United States Department of the Interior
Geological Survey

Chemical analysis of 45 Maryland coal samples

by

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Open-file Report 81-1099

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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INTRODUCTION

This report is part of a continuing program by the U.S. Geological Survey, State Geological Surveys, and the Coal Analysis Section of the U.S. Department of Energy to provide chemical data on the composition of important coal beds of the United States of America. Such data are useful in determining the economic value of a coal, environmental effects of coal mining and coal use, and the adaptability of a coal to cleaning and to other technological processes of coal treatment and usage.

This paper summarizes the chemical analyses of 45 samples of medium- to low-volatile bituminous coal from 28 sites in Allegany and Garrett Counties in western Maryland which were collected from 12 coal beds (table 1). The coal in western Maryland is present in five coal basins, which are outliers on the eastern edge of the Applachian region; the five coal basins are (1) Georges Creek basin, (2) Upper Potomac basin, (3) Castleman basin, (4) Upper Youghiogheny basin, and (5) Lower Youghiogheny basin. The samples are from channels cut in fresh mine faces; 27 of the samples represent the total thickness of single coal beds, and 18 represent channels cut in benches from four coal beds. The 12 coal beds sampled range from the Upper Kittanning coal bed of the Allegheny Formation of Pennsylvanian age to the Waynesburg (= Uniontown) coal bed of the Monongahela Formation of Late Pennsylvanian age. The relative stratigraphic position of the coal beds and number of samples from each bed are shown in table 1. The areal locations of the coal samples are shown on a computer-generated map (fig. 1).

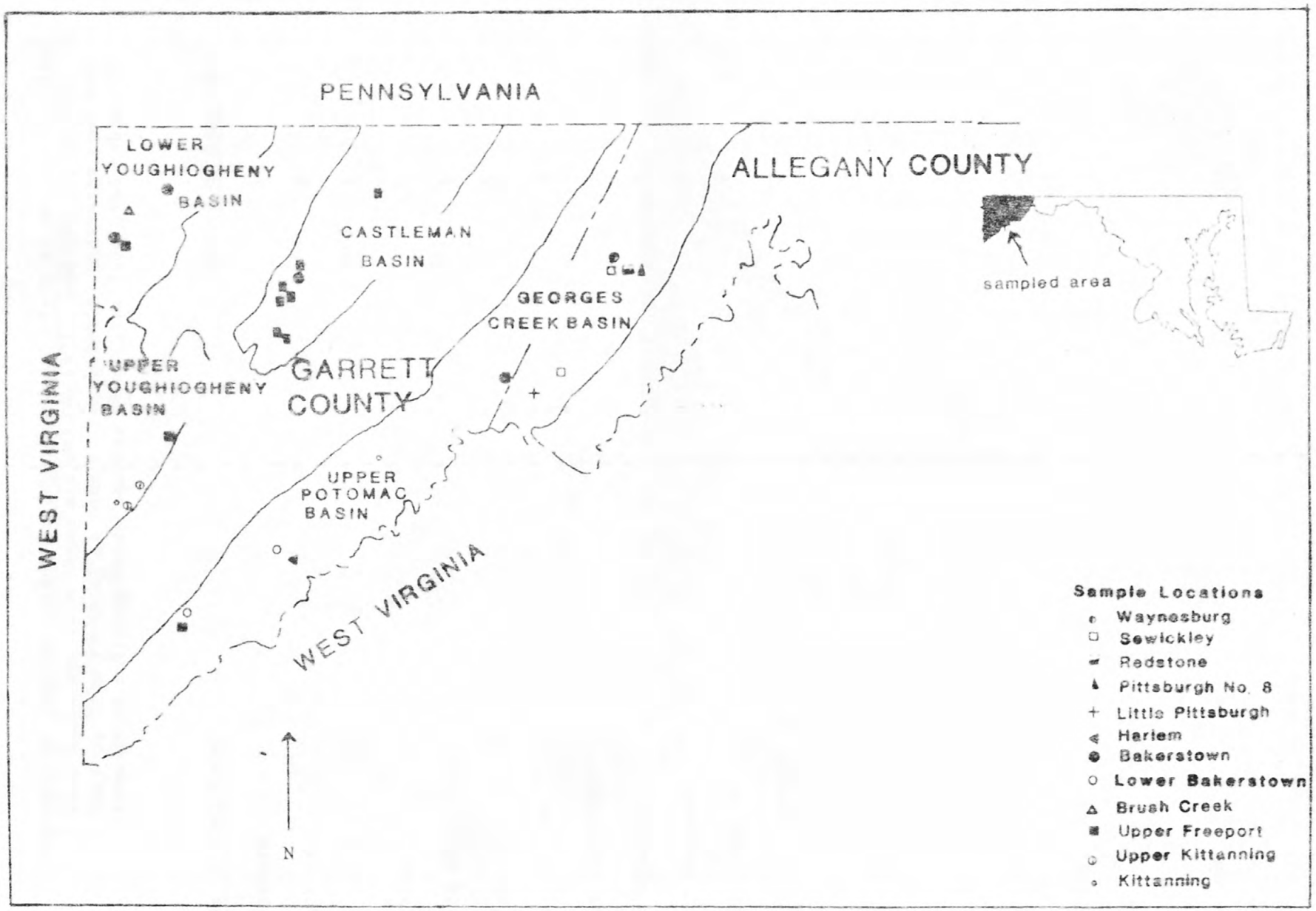

Figure 1. Locations from which Maryland coal samples were collected

Table 1.--Number of samples collected from named coal beds in western Maryland

[Bed names are from Skema and others (1977) and are listed, top to bottom, from youngest to oldest. Asterisk(*) indicates coal bed from which multiple bench samples were taken (see also table 3)]

Names of Coal Beds	Number of Samples
Waynesburg	1
Sewickley	2
Redstone	1
Pittsburgh	1
Little Pittsburgh	1
Harlem	1
Bakerstown *	6
Lower Bakerstown	2
Brush Creek *	4
Upper Freeport *	19
"Kittanning" *	5
Upper Kittanning	2
Total	45

ACKNOWLEDGMENTS

All elemental analyses of samples were made by A. J. Bartel, F. Brown, J. Budinsky, J. L. Harris, P. Hemming, L. Jenkins, H. Kirschenbaum, R. F. Knight, B. McCall, H. T. Millard, Jr., J. O'Kelley, L. J. Schwarz, F. O. Simon, R. E. VanLoenen, J. S. Wahlberg, and R. White of the U.S. Geological Survey. All ultimate, proximate, ash-fusion, free-swelling, and forms-of-sulfur analyses were made by chemists in the Coal Analysis Section (Forrest E. Walker, Chemist in Charge) of the U.S. Department of Energy (DOE), Pittsburgh, Pennsylvania.

The coal samples whose analyses are summarized in this report were collected by P. W. Harlem, R. H. Martin, and H. M. Nock of the Maryland State Geological Survey, and C. Blaine Cecil of the U.S. Geological Survey (USGS).

Some analyses summarized in this report were funded under USGS-ERDA (U.S. Energy Resources Development Agency) Interagency Agreement No. (49-18)-2005, dated April 30, 1975.

METHODS OF SAMPLE COLLECTION AND ANALYSIS

USGS guidelines on the methods of collecting coal samples and the chemical methods used in analyzing the samples were summarized by Swanson and Huffman (1976). For purposes of chemical analyses, fragmented samples weighing about 2 kg (4-5 lb.) are placed in plastic bags for transportation and storage to minimize moisture loss and possible chemical contamination, particularly trace-metal contamination by cloth bags or metal containers. The sequence of laboratory steps in the preparation of the samples and the methods of chemical analysis routinely used on samples are shown in figure 2.

