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# **HYDROCARBON SOURCE FACIES CHARACTERIZATION**

**Pennsylvanian-Age Sediment Penetrated by the  
El Paso Natural Gas Company No. 50 San Juan Unit 29-5 Well,  
Rio Arriba County, New Mexico**

**GeoChem Job Number 4389**

**Prepared for**

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**by**

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**SUMMARY**

The stratigraphic section penetrated over the gross well interval, 11,300 ± feet to 14,423 feet TD, in the El Paso Natural Gas Company No. 50 San Juan Unit 29-5 Well, Rio Arriba County, New Mexico can be subdivided into two (2) slightly different hydrocarbon source intervals based primarily on lithology and the geothermal diagenetic (time-temperature) profiles determined for these sediments.

**The Post-Pennsylvanian and Upper Pennsylvanian sediments**, 11,300 ± feet to 12,550 ± feet, rate as having a mature poor to - at best - fair gas source character at this well location. These sediments contain dominantly terrestrially derived gas-prone woody structured, herbaceous and inertinite organic matter populations with little realizable oil source capability even if buried deeper elsewhere in the basin.

**Paradox and Mississippian** sediments at this well location, 12,550 ± feet to 13,960 ± feet, have experienced a more severe mature to very mature diagenetic (time-temperature) history and contain higher amounts of organic matter still however of a gas-prone woody structured, herbaceous and inertinitic plant detritus.

These sediments reflect a mature to very mature fair to good gas source character with only the richer subzone at 12,850 ± feet to 13,225 ± feet having a fair rating for oil and associated gas generation.

It is surprising that this lower Paradox limestone - evaporitic sequence does not contain any significant amount of more oil-prone amorphous sapropellic kerogen which is a normal organic matter characteristic for sediments of this type. Development of back lagoonal and restricted depositional environments within this dominantly limestone - evaporitic sequence would possibly result in algal - amorphous sapropellic rich sediments which, at a comparable maturity rank shown for this well would represent very favorable oil and associated gas source facies in this area.

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**INTRODUCTION**

This study reports on the results of a detailed geochemical Hydrocarbon Source Facies Characterization of Pennsylvanian-age sediments, penetrated between 11,300 ± feet and 14,423 feet TD, in the El Paso Natural Gas Company No. 50 San Juan Unit 29-5 Well, Rio Arriba County, New Mexico.

A total of six hundred twenty-four (624) dried cuttings samples, contained in paper envelopes, were received at GeoChem's Houston-based laboratories on June 19, 1997. This well was logged in under the GeoChem Job Number 4389 with each sample being further identified by a suffix -001 through -624 in order of increasing depth of burial. Sample identification against depth is presented for this well in Appendix I, hereto appended.

A copy of an Amstrat Sample Litholog and a Gamma-Neutron log were provided to GeoChem for sample selection purposes. The formation top information was marked on these logs and indicated the stratigraphic zonation as:

Top of Pennsylvanian	11,520 ± feet
Top of Paradox	12,550 ± feet
Top of Mississippian	13,810 ± feet
Top of PreCambrian	13,960 ± feet
Total Depth (TD)	14,423 ± feet

Three (3) core runs were made at 12,706 ± feet to 12,711 ± feet (recovery 6 feet), 12,736 ± feet to 12,753 ± feet (18 feet recovery) and 12,870 ± feet to 12,899 ± feet (30 feet recovery). Pieces of the core at one (1) foot intervals were also provided and logged in under the same GeoChem Job Number, 4389, with individual samples being identified by a suffix -001C through -054C in order of increasing depth.

Sample frequency over the interval 11,300  $\pm$  feet to 14,423 feet TD was at five (5) foot intervals.

### **Sample Selection**

The quality of the sample material available on this well was very good although each sample consisted of small-size cuttings of varied mixed lithologies. The quality of the litholog supplied was unfortunately poor probably due to the original having been colored prior to reproduction. However, based primarily on the written sample description it would seem that the sediments representative of the Pennsylvanian upper section, 11,500  $\pm$  feet to 12,550  $\pm$  feet, is a dominant clastic depositional sequence of interbedded sandstones, siltstone, and pale, red dark reddish brown, blackish red and medium dark gray to brownish black shales. There appeared to be almost no limestone of any significance in this interval. A similar depositional character extends into the top of the Paradox formation to a depth of 12,970  $\pm$  feet whereupon the remaining sediments in the deeper Paradox and in the underlying Mississippian consist of a more dominant limestone facies interbedded with sands, siltstones and light gray to medium dark gray limestones and red, grayish red, olive gray and medium dark gray to dark gray shales.

This lithologic interbedding was also characteristic of the sample cuttings with almost every sample examined having mixed lithologies. In keeping with the objectives of this well study, it was decided to select representative 'composite' samples over 45-50 foot intervals and to analyzed such without detailed picking which it was felt may bias the assessment data. In all a total of sixty-three (63) samples were chosen using the sample litholog information and a detailed examination of the sample cuttings. Each sample taken was sieved to remove fines and possible cave, iron removed and the cuttings placed in a suitably labelled vial. Seven (7) core samples were also included in this sample suite.

In total, the sample suite consisted of five (5) Post-Pennsylvanian samples (11,300  $\pm$  feet to 11,510  $\pm$  feet), twenty-one (21) Upper Pennsylvanian samples (11,550  $\pm$  feet to 12,540  $\pm$  feet), thirty-one (31) Paradox samples (12,565  $\pm$  feet to 13,805  $\pm$  feet), three (3) Mississippian (13,825  $\pm$  feet to 13,930  $\pm$  feet) samples and three (3) PreCambrian samples (14,000  $\pm$  feet to 14,405  $\pm$  feet).



A brief lithologic description of these samples is provided in Table I.

In addition, it was decided to select eight (8) samples from the sixty-three (63) total as control samples and to pick and analyze the dominant lithologies in these samples. A lithological description made on these samples is presented in Table III. Thirteen (13) of the sixty-three (63) sample suite were also selected for visual kerogen processing and assessment.

### **Analytical Program**

The analytical program planned for this well study involved measurement of total organic carbon content (TOC) and Rock-Eval (R-E) pyrolysis analysis on all sixty-three (63) representative 'composite' samples as well as the same analyses carried out on the sixteen (16) picked lithology control samples. The data for the total organic carbon (TOC) and Rock-Eval (R-E) pyrolysis analyses is reported in Tables I, II-A, II-B, III, III-A and III-B. The Rock-Eval data is reported in both milligrams/gram (mgm/gm) and in parts per million (ppm wt/wt) for convenient reference. Rock-eval pyrograms are appended in Appendices II and III.

The thirteen (13) samples chosen for visual kerogen work were processed to isolate the contained palynological kerogen. A coarse size portion (approximately 1 gram) of each sample was treated with cold and hot hydrochloric acid, washed to remove calcium and magnesium ions, floated with zinc bromide at sp gr 2.0, washed to remove zinc bromide and a strew slide prepared of the isolated kerogen. The strew slide was examined in transmitted light at high magnification (10X, 40X) and appraised for organic matter type (OMT) and thermal alteration index (TAI) based on the coloration of the spore-pollen and herbaceous cuticle plant material. The summary of the visual kerogen assessment data is shown in Table IV-A with the assessment worksheet reproduced in Table IV-B.

The yield of organic matter (kerogen) was insufficient to enable vitrinite reflectance plugs to be prepared for assessment. If desired, such work can be carried out on a larger sample aliquot should this be necessary.

## **RESULTS AND DISCUSSION**

The results of the various geochemical analyses carried out on the sixty-three (63) selected samples representative of the stratigraphic interval between 11,300 ± feet and 14,423 feet TD are presented in Tables I-Sample Lithological Description, Sample Identification and Total Organic Carbon (TOC); Table II-A and II-B, Results of Rock-Eval Pyrolysis in mgm/gm and ppm wt/wt values respectively; Table III-Sample Lithological Description, Sample Identification and Total Organic Carbon (TOC) for the Control Samples, Table III-A and III-B, Results of Rock-Eval Pyrolysis for the Control Samples in mgm/gm and ppm wt/wt values respectively; Table IV-A, Summary of Organic Carbon and Visual Kerogen Data, Table IV-B, Visual Kerogen Assessment Worksheet and Table IV-C, Oil and Gas Factors based on Organic Facies Type. A complete sample identification listing is presented in Appendix I with the Rock-Eval pyrogram traces being reproduced in Appendices II and III.

The various sets of data recorded in the designated tables, Tables I through IV-C, have also been presented graphically in a series of Figures which allows the reader to clearly see the data in well profile format. A number of these figures have been presented with different numerical units such that one can readily cross-reference analytical data with interpretational values used in the text. For instance, the Rock-Eval Pyrolysis Summary data has been presented in Figure 1 in milligrams/gram (mgm/gm) and also as parts per million (ppm wt/wt); the former being printed on the pyrograms (Appendices II and III) with the latter being calculated for more convenient discussion purposes.

### **A. Geological Zonation**

A delineation of the various stratigraphic units penetrated by this well between 11,300 ± feet and 14,423 feet TD, was presented in the preceding Introduction. Although the prime objective was to characterize the Pennsylvanian-age sediments (Upper Pennsylvanian and Paradox), a few samples from the Post-Pennsylvanian and the underlying Mississippian and PreCambrian were also included in order to examine data changes of note across the Pennsylvanian stratigraphic boundaries. Where space has allowed, the stratigraphic tops have been marked on the Tables and Figures by a dividing line; however no names have been inserted along with these stratigraphic top lines.

In addition to comments made in the sample selection text, the litholog provided and used in this study has been included herein as Appendix IV. It is suggested that better copies from the original logs be prepared and added to each of these reports since the reader will be better able to see the overall lithology of the section examined in this study if these logs are conveniently available.

## **B. Hydrocarbon Source Richness and Source Character**

The analytical data reported in this well study addresses the Hydrocarbon Source Richness and Source Character from seven (7) significant perspectives; organic richness as measured by total organic carbon content, hydrocarbon richness as measured by the  $S_1$  volatile pyrolysis yield, the remaining hydrocarbon generating potential as measured by the  $S_2$  generatable hydrocarbon pyrolysis yield, the degree of hydrocarbon production which has already occurred expressed as the productivity index ( $S_1/S_1 + S_2$ ), the quality of the contained organic matter as determined by the Hydrogen Index, Oxygen Index,  $S_2/S_3$  ratio values and visual kerogen assessment and quantification of the various organic matter populations (AI, Am, H, W and I) as well as the measure of the geothermal diagenetic (time-temperature) history for these sediments determined from the thermal alteration index values (TAI).

The Rock-Eval geochemical data are graphically presented in well profile format in Figure 1-Rock-Eval Pyrolysis summary (ppm wt/wt). Similar data for the picked lithologic control samples is presented in Figure 1-A in a comparable manner. Comparing the control sample data to the main unpicked sample data base, one can see that the picked lithology samples are moderately richer in total organic carbon content but afford significantly higher amounts of pyrolysis  $S_1$  volatile hydrocarbon and  $S_2$  generatable hydrocarbon. It is still felt, however, that the unpicked samples chosen for this well are representative of the fifty (50) foot interval and probably provides good unit average data for each stratigraphic unit evaluated.

Reviewing the data presented in Figure 1-Rock-Eval Pyrolysis Summary, the organic carbon contents for each stratigraphic unit were Post-Pennsylvanian (11,300 ± feet to 11,520 ± feet) (0.18%-0.38%, average 0.26%), Upper Pennsylvanian (11,520 ± feet to 12,550 ± feet) (0.18%-0.68%, average 0.24%), Paradox (12,550 ± feet to 13,810 ± feet) (0.20%-1.15%, average 0.44%), Mississippian (13,810 ± feet to

13,960 ± feet) (0.22%-0.39%, average 0.30%) and PreCambrian (13,960 ± feet to 14,423 feet TD) (0.13%-0.33%, average 0.24%).

These values are generally considered to be very poor to poor for clastic type sediments but would rate more favorably as fair to good organic carbon abundances where the samples of a carbonate lithologic type.

The Rock-Eval pyrolysis data is also rated in the very poor to poor category with values for the  $S_1$  volatile hydrocarbon content and the remaining  $S_2$  generatable hydrocarbon potential for each stratigraphic unit being; Post-Pennsylvanian (20 ppm - 50 ppm  $S_1$ , average 38 ppm; 0 ppm - 90 ppm  $S_2$ , average 28 ppm), Upper Pennsylvanian (10 ppm - 140 ppm  $S_1$ , average 43 ppm; 0 ppm - 380 ppm  $S_2$ , average 48 ppm), Paradox (10 ppm - 210 ppm  $S_1$ , average 39 ppm; 0 ppm - 170 ppm  $S_2$ , average 55 ppm), Mississippian (10 ppm - 140 ppm  $S_1$ , average 63 ppm; 0 ppm - 30 ppm  $S_2$ , average 16 ppm) and PreCambrian (20 ppm - 80 ppm  $S_1$ , average 40 ppm; 0 ppm - 20 ppm  $S_2$ , average 7 ppm).

With such low values it is apparent that the entire stratigraphic section penetrated at this well location has a very poor to poor hydrocarbon source character, would be considered as nonsource for oil liquids and only marginally poor to possibly fair for the generation of gas. The gas-prone nature of the organic facies penetrated by this well is reflected in the low Hydrogen Index values, the low  $S_2/S_3$  well profile, the high Productivity Indices and the Hydrogen Index versus Oxygen Index plots (Tables II-A, II-B; Figures 1 and 2-A, 2-B).

Unfortunately, no valid  $T_{max}$  °C data which would have reflected the thermal maturity rank attained by these sediments was generated in the pyrolysis analyses. The values actually printed out were all lower than 400°C and are interpreted as being erroneous due to instrumentation limitations. This is an analytical problem which occurs whenever samples analyzed on the Rock-Eval contain low amounts of total organic carbon (TOC) or generate low yields of  $S_2$  generatable hydrocarbon. The instrument arbitrarily assigns an erroneous  $S_2$  peak value for the  $T_{max}$  °C value.

The visual kerogen assessment data of thermal alteration index (TAI) and organic matter type (OMT) (Tables IV-A, IV-B; Figure 2) also confirm a gas-prone organic matter facies type with the sediments containing dominant amounts of terrestrially derived woody structured and inertinitic plant detritus along with herbaceous plant remains. This type of kerogen population is dominantly gas-prone with only a minor potential for

contributing wet gas, condensate or oil liquids. A minor trace amount of amorphous-sapropel was present in sample 4389-261 at  $12,600 \pm$  feet to  $12,605 \pm$  feet which, although of little interest as a contributing source, could be significant as indicating an organic facies change at the top of the Paradox Formation.

The thermal maturity profile noted for the sediments penetrated by this well indicate two (2) distinctly different geothermal histories. The geothermal diagenetic (time-temperature) history experienced by the Post-Pennsylvanian and the Upper Pennsylvanian section,  $11,300 \pm$  feet to  $12,550 \pm$  feet, is at a mature thermal ranking which progressively grades from a  $TAI = 2.8$  to a  $TAI = 2.9$  with increasing depth. This ranking would place these upper sediments in the light oil and associated gas generation window. The Paradox Formation and the Mississippian Formation sediments have experienced a more severe diagenetic history and are rated as mature to bordering on very mature ( $TAI = 3.5$ ). This maturity level would place the Paradox and Mississippian sediments at a gas to wet gas state of generation at this well location.

The hydrocarbon source richness data has also been presented on GeoChem plots of Total Organic Carbon content versus  $S_1$  and  $S_2$  pyrolysis yields in ppm wt/wt (Figure 3-Hydrocarbon Source Richness-Shales & Mudstones (Total Data Base)). The  $S_1$  volatile data and the  $S_2$  generatable hydrocarbon data have also been independently plotted in Figures 3-A and 3-B for convenient reference.

As one can see (Figures 3, 3-A, 3-B), most of the samples analyzed for this well rate as nonsources (46 samples), marginal dry gas sources (9 samples), poor oil and associated gas sources (4 samples) and the remainder (4 samples) fair oil and gas sources. In addition, the remaining  $S_2$  generatable hydrocarbon distribution (Figure 3-B) would also indicate an overall poor potential for these sediments being able to contribute anything further to the system other than additionally generated methane gas.

These above comments are made based on the sample data being interpreted for clastic type shale sediments. Should one apply carbonate source richness criteria (Figure 3, 3-A, 3-B - Carbonates), there is a marked difference which clearly illustrated a much more gas-prone source character for both the hydrocarbon already sourced and represented by the  $S_1$  volatile hydrocarbon data (Figure 3-A - Carbonates) as well as the remaining hydrocarbon source potential shown by the remaining  $S_2$  generatable hydrocarbon response (Figure 3-B - Carbonates).

For completeness and ease of reference, the same data have also been presented for each stratigraphic unit (Figures 3-D1 through 3-D5) along with the data for the control samples (Figures 3-E1 through 3-E3).

It is believed that these carbonate hydrocarbon source figures are probably more representative of the actual hydrocarbon source character of the stratigraphic sections penetrated from 11,300 ± feet to 14,423 feet TD at this well location.

The dominant gas-prone hydrocarbon source character of the sediments penetrated by this well at this location is also substantiated by the calculation of the oil factor (OF) and the gas factor (GF) based on the visual abundance of the various prime palynological organic matter types assessed on the isolated kerogen concentrates. These values are presented in Table IV-C and illustrated overall high gas-prone factors ranging from 60.6% to 75.8%, average 67.9%. Similarly computed oil factor (OF) were uniformly low ranging from 24.2% to 39.4%, average 32.1%.

## **Conclusion**

The stratigraphic sections penetrated over the gross well interval 11,300 ± feet to 14,423 feet TD, in the El Paso Natural Gas Company No. 50 San Juan Unit 29-5 Well, Rio Arriba County, New Mexico can be subdivided into two (2) slightly different hydrocarbon sources intervals based primarily on the geothermal diagenetic (time-temperature) profiles measured for these two (2) sections.

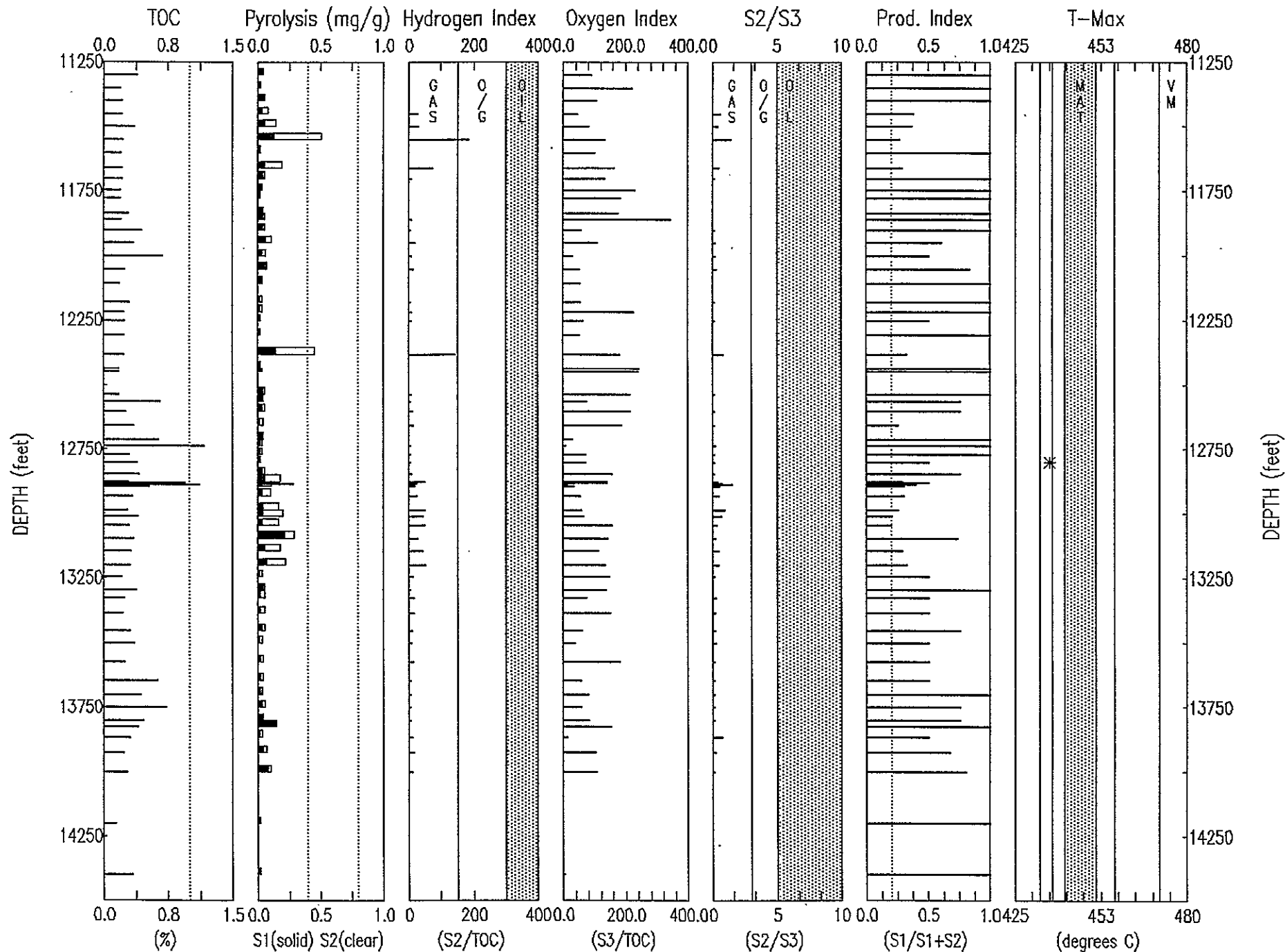
Post-Pennsylvanian and Upper Pennsylvanian sediments, 11,300 ± feet to 12,550 ± feet, have experienced a mature level of diagenetics grading with increasing depth from a thermal alteration rank of TAI = 2.8 to a slightly more mature TAI = 2.9 maturity level.

The Paradox and Mississippian sediments (12,550 ± feet to 13,960 ± feet) are ranked at a mature to very mature TAI = 3.5 maturity rank consistent with a gas and wet gas-condensate hydrocarbon generation character.

The organic facies character of both the Post-Pennsylvanian and Upper Pennsylvanian subgroup and the Paradox-Mississippian subgroup is typified by dominant amounts of gas-prone terrestrially derived woody structured, herbaceous and inertinitic

plant detritus and low overall organic carbon contents. As a consequence, the entire well section evaluated herein is characterized as a non to very poor source facies for any oil liquids generation and an equally poor to-at-best-fair source facies for the generation of gas and wet gas at this well location.

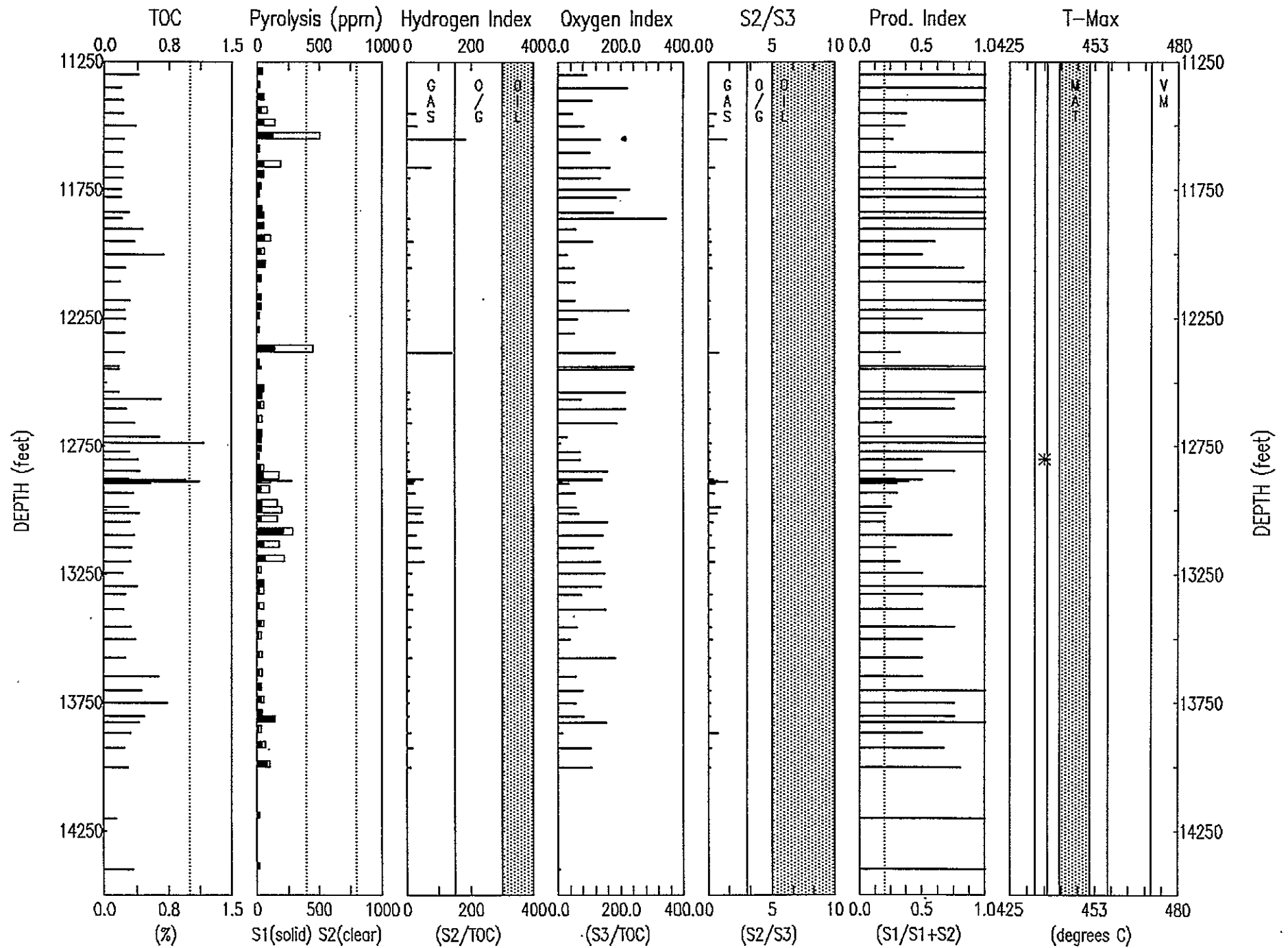
**FIGURE 1**  
**ROCK-EVAL PYROLYSIS SUMMARY (mgm/gram)**



