WELL NAME : 24/9-4		RIG :	BYFORD DOLPHIN
TOTAL DEPTH : 2208 m. (SIDETRACK 2164 m.)		DRILLING CONTRACTOR :	DOLPHIN A/S
SPUD DATE : 17/04/91		DATE RIG ON HIRE :	13/04/91
T.D. DATE : 27/05/91 (SIDETRACK 04/06/91)		DATE RIG OFF HIRE :	18/06/91

6.2. RFT MEASUREMENTS

RFT points were taken throughout the four reservoir sections. The overall quality of the data is poor due to the type of reservoir (unconsolidated sandstone), the hole conditions (caliper log indicates values from 6.5 to 14 inches) and large drilling fluid invasion in the reservoir sections.

Three RFT runs were performed and a wiper trip was required between run 2 & 3 to pass the tight point at 1805 m BRT. The main problems encountered were the followings :

- supercharging
- seal failure
- internal flowline plugged with sand and mud

Various RFT equipments (choke size, filter, probe) were tried to improve the quality of the data.

A summary of the measurements are presented in the Table below and the points are shown on Figure 12.

Run	Set	Zone	Measured Depth (m BRT)	TVD Depth (m BRT)	Hydrostatic Pressure (PSI)	Formation Pressure (PSI)	K/U (md/ft)	Comments
3	10	I	1766.0	1766.0	3634.2	2835.3		supercharged
3	11		1766.5	1766.5	3635.2			dry test
1	1	II	1780.0	1780.0	3684.5			dry test
1	3		1782.5	1782.5	3693.8			dry test
1	2		1783.5	1783.5	3695.9	3708.1		supercharged
1	7	III	1793.0	1793.0	3715.2			dry
1	6		1794.0	1794.0	3717.7	2639.3	15.04	normal
2	9		1794.5	1794.5	3717.1	2639.4		sampling plugging of flowline with sand
3	18		1794.8	1794.8	3695.8	2652.4		sampling - lost seal on first chamber remove the tool
1	5		1795.0	1795.0	3719.3	2642.9		sampling seal failure when opening the second bottle
3	19		1795.5	1795.5	3695.7	2664.1		sampling - open the first chamber for 18.4 min - final pressure 2476.6 open the second chamber for 40 min - final pressure 2589.0
1	4		1796.0	1796.0	3721.0	2651.6	12.42	normal
1	8		1796.5	1796.5	3722.8	2654.5		normal
3	12	IV	1812.5	1812.5	3725.9			seal failure
3	13		1815.5	1815.5	3734.4			dry
3	14		1816.0	1816.0	3735.3			dry
3	15		1817.0	1817.0	3738.2	2640.74	2.69	normal
3	16		1817.5	1817.5	3740.3	2641.71		normal
3	17		1818.0	1818.0	3741.0			seal failure

WELL NAME : 24/9-4		RIG	: BYFORD DOLPHIN
TOTAL DEPTH : 2208 m. (SIDETRACK 2164 m.)		DRILLING CONTRACTOR	: DOLPHIN A/S
SPUD DATE : 17/04/91		DATE RIG ON HIRE	: 13/04/91
T.D. DATE : 27/05/91 (SIDETRACK 04/06/91)		DATE RIG OFF HIRE	: 18/06/91

- four attempts were made to collect representative reservoir fluid samples. On each run, a 2 3/4 and a 1 gallon RFT chamber were used. The 2 3/4 chambers were full of mud/mudfiltrate. Some oil shows were found but could not be used for laboratory analysis.

MUD REPORT

WELL NAME	: 24/9-4	RIG	: BYFORD DOLPHIN
TOTAL DEPTH	: 2208 m. (SIDETRACK 2164 m.)	DRILLING CONTRACTOR	: DOLPHIN A/S
SPUD DATE	: 17/04/91	DATE RIG ON HIRE	: 13/04/91
T.D. DATE	: 27/05/91 (SIDETRACK 04/06/91)	DATE RIG OFF HIRE	: 18/06/91

FROM REPORT # 1 TO REPORT # 63

DATE	DEPTH (m)	MUD WT. s.g.	FUNNEL VISC s/l	FLOW TEMP degF	PLASTIC VISC. cps	YIELD POINT lb/ 100 ft2	PH	GELS 10sec 10min lb/100 ft2	FILTRATE (ml/30 min)	CAKE 32ND mm	SAND % by VOL	OIL % by VOL	SOLIDS % by VOL	ALKALINITY (Pf / Mf)		TOTAL CHLOR. IN MUD mg/l	TOTAL KCl IN MUD g/l
91/04/13								/									
91/04/14								/									
91/04/15								/									
91/04/16								/									
91/04/17	0.0	1.03	0.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/18	0.0	1.03	0.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/19	211.0	1.03	140.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/20	756.0	1.20	100.0		6.0	20.0	0.0	14.0/ 27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/21	756.0	1.03	140.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/22	756.0	1.03	140.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/23	756.0	1.03	140.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/24	756.0	1.20	37.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/25	756.0	1.20	37.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/26	756.0	1.20	37.0		0.0	0.0	0.0	0.0/ 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
91/04/27	756.0	1.08	100.0		20.0	30.0	9.0	0.0/ 0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	20000	35
91/04/28	756.0	1.08	90.0		18.0	29.0	9.3	0.0/ 0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	23000	37
91/04/29	876.0	1.09	83.0		19.0	27.0	9.4	0.0/ 0.0	9.0	1.0	0.5	0.0	3.0	0.0	0.0	25000	35
91/04/30	1155.0	1.14	77.0		20.0	27.0	8.8	3.0/ 4.0	5.0	1.0	0.5	0.0	5.0	0.2	1.1	32000	37
91/05/01	1179.0	1.15	90.0		20.0	27.0	8.9	3.0/ 4.0	4.5	1.0	0.5	0.0	5.0	0.1	0.9	33000	35
91/05/02	1179.0	1.15	90.0		19.0	26.0	8.7	3.0/ 4.0	4.5	1.0	0.3	0.0	5.0	0.1	0.9	33000	30
91/05/03	1179.0	1.15	90.0		22.0	28.0	8.7	3.0/ 4.0	4.3	1.0	0.5	0.0	5.0	1.0	0.7	32000	30
91/05/04	1396.0	1.20	80.0		25.0	30.0	10.6	3.0/ 4.0	5.5	1.0	0.5	0.0	8.0	0.1	0.5	32000	27
91/05/05	1532.0	1.20	80.0		25.0	30.0	9.1	4.0/ 5.0	4.5	1.0	0.5	0.0	9.0	0.1	0.5	32000	28
91/05/06	1654.0	1.20	74.0		34.0	28.0	8.5	4.0/ 6.0	4.5	1.0	1.0	0.0	9.5	0.1	0.4	31000	30
91/05/07	1654.0	1.20	82.0		21.0	28.0	9.0	3.0/ 4.0	4.5	1.0	0.8	0.0	9.0	0.1	0.7	33000	38
91/05/08	1654.0	1.20	75.0		20.0	23.0	8.0	1.0/ 3.0	4.1	1.0	1.3	0.0	10.0	0.2	0.4	33000	40
91/05/09	1295.0	1.20	80.0		20.0	22.0	8.3	1.0/ 3.0	4.0	1.0	1.3	0.0	10.0	0.1	0.9	32000	38
91/05/10	1654.0	1.35	75.0		20.0	21.0	8.3	1.0/ 3.0	4.2	0.5	1.3	0.0	14.0	0.2	0.9	32000	38
91/05/11	1654.0	1.35	70.0		25.0	25.0	8.4	2.0/ 5.0	0.0	1.0	1.0	0.0	14.0	0.1	0.9	33000	35
91/05/12	1654.0	1.35	65.0		24.0	22.0	8.3	1.0/ 4.0	4.2	1.0	1.0	0.0	14.0	0.1	0.9	34000	37

MUD REPORT

WELL NAME	: 24/9-4	RIG	: BYFORD DOLPHIN
TOTAL DEPTH	: 2208 m. (SIDETRACK 2164 m.)	DRILLING CONTRACTOR	: DOLPHIN A/S
SPUD DATE	: 17/04/91	DATE RIG ON HIRE	: 13/04/91
T.D. DATE	: 27/05/91 (SIDETRACK 04/06/91)	DATE RIG OFF HIRE	: 18/06/91