Data from all completed coal chemical analyses, including both DOE and USGS analyses, are stored on magnetic tapes in the U.S. Geological Survey's National Coal Resources Data System. Stored analytical information can be rapidly retrieved and statistically manipulated for local, regional, or national summation, correlation, and map-display purposes.

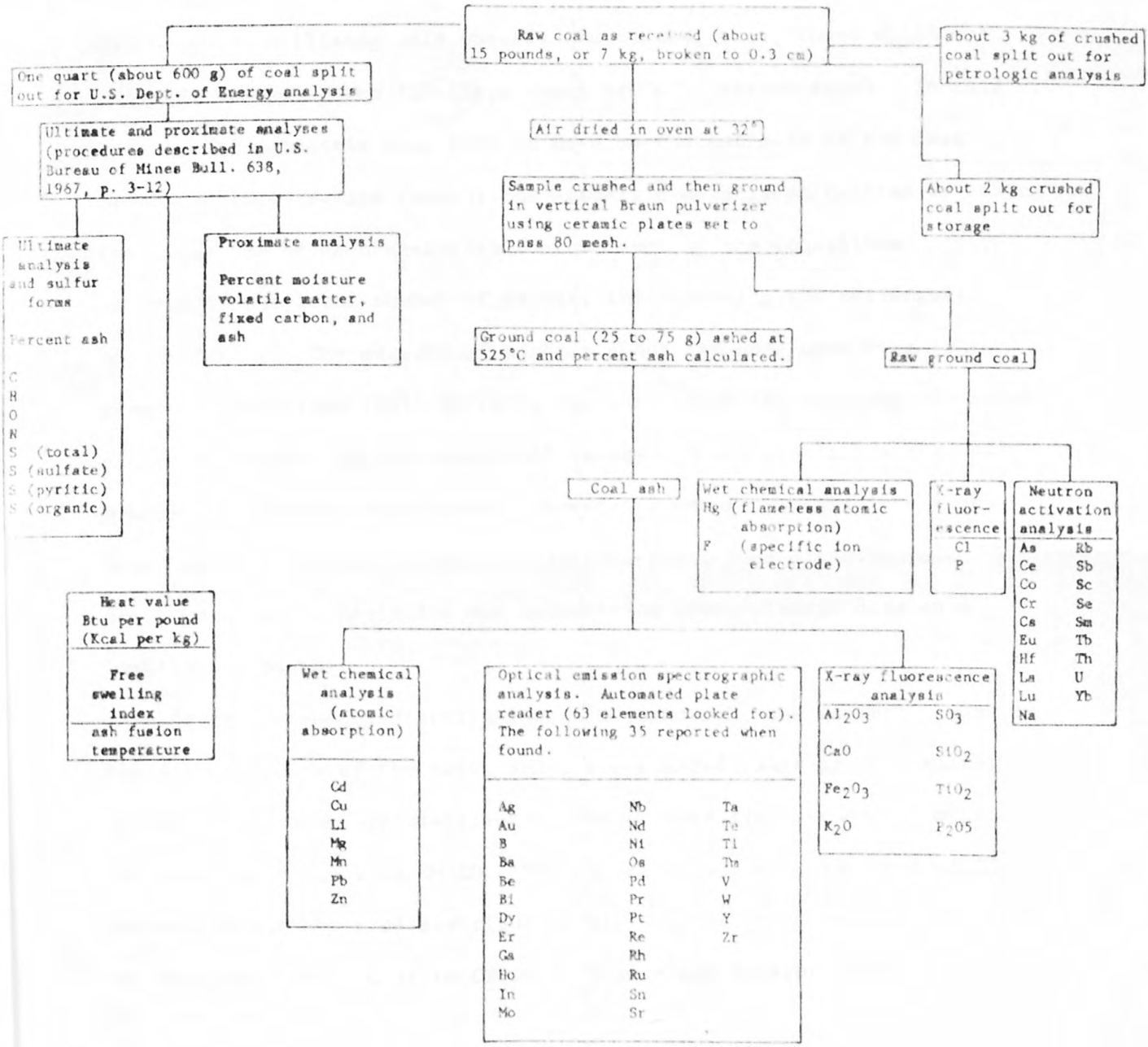

Figure 1 - Flow diagram for coal-sample analysis.

EXPLANATION OF STATISTICAL TERMS USED IN SUMMARY TABLES 2, 4-5b

Values entered in the summary tables (tables 2, 4-5b) are based on calculations utilizing only unqualified values, i.e., those which are not modified by either "L" (less than) or "G" (greater than). In this report, the geometric mean (GM) is used as the estimate of the most probable concentration (mode); the geometric mean is calculated by taking the logarithm of each analytical value, summing the logarithms, dividing the sum by the total number of values, and obtaining the antilogarithm of the result. The measure of scatter about the mode used here is the geometric deviation (GD), which is the antilog of the standard deviation of the logarithms of the analytical values. These statistics are used because the quantities of trace elements in natural materials commonly have positively skewed frequency distributions; such distributions are normalized by analyzing and summarizing trace-element data on a logarithmic basis.

If the frequency distributions are lognormal, the geometric mean is the best estimate of the mode, and the estimated range of the central two-thirds of the observed distribution has a lower limit equal to GM/GD and an upper limit equal to GM·GD. The estimated range of the central 95 percent of the observed distribution has a lower limit equal to $GM/(GD)^2$ and an upper limit equal to $GM(GD)^2$ (Connor and others, 1976).

AVERAGE ELEMENT CONTENT OF COAL AS COMPARED TO THAT OF SHALE AND THE EARTH'S CRUST.

The trace-elements concentrations of only Ge and Se are higher in Maryland coals than in the average shale (table 2). The concentrations in coal and shale of Ag, As, Hg, and Mo are similar. Six elements B, Ba, La, Sr, V, and Zr are 5 to 10 times more concentrated in shales than in the coal and Mn is more than 50 times higher in the average shale. Other elements are less than five times higher in the shales. Comparisons of the elemental contents of the Maryland coal samples with the elemental contents of the Earth's crust are also shown in table 2.

EXPLANATION OF DATA PRESENTATION IN TABLES 3-10

The data in tables 3-10 are arranged in the following format:

1. Table 3 gives the geographic and geologic description of 45 Maryland coal samples. The samples are identified by their U.S. Geological Survey analytical sample number. The geographic location is given by county, State, latitude, and longitude. Stratigraphic location is given by formation name and coal-bed name. Sample type and the thickness of the coal sampled are also given in table 3.
2. Table 4 is a statistical summary of the DOE data on 32 Maryland samples. For purposes of comparison, the geometric means of analyses of Appalachian coal samples published by Swanson and others (1976) and Zubovic and others (1979) are included in tables 4, 5a, and 5b.
3. Table 5a is a statistical summary of contents of 11 major and minor oxides in laboratory ash of 33 Maryland coal samples.

4. Table 5b is a statistical summary of concentrations of 36 trace elements on a whole-coal basis.
5. Table 6 lists the data received from DOE on 32 Maryland coal samples.
6. Table 7 lists the major- and minor-oxide and trace-element composition of laboratory ash of 45 Maryland coal samples. Those elements determined on a whole-coal basis but normally found in ash were recalculated to an ash basis. Volatile elements not normally found in the ash analyzed on a whole-coal basis and were not recalculated to an ash basis.
7. Table 8 lists the contents of 22 trace elements in 45 whole-coal samples from Maryland.
8. Table 9 gives the major-, minor-, and trace-element composition on a whole-coal basis. Elements measured in laboratory ash were recalculated to a whole-coal basis.
9. Table 10 lists elements looked for but not found, and the elements that were found in too few samples to provide meaningful statistics.

