New Mexico Bureau Mines and Mineral Resources
Open File Report No. 273

HYDROCARBON SOURCE-ROCK ANALYSES, AMOCO PRODUCTION COMPANY NO. 1 BAKER WELL, QUAY COUNTY, NEW MEXICO

By GeoChem Laboratories, Inc.
and Chevron U.S.A., Inc.

1987

GeoChem Laboratories, Inc.

Biostudy 1303

GEOCHEMICAL ANALYSES
SOURCE ROCK EVALUATION
CRUDE OIL-SOURCE ROCK CORRELATION
CRUDE OIL CHARACTERIZATION
GEOCHEMICAL PROSPECTING

GEOCHEM LABORATORIES, INC. 14697-H EAST EASTER AVENUE ENGLEWOOD, COLORADO 80112 PHONE (303) 693-0220

Rec'd 5 March 1984

20 January 1984

Mr. Steve Jacobson
CHEVRON, USA, INC.
700 S. Colorado Blvd., Box 599
Denver, CO 80201

Dear Mr. Jacobson:

Please find enclosed the results of the geochemical screening analysis on the four (4) samples as you requested.

Your reference numbers and well name for these samples are listed below with the corresponding GeoChem job and sample numbers.

GeoChem Job No. D1123-001	P4420-5	6400'-6500'	Amoco Production Baker #1
-002	-6	7100'-7200'	29-9N-30E
-003	-7	7700'-7800'	Quay Co., NM
-004	-8	8050'-8100'	

If you should have any questions concerning this analysis, please do not hesitate to call us.

Sincerely,

Randy W. Perlis

Randy W. Perlis
Technical Manager

RWP:pkn
Enclosure

FILE INDEXING INFO.
DISPLAYS TB
SEDM. TYPE P
FOSSIL TYPE P
TYPE OF STUDY OK

Amoco Production Baker #1
29-9N-30E
Quay Co., NM

RESULTS OF TOTAL ORGANIC CARBON

GEOCHEM SAMPLE NUMBER	CLIENT IDENTIFICATION NUMBER	TOTAL ORGANIC CARBON (% of Rock)	
D1123-001	Depth 6400'-6500'	0.84	Abo
D1123-002	Depth 7100'-7200'	1.21	Canyon
D1123-003	Depth 7700'-7800'	1.67	Strawn
D1123-004	Depth 8050'-8100'	6.56/6.59	Strawn

Amoco Production Baker #1
29-9N-30E
Quay Co., NM

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

RESULTS OF ROCK-EVAL PYROLYSIS

GeoChem Sample No.	Client Identification Number	Tmax (C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	S2/S3	T.O.C. (wt. %)	Hydrogen Index	Oxyge Index
D1123-001	Depth 6400'-6500'	332	0.26	0.65	0.56	0.29	1.17	0.84	77.5	66.1
D1123-002	Depth 7100'-7200'	440	0.20	0.80	0.40	0.20	1.97	1.21	66.0	33.5
D1123-003	Depth 7700'-7800'	445	0.26	1.63	0.42	0.14	3.90	1.67	97.5	25.0
D1123-004	Detph 8050'-8100'	442	0.74	8.78	0.33	0.08	26.22	6.58	133.4	5.1

Terminated

GEOCOM ROCK EVAL II

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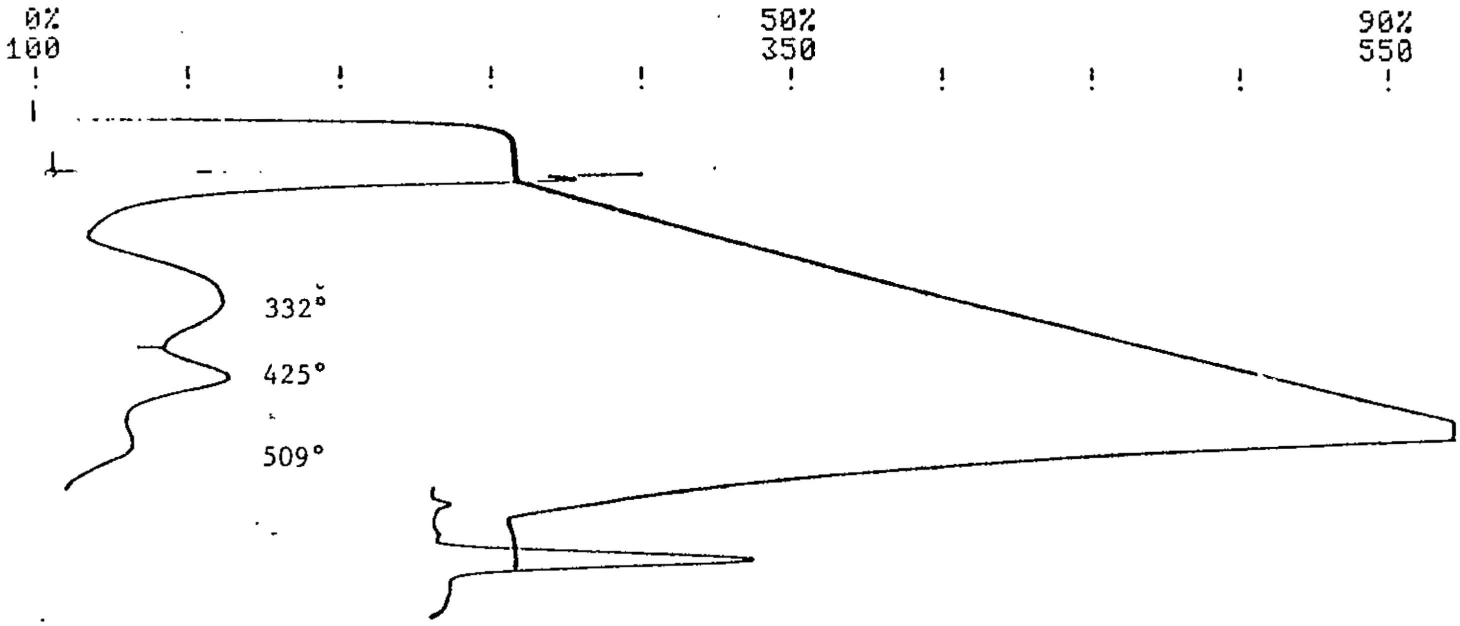
FID ATTENUATION= 4
TCD ATTENUATION= 32



