U. S. DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

Gas Chromatography and Rock-Eval Pyrolysis Analyses of Some Well Cuttings and Cores from Nevada

by

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INTRODUCTION

This open file releases some organic geochemical data because of public requests: A) a gas chromatographic (GC) analysis of fluids recovered from drill stem test (no. 1) at 5720-5803 feet in the Cenex Federal 5-14 well (section 14, T. 7 N., R. 56 E., Nye County, Nevada; and, B) some Rock-Eval data from western Nevada. The oil was supplied to the USGS by Cenex. The well cuttings and cores were collected from the Nevada Bureau of Mines and Geology core library at the University of Nevada, Reno. The Rock-Eval data list includes a "NV no." column to cross reference our data to the more complete well information, including formation tops, in Garside et al. (1988).

The GC analyses were performed on the C_{10} plus saturated hydrocarbon fraction isolated from the oil by silica-alumina column chromatography. Analysis was performed on a Hewlett-Packard 5880A GC equipped with a 50 m by 0.25mm, 5% phenyl methyl silicone (D) capillary column using hydrogen as the carrier gas. The GC was programmed at 50°C for two minutes then from 50°C to 320°C at 4°C per minute and then held for 10 minutes. The detector output was digitized and stored on computer disk using Nelson chromatography software. The mention of brand names is for the purpose of identification not official endorsement.

Our overall impression of the GC analysis (Fig. 1) is that it looks to be of a mature oil, suggesting it was derived from mature source rocks in the 0.6% to 0.9% vitrinite reflectance thermal maturation range. Solely from consideration of the GC signature, including the pristane(Pr) to phytane (Ph) ratio >1, it appears that the oil could belong to the Mississippian Chainman type of oils (Poole and Claypool, 1984) apparently derived from a clastic facies. Oils hosted in the Late Cretaceous -Tertiary Sheep Pass Formation are commonly characterized by a Pr/Ph of < 1 and are apparently derived from carbonate facies. However, before any definite conclusion can be drawn, other supporting evidence such as biomarkers and carbon and sulfur isotope analyses, should be made.

Rock-Eval analyses (Table 1) were performed on a Delsi Rock-Eval II system. The drill cuttings samples for Rock-Eval were picked out of the sample bags based on dark color and how fine grained the rock is. Pieces of core for analysis were selected on the same lithologic criteria. All samples were finely pulverized before analysis. The Rock-Eval analyses indicate oil and gas potential exists in Tertiary and Cretaceous lacustrine source rocks of Western Nevada.

REFERENCES

Garside, L.J., Hess, R.H., Fleming, K.L., and Weimer, B.S., 1988, Oil and gas developments in Nevada: Nevada Bureau of Mines and Geology Bulletin 104. 136 p.

Poole, F.G., and Claypool, G.E., 1984, Petroleum source-rock potential and crude-oil correlation in the Great Basin, in Woodward, J., Meissner, F.F., and Clayton, J.L., eds., Hydrocarbon Source Rocks of the Greater Rocky Mountain Area: Rocky Mountain Association of Geologists. p. 179-229.

Figure 1. Gas Chromatogram of the saturated hydrocarbon fraction of the Cenex Federal 5-14 crude oil. The notation n-C_{15} relates to the carbon numbers of the homologous series of n-paraffin hydrocarbons; Pr = Pristane; Ph = Phytane.

