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PETROGRAPHIC CHARACTERIZATION OF KENTUCKY COALS

Final Report, Part IV: A Petrographic and Chemical Model for the
Evolution of the Tradewater Formation Coals in Western Kentucky

By
Anne M. Graese
James C. Hower
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February 1984

Work Performed Under Contract No. FG22-80PC30223

University of Kentucky
Lexington, Kentucky

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**PETROGRAPHIC CHARACTERIZATION
OF KENTUCKY COALS:
FINAL REPORT: PART IV:
A PETROGRAPHIC AND CHEMICAL MODEL
FOR THE
EVOLUTION OF THE TRADEWATER FORMATION COALS
IN WESTERN KENTUCKY**

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ABSTRACT

A depositional model for the coals of the Tradewater Formation and associated rock units was constructed as a predictive device for the occurrence of economically important low sulfur coal. Twenty-one cores were examined and ninety-eight coal samples were analyzed for maceral, ash, and sulfur contents. These data were then analyzed to determine regional variation as well as vertical variation in single coal columns.

Core data indicate that the majority of the Tradewater rocks consist of irregularly distributed, coarsening-upward, fine-grained detrital material which was deposited in shallow bodies of water. Minor fossiliferous shales and limestones suggest a marine influence. Less common coarse-grained, fining-upward sequences appear to be deposits of meandering channels.

Like the detrital rocks, the coal seams are also irregularly distributed and exhibit variable petrographic and chemical properties reflecting changes in the Eh and pH of the coal swamp waters as well as detrital influx into the swamps. These swamps were relatively limited in extent and probably occupied the upper reaches of the tidal zone. The lack of significant stratigraphic and geographic trends in the regional data suggests that this mode of deposition was widespread and continued for a long period of time.

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INTRODUCTION

Although the coals of the Tradewater Formation in the western Kentucky coal field are thinner and less widespread than seams in the overlying Carbondale Formation, they are actively mined because of their low sulfur (less than 3%) and ash (less than 8%) content which makes them desirable as a low sulfur steam coal. The objective of this investigation was to construct a predictive petrographic and chemical model for the mineable portions of some of these seams. The approach was twofold. First, the regional variation of these seams was assessed to determine possible stratigraphic and geographic patterns. Vertical variation within these seams was then examined in greater detail to determine whether the history of coal swamp development could lead to a predictive petrographic and chemical model.

GEOLOGIC SETTING

The area selected for study was the eastern portion of the western Kentucky coal field which makes up the south-eastern portion of the Eastern Interior Basin (Figure 1). The stratigraphic range of the rocks included in the study extends from the top of the quartzose-sandstone-dominated Caseyville Formation to the base of the Davis (no. 6) seam which has been defined as the base of the Carbondale Formation (Whaley and others, 1979; Williams and others, 1982). The specific seams studied, however, included only the Dunbar, Lead Creek, and Elm Lick coal seams. Examination of the variation in petrography and chemistry of the Mannington, Lewisport, and Mining City coals was also undertaken for comparison with the

Figure 1: Location of the study area (dotted pattern) within the western Kentucky coal field of the Eastern Interior Basin.

Lead Creek and Dunbar coals (see Baynard, 1983). The stratigraphic relationships between these seams are not well understood, but the Dunbar and Lead Creek coals are assumed to comprise a general lower stratigraphic group and the Elm Lick, Mannington, Lewisport, and Mining City, an upper group (Figure 2).

Outcrops of these seams are determined by the general synclinal structure of the Eastern Interior Basin. Within the outcrop area, the coals are mined primarily within the Moorman Syncline, which is bound on the north by the Rough Creek Fault Zone and to the south by the Pennyrite Fault Zone (Figure 3).

Figure 2: Generalized cross-section through the study area.

Figure 3. Structural features in western Kentucky (from Krausse and Treworgy, 1979).

METHODS AND TECHNIQUES

LITHOSTUDY AND SAMPLING METHODS

Two types of data were available for this study. The first was a series of 32 cores (Gil series) drilled across the western Kentucky coal field under the auspices of the Kentucky Geological Survey (KGS) and the Institute For Mining and Minerals Research (IMMR). The holes penetrated the Tradewater Formation at 21 locations within the study area. These cores were available for study at the KGS Sample Library, but the coal had been sampled previously by IMMR and was available only in the form of crushed samples (see Hower and others, 1982; Hower and others, 1983). The second type of data was intact coal seams exposed in surface mines and outcrops along the eastern margin of the western Kentucky coal field. The location of core and surface samples is shown on Figures 4 and 5.

The rock cores were described using a three-digit lithocode (Ferm and Smith, 1980; Ferm and Weisenfluh, 1981). These codes, plus comments and cumulative footage (in tenths of feet) were entered, compiled, and stored according to the Coal Editor program in the University of Kentucky, Department of Geology, Coal Research Group computer system (Ferm and others, 1979). Log strips were plotted on a Gould 5005 electrostatic plotter at scales of one inch to ten feet and one inch to twenty feet. Using these logs, two cross-sections were constructed, one north-to-south and the other east-to-west through the area (Figures 5, 6, 7, and 8) using the "Lead Creek Limestone" as a datum.

Figure 4. Locations of the Gil-series cores and cross-sections A-A' and B-B'.

Figure 5. Locations for channel and bench samples collected from strip mines and outcrops.

Figure 6. Rock symbols for Figures 7 and 8.

Figure 7. Cross-section A-A'.

Figure 8. Cross-section B-B'.

A
NORTH

A'
SOUTH

Because the cores represented a relatively wide geographic area, coal samples from them were used for the study of regional variation in petrographic and chemical properties. In addition to the core material, channel and bench samples were collected from active surface mines and outcrops. These samples served two purposes. Channel samples were collected to supplement similar material taken from the cores for the study of regional variation. A second set of samples was then collected at each site by dividing the coal seam into approximately equal parts for the study of vertical variation in mineable seams.

At each field site, the coal face was completely cleared of weathered or surficial material and was described megascopically (see Appendices I and II) using a classification scheme by Stopes (1919). Because of the predominance of clarain lithotypes in most western Kentucky coals, the clarain group was further subdivided into bright clarain, clarain, and dull clarain depending on the percentage of bright and dull banding (Figure 9). The unit of measurement was 3 millimeters or greater. Any lithotype thinner than this was lumped with the unit above, but any noticeable fusain or pyrite layers and shale partings were recorded regardless of thickness. About 5 to 30 feet of roof and floor lithologies were also described.

Following description of the coal seam, a channel sample was removed for the regional study. Three benches were then collected to examine vertical changes within the seam. All samples were placed in plastic bags, sealed with tape, and labeled according to location, seam name, type of sample, and date collected.

LITHOTYPE	DESCRIPTION
VITRAIN	very bright glassy bands or lenses, greater than 90% bright bands
CLARAINS	bands of variable thickness with a luster between that of vitrain and durain, striated due to the alternation of bright and dull bands
BRIGHT CLARAIN	60 - 90% bright bands
CLARAIN	40 - 60% bright bands
DULL CLARAIN	10 - 40% bright bands
DURAIN	gray to brownish black dull coal, 0 - 10% bright bands
FUSAIN	black or gray, very friable, dirty to tough
BONE	50 - 75% inorganic components, may be difficult to tell from durain in the field

Figure 9. Description of coal lithotypes (after Stopes, 1919).

LABORATORY PROCEDURES

All samples were analyzed to determine the types and proportions of macerals and pyrite present, the vitrinite reflectance (a rank indicator), and the proportions of ash and sulfur within the seams or benches.

Maceral and Pyrite Counts

Representative splits of the 98 channel and bench samples were crushed to a minus 20 and minus 60 mesh size respectively, for microscopic and chemical analyses, according to ASTM standard D-2013 (ASTM, 1982). The results of these analyses are shown in Appendix III. The minus 20 mesh sized coal for each sample was bound into two pellets (ASTM D-2797, 1982), which were then polished and a five-hundred-point-count was completed for each pellet. This technique is described in standard procedure D-2799 (ASTM, 1982) and Stach and others (1982). The macerals counted were vitrinites (vitrinite and pseudovitrinite), inertinites (fusinite, semifusinite, micrinite, and macrinite), and liptinites (sporinite, cutinite, and resinite) (see Figure 10). Further discussion of the characteristics and the origin of these macerals is given by Stach and others (1982, pages 87-285).

Pellets of 26 samples were analyzed microscopically to determine size, form, and microlithotype variability of pyrite using a procedure described by Hower and others (1981). Two-hundred-and-fifty-point-counts were made on each of two pellets. The pyrite forms were classified as framboidal, euhedral, dendritic, cleat, and massive (Figure 11), and the various forms were categorized into the size fractions of less than 5, 5-10, 10-40, 40-75, 75-150,

MACERAL GROUP	MACERAL NAME	MACERAL DESCRIPTION
VITRINITE	Vitrinite	Gelified woody tissue with lower reflectance
	Pseudovitrinite	Gelified woody tissue with higher reflectance
LIPTINITE (EXINITE)	Sporinite	Exines of spores
	Cutinite	Waxy cuticles of leaves and stems
	Resinite	Round, oval, or rod - like resinous bodies
INERTINITE	Fusinite	Carbonized woody tissue with cell structure
	Semifusinite	Partially carbonized woody tissue
	Macrinite	Massive degradation products
	Micrinite	Granular residue of plant materials

Figure 10. Stopes-Heerlen maceral classification system (from Austin, 1979).

FORM	DESCRIPTION
FRAMBOIDAL	spherical or subspherical aggregates of crystals
EUHEDRAL	well developed crystalline form or too small to distinguish form
DENDRITIC	branching
CLEAT	cleat, fissure, or fracture filling
MASSIVE	no distinct structure or form, recrystallized frambooids or cell infillings

Figure 11. Forms of pyrite (after Hower and others, 1981).

and greater than 150 microns. The associated microlithotypes were also noted (Figure 12). All of this information was entered into the IMMR Vax/Vms-11/780 computer; a printout of this information is given in Appendix IV.

Vitrinite Reflectance

The reflectance of the vitrinite macerals (for use as a rank indicator) was determined by 25 measurements made on each pellet according to standard D-2798 (ASTM, 1982).

Chemical Analyses

Proximate and ultimate analyses, using ASTM standard procedures D-3172 and D-3176 (1982) were completed on all samples, but only ash (dry) and sulfur (dry) results are given in this report. These results are presented in Appendix III.

The coal remaining after these petrographic and chemical analyses was stored in plastic containers at the University of Kentucky, Institute for Mining and Minerals Research Laboratory under the KCER numbers shown in Appendix III.

METHODS OF DATA ANALYSIS

The general format for laboratory data analysis was as follows:

1. Comparison of field descriptions with maceral counts, ash, and sulfur data to determine the degree to which field descriptions estimate the more precisely determined laboratory measurements. These comparisons were made by use of a non-parametric chi-square test and Spearman's rank correlation coefficient.

COAL MICROLITHOTYPES

Figure 12. Coal microlithotypes (from Baynard, 1983).

2. Comparison of maceral count results with ash and sulfur data to determine whether these properties vary independently. These parameters were compared using chi-square, Spearman's rank and Pearson's correlation coefficients.
3. Regional comparisons of maceral counts, vitrinite reflectance, ash, and sulfur, considering both geographic and stratigraphic distributions, were made by using a one-way analysis-of-variance.
4. Comparison of variation in laboratory determined macerals, pyrite forms, ash, and sulfur in the upper, middle, and basal portions of the 12 coal columns were made to determine coal swamp evolution. No statistical tests were used although the significance of the magnitude in variation was considered.

All statistical tests utilized a RS/1 statistical package on the IMMR Vax/Vms-11/780 operating system.

RESULTS AND INTERPRETATIONS

LITHOSTUDY AND FIELD STUDY

Examination of the logs in Figures 7 and 8 show a low level of lateral continuity of rock units and coal seams. This would be expected with logs which are several miles apart but even logs as close as one mile exhibit only a slight tendency for continuity of rock units. Some limestones (Lead Creek Limestone) appear to be continuous over distances of 15 to 20 miles and in these areas may be used as a marker bed and datum. A thick (60 to 100 foot) sandstone unit underlying the Dunbar and Lead Creek coals can also be used for local stratigraphic control.

In the absence of laterally continuous rock units in which facies changes can be documented, the analysis of the Tradewater rocks can be made on the basis of the character of the vertical sequences which are of two main types - coarsening-upward and fining-upward. Greater than 75% of the rocks consist of coarsening-upward sequences which are generally less than 40 feet thick (mean = 20 feet). The lower parts of these sequences consist of black, dark-gray, to light-gray-green carbonaceous shales, and shales with siderite nodules. These rocks grade upward into sandy shales, and shales with sandstone streaks which, in turn, are overlain by rippled (some flasered) to flat interbedded sandstones and shales, sandstones with shale streaks, and massive to cross-bedded sandstones. Some sandstones at the top of the coarsening upward sequences are siderite cemented and some are rooted or burrowed. A few of the sandstones

are orthoquartzitic, but most contain a substantial amount of non-quartz material. The coarsening-upward sequences are frequently capped by root penetrated underclays; coals; burrowed, sandy shales; black, calcareous, fossiliferous shales; and fossiliferous, shaley, nodular, limestones. The calcareous shales and limestones may attain thicknesses of 10 feet, but are most frequently less than 5 feet thick. The fossils are typical of a Pennsylvanian assemblage of echinoderms, pelecypods, ostracods, bryozoans, and fusilinids as well as some other foraminifera.

The fining-upward sequences are sandstone-dominated consisting of massive, rippled, and cross-bedded, carbonaceous and sideritic (cement), sandstones which grade upward into interbedded sandstones and shales; sandy shales; underclays; coals; and limestones. These sequences may range in thickness from less than 10 feet to greater than 120 feet, but are most commonly 10 to 30 feet thick. Some sandstones have erosional basal surfaces with basal beds of transported siderite nodules of shale pebbles.

In order to explore for possible relationships between the thickness of the coal seams and the underlying and overlying strata, a series of chi-square tests were conducted to determine possible relationships between the thickness of the coal seams and the thickness of the coarsening and fining-upward sequences both overlying and underlying the seams. The results of these tests, shown on Table 1, indicate independance of these attributes.

