



New Mexico Bureau of Mines & Mineral Resources

Socorro, NM 87801

A DIVISION OF
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY

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October 6, 1981

MEMO

TO: Frank E. Kottlowski, Director
FROM: Sam Thompson III, Petroleum Geologist
SUBJECT: Open-file report no. OF-152

As we discussed, the following report from GeoChem Laboratories, Inc. is to be placed in the Bureau Open-file:

OF-152 Hydrocarbon source-rock evaluation study, Cockrell Corp. No. 1 Pyramid Federal well, Hidalgo County, New Mexico, by L. Paul Tybor, GeoChem Laboratories, Inc., 1981, 11 p. (including 2 p. text, 8 tables, 2 charts)

ST:sn

cc: Mike R. Smith, GeoChem
Robert A. Bieberman, Subsurface Library
Robert W. Kelley, Editor



GEOCHEMICAL ANALYSES
SOURCE ROCK EVALUATION

CRUDE OIL—SOURCE ROCK CORRELATION

CRUDE OIL CHARACTERIZATION
GEOCHEMICAL PROSPECTING

1143-C BRITTMOORE ROAD • HOUSTON, TEXAS 77043-5094 • 713/467-7011

September 15, 1981

Mr. Sam Thompson III
New Mexico Bureau of Mines &
Mineral Resources
Socorro, New Mexico 87801

Dear Mr. Thompson:

Enclosed please find the results of the organic geochemical analyses performed on well cuttings samples from the Cockrell No. 1 Pyramid Federal Well, located in Sec. 31-24S-19W, Hidalgo County, New Mexico.

Upon arrival at GeoChem the samples were assigned the GeoChem Job Number 2090 and submitted to the following analytical program:

<u>Type of Analysis</u>	<u>Table</u>
Total organic carbon determination & brief lithological description.....	I
C ₁₅₊ soxhlet extraction, deas- phalting and liquid chromatography.....	II-A,-B,-C
C ₁₅₊ paraffin-naphthene gas chromatography.....	III-A,-B,-C
Visual kerogen assessment.....	IV
Vitrinite reflectance.....	V; Histogram

DISCUSSION OF THE RESULTS

A. Thermal Maturity of Sediments

The thermal maturity of the analyzed Paleozoic sediments from this well is a very mature Maturation Index Stage 3 to 3+. At this level of thermal maturity, this well interval is considered to be beyond the oil window, within the wet gas-condensate generating zone.

This maturity interpretation was based on the brown to dark brown coloration of the kerogen isolated from these samples. Also the lower vitrinite reflectance value, 1.54% Ro (Table V), of sample 2090-010 indicates a very mature geothermal regime for these sediments.

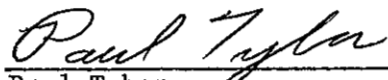
B. Hydrocarbon Source Characterization of Sediments

With the exception of the lowest sample within the Percha Formation, all of the samples from these Paleozoic units are organic-lean, with poor hydrocarbon generating capabilities.

The lowest Percha sample (2090-010) was analyzed to contain fair amounts (Table I) of gas-prone organic matter (woody and inertinite; Table IV), and as a result this interval is characterized as a very mature, fair gas source.

Should you have any questions concerning this study, or if we may be of further service, please feel free to contact me.

Sincerely,



Paul Tybor
GEOCHEM LABORATORIES, INC.

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Enclosures

Table I

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Well Interval (Feet)	Brief Lithological Description	Total Organic Carbon (% of Rock)
2090-001	5990-6000	Limestone, pinkish gray to light gray.	0.14
2090-002	6060-6070	Limestone, pinkish gray to light gray.	0.10; 0.10R
2090-003	6160-6170	Limestone, pinkish gray to brownish gray.	0.09
2090-004	6490-6500	Limestone, light brownish gray.	0.04
2090-005	6560-6570	Limestone, light brownish gray.	0.05
2090-006	6620-6630	Limestone, light gray to brownish gray.	0.09
2090-007	6680-6690	Mudstone, brownish gray.	0.16; 0.16R
2090-008	6760-6770	Shale, medium dark gray to dark gray.	0.26
2090-009	6790-6800	Shale, medium dark gray to dark gray.	0.30
2090-010	6840-6850	Shale, medium dark gray to dark gray.	0.68
2090-011	6940-6950	Dolomite, brownish gray.	0.01
2090-012	6970-6980	Dolomite, brownish gray.	0.05
2090-013	7000-7010	Dolomite, brownish gray.	0.04
2090-014	7100-7110	Dolomite, brownish gray.	0.04; 0.04R