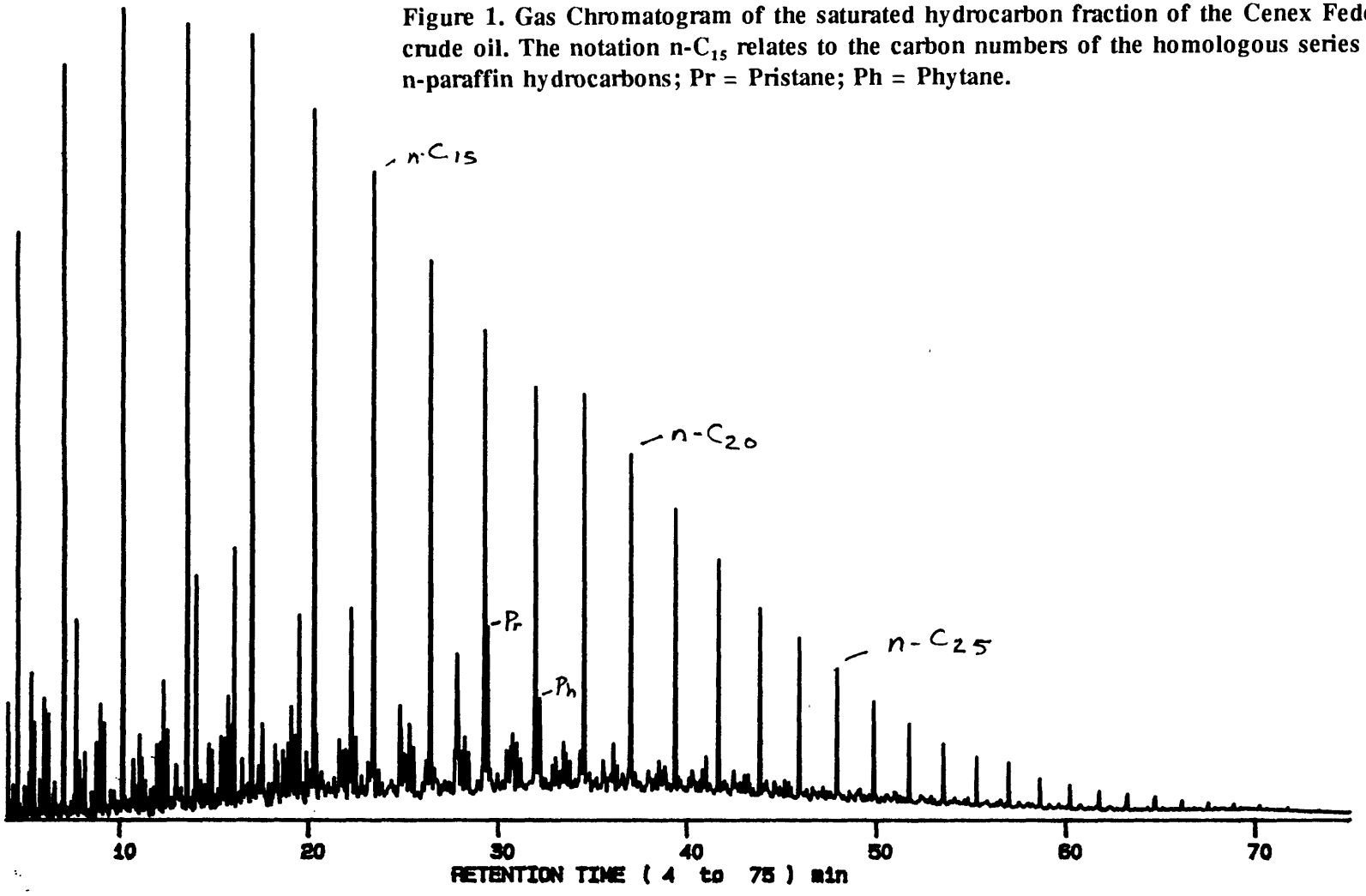

Figure 1.

Additional Data for Figure 1

JOB: 93034
FOR: BARKER, C
BY: LILLIS, PAUL
DESCRIPTION: NEVADA OIL
DATE: MAY 6,1993

LAB SMPLE	SAMPLE IDENTIFICATION	BITUMEN PPM-ROCK	C15+ WEIGHT PERCENT SAT	AROM	NSO	ASPH	COLUMN HOLDUP	SAT/AROM RATIO	C15+ NORMALIZED PERCENT SAT	AROM	NSO	ASPH	PERCENT RECOVERY
93034 0015-14	CENEX FED DST	NA	62.3	16.8	6.2	9.2	5.5	3.72	65.9	17.7	6.6	9.7	83.6

LAB SMPLE	PERCENT VOLATILE [OIL]	%TOTAL COLUMN HOLDUP	COLUMN TYPE	API GRAV [OIL]	BITUMEN EXTRACTION TECHNIQUE	TIME (hrs)	SOLVENT	SULFUR REACTION	COMMENTS
93034 001	11.5	4.9	AL-SI	NA	NA	NA		NA	Collected fraction between SATS and AROM, added to SATS

LAB SMPLE	EXTRACTION TIMES START Time	Date	STOP Time	Date	ROCK SAMPLE WT. (g)	BITUMEN TOTAL WT. (mg)	FRACTIONS FROM COLUMN CHROM SAT (mg)	AROM (mg)	NSO (mg)	ASPH (mg)	OTHER (mg)	VOLUME FLASK (ml)	ALIQUOT TOTAL BIT(ml)	ALIQUOT COLMN CHRM(ml)	COLMN-CHR OIL/BIT (Mg)
93034 001	NA	NA	NA	NA	NA	NA	27.51	7.40	2.76	4.06	0.00	[FOR OIL ENTER WEIGHT]--->			49.89

LAB SMPLE	SATURATE FRACTION vial#	gross (g)	tare (g)	AROMATIC FRACTION vial#	gross (g)	tare (g)	RESIN FRACTION vial#	gross (g)	tare (g)	ASPHALTENE FRACTION vial#	gross (g)	tare (g)	OTHER FRACTION vial#	gross (g)	tare (g)
93034 001	16983	7.03273	7.00522	16984	7.2361	7.2287	16985	7.08114	7.07838	16989	7.31983	7.31577			