FROM REPORT # 1 TO REPORT # 63

DATE	DEPTH (m)	MUD WT. s.g.	FUNNEL VISC s/l	FLOW TEMP degF	PLASTIC VISC. cps	YIELD POINT lb/ 100 ft2	PH	GELS 10sec 10min lb/100 ft2	FILTRATE (ml/30 min)	CAKE 32ND mm	SAND % by VOL	OIL % by VOL	SOLIDS % by VOL	ALKALINITY (Pf / Mf)		TOTAL CHLOR. IN MUD mg/l	TOTAL KCl IN MUD g/l
91/05/13	1654.0	1.42	70.0		26.0	38.0	8.2	5.0/ 9.0	4.8	1.0	1.8	0.0	16.0	0.1	1.0	36000	35
91/05/14	1654.0	1.42	70.0		24.0	27.0	8.3	3.0/ 6.0	4.7	1.0	1.8	0.0	16.0	0.1	1.0	36000	36
91/05/15	1585.0	1.42	70.0		26.0	25.0	8.3	3.0/ 6.0	5.1	1.0	1.8	0.0	16.0	0.1	1.0	36000	36
91/05/16	1585.0	1.39	65.0		35.0	22.0	8.5	3.0/ 6.0	5.2	1.0	1.5	0.0	15.0	0.1	1.0	36000	36
91/05/17	1657.0	1.39	60.0		19.0	19.0	10.2	3.0/ 6.0	6.5	1.0	1.8	0.0	15.0	0.1	1.0	36000	35
91/05/18	1773.0	1.14	26.0		16.0	20.0	8.4	3.0/ 6.0	4.0	1.0	1.0	0.0	7.0	0.1	1.0	38000	38
91/05/19	1787.5	1.14	24.5		16.0	20.0	8.3	3.0/ 2.0	3.9	0.5	0.8	0.0	7.0	0.1	1.0	38500	37
91/05/20	1870.0	1.14	21.0		14.0	14.0	8.2	1.0/ 2.0	3.9	0.5	0.5	0.0	6.0	0.1	0.8	39000	37
91/05/21	1875.0	1.14	62.0		14.0	15.0	8.2	1.0/ 2.0	4.0	0.5	0.5	0.0	6.0	0.1	0.8	39000	37
91/05/22	1900.0	1.25	62.0		14.0	14.0	8.1	3.0/ 3.0	3.3	0.5	1.0	0.0	11.0	0.1	1.2	39000	35
91/05/23	1950.0	1.35	57.0		19.0	19.0	8.7	3.0/ 4.0	3.7	0.5	1.5	0.0	14.0	0.1	1.7	37000	35
91/05/24	1949.0	1.35	52.0		17.0	14.0	8.2	2.0/ 3.0	3.8	3.8	1.5	0.0	14.0	0.1	1.3	37000	32
91/05/25	1949.0	1.35	57.0		17.0	14.0	8.0	2.0/ 3.0	4.0	0.5	1.5	0.0	14.0	0.0	1.1	37000	30
91/05/26	1975.0	1.29	64.0		17.0	14.0	8.8	2.0/ 3.0	3.9	0.5	1.0	0.0	12.0	0.0	1.4	38000	29
91/05/27	2204.0	1.25	53.0		19.0	18.0	9.0	3.0/ 5.0	3.9	0.5	1.0	0.0	10.0	0.0	1.5	40000	40
91/05/28	1837.0	1.42	57.0		20.0	15.0	9.0	2.0/ 3.0	3.9	0.5	1.0	0.0	15.5	0.0	1.5	40000	38
91/05/29	1837.0	1.42	57.0		20.0	16.0	9.0	2.0/ 3.0	3.9	0.5	1.0	0.0	15.5	0.0	2.0	40000	38
91/05/30	1864.0	1.42	60.0		20.0	18.0	8.6	3.0/ 4.0	4.0	0.5	1.0	0.0	15.5	0.0	1.4	39000	38
91/05/31	1745.0	1.42	54.0		23.0	14.0	10.8	3.0/ 4.0	5.5	0.5	1.5	0.0	16.0	0.4	1.2	39000	38
91/06/01	1842.0	1.42	61.0		25.0	20.0	11.9	4.0/ 6.0	6.5	0.5	1.5	0.0	17.0	0.4	1.8	39000	38
91/06/02	1979.0	1.42	56.0		22.0	16.0	11.3	3.0/ 7.0	4.3	0.5	1.0	0.0	17.0	0.4	2.2	39000	40
91/06/03	2151.0	1.42	64.0		27.0	16.0	10.2	3.0/ 4.0	3.2	0.5	1.0	0.0	17.0	0.2	1.5	39000	40
91/06/04	1941.0	1.42	60.0		25.0	15.0	9.8	3.0/ 4.0	3.7	0.5	1.0	0.0	16.5	0.1	1.7	40500	40
91/06/05	1903.0	1.42	82.0		25.0	14.0	9.6	2.0/ 4.0	3.7	0.5	1.0	0.0	17.0	0.1	1.3	40000	40
91/06/06	1903.0	1.42	75.0		27.0	15.0	8.3	1.0/ 2.0	3.2	0.5	1.0	0.0	16.0	0.0	0.9	38000	39
91/06/07	1879.0	1.42	80.0		27.0	18.0	8.7	3.0/ 6.0	3.3	0.5	1.0	0.0	16.0	0.1	0.9	39000	39
91/06/08	1887.0	1.42	73.0		25.0	19.0	8.3	2.0/ 5.0	3.0	0.5	1.3	0.0	16.0	0.1	0.9	40000	39
91/06/09	1881.0	1.42	62.0		24.0	18.0	8.1	2.0/ 4.0	3.2	0.0	1.0	2.0	16.0	0.1	1.0	40000	39
91/06/10	1903.0	1.42	61.0		23.0	17.0	8.0	2.0/ 3.0	3.2	0.0	1.0	2.0	16.0	0.0	0.9	41000	40
91/06/11	1903.0	1.42	63.0		23.0	18.0	8.0	2.0/ 3.0	2.9	0.0	0.8	2.0	16.0	0.0	1.0	41000	40

MUD REPORT

WELL NAME	: 24/9-4	RIG	: BYFORD DOLPHIN
TOTAL DEPTH	: 2208 m. (SIDETRACK 2164 m.)	DRILLING CONTRACTOR	: DOLPHIN A/S
SPUD DATE	: 17/04/91	DATE RIG ON HIRE	: 13/04/91
T.D. DATE	: 27/05/91 (SIDETRACK 04/06/91)	DATE RIG OFF HIRE	: 18/06/91

FROM REPORT # 1 TO REPORT # 63

DATE	DEPTH (m)	MUD WT. s.g.	FUNNEL VISC s/l	FLOW TEMP degF	PLASTIC VISC. cps	YIELD POINT lb/ 100 ft2	PH	GELS 10sec 10min lb/100 ft2	FILTRATE (ml/30 min)	CAKE 32ND mm	SAND % by VOL	OIL % by VOL	SOLIDS % by VOL	ALKALINITY (Pf / Mf)		TOTAL CHLOR. IN MUD mg/l	TOTAL KCl IN MUD g/l
91/06/12	1903.0	1.42	63.0		23.0	18.0	8.0	2.0/ 3.0	2.9	0.5	0.8	2.0	16.0	0.1	1.0	41000	40
91/06/13	1903.0	1.42	63.0		23.0	18.0	8.0	2.0/ 3.0	2.9	0.5	0.8	2.0	16.0	0.0	1.0	41000	40
91/06/14								/									

FINA EXPLORATION NORWAY, 24/9-4
COST AND PRODUCT ADDITIONS

36" HOLE SECTION

Rig: BYFORD DOLPHIN

Contractor: DOLPHIN A/S

Start date for hole section:	16.04.91	Last date hole section:	18.04.91
Start FSR No. for hole sect:	1	Hole section [inches]:	36
Start volume for hole section:	0	Drilling days:	3
Hole from [metre] :	119	Hole to [metre] :	211

Product	Quantity	Units	Unit price NOK	Total cost NOK
Barite	68	m/t	575,00	39 100,00
Bentonite	28	m/t	1 700,00	47 600,00
Soda Ash	10	25 kg sacks	120,00	1 200,00
Caustic Soda	5	25 kg sacks	180,00	900,00
XCD-polymer	2	25 kg sacks	1 850,00	3 700,00

