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Otto C. Kopp, Major Professor

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GEOCHEMICAL AND PETROLOGIC CHARACTERIZATION OF THE GLAMORGAN COAL SEAM AND IMPLICATIONS FOR PALEOENVIRONMENT RECONSTRUCTION IN SOUTHEASTERN PIKE COUNTY, KENTUCKY

A Thesis

Presented for the

Master of Science

Degree

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Anthony Scott Scales

December 1985

CRANE & CO BOND PAPER

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X-ray fluorescence analysis. Jim Carter of the Geography Department and Alice Beauchene of the Computing Center helped with the computer mapping. Dennis and Susan Owen allowed me use of their word processor.

Lastly, Janice Herndon typed the bulk of the manuscript. More than that, she always forgave and never forgot.

ABSTRACT

The Lower Pennsylvanian Glamorgan Coal of the Lee and Breathitt Formation (undifferentiated) in southeastern Pike County, Kentucky, is a high-volatile type-A bituminous coal. A low-sulfur ($\bar{x}$= 0.96%, std. $\bar{x}$= 0.47%, raw coal basis), relatively high-BTU ($\bar{x}$= 13,360, std. $\bar{x}$= 1757, raw coal basis) coal, the Glamorgan is of economic interest but exhibits peculiar thinning and splitting characteristics, making assessment of mineable areas difficult. This study was undertaken within an approximately 440 sq. km. area of southeastern Pike County, Kentucky, to characterize the seam and explain its occurrence in light of its depositional setting.

Utilizing the Surface II Computer Mapping Program, core, outcrop and chemical data were used to generate a series of computer maps, including isopach, structure contour and chemical isopleth maps. Proximate analyses were enhanced by X-ray fluorescence analysis of coal samples to determine weight percent of major oxides (Na_2O, MgO, Al_2O_3, SiO_2, P_2O_5, K_2O, CaO, TiO_2, Fe_2O_3) and sulfur. Raw coal samples were described petrographically.

Elemental content of the Glamorgan seam is directly related to depositional subenvironments within the study area. To the east, where peat accumulation was relatively uninterrupted, Al_2O_3 is enriched in the 1.5

specific gravity float separate, i.e., the coal portion of samples, and is interpreted to be due to slow settling of suspended clays in a low energy backswamp environment. Na_2O, MgO, Al_2O_3, SiO_2, TiO_2 and Fe_2O_3 are enriched in the 1.5 specific gravity sink separate, i.e., the sediment enriched portion of samples. Na_2O is enriched in the float separate, but is probably not present in a mineral matrix. The low amount of total sulfur within the seam as a whole ($\bar{x}$= 0.96%, std. $\bar{x}$= 0.47%) is indicative of little marine influence on the swamp during peat accumulation. Marine lithologies above the seam in the northwestern portion of the study area are interpreted to be the source of higher sulfur values in the upper split of the Glamorgan.

The Glamorgan is split into an upper and lower seam by a major intra-seam parting (Middleman), and each split contains numerous minor partings in the western portion of the study area, reflecting its river-dominated setting. Thickness variations (from approximately 0.5 - 1.5 m) of the Glamorgan are likely due to a buttressing effect of the underlying Gladeville Sandstone during compaction.

Petrographic data indicate uniformity of maceral content across the study area (vitrinite $\bar{x}$= 75.9%, std. $\bar{x}$= 16.4%, exinite $\bar{x}$= 13.8%, std. $\bar{x}$= 4.7% and inertinite

$\bar{x}$= 7.2%, std. $\bar{x}$= 2.2%). A possible trend of exinite enrichment may be due to marine influence, although the limited number of data points makes statistical evaluation uncertain.

Comparison of all data indicates the Glamorgan coal seam formed on a lower delta plain. Two distinct subenvironments are present in the study area: 1) a river-dominated setting in the western portion of the study area, and 2) a protected backswamp setting to the east.

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CHAPTER I

INTRODUCTION

Purpose of the Study

The Glamorgan Coal Seam of southeastern Pike County, Kentucky, is a high volatile type-A bituminous coal. Averages of 64 raw coal analyses within the study area show the seam to contain 0.96% sulfur, 13.10% ash and 13360 BTU. Averages of 70 analyses of the 1.5 specific gravity float separate of the seam show 0.81% sulfur, 5.74% ash and 14556 BTU (Table B1)*. As such, the Glamorgan is of interest as a low sulfur, relatively high BTU coal; however, the seam exhibits peculiar thinning and splitting characteristics which makes assessment of mineable areas difficult.

To explain the occurrence and distribution of the seam, a study was undertaken to develop possible depositional environment models using available lithologic and chemical data. In addition, this chemical characterization was tested and further enhanced by the use of X-ray fluorescence (XRF) and the coal was described petrographically.

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*All tables may be found in the appendices.

Description of Study Area

The study area, approximately 440 sq. km. (170 sq. mi.) in area, is located in southeastern Pike County, Kentucky and a portion of adjacent Buchanan County, Virginia. Phelps, Kentucky lies on the extreme northeast corner, and Elkhorn, Kentucky lies just outside the southwest edge, of the study area. The Kentucky-Virginia border parallels the southeast side of the study area (Figure 1).

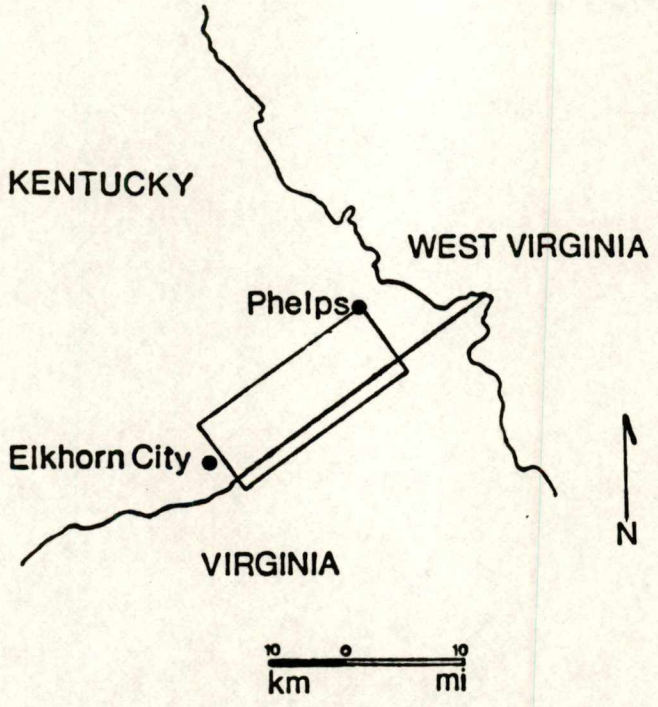


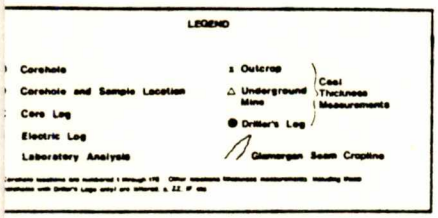
Figure 1. Study area (shaded).

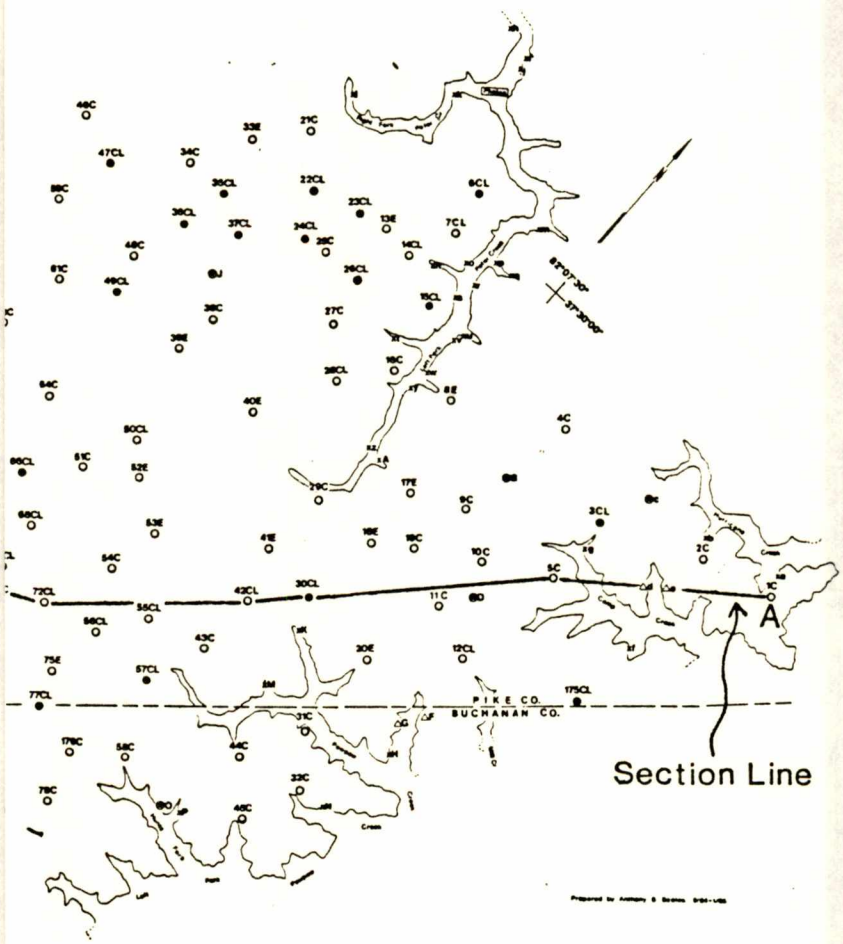
To the northeast, the area is bounded by the Peter, Hurricane, Camp and Pawpaw Creek drainages of the Tug Fork River. To the southwest, the area is bounded by the Trace and Abes Fork, Grassy and Wolfpen Branch, and Beaver and Ferrell Creek drainages of the Russell Fork River, and the area is roughly bisected by the Levisa Fork River and associated drainages (see Plate 1, in Pocket, and Figure 2).

Stratigraphy and Local Geology

The Glamorgan Coal lies within the Lower Pennsylvanian Lee and Breathitt Formation (undifferentiated), which comprise a sequence of interbedded sandstone, siltstone, shale, limestone, coal and underclay. Within the study area, correlative coal seams include the Millard, Little Eagle and Cedar (Rice and Smith, 1980).

The Glamorgan overlies the Gladeville Sandstone (Hinds, 1918), which in turn overlies the Eagle Shale (Hennen and Reger, 1914), formerly called the Eagle Limestone (White, 1891). The Hagy zone is the first prominent coal interval below the Eagle Shale. The rock unit above the Glamorgan separating it from the overlying rider has not been named. The next prominent coal interval above the Glamorgan Rider is the Blair zone (Figure 3).


LEGEND
Corehole
Corehole and Sample Location
Core Log
Electric Log
Laboratory Analysis
Outcrop
Underground Mine
Driller's Log
Coal Thickness Measurements
Glamorgan Seam Cropline


PIKE CO.
BUCHANAN CO.
A
Section Line

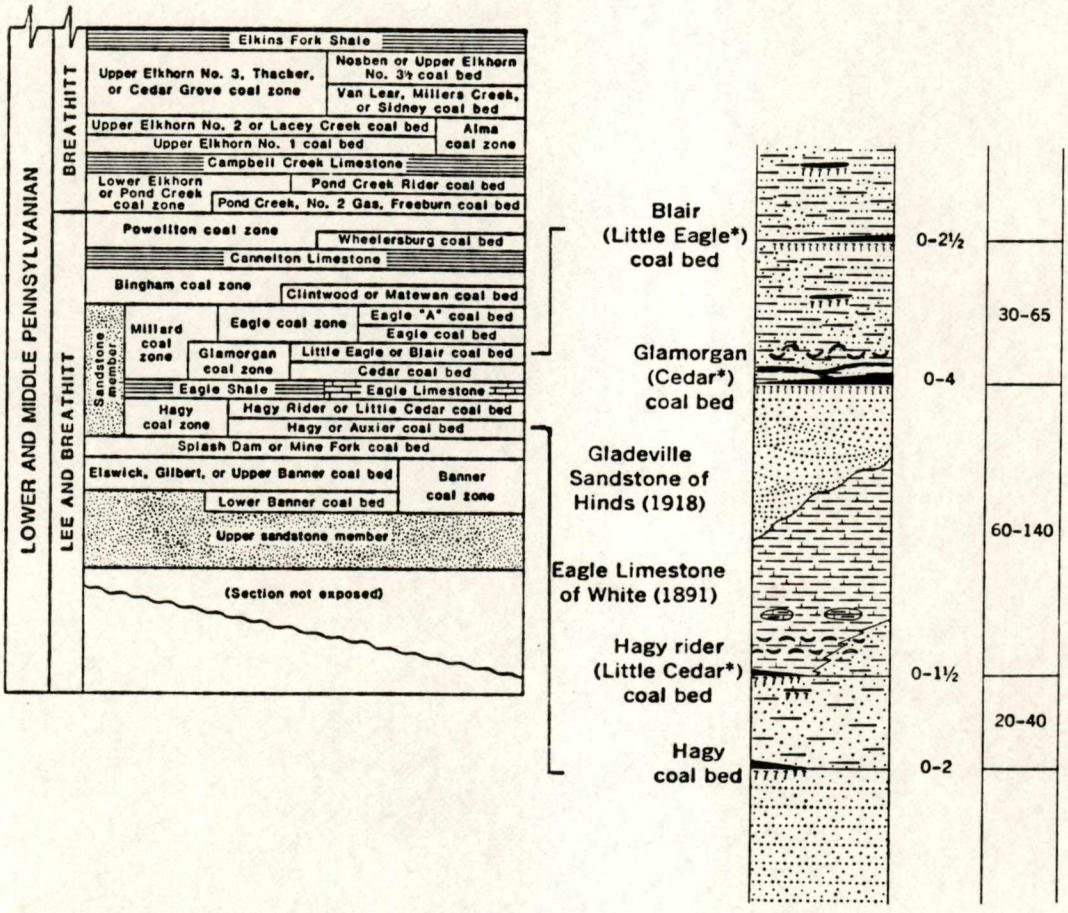


Figure 3. Correlative coal zones (from Rice and Smith, 1980) and generalized stratigraphic column (modified from Outerbridge, 1968).

In the eastern portion of the study area, the Glamorgan is a single seam with occasional thin and discontinuous partings. In the vicinity of Levisa Fork and to the west and southwest, however, the seam is split by a major parting (Middleman in miners' terminology) into two thin seams that appear to converge back to a single seam with partings near Elkhorn City. Data also indicate that the Glamorgan rider joins the upper split in this vicinity (see Plate 2, in Pocket).

The area is not complex structurally, although the northeastern terminus of the Pine Mountain thrust fault is located approximately 3.2 km (2 mi) south of Elkhorn City. The regional dip of the Lee and Breathitt Formation is to the northwest at 2-5 degrees.

Previous Work

Previous work on the Glamorgan, within the public domain, has been limited to field mapping and description. So far as the author is aware, no depositional environment studies specific to the Glamorgan have been made. Chemical analyses have not been performed on the Glamorgan within the study area other than for pre-mining evaluation by the Kentucky Berwind Land Company (J. Currens, Personal Communication, 1984). Only two petrographic descriptions that may be

related to this study are available, but are of the correlative Millard seam (J.C. Hower, Personal Communication, 1984).

Though not addressing the Glamorgan specifically, there have been a number of paleoenvironment depositional models described for nearby areas. Arkle (1974) provided a review of previous studies within the eastern Kentucky coalfields and summarized the Breathitt Formation as consisting of brackish to non-marine sediments deposited in a linear basin, intermittently subsiding to the southeast, and trending northeast - southwest across West Virginia and adjacent areas of Kentucky. He specified a source area to the southwest and noted an increasing marine influence in this direction. Horne and Ferm (1978) provided excellent descriptions of depositional environments in field guide descriptions of areas near Pikeville, Kentucky, and parts of West Virginia adjacent to the study area. Cobb, et al., (1981) also provided field descriptions of areas west and northwest of the study area with detailed depositional environment interpretations. Haney, et al., (1984) described structural controls on environments of deposition in Kentucky and note the Eastern Kentucky Syncline's influence on coals within the study area. The axis of

the Eastern Kentucky Syncline coincides with the axis of the basin described by Arkle (1974).

Data and Sample Collection

Data collected by Geological Consulting Services, Inc., of Bluefield, Virginia, as part of a property evaluation for the Kentucky Berwind Land Co., were made available. These data include:

1. maps showing outcrop and corehole locations, and outcrop and in-mine sampling and measurement locations;
2. corelogs, electric logs and driller's logs for 176 coreholes;
3. coal thickness and elevation measurements for 105 outcrop and in-mine locations, and;
4. 70 proximate coal analyses (Table B1).

Splits of coal samples obtained by core drilling were retained at the Kentucky Berwind Land Co. field office at Big Creek, Kentucky. These samples were further split, resulting in samples from 50 corehole locations. Of these, 21 comprised raw coal samples, whereas 44 are represented by both 1.5 float and sink specific gravity separates. Four are represented by 1.5 float and two by 1.5 sink separates, only.

CHAPTER 2

ANALYTICAL METHODS

Data Distribution Map

In the original property evaluation, outcrop and corehole locations, and in-mine sampling and measurement locations, were plotted at various scales and using differing coordinate systems. For this study, outcrop and data points were replotted at 1:24,000 scale. For drafting purposes, north was rotated 42° to the northeast for each map, therefore the top of each map is N42W (see Plate 1, in Pocket, and Figure 2, page 4).

Surface II Computer Contour Mapping Program

To synthesize the data available, a series of contour maps were prepared using the Surface II Graphics System, developed by R. J. Sampson of the Kansas Geological Survey, and the computing facilities of the University of Tennessee. Surface II is particularly useful in that it can quickly assimilate a large volume of data, producing maps in orders of magnitude less time than if done by hand, and, once set up properly, requires little user interaction.

Initially, all data points were assigned X-Y coordinates from an arbitrary origin (see Figure 2, page

4). Values to be contoured were then tabulated for each data point (see Appendix A). These coordinates and values were then programmed into the computer.

To produce each contour map, a series of commands were inserted controlling contour interval, labelling, map size, etc. Each map was then previewed on a graphics terminal and plotted on a flatbed plotter. After correction of any problems, the final copy was produced on a drum plotter.

When interpreting maps produced by the Surface II program, three factors must be considered:

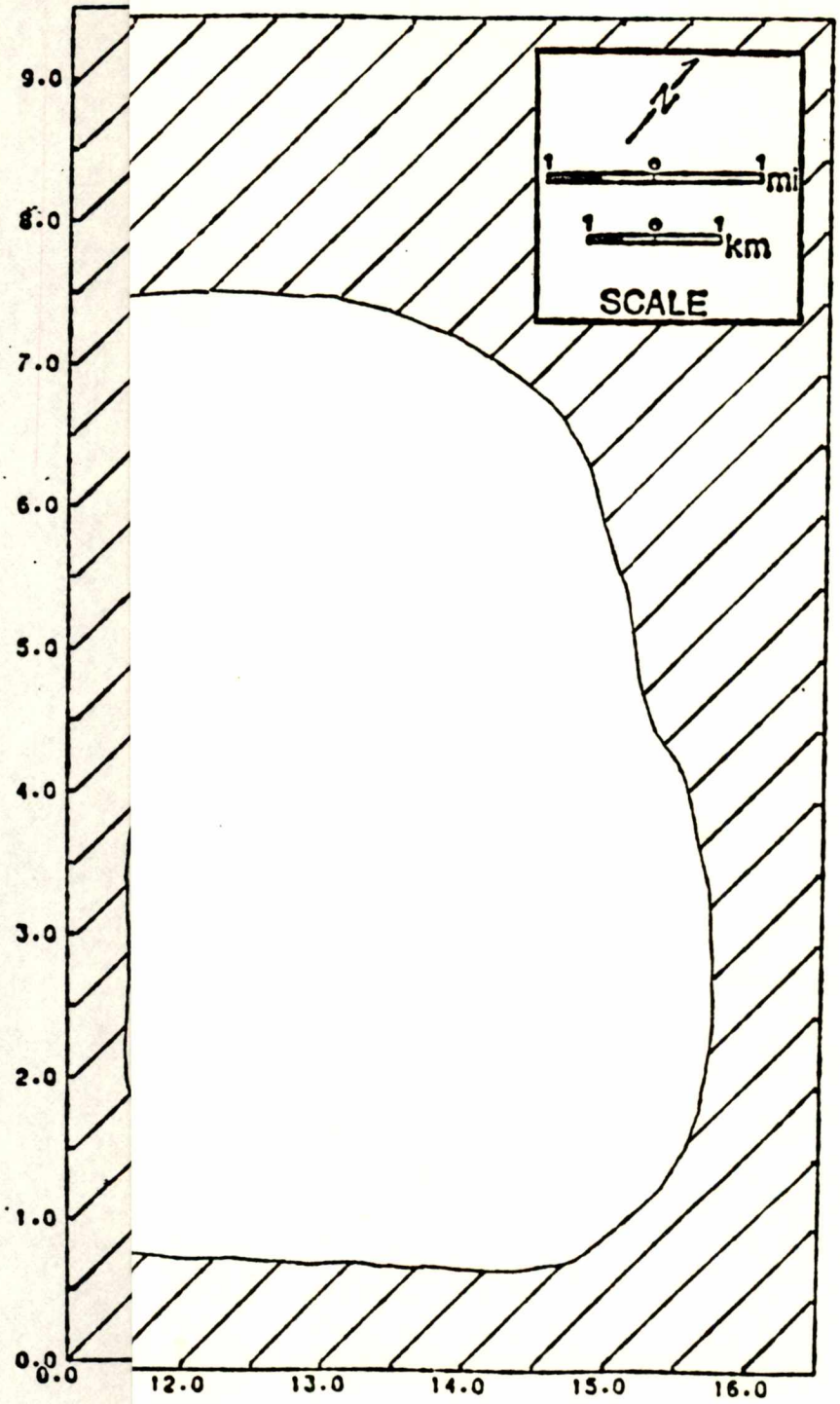
1. At map edges, closing or fanning contours probably do not represent actual contour patterns. After generation of the initial X-Y coordinate grid, the program superimposes another grid system, the spacing of which can be controlled by the user. (In the present study, all available memory was used to generate a closely spaced grid so as to smooth contour lines.) Each grid node then is assigned the average value of its eight surrounding grid nodes by the program. The program simply interpolates between grid nodes to generate contour lines. Contour lines at map edges will thus be drawn towards areas of data points with values and away from areas of non-existent values;

2. Anomalies noted within a contour map, other than the above, may not represent true anomalies. When estimating the values being contoured (Z-values) at nodes on the secondary grid system, an original data point may be reassigned a value greatly changed from its original value. Fortunately, the Surface II program affords a statistics output showing the amount of change in the original data. Any anomalies noted may be verified or negated by reference to the statistics output;

3. Lastly, as a combination of 1 and 2, above, areas with low data point density should be treated warily. Figure 4 shows areas where contour lines are questionable or invalid on most maps due to low data point density. Even so, the reliable area covered includes an area of approximately 340 sq. km. (130 sq. mi.). When discussing individual maps in Chapter 3, the above three items will be noted where necessary.

X-ray Fluorescence (XRF)

To supplement the available proximate analyses, coal samples were pelletized and analyzed with an EG&G ORTEC Model 6110 Tube Excited Fluorescence Analyzer (pellet preparation procedures and run conditions are given in Appendix C). Standards used were kindly supplied by Brad Wheeler of EG&G ORTEC, Oak Ridge, Tennessee. Values for


N
1
1 mi
1
1 km
SCALE
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
12.0
13.0
14.0
15.0
16.0

Figu

these standards are averages of over 40 replicate analyses for each sample. To check the calibration protocol, standards were run as unknowns with each batch of samples. Standard deviations were compared to the standard error of calibration for each element (see Table C1).

Petrographic Analysis

Crushed particle pellets (see Appendix D for preparation procedure) were analyzed for maceral, pyrite and mineral matter composition using an automatic point counting stage (1000 point counts per sample). Counting error was assessed using the chart of Van der Plas and Tobi (1965).

CHAPTER 3

RESULTS

Underlying Sedimentary Rocks

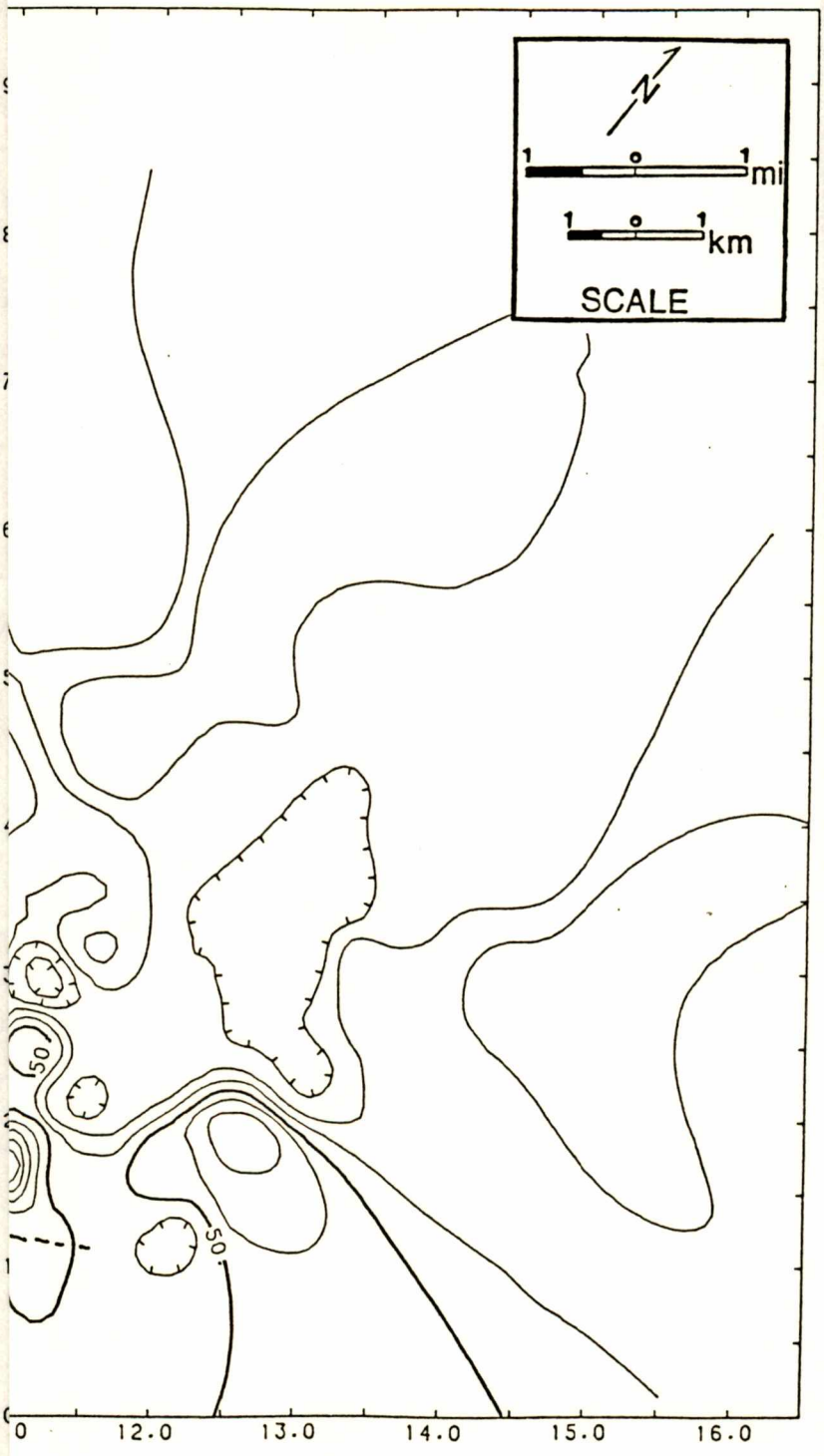
Eagle Shale. The stratigraphic interval from the top of the Hagy coal bed to the base of the Gladeville Sandstone is the Eagle Shale. Within the study area, the Hagy coal is typically overlain by a thin, <1 m (<3 ft), rooted, commonly carbonaceous shale. The remainder of the Eagle Shale interval is generally a coarsening upward sequence, with the shale becoming more arenaceous upsection, though all combinations of interbedding of sandstone, siltstone and shale are noted. Though dominantly a shale interval, sandstone and siltstone rarely occur at the base of the interval. Where present, the sandstone overlying the thin shale is a maximum of 9 m (30 ft) thick, medium- to fine-grained, planar- to wavy bedded or rarely cross-bedded and commonly with coal spars and/or siderite nodules at its base. The siltstone overlying this sandstone, where present, is up to 6 m (20 ft) thick, planar-bedded and commonly contains siderite and sandstone laminae. Overlying the siltstone and dominating the interval, the shale is a maximum of 23 m (75 ft) thick and also planar-bedded with siderite laminae and nodules, and sandstone streaks.

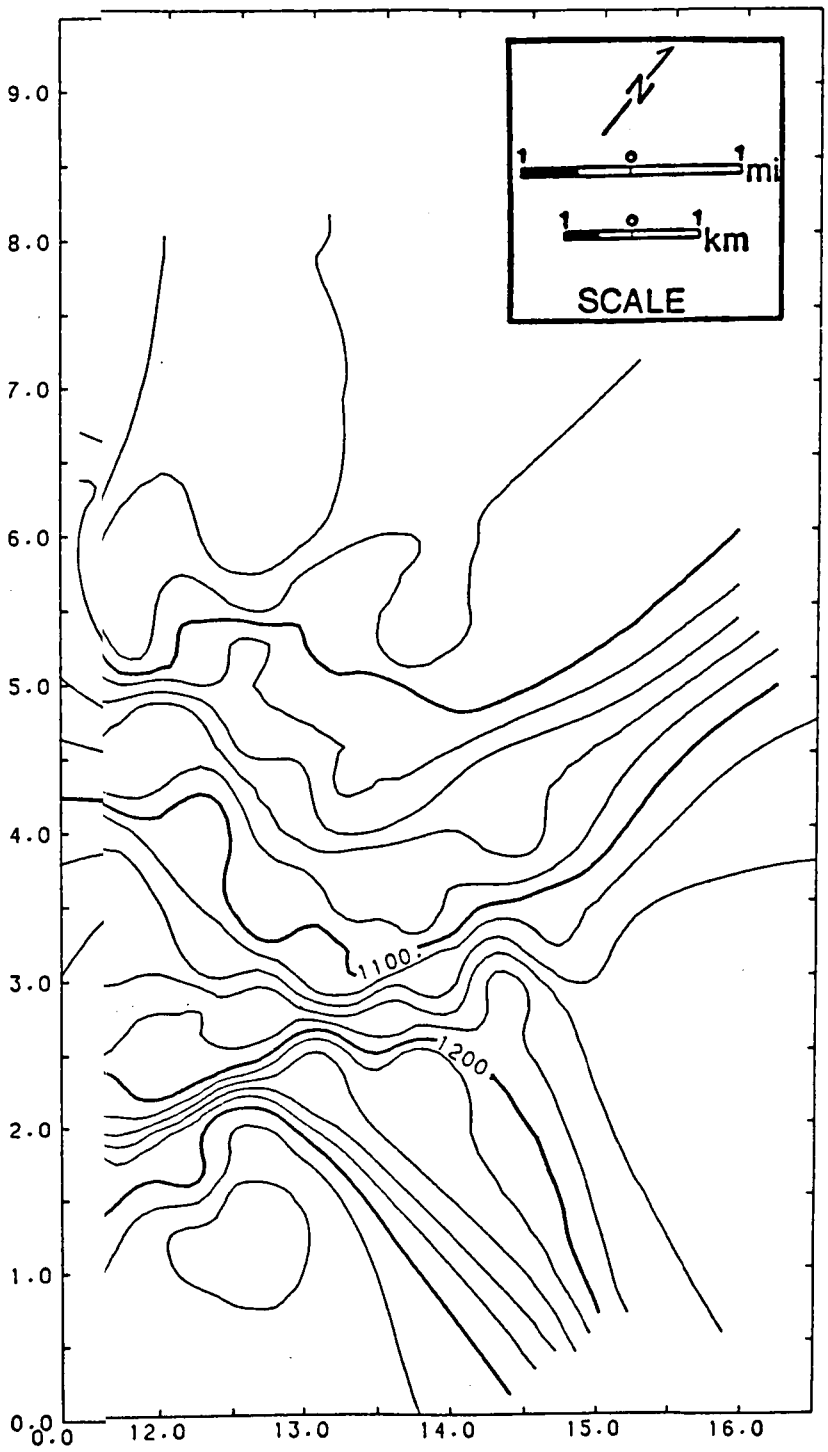
Core logs commonly note the calcareous nature of the shale and siltstone, especially the more arenaceous portions. A 20 cm (8 in) argillaceous limestone is reported above a burrowed zone in the basal portion of the shale in corehole 110. Bioturbation and burrowing are common in the basal, typically sandy, portion of the shale or near the siltstone-sandstone contact where the sandstone is present. Fossil shells (type unspecified) are reported from these zones in coreholes 4 and 34.