SUMMARY TABLE I

AGE Stratigraphic Unit	Top (Feet)	Lithology	Organic Richness					Predominant Kerogen Type Visual Assessment	Thermal Maturity		T-Max (°C)	Hydrocarbon Source Potential
			Organic Carbon (% of rock)	S1 Free H.C.'s (mg/g)	C ₁₅ ⁺ Total H.C. (ppm)	S2 Residual H.C. Yield (mg/g)	C ₁₅ ⁺ Bitumen (ppm)		Kerogen Alteration (1-5 Scale)	Vitrinite Reflectance (%Ro)		
			MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	MEAN		
<u>MISSISSIPPIAN</u>												
Escabrosa	5795- 6680	Limestone, pinkish gray to light gray to light brownish gray.	(6) 0.08	n/a	n/a	n/a	n/a	(2) Am-H*-W;-;1	(2) 3 to 3+	n/a	n/a	Very mature, poor oil and associated gas source.
<u>DEVONIAN</u>												
Percha	6680- 6860	Shale, medium dark gray to dark gray.	(4) 0.35	n/a	(1) 69	n/a	(1) 264	(2) W-1;Am-H;-	(2) 3 to 3+	(1) 2.59	n/a	Very mature, overall poor hydrocarbon source. The lower portion of this unit has a fair gas source charac- ter.
<u>ORDOVICIAN</u>												
Montoya	6860- 6980	Dolomite, brownish gray.	(2) 0.03	n/a	n/a	n/a	n/a	(1) Am(A1);-;-	(1) 3 to 3+	n/a	n/a	Very mature, poor oil and associated gas source.
El Paso	6980- 7130	Dolomite, brownish gray.	(2) 0.04	n/a	n/a	n/a	n/a	(1) Am;-;-	(1) 3 to 3+	n/a	n/a	Very mature, poor oil and associated gas source.

TABLE I-A
RESULTS OF ROCK-EVAL PYROLYSIS

T.O.C. = Total organic carbon, wt. %
 S1 = Free hydrocarbons, mg HC/g of rock
 S2 = Residual hydrocarbon potential
 (mg HC/g of rock)
 S3 = CO₂ produced from kerogen pyrolysis
 (mg CO₂/g of rock)
 S1+S2 = Genetic hydrocarbon pot. ...
 (mg HC/g of rock)
 Hydrogen
 Index = mg HC/g organic carbon
 Oxygen
 Index = mg CO₂/g organic carbon
 S1/S1+S2 = Transformation ratio
 Tmax = Temperature Index, degrees C.

GeoChem Sample No.	Depth	T.O.C. (Wt. %)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	S1+S2 (mg/g)	S2/S3	Hydrogen Index	Oxygen Index	S1/S1+S2	Tmax (° C)
2090-010	6840-6850	0.68	0.09	0.16	0.21	0.25	0.76	23.5	30.8	0.37	354

TABLE II

Summary of C15+ Soxhlet Extraction, Deasphaltening
and Liquid Chromatography

A. Weights of Extracts and Chromatographic Fractions

GeoChem Sample Number	Well Interval	Weight of Rock Extd. (grams)	Total Extract (grams)	Precipitated Asphaltenes (grams)	N-C5 Soluble (grams)	Sulfur (grams)	Paraffins- Naphthenes (grams)	Aromatics (grams)	Eluted NSO'S (grams)	Noneluted NSO'S (grams)
2090-010	6840-6850	100.0	0.0264	0.0155	0.0109	0.0003	0.0049	0.0020	0.0029	0.0008

