New Mexico Bureau of Mines and Mineral Resources
Open File Report No. OF 201

HYDROCARBON SOURCE-ROCK EVALUATION STUDY, SINCLAIR NO. 1 DOÑA ANA FEDERAL 18 WELL DOÑA ANA COUNTY, NEW MEXICO

by Douglas A. Muckelroy
GeoChem Laboratories, Inc.
Houston, Texas
January 10, 1983

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

January 10, 1983

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 a suite of thirty-four (34) dry well cuttings samples from the Sinclair No.1 Dona Ana Fed. 18 Well (Sec.27,T.22S,R.1W) located in Dona Ana County, New Mexico.

Upon arrival at GeoChem's Houston laboratory, the samples were assigned the GeoChem Job Number 2391 and were submitted to the following organic geochemical analyses:

Type of Analyses	Table
Total organic carbon analyses and brief lithological descriptions	I
Rock-Eval pyrolysis	II
Visual kerogen assessment	III
Vitrinite reflectance	IV

RESULTS AND INTERPRETATIONS

A. Thermal Maturity

The sediments penetrated by this well can be divided into three (3) zones of thermal maturity.

Zone I (2840+ feet to 3330+ feet)

The sediments contained within Zone I (Magdalena Formation) have a moderately mature Maturation Index (Stage 2 to 2+). This rating is based on the orange-brown to light brown coloration of the recognizable amorphous organic matter contained in the kerogen isolated from the cuttings samples (Table III). Supporting this rating is the moderately mature value detected from the vitrinite reflectance analyses on sample 2393-003 (Table IV).

At this level of thermal maturity these sediments are located in the upper portion of the oil-generating window, wherein oil and associated gas could have been generated.

Zone II (3420+ feet to 4100+ feet)

The lower sediments of the Magdalena Formation and the sediments of the Lake Valley and the upper Percha Formations have a very mature (mean Stage 3 to 3+; Table III) thermal maturation rating. This state of thermal maturity is based on the brown to black coloration of the recognizable amorphous, herbaceous, and woody debris contained in the kerogen isolated from the cuttings samples (Table III). The very mature rating for these rocks is probably due to the presence of Tertiary intrusive rocks within this basin.

The thermal maturity of these sediments have progressed beyond the oil-generating window; thus only "wet" gas and condensate could be generated.

Zone III (4190+ feet to 6340+ feet)

The remaining sediments of the Percha, Fusselman, Montoya, El Paso and Bliss Formations are rated as thermally mature (mean Stage 2+ to 3-; Table III). This rating is based on the light brown to brown coloration of the recognizable amorphous-algae matter type contained in the kerogen isolated from the cuttings samples (Table III).

At this level of thermal maturity, these sediments are located in the oil-generating window, wherein oil and associated gas could be generated.

B. Hydrocarbon Source Characterization

The sediments of the Percha Formation (Devonian) have a mature poor to possibly fair oil and associated gas source character. This interpretation is based on the poor to fair amounts of organic matter (0.22% avg. total organic carbon; Table I) analyzed which is comprised of the oil-prone amorphous organic matter type (Table III). Even though these sediments contain poor amounts of free hydrocarbon and hydrocarbon generating potential (S_1=0.19 mg/g;S_2=0.35 mg/g; Table II), these values are considered borderline and thus, gives these sediments a possibly fair hydrocarbon source character.

The remaining sediments penetrated by this well contain poor amounts of organic matter (0.07% avg. total organic carbon; Table I) and poor amounts of hydrocarbon generating potential (S_2=0.05 mg/g avg.; Rock-Eval pyrolysis; Table II) giving these sediments a poor hydrocarbon source character.

Should we be of any further assistance concerning this study or any other matter, please do not hesitate to call upon us.

