

New Mexico Bureau of Mines and Mineral Resources  
Open File Report No. OF 194

HYDROCARBON SOURCE-ROCK EVALUATION STUDY,  
SUNRAY MID-CONTINENT NO. 1 FEDERAL R WELL,  
LUNA COUNTY, NEW MEXICO

by L. Paul Tybor  
GeoChem Laboratories, Inc.  
Houston, Texas  
March 5, 1982



GEOCHEMICAL ANALYSES  
SOURCE ROCK EVALUATION

CRUDE OIL—SOURCE ROCK CORRELATION

CRUDE OIL CHARACTERIZATION  
GEOCHEMICAL PROSPECTING

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

March 5, 1982

Mr. Clayton S. Valder  
Lordsburg Exploration Group  
Marshall R. Young Oil Co.  
750 West Fifth St.  
Ft. Worth, Texas 76102

Dear Mr. Valder:

Enclosed please find the results of the organic geochemical analyses performed on well cuttings samples from the Sunray No. 1 <sup>New</sup> Mexico-Federal R. Well located in Sec. 27-28S-5W Luna County, New Mexico.

Upon arrival at GeoChem the samples were assigned the GeoChem Job Number 2243, and were submitted to the following analytical program:

| <u>Type of Analysis</u>                                                      | <u>Table</u> |
|------------------------------------------------------------------------------|--------------|
| Total organic carbon determination<br>& brief lithological description.....I |              |
| Pyrolysis analysis.....II                                                    |              |
| Visual kerogen assessment.....III                                            |              |
| Vitrinite reflectance.....IV                                                 |              |

The averaged mean geochemical data values, along with the hydrocarbon source rock characteristic interpretations for each stratigraphic unit analyzed from the well is presented in Summary Table 1.

## DISCUSSION OF THE RESULTS

### A. Thermal Maturity of Sediments

The thermal maturity of the sediments analyzed from this well ranges from a mature Maturation Index Stage 2+ to 3- at 2710± feet, within an undifferentiated section, to a severely altered Maturation Index Stage 3+ to 4- at 6520± feet, within the Cambrian Bliss dolomite. The rocks from 2710' to 2830' are at a mature maturation level, which is considered to be within the oil-generating window. From 4420' to 6300' the thermal maturity increases to a very mature maturation level at which maturity, only wet gas and condensate would be expected to have been generated. Below 6300' the thermal maturity of the sediments increase to severely altered maturation levels, wherein only thermally-derived methane gas could have been generated.

These maturity interpretations are based on the coloration of the kerogen isolated from the samples analyzed (Table III). Vitrinite reflectance analysis was performed on one sample (2243-001) from the Fusselman, however no vitrinite was observed.

### B. Hydrocarbon Source Characterization of Sediments

The rocks within the Fusselman, Montoya, El Paso and dolomites in the Bliss sandstone are organic-lean (Table I) with poor hydrocarbon generating characteristics.

The clastic section of the Simpson from 4355' to 4450' is also organic-lean and is rated as a poor hydrocarbon source unit. However, the carbonate section within the Simpson, from 4450' to 4870', contains fair to good carbonate organic richness (Table I). As a result, this carbonate interval is characterized as a very mature, fair to possible good wet gas-condensate hydrocarbon source unit. The results of the pyrolysis analyses performed on these carbonate rocks indicate that they are hydrocarbon-lean. This is probably due to the fact that these rocks are generating light hydrocarbons ( $C_2-C_7$ ), which are sometimes not recorded in this analysis.



March 5, 1982

Within the sands and silts at well interval 2700' to 2830', above the Fusselman, good  $S_1$  and  $S_2$  values were recorded in the pyrolysis analysis. Since sands and silts are nonhydrocarbon source rocks, we interpret this high concentration of hydrocarbon to represent either reservoir, out-of-place hydrocarbon, or else some form of contamination (oil-base mud, pipe dope). At this time we are unable to determine which of the above two are responsible for these high pyrolysis values, however by extraction, liquid chromatography and  $C_{15+}$  paraffin-naphthene gas chromatography we would be able to give an interpretation of the nature of this hydrocarbon.

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

Sincerely,

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Paul Tybor  
GEOCHEM LABORATORIES, INC.