Gladeville Sandstone. The stratigraphic interval from the top of the Eagle Shale to the base of the Glamorgan coal bed is the Gladeville Sandstone. Within the study area, the Gladeville is generally a fining-upward sequence, from coarse- to medium-, or medium- to fine-grained sandstone. Wavy bedding and cross-bedding are common. Coal spars, clay clasts and siderite nodules are common, particularly near the base of the interval, and probably represent lag deposits. Clay laminae occur throughout the section. The contact with the underlying Eagle Shale is commonly abrupt. When in contact with the overlying Glamorgan, the Gladeville is commonly rooted, but it can also be separated from the coal by an interval of variable lithology. (See Plate 2, in Pocket, and discussion of lithology subjacent to seam, below.)

Figure 5 is an isopach map of the Gladeville Sandstone. Thickness of the Gladeville varies from 4 m (12 ft) to 31 m (103 ft). Within the eastern half of the study area, the Gladeville is typically 15 m (50 ft) thick or less, whereas in the western half it attains its maximum thickness and is typically greater than 15 m (50 ft). Due to data point density, the thinning seen at coordinates 6.5,6.5 and the upper left corner of the map may not necessarily reflect actual contours. Note that the sandstone thickens at the area centered on coordinates 3.5,3.5 and that it thins along a trend from coordinates 8.0,6.0 to 13.0,3.0. Note also how this trend is bounded by thicknesses of 15 m (50 ft) or more.

Figure 6 is a structure contour map of the top of the Gladeville Sandstone. Due to estimation of Z-values and low data point density, the structural closures seen at coordinates 3.0,5.0 and 7.0,7.0 are not true anomalies though these are structural highs. The closure and 1000 ft. contour at coordinates 8.0,8.0 are due to nearest neighbor analysis and should be disregarded entirely. The curving of contours to the southeast along the 6.5 ordinate is due to low data point density. The upper left corner of the map also has low data point density, though general dip seen is in agreement with the rest of


N
1 0 1 mi
1 0 1 km
SCALE
50
50
12.0
13.0
14.0
15.0
16.0


9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
12.0
13.0
14.0
15.0
16.0
1100
1200
1
mi
km
SCALE

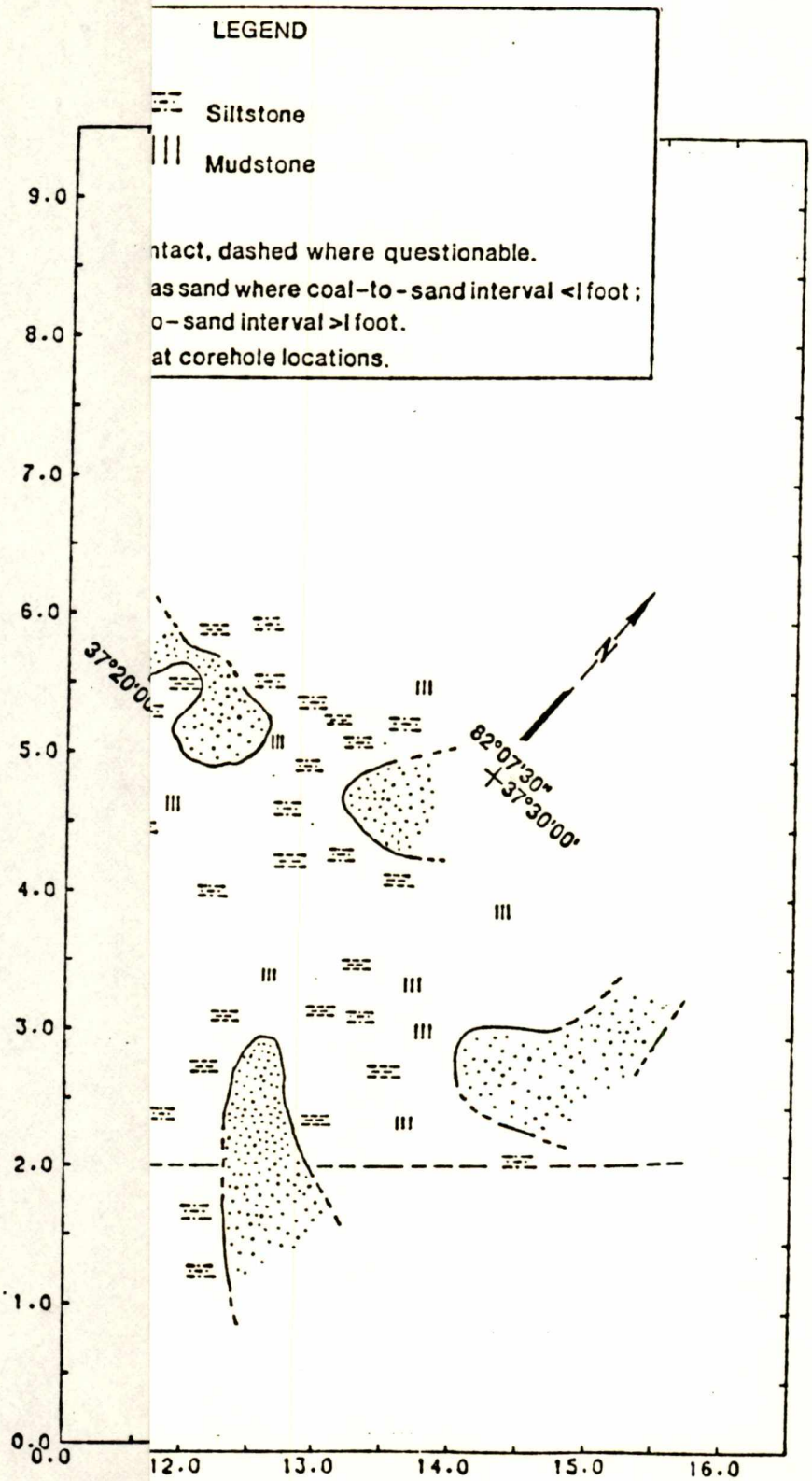
Fi

the map. In areas of reliable structural contours, dip averages 1° to the northwest and strike N30E.

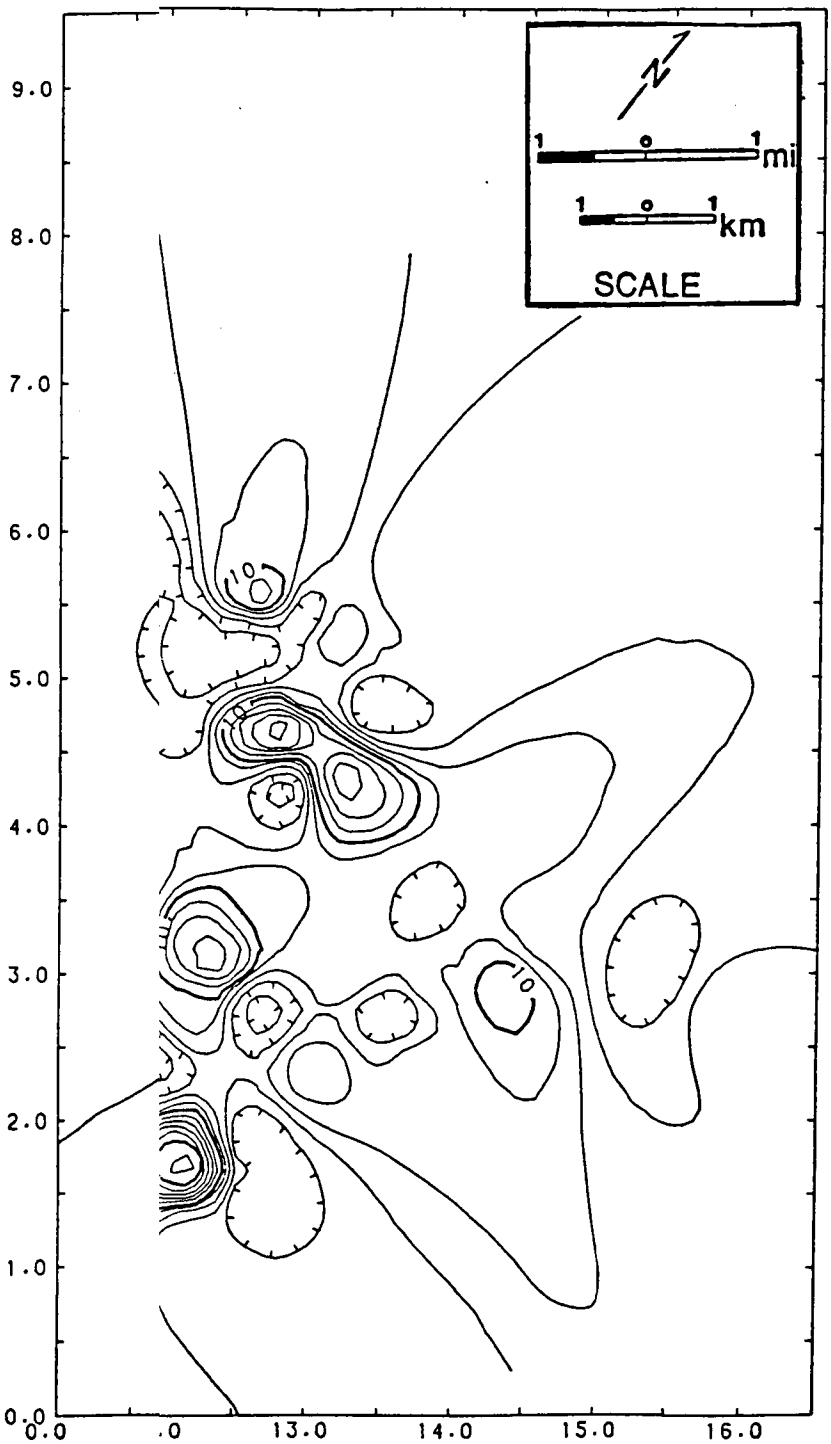
Lithology subjacent to seam. Figure 7 is a map showing the lithology subjacent to the coal seam. The stippled sandstone pattern in this figure indicates those areas where the Gladeville Sandstone is in contact with the seam. At those corehole locations where the Gladeville is not in contact (non-sandstone thickness interval greater than .3m (1 ft)), symbols representing the non-sandstone lithologies are shown. Note the resulting digital pattern indicating the trend of the sandstone bodies approximates the strike of the Gladeville Sandstone.

Non-sandstone lithologies subjacent to the seam include shale, carbonaceous shale, siltstone and mudstone. Commonly they contain plant fossils, coal spars and occasional siderite laminae, and are extensively rooted. Maximum thickness of these non-sandstone lithologies is 8.5 m (28 ft).

Figure 8 is an isopach map of the non-sandstone lithologies below the seam. Areas of questionable validity are the same as noted for Figure 5. Comparison of Figure 8 with Figures 6 and 7 shows that the non-sandstone lithologies thicken where the Gladeville is thinnest and on flanks of the thickest part of the


LEGEND
Siltstone
Mudstone
ntact, dashed where questionable.
as sand where coal-to-sand interval <1 foot;
o-sand interval >1 foot.
at corehole locations.
9.0
8.0
7.0
6.0
5.0
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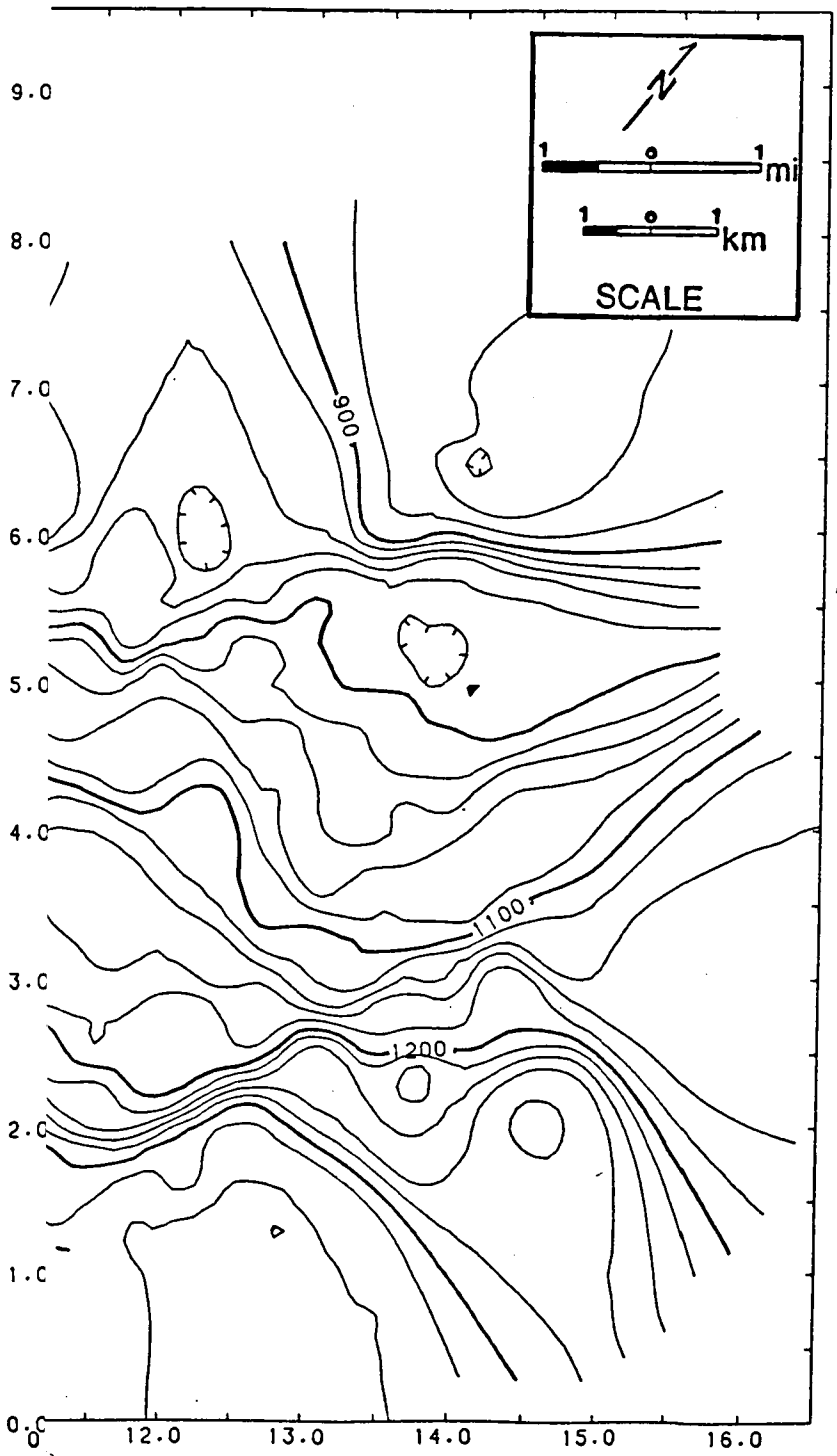
Figure

sandstone, i.e., where the Gladeville is in contact with the coal. Note the thickening trend of the non-sandstone lithology along the same thinning trend of the Gladeville, from coordinates 8.0,6.0 to 13.0,3.0.

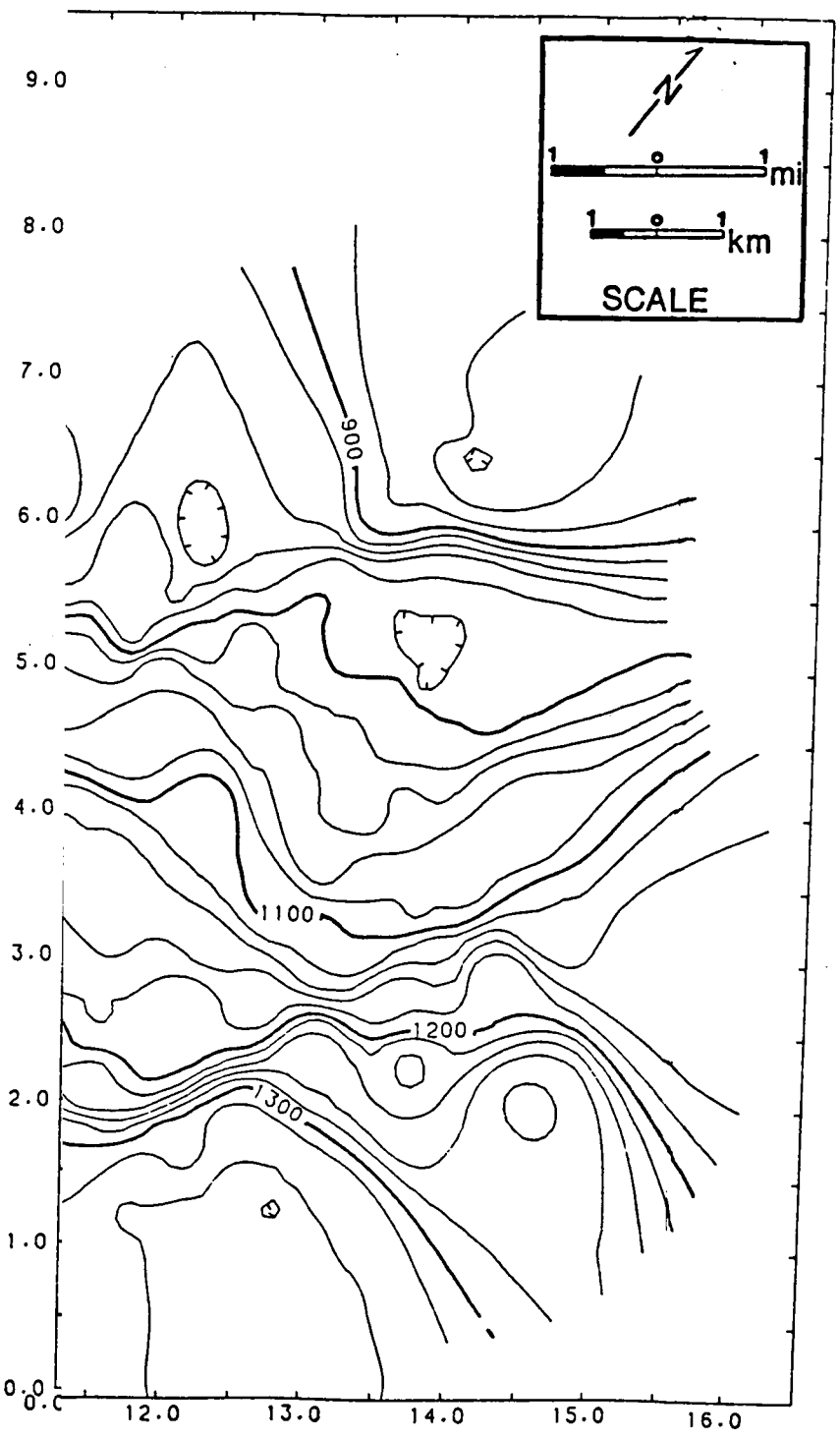
Coal Seam Characterization

Structure contour maps. To determine if there is structural influence on the seam, and to test the effect of data point density on the contouring program, two structure contour maps were prepared. Figure 9 is a structure contour map using base-of-seam elevations from collected core, outcrop and in-mine measurements. Note the bunching and downward curving pattern along the 7.0 ordinate.

Figure 10 is a structure contour map using the same data and 55 additional base-of-seam elevations taken from geologic quadrangles in the study area. The pattern along the 7.0 ordinate seen on Figure 8 is removed. The structural high at coordinates 6.5,7.0 is an anomaly, but not as great as shown, due to Z-values estimated well above their original values. The 1000 ft. contour and recurved 900 ft. contour at coordinates 8.5,8.5 are functions of the nearest neighbor analysis and should be disregarded. With the additional measurements,


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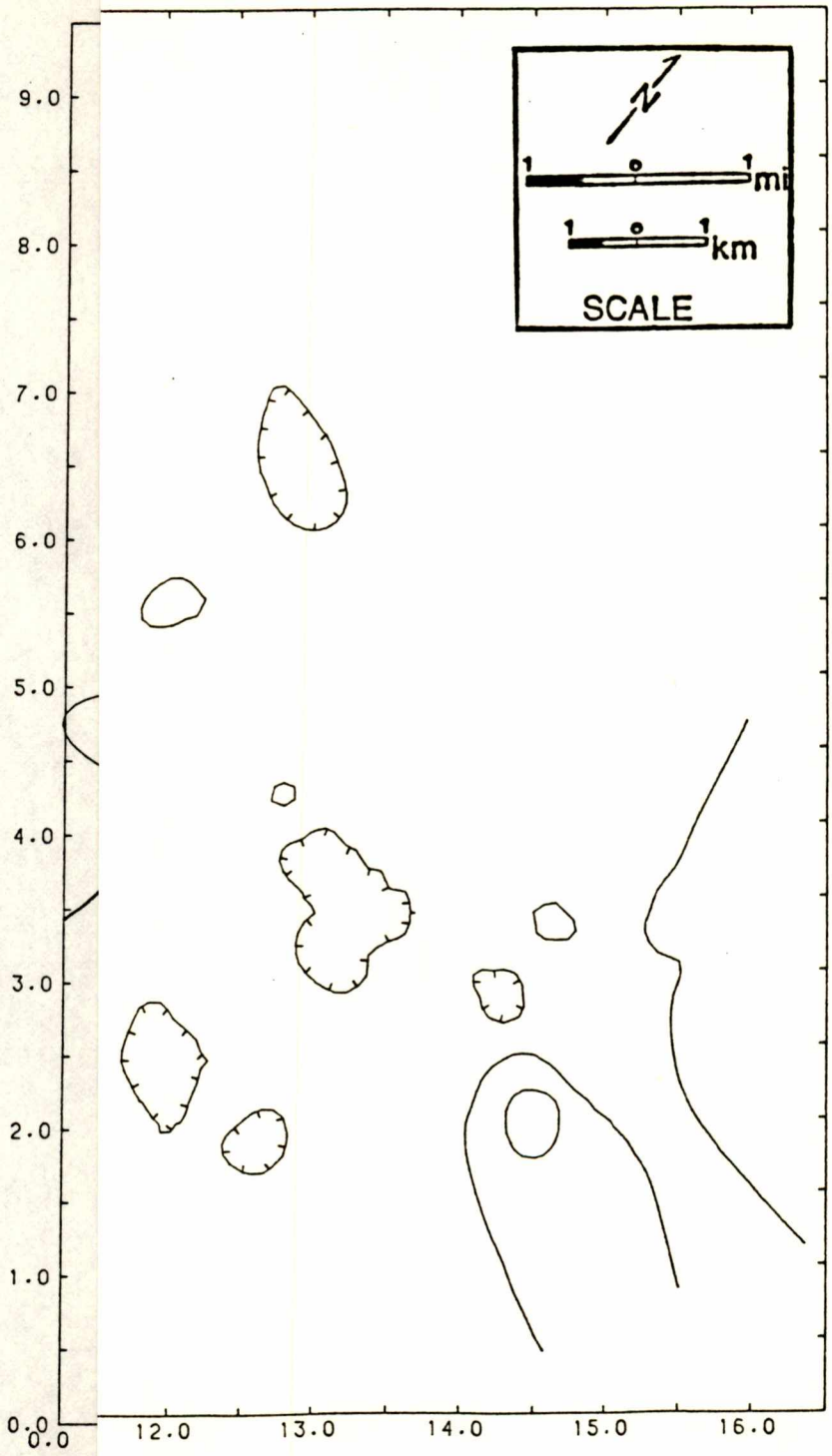


Ɓgic quadrangles.

the northwest corner of the map assumes a pattern similar to the rest of the map.

The general patterns of the maps differ little from each other. Average dip in areas of good control is 1° degree to the northwest and strike is N30E. These figures are identical to those of the underlying Gladeville Sandstone. The slight dip of both surfaces indicates little, if any, structural influence on the seam and probably reflects the original depositional surface.

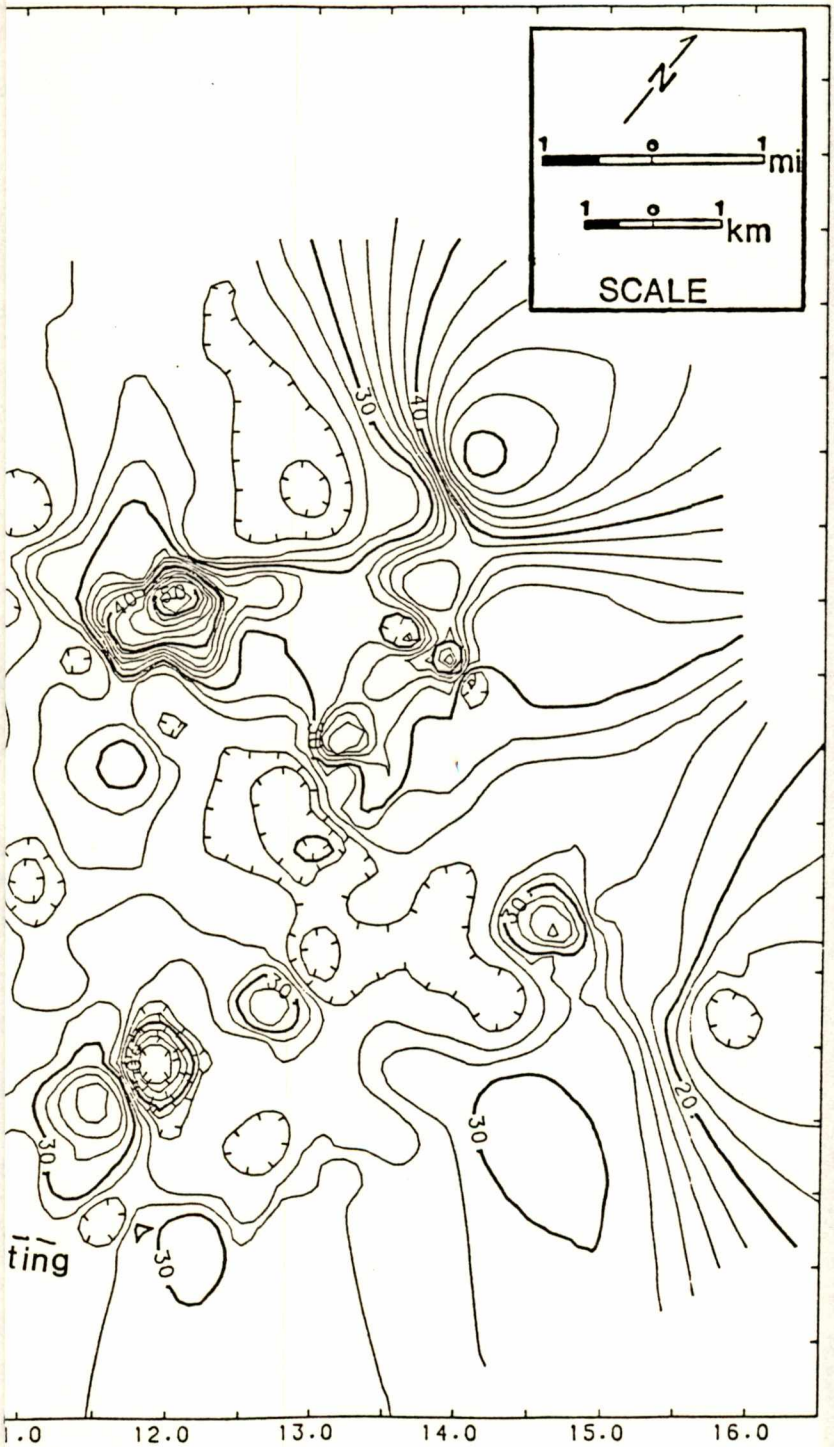
Seam isopach maps. Figure 11 is an isopach map of the total seam, from the first to last appearance of coal and including all non-coal partings. The closure of the 20 ft. contour at coordinates 8.5,8.5 and the closures within the upper left corner of the map above the 5.0 abscissa and left of the 7.0 ordinate are functions of data point density and are not real anomalies. The bunching of contours along the 7.0 ordinate is also a function of this, but does reflect the thinning of the Middleman parting to the east. Note the only slightly variable thickness in the eastern half of the study area as opposed to the highly variable thickness in the western half. Note the thinning in the area centered on coordinates 4.5,3.5.

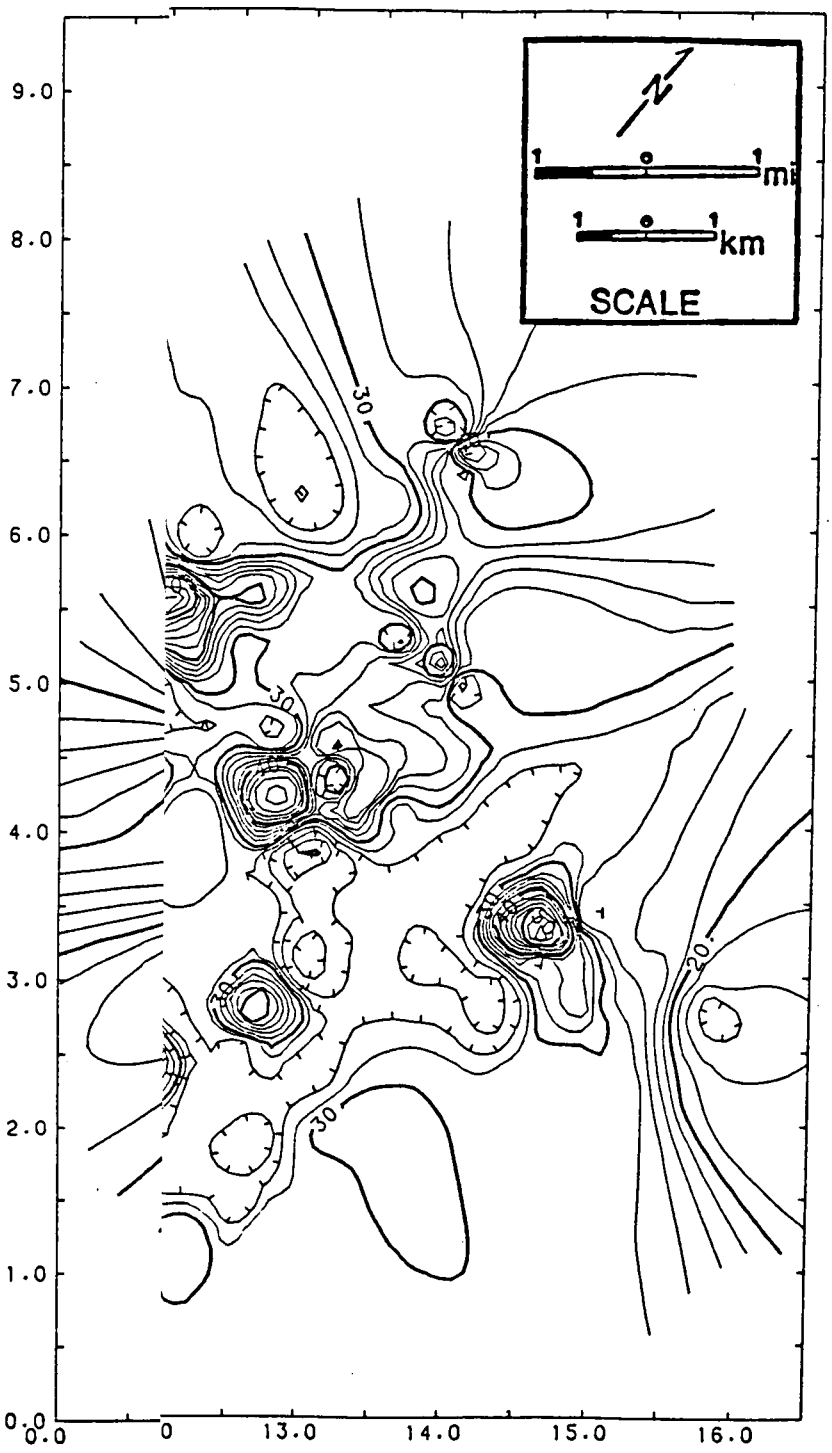

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Figure 12 is an isopach map of total coal, excluding any non-coal partings. Areas of questionable contour validity are the same as for Figure 10. In addition, the extention of contour lines across the 7.0 ordinate may or may not reflect actual contour patterns. For the entire study area, total coal thickness ranges generally from just below to just above 76 cm (30 in). Pockets of total coal greater than 100 cm (40 in) are found at coordinates 12.5,5.5, 4.5,3.0 and 1.5,3.0.