LAB SMPLE	OIL OR BITUMEN NET WT. (mg)	vial#	tare (g)	INITIAL GROSS [OIL]	FINAL GROSS [OIL]	FRACTION INITIAL VOLATILE [OIL]	WEIGHT [OIL](mg)	PERCENT LASTCHANG	GROSS WEIGHTS FIRST WT	SECOND WT	ETCETERA			
93034 001	59.20	1	7.24368	7.31054	7.30288	0.11	66.86	0.30%	7.30449	7.30416	7.30397	7.30361	7.3032	7.30306 7.30288

Additional Data for Figure 1

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**********************************************************************
         NORMAL ALKANE & ACYCLIC ISOPRENOID RATIOS REPORT

            PROGRAM BY: Paul G. Lillis and J. David King
            Source program: C:\PROG\ALK2-6.BAS   Ver 2.6
**********************************************************************

SAMPLE NAME: 93034001  5-14 CENEX FED   5720 5803 FT
DATA FILE: E:93034S01.PTS  METHOD: E:S93034 DATE: 05-14-1993
GC RUN ON: 05-07-1993 07:41:08
----------------------------------------------------------------------

RATIOS
                        BASED ON        BASED ON
                        PEAK AREA       PEAK HEIGHT
Pristane/Phytane          1.53            1.73
Pristane/n-C17            0.41            0.35
Phytane/n-C18             0.28            0.22

CPI(n-C23 to n-C33)       1.02            1.01    (Hunt, 1979)
CPI(n-C25 to n-C35)       0.98            1.01
CPI(n-C27 to n-C37)       0.95            1.00
CPI(n-C24 to n-C34)       1.00            1.02    (Bray and Evans, 1961)
CPI(n-C24 to n-C32)       1.03            1.03    (Hunt, 1973)
CPI(n-C24 to n-C30)       1.04            1.04    (Lewan)
CPI(n-C28 to n-C30)       0.99            0.95    (Philippi, 1965)

OEP(at n-C19)             0.97            1.06
OEP(at n-C21)             0.99            1.01
OEP(at n-C23)             0.98            0.98
OEP(at n-C25)             1.02            1.00
OEP(at n-C27)             1.01            1.03
OEP(at n-C29)             0.99            0.98
OEP(at n-C31)             0.90            0.88
OEP(at n-C33)             0.74            0.91
OEP(at n-C35)             0.81            1.07
                                                  (Scalan & Smith, 1970)
----------------------------------------------------------------------

ACYCLIC ISOPRENOIDS/NORMAL ALKANES                =    0.20
PERCENT ACYCLIC ISOPRENOIDS (of total saturates) =   13.1%
PERCENT NORMAL ALKANES (of total saturates)      =   64.0%

ACYCLIC ISOPRENOIDS (normalized percent)

   I-13   I-14   I-15   I-16   I-18   I-19   I-20   I-21
  14.8%  14.9%   9.6%  17.2%  19.4%  12.5%   8.2%   3.5% AREA
  18.4%  20.5%  14.2%  14.8%  10.7%  12.0%   6.9%   2.5% HEIGHT

----------------------------------------------------------------------

CONDENSATE INDEX =  8.3%              (Lewan and Buchardt, 1989)
 (percent n-C11 of n-C10 to n-C30)


  NOTE: CPI and OEP values reported may not be valid if
        n-alkanes coelute with other compounds, i.e. biomarkers.
        Values reported as -1.0 indicate that one or more
        of the values needed for the calculation was zero
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Additional Data for Figure 1

93034001 5-14 CENEX FED 5720 5803 FT E:93034S01.PTS

PEAK	AREA	HEIGHT	RET.TIME (min)	COMMENTS
n-C09	447261	232953	4.61	
n-C10	651147	297080	7.07	
n-C11	857688	317536	10.19	
n-C12	969303	312140	13.59	
i-C13	328970	93210	14.04	
i-C14	330872	103900	16.05	
n-C13	974546	304317	17.00	
i-C15	212812	72303	19.51	
n-C14	918797	269372	20.31	
i-C16	381270	75265	22.27	
n-C15	904030	244406	23.47	
n-C16	836316	210354	26.45	
i-C18	430220	54333	27.84	
n-C17	681474	176039	29.29	
i-C19	277865	60775	29.44	
n-C18	662002	158852	32.00	
i-C20	182074	35208	32.21	
i-C21	78726	12643	34.39	
n-C19	559092	155625	34.59	
n-C20	475860	130724	37.05	
n-C21	388745	112487	39.41	
n-C22	321135	93311	41.68	
n-C23	253426	75049	43.84	
n-C24	210670	63480	45.93	
n-C25	171617	50994	47.95	
n-C26	128580	39355	49.88	
n-C27	99774	31371	51.75	
n-C28	79295	23380	53.55	
n-C29	70942	19648	55.29	
n-C30	64470	17773	56.99	
n-C31	41900	11467	58.64	
hopane	-0-	-0-	-0-	NOT FOUND
n-C32	30898	9137	60.23	
n-C33	22654	6656	61.77	
n-C34	35158	6289	63.27	
n-C35	18510	4837	64.73	
n-C36	8434	2579	67.53	
n-C37	7258	2102	68.88	
b-CARO	-0-	-0-	-0-	NOT FOUND
n-C38	5297	1427	70.21	