TOC = 0.84
WT = 99.4
TMAX = 332 DEGREES C
S1= +2.632E-01 SUM= +1.902E+03
S2= +6.511E-01 SUM= +4.704E+03
S3= +5.555E-01 SUM= +7.391E+03
UNKNOWN

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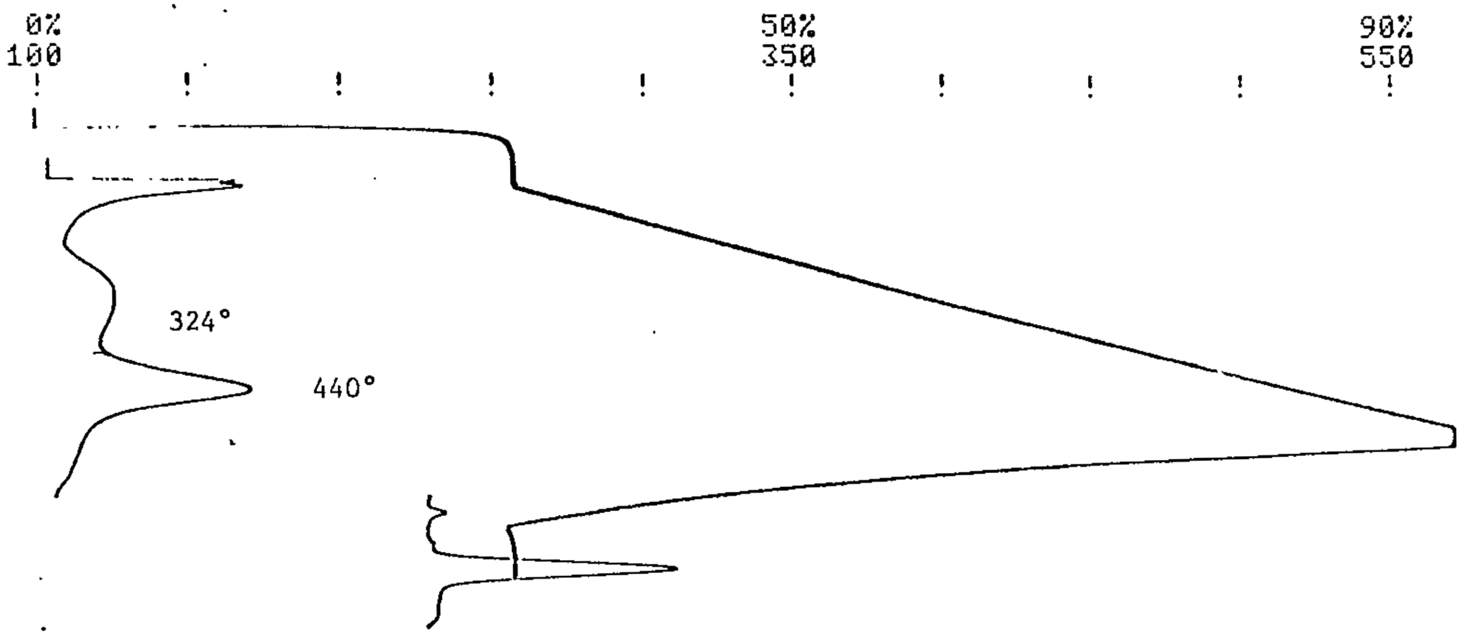