Figure 13 is an isopach map of the main Glamorgan seam (a single, unsplit seam) in the eastern portion of the study area, and the lower split, including all non-coal partings, in the western portion of the study area. Areas of questionable contour validity are the same as for Figure 12. Comparing Figures 12 and 13, note that total coal and main seam contours are generally in agreement for the eastern portion of the study area. Exceptions are the areas centered on coordinates 12.0,4.5, 13.0,4.5 and 14.75,3.5 where the greater total seam thicknesses are due to non-coal partings. In the western portion of the study area, the lower split is generally thin and less than 50 cm (20 in). The lower split thickens westward of the 2.5 ordinate and at coordinates 4.0,3.0. The latter is due primarily to total coal values, whereas the former is due to non-coal


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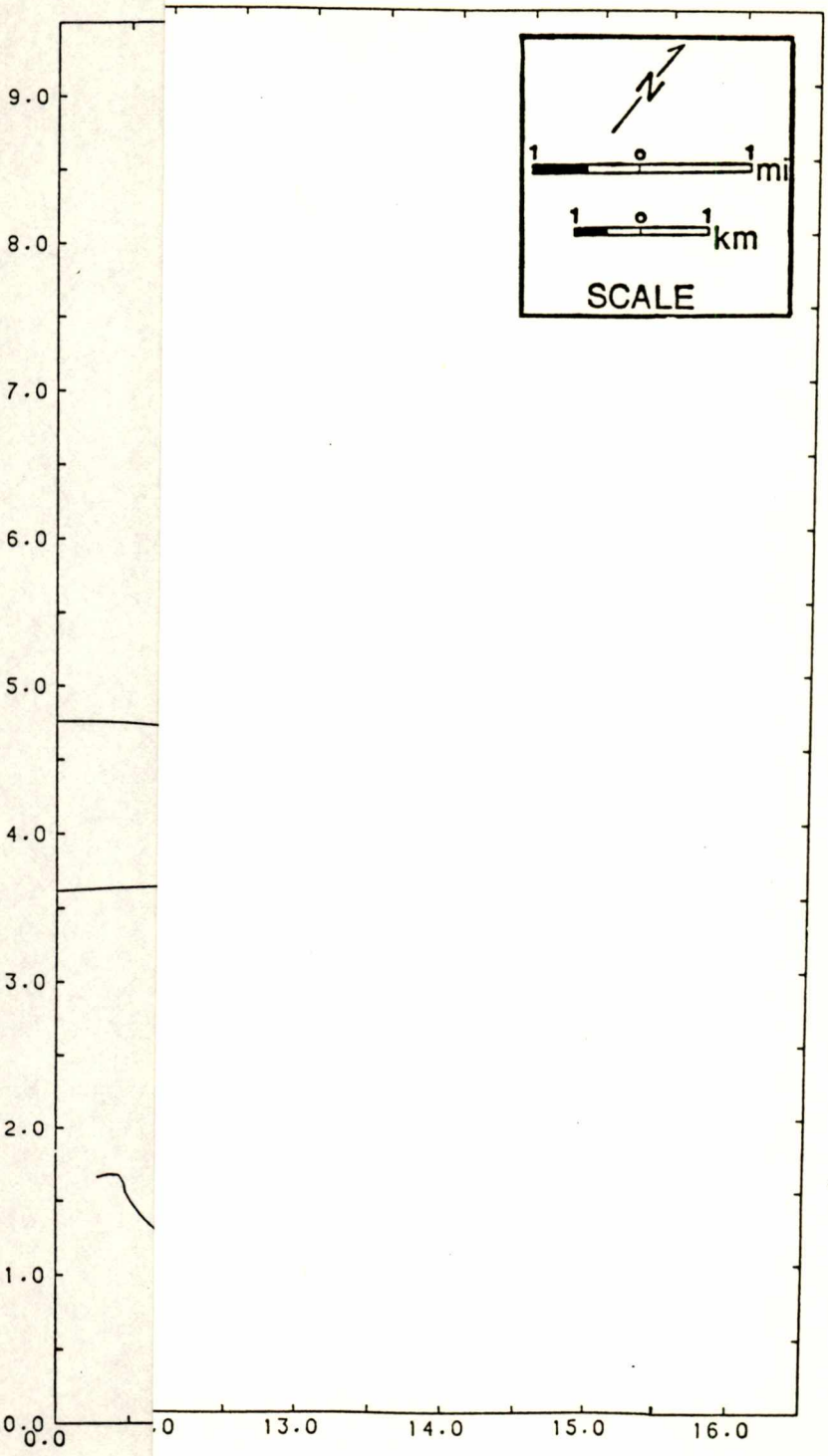

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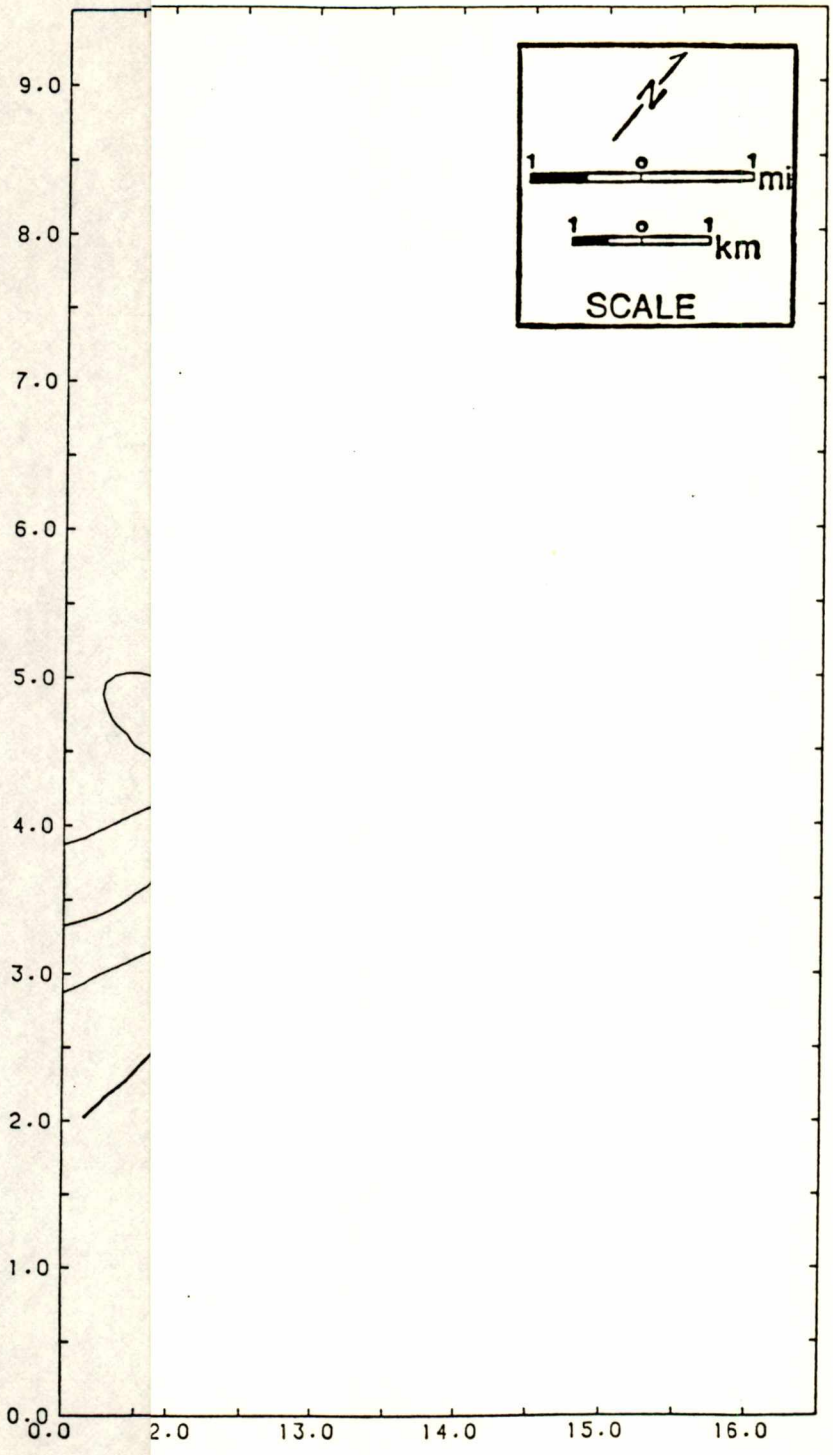
partings (see further discussion under intra-seam rocks, below).

Figure 14 is an isopach map of the upper split in the western portion of the study area. Areas of questionable contour validity are the same as for the previous isopach maps. Although generally thicker than the lower split, the greater total thickness is due predominantly to non-coal partings. A notable exception is the area centered on coordinates 4.0,3.0 (see further discussion under intra-seam sediments, below).

Intra-seam rocks. The Glamorgan coal seam contains a major intra-seam parting, termed the Middleman in miner's terminology, whose feather edge (i.e., line of splitting) divides the study area into two areas of differing character. Figure 15 is an isopach map of this parting. The closures within the upper left corner of the map above the 5.0 abscissa and left of the 7.0 ordinate are functions of data point density and are not viable anomalies. The closure of the 20 ft (6 m) contour at coordinates 8.5,8.5 and the thickening along the 7.0 ordinate are also due to this, but graphically display the thinning of the Middleman to the east, the former coordinates lying at the feather edge of the parting. Note the thickening of this parting radially away from the area centered on coordinates 4.0,3.5.



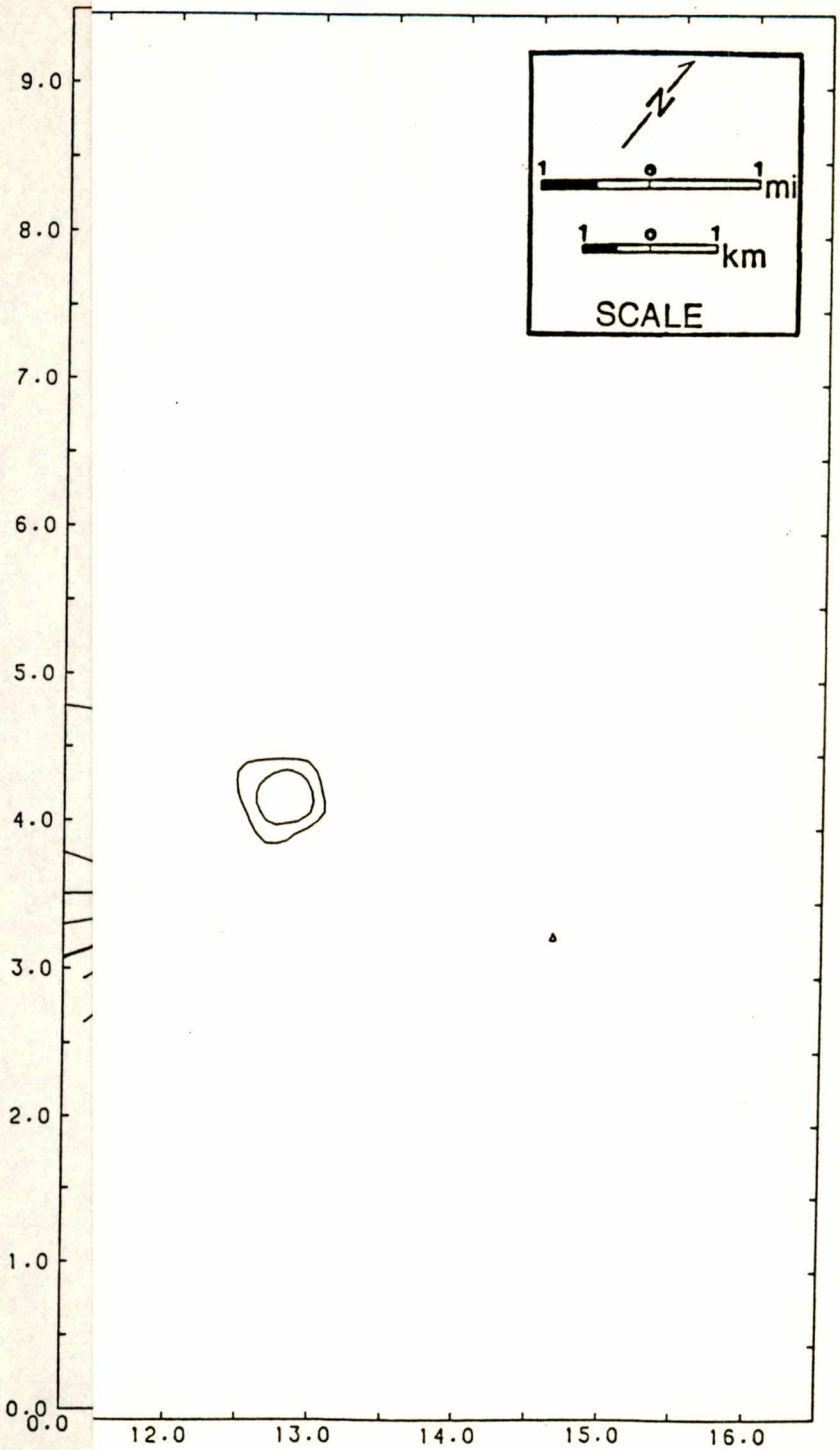
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Where thicker than 6 m (20 ft), this parting commonly consists of a thin shale, less than 0.6 m (2 ft), overlain by a fine-grained sandstone, in turn overlain by a siltstone of approximately the same thickness. Between thicknesses of 3 and 6 m (10 and 20 ft), the parting commonly consists solely of siltstone. At thicknesses less than 3 m (10 ft), the interval is either interbedded siltstone and shale, or solely shale. Siltstone and shale strata are commonly rooted and contain siderite nodules and/or laminations and plant impressions. Where the parting is very thin, 0.3 m (1 ft) or less, the shale is commonly carbonaceous.

Figure 16 is an isopleth map of the ratio of non-coal to coal for the total seam. These values were obtained by determining the ratio of non-coal thickness to coal thickness at each data point. For the total seam plot, the Middleman was included in the non-coal thickness. Areas of questionable contour validity are the same as for Figure 14. Note again the definition of the thinning of the Middleman parting and the low non-coal:coal ratio in the area centered at coordinates 4.5,3.0. Within the unsplit eastern area, two areas of only slightly elevated non-coal ratios are seen.

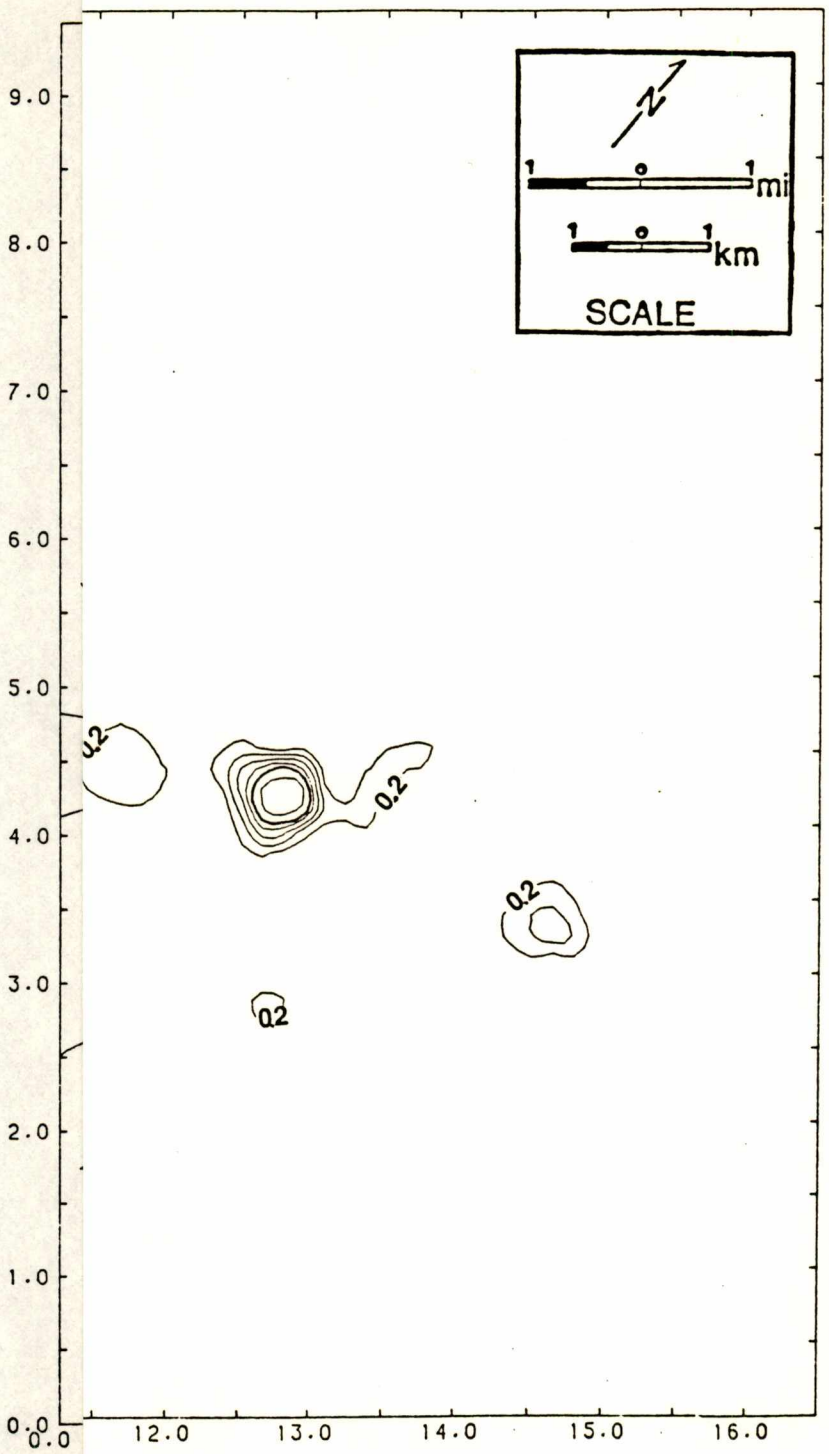

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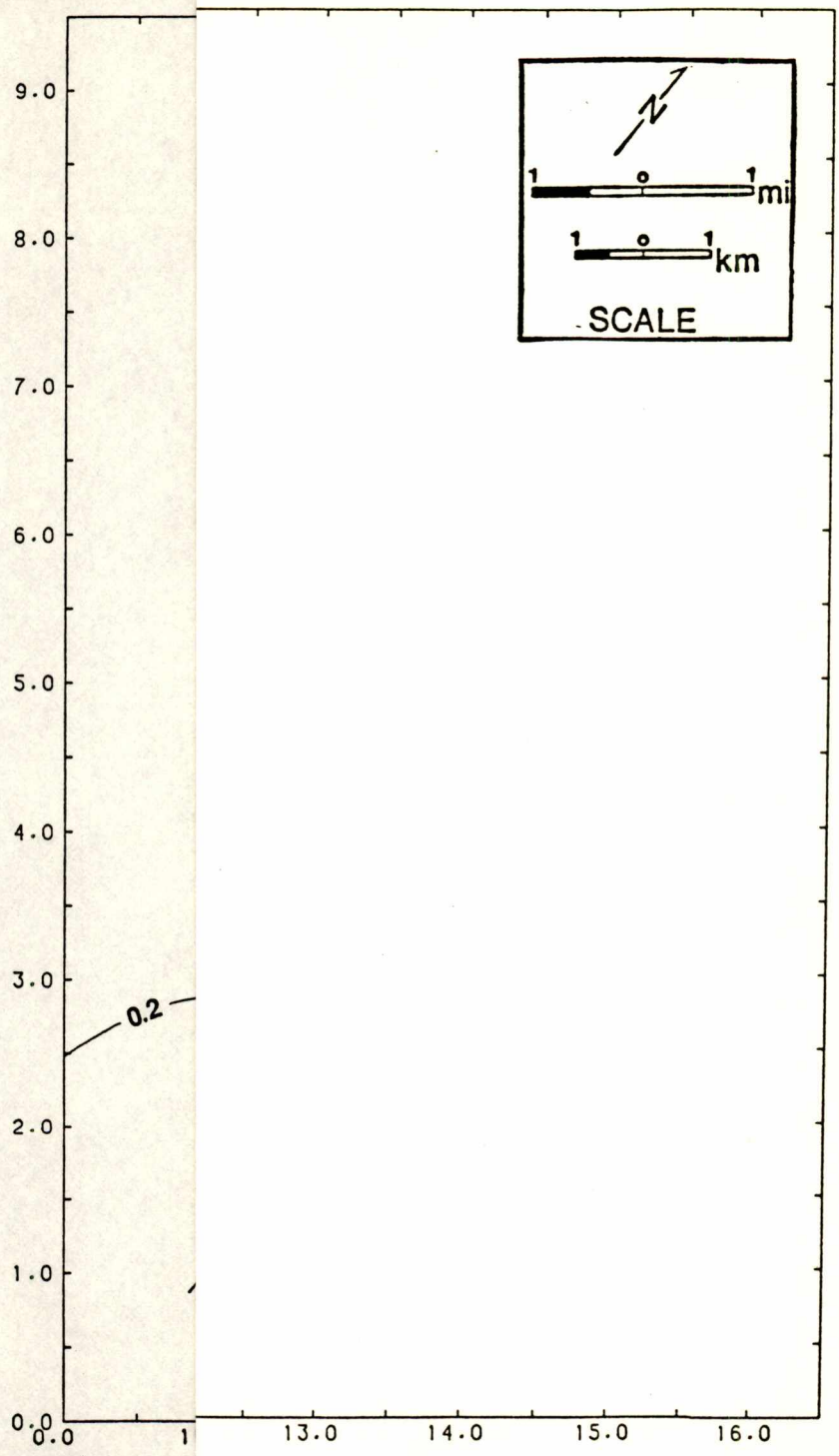
Figure 17 is an isopleth map of the ratio of non-coal to coal for the main and lower split. This map shows that within the study area, the main and lower split of the Glamorgan is dominantly coal. Only on the extreme southwestern edge and at an area centered on coordinates 13.0,4.0 is non-coal content equal to, or greater than, coal content.

Figure 18 is an isopleth map of the ratio of non-coal to coal for the upper split. In comparison with Figure 16, the upper split is more non-coal enriched than the main and lower split. The ratio of non-coal to coal increases radially away from the area centered at coordinates 4.5,3.0.

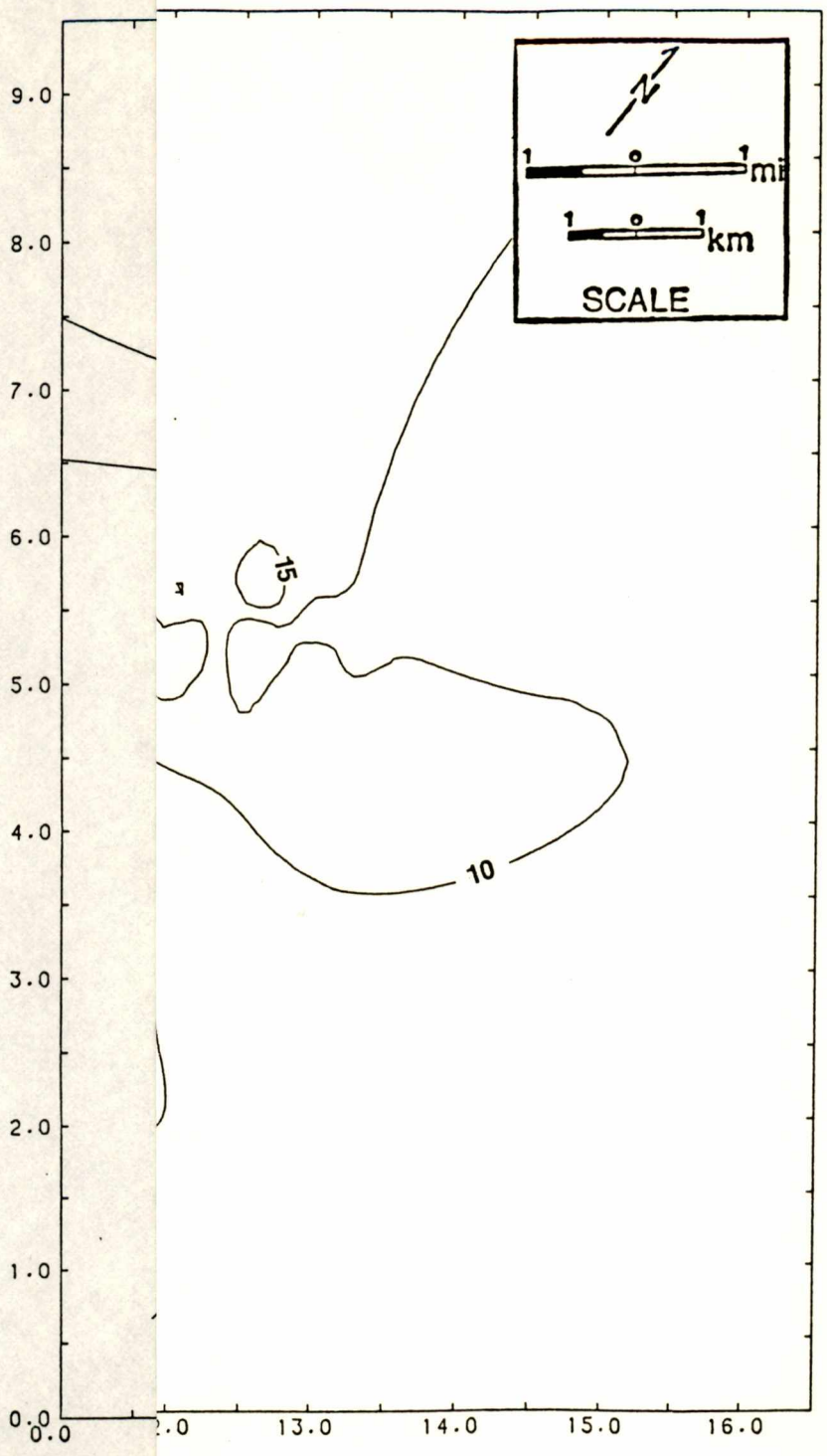
Proximate analyses. Figure 19 is an isoash map based on raw coal values. The bunching of contours along the 6.5 ordinate and the closure seen in the upper left corner of the map is due to data point density. In the eastern portion of the study area, values for raw coal ash range, generally, from just below to just above 10%. In the western portion of the study area, values are typically above 25% and range up to 45%. Note the low ash values at that area centered around coordinates 4.0,2.5. Analyses of 64 samples of the main seam and both splits yield a mean of 13.10% ash with a standard deviation of 10.94%. Analyses of 55 samples of the main


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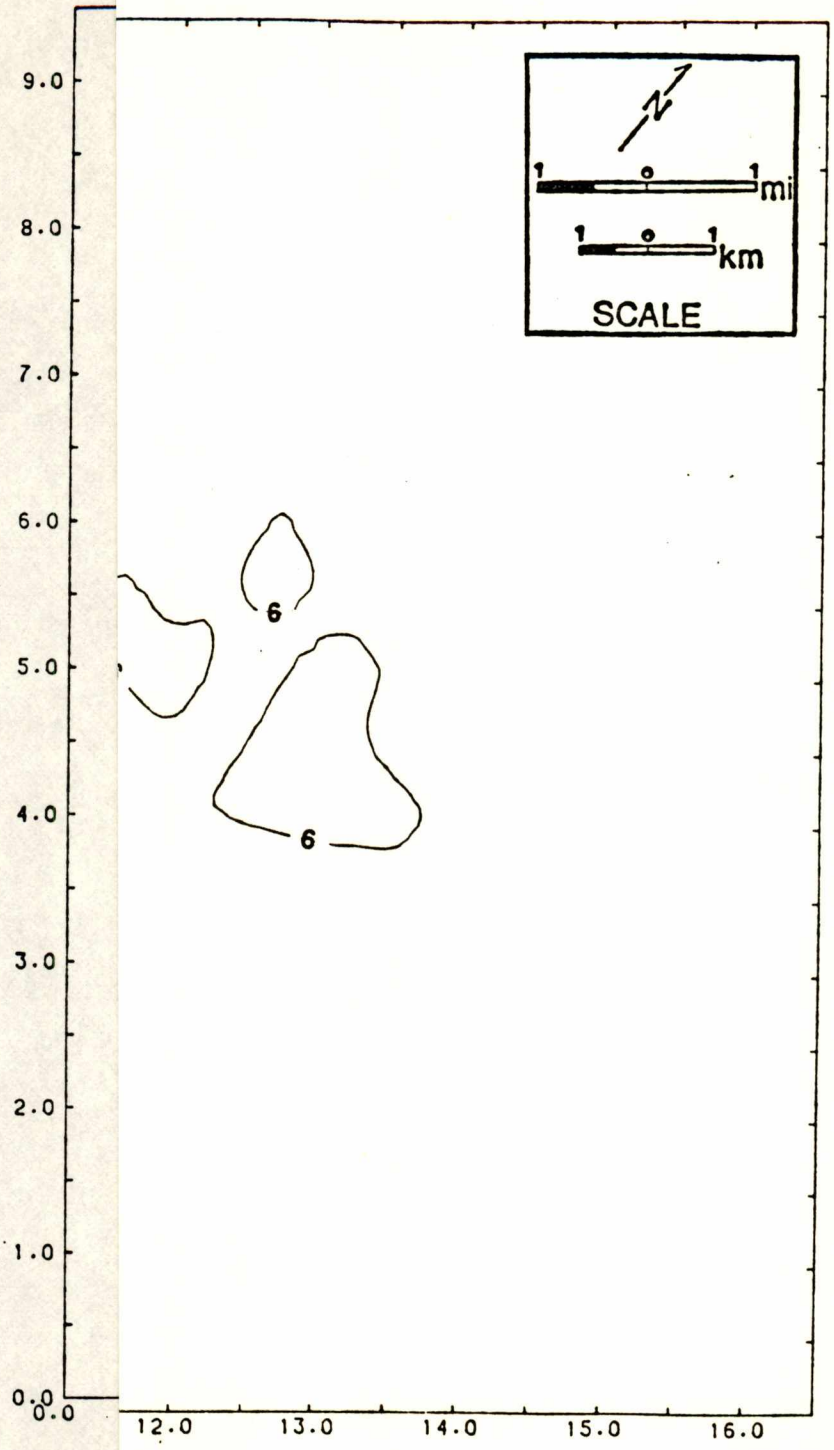


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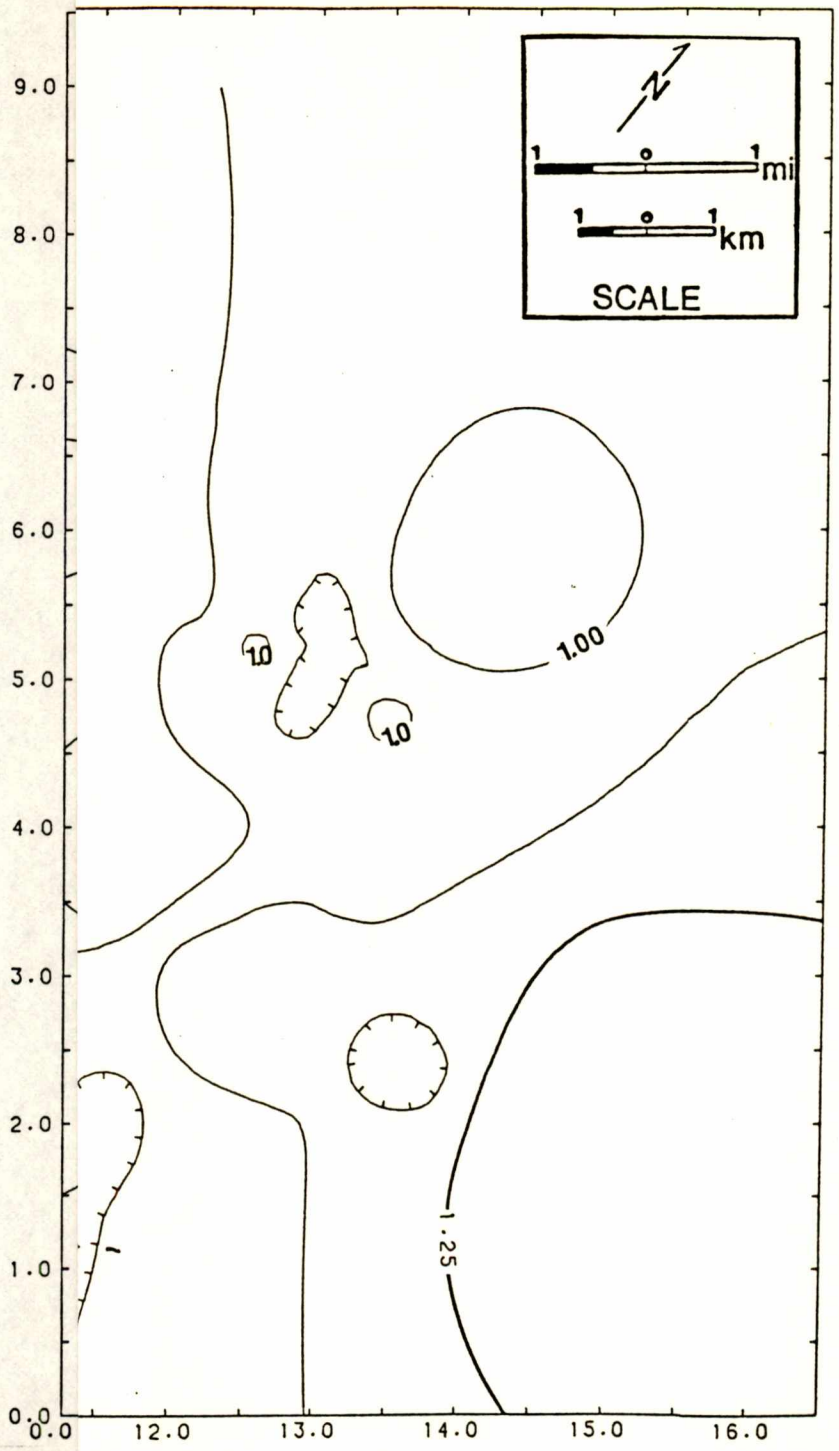
seam and lower split yield a mean of 9.86% ash, with a standard deviation of 6.00%. Analyses of 9 upper split samples yield an average of 31.73% ash with a standard deviation of 12.78%.

