New Mexico Bureau of Mines and Mineral Resources

Open File Report No. OF 247

HYDROCARBON SOURCE-ROCK EVALUATION STUDY, SELECTED OUTCROP SAMPLES OF PALEOZOIC AND MESOZOIC ROCKS GRANT, HIDALGO, AND LUNA COUNTIES, NEW MEXICO

by L. Paul Tybor
GeoChem Laboratories, Inc.
Houston, Texas
April 15, 1982

(Additional data on locations and stratigraphic positicns of samples are available for inspection at NMBMMR. Contact Sam Thompson III).

GeoChem Laboratories, Inc.

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

April 15, 1982

Mr. Clayton S. Valder
Marshall R. Young Oil Co.
750 West Fifth Street
Fort Worth, Texas 76102

Dear Mr. Valder:

Enclosed please find the results of the organic geochemical analyses performed on thirty-two (32) shale outcrop rock samples from Luna, Grant, and Hidalgo Counties, New Mexico.

Upon arrival at GeoChem the samples were assigned the GeoChem Job Number 2259, and were submitted to the following analytical program:

Type of Analysis	Table
% total organic carbon determination	I
Pyrolysis analysis	II
Visual kerogen assessment	III
Vitrinite reflectance	IV; Histograms

DISCUSSION OF THE RESULTS

Colorado Shale

Colorado Shale samples 2259-003,-005,-006,-008,-011,-012,and -016, collected from Cooks Range contain fair amounts of organic matter (Table VI) comprised predominantly of the gas-prone woody organic matter type (Table III). These rocks have experienced a mature geothermal history, based on the light brown kerogen coloration (Table III), and as a result, these shales have a mature, poor oil, fair gas source character. The poor oil potential of these sediments is evidenced by the poor free hydrocarbon yields (S_1; Table II) obtained in the pyrolysis analyses performed on these samples. [During pyrolysis analysis, the gaseous hydrocarbon is normally lost, however, any liquid is recovered.]

The remaining Colorado Shale samples are organic-lean with poor hydrocarbon generating capabilities.

Percha Shale

The two (2) Percha Shale samples (2259-014 and -015) analyzed have experienced mature (-014) and very mature (-015) geothermal histories, and are comprised predominantly of the oil-prone, amorphous-sapropel organic matter type (Table III). However, the amount of organic matter contained in these two (2) Percha Shale samples is lean (Table I) and consequently these sediments are considered nonhydrocarbon sources.

Shale in Sarten and Scherrer Formations

The two (2) shale samples from Sarten (2259-017) and the Scherrer formation (2259-018) are very organic-lean, such that no assessment of their thermal maturation was possible. These rocks have a poor hydrocarbon source character.

U-Bar Formations

All U-Bar Shale samples contain poor amounts of organic matter (<0.50% TOC; Table I) at very mature thermal maturation levels. These sediments are rated as poor hydrocarbon sources.

Mojado Formation

With the exception of Mojado shale samples 2259-030 and -031 within the Brockman Hills, all of the Mojado rocks are organic deficient, with poor hydrocarbon-generating potential. The two Mojado shales from Brockman Hills, contain fair to good amounts (%TOC; Table I) of gas-prone woody organic matter type (Table III), at moderately immature thermal maturation levels. As a result, these rocks are characterized as moderately immature, poor oil, fair to good gas sources.

Should you have any questions concerning this data, of if we can be of further assistance to you, please feel free to contact us.

Yours truly,

Paul Tybor
Project Coordinator
GEOCHEM LABORATORIES, INC.

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Enclosures

Table I

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Client I.D.	Location	Total Organic Carbon (% of Rock)
2259-001	A-1	Colorado Shale- Cooks Range	0.30
2259-002	A-2	Colorado Shale - Cooks Range	0.34
2259-003	A-3	Colorado Shale - Cooks Range	0.64
2259-004	A-4	Colorado Shale - Cooks Range	0.33
2259-005	A-5	Colorado Shale - Cooks Range	0.54
2259-006	A-6	Colorado Shale - Cooks Range	0.58
2259-007	A-7	Colorado Shale - Cooks Range	0.28
2259-008	A-8	Colorado Shale - Cooks Range	0.77
2259-009	A-9	Colorado Shale - Cooks Range	0.47
2259-010	A-10	Colorado Shale - Cooks Range	0.40
2259-011	A-11	Colorado Shale - Cooks Range	0.63
2259-012	A-12	Colorado Shale - Cooks Range	0.54
2259-013	A-13	Colorado Shale - Cooks Range	0.34
2259-014	#81	Percha-Gym Peak-Floridas	0.27
2259-015	158A	Percha Shale - Cooks Range	0.27
2259-016	159A	Colorado Shale - Cooks Range	1.10
2259-017	163A	Shale in Sarten - Cooks Range	0.07
2259-018	275	Scherrer Form - Peloncillo Mts.	0.03
2259-019	325	U-Bar - Little Hatchets	0.24
2259-020	327	U-Bar - Little Hatchets	0.25
2259-021	330	U-Bar - Little Hatchets	0.31
2259-022	333	U-Bar - Little Hatchets	0.28

Table I

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Client I.D.	Location	Total Organic Carbon (% of Rock)
2259-023	334	U-Bar - Little Hatchets	0.48
2259-024	341	U-Bar - Little Hatchets	0.03
2259-025	342	U-Bar - Little Hatchets	0.21
2259-026	351	Mojado - Little Hatchets	0.06/0.07
2259-027	352	Mojado - Little Hatchets	0.15
2259-028	357	Mojado - Little Hatchets	0.10
2259-029	373	Mojado - Brockman Hills	0.15
2259-030	374	Mojado - Brockman Hills	0.93
2259-031	375	Mojado - Brockman Hills	0.97/0.96
2259-032	376	Mojado - Brockman Hills	0.26

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)
PC* = 0.083 ($S_1 + S_2$)

Hydrogen Index = mg HC/g organic carbon
Oxygen Index = mg CO2/g organic carbon
PI = S1/S1+S2
Tmax = Temperature Index, degrees C.