TOC = 1.21
WT = 99.4
TMAX = 440 DEGREES C
S1= +2.014E-01 SUM= +1.455E+03
S2= +7.991E-01 SUM= +5.773E+03
S3= +4.049E-01 SUM= +5.683E+03
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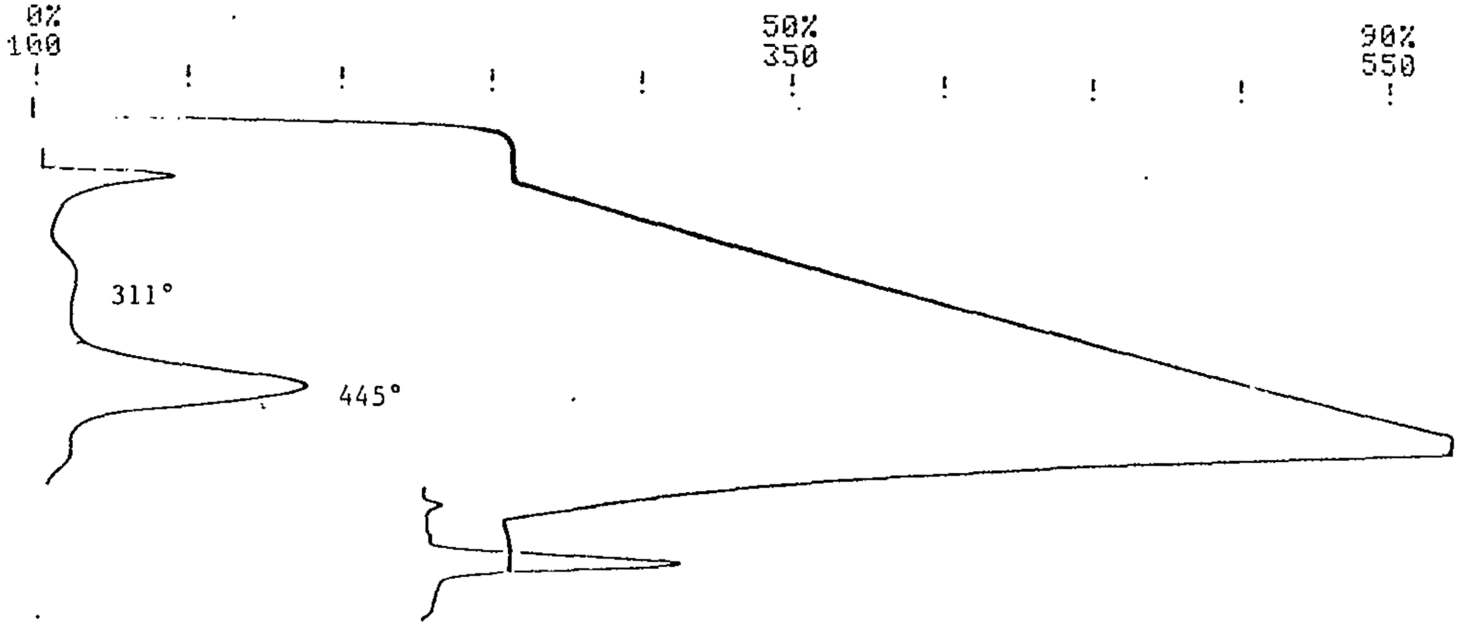

TOC = 1.67
WT = 99.6
TMAX = 445 DEGREES C
S1= +2.563E-01 SUM= +1.856E+03
S2= +1.628E+00 SUM= +1.179E+04
S3= +4.181E-01 SUM= +5.843E+03
UNKNOWN

