

Prepared for

FINA EXPLORATION NORWAY INC

**ANALYTICAL DATA FOR CRUDE OILS,
NORWEGIAN CONTINENTAL SHELF**

JULY 1993

Geochem Group Limited

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GENERAL COMMENT

Only limited amounts of sample material were available for this study. In consequence some analyses had to be omitted. Distillations were difficult with only 3g of crude oil.

It was not possible to perform the following analyses

- a) %S:
- b) % N₂: HA 564
- c) Ni, V: HA 564
- d) Distillation:
- e) Carbon isotopes:

Front end loss was evident in some of the saturates fractions obtained by distillation. Accordingly, fresh saturates fractions were prepared without distillation for the following samples: HA 564

TABLE 1
CRUDE OIL COMPOSITION - PHYSICAL

JOB 8237						
GEOCHEM SAMPLE NUMBER	DEPTH/ IDENTITY	SPECIFIC GRAVITY (g/cc)	API GRAVITY	VISCOSITY (cp)	POUR POINT (°C)	DISTILLA TO 210° (%)

8237-014 HA 564

50.00

TABLE 2
CRUDE OIL COMPOSITION - CHEMICAL

JOB 8237							
GEOCHEM SAMPLE NUMBER	DEPTH/ IDENTITY	WAX CONTENT (%)	WAX MELTING POINT (°C)	SULPHUR (%)	NITROGEN (%)	V (ppm)	Ni (ppm)

8237-014	HA 564	3	30	0.25			
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TABLE 3
COMPOSITION (NORMALISED %) OF C₁₅₊ MATERIAL

JOB 8237	L I T H O	DEPTH/ IDENTITY	HYDROCARBONS		NON HYDROCARBONS		
GEOCHEM SAMPLE NUMBER			Saturates	Aromatics	Preciptd. Asphaltenes	Eluted NSO's	Non-Eluted NSO's
8237-014		HA 564	63.49	28.07	1.32	5.68	1.44

TABLE 4
SIGNIFICANT C₁₅₊ RATIOS

JOB 8237	L I T H O	DEPTH/ IDENTITY	TOC (%)	mg/g TOC					HYDROCARBONS & TOTAL EXTRACT	SATURATES AROMATIC
				TOTAL EXTRACT	SATURATES	AROMATIC	TOTAL HYDROCARBONS	ELUTED NSO's		

8237-014

HA 564

91.56

2.26

TABLE 5
COMPOSITION (NORMALISED %) OF C₁₅₊ SATURATE (PARAFFIN - NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	014
DEPTH	HA 564
SAMPLE TYPE	
nC15	10.77
nC16	9.98
nC17	9.06
nC18	8.00
nC19	8.39
nC20	7.24
nC21	6.46
nC22	5.97
nC23	5.44
nC24	4.47
nC25	4.66
nC26	3.60
nC27	3.41
nC28	2.86
nC29	2.44
nC30	2.14
nC31	2.01
nC32	1.45
nC33	1.01
nC34	0.46
nC35	0.16
Paraffin	23.29
Isoprenoid	4.13
Naphthene	72.58
CPI 1 Index	1.06
CPI 2 Index	1.10
CPI 3 Index	1.06
Prist/Phytane	1.42
Prist/nC17	0.60
Phytane/nC18	0.48

Job Number : 8237

$$C.P.I. 1 = \frac{1}{2} \left[\frac{C_{21} + C_{23} + C_{25} + C_{27}}{C_{20} + C_{22} + C_{24} + C_{26}} + \frac{C_{21} + C_{23} + C_{25} + C_{27}}{C_{22} + C_{24} + C_{26} + C_{28}} \right]$$

$$C.P.I. 2 = \frac{1}{2} \left[\frac{C_{25} + C_{27} + C_{29} + C_{31}}{C_{24} + C_{26} + C_{28} + C_{30}} + \frac{C_{25} + C_{27} + C_{29} + C_{31}}{C_{26} + C_{28} + C_{30} + C_{32}} \right]$$