INTERPRETATIONS OF LITHOSTUDY

The lithologic data suggests a very heterogeneous depositional

TABLE 1

CHI-SQUARE TESTS
COAL THICKNESS VS. OVERLYING AND UNDERLYING SEQUENCES

COARSENING-UP SEQUENCES

COAL THICKNESS VS. UNDERLYING THICKNESS

ROCK THICKNESS	COAL		TOTALS
	LESS THAN 1'	GREATER THAN 1'	
LESS THAN 30'	40*(38.1)**	42 (43.9)	82
GREATER THAN 30'	12 (13.9)	18 (16.1)	30
TOTALS	52	60	112

$$\chi^2 = 0.65 \text{ N. S.}$$

COAL THICKNESS VS. OVERLYING THICKNESS

ROCK THICKNESS	COAL		TOTALS
	LESS THAN 1'	GREATER THAN 1'	
LESS THAN 30'	42*(40.4)**	16 (17.5)	58
GREATER THAN 30'	41 (42.5)	20 (18.4)	61
TOTALS	83	36	119

$$\chi^2 = 0.33 \text{ N. S.}$$

FINING-UP SEQUENCES

COAL THICKNESS VS. UNDERLYING THICKNESS

ROCK THICKNESS	COAL		TOTALS
	LESS THAN 1'	GREATER THAN 1'	
LESS THAN 30'	11*(11.6)**	9 (8.4)	20
GREATER THAN 30'	7 (6.4)	4 (4.6)	11
TOTALS	18	13	31

$$\chi^2 = 0.21 \text{ N. S.}$$

COAL THICKNESS VS. OVERLYING THICKNESS

ROCK THICKNESS	COAL		TOTALS
	LESS THAN 1'	GREATER THAN 1'	
LESS THAN 30'	1*(1.0)**	2 (2.0)	3
GREATER THAN 30'	2 (2.0)	4 (4.0)	6
TOTALS	3	6	9

$$\chi^2 = 0.0 \text{ N. S.}$$

* observed value

** expected value

N. S. not significant at the 95% confidence level

setting for the Tradewater seams. If the thickness of coarsening-upward sequences suggest depths of bodies of open water (Ferm and Cavaroc, 1968), such bodies ranged from less than 5 feet to as much as 70 feet in depth. Since most of the sequences cannot be correlated for distances as little as one mile, it can be inferred that most were of very modest extent. Some, which are topped by marine limestone which appear to be continuous for distances up to twenty miles, may have been relatively broad, but there is no uniform coarsening-upward pattern associated with them. This may indicate a very erratic pattern of basin fill.

The sandstone-dominated, fining-upward sequences suggest deposition by meandering channels (Reineck and Singh, 1980 Walker and Cant, 1979), and the average thickness of about 30 feet may indicate channel depth. Thicker sandstone bodies could represent superimposed channels or unusual depth produced by constriction of channel width. Thinner sandstones may represent overbank splays.

The very large proportion of fine-grained coarsening-upward deposits suggest a setting remote from a major detrital source and the presence of marine fossils and burrows in many of the shales indicate sites not far removed from an open marine setting. The low level of lateral continuity of all the detrital units suggest deposition of sediments not characteristic of large bodies of open water. Such a pattern is similar to that described for Carboniferous tidal zones (Hobday and Horne, 1977; Horne and others, 1978), but the absence of large bodies of barrier-derived orthoquartzitic sandstones suggests an area in the upper reaches of tidal influence.

The coal bodies, like the other sediments, are erratically distributed, and relative to seams in the overlying Carbondale Formation are thin; both of these characteristics indicating that the swamps were neither widespread nor long lived. Unlike the seams in the Carbondale Formation (Mathis, 1983; Neuder, 1984), the Tradewater swamps did not appear to be influenced by the substrate on which they were deposited, nor did they seem to influence the kinds of deposits which buried them. The major source of data used in studying the evolution of the Tradewater swamps must then be the properties of the coal itself. These characteristics are described in the following sections.

LABORATORY DATA AND ANALYSIS

The results of the statistical analysis of all laboratory data is shown on Tables 2 and 3. The chi-square tests and Spearman's rank correlation coefficient for comparison of field description and laboratory determined properties (Table 2) show that if the field descriptions are simply treated as bright (vitrain and bright clarain), intermediate (clarain), and dull (dull clarain, durain, and bone), the megascopic descriptions can predict the vitrinite contents in the range of 49% to 95% to a reasonable degree ($r_s = 0.68$). Sulfur and ash content, however, based on the proportions represented in these samples (0.8% to 6.9% for sulfur and 2.0% to 19.8% for ash) are not predictable by megascopic description ($r_s = 0.04$ for ash; $r_s = -0.12$ for sulfur).

The results of associations of maceral content, ash, and

TABLE 2

FIELD DESCRIPTION VS. LABORATORY PROPERTIES

SPEARMAN'S RANK CORRELATION COEFFICIENT r_s

LITHOTYPE VS. VITRINITE	$r_s = 0.68$	Sig.*
LITHOTYPE VS. ASH	$r_s = 0.04$	N. S. **
LITHOTYPE VS. SULFUR	$r_s = -0.12$	N. S.

CHI-SQUARE χ^2

LITHOTYPE VS. VITRINITE	$\chi^2 = 25.6$	Sig.
LITHOTYPE VS. ASH	$\chi^2 = 0.37$	N. S.
LITHOTYPE VS. SULFUR	$\chi^2 = 3.35$	N. S.

* significant at the 95% confidence level

** not significant at the 95% confidence level

TABLE 3

COMPARISON OF LABORATORY PROPERTIES

PEARSON'S CORRELATION COEFFICIENT r_p VITRINITE VS. ASH $r_p = -0.09$ N. S.*VITRINITE VS. SULFUR $r_p = -0.07$ N. S.**ASH VS. SULFUR $r_p = 0.53$ Sig.SPEARMAN'S RANK CORRELATION COEFFICIENT r_s VITRINITE VS. ASH $r_s = -0.23$ N. S.VITRINITE VS. SULFUR $r_s = -0.12$ N. S.ASH VS. SULFUR $r_s = 0.70$ Sig.CHI-SQUARE χ^2 VITRINITE VS. ASH $\chi^2 = 10.11$ Sig.VITRINITE VS. SULFUR $\chi^2 = 4.75$ N. S.ASH VS. SULFUR $\chi^2 = 50.82$ Sig.

* not significant at the 95% confidence level

** significant at the 95% confidence level

sulfur are shown in Table 3. Chi-square tests, Spearman's rank and Pearson's correlation coefficients all show an absence of any significant relationships between macerals and ash, and macerals and sulfur. Tests for ash and sulfur, however, show a small but significant relationship between these two parameters. This relationship is not surprising as pyrite will be present in the coal ash. The coefficient of determination ($r^2 = 0.28$) shows that about one-quarter of the variation in the ash may be attributed to the variation in pyrite content, and the remaining presumably arising from other causes.

REGIONAL VARIATION

The two methods of assessing regional variation in petrographic and chemical components were mapping of components and statistical analysis. Maps showing the distribution of vitrinite, ash, sulfur, and thickness of the Dunbar and Lead Creek seams, and the maximum vitrinite reflectance ($\%R_{\max}$) for the Lead Creek, Dunbar, and Elm Lick seams are shown on Figures 13 to 17. All of these maps show that although there is substantial variation in components (62.5% to 92.1% for vitrinite; 0.8% to 8.6% for sulfur; 2.4% to 30.9% for ash, 10 to 36 inches for thickness; and 0.42 to 0.68 for maximum vitrinite reflectance), none can be clearly attributed to geographic location. This lack of consistent geographic pattern may arise from the uncertainty of stratigraphic position of samples, but this appears unlikely as very closely spaced samples which are least likely to stratigraphic error, vary almost as much as samples from widely spaced localities.

Figure 13. Regional variation of vitrinite.

Figure 14. Regional variation of ash (dry).

Figure 15. Regional variation of sulfur (dry).

Figure 16. Regional variation of thickness (inches).

Figure 17. Regional variation of vitrinite reflectance in relation to the faults within the area.

Statistical tests for regional variation in petrographic and chemical parameters were conducted to test geographic variation independent of stratigraphic effects and stratigraphic variation independent of geographic effects. Comparisons were made between northern and southern portions of one stratigraphic position (Dunbar-Lead Creek) and between two stratigraphic positions (Dunbar-Lead Creek vs. Elm Lick-Lewisport-Mannington-Mining City). Analysis-of-variance tests showed no significant variation, suggesting that with respect to these parameters, the variation in the Tradewater seams is essentially homogeneous (see Table 4).

RESULTS OF VARIATION OF VITRINITE, ASH, AND SULFUR IN VERTICAL COLUMNS

Because statistical tests described previously showed no geographic or stratigraphic variation in the Tradewater seams, and because of uncertainty in correlations, the bench column samples can be considered as a series of samples of Tradewater peat swamps which accumulated peat equivalent to 10 to 42 inches of coal. The variation in these columns taken collectively reflect variations in kinds of swamps or locations within a swamp. Environmental conditions present in modern day swamps may then be used to explain these variations. All data for column samples are graphically presented in Appendix II.

Data from 12 coal seams, which includes percentages of macerals, ash, and sulfur from the top, middle, and bottom portions of the seams, formed the basis for analysis of swamp evolution. Also included are size/form/microlithotype data for 15 samples (Appendix IV).

The first step in evaluating variation in vitrinite, ash, and

These calculations are given in Table 2

3.5.2 GEOGRAPHIC VARIATION

REFLECTANCE $\epsilon E_{\text{refl}} = 0.69$ IN. Sp. in

10-10-68

the first, which exhibit high values or low values.

sulfur in vertical columns was by comparing vertical changes within columns to experimental error. This consisted of evaluating upward increase or decrease, or increase or decrease towards the middle of the seam for each component in each column relative to variation in experimental error as predicted by ASTM (1982; macerals = $\pm 2.0\%$, p. 383; ash = $\pm 0.5\%$, p. 407; and sulfur = $\pm 0.05\%$, p. 407). The results of this evaluation are given on Table 5.

The next step was evaluation of the amount of change within the columns and the differences between columns. This consisted of subtracting low from high values of each component in which variation occurs. The results of this are shown on Tables 6, 7, and 8.

Table 6, showing data for vitrinite, indicates that for columns in which there is an upward change, the high values are usually very high (greater than 75%) and the lows are less than 75%. The differences between high and low values are most often greater than 20%. For columns, in which there is little to no change, the columns remain consistently high (greater than 75%).

The data for ash, in Table 7, shows that for columns in which changes are minor (less than 4%), there are two general types - those in which the ash is low (less than 5%) and those in which it is high (6.6% to 10.9%). For those columns which show a significant change upward (increase and decrease up), the amount of change ranges from very high (8.5% to 19.8%) to low (3.2% to 6.4%).

Sulfur variation, shown in Table 8, differs from vitrinite and ash percentages in that only 3 of the 12 columns show any appreciable change. The columns which show little change can be grouped into those which exhibit high values or low values.

TABLE 5

VERTICAL VARIATION IN VITRINITE, ASH, AND SULFUR

COMPONENT	INCREASE UPWARD	DECREASE UPWARD	INCREASE TOWARD MIDDLE	DECREASE TOWARD MIDDLE	CHANGE LESS THAN EXP. ERROR
VITRINITE	0	9	0	2	2
ASH	4	4	0	5	0
SULFUR	7	0	3	1	2

TABLE 6
CHANGES IN VITRINITE

TYPE OF CHANGE	HIGH VALUE (%)	LOW VALUE (%)	CHANGE (%)
DECREASE UP	75	49	26
	79	51	20
	86	70	16
	86	74	12
	88	68	20
DECREASE TOWARDS THE MIDDLE	90	68	22
	78	53	25
MINOR (LESS THAN 10%) TO NO CHANGE	91	84	7
	85	79	6
	90	87	3
	93	87	6
	95	87	8

TABLE 7
CHANGES IN ASH

TYPE OF CHANGE	HIGH VALUE (%)	LOW VALUE (%)	CHANGES (%)
INCREASE UP	14.6	5.1	9.5
	19.8	3.2	16.6
	17.8	6.4	11.4
DECREASE UP	8.5	3.6	4.9
	10.7	4.5	6.2
	10.0	4.5	5.5
MINOR (LESS THAN 4%)			
TO NO CHANGE	4.3	3.3	1.0
	4.8	2.8	2.0
	4.0	2.0	2.0
	10.3	6.8	3.5
	6.6	3.3	3.3
	10.9	8.4	2.5

TABLE 8
CHANGES IN SULFUR

TYPE OF CHANGE	HIGH VALUE (%)	LOW VALUE (%)	CHANGE (%)
INCREASE UP	5.4	2.1	3.3
	3.8	1.7	2.1
	9.2	4.0	5.2
MINOR (LESS THAN 2.0%) TO NO CHANGE	1.3	0.9	0.4
	1.9	1.1	0.8
	1.9	0.8	1.1
	3.0	1.5	1.5
	1.8	1.5	0.3
	2.8	1.6	1.2
	4.1	3.8	0.3
	5.0	3.4	1.6
	5.1	4.4	0.7

The final step in evaluating the column data was grouping the columns with respect to vertical variation in vitrinite, ash, and sulfur. The thicknesses of these columns were also examined to determine any significant variation in thickness versus column pattern. This data, shown on Table 9, indicate little tendency of vertical patterns to cluster and hence seem to reflect a series of unique events in the history of different swamps or different parts of the same swamp. What these events were depends on the inferences that can be made about the origin of each of the components.

PYRITE SIZE/FORM/MICROLITHOTYPE VARIATION

Pyrite size/form/microlithotype analyses were completed for only 15 of the 36 samples represented in the 12 columns shown in Appendices II and IV. The predominant size category of the pyrite was less than 5 microns and the forms seem to be related to maceral percentages. As vitrinite decreased within the seams, the percentages of euhedral forms also decreased with concomitant increases in massive and, in some instances framboidal pyrite towards the top of the seams. Also, in columns where the total sulfur varied, those parts of the seam with higher sulfur values often showed greater percentages of massive forms. The variation in microlithotypes also appears to be related to vitrinite percentages. In columns where the vitrinite decreased upwards, vitrite and clarite also decreased, while the proportion of vitrinertinite and trimacerite increased.

INTERPRETATIONS OF COLUMN DATA

Environmental Significance of Components

If the vertical patterns of lithotypes, vitrinite, ash, and

TABLE 9

VERTICAL PATTERNS

PATTERN	VITRINITE	ASH	SULFUR	# OF COLUMNS	THICKNESS (CM)
A	NO CHANGE-HIGH	NO CHANGE-LOW	NO CHANGE-LOW	2	68, 69
B	NO CHANGE-HIGH	DECREASE UP	NO CHANGE-LOW	1	75
C	DECREASE UP	NO CHANGE-LOW	NO CHANGE-LOW	2	64, 105
D	DEC. TO MIDDLE	INCREASE UP	NO CHANGE-LOW	1	84
E	NO CHANGE-HIGH	INCREASE UP	INCREASE UP	1	48
F	DECREASE UP	INCREASE UP	INCREASE UP	2	51, 68
G	NO CHANGE-HIGH	NO CHANGE-HIGH	NO CHANGE-HIGH	1	48
H	DECREASE UP	DECREASE UP	NO CHANGE-HIGH	1	61
I	DEC. TO MIDDLE	NO CHANGE-HIGH	NO CHANGE-HIGH	1	85

sulfur, as well as the variation in pyrite forms are considered to reflect changes within the development of the Tradewater swamps, then it is first necessary to examine the specific environmental conditions by which these changes may occur.