B. Concentration of Extracted Materials in Rock

GeoChem Sample Number	Well Interval	Total Extract (ppm)	-----Hydrocarbons-----				-----Nonhydrocarbons-----			
			Paraffin- Naphthene (ppm)	Aromatic (ppm)	Total (ppm)	Sulfur (ppm)	Preciptd. Asphaltene (ppm)	Eluted NSO'S (ppm)	Noneluted NSO'S (ppm)	Total (ppm)
2090-010	6840-6850	264	49	20	69	3	155	29	8	195

C. Composition of Extracts

GeoChem Sample Number	Well Interval	-----Hydrocarbons-----				-----Nonhydrocarbons-----					
		Paraffin- Naphthene %	Aromatic %	PN/Arom	Sulfur %	Eluted NSO'S %	Noneluted NSO'S %	Precipitd. Asphaltene %	Asph/NSO	HC'S %	HC/Non HC
2090-010	6840-6850	18.6	7.6	2.45	1.1	11.0	3.0	58.7	4.19	26.1	0.35

TABLE III-A

Saturate Hydrocarbon Analyses

Summary of Paraffin-Naphthene Distribution

GeoChem Sample Number	Well Interval	% Paraffin	% Isoprenoid	% Naphthene	C-P Index A	C-P Index B	ip19/ip20
2090-010	6840-6850	32.9	4.0	63.1	1.01	1.08	1.58

TABLE III-B

Saturate Hydrocarbon Analyses

Normalized Paraffin Distribution

GeoChem Sample Number	Well Interval	% nC15	% nC16	% nC17	% ip19	% nC18	% ip20	% nC19	% nC20	% nC21	% nC22	% nC23	% nC24	% nC25	% nC26	% nC27	% nC28	% nC29	% nC30	% nC31	% nC32	% nC33	% nC34	% nC35
2090-010	6840-6850	5.3	7.4	9.1	6.7	9.4	4.2	9.1	7.1	6.6	6.5	6.0	4.8	3.9	3.2	2.7	2.3	1.9	1.4	1.4	0.6	0.3	0.1	0.0

TABLE IV

VISUAL KEROGEN ASSESSMENT WORKSHEET

GEOCHEM No	DEPTH	INDIGENOUS POPULATION (INTERPRETED)				GENERAL CHARACTERISTICS						CAVED AND/OR REWORKED POPULATION(S)		SUMMARY ORGANIC MATTER TYPE				
		TYPE OF ORGANIC MATTER		MATURATION INDEX		COLOR OF ORGANIC MATTER		STATE OF ORGANIC MATTER		%		TYPE OF ORGANIC MATTER			MATURATION INDEX			
		REMARKS				SHEDDING	YELLOW	YELLOW-DRY	YELLOW-BROWN	BROWN	VERY BROWN	VERY DARK BROWN	BLACK	STRENGTH	PLASTICITY	REMARKS		
2090-001	6000	H*-W; Am-I; -																
2090-006	6630	Am; -; H-W-I																
2090-003	6770	W-I; Am-H; -																
2090-010	6350	W-I; Am-H; -																
2090-012	6980	Am(A1); -; -																
2090-014	7110	Am; -; -														caved		