Yours truly,

Doug Muckelroy

Douglas A. Muckelroy
GEOCHEM LABORATORIES, INC.

st

Enclosures

c: Sam Thompson III
New Mexico Bureau of Mines

SUMMARY TABLE 1

SINCLAIR NO. 1 DONA ANA FED 18

Age Formation	Depth Interval (Feet)	Lithology	Organic Richness: Organic Carbon (% rock)	Organic Richness: Free Hydrocarbons Mg HC/g S1	Organic Richness: Hydrocarbon Generating Potential Mg HC/g S2	Predominant Kerogen Type Visual Assessment	Thermal Maturity: Kerogen Alteration (1-5 Scale)	Thermal Maturity: Vitrinite Reflectance	Hydrocarbon Source Potential
			MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	
PENNSYLVANIAN									
Magdalena	2840-3650	Limestone, brownish gray.	(8) 0.06	(1) 0.02	(1) 0.06	(7) Am;-;H*-W	(7) 2 to 2+	(1) 0.80	Moderately mature, poor hydrocarbon source character.
MISSISSIPPIAN									
Lake Valley	3650-3930	Limestone, white to gray.	(3) 0.05	n.a.	n.a.	(1) W-I;H*;Am	(1) 3 to 3+	n.a.	Very mature, poor hydrocarbon source character.
DEVONIAN									
Percha	3930-4300	Limestone, light brownish gray; shale, dark gray.	(3) 0.22	(1) 0.19	(1) 0.35	(3) Am;-;H-W-I	(3) 2+ to 3-	(1) 0.62	Mature, poor to possibly fair oil and associated gas source character.
SILURIAN									
Fusselman	4300-4580	Dolomite, brownish gray.	(3) 0.10	(1) 0.05	(1) 0.08	(3) Am;-;H	(3) 2+	n.a.	Mature, poor hydrocarbon source character.

SUMMARY TABLE 1

SINCLAIR NO. 1 DONA ANA FED 18

Age Formation	Depth Interval (Feet)	Lithology	Organic Richness: Organic Carbon (% rock)	Organic Richness: Free Hydrocarbons Mg HC/g S1	Organic Richness: Hydrocarbon Generating Potential Mg HC/g S2	Predominant Kerogen Type Visual Assessment	Thermal Maturity: Kerogen Alteration (1-5 Scale)	Thermal Maturity: Vitrinite Reflectance	Hydrocarbon Source Potential
			MEAN	MEAN	MEAN	MEAN	MEAN	MEAN	
ORDOVICIAN									
Montoya	4580 4970	Dolomite, brownish gray.	(4) 0.08	(1) 0.01	(1) 0.03	(4) Am(Al);-;-	(4) 2+ to 3-	n.a.	Mature, poor hydrocarbon source character.
El Paso	4970- 6330	Limestone, brownish gray.	(11) 0.09	(3) 0.02	(3) 0.04	(11) Am(Al);-;-	(11) 2+ to 3-	n.a.	Mature, poor hydrocarbon source character.
ORDOVICIAN/ CAMBRIAN									
Bliss	6330- 6519 TD	Limestone, brownish gray.	(1) 0.04	n.a.	n.a.	(1) Am;-;-	(1) 2+ to 3-	n.a.	Mature, poor hydrocarbon source character.