$$C.P.I. 3 = \frac{2 \times (C_{27})}{C_{26} + C_{28}}$$

CT - ditch cuttings CO - core SWC - sidewall core

TABLE 6
COMPOSITION (PPM) OF C₁₅₊ SATURATE (PARAFFIN - NAPHTHENE) HYDROCARBONS

GEOCHEM SAMPLE NUMBER	014
DEPTH	HA 564
SAMPLE TYPE	
nC15	25083
nC16	23243
nC17	21101
nC18	18632
nC19	19540
nC20	16862
nC21	15045
nC22	13904
nC23	12670
nC24	10411
nC25	10853
nC26	8384
nC27	7942
nC28	6661
nC29	5683
nC30	4984
nC31	4681
nC32	3377
nC33	2352
nC34	1071
nC35	373
Paraffin	232900
Isoprenoid	41300
Naphthene	725800
CPI 1 Index	1.06
CPI 2 Index	1.10
CPI 3 Index	1.06
Prist/Phytane	1.42
Prist/nC17	0.60
Phytane/nC18	0.48

Job Number : 8237

$$C.P.I. 1 = \frac{1}{2} \left[\frac{C_{21} + C_{23} + C_{25} + C_{27} + C_{21} + C_{23} + C_{25} + C_{27}}{C_{20} + C_{22} + C_{24} + C_{26}} \right]$$

$$C.P.I. 2 = \frac{1}{2} \left[\frac{C_{25} + C_{27} + C_{29} + C_{31} + C_{25} + C_{27} + C_{29} + C_{31}}{C_{24} + C_{26} + C_{28} + C_{30}} \right]$$

$$C.P.I. 3 = \frac{2 \times (C_{27})}{C_{26} + C_{28}}$$

CT - ditch cuttings CO - core SWC - sidewall core

TABLE 7
 CARBON ISOTOPE COMPOSITIONS (‰, PDB)

JOB 8237								
GEOCHEM SAMPLE NUMBER	DEPTH/ IDENTITY	TOTAL EXTRACT WHOLE OIL	SATURATES	AROMATICS	NSO	ASPHALTENES	KEROGEN	DISTILLATE

8237-014	HA 564	-27.31	-27.40	-26.27	-26.03	-26.32		-27.56
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TABLE 8

HYDROGEN AND SULPHUR ISOTOPE COMPOSITIONS

GEOCHEM SAMPLE NUMBER	FINA IDENTIFICATION	δD (‰, SMOW)	δS (‰, CDT)
8327-014	HA 564	-121.3	+4.3

() - small sample, treat data with caution

ndp - no determination possible, sample prepared and analysed, insufficient SO₂ to measure

TABLE 9
DETAILED GASOLINE RANGE (C₄-C₇) COMPOSITION

GEOCHEM SAMPLE NUMBER	8237-014
DEPTH	HA 564
NORMALISED COMPOSITION	
isobutane	0.45
n-butane	2.73
isopentane	3.65
n-pentane	7.42
2,2-dimethylB	0.07
cyclopentane	1.16
2,3-dimethylB	0.45
2-methylP	4.76
3-methylP	2.99
n-hexane	11.18
methylCP	5.30
2,2-dimethylP	0.57
2,4-dimethylP	0.00
2,2,3-trimethylB	0.00
benzene	2.92
cyclohexane	7.48
3,3-dimethylP	0.00
1,1-dimethylCP	0.00
2-MH	5.03
2,3-dimethylP	0.30
3-MH	3.83
1,c,3-DMCP	1.23
1,t,3-DMCP	1.20
1,t,2-DMCP	2.43
3-ethylP	0.00
n-heptane(nC7)	13.04
methylCH	15.16
1,c,2-DMCP	0.00
toluene	6.66
ABUNDANCE	207690
nC7/C7NAPHTHENES	0.65
total MH/DMCP	1.82
1,t,2-/1,c,2-DMCP	0.00
nC6/methylCP	2.11
C6-C7 FRACTION	
%n-PARAFFINS	28.63
%iso-PARAFFINS	21.28
% NAPHTHENES	38.78
% AROMATICS	11.33