GEOCOM ROCK EVAL II

JAN 18, 1984
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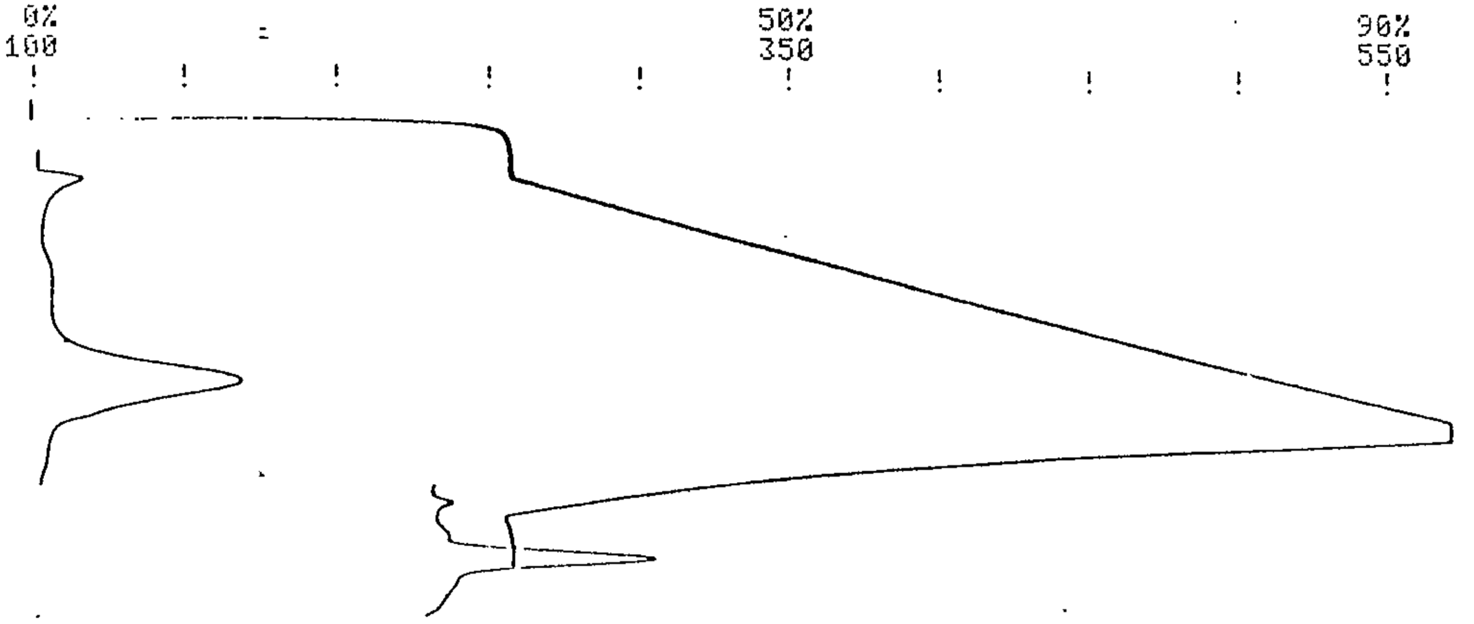
FID ATTENUATION= 128
TCD ATTENUATION= 32



TOC = 6.58
WT = 99.4
TMAX = 442 DEGREES C
S1= +7.393E-01 SUM= +5.341E+03
S2= +8.780E+00 SUM= +6.343E+04
S3= +3.349E-01 SUM= +4.889E+03
UNKNOWN

GEOCOM ROCK EVAL II

'AN 19, 1984
TIME= 0721

DEPTH	S1	S2	S3	TMAX	PI	S2/S3	TOC	HI	OI
001	00.26	000.65	00.56	332	0.29	01.17	00.84	077.5	066.1
002	00.20	000.80	00.40	440	0.20	01.97	01.21	066.0	033.5
003	00.26	001.63	00.42	445	0.14	03.90	01.67	097.5	025.0
004	00.74	008.78	00.33	442	0.08	26.22	06.58	133.4	005.1

LEGEND
- = NEGATIVE DATA
* = SIGNAL > A/D LIMIT
+ = DATA > COLUMN LIMIT
# = INVALID DATA/RESULTS

Chevron Laboratory
California

Tom Jonas

BIOSTRATIGRAPHIC STUDY #1303 (ADDENDUM)

LOCATION: Amoco Baker #1 (P4420)
Sec. 29, T9N, R30E
Quay County, New Mexico

PROBLEM: MOA, TAI and RoV analyses of four Pennsylvanian age well cuttings samples for J. T. Jonas.

RESULTS:

Sample No.	Depth	MOA Kerogen Type % I	II	III	IV	Organic Yield ml/10 grm	TAI	RoV	Submitted Age/J.T. Jonas
P4420-1	6300 - 400'	0	20	40	40	Trace	2.7	No plug.	Wolfcamp?-Penn.
2	6600 - 700'	0	15	45	40	Trace	2.7	No plug.	"
3	7500 - 600'	0	20	50	30	Trace	2.8-2.9	No plug.	"
4	7800 - 900'	0	20	40	40	Trace	2.7	No plug.	"

DISCUSSION:

MOA analysis of these samples by S. C. Teerman - COFRC (re memo to S. R. Jacobson, 3/25/85) and J. D. Saxton indicate the organic matter in these samples to be dominantly Type III vitrinitic "gas prone" kerogen. This determination is somewhat corroborated by pyrolysis results of four other samples within the same over-all well interval, in which HI values range from 66.0 to 133.4 indicating gas proneness (i.e., 0-150).

This degree of corroboration became necessary because of the presence of a great deal of amorphous Type III ~~amorphous~~ material which resembles Type II "oil prone" kerogen.

M W Thompson

M. W. THOMPSON/J. D. SAXTON

S. C. TEERMAN (COFRC)

MWT:mm

Tom - copy
... Ellman

MEMORANDUM

Box 446
La Habra, CA 90631
March 25, 1985

MOA ANALYSIS AMOCO BAKER #1, NM AND IDENTIFICATION OF AMORPHOUS VITRINITE

29-9N-30E Quay Co, N.M.
Addendum to Biostudy 1303
Wolfcamp ? Pennsyl.