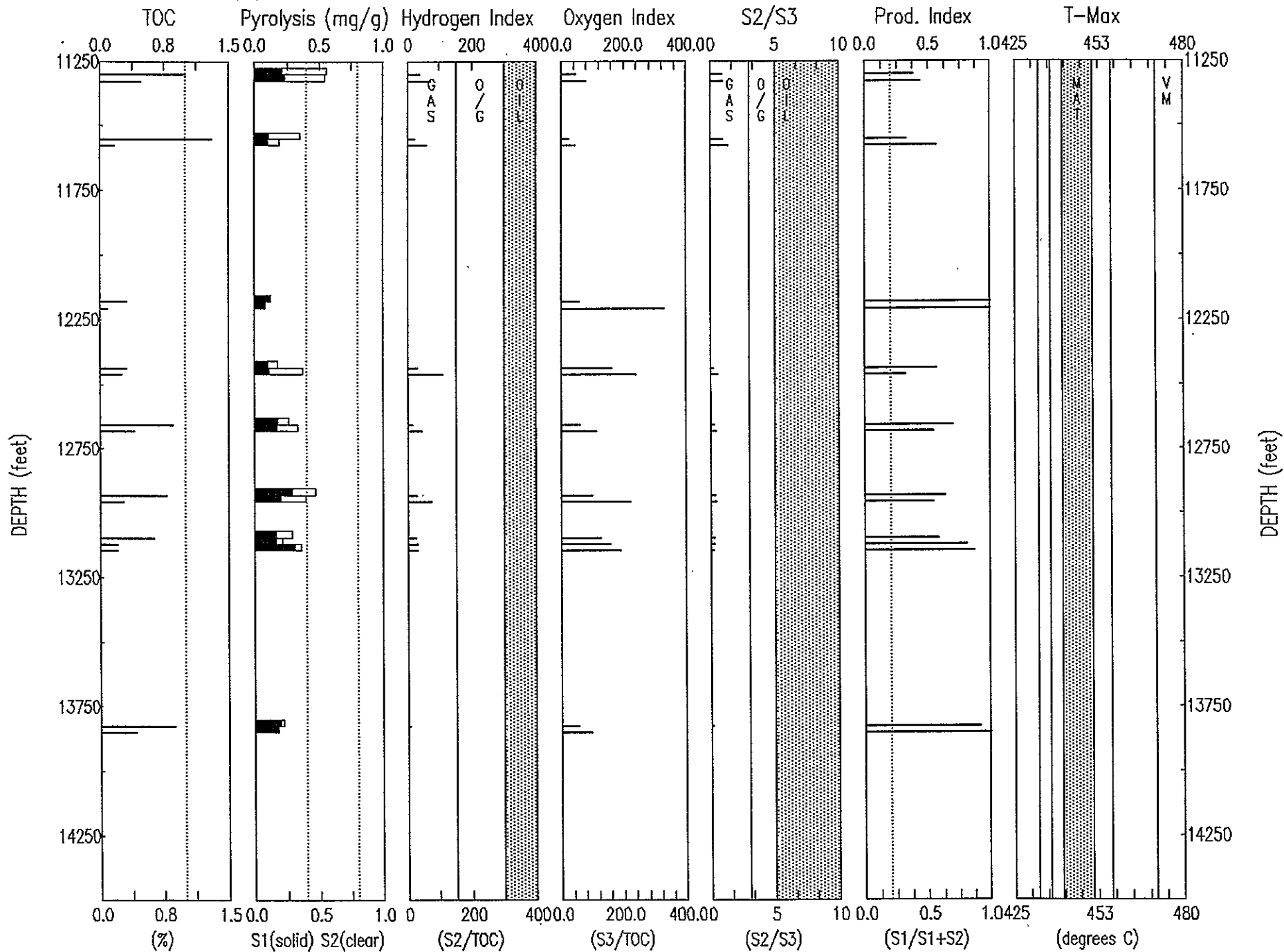


# FIGURE 1

## ROCK-EVAL PYROLYSIS SUMMARY (ppm wt/wt)

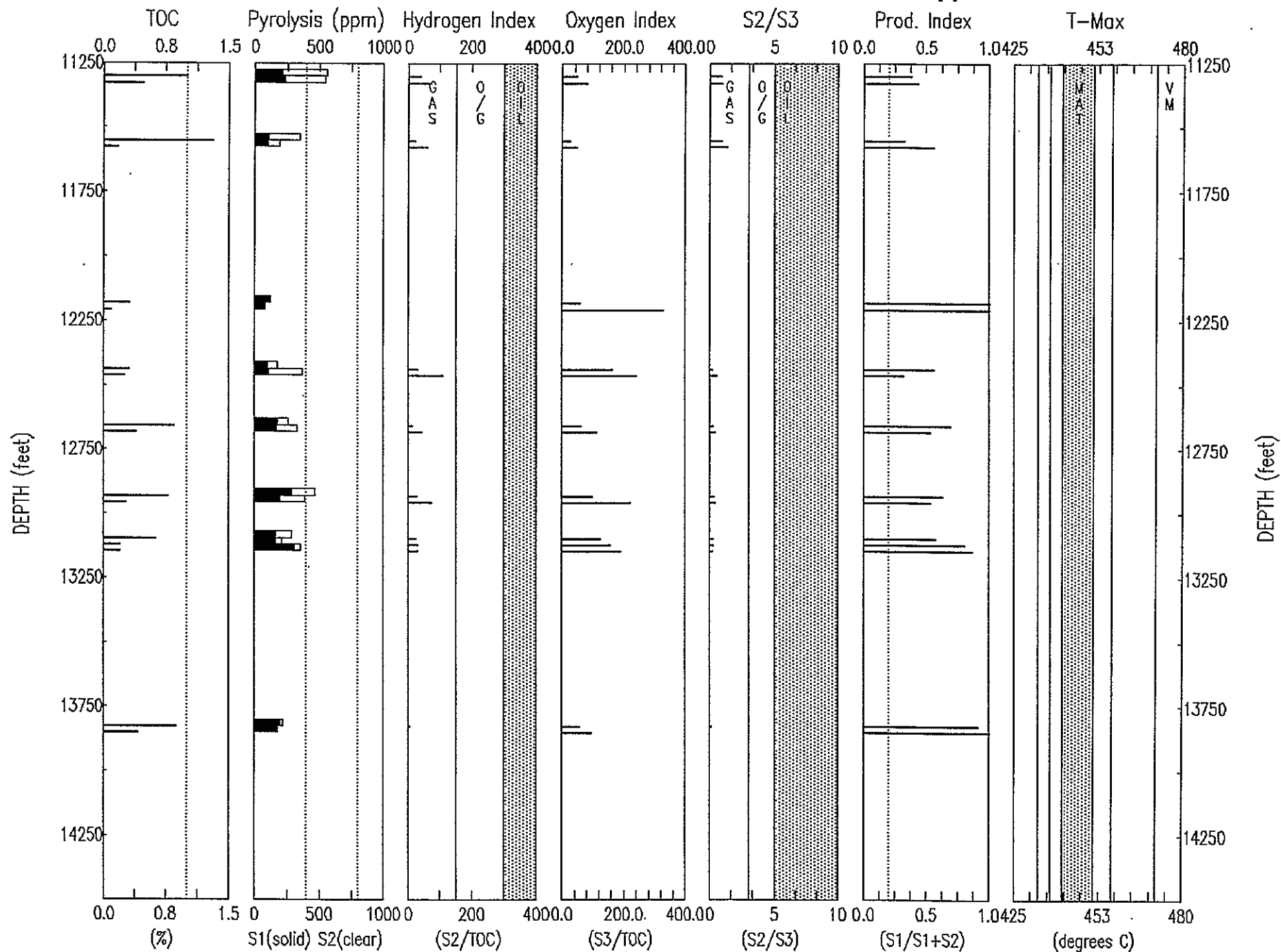


**FIGURE 1-A**  
**ROCK-EVAL PYROLYSIS SUMMARY - CONTROL SAMPLES (mgm/gram)**



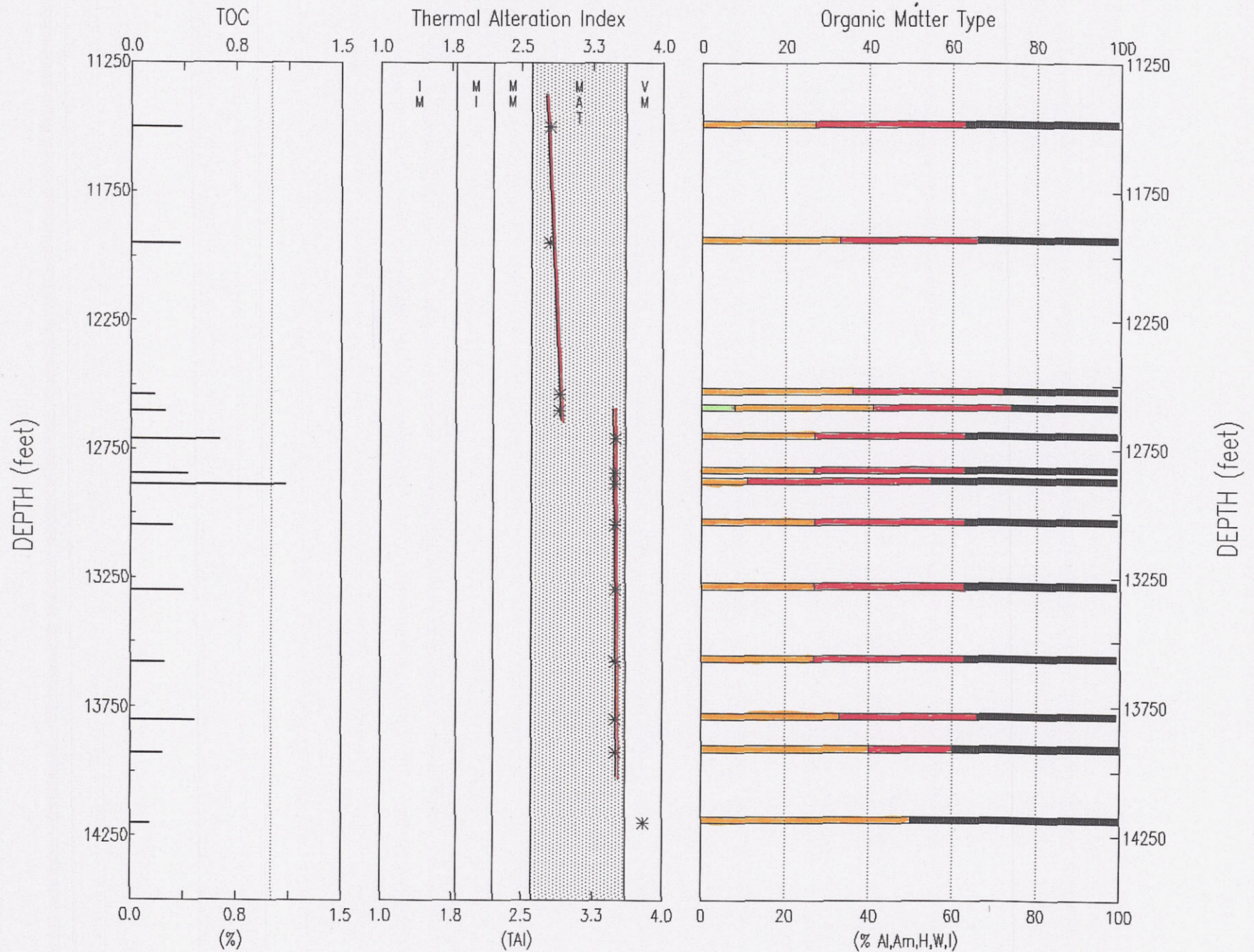
# FIGURE 1-A

## ROCK-EVAL PYROLYSIS SUMMARY - CONTROL SAMPLES (ppm wt/wt)

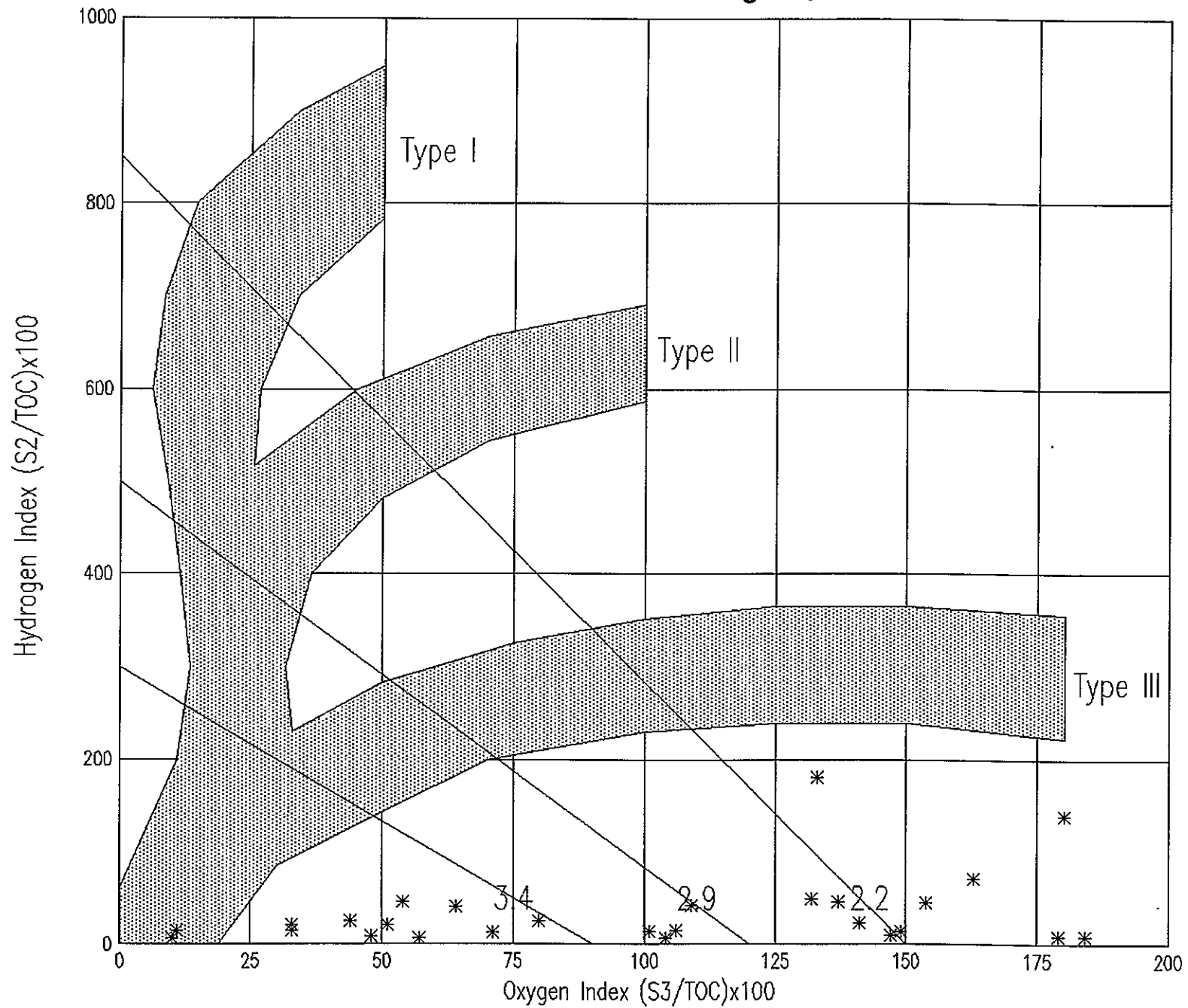


# FIGURE 2 KEROGEN SUMMARY - TAI AND OMT

GeoChem Job Number 4389

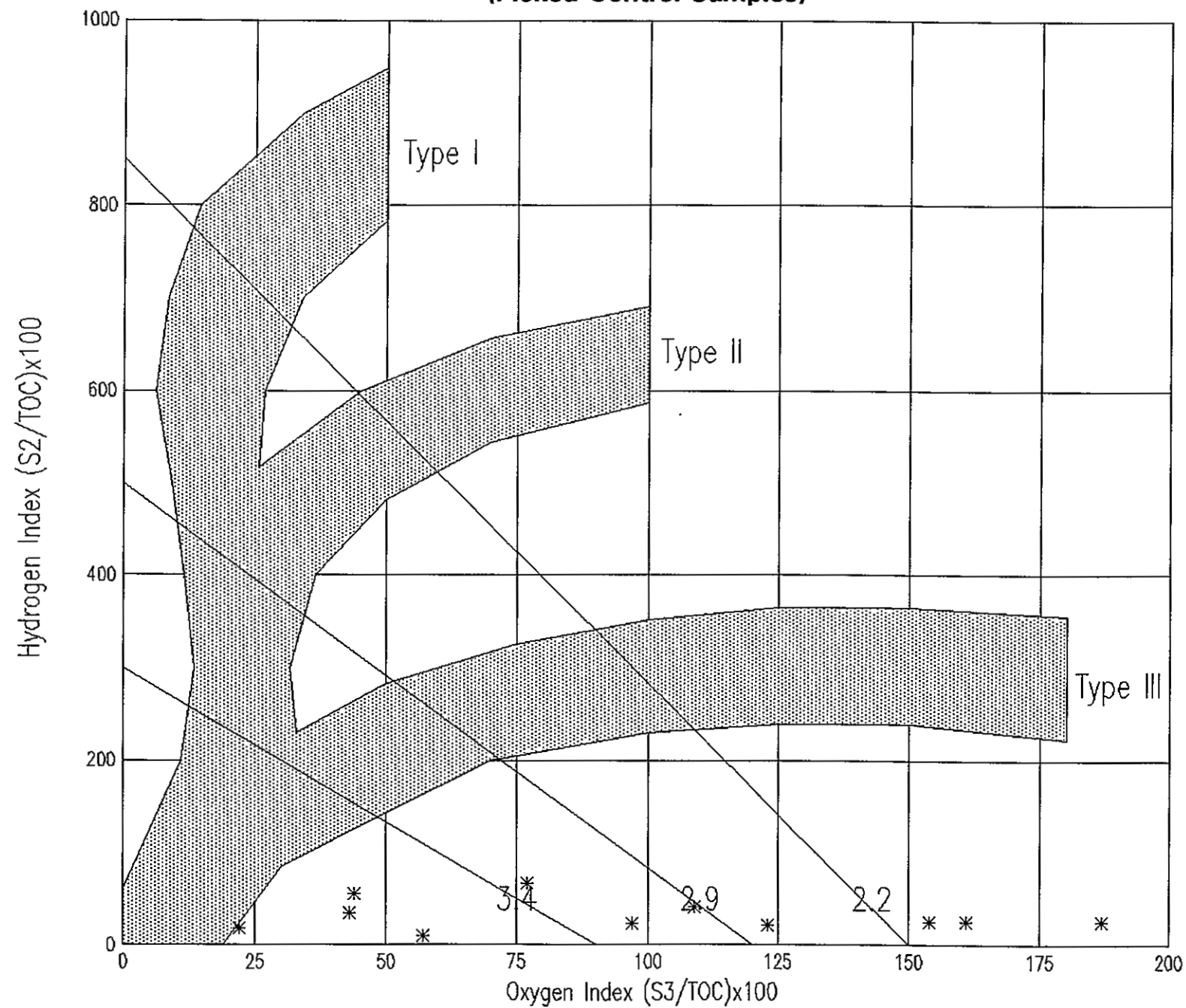


**FIGURE 2-A**  
**HYDROGEN INDEX VS. OXYGEN INDEX**  
**(Modified Van Krevelin Diagram)**

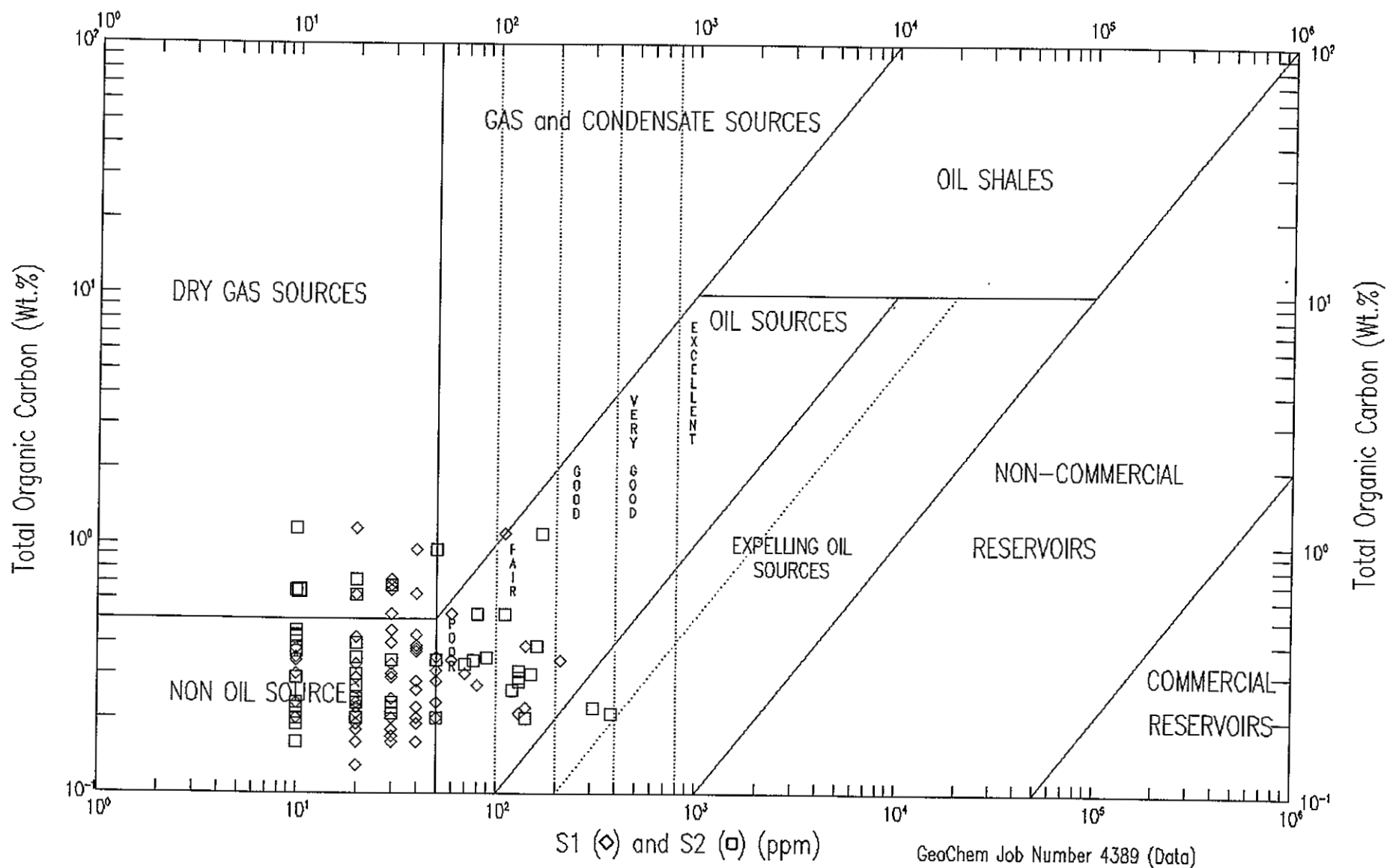




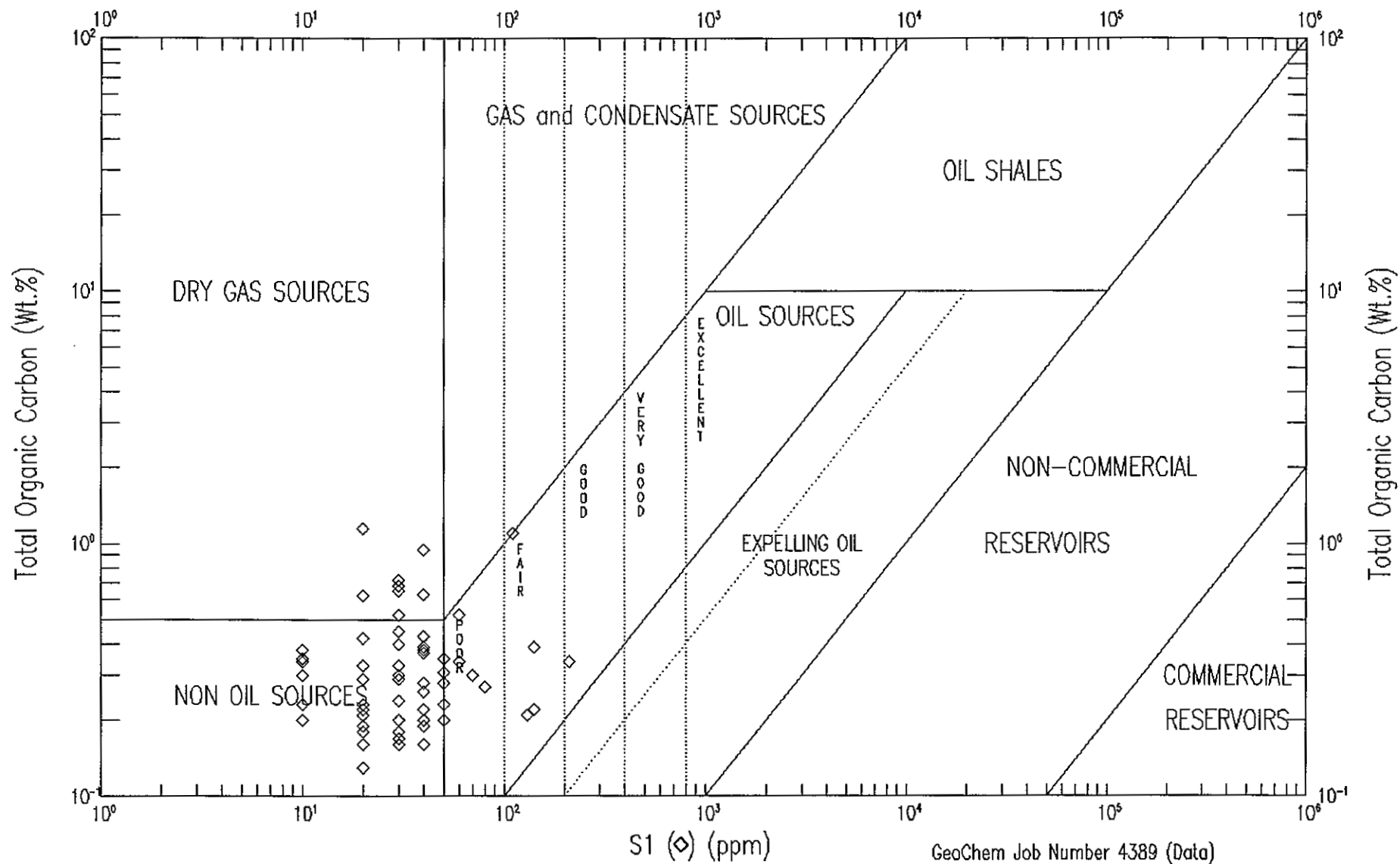
**FIGURE 2-B**  
**HYDROGEN INDEX VS. OXYGEN INDEX**  
**(Picked Control Samples)**



**FIGURE 3**  
**HYDROCARBON SOURCE RICHNESS - SHALES & MUDSTONES**  
**(Total Data Base)**

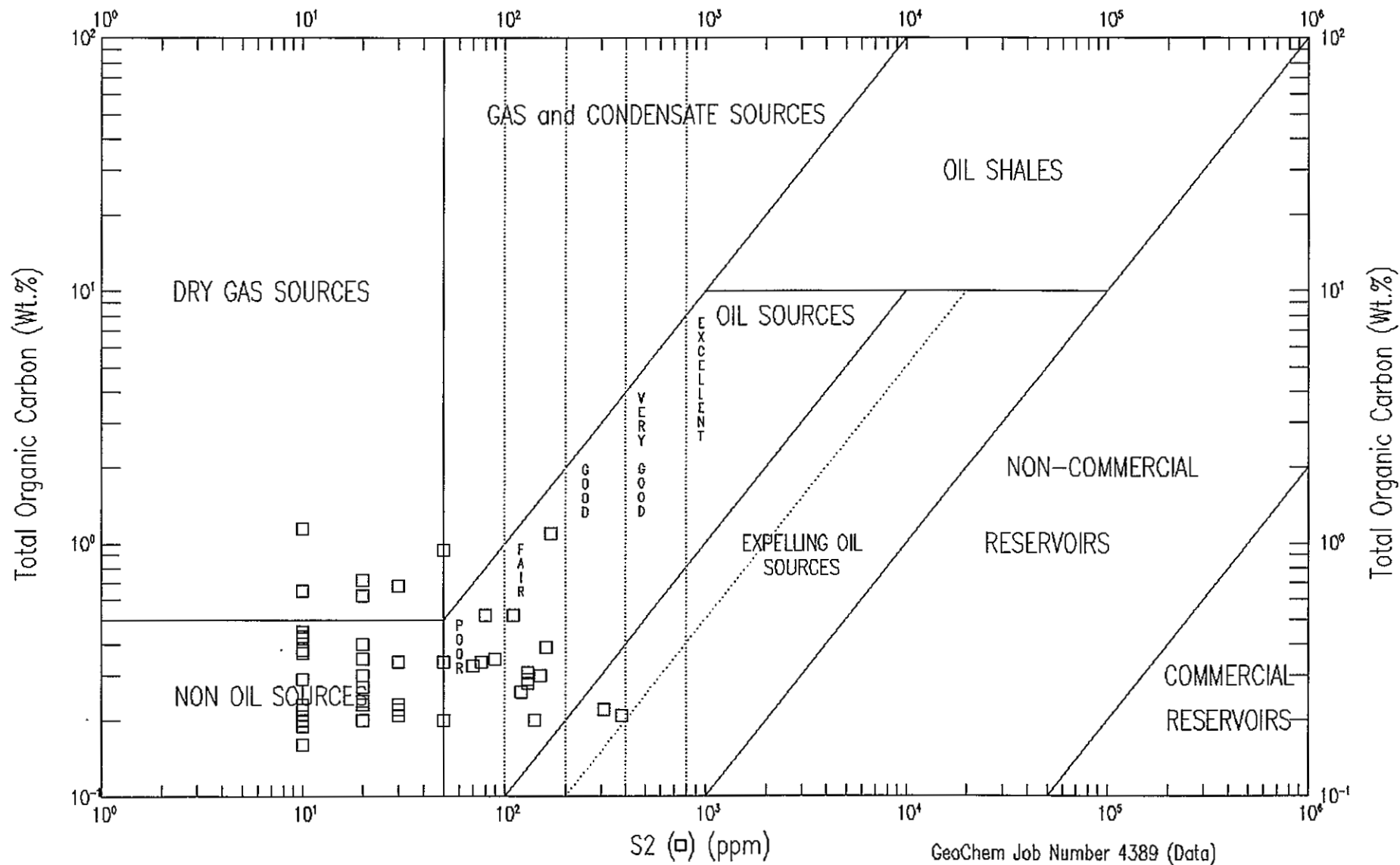


**FIGURE 3-A**  
**HYDROCARBON SOURCE RICHNESS - SHALES & MUDSTONES**  
**S<sub>1</sub> VOLATILE HYDROCARBON**



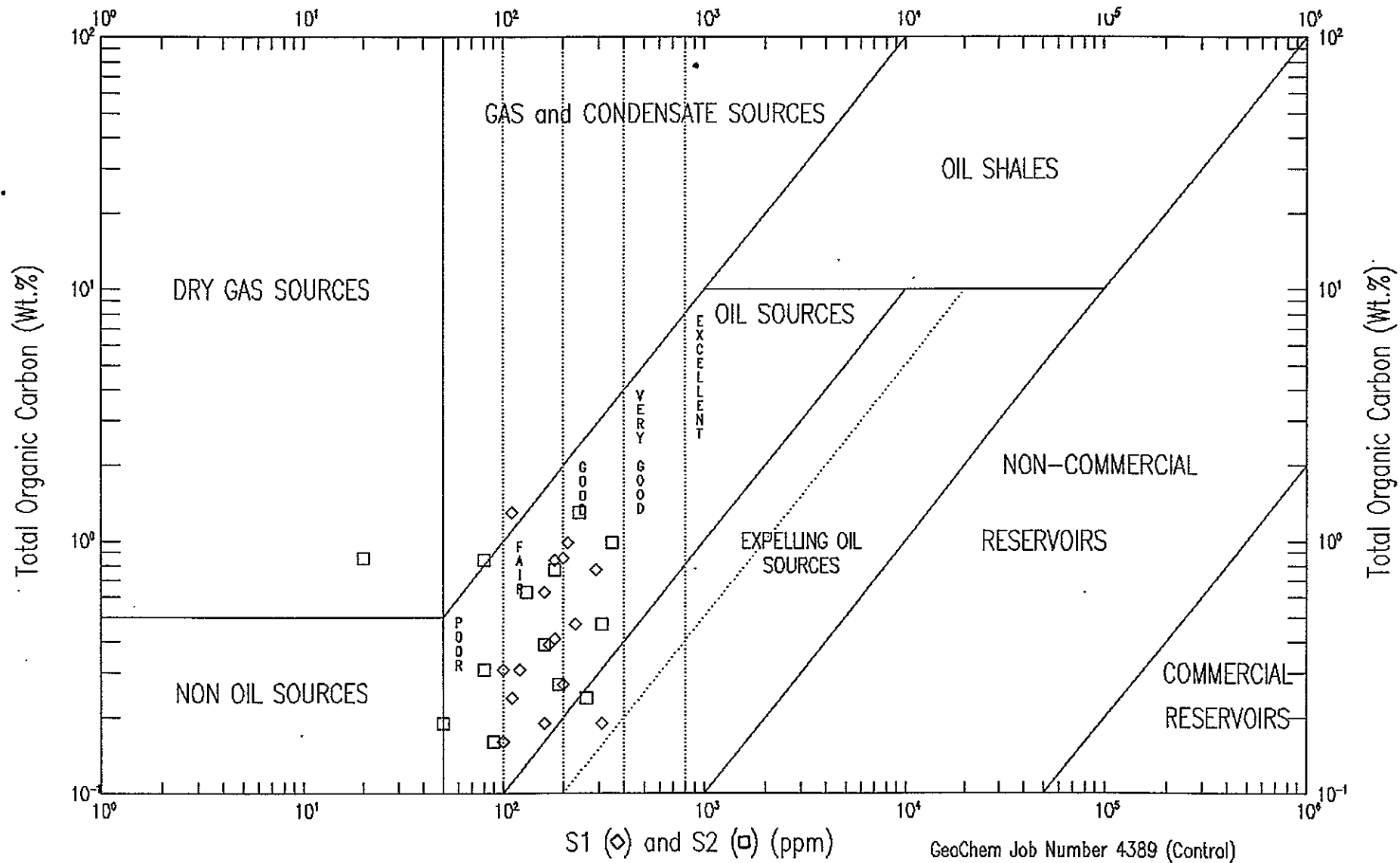


**FIGURE 3-B**  
**HYDROCARBON SOURCE RICHNESS - SHALES & MUDSTONES**  
**S<sub>2</sub> REMAINING GENERATABLE HYDROCARBON**

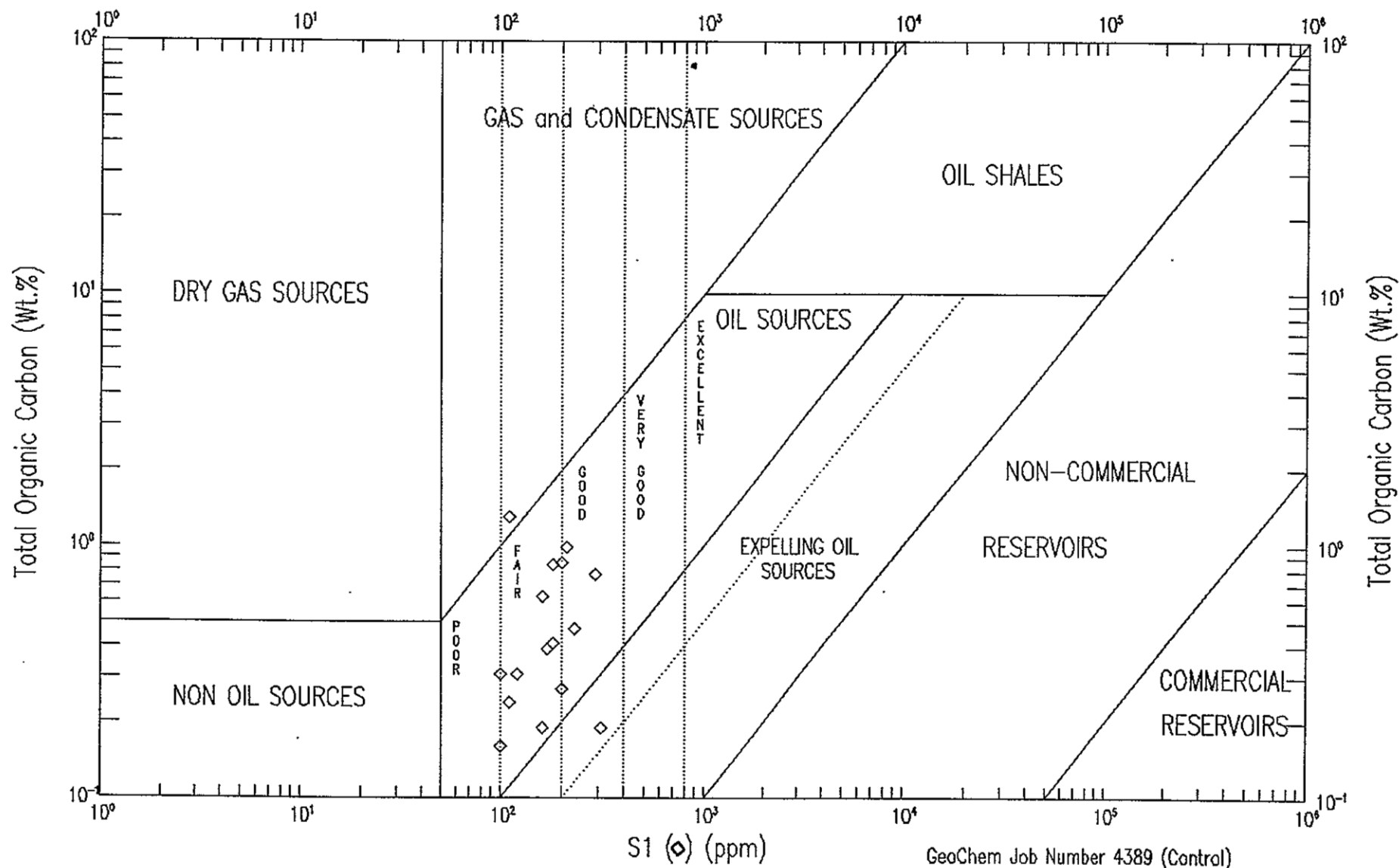


GeoChem Job Number 4389 (Data)