Figure 20 is an isoash map based on the 1.5 specific gravity float separate of the coal. Note the uniformity of ash content of this separate, with values close to 6%. Analyses of 70 samples of the main seam and both splits yield a mean of 5.74% ash with a standard deviation of 1.03%. Analyses of 60 samples of the main and lower split yield a mean of 5.74% ash with a standard deviation of 1.05%. Analyses of 9 upper split samples yield a mean also of 5.74% ash with a standard deviation of 0.94%.

Figure 21 is an isosulfur map based on raw coal analyses. The pattern seen in the northwestern corner of the map is due to three analyses having elevated sulfur values (coreholes 151, 162 and 169) and the lack of intervening data points between them and the data points in the southwestern portion of the map. As such, the contours above the 5.0 abscissa and left of the 6.0 ordinate may or may not reflect actual patterns. Eastern and western portions of the study area are quite similar, with most concentrations near 1.00% sulfur, except for the higher values in the northwest corner. Analyses of


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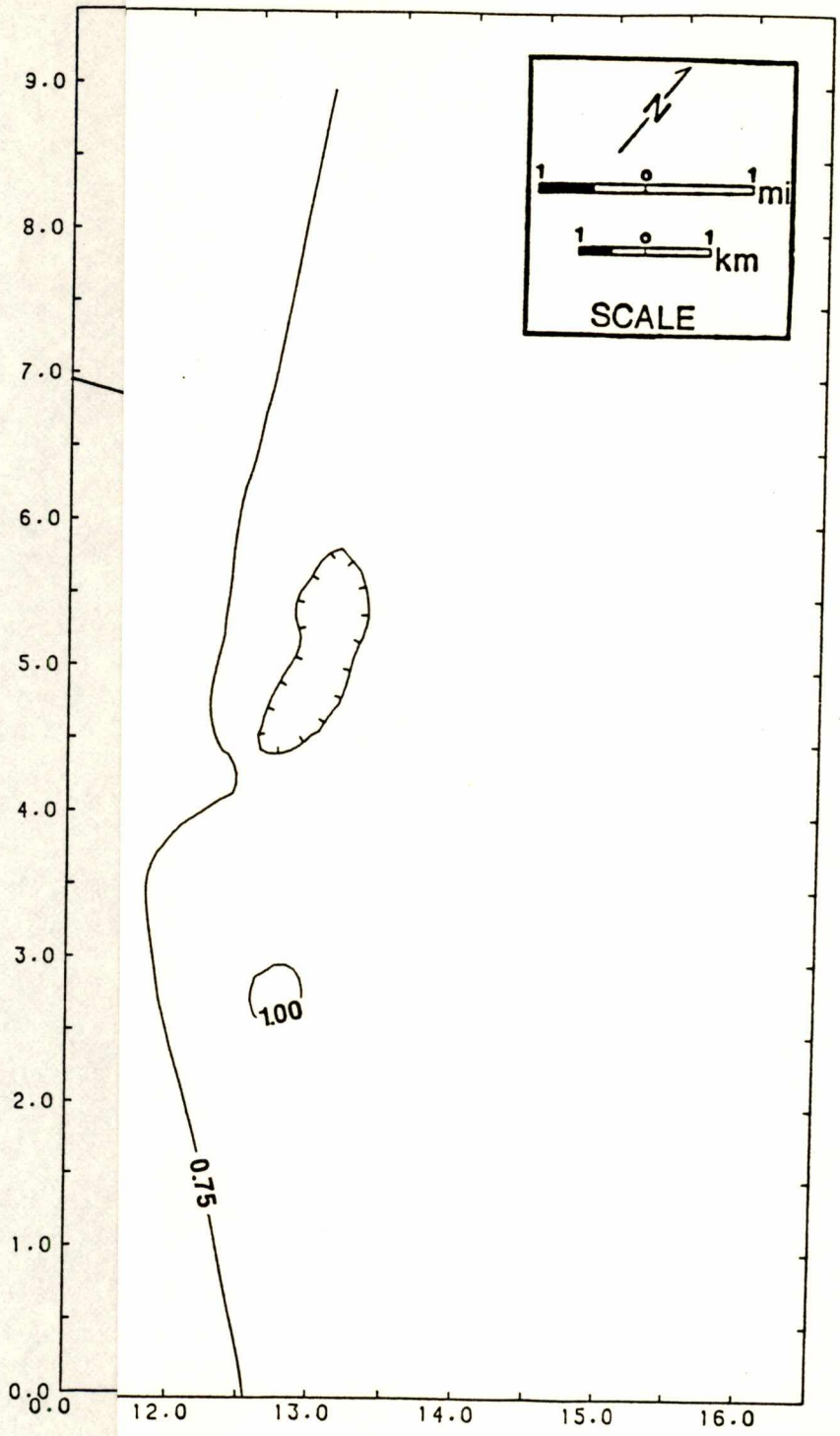

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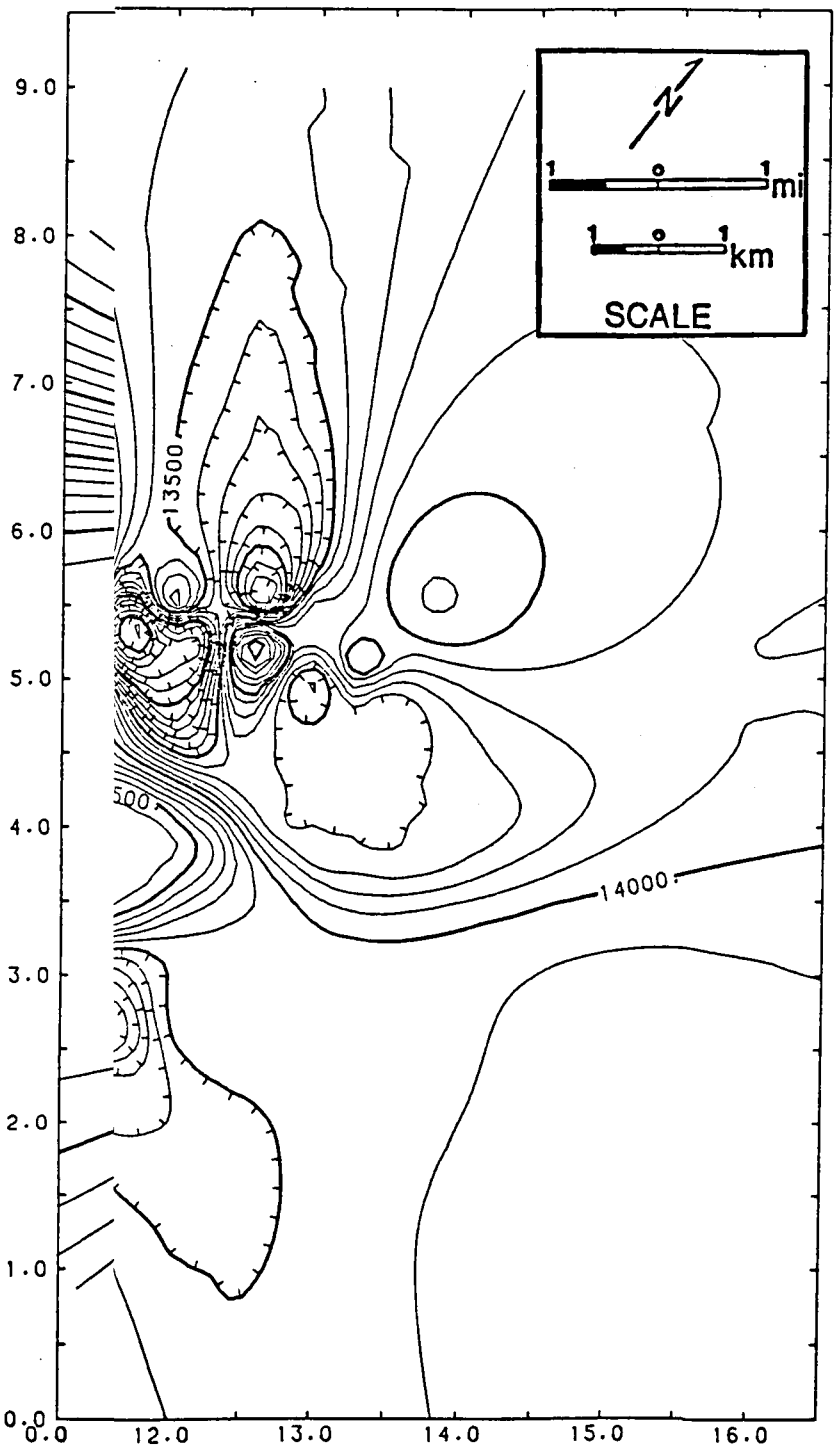
64 samples of the main seam and both splits yield a mean of 0.96% sulfur with a standard deviation of 0.47%. Analyses of 55 samples of the main seam and lower split yield a mean of 0.86% sulfur with a standard deviation of 0.30%. Analyses of 9 upper split samples yield a mean of 0.69% with a standard deviation of 0.73%.

Figure 22 is an isosulfur map based on the 1.5 specific gravity float separate. Note that the eastern portion of the study area is quite uniform in its sulfur content for this separate, ranging generally from slightly below to slightly above 0.75%. Although map patterns in the western portion reflect the data point density problem described for Figure 20, note that values are generally greater than 1.00% S. Analyses of 70 samples of the main seam and both splits yield a mean of 0.81% sulfur with a standard deviation of 0.27%. Analyses of 61 samples of the main seam and lower split yield a mean of 0.76% sulfur with a standard deviation of 0.24%. Analyses of 9 upper split samples yield a mean of 1.11% with a standard deviation of 0.22%.

The isopleths of Figure 23 are BTU values based on raw coal analyses. The bunching of isopleths along the 6.5 ordinate and the pattern in the upper left corner of the map above the 5.0 abscissa and left of the 6.5 ordinate are a function of data point density. Note that


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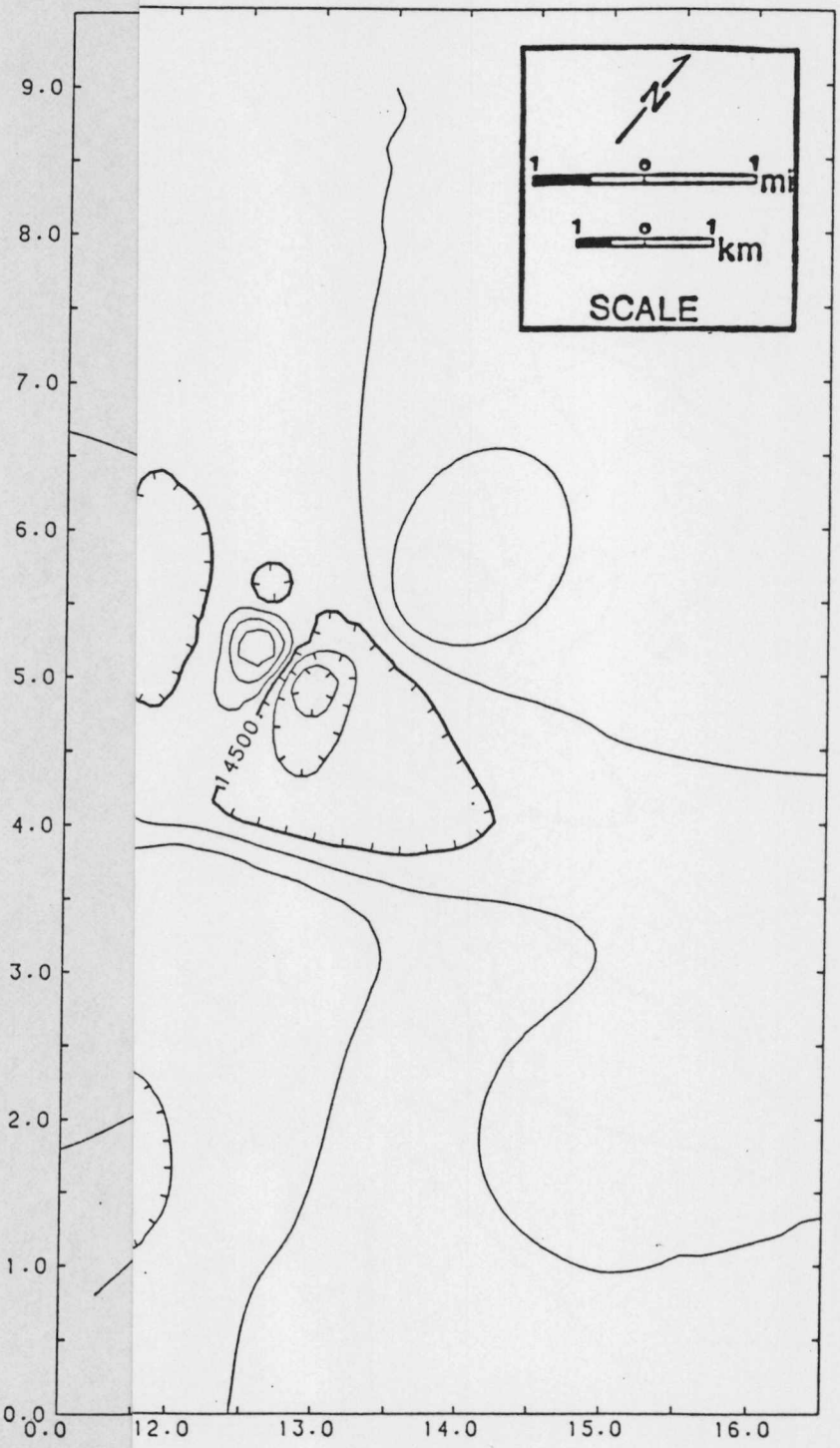
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in the eastern portion of the study area, BTU values are generally greater than 13,000. In the western portion of the study area, values are lower and more variable, reflecting the greater sediment content of the seam in this area. Note, however, the BTU high centered on coordinates 4.0,2.5. Analyses of 64 samples of the main seam and both splits yield a mean of 13,360 BTU with a standard deviation of 1757 BTU. Analyses of 55 samples the main seam and lower split yield a mean of 13,888 BTU with a standard deviation of 970 BTU. Analyses of 9 upper split samples yield a mean of 10,142 BTU with a standard deviation of 2,158 BTU.

The isopleths of Figure 24 are BTU values based on the 1.5 specific gravity float separate. For this separate, BTU values are quite uniform across the study area. Analyses of 70 samples of the main seam and both splits yield a mean of 14,566 BTU with a standard deviation of 180 BTU. Analyses of 61 samples of the main seam and lower split yield a mean of 14,576 BTU with a standard deviation of 178 BTU. Analyses of 9 upper split samples yield a mean of 14,497 BTU with a standard deviation of 182 BTU. (See Table B1 for specific analytical data.)


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X-ray fluorescence analyses. Tables C2 and C3 list values in weight percent for major oxides and sulfur obtained by X-ray fluorescence (XRF) for the 1.5 specific gravity float and sink separates, respectively. These values were normalized by calculation to original weight percent of the separates (see Table B1) and are shown in Tables C4 and C5. (For example, the float-sink separates of sample 6 are 90.80% and 9.20% of the total weight of the sample, respectively, and contain 2.66% and 30.40% SiO_2, respectively. Multiplying the amount of SiO_2 in each separate by each separate's percent weight of the total sample gives the amount actually in the original sample prior to separation, here 2.42% in the float fraction and 2.80% in the sink fraction. A reconstituted seam value for each element can be obtained by simply adding the two normalized values.) The mean values and standard deviations are given for each element. The samples are divided into three sets: 1) total seam, 2) samples east of the line of the splitting and lower split samples west of the line of splitting and 3) upper split and all-seam samples west of the line of splitting.

Assuming the 1.5 specific gravity separation divides each sample into relatively clean coal and mostly sediment-rich separates, the geochemical affinities of each element for the different portions can be determined

by comparing the means and standard deviations for each sample subset. An element is assumed to be preferentially concentrated in a specific gravity separate when its mean in one separate is greater than the other and their standard deviations do not substantially overlap. To test this assumption, a t-test was performed to determine if the float-sink separates were in fact two populations with means significantly different at the 95% confidence interval. For example, CaO in the main and lower split has identical means and standard deviations in the float and sink portions. In the upper split and all-seam, CaO appears to be enriched in the sink, with a mean of 0.18% versus 0.06% in the float. However, the t-test shows that the means of the float and sink are not significantly different, therefore CaO cannot be shown to be preferentially concentrated in either separate (see Table C6).

Within the main and lower split, Na_2O, Al_2O_3, and S are enriched in the float and K_2O and Fe_2O_3 in the sink. Those elements not concentrated in either separate are MgO, SiO_2, P_2O_5, CaO and TiO_2.

Within the upper split and all-seam west of the line of splitting, S is enriched in the float and Na_2O, MgO, Al_2O_3, K_2O, TiO_2 and Fe_2O_3 in the sink. P_2O_5 and CaO are not concentrated in either separate.

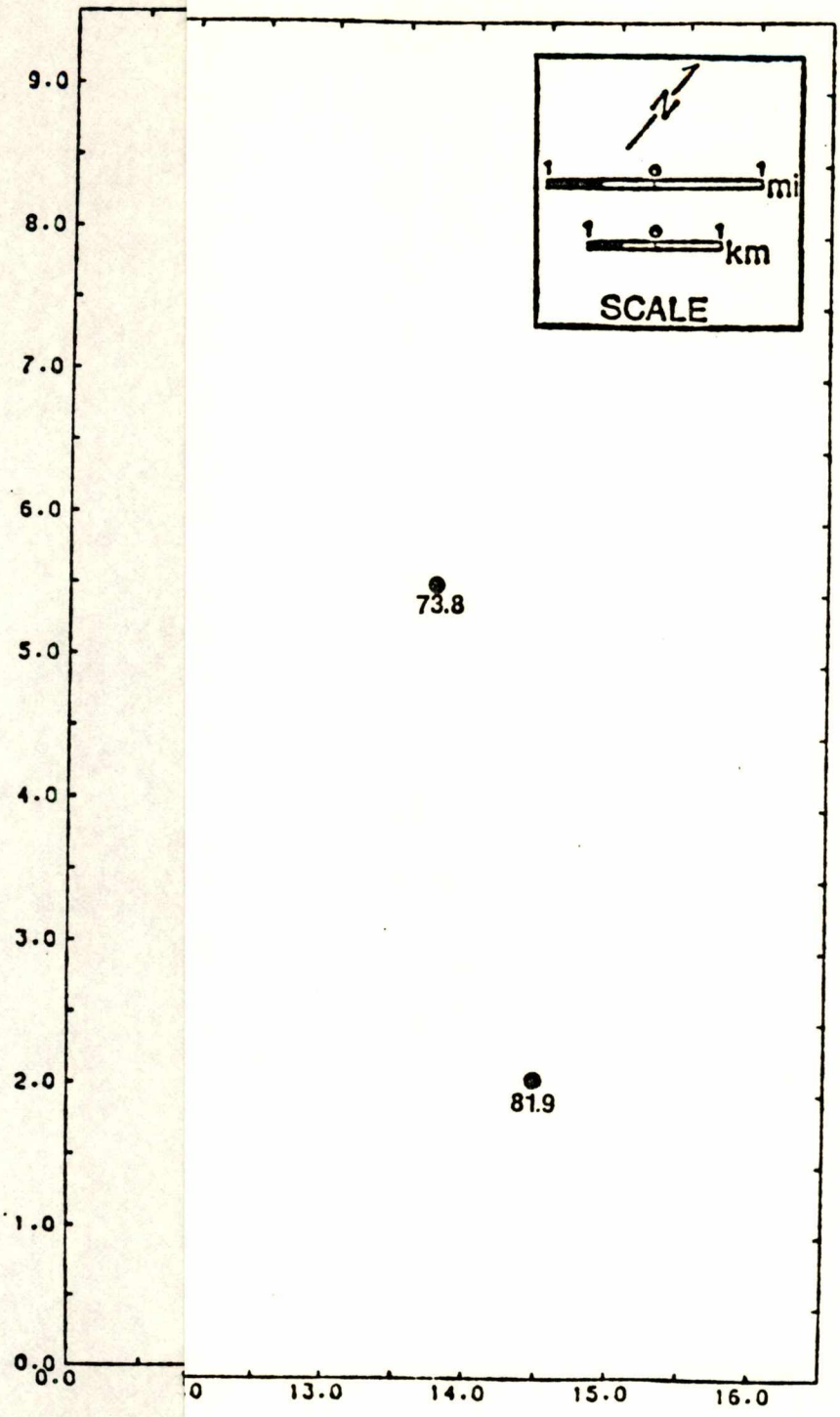
Values normalized to weight percent in Tables C4 and C5 were added to give a reconstituted seam value for each element at each sample location. Because some sample locations were represented by only float-sink or raw coal samples, those represented by both were used in linear regression analysis to determine the correlation coefficient, r, for the seam (reconstituted from float-sink data) as compared to the average of two replicate analyses of the raw coal. In all cases (except for Na_2O which is the least reliable) the correlation between reconstituted seam (float-sink) and raw coal data is significant at the 99.9% confidence interval. This supports the use of reconstituted seam data for raw coal interpretations and supports the view that the sampling process provided valid splits, both of raw and float-sink samples (see Tables C7 and C8).

Maceral analyses. Twenty-one pellets of raw coal were point counted (1000 points) to determine maceral (vitrinite, exinite and inertinite), pyrite and other mineral matter volumetric composition. Results are shown in Table D1 on both raw and mineral-matter-free (mmf) bases, the latter values obtained by subtraction of pyrite and other mineral matter counts from the total number of counts and normalization of maceral content to 100%. Because of the low number of data points, the

results were treated on a statistical basis, i.e., comparing means and standard deviations, rather than by contour mapping. Figures 25, 26 and 27, which show vitrinite, exinite and inertinite content (mmf) respectively, were qualitatively assessed for trends. Although the limited number and location of data points makes any trend suspect, there is an apparent increase in exinite to the northwest across the study area, roughly paralleling depositional dip.

Table D2 shows means and standard deviations of maceral content for the total seam (21 data points), main and lower split (17 data points) and upper split (3 data points). These values do not show any significant difference and do not allow for discrimination based on stratigraphic position. Although upper split vitrinite appears higher than the other two categories, the number of data points is too low for statistical inference.

To determine whether samples could be discriminated on the basis of maceral composition, data points were classified according to subjacent lithology, i.e., those where the coal is underlain by non-sandstone (coreholes 6, 47, 57, 65, 67, 98, 100, 127, 149, 150, 169 and 175) and those underlain by sandstone (coreholes 69, 73, 74, 77, 86, 89, 102 and 142). Means and standard deviations for these subsets are shown in Table D3. In addition,


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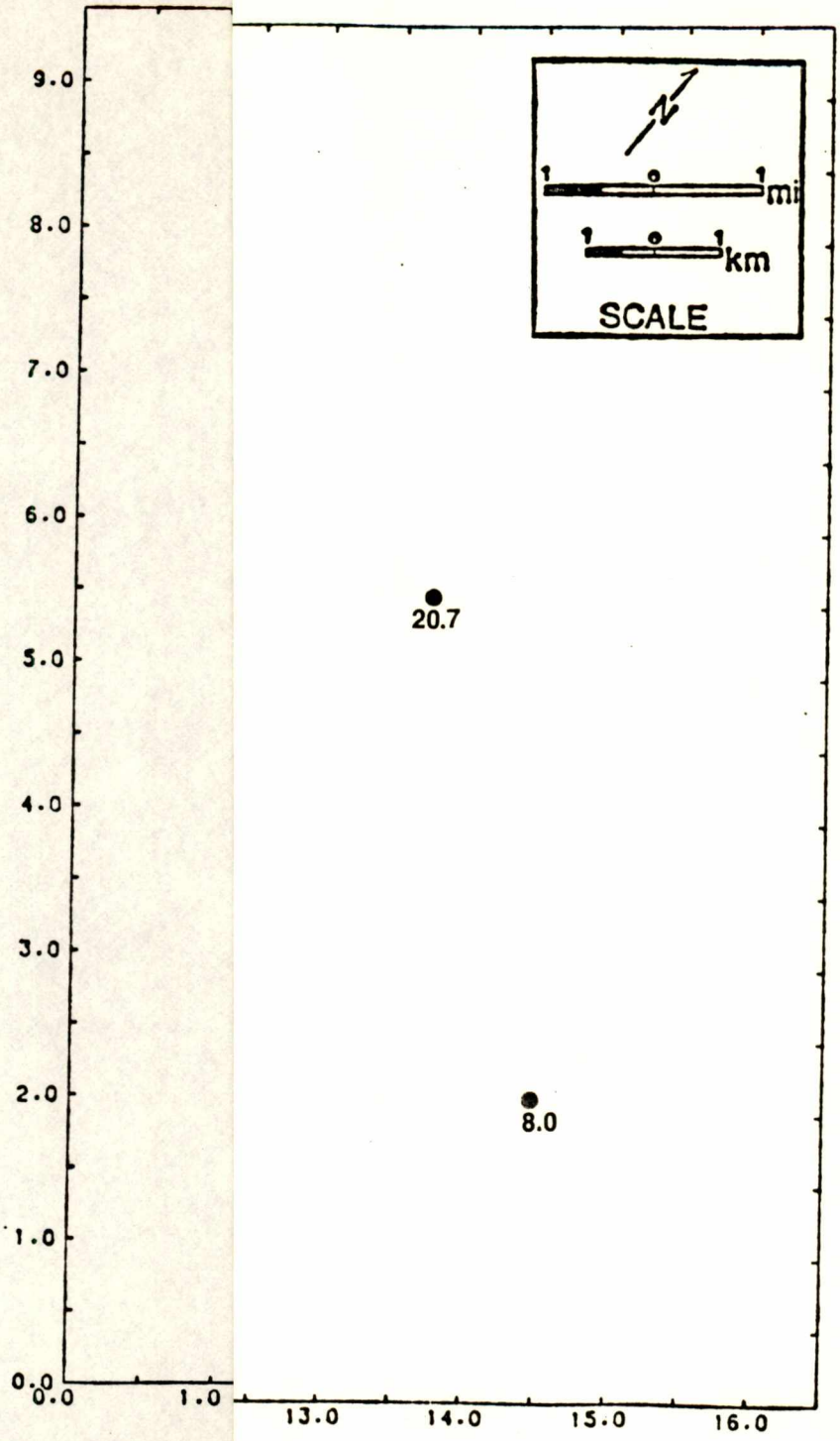
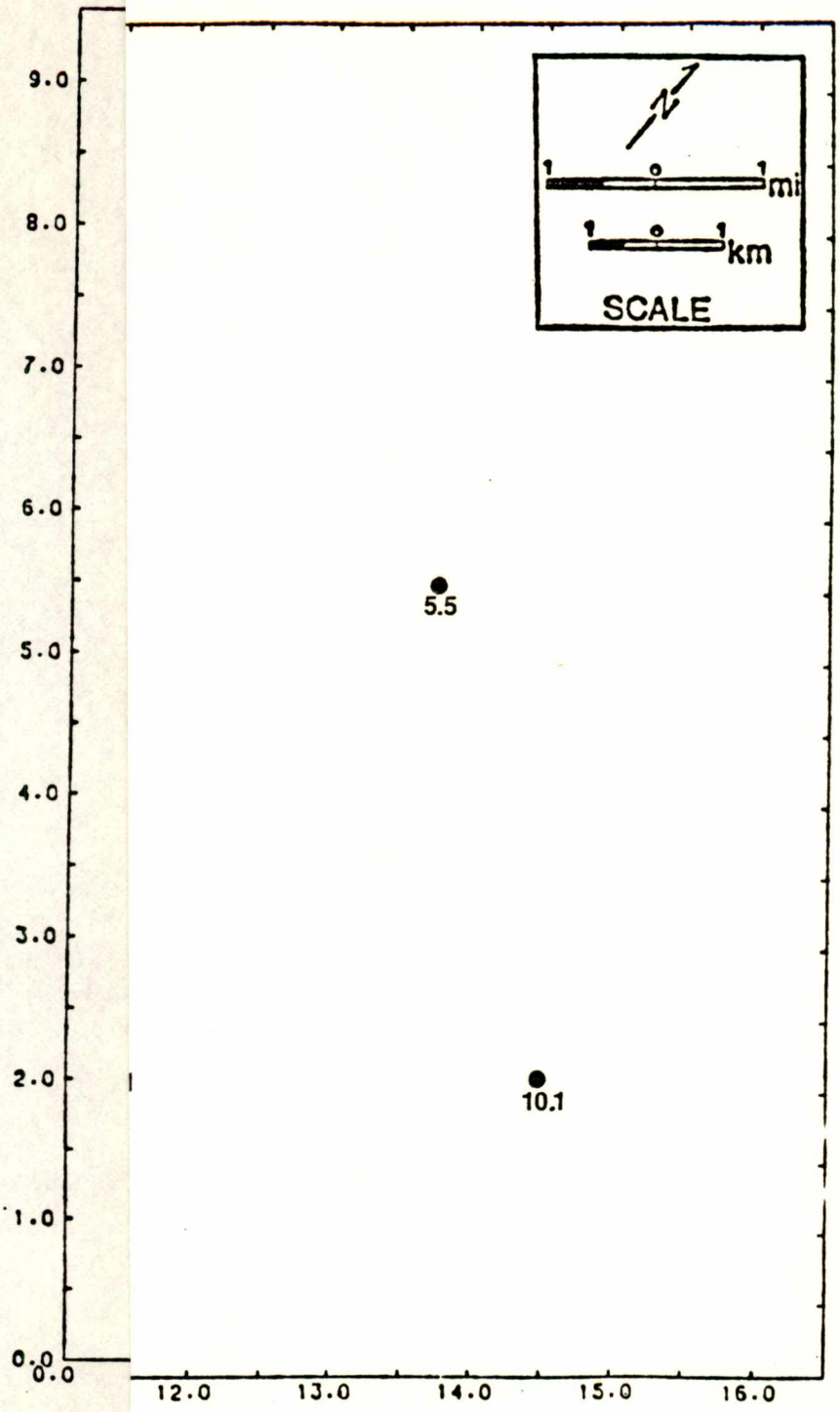

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1.0
13.0
14.0
15.0
16.0
20.7
8.0
1
0
1
mi
1
0
1
km
SCALE

Figure 26


9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
12.0
13.0
14.0
15.0
16.0
5.5
10.1
1
mi
1
km
SCALE

Figu

data points were classified as to their location either east of the line of splitting (coreholes 6, 47, 57, 65, 67, 69, 73, 74, 77, 86, 89, 98, 100, 102 and 175) or west of this line (coreholes 127, 142, 149, 150 and 169). Means and standard deviations for these subsets are shown in Table D4.

Vitrinite appears slightly elevated in the western portion of the study area, but the number of data points is small. Statistics shown in these tables suggest that, regardless of subjacent lithology or geographic position, maceral composition is fairly constant.

Statistical values for pyrite and other mineral matter were also generated for the above subsets, but due to the low number of data points, standard deviations gave contents ranging into negative numbers. For further discrimination, inertinite, pyrite and other mineral matter content were summed for each data point, assuming that inertinite macerals attain a more mineralogical character due to degradation. Where underlain by non-sandstone (12 data points), the mean is 10.9% with a std. $\bar{x}$ of 8.1%. Where underlain by sandstone (8 data points), the mean is 9.7% with a std. $\bar{x}$ of 3.3%. East of the line of splitting (15 data points), the mean is 8.7% with a std. $\bar{x}$ of 3.3%. West of the line of splitting (5 data points), the mean is 15.7% with a std. $\bar{x}$ of 10.9%.

