

## II.2 Formation Multi Tester

3 FMT runs were performed, one of them to obtain pressure points and samples, while the other two were performed to obtain samples. The first run resulted in

26 pressure points out of 31 attempts in the interval 1882.5 to 2068 m RKB. 15 of the pressure points were in the gas-bearing zone and 11 pressure points were in the water-bearing zone.

The second run resulted in 1 pressure point out of 1 attempt in the gas zone. The third run resulted in 1 pressure point out of 1 attempt in the gas zone.

Pretest record in Stø and Nordmela formation.

Run no.	Test no.	Depth mRKB	Form. pressure kPa		Permeability	Comments
			Hp/Strain	gm/cc		
3A	1	1882.5	21033/21096	1.140	Good	Used
3A	2	1884.5	21039/21055	1.139	Good	Used
3A	3	1886	21045/21055	1.138	Good	Used
3A	4	1887	21030/20882	1.137	Fair	Used
3A	5	1889	21038/20979	1.136	Excellent	Used
3A	6	1888	21043/21055	1.137	Good-fair	Used
3A	7	1890	21042/21069	1.136	Very good	Used
3A	8	1897	21058/21090	1.132	Good	Used
3A	9	1899	21059/21076	1.131	Good	Used
3A	10	1901	21065/21083	1.130	Fair	Used
3A	11	1902	21066/21083	1.130	Good	Used
3A	12	1904	21068/21084	1.129	Fair	Used
3A	13	1906	21081/21084	1.128	Fair	Not used
3A	14	1908.4	21089/21098	1.127	Good	Not used
3A	15	1911.5	21096/21091	1.126	Fair	Used
3A	16	1913.6	21085/21085	1.124	Fair	Used
3A	17	1915	21092/21106	1.123	Good	Used
3A	18	1916.5	21108/21119	1.123	Good	Used
3A	19	1918.3	21129/21134	1.123	Fair	Used

Run no.	Test no.	Depth mRKB	Form. pressure kPa Hp/Strain gm/cc	Permeability	Comments
3A	20	1920	21152/21154 1.124	Fair	Used
3A	21	1925.7	21247/21231 1.125	Fair-good	Not used
3A	22	1927	22734/22713	Supercharge	Not used
3A	23	1931.5	21261/21272 1.122	Very good	Used
3A	24	1933.7	n.a./n.a.	Nearly tight	Not used
3A	25	1934	21289/21285 1.123	Excellent	Used
3A	26	1947	21423/21417 1.122	Excellent	Used
3A	27	1949	21444/21438 1.122	Excellent	Used
3A	28	2031	22291/22280 1.119	Excellent	Used
3A	29	2056	22551/22570 1.119	Excellent	Used
3A	30	2068	22684/22682 1.119	Excellent	Used
3A	31	1884.5	21050/21022 1.139	Excellent	Sample 1
3B	32	1899	21060/n.a. 1.131	Fair	Sample 2
3C	33	1899	n.a./21117 1.134	Fair	Sample 3

\* HP-gauge pressures is corrected for distance from FMT measuring point to H.P. crystal gauge. (The distance is 1 meter). Pressures are converted from psia to kPa.

\* Crystal gauge measured pressure are corrected according to calibration curve. Pressures are converted from psig to kPa.

Contact and gradients from FMT

### II.2.1 Sampling

-----  
3 samples were taken out of 3 attempts. Onshore-results are not available yet. The following results were obtained offshore:

#### Sample No 1 at 1884.5 m RKB

1 gallon chamber: 2000 psi opening pressure.  
2 3/4 gallon chamber did not open, no recovery.

Gas composition (PPM):	Methane	: 88733
	Ethane	: 3097
	Propane	: 2803
	Iso-Butane	: 428
	N-Butane	: 729
	Pentane	: 156
	CO <sub>2</sub>	: 4 %

The 1 gallon chamber was sent onshore for laboratory analysis. Opening pressure for this was 1990 PSI.

#### Sample No 2 at 1899 m RKB

1 gallon chamber: 800 psi opening pressure.  
2 3/4 gallon chamber did not open, no recovery.