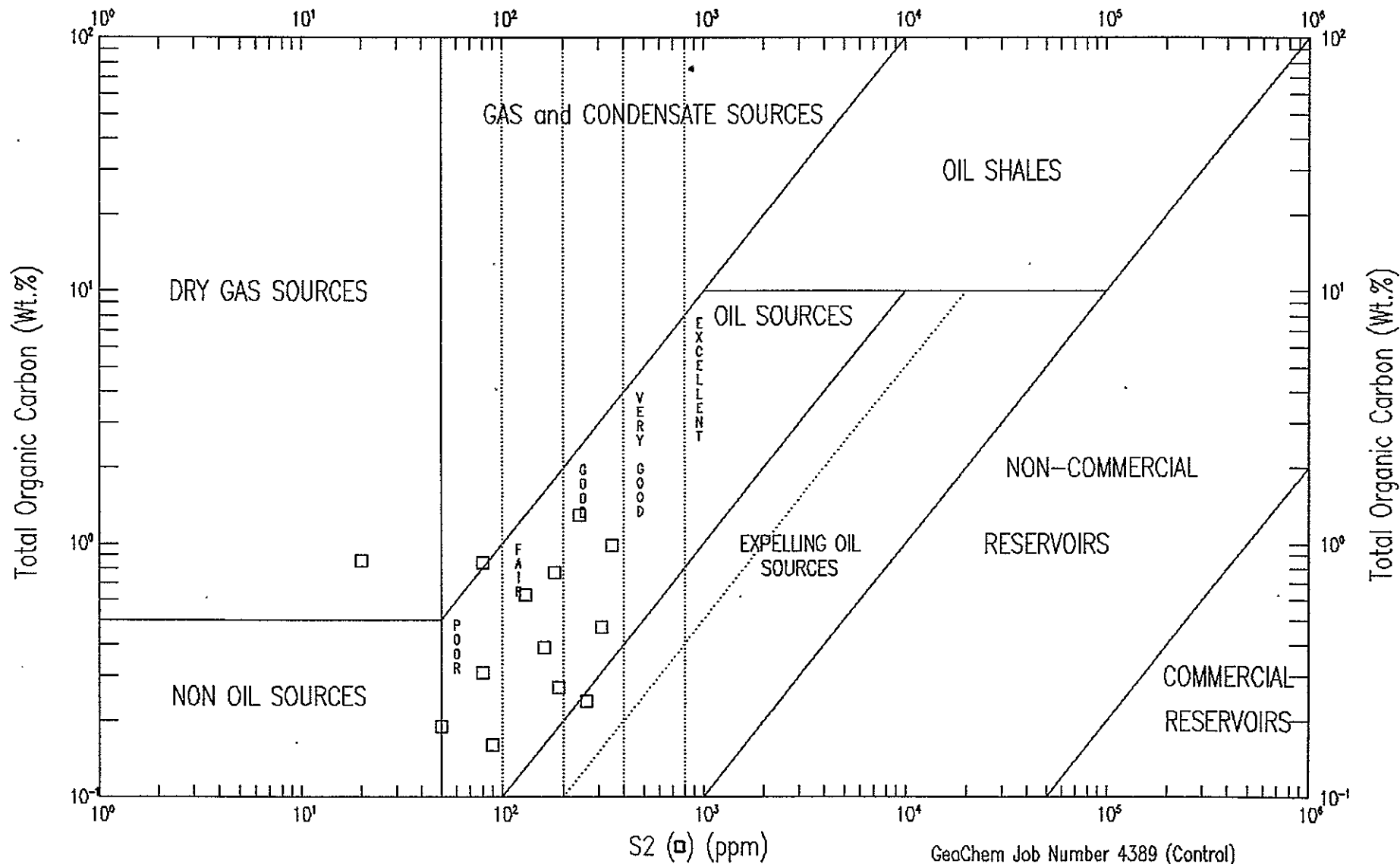
**FIGURE 3**  
**HYDROCARBON SOURCE RICHNESS - SHALES & MUDSTONES**  
**(Picked Control Samples)**



**FIGURE 3-A**  
**HYDROCARBON SOURCE RICHNESS - SHALES & MUDSTONES**  
**CONTROL SAMPLES - S<sub>1</sub> VOLATILE HYDROCARBON**



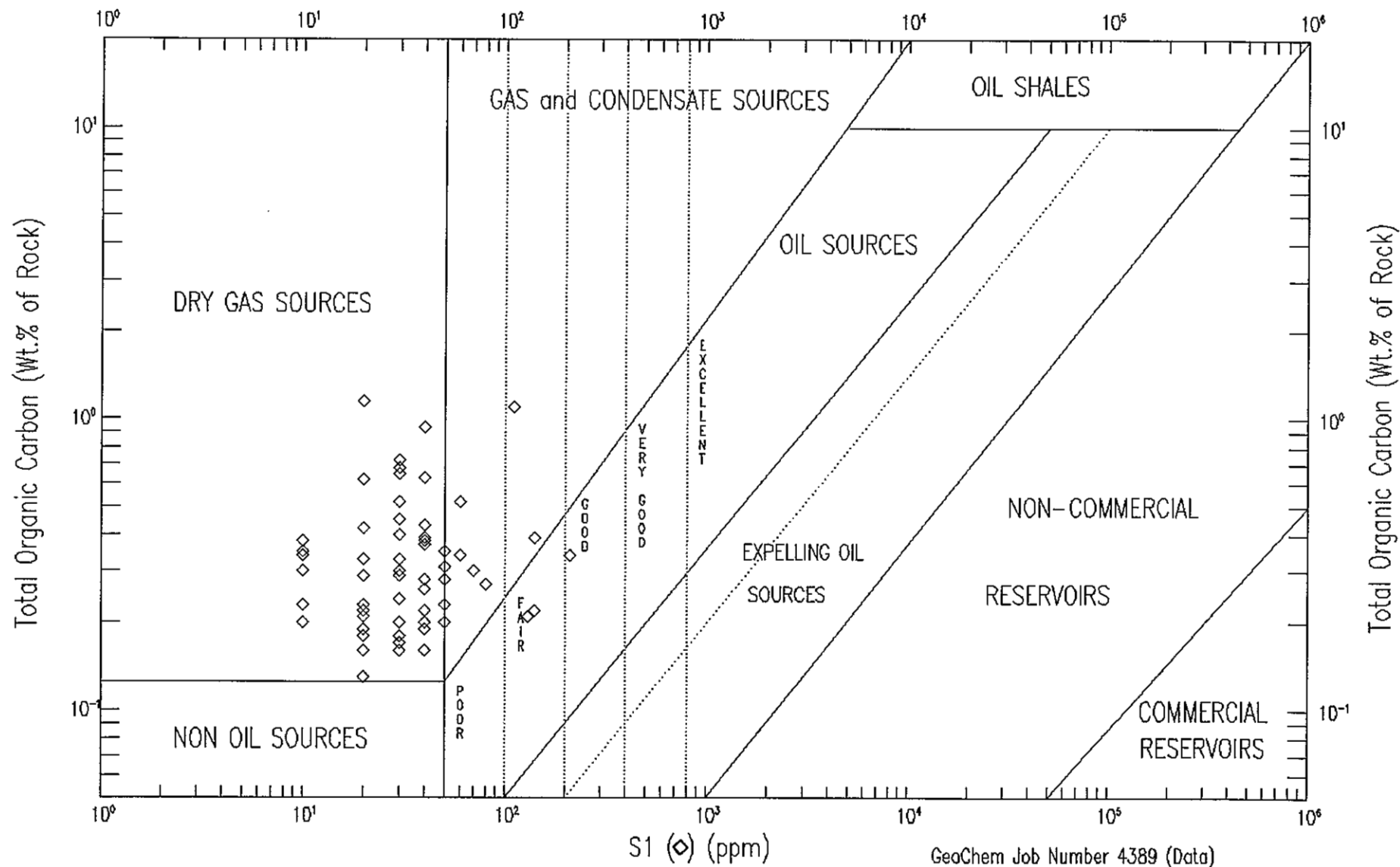
**FIGURE 3-B**  
**HYDROCARBON SOURCE RICHNESS - SHALES & MUDSTONES**  
**CONTROL SAMPLES - S<sub>2</sub> REMAINING GENERATABLE HYDROCARBON**



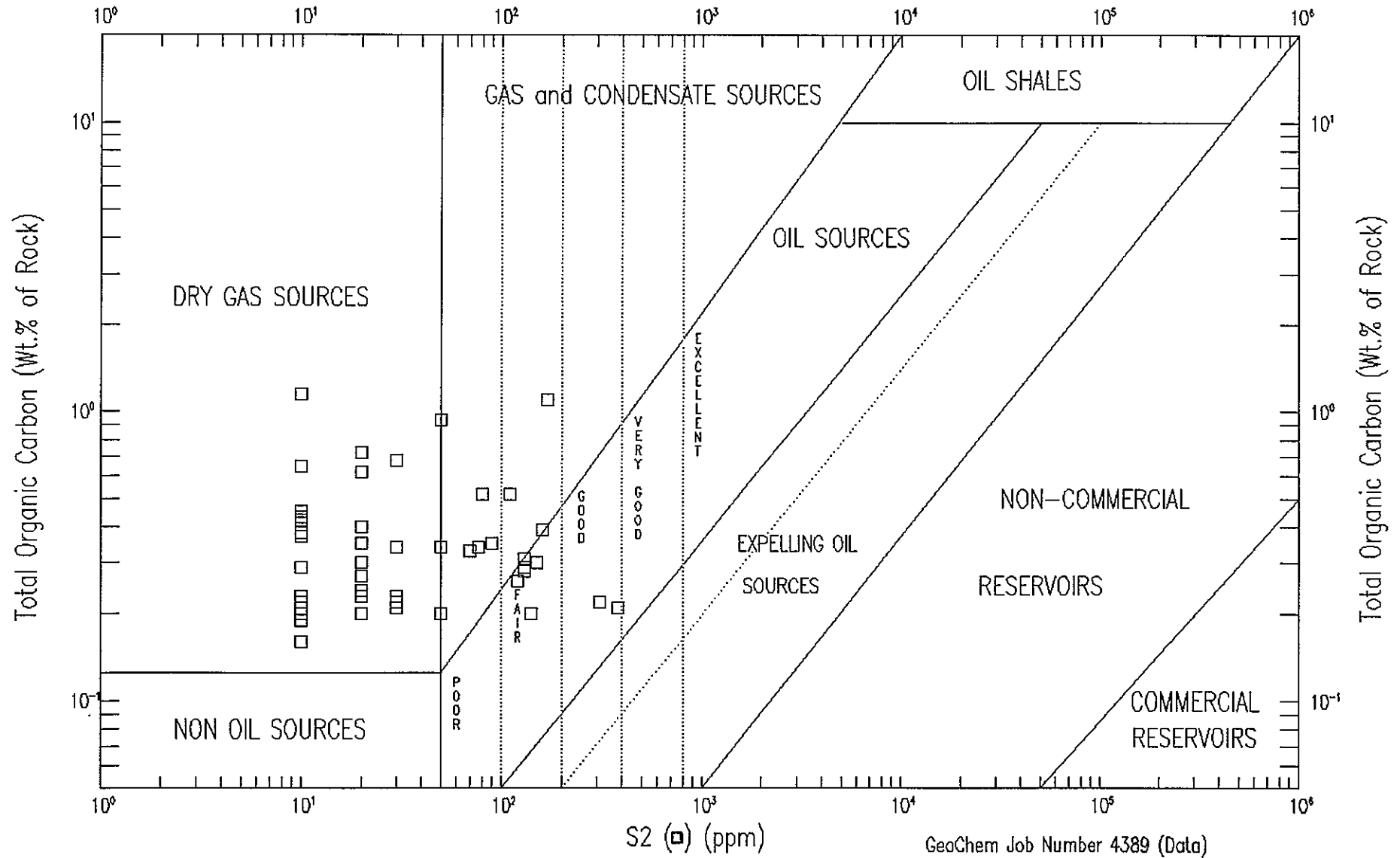
GeoChem Job Number 4389 (Control)



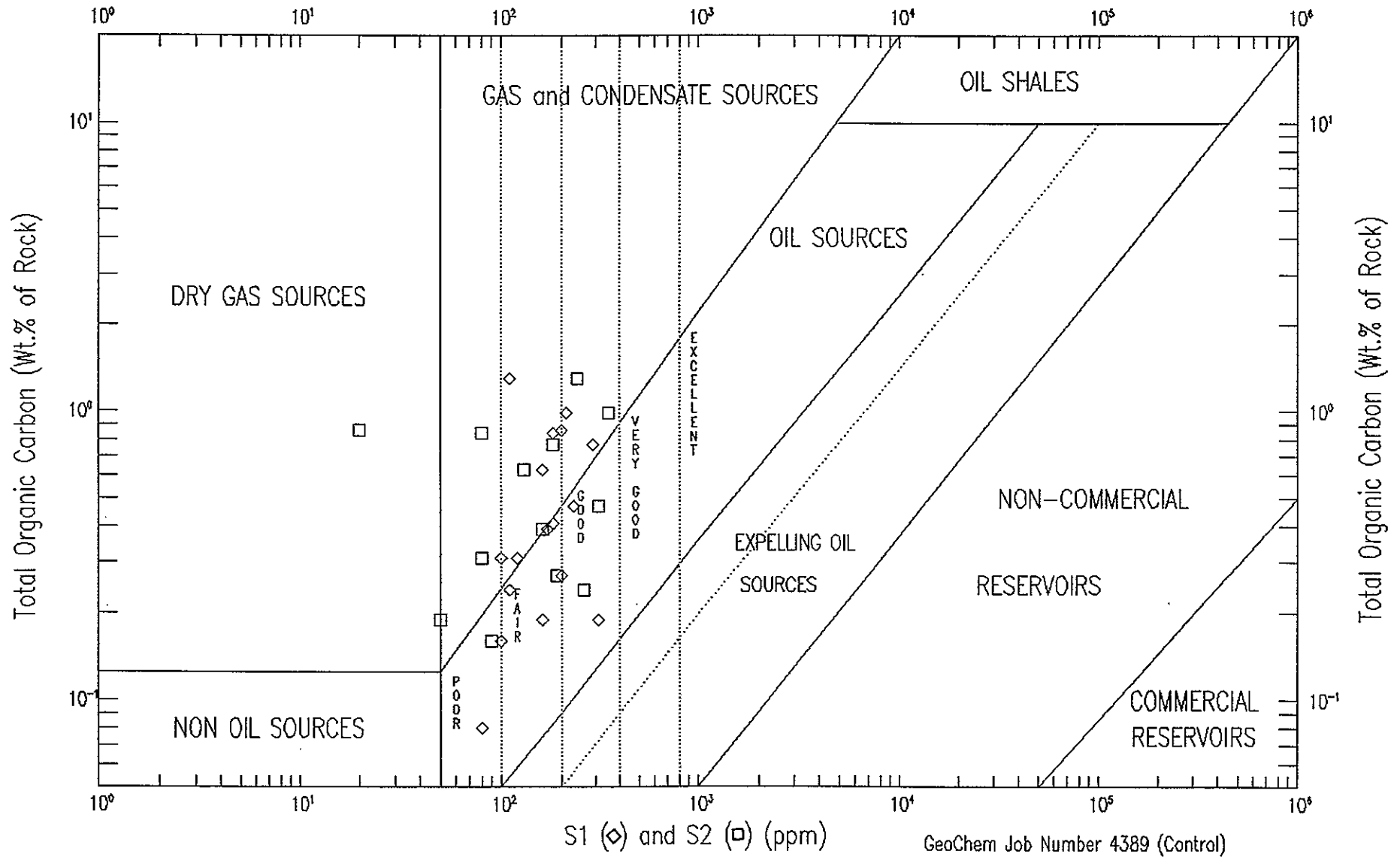
**FIGURE 3-A**  
**HYDROCARBON SOURCE RICHNESS - CARBONATES**  
**S<sub>1</sub> VOLATILE HYDROCARBON**



**FIGURE 3-B**  
**HYDROCARBON SOURCE RICHNESS - CARBONATES**  
**S<sub>2</sub> REMAINING GENERATABLE HYDROCARBON**

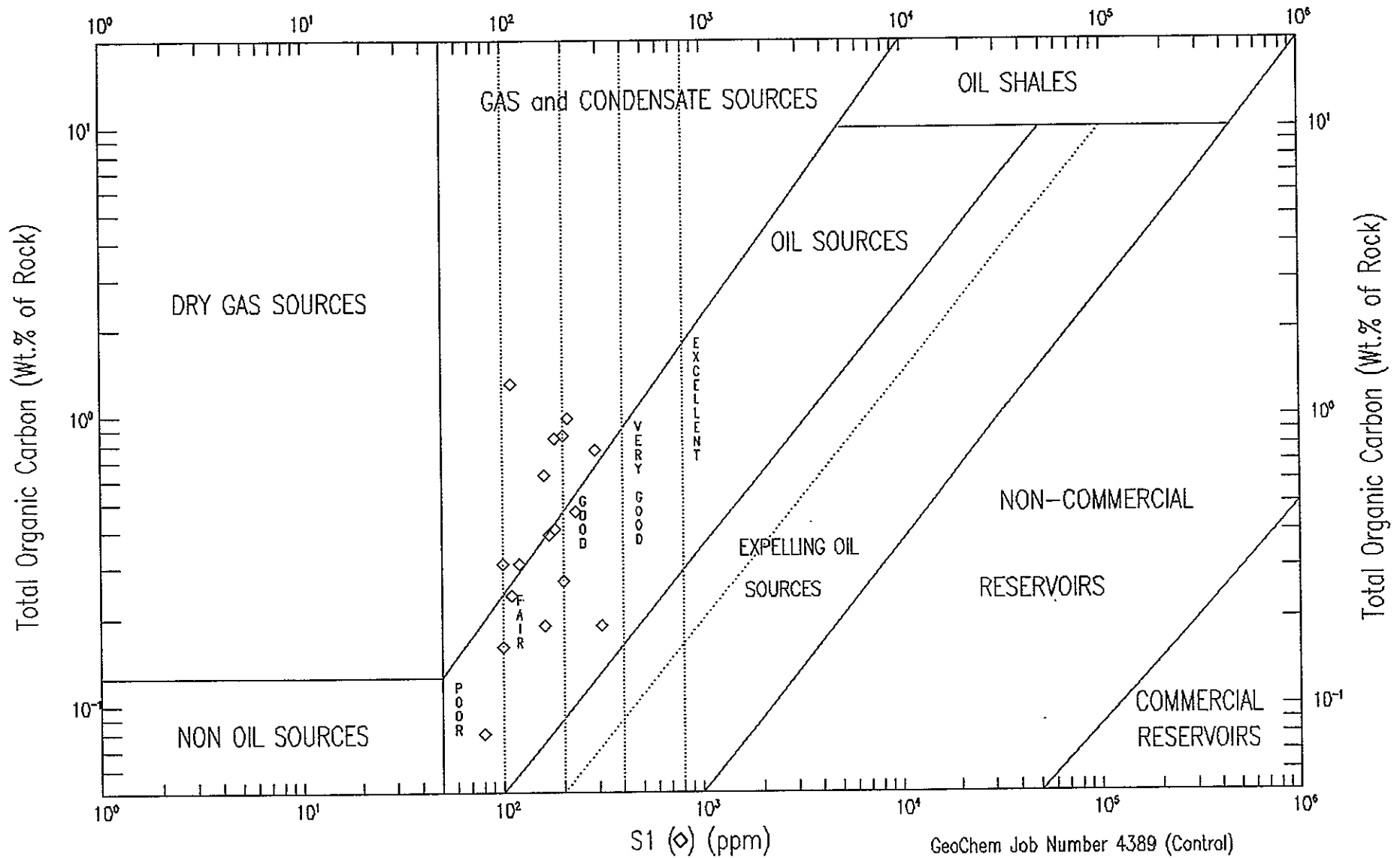


**FIGURE 3**  
**HYDROCARBON SOURCE RICHNESS - CARBONATES**  
**(Total Data Base)**

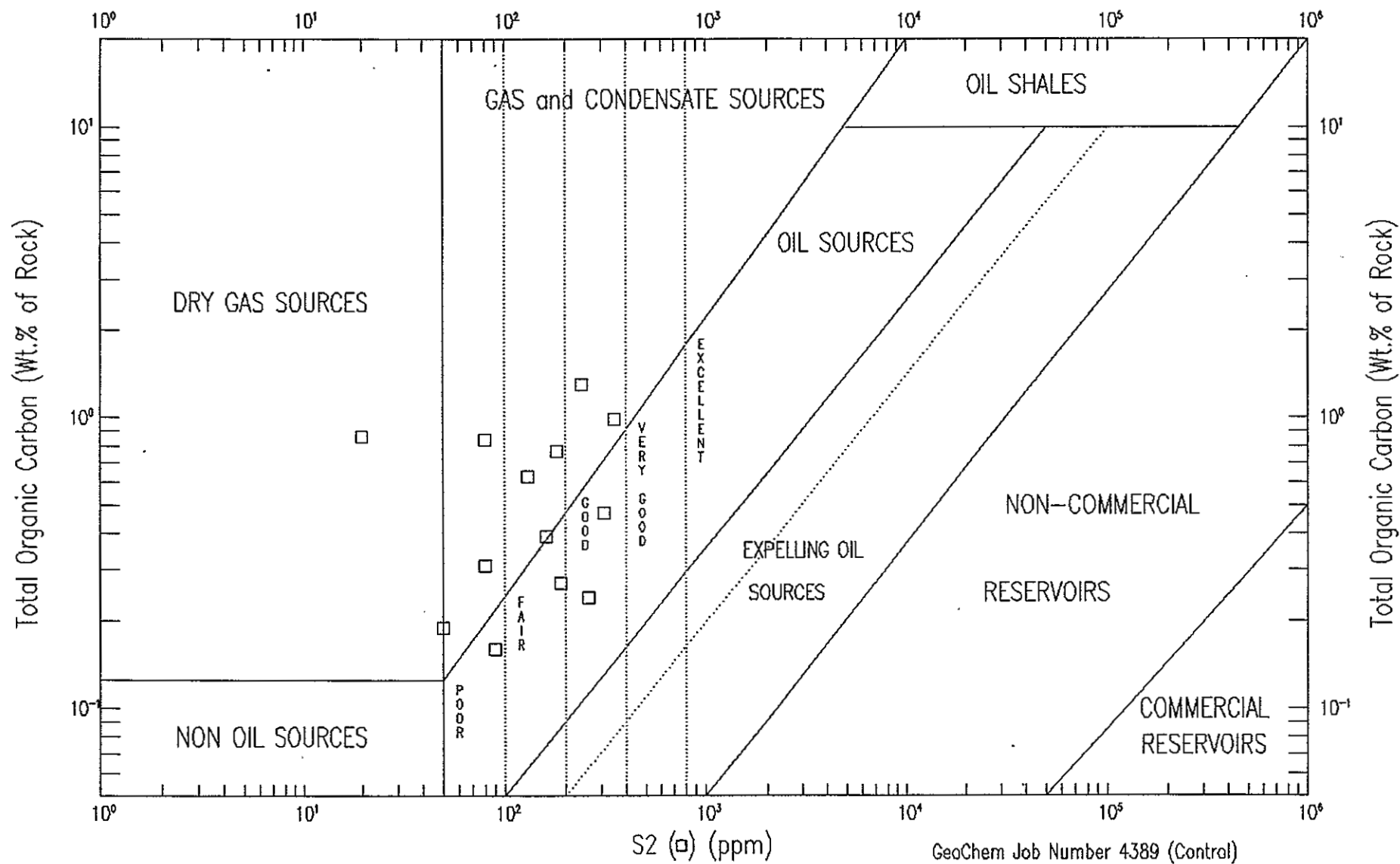




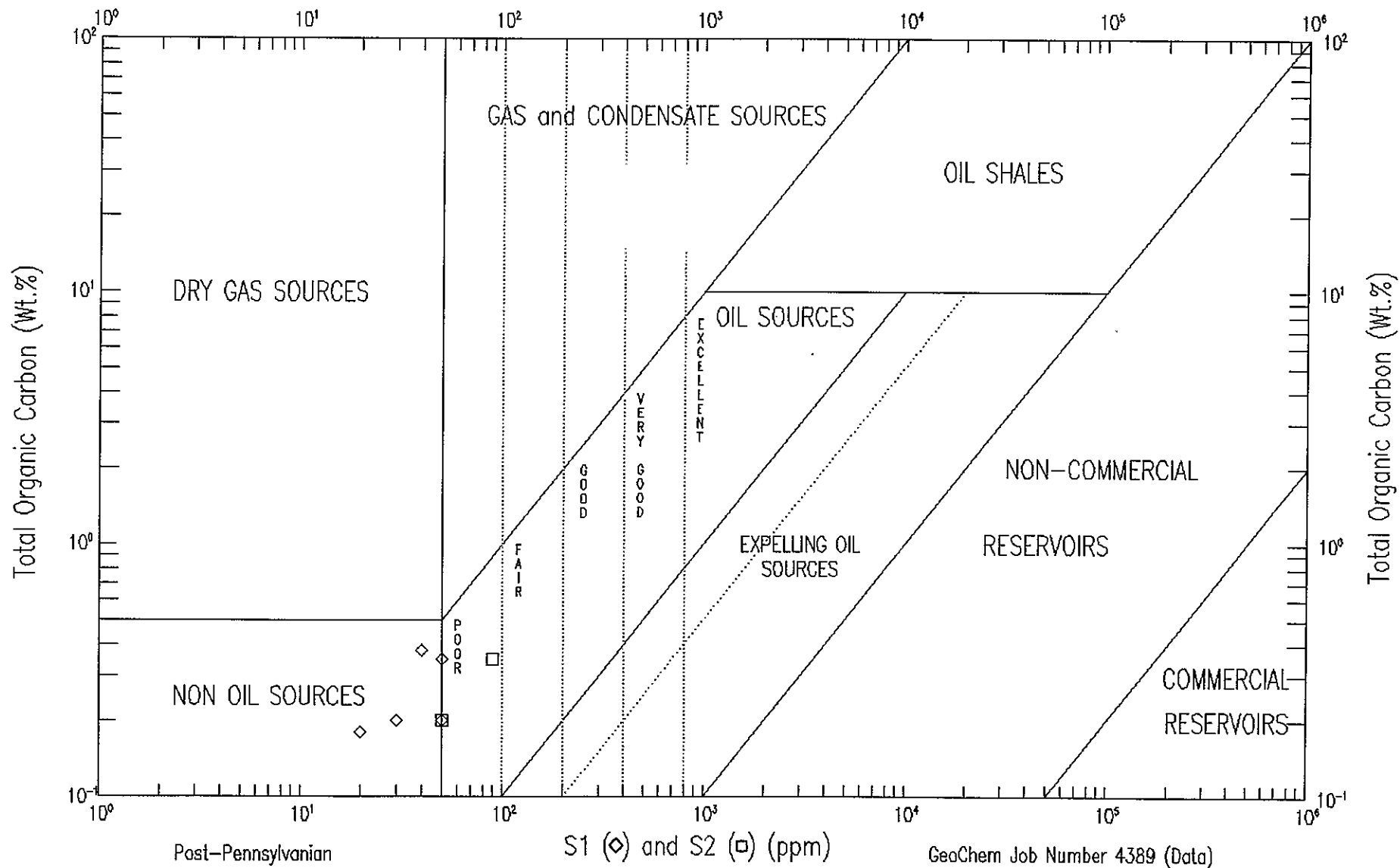
60



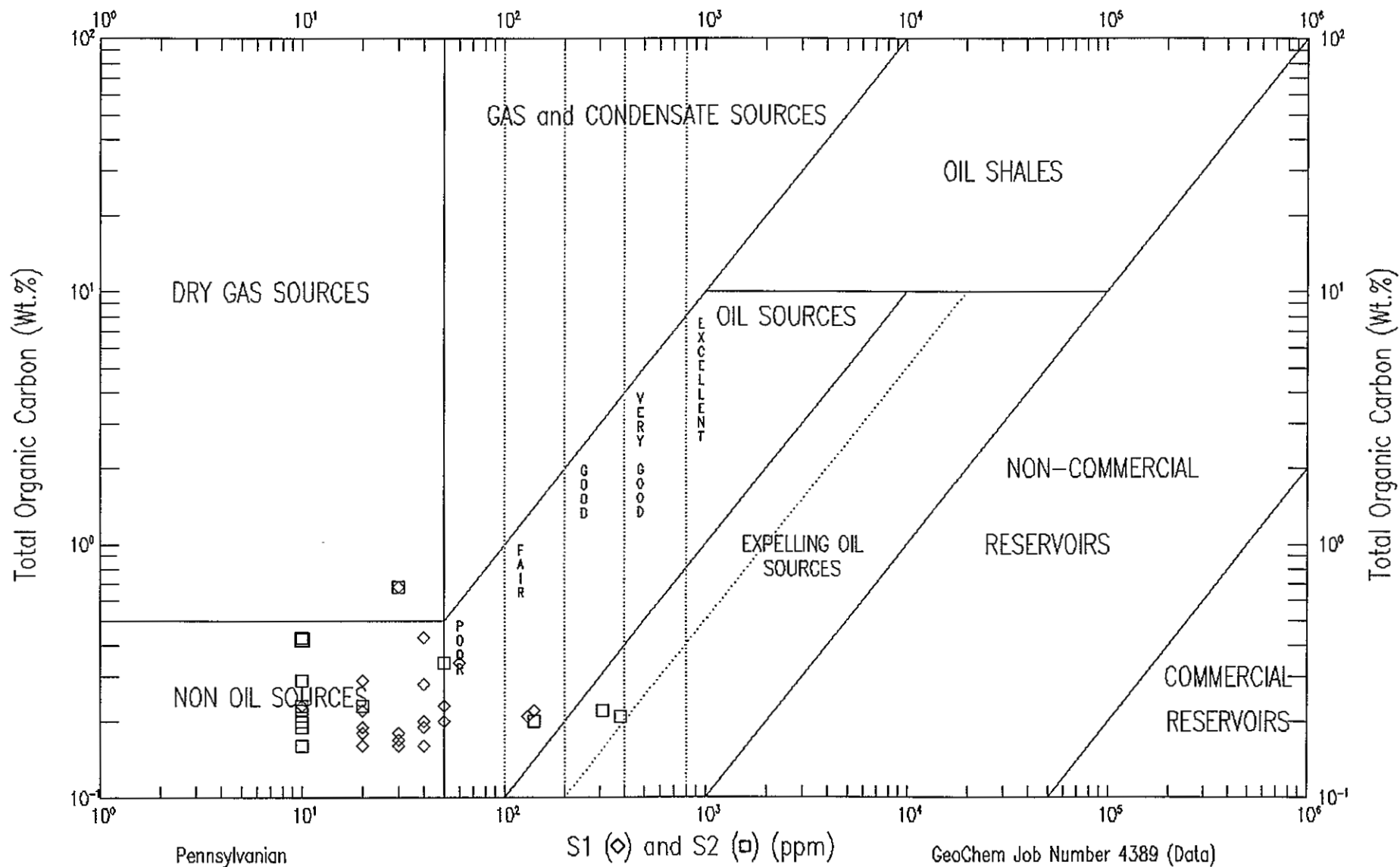
**FIGURE 3-B**  
**HYDROCARBON SOURCE RICHNESS - CARBONATES**  
**S<sub>2</sub> REMAINING GENERATABLE HYDROCARBON**