TABLE II

RESULTS OF ROCK-EVAL PYROLYSIS

GeoChem Sample No.	Client I.D.	Tmax (C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	PC*	T.O.C. (wt. %)	Hydrogen Index	Oxygen Index
2259-003	A-3	366	0.03	0.13	0.56	0.19	0.01	0.64	20	87
2259-005	A-5	297	0.01	0.07	0.49	0.12	0.00	0.54	12	90
2259-006	A-6	428	0.03	0.29	0.52	0.09	0.02	0.58	50	89
2259-008	A-8	433	0.04	0.30	0.60	0.12	0.02	0.77	38	77
2259-011	A-11	421	0.02	0.33	1.22	0.06	0.02	0.63	52	193
2259-012	A-12	366	0.02	0.14	0.54	0.12	0.01	0.54	25	100
2259-016	159A	273	0.01	0.03	0.43	0.25	0.00	1.10	2	39
2259-023	334	378	0.01	0.19	0.92	0.05	0.01	0.48	39	191
2259-030	374	372	0.02	0.09	0.37	0.20	0.00	0.93	9	39
2259-031	375	271	0.02	0.06	0.47	0.25	0.00	0.97	6	48

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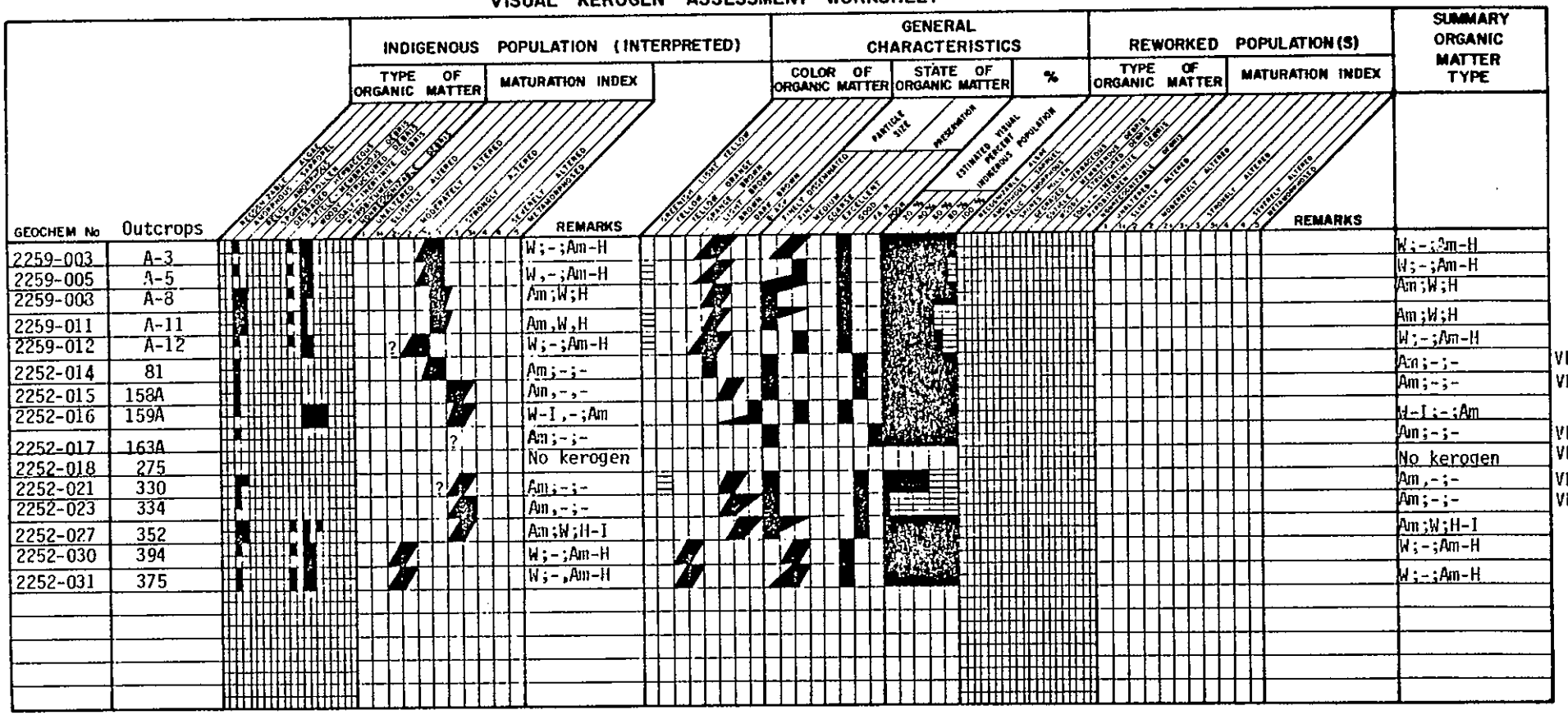
TABLE III
VISUAL KEROGEN ASSESSMENT WORKSHEET



GEOCHEM No	Outcrops	REMARKS	SUMMARY ORGANIC MATTER TYPE	
2259-003	A-3	W;-;Am-H	W;-;Am-H	
2259-005	A-5	W,-;Am-H	W;-;Am-H	
2259-003	A-8	Am;W;H	Am;W;H	
2259-011	A-11	Am,W,H	Am;W;H	
2259-012	A-12	W;-;Am-H	W;-;Am-H	
2252-014	81	Am;-;-	Am;-;-	VLOM
2252-015	158A	Am,-,-	Am;-;-	VLOM
2252-016	159A	W-I,-;Am	W-I;-;Am	
2252-017	163A	Am;-;-	Am;-;-	VLOM
2252-018	275	No kerogen	No kerogen	VLOM
2252-021	330	Am,-;-	Am,-;-	VLOM
2252-023	334	Am,-;-	Am;-;-	VLOM
2252-027	352	Am;W;H-I	Am;W;H-I	
2252-030	394	W;-;Am-H	W;-;Am-H	
2252-031	375	W;-,Am-H	W;-;Am-H	

recent material, mostly tree roots.