Even though there is overlap of this content in all subsets, the latter value reflects the greater clastic influence in the western portion of the study area, though, again, the limited number of data points makes statistical inference questionable.

Pyrite occurs primarily in two forms, as noted in polished sections; 1) as void filling within fusinite and vitrinite retaining cell structure and 2) as scattered blebs imbedded in featureless vitrinite. Where filling voids, pyrite is dominantly framboidal. In featureless vitrinite, it is either single, or agglomerates of, subhedral crystals.

Overlying Sedimentary Rocks

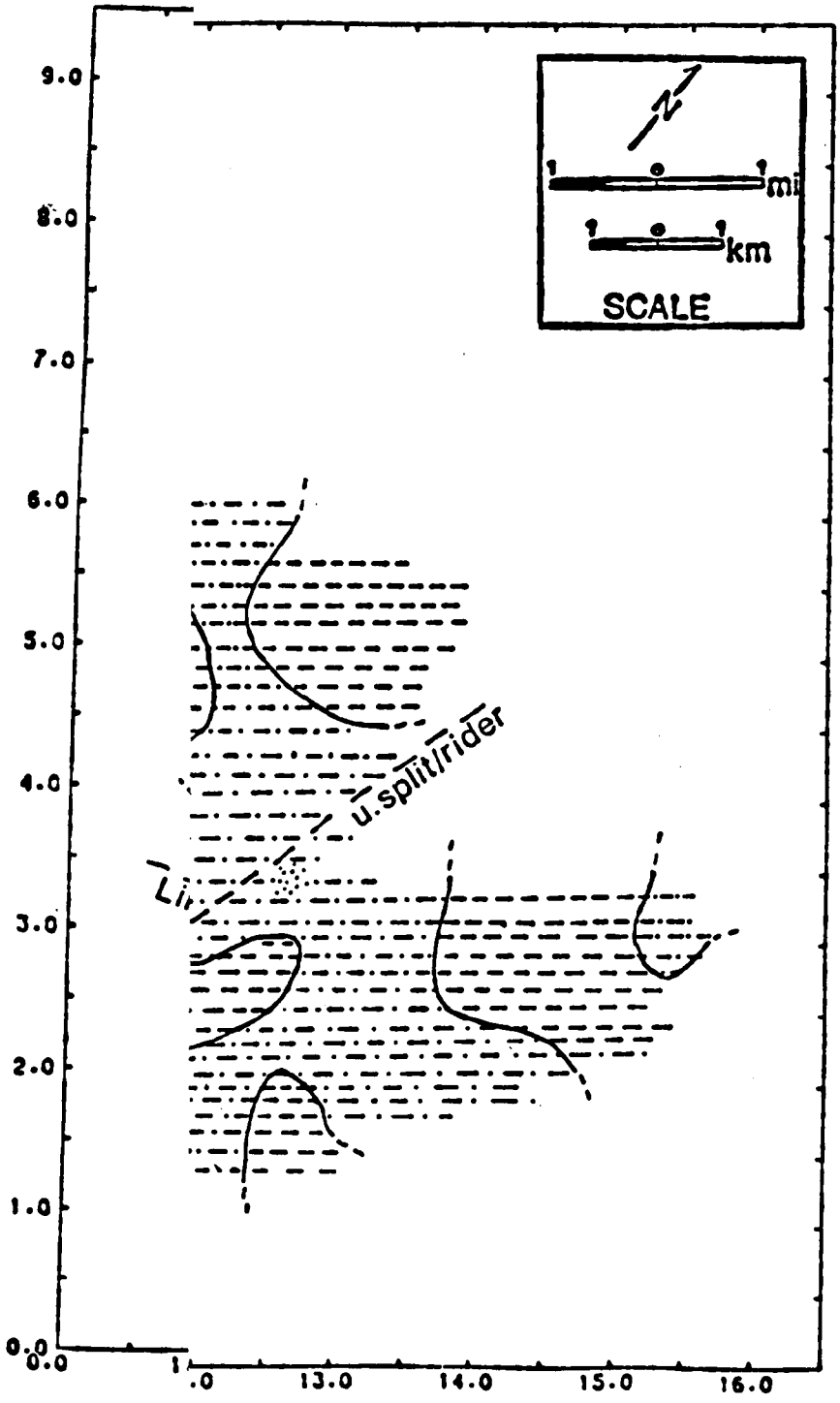
The Glamorgan rider typically lies 5 to 10 m (15 to 30 ft) above the Glamorgan seam in the eastern part of the study area. To the west, the rider merges with the upper split of the Glamorgan (Scott Nelson, personal communication, 1984). Although mostly continuous, the rider horizon is locally occupied by sandstone bodies, probably due to removal of the peat mass by channel entrenchment. The rider is thin, typically less than .3 m (1 ft), but can attain thicknesses of up to .45 m (1.5 ft).

The Glamorgan-to-rider interval is a highly variable lithology. Immediately overlying the coal, siltstone and

shale predominate (see Figure 28). Siltstone and shale beds commonly contain siderite laminae, coal spars and plant fossils. Carbonaceous shale and rooted zones occur locally within these shale and siltstone sequences.

Sandstone strata occur in discrete intervals up to 3 m (10 ft) thick or as interbeds in the silty units. These sandstone lithologies commonly are medium- to fine-grained, wavy bedded and contain clay laminae, clay clasts, and siderite nodules, the latter particularly near the base. Compactional features, such as ball-and-pillow structures and slickensides, are rarely seen at sandstone-siltstone and sandstone-shale contacts.

Lithologies above the rider are very similar to those below. Of particular note, however, is a zone 3 to 5 m (10 to 15 ft) above the rider to the east and 3 to 8 m (10 to 25 ft) above the upper split/rider to the west. This zone is typically thin, 1 to 1.5 m (3 to 5 ft) thick, but is similar to the zone in the Eagle Shale underlying the Glamorgan. It is variously described as burrowed/bioturbated, calcareous-cemented, containing siderite nodules replaced by calcite and with rare, sparse fossil shells (type unspecified). This zone is typically within sandstone or sandier portions of siltstone and shale beds.


N
mi
km
SCALE
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
13.0
14.0
15.0
16.0
u.split/rider

Figure

CHAPTER 4

DISCUSSION AND CONCLUSIONS

Conditions Prior to Peat Accumulation

In a preliminary report, Chesnut (1981) listed known marine zones of the Upper Carboniferous in eastern Kentucky and described the typical lithologic nature of these zones. This zone is commonly a coarsening-upward sequence that ranges from a few to up to 37 m (120 ft) thick, interpreted as bayfill. This sequence typically overlies a coal seam and grades from shale at the base, to siltstone midway in the section, to sandstone at the top of the section which is subjacent to the next coal. Brackish to marine body fossils and ichnofossils are common in the basal sequence. Chesnut identifies the Eagle Shale as such a sequence (see Figure 29, A).

According to Chesnut, sandstone typically caps the bayfill sequence, representing the culmination of the progradational-regressive sequence. As noted previously, the Gladeville Sandstone caps the Eagle Shale bayfill sequence. The following stratigraphic aspects of the Gladeville, including:

1) thickness greater than 8 m (25 ft);

2) commonly an abrupt contact with the underlying Eagle Shale;

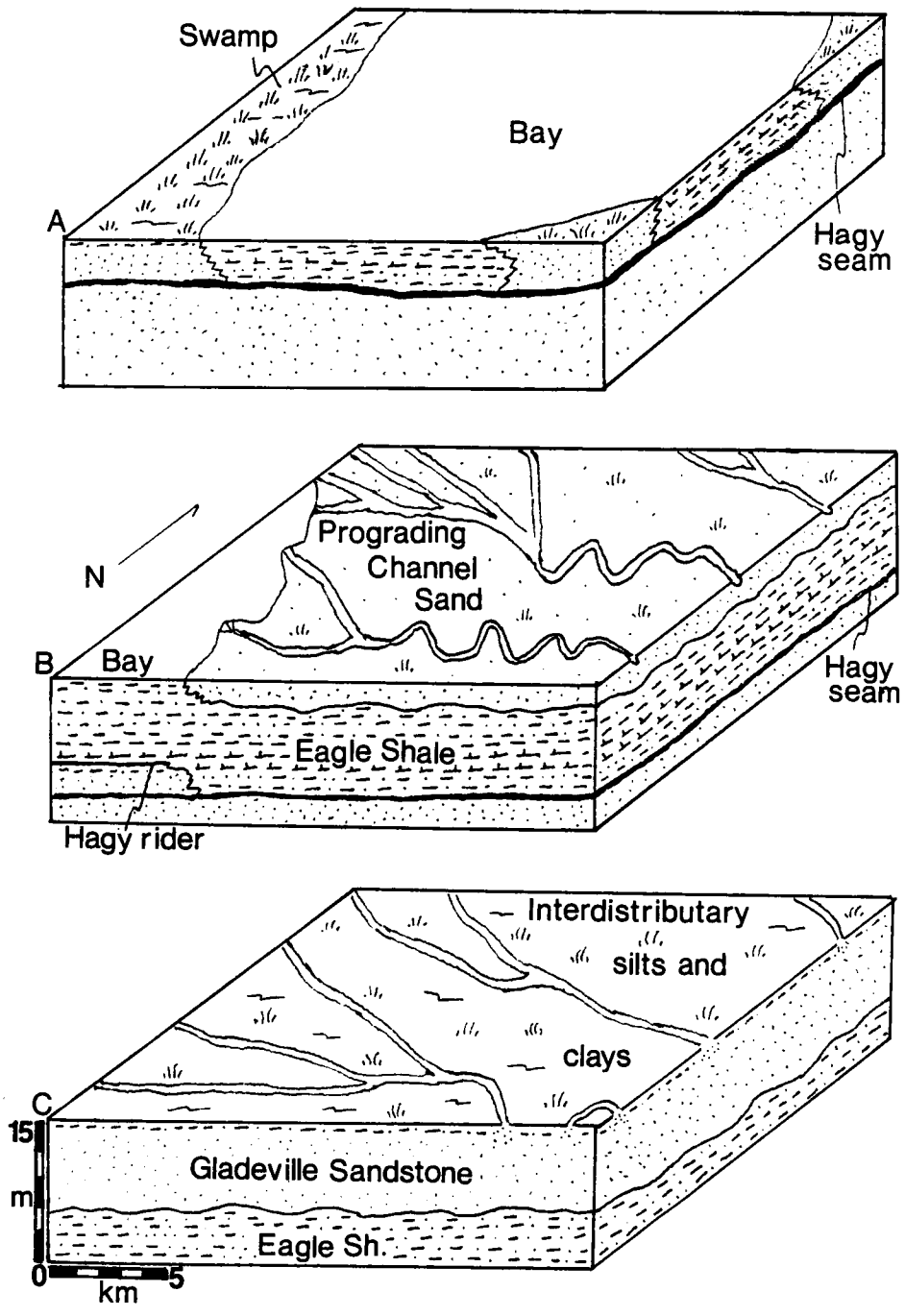


Figure 29. Conditions prior to peat accumulation.
A.) Bayfill sequence.
B.) Distributary channel sand progradation.
C.) Distributary channel abandonment.
Coal thickness exaggerated. Schematic only.

3) siderite pebbles, clay clasts and coal spars, especially near the base, and;

4) cross bedding, ripple drift (interpreted as the "wavy bedding" from core log descriptions) and clay laminae;

are indicative of a distributary channel sand migrating across a lower delta plain, according to depositional environment models proposed by Horne and Ferm (1978). (See Figure 29, B).

Also according to the Horne and Ferm model, interdistributary silt and clay of the backswamp environment are laterally equivalent to the distributary channels and that the channels themselves can be characterized by three types of fills:

1) active channel sandstone fill;

2) abandoned channel fills of clay and silt and;

3) abandoned channel fills of organic debris.

Figure 7, page 20, represents the lower delta plain surface soon after abandonment, and just prior to establishment of the Glamorgan peat swamp in the study area. Areas of interdistributary clay and silt appear in the areas occupied by distributary channels (some perhaps abandoned). Where the Gladeville is in contact with Glamorgan, the sandstone is generally a fining-upward sequence and represents the decreasing energy of the

channel environment prior to abandonment of the distributary. The coal is also underlain by siltstone, shale and mudstone, and by carbonaceous shale, representing the two types of abandoned channel fills (see Plate 2, in Pocket, for examples, and Figure 29, C).

Conditions During Peat Accumulation

Following abandonment of the distributary channel system, conditions favorable for plant growth allowed establishment of a swamp environment across the entire delta plain surface (see Figure 30, A). Initially, sediment influx was minimal, although locally the non-coal:coal ratios are high, probably due to overbank or flood deposits (Figure 17, page 36). Note that the extreme southwestern part of the study area (Figure 17, page 36) represents the lower split, which is thin, whereas the southeastern half of the study area is the thick main seam. Although locally high ratios (0.2 - 1.0) are present in the latter area, these are spread over a greater interval. Quantitatively, the southwestern portion of the study area was subjected to substantially greater terrigenous sediment influx.

This observation is substantiated by the establishment of the Middleman parting. The geometry and lithologies of this parting are similar to the upper portion of the sequence underlying the seam and imply

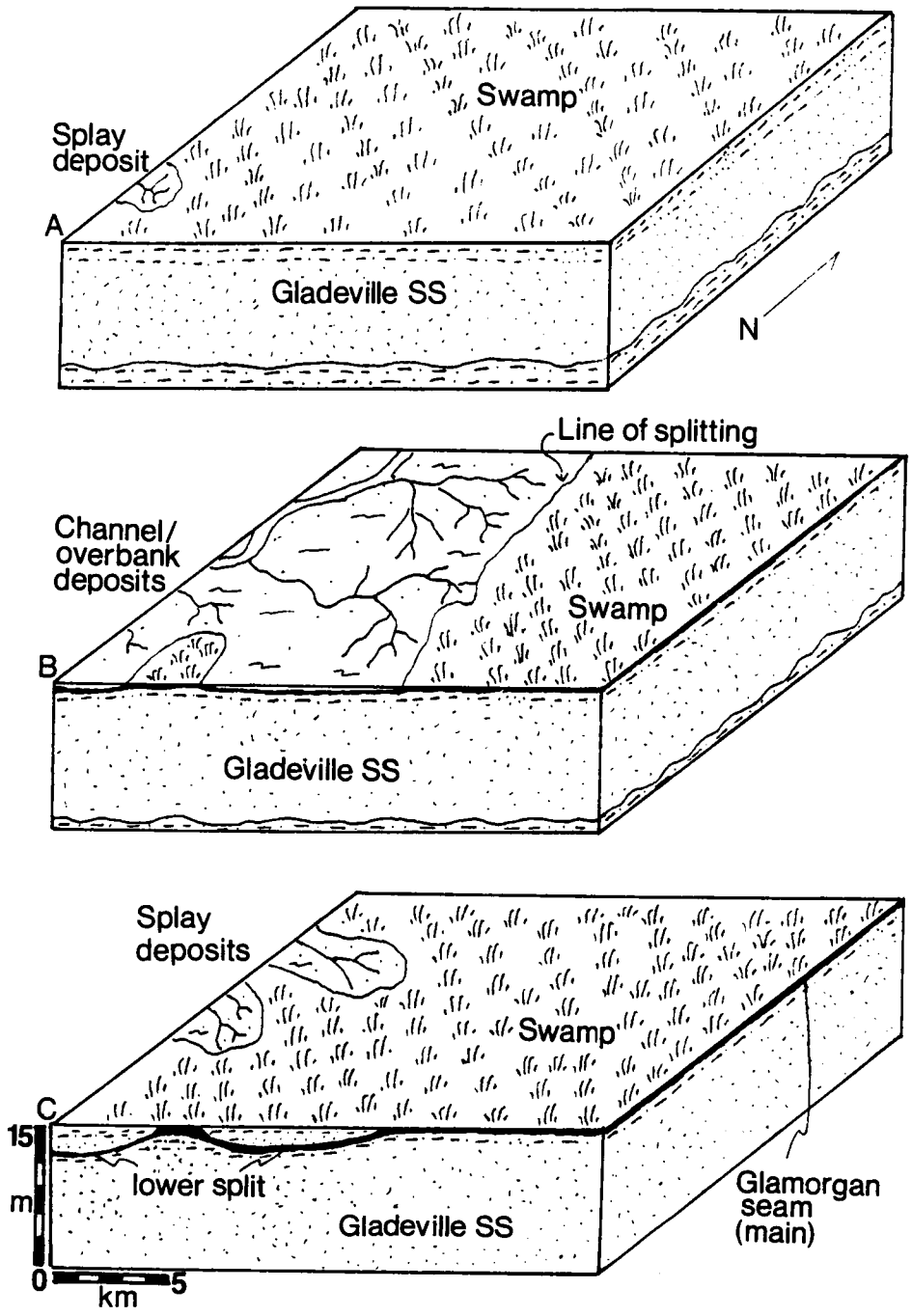


Figure 30. Conditions during peat accumulation.
A.) Establishment of peat swamp.
B.) Development of Middleman parting and lower split.
C.) Reestablishment of peat swamp.
Coal thickness and geometry exaggerated.
Schematic only.

origin by channel migration and abandonment, and/or overbank or splay deposits. This parting is found only in the western half of the study area and reinforces the interpretation of greater clastic influx inferred for the lower split in this area (see Figure 30, B).

Following abandonment of the channel system that resulted in the Middleman parting, conditions in the western half of the study area again became favorable for peat accumulation. This accumulation was continually interrupted by terrigenous clastic sediment deposition, probably as overbank deposits (Figure 18, page 37). Of particular note is the area centered at coordinates 4.5,3.0. On most maps this area shows characteristics very similar to the eastern half of the study area, where peat accumulation was uninterrupted. This area is located where the lower and upper splits join, separated only by thin partings. Apparently this part of the swamp was protected from significant amounts of clastic deposition (see Figure 30, C).

The seam is thickest where underlain by non-sandstone lithologies, interpreted here to be interdistributary areas, and thins where underlain by sandstone, interpreted here to be areas of channel fill. Two alternatives might explain this relationship: a) where in contact with the coal, the underlying linear sand

bodies acted as buttresses, and the coal thins due to a wedging effect due to greater compaction of shale and siltstone away from the channels (Wanless, et al., 1969), or; b) plant growth and peat accumulations may have started first in the interdistributary areas, leading to a greater total thickness than in areas of channels, which did not become sites for growth and accumulation until total abandonment.

The enrichment of sulfur in the float separate, i.e., the coal, is to be expected and has long been recognized by many authors (Thiessen, 1945; Stach, et al., 1975; Reyes-Navarro and Davis, 1976). The low amount of total sulfur within the seam as a whole is indicative of little, or no, marine influence on the swamp during peat accumulation (Cecil, et al., 1981). The enrichment of Na_2O, MgO, Al_2O_3, SiO_2, K_2O, TiO_2 and Fe_2O_3 in the sink of the upper split may be explained in light of the western portion of the study area's depositional setting, i.e., an area subject to much greater sediment influx than the eastern half. The enrichment of Na_2O and Al_2O_3 in the float separate of the main and lower seam may also be related to depositional setting. The eastern half of the study area was a more protected backswamp and would have been a low-energy, quiet water setting, allowing the slow settling of suspended clay particles and their

incorporation into the peat mass. The resultant enrichment of Al_2O_3 in the float separate can be explained by this mechanism. Gronhovd, et al., (1967), in a study of western U.S. lignites, noted that Na_2O, was organically bound and did not exist in a mineral matrix. Although this may explain the enrichment of Na_2O in the float separate, Na_2O may also be associated with the clays.

It was expected that the maceral composition would reflect the two different environments of the Glamorgan seam in the study area, particularly the inertinite percentage. No clear difference was noted between the two areas. The slight increase of exinite to the northwest could be due to increasing marine influence in this direction. Stach, et al., (1975) noted that marine and brackish waters tend to preserve exinite macerals. The limited number of samples may mask any real differences or trends. The petrographic data should be regarded as reconnaissance information, only.

Conditions After Peat Accumulation

In the eastern portion of the study area, peat accumulation was terminated by a series of newly established channels and overbank deposits (see Figure 31, A). Rooting and carbonaceous shale in the interval indicate the periodicity of these deposits. With

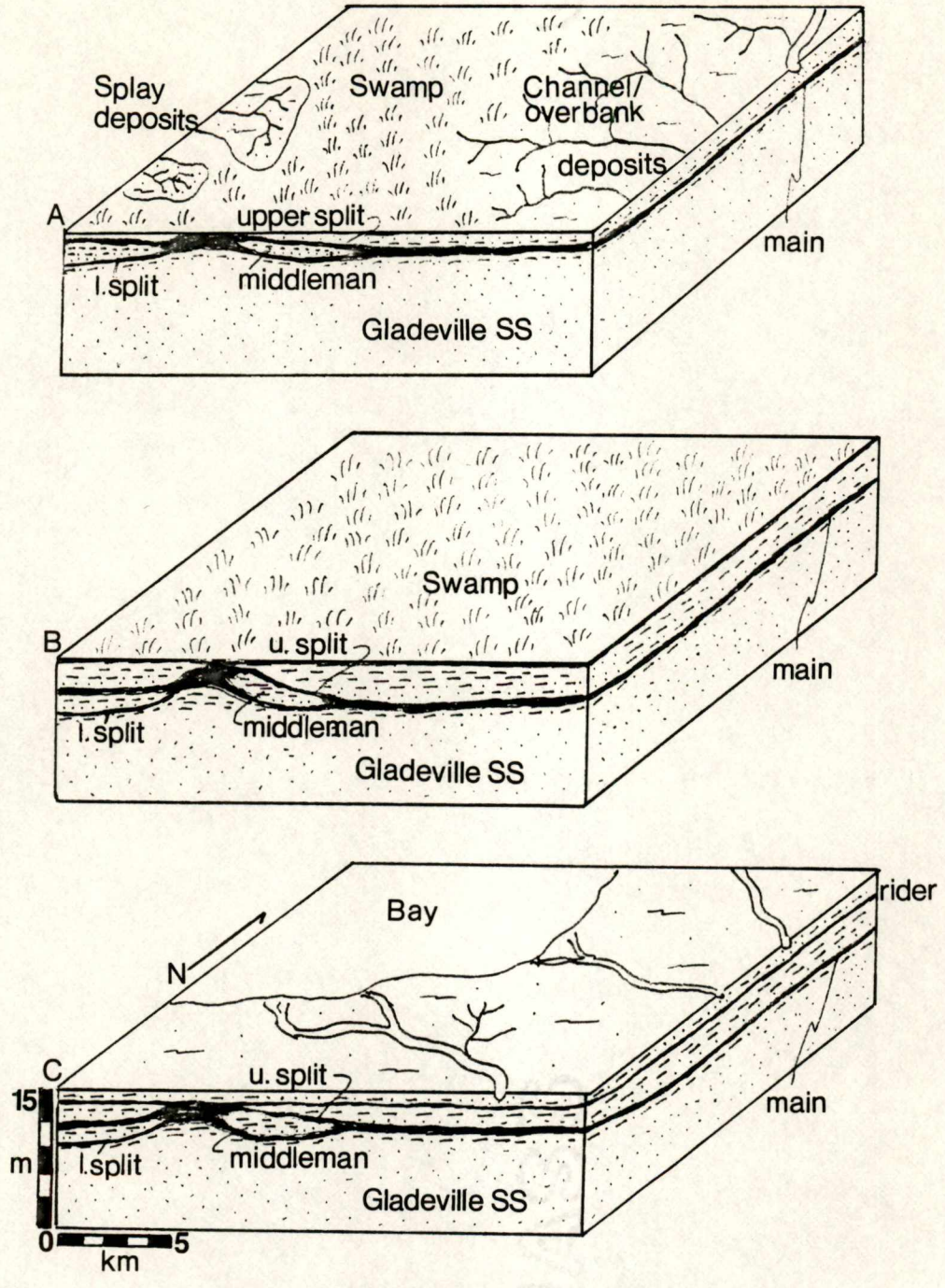


Figure 31. Conditions after peat accumulation.
A.) Development of upper split and end of eastern peat swamp.
B.) Reestablishment of peat swamp preceding rider.
C.) Marine/brackish transgressive sequence.
Coal thickness and geometry exaggerated.
Schematic only.

cessation of clastic influx, peat accumulation again occurred, resulting in formation of the rider concurrent with the upper portion of the upper split (see Figure 31, B).

At this time, peat accumulation was terminated over the entire study area by a marine transgressive sequence (see Figure 28, page 57, and Figure 31, C). Although no analyses of the rider are available, sulfur content is highest on average in the upper split in the western portion of the study area. This can be interpreted as due to the presence of marine/brackish sediments overlying the upper split (Horne, et al., 1978).

Some Final Observations and Suggestions for Further Study

1) Whereas a river-dominated, lower delta plain depositional environment is proposed for the Glamorgan to explain its peculiar splitting characteristics, tectonics may play an important role, also. Haney, et al., (1984), noted the importance of penecontemporaneous folding and faulting on the development of coals in northeastern Kentucky, while pointing out that the only tectonic movement affecting formation of coals within the study area was development of the Eastern Kentucky Syncline, whose axis is approximately 48 km (30 mi) to the northeast. Nelson (personal communication, 1984) reported similar splitting characteristics in coal seams

above the Glamorgan. Further work is needed relating seams over a larger stratigraphic interval to determine tectonic influence.

2) Recent work by Nolde (1984) has related the mineralogical makeup of clays in the Wise Formation, in part equivalent to the Breathitt Formation, to their depositional setting. A similar study of seatrock and coal partings makeup could further refine the hypotheses made here.

3) More detailed coal petrography, including vitrinite reflectance measurements, could enhance depositional environment determinations and reveal the coalification history of the Glamorgan seam.

4) Because it is not mineable, the Glamorgan rider has remained unsampled. Proximate analyses of this interval would be helpful for comparison to the characteristics of the upper split.

5) Areas of greater seam thickness were observed to occur in and along present topographic valleys. It may be possible that ancient topographic lows may control development of present drainage. Hylbert (1976) has noted the correlation between paleochannels and present drainage of the Clover Fork River within the Pine Mountain thrust block southwest of the study area, pointing out that jointing is inherited, at least in

part, from original depositional features. If paleotopographic lows and lithologies exert control on modern drainages, the present courses of Levisa and Russell Fork could be likely locations of paleochannels contemporaneous with the Glamorgan swamp that may have served as sources of sediments associated with the coal in the western portion of the study area. Additional field study to locate possible channels that cut out the Glamorgan would be very beneficial.

6) Findings in this study of use in future exploration and exploitation of the Glamorgan include:

A) the relationship between coal thickness and subjacent lithology. East of the line of splitting, areas where the coal is underlain by non-sandstone lithologies are likely to be areas of greatest coal thickness. In addition, the pattern of sandstone bodies seen on the subjacent lithology map (Figure 7, page 20) may also be repeated north and south of the study area and could serve as a guide for exploration;

B) sulfur distribution. It was noted that sulfur content increases to the northwest, perhaps due to marine/brackish units overlying the coal in this area. It may be expected that this trend will persist to the northwest outside of the study area, at least in the upper split/rider;

C) depositional subenvironments. West of the line of splitting, it may be expected that ash content will be the greatest and BTU content the least within the study area, due to the river-dominated depositional setting. It may also be expected that these characteristics extend north and south of the study area along and west of the line of splitting.

7) The size and shape of the Middleman parting suggest sediments were deposited from a westerly source. Whether a distributary channel system flowing generally westward deposited the sediments eastward, or whether a northwestern source existed at this time, is not known. Further study of the Middleman in this regard would be most beneficial.

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APPENDIXES

APPENDIX A

COMPUTER DATA

GLADEVILLE SANDSTONE, SEATROCK AND PROXIMATE ANALYSES DATA

DP	X	Y	P	GL	GC	GT	RS	RA	RB	FS	FA	FB	%V	%FC
1	15.07	2.79	3	43	3	1145	9999	9999	9999	9999	9999	9999	9999	9999
2	15.39	3.04	3	50	0	1149	9999	9999	9999	9999	9999	9999	9999	9999
3	14.67	3.28	4	9999	4	1113	9999	9999	9999	9999	9999	9999	9999	9999
4	14.42	3.02	3	36	7	1057	9999	9999	9999	9999	9999	9999	9999	9999
5	14.55	2.90	3	47	11	1137	9999	9999	9999	9999	9999	9999	9999	9999
6	13.80	3.54	4	9999	2	980	1.14	8.52	14113	0.83	4.50	14786	39.3	56.2
7	13.64	3.26	3	9999	4	974	9999	9999	9999	9999	9999	9999	9999	9999
9	13.74	3.37	3	39	5	1074	9999	9999	9999	9999	9999	9999	9999	9999
10	13.85	3.02	3	41	3	1130	9999	9999	9999	9999	9999	9999	9999	9999
11	13.56	2.72	3	42	2	1172	9999	9999	9999	9999	9999	9999	9999	9999
12	13.73	2.69	3	42	7	1237	0.97	8.66	14044	0.78	5.04	14651	33.6	61.4
13	13.15	3.29	3	36	8	990	9999	9999	9999	9999	9999	9999	9999	9999
14	13.31	3.11	3	9999	9999	9999	0.74	9.33	14066	9999	9999	9999	9999	9999
15	13.45	4.77	4	9999	0	1013	1.04	11.76	13431	0.88	5.38	14481	33.9	60.3
16	13.22	4.32	3	9999	17	1013	9999	9999	9999	9999	9999	9999	9999	9999
17	13.34	3.48	3	33	7	1072	9999	9999	9999	9999	9999	9999	9999	9999
18	13.03	3.14	3	30	7	1112	9999	9999	9999	9999	9999	9999	9999	9999
19	13.37	3.10	3	44	9	1095	9999	9999	9999	9999	9999	9999	9999	9999
20	13.06	2.34	3	34	3	1247	9999	9999	9999	9999	9999	9999	9999	9999
21	12.62	5.95	3	9999	3	943	9999	9999	9999	9999	9999	9999	9999	9999
22	12.64	5.59	3	30	13	965	0.82	17.14	12666	0.80	6.35	14477	35.3	58.7
23	12.97	5.39	4	9999	2	1000	0.69	9.43	13875	0.70	5.92	14499	33.2	60.9
24	12.58	5.22	4	9999	0	1027	1.04	5.49	14601	0.67	3.94	14867	35.5	60.6
25	12.74	5.13	3	9999	2	1019	9999	9999	9999	9999	9999	9999	9999	9999
26	12.96	4.94	3	9999	5	1005	0.66	12.58	13579	0.69	7.34	14233	33.7	58.9
27	12.80	4.84	3	9999	19	1027	9999	9999	9999	9999	9999	9999	9999	9999
28	12.83	4.25	3	9999	1	1059	9999	9999	9999	9999	9999	9999	9999	9999
29	12.71	3.43	3	31	9	1088	9999	9999	9999	9999	9999	9999	9999	9999
30	12.65	2.76	4	34	1	1171	9999	9999	9999	1.03	4.85	14776	35.3	59.9
31	12.63	1.84	3	64	0	1324	9999	9999	9999	9999	9999	9999	9999	9999
32	12.66	1.45	3	57	0	1354	9999	9999	9999	9999	9999	9999	9999	9999
34	11.79	5.74	3	45	0	979	9999	9999	9999	9999	9999	9999	9999	9999
35	12.01	5.53	4	9999	9999	9999	0.67	9.32	13872	0.66	5.58	14476	33.4	61.1
36	11.75	5.31	4	9999	6	965	0.73	16.54	12335	0.73	6.49	14396	34.4	59.2
37	12.12	5.25	4	9999	5	1002	0.78	16.87	12699	0.71	6.32	14439	33.8	59.9
38	11.95	4.66	3	9999	2	1071	9999	9999	9999	9999	9999	9999	9999	9999
39	11.73	4.47	3	31	8	1063	9999	9999	9999	9999	9999	9999	9999	9999
40	12.24	4.03	3	39	6	1108	9999	9999	9999	9999	9999	9999	9999	9999
41	12.36	3.10	3	35	17	1132	9999	9999	9999	9999	9999	9999	9999	9999
42	12.21	2.74	3	37	9	1181	1.11	8.48	14087	0.79	4.44	14771	34.8	60.8
43	11.91	2.41	3	36	1	1189	9999	9999	9999	9999	9999	9999	9999	9999
44	12.17	1.66	3	54	23	1294	9999	9999	9999	9999	9999	9999	9999	9999
45	12.20	1.25	3	43	2	1343	9999	9999	9999	9999	9999	9999	9999	9999
46	11.04	6.06	3	9999	4	895	9999	9999	9999	9999	9999	9999	9999	9999
47	11.21	5.73	4	9999	14	941	0.62	7.09	14341	0.63	5.90	14548	34.7	59.4
48	11.39	5.09	3	9999	7	1018	9999	9999	9999	9999	9999	9999	9999	9999
49	11.23	4.85	4	9999	0	1058	0.65	7.61	14231	0.63	5.52	14580	34.7	59.7
50	11.43	3.84	3	45	1	1139	0.51	5.68	14093	9999	9999	9999	9999	9999
51	11.05	3.65	3	40	0	1162	9999	9999	9999	9999	9999	9999	9999	9999
52	11.45	3.58	3	38	3	1154	9999	9999	9999	9999	9999	9999	9999	9999
53	11.58	3.19	3	46	4	1153	9999	9999	9999	9999	9999	9999	9999	9999
54	11.26	2.95	3	28	13	1158	9999	9999	9999	9999	9999	9999	9999	9999
55	11.52	2.61	3	37	7	1172	0.82	12.76	13408	0.65	5.03	14811	34.5	60.4
56	11.15	2.52	3	55	0	1210	0.96	5.89	14514	0.74	4.09	14819	34.9	61.0
57	11.51	2.18	4	34	9	1218	0.69	10.25	13866	0.70	5.73	14626	34.6	59.7
58	11.37	1.65	3	46	8	1293	9999	9999	9999	9999	9999	9999	9999	9999
59	10.86	5.49	3	9999	0	990	9999	9999	9999	9999	9999	9999	9999	9999
60	10.05	5.32	3	37	5	1019	9999	9999	9999	9999	9999	9999	9999	9999
61	10.37	4.94	3	9999	0	1063	9999	9999	9999	9999	9999	9999	9999	9999
62	10.06	4.82	3	9999	3	1067	0.80	10.15	13865	0.82	5.00	14725	35.1	59.9