**FIGURE 3-D1**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**POST-PENNSYLVANIAN**



**FIGURE 3-D2**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**PENNSYLVANIAN**



**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-001	11300	A. 40% Shale, dark reddish brown. B. 40% Shale, blackish red. C. 20% Shale, medium dark gray. Trace Limestone, white.	10R 3/4 5R 2/2 N4
4389-011	11350	A. 20% Shale, dark reddish brown. B. 60% Shale, blackish red. C. 20% Shale, medium gray.	10R 3/4 5R 2/2 N5
4389-021	11400	A. 30% Shale, dark reddish brown. B. 30% Shale, blackish red. C. 30% Shale, medium gray. D. 10% Limestone, light gray to white.	10R 3/4 5R 2/2 N5 N7
4389-031	11450	A. 20% Shale, dark reddish brown. B. 30% Shale, blackish red. C. 50% Shale, medium gray.	10R 3/4 5R 2/2 N5
4389-041/042	11500-11505	A. 20% Shale, dark reddish brown. B. 40% Shale, blackish red. C. 40% Shale, olive gray.	10R 3/4 5R 2/2 5Y 4/1
4389-051	11550	A. 10% Shale, pale red. B. 60% Shale, blackish red. C. 30% Shale, dark gray.	10R 6/2 5R 2/2 N3
4389-061	11600	A. 30% Shale, dark reddish brown. B. 30% Shale, blackish red. C. 40% Shale, medium dark gray.	10R 3/4 5R 2/2 N4
4389-073	11660	A. 20% Shale, dark reddish brown. B. 40% Shale, blackish red. C. 40% Shale, brownish black.	10R 3/4 5R 2/2 5YR 2/1
4389-081	11700	A. 20% Shale, dark reddish brown. B. 40% Shale, blackish red. C. 40% Shale, medium dark gray.	10R 3/4 5R 2/2 N4

**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-090	11745	A. 30% Shale, dark reddish brown. B. 40% Shale, blackish red. C. 30% Shale, medium dark gray.	10R 3/4 5R 2/2 N4
4389-096	11780	A. 20% Shale, dark reddish brown. B. 60% Shale, blackish red. C. 20% Shale, olive gray and greenish gray.	10R 3/4 5R 2/2 5Y 4/1 and 5G 6/1
4389-108	11835	A. 10% Shale, dark reddish brown. B. 70% Shale, blackish red. C. 20% Shale, light olive gray.	10R 3/4 5R 2/2 5Y 6/1
4389-113	11860	A. 10% Shale, dark reddish brown. B. 70% Shale, blackish red. C. 20% Shale, light olive gray.	10R 3/4 5R 2/2 5Y 6/1
4389-121	11900	A. 10% Shale, dark reddish brown. B. 70% Shale, blackish red. C. 20% Shale, light brownish gray.	10R 3/4 5R 2/2 5YR 6/1
4389-131	11950	A. 30% Shale, dark reddish brown. B. 20% Shale, blackish red. C. 50% Shale, brownish gray.	10R 3/4 5R 2/2 5YR 4/1
4389-141	12000	A. 10% Shale, dark reddish brown. B. 50% Shale, blackish red. C. 40% Shale, medium dark gray.	10R 3/4 5R 2/2 N4
4389-151	12050	A. 10% Shale, dark reddish brown. B. 50% Shale, blackish red. C. 40% Shale, brownish gray.	10R 3/4 5R 2/2 5YR 4/1
4389-162	12105	A. 10% Shale, dark reddish brown. B. 60% Shale, blackish red. C. 30% Shale, brownish gray.	10R 3/4 5R 2/2 5YR 4/1
4389-177	12180	A. 70% Shale, blackish red. B. 30% Shale, brownish gray.	5R 2/2 5YR 4/1

**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-184	12215	A. 80% Shale, blackish red. B. 20% Shale, brownish gray.	5R 2/2 5YR 4/1
4389-191	12250	A. 20% Shale, grayish red. B. 70% Shale, blackish red. C. 10% Shale, brownish gray.	10R 4/2 5R 2/2 5YR 4/1
4389-202	12305	A. 10% Shale, moderate red. B. 50% Shale, grayish red. C. 40% Shale, olive gray.	5R 5/4 5R 4/2 5Y 4/1
4389-217	12380	A. 60% Shale, grayish red. B. 40% Shale, brownish gray.	10R 4/2 5YR 4/1
4389-228	12435	A. 70% Shale, grayish red. B. 30% Shale, olive gray.	5R 4/2 5Y 4/1
4389-230	12495	A. 50% Shale, grayish red. B. 40% Shale, moderate red. C. 10% Shale, light brownish gray.	5R 4/2 5R 5/4 5YR 6/1
4389-248	12535	A. 30% Shale, dark reddish brown. B. 30% Shale, olive gray. C. 40% Siltstone, white and light gray.	10R 3/4 5Y 4/1 N7
4389-254	12565	A. 40% Shale, blackish red. B. 30% Shale, dusky red. C. 30% Shale, brownish gray.	5R 2/2 5R 3/4 5YR 4/1
4389-261	12600	A. 40% Shale, light olive gray. B. 40% Shale, grayish red. C. 20% Limestone, white.	5Y 6/1 5R 4/2
4389-272	12655	A. 10% Shale, pale red. B. 10% Shale, grayish red. C. 40% Shale, grayish red. D. 40% Shale, medium light gray.	10R 6/2 10R 4/2 5R 4/2 N6
4389C-005C	12710	100% Siltstone, brownish gray.	5YR 4/1

**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389C-007C	12736	100% Shale, silty, brownish gray.	5YR 4/1
4389-295	12770	A. 30% Shale, dark reddish brown. B. 30% Shale, blackish red. C. 40% Shale, light olive gray.	10R 3/4 5R 2/2 5Y 6/1
4389-301	12800	A. 30% Shale, grayish red. B. 60% Shale, medium dark gray. C. 10% Limestone, white.	10R 4/2 N4
4389-310	12845	A. 10% Shale, grayish red. B. 60% Shale, medium gray. C. 30% Limestone, white and light gray.	5R 4/2 N5 N7
4389C-030C	12875	100% Shale, silty, brownish gray.	5YR 4/1
4389C-033C	12878	100% Shale, silty, dark gray.	N3
4389C-037C	12882	100% Shale, dark gray.	N3
4389C-042C	12887	100% Shale, dark gray.	N3
4389C-048C	12893	100% Shale, olive gray.	5Y 4/1
4389-327	12930	A. 20% Shale, grayish red. B. 20% Shale, grayish red. C. 20% Shale, olive black. D. 20% Shale, olive gray. E. 20% Limestone, white and light gray.	10R 4/2 5R 4/2 5Y 2/1 5Y 4/1 N7
4389-338	12985	A. 20% Shale, grayish red. B. 70% Limestone, medium gray. C. 10% Limestone, white and light gray.	10R 4/2 N5 N7
4389-343	13010	A. 30% Shale, dark gray. B. 50% Limestone, medium light gray. C. 20% Limestone, grayish pink.	N3 N6 5R 8/2



**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-350	13045	A. 10% Shale, pale red. B. 40% Shale, brownish gray. C. 50% Limestone, medium light gray. Trace Limestone, white.	5R 6/2 5YR 4/1 N6
4389-360	13095	A. 30% Shale, pale yellowish brown. B. 30% Shale, moderate reddish brown. C. 40% Limestone, pinkish gray.	10YR 6/2 10R 4/6 5YR 8/1
4389-370	13145	A. 30% Shale, grayish red. B. 20% Shale, dark gray. C. 30% Shale, brownish gray. D. 20% Limestone, medium light gray.	10R 4/2 N3 5YR 4/1 N6
4389-381	13200	A. 20% Shale, pale red. B. 40% Limestone, white and light gray. C. 40% Shale, brownish gray.	5R 6/2 N7 5YR 4/1
4389-390	13245	A. 20% Shale, grayish red. B. 40% Shale, olive gray. C. 40% Limestone, medium gray.	10R 4/2 5Y 4/1 N6
4389-400	13295	A. 10% Shale, grayish red. B. 45% Shale, medium dark gray. C. 45% Limestone, medium light gray.	10R 4/2 N4 N6
4389-406	13325	A. 10% Shale, grayish red. B. 45% Shale, medium dark gray. C. 45% Limestone, medium light gray.	10R 4/2 N4 N6
4389-418	13385	A. 50% Limestone, very pale orange. B. 10% Shale, pale red. C. 10% Limestone, medium dark gray. D. 20% Limestone, medium light gray. E. 10% Limestone, white.	10YR 8/2 5R 6/2 N4 N6

**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-432	13455	A. 30% Shale, dark reddish brown. B. 30% Shale, grayish red. C. 30% Shale, dark gray. D. 10% Limestone, white and light gray.	10R 3/4 5R 4/2 N3 N7
4389-441	13500	A. 20% Shale, grayish red. B. 30% Shale, dark gray. C. 50% Limestone, medium dark gray.	5R 4/2 N3 N4
4389-456	13575	A. 10% Shale, grayish red. B. 50% Limestone, light gray and white. C. 40% Limestone, medium gray.	5R 4/2 N7 N5
4389-470	13645	A. 10% Shale, grayish red. B. 40% Shale, dark gray. C. 40% Limestone, medium light gray. D. 10% Limestone, white and light gray.	5R 4/2 N3 N6 N7
4389-481	13700	A. 10% Shale, grayish red. B. 40% Shale, dark gray. C. 40% Limestone, medium light gray. D. 10% Limestone, white and light gray.	5R 4/2 N3 N6 N7
4389-491	13750	A. 10% Shale, grayish red. B. 30% Shale, dark gray. C. 50% Limestone, medium light gray. D. 10% Limestone, white and light gray.	5R 4/2 N3 N6 N7
4389-501	13800	A. 10% Shale, grayish red. B. 10% Shale, dark gray. C. 70% Limestone, medium light gray. D. 10% Limestone, white and light gray.	5R 4/2 N3 N6 N7
4389-506	13825	A. 20% Shale, grayish red. B. 20% Shale, dark gray. C. 20% Limestone, medium light gray. D. 40% Limestone, white and light gray.	5R 4/2 N3 N6 N7

**TABLE I**  
**SAMPLE LITHOLOGICAL DESCRIPTION**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-514	13865	A. 10% Shale, grayish red. B. 30% Limestone, light brownish gray. C. 60% Limestone, white and light gray.	5R 4/2 5YR 6/1 N7
4389-526	13925	A. 20% Shale, grayish red. B. 40% Limestone, brownish gray. C. 40% Limestone, white and light gray.	5R 4/2 5YR 4/1 N7
4389-541	14000	A. 20% Shale, grayish red. B. 30% Limestone, medium dark gray. C. 50% Limestone, white and grayish orange pink.	10R 4/2 N4 5YR 7/2
4389-581	14200	100% Limestone, white and light gray.	N7
4389-621	14400	A. 20% Limestone, medium light gray. B. 80% Quartzite, clear, crystalline, white.	N6

**TABLE I**

**SAMPLE IDENTIFICATION  
AND  
TOTAL ORGANIC CARBON RESULTS**

GeoChem Sample Number	Client Identification Number	Total Organic Carbon (% of Rock)
4389-001	11300-11305	0.38
4389-011	11350-11355	0.18
4389-021	11400-11405	0.20
4389-031	11450-11455	0.20
4389-041/042	11500-11510	0.35
4389-051	11550-11555	0.21
4389-061	11600-11605	0.19
4389-073	11660-11665	0.20
4389-081	11700-11705	0.20
4389-090	11745-11750	0.18
4389-096	11775-11780	0.18
4389-108	11835-11840	0.28
4389-113	11860-11865	0.19
4389-121	11900-11905	0.43
4389-131	11950-11955	0.34
4389-141	12000-12005	0.68
4389-151	12050-12055	0.23 ; 0.24R
4389-162	12105-12110	0.17
4389-177	12180-12185	0.29
4389-184	12215-12220	0.22
4389-191	12250-12255	0.23
4389-202	12305-12310	0.22
4389-217	12380-12385	0.22
4389-228	12435-12440	0.16
4389-230	12445-12450	0.16
4389-248	12535-12540	0.16
4389-254	12565-12570	0.65
4389-261	12600-12605	0.24
4389-272	12655-12660	0.34
4389C-005C	12710	0.63 ; 0.70R
4389C-007C	12736	1.15
4389-295	12770-12775	0.29
4389-301	12800-12805	0.38
4389-310	12845-12850	0.40

# TABLE I

## SAMPLE IDENTIFICATION AND TOTAL ORGANIC CARBON RESULTS

GeoChem Sample Number	Client Identification Number	Total Organic Carbon (% of Rock)
4389C-030C	12875	0.28
4389C-033C	12878	0.94
4389C-037C	12882	0.52
4389C-042C	12887	1.10
4389C-048C	12893	0.52
4389-327	12930-12935	0.33
4389-338	12985-12990	0.26
4389-343	13010-13015	0.39 ; 0.43R
4389-350	13045-13050	0.29
4389-360	13095-13100	0.34
4389-370	13145-13150	0.31
4389-381	13200-13205	0.30
4389-390	13245-13250	0.20
4389-400	13295-13300	0.37
4389-406	13325-13330	0.23
4389-418	13385-13390	0.21
4389-432	13455-13460	0.30
4389-441	13500-13505	0.35 ; 0.46R
4389-456	13575-13580	0.23
4389-470	13645-13650	0.62
4389-481	13700-13705	0.42
4389-491	13750-13755	0.72
4389-501	13800-13805	0.45
4389-506	13825-13830	0.39
4389-514	13865-13870	0.30
4389-526	13925-13930	0.22
4389-541	14000-14005	0.27 ; 0.31R
4389-581	14200-14205	0.13
4389-621	14400-14405	0.33

**TABLE II-A**  
**RESULTS OF ROCK-EVAL PYROLYSIS**  
**(mgm/gram)**

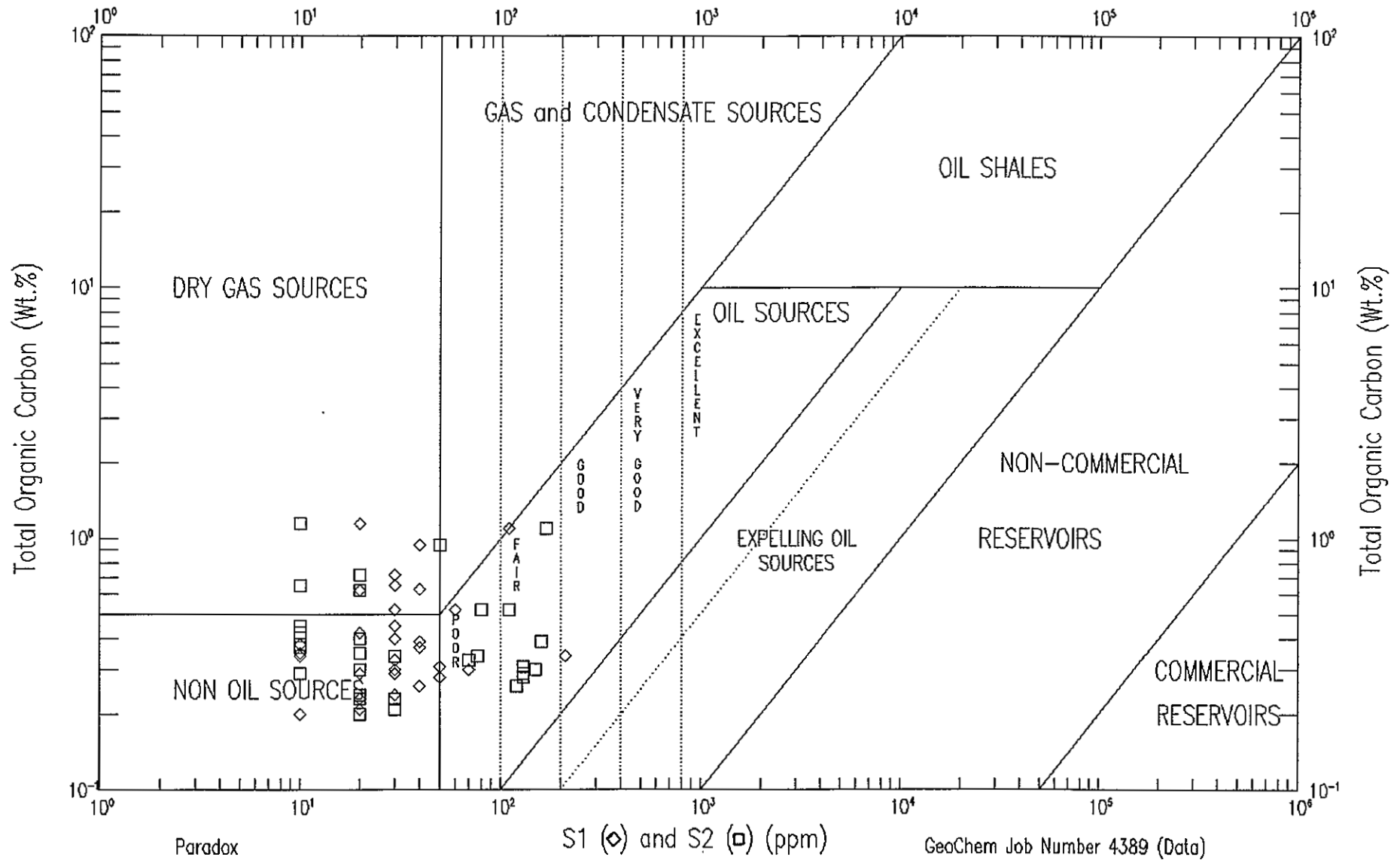
GeoChem Sample No.	Client Identification	Tmax (°c)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	PC*	T.O.C. (wt%)	Hydrogen Index	Oxygen Index
4389-001	11300-11305	260	0.04	0.00	0.34	1.00	0.00	0.38	0	89
4389-011	11350-11355	218	0.02	0.00	0.40	1.00	0.00	0.18	0	218
4389-021	11400-11405	260	0.05	0.00	0.21	1.00	0.00	0.20	0	104
4389-031	11450-11455	260	0.03	0.05	0.09	0.37	0.00	0.20	25	44
4389-041/042	11500-11510	266	0.05	0.09	0.28	0.36	0.01	0.35	26	80
4389-051	11550-11555	292	0.13	0.38	0.28	0.26	0.04	0.21	181	133
4389-061	11600-11605	236	0.02	0.00	0.19	1.00	0.00	0.19	0	100
4389-073	11660-11665	267	0.05	0.14	0.32	0.28	0.01	0.20	71	163
4389-081	11700-11705	200	0.04	0.01	0.26	1.00	0.00	0.20	5	132
4389-090	11745-11750	210	0.03	0.00	0.40	1.00	0.00	0.18	0	225
4389-096	11775-11780	266	0.02	0.00	0.33	1.00	0.00	0.18	0	183
4389-108	11835-11840	264	0.04	0.00	0.49	1.00	0.00	0.28	0	173
4389-113	11860-11865	349	0.04	0.01	0.65	1.00	0.00	0.19	5	342
4389-121	11900-11905	206	0.04	0.01	0.24	1.00	0.00	0.43	2	56
4389-131	11950-11955	646	0.06	0.05	0.36	0.60	0.00	0.34	15	106
4389-141	12000-12005	646	0.03	0.03	0.19	0.50	0.00	0.68	4	28
4389-151	12050-12055	646	0.05	0.02	0.11	0.83	0.00	0.23	9	48
4389-162	12105-12110	646	0.03	0.00	0.09	1.00	0.00	0.17	0	52
4389-177	12180-12185	646	0.02	0.01	0.15	1.00	0.00	0.29	3	51
4389-184	12215-12220	646	0.02	0.01	0.49	1.00	0.00	0.22	5	223
4389-191	12250-12255	646	0.01	0.01	0.14	0.50	0.00	0.23	4	60
4389-202	12305-12310	646	0.02	0.00	0.11	1.00	0.00	0.22	0	49
4389-217	12380-12385	646	0.14	0.31	0.40	0.32	0.03	0.22	139	180
4389-228	12435-12440	646	0.02	0.00	0.39	1.00	0.00	0.16	0	240
4389-230	12445-12450	646	0.03	0.00	0.37	1.00	0.00	0.16	0	238
4389-248	12535-12540	646	0.04	0.01	0.34	1.00	0.00	0.16	6	213
4389-254	12565-12570	646	0.03	0.01	0.47	0.75	0.00	0.65	2	72
4389-261	12600-12605	646	0.03	0.02	0.52	0.75	0.00	0.24	8	213
4389-272	12655-12660	646	0.01	0.03	0.63	0.25	0.00	0.34	9	184
4389C-005C	12710	646	0.04	0.00	0.17	1.00	0.00	0.63	0	27
4389C-007C	12736	646	0.02	0.01	0.07	1.00	0.00	1.15	1	6
4389-295	12770-12775	646	0.02	0.01	0.20	1.00	0.00	0.29	3	69
4389-301	12800-12805	436	0.01	0.01	0.26	0.50	0.00	0.38	3	68
4389-310	12845-12850	374	0.03	0.02	0.61	0.75	0.00	0.40	5	154
4389C-030C	12875	266	0.05	0.13	0.39	0.28	0.01	0.28	46	137
4389C-033C	12878	266	0.04	0.05	0.00	0.50	0.00	0.94	5	137
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, °C.		

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**TABLE II-A**  
**RESULTS OF ROCK-EVAL PYROLYSIS**  
**(mgm/gram)**

GeoChem Sample No.	Client Identification	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	PC*	T.O.C. (wt%)	Hydrogen Index	Oxygen Index
4389C-037C	12882	266	0.06	0.11	0.17	0.37	0.01	0.52	21	33
4389C-042C	12887	266	0.11	0.17	0.12	0.39	0.02	1.10	15	11
4389C-048C	12893	400	0.03	0.08	0.17	0.30	0.00	0.52	15	33
4389-327	12930-12935	290	0.03	0.07	0.17	0.30	0.00	0.33	21	51
4389-338	12985-12990	266	0.04	0.12	0.14	0.25	0.01	0.26	46	54
4389-343	13010-13015	288	0.04	0.16	0.25	0.20	0.01	0.39	41	64
4389-350	13045-13050	266	0.03	0.13	0.44	0.19	0.01	0.29	45	154
4389-360	13095-13100	269	0.21	0.08	0.47	0.73	0.02	0.34	23	141
4389-370	13145-13150	287	0.05	0.13	0.34	0.28	0.01	0.31	42	109
4389-381	13200-13205	266	0.07	0.15	0.40	0.32	0.01	0.30	49	132
4389-390	13245-13250	192	0.01	0.02	0.30	0.50	0.00	0.20	10	147
4389-400	13295-13300	266	0.04	0.01	0.49	1.00	0.00	0.37	3	134
4389-406	13325-13330	263	0.02	0.03	0.16	0.50	0.00	0.23	13	71
4389-418	13385-13390	200	0.02	0.03	0.31	0.50	0.00	0.21	14	149
4389-432	13455-13460	208	0.03	0.02	0.17	0.75	0.00	0.30	7	57
4389-441	13500-13505	221	0.01	0.02	0.12	0.50	0.00	0.35	6	34
4389-456	13575-13580	167	0.02	0.02	0.42	0.50	0.00	0.23	9	179
4389-470	13645-13650	227	0.02	0.02	0.35	0.50	0.00	0.62	3	56
4389-481	13700-13705	199	0.02	0.01	0.32	1.00	0.00	0.42	2	77
4389-491	13750-13755	183	0.03	0.02	0.40	0.75	0.00	0.72	3	56
4389-501	13800-13805	349	0.03	0.01	0.36	0.75	0.00	0.45	2	80
4389-506	13825-13830	214	0.14	0.00	0.60	1.00	0.01	0.39	0	152
4389-514	13865-13870	186	0.01	0.02	0.03	0.50	0.00	0.30	7	10
4389-526	13925-13930	179	0.04	0.03	0.22	0.67	0.00	0.22	14	101
4389-541	14000-14005	153	0.08	0.02	0.28	0.80	0.00	0.27	7	104
4389-581	14200-14205	174	0.02	0.00	0.00	1.00	0.00	0.13	0	0
4389-621	14400-14405	171	0.02	0.00	0.01	1.00	0.00	0.33	0	3
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, °C.			

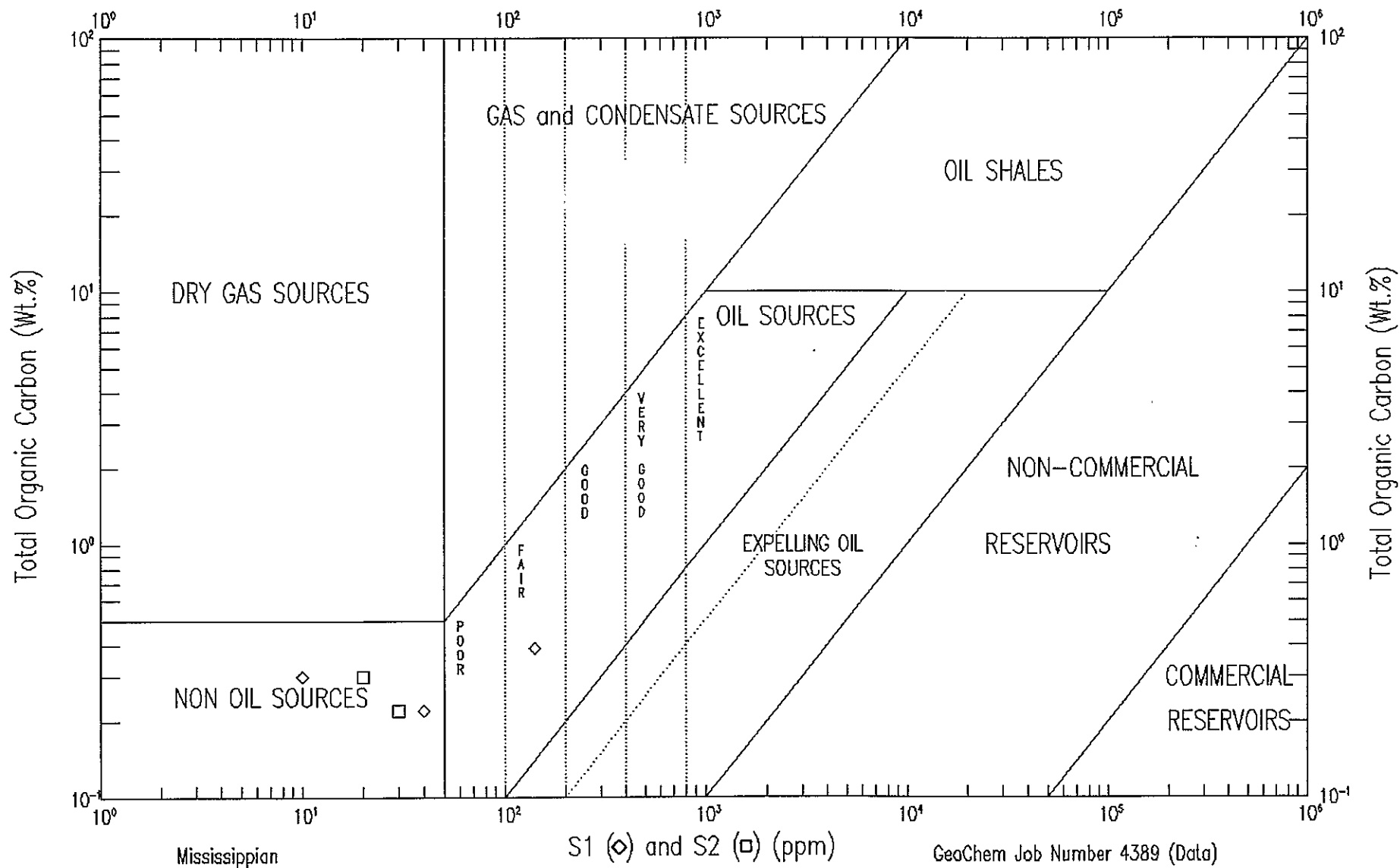
**FIGURE 3-D3**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**PARADOX**



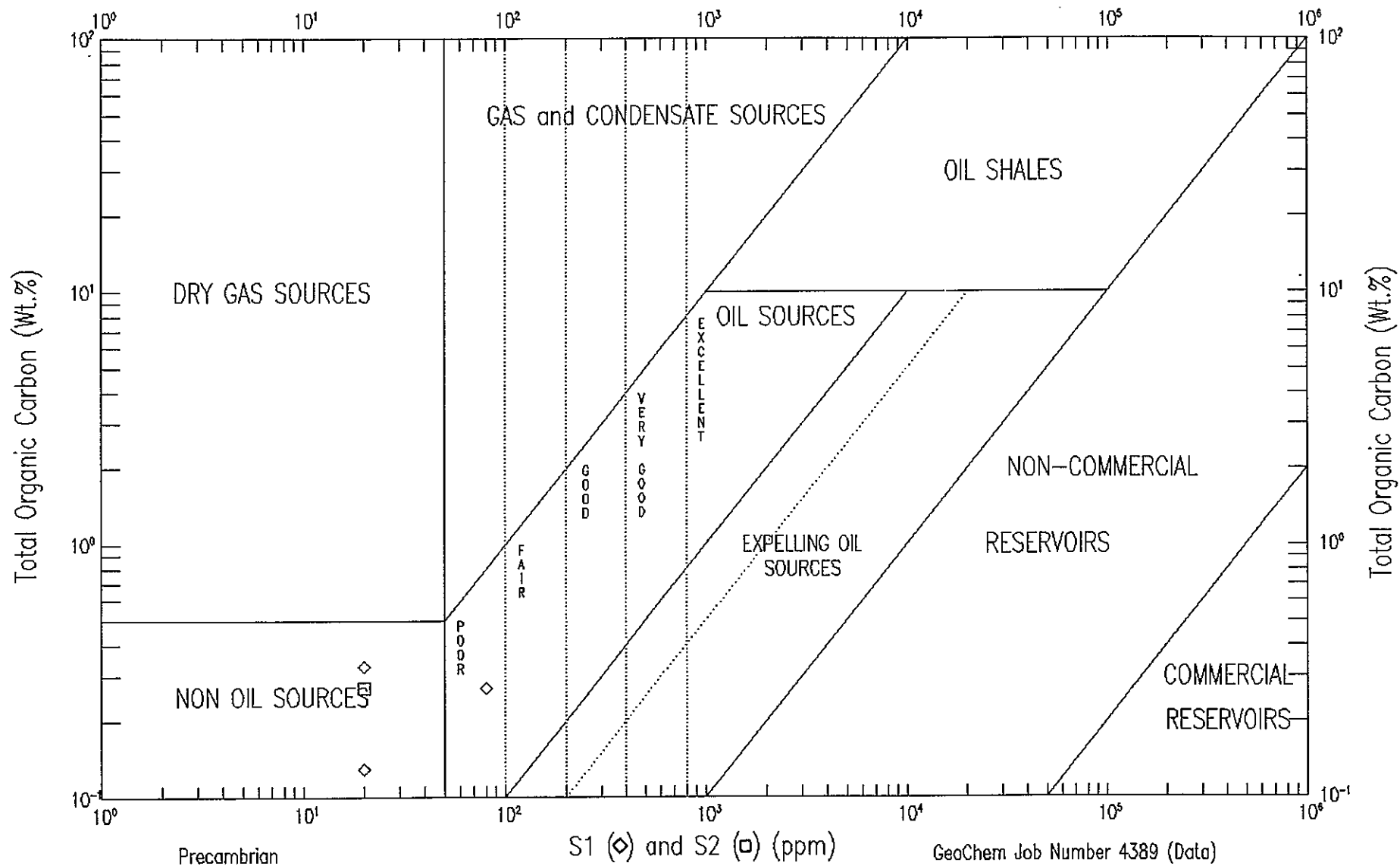
GeoChem Job Number 4389 (Data)