Additional Data for Figure 1

WELL NAME	API No.	SECTION TOWNSHIP RANGE	NV NO.	DEPTH	SAMPLE TYPE	T_{max}	S1 mg/gm	S2 mg/gm	S3 mg/gm	PI	S2/S3	TOC	HI	OI
Standard-Amoco S.P. Land Co.-1	27-001-05062	33-24N-33E	161	2380	Cuttings	432	0.1	4.12	1.79	0.02	2.30	1.45	284	123
			161	2900	"	423	0.11	4.41	1.71	0.02	2.57	1.57	280	108
			161	3020	"	423	0.13	3.71	1.61	0.03	2.30	2.21	167	72
			161	3180	"	428	0.18	11.65	4.28	0.02	2.72	2.32	502	184
			161	3400	"	431	0.13	16.75	4.05	0.01	4.13	2.99	560	135
			161	3840	"	443	0.12	10.98	1.51	0.01	7.27	2.23	492	67
			161	5510	"	437	0.13	7.05	0.86	0.02	8.19	1.59	443	54
			161	5320	"	440	0.04	6.45	0.88	0.01	7.32	1.53	421	57
			161	6410	"	430	0.01	1.37	0.60	0.01	2.28	1.15	119	52
			161	7700	"	453	0.02	0.71	0.68	0.03	1.04	0.54	131	125
			161	9129	Core	0	0	0.20	0.25	0	0.80	0.13	153	192
Sun King Lear Federal - 1	27-013-05002	17-37N-29E	347	6030	Cuttings	432	1.05	230.17	14.38	0	16.00	72.55	317	19
			347	6940	"	431	0.14	0.81	1.37	0.15	0.59	0.56	144	244
			347	6990	"	444	1.02	8.02	1.64	0.11	4.89	1.59	504	103
Arco Tobin - 1	27-027-05000	4-25N-39E	408	1050	"	0	0	0.03	0.20	0	0.15	0.07	42	285
			408	1880	"	0	0.07	0.31	0.47	0.18	0.65	0.55	56	85
Haskin Reis Federal- 1	27-001-05068	36-18N-30E	561	790	"	0	0	0.12	0.37	0	0.32	0.05	240	740
			561	1270	"	443	0.55	3.09	0.75	0.15	4.12	0.71	435	105
			561	3370	"	0	0.06	0.23	0.28	0.21	0.82	0.44	20	63
			561	4020	"	435	0	0.06	0.22	0	0.27	0.07	85	314
Arco Antelope Valley - 1	27-015-05005	26-25N-40E	407	3140	"	439	0.19	0.91	0.64	0.17	1.42	0.91	100	70
			407	4220	"	0	0.11	0.34	0.56	0.25	0.60	0.69	49	81
			407	4290	"	0	0.10	0.28	0.47	0.26	0.59	0.52	53	90
			407	4590	"	0	0.08	0.23	0.33	0.27	0.69	0.24	95	137
Nevada Oil & Gas VRS - 1	27-009-05201	16-1S-36E	146	5900	"	529	0.23	0.56	0.35	0.29	1.60	2.61	21	13
			146	6690	"	445	0.02	0.14	0.26	0.12	0.53	0.34	41	76

Specific definitions for Rock Eval analyses are as follows; S1 and S2 are the first and second peaks of hydrocarbon yield occurring during pyrolysis of the sample; S3 is the amount of CO_2 generated during pyrolysis; TOC is total organic carbon; T_{max} is the temperature at which the S2 peak occurs during pyrolysis of kerogen; Hydrogen index (HI) = (S2/TOC)x100; Oxygen index (OI) = (S3/TOC)x100; PI = Production index = S1/(S1+S2); PC = pyrolysable carbon in the sample.

A zero reported value in the T_{max} column indicates T_{max} values considered by the analyst to be unreliable due to low concentration of S2. Zeros in other columns indicate the sample did not produce a complete pyrogram, and this parameter could not be computed.

TABLE 1.