GLADEVILLE SANDSTONE, SEATROCK AND PROXIMATE ANALYSES DATA (CONTINUED)

DP	X	Y	P	GL	GC	GT	RS	RA	RB	FS	FA	FB	%V	%FC
63	10.47	4.04	3	9999	0	1053	9999	9999	9999	9999	9999	9999	9999	9999
64	10.82	4.13	3	49	0	1112	9999	9999	9999	9999	9999	9999	9999	9999
65	10.32	4.04	4	9999	8	1115	0.75	7.76	14256	0.77	5.88	14579	34.4	59.8
66	10.63	3.63	4	37	0	1161	0.71	7.85	14261	0.65	4.92	14743	33.8	61.3
67	10.15	3.44	4	47	2	1193	1.13	7.97	14251	0.77	5.17	14726	34.1	60.8
68	10.69	3.24	3	47	3	1174	0.71	8.39	14509	0.73	5.21	14713	34.5	60.3
69	10.07	2.38	4	43	0	1200	0.97	7.34	14372	0.80	5.50	14699	33.6	60.9
70	10.50	2.96	4	50	0	1194	0.84	8.28	14115	0.74	5.19	14623	34.8	60.1
71	10.46	2.80	4	9999	2	9999	9999	9999	9999	9999	9999	9999	9999	9999
72	10.79	2.72	3	35	3	1189	0.61	7.54	14294	0.63	4.77	14772	35.8	59.4
73	10.42	2.54	3	62	0	1246	2.05	7.81	14225	0.71	4.41	14816	33.6	62.0
74	10.05	2.51	4	9999	2	1251	1.26	8.06	14205	0.69	7.07	14403	33.1	59.8
75	10.84	2.24	3	45	3	1276	9999	9999	9999	9999	9999	9999	9999	9999
76	10.41	2.16	3	41	3	1280	9999	9999	9999	9999	9999	9999	9999	9999
77	10.75	2.00	4	54	0	1271	0.63	8.60	14511	0.64	5.11	14755	34.1	60.8
78	10.82	1.33	3	48	0	1329	9999	9999	9999	9999	9999	9999	9999	9999
79	10.26	1.16	3	42	5	1350	9999	9999	9999	9999	9999	9999	9999	9999
80	9.76	3.80	3	42	0	976	9999	9999	9999	9999	9999	9999	9999	9999
81	9.41	5.54	3	9999	2	992	1.54	9.29	13996	0.80	6.61	14458	34.7	58.7
82	9.34	5.10	3	9999	5	1035	1.40	7.80	14202	0.80	5.83	14571	34.1	60.1
83	9.55	4.60	3	19	7	1059	9999	9999	9999	9999	9999	9999	9999	9999
84	9.60	4.41	4	9999	0	1110	1.00	5.27	14678	0.83	4.23	14848	36.5	59.3
85	9.88	4.30	3	22	12	1093	0.80	6.54	14420	0.81	5.48	14620	34.1	60.5
86	9.44	4.25	4	9999	0	1111	1.42	7.91	14201	0.79	5.86	14561	34.8	59.4
87	9.83	4.07	3	9999	0	1136	0.76	8.29	14156	0.76	6.20	14506	35.6	58.3
88	9.56	3.89	4	9999	0	1136	1.11	8.54	14139	1.03	7.08	14385	34.6	58.3
89	9.77	3.76	4	9999	0	1163	0.95	9.24	13973	0.88	6.39	14461	33.7	59.9
90	9.80	3.42	4	9999	0	1194	0.74	6.43	14533	0.70	5.89	14654	33.9	60.2
91	9.43	3.40	3	9999	1	1183	9999	9999	9999	0.73	7.37	14351	33.5	59.2
92	9.75	3.20	3	48	0	1220	9999	9999	9999	9999	9999	9999	9999	9999
93	9.22	2.16	3	49	2	1283	9999	9999	9999	9999	9999	9999	9999	9999
94	8.69	6.42	3	9999	0	886	9999	9999	9999	0.71	5.46	14655	35.8	58.8
95	9.07	6.18	3	54	3	915	9999	9999	9999	9999	9999	9999	9999	9999
96	8.90	5.86	3	9999	1	952	0.46	46.03	8196	0.75	5.42	14659	37.3	57.3
97	8.70	5.84	3	9999	1	948	0.63	6.99	14375	0.63	5.85	14564	35.0	59.2
98	8.61	5.68	4	9999	3	962	0.58	12.99	13253	0.62	6.77	14360	34.2	59.1
99	8.98	5.30	3	50	0	1025	9999	9999	9999	9999	9999	9999	9999	9999
100	8.70	4.86	4	9999	3	1035	0.67	7.15	14322	0.67	5.78	14575	34.7	59.6
101	9.01	4.75	4	9999	9999	9999	0.78	18.02	12574	0.88	8.98	14073	34.5	56.5
102	9.04	4.36	4	9999	0	1097	1.23	8.11	14146	0.81	6.57	14425	35.4	58.1
103	8.95	4.07	3	56	0	1141	9999	9999	9999	9999	9999	9999	9999	9999
104	9.12	3.77	4	9999	2	1161	0.58	7.85	14214	0.60	5.34	14644	33.5	61.2
105	8.72	3.65	3	34	0	1192	9999	9999	9999	9999	9999	9999	9999	9999
106	9.03	3.36	3	56	0	1215	9999	9999	9999	9999	9999	9999	9999	9999
107	8.00	6.57	3	58	5	910	9999	9999	9999	9999	9999	9999	9999	9999
108	8.41	6.30	3	9999	0	908	0.64	7.20	14245	0.63	5.41	14543	35.8	58.8
109	8.44	6.16	3	38	0	902	0.65	6.76	14448	0.65	6.31	14529	35.3	58.4
110	8.17	5.95	3	20	1	924	9999	9999	9999	0.60	5.71	14585	35.1	59.2
111	8.08	5.71	3	9999	4	955	9999	9999	9999	9999	9999	9999	9999	9999
112	8.24	5.53	3	9999	7	955	0.77	7.09	14281	0.77	5.26	14589	34.6	60.2
113	7.94	5.34	3	9999	0	1013	9999	9999	9999	9999	9999	9999	9999	9999
114	7.94	4.93	3	9999	0	1032	9999	9999	9999	9999	9999	9999	9999	9999
115	8.35	4.78	4	9999	0	1057	0.51	11.02	13645	0.53	6.05	14557	34.5	59.5
116	8.03	8.03	3	44	1	1132	9999	9999	9999	9999	9999	9999	9999	9999
118	7.74	7.74	3	9999	3	892	0.61	8.90	13962	0.56	4.57	14685	35.4	60.1
119	7.61	7.61	3	9999	0	898	0.68	8.45	14142	0.63	5.52	14653	35.3	59.1
120	7.31	7.31	3	44	1	896	9999	9999	9999	9999	9999	9999	9999	9999
121	7.72	7.72	3	38	2	921	0.73	7.91	14212	0.58	5.15	14682	34.5	60.4
122	7.76	7.76	3	43	2	958	9999	9999	9999	9999	9999	9999	9999	9999
124	8.55	8.55	3	12	11	1002	9999	9999	9999	9999	9999	9999	9999	9999

GLADEVILLE SANDSTONE, SEATROCK AND PROXIMATE ANALYSES DATA (CONTINUED)

DP	X	Y	P	GL	GC	GT	RS	RA	RB	FS	FA	FB	%V	%FC
125	6.90	5.90	3	42	4	1190	9999	9999	9999	9999	9999	9999	9999	9999
126	4.94	6.10	3	39	0	952	9999	9999	9999	9999	9999	9999	9999	9999
127	4.66	5.69	4	34	5	995	9999	9999	9999	9999	9999	9999	9999	9999
128	4.72	5.20	3	48	0	1055	9999	9999	9999	9999	9999	9999	9999	9999
129	5.62	4.75	3	22	15	1059	9999	9999	9999	9999	9999	9999	9999	9999
130	4.47	4.77	3	39	7	1098	9999	9999	9999	9999	9999	9999	9999	9999
131	5.27	4.61	3	45	1	1099	9999	9999	9999	9999	9999	9999	9999	9999
132	5.46	4.51	3	78	0	1124	9999	9999	9999	9999	9999	9999	9999	9999
133	4.61	4.37	3	59	0	1154	9999	9999	9999	9999	9999	9999	9999	9999
134	5.12	4.26	3	64	2	1162	9999	9999	9999	9999	9999	9999	9999	9999
135	4.42	5.37	3	51	6	1195	9999	9999	9999	9999	9999	9999	9999	9999
137	4.49	5.53	3	50	5	1226	9999	9999	9999	9999	9999	9999	9999	9999
138	4.02	5.66	3	38	3	9999	9999	9999	9999	9999	9999	9999	9999	9999
139	4.19	5.08	3	62	0	1103	9999	9999	9999	9999	9999	9999	9999	9999
140	4.03	4.80	4	33	0	1106	1.25	27.89	10811	1.43	6.66	14397	34.2	59.2
141	3.75	4.48	3	9999	0	1155	9999	9999	9999	9999	9999	9999	9999	9999
142	4.23	4.33	4	48	2	1156	0.88	37.99	9053	1.01	5.62	14484	34.5	59.9
143	3.76	3.99	3	51	2	1195	9999	9999	9999	9999	9999	9999	9999	9999
145	3.77	3.73	3	38	15	1195	9999	9999	9999	9999	9999	9999	9999	9999
146	4.31	3.97	4	9999	0	1214	0.61	26.92	10972	0.87	5.79	14558	33.3	60.4
149	3.97	3.27	4	9999	5	1227	0.47	49.36	7234	0.86	4.49	14723	34.3	61.2
150	4.10	2.82	4	49	7	1315	1.11	6.91	14341	1.06	4.15	14802	33.6	62.3
151	3.47	3.27	3	9999	14	644	2.12	26.50	10937	9999	9999	9999	9999	9999
152	3.55	7.09	3	53	2	992	9999	9999	9999	9999	9999	9999	9999	9999
155	3.28	4.29	3	62	1	1200	1.38	45.77	7849	1.13	5.94	14491	34.2	59.9
156	3.07	3.97	3	9999	2	1227	9999	9999	9999	9999	9999	9999	9999	9999
157	3.37	3.77	4	64	0	1211	0.76	41.00	8602	1.08	5.77	14451	33.3	60.9
159	3.48	3.39	3	68	3	1238	9999	9999	9999	9999	9999	9999	9999	9999
160	3.57	3.15	3	9999	0	1237	9999	9999	9999	9999	9999	9999	9999	9999
161	3.10	2.96	3	77	3	1242	9999	9999	9999	9999	9999	9999	9999	9999
162	3.02	8.68	3	9999	0	859	2.89	42.47	8420	9999	9999	9999	9999	9999
163	2.05	4.58	3	59	22	1555	9999	9999	9999	9999	9999	9999	9999	9999
164	2.25	4.50	3	41	28	1167	9999	9999	9999	9999	9999	9999	9999	9999
165	2.66	4.02	3	58	4	1214	9999	9999	9999	9999	9999	9999	9999	9999
166	2.27	3.69	3	37	19	1209	9999	9999	9999	9999	9999	9999	9999	9999
167	2.52	3.35	3	80	7	1231	9999	9999	9999	9999	9999	9999	9999	9999
168	2.82	3.17	3	66	4	1260	9999	9999	9999	9999	9999	9999	9999	9999
169	2.62	8.81	4	9999	11	849	2.41	18.77	12367	1.48	6.11	14369	38.0	55.9
170	1.42	4.94	3	52	0	1086	9999	9999	9999	9999	9999	9999	9999	9999
172	1.85	4.18	3	44	0	1191	9999	9999	9999	9999	9999	9999	9999	9999
173	1.13	4.05	4	56	3	1196	1.79	38.31	8639	1.09	7.13	14196	34.1	58.8
174	1.10	3.47	3	103	3	1269	9999	9999	9999	9999	9999	9999	9999	9999
175	14.53	2.06	4	9999	9999	9999	1.50	7.55	14186	0.87	5.26	14576	34.9	59.8
176	10.97	1.68	3	74	0	1321	9999	9999	9999	9999	9999	9999	9999	9999

GLADEVILLE SANDSTONE, SEATROCK AND PROXIMATE ANALYSES DATA
(CONTINUED)

DP= Data point X= x-coordinate Y= y-coordinate
P= Posting code GL= Gladeville Sandstone thickness (ft)
GC= Gladeville-to-coal interval thickness (ft)
GT= Top-of-Gladeville elevation (ft)
RS= Percent raw sulfur RA= Percent raw ash RB= Raw BTUs
FS= Percent float sulfur FA= Percent float ash
FB= Float BTUs
%V= Percent volatile matter %FC= Percent fixed carbon
9999= Code for missing data

SEAM AND PARTINGS DATA

L	DP	X	Y	P	BS	TS	TC	TU	TM	MM	AR	AU	AM
00100	1	15.87	2.79	3	1150	1.0	12.0	0.0	12.0	0.0	0.0	0.0	0.0
00200	2	15.39	3.04	3	1149	2.1	22.5	0.0	25.5	0.0	0.13	0.0	0.13
00300	3	14.87	3.28	4	1121	4.7	37.0	0.0	56.6	0.0	0.53	0.0	0.53
00400	4	14.42	3.92	3	1064	2.1	25.0	0.0	25.0	0.0	0.0	0.0	0.0
00500	5	14.35	2.90	3	1198	1.9	23.0	0.0	23.0	0.0	0.0	0.0	0.0
00600	6	13.80	5.54	4	982	3.4	40.0	0.0	40.5	0.0	0.01	0.0	0.01
00700	7	13.64	5.26	3	978	2.3	27.0	0.0	27.5	0.0	0.02	0.0	0.02
00800	8	13.62	4.12	3	1045	2.2	26.5	0.0	26.5	0.0	0.0	0.0	0.0
00900	9	13.74	3.37	3	1079	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
01000	10	13.85	3.02	3	1138	2.0	23.5	0.0	23.5	0.0	0.04	0.0	0.04
01100	11	13.50	2.72	3	1174	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
01200	12	13.73	2.35	3	1244	2.5	30.0	0.0	30.0	0.0	0.0	0.0	0.0
01300	13	13.15	5.29	3	998	2.5	30.0	0.0	30.0	0.0	0.0	0.0	0.0
01400	14	13.31	5.11	3	995	2.7	32.0	0.0	32.0	0.0	0.0	0.0	0.0
01500	15	13.45	4.77	4	1019	2.8	33.8	0.0	34.0	0.0	0.01	0.0	0.01
01600	16	13.22	4.32	3	1035	2.1	25.0	0.0	25.0	0.0	0.0	0.0	0.0
01700	17	13.34	3.48	3	1078	2.0	24.5	0.0	24.5	0.0	0.0	0.0	0.0
01800	18	13.08	3.14	3	1119	1.8	21.0	0.0	21.0	0.0	0.0	0.0	0.0
01900	19	13.37	3.10	3	1103	2.0	23.5	0.0	24.5	0.0	0.04	0.0	0.04
02000	20	13.06	2.34	3	1256	2.1	25.0	0.0	25.0	0.0	0.0	0.0	0.0
02100	21	12.62	5.96	3	951	2.3	23.0	0.0	27.0	0.0	0.17	0.0	0.17
02200	22	12.64	5.55	3	978	3.4	35.8	0.0	41.0	0.0	0.15	0.0	0.15
02300	23	12.97	5.39	4	1002	2.6	30.8	0.0	31.0	0.0	0.01	0.0	0.01
02400	24	12.58	5.22	4	1027	2.4	28.3	0.0	28.3	0.0	0.0	0.0	0.0
02500	25	12.74	5.13	3	1021	2.5	30.0	0.0	30.5	0.0	0.02	0.0	0.02
02600	26	12.96	4.94	3	1010	2.7	30.0	0.0	32.5	0.0	0.08	0.0	0.08
02700	27	12.80	4.64	3	1040	2.1	25.0	0.0	25.0	0.0	0.0	0.0	0.0
02800	28	12.63	4.25	3	1060	4.1	20.5	0.0	49.0	0.0	1.4	0.0	1.4
02900	29	12.71	3.43	3	1097	2.3	25.0	0.0	27.0	0.0	0.01	0.0	0.01
03000	30	12.65	2.76	4	1171	3.5	34.0	0.0	42.0	0.0	0.24	0.0	0.24
03100	31	12.63	1.84	3	1324	1.9	23.0	0.0	23.0	0.0	0.0	0.0	0.0
03200	32	12.60	1.43	3	1354	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
03300	33	12.21	5.90	3	929	2.0	24.2	0.0	24.2	0.0	0.0	0.0	0.0
03400	34	11.79	5.74	3	979	2.5	30.0	0.0	30.5	0.0	0.02	0.0	0.02
03500	35	12.01	5.53	4	957	4.8	55.5	0.0	57.5	0.0	0.04	0.0	0.04
03600	36	11.75	5.31	4	971	4.0	44.5	0.0	48.5	0.0	0.09	0.0	0.09
03700	37	12.12	5.25	4	1003	3.6	41.0	0.0	43.5	0.0	0.06	0.0	0.06
03800	38	11.95	4.66	3	1073	2.1	23.5	0.0	25.0	0.0	0.06	0.0	0.06
03900	39	11.73	4.47	3	1071	3.5	31.0	0.0	42.5	0.0	0.37	0.0	0.37
04000	40	12.24	4.03	3	1114	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
04100	41	12.36	3.10	3	1149	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
04200	42	12.21	2.74	3	1190	2.2	25.5	0.0	26.0	0.0	0.02	0.0	0.02
04300	43	11.91	2.41	3	1190	1.0	12.0	0.0	12.0	0.0	0.0	0.0	0.0
04400	44	12.17	1.66	3	1317	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
04500	45	12.20	1.23	3	1345	2.7	32.0	0.0	32.0	0.0	0.0	0.0	0.0
04600	46	11.04	6.06	3	899	1.8	21.0	0.0	21.0	0.0	0.0	0.0	0.0
04700	47	11.21	5.73	4	955	2.5	29.5	0.0	29.5	0.0	0.0	0.0	0.0
04800	48	11.39	5.09	3	1025	1.9	23.0	0.0	23.0	0.0	0.0	0.0	0.0
04900	49	11.28	4.85	4	1058	2.3	27.0	0.0	28.0	0.0	0.04	0.0	0.04
05000	50	11.43	3.84	3	1140	2.3	27.5	0.0	27.5	0.0	0.0	0.0	0.0
05100	51	11.05	3.65	3	1162	1.8	21.0	0.0	21.0	0.0	0.0	0.0	0.0
05200	52	11.45	3.58	3	1153	2.1	24.8	0.0	24.8	0.0	0.0	0.0	0.0
05300	53	11.56	3.19	3	1157	2.3	27.8	0.0	27.8	0.0	0.0	0.0	0.0
05400	54	11.26	2.95	3	1171	2.0	24.5	0.0	24.5	0.0	0.0	0.0	0.0
05500	55	11.52	2.61	3	1179	2.5	30.0	0.0	30.0	0.0	0.0	0.0	0.0
05600	56	11.15	2.52	3	1210	2.3	27.5	0.0	28.5	0.0	0.04	0.0	0.04
05700	57	11.51	2.18	4	1227	3.1	37.0	0.0	37.3	0.0	0.01	0.0	0.01
05800	58	11.37	1.65	3	1301	2.7	32.0	0.0	32.0	0.0	0.0	0.0	0.0
05900	59	10.86	5.47	3	990	1.8	21.5	0.0	21.5	0.0	0.0	0.0	0.0
06000	60	10.65	5.32	3	1024	2.0	23.6	0.0	23.6	0.0	0.0	0.0	0.0

SEAM AND PARTINGS DATA (CONTINUED)

L	DP	X	Y	P	BS	TS	TC	TU	TM	MM	AR	AU	AM
06100	61	10.87	4.34	3	1068	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
06200	62	10.86	4.82	3	1070	2.0	24.0	0.0	26.0	0.0	0.08	0.0	0.08
06300	63	10.49	4.84	3	1058	1.7	20.5	0.0	23.5	0.0	0.15	0.0	0.15
06400	64	10.82	4.13	3	1112	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
06500	65	10.62	4.04	4	1123	2.6	31.3	0.0	33.3	0.0	0.06	0.0	0.06
06600	66	10.63	3.60	4	1181	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
06700	67	10.15	3.44	4	1192	2.3	27.5	0.0	28.5	0.0	0.04	0.0	0.04
06800	68	10.09	3.24	4	1177	2.3	28.0	0.0	28.0	0.0	0.0	0.0	0.0
06900	69	10.07	2.98	4	1200	2.6	31.5	0.0	31.5	0.0	0.0	0.0	0.0
07000	70	10.50	2.96	4	1154	2.4	28.5	0.0	29.0	0.0	0.02	0.0	0.02
07100	71	10.46	2.80	4	9999	2.1	25.5	0.0	29.0	0.0	0.14	0.0	0.14
07200	72	10.79	2.72	3	1192	2.2	26.0	0.0	27.0	0.0	0.04	0.0	0.04
07300	73	10.42	2.54	3	1248	2.2	26.3	0.0	29.5	0.0	0.12	0.0	0.12
07400	74	10.05	2.51	4	1263	2.3	27.0	0.0	28.5	0.0	0.06	0.0	0.06
07500	75	10.84	2.24	3	1279	9999	9999	0.0	9999	0.0	9999	0.0	9999
07600	76	10.41	2.18	3	1288	1.6	19.0	0.0	19.0	0.0	0.0	0.0	0.0
07700	77	10.75	2.00	4	1271	2.4	28.8	0.0	28.8	0.0	0.0	0.0	0.0
07800	78	10.32	1.53	3	1329	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
07900	79	10.23	1.18	3	1355	9999	9999	0.0	9999	15.0	9999	9999	9999
08000	80	9.76	5.30	3	974	2.1	25.0	0.0	25.0	0.0	0.0	0.0	0.0
08100	81	9.41	5.24	3	994	3.0	35.5	0.0	35.5	0.0	0.0	0.0	0.02
08200	82	9.44	5.10	3	1040	2.4	29.0	0.0	29.5	0.0	0.02	0.0	0.12
08300	83	9.55	4.86	3	1062	2.7	32.3	0.0	36.1	0.0	0.12	0.0	0.0
08400	84	9.66	4.41	4	1110	1.9	23.0	0.0	23.0	0.0	0.0	0.0	0.0
08500	85	9.88	4.30	3	1105	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
08600	86	9.44	4.23	4	1111	2.0	24.5	0.0	26.5	0.0	0.08	0.0	0.0
08700	87	9.89	4.07	3	1136	3.1	37.0	0.0	39.0	0.0	0.05	0.0	0.0
08800	88	9.36	3.89	4	1136	2.1	25.8	0.0	26.5	0.0	0.03	0.0	0.0
08900	89	9.77	3.76	4	1163	2.7	32.0	0.0	34.0	0.0	0.06	0.0	0.0
09000	90	9.80	3.42	4	1194	2.2	26.0	0.0	28.0	0.0	0.08	0.0	0.0
09100	91	9.43	3.48	3	1184	2.8	34.0	0.0	40.0	0.0	0.18	0.0	0.0
09200	92	9.76	3.20	3	1220	2.3	28.0	0.0	29.5	0.0	0.05	0.0	0.0
09300	93	9.22	2.18	3	1285	9999	9999	0.0	9999	9999	0.0	9999	9999
09400	94	8.67	6.42	3	886	2.5	29.5	0.0	30.5	0.0	0.03	0.0	0.0
09500	95	9.07	6.16	3	916	1.4	17.2	0.0	20.5	0.0	0.19	0.0	0.0
09600	96	8.90	5.86	3	953	2.2	26.0	0.0	35.0	0.0	0.35	0.0	0.0
09700	97	8.70	5.84	3	949	2.6	30.8	0.0	30.8	0.0	0.0	0.0	0.0
09800	98	8.61	5.68	4	965	2.5	30.0	0.0	35.0	0.0	0.17	0.0	0.0
09900	99	8.98	5.30	3	1025	9999	9999	0.0	9999	0.0	9999	0.0	0.0
10000	100	8.70	4.86	4	1038	2.3	27.0	0.0	29.3	0.0	0.08	0.0	0.0
10100	101	9.01	4.75	4	1043	2.6	28.3	0.0	30.8	0.0	0.09	0.0	0.09
10200	102	9.04	4.36	4	1097	2.2	24.8	0.0	26.8	0.0	0.08	0.0	0.08
10300	103	8.95	4.07	3	1141	2.4	25.8	0.0	28.2	0.0	0.09	0.0	0.09
10400	104	9.12	3.77	4	1163	2.4	27.3	0.0	28.5	0.0	0.05	0.0	0.05
10500	105	8.72	3.65	3	1192	7.3	32.0	14.0	18.0	4.6	1.7	9999	9999
10600	106	8.03	3.36	3	1215	6.5	29.0	12.0	17.0	4.1	1.7	9999	9999
10700	107	8.00	6.57	3	913	2.3	25.6	0.0	27.6	0.0	0.08	0.0	0.08
10800	108	8.41	6.56	3	908	2.2	24.0	0.0	26.0	0.0	0.08	0.0	0.08
10900	109	8.44	6.16	3	902	3.2	34.5	0.0	38.5	0.0	0.12	0.0	0.12
11000	110	8.17	5.95	3	925	2.9	31.0	0.0	35.3	0.0	0.14	0.0	0.14
11100	111	8.03	5.71	3	959	2.7	28.0	0.0	32.5	0.0	0.16	0.0	0.16
11200	112	8.24	5.53	3	962	2.3	27.5	0.0	28.0	0.0	0.02	0.0	0.02
11300	113	7.94	5.34	3	1013	8.2	29.5	11.5	18.0	5.7	2.3	0.0	0.0
11400	114	7.94	4.93	3	1052	14.3	26.0	10.0	16.0	12.1	5.6	0.0	0.0
11500	115	8.35	4.78	4	1057	2.5	27.3	0.0	30.0	0.0	0.10	0.0	0.0
11600	116	8.03	8.03	3	1133	35.0	32.0	20.5	20.0	32.3	12.4	0.0	0.35
11700	117	8.44	8.44	3	9999	9999	9999	9999	9999	9999	9999	9999	9999
11800	118	7.74	7.74	3	895	3.1	32.8	0.0	37.8	0.0	0.15	0.0	0.0
11900	119	7.61	7.61	3	898	3.8	35.5	0.0	46.0	0.0	0.30	0.0	0.0
12000	120	7.31	7.31	3	897	6.5	32.5	13.0	19.5	3.8	1.4	0.0	0.0

SEAM AND PARTINGS DATA (CONTINUED)

D	DP	X	Y	P	BS	TS	TC	TU	TM	MM	AR	AU	AM
12100	121	7.72	7.72	3	923	2.7	29.6	0.0	32.5	0.0	0.09	0.0	0.0
12200	122	7.76	7.76	3	960	2.5	29.3	0.0	30.5	0.0	0.04	0.0	0.0
12300	123	6.80	6.80	3	859	9999	9999	9999	9999	18.0	9999	9999	9999
12400	124	6.55	6.55	3	1013	31.2	40.0	27.0	20.0	27.3	8.35	0.35	0.0
12500	125	6.90	6.90	3	1104	21.3	47.0	23.5	23.5	17.4	4.4	0.0	0.0
12600	126	4.94	6.10	3	952	9999	9999	9999	18.3	9999	9999	9999	0.0
12700	127	4.66	5.07	4	1000	41.3	38.5	0.0	38.5	37.5	11.9	0.50	0.12
12800	128	4.72	5.20	3	1055	9999	9999	9999	15.0	9999	9999	9999	0.0
12900	129	5.62	4.95	3	1074	24.6	38.0	20.0	18.0	21.7	6.8	0.0	0.0
13000	130	4.47	4.77	3	1105	29.3	41.0	22.5	20.5	25.7	7.6	0.10	0.0
13100	131	5.27	4.61	3	1150	14.2	26.5	10.5	16.0	12.0	5.4	9999	0.0
13200	132	5.46	4.51	3	1124	26.8	31.5	6.5	15.0	25.0	14.0	0.0	0.0
13300	133	4.61	4.37	3	1154	24.4	23.0	0.0	15.0	25.0	11.7	0.0	0.0
13400	134	5.12	4.20	3	1164	25.3	23.0	8.0	15.0	23.4	12.2	0.0	0.0
13500	135	4.65	4.15	3	1159	24.6	27.3	16.0	13.0	22.0	9.8	0.26	0.0
13600	136	4.42	3.87	3	1201	7.5	42.9	20.7	19.6	5.7	1.1	0.15	0.0
13700	137	4.49	3.58	3	1231	5.2	40.5	28.5	16.5	1.5	0.54	0.19	0.0
13800	138	4.02	3.66	3	1032	9999	9999	9999	9999	23.0	9999	9999	9999
13900	139	4.19	3.98	3	1103	30.4	31.0	17.0	15.5	27.5	10.7	0.10	0.0
14000	140	4.05	4.30	4	1106	25.1	47.5	32.3	20.5	20.7	5.3	0.13	0.11
14100	141	3.75	4.43	3	1155	9.0	9999	30.0	13.5	5.3	9999	0.31	9999
14200	142	4.23	4.33	4	1158	15.0	9999	30.0	18.5	11.0	9999	0.32	9999
14300	143	3.96	3.99	3	1197	14.8	43.0	38.7	23.3	10.0	3.1	0.72	0.13
14400	144	4.09	3.77	3	1244	4.3	9999	25.1	17.5	0.8	9999	0.04	9999
14500	145	3.77	3.73	3	1206	9.3	45.3	30.5	22.5	4.8	1.5	0.28	0.10
14600	146	4.31	3.57	4	1214	5.0	49.8	29.8	22.8	0.6	0.21	0.10	9999
14700	147	4.11	3.43	3	1214	5.0	42.5	34.3	17.8	0.6	0.40	0.36	9999
14800	148	3.80	3.34	3	1240	6.3	46.1	45.6	20.4	0.8	0.64	0.68	0.07
14900	149	3.97	3.27	4	1232	5.7	42.8	38.5	18.8	0.9	0.60	0.60	9999
15000	150	4.10	2.82	4	1322	6.1	45.0	29.0	22.0	1.8	0.62	0.26	0.0
15100	151	3.47	3.27	3	856	16.6	36.0	44.5	17.0	11.5	4.3	1.1	0.0
15200	152	3.55	7.09	3	994	20.0	23.0	15.0	9.5	18.0	9.5	0.11	0.0
15300	153	2.96	4.66	3	1119	29.7	51.7	52.3	24.0	23.3	5.9	0.90	0.0
15400	154	3.00	4.31	3	1194	11.4	29.1	49.6	5.5	6.8	3.7	1.1	0.0
15500	155	3.28	4.29	3	1201	5.6	37.4	51.6	9.0	1.1	0.80	0.78	0.0
15600	156	3.07	3.97	3	1229	13.6	31.5	38.6	6.5	9.9	4.2	0.54	0.0
15700	157	3.37	3.77	4	1211	5.6	40.0	32.5	10.0	1.3	0.68	0.15	0.0
15800	158	3.17	3.44	3	1235	9.4	41.0	58.6	9.5	4.7	1.7	0.86	0.0
15900	159	3.48	3.39	3	1241	10.1	31.3	26.5	10.0	7.1	2.9	0.25	0.0
16000	160	3.57	3.15	3	1237	14.2	47.5	32.5	23.3	8.8	2.6	0.34	0.39
16100	161	3.16	2.96	3	1295	18.8	24.0	19.0	6.0	16.8	8.4	0.06	0.0
16200	162	3.02	6.64	3	859	12.1	35.3	38.0	5.0	8.5	3.1	0.26	0.0
16300	163	2.65	4.53	3	1167	15.2	34.2	35.3	10.0	11.4	4.3	0.46	0.0
16400	164	2.25	4.50	3	1195	14.0	24.0	18.0	6.0	12.0	6.0	0.0	0.0
16500	165	2.66	4.02	3	1216	16.1	9999	9999	12.0	13.4	9999	9999	0.0
16600	166	2.27	3.69	3	1228	16.7	9999	9999	8.5	14.3	9999	9999	0.0
16700	167	2.52	3.35	3	1238	9999	9999	25.0	9.0	18.8	9999	9999	0.06
16800	168	2.82	3.17	3	1264	15.9	33.0	23.0	10.0	13.0	4.7	0.0	0.0
16900	169	2.62	8.81	4	860	13.6	32.3	31.8	9.5	10.1	4.0	0.40	0.0
17000	170	1.42	4.94	3	1066	18.7	39.3	22.0	10.0	16.0	4.6	0.11	0.0
17100	171	1.89	4.66	3	1111	9999	9999	9999	15.0	9999	9999	9999	0.0
17200	172	1.85	4.18	3	1191	37.2	32.0	20.0	12.0	34.5	13.0	0.0	0.0
17300	173	1.12	4.05	4	1159	13.5	9999	9999	9999	8.6	9999	9999	9999
17400	174	1.10	3.47	3	1272	9999	9999	9999	9999	9999	9999	9999	0.72
17500	175	14.53	2.06	4	1282	6.3	31.0	0.0	76.0	0.0	1.5	0.0	0.0
17600	176	10.97	1.68	3	1321	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
17700	A	15.91	2.93	2	9999	1.4	16.3	0.0	17.3	0.0	0.00	0.0	0.06
17800	B	15.46	3.19	2	9999	1.9	22.5	0.0	23.3	0.0	0.03	0.0	0.03
17900	C	15.00	3.44	1	9999	2.0	23.4	0.3	23.4	0.0	0.0	0.0	0.0
18000	D	14.98	2.84	5	9999	3.0	9999	0.0	36.0	0.0	9999	0.0	0.0