DMCP dimethylcyclopentane MH methylhexane B butane CH cyclohexane CP cyclopentane H hexane P pentane

TABLE 10
DETAILED GASOLINE RANGE (C₄-C₇) COMPOSITION

GEOCHEM SAMPLE NUMBER	8237-014
DEPTH	HA 564
PPM COMPOSITION	
isobutane	935
n-butane	5670
isopentane	7581
n-pentane	15411
2,2-dimethylB	145
cyclopentane	2409
2,3-dimethylB	935
2-methylP	9886
3-methylP	6210
n-hexane	23220
methylCP	11008
2,2-dimethylP	1184
2,4-dimethylP	0
2,2,3-trimethylB	0
benzene	6065
cyclohexane	15535
3,3-dimethylP	0
1,1-dimethylCP	0
2-MH	10447
2,3-dimethylP	623
3-MH	7955
1,c,3-DMCP	2555
1,t,3-DMCP	2492
1,t,2-DMCP	5047
3-ethylP	0
n-heptane(nC7)	27083
methylCH	31486
1,c,2-DMCP	0
toluene	13832
ABUNDANCE	207690
nC7/C7NAPHTHENES	0.65
total MH/DMCP	1.82
1,t,2-/1,c,2-DMCP	0.00
nC6/methylCP	2.11
C6-C7 FRACTION	
%n-PARAFFINS	28.63
%iso-PARAFFINS	21.28
% NAPHTHENES	38.78
% AROMATICS	11.33

DMCP dimethylcyclopentane MH methylhexane B butane CH cyclohexane CP cyclopentane H hexane P pentane

TABLE 11
METHYLPHENANTHRENE INDICES (MPI)