STATISTICAL COMPARISONS OF MARYLAND COALS WITH OTHER APPALACHIAN REGION COALS.

Comparison of geometric means of the ultimate and proximate analyses (table 4), shows moisture, volatile matter, hydrogen, and oxygen contents to be lower in Maryland coals than in other Appalachian coals. The fixed carbon and ash contents are higher in the Maryland coals. The geometric means for carbon, nitrogen, and sulfur in the Maryland coals are within the same range as these means for other Appalachian coals. The free-swelling index of the average Maryland coals is significantly higher than that of the average Appalachian region coal.

The data on the fixed-carbon and volatile matter contents indicate that coals in Maryland are higher in rank than the average Appalachian region coal. The rank of coals of the Appalachian region increases in

Table 2. -- Average content (in parts per million) of 30 elements in shale and in the Earth's crust compared with the contents of these elements in 45 Maryland coal samples

	Geometric mean from Maryland coal samples	Shale, average (Turekian and Wedepohl, 1961)	Earth's crust, average (Taylor, 1964)
Ag	0.08	0.07	0.07
As	12	13	1.8
B	12	100	10
Ba	64	580	425
Be	1.8	3	2.8
Cd	.11	.3	.2
Ce	23	59	60
Co	7.7	19	25
Cr	26	90	100
Cu	12	45	55
F	84	740	625
Ga	8	19	15
Ge	2.1	1.6	1.5
Hg	.26	.4	.08
La	13	92	30
Li	23	66	20
Mn	15	850	950
Mo	2.5	2.6	1.5
Ni	15	68	75
Pb	9	20	75
Sb	.73	1.5	.2
Sc	5.4	13	22
Se	2.9	.6	.05
Sr	52	300	375
U	1.3	3.7	2.7
V	24	130	135
Y	16	26	33
Yb	1	2.6	3.0
Zn	24	95	70
Zr	17	160	165

general in a southeasterly direction. Coals collected from the southeastern part of the Appalachian basin in western Maryland are on structural strike with those of the Broad Top field of Pennsylvania, which are also of low-volatile bituminous rank (Trumbull, 1960).

A review of the geometric means (table 5a) shows that ash and the 11 major and minor oxide concentrations in the Maryland coals is similar to other coals in the Appalachian region.

Geometric means for the trace elements Hg is the only element that is two times higher in the Maryland coals than in other Appalachian region coals, no elements are two times lower in concentration. All of the other trace elements are similar in concentration for Maryland coals and other Appalachian region coals.

After all the Maryland data were reviewed, the stratigraphic and areal distributions of the samples were considered for additional interpretation. Too few samples were collected from individual beds to justify studies of a stratigraphic nature.

In order to study the areal distribution, the samples were grouped by basins: 1. Georges Creek and Upper Potomac basins; 2. Castleman basin, and 3. Upper and Lower Youghiogheny basins. A review of the data for coal samples from the three basins shows that the ash and oxide contents do not show significant differences.

According to the DOE Coal Analysis Section data, the Youghiogheny basins have the lowest BTU, ash deformation, and hydrogen, carbon, and nitrogen concentrations and have the highest ash concentration. The Castleman basin has the highest BTU, ash-fusion temperature, free-swelling index, and volatile matter, hydrogen, and sulfur contents; and the lowest moisture and oxygen contents. The Georges Creek basin and Upper Potomac

basins have the highest moisture, fixed-carbon, carbon, nitrogen, oxygen, and ash contents and the lowest free-swelling index, and volatile-matter, and sulfur contents.

The variations between basins for most of the analyses are less than 20 percent. Characteristics that have greater than 20 percent difference are free-swelling index and moisture, ash, and sulfur contents. The free-swelling index for the Castleman basin is 8, and that for the Georges Creek and Upper Potomac basins is 4.6. Moisture content in the Castleman basin is 1 percent and in the Georges Creek and Upper Potomac basins, it is 1.7 percent. Ash content is 18.4 percent in the Youghoigheny basins and 11.6 percent in the Georges Creek and Upper Potomac basins. Sulfur content is 1 percent in the Georges Creek and Upper Potomac basins and 2.1 percent in the Castleman basin. All the coals are medium- to low-volatile bituminous in rank.

The trace element concentrations of coal from the three groups of basins are similar. Six elements have concentrations that are two times higher between basins. Arsenic has geometric means of 5.9 ppm in the Georges Creek and Upper Potomac basins, 18 ppm in the Castleman basin, and 21 ppm in the Youghiogheny basins. Germanium has geometric means of 1.2 ppm in the Georges Creek and Upper Potomac basins, 3 ppm in the Youghiogheny basins, and 3.9 ppm in the Castleman basin. The geometric means of Hg are 0.12 ppm in the Georges Creek and Upper Potomac basins, 0.34 ppm in the Castleman basins and 0.55 ppm in the Youghiogheny basins. The geometric means of Mn are very similar in the Georges Creek and Upper Potomac basins (19 ppm) and in the Youghiogheny basins (20 ppm), but the geometric mean of Mn is lower in the Castleman basin (9 ppm). The geometric means of Sb are lowest in the Youghiogheny basins (0.09 ppm), higher in the Georges Creek basin and Upper Potomac basins (0.61 ppm),

and highest in the Castleman basin (0.76 ppm). The geometric means of Se are highest in the Youghiogheny basins (4.2 ppm), lower in the Castleman basin (3.3 ppm), and lowest in the Georges Creek and Upper Potomac basin (2 ppm).

An examination of the preceding data shows that Hg, Se, and S contents decrease significantly in a southeast direction. This is the same direction of increasing metamorphism of the coal. Probably because these elements either are volatile or can form volatile compounds, they were lost from the coal as a result of thermal processes that increased the metamorphic rank of these coals.

Table 3.--Descriptions for 45 coal samples from Maryland. Eighteen samples are bench samples (indicated by the letter "B" following the designation of sample type); these represent 5 complete channel samples from 4 coal beds; numbers may not be consecutive but are numbered from the top bench down.