Macerals and Environments

It is generally agreed that coal macerals reflect both the kinds of plant materials living in the peat swamps as well as the degree to which the plant parts are degraded. The general categorization of maceral producing plant parts includes partially degraded fibrous or woody materials which yield vitrinites, and waxy leaf and stem cuticles, spores, and resins which yield exinite. Any of these materials may further be degraded into carbon-rich inertinites, but it is probable that the woody material is the greatest contributor. As indicated in Figure 18, this process of degradation is strongly controlled by the chemical background in which the peat accumulates. Vitrinite is preserved in very acidic (pH less than 4.5) and reducing (negative Eh) settings which are continuously saturated with stagnant water in which the absence of oxygen and high acidity inhibits either chemical or biological degradation. In situations where the oxygen content of the water is slightly higher, it can be expected that more of the vitrinite-producing material will be degraded to inertinite and under extreme conditions, such as burning or exposure to the air, a very high carbon fusain band (charcoal layer primarily composed of inertinite macerals) could be produced. Acidity presumably controls the activity of microbial decay and above a pH of 4.5, it is expected that much of the vitrinite will be decomposed leaving the resistant exinite macerals under reducing conditions,

Figure 10. Eh-pH model. The parallelogram indicates the Eh-pH limits of most natural environments (after Baas-Becking and others, 1960; and Krauskopf, 1967).

and increase the amount of both inertinites and exinites under slightly oxidizing conditions. Viewed in this light, the very high content of vitrinite in the Tradewater coals suggests an extremely acidic and anoxic setting for the swamps relative to those of the Appalachian region in which the vitrinite content is much lower and more variable (Hower and others, 1983).

Sulfur and Environments

Most of the sulfur in the Tradewater coals is pyritic and organic in origin and, as in the case of macerals, the formation of this material is strongly influenced by the chemical background. As indicated in Figure 18, pyrite does not readily form under positive Eh conditions and the activity of the pyrite-producing bacteria is suppressed when the pH is less than 4.5 (Baas-Becking and others, 1960). Hence high vitrinite and low sulfur in some Tradewater samples seems to reflect the same conditions of negative Eh and high acidity. However, other samples which are high in both sulfur and vitrinite suggests a somewhat greater tolerance of pyrite-producing bacteria to low pH, which would allow high vitrinite coals to form. This variation in sulfur due to pH conditions is thought to reflect the salinity of the waters in which the swamps developed. Modern fresh water (acidic) swamps generally have both low organic and pyritic sulfur contents (Casagrande and others, 1977), while those formed under more brackish conditions will contain much higher sulfur values (Casagrande and others, 1977; Altschuler and others, 1983; Given and others, 1983; Styan and Bustin, 1983a; Styan and Bustin, 1983b). The acidic nature of the fresh water swamps is thought to be due to the cation exchange of hydrogen on the plant

cell walls for metal ions (Baas-Becking and others, 1960; Wetzel, 1983). The higher sulfur values are generally attributed to both higher sulfate concentrations of marine waters and high microbial activity under basic conditions but is also dependent on the availability of iron (Baas-Becking and others, 1960; Francis, 1961; Degens, 1965; Neavel, 1966; Krauskopf, 1967; Berner, 1970; Berner, 1971; Goldhaber and Kaplan, 1974).

Ash and Environments

As previously indicated, ash content of the Tradewater coals is partially dependent on sulfur content, but in some instances may reflect the presence of primarily silicate and carbonate minerals. Some authors (such as Cecil and others, 1981) suggest that the mineral matter is primarily generated by the plant themselves. More likely, the mineral matter is introduced by aqueous suspensions entering into the swamp or chemically precipitated (Staub and Cohen, 1979; Altschuler and others, 1983; Styau and Bustin, 1983a; Styau and Bustin, 1983b; Andrejko and others, 1983). The only information in this data set that has any bearing on the problem is the lack of association found between maceral content and ash content. If minerals were derived solely from plants, then those coals which are highly degraded (high inertinite and/or exinite percentages) should contain a greater amount of ash. Since this is not the case, it may be assumed that most of the minerals originated from suspensions introduced into the swamp or were chemically precipitated.

Interpretations of Column Patterns

Because the patterns found in the columns of Tradewater coals

display such a large degree of heterogeneity, selection of the component that would comprise a starting point for discussion is one which is most often considered as a fundamental environmental index - water salinity. The best criteria for this quantity, among the parameters measured, is sulfur which is believed to be pH controlled with fresh water peat swamps generally more acidic than those formed under brackish or saline conditions. On this basis, the columns fall into three groups - low sulfur (fresh water) coals, high sulfur (saline water) coals, and coals with sulfur increasing upward (fresh to saline waters). Environmental significance of variation in macerals and ash within these groups in context of the Eh-pH model on Figure 18 is given below.

Low Sulfur (fresh water) Coals

These coals are considered to have been deposited under relatively acidic conditions in fresh waters. The ash percentages of Patterns A and C are also low (less than 7%), which suggests minor mineral matter from sources other than the original plant materials. Slight increases in ash values towards the top and/or the base of the seams (Patterns B and D) may reflect increased detrital influx when the swamp vegetation was still incompletely developed early in its history, or, near its end when the vegetation died out.

The maceral percentages show varying degrees of plant degradation through oxidation. In some instances, this is minor (Patterns A and B), while in others (Patterns C and D), it is quite significant. The Eh-pH model (Figure 18) indicates possible pathways by which this oxidation might occur. Patterns A, B, and C, all show

a decrease in vitrinite towards the top of the seam, which may reflect oxidation possibly due to exposure to the air at the top of the peat prior to burial, changes in ground water levels, or may be due to increased oxidation produced by an influx of oxygenated waters. Pattern D, which indicates oxidation in the middle of the seam, may reflect renewed plant growth due to flooding by oxygenated waters which initially oxidize the plants, but also provided nutrients for greater productivity as the swamp becomes reestablished and organic matter is again preserved under reducing conditions. The fresh water coals also appear to reflect the greatest productivity and/or least degradation as is indicated by the greater thickness of these coals (mean = 78 cm) as compared to those which accumulated under more saline conditions.

High Sulfur (saline water) Coals

These coals reflect deposition in the presence of marine, or more likely, brackish waters. Patterns G and I, which show relatively high ash values, may reflect proximity to sediment-bearing tidal creeks. Pattern H which shows a decrease in ash upward may indicate a better developed swamp which was shielded from active detrital influx. Diminished vitrinite at the top of the seam (Pattern G) and at the middle of the seam (Pattern I) may indicate influx of oxygen-bearing tidal waters which degraded the peat. These coals are generally thinner (mean = 65 cm) than those deposited in fresh waters, reflecting greater degradation and less productivity within a brackish setting.

Coals with Increasing Sulfur Upward (fresh to saline water)

Sulfur and ash values of the coals in this group (Patterns

E and F) are low at the bottom and middle of the seams, but increase strongly towards the top. This change suggests influx of oxygenated, sediment-laden tidal water perhaps prior to marine inundation. Such an event would also account for the diminished vitrinite content in the upper part of the seam (Figure 18). The increase in massive and framboidal pyrite (Pattern F) towards the top of the seams may indicate a transgression of brackish waters over the fresh swamps as well (Horne and others, 1978, Caruccio and others, 1977). These coals are also somewhat thinner than the fresh water types, presumably due to the degradation at the tops of the seams.

SUMMARY

This study of the coal-bearing Tradewater Formation in western Kentucky indicates a very irregular pattern of deposition relative to the overlying Carbondale Formation in which coals and other rock units are very widespread. The discontinuous, but relatively abundant, coarsening-upward sequences of the Tradewater rocks, which are composed of fine-grained material suggest deposition in shallow lakes, ponds, and bays. The marine fossils and fossil-bearing limestones in these rocks indicate close proximity to the sea. Coarse-grained fining-upward sequences, which are not common, are most likely channel deposits. These channels may have contained fresh or brackish waters, but the absence of very clean sandstones in them suggests that the shoreline from which they could be derived was not nearby.

Like the detrital rocks, the coals of the Tradewater Formation are erratically distributed and petrographic, ash, and sulfur differences between samples indicate that the swamps in which they developed had very different histories. Some were apparently deposited under the influence of fresh water and several of these were apparently isolated from periodic flooding as the ash content is low, and the vitrinite remains high. Others which were also deposited in fresh waters, periodically received influx of sediment-laden oxygenated waters which reduced the vitrinite and increased the ash in some parts of the seams. However, reduced vitrinite content could also be due to fires or exposure of the peat to the air. Samples which

indicate peat accumulation in the presence of saline water show a somewhat greater tendency for detrital influx and degradation by oxygenated water.

Because the areal extent of the seams from which the samples were collected is not known, it cannot be determined whether any one swamp in which the coal accumulated would be large enough to include all environmental settings described above. However, if the swamps can be assumed to be of very modest extent, then the surface on which the coals accumulated may have been similiar to that depicted in Figure 19. That this general pattern was geographically widespread and persisted over a considerable period of time is indicated by the lack of significant trends in coal properties, either geographically or stratigraphically in the 1500 square mile area and 200 to 300 foot block of sediment that comprised the area of this study.

LEGEND

SHALEY SEDIMENTS

SWAMPS

CARBONATES

OPEN WATERS

Figure 19. Depositional setting for the Tradewater peat swamps in western Kentucky.

APPENDIX I

MEGASCOPIC DESCRIPTIONS

DUNBAR COAL ZONE
KCER #'s 7635 - 7638

DATE COLLECTED - June 28, 1982

COUNTY - Butler

QUADRANGLE - South Hill

CARTER COORDINATES - 15-I-33 840' FSL 4360' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7636	9.9	100.0+	gray shale
		0.3	vitrain
		4.2	bone or durain
		0.3	vitrain
		1.9	dull clarain
		1.0	pyrite layer
7637	13.4	2.2	bright clarain
		2.0	durain with thin fusains
		0.3	bright clarain
		3.1	clarain
		0.9	bright clarain
		2.1	dull clarain
7638	27.0	5.0	bright clarain
		0.3	durain
		1.8	bright clarain
		0.8	vitrain
		7.4	dull clarain
		0.5	vitrain
		1.5	bright clarain
		0.4	vitrain
		1.8	dull clarain
		6.5	clarain
		0.3	vitrain
		3.2	clarain
		2.5	durain
		2.0+	light gray underclay

DUNBAR COAL ZONE
KCER #'s 7639 - 7642

DATE COLLECTED - June 29, 1982

COUNTY - Butler

QUADRANGLE - South Hill

CARTER COORDINATES - 14-I-33 3200' FSL 1080' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7640	18.7	300.0	light gray sandstone
		300.0	gray shale
		8.0	bone or durain
		0.2	fusain
		2.0	bone or durain
		2.0	dull clarain
		2.0	bright clarain
		0.4	fusain
		1.7	bright clarain
		2.0	dull clarain
		0.4	fusain
		0.6	vitrain
		0.7	clarain - with some thin pyrite layers
7641	20.7	0.9	durain
		0.3	vitrain
		1.2	durain
		2.0	clarain
		0.5	vitrain
		2.0	dull clarain
		1.5	bright clarain
		1.0	dull clarain
		1.5	vitrain
		5.0	clarain
		3.0	vitrain
		0.5	fusain
		3.5	clarain
		0.4	vitrain
		2.0	bright clarain
		1.8	dull clarain
7642	26.0	0.5	fusain
		0.7	vitrain
		1.5	fusain
		2.0	dull clarain
		1.0	vitrain
		1.0	dull clarain
		0.4	fusain
		0.9	vitrain
		0.5	bright clarain
		4.0	dull clarain
		0.6	vitrain

DUNBAR COAL ZONE
KCER # 's 7639 - 7642 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		1.0	clarain
		1.0	fusain
		2.0	clarain
		0.5	pyrite layer
		0.7	vitrain
		2.0+	light gray underclay

ELM LICK COAL ZONE
KCER #'s 7651 - 7655

DATE COLLECTED - July 20, 1982

COUNTY - Ohio

QUADRANGLE - Flener

CARTER COORDINATES - 15-K-35 2900' FSL 2350' FEL

COMMENTS - Three seams were collected at this site, but three benches of each were not collected.

