Lost time: 22 hrs 30 min:
			Run 3, RCI - GR, run # 1B
	08:30		Start RU
	09:45		Cable head on tool, start checking
	10:19		RIH
	10:24		Compensator on
	10:44		Stop @ 914m to stabilize tool
	11:13		Continue through shoe
	11:55		Stop @ 2025m to tie in on depth
	12:02		Stopped tie in @1975m, shifted down 0.8m, PU to first pressure point @ 1967m
	12:04		Set packer @1967m, repeated 3 drawdowns. Good mobility (2.1 Darcy).
	12:11		Retracted and moved on to next point @ 1965m
	12:13		Set packer @1965m, repeated 4 drawdowns. Good mobility (2.6Darcy)
	12:28		Retracted and moved on to next point @ 1963.5m
	12:34		Set packer @ 1963.5m, repeated 4 drawdowns. Good mobility (Darcy)
	12:42		Retracted and moved on to next point @ 1888m
	12:57		Set packer @ 1888m, repeated 4 drawdowns. Good mobility (2.9 Darcy)
	13:10		Retracted and moved on to next point @ 1886m
	13:14		Set packer @ 1886m, repeated 3 drawdowns. Good mobility .(Darcy)
	13:22		Retracted and moved on to next point @ 1884m
	13:25		Set packer @ 1884m, repeated 3 drawdowns. Good mobility .(Darcy)
	13:49		RIH to 1965m
	14:05		Set packer @ 1965m
	14:14		Started cleanup
	15:00		Switched to bigger pump (500 cc / stroke)
	15:55		Started sampling in PVT chamber #1
	16:16		Started sampling in PVT tank #2
	16:19		Tank #2 full, open PVT tank # 3
	16:23		Tank # 3 full, open PVT tank # 4
	16:28		Tank # 4 full, start clean up

	16:35		Finished clean up, start sampling in 10 litre chamber. Saw no pressure build up for filled chamber. Suspect a leakage in "Lower borehole Exit"
	18:42		Stopped filling 10 litre tank, and tried for 20l tank instead
	19:54		20l pumped into 20 l chamber, still 200-700psi pumping pressure
	20:17		25l pumped into 20 l chamber, still 200-700psi pumping pressure. Possibly gas in pump. Flowlines were checked to be tight before start of sampling.
	20:27	20:25 - 20:30	27.5l pumped. Close chamber to check for leaks. Pump did not stall so leak in lines. Re-close borehole exits on lines past chambers – pump stalled proving lines now tight.
	20:31		Resume pumping to 20l chamber
	20:35		Noticed occasional flashes of water on optical sample viewer
	20:41		"L" gauge drawdown changed from 190 to 92 bar indicating probe plugging. Close 20gal chamber and stop pumping. Gauge drops to -513bar - suspect dead. Open borehole exit and see pressure drop on K gauge while L (main) gauge still stuck at –513bar.
	20:50		Cont. pumping to borehole exit as optical viewer indicates slight contamination. Cleaned up quickly. Suspect probe is plugging.
	21:02		Test lines – motor stalls indicating no leaks.
	21:03		Open single phase chamber #1 to acquire a safety sample in case of tool problems.
	21:05		Chamber full (490cc to fill)
	21:06		Start bubble point analysis of formation fluid (oil). Decided to first try faster simple method (without overpressuring sample)
	21:10		L gauge came back to life – reads 195bar
	21:20		Pump piston stalling while filling pump with Fm fluid prior to stroking piston for bubble point test.
	21:25		Dave - may want samples in gas zone - will call to confirm
	21:29		Acquire bubble point test – but not good test – rate too fast?
	21:35		New test acquired – this time too slow
	21:40		New test acquired – too slow again but indicates we do need to pressurize sample first.
	21:49		Good Bubble point test acquired – analyse data to check OK
	21:55		Bubble point at 1965m: 135.89bar at 73.24deg C
	21:58		Dave: Samples to be sent in on boat not helicopter. 1 PVT gas sample to be taken at 1886m and 1 at 1906.5m MD
	22:05		Clean up again prior to continuing sampling.
	22:09	22:10 - 23:30	Checked lines tight – start topping up 20l chamber
	22:12		Pump immediately stalled indicating 20l ch full – suspicious that this happened immediately upon re-commencing pumping but go to single phase sampling.
	22:13		Open single phase # 2 – pump stalled after 2 strokes – suspect pressure lock
	22:15		Cleared pump and cont. filling #2. Noticed "L" gauge no longer working – stuck on 195 bar. "K" gauge is OK but, as is at a different level in the tool, it measures at a different TVD to the probe and thus the pressure readings will have a constant offset. Gradients will be, however, unaffected. Drawdown pump repeatedly stalls out after 2 strokes – investigate possible software glitch after bubble point procedure.
	22:24		Close chamber #2 and pump to borehole exit – still stalls
	22:27		Close all chambers and exits – still runs 2 cycles and stalls (but should stall at once in a closed system)
	22:30		Started large pump in closed system – stalled immediately as it should. Started small pump again - this time it stalled immediately as it should.
	22:32		Pump out of borehole exit to check pump but it did not start.
	22:36		Decided to use large pump to fill chambers.
	22:42		Large pump not behaving as should – only 1/3 of pressure it should have. Close chambers and pump to BH exit – same symptoms. Engineer thinks pump is working OK despite anomalous signals.
	22:47		Close BH exit – pump does not stall – failure or leak in line?
	22:56		Pump small pump against closed system – stops after 2 strokes again suggesting leak in system.
	23:04		Suspect software problem with small pump (consistently stops after 2 cycles). May be able to reboot without retracting tool.
	23:07		Pump against closed system with large pump – no stall. Conclusion: need to reset system.

	23:11		Recharge packer prior to shut down tool (at 23:12)
	23:16		Tool restarted again OK (still set against Fm.)
	23:23		Small pump working OK again
	23:26		Check for leaks using small pump – stalled OK.
	23:28		Cont. filling 20 l chamber. Top up single phase # 2
	23:39		Fill single phase # 3, full 23:41
	23:42		Fill single phase # 4, 23:44 pump stopped then started by itself – then stopped again. Pump seems to stop at one end after 2 strokes – so may be the same problem as before, - possibly a pressure lock. Manually force new strokes. Chamber full 23:49.
	23:50		Fill single phase # 5 using big pump, full 23:51
	23:52		Fill single phase # 6 using big pump, full 23:53
19.3.04	23:57		Finish sampling Final formation pressure at 1965m MD/1953.3mTVDSS: 195.225bar
20.3.04	00:01		Retract packer, cycle large pump to get hydrostatic to read on K gauge.
	00:08		Clean up tool.
	00:40	00:40 - 01:05	At 2054m to take mud bubble point in uncontaminated mud.
	00:48		Small pump: having trouble getting pump to move in right direction. Will not react to commands as expected – constantly reverses direction.
	01:07		Abandon Mud bubble point test after consultation with Dave RIH to take Fm press tests in Heimdal while Dave confers.
	01:13		Tie in from 2200m, 0.8m shallow. Dave: take 9+ pressure pts + 2 gas PVT samples.
	01:21		On depth @ 2195m – 5 min for temp stabilisation.
	01:34		Start pressure points. Using small pump. 2 drawdowns taken on all tests to ensure best results. Establish water gradient 1.044
	02:10		Move to oil zone. Tie in at 2010m. Need to activate packer several times before the tool will finally set against the borehole - Flush lines between each test to minimise chance of getting gas in system.
	05:00		Try to plot first 3 gas points – find that the stored curves have changed / become incomplete. Final pressure at 1909.5m has changed from 192.060 to 191.985. Decide to redo.
	05:45		Finish pressure tests.
	05:47		At 1905.6m, start cleanup for sampling
	06:20		Start sampling gas at 1905.6m in PVT chamber # 5. (Problems to see stall out even if tank should be full). Tried to close everything to see stall out – OK
	06:41		Opened PVT chamber # 6, full 06:48 POOH taking original pressure points on way out.
	07:15		Start tie in
	07:40		1m shallow; add 1m.
	07:47		Pick up to 1883 for first press pt. Flush lines.
	07:57		Set packer. Tried 2 drawdowns. Dubious test.
	08:20		Set packer at 1885m. Good test.
	08:36		Finished pressure tests in order to be out of hole with samples when boat available to transport them to land. POOH
	10:15		OOH, start rig down RCI tool run # 2
	11:30		Finished rig down, started taking out sample chambers
	13:30		Start empty 10l & 20l tanks from 1965m MD / 1935.3m TVD SS
			10 litre tank: Opening pressure 1100 psi
			15.8 cu ft gas
			6 litres of oil, colour: brownish black
			20 litre tank: Opening pressure 400 psi
			12 cu ft gas
			4.4 litres oil, colour: brownish black
			Specific gravity of oil: 0.83 sg (measured by mud engineer)