Volume transf. from previous hole section:	[cubic metres]	0
VOLUME MIXED:	[cubic metres]	240
VOLUME USED:	[cubic metres]	114
Volume transferred to next hole section:	[cubic metres]	126

Cost per metre:	NOK	1 005,43
Cost per cubic metre:	NOK	385,42
Total product cost for interval:	**NOK**	**92 500,00**

FINA EXPLORATION NORWAY, 24/9-4
COST AND PRODUCT ADDITIONS

26" HOLE SECTION

Rig: BYFORD DOLPHIN

Contractor: DOLPHIN A/S

Start date for hole section:	19.04.91	Last date hole section:	27.04.91
Start FSR No. for hole sect:	3	Hole section [inches]:	26
Start volume for hole section:	126	Drilling days:	9
Hole from [metre] :	206	Hole to [metre] :	756

Product	Quantity	Units	Unit price NOK	Total cost NOK
Barite	112	m/t	575,00	64 400,00
Bentonite	80	m/t	1 700,00	136 000,00
Soda Ash	12	25 kg sacks	120,00	1 440,00
Caustic Soda	14	25 kg sacks	180,00	2 520,00
XCD-polymer	3	25 kg sacks	1 850,00	5 550,00
Cepac Regular	13	25 kg sacks	505,00	6 565,00

Volume transf. from previous hole section:	[cubic metres]	126
VOLUME MIXED:	[cubic metres]	819
VOLUME USED:	[cubic metres]	839
Volume transferred to next hole section:	[cubic metres]	106

Cost per metre:	NOK	393,59
Cost per cubic metre:	NOK	264,32
Total product cost for interval:	**NOK**	**216 475,00**

FINA EXPLORATION NORWAY, 24/9-4
COST AND PRODUCT ADDITIONS

17 1/2" HOLE SECTION

Rig: BYFORD DOLPHIN

Contractor: DOLPHIN A/S

Start date for hole section:	28.04.91	Last date hole section:	02.05.91
Start FSR No. for hole sect:	12	Hole section [inches]:	17 1/2
Start volume for hole section:	106	Drilling days:	5
Hole from [metre] :	756	Hole to [metre] :	1180

Product	Quantity	Units	Unit price NOK	Total cost NOK
Barite	14	m/t	575,00	8 050,00
PHPA	160	50 lbs sacks	850,00	136 000,00
Cepac Regular	117	25 kg sacks	505,00	59 085,00
Cepac Super Low	90	25 kg sacks	505,00	45 450,00
XCD-polymer	5	25 kg sacks	1 850,00	9 250,00
Potassium Carbonate	9	25 kg sacks	210,00	1 890,00
Ancocide	5	25 litre cans	350,00	1 750,00
Defoamer	2	25 litre cans	350,00	700,00
WBS 200	40	50 lbs sacks	1 050,00	42 000,00
KCl-brine	95	m3	450,00	42 750,00
Soda Ash	4	25 kg sacks	120,00	480,00

Volume transf. from previous hole section:	[cubic metres]	106
VOLUME MIXED:	[cubic metres]	525
VOLUME USED:	[cubic metres]	315
Volume transferred to next hole section:	[cubic metres]	316

Cost per metre:	NOK	819,35
Cost per cubic metre:	NOK	661,72
Total product cost for interval:	**NOK**	**347 405,00**

FINA EXPLORATION NORWAY, 24/9-4
COST AND PRODUCT ADDITIONS

12 1/4" HOLE SECTION

Rig: BYFORD DOLPHIN

Contractor: DOLPHIN A/S

Start date for hole section:	03.05.91	Last date hole section:	16.05.91
Start FSR No. for hole sect:	17	Hole section [inches]:	12 1/4
Start volume for hole section:	316	Drilling days:	14
Hole from [metre] :	1144	Hole to [metre] :	1585

Product	Quantity	Units	Unit price NOK	Total cost NOK
Barite	234	m/t	575,00	134 550,00
PHPA	210	50 lbs sacks	850,00	178 500,00
Cepac Regular	77	25 kg sacks	505,00	38 885,00
Cepac Super Low	166	25 kg sacks	505,00	83 830,00
XCD-polymer	65	25 kg sacks	1 850,00	120 250,00
Potassium Carbonate	36	25 kg sacks	210,00	7 560,00
Ancocide	9	25 litre cans	350,00	3 150,00
Defoamer	7	25 litre cans	350,00	2 450,00
WBS 200	110	50 lbs sacks	1 050,00	115 500,00
KCl-brine	138	m3	450,00	62 100,00
Soda Ash	5	25 kg sacks	120,00	600,00
Soduim Bicarbonate	33	25 kg sacks	120,00	3 960,00
KOH	5	25 kg sacks	250,00	1 250,00

Volume transf. from previous hole section:	[cubic metres]	316
VOLUME MIXED:	[cubic metres]	633
VOLUME USED:	[cubic metres]	615
Volume transferred to next hole section:	[cubic metres]	334

Cost per metre:	NOK	1 706,54
Cost per cubic metre:	NOK	1 188,92
Total product cost for interval:	**NOK**	**752 585,00**

FINA EXPLORATION NORWAY, 24/9-4
COST AND PRODUCT ADDITIONS

8 1/2" HOLE SECTION

Rig: BYFORD DOLPHIN

Contractor: DOLPHIN A/S

Start date for hole section:	17.05.91	Last date hole section:	14.06.91
Start FSR No. for hole sect:	31	Hole section [inches]:	8 1/2
Start volume for hole section:	334	Drilling days:	27
Hole from [metre] :	1585	Hole to [metre] :	2163

Product	Quantity	Units	Unit price NOK	Total cost NOK
Barite	443	m/t	575,00	254 725,00
PHPA	222	50 lbs sacks	850,00	188 700,00
Cepac Regular	124	25 kg sacks	505,00	62 620,00
Cepac Super Low	227	25 kg sacks	505,00	114 635,00
XCD-polymer	108	25 kg sacks	1 850,00	199 800,00
Potassium Carbonate	80	25 kg sacks	210,00	16 800,00
Ancocide	6	25 litre cans	350,00	2 100,00
Defoamer	1	25 litre cans	350,00	350,00
KCl-brine	192	m3	450,00	86 400,00
Soduim Bicarbonate	80	25 kg sacks	120,00	9 600,00
KOH	24	25 kg sacks	250,00	6 000,00
Liquid Casing	48	25 lbs sacks	490,00	23 520,00
Nutplug Fine	28	25 kg sacks	150,00	4 200,00
Mica Fine	24	25 kg sacks	150,00	3 600,00
Anco Free Pipe W	8	200 litre	6 400,00	51 200,00
Anco Lub	4	200 litre	4 900,00	19 600,00
Anco Detergent	4	200 litre	3 680,00	14 720,00

Volume transf. from previous hole section:	[cubic metres]	334
VOLUME MIXED:	[cubic metres]	637
VOLUME USED:	[cubic metres]	904
Volume transferred to next hole section:	[cubic metres]	67

Cost per metre:	NOK	1 831,44
Cost per cubic metre:	NOK	1 661,81
Total product cost for interval:	**NOK**	**1 058 570,00**

U-675

FINA
Exploration & Production

A division of Petrofina

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Date : October 24, 1991

From : R. Burwood/S-M. De Witte

To : Attn: C. NEEDHAM/S. GOERGENVAAG
Fina Exploration Norway, Stavanger

If not received properly, please call : Hilde Van Doorslaer (Tél : 32.2/288.3103)

NUMBER OF PAGES INCLUDING THIS ONE : 22.- (twenty-two)

Message :

Subject : NCS BLOCK 24/9 : COMPARISON AND PROVENANCE OF PALEOGENE RESERVOIRED HEAVY OILS FROM WELLS 24/9-3 AND 24/9-4. EXPLORATION BRIEF EGC/EB 107.

Petrofina s.a.
Rue de l'Industrie, 52 - B-1040 Bruxelles - Belgium - R.C. Bruxelles : 227957 - T.V.A. : 403.079.441
Tel. : 32.2.233.91.11 - Telex : 21556 PFINA B, Explo 1+++ - Fax : 32.2.233.91.42

In essence the level of oil saturation in a series of side wall cores recovered from Paleogene sands at 1837.5 - 1784m in the subject well has been established. The character of the component fluids was then examined and compared with that of an analogous produced sample (DST # 2) from 24/9-3.