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7654	28.8	360.0+	gray shale with several thin vitrain bands at the base
		28.8	clarain with several thin fusain and pyrite bands
		15.0+	light gray underclay
		540.0+	gray shale
		3.0	gray shale with carbonaceous plant remains and several thin vitrain bands
7652	23.1	0.6	fusain
		0.1	pyrite
		9.7	clarain with several thin pyrite layers
		0.7	vitrain
		0.1	fusain
		0.2	vitrain
		0.2	fusain
		0.3	dull clarain
		0.5	vitrain
		0.9	dull clarain
		0.7	vitrain
		0.3	fusain
		0.3	vitrain
		0.2	fusain
		1.8	clarain
		1.8	fusain
		0.3	vitrain
		0.8	fusain
		0.4	vitrain
		0.2	fusain
		1.4	dull clarain with several thin fusain bands
7653	13.0	0.7	fusain
		0.3	vitrain
		0.3	fusain
		0.3	vitrain
		8.0	bright clarain with several thin fusain bands

ELM LICK COAL ZONE
KCER #'s 7651 - 7655 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7655	26.0	3.5	bright clarain
		1.5	dull clarain with numerous thin fusain bands
		5.0+	light gray underclay
		600.0+	gray shale
		13.0	bright clarain with several thin pyrite bands at the top
		7.0	bright clarain
		6.0	bright clarain with several thin pyrite bands
		5.0+	light gray underclay

ELM LICK COAL ZONE
KCER #'s 7656 - 7659

DATE COLLECTED - July 20, 1982

COUNTY - Ohio

QUADRANGLE - Rosine

CARTER COORDINATES - 6-K-35 200' FSL 300' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7657	28.1	15.0	black carbonaceous shale
		10.5	vitrain
		0.1	fusain
		3.0	clarain
		11.5	bright clarain
		0.1	fusain
		0.4	vitrain
		1.2	fusain
		0.3	vitrain
		1.0	fusain
7658	32.2	1.0	durain
		0.4	fusain
		2.8	dull clarain
		0.2	fusain
		1.8	vitrain
		0.4	durain
		0.3	fusain
		1.1	clarain
		0.2	fusain
		0.4	clarain
		0.3	fusain
		4.0	clarain
		4.0	vitrain
		1.2	clarain
		1.5	fusain
		1.5	clarain
		4.0	fusain
		1.7	clarain
		0.5	fusain
		1.8	clarain
7659	26.0	0.2	fusain
		2.5	clarain
		0.4	dark gray shale
		26.0	clarain with two thin fusain bands
		5.0	dark gray shale
		0.9	vitrain
		5.0+	light gray underclay

DUNBAR COAL ZONE

KCER # 7665

DATE COLLECTED - July 21, 1982

COUNTY - Butler

QUADRANGLE - Morgantown

CARTER COORDINATES -- 19-I-34 3100' FSL 1000' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		30.0+	gray shale
		14.0	carbonaceous shale
7665	12.0	12.0	clarain
		5.0+	light gray underclay

DUNBAR COAL ZONE

KCER # 7666

DATE COLLECTED - July 22, 1982

COUNTY - Butler

QUADRANGLE - Morgantown

CARTER COORDINATES - 19-I-34 4780' FSL 3880' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7666	23.9	30.0+	light gray sandstone
		5.0	clarain
		130.0	fossiliferous limestone
		15.0	gray shale
		8.0	fossiliferous limestone
		45.0	gray shale
		2.5	fusain
		1.0	vitrain
		0.3	fusain
		0.5	vitrain
		0.3	fusain
		1.5	vitrain
		0.5	fusain
		1.0	clarain
		0.5	gray shale
		0.6	dull clarain
		1.0	vitrain
		1.5	bright clarain
		1.0	vitrain
		0.6	clarain
		3.5	vitrain
		1.0	clarain
		0.6	fusain
		6.0	vitrain
		5.0	rooted underclay
		5.0	black carbonaceous shale
		100.0	gray silty shale
		260.0+	light gray sandstone

DUNBAR COAL ZONE
KCER #'s 7667 - 7670

DATE COLLECTED - July 22, 1982

COUNTY - Butler

QUADRANGLE - Morgantown

CARTER COORDINATES - 13-I-34 1900' FSL 800' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7668	27.6	60.0+	gray shale
		3.0	clarain
		6.0	vitrain
		0.3	fusain
		2.5	bright clarain
		1.0	durain
		2.0	vitrain
		0.1	pyrite layer
		1.0	clarain
		2.5	bright clarain
		1.5	vitrain
		0.2	fusain
		2.0	vitrain with a few thin fusain bands
		1.5	vitrain
		0.4	fusain
		0.4	vitrain
		0.2	fusain
		0.8	vitrain
		0.3	fusain
		0.2	vitrain
		0.4	fusain
		0.5	vitrain
		0.5	fusain
		0.3	vitrain
7669	19.5	2.0	dull clarain
		10.0	clarain
		1.5	vitrain
		2.5	dull clarain
		2.0	vitrain
7670	35.0	1.5	dull clarain
		9.3	bright clarain
		5.0	vitrain
		2.0	dull clarain
		2.5	vitrain
		2.5	clarain
		1.0	fusain
		0.9	vitrain
		1.0	clarain
		0.8	vitrain
		6.0	dull clarain

DUNBAR COAL ZONE
KCER #'s 7667 - 7670 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		3.0	vitrain
		1.0	fusain
		30.0+	light gray underclay which grades into a silty shale

ELM LICK COAL ZONE
KCER #'s 7680 - 7683 (middle)
7684 - 7687 (lower)

DATE COLLECTED - July 27, 1982

COUNTY - Ohio

QUADRANGLE - Horton

CARTER COORDINATES - 15-L-33 1100' FSL 1700' FEL

COMMENTS - Two seams collected at this site

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		450.0+	gray shale
		30.0	coal-too high up to collect
		1200.0	gray shale
7681	14.9	4.2	fusain and pyrite
		4.5	bright clarain
		0.1	fusain
		6.0	clarain
		0.1	fusain
7682	16.5	16.5	dull clarain with several thin fusain bands
7683	15.5	15.5	clarain with several thin fusain bands
		3.0	black carbonaceous shale with several thin vitrain bands
7685	32.8	9.5	dull clarain
		0.4	fusain
		5.4	clarain
		5.0	dull clarain
		0.3	fusain
		0.5	dull clarain
		0.3	vitrain
		1.4	dull clarain
		0.1	fusain
		0.4	vitrain
		0.2	dull clarain
		0.1	fusain
		0.3	dull clarain
		0.6	vitrain
		1.0	fusain
		0.4	vitrain
		0.4	clarain
		0.4	vitrain
		1.8	clarain
		0.3	vitrain
		3.0	clarain
7686	40.0	4.5	bright clarain
		0.3	fusain
		15.5	clarain
		0.1	fusain

KCER # 1's 7680 - 7683 (middle)
7684 - 7687 (lower)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		20.0	bright clarain with several thin fusain bands
7687	31.0	1.0	pyrite band
		30.0	bright clarain
		5.0+	light gray underclay

ELM LICK COAL ZONE
 KCER #'s 7688 - 7691 (middle)
 7691 - 7695 (lower)

DATE COLLECTED - July 28, 1982

COUNTY - Ohio

QUADRANGLE - Horton

CARTER COORDINATES - 20-L-33 2300' FSL 3100' FEL

COMMENTS - Two seams collected at this site

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7689	13.3	600.0+	gray shale
		2.5	clarain with two thin pyrite bands
		0.1	fusain
		8.5	dull clarain
		0.3	fusain
		0.5	pyrite
		0.3	vitrain
		0.4	dull clarain
		0.3	vitrain
		0.4	dull clarain
7690	19.2	0.1	fusain
		1.0	vitrain
		3.5	clarain
		0.1	fusain
		5.0	bright clarain
		2.5	fusain and pyrite
		7.0	clarain
7691	14.0	0.1	fusain
		3.0	dull clarain
		0.1	fusain
		0.4	dull clarain
		2.5	fusain
		2.5	clarain with two thin fusain bands
		4.0	bright clarain
		1.0	fusain and pyrite
		0.4	vitrain
		5.5	dark gray shale
		37.0	gray shale
7693	22.1	4.5	durain with thin fusain bands
		0.1	fusain
		8.0	clarain
		1.0	fusain
		2.5	clarain
		0.1	fusain
		3.0	dull clarain
		0.3	fusain

ELM LICK COAL ZONE
 KCER #'s 7688 - 7691 (middle)
 7691 - 7695 (lower)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7694	17.7	0.3	vitrain
		0.8	fusain
		0.5	vitrain
		0.5	fusain
		0.5	dull clarain
		2.0	fusain
		2.5	dull clarain
		0.3	vitrain
		0.3	fusain and pyrite
		0.5	dull clarain
		1.0	fusain
		8.5	dull clarain
		0.1	fusain
		1.5	bright clarain
		1.0	fusain and pyrite
7695	23.5	23.5	bright clarain
		5.0+	light gray underclay

LEAD CREEK COAL ZONE
KCER #'s 7696 - 7699

DATE COLLECTED - July 29, 1982

COUNTY - Daviess

QUADRANGLE - Philpot

CARTER COORDINATES - 23-O-31 200' FSL 4300' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7697	26.2	900.0+	gray shale
		0.6	dull clarain
		0.1	pyrite band
		0.3	bright clarain
		1.8	clarain
		0.1	pyrite band
		0.4	dull clarain
		0.1	pyrite band
		1.5	dull clarain
		0.2	fusain and pyrite
		0.3	vitrain
		0.2	fusain
		0.3	vitrain
		0.3	dull clarain
		0.3	vitrain
		0.6	dull clarain
		0.1	pyrite band
		0.3	dull clarain
		1.5	clarain
		0.3	vitrain
		1.5	clarain
		0.5	vitrain
		1.2	dull clarain
		0.3	vitrain
		1.0	dull clarain
		0.3	vitrain
		0.3	dull clarain
		0.5	clarain
		1.3	dull clarain
		0.5	vitrain
		0.3	dull clarain
		0.1	fusain
		0.4	dull clarain
		1.0	bright clarain
		0.6	dull clarain
		0.3	clarain
		0.3	dull clarain
		0.1	fusain

LEAD CREEK COAL ZONE
KCER #'s 7696 - 7699 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7698	16.0	0.3	vitrain
		0.1	fusain
		0.2	pyrite band
		0.6	dull clarain
		0.4	bright clarain
		0.6	dull clarain
		3.0	bright clarain
		0.9	dull clarain
		0.3	bright clarain
		0.3	dull clarain
		0.2	fusain
		0.2	pyrite band
		0.4	dull clarain
		0.4	vitrain
		2.5	clarain
		0.3	vitrain
		5.0	clarain
		0.3	vitrain
		2.5	clarain
		0.4	vitrain
		0.8	clarain
		0.3	vitrain
		0.8	clarain
7699	25.1	0.3	vitrain
		0.6	dull clarain
		0.5	clarain
		0.2	fusain and pyrite
		3.4	bright clarain
		0.2	pyrite band
		0.1	fusain
		1.0	clarain
		0.1	fusain
		1.0	clarain
		0.1	fusain
		0.3	vitrain
		1.0	bright clarain
		0.1	fusain
		0.3	bright clarain
		0.1	fusain
		1.0	bright clarain

LEAD CREEK COAL ZONE
KCER #'s 7696 - 7699 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		0.1	pyrite band
		0.3	vitrain
		1.5	bright clarain
		0.1	pyrite band
		1.0	vitrain
		0.1	pyrite band
		2.5	vitrain
		0.4	clarain
		0.1	pyrite band
		4.0	bright clarain
		5.0	vitrain with numerous thin fusain bands
		5.0+	light gray underclay

DUNBAR COAL ZONE
KCER #'s 7711 - 7714

DATE COLLECTED - August 17, 1982

COUNTY - Butler

QUADRANGLE - Flener

CARTER COORDINATES - 8-J-34 600' FSL 4300' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		750.0+	gray shale and siltstone, some rippled
7712	22.1	9.0	dull clarain
		0.5	fusain
		0.4	vitrain
		1.0	fusain
		11.0	clarain
		0.2	fusain
7713	27.8	11.0	clarain
		1.0	fusain
		0.5	clarain
		0.5	vitrain
		0.5	clarain
		1.0	vitrain
		1.5	clarain
		0.5	fusain
		11.0	bright clarain
		0.3	fusain
7714	24.2	2.0	bright clarain
		0.2	fusain
		21.0	clarain
		3.5	black carbonaceous shale with thin vitrain bands
		5.0+	light gray underclay

LEAD CREEK COAL ZONE
KCER #'s 7716 - 7719

DATE COLLECTED - August 16, 1982
COUNTY - Daviess
QUADRANGLE - Philpot
CARTER COORDINATES - 22-O-31 1100' FSL 2800' FEL

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		900.0+	gray shale
7717	18.9	12.6	dull clarain with numerous thin fusain bands
		0.3	fusain
		0.4	vitrain
		0.2	fusain
		0.4	dull clarain
		0.2	vitrain
		0.3	fusain
		0.2	vitrain
		0.2	fusain
		0.5	vitrain
		1.0	fusain
		1.0	vitrain
		0.2	fusain
		0.2	vitrain
		0.2	fusain
		0.5	vitrain
		0.5	fusain
7718	21.1	5.0	clarain with thin fusain bands
		1.0	fusain and pyrite
		8.0	clarain with thin fusain bands
		0.4	fusain and pyrite
		0.5	dull clarain with thin fusain bands
		0.3	vitrain
		2.0	clarain with thin fusain bands
		0.5	vitrain
		0.7	clarain with thin fusain bands
		0.2	fusain
		2.5	clarain
7719	17.5	0.5	vitrain
		0.1	fusain
		1.2	dull clarain
		0.2	fusain
		1.0	dull clarain
		0.4	vitrain
		3.0	clarain with thin fusain bands
		4.0	bright clarain
		0.1	fusain
		5.5	bright clarain

LEAD CREEK COAL ZONE
KCER #'s 7716 - 7719 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
		0.2	fusain and pyrite
		1.3	bright clarain
		1.2	dark gray shale with numerous thin vitrain bands
		0.3	vitrain
		1.0	fusain
		5.0+	light gray underclay

LEAD CREEK COAL ZONE
KCER #'s 7720 - 7723

DATE COLLECTED - August 16, 1982
COUNTY - Daviess
QUADRANGLE - Philpot
CARTER COORDINATES - 20-O-31 4000' FSL 5280' FEL
COMMENTS - Pyrite in cleat and fractures

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7721	20.8	900.0+	gray shale
		1.5	durain
		0.4	vitrain
		0.2	fusain
		0.5	vitrain
		0.1	fusain
		0.5	dull clarain
		0.2	pyrite layer
		1.3	dull clarain
		0.3	vitrain
		2.0	bright clarain
		0.1	fusain
		2.0	bright clarain
		0.4	vitrain
		0.2	fusain
		1.0	vitrain
		0.2	fusain
		1.0	bright clarain
		0.2	fusain
		1.0	clarain
		0.2	fusain
		2.5	vitrain
		0.1	fusain
		0.7	vitrain
		0.1	fusain
		1.0	bright clarain
		0.1	fusain
		0.3	vitrain
		0.1	fusain
		0.5	bright clarain
		0.1	fusain
		0.3	vitrain
		0.3	fusain
		0.3	vitrain
		0.2	fusain
		0.5	bright clarain
		0.1	fusain
		0.3	vitrain
7722	22.0	13.0	bright clarain

LEAD CREEK COAL ZONE
KCER #'s 7720 - 7723 (cont.)