			Analysis of gas sample from 20 tank: (Injected directly from balloon)
			C1 – 1048458 C1/C2 C1/C3 C1/C4 C1/C5 GWR LHR OCQ
			C2 - 73719 14.2 49.1 128.4 444.23 9.1 35.1 0.49
			C3 - 21359
			iC4 - 3066
			nC4 - 5116
			iC5 - 1220
			nC5 - 1140
			All sample chambers and bottles with oil from 10 litre and 20 litre tanks sent with Northern Challenger in container AMB 846
			Tank Summary:
			Upper 6 tank carrier 1970WA - 10107899
			Slot # 1 SPS Tank # 10089192 480 bar Depth 1965m MD / 1935.3m TVD SS
			Slot # 2 SPS Tank # 10089193 a/a
			Slot # 3 SPS Tank # 10089194 a/a
			Slot # 4 SPS Tank # 10089195 a/a
			Slot # 5 SPS Tank # 10089196 a/a
			Slot # 6 SPS Tank # 10089197 a/a
			Lower 6 Tank carrier 1970WA - 10072969
			Slot # 1 PVT Tank # 10047688 480 bar Depth 1965m MD / 1935.3m TVD SS
			Slot # 2 PVT Tank # 10047691 a/a
			Slot # 3 PVT Tank # 10047696 a/a
			Slot # 4 PVT Tank # 10047697 a/a
			Slot # 5 PVT Tank # 10047698 480 bar Depth 1906.5m MD / 1876.9m TVD SS
			Slot # 6 PVT Tank # 10047699 480 bar Depth 1906.5m MD / 1876.9m TVD SS
	16:45		
			Total operating time: 32 hrs 15 min
			Lost time: 2 hrs 20 min
			RUN 4: RCI-GR, run # 1C
	16:45		Start RU 3 rd run RCI, run # 1 C
	18:10		Start checking tools on surface
	18:55	18:55 - 19:25	Discovered dubious signals from BB pump that has been in hole during 2nd RCI run. Take it off and check backup BB pump which came by boat today. – approx. 30 min lost.
	20:00		Testing tools
	21:00		Finished testing tools. Start RIH
	22:10		At 100m, set compensator
	21:25		RIH. Stop in shoe for 30 min temperature stabilisation.
	22:30		Run into open hole
	22:55 6		Start tie in from 1888m – 1.5m deep.
	23:05		At first level 1825.9m. 20 deg temp difference from last run –yo-yo cable and wait for temp stabilisation.
	23:34		Stable temp. start logging at 1825.9m. Generally 10cc drawdown. Reduced to 5cc and even 2 cc at tight levels. Flush lines between each level. Take 2 drawdowns at each level. If not stable or not expected pressure, take more until stable pressure obtained. Frequently noticed stabilisation down over after first drawdown. Usually stabilised up over after second drawdown.
20.3.04	23:48		Bad seal at first level – reset tool
21.3.04	01:50		Check tie in from 2000m – 0.3m shallow
	03:05		Except for topmost level, Gas zone points approximate to a common 0.162 gradient. Will retake top level on way out. Re-take uppermost and lowermost oil zone levels as points.10, 11, 12 and 13 lie on a water gradient (0.938). Both points moved significantly and the scatter of points thus produced fit better an oil gradient. This scatter over a very restricted TVD

			probably represents the limits of precision for this combination of formation, fluid and equipment.
	03:26		Move back to re-try the tight level at 1923.5 which is near the projected GOC
	03:42		Attempt tight level using 5cc drawdown – no go
	03:45		Check tie in - on depth
	03:53		At 1923.3m, Used 2cc drawdown to avoid excessive drawdown. Made repeated 2cc drawdowns until pressure stabilised at expected (projected gas gradient) level, then made more drawdowns to ensure that pressure thus obtained was genuine Fm press. Final value lay just below the projected 0.162 gradient
	04:10		Finish pressure testing (except for 1823.5m which should be re-tested on the way out after sampling). Move to 1965m for sampling.
	04:23	04:25 - 04:40	Sample view program hanging. Re-boot software.
	04:30		Back online. Set up for sampling.
	04:56		Extend packer for initial pressure test at 1965m
	05:02		Start cleanup
	05:56		Stable optical readings indicating clean oil for approx 30 min. Have pumped 13.3l fluid.
	05:57		Start sampling into 10l chamber. Sampling pressure 195-189bar
	06:15		Optical readings indicate contaminations while sampling. Try to clean up. Pumped 13.4 litres. Possible leakage around packer. Moved 0.5m up to 1964.5mMD / 1934.8m TVD SS.
	06:43		Set packer @ 1964.5m. No good draw down. Possible plugging of tool. Aborted pressure test.
	06:55		Pumped reverse with BB and RB. Open / close packer several times to clean lines
	07:10		Continued to cycle extend / retract packer to attempt to clean lines, pumping through tool in up direction w/ BB and RB after each 3 extend/retract cycle.
	07:48		PU to 1955m to continue cleaning. No improvements pump stalled again. Found that blockage must be located to snorkel. Told town. Might go for sampling in gas zone first in case that could help.
	08:25		Drop down to 2020m to do correlation before try sampling gas
	08:52		Finished correlation, 0.2m shallow. Still plugged tool.
	09:00		Got message from town to POOH to run VSP first while trying to clean RCI tool or change parts of tool. POOH.
	09:45		OOH, start rig down
	12:30		Finished rig down
			Emptied 10 litre tank from 1965m MD / 1935.3m TVD SS
			10 litre tank: Opening pressure 150 psi
			3 cu ft gas
			1.1 litres of oil, colour: brownish black
			Analysis of gas sample from 10 tank: (Injected directly from balloon)
			C1 – 905784 C1/C2 C1/C3 C1/C4 C1/C5 GWR LHR OCQ
			C2 - 70201 17.06 43.75 185 4461.2 9.5 38 0.25
			C3 - 21225
			iC4 - 3469
			nC4 - 1594
			iC5 - 188
			nC5 - 15
			Total operating time: 19 hrs 45 min
			Lost time: 0 hrs 45 min
			Run # 5, VSP – GR, run # 1A
			Tool configured as: main tool with telemetry, hydraulic pump and GR, six SST500 geophones and one weight. The geophones are suspended on cables 10m apart and 10m below the main tool. The topmost geophone has a 16" setting arm for use within casing (checkshots) The 5 remaining geophones have 10" arms for use in open hole. All 6 geophones are recorded at all levels but only short arms are stacked in open hole while long arm only is stacked in casing. The bottom weight is