Contents 1 gallon chamber: Gas : 2 cuft  
Mudfiltrate : 2.5 l

Mudfiltrate : PH = 9.2  
CL- = 58000PPM

Gas composition (PPM)	:	Methane	:	70343
		Ethane	:	2202
		Propane	:	1716
		Iso-Butane	:	215
		N-Butane	:	397
		Pentane	:	97
		CO <sub>2</sub>	:	4 %

The 1 & 2 3/4 gallon chamber were bled off offshore.

Sample No 3 at 1899 m RKB

1 gallon chamber	:	2200 PSI opening pressure
2 3/4 gallon chamber:		2200 PSI opening pressure

Contents 2 3/4 gallon chamber:	Gas: 26.2 Cuft
	Mudfiltrate: 5.0 l

Mudfiltrate: PH = 9.2

CL- = 58000PPM

Gas composition (PPM)	:	Methane	:	94036
		Ethane	:	2202
		Propane	:	2514
		Iso-Butane	:	352
		N-Butane	:	713
		Pentane	:	265
		CO <sub>2</sub>	:	3 %

The one gallon chamber was sent onshore for laboratory analysis. Opening pressure for this was 2050 PSI.

## II.3 Testing

DST No. 1.

Objectives: Receive good reservoir samples for analysis.

Pressure and temperature measurements.

Determine productivity of the perforated interval.

Perforation interval: 1881.8 - 1889.9 m RKB.

The test was performed by use of the following test string.

- 5" modified drill pipe in a 9 5/8" casing
- Downhole tester valve
- 4 pressure gauges in gauge carriers
- Tubing conveyed perforation, 12 shots/foot

### II.3.1 Test performance

The well was perforated underbalanced using diesel and water as cushion.

On perforation the well was open on a 19.05 mm adjustable choke to surge tank. After 8 minutes 1208 liter were produced.

The following flow and shut-in periods were performed:

Initial flow	: 0.08 hr
Initial build-up	: 0.80 hr
Clean-up flow	: 4.10 hr
Build-up	: 5.80 hr

Main flow	: 7.60 hr
Main build-up	: 10.50 hr
Sampling flow	: 7.08 hr

Three of four gauges performed well during the drill stem test.

During the main flow and sampling flow period, CO<sub>2</sub> and H<sub>2</sub>S content were measured in the gas. Also density and BS&W was measured in addition to samples taken for trace element analysis.

Results from main flow:

CO <sub>2</sub>	: 8 %
H <sub>2</sub> S	: 0 %
BS&W	: 2 %

Results from sampling flow:

CO <sub>2</sub>	: 8 %
H <sub>2</sub> S	: 0 %
BS&W	: 1-10 %

II.3.2 Test results  
-----

	Choke mm	Duration hrs:min	Gas rate sm <sup>3</sup> /d 10 <sup>3</sup>	Cond.rate m <sup>3</sup> /d	GOR sm <sup>3</sup> /m <sup>3</sup>
Initial flow	19.05	:05			
Initial shut-in	-	:50			
Clean-up flow	15.88	4:00	546	20	27300
Shut-in	-	5:49	-	-	-
Main flow	15.88	7:35	527	28	18821
Main shut-in	-	10:27	-	-	-
Sampling flow	15.88	7:08	506	20	25300

From Horner analysis of the main build-up:

$$k = 0.32 \text{ um}^2 \text{ (324 mD)}$$

$$S = 36.4$$

$$\Delta P_{\text{skin}} = 1466 \text{ kPa}$$

The analysis is based on SDP gauge no. 83060 from Flopetrol. The sensing depth is 1847.5 m RKB.

$$PI = 295 \text{ sm}^3/\text{d/kPa}$$



MATERIAL CONSUMPTION REPORT

NORCEM ANCHOR A/S

WELL NAME: 7121/7-26

MUD SYSTEM:

OPERATOR: STATOIL

Spud Mud

ENGINEERS: VASTVEIT, HOLDNUS

SECTION: 36"