Table I

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Well Interval (Feet)	Brief Lithological Description	Total Organic Carbon (% of Rock)
2391-001	2860-2880	100% Limestone, medium gray.	0.05
2391-002	2940-2950	100% Siltstone, brownish gray.	0.04
2391-003	3040-3050	100% Siltstone, brownish gray.	0.10
2391-004	3130-3140	100% Limestone, light brownish gray.	0.03
2391-005	3240-3250	100% Limestone, light brownish gray.	0.04/0.04
2391-006	3320-3330	100% Limestone, light brownish gray.	0.07
2391-007	3420-3430	100% Limestone, light brownish gray to brownish gray.	0.09
2391-008	3590-3600	100% Limestone, light brownish gray to brownish gray.	0.09
2391-009	3690-3700	100% Limestone, cherty, white.	0.03
2391-010	3790-3800	100% Limestone, cherty, white.	0.04
2391-011	3890-3900	100% Limestone, cherty, light brownish gray.	0.09
2391-012	3990-4000	100% Limestone, cherty, light brownish gray.	0.07
2391-013	4090-4100	100% Limestone, cherty, light brownish gray.	0.09/0.07
2391-014	4190-4200	60% Limestone, cherty, light brownish gray. 40% Shale, dark gray.	0.50
2391-015	4330-4340	70% Dolomite, brownish gray. 30% Shale, dark gray.	0.20
2391-016	4430-4440	100% Dolomite, brownish gray.	0.05
2391-017	4530-4540	100% Dolomite, brownish gray.	0.05
2391-018	4630-4640	100% Dolomite, brownish gray.	0.04
2391-019	4730-4740	100% Dolomite, brownish gray.	0.09
2391-020	4830-4840	100% Dolomite, light brownish gray.	0.06

Table I

SCREEN ANALYSIS SUMMARY

GeoChem Sample Number	Well Interval (Feet)		Brief Lithological Description	Total Organic Carbon (% of Rock)
2391-021	4930-4940	70% 30%	Dolomite, brownish gray. Chert, white.	0.12/0.12
2391-022	5030-5040	100%	Limestone grading to dolomite, brownish gray.	0.08
2391-023	5130-5140	100%	Limestone, brownish gray.	0.09
2391-024	5230-5240	100%	Limestone, brownish gray.	0.07
2391-025	5330-5340	100%	Limestone, brownish gray.	0.08
2391-026	5400-5410	100%	Limestone, brownish gray.	0.19
2391-027	5500-5510	100%	Limestone, light brownish gray to brownish gray.	0.17
2391-028	5600-5610	100%	Limestone, light brownish gray to brownish gray.	0.10
2391-029	5700-5710	100%	Limestone, light brownish gray to brownish gray.	0.07/0.07
2391-030	5850-5860	100%	Limestone, light brownish gray to brownish gray.	0.04
2391-031	5930-5940	100%	Limestone, light brownish gray to brownish gray.	0.08
2391-032	6020-6040	100%	Limestone, light brownish gray to brownish gray.	0.04
2391-033	6040-6330	100%	Tertiary intrusion, no sample picked.	
2391-034	6330-6340	100%	Limestone, light brownish gray to brownish gray.	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 ($S_1 + S_2$)