			8m below lowest geophone. Top geophone measure point is 10m below tool zero. Source: Buoyed 4 x 150cu. in. sleeve guns, 4m below SL Hydrophone: 2.5m below SL Gun offset: 40.3m at 131deg First run in hole was a misrun due to tool failure. Lost time calculated from first RIH on misrun to RIH on successful run.
	12::3 0		Started rig up
	14:19		Compensator on
	14:20	14:20 - 19:30	RIH to 455m, first checkshot
	14:30		@455m, did 10 shots, mostly noisy
	14:42		Closed arms and RIH to checkshot @955m
	14:54		@955m, did 3 good checkshots
	15:00		Closed arms and RIH to 1255m checkshot to cover for base Grid Fm @ 1271m
	15:10		@1255m, opened arms, did 3 good shots
	15:15		Closed arms and RIH to 2125m for GR tie in. Was 0.6m shallow.
	16:05		@ 2205m to open arms and start shooting.
			Pressure would not build up to more than 305 bars. (Should be 360 bars to indicate that arms were opened.) Tried several times, but no success.
	16:30		POOH to troubleshoot leak on tool before running in again.
	17:30		OOH, start to troubleshoot for leak. Arms on all 6 geophones are operated from a common hydraulic line which is pressured from the main tool. A leak anywhere in the system will cause all arms to fail.
	18:30		Found leak in second lowest station. Replaced same with backup and rigged up to RIH again.
	19:30		RIH (set compensator at 100m)
	20:05		Synchronise guns at first checkshot level. 955m, stack 3 of 3 shots
	20:10		RIH
	20:20		Second checkshot level: 1255m, stack 3 of 3 shots
	20:30		RIH
	20:45		Third checkshot level: 1855m, stack 3 of 3 shots
	20:51		RIH
	20:57		Tie in from 2130m. 0.5m shallow, add 0.5m.
	21:17		RIH to TD
	21:24		At 2205m, set tool for first level
	21:25		2205m, stack 5 of 5 shots, good signal, frequency response >150Hz
	21:33		2155m, stack 5 of 5 shots, good signal
	21:41		2105m, stack 5 of 5 shots, good signal, frequency response >120Hz
	21:49		2055m, stack 5 of 5 shots, good signal
	21:55		2005m, stack 5 of 5 shots, good signal, frequency response >110Hz
	22:01		1955m, stack 5 of 5 shots, good signal
	22:08		1905m, stack 5 of 6 shots, good signal, 1 bad telemetry shot, frequency response >100Hz
	00:13		1855m, stack 5 of 5 shots, good signal, frequency response >110Hz
	22:19		1805m, stack 5 of 5 shots, good signal
	22:24		Check tie in at 1775m: 0.8m shallow.
	22:34		1755m, stack 5 of 5 shots, good signal, frequency response >140Hz
	22:41		1705m, stack 5 of 5 shots, good signal
	22:46		1655m, stack 5 of 5 shots, good signal
			1605m, stack 5 of 5 shots, good signal
			1555m, stack 5 of 5 shots, good signal
	23:07		1505m, stack 5 of 5 shots, good signal, frequency response >160Hz
	23:16		1455m, stack 5 of 5 shots, good signal Last VSP level. Move 100m for checkshots in open hole.
	23:27		1355m, stack 5 of 5 shots, good signal

	23:35		1255m, stack 5 of 5 shots, good signal
	23:43		1155m, stack 5 of 5 shots, good signal, frequency response >150Hz
	23:51		1055m, stack 5 of 5 shots, good signal
21.3.04	23:58		955m, stack 5 of 5 shots, good signal
22.3.04	00:04		905m, stack 3 of 3 shots, good signal In casing Stack only top geophone and move 50m
	00:15		855m, stack 3 of 4 shots, good signal, frequency response >175Hz
	00:20		805m, stack 3 of 9 shots, noise starting
	00:27		755m, stack 3 of 5 shots, good signal
	00:32		705m, stack 3 of 9 shots, good signal
	00:39		655m, stack 3 of 8 shots, good signal
	00:46		605m, stack 3 of 11 shots, good signal
	00:54		555m, stack 3 of 12 shots, Casing ringing on top geophone, good first arrival below.
	01:03		505m, stack 3 of 11 shots, ?casing ringing
	01:14		455m, stack 3 of x shots, casing ringing
	01:22		405m, stack 0 of 1 shots, casing ringing
	01:24		POOH
	01:55		Tools at surface – start rig down
	03:00		Finish rig down
			Total operating time: 14 hrs 30 min
			Lost time: 5 hrs 10 min
			Run # 6, CBIL-Earth Imager-ORIT-GR-CHT, run # 1A
	03:00		Start rig up
	05:05		Finish making up tool string. Calibrate tools
	05:40		RIH (set compensator at 100m)
	06:20		At shoe, 932m. Check, set-up and calibrate tools.
	06:54		Move into open hole and drop towards 2100m.
	07:02		Stop and PU @ 980m to check tension. Readings were too low. Software related. Fixed it.
	07:11		RIH
	07:14		Back to 980m
	07:55		@ 1853m. Stop and set all parameters for logging. Adjusted depth: 0.2m shallow
	08:25		Closed arms and RIH
	08:42		@2120m. Prepare for logging, open arms, PU to control functions. Sonic do not give good signals.
	08:52		Start main log. Button #7 at pad #6 is almost “dead”. Logging speed: 2.5m/min.
	10:50		Finished main log with lowest sensor @ 1800m
	10:54		Closed tool and RIH for repeat.
	11:03		@1935m, opened arms and start repeat with highest sensor @ 1928m
	11:27		Finished repeat with deepest sensor @ 1875m
	11:28		Closed arms and POOH
	12:00		Stopped in shoe to verify tools
	12:10		Tools OK, continued POOH
	12:45		OOH, after verification of GR OK
	13:00		Started rig down
	14:00		Finished rigging down CBIL combination
			Total operating time: 11 hrs
			Lost time: nil
			RUN 7: RCI-GR, run # 1D
	14:00		Start RU
	15:30		Standby for rig crew while they had handover
	16:05		Continued RU
	16:50		Rig up finished, removed cable head, check cable head
	17:05		Check tool string

	17:44	17:45 – 21:10	Had to swap Telemetry, GR and Power adapter as signal not 100%
	18:20		Still initial problems, change EB
	18:45		RIH, 18:53 set compensator at 100m
	19:25		Lost communication with tool during RIH, stop at 743m
	19:12		POOH
	20:00		At surface – check cable and toolstring
	20:20		Cable OK
	20:50		Changed out everything above RCI (back to original parts). Tools check out OK.
	21:10		RIH
	21:20		Comp on at 100m, cont RIH
	21:40		In shoe at 920m – stop for temp stabilisation
	21:57		Temp not fully stable but RIH slowly as full stabilisation not critical for sampling.
	22:42		Tie in from 2000m – 0.7m deep, subtract 0.7m.
	22:47		At first sample level 1967m. Set up tool. Temp 50deg (14 deg lower than last time here)
	22:59	22:55 - 23:35	Both pumps stalling, cycle tool operations to try and clear them.
	23:09		Re-boot software.
	23:21		Small pump calibrates and pumps OK.
	23:23		Large pump suspect – stalls out
	23:26		Small pump pumping slowly and stalling out
	23:35		Small pump started working during call. (large pump not tested) Start pressure test at 1967m
	23:44		Cannot get seal against formation – move up 0.5m.
			Pretest at 1966.5m OK, start cleanup pumping.
22.3.04	23:58		2 ltr cleanup pumped
23.3.04	0028	00:30 - 00:35	10 ltr pumped. – stable optical readings, close borehole exits to check for leaks. Pump did not stall (therefore leak in system). (11 ltr pumped)
	00:30		Reclose borehole exits several times then open and close lower exit.
	00:35		Pump stalls proving system integrity
	00:36		Open 20 ltr chamber with 12 ltr cleanup pumped. Pumping pressure 194.7-195.3bar, cf Fm press: 195.5
	01:40		Pumped 20 ltr
	01:48		22.2 ltr pumped, pump stalls but (suspiciously) at end of stroke. Close 20 ltr and open 10 ltr chamber. Pumping resumed OK
	01:50	01:50 - 02:30	Close 10 ltr & re-open 20 ltr to check full – pump stalls at end of stroke Close 20 ltr and re-open 10 ltr chamber.
	01:53		Pump stops after 2 strokes – same problem as on RCI run 1B
	01:56		Charge packer in preparation for re-starting tool
	02:02		Tool back online without loosing seal against Fm. 195.237bar Fm press. Calibrate pump
	02:04		Pump to borehole exits to check function of small (BB) pump - OK
	02:06		Close borehole exits – pump doesn't stall. Reclose upper exit – pump stalls – system tight.
	02:09		Re-open 20 ltr – pump working
	02:12		Pump stops at end of stroke after1.3 ltr pumped
	02:16		Manually re-start pump – stops after 1 cycle. Re-start several times. 20 ltr chamber probably still not full.
	02:32		Decided to go to smaller chambers as have more control over volume and filling
	02:33		0pen PVT chamber # 1
	02:40		Taking too many strokes to fill, close chamber to check for leaks
	02:43		Leak in top borehole exit confirmed and fixed
	02:44		Cont filling PVT # 1. Full 02:48
	02:49		0pen PVT chamber # 2. Full 02:53
	02:54		0pen PVT chamber # 3. Full 02:58
	02:58		Open single phase chamber # 1. Full 03:01
	03:02		Open single phase chamber # 2. Full 03:04