BENCH	BENCH THICKNESS (CM)	LITHOTYPE THICKNESS (CM)	LITHOTYPE DESCRIPTION
7723	22.0	2.0	fusain and pyrite which grades laterally into bright clarain
		7.0	bright clarain
		8.0	bright clarain
		14.0	clarain
		5.0+	light gray underclay

APPENDIX II

COAL COLUMNS

MEGASCOPIC DESCRIPTIONS **FUSAIN** **VITRAIN** **BRIGHT CLARAIN** **CLARAIN** **DULL CLARAIN** **DURAIN** **BONE** **CARBONACEOUS SHALE** **GRAY SHALE** **ROOTED UNDERCLAY** **PYRITE****MACERAL COUNTS** **VITRINITES** **INERTINITES** **EXINITES** **SULFUR (DRY)** **ASH (DRY)****FORMS OF PYRITE** **EUHEDRAL** **FRAMBOIDAL** **MASSIVE, CLEAT**

PATTERN A

LEAD CREEK COAL ZONE

7696 - 7699

PATTERN B

DUNBAR COAL ZONE

7711 - 7714

PATTERN C

8

ELM LICK COAL ZONE (LOWER)

ELM LICK COAL ZONE (LOWER)

7684 - 7687

PATTERN D

DUNBAR COAL ZONE

7667 - 7670

PATTERN E

ELM LICK COAL ZONE (MIDDLE)

7680 - 7683

PATTERN F

3

DUNBAR COAL ZONE

7635 - 7638

DUNBAR COAL ZONE

7639 - 7642

PATTERN G

ELM LICK COAL ZONE (MIDDLE)

PATTERN H

1

1

LEAD CREEK COAL ZONE

7716 - 7719

PATTERN I

ELM LICK COAL ZONE

7656 - 7659

APPENDIX III

PETROGRAPHIC AND CHEMICAL DATA

DUNBAR COAL (CHANNELS)

KCER #	CARTER COORD	CORE # CHANNEL	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	VIT MAX R	V MAX s. d.	ASH (DRY)	SULFUR (DRY)
7026	2-I-34	Gil 8	57.4	12.2	15.5	4.8	3.3	0.0	5.7	C.0	0.57	0.03	22.9	4.6
7033	13-I-31	Gil 10	76.4	0.9	11.0	4.2	1.8	0.0	5.0	C.7	0.49	0.04	14.0	2.7
7034	13-I-31	Gil 10	73.7	1.6	5.5	4.0	3.9	0.0	9.5	C.9	0.61	0.04	15.6	1.3
7035	13-I-31	Gil 10	72.5	5.0	9.5	4.1	3.1	0.2	5.5	C.0	0.48	0.03	19.4	3.5
7038	24-K-34	Gil 11	66.6	9.6	10.7	3.0	4.3	0.0	5.8	C.0	0.54	0.03	15.7	5.3
7040	13-I-32	Gil 12	72.2	11.7	11.1	2.8	3.3	0.0	9.0	C.0	0.56	0.03	16.7	5.7
7043	8-I-33	Gil 13	73.7	5.8	4.6	2.4	5.2	0.5	7.4	C.4	0.57	0.04	3.7	1.4
7071	15-I-31	Gil 19	84.0	1.5	3.7	1.4	0.8	0.0	3.6	0.0	0.51	0.03	4.6	1.3
7076	16-I-28	Gil 20	80.5	2.9	4.9	1.0	0.9	0.0	9.8	0.0	0.61	0.03	11.2	4.2
7077	16-I-28	Gil 20	74.9	1.8	10.0	1.0	2.4	0.0	9.8	0.1	0.57	0.02	9.9	6.6
7086	25-J-33	Gil 23	70.7	1.8	18.1	2.1	1.6	0.3	5.4	0.0	0.57	0.02	14.6	3.3
7087	25-I-33	Gil 23	86.0	1.6	2.0	0.5	2.3	0.0	7.6	0.0	0.68	0.04	3.7	0.8
7090	10-K-33	Gil 24	84.9	3.8	3.5	1.3	2.4	0.2	4.1	0.0	0.52	0.02	8.6	1.8
7091	10-K-33	Gil 24	64.1	3.2	17.6	1.3	2.5	0.0	11.1	0.0	0.53	0.03	17.4	7.9
7092	10-K-33	Gil 24	59.4	1.8	26.4	2.9	3.0	0.1	6.2	0.2	0.54	0.03	18.8	5.2
7328	24-I-31	Channel	81.2	2.6	4.2	0.8	3.0	0.3	7.9	0.0	0.61	0.04	N/A	N/A
7331	24-I-34	Channel	61.3	6.3	6.9	5.1	6.8	0.3	13.1	0.0	0.66	0.05	N/A	N/A
7338	17-I-33	Channel	80.5	0.1	4.9	5.7	2.9	0.0	5.1	0.7	0.57	0.04	N/A	N/A
7349	12-L-32	Channel	76.7	1.9	7.4	1.8	3.9	0.0	8.3	0.0	0.52	0.02	N/A	N/A
7635	15-I-33	Channel	61.1	2.5	6.9	5.0	3.1	0.0	21.3	0.1	0.56	0.07	6.6	3.0
7639	14-I-33	Channel	54.7	7.8	9.0	9.4	3.9	0.0	14.9	0.3	0.47	0.05	7.2	2.4
7665	19-I-34	Channel	88.1	1.7	1.9	0.9	2.9	0.0	4.4	0.1	0.44	0.03	7.5	3.7
7666	19-I-34	Channel	65.6	3.1	16.3	6.9	2.3	0.4	5.4	0.0	0.46	0.04	18.7	2.3
7667	13-I-34	Channel	67.0	3.1	8.7	5.5	3.5	0.0	11.4	0.6	0.62	0.05	5.4	1.0
7711	8-J-34	Channel	81.9	6.3	3.6	1.7	1.4	0.0	5.0	0.1	0.58	0.04	3.2	1.4
7755	2-J-32	Gil 9	78.5	8.1	3.9	2.8	1.1	0.3	4.9	0.4	0.54	0.04	12.4	4.4
7763	10-K-33	Gil 24	80.6	6.0	2.1	1.2	2.7	0.9	5.9	0.6	0.57	0.03	4.3	3.9

LEAD CREEK COAL (CHANNELS)

KCER #	CARTER COORD	CORE # CHANNEL	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	VIT MAX	V MAX R s. d.	ASH (DRY)	SULFUR (DRY)
7010	2-Q-32	Gil 1	65.5	3.4	15.3	5.0	2.5	0.8	6.6	0.9	0.53	0.03	14.7	2.5
7014	16-O-31	Gil 2	82.7	4.4	2.3	2.5	2.9	0.0	4.6	0.6	0.52	0.07	8.4	1.8
7015	16-O-31	Gil 2	89.4	0.5	0.9	1.0	3.2	0.0	4.2	0.7	0.52	0.04	26.0	5.9
7016	16-O-31	Gil 2	75.0	2.5	8.5	3.9	3.5	0.1	5.9	0.6	0.55	0.02	4.2	1.8
7018	17-P-32	Gil 3	62.8	1.7	11.4	6.6	4.5	1.3	10.8	0.9	0.55	0.04	11.8	4.8
7019	17-P-32	Gil 3	90.2	0.7	1.4	1.0	1.2	0.0	5.3	0.2	0.53	0.03	17.0	4.3
7097	6-L-30	Gil 25	76.8	4.3	7.9	2.3	1.9	0.2	6.6	0.0	0.60	0.03	11.8	3.3
7098	6-L-30	Gil 25	75.8	2.3	10.0	1.3	2.2	0.0	8.4	0.0	0.63	0.03	34.2	3.6
7102	1-N-27	Gil 27	90.8	1.9	2.4	0.3	0.1	0.0	4.5	0.0	0.53	0.02	49.3	6.3
7103	1-N-27	Gil 27	82.4	3.5	7.0	1.4	0.9	0.0	4.8	0.0	0.66	0.03	29.0	1.7
7105	7-Q-31	Gil 28	76.3	2.8	9.6	2.2	2.2	0.0	6.9	0.0	0.46	0.03	17.6	2.8
7351	7-M-31	Channel	85.2	4.7	1.5	2.3	3.5	0.1	2.5	0.2	0.57	0.05	N/A	N/A
7352	8-M-31	Channel	87.7	3.4	1.5	0.8	2.7	0.0	3.6	0.3	0.70	0.04	N/A	N/A
7355	18-N-31	Channel	75.2	4.8	1.5	2.4	7.7	0.2	5.6	2.6	0.54	0.05	N/A	N/A
7696	20-L-33	Channel	88.7	0.9	1.9	2.1	1.6	0.0	4.3	0.6	0.50	0.04	4.0	2.2
7716	22-O-31	Channel	83.1	0.2	5.2	3.3	2.1	0.1	5.8	0.2	0.46	0.03	10.0	4.4
7720	22-O-31	Channel	90.0	2.1	1.6	1.5	1.7	0.0	2.9	0.2	0.57	0.04	2.4	1.3
7750	9-O-33	Gil 4	73.3	4.4	5.4	4.3	3.9	0.6	8.1	0.0	0.42	0.03	11.2	8.6

DUNBAR, LEAD CREEK, AND ELM LICK COALS (BENCHES)

KCER #	CARTER COORD	BENCH	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	VIT MAX	V MAX R s. d.	ASH (DRY)	SULFUR (DRY)
7636	15-I-33	Upper	44.8	4.2	11.2	11.3	8.3	0.0	19.2	0.9	0.54	0.04	14.6	5.4
7637	15-I-33	Middle	48.5	0.2	4.8	8.9	4.1	0.0	33.3	0.2	0.61	0.04	5.4	2.8
7638	15-I-33	Lower	72.5	2.4	2.1	1.2	4.1	0.0	17.2	0.5	0.60	0.04	5.1	2.1
7640	14-I-33	Upper	50.0	0.6	9.9	14.3	2.5	0.1	22.3	0.3	0.51	0.05	19.8	3.8
7641	14-I-33	Middle	64.7	2.6	12.4	7.7	2.1	0.2	10.1	0.2	0.47	0.04	2.7	1.7
7642	14-I-33	Lower	74.1	4.8	4.7	3.5	3.3	0.0	9.5	0.2	0.49	0.04	3.2	1.7
7652	15-K-35	Upper	77.1	3.3	8.6	1.8	2.3	0.2	6.3	0.5	0.53	0.03	4.1	1.6
7653	15-K-35	Lower	76.0	8.7	2.9	1.0	3.9	0.0	7.3	0.2	0.51	0.05	5.2	0.9
7654	15-K-35	Middle	76.4	1.7	3.9	4.2	3.4	0.1	10.0	0.3	0.50	0.04	15.9	6.9
7655	15-K-35	Middle	71.7	16.6	0.3	1.1	4.6	0.0	5.7	0.0	0.53	0.03	7.3	4.2
7657	15-K-35	Upper	80.9	2.1	4.3	4.1	4.1	0.0	4.1	0.4	0.53	0.04	9.3	4.1
7658	15-K-35	Middle	66.6	1.1	11.4	7.9	1.8	0.0	11.2	0.0	0.53	0.05	6.8	3.8
7659	15-K-35	Lower	88.4	1.8	1.9	1.1	1.6	0.0	4.6	0.6	0.56	0.03	10.3	3.9
7668	13-I-34	Upper	72.6	1.5	5.8	6.7	2.4	0.0	10.8	0.2	0.57	0.03	10.0	1.3
7669	13-I-34	Middle	49.1	4.2	7.1	11.2	4.0	0.0	23.6	0.9	0.57	0.05	2.1	0.9
7670	13-I-34	Lower	74.9	3.5	4.0	1.9	3.5	0.0	10.5	1.7	0.57	0.05	4.5	0.9
7681	15-L-33	Upper	91.1	0.0	2.2	1.7	0.9	0.0	4.2	0.0	0.63	0.04	17.8	9.2
7682	15-L-33	Middle	83.9	0.5	5.2	4.0	2.2	0.1	4.0	0.1	0.58	0.04	8.8	5.4
7683	15-L-33	Lower	84.4	1.4	4.1	4.1	0.4	0.1	5.4	0.2	0.57	0.05	6.4	4.0
7685	15-L-33	Upper	63.9	3.7	9.4	7.2	5.4	0.1	10.1	0.2	0.65	0.03	6.6	2.2
7686	15-L-33	Middle	77.4	2.3	5.9	4.9	3.8	0.5	5.0	0.2	0.56	0.04	3.3	1.5
7687	15-L-33	Lower	85.7	2.8	3.0	3.6	1.2	0.1	3.2	0.4	0.54	0.05	6.3	3.0
7689	20-L-33	Upper	84.8	0.1	3.0	6.3	1.3	0.1	4.4	0.0	0.50	0.03	9.2	4.4
7690	20-L-33	Middle	78.4	1.4	9.4	5.0	0.5	0.0	5.1	0.2	0.50	0.04	8.4	5.1
7691	20-L-33	Lower	77.2	2.0	8.4	5.3	1.6	0.0	5.0	0.6	0.52	0.05	10.9	4.8
7693	20-L-33	Upper	69.5	0.1	12.6	4.5	4.6	0.1	7.9	0.7	0.61	0.03	4.8	1.9
7694	20-L-33	Middle	80.7	0.0	5.7	2.4	4.6	0.0	6.6	0.0	0.62	0.04	4.4	1.7
7695	20-L-33	Lower	83.6	2.6	4.7	2.7	1.2	0.3	4.6	0.4	0.46	0.04	2.8	1.1
7697	23-O-31	Upper	86.0	1.0	1.5	1.0	3.2	0.0	6.7	0.6	0.52	0.04	3.3	2.3
7698	23-O-31	Middle	90.4	0.4	2.0	0.4	2.9	0.0	3.8	0.1	0.52	0.04	3.7	2.8

DUNBAR, LEAD CREEK, AND ELM LICK COALS (BENCHES; cont.)