TABLE 1

S. VIKING GRABEN - QUADRANT N 24 HINTERLAND

CHARACTERISATION AND COMPARISON OF PALEOGENE RESERVOIRED HEAVY OILS

ASSAY - QUALITY

PETROLEUM	TVD (OWC) (m SS)	PRESENT RES.TEMP. (°C)	GRAVITY (°API)	COMPOSITION (% WT)		
				WAX	SULPHUR	ASPH.
N 24/9-3 (DST # 2)	1661	63.5	19.5	3.5	0.52	2.32
N 24/9-4 (SWC 19/17)*	(1796-94) +	-	NA	< 1.0	4.65	9.48
N 24/9-4 (SWC 11/10/9*	(1817.5-15.5)+	-	NA	< 1.0	1.04	24.16

* BITUMEN EXTRACT

\+ SAMPLING INTERVAL

TABLE 2

NCS BLOCK 24/9

QUANTIFICATION OF LEVEL OF BIODEGRADATIVE ALTERATION

PETROLEUM	ACYCLIC ISOPRENOID BIODEGRADATION RATIO +	DESMETHYHOPANE RATIO *
24/9-4 (1796-94 m)	0.36	0.57
24/9-4 (1817.5-15.5 m)	0.65	0.53
24/9-3 DST # 2 (1782-1765m)	0.28	0.20

\+ PHYTANE/PHYTANE + UNRESOLVED HUMP

* 25-NORHOPANE/25-NORHOPANE + HOPANE

NCS BOCK 24/9 – WELL 24/9-4 PALEOGENE SAND OIL BEARING SECTION.

OIL SATURATION AND ASPHALTENE CONTENT

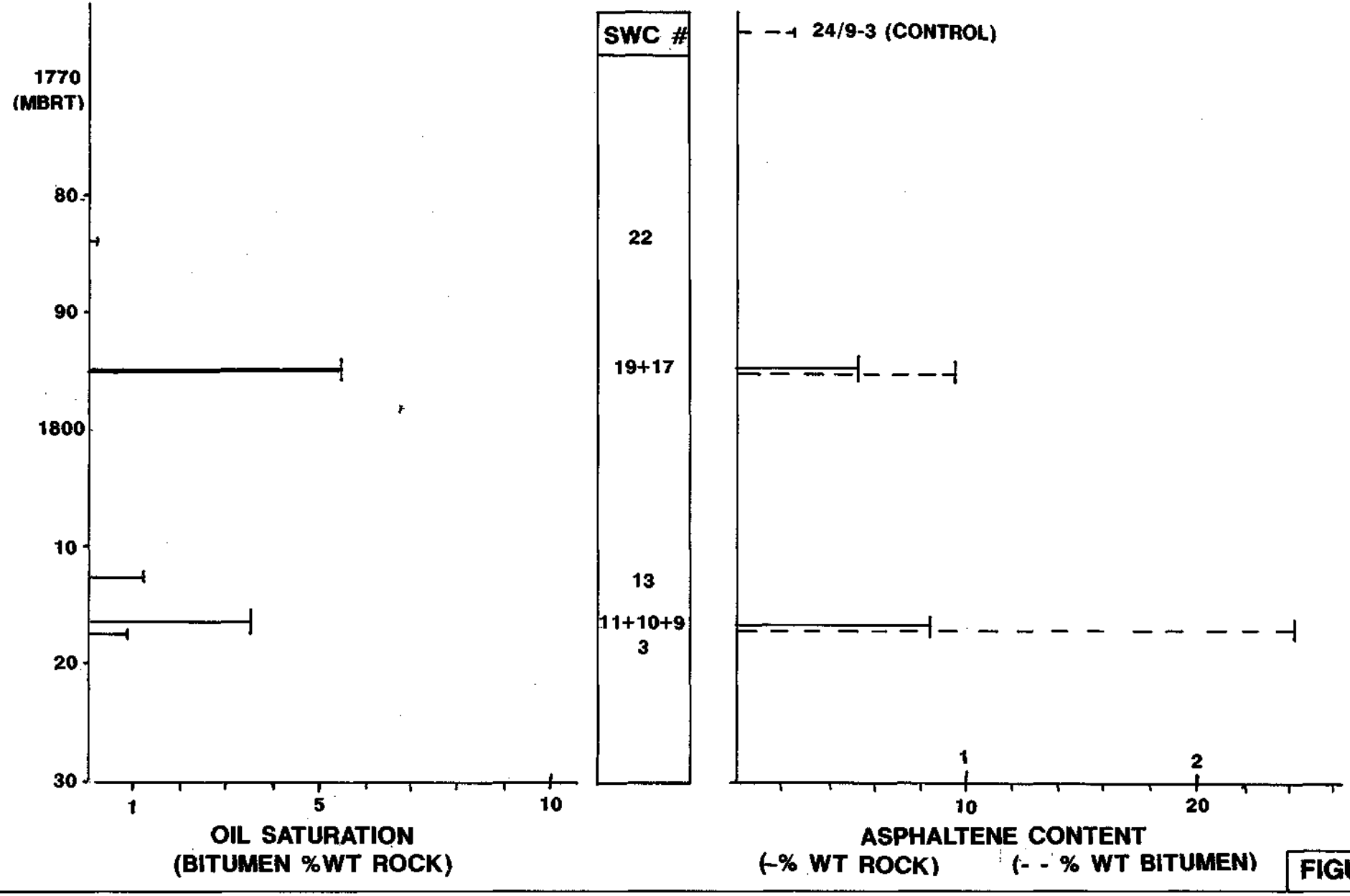


FIGURE 1

MIGRATED HYDROCARBONS
COMPOSITIONAL CLASSIFICATION OF C_{15+} EXTRACT

WELL NO / LOCALITY – **NCS BLOCK 24/9**
COMPARISON OF PALEOGENE RESERVOIRED HEAVY OILS

KEY TO SYMBOLS

- 24/9-4 (1796-94M)
- 24/9-4 (1817.5-15.5M)
- 24/9-3 (DST 2)