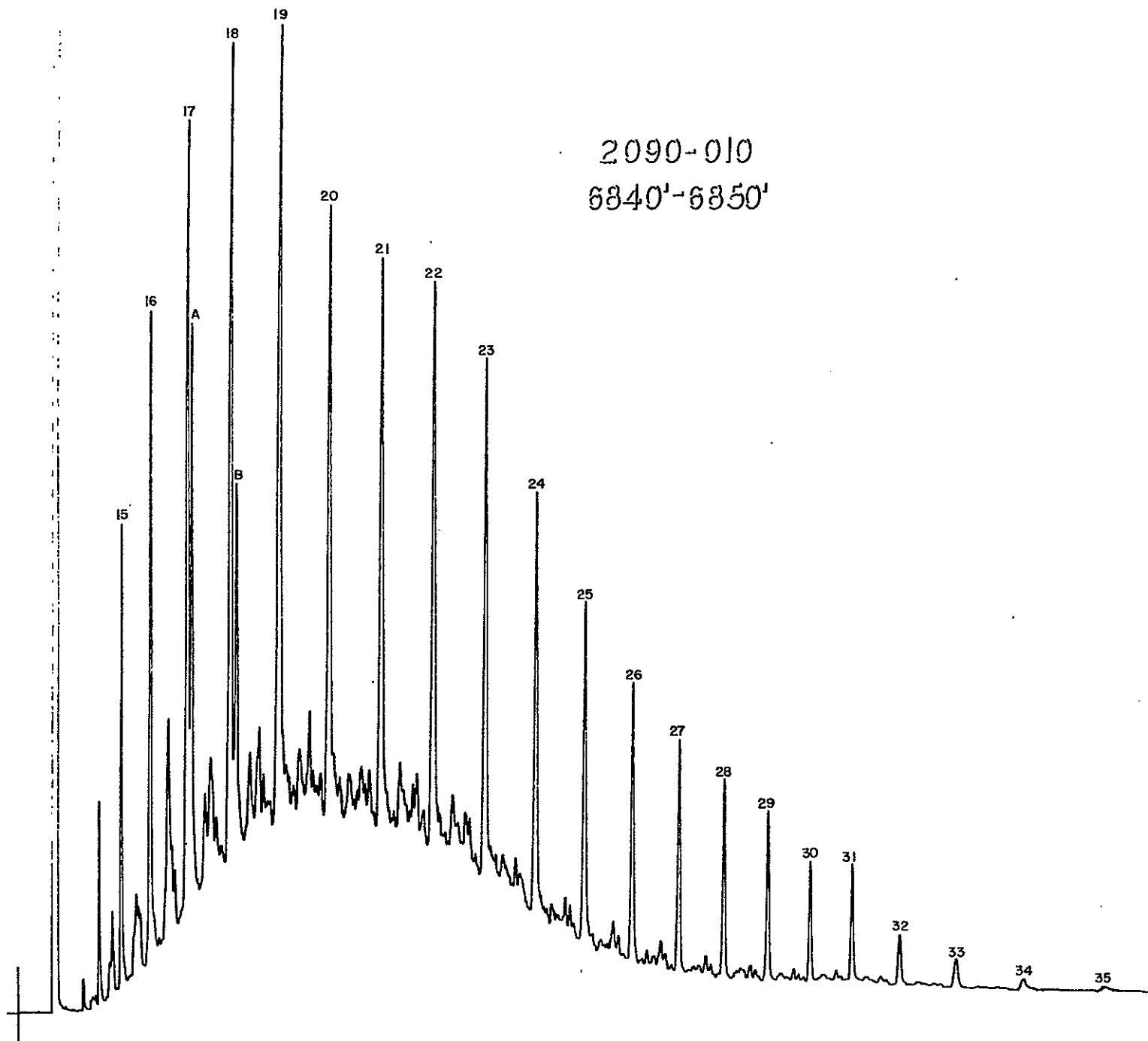
The material in 012 came from recrystallized dolomite,
the material in 014 is probably 80% caved Escabrosa.

TABLE V

VITRINITE REFLECTANCE SUMMARY

GEOCHEM SAMPLE NUMBER	DEPTH (feet)	TYPE OF SAMPLE	POPULATION	NUMBER OF READINGS	MINIMUM REFLECTANCE (% Ro)	MAXIMUM REFLECTANCE (% Ro)	MEAN REFLECTANCE (% Ro)	STD. DEV. (% Ro)	REMARKS
2090-010	6850	CTG	(1)	17	1.54	2.24	1.93	0.200	
			(2)	43	2.32	3.89	2.85	0.452	

2090-010
6840'-6850'