DB 8237	DEPTH/ IDENTITY	SAMPLE TYPE	MPI 1		Rcalc		MPI 2	
GEOCHEM SAMPLE NUMBER			AREA	HEIGHT	AREA	HEIGHT	AREA	HEIGHT

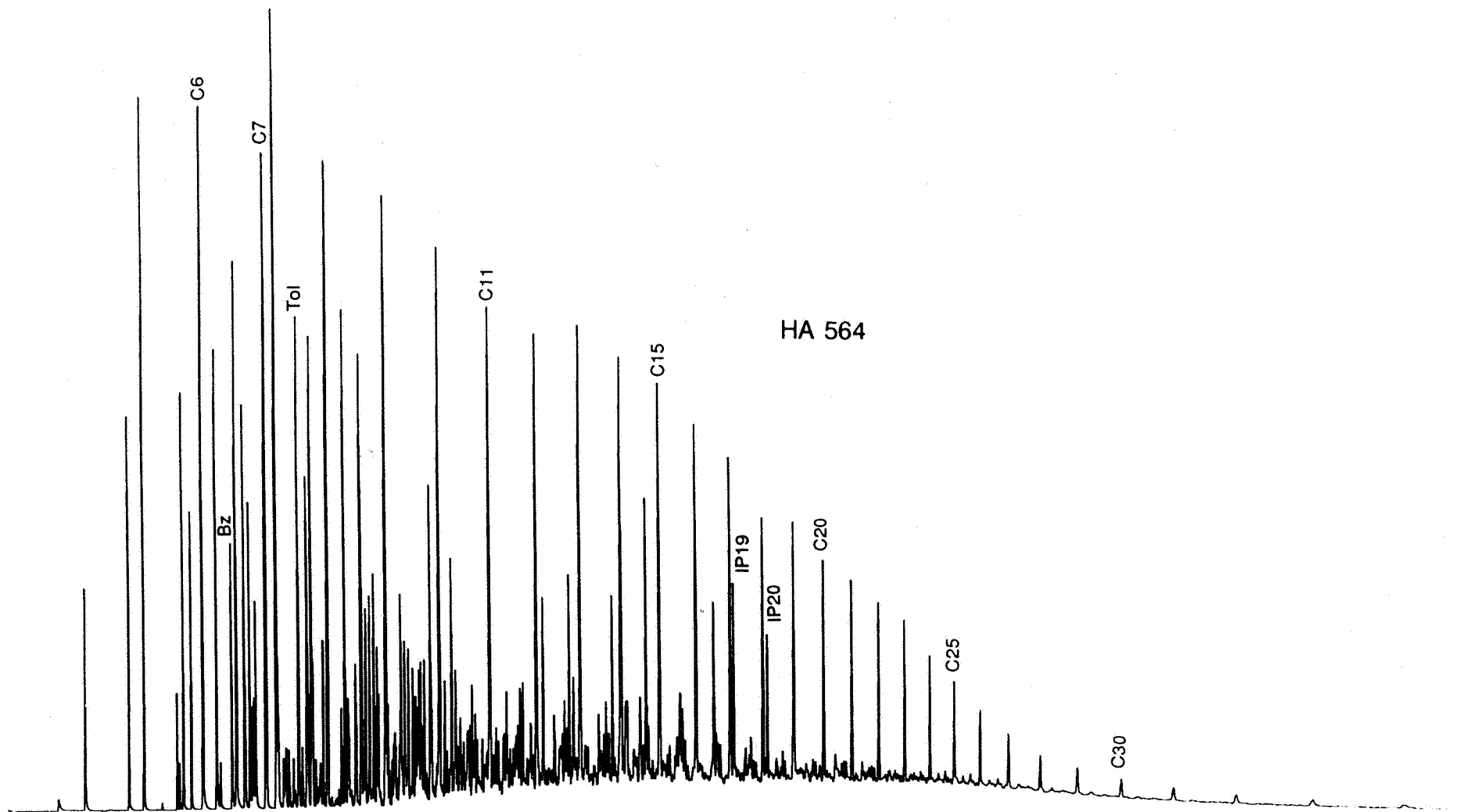
8237-014	HA 564		0.79	0.83			0.86	0.95
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$$MPI\ 1 = \frac{1.5(2-MP + 3-MP)}{P + 1-MP + 9-MP} \quad MPI\ 2 = \frac{3(2-MP)}{P + 1-MP + 9-MP}$$