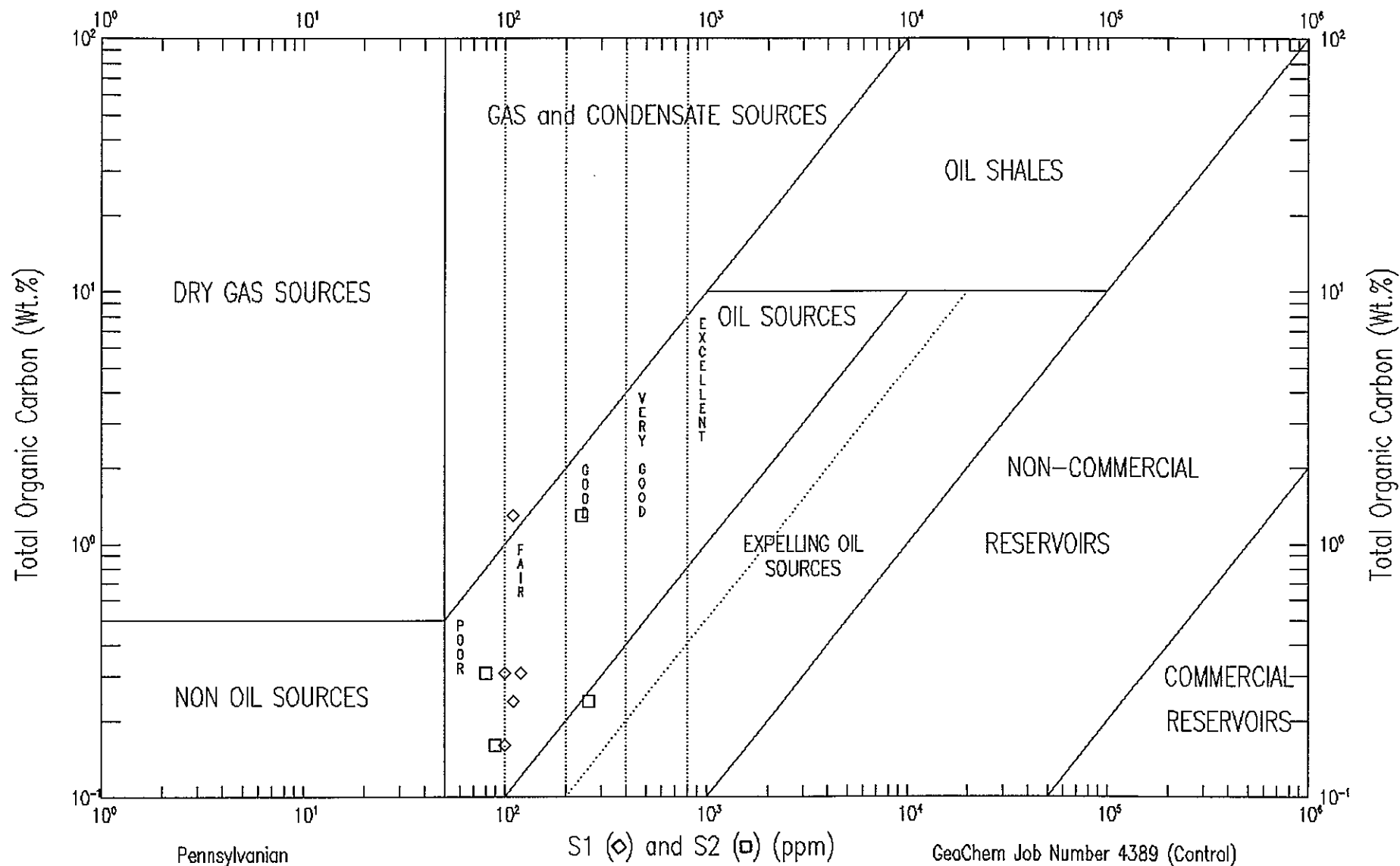
**FIGURE 3-D4**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**MISSISSIPPIAN**



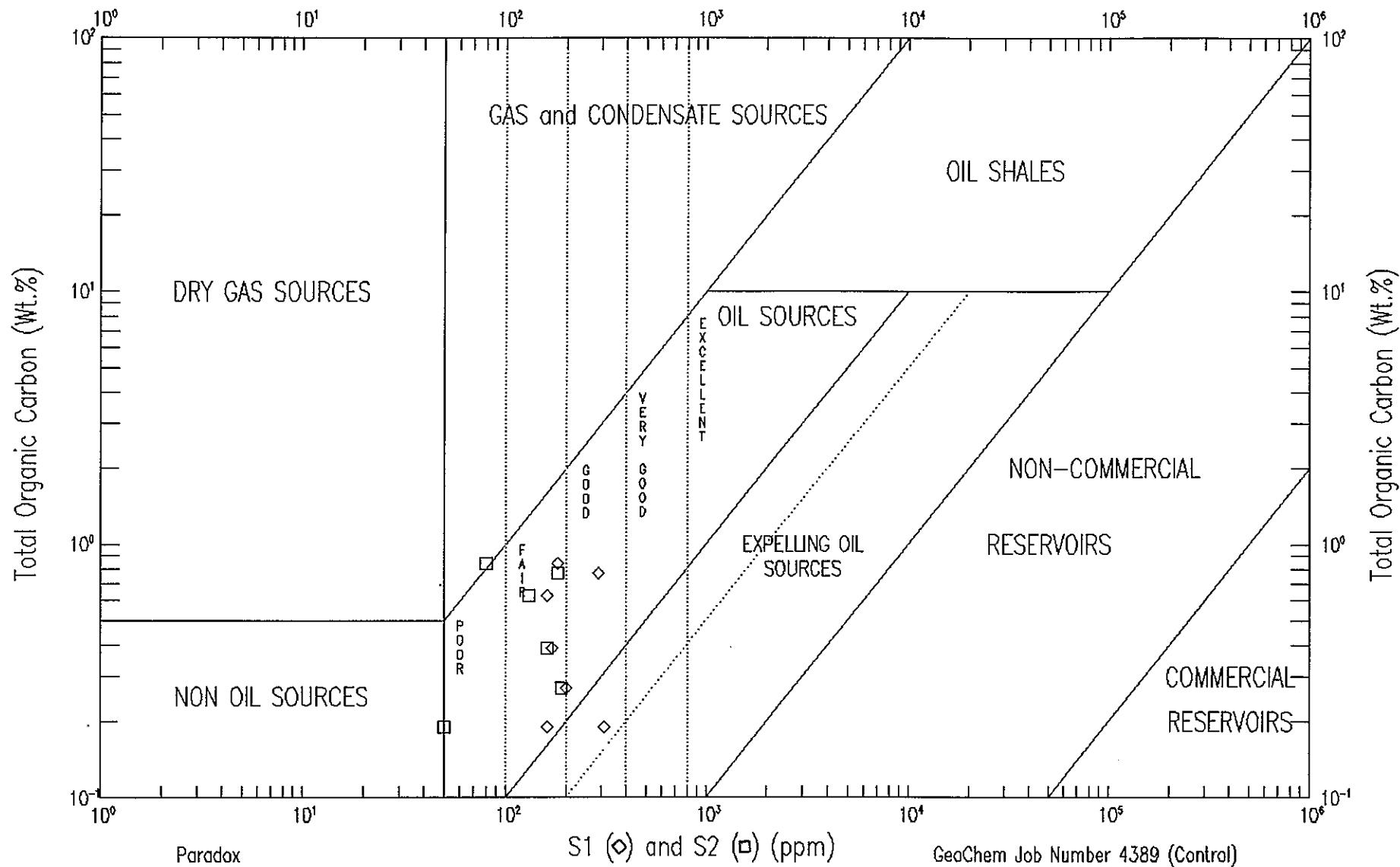
**FIGURE 3-D5**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**PRECAMBRIAN**



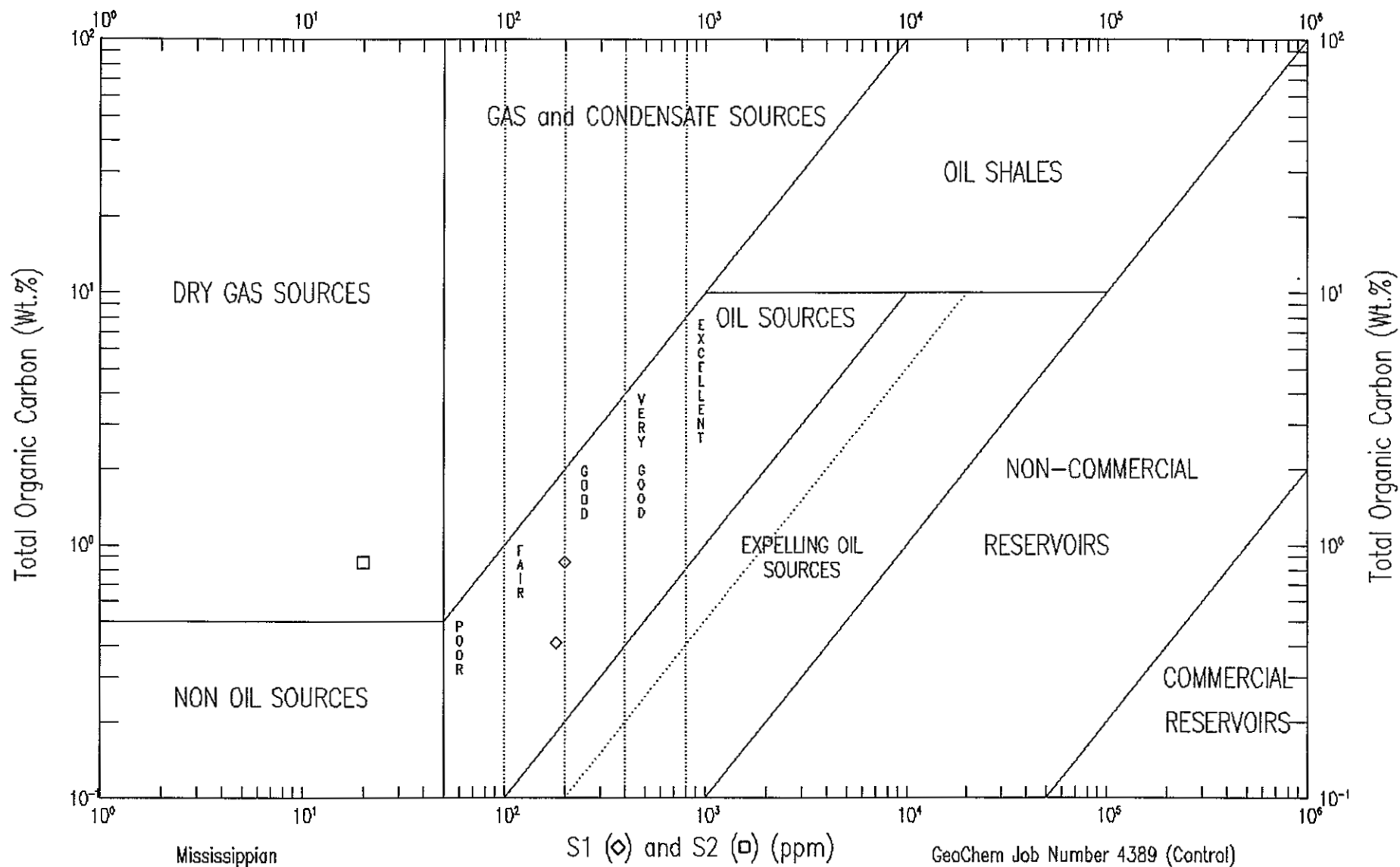
**FIGURE 3-E1**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**CONTROL SAMPLES - PENNSYLVANIAN**



**FIGURE 3-E2**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**CONTROL SAMPLES - PARADOX**



**FIGURE 3-E3**  
**HYDROCARBON SOURCE RICHNESS BY STRATIGRAPHIC SECTION -**  
**CONTROL SAMPLES - MISSISSIPPIAN**



**TABLE II-B**  
**RESULTS OF ROCK-EVAL PYROLYSIS**  
**(ppm wt/wt)**

GeoChem Sample No.	Client Identification	Tmax (°C)	S1 (ppm)	S2 (ppm)	S3 (ppm)	PI	PC*	T.O.C. (wt%)	Hydrogen Index	Oxygen Index
4389-001	11300-11305	260	40	0	340	1.00	0.00	0.38	0	89
4389-011	11350-11355	218	20	0	400	1.00	0.00	0.18	0	218
4389-021	11400-11405	260	50	0	210	1.00	0.00	0.20	0	104
4389-031	11450-11455	260	30	50	90	0.37	0.00	0.20	25	44
4389-041/042	11500-11510	266	50	90	280	0.36	0.01	0.35	26	80
4389-051	11550-11555	292	130	380	280	0.26	0.04	0.21	181	133
4389-061	11600-11605	236	20	0	190	1.00	0.00	0.19	0	100
4389-073	11660-11665	267	50	140	320	0.28	0.01	0.20	71	163
4389-081	11700-11705	200	40	10	260	1.00	0.00	0.20	5	132
4389-090	11745-11750	210	30	0	400	1.00	0.00	0.18	0	225
4389-096	11775-11780	266	20	0	330	1.00	0.00	0.18	0	183
4389-108	11835-11840	264	40	0	490	1.00	0.00	0.28	0	173
4389-113	11860-11865	349	40	10	650	1.00	0.00	0.19	5	342
4389-121	11900-11905	206	40	10	240	1.00	0.00	0.43	2	56
4389-131	11950-11955	646	60	50	360	0.60	0.00	0.34	15	106
4389-141	12000-12005	646	30	30	190	0.50	0.00	0.68	4	28
4389-151	12050-12055	646	50	20	110	0.83	0.00	0.23	9	48
4389-162	12105-12110	646	30	0	90	1.00	0.00	0.17	0	52
4389-177	12180-12185	646	20	10	150	1.00	0.00	0.29	3	51
4389-184	12215-12220	646	20	10	490	1.00	0.00	0.22	5	223
4389-191	12250-12255	646	10	10	140	0.50	0.00	0.23	4	60
4389-202	12305-12310	646	20	0	110	1.00	0.00	0.22	0	49
4389-217	12380-12385	646	140	310	400	0.32	0.03	0.22	139	180
4389-228	12435-12440	646	20	0	390	1.00	0.00	0.16	0	240
4389-230	12445-12450	646	30	0	370	1.00	0.00	0.16	0	238
4389-248	12535-12540	646	40	10	340	1.00	0.00	0.16	6	213
4389-254	12565-12570	646	30	10	470	0.75	0.00	0.65	2	72
4389-261	12600-12605	646	30	20	520	0.75	0.00	0.24	8	213
4389-272	12655-12660	646	10	30	630	0.25	0.00	0.34	9	184
4389C-005C	12710	646	40	0	170	1.00	0.00	0.63	0	27
4389C-007C	12736	646	20	10	70	1.00	0.00	1.15	1	6
4389-295	12770-12775	646	20	10	200	1.00	0.00	0.29	3	69
4389-301	12800-12805	436	10	10	260	0.50	0.00	0.38	3	68
4389-310	12845-12850	374	30	20	610	0.75	0.00	0.40	5	154
4389C-030C	12875	266	50	130	390	0.28	0.01	0.28	46	137
4389C-033C	12878	266	40	50	0	0.50	0.00	0.94	5	137
T.O.C. = Total organic carbon, wt. %			S3 = CO2 produced from kerogen pyrolysis (mg CO2/g of rock)				Oxygen Index = mg CO2/g organic carbon			
S1 = Free Hydrocarbons, mg HC/g of rock			PC* = 0.083 (S1 + S2)				PI = S1/(S1+S2)			
S2 = Residual hydrocarbon potential (mg HC/g of rock)			Hydrogen index = mg HC/g organic carbon				Tmax = Temperature Index, °C.			

**TABLE II-B**  
**RESULTS OF ROCK-EVAL PYROLYSIS**  
(ppm wt/wt)

GeoChem Sample No.	Client Identification	Tmax (°C)	S1 (ppm)	S2 (ppm)	S3 (ppm)	PI	PC*	T.O.C. (wt%)	Hydrogen Index	Oxygen Index
4389C-037C	12882	266	60	110	170	0.37	0.01	0.52	21	33
4389C-042C	12887	266	110	170	120	0.39	0.02	1.10	15	11
4389C-048C	12893	400	30	80	170	0.30	0.00	0.52	15	33
4389-327	12930-12935	290	30	70	170	0.30	0.00	0.33	21	51
4389-338	12985-12990	266	40	120	140	0.25	0.01	0.26	46	54
4389-343	13010-13015	288	40	160	250	0.20	0.01	0.39	41	64
4389-350	13045-13050	266	30	130	440	0.19	0.01	0.29	45	154
4389-360	13095-13100	269	210	77	473	0.73	0.02	0.34	23	141
4389-370	13145-13150	287	50	130	340	0.28	0.01	0.31	42	109
4389-381	13200-13205	266	70	150	400	0.32	0.01	0.30	49	132
4389-390	13245-13250	192	10	20	300	0.50	0.00	0.20	10	147
4389-400	13295-13300	266	40	10	490	1.00	0.00	0.37	3	134
4389-406	13325-13330	263	20	30	160	0.50	0.00	0.23	13	71
4389-418	13385-13390	200	20	30	310	0.50	0.00	0.21	14	149
4389-432	13455-13460	208	30	20	170	0.75	0.00	0.30	7	57
4389-441	13500-13505	221	10	20	120	0.50	0.00	0.35	6	34
4389-456	13575-13580	167	20	20	420	0.50	0.00	0.23	9	179
4389-470	13645-13650	227	20	20	350	0.50	0.00	0.62	3	56
4389-481	13700-13705	199	20	10	320	1.00	0.00	0.42	2	77
4389-491	13750-13755	183	30	20	400	0.75	0.00	0.72	3	56
4389-501	13800-13805	349	30	10	360	0.75	0.00	0.45	2	80
4389-506	13825-13830	214	140	0	600	1.00	0.01	0.39	0	152
4389-514	13865-13870	186	10	20	30	0.50	0.00	0.30	7	10
4389-526	13925-13930	179	40	30	220	0.67	0.00	0.22	14	101
4389-541	14000-14005	153	80	20	280	0.80	0.00	0.27	7	104
4389-581	14200-14205	174	20	0	0	1.00	0.00	0.13	0	0
4389-621	14400-14405	171	20	0	10	1.00	0.00	0.33	0	3
T.O.C. = Total organic carbon, wt. %			S3 = CO2 produced from kerogen pyrolysis (mg CO2/g of rock)			Oxygen Index = mg CO2/g organic carbon				
S1 = Free Hydrocarbons, mg HC/g of rock			PC* = 0.083 (S1 + S2)			PI = S1/(S1+S2)				
S2 = Residual hydrocarbon potential (mg HC/g of rock)			Hydrogen index = mg HC/g organic carbon			Tmax = Temperature Index, °C.				

**TABLE III**  
**SAMPLE LITHOLOGICAL DESCRIPTION, SAMPLE IDENTIFICATION**  
**AND TOTAL ORGANIC CARBON RESULTS**  
**(Picked Control Samples)**

<b>GeoChem Sample Number</b>	<b>Depth (feet)</b>	<b>Lithological Description</b>	<b>GSA Color Code</b>
4389-001A 4389-001B	11300 11300	Shale, slightly calcareous, pale yellowish brown. Shale, slightly calcareous, pale reddish brown.	10YR 6/2 10R 5/4
4389-051A 4389-051B	11550 11550	Shale, noncalcareous, light gray. Shale, noncalcareous, pale reddish brown.	N7 10Y 5/4
4389-177A 4389-177B	12180 12180	Shale, noncalcareous, very light gray. Shale, moderate reddish brown.	N8 10R 4/6
4389-228A 4389-228B	12435 12435	Shale, noncalcareous, very light gray. Shale, slightly calcareous, moderate reddish brown.	N8 10R 4/6
4389-272A 4389-272B	12655 12655	Shale, noncalcareous, yellowish gray. Shale, noncalcareous, pale reddish brown.	5Y 8/1 10R 5/4
4389-327A 4389-327B	12930 12930	Shale, noncalcareous, light brownish gray. Shale, noncalcareous, moderate reddish brown.	5YR 6/1 10R 4/6
4389-360A 4389-360B 4389-360C	13095 13095 13095	Shale, calcareous, pale yellowish brown. Shale, slightly calcareous, moderate reddish brown. Limestone, slightly argillaceous, pinkish gray.	10YR 6/2 10R 4/6 5YR 8/1
4389-506A 4389-506B	13825 13825	Shale, calcareous, pale yellowish brown. Limestone, argillaceous, pale red.	10YR 6/2 10R 6/2

\* Note: Color of ground picked sample.



**TABLE III**  
**SAMPLE LITHOLOGICAL DESCRIPTION, SAMPLE IDENTIFICATION**  
**AND TOTAL ORGANIC CARBON RESULTS**  
**(Picked Control Samples)**

<b>GeoChem Sample Number</b>	<b>Client Identification Number</b>	<b>Total Organic Carbon (% of Rock)</b>
4389-001A	11300	0.99
4389-001B	11300	0.47
4389-051A	11550	1.30
4389-051B	11550	0.16
4389-177A	12180	0.31
4389-177B	12180	0.08
4389-228A	12435	0.31
4389-228B	12435	0.24
4389-272A	12655	0.84
4389-272B	12655	0.39
4389-327A	12930	0.77
4389-327B	12930	0.27
4389-360A	13095	0.63
4389-360B	13095	0.19
4389-360C	13095	0.19
4389-506A	13825	0.86
4389-506B	13825	0.41

**TABLE III-A**  
**RESULTS OF ROCK-EVAL PYROLYSIS (mgm/gram) -**  
**PICKED CONTROL SAMPLES**

GeoChem Sample No.	Client Identification	Tmax (°C)	S1 (mg/g)	S2 (mg/g)	S3 (mg/g)	PI	PC*	T.O.C. (wt%)	Hydrogen Index	Oxygen Index
4389-001A	11300	396	0.21	0.35	0.43	0.37	0.04	0.99	35	43
4389-001B	11300	360	0.23	0.31	0.36	0.43	0.04	0.47	67	77
4389-051A	11550	370	0.11	0.24	0.28	0.32	0.02	1.30	18	22
4389-051B	11550	401	0.10	0.09	0.07	0.56	0.01	0.16	56	44
4389-177A	12180	263	0.12	0.00	0.17	1.00	0.01	0.31	0	54
4389-177B	12180	263	0.08	0.00	0.26	1.00	0.00	0.08	0	326
4389-228A	12435	345	0.10	0.08	0.50	0.56	0.01	0.31	26	161
4389-228B	12435	512	0.11	0.26	0.58	0.31	0.03	0.24	106	237
4389-272A	12655	397	0.18	0.08	0.48	0.69	0.02	0.84	10	57
4389-272B	12655	323	0.17	0.16	0.43	0.53	0.02	0.39	41	109
4389-327A	12930	266	0.29	0.18	0.75	0.63	0.03	0.77	23	97
4389-327B	12930	257	0.20	0.19	0.59	0.53	0.03	0.27	70	218
4389-360A	13095	260	0.16	0.13	0.77	0.57	0.02	0.63	21	123
4389-360B	13095	312	0.16	0.05	0.29	0.80	0.01	0.19	26	154
4389-360C	13095	236	0.31	0.05	0.36	0.86	0.03	0.19	26	187
4389-506A	13825	227	0.20	0.02	0.45	0.91	0.01	0.86	2	52
4389-506B	13825	224	0.18	0.00	0.38	1.00	0.01	0.41	0	93
<div> <div> T.O.C. = Total organic carbon, wt.%  S1 = Free Hydrocarbons, mg HC/g of rock  S2 = Residual hydrocarbon potential  (mg HC/g of rock) </div> <div> S3 = CO2 produced from kerogen pyrolysis  (mg CO2/g of rock)  PC* = 0.083 (S1 + S2)  Hydrogen Index = mg HC/g organic carbon </div> <div> Oxygen Index = mg CO2/g organic carbon  PI = S1/(S1+S2)  Tmax = Temperature Index, °C. </div> </div>										

**TABLE III-B**  
**RESULTS OF ROCK-EVAL PYROLYSIS (ppm wt/wt) -**  
**PICKED CONTROL SAMPLES**

GeoChem Sample No.	Client Identification	Tmax (°C)	S1 (ppm)	S2 (ppm)	S3 (ppm)	PI	PC*	T.O.C. (wt%)	Hydrogen Index	Oxygen Index
4389-001A	11300	396	210	350	430	0.37	0.04	0.99	35	43
4389-001B	11300	360	230	310	360	0.43	0.04	0.47	67	77
4389-051A	11550	370	110	240	280	0.32	0.02	1.30	18	22
4389-051B	11550	401	100	90	70	0.56	0.01	0.16	56	44
4389-177A	12180	263	120	0	170	1.00	0.01	0.31	0	54
4389-177B	12180	263	80	0	260	1.00	0.00	0.08	0	326
4389-228A	12435	345	100	80	500	0.56	0.01	0.31	26	161
4389-228B	12435	512	110	260	580	0.31	0.03	0.24	106	237
4389-272A	12655	397	180	80	480	0.69	0.02	0.84	10	57
4389-272B	12655	323	170	160	430	0.53	0.02	0.39	41	109
4389-327A	12930	266	290	180	750	0.63	0.03	0.77	23	97
4389-327B	12930	257	200	190	590	0.53	0.03	0.27	70	218
4389-360A	13095	260	160	130	770	0.57	0.02	0.63	21	123
4389-360B	13095	312	160	50	290	0.80	0.01	0.19	26	154
4389-360C	13095	236	310	50	360	0.86	0.03	0.19	26	187
4389-506A	13825	227	200	20	450	0.91	0.01	0.86	2	52
4389-506B	13825	224	180	0	380	1.00	0.01	0.41	0	93
<div> <div> T.O.C. = Total organic carbon, wt.%  S1 = Free Hydrocarbons, mg HC/g of rock  S2 = Residual hydrocarbon potential  (mg HC/g of rock) </div> <div> S3 = CO2 produced from kerogen pyrolysis  (mg CO2/g of rock)  PC* = 0.083 (S1 + S2)  Hydrogen index = mg HC/g organic carbon </div> <div> Oxygen Index = mg CO2/g organic carbon  PI = S1/(S1+S2)  Tmax = Temperature Index, °C. </div> </div>										

**TABLE IV-A**  
**SUMMARY OF ORGANIC CARBON AND VISUAL KEROGEN DATA**

GEOCHEM SAMPLE NUMBER	CLIENT IDENTIFICATION NUMBER	TOTAL ORGANIC CARBON	ORGANIC MATTER TYPE	VISUAL ABUNDANCE NORMALIZED PERCENT					ALTERATION STAGE	THERMAL ALTERATION INDEX
				AL	AM	H	W	I		
4389-041/042	11500-11505	0.35	W-I;H;-	0	0	27	36	36	2+ to 3-	2.8
4389-131	11950-11955	0.34	H-W-I;-;-	0	0	33	33	33	2+ to 3-	2.8
4389-248	12535-12540	0.16	H-W;I;-	0	0	36	36	27	2+ to 3-	2.9
4389-261	12600-12605	0.24	H-W;I;Am	0	8	33	33	25	2+ to 3-	2.9
4389C-005C	12710	0.63; 0.70R	W-I;H;-	0	0	27	36	36	3 to 3+	3.5
4389-310	12845-12850	0.40	W-I;H;-	0	0	27	36	36	3 to 3+	3.5
4389C-042C	12887	1.10	W-I;-;H	0	0	11	44	44	3 to 3+	3.5
4389-350	13045-13050	0.29	W-I;H;-	0	0	27	36	36	3 to 3+	3.5
4389-400	13295-13300	0.37	W-I;H;-	0	0	27	36	36	3 to 3+	3.5
4389-456	13575-13580	0.23	W-I;H;-	0	0	27	36	36	3 to 3+	3.5
4389-501	13800-13805	0.45	H-W-I;-;-	0	0	33	33	33	3 to 3+	3.5
4389-526	13925-13930	0.22	H-I;W;-	0	0	40	20	40	3 to 3+	3.5
4389-581	14200-14205	0.13	H-I;-;-	0	0	50	0	50	3+	3.8

LEGEND:

KEROGEN KEY

Predominant; 60-100%	Secondary; 20-40%	Trace 0-20%
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Al	=	Algal
Am	=	Amorphous-Sapropel
Am**	=	Relic Amorphous-Sapropel
H	=	Herbaceous-Spore/Pollen
H*	=	Degraded Herbaceous

W	=	Woody-Structured
U	=	Unidentified Material
I	=	Inertinite
C	=	Coaly

# VISUAL KEROGEN ASSESSMENT WORKSHEET

[illegible]

**TABLE IV - C - 4389**  
**OIL AND GAS FACTORS BASED ON ORGANIC FACIES TYPE**

GeoChem Sample Number	Depth (feet)	Am(Al)	H	W	I	Oil * Factor (OF)	Gas ** Factor (GF)
4389-041/042	11500-11505	-	16.2	10.8	3.6	30.6	69.4
4389-131	11950-11955	-	19.8	9.9	3.3	33.0	67.0
4389-248	12535-12540	-	21.6	10.8	2.7	35.1	64.9
4389-261	12600-12605	7.2	19.8	9.9	2.5	39.4	60.6
4389-005C	12710	-	16.2	10.8	3.6	30.6	69.4
4389-310	12845-12850	-	16.2	10.8	3.6	30.6	69.4
4389-042C	12887	-	6.6	13.2	4.4	24.2	75.8
4389-350	13045-13050	-	16.2	10.8	3.6	30.6	69.4
4389-400	13295-13300	-	16.2	10.8	3.6	30.6	69.4
4389-456	13575-13580	-	16.2	10.8	3.6	30.6	69.4
4389-501	13800-13805	-	19.8	9.9	3.3	33.0	67.0
4389-526	13925-13930	-	24.0	6.0	4.0	34.0	66.0
4389-581	14200-14205	-	30.0	0.0	5.0	35.0	65.0

\* Oil Factor (OF) = (%Am(Al)\*0.9)+(%H\*0.6)+(%W\*0.3)+(I\*0.1)

\*\* Gas Factor (GF) = (100 - Oil Factor (OF))

## **APPENDIX I**

### **SAMPLE IDENTIFICATION**

# APPENDIX I

## Sample Identification

GeoChem Sample Number	Depth (feet)	GeoChem Sample Number	Depth (feet)	GeoChem Sample Number	Depth (feet)
4389-001	11300-11305	4389-039	11490-11495	4389-077	11680-11685
4389-002	11305-11310	4389-040	11495-11500	4389-078	11685-11690
4389-003	11310-11315	4389-041	11500-11505	4389-079	11690-11695
4389-004	11315-11320	4389-042	11505-11510	4389-080	11695-11700
4389-005	11320-11325	4389-043	11510-11515	4389-081	11700-11705
4389-006	11325-11330	4389-044	11515-11520	4389-082	11705-11710
4389-007	11330-11335	4389-045	11520-11525	4389-083	11710-11715
4389-008	11335-11340	4389-046	11525-11530	4389-084	11715-11720
4389-009	11340-11345	4389-047	11530-11535	4389-085	11720-11725
4389-010	11345-11350	4389-048	11535-11540	4389-086	11725-11730
4389-011	11350-11355	4389-049	11540-11545	4389-087	11730-11735
4389-012	11355-11360	4389-050	11545-11550	4389-088	11735-11740
4389-013	11360-11365	4389-051	11550-11555	4389-089	11740-11745
4389-014	11365-11370	4389-052	11555-11560	4389-090	11745-11750
4389-015	11370-11375	4389-053	11560-11565	4389-091	11750-11755
4389-016	11375-11380	4389-054	11565-11570	4389-092	11755-11760
4389-017	11380-11385	4389-055	11570-11575	4389-093	11760-11765
4389-018	11385-11390	4389-056	11575-11580	4389-094	11765-11770
4389-019	11390-11395	4389-057	11580-11585	4389-095	11770-11775
4389-020	11395-11400	4389-058	11585-11590	4389-096	11775-11780
4389-021	11400-11405	4389-059	11590-11595	4389-097	11780-11785
4389-022	11405-11410	4389-060	11595-11600	4389-098	11785-11790
4389-023	11410-11415	4389-061	11600-11605	4389-099	11790-11795
4389-024	11415-11420	4389-062	11605-11610	4389-100	11795-11800
4389-025	11420-11425	4389-063	11610-11615	4389-101	11800-11805
4389-026	11425-11430	4389-064	11615-11620	4389-102	11805-11810
4389-027	11430-11435	4389-065	11620-11625	4389-103	11810-11815
4389-028	11435-11440	4389-066	11625-11630	4389-104	11815-11820
4389-029	11440-11445	4389-067	11630-11635	4389-105	11820-11825
4389-030	11445-11450	4389-068	11635-11640	4389-106	11825-11830
4389-031	11450-11455	4389-069	11640-11645	4389-107	11830-11835
4389-032	11455-11460	4389-070	11645-11650	4389-108	11835-11840
4389-033	11460-11465	4389-071	11650-11655	4389-109	11840-11845
4389-034	11465-11470	4389-072	11655-11660	4389-110	11845-11850
4389-035	11470-11475	4389-073	11660-11665	4389-111	11850-11855
4389-036	11475-11480	4389-074	11665-11670	4389-112	11855-11860
4389-037	11480-11485	4389-075	11670-11675	4389-113	11860-11865
4389-038	11485-11490	4389-076	11675-11680	4389-114	11865-11870



# APPENDIX I

## Sample Identification

GeoChem Sample Number	Depth (feet)
4389-115	11870-11875
4389-116	11875-11880
4389-117	11880-11885
4389-118	11885-11890
4389-119	11890-11895
4389-120	11895-11900
4389-121	11900-11905
4389-122	11905-11910
4389-123	11910-11915
4389-124	11915-11920
4389-125	11920-11925
4389-126	11925-11930
4389-127	11930-11935
4389-128	11935-11940
4389-129	11940-11945
4389-130	11945-11950
4389-131	11950-11955
4389-132	11955-11960
4389-133	11960-11965
4389-134	11965-11970
4389-135	11970-11975
4389-136	11975-11980
4389-137	11980-11985
4389-138	11985-11990
4389-139	11990-11995
4389-140	11995-12000
4389-141	12000-12005
4389-142	12005-12010
4389-143	12010-12015
4389-144	12015-12020
4389-145	12020-12025
4389-146	12025-12030
4389-147	12030-12035
4389-148	12035-12040
4389-149	12040-12045
4389-150	12045-12050
4389-151	12050-12055
4389-152	12055-12060