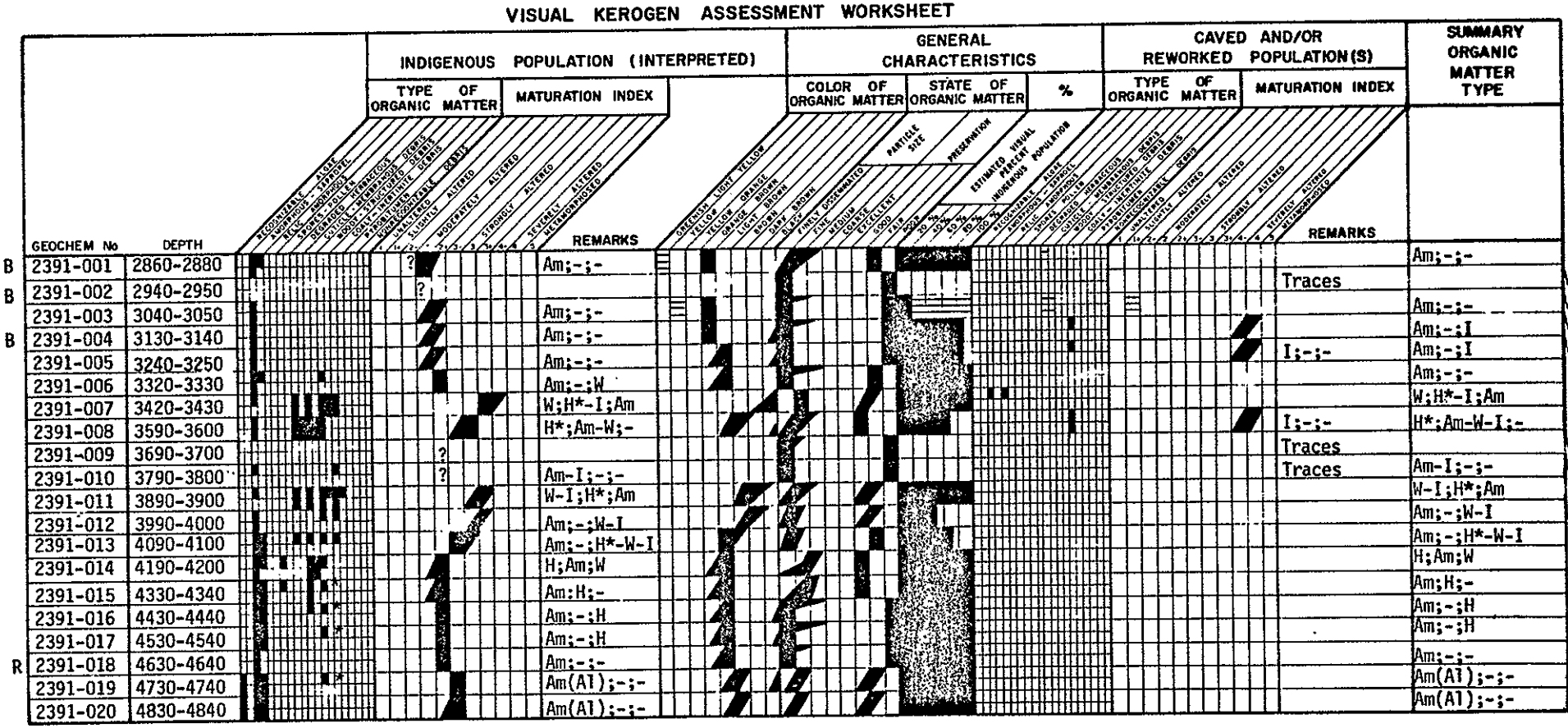
Hydrogen Index = mg HC/g organic carbon
Oxygen Index = mg CO2/g organic carbon
PI = S1/S1+S2
Tmax = Temperature Index, degrees C.

TABLE II

RESULTS OF ROCK-EVAL PYROLYSIS

GeoChem Sample No.	Depth Interval (Ft.)	Tmax (C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	PC*	T.O.C. (wt. %)	Hydrogen Index	Oxygen Index
2391-003	3040-3050	407	0.02	0.06	0.17	0.25	0.00	0.10	60	170
2391-014	4190-4200	434	0.19	0.35	0.45	0.35	0.04	0.50	70	90
2391-015	4330-4340	391	0.05	0.08	0.35	0.42	0.01	0.20	40	175
2391-021	4930-4940	374	0.01	0.03	0.20	0.25	0.00	0.12	25	166
2391-026	5400-5410	345	0.02	0.06	0.17	0.25	0.00	0.19	31	89
2391-027	5500-5510	358	0.02	0.05	0.21	0.33	0.00	0.17	29	123
2391-028	5600-5610	267	0.00	0.01	0.22	0.00	0.00	0.10	10	220