VLOM = very little organic material.

Table IV

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
2259-003	A-3	OC	(1)	43	0.85	1.06	0.94	0.065	INDIGENOUS
			(2)	17	1.10	1.50	1.20	0.102	REWORKED
2259-008	A-8	OC	(1)	17	0.97	1.15	1.06	0.057	INDIGENOUS
			(2)	10	1.22	2.16	1.48	0.271	REWORKED
2259-016	159 A	OC	(1)	9	1.00	1.24	1.09	0.076	INDIGENOUS
			(2)	8	1.38	2.33	1.85	0.356	REWORKED
2259-032	334	OC	(1)	8	1.40	1.76	1.60	0.141	INDIGENOUS
			(2)	8	1.96	2.44	2.16	0.176	REWORKED
2259-031	375	OC	(1)	34	0.45	0.61	0.53	0.045	INDIGENOUS
			(2)	26	0.62	0.84	0.68	0.053	REWORKED

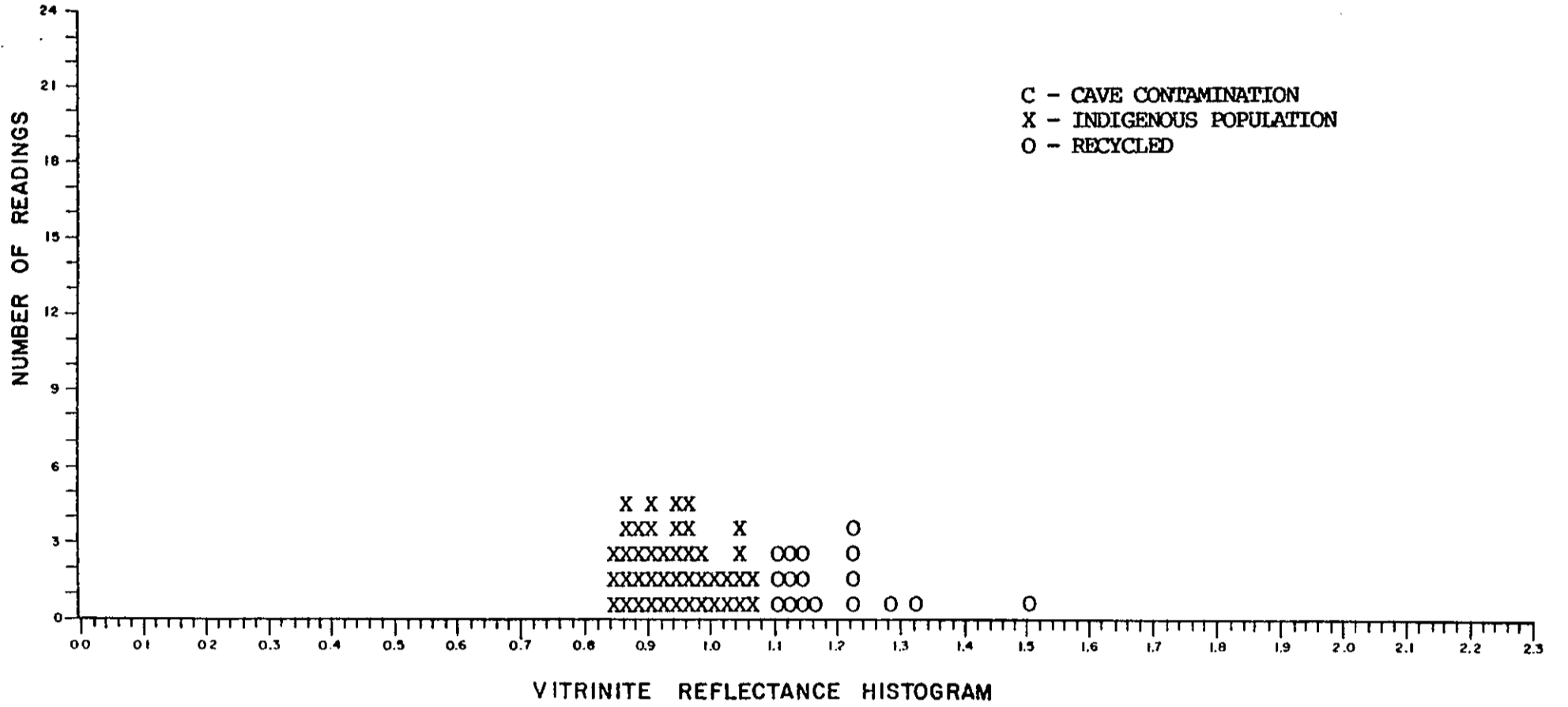
ALL SAMPLES BADLY WEATHERED - MAY HAVE ALTERED REFLECTANCE VALUES

GEOCHEM NO. 2259-003 TYPE OF SAMPLE: OUTCROPS DEPTH / SAMPLE NO. A-3

CLIENT'S NAME MARSHALL YOUNG WELL NAME

(NO. OF READINGS = 60) 0.85 0.85 0.85 0.86 0.86 0.86 0.87 0.87 0.88 0.88 0.89 0.89 0.90 0.90
0.90 0.91 0.91 0.92 0.93 0.93 0.94 0.94 0.95 0.95 0.95 0.96 0.96 0.96 0.97 0.97 0.99 0.99
0.99 1.00 1.01 1.02 1.03 1.04 1.04 1.05 1.05 1.06 1.06 1.10 1.11 1.11 1.13 1.13 1.13 1.14
1.14 1.15 1.17 1.22 1.23 1.23 1.23 1.29 1.32 1.50