GeoChem Sample Number	Depth (feet)
4389-153	12060-12065
4389-154	12065-12070
4389-155	12070-12075
4389-156	12075-12080
4389-157	12080-12085
4389-158	12085-12090
4389-159	12090-12095
4389-160	12095-12100
4389-161	12100-12105
4389-162	12105-12110
4389-163	12110-12115
4389-164	12115-12120
4389-165	12120-12125
4389-166	12125-12130
4389-167	12130-12135
4389-168	12135-12140
4389-169	12140-12145
4389-170	12145-12150
4389-171	12150-12155
4389-172	12155-12160
4389-173	12160-12165
4389-174	12165-12170
4389-175	12170-12175
4389-176	12175-12180
4389-177	12180-12185
4389-178	12185-12190
4389-179	12190-12195
4389-180	12195-12200
4389-181	12200-12205
4389-182	12205-12210
4389-183	12210-12215
4389-184	12215-12220
4389-185	12220-12225
4389-186	12225-12230
4389-187	12230-12235
4389-188	12235-12240
4389-189	12240-12245
4389-190	12245-12250

GeoChem Sample Number	Depth (feet)
4389-191	12250-12255
4389-192	12255-12260
4389-193	12260-12265
4389-194	12265-12270
4389-195	12270-12275
4389-196	12275-12280
4389-197	12280-12285
4389-198	12285-12290
4389-199	12290-12295
4389-200	12295-12300
4389-201	12300-12305
4389-202	12305-12310
4389-203	12310-12315
4389-204	12315-12320
4389-205	12320-12325
4389-206	12325-12330
4389-207	12330-12335
4389-208	12335-12340
4389-209	12340-12345
4389-210	12345-12350
4389-211	12350-12355
4389-212	12355-12360
4389-213	12360-12365
4389-214	12365-12370
4389-215	12370-12375
4389-216	12375-12380
4389-217	12380-12385
4389-218	12385-12390
4389-219	12390-12395
4389-220	12395-12400
4389-221	12400-12405
4389-222	12405-12410
4389-223	12410-12415
4389-224	12415-12420
4389-225	12420-12425
4389-226	12425-12430
4389-227	12430-12435
4389-228	12435-12440

# APPENDIX I

## Sample Identification

GeoChem Sample Number	Depth (feet)	GeoChem Sample Number	Depth (feet)	GeoChem Sample Number	Depth (feet)
4389-229	12440-12445	4389-267	12630-12635	4389-305	12820-12825
4389-230	12445-12450	4389-268	12635-12640	4389-306	12825-12830
4389-231	12450-12455	4389-269	12640-12645	4389-307	12830-12835
4389-232	12455-12460	4389-270	12645-12650	4389-308	12835-12840
4389-233	12460-12465	4389-271	12650-12655	4389-309	12840-12845
4389-234	12465-12470	4389-272	12655-12660	4389-310	12845-12850
4389-235	12470-12475	4389-273	12660-12665	4389-311	12850-12855
4389-236	12475-12480	4389-274	12665-12670	4389-312	12855-12860
4389-237	12480-12485	4389-275	12670-12675	4389-313	12860-12865
4389-238	12485-12490	4389-276	12675-12680	4389-314	12865-12870
4389-239	12490-12495	4389-277	12680-12685	4389-315	12870-12875
4389-240	12495-12500	4389-278	12685-12690	4389-316	12875-12880
4389-241	12500-12505	4389-279	12690-12695	4389-317	12880-12885
4389-242	12505-12510	4389-280	12695-12700	4389-318	12885-12890
4389-243	12510-12515	4389-281	12700-12705	4389-319	12890-12895
4389-244	12515-12520	4389-282	12705-12710	4389-320	12895-12900
4389-245	12520-12525	4389-283	12710-12715	4389-321	12900-12905
4389-246	12525-12530	4389-284	12715-12720	4389-322	12905-12910
4389-247	12530-12535	4389-285	12720-12725	4389-323	12910-12915
4389-248	12535-12540	4389-286	12725-12730	4389-324	12915-12920
4389-249	12540-12545	4389-287	12730-12735	4389-325	12920-12925
4389-250	12545-12550	4389-288	12735-12740	4389-326	12925-12930
4389-251	12550-12555	4389-289	12740-12745	4389-327	12930-12935
4389-252	12555-12560	4389-290	12745-12750	4389-328	12935-12940
4389-253	12560-12565	4389-291	12750-12755	4389-329	12940-12945
4389-254	12565-12570	4389-292	12755-12760	4389-330	12945-12950
4389-255	12570-12575	4389-293	12760-12765	4389-331	12950-12955
4389-256	12575-12580	4389-294	12765-12770	4389-332	12955-12960
4389-257	12580-12585	4389-295	12770-12775	4389-333	12960-12965
4389-258	12585-12590	4389-296	12775-12780	4389-334	12965-12970
4389-259	12590-12595	4389-297	12780-12785	4389-335	12970-12975
4389-260	12595-12600	4389-298	12785-12790	4389-336	12975-12980
4389-261	12600-12605	4389-299	12790-12795	4389-337	12980-12985
4389-262	12605-12610	4389-300	12795-12800	4389-338	12985-12990
4389-263	12610-12615	4389-301	12800-12805	4389-339	12990-12995
4389-264	12615-12620	4389-302	12805-12810	4389-340	12995-13000
4389-265	12620-12625	4389-303	12810-12815	4389-341	13000-13005
4389-266	12625-12630	4389-304	12815-12820	4389-342	13005-13010

# APPENDIX I

## Sample Identification

GeoChem Sample Number	Depth (feet)
4389-343	13010-13015
4389-344	13015-13020
4389-345	13020-13025
4389-346	13025-13030
4389-347	13030-13035
4389-348	13035-13040
4389-349	13040-13045
4389-350	13045-13050
4389-351	13050-13055
4389-352	13055-13060
4389-353	13060-13065
4389-354	13065-13070
4389-355	13070-13075
4389-356	13075-13080
4389-357	13080-13085
4389-358	13085-13090
4389-359	13090-13095
4389-360	13095-13100
4389-361	13100-13105
4389-362	13105-13110
4389-363	13110-13115
4389-364	13115-13120
4389-365	13120-13125
4389-366	13125-13130
4389-367	13130-13135
4389-368	13135-13140
4389-369	13140-13145
4389-370	13145-13150
4389-371	13150-13155
4389-372	13155-13160
4389-373	13160-13165
4389-374	13165-13170
4389-375	13170-13175
4389-376	13175-13180
4389-377	13180-13185
4389-378	13185-13190
4389-379	13190-13195
4389-380	13195-13200

GeoChem Sample Number	Depth (feet)
4389-381	13200-13205
4389-382	13205-13210
4389-383	13210-13215
4389-384	13215-13220
4389-385	13220-13225
4389-386	13225-13230
4389-387	13230-13235
4389-388	13235-13240
4389-389	13240-13245
4389-390	13245-13250
4389-391	13250-13255
4389-392	13255-13260
4389-393	13260-13265
4389-394	13265-13270
4389-395	13270-13275
4389-396	13275-13280
4389-397	13280-13285
4389-398	13285-13290
4389-399	13290-13295
4389-400	13295-13300
4389-401	13300-13305
4389-402	13305-13310
4389-403	13310-13315
4389-404	13315-13320
4389-405	13320-13325
4389-406	13325-13330
4389-407	13330-13335
4389-408	13335-13340
4389-409	13340-13345
4389-410	13345-13350
4389-411	13350-13355
4389-412	13355-13360
4389-413	13360-13365
4389-414	13365-13370
4389-415	13370-13375
4389-416	13375-13380
4389-417	13380-13385
4389-418	13385-13390

GeoChem Sample Number	Depth (feet)
4389-419	13390-13395
4389-420	13395-13400
4389-421	13400-13405
4389-422	13405-13410
4389-423	13410-13415
4389-424	13415-13420
4389-425	13420-13425
4389-426	13425-13430
4389-427	13430-13435
4389-428	13435-13440
4389-429	13440-13445
4389-430	13445-13450
4389-431	13450-13455
4389-432	13455-13460
4389-433	13460-13465
4389-434	13465-13470
4389-435	13470-13475
4389-436	13475-13480
4389-437	13480-13485
4389-438	13485-13490
4389-439	13490-13495
4389-440	13495-13500
4389-441	13500-13505
4389-442	13505-13510
4389-443	13510-13515
4389-444	13515-13520
4389-445	13520-13525
4389-446	13525-13530
4389-447	13530-13535
4389-448	13535-13540
4389-449	13540-13545
4389-450	13545-13550
4389-451	13550-13555
4389-452	13555-13560
4389-453	13560-13565
4389-454	13565-13570
4389-455	13570-13575
4389-456	13575-13580

# APPENDIX I

## Sample Identification

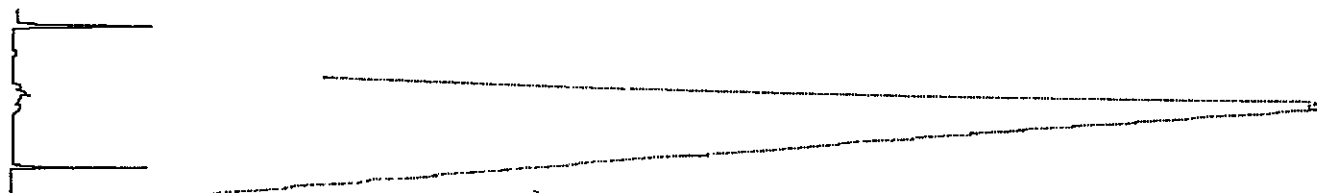
GeoChem Sample Number	Depth (feet)	GeoChem Sample Number	Depth (feet)	GeoChem Sample Number	Depth (feet)
4389-457	13580-13585	4389-495	13770-13775	4389-533	13960-13965
4389-458	13585-13590	4389-496	13775-13780	4389-534	13965-13970
4389-459	13590-13595	4389-497	13780-13785	4389-535	13970-13975
4389-460	13595-13600	4389-498	13785-13790	4389-536	13975-13980
4389-461	13600-13605	4389-499	13790-13795	4389-537	13980-13985
4389-462	13605-13610	4389-500	13795-13800	4389-538	13985-13990
4389-463	13610-13615	4389-501	13800-13805	4389-539	13990-13995
4389-464	13615-13620	4389-502	13805-13810	4389-540	13995-14000
4389-465	13620-13625	4389-503	13810-13815	4389-541	14000-14005
4389-466	13625-13630	4389-504	13815-13820	4389-542	14005-14010
4389-467	13630-13635	4389-505	13820-13825	4389-543	14010-14015
4389-468	13635-13640	4389-506	13825-13830	4389-544	14015-14020
4389-469	13640-13645	4389-507	13830-13835	4389-545	14020-14025
4389-470	13645-13650	4389-508	13835-13840	4389-546	14025-14030
4389-471	13650-13655	4389-509	13840-13845	4389-547	14030-14035
4389-472	13655-13660	4389-510	13845-13850	4389-548	14035-14040
4389-473	13660-13665	4389-511	13850-13855	4389-549	14040-14045
4389-474	13665-13670	4389-512	13855-13860	4389-550	14045-14050
4389-475	13670-13675	4389-513	13860-13865	4389-551	14050-14055
4389-476	13675-13680	4389-514	13865-13870	4389-552	14055-14060
4389-477	13680-13685	4389-515	13870-13875	4389-553	14060-14065
4389-478	13685-13690	4389-516	13875-13880	4389-554	14065-14070
4389-479	13690-13695	4389-517	13880-13885	4389-555	14070-14075
4389-480	13695-13700	4389-518	13885-13890	4389-556	14075-14080
4389-481	13700-13705	4389-519	13890-13895	4389-557	14080-14085
4389-482	13705-13710	4389-520	13895-13900	4389-558	14085-14090
4389-483	13710-13715	4389-521	13900-13905	4389-559	14090-14095
4389-484	13715-13720	4389-522	13905-13910	4389-560	14095-14100
4389-485	13720-13725	4389-523	13910-13915	4389-561	14100-14105
4389-486	13725-13730	4389-524	13915-13920	4389-562	14105-14110
4389-487	13730-13735	4389-525	13920-13925	4389-563	14110-14115
4389-488	13735-13740	4389-526	13925-13930	4389-564	14115-14120
4389-489	13740-13745	4389-527	13930-13935	4389-565	14120-14125
4389-490	13745-13750	4389-528	13935-13940	4389-566	14125-14130
4389-491	13750-13755	4389-529	13940-13945	4389-567	14130-14135
4389-492	13755-13760	4389-530	13945-13950	4389-568	14135-14140
4389-493	13760-13765	4389-531	13950-13955	4389-569	14140-14145
4389-494	13765-13770	4389-532	13955-13960	4389-570	14145-14150

**APPENDIX II**  
**ROCK-EVAL PYROGRAMS**  
**(Picked Control Samples)**

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-051A 98.4: 379: 0.11: 0.24: 0.28: 0.32: 0.85: 0.02: 1.30 : 18 : 22 :

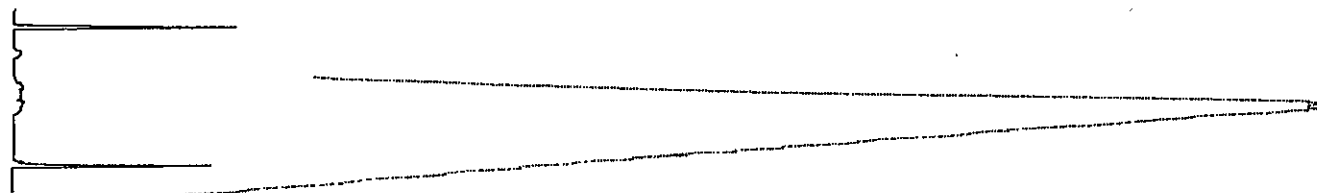


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-001B 94.1: 366: 0.23: 0.31: 0.36: 0.43: 0.86: 0.04: 0.47 : 67 : 77 :

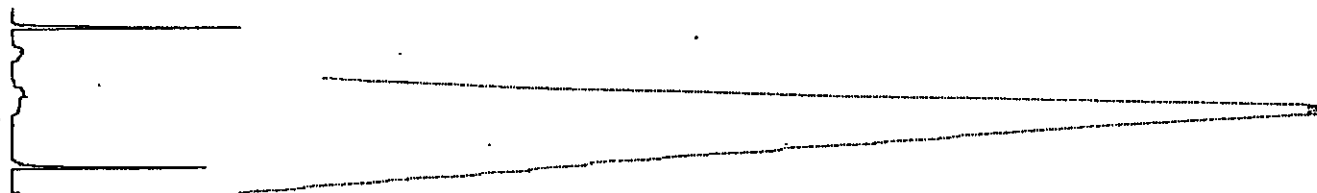


DATE: 15-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

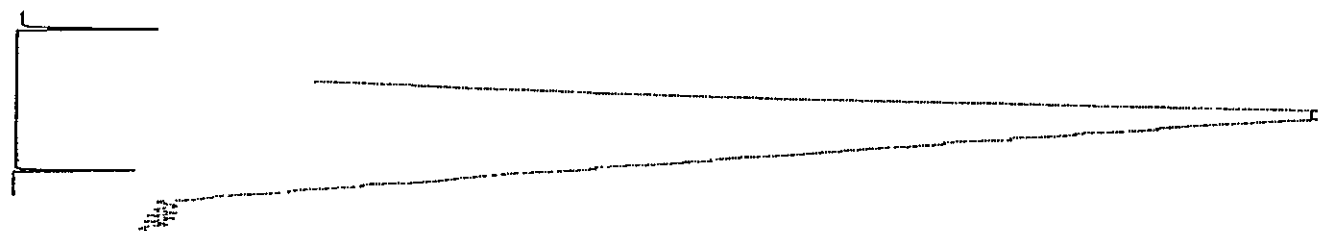
4389-001A 93.9: 396: 0.21: 0.35: 0.43: 0.37: 0.81: 0.04: 0.99 : 35 : 43 :



INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-177B 94.1: 263: 0.08: 0.00: 0.26: 1.00: 0.00: 0.00: 0.08 : 0 : 326 :

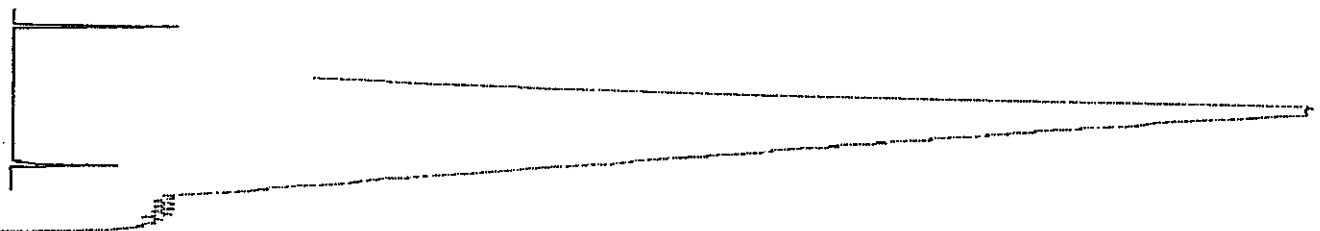


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-177A 92.8: 263: 0.12: 0.00: 0.17: 1.00: 0.00: 0.01: 0.31 : 0 : 54 :

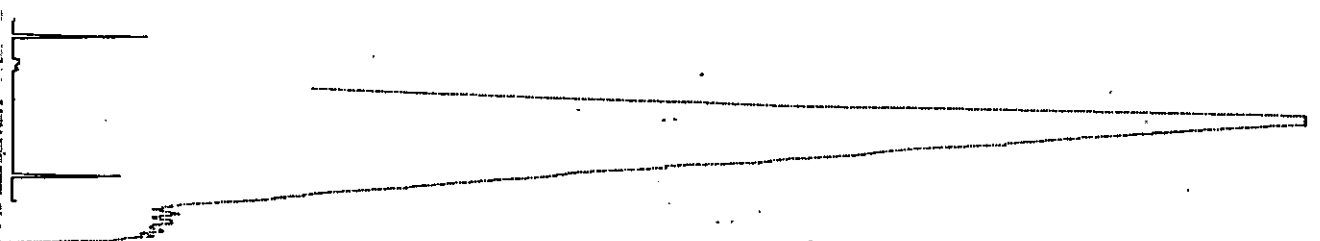


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-051B 94.4: 401: 0.10: 0.09: 0.07: 0.56: 1.28: 0.01: 0.16 : 56 : 44 :



**APPENDIX III**  
**ROCK-EVAL PYROGRAMS**  
**(Total Data Base)**

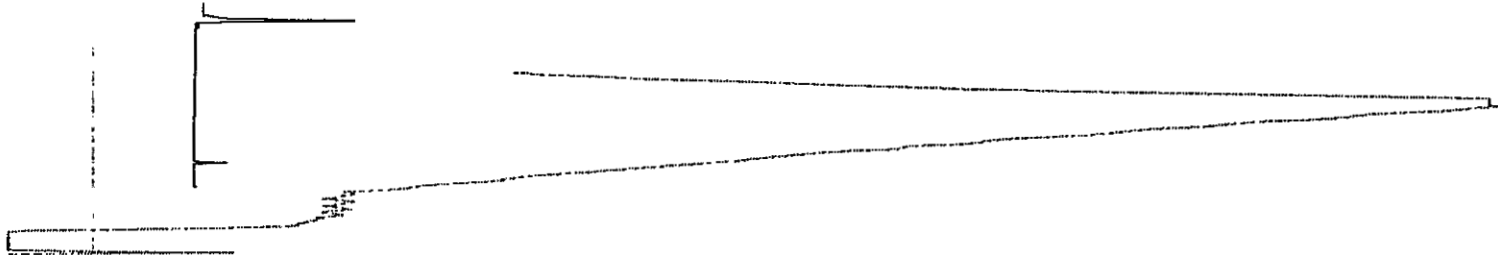


IN : IE : F : 200 : 150 : IM : 3 : 20 : I : 0 : IE : 25 : 10 : S : 1 : 3 :  
 : DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :  
 4389-021: 97.7: 260: 0.05: 0.00: 0.21: 1.00: 0.00: 0.00: 0.20 : 0 : 104 :



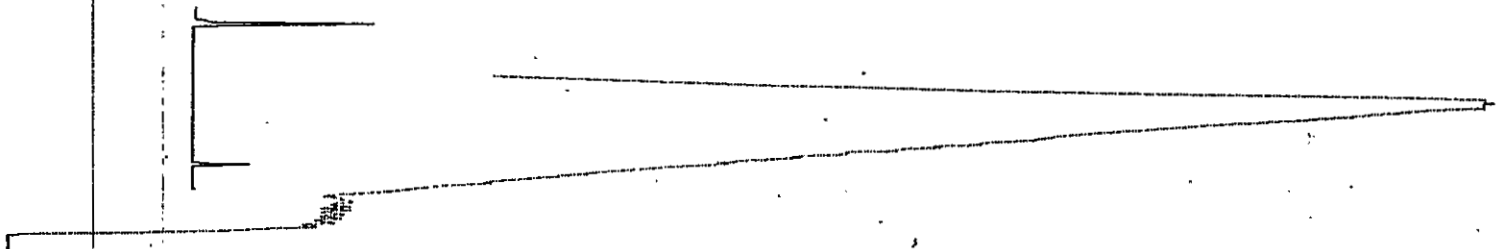
DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390  
 : DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :  
 4389-011: 96.3: 218: 0.02: 0.00: 0.40: 1.00: 0.00: 0.00: 0.18 : 0 : 218 :



DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

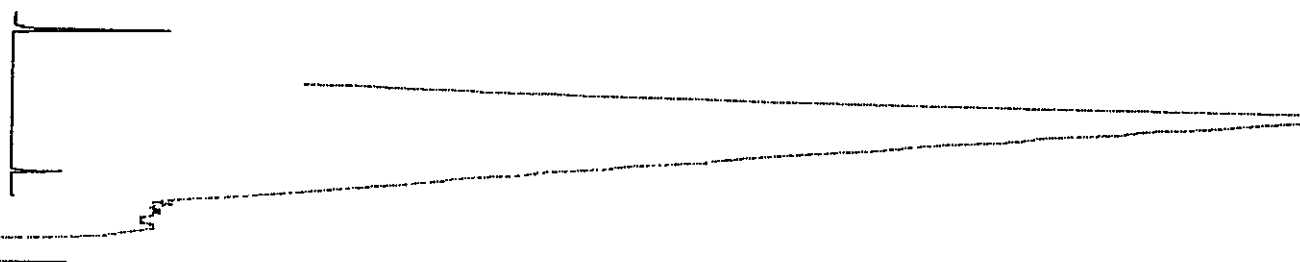
INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390  
 : DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :  
 4389-001: 94.3: 260: 0.04: 0.00: 0.34: 1.00: 0.00: 0.00: 0.38 : 0 : 89 :





DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-081: 97.2: 299: 0.04: 0.01: 0.26: 1.00: 0.03: 0.00: 0.20 : 5 : 132

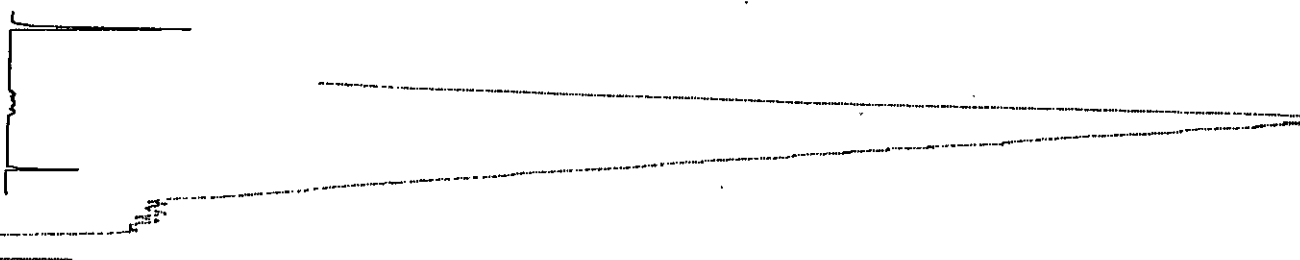


DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-073: 95.3: 267: 0.05: 0.14: 0.32: 0.28: 0.43: 0.01: 0.21 : 71 : 163

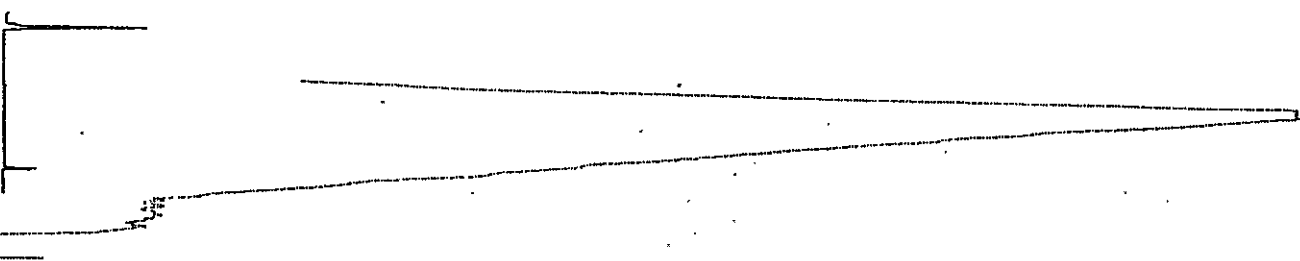


DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

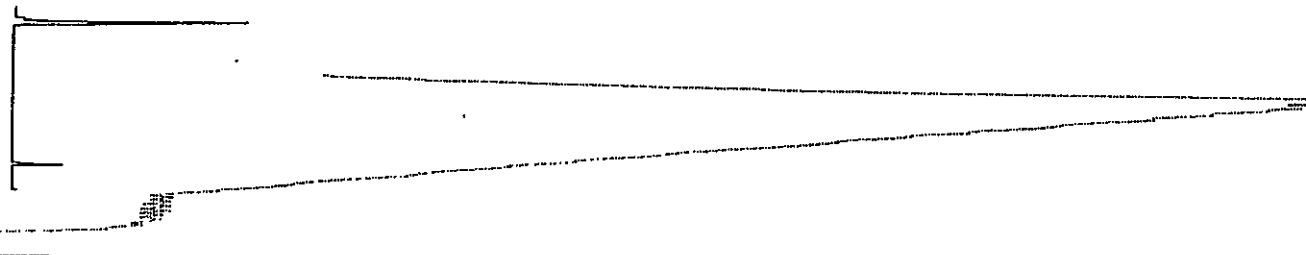
DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-061: 97.9: 236: 0.02: 0.00: 0.19: 1.00: 0.00: 0.00: 0.19 : 0 : 100



INITIAL TEMPERATURE: 250.00 : ISO TIME = 5 : TEMP GRADIENT = 25 : TRAP STOP T = 390  
 : DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-108: 95.0: 264: 0.04: 0.00: 0.49: 1.00: 0.00: 0.00: 0.28 : 0 : 173 :



DATE: 20-07-97

ANALYSIS

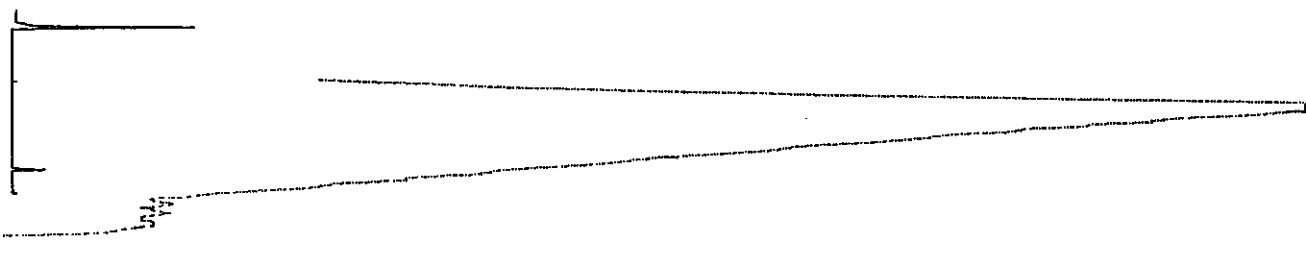
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

: DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-096: 97.8: 266: 0.02: 0.00: 0.33: 1.00: 0.00: 0.00: 0.18 : 0 : 183 :



DATE: 20-07-97

ANALYSIS

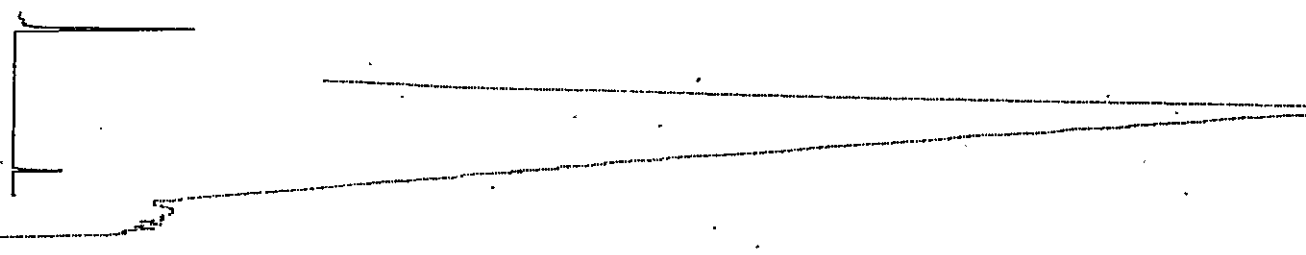
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

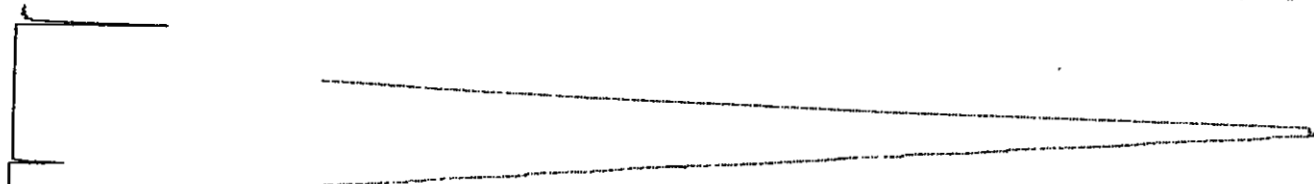
: DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-090: 98.5: 210: 0.03: 0.00: 0.40: 1.00: 0.00: 0.00: 0.18 : 0 : 225 :



DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-131: 94.4: 646: 0.06: 0.05: 0.36: 0.60: 0.13: 0.00: 0.34 : 15 : 106

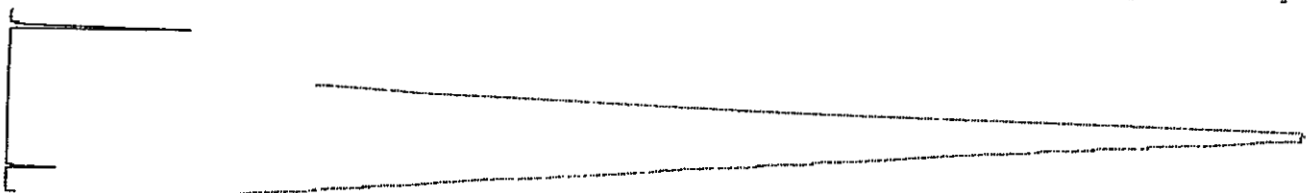


DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-121: 96.2: 206: 0.04: 0.01: 0.24: 1.00: 0.04: 0.00: 0.43 : 2 : 56