SEAM AND PARTINGS DATA (CONTINUED)

L	DP	X	Y	P	BS	TS	TC	TU	TM	MM	AR	AU	AM
17900	E	15.14	2.84	5	9999	2.5	9999	0.0	27.0	0.0	9999	0.0	9999
18000	F	14.89	2.43	2	9999	2.5	29.0	0.0	29.5	0.0	0.02	0.0	0.02
18100	G	14.67	3.10	2	9999	2.6	27.8	0.0	31.0	0.0	0.12	0.0	0.12
18200	H	15.99	3.66	2	865	2.1	9999	0.0	25.0	0.0	9999	0.0	9999
18300	I	14.11	6.40	2	836	4.4	50.8	0.0	52.5	0.0	0.03	0.0	0.03
18400	J	14.07	6.39	2	9999	3.1	9999	0.0	37.0	0.0	9999	0.0	9999
18500	K	13.81	6.21	2	879	2.3	26.8	0.0	27.0	0.0	0.01	0.0	0.01
18600	L	12.91	6.20	2	935	1.8	21.5	0.0	21.8	0.0	0.01	0.0	0.01
18700	M	14.22	5.29	2	9999	2.5	30.0	0.0	30.0	0.0	0.0	0.0	0.0
18800	N	13.48	5.04	2	993	3.0	36.3	0.0	36.5	0.0	0.01	0.0	0.01
18900	O	13.71	5.05	2	980	3.1	37.3	0.0	37.3	0.0	0.0	0.0	0.0
19000	P	13.92	5.06	2	967	4.0	47.8	0.0	47.8	0.0	0.0	0.0	0.0
19100	Q	14.03	4.97	2	1003	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
19200	R	13.77	4.91	2	979	2.6	30.5	0.0	31.5	0.0	0.03	0.0	0.03
19300	S	13.64	4.83	2	1018	2.8	32.0	0.0	33.0	0.0	0.03	0.0	0.03
19400	T	13.21	4.54	2	1022	3.4	39.8	0.0	40.3	0.0	0.01	0.0	0.01
19500	U	13.71	4.56	2	1012	2.8	28.0	0.0	34.0	0.0	0.21	0.0	0.21
19600	V	13.63	4.53	2	1013	3.1	30.5	0.0	37.0	0.0	0.21	0.0	0.21
19700	W	13.45	4.30	2	1022	2.5	33.0	0.0	41.5	0.0	0.26	0.0	0.26
19800	Y	13.34	4.20	2	1023	3.4	30.5	0.0	41.0	0.0	0.34	0.0	0.34
19900	Z	13.05	3.79	2	9999	1.6	18.5	0.0	19.0	0.0	0.03	0.0	0.03
20000	A	13.13	3.71	2	1046	2.0	23.8	0.0	24.0	0.0	0.01	0.0	0.0
20100	B	14.01	3.58	1	1069	2.0	23.8	0.0	24.5	0.0	0.03	0.0	0.0
20200	D	13.79	2.77	1	1176	2.2	24.3	0.0	26.0	0.0	0.07	0.0	0.0
20300	F	13.47	1.94	5	9999	2.7	29.0	0.0	32.0	0.0	0.28	0.0	0.0
20400	G	13.27	1.85	5	9999	2.6	29.0	0.0	31.0	0.0	0.24	0.0	0.0
20500	H	13.22	1.69	2	9999	2.4	29.0	0.0	29.0	0.0	0.0	0.0	0.0
20600	J	11.95	4.98	1	1056	2.0	24.0	0.0	24.0	0.0	0.0	0.0	0.0
20700	K	12.57	2.54	2	9999	2.0	24.5	0.0	24.5	0.0	0.0	0.0	0.0
20800	M	12.54	2.17	2	9999	2.2	26.0	0.0	26.0	0.0	0.0	0.0	0.0
20900	N	12.76	1.32	2	1339	2.5	30.0	0.0	30.0	0.0	0.0	0.0	0.0
21000	O	11.65	1.32	1	1330	1.9	22.8	0.0	22.8	0.0	0.0	0.0	0.0
21100	P	11.75	1.26	2	1343	2.6	31.0	0.0	31.0	0.0	0.0	0.0	0.0
21400	Q	8.80	7.16	1	361	2.5	28.0	0.0	30.0	0.0	0.07	0.0	0.0
21500	R	9.23	6.84	1	348	2.2	22.5	0.0	26.5	0.0	0.04	0.0	0.0
21600	S	7.83	6.39	2	908	2.9	34.3	0.0	35.3	0.0	0.03	0.0	0.0
21700	T	7.73	6.32	2	910	3.4	39.5	0.0	40.5	0.0	0.03	0.0	0.0
21800	U	7.56	6.11	2	918	3.0	33.0	0.0	36.5	0.0	0.11	0.0	0.0
21900	V	7.53	5.96	2	930	7.3	35.0	15.0	20.0	4.3	1.5	0.09	0.0
22000	W	7.60	5.77	2	940	3.4	30.8	12.8	19.0	0.8	0.33	0.0	0.0
22100	Y	7.53	5.64	2	957	3.4	29.8	10.5	19.3	1.0	0.39	0.0	0.0
22200	Z	8.05	5.67	2	942	2.8	32.8	0.0	34.0	0.0	0.04	0.0	0.0
22300	AA	7.94	5.62	2	965	2.6	29.5	0.0	30.8	0.0	0.04	0.0	0.0
22400	BB	8.21	5.35	2	1003	2.6	29.8	0.0	31.5	0.0	0.06	0.0	0.0
22500	CC	8.48	5.55	2	990	2.4	27.5	0.0	28.5	0.0	0.04	0.0	0.0
22600	DD	8.17	5.19	2	1024	3.0	34.5	0.0	35.5	0.0	0.03	0.0	0.0
22700	EE	8.31	5.07	2	1016	2.8	32.5	0.0	33.0	0.0	0.02	0.0	0.0
22800	FF	8.49	5.20	2	1015	2.4	27.5	0.0	28.3	0.0	0.03	0.0	0.0
22900	GG	8.64	5.17	2	1018	2.6	30.0	0.0	30.8	0.0	0.03	0.0	0.0
23000	HH	8.65	5.07	2	1030	2.6	31.5	0.0	31.5	0.0	0.0	0.0	0.0
23100	II	8.85	5.14	2	1044	2.3	27.0	0.0	27.0	0.0	0.0	0.0	0.0
23200	JJ	9.06	5.38	2	1014	3.4	39.3	0.0	40.4	0.0	0.03	0.0	0.0
23300	KK	9.04	5.22	2	1026	2.5	28.5	0.0	29.8	0.0	0.04	0.0	0.0
23400	LL	9.16	5.03	2	1048	2.4	26.8	0.0	28.5	0.0	0.07	0.0	0.0
23500	MM	9.21	4.89	2	1049	2.5	25.3	0.0	30.0	0.0	0.19	0.0	0.0
23600	NN	9.30	4.75	2	1051	2.3	26.5	0.0	27.8	0.0	0.05	0.0	0.0
23700	OO	9.70	5.11	1	1029	2.6	28.0	0.0	31.0	0.0	0.11	0.0	0.0
23800	PP	5.62	5.75	1	952	27.0	31.6	32.4	17.0	24.5	9.2	1.1	9999
23900	QQ	5.45	5.44	1	979	27.0	30.4	24.0	20.4	21.5	7.4	0.33	9999
24000	RR	5.88	3.28	2	1255	25.1	31.3	31.8	16.8	21.0	8.6	1.2	9999

SEAM AND PARTINGS DATA (CONTINUED)

L	DP	X	Y	P	BS	TS	TC	TU	TM	MM	AR	AU	AM
24100	SS	5.61	2.40	1	1412	5.4	40.6	9999	9999	9999	0.61	9999	9999
24200	TT	4.51	4.32	2	9999	9999	9999	32.6	9999	9999	9999	0.64	9999
24300	UU	4.26	3.96	2	1150	5.4	43.3	9999	9999	9999	0.50	9999	9999
24400	VV	4.09	3.94	2	1183	6.9	55.0	9999	9999	9999	0.50	9999	9999
24500	WW	4.82	3.50	5	9999	7.5	42.5	9999	9999	9999	1.1	9999	9999
24600	YY	4.63	3.41	5	9999	4.6	42.0	9999	9999	9999	0.36	9999	9999
24700	ZZ	4.52	3.29	5	1259	4.7	42.5	9999	9999	9999	0.32	9999	9999
24800	AA	4.60	3.24	2	1265	4.4	38.5	9999	9999	9999	0.36	9999	9999
24900	BB	4.26	3.10	5	9999	5.5	36.0	9999	9999	9999	0.90	9999	9999
25000	DD	4.41	3.06	5	9999	4.6	41.5	9999	9999	9999	0.34	9999	9999
25100	EE	5.10	3.01	2	1278	5.3	43.8	9999	9999	9999	0.44	9999	9999
25200	FF	4.61	2.87	2	1340	6.0	44.3	9999	9999	9999	0.62	9999	9999
25300	GG	5.03	2.82	1	1309	7.4	43.8	9999	9999	9999	1.0	9999	9999
25400	HH	4.62	2.70	1	1354	7.8	42.9	29.5	19.5	3.7	1.2	0.26	9999
25500	II	4.42	2.67	2	1345	5.7	47.7	33.0	22.7	5.1	0.35	0.32	9999
25600	JJ	4.89	2.62	2	1340	5.0	44.3	9999	9999	9999	0.78	9999	9999
25700	KK	4.69	2.35	2	1416	3.8	25.5	9999	9999	9999	1.45	9999	9999
25800	MM	4.44	2.17	1	9999	11.0	9999	9999	18.0	7.0	9999	9999	0.0
25900	NN	4.65	2.17	2	1427	6.4	45.8	9999	9999	9999	0.69	9999	9999
26000	OO	2.67	4.40	1	9999	9.1	37.5	35.0	10.0	5.3	1.9	0.27	0.0
26100	PP	2.50	4.17	1	1213	12.4	9999	9999	9999	8.0	9999	9999	9999
26200	QQ	3.40	4.07	1	9999	7.0	43.3	51.0	15.5	1.5	0.35	0.64	0.0
26300	RR	2.87	3.59	1	9999	17.8	30.0	17.0	19.0	14.9	4.9	0.0	0.0
26400	SS	3.69	2.88	2	1319	6.4	46.8	33.5	25.5	1.4	0.03	0.52	0.03
26500	TT	3.80	2.82	2	1315	8.4	48.0	9999	9999	9999	1.1	9999	9999
26600	UU	3.70	2.79	2	1330	9999	9999	9999	9999	9999	9999	9999	9999
26700	VV	3.74	2.67	1	9999	9.8	23.2	20.0	15.0	6.4	4.1	0.24	0.0
26800	WW	4.04	2.52	1	9999	7.8	46.6	34.5	19.8	3.3	1.0	0.28	0.0
26900	YY	4.10	2.42	1	9999	8.6	41.3	29.5	18.2	4.8	1.5	0.28	0.0
27000	ZZ	4.24	2.32	2	9999	9999	9999	34.0	9999	9999	9999	0.36	9999
27100	AA	1.18	4.25	1	9999	29.9	45.0	20.0	33.0	25.6	7.0	0.0	0.74
27200	BB	1.80	3.20	1	9999	15.5	61.0	27.0	47.0	15.5	2.8	0.0	0.68
27300	DD	2.28	2.93	1	9999	38.5	47.0	21.0	33.0	33.8	8.0	0.0	0.27
27400	EE	1.79	2.85	2	9999	10.5	54.8	32.8	47.5	3.8	1.3	0.03	1.1
27500	FF	1.84	2.72	2	9999	24.9	54.3	28.3	72.0	16.5	4.5	0.06	1.6
27600	GG	1.50	2.50	2	9999	9999	9999	26.8	9999	9999	9999	0.41	9999
27700	HH	1.76	2.46	2	9999	9999	9999	9999	24.0	6.4	9999	9999	0.33
27800	II	2.58	2.65	2	9999	21.2	31.0	35.0	8.0	17.6	7.2	0.52	0.0
27900	JJ	3.17	2.49	2	9999	19.8	33.5	29.1	10.5	16.4	6.1	0.27	0.0
28000	KK	2.96	2.17	2	9999	20.4	31.6	36.0	11.5	16.4	6.7	0.58	0.28
28100	MM	2.63	2.26	2	9999	6.8	17.6	28.1	10.8	3.6	3.6	1.6	0.60
28200	T1	6.31	2.26	6	1530								
28300	T2	6.71	2.40	6	1300								
28400	T3	6.31	2.36	6	1320								
28500	T4	7.99	2.48	6	1320								
28600	T5	8.57	2.61	6	1260								
28700	T6	5.97	2.86	6	1260								
28800	T7	6.65	2.96	6	1260								
28900	T8	7.42	2.80	6	1285								
29000	T9	7.29	3.06	6	1240								
29100	T10	7.88	3.07	6	1240								
29200	T11	9.07	2.79	6	1255								
29300	T12	9.38	2.94	6	1240								
29400	T13	8.51	3.28	6	1220								
29500	T14	8.44	3.31	6	1240								
29600	T15	8.15	3.01	6	1220								
29700	T16	7.19	3.38	6	1200								
29800	T17	8.57	3.86	6	1180								
29900	T18	8.07	3.75	6	1200								
30000	T19	7.55	3.68	6	1200								

SEAM AND PARTINGS DATA (CONTINUED)

L	DP	X	Y	P	BS
30100	T20	8.48	3.96	6	1160
30200	T21	8.55	4.31	6	1120
30300	T22	7.38	4.45	6	1110
30400	T23	7.85	4.37	6	1080
30500	T24	8.04	4.69	6	1120
30600	T25	8.41	4.81	6	1120
30700	T26	7.49	4.97	6	1020
30800	T27	7.12	5.42	6	1000
30900	T28	8.68	5.79	6	940
31000	T29	8.06	5.83	6	940
31100	T30	6.59	6.30	6	920
31200	T31	5.23	6.36	6	935
31300	T32	6.60	6.67	6	880
31400	T33	5.96	6.16	6	1000
31500	T34	4.71	6.49	6	980
31600	T35	5.30	6.72	6	920
31700	T36	5.40	7.44	6	880
31800	T37	5.46	7.76	6	860
31900	T38	4.44	7.78	6	920
32000	T39	5.48	8.32	6	840
32100	T40	4.19	8.58	6	840
32200	T41	4.85	8.96	6	840
32300	T42	2.69	2.28	6	1420
32400	T43	2.14	2.70	6	1360
32500	T44	1.80	2.90	6	1300
32600	T45	1.56	3.10	6	1280
32700	T46	1.16	4.54	6	1120
32800	T47	3.21	4.78	6	1140
32900	T48	3.10	5.44	6	1120
33000	T49	2.32	5.36	6	1040
33100	T50	1.56	5.79	6	1040
33200	T51	2.50	6.31	6	1030
33300	T52	1.04	6.02	6	1040
33400	T53	1.48	6.82	6	1000
33500	T54	2.00	7.24	6	940
33600	T55	2.10	8.62	6	840

L= Line number DP= Data point
X= x-coordinate Y= y-coordinate P= Posting code
BS= Base of seam elevation (ft) TS= Total seam (ft)
TC= Total coal (in) TU= Total upper split (in)
TM= Total main and lower split (in)
MM= Middleman thickness (ft)
AR= Non-coal:coal, all seam
AU= Non-coal:coal, upper split
AM= Non-coal:coal, main and lower split
9999= Code for missing data
T= Outcrop elevations (ft) from geologic quadrangles

APPENDIX B

PROXIMATE ANALYSES

TABLE B1

Proximate analyses of the Glamorgan coal, dry, mmf basis

	Sample	%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	15.30	1.23	12986			
3	1.5fl	84.51	5.11	0.93	14714	34.02	60.87	7.5
	1.5sk	15.49	70.90	2.86	3560			
	raw	100.00	8.52	1.14	14113			
6	1.5fl	90.80	4.50	0.83	14786	39.31	56.19	7.5
	1.5sk	9.20	48.18	4.17	7475			
	raw	100.00	28.55	1.01	10746			
7	1.5fl	68.83	5.29	0.84	14581	34.94	59.77	6.5
	1.5sk	31.17	79.90	1.38	2276			
	raw	100.00	8.66	0.97	14044			
12	1.5fl	91.69	5.04	0.78	14651	33.56	61.40	7.5
	1.5sk	8.31	48.56	3.12	7349			
14	raw	100.00	9.33	0.74	14066	34.90	55.77	6.5
	raw	100.00	11.76	1.04	13481			
15	1.5fl	84.88	5.88	0.88	14481	33.85	60.27	6.5
	1.5sk	15.12	44.88	1.94	7866			
	raw	100.00	17.14	0.82	12666			
22	1.5fl	77.85	6.35	0.80	14477	35.00	58.66	5.5
	1.5sk	22.15	55.06	0.91	6299			
	raw	100.00	9.43	0.69	13875			
23	1.5fl	89.18	5.92	0.70	14499	33.22	60.86	7.0
	1.5sk	10.82	38.37	0.61	8735			
	raw	100.00	5.49	1.04	14601			
24	1.5fl	96.34	3.94	0.87	14889	35.46	60.60	8.0
	1.5sk	3.66	46.38	5.43	7030			
	raw	100.00	12.58	0.66	13379			
26	1.5fl	87.94	7.34	0.69	14233	33.73	58.93	7.0
	1.5sk	12.06	50.75	0.41	7153			
	raw	100.00	13.75	3.36	13154			
28	1.5fl	87.21	9.49	2.46	13944	36.93	53.58	5.5
	1.5sk	12.79	42.79	9.53	7770			

TABLE B1 (CONTINUED)

	Sample	%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	25.07	0.91	11358			
30	1.5fl	73.08	4.85	1.03	14776	35.28	59.87	5.5
	1.5sk	26.92	79.96	0.57	2079			
	raw	100.00	9.32	0.67	13872			
35	1.5fl	89.79	5.58	0.66	14476	33.37	61.05	8.5
	1.5sk	10.21	42.24	0.71	8556			
	raw	100.00	18.54	0.73	12335			
36	1.5fl	80.88	6.49	0.73	14396	34.35	59.16	7.5
	1.5sk	19.12	69.49	0.75	3617			
	raw	100.00	16.87	0.78	12699			
37	1.5fl	79.01	6.32	0.71	14499	33.82	59.86	8.0
	1.5sk	20.99	56.56	1.06	5925			
	raw	100.00	8.48	1.11	14087			
42	1.5fl	91.88	4.44	0.79	14771	34.81	60.75	6.0
	1.5sk	8.12	54.22	4.71	6345			
	raw	100.00	7.09	0.62	14341			
47	1.5fl	95.95	5.90	0.63	14548	34.67	59.43	7.0
	1.5sk	4.05	35.37	0.38	9436			
	raw	100.00	7.61	0.65	14231			
49	1.5fl	93.64	5.52	0.63	14580	34.74	59.74	7.5
	1.5sk	6.36	38.37	0.97	9094			
50	raw	100.00	7.49	0.71	14470	37.39	55.12	6.5
	raw	100.00	12.76	0.82	13468			
55	1.5fl	83.90	5.03	0.65	14811	34.54	60.43	6.0
	1.5sk	16.10	53.05	1.69	6467			
	raw	100.00	5.89	0.96	14514			
56	1.5fl	95.06	4.09	0.74	14819	34.89	61.02	5.5
	1.5sk	4.94	40.61	5.29	8654			
	raw	100.00	10.25	0.69	13868			
57	1.5fl	90.65	5.73	0.70	14626	34.56	59.71	6.0
	1.5sk	9.35	54.03	0.62	6521k			
	raw	100.00	10.15	0.80	13885			
62	1.5fl	91.47	5.00	0.82	14725	35.10	59.90	5.5
	1.5sk	8.53	65.41	0.60	4878			

TABLE B1 (CONTINUED)

	Sample	%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	7.78	0.75	14256			
65	1.5fl	96.03	5.88	0.77	14579	34.37	59.75	7.0
	1.5sk	3.97	53.62	0.38	6433			
	raw	100.00	7.83	0.71	14261			
66	1.5fl	91.42	4.92	0.65	14743	33.77	61.31	8.0
	1.5sk	8.58	38.86	1.39	9131			
	raw	100.00	7.97	1.13	14251			
67	1.5fl	93.95	5.17	0.79	14726	34.08	60.75	7.5
	1.5sk	6.05	51.42	6.45	6867			
	raw	100.00	6.39	0.73	14509			
68	1.5fl	95.51	5.21	0.73	14713	34.53	60.26	7.0
	1.5sk	4.49	31.60	0.76	10161			
	raw	100.00	7.34	0.97	14372			
69	1.5fl	94.50	5.50	0.80	14699	33.59	60.91	7.0
	1.5sk	5.50	39.01	3.96	8749			
	raw	100.00	8.28	0.84	14115			
70	1.5fl	91.20	5.19	0.74	14623	34.75	60.06	5.0
	1.5sk	8.80	40.30	1.87	8851			
	raw	100.00	7.54	0.61	14294			
72	1.5fl	93.35	4.77	0.63	14772	35.79	59.44	4.5
	1.5sk	6.65	46.48	0.30	7591			
	raw	100.00	7.81	2.05	14225			
73	1.5fl	91.82	4.41	0.71	14816	33.59	62.00	7.5
	1.5sk	8.18	45.97	17.08	7586			
	raw	100.00	8.06	1.26	14205			
74	1.5fl	97.27	7.07	0.69	14403	33.10	59.83	7.5
	1.5sk	2.73	43.30	21.75	7140			
	raw	100.00	6.60	0.63	14511			
77	1.5fl	95.64	5.11	0.64	14755	34.08	60.81	6.5
	1.5sk	4.36	39.29	0.47	9169			
	raw	100.00	9.29	1.54	13996			
81	1.5fl	89.76	6.61	0.80	14468	34.65	58.74	4.0
	1.5sk	10.24	32.80	8.01	9861			

TABLE B1 (CONTINUED)

	Sample	%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	7.80	1.40	14202			
82	1.5fl	94.52	5.83	0.80	14571	34.11	60.06	5.0
	1.5sk	5.48	41.78	11.77	7839			
	raw	100.00	5.27	1.00	14678			
84	1.5fl	96.41	4.23	0.83	14848	36.47	59.30	8.0
	1.5sk	3.59	33.24	5.43	10111			
	raw	100.00	6.54	0.80	14420			
85	1.5fl	96.97	5.48	0.81	14620	34.07	60.45	8.0
	1.5sk	3.03	40.56	0.42	8027			
	raw	100.00	7.91	1.42	14201			
86	1.5fl	93.89	5.86	0.79	14561	34.79	59.35	6.5
	1.5sk	6.11	39.45	11.17	8669			
	raw	100.00	8.29	0.76	14156			
87	1.5fl	94.64	6.20	0.76	14506	35.55	58.25	6.5
	1.5sk	5.36	45.28	0.69	7969			
	raw	100.00	8.54	1.11	14139			
88	1.5fl	95.12	7.08	1.03	14385	34.62	58.30	8.0
	1.5sk	4.88	37.08	2.63	9348			
	raw	100.00	9.24	0.95	13973			
89	1.5fl	92.96	6.39	0.88	14461	33.72	59.89	7.5
	1.5sk	7.04	46.93	1.87	7533			
	raw	100.00	6.43	0.74	14533			
90	1.5fl	98.28	5.89	0.70	14654	33.87	60.24	6.5
	1.5sk	1.72	37.38	3.07	7605			
	raw	100.00	17.21	1.28	12609			
91	1.5fl	83.62	7.37	0.73	14351	33.45	59.18	8.0
	1.5sk	16.38	67.45	4.11	3716			
	raw	100.00	17.53	0.62	12634			
94	1.5fl	83.52	5.46	0.71	14655	35.80	58.75	5.0
	1.5sk	16.48	78.71	0.17	2393			
	raw	100.00	46.03	0.46	8196			
96	1.5fl	54.17	5.42	0.75	14659	37.33	57.25	5.5
	1.5sk	45.83	94.03	0.12	557			

TABLE B1 (CONTINUED)

	Sample	%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	6.99	0.63	14375			
97	1.5fl	97.11	5.85	0.63	14564	34.99	59.16	7.5
	1.5sk	2.89	45.33	0.52	8058			
	raw	100.00	12.99	0.58	13253			
98	1.5fl	87.10	6.77	0.62	14360	34.15	59.08	7.0
	1.5sk	12.90	55.00	0.28	5779			
	raw	100.00	7.15	0.67	14322			
100	1.5fl	96.73	5.78	0.67	14575	34.66	59.56	7.5
	1.5sk	3.27	47.74	0.54	6841			
	raw	100.00	18.02	0.78	12574			
101	1.5fl	86.44	8.98	0.88	14073	34.52	56.50	8.0
	1.5sk	13.56	75.67	0.14	3020			
	raw	100.00	8.11	1.23	14146			
102	1.5fl	96.54	6.57	0.81	14425	35.36	58.07	7.0
	1.5sk	3.46	51.13	13.01	6364			
	raw	100.00	7.85	0.58	14214			
104	1.5fl	94.30	5.34	0.60	14644	33.48	61.18	8.0
	1.5sk	5.70	49.33	0.29	7099			
	raw	100.00	7.20	0.64	14245			
108	1.5fl	95.38	5.41	0.63	14543	35.76	58.83	6.5
	1.5sk	4.62	44.22	0.78	8099			
	raw	100.00	6.76	0.65	14448			
109	1.5fl	98.41	6.31	0.65	14529	35.30	58.39	5.0
	1.5sk	1.59	34.42	0.58	9425			
	raw	100.00	25.26	0.47	11398			
110	1.5fl	65.86	5.71	0.60	14585	35.05	59.24	6.0
	1.5sk	34.14	62.97	0.22	5249			
111	raw	100.00	10.24	0.64	13759	33.13	56.63	7.5
	raw	100.00	7.09	0.77	14281			
112	1.5fl	95.69	5.26	0.77	14589	34.58	60.16	5.0
	1.5sk	4.31	47.67	0.79	7433			
	raw	100.00	11.02	0.51	13645			
115	1.5fl	88.60	6.05	0.53	14557	34.46	59.49	8.5
	1.5sk	11.40	49.62	0.34	6558			

TABLE B1 (CONTINUED)

	Sample	%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	8.90	0.61	13962			
118	1.5fl	90.53	4.57	0.56	14686	35.38	60.05	7.5
	1.5sk	9.47	50.32	1.10	7051			
	raw	100.00	8.45	0.68	14142			
119	1.5fl	91.10	5.52	0.63	14653	35.34	59.14	7.5
	1.5sk	8.90	38.40	1.22	8906			
	raw	100.00	7.91	0.73	14212			
120	1.5fl	95.24	5.15	0.58	14682	34.45	60.40	5.5
	1.5sk	4.76	63.21	3.63	4818			
	raw	100.00	12.75	0.54	13123			
122	1.5fl	87.87	4.79	0.55	14423	33.10	62.11	5.5
	1.5sk	12.13	70.40	0.47	3708			
	raw	100.00	22.14	0.71	11848			
127LS	1.5fl	65.18	8.20	0.76	14236	33.80	58.00	7.0
	1.5sk	34.82	48.24	0.62	7378			
	raw	100.00	27.89	1.25	10811			
140US	1.5fl	71.45	6.66	1.43	14397	34.18	59.16	9.0
	1.5sk	28.55	81.02	0.81	1837			
	raw	100.00	37.99	0.88	9053			
142US	1.5fl	58.18	5.62	1.01	14484	34.45	59.93	8.5
	1.5sk	41.82	83.03	0.70	1497			
	raw	100.00	26.92	0.81	10972			
146AS	1.5fl	69.98	5.79	0.87	14558	33.78	60.43	6.5
	1.5sk	30.02	76.17	0.66	2613			
	raw	100.00	49.36	0.47	7234			
149AS	1.5fl	45.60	4.49	0.86	14723	34.34	61.17	8.5
	1.5sk	54.40	86.97	0.14	958			
	raw	100.00	7.52	0.64	14260			
150LS	1.5fl	95.72	5.86	0.65	14541	33.08	61.06	8.0
	1.5sk	4.28	44.57	0.36	7980			
	raw	100.00	6.91	1.11	14341			
150US	1.5fl	95.19	4.15	1.06	14802	33.59	62.26	9.0
	1.5sk	4.81	61.54	2.06	5224			
151US	raw	100.00	26.50	2.12	10997	29.30	44.20	6.5

TABLE B1 (CONTINUED)

Sample		%wt	%ash	%S	BTU	%vol	%FC	FSI
	raw	100.00	45.77	1.38	7849			
155US	1.5fl	50.41	5.94	1.13	14491	34.16	59.90	8.0
	1.5sk	49.59	86.26	1.63	1098			
	raw	100.00	41.00	0.76	8602			
157US	1.5fl	55.84	5.77	1.08	14451	33.29	60.94	8.5
	1.5sk	44.16	85.55	0.35	1205			
162US	raw	100.00	42.47	2.89	8420	25.26	32.27	4.5
	raw	100.00	18.77	2.41	12367			
169US	1.5fl	75.86	6.11	1.48	14368	37.96	55.93	7.5
	1.5sk	24.14	58.55	5.32	6076			
	raw	100.00	38.81	1.79	8839			
173US	1.5fl	56.48	7.13	1.09	14196	34.08	58.79	8.5
	1.5sk	43.52	79.93	2.70	1887			
	raw	100.00	7.55	1.50	14186			
175	1.5fl	94.31	5.26	0.87	14576	34.93	59.81	8.0
	1.5sk	5.69	45.57	11.94	7726			

%wt= percent weight %ash= percent ash %S= percent sulfur
BTU= British Thermal Units %vol= percent volatile matter
%FC= percent fixed carbon FSI= fusibility index

Statistics:

		All Seam			Main and L. Split			U. Split	
		n	$\bar{x}$	std. $\bar{x}$	n	$\bar{x}$	std. $\bar{x}$	n	$\bar{x}$	std. $\bar{x}$
%S	raw	64	0.96	0.47	55	0.86	0.30	9	1.62	0.73
	float	70	0.81	0.27	61	0.76	0.24	9	1.11	0.22
%ash	raw	64	13.10	10.94	55	9.86	6.00	9	31.73	12.78
	float	70	5.74	1.03	61	5.74	1.05	9	5.74	0.94
BTU	raw	64	13360	1757	55	13888	970	9	10142	2158
	float	70	14566	180	61	14576	178	9	14497	182

APPENDIX C

X-RAY FLUORESCENCE DATA

Pressed Pellet Preparation

1. Each split sample obtained was further split by quartering, etc., to make a 50-75 gram sample.

2. Six grams were separated from this sample for pressed pellet preparation. The remaining sample was retained for preparation of petrographic pellets.