	03:05		Open single phase chamber # 3. Full 03:08 Decide to re-start tool again prior to filling 10 ltr chamber
	03:09		Charge packer and re-start tool
	03:13		Back again without loss of seal. Re-charge packer and set up tool
	03:15		Open 10 ltr chamber and calibrate pump.
	03:16		Start automatic pumping. Close 10 ltr to check system tight – OK. Re-open 10 ltr and continue pumping automatically.
	03:45		Pump stops auto function with 3.7 ltr pumped. Return to manual pumping with occasional closure of chamber to check for leaks.
	04:40		Pump started automatic operation again – at full speed.
	04:53		10 ltr chamber full with approx 20 ltr pumped.
	04:54		Re-open 20 ltr chamber to top it up (pump working properly)
	05:36		20 ltr chamber full after approx 41 ltr pumped
	05:39		Retract and move to next sample at 1884m in gas zone. Tie in on the way. (on depth, no correction)
	05:55		Start pretest at 1884m
	05:57		Start cleanup pumping
	06:25		Lost seal, aborted 1884m, moved to 1885m instead
	06:57		@ 1885m, set packer, difficult to have draw downs to formation pressure
	07:08		Retracted packer and flushed
	07:11		Set packer again and used RB pump. Lost seal.
	07:35		Retracted packer and moved to 1887m
	07:44		Set packer at 1887. Started cleanup with RB pump.
	08:47		Finished cleanup, had pumped a total of about 32 litres. Started sampling single phase chamber # 4
	08:56		Filled chamber (Had pump strokes equivalent to 2-2.5liters) Start filling PVT chamber # 4.
	09:04		PVT chamber #4 full (Had pump strokes equivalent to about 2.7liters)
	09:08		Drop down to 1950m to tie in on GR. Tie in showed 0.2m shallow.
	09:15		PU to sample depth 1893.5m
	09:19		At 1893.5m, set packer.
	09:23		Start cleanup with RB pump. Totally pumped about 36liters.
	10:25		Clean, start filling PVT chamber #5
	10:32		PVT chamber #5 full (Had pump strokes equivalent to about 2.5-3liters). Opened single phase chamber #5
	10:36		Single phase chamber #5 full,(Had pump strokes equivalent to about 2.5-3liters). Retracted packer
	10:38		Finished sampling, POOH
	12:25		OOH, start RD
23.3.04	14:35		Finished RD
			Emptied 10 litre tank from 1965m MD / 1935.3m TVD SS
			10 litre tank: Opening pressure: 2300 psi
			24 cu ft gas
			8.3 litres of oil, colour: brownish black
			Emptied 20 litre tank from 1965m MD / 1935.3m TVD SS
			20 litre tank: Opening pressure: 2300 psi
			32 cu ft gas
			16.6 litres of oil, colour: brownish black
			Total operating time: 24 hrs 35 min
			Lost time: 5 hrs 30 min
			Min
			SUM OPERATIONS TIME: 141 hrs 35 min **8495 Tot**
			SUM LOST TIME: 36 hrs 15 min **2175 Lost**
			OPERATING TIME – LOST TIME (Logging time): 105 hrs 30 min **6330 Log**
			EFFICIENCY = 1-[LT/(TT-LT)]: 65.6%

Comments on operational problems encountered

Run #2, **RCI-GR,** While strongly recommending we POOH to run a fully functional RCI tool, Baker Atlas suggested we could log satisfactorily using the large drawdown pump. The use of this pump is believed to be the underlying cause of subsequent logging problems as a result of trapped gas within the tool. Failure of the main (L) Quartz gauge required pressures to be measured with the (K) gauge (gauge (situated 1.04m below probe depth). Pressures needed to be recalculated for this offset. Values were quality checks on subsequent run in hole and found to be accurate.
Run # 6, CBIL-Earth Imager-ORIT-GR-CHT: . Sonic signals questioned by witness. Engineers consider impurities in mud (drill cuttings, water bubbles, gas bubbles, etc.). Tool response to be verified by operations base onshore.
General operational comments/finding:
RCI: In the highly permeable and friable sands encountered, it was found that repeated small drawdowns were better than one large one (which produced sand or damaged seals). It was also noted that formation pressure stabilised down so continued taking repeated drawdowns until 2 successive drawdowns resulted in the same upwardly stabilising formation pressure.
Hole: No hole problems were noted despite extended sampling. Tools released with no overpull and no sticking when moving.

24/9-7A

Date	Time	Lost Time	Operation
			Run 1A: GR-HDIL-ZDL-CND-XMAC
26.03.04	18:30		Drill floor cleared to logging contractor, commence rig up
	20:45		Install sources
	21:10		RIH
	22:10		At 1450 m Start acquire safety log while RIH
	23:15		At 2270 m finish down log. Set up tools and surface systems for main log. Time window for Shear sonic difficult to pick extended set-up time to correctly acquire. RIH and tag bottom at 2277m
	23:55		Start main log up with 5m/min, experienced slight OP when starting log up from Heimdal Sd. (approx 1 klb)
27.03.04	03:00		At 1480 m stop main log (-0.3m shallow).
	03:05		RIH for repeat over reservoir.
	03:25		At 2060 m Start log up for repeat section
	03:55		At 1940 m Stop repeat section
	04:00		Finished logging. Close calliper and POOH w 30m/min.
	04:30		Inside casing CAL check 12.303", Sonic check 56.6 us/ft.
	04:35		Continue to POOH.
	04:50		OOH, start rigging down.
	07:00		Finished RD
			Total operating time: 11 hrs 30 min
			Lost time: 0 min
			Run 2A: RCI-GR
27.03.04	07:00		Start RU
	08:14		Check tools on surface
	08:40		Intermittent communication with mode 5, trouble shoot and replace everything above RCI
	09:20	40min	OK, continue checking. All OK.
	09:36		RIH, set compensator
	09:48		Continue RIH
	10:12		Stop inside casing @ 933m to stabilize tool
	10:40		Continue RIH
	11:17		Start tie in from 1980m
	11.23		Finished tie in, ad 0.5m, drop down to pull up to
	11:29		At 1941.4m, Tight, go to next point
	11:40		At 1955m, good test
	11:53		At 1962.5m, good test
	12:02		At 1972m, good test
	12:17		At 1982m, good test
	12:26		At 1990m, good test
	12:38		At 1996m, good test
	12:48		At 2001.5m, good test
	13:00		At 2004.5m, good test
	13:18		Go down to 2100m for tie in. Was 0.4m shallow, adjusted
	13:21		At 2076m, good test
	13:35		At 2079m, good test
	13:47		At 2086m, good test
	14:04		At 2095.4m, good test
	14:14		At 2124.5m, good test
	14:29		At 2128.3m, good test
	14:43		At 2095.4m, try to take water sample, no seal, moved to 2095m
	14:56		At 2095m, pump with both pump, set packer
	15:05		Start cleaning with BB pump.
	15:30		Pumped 7.9 L. Clean, start filling first PVT chamber
	15:33		First PVT tank full. Clean up before filling next PVT tank.
	15:46		Start filling PVT tank # 2
	15:48		Second PVT tank full, close and move to next sample level.
	16:05		Did tie in , 0.4m shallow, adjusted
			Went to 1996m for oil sampling