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Enclosures



SUMMARY TABLE 1

| Age<br>Stratigraphic<br>Unit | Top<br>(Feet) | Lithology                                                                     | Organic Richness             |                        |                        | Predominant<br>Kerogen Type<br>Visual<br>Assessment | Thermal Maturity                     |                                    | HYDROCARBON SOURCE CHARACTER                                                                                                       |
|------------------------------|---------------|-------------------------------------------------------------------------------|------------------------------|------------------------|------------------------|-----------------------------------------------------|--------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
|                              |               |                                                                               | Percent<br>Organic<br>Carbon | ROCK-EVAL<br>PYROLYSIS |                        |                                                     | Kerogen<br>Alteration<br>(1-5 Scale) | Vitrinite<br>Reflectance<br>(% Ro) |                                                                                                                                    |
|                              |               |                                                                               |                              | S <sub>1</sub><br>Mean | S <sub>2</sub><br>Mean |                                                     |                                      |                                    |                                                                                                                                    |
| <u>SILURIAN</u>              |               |                                                                               |                              |                        |                        |                                                     |                                      |                                    |                                                                                                                                    |
| Fusselman                    | 2700-4015     | Dolomite, light to medium gray, sand, silt, and dolomite from 2700' to 2830'. | (16)<br>0.13                 | (2)<br>1.77            | (2)<br>2.85            | (2)<br>Am-I;-;-                                     | 2+ to 3                              | No<br>Vitrinite                    | Mature, poor hydrocarbon source. High pyrolysis values reflect either reservoir hydrocarbon in the clastics or else contamination. |
| <u>ORDOVICIAN</u>            |               |                                                                               |                              |                        |                        |                                                     |                                      |                                    |                                                                                                                                    |
| Montoya                      | 4015-4335     | Dolomite, light to medium gray.                                               | (5)<br>0.03                  | n.a.                   | n.a.                   | n.a.                                                | n.a.                                 | n.a.                               | Very mature, poor hydrocarbon source.                                                                                              |
| Simpson                      | 4335-4450     | Shale, sand, dolomite.                                                        | (1)<br>0.28                  | (1)<br>0.09            | (1)<br>0.18            | (1)<br>Am(A1);-;-                                   | (1)<br>3                             | n.a.                               | Very mature, poor hydrocarbon source.                                                                                              |
| Simpson Dark Lime            | 4450-4870     | Limestone, shale, dolomite.                                                   | (6)<br>0.19                  | (21)<br>0.08           | (2)<br>0.09            | (2)<br>Am(A1);-;-                                   | (2)<br>3                             | n.a.                               | Very mature, fair to possible good wet gas-condensate source.                                                                      |
| El Paso                      | 4870-6390     | Dolomite, medium dark gray.                                                   | (18)<br>0.04                 | n.a.                   | n.a.                   | (2)<br>Am(A1);-;-                                   | (2)<br>3                             | n.a.                               | Very mature, poor hydrocarbon source.                                                                                              |
| Bliss Dolomite               | 6490-6530     | Dolomite, silicious, medium dark gray.                                        | (1)<br>0.07                  | n.a.                   | n.a.                   | (1)<br>Am(A1)-I;-;-                                 | (1)<br>3+ to 4-                      | n.a.                               | Very mature, poor hydrocarbon source.                                                                                              |