Sample no.	State	County	Latitude	Longitude	Formation	Coal Bed	Rank	Sample type	Sampled thickness (inches)	Basin*
w189015	Maryland	Allegany	393635n	785607w	Waynesburg	Waynesburg	Bit	Channel	26.0	GC
w189014	Maryland	Allegany	393116n	785935w	Pittsburgh	Sewickley	Bit	Channel	40.0	GC
w189016	Maryland	Allegany	393556n	785635w	Pittsburgh	Sewickley	Bit	Channel	32.0	GC
w189011	Maryland	Allegany	393615n	785529w	Pittsburgh	Redstone	Bit	Channel	83.0	GC
w189012	Maryland	Allegany	393615n	785529w	Pittsburgh	Pittsburgh	Bit	Channel	112.0	GC
w189013	Maryland	Allegany	393008n	790114w	Casselman	Little Pittsburgh	Bit	Channel	24.0	GC
w189010	Maryland	Garrett	392209n	791642w	Glenshaw	Harlem	Bit	Channel	20.0	UP
w189005	Maryland	Garrett	393049n	790255w	Glenshaw	Bakerstown	Bit	Channel	54.0	GC
w189006	Maryland	Garrett	394027n	792441w	Glenshaw	Bakerstown	Bit	Channel	31.0	LY
w194468	Maryland	Garrett	393745n	792802w	Glenshaw	Bakerstown	Bit	Channel	23.0	C
w194474	Maryland	Garrett	393454n	791702w	Glenshaw	Bakerstown	Bit	Channel	28.0	UP
w195563	Maryland	Garrett	392408n	792652w	Glenshaw	Bakerstown	Bit	Channel-B	22.0	UY
w195564	Maryland	Garrett	392408n	792652w	Glenshaw	Bakerstown	Bit	Channel-B	15.0	UY
w189008	Maryland	Garrett	391854n	792315w	Glenshaw	Lower Bakerstown	Bit	Channel	48.0	UP
w189009	Maryland	Garrett	392215n	791722w	Glenshaw	Lower Bakerstown	Bit	Channel	56.0	UP
w194469	Maryland	Garrett	393916n	792726w	Glenshaw	Brush Creek	Bit	Channel-B	20.0	LY
w195565	Maryland	Garrett	393916n	792726w	Glenshaw	Brush Creek	Bit	Channel-B	24.0	LY
w195566	Maryland	Garrett	393916n	792726w	Glenshaw	Brush Creek	Bit	Channel-B	22.0	LY
w195567	Maryland	Garrett	393916n	792726w	Glenshaw	Brush Creek	Bit	Channel-B	18.0	LY
w193854	Maryland	Garrett	393522n	791713w	Freeport	Upper Freeport Rider	Bit	Channel	14.0	C
w188873	Maryland	Garrett	391833n	792340w	Freeport	Upper Freeport	Bit	Channel-B	24.0	UP
w188874	Maryland	Garrett	391833n	792340w	Freeport	Upper Freeport	Bit	Channel-B	15.0	UP
w188875	Maryland	Garrett	391833n	792340w	Freeport	Upper Freeport	Bit	Channel-B	18.0	UP
w188876	Maryland	Garrett	391833n	792340w	Freeport	Upper Freeport	Bit	Channel-B	19.0	UP
w188877	Maryland	Garrett	393522n	791721w	Freeport	Upper Freeport	Bit	Channel	13.0	C
w188878	Maryland	Garrett	392750n	792432w	Freeport	Upper Freeport	Bit	Channel	24.0	UY
w189007	Maryland	Garrett	394009n	791119w	Freeport	Upper Freeport	Bit	Channel	29.0	C
w193853	Maryland	Garrett	393522n	791713w	Freeport	Upper Freeport	Bit	Channel	5.0	C
w193855	Maryland	Garrett	393628n	791609w	Freeport	Upper Freeport	Bit	Channel	22.0	C
w193856	Maryland	Garrett	393434n	791730w	Freeport	Upper Freeport	Bit	Channel	36.5	C
w193857	Maryland	Garrett	393733n	792735w	Freeport	Upper Freeport	Bit	Channel	19.0	LY
w194471	Maryland	Garrett	393305n	791738w	Freeport	Upper Freeport	Bit	Channel	74.0	C
w194472	Maryland	Garrett	393625n	791612w	Freeport	Upper Freeport	Bit	Channel	20.0	C
w194473	Maryland	Garrett	393253n	791706w	Freeport	Upper Freeport	Bit	Channel	20.0	C
w195568	Maryland	Garrett	393454n	791702w	Freeport	Upper Freeport	Bit	Channel-B	21.0	C

Table 3.--Descriptions for 45 coal samples from Maryland--continued

Sample no.	State	County	Latitude	Longitude	Formation	Coal Bed	Rank	Sample type	Sampled thickness (inches)	Basin*
w195569	Maryland	Garrett	393454n	791702w	Freeport	Upper Freeport	Bit	Channel-B	26.0	C
w195570	Maryland	Garrett	393454n	791702w	Freeport	Upper Freeport	Bit	Channel-B	22.0	C
w195571	Maryland	Garrett	393454n	791702w	Freeport	Upper Freeport	Bit	Channel-B	18.0	C
w188871	Maryland	Garrett	392406n	792702w	Kittanning	Upper Kittanning	Bit	Channel	44.0	UY
w188872	Maryland	Garrett	392520n	792558w	Kittanning	Upper Kittanning	Bit	Channel	16.0	UY
w194467	Maryland	Garrett	392408n	792652w	Kittanning	Kittanning	Bit	Channel-B	28.0	UY
w194466	Maryland	Garrett	392705n	791049w	Kittanning	Kittanning	Bit	Channel	43.0	UP
w195560	Maryland	Garrett	392705n	791049w	Kittanning	Kittanning	Bit	Channel-B	24.0	UP
w195561	Maryland	Garrett	392705n	791049w	Kittanning	Kittanning	Bit	Channel-B	18.0	UP
w195562	Maryland	Garrett	392705n	791049w	Kittanning	Kittanning	Bit	Channel-B	26.0	UP

* Basin abbreviations: GC, Georges Creek; UP, Upper Potomac; C, Castleman; UY, Upper Youghiogheny; LY, Lower Youghiogheny

able 4.-- Arithmetic mean, observed range, geometric mean, and geometric deviation of proximate and ultimate analyses, heat of combustion, forms of sulfur, and ash-fusion temperatures of 32 coal samples from Maryland.

[For comparison, geometric means for 158 and 491 bituminous coal samples from the Appalachian region are included (Swanson and others, 1976; Zubovic and others, 1979). All values are in percent except heats of combustion, free-swelling indexes, and ash-fusion temperatures and are reported on the as-received basis. Leaders (---) indicate no data available]

	Arithmetic Mean	Observed range		Geometric mean	Geometric deviation	Appalachian Region	
		Minimum	Maximum			Geometric mean 158 samples	Geometric mean 491 samples
Proximate and ultimate analyses							
isture	2.0	.6	22.2	1.4	1.9	2.4	3.3
latile matter	20.5	13.6	27.2	20.3	1.2	30.8	31.9
ixed carbon	61.5	42.8	73.6	61	1.1	53.7	52.2
sh	16	5.7	39.3	14	1.7	9.2	8.8
ydrogen	4.3	3.2	4.9	4.3	1.1	4.9	5.5
rbon	70.9	48.6	81.7	70.3	1.1	72.0	70.5
trogen	1.3	.8	2.3	1.3	1.2	1.3	1.3
xygen	5.7	2.9	32.2	4.9	1.6	7.2	9.3
lfur	1.2	.4	4.4	1.5	1.9	1.6	1.5
Heat of combustion (in Btu/lb)							
	12,400	8,400	14,300	13,330	1.1	12,800	12,590
Forms of sulfur							
lfate	.06	.01	.22	.03	2.7	.05	.07
ritic	1.1	.01	3.1	.56	4.6	.60	.65
ganic	.65	.29	1.5	.61	1.5	.66	.80
Ash-fusion temperature (in °C)							
itial deformation	1340	1060	1565	1330	1.1	--	1,300
ftening temperature	1365	1100	1565	1360	1.1	--	1,300
luid temperature	1400	1180	1590	1400	1.1	--	1,340
Free-swelling index							
	6.8	.5	9	5.5	2.3	--	2.3

ble 5a.-- Arithmetic mean, observed range, geometric mean, and geometric deviation of ash content and contents of 11 major and minor oxides in the laboratory ash of 33 coal samples from Maryland.