KCER #	CARTER COORD	BENCH	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	VIT MAX R	V MAX s. d.	ASH (DRY)	SULFUR (DRY)
7699	23-O-31	Lower	84.0	6.5	1.0	0.9	2.8	0.0	4.7	0.1	0.52	0.04	4.3	1.6
7712	8-J-34	Upper	80.0	6.9	3.6	1.8	1.8	0.0	5.8	0.1	0.57	0.04	3.6	1.5
7713	8-J-34	Middle	89.6	0.1	2.2	2.0	1.3	0.1	4.7	0.0	0.62	0.03	2.5	1.5
7714	8-J-34	Lower	90.6	2.5	2.1	1.0	0.9	0.0	2.6	0.3	0.55	0.04	8.5	1.8
7717	22-O-31	Upper	74.0	0.2	7.4	5.0	4.4	0.4	7.8	0.8	0.44	0.03	4.5	3.4
7718	22-O-31	Middle	80.6	0.1	5.2	3.9	2.9	0.4	6.6	0.3	0.44	0.04	7.0	5.0
7719	22-O-31	Lower	84.6	1.4	3.5	3.9	2.5	0.0	3.9	0.2	0.37	0.04	10.7	4.5
7721	22-O-31	Upper	85.1	1.5	1.8	1.6	3.5	0.1	6.3	0.1	0.52	0.05	4.0	1.9
7722	22-O-31	Middle	90.0	1.1	2.4	0.9	2.4	0.0	3.2	0.0	0.52	0.04	2.1	0.8
7723	22-O-31	Lower	94.9	0.5	0.3	0.3	1.2	0.0	2.6	0.2	0.52	0.05	2.0	0.8

MINING CITY, LEWISPORT, AND ELM LICK COALS (CHANNELS)

KCER #	CARTER COORD	CORE # CHANNEL	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	VIT MAX R	V MAX s. d.	ASH (DRY)	SULFUR (DRY)
7009	2-Q-32	Gil 1	79.2	1.6	7.7	2.5	3.6	0.0	5.3	0.0	0.49	0.04	10.0	6.0
7012	16-O-31	Gil 2	75.7	1.9	10.1	3.7	3.5	0.2	4.4	0.5	0.50	0.04	13.1	5.5
7017	17-P-32	Gil 3	79.5	3.9	7.3	1.7	4.5	0.0	2.7	0.4	0.49	0.04	8.8	6.8
7023	21-L-32	Gil 7	73.7	11.9	3.5	2.7	2.9	0.0	5.3	0.0	0.58	0.04	2.8	1.2
7024	21-L-32	Gil 7	69.4	3.1	10.3	4.0	3.7	0.2	9.1	0.2	0.55	0.04	5.7	1.5
7025	21-L-32	Gil 7	63.9	0.5	13.9	9.1	3.4	0.4	6.9	2.0	0.46	0.03	24.0	3.6
7032	13-I-31	Gil 10	79.8	0.9	7.7	3.5	3.7	0.0	4.2	0.2	0.46	0.03	6.3	4.8
7037	24-K-34	Gil 11	74.7	14.4	2.0	2.0	2.1	0.0	4.8	0.0	0.60	0.04	7.8	1.4
7039	13-I-32	Gil 12	53.7	9.1	21.4	3.2	3.8	0.0	8.8	0.0	0.53	0.04	10.8	4.7
7041	8-I-33	Gil 13	74.9	2.9	7.3	4.4	5.2	0.0	4.8	0.5	0.44	0.03	4.3	3.5
7042	8-I-33	Gil 13	65.3	14.5	7.4	2.8	3.7	0.0	6.3	0.0	0.57	0.04	5.8	2.5
7070	15-I-31	Gil 19	80.8	1.1	8.3	1.0	2.3	0.0	6.5	0.0	0.66	0.02	5.3	1.4
7075	16-I-28	Gil 20	85.3	1.3	6.2	0.9	1.8	0.0	4.5	0.0	0.53	0.02	7.2	5.0
7085	25-J-33	Gil 23	82.5	3.6	4.5	1.6	2.5	0.2	5.1	0.0	0.56	0.02	7.3	2.8
7089	10-K-33	Gil 24	80.7	1.4	9.3	0.6	2.0	0.0	6.0	0.0	0.62	0.03	11.1	3.7
7096	6-L-30	Gil 25	64.7	2.3	16.3	2.2	2.0	0.3	12.2	0.0	0.54	0.03	14.8	7.6
7099	8-Q-31	Gil 26	79.7	3.3	6.8	1.6	2.2	0.0	6.4	0.0	0.51	0.04	4.4	1.8
7101	1-N-27	Gil 27	68.4	3.3	13.8	3.4	2.0	0.1	9.1	0.0	0.51	0.03	15.5	2.8
7242	7-I-34	Channel	70.8	5.8	8.0	2.8	6.5	0.3	5.0	0.8	0.41	0.02	N/A	N/A
7329	13-I-33	Channel	61.7	13.1	6.9	6.9	6.9	0.5	2.9	0.3	0.51	0.03	N/A	N/A
7330	12-I-32	Channel	58.4	3.9	8.2	8.0	7.3	0.3	13.1	0.8	0.56	0.04	N/A	N/A
7346	8-J-34	Channel	84.7	4.2	2.5	0.9	2.0	0.0	5.4	0.3	0.69	0.04	N/A	N/A
7350	19-L-32	Channel	75.9	2.1	8.0	3.0	3.2	0.0	7.8	0.0	0.53	0.02	N/A	N/A
7353	23-N-31	Channel	65.3	0.9	11.8	8.3	7.9	0.0	5.1	0.7	0.55	0.04	N/A	N/A
7356	7-M-30	Channel	77.9	1.2	4.8	4.3	5.1	0.4	4.7	1.6	0.47	0.04	N/A	N/A
7357	1-Q-32	Channel	78.0	1.0	7.2	3.4	1.4	0.4	8.3	0.3	0.57	0.04	N/A	N/A
7643	12-I-32	Channel	85.1	1.0	3.8	4.4	3.0	0.0	2.3	0.4	0.51	0.03	7.5	4.4
7647	12-I-32	Channel	81.8	0.8	6.4	5.8	2.4	0.0	2.8	0.0	0.48	0.04	5.6	2.9
7651	15-K-35	Channel	76.8	2.5	7.2	1.7	3.6	0.0	7.5	0.7	0.56	0.03	5.5	1.9

MINING CITY, LEWISPORT, AND ELM LICK COALS (CHANNELS; cont.)

KCER #	CARTER COORD	CORE # CHANNEL	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	VIT MAX	V MAX R s. d.	ASH (DRY)	SULFUR (DRY)
7654	15-K-35	Channel	76.4	1.7	3.9	4.2	3.4	0.1	10.0	0.3	0.50	0.04	15.9	6.9
7655	15-K-35	Channel	71.7	16.6	0.3	1.1	4.6	0.0	5.7	0.0	0.53	0.03	7.3	4.2
7656	6-K-35	Channel	82.8	5.7	5.1	2.1	1.2	0.2	2.9	0.0	0.51	0.03	9.8	3.9
7660	24-J-34	Channel	80.4	0.2	5.4	5.7	4.2	0.0	3.6	0.5	0.49	0.03	8.7	6.5
7671	7-I-34	Channel	85.2	0.6	3.5	3.8	4.3	0.0	2.6	0.0	0.48	0.04	5.2	2.8
7675	4-I-34	Channel	76.3	0.1	5.1	6.8	6.0	0.3	5.0	0.4	0.48	0.03	8.4	6.1
7679	4-I-34	Channel	89.8	0.1	5.7	2.4	0.4	0.0	1.6	0.0	0.48	0.03	14.5	6.0
7680	15-L-33	Channel	84.7	2.8	4.7	2.0	0.7	0.2	4.9	0.0	0.58	0.05	10.8	6.1
7684	15-L-33	Channel	78.7	1.8	6.0	1.7	6.1	0.1	5.2	0.4	0.57	0.05	2.9	1.4
7688	20-L-33	Channel	78.5	0.7	10.4	3.9	1.4	0.0	5.0	0.1	0.53	0.05	7.8	4.4
7692	20-L-33	Channel	74.7	2.5	6.6	5.7	2.8	0.1	7.6	0.0	0.55	0.05	4.1	1.9
7710	8-J-34	Channel	82.9	0.0	2.9	7.3	1.9	0.0	4.8	0.2	0.59	0.04	9.8	4.8
7741	6-K-33	Gil 5	80.0	0.0	7.2	7.4	1.6	0.0	3.2	0.6	0.54	0.04	13.0	3.6
7742	2-J-32	Gil 9	92.5	0.0	3.5	3.0	0.5	0.0	0.5	0.0	0.57	N/A	N/A	N/A

APPENDIX IV

PYRITE SIZE/FORM/MICROLITHOTYPE DATA

SAMPLE # 7035

FRAMBOIDAL DISTRIBUTION:

[illegible]

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
Y	86	84				
Q	6	0				
U	7	44				
S	12	39				
P	10	31				
C	4	10				
N	43	10				
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DENDRITIC DISTRIBUTION:

[illegible]

CLEAR DISTRIBUTION:

[illegible]

MASSIVE DISTRIBUTION:

[illegible]

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	5-10	10-40	40-75	75-150	>150
FR	4.8	3.2	.6	0	0
EU	80.2	0	0	0	0
CON	0	0	0	0	0
MS	2.4	.4	.2	0	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	5-10	10-40	40-75	75-150	>150
5	0	0	0	0	0
38	0	0	0	0	0
1.2	0	0	0	0	0
10.8	0	0	0	0	0
11	0	0	0	0	0
11.4	0	0	0	0	0
2.4	0	0	0	0	0
11	0	0	0	0	0
11	0	0	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

FR	EU	DN	CU	MS
0.4	35	0000000000	0000000000	0.1
0.8	1.2	0000000000	0000000000	1.1
1.0	10.2	0000000000	0000000000	1.2
1.0	10.6	0000000000	0000000000	0.6
1.1	11.6	0000000000	0000000000	0.6
1.4	13	0000000000	0000000000	0.6
4.8	10.6	0000000000	0000000000	0.6

VARIABLE TOTALS:

SIZE		FORM		MICROTYPE	
	CNT		CNT		CNT
<5	437	FR	68	VT	210
5-10	40	EU	411	LP	6
10-40	18		0	IN	61
40-75	4	TS	0	CL	59
75-150	0		21	DI	0
>150	1			VI	67
				TR	17
				CM	80

SAMPLE #1 7038

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	29	22	19	16		
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
BU	16	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	16	2	1	4		

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	36	70	4			
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
BU	0	0	0	0	0	0
VI	19	13	0	0	0	0
TR	0	17	0	0	0	0
CH	8	30	0	1		

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	1			
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
BU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	1	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0			
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
BU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	13	4	3			
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
BU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	1	0	0	0	0	1

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	17.8	12.4	2.8			
EU	45.4	5.8	1.2			
CL	0	0	0			
MS	50.8	80.2	2.4		.2	.2

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	34.8	13.2	4.4			
LP	0	0	0	0	0	0
IN	4.4	3.2	0	0	0	0
CL	4.8	0	0	0	0	0
BU	4	0	0	0	0	0
VI	11.4	3.8	1.2			
TR	11.8	1.2	0			
CH	11.4	1.0	.4			.2

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	18.4	23.2	0.2		58.8
LP	0	0	0		0
IN	2	4.6	0		0
CL	3	4.6	0		0
BU	50.8	80.4	0.4		1.8
VI	5.6	7.8	.2		.8
TR					
CH					

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
VT	345	69	FR	145	33	VT	263	52.6
LP	118	23.6	EU	262	52.4	LP	0	0
IN	35	7	CL	0	0	IN	224	44.8
CL	0	0	MS	69	13.8	CL	45	9
BU	1	.2				BU	82	16.4
VI						VI	15	3
TR						TR	69	13.8
CH						CH		

SAMPLE #: 7040

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	6	3	13	18		
LFP	0	0	0	0	0	0
IPN	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	104	89	1	3		
LFP	4	1	0	0	0	0
IPN	3	1	0	0	0	0
DU	3	1	0	0	0	0
VI	12	0	0	0	0	0
TR	9	0	0	0	0	0
CH	9	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	2	1	2	0
LFP	0	0	0	0	0	0
IPN	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	1	0	0	1	1	0
CH	1	0	0	1	1	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LFP	0	0	0	0	0	0
IPN	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	1	1	1	0
CH	0	0	1	1	1	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	8	3	12	2		
LFP	0	0	0	0	0	0
IPN	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	8	1	4	1	1	0
CH	8	1	4	1	1	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	2.8	9.2	1.6	0	0	0
EU	37	1.6	0.6	0.4	0.4	0
DN	0.2	1	0.6	1	0	0
CL	10.2	0.4	5.2	0	0	0
MS	7.8	8.2				1

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	41.4	10.4	3.8	0.6	0.8	0.2
LFP	0.8	0	0	0	0	0
IPN	3.2	1.4	0.2	0.2	0	0
DU	3.4	1.6	0.2	0.2	0	0
VI	6	4.2	1.2	0.2	0	0
TR	2.4	1.6	1.4	0.4	0.6	0.8
CH	5.6	1.4	1.8	0.4	0.6	0.8

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	9	37.8	0.2	0	0.4
LFP	0	0.8	0	0	0.6
IPN	0	3.8	0.4	0	1.4
DU	1.2	3.4	0.2	0	4.6
VI	1.6	4.6	0.2	0.4	4.6
TR	0.8	3.6	0.6	1	5.2
CH	0.2	3.6	0.6	1	5.2

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
<5	339	67.79	FR	68	13.6	VT	286	57.2
5-10	102	20.4	EU	293	58.6	LFP	4	0.8
10-40	40	8	DN	16	3.2	IPN	26	5.2
40-75	7	1.4	CL	7	1.4	DU	32	6.4
75-150	7	1.4	MS	116	23.2	VI	58	11.6
>150	5	1				TR	17	3.4
						CH	53	10.6

SAMPLE #1 7043

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	4	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	64	33	1	0	0	0
LP	19	0	0	0	0	0
IN	14	8	0	0	0	0
CU	0	0	0	0	0	0
VI	16	15	1	0	0	0
TR	11	12	0	0	0	0
CH	3	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	20	7	4	0	0	0
LP	20	0	0	0	0	0
IN	20	3	0	0	0	0
CU	6	1	0	0	0	0
VI	6	3	0	0	0	0
TR	19	3	0	0	0	0
CH	3	1	1	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	1	0	0	0	0	0
EU	98.6	0.8	0	0.4	0	0
DN	0	0	0	0.4	0	0
CL	31	12.6	8.6	3.2	1.2	1

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	28.2	4.8	2.4	1.4	0.2	0
LP	0	0	0	0	0	0
IN	11.4	2.2	3.6	0	0.6	0.8
CU	0	0	0	0	0	0
VI	13.8	3.2	0.8	0.4	0.2	0
TR	4.4	2.4	1.4	1.2	0.4	0.2
CH	0	0	0	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	1.6	20	0	0.4	15
LP	0	0	0	0	0
IN	0	2.8	0	0	16.8
CU	0	0.4	0	0	3.4
VI	0	0	0	0	0
TR	0.2	4.4	0	0	12
CH	0	1.6	0	0.2	7.6

VARIABLE TOTALS:

SIZE	CNT	X	FORM	CNT	X	MICROLITHOTYPE	CNT	X
<5	354	70.8	VT	9	1.79	VT	185	37
5-10	71	14.2	LP	200	40	LP	0	0
10-40	43	8.6	IN	0	0	IN	98	19.6
40-75	4	0.8	CU	3	0.6	CU	59	11.8
75-150	20	4	VI	288	57.59	VI	92	18.4
>150	5	1.0	TR			TR	38	7.6
			CH			CH	48	9.6

SAMPLE #1 7087

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	128	140	0	0	0	0
LP	1	0	0	0	0	0
IN	0	1	0	0	0	0
CL	47	38	0	0	0	0
DU	0	0	0	0	0	0
VI	11	10	0	0	0	0
TR	13	39	0	0	0	0
CH	27	14	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	5	4	0	0	0	0
LP	0	0	0	0	0	0
IN	3	0	1	0	0	0
CL	2	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	4	2	1	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	4	0	0	0	0	0
EU	93.8	0	0	0	0	0
DN	0	0	0	0	0	0
CL	0	0	0	0	0	0
MS	4	.4	.4	0	0	.4