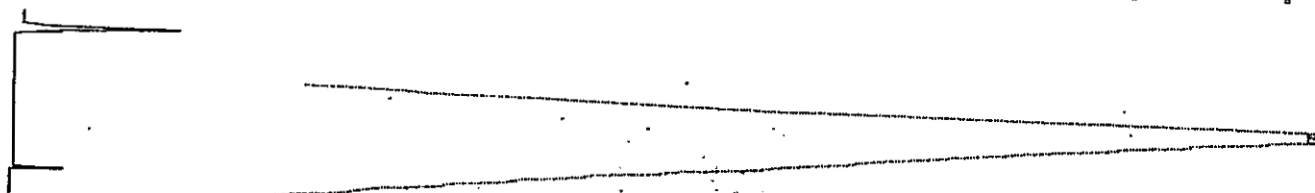


DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

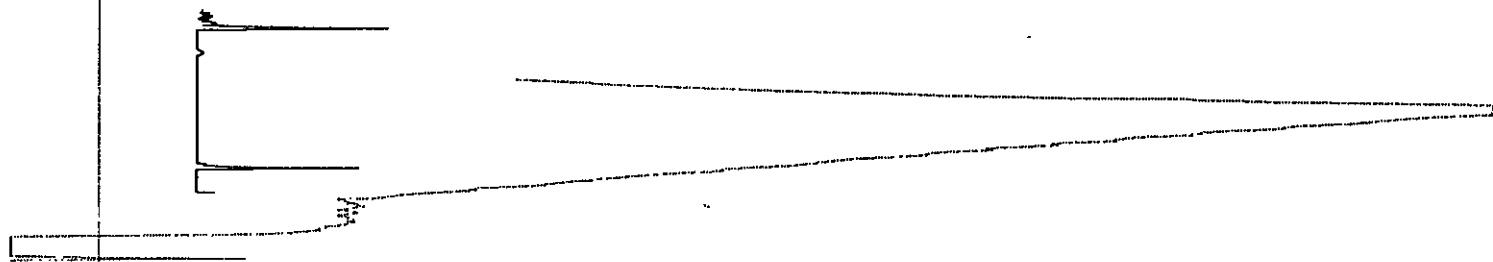
4389-113: 97.7: 349: 0.04: 0.01: 0.65: 1.00: 0.01: 0.00: 0.19 : 5 : 342



INIT TEMP - 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-272A 99.7: 397: 0.18: 0.08: 0.48: 0.69: 0.16: 0.02: 0.84 : 10 : 57

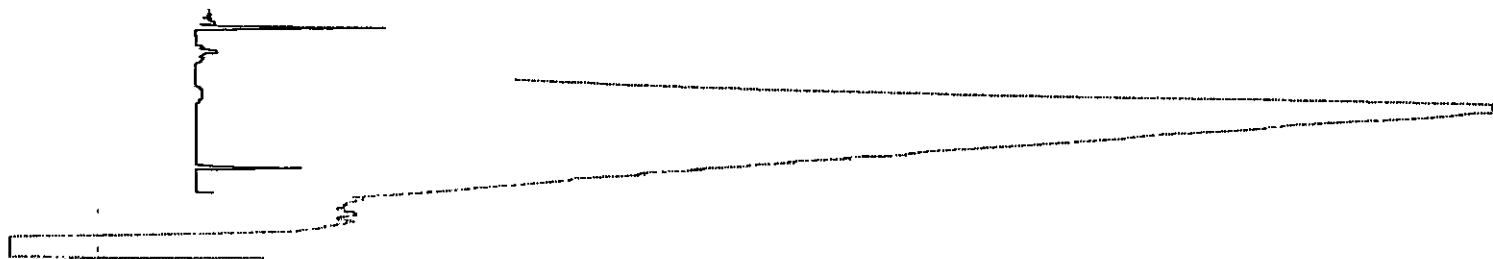


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP - 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-228B 93.8: 512: 0.11: 0.26: 0.58: 0.31: 0.44: 0.03: 0.24 : 106 : 237

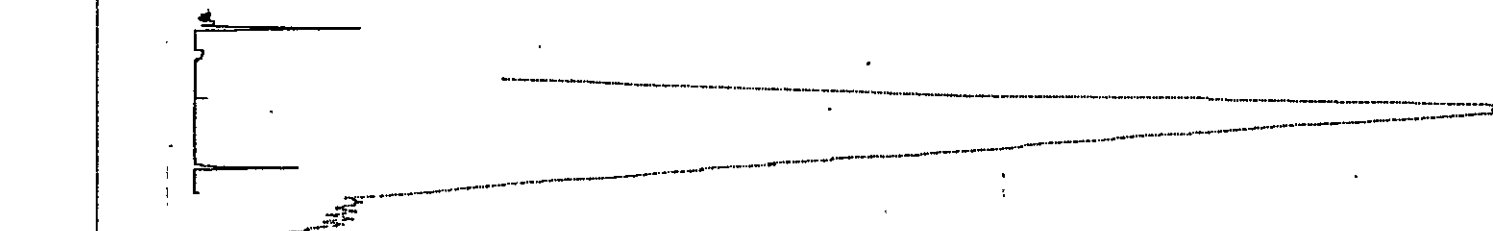


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP - 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

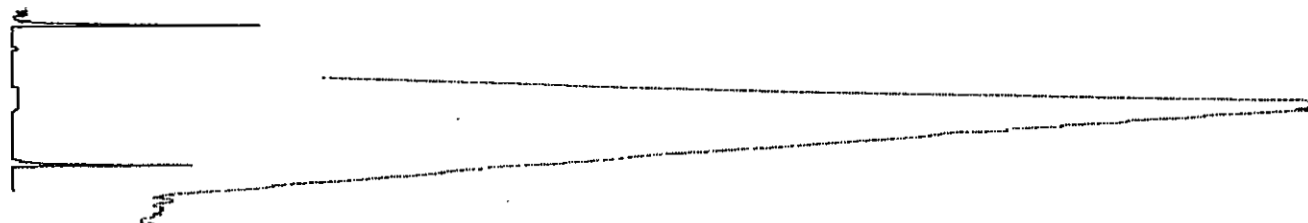
4389-228A 97.2: 345: 0.10: 0.08: 0.50: 0.56: 0.16: 0.01: 0.31 : 26 : 161



INITIAL TEMP - 350 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-3276 98.1: 257: 0.20: 0.19: 0.59: 0.53: 0.32: 0.03: 0.27 : 70 : 218

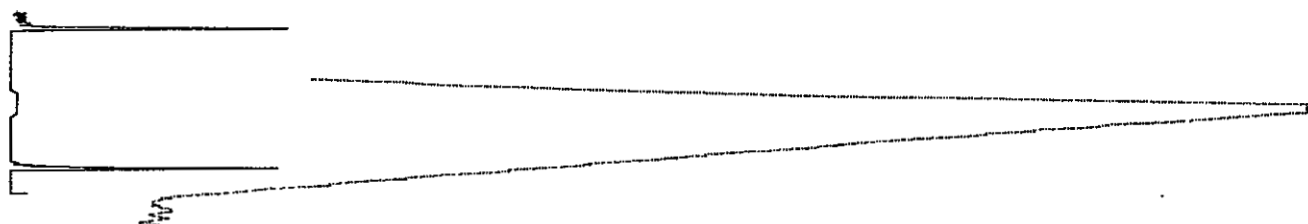


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP - 350 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-327A 99.9: 266: 0.29: 0.18: 0.75: 0.63: 0.24: 0.03: 0.77 : 23 : 97

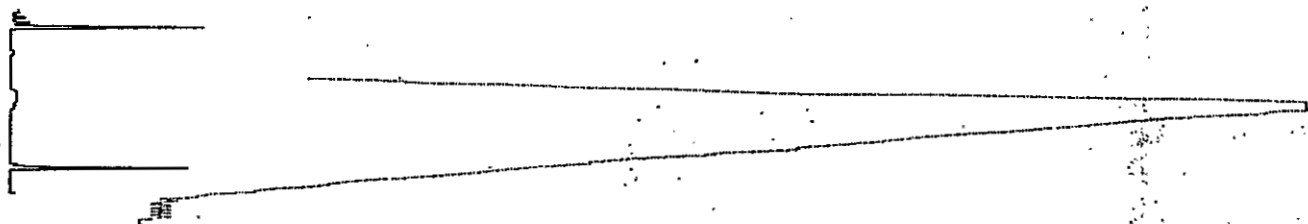


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP - 350 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

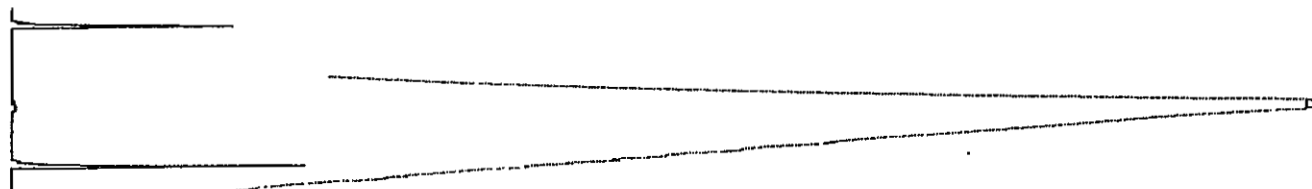
4389-2726 95.8: 323: 0.17: 0.16: 0.43: 0.53: 0.37: 0.02: 0.39 : 41 : 109



INIT TEMP = 250 ISO TIME = 5 TEM GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-360C 98.8: 236: 0.31: 0.05: 0.36: 0.86: 0.13: 0.03: 0.19 : 26 : 187

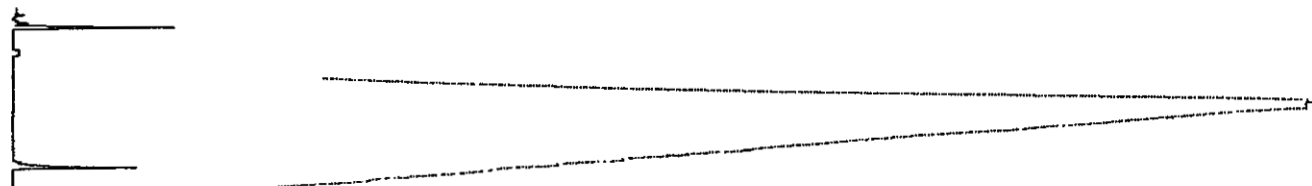


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-360B 99.7: 312: 0.16: 0.05: 0.29: 0.80: 0.17: 0.01: 0.19 : 26 : 154

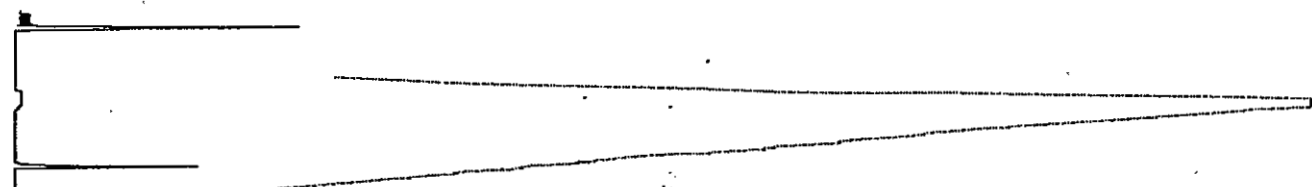


DATE: 17-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I

4389-360A 94.4: 260: 0.16: 0.13: 0.77: 0.57: 0.16: 0.02: 0.63 : 21 : 123





DATE: 17-07-97

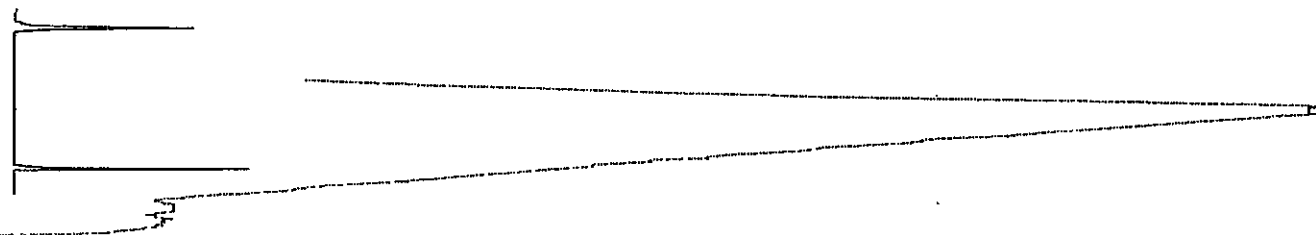
ANALYSIS

CYCLE : 4

SCALE = 1/32

INIT TEMP - 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-506B	99.8	224	0.18	0.00	0.38	1.00	0.00	0.01	0.41	0	93



DATE: 17-07-97

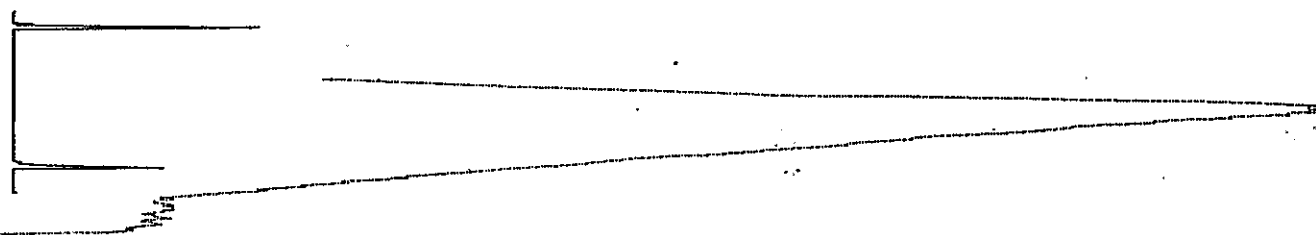
ANALYSIS

CYCLE : 4

SCALE = 1/32

INIT TEMP - 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

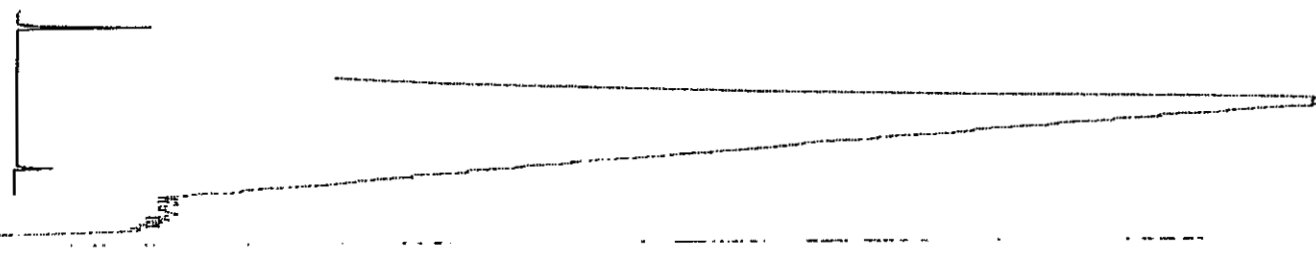
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-506A	94.8	227	0.20	0.02	0.45	0.91	0.04	0.01	0.86	2	52



HI TEMPERATURE GRADIENT = 150

DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-162	97.3	646	0.03	0.00	0.09	1.00	0.00	0.00	0.17	0	52
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DATE: 20-07-97

ANALYSIS

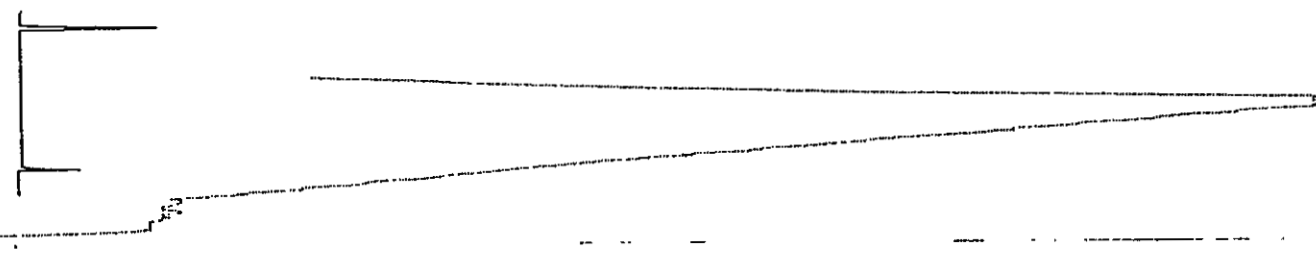
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-151	95.2	646	0.05	0.02	0.11	0.83	0.18	0.00	0.23	9	48
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DATE: 20-07-97

ANALYSIS

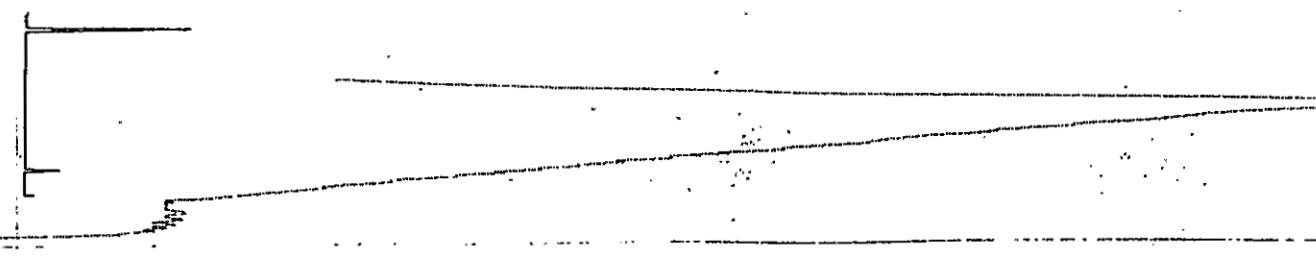
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

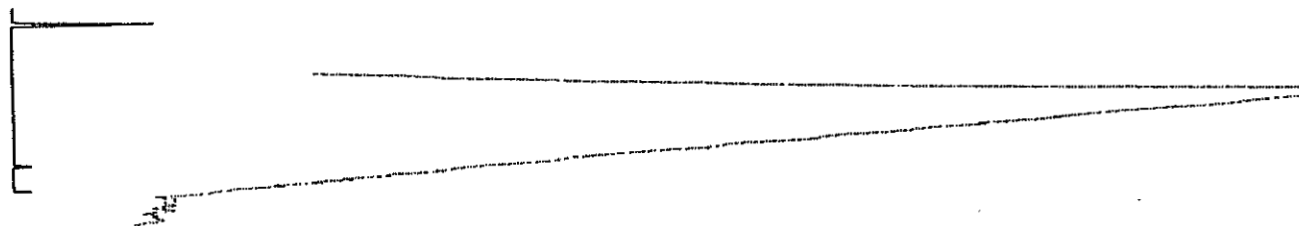
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-141	98.7	646	0.03	0.03	0.19	0.50	0.15	0.00	0.68	4	28
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INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

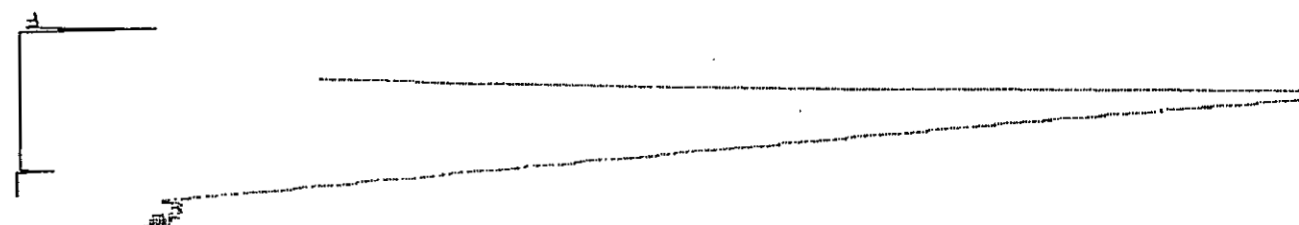
DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-191	96.7	646	0.01	0.01	0.14	0.50	0.07	0.00	0.23	4	60



DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

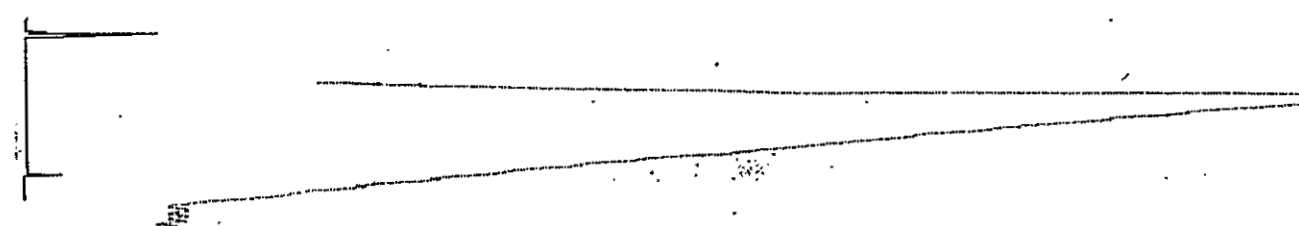
DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-184	93.6	646	0.02	0.01	0.49	1.00	0.02	0.00	0.22	5	223



DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

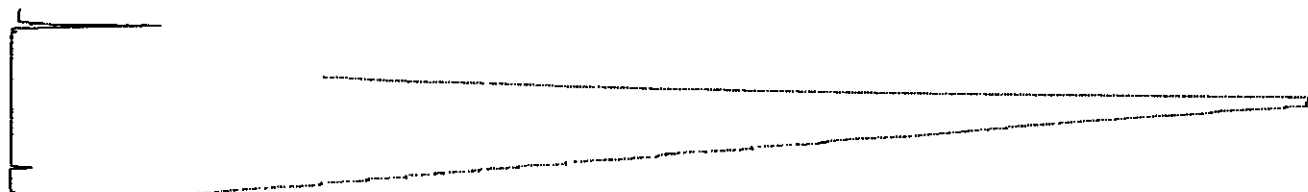
DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-177	92.9	646	0.02	0.01	0.15	1.00	0.06	0.00	0.29	3	51



NI EM SU ME S IE GR EN S IRI DIL I 39

DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389- 228: 95.2: 646: 0.02: 0.00: 0.39: 1.00: 0.00: 0.00: 0.16 : 0 : 240 :



DATE: 20-07-97

ANALYSIS

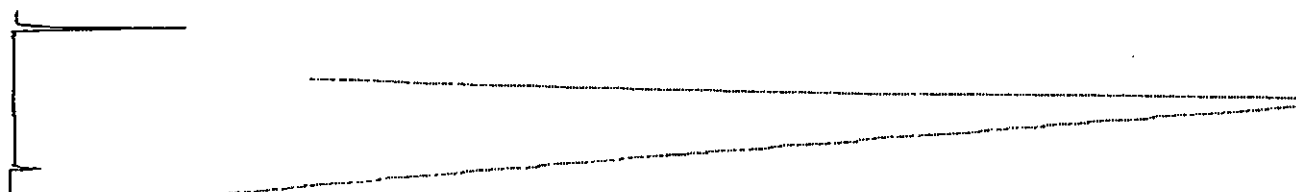
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389- 217: 94.5: 646: 0.14: 0.31: 0.40: 0.32: 0.77: 0.03: 0.22 : 139 : 180 :



DATE: 20-07-97

ANALYSIS

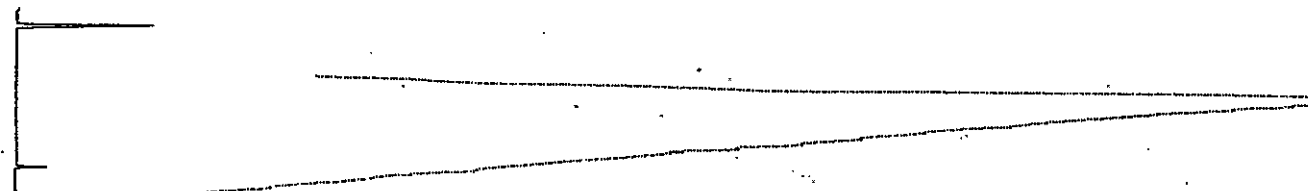
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTY :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389- 202: 98.3: 646: 0.02: 0.00: 0.11: 1.00: 0.00: 0.00: 0.22 : 0 : 49 :



INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-254	94.7	646	0.03	0.01	0.47	0.75	0.02	0.00	0.65	2	72
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DATE: 20-07-97

ANALYSIS

CYCLE : 4

SCALE = 1/32

INIT TEMP = 250

ISO TIME = 5

TEMP GRADIENT=25

TRAP STOP T = 390

DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-248	98.1	646	0.04	0.01	0.34	1.00	0.02	0.00	0.16	6	213
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DATE: 20-07-97

ANALYSIS

CYCLE : 4

SCALE = 1/32

INIT TEMP = 250

ISO TIME = 5

TEMP GRADIENT=25

TRAP STOP T = 390

DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-230	98.8	646	0.03	0.00	0.37	1.00	0.00	0.00	0.16	0	238
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INITIAL TEMPERATURE = 390 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-005C 97.3: 646: 0.04: 0.00: 0.17: 1.00: 0.00: 0.00: 0.63 : 0 : 27 :

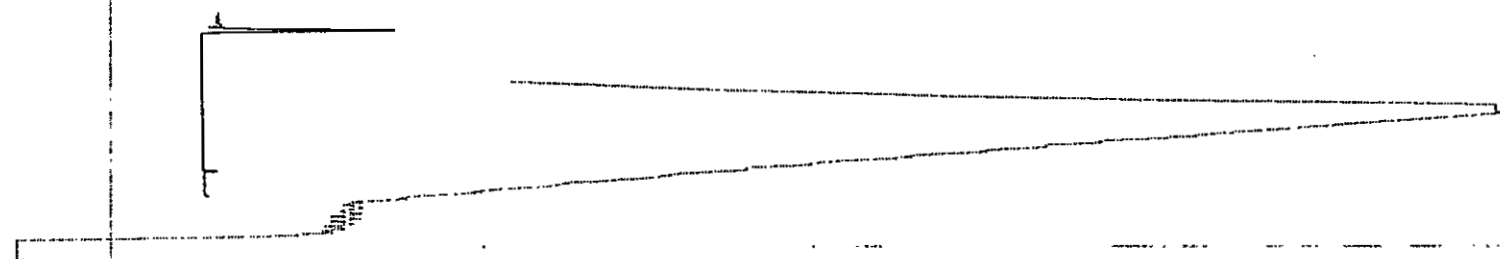


DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 350 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-272: 98.0: 646: 0.01: 0.03: 0.63: 0.25: 0.04: 0.00: 0.34 : 9 : 184 :

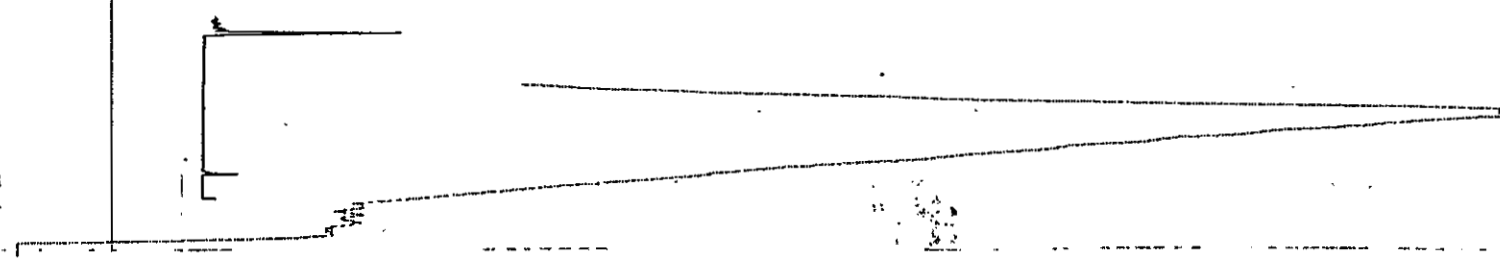


DATE: 20-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

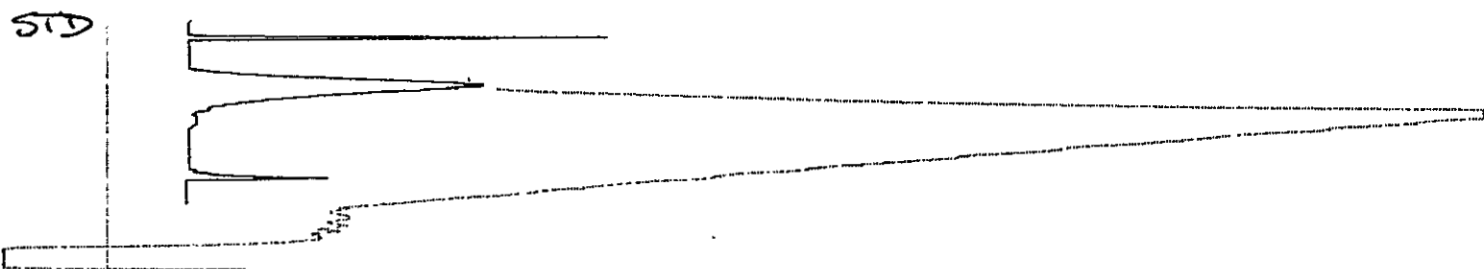
INIT TEMP = 350 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-261: 98.7: 646: 0.03: 0.02: 0.52: 0.75: 0.03: 0.00: 0.24 : 8 : 213 :



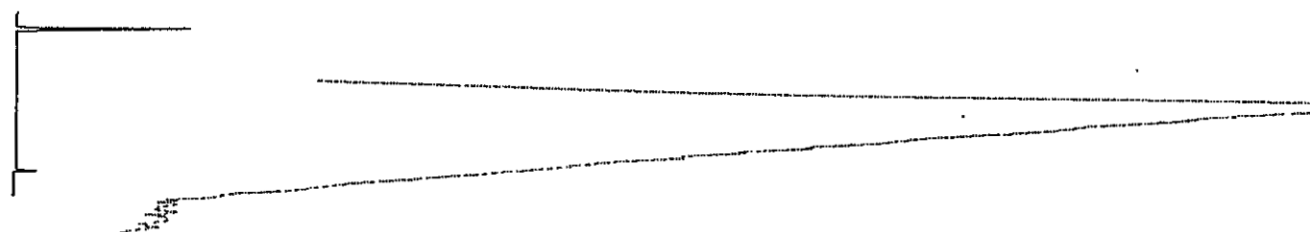
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
1111	100.0	439	0.24	2.81	0.83	0.08	3.38	0.25	2.89	97	28



DATE: 21-07-97 ANALYSIS CYCLE: 4 SCALE = 1732

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

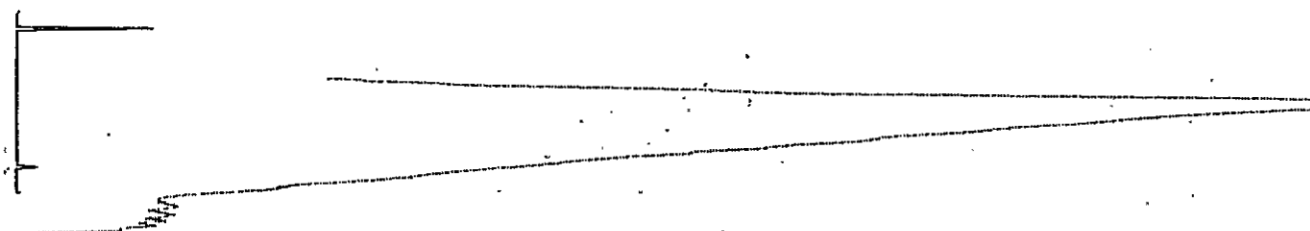
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-295	99.0	646	0.02	0.01	0.20	1.00	0.05	0.00	0.29	3	69



DATE: 21-07-97 ANALYSIS CYCLE: 4 SCALE = 1732

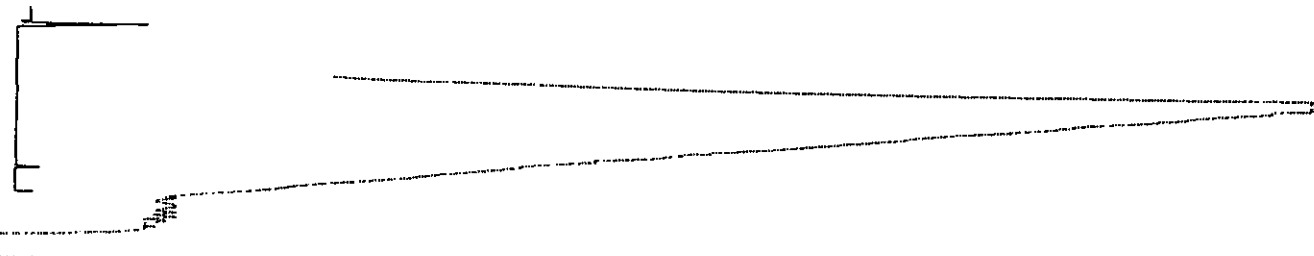
INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-007C	95.2	646	0.02	0.01	0.07	1.00	0.14	0.00	1.15	1	6



DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-0300 96.1: 266: 0.05: 0.13: 0.39: 0.28: 0.33: 0.01: 0.28 : 46 : 137 :