MR. S. R. JACOBSON
Chevron-Central

Dear Steve:

Much of the amorphous fraction in the four Amoco Baker #1 samples (P-4420) consists of vitrinitic organic matter (OM). However, some oil-prone amorphous OM and degraded cutinite also occur in these samples (approximately 5-20%). This observation is based on microscopic analysis of sieved transmitted light slides only. Geochemical data are necessary to confirm the microscopic classification of amorphous organic matter.

P4420-1 6300-6400 3 7500-7600
2 6600-6700 4 7800-7900

Identification of Amorphous Vitrinite

The following are some general comments and microscopic properties that can be used to help identify amorphous vitrinite:

1: Descending gradation of identifiable vitrinitic particles to amorphous-like OM. Often, amorphous vitrinitic material will display a transition between amorphous and structured OM (Plates 1 and 2). Vitrinitic particles that display amorphous edges or "coatings" are often a good clue that the amorphous OM may be humic in origin. Remnants of vegetal or woody structure (incompletely altered humic remains) in amorphous-looking particles also suggest a humic origin of the OM (Plate 2).

2. Appearance in reflected light. Amorphous vitrinite with a maturity less than about 0.8% vitrinite reflectance will generally have higher "visual reflectivity" than oil-prone amorphous OM. However, with increasing maturity, the hydrogen content of oil-prone amorphous OM decreases; therefore, their reflectivity or "gray level" increases and they develop a more consolidated texture resulting in an appearance similar to vitrinitic OM. Vitrinitic remnants in amorphous clumps or particles are easier to recognize in reflected light. As shown in Plates 1 and 2, using a transmitted light slide and alternating between transmitted and reflected light can be very useful to help recognize vitrinite remnants.

3. Color of amorphous OM in transmitted light. In general, humic amorphous OM will be a darker color (reddish brown or dark brown) compared to oil-prone OM. This color difference is especially evident at the edges of amorphous particles. However, this is a subjective and maturation dependent property. The color of amorphous OM is somewhat dependent upon the Eh potential of the depositional environment, (Masran and Pockock, 1981). With increasing maturity, the color differences between different types of amorphous kerogens become less distinctive.

4. Fluorescence of amorphous OM. Although the fluorescence of oil-prone kerogens is often extremely weak, it can sometimes be used to help distinguish oil-prone and vitrinitic (non-fluorescent) amorphous OM. Immature oil-prone amorphous kerogens have a positive fading effect (increase in fluorescent intensity with time of excitation), which can be used to help identify the oil-prone amorphous kerogen. However, fluorescence is subjective and also maturation dependent and can not be used alone to distinguish different types of amorphous kerogens.

5. Texture. Oil-prone amorphous kerogen will sometimes display a more crystalline or "grainy" texture in contrast to amorphous vitrinite.

6. Other characteristics useful in detecting amorphous vitrinite include: (a) evidence of fungal breakdown such as woody remains permeated with fungal hyphae, (b) partial degradation, pitting, or patterned thinning of exinitic material, and (c) diagnostic microfossils, which provide information on the depositional environment.

As stated above, most of these microscopic properties that can be used to identify amorphous vitrinite are subjective and often difficult to detect. No single microscopic property will provide a conclusive answer. The problem is compounded with mature and post-mature samples. However, by piecing together as much information as possible by using the above criteria a decision can often be made on the type of amorphous OM. This decision needs to be confirmed with geochemical analyses. I hope in the near future to write a more complete description (with photomicrographs) of the microscopic properties and identification of amorphous humic material.

S. C. Teerman

S. C. TEERMAN
COFRC

SCT:ez

Attach: Plates 1-2
cc w/attach:
L. C. Bonham
R. W. Jones

File-4+4

REFERENCES

Masran, T. C. and Pockock, S., 1981. The classification of plant-derived particulate organic matter in sedimentary rocks. In: Brooks, J. (ed.). Organic maturation studies and fossil fuel exploration, pp. 145-175. Academic Press, New York.

PLATE 1

Figure 1. Amorphous vitrinitic particles in transmitted light (arrows). Note gradation of identifiable vitrinitic particles to amorphous-like organic matter. 750X

Figure 2. Amorphous vitrinitic particle in reflected light. Using transmitted light. Note the more vitrinitic appearance of particles in reflected light. Same field of view as Figure 1. 750X

PLATE 2

Figure 1. Amorphous vitrinitic particle in transmitted light. Note reddish-brown color of particle (arrow), which is transition between vitrinite and amorphous. 750X

Figure 2. Amorphous vitrinitic particle in reflected light. Note vitrinite relic in particle (arrow). Same field of view as Figure 1. 750X

oco Production Baker #1
-9N-30E
ay Co., NM

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

RESULTS OF ROCK-EVAL PYROLYSIS

oChem mple No.	Client Identification Number	Tmax (C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI (S1/S1 + S2)	S2/S3	T.O.C. (wt. %)	Hydrogen Index	Oxygen Ind
123-001	Depth 6400'-6500'	332 ?	0.26	0.65 ? Tri-modal	0.56	0.29	1.17	0.84 < 1%	77.5 ?	66.1 ?
123-002	Depth 7100'-7200'	440 ?	0.20	0.80 ? bi-modal	0.40	0.20	1.97	1.21	66.0	33.5
123-003	Depth 7700'-7800'	445	0.26	1.63 ? bimodal	0.42	0.14	3.90	1.67	97.5	25.0
123-004	Detph 8050'-8100'	442	0.74	8.78	0.33	0.08	26.22 > 5 oil	6.58	133.4	5.1