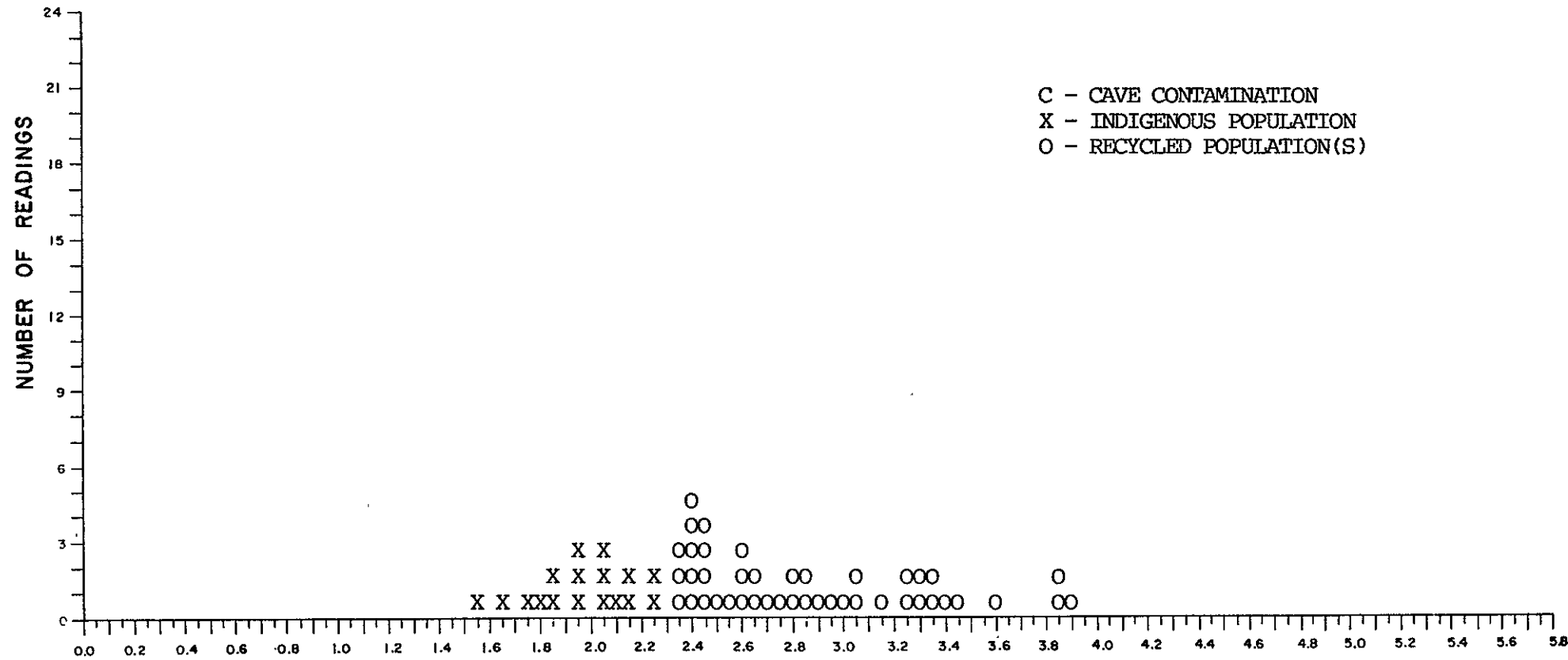


GEOCHEM NO. 2090-010 TYPE OF SAMPLE: CTG DEPTH/SAMPLE NO. 6850

CLIENT'S NAME NEW MEXICO BUREAU OF MINES WELL NAME COCKRELL #1 PYRAMID FEDERAL

(NO. OF READINGS = 60)	1.54	1.63	1.72	1.76	1.80	1.82	1.91	1.93	1.93	2.00	2.02	2.03	2.08	2.10
2.11	2.23	2.24	2.32	2.34	2.34	2.36	2.37	2.38	2.39	2.39	2.41	2.41	2.43	2.43
2.58	2.59	2.62	2.63	2.69	2.70	2.78	2.78	2.82	2.83	2.87	2.94	2.95	3.00	3.03
3.28	3.29	3.33	3.34	3.36	3.40	3.56	3.81	3.84	3.89					

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV (%)	REMARKS
(1)	17	1.54	2.24	1.93	0.200	
(2)	43	2.32	3.89	2.85	0.452	



VITRINITE REFLECTANCE HISTOGRAM