Table I

SCREEN ANALYSIS SUMMARY

| GeoChem<br>Sample<br>Number | Well<br>Interval<br>(Feet) | Brief Lithological Description                                          | Total Organic<br>Carbon<br>(% of Rock) |
|-----------------------------|----------------------------|-------------------------------------------------------------------------|----------------------------------------|
| 2243-001                    | 2700-2710                  | Composite: sand, siltstone, and dolomitic.                              | 0.92                                   |
| 2243-002                    | 2760-2770                  | Siltstone, slightly dolomitic, grayish purple.                          | 0.32                                   |
| 2243-003                    | 2820-2830                  | Siltstone, slightly dolomitic, light blush gray.                        | 0.36                                   |
| 2243-004                    | 3000-3010                  | Anhydrite. No sample given.                                             | no sample                              |
| 2243-005                    | 3060-3070                  | Composite: dolomite and anhydrite.                                      | 0.05/0.05                              |
| 2243-006                    | 3120-3130                  | Composite: dolomite and limestone; trace of shale.                      | 0.10                                   |
| 2243-007                    | 3180-3190                  | Composite: limestone and dolomite.                                      | 0.03                                   |
| 2243-008                    | 3430-3440                  | Dolomite, light gray to medium gray.                                    | 0.03                                   |
| 2243-009                    | 3510-3520                  | Dolomite, very light gray to medium light gray.                         | 0.02                                   |
| 2243-010                    | 3570-3580                  | Dolomite, very light gray to medium gray.                               | 0.04                                   |
| 2243-011                    | 3630-3640                  | Dolomite, very light gray to medium gray; trace of chert and anhydrite. | 0.03                                   |
| 2243-012                    | 3690-3700                  | Dolomite, white to very light gray.                                     | 0.03/0.02                              |
| 2243-013                    | 3750-3760                  | Dolomite, white to very light gray.                                     | 0.02                                   |
| 2243-014                    | 3810-3820                  | Dolomite, white to very light gray.                                     | 0.02                                   |
| 2243-015                    | 3870-3880                  | Dolomite, white to very light gray.                                     | 0.02                                   |
| 2243-016                    | 3930-3940                  | Composite: dolomite and chert; trace of shale.                          | 0.03                                   |
| 2243-017                    | 3990-4000                  | Composite: dolomite and chert.                                          | 0.01                                   |
| 2243-018                    | 4050-4060                  | Composite: dolomite and chert; trace of anhydrite.                      | 0.02                                   |
| 2243-019                    | 4110-4120                  | Composite: dolomite and chert.                                          | 0.04                                   |
| 2243-020                    | 4200-4210                  | Composite: dolomite and chert.                                          | 0.02/0.02                              |
| 2243-021                    | 4260-4270                  | Composite: dolomite and chert.                                          | 0.03                                   |

Table I.

SCREEN ANALYSIS SUMMARY

| GeoChem<br>Sample<br>Number | Well<br>Interval<br>(Feet) | Brief Lithological Description                            | Total Organic<br>Carbon<br>(% of Rock) |
|-----------------------------|----------------------------|-----------------------------------------------------------|----------------------------------------|
| 2243-022                    | 4320-4330                  | Composite: dolomite and chert.                            | 0.02                                   |
| 2243-023                    | 4410-4420                  | Composite: shale, sand, and dolomite.                     | 0.28                                   |
| 2243-024                    | 4480-4490                  | Composite: shale, dolomite, and sand; trace of limestone. | 0.29                                   |
| 2243-025                    | 4540-4550                  | Composite: limestone, dolomite, and shale.                | 0.18                                   |
| 2243-026                    | 4610-4620                  | Composite: limestone, shale, and dolomite.                | 0.30                                   |
| 2243-027                    | 4680-4690                  | Composite: limestone, shale, and dolomite.                | 0.13                                   |
| 2243-028                    | 4750-4760                  | Composite: limestone, shale, and dolomite.                | 0.11                                   |
| 2243-029                    | 4820-4830                  | Composite: limestone, shale, dolomite and chert.          | 0.10/0.10                              |
| 2243-030                    | 4940-4950                  | Composite: limestone, shale, dolomite and chert.          | 0.11                                   |
| 2243-031                    | 5010-5020                  | Composite: dolomite, shale, and chert.                    | 0.09                                   |
| 2243-032                    | 5070-5080                  | Composite: dolomite, limestone, shale and chert.          | 0.06                                   |
| 2243-033                    | 5160-5170                  | Composite: dolomite, limestone, shale and chert.          | 0.07                                   |
| 2243-034                    | 5270-5280                  | Composite: dolomite, limestone, shale and chert.          | 0.05                                   |
| 2243-035                    | 5330-5340                  | Composite: dolomite, limestone, shale and chert.          | 0.05                                   |
| 2243-036                    | 5390-5400                  | Dolomite, brownish gray.                                  | 0.04/0.03                              |
| 2243-037                    | 5450-5460                  | Composite: dolomite and limestone.                        | 0.03                                   |
| 2243-038                    | 5510-5520                  | Composite: dolomite and limestone.                        | 0.03                                   |
| 2243-039                    | 5590-5600                  | Composite: dolomite and limestone.                        | 0.05                                   |
| 2243-040                    | 5650-5660                  | Composite: dolomite and limestone.                        | 0.01                                   |