[For comparison, geometric means of 331 and 617 bituminous coal samples from the Appalachian region are included (Swanson and others, 1976; Zubovic and others, 1979). All samples were ashed at 525°C; all data except geometric deviation are in percent]

ide	Arithmetic mean	Observed range		Geometric mean	Geometric deviation	Appalachian region	
		Minimum	Maximum			Geometric mean 331 samples	Geometric mean 617 samples
sh)	16.5	3.7	39.5	14.3	1.7	11	9.5
O_2	48	28	61	47	1.2	39	42
$_2O_3$	25	16	32	24	1.2	22	23
0	1.1	.23	6.3	.82	2.1	1.2	1.3
0	.76	.36	1.3	.73	1.3	.80	.78
$_2O$	.32	.05	1.5	.26	1.9	.30	.44
0	2.2	.54	3.9	2	1.5	1.5	1.6
$_2O_3$	15	2.8	41	12	1.9	14	11.2
0	.02	.003	.12	.01	2.3	.05	.02
O_2	1.3	.74	2	1.3	1.3	1.1	1.1
O_5	.46	.08	1.9	.3	2.5	---	.17
3	1.7	.4	9.8	1.3	2.0	1.2	2

Table 5b.--Arithmetic mean, observed range, geometric mean, and geometric deviation of concentrations of 36 trace elements in Maryland coal samples.

[For comparison, geometric means for 331 and 617 bituminous coal samples from the Appalachian region are included (Swanson and others, 1976; Zubovic and others, 1979). All analyses are in parts per million and are reported on a whole-coal basis; 18 elements whose contents are reported in table 8 were determined directly on whole coal. All other values were determined on coal ash and then converted to whole-coal values; then statistics were calculated on a whole-coal basis]

Number of samples	Arithmetic mean	Observed range		Geometric mean	Geometric deviation	Appalachian region	
		Minimum	Maximum			Geometric mean 331	Geometric mean 617
24	0.1	0.04	0.33	0.08	1.7		0.05
45	21	.82	90	12	3.2	11	7.4
33	16	.55	58	12	2.6	20	21
33	95	7.3	460	64	2.6	70	56
33	2	.22	3.8	1.8	1.7	2	2.4
30	.13	.04	.35	.11	1.7	.3	.08
45	26	7	54	23	1.6		15
45	9.2	2.3	23	7.7	1.8	5	5.5
45	28	9.7	49	26	1.5	15	14
45	1.8	.2	4.8	1.4	2.1		.75
33	15	3.3	56	12	2	16	14
45	.5	.13	.96	.46	1.5		.31
32	100	26	280	84	1.8	60	64
33	9.4	1.4	20	8	1.8	7	5.1
28	3.5	.35	13	2.1	2.8		2.9
45	1.2	.4	2.3	1.1	1.7		.65
45	.46	.01	1.6	.26	3.5	.14	.1
45	14	4	29	13	1.6		7.8
33	30	5.7	95	23	2.2	19	12
45	.19	.1	.4	.17	1.5		.14
33	30	2	370	15	2.7		14
33	3.3	.42	15	2.5	2.2	2	1.8
33	18	2.6	100	15	1.8	15	12
33	12	1.7	32	9	2.1	11	5.9
45	1.4	.2	28	.73	2.3	.8	.69
45	5.9	2.1	12	5.4	1.5	3	3.1
44	3.8	.7	14	2.9	2.1	3.5	2.9
42	3.4	.8	12	2.8	1.9		1.5
33	9.	9	945	52	2.5	70	57
45	.38	.1	.9	.35	1.6		.26
33	1.5	.4	3.2	1.3	1.7	1	1.2
33	28	3.7	79	24	1.9	20	17
33	7.2	1.1	16	6.1	1.8	7	7.2
45	1.1	.4	2.3	1	1.5	.7	.74
33	29	6.5	94	24	1.9	13	13
33	2.	2.8	65	17	2	30	20

Table 6.--Proximate and ultimate analyses and heat-of-combustion, forms-of-sulfur, free-swelling-index, and ash-fusion-temperature determinations for 32 coal samples from Maryland.

[All analyses except heats of combustions, free-swelling-indexes and ash-fusion temperatures in percent. For each sample number, the analyses are reported three ways: first, as received; second, moisture free; and third, moisture and ash free. All analyses by Coal Analysis Section, Department of Energy, Pittsburgh, Pa. 1600G for ash-fusion teperatures means greater than 1600 C.]

	Proximate Analysis				Ultimate Analysis					Heat of Combustion	
Sample number	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Kcal/kg	Btu/lb
w188871	2.0	22.0	67.8	8.2	4.6	77.4	1.2	7.9	0.7	7,490	13,470
	---	22.4	69.2	8.4	4.5	79.0	1.2	6.2	.7	7,640	13,750
	---	24.5	75.5	---	4.9	86.2	1.3	6.8	.8	8,340	15,010
w188872	2.1	24.5	52.6	20.8	4.3	64.5	1.1	8.8	.5	6,240	11,230
	---	25.0	53.7	21.2	4.2	65.9	1.1	7.1	.5	6,370	11,470
	---	31.8	68.2	---	5.3	83.7	1.4	9.0	.6	8,090	14,570
w188873	1.1	18.3	64.3	16.3	4.3	72.9	.8	4.5	1.2	7,050	12,690
	---	18.5	65.0	16.5	4.2	73.7	.8	3.6	1.2	7,130	12,830
	---	22.2	77.8	---	5.1	88.3	1.0	4.3	1.5	8,540	15,360
w188874	1.1	22.9	67.3	8.7	4.7	78.6	1.4	4.1	2.5	7,720	13,900
	---	23.2	68.0	8.8	4.6	79.5	1.4	3.2	2.5	7,810	14,050
	---	25.4	74.6	---	5.1	87.1	1.6	3.5	2.8	8,560	15,410
w188875	1.0	23.3	66.2	9.5	4.8	78.6	1.1	4.7	1.3	7,740	13,940
	---	23.5	66.9	9.6	4.7	79.4	1.1	3.8	1.3	7,820	14,080
	---	26.0	74.0	---	5.2	87.8	1.2	4.3	1.5	8,650	15,580
w188876	1.1	22.4	69.2	7.3	4.7	80.0	2.3	4.0	1.7	7,840	14,110
	---	22.6	70.0	7.4	4.6	80.9	2.3	3.1	1.7	7,930	14,270
	---	24.5	75.5	---	5.0	87.3	2.5	3.3	1.9	8,560	15,400
w188877	.7	22.3	54.3	22.7	4.1	65.7	1.0	2.9	3.6	6,510	11,720
	---	22.5	54.7	22.9	4.1	66.2	1.0	2.3	3.6	6,560	11,800
	---	29.1	70.9	---	5.3	85.8	1.3	3.0	4.7	8,500	15,300
w188878	.9	20.9	56.0	22.2	4.1	64.9	1.2	3.2	4.4	6,410	11,540
	---	21.1	56.5	22.4	4.0	65.5	1.2	2.4	4.4	6,470	11,640
	---	27.2	72.8	---	5.2	84.4	1.6	3.1	5.7	8,340	15,010
w189005	2.0	15.9	42.8	39.3	3.2	48.6	.8	7.3	.8	4,670	8,400
	---	16.2	43.7	40.1	3.0	49.6	.8	5.6	.8	4,760	8,570
	---	27.1	72.9	---	5.1	82.8	1.4	9.4	1.4	7,950	14,310
w189006	.7	23.2	51.2	24.9	4.1	63.7	1.4	3.4	2.5	6,230	11,220
	---	23.4	51.6	25.1	4.1	64.1	1.4	2.8	2.5	6,280	11,300
	---	31.2	68.8	---	5.4	85.6	1.9	3.7	3.4	8,380	15,080
w189007	.7	21.5	64.0	13.8	4.5	75.3	1.3	3.7	1.4	7,330	13,190
	---	21.7	64.5	13.9	4.5	75.8	1.3	3.1	1.4	7,380	13,280
	---	25.1	74.9	---	5.2	88.1	1.5	3.6	1.6	8,570	15,430

Table 6.--Proximate and ultimate analyses and heat-of-combustion, forms-of-sulfur, free-swelling-index, and ash-fusion-temperature determinations for 32 coal samples from Maryland.