	16:20		At 1996m, Set packer
	14:27		Start cleanup before sampling. Pumped 6 L
	16:43		Start filling 10 L chamber
	17:18		Tank full after pumping 10.6 L. 2500 psi overpressure.
	17:21		Switch to filling PVT tank #3, full
	17:24		Start filling # 4, full
	17:26		Start filling #5, full
	17:27		Start filling #6
	17:29		Tank #6 full. Closed tank.
	17:41		Closed tool, RIH to 2077.5m for an extra pressure point
	17:47		At 2077.5m
	17:56		Flushed tool before taking pressure test in water at 2077.5m. Seal failure.
	18:01		Moved to 2078m
	18:03		At 2078m, good test, flush tool and retract
	18:12		Run up to 1915m to tie in before taking pressure points in gas zone
	18:20		Start tie in, 0.3m shallow, adjusted
	18:25		At 1873.5
	18:25		Set packer at 1873.5m, good test
	18:33		At 1869.5m, good test
	18:40		At 1868m, tool plugged, abort and retry after pumping out
	18:46		Retry @ 1868m, good test
	18:54		At 1865.5m, good test
	19:05		Finished logging, POOH
	20:20		At surface. Thermometer reads 62 deg C
	22:00		RCI rigged down and samples secured.
			Start empty 10L tanks from 1996/ 1936.1m TVD SS
			10 litre tank: Opening pressure 1500 psi
			20.3 cu ft gas
			8.3 litres of oil, colour: brownish black
			Specific gravity of oil: 0.86 sg (measured by mud engineer)
			Analysis of gas sample from 10 tank: (Injected directly from balloon)
			C1 – 878778 C1/C2 C1/C3 C1/C4 C1/C5 GWR LHR OCQ
			C2 - 34403 25.54 71.27 134.56 364.72 6 42.9 0.73
			C3 - 12330
			iC4 - 2299
			nC4 - 4231
			iC5 - 1272
			nC5 - 1137
			All sample chambers and bottles with oil from 10 litre tank sent with Olympic Poseidon ETA Asko base 29.03.04
			Total operating time: 17 hrs
			Lost time: 40 min
			Run 3A: GR-EI
27.03.04	22:45		Start rig up
	23:15		RIH w/ 30m/min
28.03.04	00:20		Stop at 1980 m for depth correlation. Come up w /10m/min. Performed depth correction. GR –1m shallow compared with reference log. Shift EI log accordingly.
	00:27		Continue to RIH.
	00:40		At TD, Prepare tool and surface systems.
	00:45		Start coming out of hole for main log (ML). Pick up weight indicate TD at 2277m MD.
	00:50		Close callipers/pads and drop down to TD
	00:55		Start coming up for ML. w/ 2m/min
	02:00 03:00		Adjust clocks to summer time by adding 1 hrs.
	06:20		At 1850m. Finish main pass. Close pads and drop down to 2010m. Come up to

			2005. Open calliper and start logging over main reservoir sand for repeat section.
	06:52		Start repeat with more gain on pads to obtain better signals
	07:35		1950m, finished repeat, POOH
	0810		Verify callipers inside casing
	0855		At surface
	0900		After log verification and start rig down tools
	0940		Tools rigged down
	0945		Finished RD. Clear drill floor to drilling contractor.
			Total operating time: 11 hrs 0min
			Lost time: nil
			Total operating time: 11 hrs 0 min
			Lost time: nil
			Min
			SUM OPERATIONS TIME: 39 hrs 30 min 8495 Tot
			SUM LOST TIME: 0 hrs 40min 2175 Lost
			OPERATING TIME – LOST TIME (Logging time): 38 hrs 50 min 6330 Log
			EFFICIENCY = 1-[LT/(TT-LT)]: 98.3%

Comments on operational problems encountered

RUN #1, GR/HDIL/ZDL/CND/XMAC: Efficient log run with only minor problems at start up of main log as a result of difficulty to define time window for Shear time pick.
Run #2, RCI–GR: Tool check at surface revealed short circuit in telemetry cartridge. Changed out all items above RCI. Took 25 pre-tests 21 good, 1 tight, 2 lost seal, 1 aborted due to plugging of tool. Took 2x 840cc PVT samples in the water zone, 4x840cc and 1x10L samples in the oil zone. Pre-tests showed over all good mobility**.** Efficient logging operation.
RUN#3, GR/EA: Efficient log run, Some rotation of tool noted from TD up to 2100m although within specification i.e. not more than 1 rotation per 30 ft. No rotation of tool above 2100m. Pad 1-3 (high side) weak signal compared to pad 4-6 (low side). It was not possible to increase gains without saturating pads 4-6. Weak signal on all pads through main sand (2008m- 1953m) noted. It was decided not to change gain on pads while logging, since processing specialist strongly advice against this. Logging engineer was positive that signal contained usable data. A repeat run was made over the reservoir with increased gain on pads.

24/9-7B

Date	Time	Lost Time	Operation
			Run 1A: GR-HDIL-ZDL-CND-XMAC
01 04.04	22:20		Rig floor cleared to contractor, SJA / Toolbox meeting w/ rig crew
01.04.04	22:45		Start RU
02.04.04	00:10		Finish M/U toolstring. Check, verify and calibrate.
	01:05		Tools checked OK.
	01:10		Install sources
	01:20		RIH. Set compensator at 150m.
	01:50		Check tie at 1050m and calibrate in shoe. 1.4 m deep - subtract 1.4m.
	02:05		RIH acquiring safety log. (20m/min)
	03:10		Take repeat during RIH in order to save time and yet acquire repeat section over most interesting zone 1875-1975m,
	03:30		Sand at 1950m shows gas separation on Dens/Neutron curves. Wireline 2m shallow vs MWD log.
	03:45		Thin sands at 1880m show less separation – more like oil, but may be due to tool resolution in thin beds. If it is in fact oil, then this is perched above thicker gas bearing sand bed at 1950m.
	03:55		Stop repeat section with all curves to 1870m. Close CAL.
	03:57		To save time, RIH fast (30m/min) without acquiring data (section below 2000m is below reservoir level).
	04:13		At TD
	04:14		Start main log up, 5 m/min from 2227.5m Loggers Depth
	04:20		Data overload; reduce logging speed to around 4.6-4.7 m/min.
	05:35		Main log and repeat section match.
	06:00		Logging at 1750m, 4.6 m/min.
	08:50		At 975m -2.4m shallow compared with main log. Apply depth shift accordingly
	09:00		At 900m stop main log. RIH for verification of Resistivity tool.
	09:20		Start new main log for GR-XMAC wave form w/4min/m from 960m.
	10:25		At 640m stop main log GR-XMAC. Close caliper and POOH w 40m/min.
	10:45		OOH start rig down.
	11:15		Finished w/ radioactive sources
	13:15		BA finished rig down, floor ready for Odfjell drilling.
			SUM OPERATIONS TIME: 14 hrs 55min
			SUM LOST TIME: nil hrs
			OPERATING TIME – LOST TIME (Logging time): 14 hrs 55 min
			EFFICIENCY = 1-[LT/(TT-LT)]: 100 %

24/9-7C

Date	Time	Lost Time	Operation
			Run 1A: RCI-GR
07.04.04	04:55		Rig floor cleared to contractor, commence R/U sheaves on floor
	05:55		Tool string made up - check tools
	06:05		RIH. Set compensator at 75m.
	06:38		Stop in side shoe at 930m for tool check and temp stabilisation.
	06:50		Run into open hole ~15 m/min Decide to make an initial slow tie in / temp stabilisation pass above the reservoir (from 2250m) in order to spend as little time as possible in a possibly sticky reservoir.
	07:27		Tool stood up at 1605m. Pick up and try again – hung up - also had 750lb overpull when picking up. Tool sticking rather than cable
	07:30		Dropped past Ls stringer at 1607m on 3rd attempt.
	07:33		Hanging again at 1650m (Ls stringer at 1648m.) – through on 2nd pass.
	07:38		1687 stringer – 2 passes,
			Cont RIH 20m/min – faster speed may help.
	07:48		Hung again at 1895m (stringer at 1888m)- through on 2nd pass
			Cont RIH. Note frequent minor fluctuations in tension associated with Ls stringers.
	08:08		Hang at 2247m on Ls just above reservoir, pick up for tie in (without attempting to pass into the reservoir sands). 2.2m shallow. Add 2.2m. Temp still increasing despite logging up – so drop back and make a second pass to keep tool in motion while temp stabilising
	08:25		On depth but temp still ~10 deg below temp at equivalent depth on 7B track – yo-yo cable. Hang up while yo-yo
	08:38		Drop to first test level.
	08:41		Pass 2250m (into sand) with no sign of hanging
	08:43		At 2262m – start logging.
	09:55		At 2290.5m – probe plugging – retract and yo-yo while trying to clear by flushing/pumping out of probe
	10:05		Reset at 2290.5m – packer pressure low – recharge – looks OK Take drawdown – looks tight – suspect formation damaged – but comes to expected Fm press. Try 2cc drawdown – tight again – suspect probe plugged
	10:16		No problems coming off. YO-YO and flush partially plugged probe. Abandon rest of points in transition zone.
	10:30		At 2293m – set packer – no seal – move 0.5m down
	10:35		At 2293.5m – set packer – good test – drop to 2299m
	10:53		At 2299m – set packer – good test – drop to 2280.1m
	11:07		At 2280.1m – set packer – good test – drop to 2286m to start logging GR out
	11:17		Start logging GR out passed casing shoe
	13:00		Finish correlation log, POOH
	13:40		Tool on surface, start rigging down
	14:30		Rigged down BakerAtlas.
			SUM OPERATIONS TIME: 9 hrs 35min
			SUM LOST TIME: nil hrs
			OPERATING TIME – LOST TIME (Logging time): 9 hrs 35 min
			EFFICIENCY = 1-[LT/(TT-LT)]: 100 %