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	43	0.85	1.06	0.94	0.065	
(2)	17	1.10	1.50	1.20	0.102	

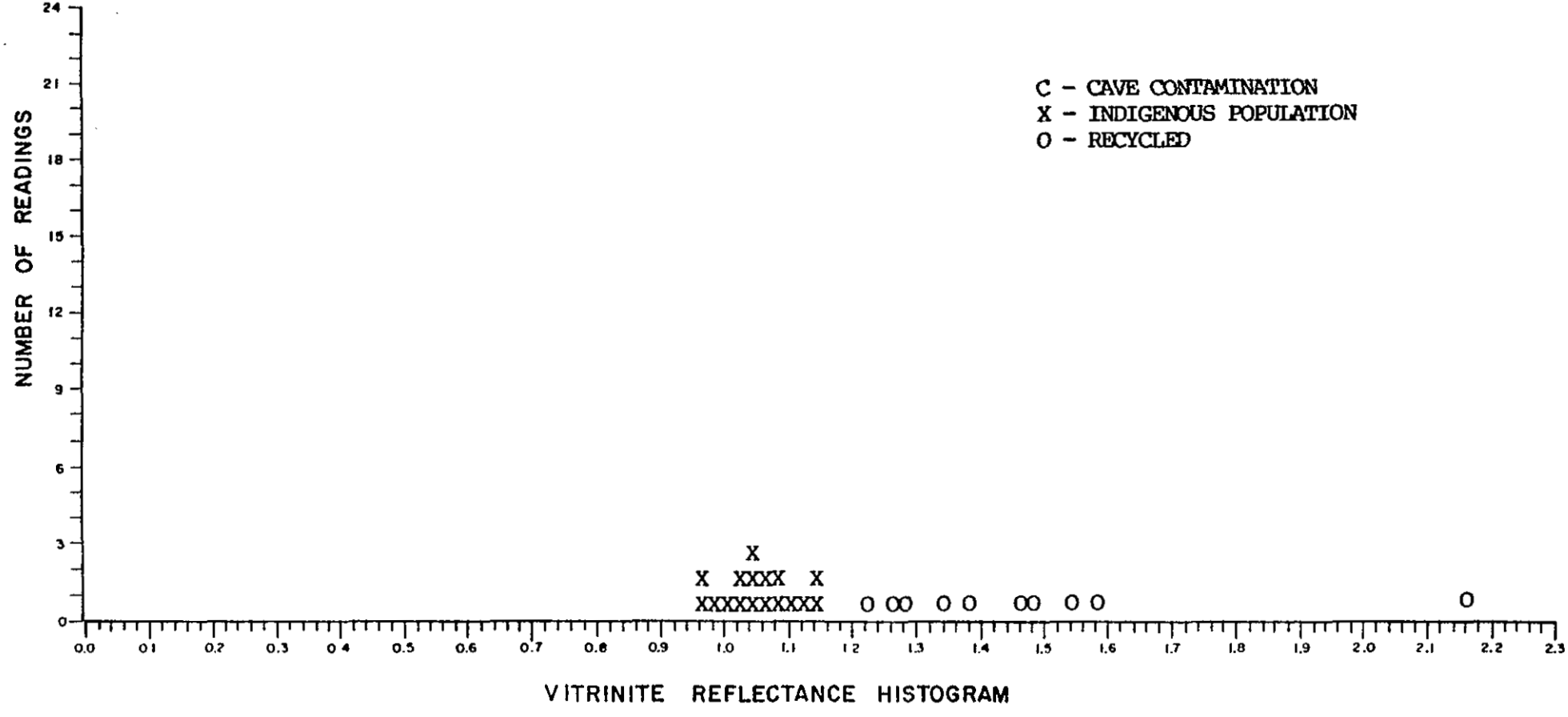


GEOCHEM NO. 2259-008 TYPE OF SAMPLE: OUTCROPS DEPTH / SAMPLE NO. A-8

CLIENT'S NAME MARSHALL YOUNG WELL NAME

(NO. OF READINGS = 27) 0.97 0.97 0.98 1.00 1.02 1.03 1.04 1.05 1.05 1.06 1.06 1.09 1.09 1.11
1.13 1.14 1.15 1.22 1.26 1.28 1.35 1.39 1.47 1.49 1.55 1.59 2.16

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	17	0.97	1.15	1.06	0.057	
(2)	10	1.22	2.16	1.48	0.271	