Table I

SCREEN ANALYSIS SUMMARY

| GeoChem<br>Sample<br>Number | Well<br>Interval<br>(Feet) | Brief Lithological Description                      | Total Organic<br>Carbon<br>(% of Rock) |
|-----------------------------|----------------------------|-----------------------------------------------------|----------------------------------------|
| 2243-041                    | 5750-5760                  | Dolomite: medium dark gray; trace of chert.         | 0.03                                   |
| 2243-042                    | 5820-5830                  | Composite: dolomite and limestone.                  | 0.03                                   |
| 2243-043                    | 5900-5910                  | Composite: dolomite and limestone.                  | 0.01                                   |
| 2243-044                    | 5970-5980                  | Composite: dolomite and shale.                      | 0.04/0.04                              |
| 2243-045                    | 6030-6040                  | Composite: dolomite and shale.                      | 0.02                                   |
| 2243-046                    | 6130-6140                  | Composite: dolomite and chert.                      | 0.02                                   |
| 2243-047                    | 6290-6300                  | Composite: dolomite and igneous? Trace of<br>chert. | 0.07                                   |
| 2243-048                    | 6510-6520                  | Dolomite, silicified, medium dark gray.             | 0.07                                   |

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 = CO<sub>2</sub> produced from kerogen pyrolysis  
 (mg CO<sub>2</sub>/g of rock)  
 PC\* = 0.083 (S<sub>1</sub> + S<sub>2</sub>)

Hydrogen  
 Index = mg HC/g organic carbon  
 Oxygen  
 Index = mg CO<sub>2</sub>/g organic carbon  
 PI = S<sub>1</sub>/S<sub>1</sub>+S<sub>2</sub>  
 Tmax = Temperature Index, degrees C.

TABLE II  
 RESULTS OF ROCK-EVAL PYROLYSIS

| GeoChem<br>Sample No. | Depth<br>Interval<br>(ft.) | Tmax<br>(C) | S1<br>(mg/g) | S2<br>(mg/g) | S3<br>(mg/g) | PI   | PC*  | T.O.C.<br>(wt. %) | Hydrogen<br>Index | Oxygen<br>Index |
|-----------------------|----------------------------|-------------|--------------|--------------|--------------|------|------|-------------------|-------------------|-----------------|
| 2243-001              | 2700-2710                  | 407         | 3.18         | 3.85         | 0.79         | 0.45 | 0.58 | 0.92              | 418               | 85              |
| 2243-003              | 2820-2830                  | 354         | 0.35         | 1.85         | 0.57         | 0.16 | 0.18 | 0.36              | 513               | 158             |
| 2243-023              | 4410-4420                  | 362         | 0.09         | 0.18         | 0.76         | 0.35 | 0.02 | 0.28              | 64                | 271             |
| 2243-025              | 4540-4550                  | 332         | 0.06         | 0.09         | 0.39         | 0.43 | 0.01 | 0.18              | 50                | 216             |
| 2243-026              | 4610-4620                  | 255         | 0.09         | 0.09         | 0.51         | 0.50 | 0.01 | 0.30              | 30                | 170             |

**TABLE III**  
**VISUAL KEROGEN ASSESSMENT WORKSHEET**

| GEOCHEM No | DEPTH | INDIGENOUS POPULATION (INTERPRETED) |   |                  |   |         | GENERAL CHARACTERISTICS |   |                         |   |   | CAVED AND/OR REWORKED POPULATION(S) |    |                  |    |         | SUMMARY ORGANIC MATTER TYPE |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|            |       | TYPE OF ORGANIC MATTER              |   | MATURATION INDEX |   | REMARKS | COLOR OF ORGANIC MATTER |   | STATE OF ORGANIC MATTER |   | % | TYPE OF ORGANIC MATTER              |    | MATURATION INDEX |    | REMARKS |                             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|            |       | 1                                   | 2 | 3                | 4 |         | 5                       | 6 | 7                       | 8 |   | 9                                   | 10 | 11               | 12 |         |                             | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2243-001   | 2710  | Am-I,-;-                            |   |                  |   |         |                         |   |                         |   |   |                                     |    |                  |    |         |                             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

TABLE IV

## VITRINITE REFLECTANCE SUMMARY

| GEOCHEM<br>SAMPLE<br>NUMBER | DEPTH<br>(feet) | TYPE<br>OF<br>SAMPLE | POPULATION   | NUMBER<br>OF<br>READINGS | MINIMUM<br>REFLECTANCE<br>( % Ro) | MAXIMUM<br>REFLECTANCE<br>( % Ro) | MEAN<br>REFLECTANCE<br>( % Ro) | STD. DEV.<br>( % Ro) | REMARKS |
|-----------------------------|-----------------|----------------------|--------------|--------------------------|-----------------------------------|-----------------------------------|--------------------------------|----------------------|---------|
| 2243-001                    | 2710            | CTG                  | NO VITRINITE |                          |                                   |                                   |                                |                      |         |