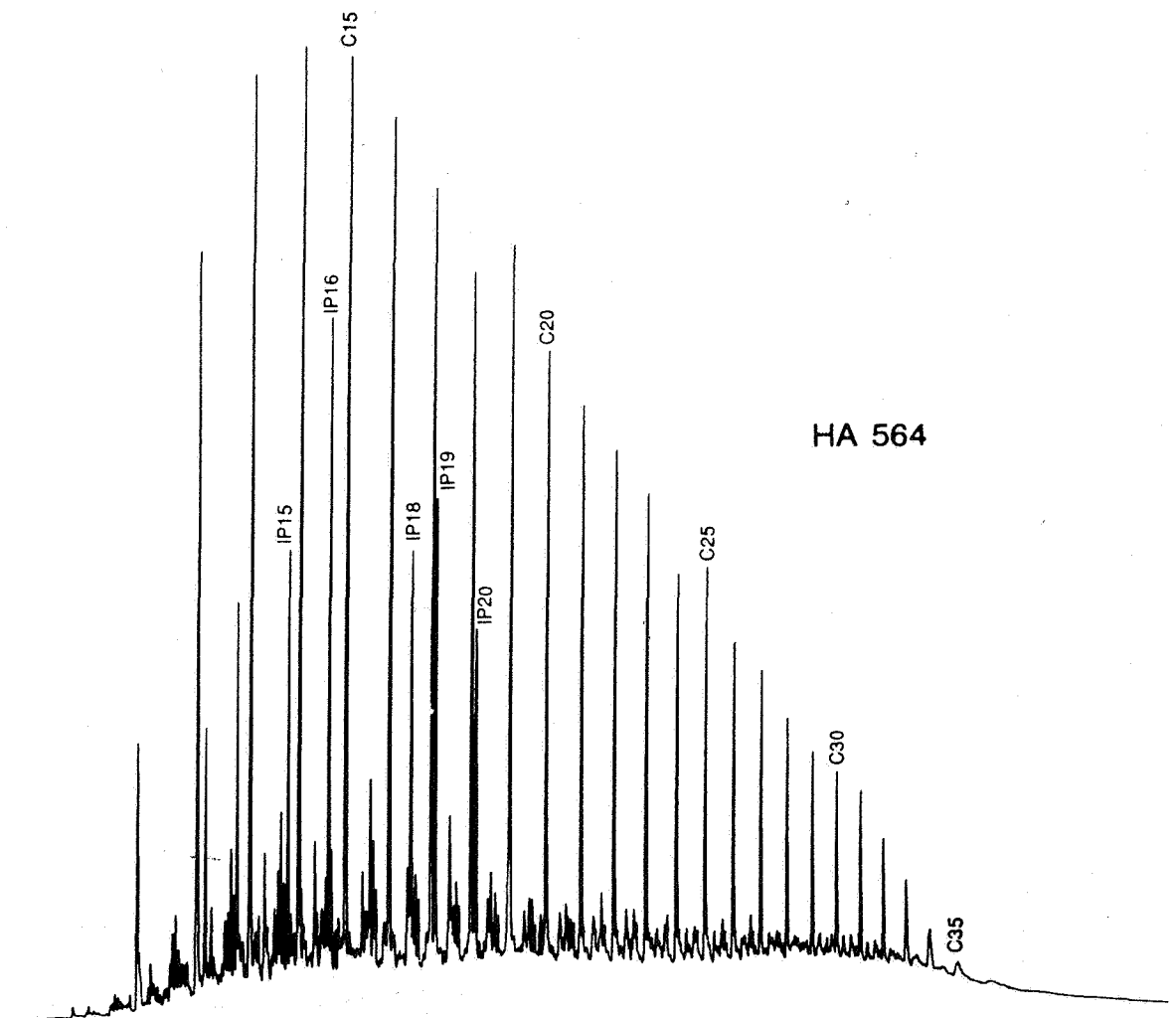
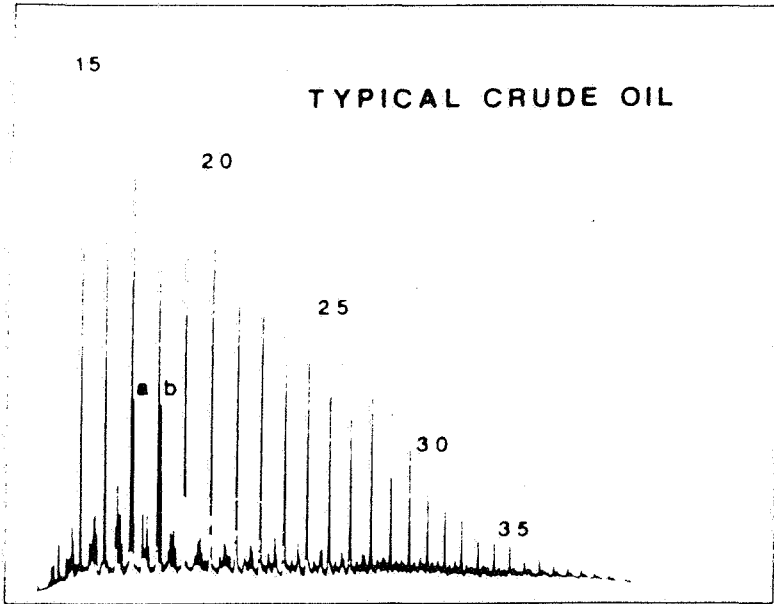
$$R_{calc} = \begin{cases} 0.60(MPI\ 1) + 0.40 & (\text{if } Ro < 1.35\%) \\ -0.60(MPI\ 1) + 2.30 & (\text{if } Ro > 1.35\%) \end{cases}$$