(0.1-0.4)

TABLE 1

GEOCHEMICAL PARAMETERS DESCRIBING SOURCE ROCK GENERATIVE POTENTIAL AND LEVEL OF THERMAL MATURATION

Quantity	TOC (wt.%)	S2 (mg HC/g rock)
Poor	0-0.5	0-3
Fair	0.5-1	3-5
Good	1-2	5-10
Very Good	>2	>10

Quality	HI* (mg HC/g C_{org})	S2/S3
Gas	0-150	0-3
Gas and oil	150-300	3-5
Oil	>300	>5

Maturation	PI [S1/(S1+S2)]	T_{max} (°C)	R_o (%)
Oil "birthline"	~0.1	~435	~0.6
Oil "deadline"	~0.4	~460	~1.2

*Hydrogen Index, assuming a level of thermal maturation for the organic matter equivalent to R_o = 0.6%.

MATURATION RANGE CHART

JAN. 15, 1980

G. J. DEMAISON

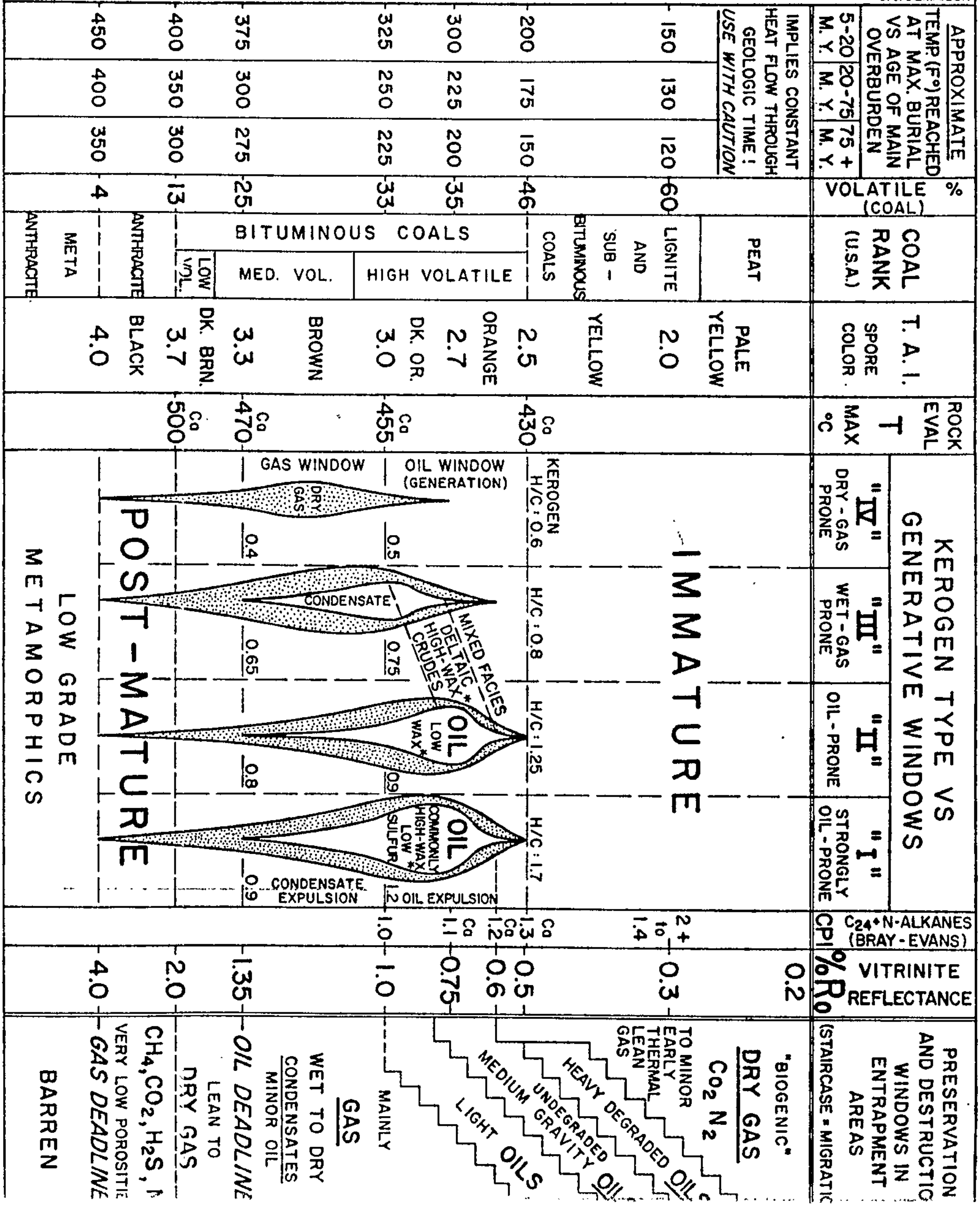


PLATE 1