INITIAL VOLUME: 0

DATE	7/ 7		7/ 8:	TOTALS
DEPTH	m.	425	425:	0
VOLUME MADE	m.cu.	280	331:	611
VOLUME RECEIVED	m.cu.		:	0
SURFACE LOSSES	m.cu.		:	0
DOWNHOLE LOSSES	m.cu.	240	50:	290
VOLUME DUMPED	m.cu.		:	0
LEFT IN HOLE	m.cu.		:	0
BACK LOADED	m.cu.		:	0
FINAL VOLUME	m.cu.	230	321:	0
BARYTE	M/T		93:	93
BENTONITE	M/T	31	17:	48
CAUSTIC SODA	25Kg	6	7:	13
SODA ASH	50Kg	3	3:	6

MATERIAL CONSUMPTION REPORT

NORCEM ANCHOR A/S

MUD SYSTEM:  
Spud Mud

SECTION: 26"

INITIAL VOLUME: 321

WELL NAME: 7121/7-26

OPERATOR: STATOIL

ENGINEERS: VASTVEIT, HOLDHUS

DATE	TOTALS				TOTALS	
	7/ 9	7/10	7/11	7/12		
DEPTH	m.	458	675	675	675;	0
VOLUME MADE	m.cu.	50	57	85	40;	232
VOLUME RECEIVED	m.cu.				:	0
SURFACE LOSSES	m.cu.	16	10		:	26
DOWNHOLE LOSSES	m.cu.	15	50	116	260;	441
VOLUME DUMPED	m.cu.				62;	62
LEFT IN HOLE	m.cu.				:	0
BACK LOADED	m.cu.				:	0
FINAL VOLUME	m.cu.	340	337	306	24;	0
BARYTE	M/T		7		:	7
BENTONITE	M/T			10	:	10
CAUSTIC SODA	25Kg	3	6	4	:	13

MATERIAL CONSUMPTION REPORT

NORCEM ANCHOR A/S

MUD SYSTEM:  
Polymer/Shaletrol

SECTION: 17.5"

INITIAL VOLUME: 24

WELL NAME: 7121/7-26  
OPERATOR: STATOIL

ENGINEERS: VASTVEIT, BRAUTI (PROMUD), ALISON

		7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	TOTALS
DEPTH	m.	675	678	871	1090	1298	1546	1698	1698	1698	1698	
VOLUME MADE	m.cu.	200	90	135	90	135	75	120	2	32		879
VOLUME RECEIVED	m.cu.											0
SURFACE LOSSES	m.cu.		4	20	59	44	17	42	3	4		193
DOWNHOLE LOSSES	m.cu.											0
VOLUME DUMPED	m.cu.		6	40	35	45	45	44		14	18	247
LEFT IN HOLE	m.cu.										30	30
BACK LOADED	m.cu.											0
FINAL VOLUME	m.cu.	224	304	379	375	421	434	466	467	481	433	0
BARYTE	M/T	6	3	3	3	8	4		9	11		47
BENTONITE	M/T									3		3
CAUSTIC SODA	25Kg	106	70	114	82	108	34	184	4	2	2	706
SODA ASH	50Kg			4								4
SHALE TROL	25Kg	260	180	300	280	180		440				1640
DRISPAC REG.	50lbs	10	3		3	3	3	7	7	15	2	53
DRISPAC SL	50lbs	56	36	57	60	95	7					311
ICD POLYMER	50lbs	12		4	6	11	7	26	15	14		95
STAFLO EXLO	25Kg						75	57	18			150
SOLTEX	50lbs						202					202
ZINC CARBONATE	25Kg								40	15		55
ANCOCIDE	25L									8		8

MATERIAL CONSUMPTION REPORT

NORCEM ANCHOR A/S

MUD SYSTEM:  
Polymer/Shaletrol

SECTION: 12.25"