DATE: 21-07-97

ANALYSIS

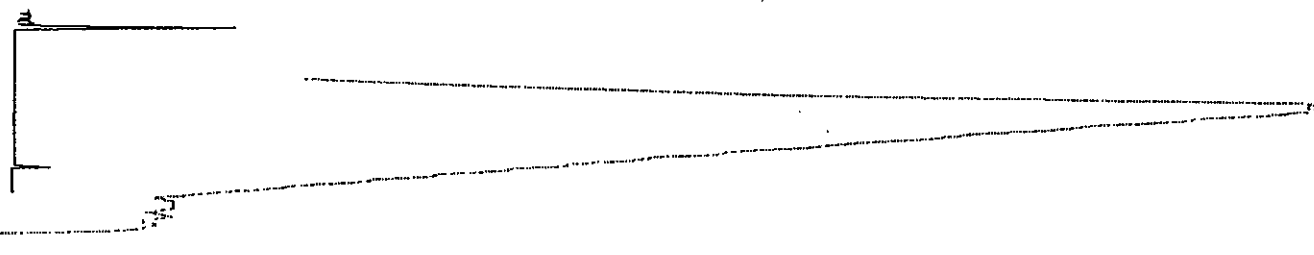
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

4389-310: 98.1: 374: 0.03: 0.02: 0.61: 0.75: 0.03: 0.00: 0.40 : 5 : 154 :



DATE: 21-07-97

ANALYSIS

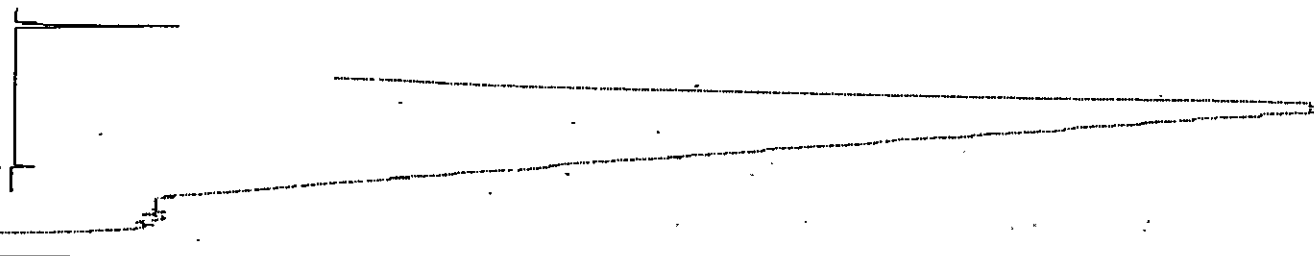
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

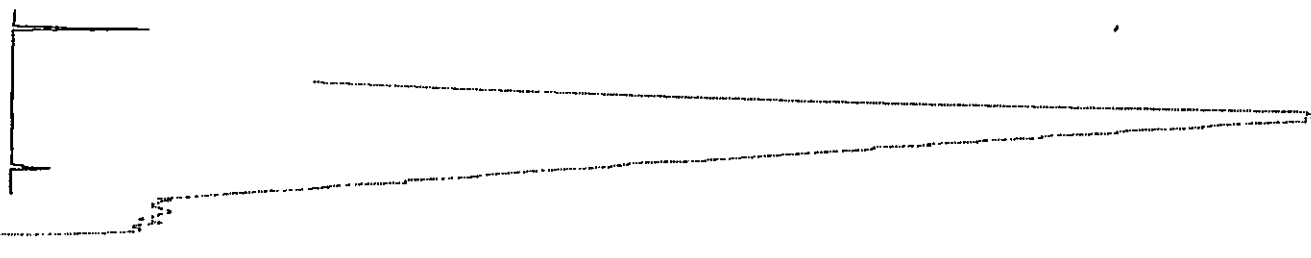
4389-301: 94.1: 436: 0.01: 0.01: 0.26: 0.50: 0.03: 0.00: 0.38 : 3 : 68 :





DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-042C 93.2: 266: 0.11: 0.17: 0.12: 0.39: 1.41: 0.02: 1.10 : 15 : 11

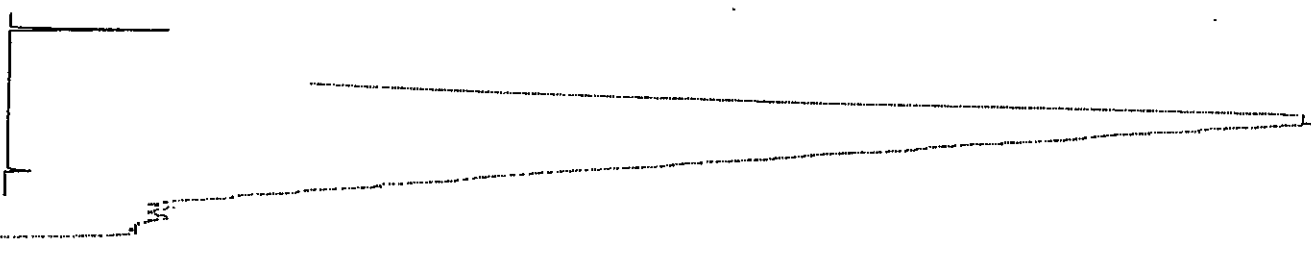


DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-037C 97.0: 266: 0.06: 0.11: 0.17: 0.37: 0.64: 0.01: 0.52 : 21 : 33

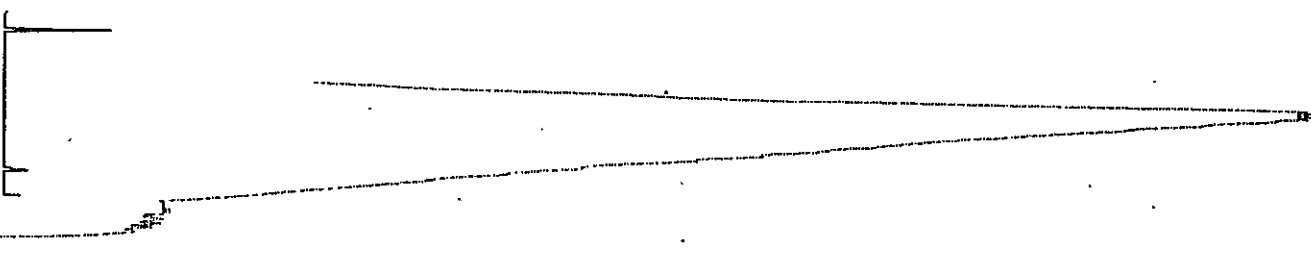


DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP TIME= 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-033C 98.7: 266: 0.04: 0.05: 0.00: 0.50: 0.00: 0.00: 0.94 : 5 : 137



DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-327: 92.1: 290: 0.03: 0.07: 0.17: 0.30: 0.41: 0.00: 0.33 : 21 : 51 :

DATE: 21-07-97 ANALYSIS CYCLE: 4 SCALE = 1/32

INIT TEMP = 350 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-048R 97.1: 400: 0.03: 0.08: 0.17: 0.30: 0.47: 0.00: 0.52 : 15 : 33 :

DATE: 21-07-97 ANALYSIS CYCLE: 4 SCALE = 1/32

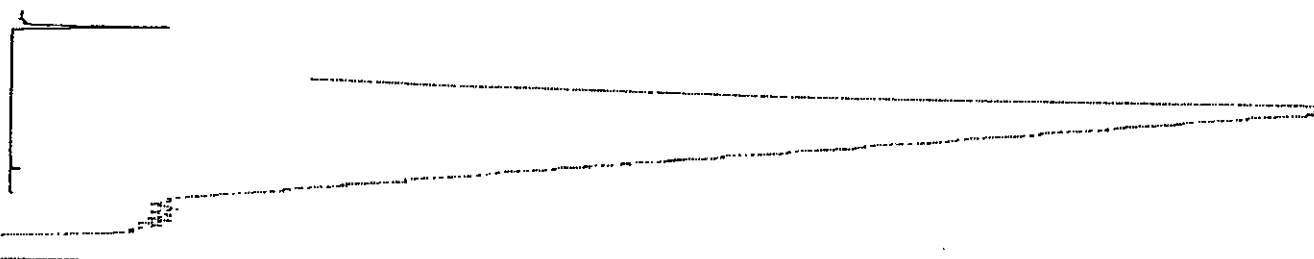
INIT TEMP = 350 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

STD 1111: 100.0: 433: 0.11: 2.22: 1.47: 0.05: 1.51: 0.19: 2.89: 76 : 50 :

DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-350	92.0	266	0.03	0.13	0.44	0.19	0.29	0.01	0.29	45	154
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DATE: 21-07-97

ANALYSIS

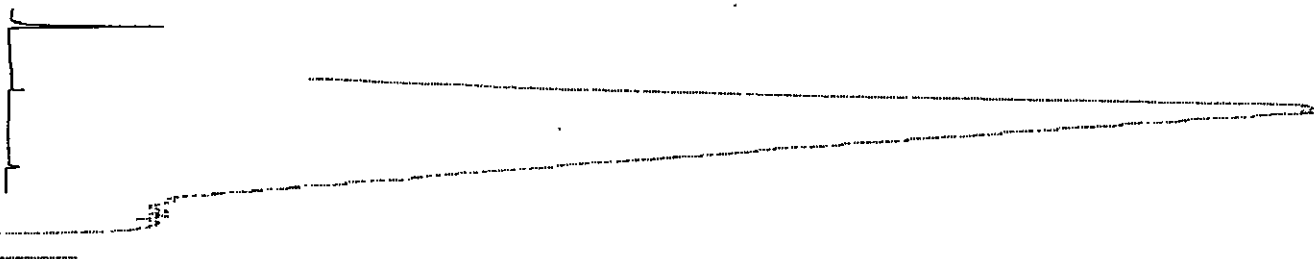
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-343	99.8	288	0.04	0.16	0.25	0.20	0.64	0.01	0.39	41	64
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ANALYSIS

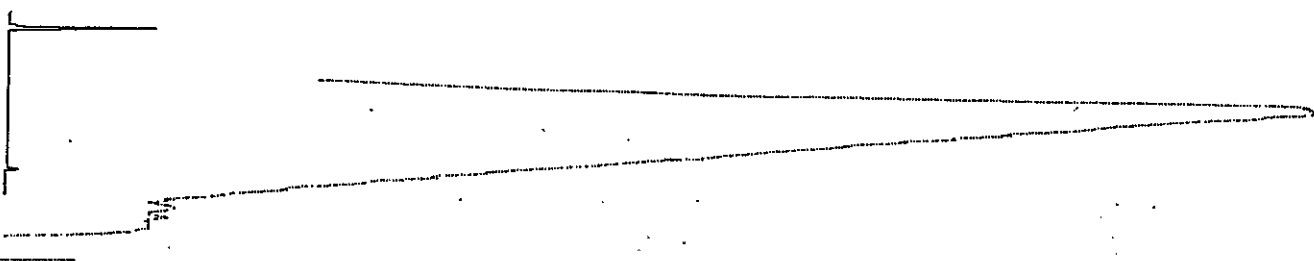
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTY	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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4389-338	97.0	266	0.04	0.12	0.14	0.25	0.85	0.01	0.26	46	54
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INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: DTV TMAX: S 1 S 2 S 3 P I S2/S3 P C TOC H I O I

4389-381 97.2 266 0.07 0.15 0.40 0.32 0.37 0.01 0.30 49 132



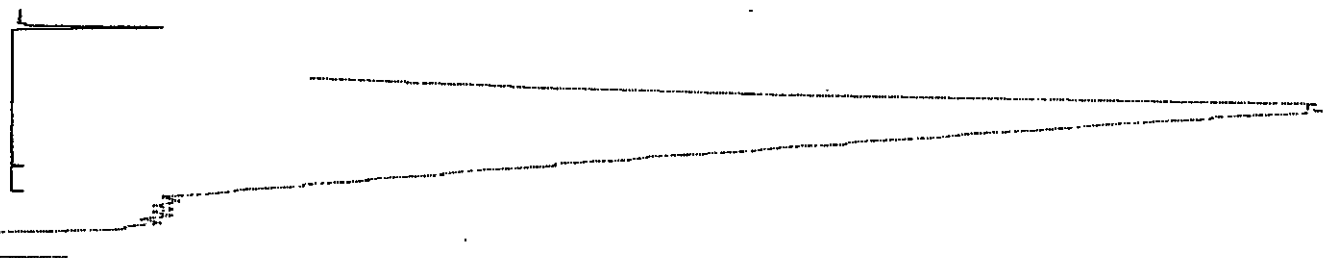
DATE: 21-07-97

ANALYSIS CYCLE : 4 SCALE = 1/32

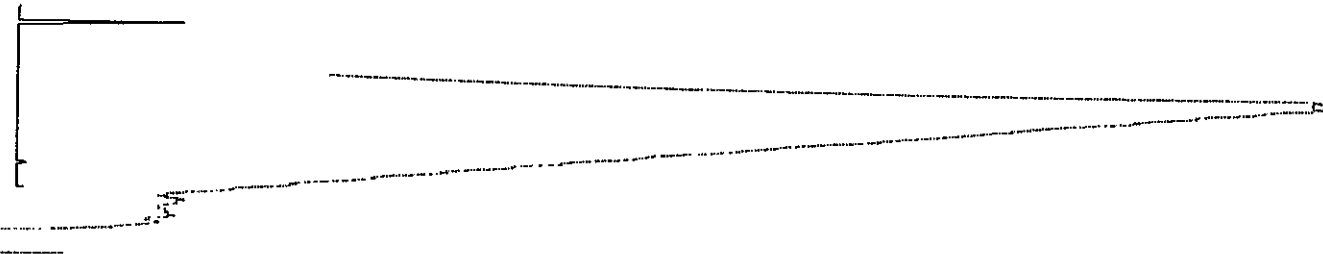
INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: DTV TMAX: S 1 S 2 S 3 P I S2/S3 P C TOC H I O I

4389-370 98.8 287 0.05 0.13 0.34 0.28 0.38 0.01 0.31 42 109



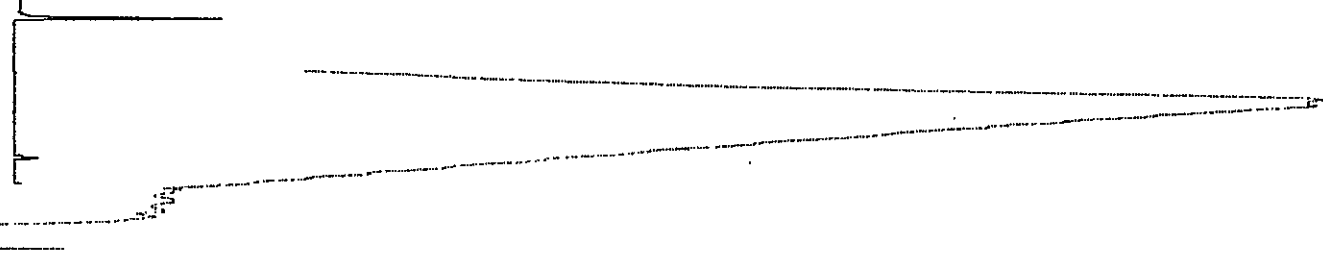
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-406	96.0	263	0.02	0.03	0.16	0.50	0.18	0.00	0.23	13	71



DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

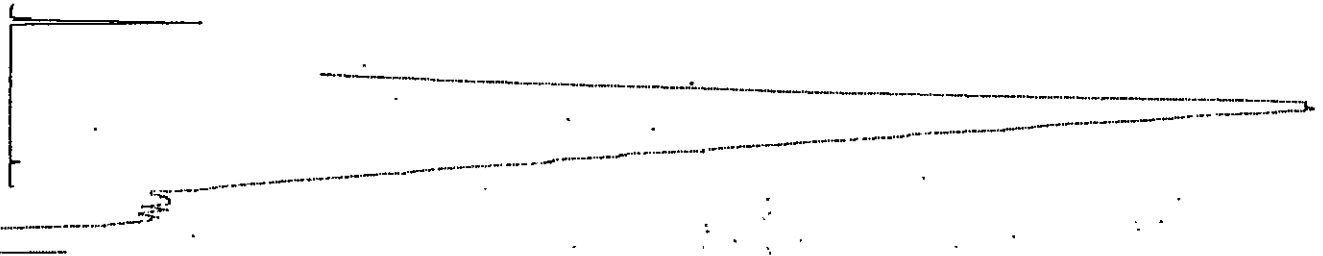
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-400	97.0	266	0.04	0.01	0.49	1.00	0.02	0.00	0.37	3	134



DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

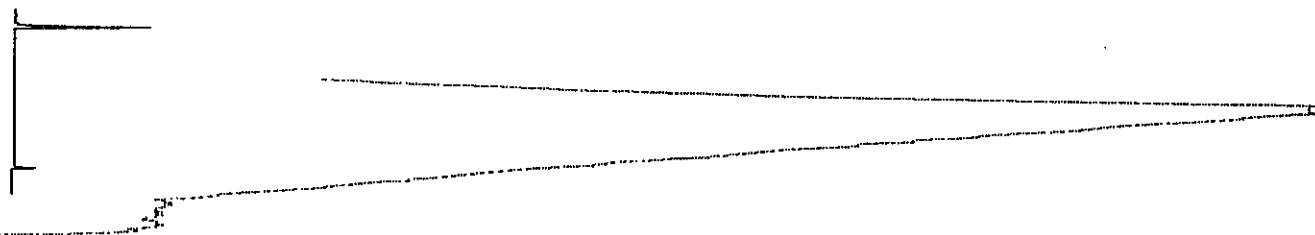
INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-390	94.7	192	0.01	0.02	0.30	0.50	0.06	0.00	0.20	10	147



DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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1389-441	97.0	221	0.01	0.02	0.12	0.50	0.16	0.00	0.35	6	34
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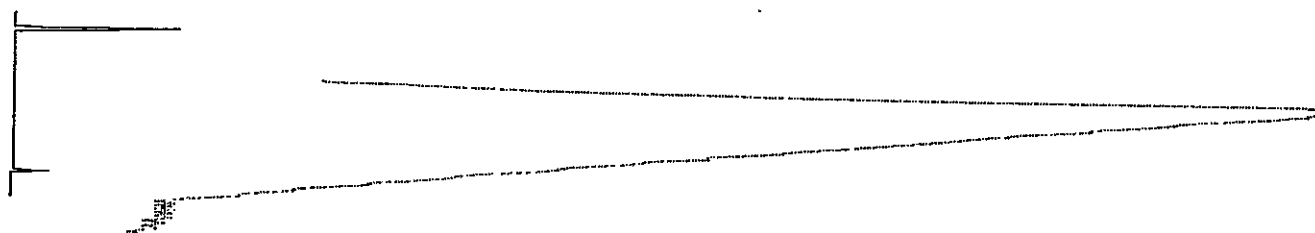


DATE: 21-07-97 ANALYSIS CYCLE: 4 SCALE = 1732

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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1389-432	97.9	209	0.03	0.02	0.17	0.75	0.11	0.00	0.30	7	57
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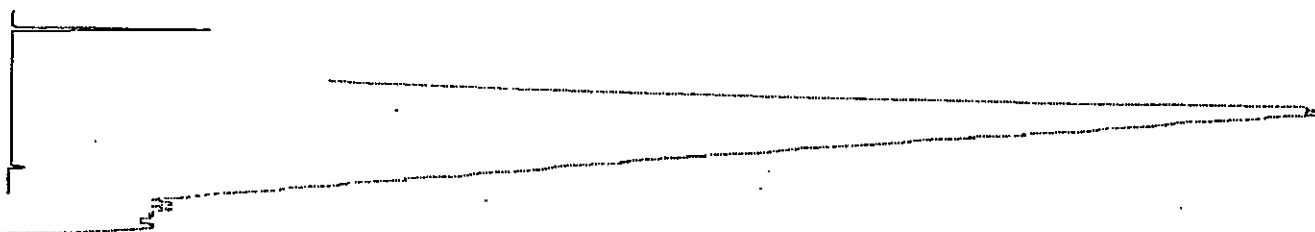


DATE: 21-07-97 ANALYSIS CYCLE: 4 SCALE = 1732

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

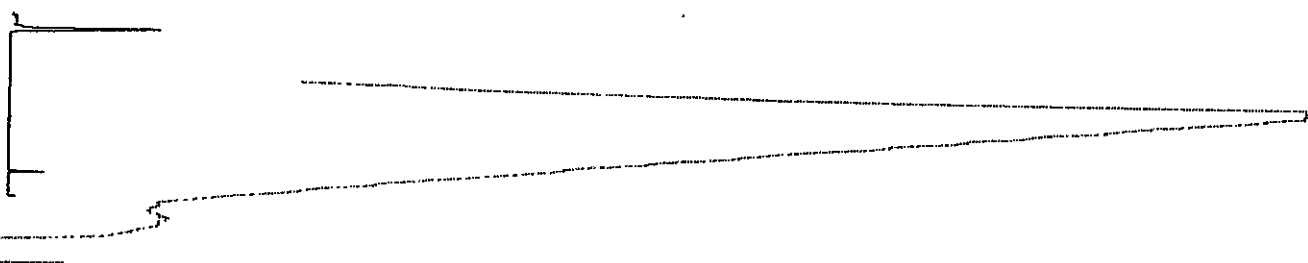
DEPTH	QTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
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1389-418	95.4	200	0.02	0.03	0.31	0.50	0.09	0.00	0.21	14	149
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DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-481: 98.4: 199: 0.02: 0.01: 0.32: 1.00: 0.03: 0.00: 0.42 : 2 : 77

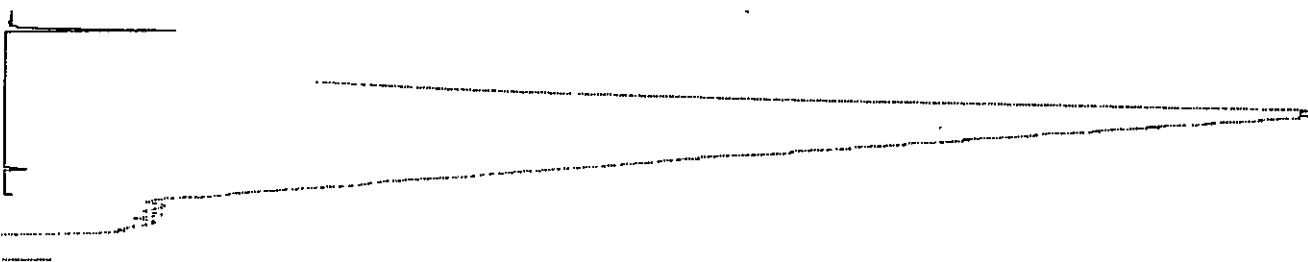


DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1732

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

4389-470: 95.8: 227: 0.02: 0.02: 0.35: 0.50: 0.05: 0.00: 0.62 : 3 : 56

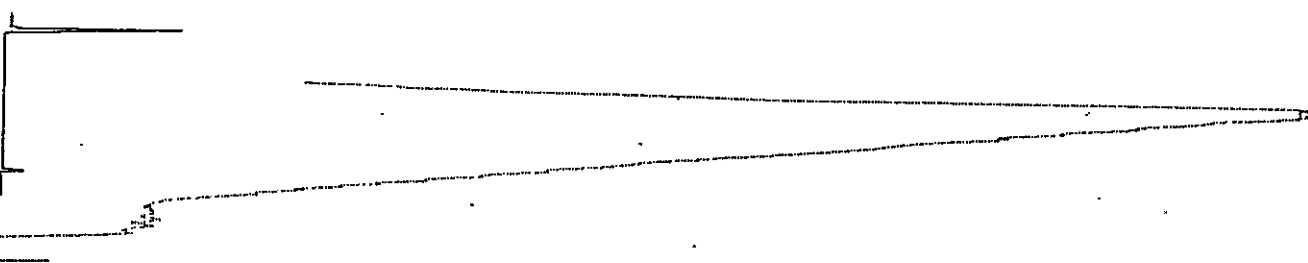


DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1732

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I

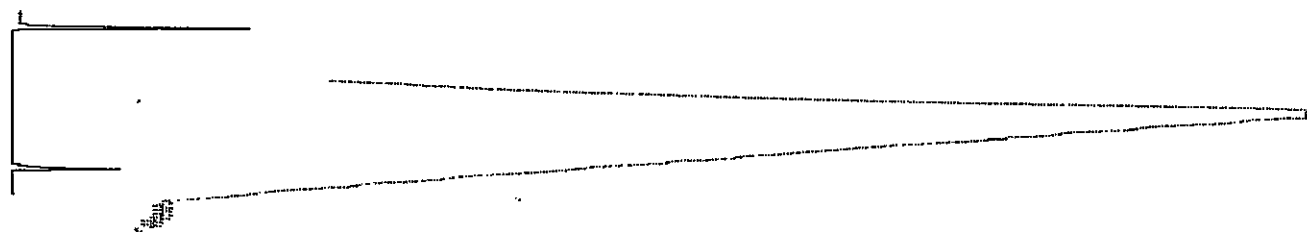
4389-456: 95.0: 157: 0.02: 0.02: 0.42: 0.50: 0.04: 0.00: 0.23 : 9 : 179



INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-506: 98.0: 214: 0.14: 0.00: 0.60: 1.00: 0.00: 0.01: 0.39: 0: 152:



DATE: 21-07-97

ANALYSIS

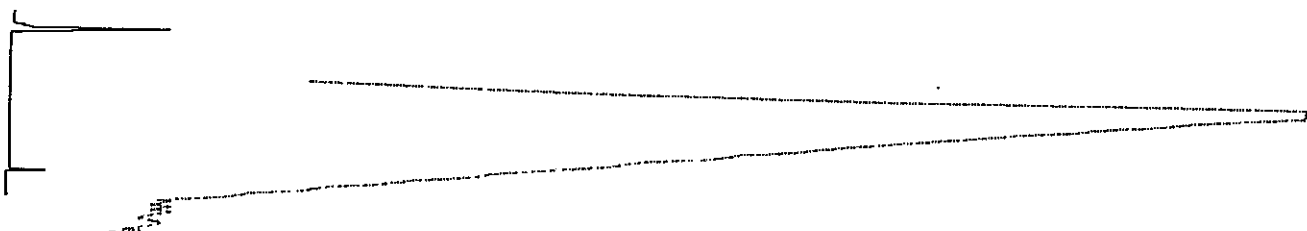
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-501: 97.4: 349: 0.03: 0.01: 0.36: 0.75: 0.02: 0.00: 0.45: 2: 80:



DATE: 21-07-97

ANALYSIS

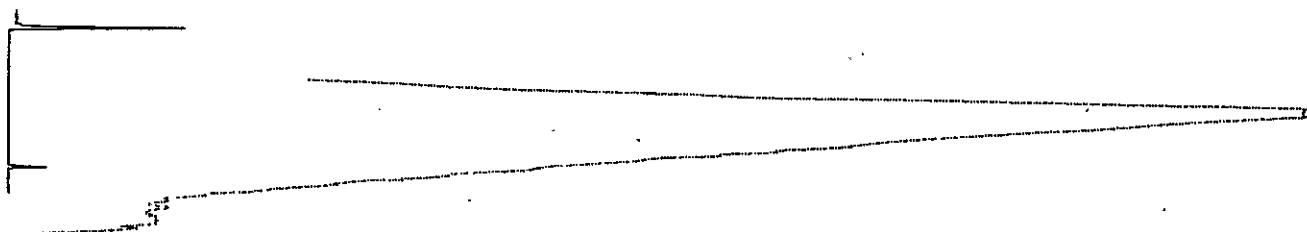
CYCLE : 4

SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT = 25 TRAP STOP T = 390

DEPTH: QTV : TMAX: S 1 : S 2 : S 3 : P I : S2/S3 : P C : TOC : H I : O I :

4389-491: 98.5: 183: 0.03: 0.02: 0.40: 0.75: 0.05: 0.00: 0.72: 3: 56:

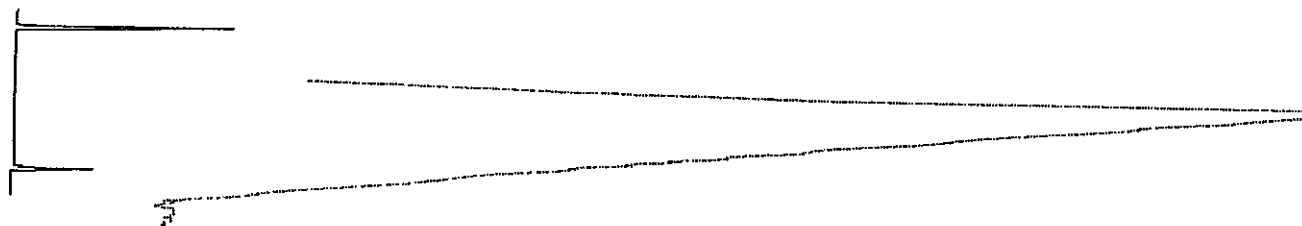




IN TE - 150 150 5 T G IE 25 TR SC T 3

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

1389- 541: 98.7: 153: 0.08: 0.02: 0.28: 0.80: 0.07: 0.00: 0.27 : 7 : 104 :

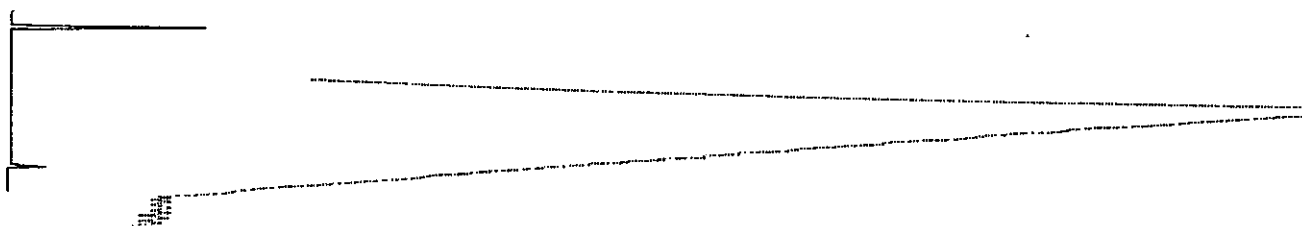


DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

1389- 526: 97.8: 179: 0.04: 0.03: 0.22: 0.67: 0.13: 0.00: 0.22 : 14 : 101 :

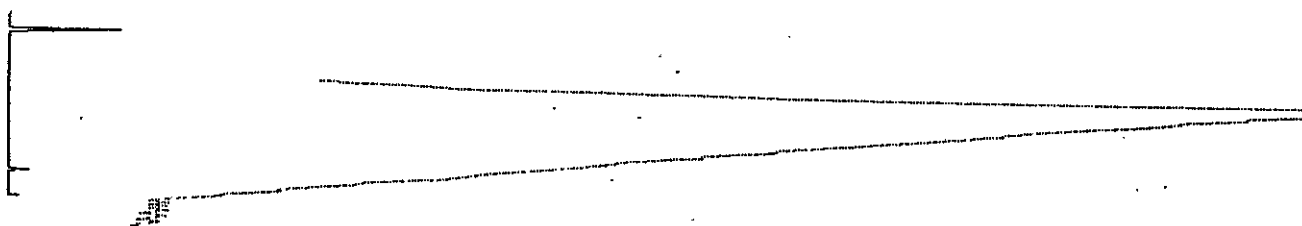


DATE: 21-07-97 ANALYSIS CYCLE : 4 SCALE = 1/32

INIT TEMP = 250 ISO TIME = 5 TEMP GRADIENT=25 TRAP STOP T = 390

DEPTH: QTV :TMAX: S 1 : S 2 : S 3 : P I :S2/S3 : P C : TOC : H I : O I :

1389- 514: 96.7: 186: 0.01: 0.02: 0.03: 0.50: 0.66: 0.00: 0.30 : 7 : 10 :



DATE: 21-07-97

ANALYSIS

CYCLE : 4

SCALE = 1/32

INIT TEMP - 350

ISO TIME = 5

TEMP GRADIENT=25

TRAP STOP T = 390

DEPTH	DTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-621	96.8	171	0.02	0.00	0.01	1.00	0.00	0.00	0.33	0	3



DATE: 21-07-97

ANALYSIS

CYCLE : 4

SCALE = 1/32

INIT TEMP - 350

ISO TIME = 5

TEMP GRADIENT=25

TRAP STOP T = 390

DEPTH	DTV	TMAX	S 1	S 2	S 3	P I	S2/S3	P C	TOC	H I	O I
4389-581	98.6	174	0.02	0.00	0.00	1.00	0.00	0.00	0.13	0	0