Log Header Information

Company	Marathon
Wells	24/9-7, 7A, 87B and 7C
Field	Hamsun Prospect
Country	Norway
Location	North Sea
State	
Latitude	59° 28' 42.701" N
Longitude	001° 57' 44.422" E
Rig	Deepsea Delta
Permanent Datum	LAT
Log Measured From	Rig floor
Drilling Measured From	Rig floor
Elevation: RT	29m
: GL	29m
: DF	29m
Casing 30"	212.5m
Casing 13 3/8"	947.5m

Well Specific Data

Well	**24/9-7**
Logging Date	17/22-03-04
Drillers Depth	2280m
Hole Size	8½"
Max Well Deviation	4.15 degr @ 2266m
Type Fluid in Hole	OBM
Source of Sample	flow line
Density (ppg)	1.3sg
Viscosity	
Fluid Loss (HTHP)	2.2
Oil/Water ratio	76/24
pH	
Barite (%, ppb)	
KCl	
Cl/Ca	
LCM	
Drilling Stopped	08:45 17.3.04
Circulation Time	1:50
Time Circulation Stopped	10:35
RM @ measured temp	N/a
RMF @ measured temp	N/a
RMC @ measured temp	N/a
Witness	Mike Henderson / Sigvart Bjerkenes
Logging Engineers	Svein Hadeland, Sean Renwick, Bjørn Sondoy
RCI Specialist	Svein Hadeland, Sean Renwick, Bjørn Sondoy
VSP	Jurian Claudius, Ronnie Vrieling, Andrew Smith

Well	**24/9-7A**
Logging Date	26/27-03-04
Drillers Depth	2277m
Hole Size	8½"
Max Well Deviation	32.13 deg at 2013.31m
Type Fluid in Hole	OBM
Source of Sample	flow line
Density (ppg)	1.3sg
Viscosity	
Fluid Loss (HTHP)	
Oil/Water ratio	
pH	
Barite (%, ppb)	
KCl	
Cl/Ca	
LCM	
Drilling Stopped	26.03.2004 08:29 hrs
Circulation Time	
Time Circulation Stopped	26.03.2004 11:35 hrs
RM @ meas. Temp.	N/a
RMF @ meas. Temp.	N/a
RMC @ meas. Temp.	N/a
Witness	Anders Knape / Sigvart Bjerkenes
Logging Engineers	Svein Hadeland, Sean Renwick, Bjoerne Sondoy, Scott Ingram
RCI Specialist	Svein Hadeland, Sean Renwick, Bjørn Sondoy, Scott Ingram

Well	**24/9-7B**
Logging Date	01-04-04
Drillers Depth	2230m
Hole Size	8½"
Max Well Deviation	29.81 degr @ 1638m
Type Fluid in Hole	OBM
Source of Sample	flow line
Density (ppg)	1.3sg
Viscosity	
Fluid Loss (HTHP)	1.8
Oil/Water ratio	77/23
pH	
Barite (%, ppb)	
KCl	
Cl/Ca	125600/
LCM	
Drilling Stopped	14:35 01.04.04
Circulation Time	2:15
Time Circulation Stopped	16:50
RM @ measured temp	N/a
RMF @ measured temp	N/a
RMC @ measured temp	N/a
Witness	Mike Henderson / Anders Knape
Logging Engineers	Knut Toerlen, Bjørn Sondoy

Well	**24/9-7C**
Logging Date	07-04-04
Drillers Depth	2363m
Hole Size	8½"
Max Well Deviation	43.97 deg @ 1881m
Type Fluid in Hole	OBM
Source of Sample	flow line
Density (ppg)	1.34sg
Viscosity	
Fluid Loss (HTHP)	1.9
Oil/Water ratio	72/28
pH	
Barite (%, ppb)	
KCl	
Cl/Ca	106400/
LCM	
Drilling Stopped	18:00hrs 06.04.04
Circulation Time	2:00
Time Circulation Stopped	20:00hrs 06.04.04
RM @ measured temp	N/a
RMF @ measured temp	N/a
RMC @ measured temp	N/a
Witness	Mike Henderson / Anders Knape / Sigvart Bjerkenes
Logging Engineers	Knut Toerlen, Sean Renwick
RCI Specialist	Knut Toerlen, Sean Renwick

Appendix E – RCI Formation Pressure / Sample Details

RCI Pre-test Survey, accepted pretests.

RCI PRESSURE WORK SHEET

PreTest Chamber Size: variable					Geologists: Sigvart Bjerkenes / Anders Knape			
Probe Type: Large					Engineer: Sean Renwick			
Guartz Pressure Gauge serial no:					Ref Log(s): GR-ZSlam-HDIL (Run#1)			
#	**Depth BRT**	**Depth TVDSS**	**Hydro-static before**	**Hydro-static after**	**Final shut-in press**		**Draw-down Perm**	Comments Temp: T= ºC
	(m)	**(m)**	**(bara)**	**(bara)**	**(psia)**	**(bara)**	**(md/cp)**	
24/9-7								
1	1825.5	1795.9	236.40	236.57		190.269		55.5
2	1829.5	1793.9	237.86	237.41		190.590	652	53.3
3	1835.0	1805.4	238.71	239.25		190.786	528	53.5
4	1846.9	1817.3	241.27	241.01		191.006	1129	54.0
5	1880.0	1850.4	245.00	244.30		191.615		
6	1880.0	1850.4	245.01	244.64		191.913		
7	1884.0	1854.4	244.89	245.12		191.530		
8	1884.0	1854.4	244.30	244.92		191.523		
9	1886.0	1856.4	245.14	245.07		191.578		59.1
10	1900.0	1870.4	248.60	248.26		191.801	1256	55.8
11	1902.0	1872.4	248.13	247.96		191.845	471	57.6
12	1904.0	1874.4	247.23	246.85		191.836		59.4
13	1906.5	1876.9	247.24	247.40		191.888		
14	1918.7	1889.1	240.68	250.48		192.105	299	58.1
15	1963.5	1933.8	255.20	254.53		195.113		63.0
16	1963.5	1933.8	255.26	254.48		195.017	1808	65.0
17	1964.0	1934.3	255.32	255.00		195.025	520	62.5
18	1964.5	1934.8	255.54	255.01		195.067	829	62.8
19	1965.0	1935.3	255.29	254.93		195.144		
20	1965.0	1935.3	255.38	255.07		195.117	325	63.2
21	1967.0	1937.3	255.772	255.143		195.161	1094	65.9
22	1967.5	1937.8	255.792	255.153		195.296	1031	63.9
23	2167.0	2146.1	276.384	280.944		208.011		71.0
24	2184.0	2154.1	282.959	283.183		208.939		70.3
25	2195.0	2165.1	282.829			209.957		70.2
24/9-7A								
1	1865.5	1824.3	243.26	243.29		191.050	8500	62.8
2	1868.0	1826.5	243.57	243.53		191.120	500	63.6
3	1869.5	1827.9	243.70	243.70		191.164	15400	64.9
4	1873.5	1831.4	244.15	244.21		191.206	3670	66.5
5	1955.0	1901.2	253.66	253.49		192.871	11900	55.5
6	1962.5	1907.6	254.37	254.19		193.298	10700	56.5
7	1972.0	1915.7	255.45	255.31		193.897	10800	57.5
8	1982.0	1924.2	256.74	256.54		194.514	7600	58.5
9	1990.0	1931.0	257.67	257.46		195.029	9200	58.8
10	1996.0	1936.1	258.25	258.03		195.378	8100	59.4
11	2001.5	1940.7	258.85	258.55		195.732	5900	59.9
12	2004.5	1943.3	259.06	259.01		195.938	23300	60.5
13	2076.0	2004.3	266.28	266.74		200.361	7100	61.9
14	2078.0	2006.0	267.49	267.34		200.516	7400	66.9
15	2079.0	2006.9	267.19	267.02		200.617	3200	62.7
16	2086.0	2012.9	268.61	267.78		201.225	8700	63.5
17	2095.4	2021.1	269.13	268.90		202.052	3200	64.1