3. Each six gram sample was placed in a tungsten carbide grinding mill (SPEX Industries, Inc. Shatterbox) along with approximately 6 drops (one drop per gram of sample) of Freon TF solvent (trichlorotrifluorethane) as a grinding agent. Each sample was then ground for six minutes.

4. The ground sample was then placed in a one and one-quarter inch pellet die. Powdered boric acid was added to the die and the contents pressed in a Carver Laboratory Press @ 10,000 psi for 20 seconds for air removal and then @ 30,000 psi for one minute.

5. The resulting pellets were marked and placed in a dessicator.

6. Between each pellet preparation, the grinding mill was cleaned with six grams of beach sand with five ml. of methanol as a grinding agent. After grinding for six minutes, the entire mill was flushed and scrubbed under hot water and rinsed with distilled water. After partial towel drying, the mill was allowed to air dry.

Spectrometer Run Conditions

Instrument: TEFA EEDS II
Manufacturer: EG&G ORTEC
Model No.: 6110

Condition 1
Element Assayed: Na_2O, MgO, Al_2O_3
Anode: W
Anode Volt. (Kv): 6
Anode Curr. (a): 200
Count Time (sec): 300 seconds live time
Filter: None

Condition 2
Elements Assayed: SiO_2, P_2O_5, S, K_2O, CaO
Anode: Rh
Anode Volt. (Kv): 10
Anode Curr. (a): 200
Count Time (sec): 300 seconds live time
Filter: None

Condition 3
Elements Assayed: TiO_2, Fe_2O_5
Anode: W
Anode Volt. (Kv): 25
Anode Curr. (a): 300
Count Time (sec): 300 seconds live time
Filter: Cu

Note: For all subsequent tables, Na= Na_2O, Mg= MgO, Al= Al_2O_3, Si= SiO_2, P= P_2O_5, S= S, K= K_2O, Ca= CaO, Ti= TiO_2, Fe= Fe_2O_3

TABLE C1

Comparison of Standard Error of Calibration of Protocol (SECP) and Sum of Squares Error of Replicate (SSER) Analyses of Standards.

Element	SECP	SSER
Na	+/-0.36	+/-0.07
Mg	+/-0.03	+/-0.06
Al	+/-0.09	+/-0.05
Si	+/-0.11	+/-0.06
P	+/-0.02	+/-<0.01
S	+/-0.07	+/-0.08
K	+/-0.01	+/-0.02
Ca	+/-0.03	+/-0.01
Ti	+/-0.01	+/-<0.01
Fe	+/-0.04	+/-0.02

SSER was determined by the formula:

$$\sqrt{\frac{\Sigma n_1(s_1)^2 + n_2(s_2)^2 \ldots\ldots n_j(s_j)^2}{\Sigma n_{1-j}}}$$

where n = number of replicate analyses for each element and s = standard deviation for mean of replicate analyses.
For all elements, n = 33, except Na_2O = 28 and MgO = 16.

TABLE C2

Major element content of the Glamorgan coal 1.5 specific gravity (S.G.) float separate in weight percent

Sample	Na	Mg	Al	Si	P	S	K	Ca	Ti	Fe
6	0.49		1.90	2.66	0.03	0.74	0.06	0.02	0.09	0.53
repl.	0.47	0.07	1.91	2.68	0.03	0.74	0.06	0.02	0.09	0.55
23	0.48		2.37	3.52	0.03	0.75	0.11	0.03	0.11	0.30
repl.	0.50		2.33	3.52	0.03	0.75	0.11	0.03	0.12	0.30
24	0.55		1.72	2.44	0.03	0.80	0.07	0.02	0.07	0.52
repl.	0.58	0.01	1.71	2.48	0.03	0.80	0.07	0.02	0.07	0.54
26	0.52		2.91	4.49	0.04	0.63	0.12	0.03	0.15	0.29
36	0.37		3.42	5.16	0.03	0.65	0.19	0.05	0.11	0.41
repl.	0.39		3.31	5.07	0.03	0.65	0.19	0.04	0.11	0.41
37	0.96	0.08	2.73	4.14	0.05	0.69	0.09	0.04	0.10	0.30
repl.	0.96	0.12	2.80	4.27	0.06	0.70	0.09	0.04	0.10	0.32
49	0.54		2.18	3.43	0.04	0.54	0.10	0.04	0.08	0.08
repl.	0.61		2.18	3.43	0.04	0.54	0.09	0.04	0.08	0.09
62	0.52		2.17	3.15	0.03	0.65	0.08	0.05	0.09	0.39
69	0.84		2.51	4.04	0.04	0.76	0.11	0.01	0.08	0.38
repl.	0.75	0.07	2.50	4.01	0.04	0.77	0.10	0.01	0.09	0.39
71	1.05	0.21	3.03	5.05	0.06	0.73	0.10	0.06	0.09	1.00
repl.	0.97	0.21	2.96	5.02	0.06	0.74	0.10	0.06	0.09	1.01
73	0.48		2.05	2.67	0.03	0.70	0.06	0.05	0.08	0.35
repl.	0.46		2.05	2.67	0.03	0.72	0.06	0.05	0.08	0.37
81	0.49		2.94	4.42	0.05	0.65	0.11	0.05	0.10	0.29
84	0.64		2.04	2.82	0.03	0.73	0.06	0.03	0.07	0.46
repl.	0.64	0.01	2.01	2.80	0.03	0.73	0.06	0.02	0.08	0.47
88	0.85	0.09	2.80	4.76	0.05	0.87	0.11	0.03	0.10	0.81
repl.	0.78	0.19	2.81	4.76	0.05	0.87	0.11	0.03	0.10	0.83
90	0.92	0.13	3.12	5.30	0.05	0.60	0.13	0.06	0.11	0.27
repl.	0.90	0.09	3.09	5.23	0.05	0.60	0.13	0.06	0.11	0.28
98	1.26	0.13	3.22	5.50	0.07	0.60	0.12	0.18	0.09	0.15
repl.	1.07	0.10	3.17	5.47	0.07	0.61	0.12	0.18	0.09	0.15
100	0.85	0.06	2.58	4.15	0.05	0.64	0.10	0.04	0.08	0.24
repl.	0.76	0.15	2.54	4.07	0.05	0.64	0.10	0.04	0.09	0.25
101	0.92	0.16	2.93	5.37	0.05	0.72	0.13	0.05	0.10	0.53
repl.	0.88	0.13	2.87	5.32	0.05	0.73	0.13	0.06	0.10	0.52
102	0.42	0.01	2.64	4.19	0.03	0.72	0.13	0.04	0.10	0.51
repl.	0.43		2.58	4.14	0.03	0.72	0.13	0.04	0.10	0.49
109	0.39		2.76	4.19	0.04	0.58	0.11	0.04	0.11	0.19
115	0.56		2.76	3.93	0.04	0.53	0.11	0.07	0.09	0.22
119	0.34		2.36	3.34	0.03	0.66	0.09	0.06	0.09	0.36
127LS	0.58		3.47	5.36	0.05	0.66	0.15	0.05	0.11	0.30
140US	0.38	0.02	2.05	3.41	0.02	1.19	0.13	0.08	0.08	1.10
142US	0.76	0.09	2.31	3.87	0.03	1.02	0.13	0.12	0.07	0.77
146AS	0.36		2.24	3.32	0.03	0.74	0.11	0.08	0.09	0.31

TABLE C2 (CONTINUED)

Sample	Na	Mg	Al	Si	P	S	K	Ca	Ti	Fe
149AS	0.41		1.94	2.78	0.03	0.79	0.09	0.06	0.07	0.43
150LS	0.46		2.45	3.49	0.04	0.61	0.07	0.04	0.10	0.08
150US	0.51	0.01	1.75	2.59	0.03	0.97	0.09	0.06	0.06	0.60
157US	0.28		2.05	3.41	0.02	0.95	0.17	0.11	0.08	0.67
169US	0.65	0.13	2.11	3.61	0.03	1.21	0.11	0.09	0.08	1.12
173US	0.28		2.37	4.10	0.03	1.16	0.15	0.10	0.11	1.00
Standard Error of Calibration:										
+/-	0.36	0.03	0.09	0.11	0.02	0.07	0.01	0.03	0.01	0.04

TABLE C3

Major element content of the Glamorgan coal, 1.5 S.G. sink separate in weight percent

Sample	Na	Mg	Al	Si	P	S	K	Ca	Ti	Fe
6	0.29	0.80	9.20	30.40	0.30	3.76	1.24	0.08	0.86	4.22
23	0.80	0.55	10.75	24.58	0.04	0.61	1.61	0.15	0.72	1.24
24	0.35	1.00	9.94	30.14	0.10	4.31	1.56	0.18	0.46	6.92
36	1.32	1.49	20.22	49.02	0.02	0.51	3.67	0.33	0.84	6.08
37	1.06	0.99	15.59	38.62	0.07	0.77	2.43	0.24	0.81	3.60
49	0.74	0.72	10.24	26.37	0.12	0.77	1.46	0.12	0.57	1.70
69	0.48	0.84	8.42	24.23	0.05	3.59	1.37	0.19	0.34	5.76
repl.	0.49	0.82	8.38	24.00	0.05	3.66	1.40	0.19	0.35	5.78
71	0.53	2.10	12.45	44.57	0.06	5.40	2.04	0.79	0.57	12.33
repl.	0.55	2.14	12.56	44.83	0.06	5.56	2.06	0.80	0.59	12.59
73		0.46	3.91	17.68	0.03	21.28	0.70	0.09	0.30	11.26
repl.		0.45	3.82	17.15	0.02	22.42	0.73	0.09	0.31	11.36
84	0.27	0.73	6.57	20.42	0.06	4.99	0.91	0.12	0.29	6.26
85	0.92	0.60	11.42	27.98	0.25	0.45	1.25	0.11	0.60	1.11
88	0.62	0.74	8.90	25.09	0.10	2.13	1.28	0.13	0.44	3.78
repl.	0.57	0.81	8.93	25.26	0.10	2.20	1.30	0.13	0.46	3.85
90	0.60	0.72	9.34	25.26	0.09	2.47	1.25	0.25	0.37	4.83
repl.	0.57	0.86	9.27	25.15	0.08	2.54	1.28	0.26	0.38	4.90
98	1.05	0.47	17.92	45.55	0.37	0.29	1.92	0.25	0.84	1.77
repl.	1.06	0.54	18.07	45.91	0.38	0.30	1.94	0.25	0.88	1.82
100	1.19	1.04	13.04	32.69	0.18	0.56	1.63	0.29	0.64	2.61
repl.	1.15	0.98	13.19	33.16	0.17	0.57	1.67	0.28	0.66	2.65
101	1.27	1.36	19.46	52.39	0.34	0.23	3.62	0.31	0.96	3.36
repl.	1.17	1.39	19.47	52.47	0.34	0.23	3.62	0.31	0.98	3.37
102		0.84	6.15	24.63	0.07	15.04	1.01	0.12	0.35	11.26
115	0.87	1.62	13.47	38.04	0.03	0.69	1.70	0.57	0.58	9.06
127LS	0.96	0.57	15.00	33.03	0.09	0.53	1.74	0.25	0.59	2.59
140US	1.37	1.65	21.95	56.60	0.02	0.68	4.65	0.51	0.81	7.47
142US	1.52	1.69	21.79	57.15	0.02	0.67	4.96	0.63	0.82	7.14
146AS	1.34	1.38	22.45	55.80	0.05	0.36	4.04	0.42	0.87	6.03
149AS	1.40	1.85	21.92	60.12	0.08	0.29	4.22	0.46	0.93	7.90
150LS	1.07	0.59	14.12	31.41	0.07	0.36	2.01	0.30	0.50	1.20
150US	0.95	1.20	16.03	42.12	0.08	1.55	2.85	0.51	0.56	5.71
157US	1.59	1.75	22.98	58.44	0.06	0.37	4.42	0.56	0.95	6.97
173US	1.06	1.49	19.89	52.61	0.04	1.98	3.78	0.43	0.86	9.39
Standard Error of Calibration:										
+/-	0.36	0.03	0.09	0.11	0.02	0.07	0.01	0.03	0.01	0.04

TABLE C4

Major element content in weight percent of the Glamorgan coal, 1.5 S.G. float separate, normalized to weight percent of separate

Sample	Na	Mg	Al	Si	P	S	K	Ca	Ti	Fe
6	0.44		1.73	2.42	0.03	0.67	0.05	0.02	0.08	0.48
23	0.43		2.11	3.14	0.03	0.67	0.10	0.03	0.10	0.27
24	0.53		1.66	2.35	0.03	0.77	0.07	0.02	0.07	0.50
36	0.30		2.77	4.17	0.02	0.53	0.15	0.04	0.09	0.33
37	0.76	0.06	2.16	3.27	0.04	0.55	0.07	0.03	0.08	0.24
49	0.51		2.04	3.21	0.04	0.51	0.09	0.04	0.07	0.07
69	0.79		2.37	3.82	0.04	0.72	0.10	0.01	0.08	0.36
73	0.44		1.88	2.45	0.03	0.64	0.06	0.05	0.07	0.32
84	0.62		1.97	2.72	0.03	0.70	0.06	0.03	0.07	0.44
88	0.76	0.09	2.66	4.53	0.05	0.83	0.10	0.03	0.10	0.77
90	0.90	0.13	3.07	5.21	0.05	0.60	0.13	0.06	0.11	0.27
98	1.10	0.11	2.80	4.79	0.06	0.52	0.10	0.16	0.08	0.13
100	0.82	0.06	2.50	4.01	0.05	0.62	0.10	0.04	0.08	0.23
101	0.80	0.14	2.53	4.64	0.04	0.62	0.11	0.04	0.09	0.46
102	0.42		2.49	4.00	0.03	0.70	0.13	0.04	0.10	0.47
115	0.50		2.45	3.48	0.04	0.47	0.10	0.06	0.08	0.19
127LS	0.38		2.26	3.49	0.03	0.43	0.10	0.03	0.07	0.20
140US	0.27	0.01	1.46	2.44	0.01	0.85	0.09	0.06	0.06	0.79
142US	0.44	0.05	1.34	2.25	0.02	0.59	0.08	0.07	0.04	0.45
146AS	0.25		1.57	2.32	0.02	0.52	0.08	0.06	0.06	0.22
149AS	0.19		0.88	1.27	0.01	0.36	0.04	0.03	0.03	0.20
150LS	0.44		2.35	3.34	0.04	0.58	0.07	0.04	0.10	0.08
150US	0.49	0.01	1.67	2.47	0.03	0.92	0.09	0.06	0.06	0.57
157US	0.16		1.14	1.90	0.01	0.53	0.09	0.06	0.04	0.37
173US	0.26		1.34	2.32	0.03	0.66	0.08	0.06	0.10	0.56
Statistics:										
All Seam										
n	26	10	26	26	26	26	26	25	26	26
$\bar{x}$	0.52	0.08	2.03	3.18	0.03	0.63	0.09	0.05	0.08	0.38
std. $\bar{x}$	0.24	0.05	0.56	0.99	0.01	0.14	0.02	0.03	0.02	0.21
Main and Lower Split										
n	18	6	18	18	18	18	18	17	18	18
$\bar{x}$	0.61	0.10	2.32	3.61	0.04	0.62	0.09	0.04	0.08	0.30
std. $\bar{x}$	0.22	0.03	0.38	0.85	0.01	0.11	0.03	0.03	0.01	0.19
Upper Split										
n	8	4	8	8	7	7	8	8	8	8
$\bar{x}$	0.32	0.04	1.38	2.14	0.02	0.63	0.08	0.06	0.06	0.50
std. $\bar{x}$	0.13	0.04	0.26	0.43	0.01	0.20	0.02	0.01	0.02	0.24

TABLE C5

Major element content in weight percent of the Glamorgan coal, 1.5 S.G. sink separate, normalized to weight percent of separate

Sample	Na	Mg	Al	Si	P	S	K	Ca	Ti	Fe
6	0.03	0.07	0.85	2.80	0.03	0.35	0.11		0.08	0.39
23	0.09	0.06	1.16	2.65		0.07	0.17	0.02	0.08	0.13
24	0.01	0.04	0.36	1.10		0.16	0.06		0.02	0.25
36	0.25	0.28	3.87	9.37		0.10	0.70	0.06	0.16	1.16
37	0.22	0.21	3.27	8.11	0.01	0.16	0.51	0.05	0.17	0.76
49	0.05	0.05	0.65	1.68		0.05	0.09		0.04	0.11
69	0.03	0.05	0.46	1.33		0.20	0.08	0.01	0.02	0.32
73		0.04	0.32	1.45		1.74	0.06		0.02	0.92
84	0.01	0.03	0.24	0.73		0.18	0.03		0.01	0.22
88	0.03	0.04	0.43	1.22		0.10	0.06		0.02	0.18
90	0.01	0.01	0.16	0.43		0.04	0.02		0.01	0.08
98	0.14	0.06	2.31	5.88	0.05	0.04	0.25	0.03	0.11	0.23
100	0.04	0.03	0.43	1.07	0.01	0.02	0.05		0.02	0.09
101	0.17	0.18	2.64	7.10	0.05	0.03	0.49	0.04	0.13	0.46
102		0.03		0.85		0.52	0.03		0.01	0.39
115	0.10	0.18	1.54	4.34		0.08	0.09	0.06	0.07	1.03
127LS	0.33	0.20	5.22	11.50	0.03	0.18	0.61	0.09	0.21	0.90
140US	0.39	0.47	6.27	16.16	0.01	0.19	1.33	0.15	0.23	2.13
142US	0.64	0.71	9.11	23.90	0.01	0.28	2.07	0.26	0.34	2.99
146AS	0.40	0.41	6.74	16.75	0.02	0.11	1.21	0.13	0.26	1.81
149AS	0.76	1.01	11.92	32.71	0.04	0.16	2.30	0.25	0.51	4.30
150LS	0.05	0.03	0.60	1.34		0.01	0.09	0.01	0.02	0.05
150US	0.05	0.06	0.77	2.03		0.07	0.14	0.02	0.03	0.27
157US	0.70	0.77	10.15	25.81	0.03	0.16	1.95	0.25	0.42	3.08
173US	0.46	0.65	8.66	22.90	0.02	0.86	1.65	0.19	0.37	4.09
Statistics:										
All Seam										
n	23	25	24	25	12	25	25	16	25	25
$\bar{x}$	0.22	0.23	3.26	8.13	0.03	0.23	0.57	0.10	0.13	1.05
std. $\bar{x}$	0.24	0.28	3.64	9.45	0.02	0.36	0.73	0.09	0.15	1.28
Main and Lower Split										
n	16	20	17	17	6	18	18	9	18	18
$\bar{x}$	0.10	0.08	1.44	3.50	0.03	0.22	0.20	0.04	0.07	0.43
std. $\bar{x}$	0.10	0.08	1.50	3.41	0.02	0.40	0.22	0.03	0.06	0.36
Upper Split										
n	7	7	7	7	6	7	7	7	7	7
$\bar{x}$	0.49	0.58	7.66	20.04	0.02	0.26	1.52	0.18	0.31	2.67
std. $\bar{x}$	0.24	0.30	3.60	9.72	0.01	0.27	0.72	0.09	0.15	1.40

TABLE C6

t-test of elemental means, main and lower split, and upper split

Main and lower split

Element	xfl	xsk	DF	t-value 95% C.I.	t-test value	Sig. Diff.?	Enriched in :
Na	0.61	0.10	32	2.037	48.826	Yes	Fl
Mg	0.10	0.08	24	2.064	0.947	No	
Al	2.32	1.44	33	2.035	7.127	Yes	Fl
Si	3.61	3.50	33	2.035	0.101	No	
P	0.04	0.03	22	2.074	1.636	No	
S	0.62	0.22	34	2.032	4.090	Yes	Fl
K	0.09	0.20	34	2.032	2.103	Yes	Sk
Ca	0.04	0.04	24	2.064	0.042	No	
Ti	0.08	0.07	34	2.032	0.697	No	
Fe	0.30	0.43	34	2.032	4.064	Yes	Sk

Upper Split

Na	0.32	0.49	13	2.160	15.723	Yes	Sk
Mg	0.04	0.58	9	2.262	3.502	Yes	Sk
Al	1.38	7.66	13	2.160	5.660	Yes	Sk
Si	2.14	20.04	13	2.160	5.241	Yes	Sk
P	0.02	0.02	11	2.201	0.020	No	
S	0.63	0.26	13	2.160	3.044	Yes	Fl
K	0.08	1.52	13	2.160	5.689	Yes	Sk
Ca	0.06	0.18	13	2.160	0.628	No	
Ti	0.06	0.31	13	2.160	12.249	Yes	Sk
Fe	0.50	2.67	13	2.160	4.333	Yes	Sk

Procedure: To determine the t-test value, the formula used was:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where: $\bar{x}_1$ = mean of float samples,
$\bar{x}_2$ = mean of sink samples,
n_1 = number of float samples,
n_2 = number of sink samples, and
sp = pooled estimated variance, determined by;

$$sp^2 = \frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2-2}$$

where: s_1 = standard deviation of float samples
s_2 = standard deviation of sink samples and
DF = $n_1 + n_2 - 2$

TABLE C7

Reconstituted seam versus raw coal Na, Mg, Al, Si and P content in weight percent

Sample	Na		Mg		Al		Si		P	
	R	X	R	X	R	X	R	X	R	X
6	0.47	1.05	0.07	0.06	2.58	3.37	5.22	7.75	0.06	0.07
22		0.75		0.14		6.33		12.56		0.02
23	0.52		0.06		3.27		5.79		0.03	
24	0.56		0.04		2.02		3.45		0.03	
36	0.55		0.28		6.64		13.54		0.02	
37	0.98		0.27		5.43		11.38		0.04	
47		0.74				2.84		5.00		0.06
49	0.56		0.05		2.69		4.89		0.04	
57		0.79		0.23		4.72		10.54		0.04
65		1.16				2.38		4.07		0.05
67		0.41				1.68		5.10		0.03
69	0.82	0.34	0.05		2.83	2.63	5.15	4.62	0.04	0.02
73	0.44	0.66	0.04	0.02	2.20	2.58	3.90	5.45	0.03	0.04
74		0.48				2.94		5.40		0.04
77		0.50				2.16		3.31		0.03
84	0.63		0.03		2.21		3.45		0.03	
86		0.88				2.72		5.21		0.05
88	0.79		0.13		3.09		5.75		0.05	
89		1.11				2.72		4.82		0.06
90	0.91		0.14		3.23		5.64		0.05	
98	1.24	1.13	0.17	0.06	5.11	4.02	10.67	7.91	0.06	0.06
100	0.86	0.85	0.09	0.02	2.93	3.09	5.08	5.97	0.05	0.05
101	0.97		0.32		5.17		11.74		0.04	
102	0.42	0.50	0.03		2.49	3.11	4.85	6.07	0.03	0.04
115	0.60		0.18		3.99		7.82		0.04	
127LS	0.71	0.65	0.20	0.18	7.48	7.95	14.99	15.74	0.06	0.06
140US	0.66		0.48		7.73		18.60		0.02	
142US	1.08	0.76	0.76	0.68	10.45	6.87	26.15	17.07	0.03	0.02
146AS	0.6		0.41		8.31		19.07		0.04	
149AS	0.95	1.44	1.01	1.50	1.28	13.16	33.98	34.57	0.05	0.06
150LS	0.49	0.75	0.03		2.95	2.82	4.68	4.61	0.04	0.06
150US	0.54	0.47	0.07		2.44	2.34	4.50	4.62	0.03	0.02
157US	0.86		0.77		11.29		27.71		0.04	
173US	0.72		0.65		10.00		25.22		0.05	
175		0.57				1.74		2.55		0.03

R= Reconstituted seam, from float-sink XRF data
X= XRF data, raw coal

TABLE C7 (CONTINUED)

Statistics:

Element	Na	Mg	Al	Si	P
n	11	7	10	11	11
r	0.45	0.96	0.91	0.95	0.79
inter.	0.411	-0.06	1.23	1.19	-0.004
slope	0.51	1.34	0.63	0.85	1.14
r-test	80.0%	>99.9%	>99.9%	>99.9%	>99.9%

Note: Al value for 142US not used in statistics.

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TABLE C8

Reconstituted seam versus raw coal S, K, Ca, Ti and Fe content in weight percent

Sample	S		K		Ca		Ti		Fe	
	R	X	R	X	R	X	R	X	R	X
6	1.02	0.83	0.16	0.19	0.02	0.05	0.16	0.23	0.87	0.66
22		0.65		0.79		0.14		0.34		0.67
23	0.74		0.27		0.05		0.18		0.40	
24	0.93		0.13		0.02		0.09		0.75	
36	0.63		0.85		0.10		0.25		1.49	
37	0.71		0.58		0.08		0.25		1.00	
47		0.61		0.12		0.05		0.13		0.21
49	0.56		0.18		0.04		0.11		0.18	
57		0.69		0.51		0.11		0.17		1.01
65		0.81		0.09		0.03		0.08		0.50
67		1.23		0.22		0.06		0.12		1.40
69	0.92	0.88	0.18	0.21	0.01	0.05	0.10	0.12	0.68	0.84
73	2.38	1.69	0.12	0.14	0.05	0.03	0.09	0.11	1.24	2.02
74		0.97		0.18		0.04		0.13		0.98
77		0.68		0.18		0.04		0.10		0.25
84	0.88		0.09		0.03		0.08		0.66	
86		1.17		0.13		0.03		0.11		1.22
88	0.93		0.16		0.03		0.12		0.95	
89		0.71		0.10		0.03		0.10		0.49
90	0.64		0.15		0.06		0.12		0.35	
98	0.56	0.63	0.35	0.28	0.19	0.08	0.19	0.15	0.36	0.29
100	0.64	0.68	0.15	0.18	0.04	0.06	0.10	0.12	0.32	0.40
101	0.65		0.60		0.08		0.22		0.92	
102	1.22	1.11	0.16	0.19	0.04	0.05	0.11	0.13	0.86	1.25
115	0.55		0.29		0.12		0.15		1.22	
127LS	0.61	0.64	0.71	0.78	0.12	0.13	0.28	0.28	1.10	1.10
140US	1.04		1.42		0.21		0.29		2.92	
142US	0.87	1.08	2.15	1.21	0.33	0.20	0.38	0.23	3.44	2.32
146AS	0.63		1.29		0.19		0.32		2.03	
149AS	0.52	0.56	2.34	2.16	0.28	0.26	0.54	0.53	4.50	4.37
150LS	0.59	0.66	0.16	0.07	0.05	0.04	0.12	0.11	0.13	0.09
150US	0.99	1.09	0.23	0.25	0.08	0.09	0.09	0.08	0.84	0.88
157US	0.69		2.04		0.31		0.46		3.45	
173US	1.52		1.73		0.25		0.47		4.65	
175		0.81		0.06		0.04		0.07		0.35

R= Reconstituted seam, from float-sink XRF data
X= XRF data, raw coal

TABLE C8 (CONTINUED)

Statistics:

Element	S	K	Ca	Ti	Fe
n	11	11	11	11	11
r	0.95	0.95	0.89	0.93	0.94
inter.	0.34	0.06	0.02	0.03	0.20
slope	0.59	0.74	0.64	0.81	0.84
r-test	>99.9%	>99.9%	>99.9%	>99.9%	>99.9%

APPENDIX D

PETROGRAPHIC DATA

Particle Pellet Preparation

1. After removal of six grams of sample for pressed pellet preparation, the remaining sample was crushed so that all passed through a two mm sieve.

2. Approximately four grams of sample was separated from the crushed sample and placed in a one inch pellet die. Epoxy was added and allowed to cure for 24 hours.

3. Each pellet was then polished and placed in a dessicator. Immediately prior to maceral identification, each pellet was repolished to remove any oxide coating.

TABLE D1

Maceral, pyrite and mineral matter composition of raw coal in volume percent

	Raw Coal 1000 Counts					Mineral-Matter-Free			
Sample	%VIT	%EX	%IN	%PY	%MM	%VIT	%EX	%IN	Total Counts
6	73.5	20.6	5.5	0.4	0.0	73.8	20.7	5.5	996
47	68.1	22.2	9.7	0.0	0.0	68.1	22.2	9.7	1000
57	73.7	10.0	5.4	0.3	10.6	82.7	11.2	6.1	891
65	79.9	13.8	6.2	0.1	0.0	80.0	13.8	6.2	999
67	75.6	18.8	5.2	0.4	0.0	75.9	18.9	5.2	996
69	80.7	11.3	8.0	0.0	0.0	80.7	11.3	8.0	1000
73	81.9	10.8	6.8	0.2	0.3	82.3	10.9	6.8	995
74	71.2	21.5	7.2	0.1	0.0	71.3	21.5	7.2	999
77	79.0	12.0	8.8	0.0	0.2	79.2	12.0	8.8	998
86	79.7	13.7	6.6	0.0	0.0	79.7	13.7	6.6	1000
89	78.0	12.4	9.4	0.0	0.2	78.2	12.4	9.4	998
98	76.0	19.4	4.6	0.0	0.0	76.0	19.4	4.6	1000
100	80.7	10.7	6.8	0.0	1.8	82.2	10.9	6.9	982
102	72.5	12.6	12.3	0.1	2.5	74.4	12.9	12.6	974
127LS	73.7	16.3	7.1	0.4	2.5	75.9	16.8	7.3	971
142US	78.6	6.6	4.4	0.2	10.2	87.7	7.4	4.9	896
149AS	55.9	9.9	7.5	0.1	26.6	76.3	13.5	10.2	733
150LS	82.8	10.0	7.2	0.0	0.0	82.8	10.0	7.2	1000
150US	89.6	5.5	3.3	0.0	1.6	91.1	5.6	3.3	984
169US	71.9	14.9	4.2	0.9	8.1	79.0	16.4	4.6	910
175	81.8	8.0	10.1	0.1	0.0	81.9	8.0	10.1	999
Mean counting error:									
+/-	2.8	2.4	1.5	--	--	2.9	2.5	1.6	

VIT= Vitrinite
EX= Exinite
IN= Inertinite
PY= Pyrite
MM= Mineral matter

TABLE D2

Means and standard deviations of maceral content for total seam, main and lower split, and upper split

	Vitrinite		Exinite		Inertinite	
	$\bar{x}$	std. $\bar{x}$	$\bar{x}$	std. $\bar{x}$	$\bar{x}$	std. $\bar{x}$
Total seam						
Raw	76.4	6.8	13.4	4.8	7.0	2.2
MMF	75.9	16.4	13.8	4.7	7.2	2.2
Main and lower split						
Raw	77.0	4.3	14.4	4.5	7.5	2.0
MMF	78.0	4.3	14.5	4.5	7.5	4.3
Upper split						
Raw	80.0	8.9	9.0	5.1	4.0	0.6
MMF	85.9	2.0	8.1	7.9	4.3	0.9

TABLE D3

Means and standard deviations of maceral content based on subjacent lithology

	Vitrinite		Exinite		Inertinite	
	$\bar{x}$	std. $\bar{x}$	$\bar{x}$	std. $\bar{x}$	$\bar{x}$	std. $\bar{x}$
Non-sandstone						
Raw	74.5	7.3	14.5	4.8	6.5	1.9
MMF	78.9	5.6	14.4	5.1	6.7	2.2
Sandstone						
Raw	77.7	3.8	12.6	4.2	7.9	2.3
MMF	79.2	4.0	12.8	4.0	8.0	2.3

TABLE D4

Means and standard deviations of maceral content for samples east and west of the line of splitting

	Vitrinite		Exinite		Inertinite	
	$\bar{x}$	std. $\bar{x}$	$\bar{x}$	std. $\bar{x}$	$\bar{x}$	std. $\bar{x}$
East						
Raw	76.8	4.3	14.5	4.7	7.5	2.2
MMF	77.8	4.4	14.7	4.6	7.6	2.7
West						
Raw	73.3	11.2	11.1	4.3	5.7	1.5
MMF	82.1	6.2	11.6	4.7	6.3	2.5

VITA

Anthony Scott Scales was born in Bristol, Virginia on May 4, 1956. He attended elementary schools in Sullivan County, Tennessee and was graduated from Sullivan East High School in June, 1974. After one year at East Tennessee State University, he entered the University of Tennessee, Knoxville, and in March, 1978, received a Bachelor of Arts degree in Geology.

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