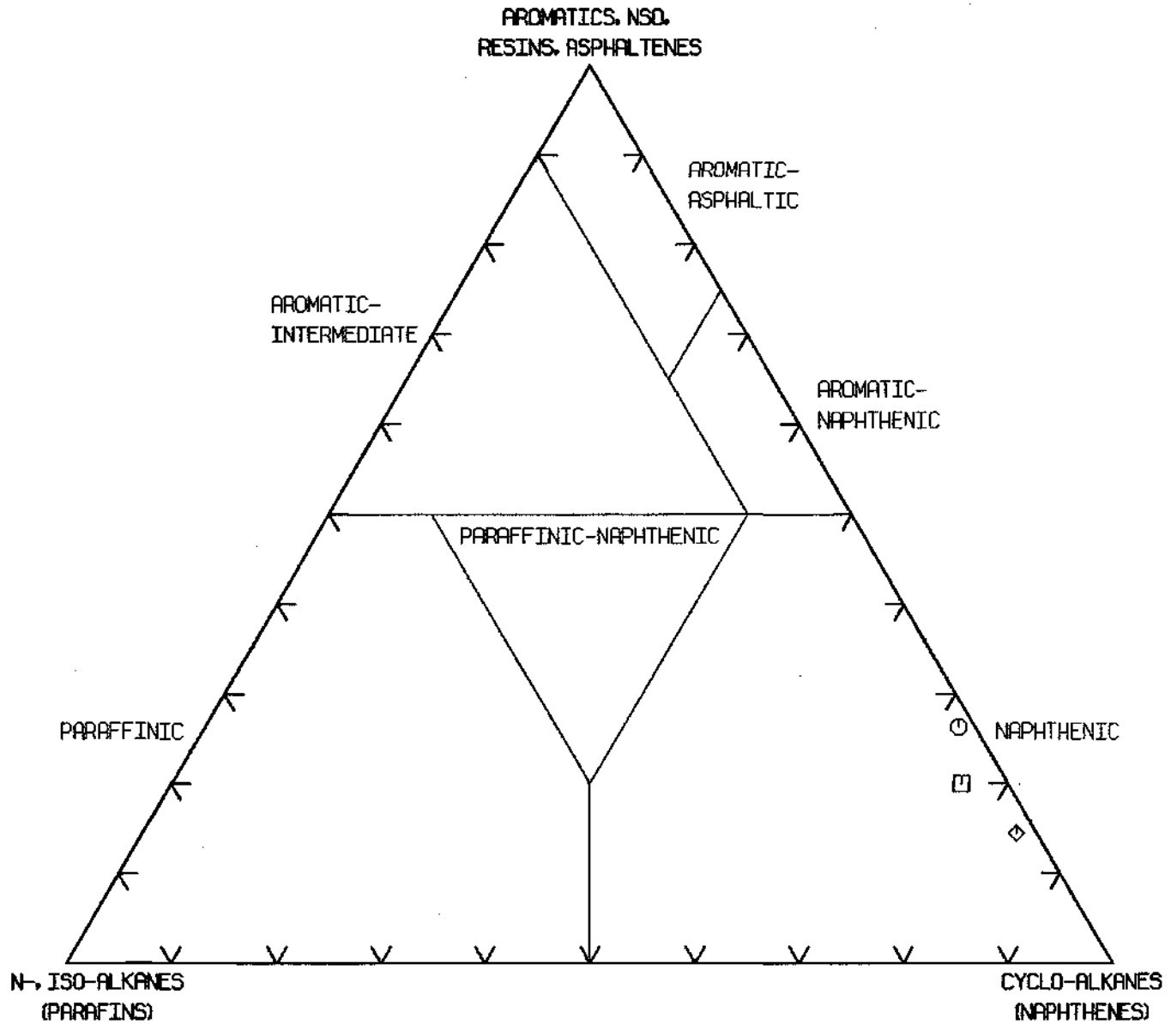
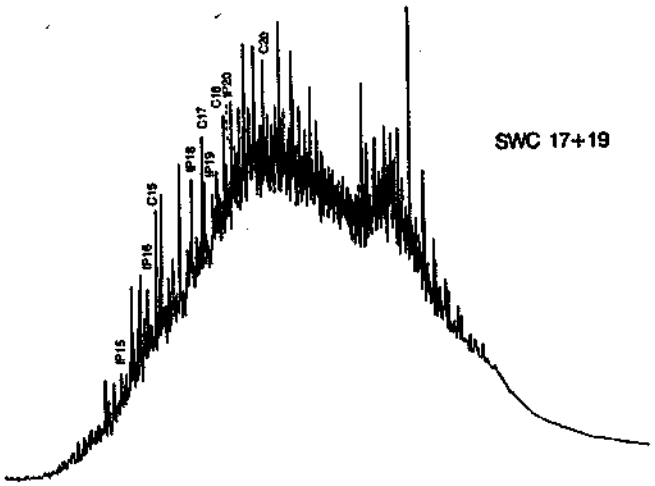