#	Depth BRT	Depth TVDSS	Hydro-static before	Hydro-static after	Final shut-in press		Draw-down Perm	Comments Temp: T= ºC
	(m)	(m)	(bara)	(bara)	(psia)	(bara)	(md/cp)	
24/9-7A								
18	2124.5	2046.4	272.91	272.55		204.647	3000	64.5
19	2128.3	2050.0	273.11	272.71		205.011	1750	65.0
24/9-7C								
1	2262.0	1972.9	266.78	266.44		198.016	3100	61.7
2	2280.0	1986.5	268.30	268.24		199.014	9300	62.7
3	2280.1	1986.6	268.46	268.43		199.015	13400	65.7
4	2285.0	1990.2	268.48	268.57		199.284	7100	63.6
5	2288.0	1992.5	269.09	268.82		199.428	15100	63.8
6	2290.5	1994.3	269.33	269.34		199.507	9500	65.0
7	2293.5	1996.6	269.70	269.70		199.743	8000	65.3
8	2299.0	2000.7	270.28	270.22		200.155	6600	65.3

RCI Samples taken

An extensive sampling program was performed using the RCI tool as outline below:

24/9-7

Single Phase samples: 6 oil from 1965m and 3 oil from 1966.5m (lower dyke)
2 gas (1 each depth) from 1887m and 1893.5m (upper dyke)

PVT samples: 4 oil from 1965m and 3 oil from 1966.5m
2 gas from 1906.5m and 2 gas from 1887 and 1893.5m

Bulk volume sample: 35.3 litres

24/9-7A

PVT samples: 4 oil from 1996m
2 water from 2095m

Bulk volume sample: 8.3 litres

No samples were taken from well 24/9-7B as a result of poor reservoir development potential at that location. No samples were taken at 24/9-7C due to the high risk of the RCI tool being subject to differential sticking.

Appendix F – Completion Logs

Enclosure 1 – 24/9-7

Enclosure 2 – 24/9-7A

Enclosure 3 – 24/9-7B

Enclosure 4 – 24/9-7C

Appendix G – Enclosure 2 – Prognosis and Results Table (NPD Format)

Section: "Well data"	Comments	Keyword name	Comments	If there is more than one prognosis per prospect,please duplicate the prognosis column					
				Prognosis	**Result**	**Result**	**Prognosis**	**Result**	**Result**
Well Name	Always fill in	WellName:=	NPD approved name	**24/9-7**	**24/9-7**	**24/9-7A**	**24/9-7B**	**24/9-7B**	**24/9-7C**
Production Licence Number	NPD input	ProdLicenseID1=	NPD approved name						
	NPD input	ProdLicenseID2=	NPD approved name						
Operator		Operator=		Marathon Petroleum Company (Norway)					
Well type: required/committed as a part of the licence award?		WellCommitment=	Yes/No	No			No		
Well classification			Wildcat / appraisal	Appraisal			Appraisal		
License round	NPD input	LicenseRound1=							
	NPD input	LicenseRound2=							
Seismic database (2D/3D)		SeismicDB=	2D/3D	3D			3D		
Frontier area?	NPD input	Frontier=	Yes/No						
Structural element/Province		StrucElement=		NORDSJOEN					
Spud date	NPD input	SpudDate=							
Completion date	NPD input	CompletionDate=							
Water depth		WaterDepth=	meter	124.5	124.2				
Stratigraphic age at TD		TDChron=		Upper Paleocene	Upper Paleocene	Upper Paleocene	Upper Paleocene	Lower Eocene	Lower Eocene
Paragraph: prospect									
Prospect name	Always fill in	ProspectName:=	Operators name	Hamsun					
Prospect ID	NPD input	ProspectID=	NPD code						
Distance to nearest relevant well		NearestWellDist=	km	0.6	0.60	0.12	0.3	0.3	0.7

Nearest well Name		NearestWellName=	NPD approved name	24/9-6	24/9-6	24/9-7	24/9-7	24/9-7	24/9-7
Prospect Priority if several in well		ProspectPriority=	number 1,2,…						
SubParagraph: prognosis // result									
Prognosis ID (if several)		PrognosisID:=	Operators name	Hamsun					
Prognosis priority in prospect	(1/2/3…)	PrognosisPriority=	number 1,2,…						
Reference(s) to mapping & evaluation		Reference=	Report name etc.	Appraisal Well 24/9-7 Data Package (PL150), drilling program	Final Geological Report 24/9-7, 7A, 7B & 7C	Final Geological Report 24/9-7, 7A, 7B & 7C	Appraisal Well 24/9-7 Data Package (PL150), drilling program	Final Geological Report 24/9-7, 7A, 7B & 7C	Final Geological Report 24/9-7, 7A, 7B & 7C
Evaluation year		EvaluationYear=		2003/4	2004	2004	2003/4	2004	2004
Reference(s) to NPD evaluation	NPD input	NPDReference=							
NPD evaluation year	NPD input	NPDEvaluationYear=							
	Date (DD.MM.YY)	DataCompileDate=		04/12/2003	04/12/2003	24/03/2004	04/12/2003	04/12/2003	01/04/2004
Data compilation	Department, Institution	DataCompileDept=		Marathon Petroleum Company (Norway), Norway Subsurface					
	Name	DataCompileResp=		Peter Rawlinson					
	Date (DD.MM.YY)	DataQCDate=							
Data Quality control	Department, Institution	DataQCDept=		Marathon Petroleum Company (Norway), Norway Subsurface					
	Name	DataQCResp=		Peter Rawlinson					
Comments	Variation from standard methodology	Comments=		No variation from standard methodology					
Geo									
Trap type		TrapType=	Defined numeric code	2.0 Stratigraphic: Injection sand	Injection sand	Injection sand	2.0 Stratigraphic: Injection sand	Injection sand	Injection sand
Reservoir stratigraphic level(s)	Chronostratigraphic	ReservoirChron=		Upper Paleocene	Upper Paleocene	Upper Paleocene	Upper Paleocene	Upper Paleocene	Upper Paleocene
Reservoir stratigraphic level(s)	Lithostratigraphic	ReservoirLithos=		Hermod Mbr.	"Hamsun Sands"	"Hamsun Sands"	"Hamsun Sands"	"Hamsun Sands"	"Hamsun Sands"
NPD play	NPD input	NPDPlay=							

New play	NPD input	NewPlay=							
Inferred source rock 1	Chronostratigraphic	Source1Chron=		UPPER JURASSIC	UPPER JURASSIC	UPPER JURASSIC	UPPER JURASSIC	UPPER JURASSIC	UPPER JURASSIC
Inferred source rock 1	Lithostratigraphic	Source1Lithos=		HEATHER / DRAUPNE			HEATHER / DRAUPNE		
Inferred source rock 2	Chronostratigraphic	Source2Chron=							
Inferred source rock 2	Lithostratigraphic	Source2Lithos=							
Seal	Chronostratigraphic	SealChron=		Lower Tertiary		Lower Tertiary	Lower Tertiary	Lower Tertiary	Lower Tertiary
Seal	Lithostratigraphic	SealLithos=		Undiff'd Hordaland Gp		Undiff'd Hordaland Gp	Undiff'd Hordaland Gp	Undiff'd Hordaland Gp	Undiff'd Hordaland Gp
Probability									
Probability of discovery, technical	Total	ProbTecTotal=	Fraction	0.41			0.70		
Probability of discovery, technical	Charge	ProbTecSource=		1.00			1.00		
Probability of discovery, technical	Trap	ProbTecTrap=		0.65			1.00		
Probability of discovery, technical	Reservoir	ProbTecReservoir=		0.70			0.70		
Comments	Comments relevant to risking (DHI, AVO analysis, etc.)	CommentsProbability=							
Resources									
Main hydrocarbon phase		MainPhase=	OIL, OIL/GAS, GAS	GAS/OIL	GAS/OIL	OIL	GAS/OIL	GAS	OIL
Fractiles, resource parameter ranges	Low/Minimum	FractileResourceLow=	Fraction						
Fractiles, resource parameter ranges	Preferably Mean (or Most likely or Median)	FractileResourceCentral=	Mean/ML/Med	Most Likely		Most Likely	Most Likely	Most Likely	Most Likely
Fractiles, resource parameter ranges	High/Maximum	FractileResourceHigh=	Fraction						
Gas in place (as main phase)	Low/Minimum	GasMainLow=		0	1.61			0.08	
Gas in place (as main phase)	Central/Most likely	GasMainCentral=	10^9Sm3	1.7	2.41			0.14	
Gas in place (as main phase)	High/Maximum	GasMainHigh=		5.1	3.39			0.14	
Oil as associated phase in place	Low/Minimum	OilAssocLow=							
Oil as associated phase in place	Central/Most likely	OilAssocCentral=	10^6Sm3						
Oil as associated phase in place	High/Maximum	OilAssocHigh=							