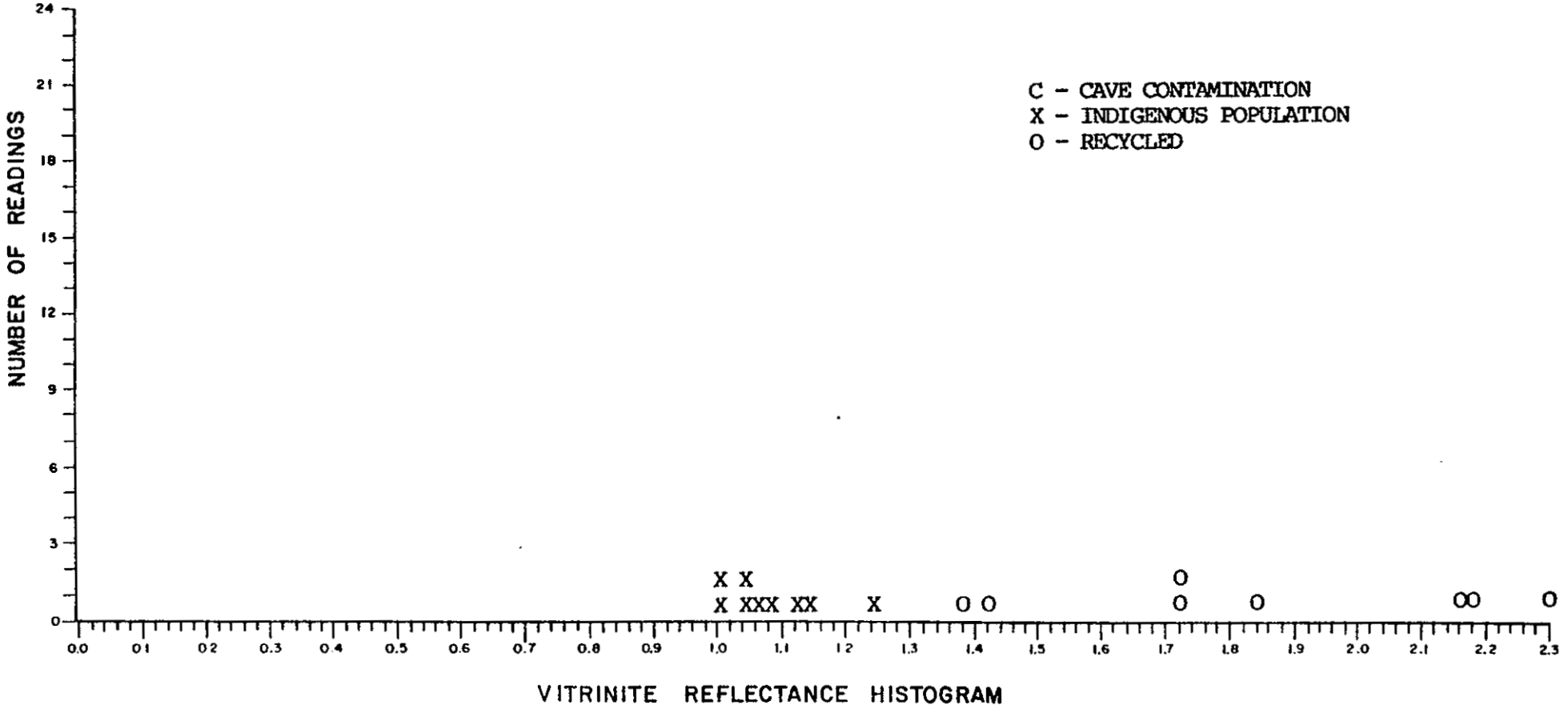


GEOCHEM NO. 2259-016 TYPE OF SAMPLE: OUTCROPS DEPTH / SAMPLE NO. 159 A

CLIENT'S NAME MARSHALL YOUNG WELL NAME

(NO. OF READINGS = 17) 1.00 1.01 1.04 1.05 1.07 1.09 1.13 1.15 1.24 1.38 1.42 1.72 1.73 1.84 2.17 2.19 2.33

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	9	1.00	1.24	1.09	0.076	
(2)	8	1.38	2.33	1.85	0.356	