Sample number	Air-dried loss	Forms of sulfur			Free swelling index	Ash fusion temperature, C		
		Sulfate	Pyritic	Organic		Initial deformation	Softening	Fluid
w188871	0.0	0.01	0.02	0.65	3.8	1,600	1,600G	1,600G
	---	.01	.02	.66				
	---	.01	.02	.72				
w188872	.0	.02	.15	.31	1.0	1,470	1,520	1,600
	---	.02	.15	.32				
	---	.03	.19	.40				
w188873	.0	.01	.60	.61	8.0	1,540	1,600	1,600G
	---	.01	.61	.62				
	---	.01	.73	.74				
w188874	.0	.10	1.91	.51	9.0	1,060	1,105	1,270
	---	.10	1.93	.52				
	---	.11	2.12	.57				
w188875	.0	.02	.76	.53	9.0	1,355	1,380	1,410
	---	.02	.77	.54				
	---	.02	.85	.59				
w188876	.0	.22	.79	.71	9.0	1,130	1,165	1,205
	---	.22	.80	.72				
	---	.24	.86	.78				
w188877	.0	.07	2.71	.86	4.0	1,165	1,180	1,200
	---	.07	2.73	.87				
	---	.09	3.54	1.12				
w188878	.0	.20	3.06	1.11	9.0	1,110	1,165	1,220
	---	.20	3.09	1.12				
	---	.26	3.98	1.44				
w189005	.0	.08	.28	.41	.50	1,600	1,600G	1,600G
	---	.08	.29	.42				
	---	.14	.48	.70				
w189006	.0	.11	1.82	.54	7.5	1,295	1,320	1,450
	---	.11	1.83	.54				
	---	.15	2.45	.73				
w189007	1.5	.00	.78	.64	9.0	1,495	1,515	1,540
	---	.00	.79	.64				
	---	.00	.91	.75				

Table 6.--Proximate and ultimate analyses and heat-of-combustion, forms-of-sulfur, free-swelling-index, and ash-fusion-temperature determinations for 32 coal samples from Maryland.

Sample number	Proximate Analysis				Ultimate Analysis					Heat of Combustion	
	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Kcal/kg	Btu/lb
w189008	3.5	19.7	62.4	14.4	4.2	70.1	1.5	9.4	0.4	6,700	12,060
	---	20.4	64.7	14.9	3.9	72.6	1.6	6.5	.4	6,940	12,500
	---	24.0	76.0	---	4.6	85.4	1.8	7.7	.5	8,160	14,690
w189009	1.0	16.7	67.6	14.7	4.1	74.8	1.4	4.0	1.0	7,200	12,960
	---	16.9	68.3	14.8	4.0	75.6	1.4	3.1	1.0	7,270	13,090
	---	19.8	80.2	---	4.7	88.7	1.7	3.7	1.2	8,540	15,370
w189010	.7	20.3	68.3	10.7	4.4	77.7	1.4	3.1	2.7	7,580	13,640
	---	20.4	68.8	10.8	4.4	78.2	1.4	2.5	2.7	7,630	13,740
	---	22.9	77.1	---	4.9	87.7	1.6	2.8	3.0	8,550	15,400
w189011	1.4	15.7	57.2	25.7	3.7	62.5	1.4	4.6	2.1	6,060	10,900
	---	15.9	58.0	26.1	3.6	63.4	1.4	3.4	2.1	6,140	11,050
	---	21.5	78.5	---	4.9	85.7	1.9	4.6	2.9	8,310	14,950
w189012	1.9	17.2	73.6	7.3	4.5	81.0	1.8	4.4	1.0	7,770	13,980
	---	17.5	75.0	7.4	4.4	82.6	1.8	2.8	1.0	7,920	14,250
	---	18.9	81.1	---	4.7	89.2	2.0	3.0	1.1	8,550	15,400
w189013	1.4	19.0	72.9	6.7	4.5	81.0	1.7	4.8	1.3	7,840	14,110
	---	19.3	73.9	6.8	4.4	82.2	1.7	3.6	1.3	7,950	14,310
	---	20.7	79.3	---	4.7	88.1	1.8	3.9	1.4	8,530	15,350
w189014	1.5	21.2	64.5	12.8	4.1	74.5	1.6	6.0	1.0	7,090	12,760
	---	21.5	65.5	13.0	4.0	75.6	1.6	4.7	1.0	7,200	12,950
	---	24.7	75.3	---	4.6	86.9	1.9	5.4	1.2	8,270	14,890
w189015	1.3	20.1	66.0	12.6	4.4	76.0	1.7	4.5	.8	7,400	13,320
	---	20.4	66.9	12.8	4.3	77.0	1.7	3.4	.8	7,500	13,500
	---	23.3	76.7	---	4.9	88.3	2.0	3.9	.9	8,590	15,470
w189016	2.1	19.3	72.9	5.7	4.6	81.7	1.8	5.2	1.0	7,940	14,300
	---	19.7	74.5	5.8	4.5	83.5	1.8	3.4	1.0	8,110	14,610
	---	20.9	79.1	---	4.7	88.6	2.0	3.6	1.1	8,620	15,510
w193853	1.3	23.3	66.7	8.7	4.9	78.5	1.4	3.9	2.6	7,800	14,040
	---	23.6	67.6	8.8	4.8	79.5	1.4	2.8	2.6	7,900	14,220
	---	25.9	74.1	---	5.3	87.2	1.6	3.0	2.9	8,660	15,600
w193855	1.3	25.4	65.7	7.6	4.9	80.4	1.5	4.3	1.3	7,950	14,310
	---	25.7	66.6	7.7	4.8	81.5	1.5	3.2	1.3	8,050	14,500
	---	27.9	72.1	---	5.2	88.3	1.6	3.5	1.4	8,730	15,710
w193856	2.9	20.7	55.5	20.9	4.2	65.4	1.1	6.1	2.2	6,440	11,590
	---	21.3	57.2	21.5	4.0	67.4	1.1	3.6	2.3	6,630	11,940
	---	27.2	72.8	---	5.1	85.8	1.4	4.6	2.9	8,450	15,220

Table 6.--Proximate and ultimate analyses and heat-of-combustion, forms-of-sulfur, free-swelling-index, and ash-fusion-temperature determinations for 32 coal samples from Maryland.