INITIAL VOLUME: 433

WELL NAME: 7121/7-2

OPERATOR: STATOIL

ENGINEERS: FOTHERINGHAM (PROMUD), ALISON

		7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/ 1	8/ 2	8/ 3	8/ 4	TOTALS
DEPTH	m.	1698	1701	1872	1903	1938	2028	2114	2156	2156	2156	2156		2156	2156	
VOLUME MADE	m.cu.	0		55		2		1					53	0	1	112
VOLUME RECEIVED	m.cu.															0
SURFACE LOSSES	m.cu.		2	15	4	5	4	32	10	9		4	10	6	10	111
DOWNHOLE LOSSES	m.cu.															0
VOLUME DUMPED	m.cu.		3	2	2	2	4	6	4	7				11	7	48
LEFT IN HOLE	m.cu.												30			30
BACK LOADED	m.cu.															0
FINAL VOLUME	m.cu.	433	428	466	460	455	447	410	396	380	380	376	389	372	356	0
BARYTE	M/T					10	2	3	2				15		3	35
BENTONITE	M/T												7			7
CAUSTIC SODA	25Kg			70					4		2					76
SODA ASH	50Kg						4									4
SHALE TROL	25Kg			200												200
DRISPAC REG.	50lbs		3	19	8	2	7	15	12						4	70
BICARBONATE	50Kg		19	4									4		4	31
XCD POLYMER	50lbs			5												5
AA 100 LOVIS	25Kg			12			8									20
NaCl	50Kg			328	12	50		38	20		13					461
ZINC CARBONATE	25Kg												22			22
ANCOCIDE	25L			6					6							12

MATERIAL CONSUMPTION REPORT

NORCEM ANCHOR A/S

MUD SYSTEM:  
Polymer/Shaletrol

SECTION: Test

INITIAL VOLUME: 356

WELL NAME: 7121/7-2

OPERATOR: STATOIL

ENGINEERS: FOLKVORD

DATE	8/ 5	8/ 6	8/ 7	8/ 8	8/ 9	8/10	8/11	TOTALS
DEPTH	m.	2156	2156	2156	1855	490	360	
VOLUME MADE	m.cu.					11	26	37
VOLUME RECEIVED	m.cu.							0
SURFACE LOSSES	m.cu.							0
DOWNHOLE LOSSES	m.cu.							0
VOLUME DUMPED	m.cu.			1	3	5	4	326
LEFT IN HOLE	m.cu.			9	10	44	4	67
BACK LOADED	m.cu.							0
FINAL VOLUME	m.cu.	356	356	346	333	295	313	0
BARYTE	N/T				3			3
BICARBONATE	50Kg				7			7

UD VOLUME DISTRIBUTION SUMMARY

ELL: 7121/7-2 RIG: ROSS ISLE

OLE IZE	HOLE FROM-TO	HOLE LENGTH	MUD/BRINE BUILT	DUMPED	LOST TO FORMATION (SEABED)	LOST OVER SOLIDS CONTROL EQUIPMENT	MUD LEFT BETWEEN CSG/CSG	CUTTINGS VOLUME DRILLED	MUD TRANSF. TO NEXT SEC.	MUD TYPE USED FOR INTERVAL
6"	348-425M	77 M	611 M <sup>3</sup>	0 M <sup>3</sup>	290 M <sup>3</sup> *	0 M <sup>3</sup>	0 M <sup>3</sup>	51 M <sup>3</sup>	321 M <sup>3</sup>	SPUD MUD
6"	678M	250 M	232 M <sup>3</sup>	62 M <sup>3</sup>	441 M <sup>3</sup> *	26 M <sup>3</sup>	0 M <sup>3</sup>	86 M <sup>3</sup>	24 M <sup>3</sup>	SPUD MUD
7.5"	1698M	1023 M	879 M <sup>3</sup>	247 M <sup>3</sup>	0 M <sup>3</sup>	193 M <sup>3</sup>	30 M <sup>3</sup>	159 M <sup>3</sup>	433 M <sup>3</sup>	POLYMER/SHALETROI
2.25"	2156M	458 M	112 M <sup>3</sup>	48 M <sup>3</sup>	0 M <sup>3</sup>	111 M <sup>3</sup>	30 M <sup>3</sup>	35 M <sup>3</sup>	356 M <sup>3</sup>	POLYMER/SHALETROI