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	55.4	.2	0	0	0	0
LP	.2	0	0	0	0	0
IN	.2	0	0	0	0	0
CL	17.8	0	.2	0	0	0
DU	0	0	0	0	0	0
VI	4.2	0	0	0	0	0
TR	10.4	0	0	0	0	0
CH	0.4	.2	.2	0	0	.4

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	0	53.6	0	0	0
LP	0	.2	0	0	0
IN	0	.2	0	0	0
CL	1	17.8	0	0	0
DU	0	0	0	0	0
VI	0	4.2	0	0	0
TR	0	10.4	0	0	0
CH	0	0.2	0	0	2

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
<5	491	98.2	FR	5	1	VT	278	55.6
5-10	1	.4	EU	469	93.8	LP	1	.2
10-40	0	0	DN	0	0	IN	1	.2
40-75	0	0	CL	0	0	CL	92	18.4
75-150	0	0	MS	26	5.2	DU	0	0
>150	2	.4				VI	21	4.2
						TR	52	10.4
						CH	31	10.2

SAMPLE #1 7635

FRAMBOIDAL DISTRIBUTION:

[illegible]

EUMEDRAL DISTRIBUTION:

	5	5-10	10-40	40-75	75-150	150
VT	55	61				
LPT	05	06	00	00	00	00
CLIN	31	16	00	00	00	00
DU	23	24	00	00	00	00
VI	8	1	00	00	00	00
CFE	16	25	00	00	00	00
CH	14	77	00	00	00	00

DENDRITIC DISTRIBUTION:

[illegible]

CLEAT DISTRIBUTION:

[illegible]

MASSIVE DISTRIBUTION:

[illegible]

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	.6	1.2	.6	0	0	0
DEU	80.6	1.6	1.6	0	0	0
DN	0	0	0	0	.2	0
CL	.2	0	.4	.2	.4	0
MS	6.4	1.6	3.2	.6	.4	.6

PEARL DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	0.4	0	0	0	0	0
LP	0.2	0.4	0.2	0.2	0.2	0.6
IN	10.2	0	0	0	0	0
EL	10.6	0	0	0	0	0
CV	0.2	0	0	0	0	0
TR	0.4	0	0	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHNOTYPES:

VT	FR	EU	DN	CL	MS
LP	0	23.4		4	2
IN	0	0	0	0	0
CL	0	9.4	0	0	0
DI	0	10.4	0	0	0
VI	0	8	0	0	0
TR	2	21.8	0	4	1
CM	1	8	0.2	2	0

VARIABLE TOTALS:

SIZE		FORM		MICROLITMOTYPE		
CNT	%	CNT	%	CNT	%	
3-5	440	FR	17	VT	120	26
5-10	22	EN	416	LP	0	0
10-40	25	DN	1	IN	65	13
40-75	3	CL	6	CL	62	12.4
75-150	3	MS	65	DU	10	2
>150	3			V1	53	10.6
				TR	120	24
				CM	60	12

SAMPLE #: 7636

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	1	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	28	40	0	0	0	0
LP	6	0	0	0	0	0
IN	9	15	0	0	0	0
CL	14	21	0	0	0	0
DU	38	43	0	0	0	0
VI	33	33	0	0	0	0
TR	9	10	0	0	0	0
CH	0	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	3	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	15	13	4	3	0	0
LP	2	0	0	0	0	0
IN	4	7	0	2	1	0
CL	1	3	0	1	1	0
DU	1	3	0	0	0	0
VI	12	16	0	0	0	0
TR	5	4	0	0	0	0
CH	11	4	4	3	0	1

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	0	0	0	0	0	0
LP	60	0	0	0	0	0
DN	0	0	0	0	0	0
CL	1	6.4	5.8	2.4	0.6	0.4
MS	20	8.4	5.8	2.4	0.6	0.4

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	20.2	2.8	1.2	1	0.2	0
LP	0.6	0	0	0	0	0
IN	6.4	1	1.8	0.6	0.4	0.2
CL	6.8	1.4	0.2	0	0	0
DU	3	0.6	0.2	0	0	0
VI	21.8	1.8	1.2	0	0	0
TR	15.4	1.8	1	0	0	0.2
CH	6.8	1.8	1	0.8	0	0.2

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	0.2	13.6	0	1.6	10
LP	0	2.2	0	0	0.6
IN	0	4.2	0	0	6.2
CL	0	6	0	0	1.4
DU	0	2.8	0	0	1.6
VI	0	16.2	0	0	8
TR	0	13.2	0	0	3
CH	0	3.8	0	0	6.8

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
<5	405	81	FR	1	0.2	VT	127	25.4
5-10	46	9.2	EU	300	60	LP	4	0.8
10-40	32	6.4	DN	0	0	IN	32	10.4
40-75	12	2.4	CL	11	2.2	CL	37	7.4
75-150	3	0.6	MS	188	37.59	DU	23	4.6
>150	2	0.4				VI	122	24.4
						TR	82	16.4
						CH	53	10.6

SAMPLE #1 7637

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	1	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	1	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	32	29	0	0	0	0
LP	0	0	0	0	0	0
IN	6	12	0	0	0	0
CL	15	10	0	0	0	0
DU	15	14	0	0	0	0
VI	7	20	0	0	0	0
TR	37	20	0	0	0	0
CH	10	12	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	13	14	2	1	0	0
LP	0	0	0	0	0	0
IN	7	13	1	0	0	0
CL	8	1	2	0	0	0
DU	2	2	1	0	0	0
VI	9	1	1	0	0	0
TR	10	9	3	1	1	1
CH	11	9	2	2	3	1

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	0	0	0	0	0	0
EU	53.6	1.6	0	0	0	0
DN	0	0	0	0	0	0
CL	0	0	0	0	0	0
MS	22.4	3.8	7.4	4.6	3.2	1.4

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	17.8	1.2	1.2	1.4	0	0
LP	0	0	0	0	0	0
IN	7.6	0	0	0	0	0
CL	6.8	0	0	0	0	0
DU	6.8	0	0	0	0	0
VI	8.4	1.2	1	0.2	0	0
TR	21.6	1.4	1.4	0.2	0.2	0
CH	8.4	0.4	1.4	0.8	0.8	0.8

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	0	12.2	0	0	9.4
LP	0	0	0	0	0
IN	0	2.8	0	0	11.2
CL	0	0	0	0	11.2
DU	0	0	0	0	11.2
VI	0	0	0	0	4.4
TR	0	17.4	0	0	5.8
CH	0	4.4	0	0	7.6

VARIABLE TOTALS:

	SIZE CNT	%	FORM CNT	%	MICROLITHOTYPE CNT	%
<5	395	77	12	2.4	112	22.4
5-10	59	8.8	271	54.2	0	0
10-40	38	7.6	0	0	79	15.8
40-75	24	4.8	3	0.6	37	7.4
75-150	17	3.4	214	42.8	38	7.6
>150	7	1.4			54	10.8
					119	23.8
					61	12.2

SAMPLE #1 7638

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	5	7	0	0	0	0
LP	0	1	0	0	0	0
IN	1	0	0	0	0	0
CL	4	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	85	77	0	0	0	0
LP	0	1	0	0	0	0
IN	2	10	0	0	0	0
CL	56	32	0	0	0	0
DU	0	1	0	0	0	0
VI	12	8	0	0	0	0
TR	23	10	0	0	0	0
CH	6	32	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	1	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	15	22	2	0	1	0
LP	0	0	0	0	0	0
IN	4	0	0	0	0	0
CL	11	6	0	0	0	0
DU	0	0	0	0	0	0
VI	3	2	0	0	0	0
TR	0	0	0	0	0	0
CH	4	17	1	1	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	4	1.4	0.2	0	0	0
EU	71	0	0	0	0	0
DN	0	0	0	0	0	0
CL	12	0	0.4	0.2	0	0
MS	16.8	2.2	2.6	0.4	0.2	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	42.2	1.4	1.6	0	0.2	0
LP	3.2	0	0	0.2	0	0
IN	3.6	0	0	0	0	0
CL	21.8	0	0.2	0	0.2	0
DU	5.2	0	0	0	0	0
VI	7	0.2	0.2	0	0	0
TR	12	0	0	0.4	0	0
CH	1	1	1	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	3.2	32.4	0	0.2	9.6
LP	0	0	0	0	1.2
IN	0	0	0	0	1.4
CL	1.6	17.6	0	0	3.8
DU	0	0	0	0	0
VI	0	4.2	0	0	0.4
TR	0.2	6.6	0	0.4	0
CH	0.2	7.6	0	0	0.2

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
<5	460	92	FR	28	5.6	VT	227	45.4
5-10	18	3.59	EU	355	71	LP	2	0.4
10-40	16	3.2	DN	0	0	IN	21	4.2
40-75	3	0.6	CL	4	0.8	CL	115	23
75-150	2	0.4	MS	113	22.6	DU	1	0.2
>150	1	0.2				VI	27	5.4
						TR	35	7
						CH	72	14.39

SAMPLE #: 7639

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	3	4	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	82	70	0	0	0	0
LP	0	13	0	0	0	0
IN	14	13	0	0	0	0
CL	21	24	0	0	0	0
DU	22	24	0	0	0	0
VI	22	24	0	0	0	0
TR	13	7	0	0	0	0
CM	13	7	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	7.4	5.8	3.5	0	0	0
EU	81.2	1.4	0	0	0	0
DN	0	0	0	0	0	0
CL	0	0	0	0	0	0
MS	1.8	.4	.6	.4	.2	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	32.8	1.8	2.4	0	0	0
LP	.2	0	0	0	0	0
IN	6	.4	.4	0	0	0
CL	17.6	2.6	.5	0	0	0
DU	18	2.4	.5	0	0	0
VI	13.2	2.4	.5	0	0	0
TR	11.8	1.2	.5	.4	.2	0
CM	4	.2	.5	.4	.2	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	4.8	31	0	0	1.2
LP	0	.2	0	0	0
IN	16	1.4	0	0	.2
CL	3.4	17.2	0	0	.2
DU	1.4	13	0	0	.6
VI	2.2	11	0	0	.6
TR	1.6	4	0	0	.4
CM	1.6	4	0	0	.4

VARIABLE TOTALS:

SIZE	CNT	%	FORM	CNT	%	MICROLITHOTYPE	CNT	%
<5	432	86.4	FR	69	13.8	VT	185	37
5-10	22	4.4	EU	414	82.8	LP	1	.2
10-40	22	4.4	DN	0	0	IN	34	6.8
40-75	22	4.4	CL	0	0	CL	104	20.8
75-150	1	.2	MS	17	3.4	DU	77	15.4
>150	0	0				VI	77	15.4
						TR	26	5.2
						CM	26	5.2

FRAMBOIDAL DISTRIBUTION:

ELIHEDRAL DISTRIBUTION:

DENDRITIC DISTRIBUTION:

CLEAR DISTRIBUTION:

MASSIVE DISTRIBUTION:

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

VARIABLE TOTALS:

SIZE		FORM		MICROLITHO TYPE	
CNT	%	CNT	%	CNT	%
447	86.4	FR 69	13.6	VT 93	18.6
37	7.4	EU 369	73.8	LF 0	0
13	2.6	DN 0	0	IN 66	13.2
2	.4	CL 4	.8	CL 40	8
1	.2	MS 58	11.6	BU 0	0
0	0			VI 127	25.4
				TR 168	33.6
				CM 6	1.2

SAMPLE #: 7665

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	9	25	15	3	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUBEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	152	143	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	21	22	0	0	0	0
DU	8	7	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	15	14	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	2	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	2	0	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	9.8	7.2	2	0	0	0
EU	79.2	7.2	2	0	0	0
DN	0	0	0	0	0	0
CL	0	0	0	0	0	0
MS	1.4	.2	0	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	66.2	4.4	2	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	13.2	2.6	0	0	0	0
DU	0	0	0	0	0	0
VI	3.8	.2	0	0	0	0
TR	.2	.2	0	0	0	0
CM	6.2	.2	0	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	12.8	59.2	0	0	.6
LP	0	0	0	0	0
IN	0	.8	0	0	0
CL	4.6	10.6	0	0	.6
DU	0	0	0	0	0
VI	1	30	0	0	0
TR	.4	0	0	0	.4
CM	.2	5.8	0	0	0

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
<5	452	90.4	FR	95	19	VT	363	72.6
5-10	38	7.6	EU	327	79.4	LP	0	0
10-40	10	2	DN	0	0	IN	4	.8
40-75	0	0	CL	0	0	CL	79	15.8
75-150	0	0	MS	8	1.6	DU	0	0
>150	0	0				VI	20	4
						TR	2	.4
						CM	32	6.4

SAMPLE #: 7666

FRAMBOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	59	44	0	0	0	0
LP	9	5	0	0	0	0
IN	9	19	0	0	0	0
CL	71	27	0	0	0	0
DU	47	17	0	0	0	0
VI	42	21	0	0	0	0
TR	22	31	0	0	0	0
CM	0	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	1	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	3	0	1	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	3.8	3.2	1.4	.2	0	0
EU	85.8	1.4	.4	0	0	0
DN	0	0	0	0	0	0
CL	2	1	.8	.6	0	0
MS	0	0	0	.2	0	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	22.6	2.2	.4	.4	0	0
LP	1	0	0	0	0	0
IN	6.2	.4	0	.6	0	0
CL	20	0	0	0	0	0
DU	24.2	1.2	.6	0	0	0
VI	9	1.4	.6	0	0	0
TR	7.6	.2	.6	0	0	0
CM	0	0	0	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	4	21	0	0	.6
LP	0	1	0	0	0
IN	0	6	0	0	1.6
CL	0.6	19.6	0	0	0
DU	0	2.4	0	0	0
VI	2.4	2.4	0	0	.6
TR	.8	9.4	0	0	1.2
CM	.8	6.6	0	0	1

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
<5	434	90.8	FR	43	8.6	VT	12	25.6
5-10	228	47.6	EU	434	86.8	LP	5	1.6
10-40	13	.6	DN	0	0	IN	41	8.2
40-75	6	.3	CL	3	.6	CL	10	20.2
75-150	0	0	MS	20	4.6	DU	1	.2
>150	0	0				VI	13	26.4
						TR	13	26.4
						CM	42	8.4

FRAMBOIDAL DISTRIBUTION:

[illegible]

EUHEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	68	68				
LIN	0	0				
P	7	11				
CUN	43	33				
DU	4	2				
VIR	37	49				
TN	61	42				
LA	8					

DENDRITIC DISTRIBUTION:

[illegible]

CLEAR DISTRIBUTION:

UT	0	25	5-10	10-50	40-75	75-150	150
L	0	0	0	0	0	0	0
P	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0
L	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
 