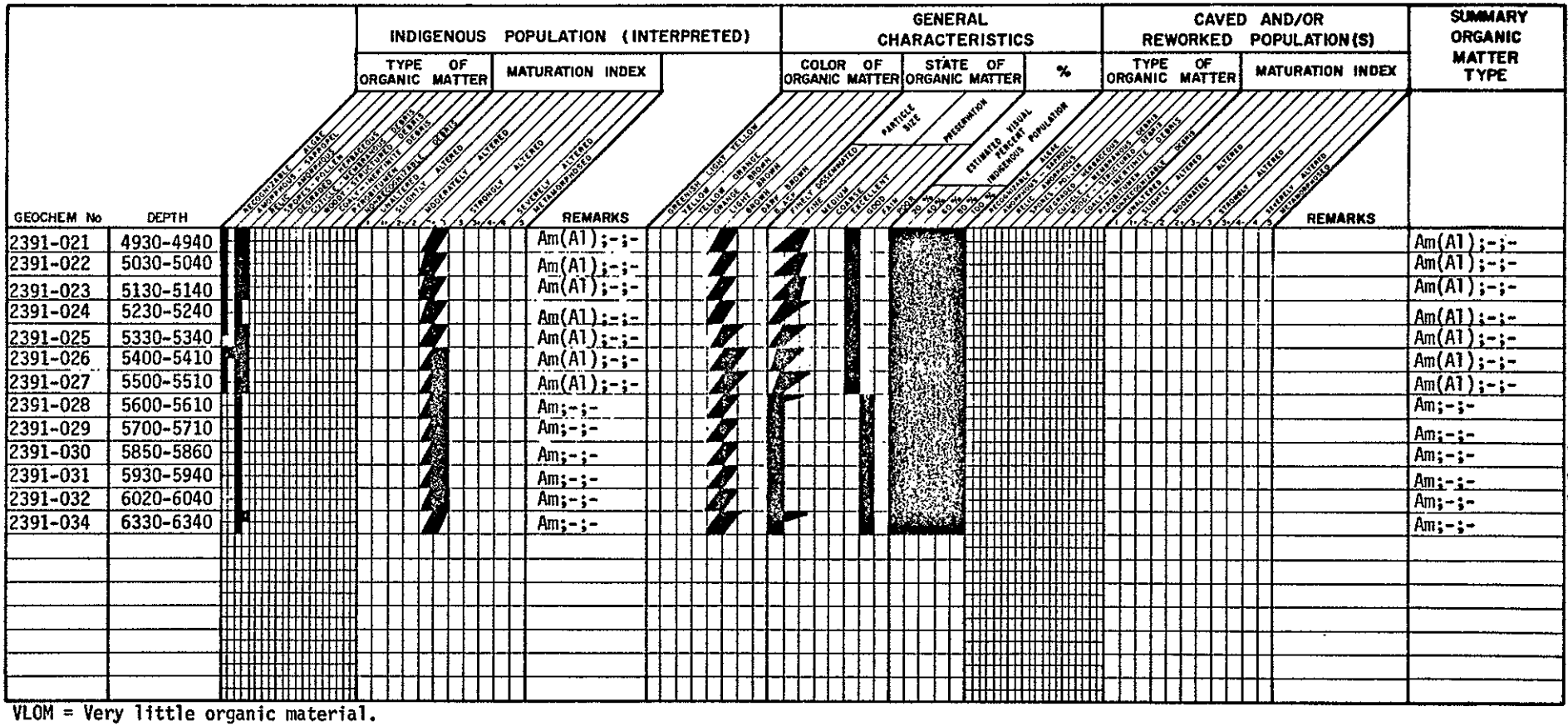
TABLE III
VISUAL KEROGEN ASSESSMENT WORKSHEET



	GEOCHEM No	DEPTH	REMARKS	REMARKS	SUMMARY ORGANIC MATTER TYPE
B	2391-001	2860-2880	Am;-;-		Am;-;-
B	2391-002	2940-2950		Traces	VLOM
	2391-003	3040-3050	Am;-;-		Am;-;- VLOM
B	2391-004	3130-3140	Am;-;-		Am;-;I VLOM
	2391-005	3240-3250	Am;-;-	I;-;-	Am;-;I VLOM
	2391-006	3320-3330	Am;-;W		Am;-;-
	2391-007	3420-3430	W;H*-I;Am		W;H*-I;Am
	2391-008	3590-3600	H*;Am-W;-	I;-;-	H*;Am-W-I;-
	2391-009	3690-3700		Traces	VLOM
	2391-010	3790-3800	Am-I;-;-	Traces	Am-I;-;- VLOM
	2391-011	3890-3900	W-I;H*;Am		W-I;H*;Am
	2391-012	3990-4000	Am;-;W-I		Am;-;W-I VLOM
	2391-013	4090-4100	Am;-;H*-W-I		Am;-;H*-W-I
	2391-014	4190-4200	H;Am;W		H;Am;W
	2391-015	4330-4340	Am:H;-		Am;H;-
	2391-016	4430-4440	Am;-;H		Am;-;H VLOM
	2391-017	4530-4540	Am;-;H		Am;-;H VLOM
R	2391-018	4630-4640	Am;-;-		Am;-;- VLOM
	2391-019	4730-4740	Am(Al);-;-		Am(Al);-;-