---

ROD. EST			36 M <sup>3</sup>	326 M <sup>3</sup>			67 M <sup>3</sup>			POLYMER/SHALRTROI
-------------	--	--	-------------------	--------------------	--	--	-------------------	--	--	-------------------

OTALS:

ud/Brine built	: 1870 m <sup>3</sup>	Total Mud/Brine left in hole/+ between csg/csg:	127 m <sup>3</sup>
ud/Brine dumped	: 683 m <sup>3</sup>	Total Mud/Brine to sea	: 1013 m <sup>3</sup>
ud/Brine lost to formation	: 730 m <sup>3</sup>	Total cuttings volume drilled	: 331 m <sup>3</sup>
ud/Brine lost over solids			
ontrol equipment	: 330 m <sup>3</sup>		
ud/Brine left between csg/csg	: m <sup>3</sup>		

RETURNS TO SEABED

STATOIL WELL NO.712177-2

DRILLING MUD PROPERTIES RECORD

MUD SYSTEM:		AREA										TROMSOFLAKET										
SPUD MUD/SHALETROL.		RIG										ROSS ISLE										
DAY No.	DATE 1986	DEPTH metre	M.W. sq	F.V. s/qt	600 cps	300 cps	AV cps	PV cps	YP	GEL 0	GEL 10	API ml	CAKE 32nds.	HTHP. ml.	pH	Pf	Chloride mg/lx1000	Calc. mg/l	Solids %	Oil %	Sand %	MBT ppb.
1	6.7						0	0	0													
2	7.7	425	1.08	125			0	0	0			N.R			10.5							
3	8.7	425	1.1	44	35	28	17.5	7	21	14	15	N.R			9.5							
4	9.7	458	1.1	45	46	38	23	8	30	19	20	N.R			10.1							
5	10.7	675	1.18	45	47	39	23.5	8	31	21	22	N.R			9.7						Tr.	
6	11.7	675	1.17	45	49	40	24.5	9	31	20	24	N.R			10						Tr.	
7	12.7	675	1.1	56	36	25	18	11	14	3	4	8	1		8.5	.05	19.00	.76	7			
8	13.7	678	1.1	55	36	25	18	11	14	3	4	8	1		8.5	.05	19.00	.76	7			
9	14.7	871	1.1	64	50	35	25	15	20	3	7	6.6	1		8.8	.05	19.00	.64	7	Tr.		3
10	15.7	1060	1.14	78	69	48	34.5	21	27	5	16	5.8	1		8.4	.05	18.50	.68	9	Tr.		8
11	16.7	1298	1.15	80	68	47	34	21	26	4	19	5.4	1		8.7	.05	19.00	.52	9	.25		10
12	17.7	1546	1.15	80	66	45	33	21	24	4	15	4.8	1		8.7	.05	19.00	.44	9	.25		12
13	18.7	1698	1.15	77	67	46	33.5	21	25	4	19	4.9	1	21.00	8.6	.05	19.50	.5	8	.25		13
14	19.7	1698	1.2	75	63	43	31.5	20	23	4	16	4.8	1	21.00	8.6	.05	19.50	.44	9	.25		13
15	20.7	1698	1.2	68	60	41	30	19	22	3	15	5.2	1	22.00	9.1	.1	19.50	.42	8	Tr.		13
16	21.7	1698	1.2	68	63	43	31.5	20	23	4	17	5.2	1	22.00	8.7	.1	19.50	.48	8	Tr.		13
17	22.7	1698	1.2	67	60	41	30	19	22	3	15	5	1	22.00	8.8	.1	19.50	.44	8	Tr.		13
18	23.7	1707	1.19	61	48	32	24	16	16	4	26	6.2	1	23.00	11	.8	20.00	.32	8	Tr.		13
19	24.7	1872	1.25	65	50	34	25	16	18	3	28	5.2	1	19.00	9.6	.3	57.90	.4	12	Tr.		13
20	25.7	1903	1.25	70	54	36	27	18	18	4	30	5	1	23.00	9.4	.2	56.00	.44	12	.25		18
21	26.7	1938	1.25	67	53	35	26.5	18	17	3	26	4.8	1	24.00	9.4	.2	56.00	.54	12	Tr.		15
22	27.7	2028	1.26	68	53	34	26.5	19	15	3	28	5.4	1	32.00	9.2	.1	58.00	.4	12.5	.25		18
23	28.7	2114	1.25	66	55	36	27.5	19	17	3	21	5.1	1	19.00	9	.1	57.00	.64	12	.3		19
24	29.7	2156	1.25	66	55	36	27.5	19	17	3	18	5	1	18.00	8.9	.05	56.00	.78	12	.25		15
25	30.7	2154	1.24	66	52	34	26	18	16	3	14	5.1	1		9.2	.05	58.00	.74	12.5	.25		15
26	31.7	2156	1.25	64	52	34	26	18	16	3	15	5	1		9.2	.05	58.00	.7	12	.25		15
27	1.8	2156	1.25	69	50	32	25	18	14	2	15	4.8	1		8.9	.05	55.00	.84	12	.25		15
28	2.8	2156	1.25	68	48	31	24	17	14	2	13	5	1		8.8	.05	54.00	.88	12	Tr.		15
29	3.8	2156	1.25	65	47	31	23.5	16	15	3	20	6	1		9.4	.05	52.00	.76	12	Tr.		15