FIGURE 3

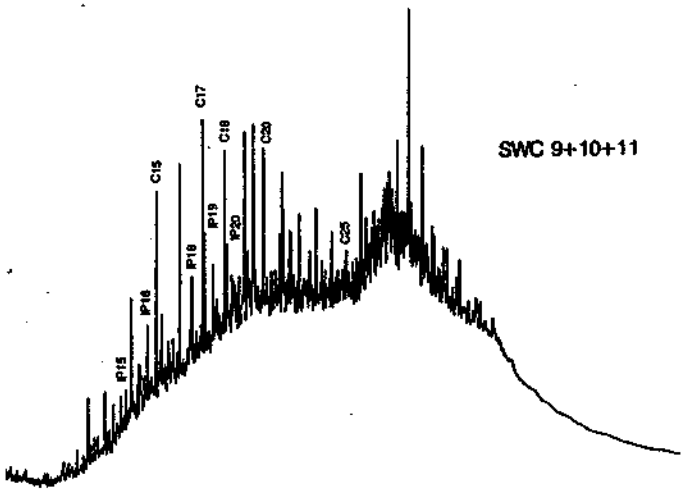
NCS BLOCK 24/9

PALEOGENE RESERVOIRED HEAVY OILS

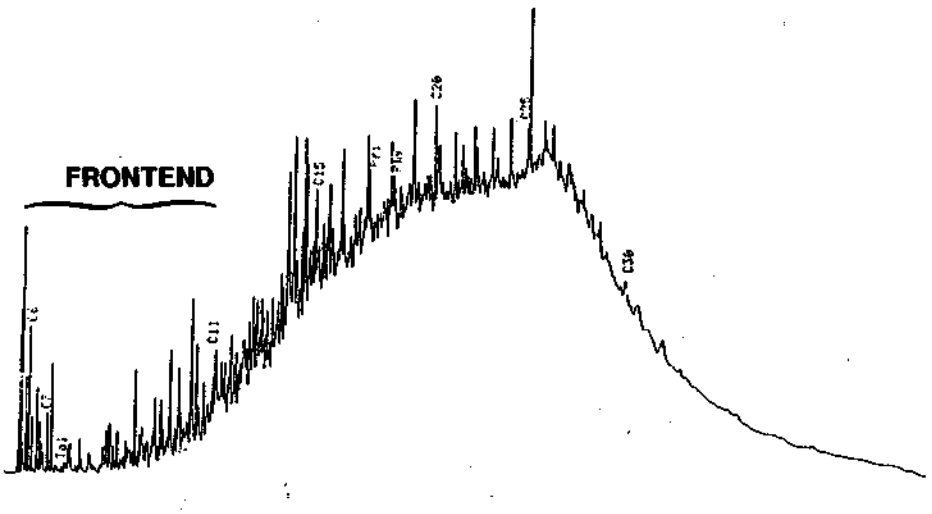
WHOLE OIL/BITUMEN COMPOSITION



24/9-4
1796-94 m



24/9-4
1817.5-15.5 m



24/9-3
DST#2

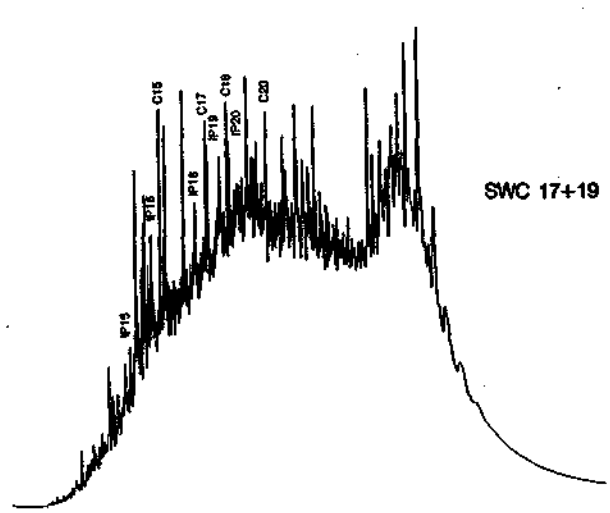
CONTROL

FIGURE 4

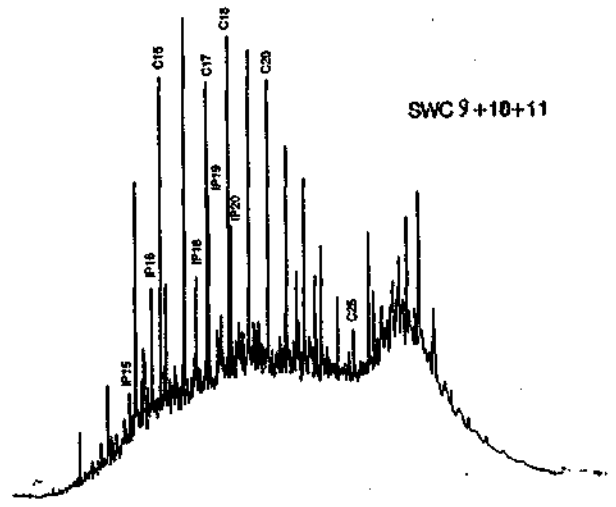
NCS BLOCK 24/9

PALEOGENE RESERVOIRED HEAVY OILS

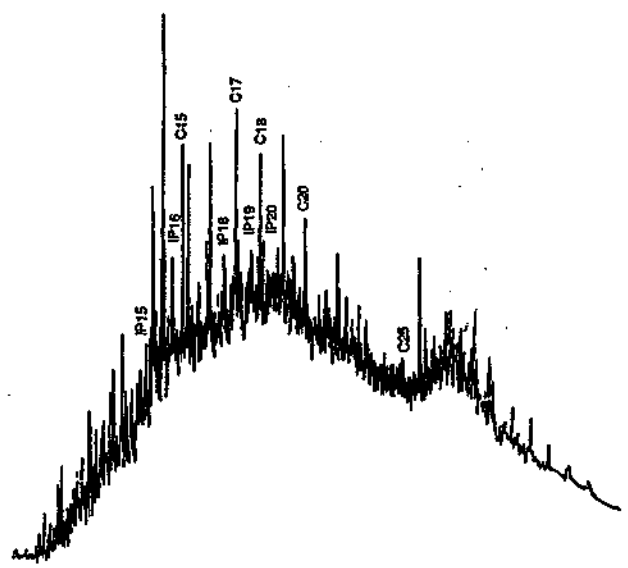
SATURATE FRACTION COMPOSITION



24/9-4
1796-94 m



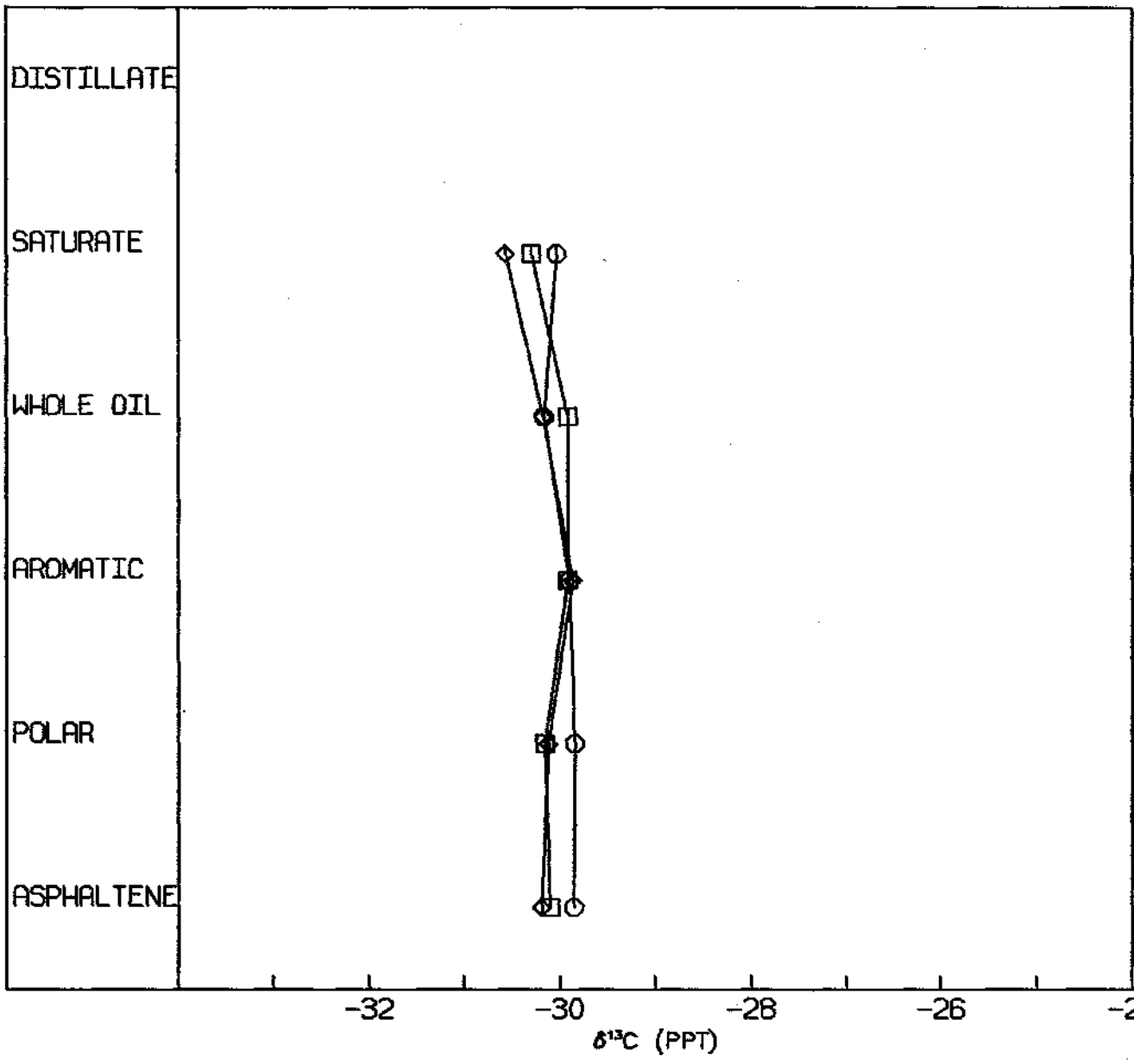
24/9-4
1817.5-15.5 m



24/9-3
DST#2

CONTROL

FIGURE 5



HYDROCARBON $\delta^{13}C$ ISOTOPIC PROFILE

NCS BLOCK 24/9

COMPARISON OF PALEOGENE RESERVOIRED HEAVY OILS (24/9-3 DST VS 24/9-4 CORE EXTRACTS).

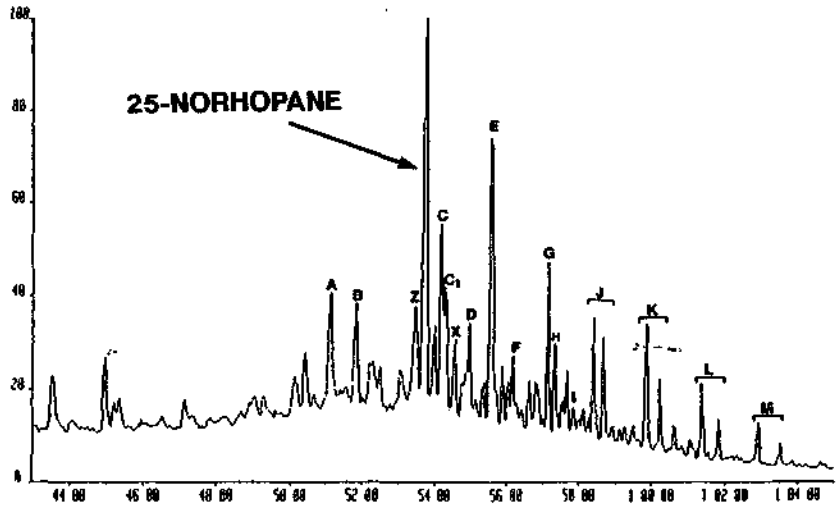
- 24/9-3 **(DST#2)**
- 24/9-4 **(1796-94 m)**
- 24/9-4 **(1817.5-15.5 m)**

FIGURE 6

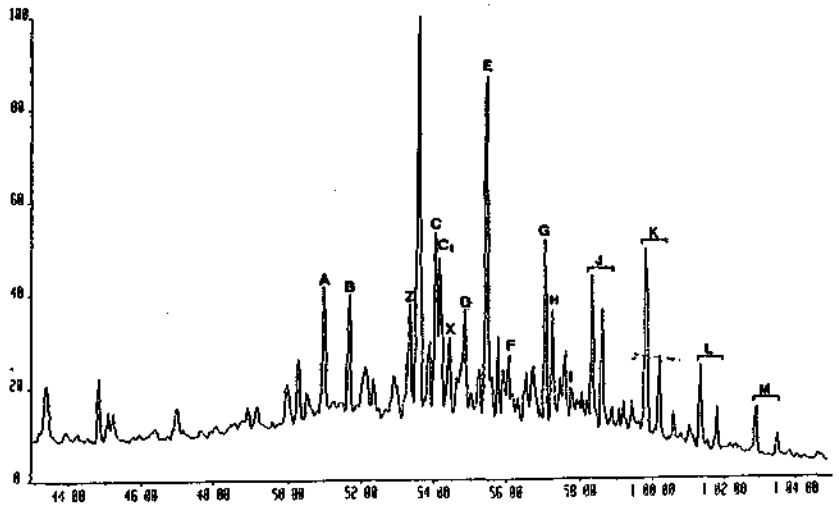
NCS BLOCK 24/9

PALEOGENE RESERVOIRED HEAVY OILS

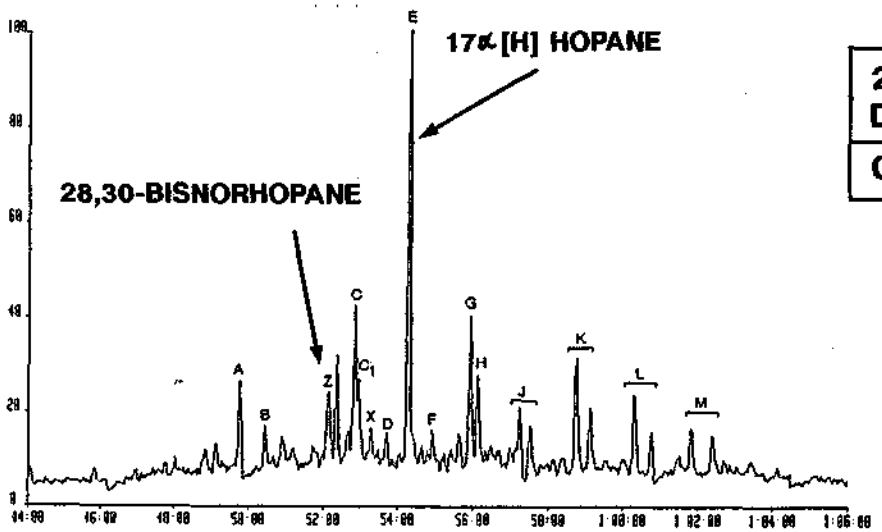
TRITERPANE COMPOSITIONS (M/Z 191)