	2391-020	4830-4840	Am(Al);-;-		Am(Al);-;-

B = Bacteria.
VLOM = Very little organic material.
R = Resin-like droplets.
*In samples 015 and deeper on the material listed under woody is probably chitinozoan debris.
Drilling mud contaminant.

TABLE III
VISUAL KEROGEN ASSESSMENT WORKSHEET



	GEOCHEM No	DEPTH	REMARKS	SUMMARY ORGANIC MATTER TYPE
	2391-021	4930-4940	Am(Al);-;-	Am(Al);-;-
	2391-022	5030-5040	Am(Al);-;-	Am(Al);-;-
	2391-023	5130-5140	Am(Al);-;-	Am(Al);-;-
	2391-024	5230-5240	Am(Al);-;-	Am(Al);-;-
	2391-025	5330-5340	Am(Al);-;-	Am(Al);-;-
	2391-026	5400-5410	Am(Al);-;-	Am(Al);-;-
	2391-027	5500-5510	Am(Al);-;-	Am(Al);-;-
	2391-028	5600-5610	Am;-;-	Am;-;-
	2391-029	5700-5710	Am;-;-	Am;-;-
B	2391-030	5850-5860	Am;-;-	Am;-;- VLOM
B	2391-031	5930-5940	Am;-;-	Am;-;- VLOM
B	2391-032	6020-6040	Am;-;-	Am;-;- VLOM
B	2391-034	6330-6340	Am;-;-	Am;-;-

VLOM = Very little organic material.
B = Bacteria.