Oil in place (as main phase)	Low/Minimum	OilMainLow=		9.38	1.76	3.53			3.53
Oil in place (as main phase)	Central/Most likely	OilMainCentral=	10^6Sm3	22.89	2.54	5.09			5.09
Oil in place (as main phase)	High/Maximum	OilMainHigh=		55.48	4.90	9.76			61.4
Gas as associated phase in place	Low/Minimum	GasAssocLow=							
Gas as associated phase in place	Central/Most likely	GasAssocCentral=	10^9Sm3						
Gas as associated phase in place	High/Maximum	GasAssocHigh=							
Gas recoverable (as main phase)	Low/Minimum	RecoverGasMainLow=		0.51					
Gas recoverable (as main phase)	Central/Most likely	RecoverGasMainCentral=	10^9Sm^3	1.70	0.25	0.25			0.25
Gas recoverable (as main phase)	High/Maximum	RecoverGasMainHigh=		5.10					
Oil as associated phase recoverable	Low/Minimum	RecoverOilAssocLow=							
Oil as associated phase recoverable	Central/Most likely	RecoverOilAssocCentral=	10^6Sm3						
Oil as associated phase recoverable	High/Maximum	RecoverOilAssocHigh=							
Oil recoverable (as main phase)	Low/Minimum	RecoverOilMainLow=		2.72	0.53	1.06			1.06
Oil recoverable (as main phase)	Central/Most likely	RecoverOilMainCentral=	10^6Sm3	7.33	0.76	1.53			1.53
Oil recoverable (as main phase)	High/Maximum	RecoverOilMainHigh=		19.97	1.47	2.93			2.93
Gas as associated phase recoverable	Low/Minimum	RecoverGasAssocLow=		0.30	0.06	0.12			0.12
Gas as associated phase recoverable	Central/Most likely	RecoverGasAssocCentral=	10^9Sm3	0.81	0.08	0.17			0.17
Gas as associated phase recoverable	High/Maximum	RecoverGasAssocHigh=		2.20	0.16	0.32			0.32
Part of prospect in Production Licence		PartInProdLicense=	Fraction	1.00	1.00	1.00	1.00	1.00	1.00
Reservoir parameters									
Pressure, top reservoir		PressureReservoir=	bar	190	192	192			192
Temperature, top reservoir		TempReservoir=	degrees C	68	69	69			69

Fractiles, reservoir parameter ranges	Low/Minimum	FractileReservoirLow=	Fraction						
Fractiles, reservoir parameter ranges	Preferably Mean (or Most likely or Median)	FractileReservoirCentral=	Mean/ML/Med	Most Likely			Most Likely		
Fractiles, reservoir parameter ranges	High/Maximum	FractileReservoirHigh=	Fraction						
Depth to top of prospect	Low/Minimum	TopProspectDepthLow=		-1831					
Depth to top of prospect	Central/Most likely	TopProspectDepthCentral=	meters, MSL	-1846	-1847.9	-1898.6	-1769	-1769.7	-1964.3
Depth to top of prospect	High/Maximum	TopProspectDepthHigh=		-1861					
Depth to top reservoir in well	Low/Minimum	TopReservoirDepthLow=		-1831					
Depth to top reservoir in well	Central/Most likely	TopReservoirDepthCentral=	meters, MSL, TVD	-1846	-1847.9	-1898.6	-1769		-1964.3
Depth to top reservoir in well	High/Maximum	TopReservoirDepthHigh=		-1861					
Gross rock volume	Low/Minimum	RockVolLow=		0.037					
Gross rock volume	Central/Most likely	RockVolCentral=	$10^9 m^3$	0.129	0.109				
Gross rock volume	High/Maximum	RockVolHigh=		0.449					
Hydrocarbon column height in prospect/ segment	Low/Minimum	HCColProspLow=							
Hydrocarbon column height in prospect/ segment	Central/Most likely	HCColProspCentral=	meters	200	147.9				
Hydrocarbon column height in prospect/ segment	High/Maximum	HCColProspHigh=							
Hydrocarbon column height in well	Low/Minimum	HCColWellLow=							
Hydrocarbon column height in well	Central/Most likely	HCColWellCentral=	meters		131.2	48.4			31.5
Hydrocarbon column height in well	High/Maximum	HCColWellHigh=							
Area of prospect/segment	Low/Minimum	AreaLow=		4.047					
Area of prospect/segment	Central/Most likely	AreaCentral=	Km^2	8.632	2.117, segment covered by 3 wells				
Area of prospect/segment	High/Maximum	AreaHigh=		18.414					
Reservoir thickness	Low/Minimum	ThicknessLow=	meters vertical at well position	9.14					
Reservoir thickness	Central/Most likely	ThicknessCentral=		14.94	45.5	74.5			59.5

Reservoir thickness	High/Maximum	ThicknessHigh=		24.38					
Net/gross	Low/Minimum	NetGrossLow=							
Net/gross	Central/Most likely	NetGrossCentral=	Fraction	0.6	0.827	0.989			0.917
Net/gross	High/Maximum	NetGrossHigh=							
Porosity	Low/Minimum	PorosityLow=		0.25					
Porosity	Central/Most likely	PorosityCentral=	Fraction	0.29	0.32	0.32		0.25	0.34
Porosity	High/Maximum	PorosityHigh=		0.32					
Water saturation	Low/Minimum	WaterSatLow=		0.25					
Water saturation	Central/Most likely	WaterSatCentral=	Fraction	0.20	0.20	0.23		0.32	0.21
Water saturation	High/Maximum	WaterSatHigh=		0.15					
Bg	Low/Minimum	BgLow=		0.004					
Bg	Central/Most likely	BgCentral=	decimal number	0.005					
Bg	High/Maximum	BgHigh=		0.006					
1/Bo	Low/Minimum	BoInvLow=		0.833					
1/Bo	Central/Most likely	BoInvCentral=	decimal number	0.769	0.769	0.769			0.769
1/Bo	High/Maximum	BoInvHigh=		0.714					
GOR, free Gas	Low/Minimum	GORGasLow=							
GOR, free Gas	Central/Most likely	GORGasCentral=	Sm3/Sm3		5650	5650			5650
GOR, free Gas	High/Maximum	GORGasHigh=							
GOR, Oil	Low/Minimum	GOROilLow=		90					
GOR, Oil	Central/Most likely	GOROilCentral=	Sm3/Sm3	98	110	110			110
GOR, Oil	High/Maximum	GOROilHigh=		110					
Evaluation - discovery									
Discovery?		Discovery=	Yes/No		YES	NO		NO	NO
Surprise discovery ?		SurpriseDiscovery=	Yes/No		NO	NO		NO	NO
Resource class	NPD input	ResourceClass=	NPD codes						
Evaluation - dry well									

If Dry, Oil shows?		ShowsOil=	Yes/No						
If Dry, Gas shows?		ShowsGas=	Yes/No						
CHARGE	Charge	Charge=	OK / Fail / Not relevant						
	Presence of source	ChargePresence=							
	Maturity of source	ChargeMaturity=							
	Migration of HC	ChargeMigration=							
TRAP	Trap	Trap=	OK / Fail / Not relevant						
	Presence of closure	TrapClosure=							
	Presence of top seal	TrapTopSeal=							
	Presence of lateral seal	TrapLateralSeal=							
RESERVOIR	Reservoir	Reservoir=	OK / Fail / Not relevant						
	Presence of reservoir	ReservoirPresence=							
	Quality of reservoir	ReservoirQuality=							
COMMENT	Dry well comments	DryWellComments=							
:::END:::									