24/9-4
1796-94 m



24/9-4
1817.5-15.5 m



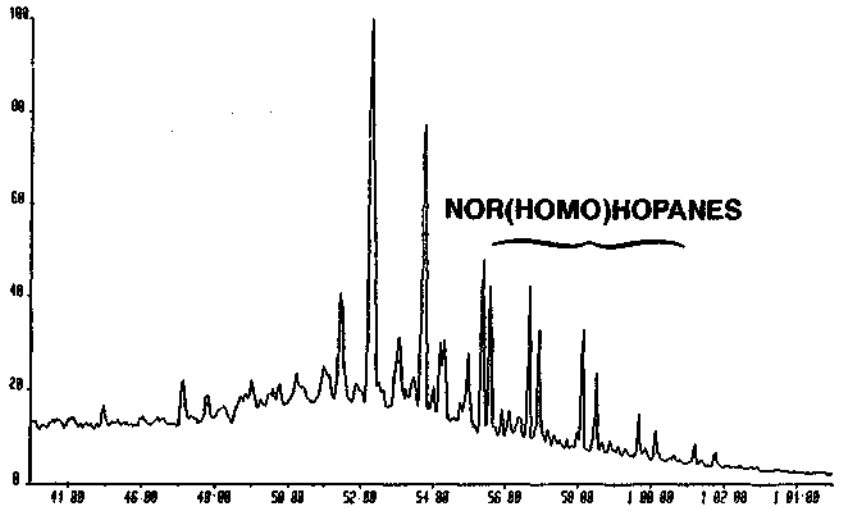
24/9-3
DST#2
CONTROL

FIGURE 10

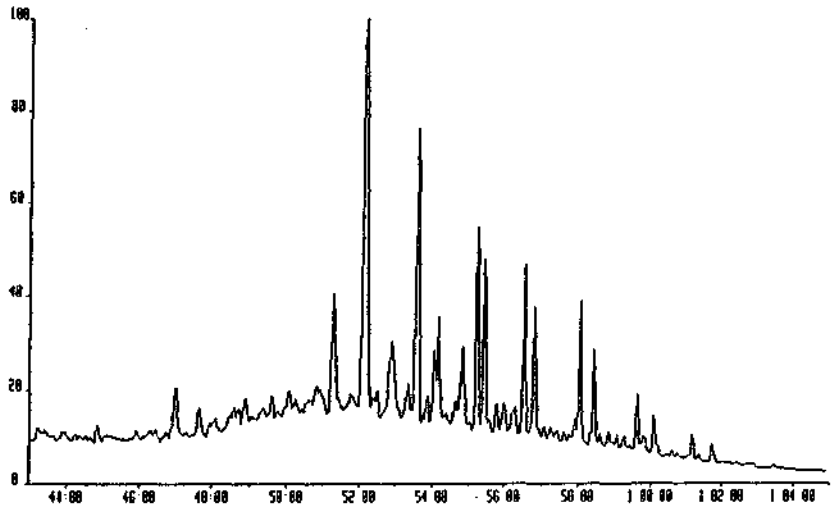
NCS BLOCK 24/9

PALEOGENE RESERVOIRED HEAVY OILS

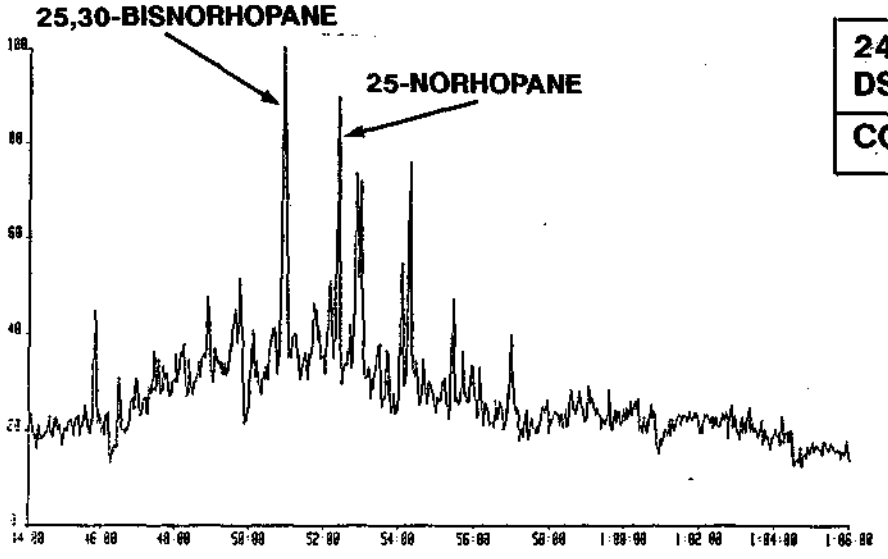
DESMETYL TRITERPANE COMPOSITIONS (M/Z 177)



24/9-4
1796-94m



24/9-4
1817.5-1815.5m



24/9-3
DST#2
CONTROL

FIGURE 11

APPENDIX 1

GEOCHEMICAL DATA REPORT

NORWEGIAN CONTINENTAL SHELF BITUMENS
24/9-4 WELL, JOB EGC/91-12

October 1991

NCS BLOCK 24/9

PALEOGENE RESERVOIRED HEAVY OILS

OIL DATA - ACQUISITION PROGRAMME
KEY TO SAMPLES

SWC No.	TEST/DEPTH (m)	BITUMEN EXTRACT ID.
22	1784	5305/1
19	1794	5305/2
17	1796	
13	1812.5	5305/4
11	1815.5	5305/5
10	1816.5	
9	1817.5	
3	1837.5	5305/8

TABLE 1
CRUDE OIL COMPOSITION - CHEMICAL

JOB 5305 GEOCHEM SAMPLE NUMBER	DEPTH/ IDENTITY	WAX CONTENT (%)	WAX MELTING POINT (°C)	SULPHUR (%)	NITROGEN (%)	V (ppm)	Ni (ppm)
WELL: 24/9-4 ST							
5305-002	1794 SWC 19			4.65			
5305-005	1815.5 SWC 11			1.04			

TABLE 2

C_{15+} CHROMATOGRAPHY WEIGHTS (grms)

JOB 5305 / GEOCHEM SAMPLE NUMBER	LITHO	DEPTH/ IDENTITY	ROCK EXTRACTED	TOTAL EXTRACT	PRECIPTD. ASPHALTENES	NC5	SATURATES	AROMATICS	ELUTED NSO's	NON-ELUTED NSO's
WELL: 24/9-4 ST										
5305-001		1784 SWC 22	12.3400	0.01261						
5305-002		1794 SWC 19	17.6500	0.96183	0.09114	0.87069	0.43621	0.15585	0.27687	0.00176
5305-004		1812.5 SWC 13	15.3300	0.18754						
5305-005		1815.5 SWC 11	17.5500	0.61178	0.14782	0.46393	0.21062	0.05242	0.19995	0.00094
5305-008		1817.5 SWC 3	6.4800	0.05456						

S-shale, SS-sandstone, L-limestone, D-dolomite, M-mixed, see Table 1.