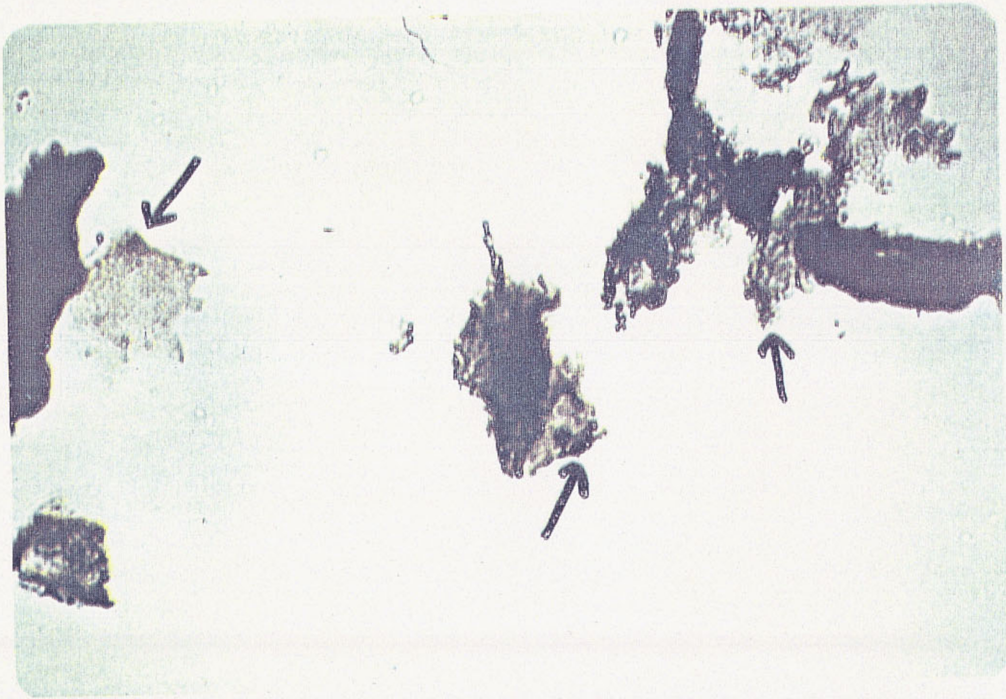


FIGURE 1

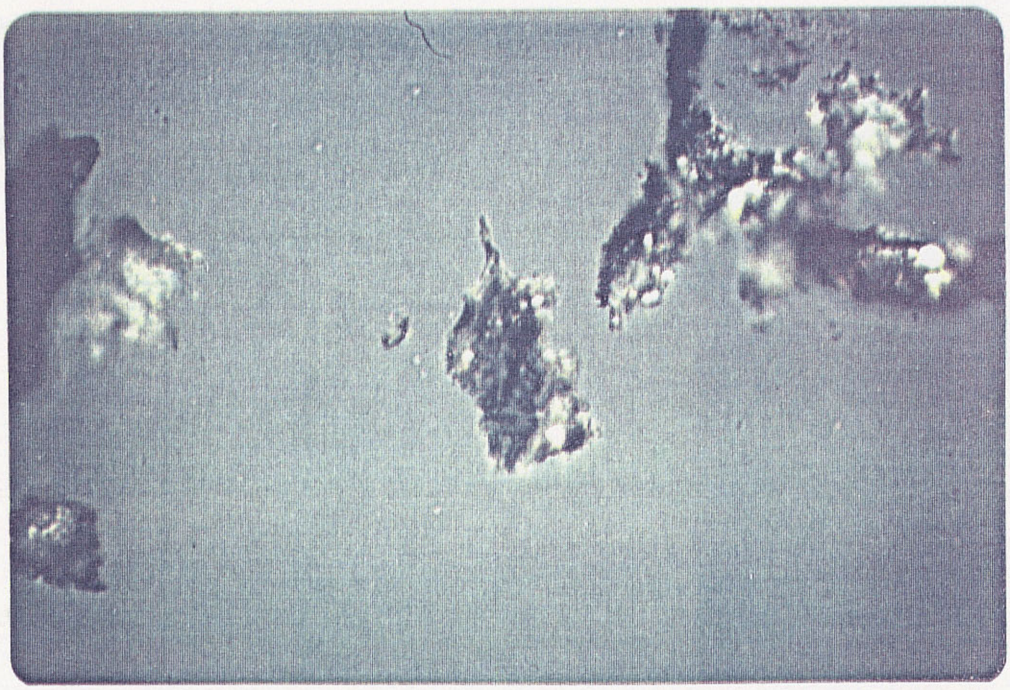


FIGURE 2

AMOCO BAKER #1
NEW MEXICO
P4420

OFR 273 #17

PLATE 2

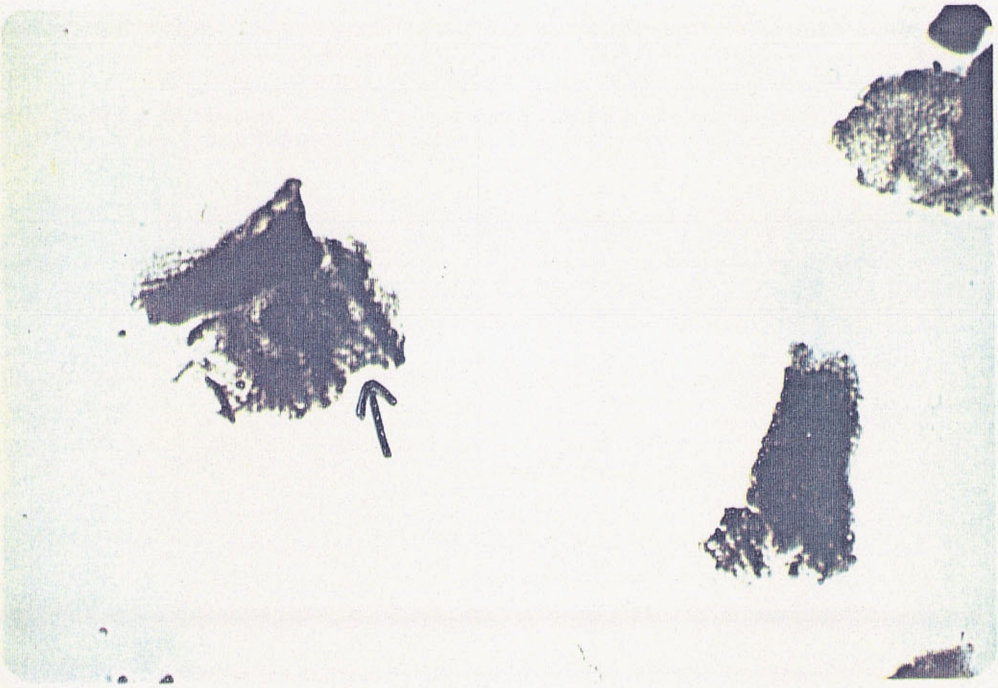


FIGURE 1

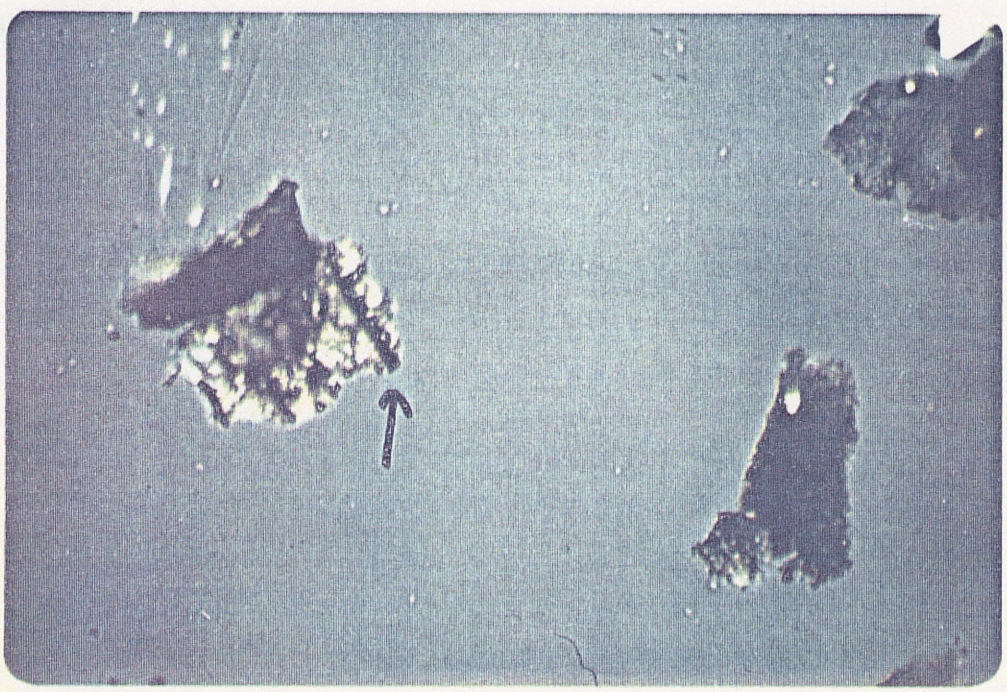


FIGURE 2

AMOCO BAKER #1
NEW MEXICO
P4420

OFR 273

#18