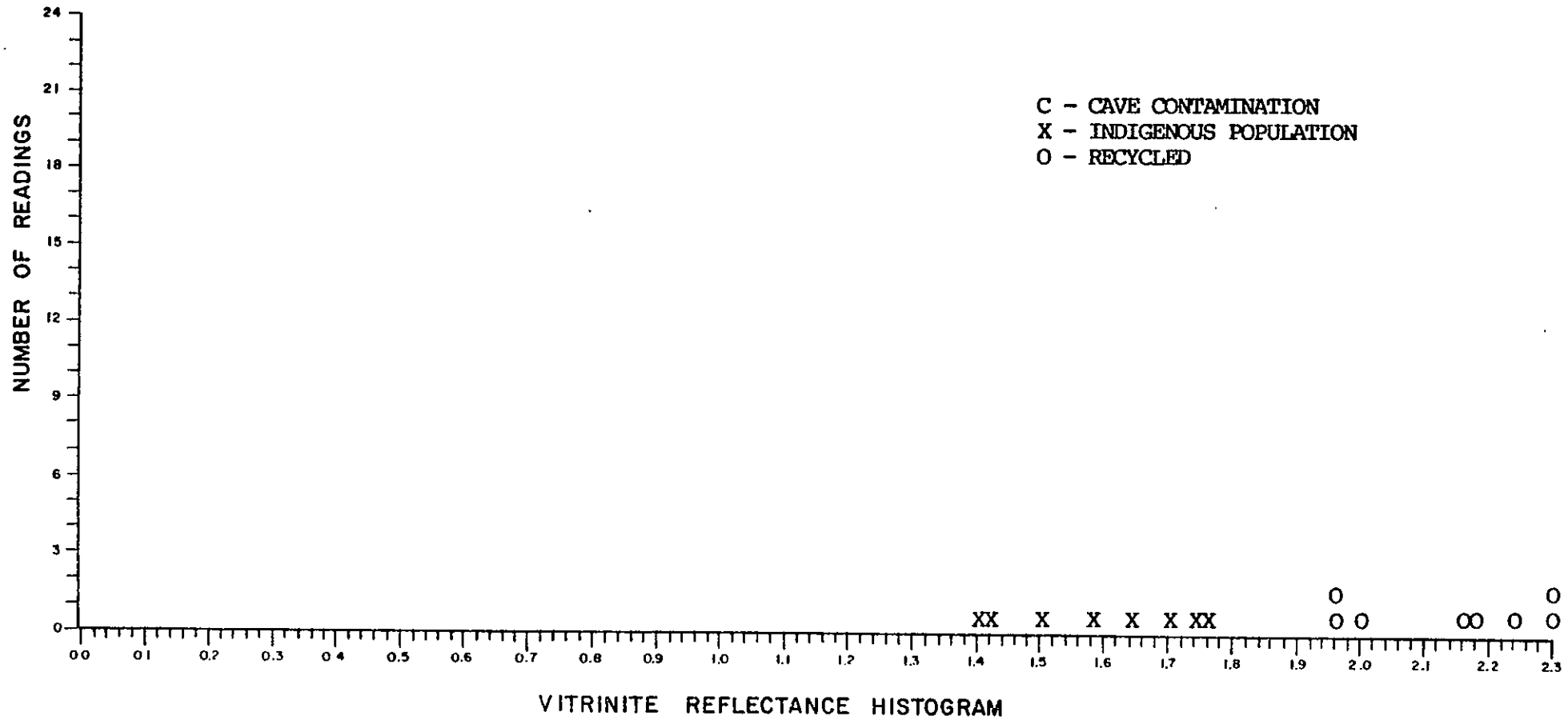
VITRINITE REFLECTANCE HISTOGRAM

GEOCHEM NO. 2259-032 TYPE OF SAMPLE: OUTCROPS DEPTH / SAMPLE NO. 334

CLIENT'S NAME MARSHALL YOUNG WELL NAME

(NO. OF READINGS = 16) 1.40 1.43 1.50 1.59 1.64 1.70 1.75 1.76 1.96 1.97 2.01 2.16 2.18 2.25 2.34 2.44

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	8	1.40	1.76	1.60	0.141	
(2)	8	1.96	2.44	2.16	0.176	

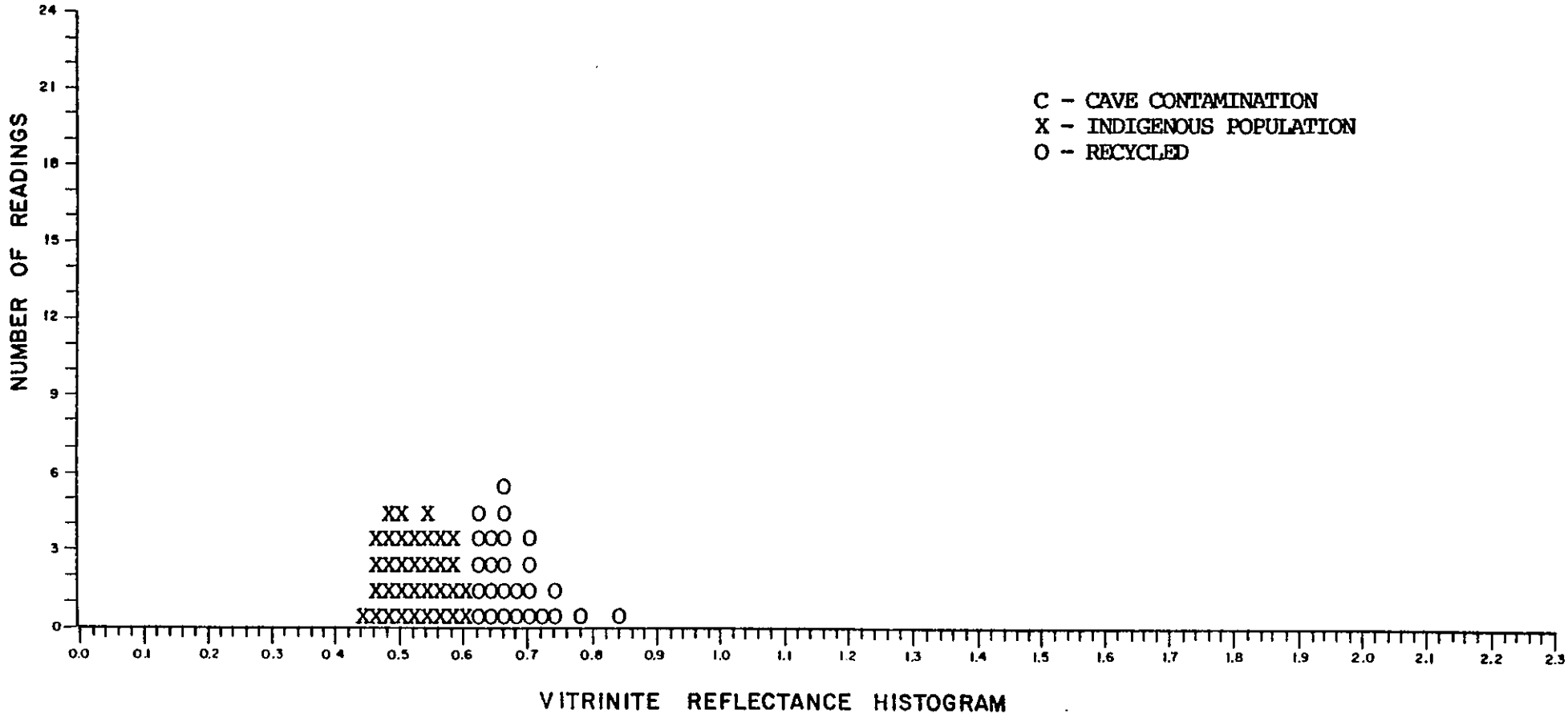


GEOCHEM NO. 2259-031 TYPE OF SAMPLE: OUTCROPS DEPTH/SAMPLE NO. 375

CLIENT'S NAME MARSHALL YOUNG WELL NAME

(NO. OF READINGS = 60) 0.45 0.46 0.47 0.47 0.47 0.48 0.48 0.49 0.49 0.49 0.50 0.50 0.50 0.51
0.51 0.52 0.52 0.53 0.53 0.54 0.55 0.55 0.55 0.55 0.56 0.56 0.56 0.57 0.58 0.59 0.59 0.59
0.60 0.61 0.62 0.63 0.63 0.63 0.63 0.64 0.64 0.65 0.65 0.66 0.66 0.67 0.67 0.67 0.67 0.68
0.68 0.70 0.70 0.70 0.71 0.72 0.74 0.75 0.79 0.84

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	34	0.45	0.61	0.53	0.045	
(2)	26	0.62	0.84	0.68	0.053	



GeoChem Laboratories, Inc.