TABLE 3
CONCENTRATION (PPM) OF EXTRACTED C_{15+} MATERIAL IN ROCK

JOB 5305	L I T H O			HYDROCARBONS			NON HYDROCARBONS			
GEOCHEM SAMPLE NUMBER		DEPTH/ IDENTITY	TOTAL EXTRACT	Saturates	Aromatics	TOTAL	Preciptd. Asphaltenes	Eluted NSO's	Non-Eluted NSO's	TOTAL
WELL: 24/9-4 ST										
5305-001		1784 SWC 22	1022							
5305-002		1794 SWC 19	54495	24714	8830	33544	5164	15687	100	20950
5305-004		1812.5 SWC 13	12234							
5305-005		1815.5 SWC 11	34859	12001	2987	14988	8423	11393	54	19870
5305-008		1817.5 SWC 3	8420							

S-shale, SS-sandstone, L-limestone, D-dolomite, M-mixed, see Table 1.

TABLE 4
COMPOSITION (NORMALISED %) OF C_{15+} MATERIAL

JOB 5305	L I T H O		HYDROCARBONS		NON HYDROCARBONS		
GEOCHEM SAMPLE NUMBER		DEPTH/ IDENTITY	Saturates	Aromatics	Preciptd. Asphaltenes	Eluted NSO's	Non-Eluted NSO's
WELL: 24/9-4 ST							
5305-001		1784 SWC 22					
5305-002		1794 SWC 19	45.35	16.20	9.48	28.79	0.18
5305-004		1812.5 SWC 13					
5305-005		1815.5 SWC 11	34.43	8.57	24.16	32.68	0.15
5305-008		1817.5 SWC 3					

S-shale, SS-sandstone, L-limestone, D-dolomite, M-mixed, see Table 1.

TABLE 5a

COMPOSITION (NORMALISED %) OF C_{15+} SATURATE (PARAFFIN - NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	002	005
DEPTH	1794	1815.5
SAMPLE TYPE		
nC15	17.29	12.61
nC16	16.48	14.58
nC17	11.51	11.50
nC18	11.54	12.92
nC19	11.25	11.84
nC20	9.14	11.07
nC21	8.36	8.61
nC22	5.84	7.10
nC23	4.80	4.74
nC24	3.79	3.17
nC25	0.00	1.88
nC26	0.00	0.00
nC27	0.00	0.00
nC28	0.00	0.00
nC29	0.00	0.00
nC30	0.00	0.00
nC31	0.00	0.00
nC32	0.00	0.00
nC33	0.00	0.00
nC34	0.00	0.00
nC35	0.00	0.00
Paraffin	1.57	4.44
Isoprenoid	0.57	1.11
Naphthene	97.86	94.45
CPI 1 Index	1.03	1.10
CPI 2 Index	0.00	0.30
CPI 3 Index	0.00	0.00
Prist/Phytane	1.19	1.28
Prist/nC17	0.87	0.63
Phytane/nC18	0.73	0.44

Job Number : 5305

$$C.P.I.\ 1 = \frac{1}{2}\left[\frac{C21 + C23 + C25 + C27}{C20 + C22 + C24 + C26} + \frac{C21 + C23 + C25 + C27}{C22 + C24 + C26 + C28}\right]$$

$$C.P.I.\ 2 = \frac{1}{2}\left[\frac{C25 + C27 + C29 + C31}{C24 + C26 + C28 + C30} + \frac{C25 + C27 + C29 + C31}{C26 + C28 + C30 + C32}\right]$$

$$C.P.I.\ 3 = \frac{2x\ (C27)}{C26 + C28}$$

CT - ditch cuttings CO - core SWC - sidewall core

TABLE 5b

COMPOSITION (PPM) OF C_{15+} SATURATE (PARAFFIN - NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	002	005
DEPTH	1794	1815.5
SAMPLE TYPE		
nC15	2715	5599
nC16	2587	6474
nC17	1807	5106
nC18	1812	5736
nC19	1766	5257
nC20	1435	4915
nC21	1313	3823
nC22	917	3152
nC23	754	2105
nC24	595	1407
nC25	0	835
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
Paraffin	15700	44400
Isoprenoid	5700	11100
Naphthene	978600	944500
CPI 1 Index	1.03	1.10
CPI 2 Index	0.00	0.30
CPI 3 Index	0.00	0.00
Prist/Phytane	1.19	1.28
Prist/nC17	0.87	0.63
Phytane/nC18	0.73	0.44

Job Number : 5305

$$C.P.I.\ 1 = \frac{1}{2}\left[\frac{C21 + C23 + C25 + C27}{C20 + C22 + C24 + C26} + \frac{C21 + C23 + C25 + C27}{C22 + C24 + C26 + C28}\right]$$

$$C.P.I.\ 2 = \frac{1}{2}\left[\frac{C25 + C27 + C29 + C31}{C24 + C26 + C28 + C30} + \frac{C25 + C27 + C29 + C31}{C26 + C28 + C30 + C32}\right]$$

$$C.P.I.\ 3 = \frac{2x\ (C27)}{C26 + C28}$$

CT - ditch cuttings CO - core SWC - sidewall core

TABLE 6
CARBON ISOTOPE COMPOSITIONS (‰,PDB)

JOB 5305 GEOCHEM SAMPLE NUMBER	DEPTH/ IDENTITY	TOTAL EXTRACT WHOLE OIL	SATURATES	AROMATICS	NSO	ASPHALTENES	KEROGEN	PYROLYSATE (S2)
WELL: 24/9-4 ST								
5305-002	1794 SWC 19	-29.91	-30.29	-29.91	-30.15	-30.10		
5305-005	1815.5 SWC 11	-30.17	-30.56	-29.86	-30.12	-30.19		

Table 7 Biomarker Peak Area Data

m/z 217

Sample	Identity	A	B	C	D	E	F	G	H	I	J
53050025		12304	9400	3763	4566	9125	4914	5420	12660	7103	2425
53050055		9542	5925	2380	3516	4070	5361	5738	8652	6197	5513

Sample	Identity	K	L	M	N	O	P	Q	R	S	T
53050025		10918	2007	5091	6241	0	2041	6237	8359	4806	5222
53050055		8815	4738	6059	6309	0	3383	5466	6479	5148	3579

m/z 218

Sample	Identity	H+I	M+N	R+S
53050025		11138	9610	11155
53050055		10163	8733	10596

m/z 191

Sample	Identity	A	B	Z	C	C1	X	D	E	F	G
53050025		7243	5312	6924	8412	5123	2862	5350	12964	2268	5051
53050055		5233	4479	4946	6669	4863	3061	4968	11891	1546	4263

Sample	Identity	H	G1	I	J	J1	K	K1	L	L1	M	M1
53050025		3172	1388	761	3718	2926	5095	2326	2522	1260	1444	669
53050055		2978	1440	1009	3453	3110	5887	2361	2562	1263	1458	670

Table . Biomarker Molecular Ratios

		Steranes (m/z 217,218)					Terpanes (m/z 191)				
Sample	Identity	Q/T	P/T	A/B	H+I / R+S	B/A	C / C+E	D / D+C	Z / Z+C	G / G+H %	G1 / G1+E
53050025		1.19	1.60	1.31	1.00	0.73	0.39	0.39	0.45	61.4	0.10
53050055		1 53	1 81	1.61	0.96	0.86	0 36	0.43	0.43	58.9	0.11

Table 8 : Aromatic Peak Area Data

Sample	Identity	Phenanthrene Series m/z 178, 192 p	3	2	9	1
5305002A		976	158	720	985	831
5305005A		1751	443	1406	2528	1671

Aromatised Sterane Peak Areas

Sample	Identity	Monoaromatics (m/z 253) A	E	G	Triaromatics (m/z 231) A	B	G
5305002A		941	2938	1867	1422	2162	4412
5305005A		1066	2884	1849	1699	2828	5895

Table Selected Peak Area Ratio Data

Sample	Identity	MPI1	MPI2	Ratio 1	Ratio 2	Ratio 3
5305002A		0.47	0.77	0.24	0.61	0.18
5305005A		0.47	0.71	0.22	0.61	0 19

MPI1 = 1 5(2mp+3mp) / p+mp+9mp
MPI2 = 3(2mp) / p+mp+9mp

RATIO 1 = A(231) / A(231)+G(231)
RATIO 2 = E(253) / E(253)+G(253)
RATIO 3 = A(253) / B(231)+E(253)