CT - ditch cuttings CO - core SWC - sidewall core

WHOLE OIL CHROMATOGRAMS



C 15+ SATURATES CHROMATOGRAMS

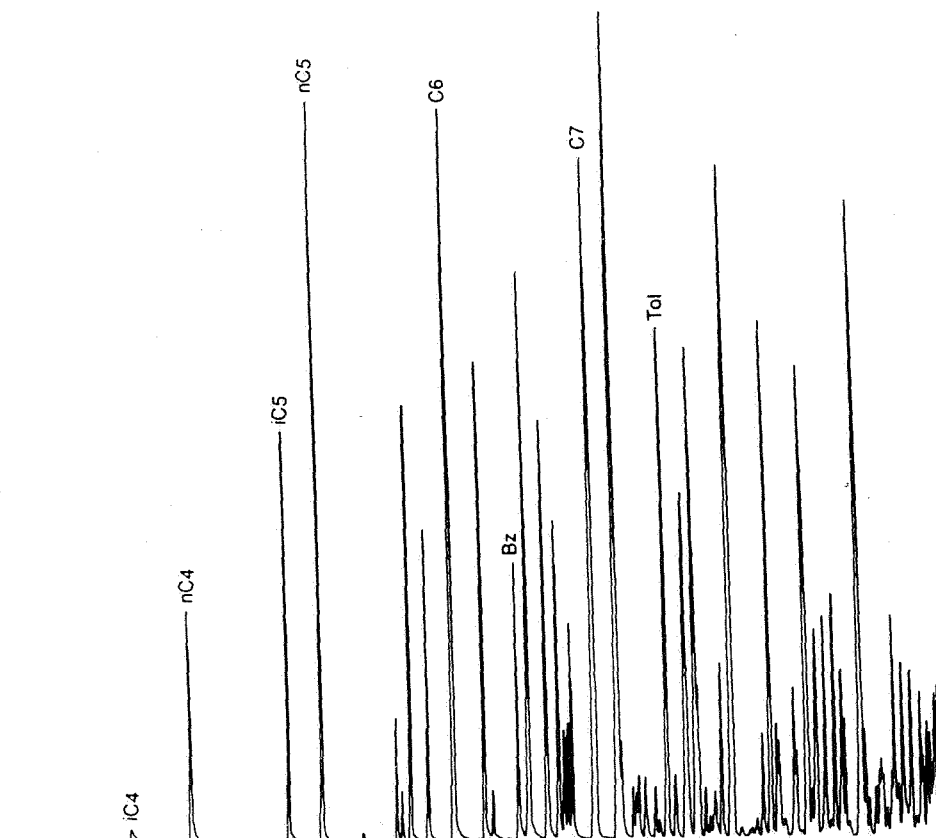


a = PRISTANE

b = PHYTANE

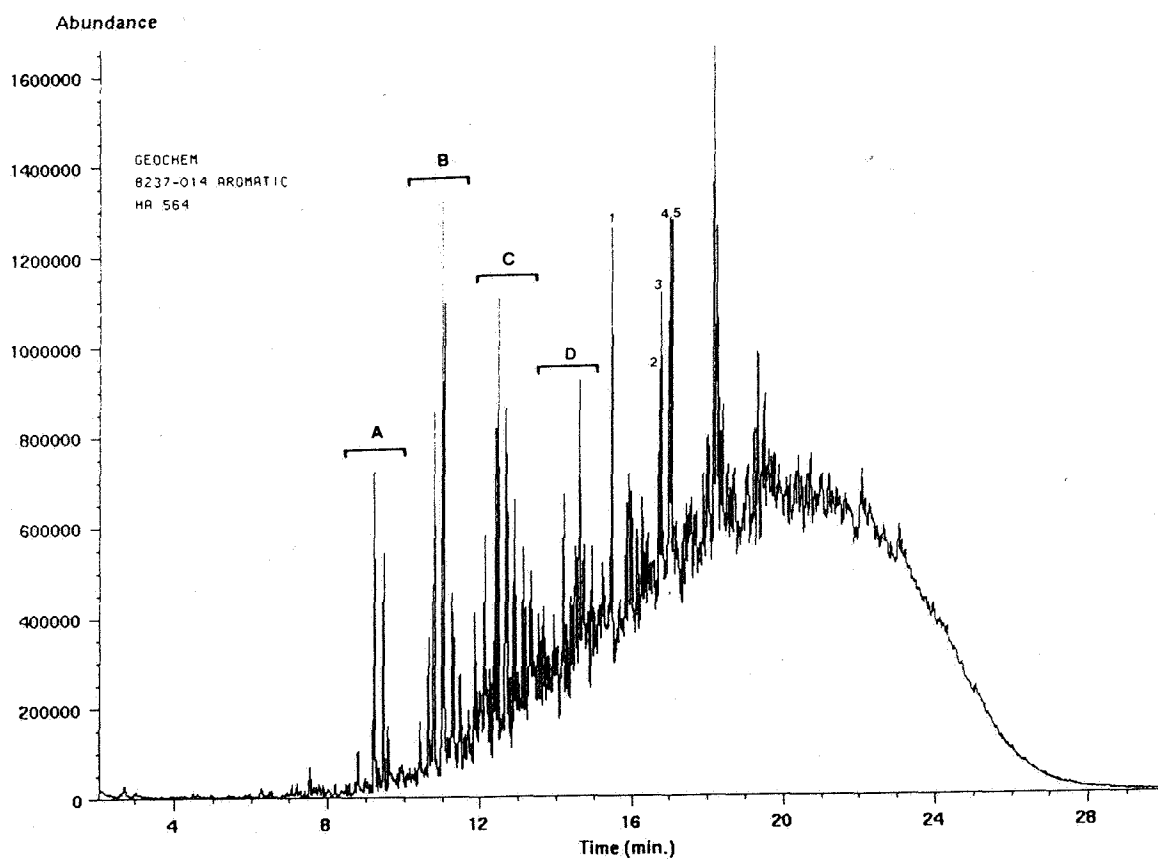