## 1. INTRODUCTION

One gas sample from well 7121/7-2 was received October 1986.

On the sample  $C_1-C_4$  and  $CO_2$  are quantified, and the  $\delta^{13}C$  value is measured on methane, ethane, propane, the butanes and  $CO_2$ . The  $\delta D$  value is also measured on methane.

## 2. ANALYTICAL PROCEDURE

The natural gas has been quantified and separated into the different gas components by a Carlo-Erba 4200 instrument. This gas chromatograph is equipped with a special injection loop in order to concentrate the samples, in the case of low concentration of the gas components. The hydrocarbon gas components were oxidized in separate  $CuO$ -ovens in order to prevent cross contamination. The combustion products  $CO_2$  and  $H_2O$  were frozen into collection vessels and separated.

The water was reduced with zinc metal in a sealed tube to prepare hydrogen for isotopic analysis. The isotopic measurements were performed on a Finnigan Mat 251 and a Finnigan Mat delta mass spectrometer. Our  $\delta^{13}C$  value on NBS22 is  $-29.77 \pm .06$  o/oo PDB.

## 3. RESULTS

The volume composition of the sample are given in Table 1. The results have been normalized to 100%. The stable isotope results are given in Table 2.

Our uncertainty on the  $\delta^{13}C$  value is estimated to be  $\pm 0.3$  o/oo and includes all the different analysis step. The uncertainty on the  $\delta D$  value is likewise estimated to be  $\pm 5$  o/oo.

Table 1 Volume composition of a natural gas from well 7121/7-2

Sample	IFE no.	C <sub>1</sub> %	C <sub>2</sub> %	C <sub>3</sub> %	i-C <sub>4</sub> %	n-C <sub>4</sub> %	CO <sub>2</sub> %	ΣC <sub>1</sub> -C <sub>4</sub>	$\frac{\Sigma C_2-C_4}{\Sigma C_1-C_4}$	$\frac{i-C_4}{n-C_4}$
7121/7-2 1881.8 - 1889.8 m	5617A	83.0	5.2	2.2	0.33	0.69	8.6	91.4	0.09	0.48

Table 2 Isotopic composition of a natural gas from well 7121/7-2

Sample	IFE no.	C <sub>1</sub> $\delta^{13}C$ PDB	C <sub>1</sub> $\delta D$ SMOW	C <sub>2</sub> $\delta^{13}C$ PDB	C <sub>3</sub> $\delta^{13}C$ PDB	i-C <sub>4</sub> $\delta^{13}C$ PDB	n-C <sub>4</sub> $\delta^{13}C$ PDB	CO <sub>2</sub> $\delta^{13}C$ PDB	$\delta^{18}O$ PDB
7121/7-2 1881.8 - 1889.8 m	5617A	-40.3	-170	-30.5	-29.4	-28.8	-29.8	- 8.6	-10.4