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
T	0	0	0	0	0	0	0
R	0	0	0	0	0	0	0
I	0	0					

MASSIVE DISTRIBUTION:

[illegible]

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	CU	5-10	10-40	40-75	75-150	>150
FR	.6	1.4	.8	0	0	0
EU	90.8	.2	0	0	0	0
OW	0	.2	0	0	0	0
DL	0	.6	.8	.2	.6	0
SS	3.8					

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	3	5-10	10-40	40-75	75-150	>150
VT	28.6	0	0	0	0	0
LP	0	0	0	0	0	0
IN	3.8	.2	.2	0	0	0
CL	20.6	.6	.4	0	0	0
DU	1.4	0	0	0	0	0
VI	18.2	0	0	0	0	0
TR	20.8	.4	.2	0	0	0
FM	1.8	0	0	0	.2	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
V	1.2	0.27.2	0	0.2	0.2
C	0	0	0	0	0
L	0	9.6	0	0	.4
I	0	19.2	0	0	1.2
E	0	1.2	0	0	.4
N	.2	17.4	0	0	1
T	.4	20.6	0	0	.2
R	0	1.8	0	0	

VARIABLE TOTALS:

	SIZE			FORM	
	CNT	%		CNT	%
CS	476	93.2	FR	14	2.8
5-10	12	2.4	EU	455	91
10-40	8	1.6	DN	0	0
40-75	1	.2	CL	1	.2
75-150	3	.6	MS	30	6
>150	0	0			

MICROLITHOTYPE		
	CNT	%
VT	154	30.8
LP	0	0
IN	21	4.2
CL	108	21.6
DU	7	1.4
VI	93	18.6
TR	107	21.4
CM	10	2

SAMPLE #: 7683

FRAMBUOIDAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	2	3	3	0	0	0
LP	0	0	0	0	0	0
IN	0	1	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	91	94	3	0	0	0
LP	0	0	0	0	0	0
IN	7	5	0	0	0	0
CL	13	30	0	0	0	0
DU	0	1	0	0	0	0
VI	20	17	0	0	0	0
TR	12	16	0	0	0	0
CM	7	1	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	21	13	3	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	4	4	1	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	1.2	2.2	.4	0	0	0
EU	64.32	1.2	0	0	0	0
DN	0	0	0	0	0	0
CL	0	0	0	0	0	0
MS	22.24	4.6	3.4	.2	0	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	44.88	3.8	1.2	0	0	0
LP	0	0	0	0	0	0
IN	11.62	.6	.4	0	0	0
CL	10.22	1.4	.4	.2	0	0
DU	.2	0	0	0	0	0
VI	10.42	.4	.8	0	0	0
TR	7.21	.6	.2	0	0	0
CM	3.2	1.2	1	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	2.4	37.67	.2	0	9.61
LP	0	0	0	0	0
IN	.4	2.4	0	0	9.81
CL	.6	9.01	0	0	2.6
DU	0	8.21	0	0	10
VI	.2	6.21	0	0	3.6
TR	0	1.6	0	0	3.8
CM	0	1.6	0	0	3.8

VARIABLE TOTALS:

	SIZE	CNT	%	FORM	CNT	%	MICROLITHOTYPE	CNT	%
	<5	438	87.77	FR	19	3.8	VT	219	49.89
	5-10	40	8.01	EU	327	65.53	LP	0	0
	10-40	20	4	DN	1	.2	IN	63	12.62
	40-75	1	.2	CL	0	0	CL	61	12.22
	75-150	0	0	MS	152	30.46	DU	1	.2
	>150	0	0				VI	48	11.62
							TR	40	8.01
							CM	27	5.41

SAMPLE #: 7698

FRAMBOIDAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	11	0	0	0	0	0
DU	0	0	0	0	0	0
VI	12	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	30	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	3	0	0	0	0	0
DU	0	0	0	0	0	0
VI	17	0	0	0	0	0
TR	17	0	0	0	0	0
CH	17	0	0	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	CS	5-10	10-40	40-75	75-150	>150
FR	0	0	0	0	0	0
EU	0	0	0	0	0	0
DN	0	0	0	0	0	0
CL	4	0	0	0	0	0
MS	50.6	12	4.4	.6	.4	1.2

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	1.4	1.2	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	29.6	8.4	2.4	.6	.4	.6
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	1.2	.6	.4	0	.4

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	0	22.4	0	0	12.4
LP	0	0	0	0	0
IN	0	0	0	0	41.4
CL	0	8.4	0	0	1.2
DU	0	0	0	0	0
VI	0	0	0	0	7.6
TR	0	0	0	0	1.2
CH	0	1	0	.2	6.6

VARIABLE TOTALS:

	SIZE	CNT	%	FORM	CNT	%	MICROLITHOTYPE	CNT	%
CS	405	61		FR	0	0	VT	176	28.2
5-10	60	12		EU	149	29.8	LP	0	0
10-40	12	4.4		DN	0	0	IN	11	42.2
40-75	2	1.4		CL	5	.6	CL	15	3.8
75-150	1	.4		MS	348	69.6	DU	1	1.2
>150	6	1.2					VI	53	10.6
							TR	1	.4
							CH	39	7.6

SAMPLE #: 7600

FRAMEDICAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	1	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	122	72	0	0	0	0
LP	0	1	0	0	0	0
IN	0	1	0	0	0	0
CL	7	4	0	0	0	0
DU	0	7	0	0	0	0
VI	0	1	0	0	0	0
TR	0	2	0	0	0	0
CH	0	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	2	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	4	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CH	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	46	53	2	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	1	1	0	0	0	0
DU	0	0	0	0	0	0
VI	1	4	0	0	0	0
TR	0	1	0	0	0	0
CH	7	44	2	4	1	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	CS	5-10	10-40	40-75	75-150	>150
FR	1.2	0	0	0	0	0
EU	46.4	0	0	0	0	0
DN	0	0	0	0	0	0
CL	2.4	.4	1.2	0	0	0
MS	34	6.4	3.6	.6	.8	.8

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	CS	5-10	10-40	40-75	75-150	>150
VT	62.4	4.4	0.2	.4	.2	0
LP	0	0	0	0	0	0
IN	0	1	0	0	0	0
CL	3.6	.2	0	0	0	0
DU	1.4	0	0	0	0	0
VI	1.4	0	0	0	0	0
TR	0	0	0	0	0	0
CH	11.4	1.2	1.6	.2	.2	.8

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	2.2	40	0	0.4	2.6
LP	0	.2	0	0	0.4
IN	0	.6	0	0	0
CL	0	2.2	0	.8	1.6
DU	0	1.4	0	0	0
VI	0	1.2	0	0	1.2
TR	0	2.2	0	.2	1.4
CH	0	2.2	0	.2	1.4

VARIABLE TOTALS:

	SIZE	CNT	%	FORM	CNT	%	MICROLITHOTYPE	CNT	%
	CS	421	86.2	FR	1	1.2	VT	346	62.6
	5-10	34	6.9	EU	242	46.4	LP	1	.2
	10-40	24	4.6	DN	0	0	IN	1	.2
	40-75	3	.6	CL	26	5.2	CL	130	23.50
	75-150	4	.8	MS	231	46.2	DU	7	1.4
	>150	4	.8				VI	11	2.2
							TR	6	1.6
							CH	82	16.4

SAMPLE #: 7717

FRAMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	1	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	25	44	0	0	0	0
LP	0	0	0	0	0	0
IN	45	42	0	0	0	0
CL	45	17	0	0	0	0
DU	0	0	0	0	0	0
VI	20	45	0	0	0	0
TR	20	34	0	0	0	0
CM	20	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LP	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	<5	5-10	10-40	40-75	75-150	>150
VT	14	8	0	0	0	0
LP	0	1	0	0	0	0
IN	15	9	2	0	0	0
CL	8	4	0	0	0	0
DU	0	0	0	0	0	0
VI	2	10	1	0	0	0
TR	2	4	1	0	0	0
CM	0	0	0	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	<5	5-10	10-40	40-75	75-150	>150
FR	0	0	0	0	0	0
EU	75.6	1.2	0	0	0	0
DN	0	0	0	0	0	0
CL	0	0	1.2	0	0	0
MS	16.4	3.6	1.2	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	<5	5-10	10-40	40-75	75-150	>150
VT	15	1.1	0	0	0	0
LP	22	0	0	0	0	0
IN	22.6	0.6	0.4	0	0	0
CL	14.3	0.6	0	0	0	0
DU	0	0	0	0	0	0
VI	18.6	1.4	0.6	0	0	0
TR	15	0.6	0.2	0	0	0
CM	4.4	0.6	0.2	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	1.2	14.6	0	0	18.6
LP	0	0	0	0	22.6
IN	0	18	0	0	22.6
CL	0.4	12.6	0	0	14.3
DU	0	0	0	0	0
VI	0.6	15.8	0	0	18.6
TR	0	11.6	0	0	15
CM	0	4.4	0	0	4.4

VARIABLE TOTALS:

SIZE	CNT	%	FORM	CNT	%	MICROLITHOTYPE	CNT	%
<5	465	93	FR	6	1.2	VT	103	20.6
5-10	25	5	EU	395	77.2	LP	1	0.2
10-40	65	1.7	DN	0	0	IN	110	22.6
40-75	0	0	CL	2	0.4	CL	77	15.4
75-150	0	0	MS	107	21.4	DU	0	0
>150	1	0.2				VI	104	20.8
						TR	22	4.4
						CM	27	5.4

SAMPLE #: 7712

FRAMBOIDAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	1	0	0	0	0
LF	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUMEDRAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	50	47	0	0	0	0
LF	12	1	0	0	0	0
IN	12	23	1	0	0	0
CL	34	19	1	0	0	0
DU	0	0	0	0	0	0
VI	43	48	0	0	0	0
TR	24	14	0	0	0	0
CM	0	0	0	0	0	0

DENDRITIC DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LF	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	4	0	2	0	0	0
LF	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DU	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	6	18	2	0	0	0
LF	0	0	0	0	0	0
IN	0	17	4	0	0	0
CL	10	6	2	0	0	0
DU	0	0	0	0	0	0
VI	11	4	3	0	0	0
TR	7	6	1	0	0	0
CM	1	4	1	1	1	1

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	CS	5-10	10-40	40-75	75-150	>150
FR	2	4	0	0	0	0
EU	67.6	1.6	0.2	0	0	0
DN	0	0	0	0	0	0
CL	0	0	0	0	0	0
MS	28.4	4.2	1.4	1.2	1.4	1.2

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	CS	5-10	10-40	40-75	75-150	>150
VT	22.2	1.4	0.2	0	0	0
LF	4	0	0	0	0	0
IN	14.8	1.8	0.6	0	0	0
CL	14.4	1.2	0	0	0	0
DU	1	0	0	0	0	0
VI	21.2	1.6	0.4	0	0	0
TR	10.1	1.2	0	0	0	0
CM	2.8	0.6	0.6	0.6	0.6	0.2

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	0.4	10.4	0	1.2	0.6
LF	0	0.4	0	0	0.2
IN	0	10.4	0	0	0.6
CL	0	11.4	0	0	0.6
DU	0	0	0	0	0.1
VI	0	18.6	0	0.2	0.4
TR	0	7.6	0	0.2	0.4
CM	1.2	1.6	0	0.6	0.6

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
CS	450	90	FR	3	6	VT	124	24.6
5-10	24	6.8	EU	348	67.6	LP	2	2.4
10-40	6	1.7	DN	0	0	IN	6	17.2
40-75	3	.6	CL	10	2	CL	78	15.6
75-150	3	.6	MS	15	27.8	DU	5	1.2
>150	1	.2				VI	114	20.2
						VF	27	5.4

SAMPLE #: 7719

FRAMBOIDAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	2	0	0	0	0
LF	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DN	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

EUNEDRAL DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	93	2	0	0	0	0
LF	0	0	0	0	0	0
IN	63	11	0	0	0	0
CL	2	54	0	0	0	0
DN	0	1	0	0	0	0
VI	17	1	0	0	0	0
TR	19	11	0	0	0	0
CM	4	1	1	0	0	0

DENDRITIC DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	0	0	0	0	0	0
LF	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DN	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

CLEAT DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	1	0	0	0	0	0
LF	0	0	0	0	0	0
IN	0	0	0	0	0	0
CL	0	0	0	0	0	0
DN	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	0	0	0	0	0	0
CM	0	0	0	0	0	0

MASSIVE DISTRIBUTION:

	CS	5-10	10-40	40-75	75-150	>150
VT	1	0	0	0	0	0
LF	0	0	0	0	0	0
IN	2	0	0	0	0	0
CL	2	0	0	0	0	0
DN	0	0	0	0	0	0
VI	0	0	0	0	0	0
TR	4	0	0	0	0	0
CM	0	0	0	0	0	0

PERCENT DISTRIBUTION OF SIZES AMONG FORMS:

	CS	5-10	10-40	40-75	75-150	>150
FR	.6	1	0	0	0	0
EU	93.4	1.2	.6	0	0	0
DN	0	0	.2	0	0	0
CL	.2	.4	.2	.4	0	0
MS	2	.4	.2	.4	0	0

PERCENT DISTRIBUTION OF SIZES AMONG MICROLITHOTYPES:

	CS	5-10	10-40	40-75	75-150	>150
VT	38.6	1.6	.2	.4	0	0
LF	0	0	.2	0	0	0
IN	15.2	.2	.2	0	0	0
CL	17.2	.2	.2	0	0	0
DN	0	0	.2	0	0	0
VI	13.8	.2	.2	0	0	0
TR	6.6	.4	.2	0	0	0
CM	3.6	.4	.2	0	0	0

PERCENT DISTRIBUTION OF FORMS AMONG MICROLITHOTYPES:

	FR	EU	DN	CL	MS
VT	.6	38.6	0	.2	1.4
LF	0	0	0	.2	0
IN	0	15.2	0	.2	.4
CL	.4	17.2	0	.2	.4
DN	0	0	0	.2	0
VI	.4	13.8	0	.2	.6
TR	.4	6.6	0	.2	.6
CM	0	3.6	0	.2	.6

VARIABLE TOTALS:

	SIZE CNT	%		FORM CNT	%		MICROLITHOTYPE CNT	%
VT	476	95.2	FR	8	1.6	VT	206	41.2
5-10	15	3	EU	471	94.2	LF	0	0
10-40	7	1.4	DN	0	0	IN	78	15.6
40-75	2	.4	CL	2	.4	CL	88	17.6
75-150	0	0	MS	19	3.8	DN	0	0
>150	0	0				VI	71	14.2
						TR	22	4.4
						CM	24	4.8

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