Sample number	Air-dried loss	Forms of sulfur			Free swelling index	Ash fusion temperature, C		
		Sulfate	Pyritic	Organic		Initial deformation	Softening	Fluid
w189008	1.4	0.00	0.01	0.43	1.5	1,600	1,600G	1,600G
	---	.00	.01	.45				
	---	.00	.01	.52				
w189009	2.5	.04	.51	.44	7.5	1,505	1,530	1,600
	---	.04	.52	.44				
	---	.05	.60	.52				
w189010	.0	.00	1.22	1.46	9.0	1,165	1,195	1,320
	---	.00	1.23	1.47				
	---	.00	1.38	1.65				
w189011	1.0	.00	1.16	.98	4.0	1,360	1,415	1,590
	---	.00	1.18	.99				
	---	.00	1.59	1.34				
w189012	1.3	.04	.08	.88	4.5	1,600	1,600G	1,600G
	---	.04	.08	.90				
	---	.04	.09	.97				
w189013	2.0	.01	.15	1.13	7.5	1,565	1,600	1,600G
	---	.01	.15	1.15				
	---	.01	.16	1.23				
w189014	1.5	.02	.11	.85	.50	1,295	1,320	1,420
	---	.02	.11	.86				
	---	.02	.13	.99				
w189015	1.9	.04	.05	.73	9.0	1,600	1,600G	1,600G
	---	.04	.05	.74				
	---	.05	.06	.85				
w189016	2.5	.09	.13	.82	9.0	1,500	1,525	1,600
	---	.09	.13	.84				
	---	.10	.14	.89				
w193853	.7	.06	2.16	.42	9.0	1,235	1,295	1,360
	---	.06	2.19	.43				
	---	.07	2.40	.47				
w193855	.5	.03	.64	.66	9.0	1,475	1,540	1,540
	---	.03	.65	.67				
	---	.03	.70	.72				
w193856	2.0	.14	1.70	.35	8.0	1,425	1,485	1,540
	---	.14	1.75	.36				
	---	.18	2.23	.46				

Table 6.--Proximate and ultimate analyses and heat-of-combustion, forms-of-sulfur, free-swelling-index, and ash-fusion-temperature determinations for 32 coal samples from Maryland.

Sample number	Proximate Analysis				Ultimate Analysis					Heat of Combustion	
	Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur	Kcal/kg	Btu/lb
w193857	1.5	27.2	63.1	8.2	4.9	78.3	1.4	4.4	2.8	7,810	14,060
	---	27.6	64.1	8.3	4.8	79.5	1.4	3.1	2.8	7,930	14,270
	---	30.1	69.9	---	5.2	86.7	1.6	3.4	3.1	8,650	15,570
w194466	22.2	13.6	55.5	8.7	4.8	52.9	1.1	32.2	.4	4,710	8,480
	---	17.5	71.3	11.2	3.0	68.0	1.4	16.0	.5	6,050	10,900
	---	19.7	80.3	---	3.4	76.6	1.6	18.0	.6	6,820	12,270
w194467	.8	15.7	60.8	22.7	3.7	66.3	1.0	3.0	3.3	6,450	11,610
	---	15.8	61.3	22.9	3.6	66.8	1.0	2.3	3.3	6,500	11,710
	---	20.5	79.5	---	4.7	86.7	1.3	3.0	4.3	8,430	15,180
w194468	1.7	20.2	48.8	29.3	3.8	57.4	.8	5.5	3.2	5,630	10,140
	---	20.5	49.6	29.8	3.7	58.4	.8	4.1	3.3	5,730	10,310
	---	29.3	70.7	---	5.2	83.2	1.2	5.8	4.6	8,160	14,690
w194469	1.0	21.7	51.8	25.5	4.0	62.0	1.1	5.3	2.1	6,140	11,060
	---	21.9	52.3	25.8	3.9	62.6	1.1	4.5	2.1	6,210	11,170
	---	29.5	70.5	---	5.3	84.4	1.5	6.0	2.9	8,360	15,040
w194471	.6	18.6	55.4	25.4	3.9	63.1	1.3	3.4	3.1	6,230	11,220
	---	18.7	55.7	25.6	3.9	63.5	1.3	2.9	3.1	6,270	11,280
	---	25.1	74.9	---	5.2	85.3	1.8	3.9	4.2	8,420	15,160
w194472	.8	22.1	56.1	21.0	4.4	67.4	1.2	3.6	2.4	6,670	12,000
	---	22.3	56.6	21.2	4.3	67.9	1.2	2.9	2.4	6,720	12,090
	---	28.3	71.7	---	5.5	86.2	1.5	3.7	3.1	8,520	15,340
w194473	.9	20.2	60.5	18.4	4.2	70.1	1.3	4.9	1.2	6,880	12,380
	---	20.4	61.0	18.6	4.1	70.7	1.3	4.1	1.2	6,940	12,500
	---	25.0	75.0	---	5.1	86.9	1.6	5.1	1.5	8,530	15,350
w194474	1.1	21.8	66.6	10.5	4.8	76.6	1.5	4.2	2.4	7,560	13,610
	---	22.0	67.3	10.6	4.7	77.5	1.5	3.3	2.4	7,640	13,760
	---	24.7	75.3	---	5.3	86.7	1.7	3.6	2.7	8,550	15,390

Table 6.--Proximate and ultimate analyses and heat-of-combustion, forms-of-sulfur, free-swelling-index, and ash-fusion-temperature determinations for 32 coal samples from Maryland.

Sample number	Air-dried loss	Forms of sulfur			Free swelling index	Ash fusion temperature, C		
		Sulfate	Pyritic	Organic		Initial deformation	Softening	Fluid
w193857	0.7	0.04	2.08	0.67	9.0	1,065	1,120	1,175
	---	.04	2.11	.68				
	---	.04	2.30	.74				
w194466	13.0	.01	.10	.29	.0	1,345	1,400	1,455
	---	.01	.13	.37				
	---	.01	.14	.42				
w194467	.1	.01	2.97	.35	4.0	1,375	1,430	1,480
	---	.01	2.99	.35				
	---	.01	3.88	.46				
w194468	.5	.12	2.50	.54	5.0	1,405	1,455	1,505
	---	.12	2.54	.55				
	---	.17	3.62	.78				
w194469	.0	.03	1.16	.87	9.0	1,345	1,405	1,455
	---	.03	1.17	.88				
	---	.04	1.58	1.18				
w194471	.1	.01	2.62	.43	8.0	1,370	1,430	1,480
	---	.01	2.64	.43				
	---	.01	3.54	.58				
w194472	.1	.01	1.94	.45	9.0	1,325	1,380	1,435
	---	.01	1.96	.45				
	---	.01	2.48	.58				
w194473	.1	.01	.56	.59	9.0	1,515	1,540	1,540
	---	.01	.57	.60				
	---	.01	.69	.73				
w194474	.2	.03	1.69	.68	9.0	1,265	1,320	1,370
	---	.03	1.71	.69				
	---	.03	1.91	.77				

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland..
[Values in percent or parts-per-million. Coal ashed at 525 C. L means less than the value shown; N, not detected; B, not determined; S, after element title indicates determinations by automatic plate reading computer assisted, emission spectographic analyses. The standard deviation of any single answer should be taken as plus 50% and minus 35%. Methods of analyses for other elements as shown in figure 1.]