GEOCHEMICAL ANALYSES
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CRUDE OIL CHARACTERIZATION
GEOCHEMICAL PROSPECTING

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

April 15, 1982

Mr. Clayton S. Valder
Marshall R. Young Oil Co.
750 West Fifth Street
Fort Worth, Texas 76102

Dear Mr. Valder:

Enclosed please find the results of the organic geochemical analyses performed on thirty-eight (38) Ordovician-age outcrop rock samples from Luna, Grant and Hidalgo Counties, New Mexico.

Upon arrival at GeoChem the samples were assigned the GeoChem Job Number 2269, and were submitted to the following analytical program:

Type of Analysis	Table
% total organic carbon determination	I
Pyrolysis analysis	II
Visual kerogen assessment	III

DISCUSSION OF THE RESULTS

The results obtained from the % total organic carbon (Table I) and pyrolysis (Table II) analyses perfromed on these rocks indicate that they are organic-lean, and nonprospective as hydrocarbon sources. There are, however, variations in the thermal maturity of these sediments, which should prove to be helpful in assessing regional thermal maturity trends within the basin.

GeoChem sample numbers 2269-017,-018,-019,-020,-021,-022,-023,-024,-025,-026, -027,and -029 are thermally mature, and considered to be within the oil window. If these rocks contained favorable amounts of organic matter, then oil and gas generation could have occurred.

Rock samples 2269-037 and -038 have experienced a very mature geothermal history, and are considered within the wet gas-condensate generating zone.

The remaining samples 2269-001 to -016, 2269-028, and 2269-030 to -036, have attained severely altered maturation levels and hence, are only prospective for thermally-derived methane (C_1) dry gas.

For the explorationist to encounter indigenously generated hydrocarbon from these Ordovician-age rock samples, an adjacent organic-rich facies would have to be present elsewhere in the basin.

Should you have any questions concerning this data, of if we can be of further assistance to you, please feel free to contact us.

Yours truly,

Paul Tybor
Project Coordinator
GEOCHEM LABORATORIES,INC.

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Enclosures

Table I

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Client I.D.	Formation	Location	Total Organic Carbon (% of rock)
2269-001	14	L/El Paso	Luna County, Sec. 10-25S-8W	0.05
2269-002	18	L/El Paso	Luna County, Sec. 10-25S-8W	0.04
2269-003	22	L/El Paso	Luna County, Sec. 10-25S-8W	0.05
2269-004	26	M/El Paso	Luna County, Sec. 10-25S-8W	0.04/0.03
2269-005	30	M/El Paso	Luna County, Sec. 10-25S-8W	0.05
2269-006	32	M/El Paso	Luna County, Sec. 10-25S-8W	0.04
2269-007	34	U/El Paso	Luna County, Sec. 10-25S-8W	0.06
2269-008	37	Upham	Luna County, Sec. 10-25S-8W	0.06
2269-009	48	Cable Canyon	Luna County, Sec. 7-26S-7W	0.08
2269-010	49	Upham	Luna County, Sec. 7-26S-7W	0.05
2269-011	50	Upham	Luna County, Sec. 7-26S-7W	0.04
2269-012	52	Aleman	Luna County, Sec. 7-26S-7W	0.05/0.05
2269-013	57	Cutter	Luna County, Sec. 7-26S-7W	0.04
2269-014	61	Cutter	Luna County, Sec. 7-26S-7W	0.06
2269-015	64	Cutter	Luna County, Sec. 7-26S-7W	0.04
2269-016	87	El Paso	Luna County, Sec. 33 & 34 24S-10W	0.04
2269-017	89	El Paso	Luna County, Sec. 33 & 34 24S-10W	0.04
2269-018	92	El Paso	Luna County, Sec. 33 & 34 24S-10W	0.04
2269-019	94	El Paso	Luna County, Sec. 33 & 34 24S-10W	0.04
2269-020	97	El Paso	Luna County, Sec. 33 & 34 24S-10W	0.18/0.18

Table 1

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Client I.D.	Formation	Location	Total Organic Carbon (% of rock)
2269-021	100	El Paso	Luna County, Sec. 33 & 34 24S-10W	0.08
2269-022	103	Cable Canyon	Luna County, Sec. 32 & 33 24S-10W	0.05
2269-023	104	Upham	Luna County, Sec. 32 & 33 24S-10W	0.06
2269-024	105	Upham	Luna County, Sec. 32 & 33 24S-10W	0.04
2269-025	106	Aleman	Luna County, Sec. 32 & 33 24S-10W	0.04
2269-026	107	Aleman	Luna County, Sec. 32 & 33 24S-10W	0.14
2269-027	164	Cable Canyon	Grant County, Sec. 17-24S-14W	0.05
2269-028	165	Cable Canyon	Grant County, Sec. 17-24S-14W	0.06
2269-029	166	Ordovician Fault Breccia	Grant County, Sec. 17-24S-14W	0.04/0.04
2269-030	167	Upham	Luna County, Sec. 28-24S-12W	0.04
2269-031	169	El Paso	Luna County, Sec. 28-24S-12W	0.02
2269-032	172	El Paso	Luna County, Sec. 28-24S-12W	0.18
2269-033	175	El Paso	Luna County, Sec. 28-24S-12W	0.03
2269-034	177	El Paso	Luna County, Sec. 28-24S-12W	0.04
2269-035	178	Cutter	Luna County, Sec. 30-24S-19W	0.05
2269-036	294	El Paso	Hidalgo County, Sec. 13-28S-19W	0.04/0.04
2269-037	295	Montoya	Hidalgo County, Sec. 13-28S-19W	0.07
2269-038	319	Bliss/El Paso	Hidalgo County, Sec. 12-28S-19W	0.04