TABLE IV

VITRINITE REFLECTANCE SUMMARY

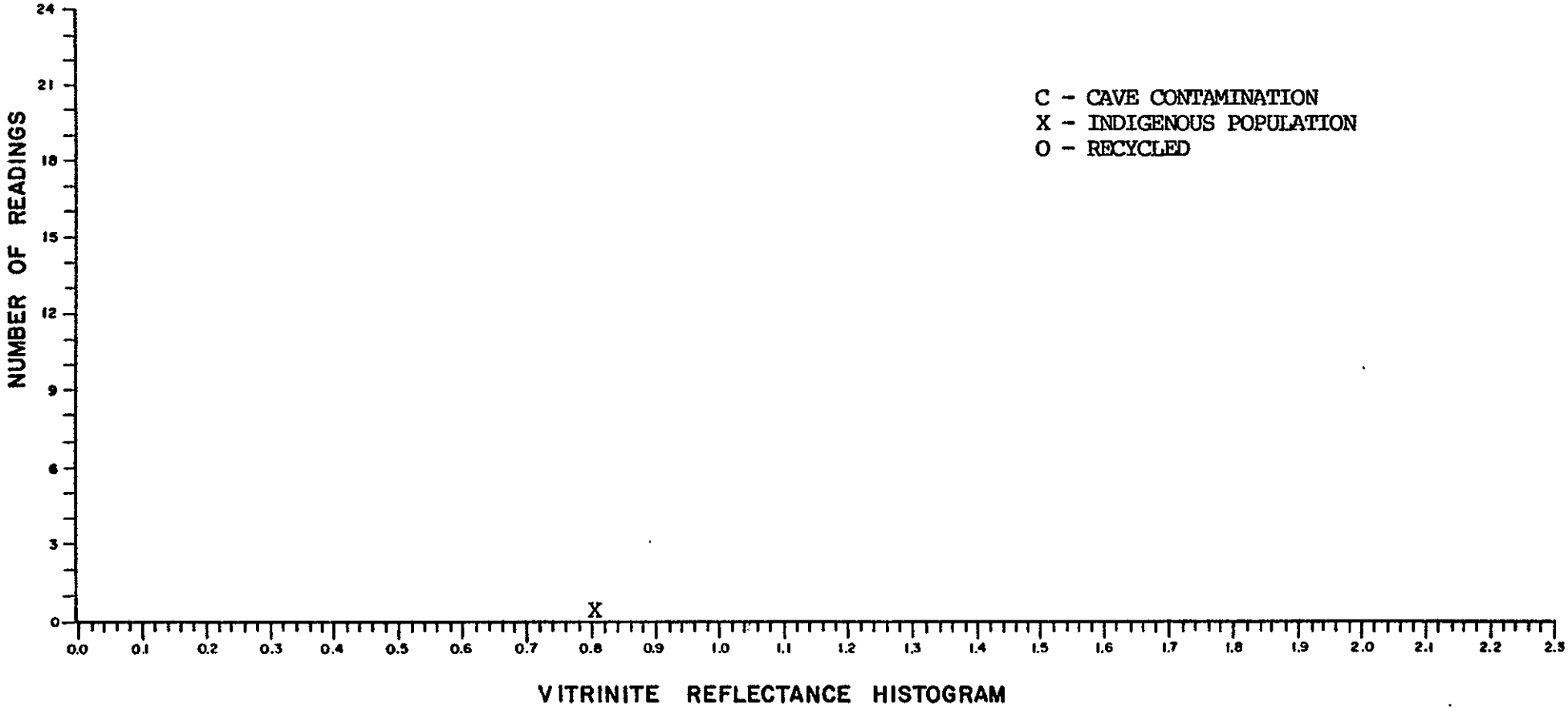
GEOCHEM SAMPLE NUMBER	DEPTH (feet)	TYPE OF SAMPLE	POPULATION	NUMBER OF READINGS	MINIMUM REFLECTANCE (% Ro)	MAXIMUM REFLECTANCE (% Ro)	MEAN REFLECTANCE (% Ro)	STD. DEV. (% Ro)	REMARKS
2391-003	3050	CTG	(1)	1	0.80	0.80	0.80	-	INDIGENOUS
2391-014	4200	CTG	(1)	1	0.62	0.62	0.62	-	INDIGENOUS
			(2)	2	1.20	1.48	1.34	-	REWORKED

GEOCHEM NO. 2391-003 TYPE OF SAMPLE: CTG DEPTH / SAMPLE NO. 3050

CLIENT'S NAME MARSHALL YOUNG WELL NAME SINCLAIR #1 DONA ANA FED 18

(NO. OF READINGS = 1) 0.80

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	1	0.80	0.80	0.80	-	



GEOCHEM NO. 2391-014 TYPE OF SAMPLE: CTG DEPTH / SAMPLE NO. 4200

CLIENT'S NAME MARSHALL YOUNG WELL NAME SINCLAIR #1 DONA ANA FED 18

(NO. OF READINGS = 3) 0.62 1.20 1.48

POPULATION	NO. OF READINGS	MIN. Ro (%)	MAX. Ro (%)	MEAN Ro (%)	STD. DEV. (%)	REMARKS
(1)	1	0.62	0.62	0.62	-	
(2)	2	1.20	1.48	1.34	-