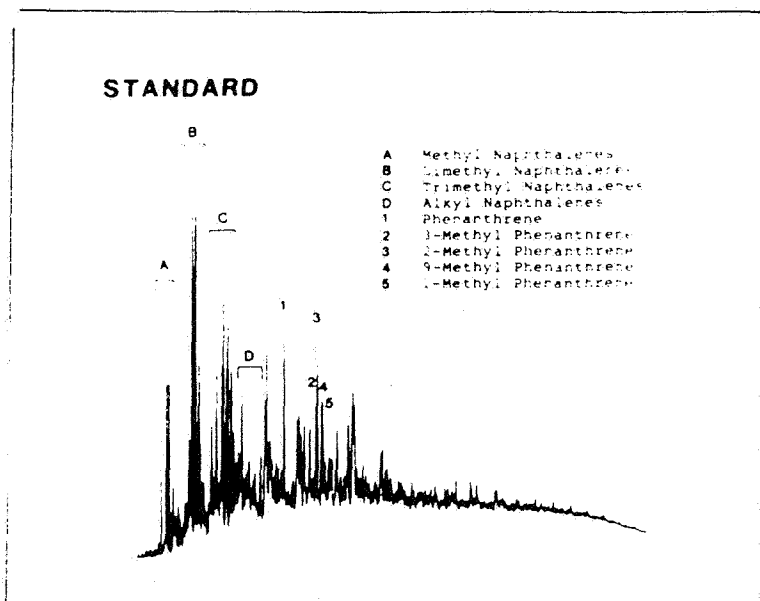
CARBON NUMBERS OF NORMAL PARAFFINS INDICATED (20 - nC 20)

GASOLINE RANGE CHROMATOGRAMS



HA 564

C₁₅+ AROMATIC CHROMATOGRAMS



C₁₅+ ORGANOSULPHUR CHROMATOGRAMS