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)
PC* = 0.083 (S1 + S2)

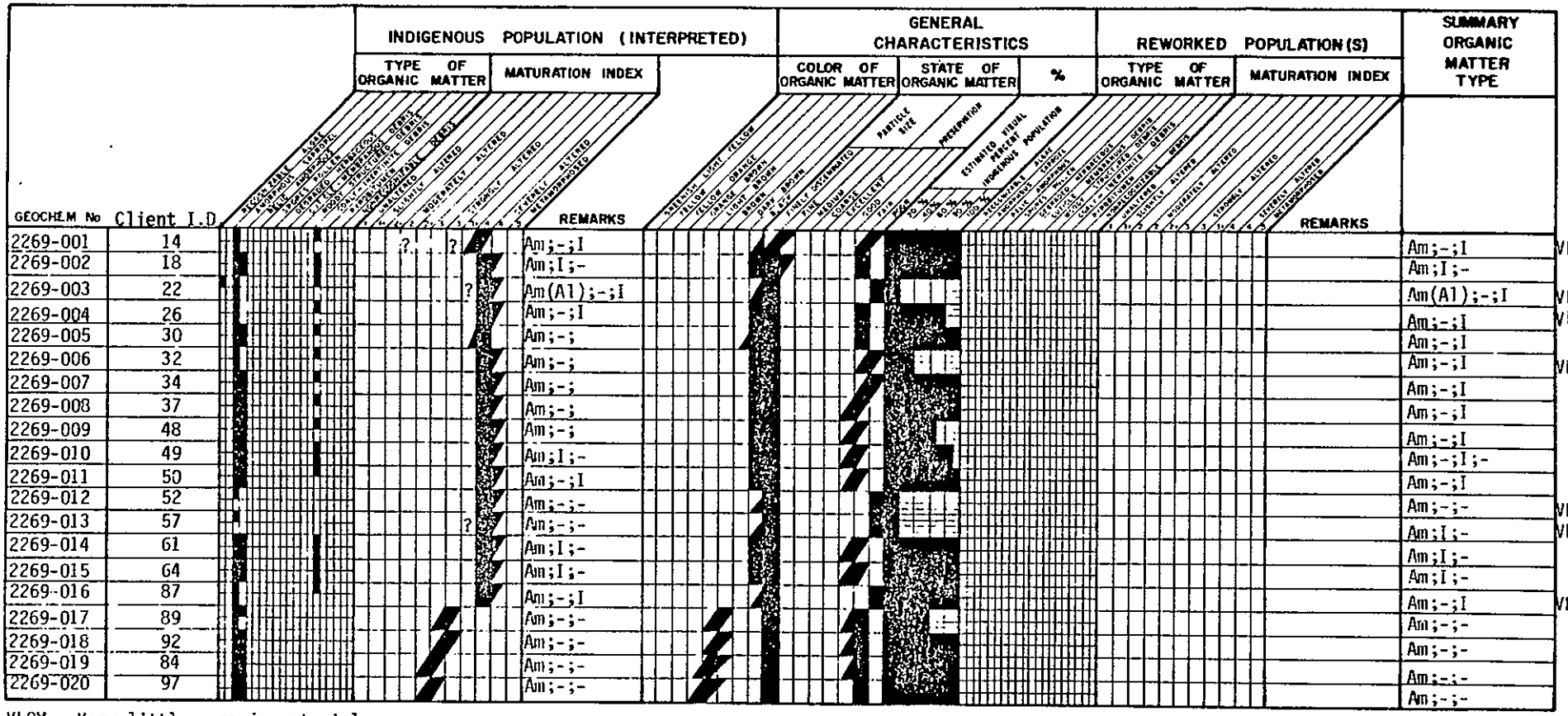
Hydrogen Index = mg HC/g organic carbon
Oxygen Index = mg CO2/g organic carbon
PI = S1/S1+S2
Tmax = Temperature Index, degrees C.

TABLE II

RESULTS OF ROCK-EVAL PYROLYSIS

GeoChem Sample No.	Client I.D.	Tmax (C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	PC*	T.O.C. (wt. %)	Hydrogen Index	Oxygen Index
2269-020	#97	399	0.00	0.54	0.37	0.00	0.04	0.18	300	205
2269-032	#172	322	0.01	0.50	1.14	0.02	0.04	0.18	277	633

TABLE III
VISUAL KEROGEN ASSESSMENT WORKSHEET



GEOCHEM No	Client I.D.	REMARKS	SUMMARY ORGANIC MATTER TYPE	
2269-001	14	Am;-;I	Am;-;I	VLOM
2269-002	18	Am;I;-	Am;I;-	
2269-003	22	Am(Al);-;I	Am(Al);-;I	VLOM
2269-004	26	Am;-;I	Am;-;I	VLOM
2269-005	30	Am;-;	Am;-;I	
2269-006	32	Am;-;	Am;-;I	VLOM
2269-007	34	Am;-;	Am;-;I	
2269-008	37	Am;-;	Am;-;I	
2269-009	48	Am;-;	Am;-;I	
2269-010	49	Am;I;-	Am;-;I;-	
2269-011	50	Am;-;I	Am;-;I	
2269-012	52	Am;-;-	Am;-;-	VLOM
2269-013	57	Am;-;-	Am;I;-	VLOM
2269-014	61	Am;I;-	Am;I;-	
2269-015	64	Am;I;-	Am;I;-	
2269-016	87	Am;-;I	Am;-;I	VLOM
2269-017	89	Am;-;-	Am;-;-	
2269-018	92	Am;-;-	Am;-;-	
2269-019	84	Am;-;-	Am;-;-	
2269-020	97	Am;-;-	Am;-;-	

VLOM = Very little organic material.

Recent contaminants.