Sample number	Ash (percent)	SiO2 (percent)	Al2O3 (percent)	CaO (percent)	MgO (percent)	Na2O (percent)	K2O (percent)	Fe2O3 (percent)	TiO2 (percent)	P2O5 (percent)	Sample number
w189015	13.0	61	28	0.24	0.71	0.09	3.1	3.1	1.4	1.0L	w189015
w189014	12.6	57	22	.37	.83	.34	2.8	14	1.1	1.0L	w189014
w189016	5.7	54	27	.48	.75	.10	2.5	9.1	1.3	1.0L	w189016
w189011	27.8	54	24	1.0	.56	.30	2.4	8.6	1.3	1.9	w189011
w189012	7.4	55	32	.46	.58	.81	2.1	6.3	1.8	1.0L	w189012
w189013	7.1	48	31	.69	.73	.32	2.3	13	1.2	1.0L	w189013
w189010	10.4	40	20	1.7	1.2	.62	1.8	25	.87	1.0L	w189010
w189005	39.5	50	28	.23	.98	.35	3.9	8.1	1.1	1.0L	w189005
w189006	23.7	49	22	.28	1.0	.24	2.7	16	.99	1.0L	w189006
w194468	29.7	47	28	.43	.85	.18	2.6	14	1.5	.17	w194468
w194474	28.2	58	23	.88	.45	.05	1.6	8.5	1.9	.19	w194474
w195563	B	B	B	B	B	B	B	B	B	B	w195563
w195564	B	B	B	B	B	B	B	B	B	B	w195564
w189008	14.5	56	29	.97	.83	.26	2.1	2.8	1.5	1.0L	w189008
w189009	14.3	56	27	1.3	.80	.28	1.6	6.8	1.8	1.0L	w189009
w194469	22.5	54	20	.93	1.3	.24	2.7	12	1.2	.17	w194469
w195565	B	B	B	B	B	B	B	B	B	B	w195565
w195566	B	B	B	B	B	B	B	B	B	B	w195566
w195567	B	B	B	B	B	B	B	B	B	B	w195567
w193854	20.4	46	21	.94	.65	.20	2.5	24	1.3	.41	w193854
w188873	17.3	57	23	.40	.63	.31	2.4	8.2	1.7	1.0L	w188873
w188874	10.7	28	16	1.1	.53	.30	.85	37	.74	1.0L	w188874
w188875	13.4	45	26	.67	.83	.62	2.8	18	1.3	1.0L	w188875
w188876	7.8	36	24	2.9	.68	.28	1.3	23	.86	1.1	w188876
w188877	18.0	43	21	.70	.70	.23	2.1	24	1.2	1.0L	w188877
w188878	24.4	40	20	.34	.65	.23	1.7	28	1.1	1.0L	w188878
w189007	11.7	46	27	.95	.80	.26	2.1	9.5	1.3	1.0L	w189007
w193853	10.4	30	19	1.4	.41	.19	1.0	41	.77	.12	w193853
w193855	8.0	48	27	1.8	.66	.31	2.2	12	1.3	.33	w193855
w193856	27.9	58	27	.61	.68	.16	2.0	11	2.0	.12	w193856
w193857	9.5	33	16	1.7	.36	.23	.85	40	1.0	.09	w193857
w194471	3.7	41	21	1.8	.65	1.5	.54	23	1.1	.76	w194471
w194472	26.9	53	29	.94	.73	.20	2.9	6.3	1.4	.63	w194472
w194473	14.4	51	23	.72	.66	.28	2.6	12	1.4	.38	w194473
w195568	B	B	B	B	B	B	B	B	B	B	w195568
w195569	B	B	B	B	B	B	B	B	B	B	w195569
w195570	B	B	B	B	B	B	B	B	B	B	w195570
w195571	B	B	B	B	B	B	B	B	B	B	w195571
w194467	23.3	47	25	.53	.73	.17	2.5	14	1.8	.08	w194467
w194466	8.9	34	30	6.3	1.3	.15	2.3	6.8	1.3	.43	w194466

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	SO3 (percent)	Ag-S (ppm)	B-S (ppm)	Ba-S (ppm)	Be-S (ppm)	Bi-S (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Sample number
w189015	0.20L	0.46L	140	1,100	15	5L	1.7	130	33	200	w189015
w189014	.65	.46L	140	990	16	5L	1.0	110	22	130	w189014
w189016	.69	.46L	170	340	41	5L	1.1	120	120	200	w189016
w189011	.90	.46L	160	1,700	8.0	5L	.48	130	32	150	w189011
w189012	.87	.50	240	940	11	5L	.74	190	31	220	w189012
w189013	1.1	.71	120	820	18	5L	1.3	180	38	200	w189013
w189010	3.2	.46L	170	550	11	5L	1.0	120	35	120	w189010
w189005	.41	.46L	150	600	7.9	5L	.24	130	59	120	w189005
w189006	.94	.47	120	1,400	8.6	5L	.70	110	29	140	w189006
w194468	.76	.30	59	340	9.0	15L	.52	180	51	150	w194468
w194474	.40	.80	81	270	4.0	15L	.92	43	21	43	w194474
w195563	B	B	B	B	B	B	B	B	B	B	w195563
w195564	B	B	B	B	B	B	B	B	B	B	w195564
w189008	1.5	2.3	110	770	18	5L	.48	160	54	170	w189008
w189009	1.3	.46L	130	820	9.9	5L	.48	170	44	230	w189009
w194469	2.0	.10L	72	460	6.0	15L	.74	120	21	120	w194469
w195565	B	B	B	B	B	B	B	B	B	B	w195565
w195566	B	B	B	B	B	B	B	B	B	B	w195566
w195567	B	B	B	B	B	B	B	B	B	B	w195567
w193854	1.2	.30	55	330	13	22L	.38	130	49	210	w193854
w188873	.51	.58	100	320	15	5L	.50L	140	52	160	w188873
w188874	1.7	.99	35	150	26	5L	1.5	110	220	200	w188874
w188875	1.4	.85	130	430	12	5L	.50L	160	46	200	w188875
w188876	2.8	.56	100	720	17	5L	.70	190	120	120	w188876
w188877	1.3	.94	81	340	16	6	1.3	120	48	200	w188877
w188878	.73	.46	81	280	6.2	5L	.70	110	19	120	w188878
w189007	1.7	.58	110	560	21	5L	1.1	170	91	200	w189007
w193853	2.0	.70	10	95	15	22L	.60	120	63	120	w193853
w193855	3.2	.50	83	240	27	22L	.98	170	61	170	w193855
w193856	.80	.30	93	160	12	22L	.44	130	33	150	w193856
w193857	2.6	1.0	15	77	27	22L	.89	120	210	140	w193857
w194471	2.9	.10L	15	200	6.0	15L	.96	1,100	140	890	w194471
w194472	1.0	.30	68	610	10	15L	.34	130	63	150	w194472
w194473	1.0	.50	57	490	9.0	15L	.94	260	65	230	w194473
w195568	B	B	B	B	B	B	B	B	B	B	w195568
w195569	B	B	B	B	B	B	B	B	B	B	w195569
w195570	B	B	B	B	B	B	B	B	B	B	w195570
w195571	B	B	B	B	B	B	B	B	B	B	w195571
w194467	.57	.30	44	330	8.0	15L	.23	150	59	150	w194467
w194466	9.8	.40	70	950	10	15L	3.9	200	69	220	w194466

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Cs (ppm)	Cu (ppm)	Dy-S (ppm)	Er-S (ppm)	Eu (ppm)	Ga-S (ppm)	Gd-S (ppm)	Ge-S (ppm)	Hf (ppm)	La (ppm)	Sample number
w189015	16	76	15L	4.9	2.2	47	22L	9.6	8.5	77	w189015
w189014	12	76	15L	7.4	2.5	46	22L	3.2L	6.3	63	w189014
w189016	14	82	15L	7.8	2.3	66	22L	13	8.8	70	w189016
w189011	13	62	15L	7.0	2.7	52	22L	3.5	7.2	68	w189011
w189012	9.5	70	32	4.6L	3.0	71	22L	4.7	12	110	w189012
w189013	13	270	15L	4.6L	4.1	62	22L	5.2	8.5	110	w189013
w189010	5.8	62	15L	6.8	2.1	46	22L	11	3.8	67	w189010
w189005	12	100	15L	4.6L	2.2	47	22L	6.9	5.1	73	w189005
w189006	8.9	64	15L	4.6L	2.1	62	22L	53	5.1	55	w189006
w194468	10	190	22L	10L	3.2	59	10	13	7.1	88	w194468
w194474	.7	130	22L	10L	.82	35	7.0L	2.0L	1.8	21	w194474
w195563	B	B	B	B	B	B	B	B	B	B	w195563
w195564	B	B	B	B	B	B	B	B	B	B	w195564
w189008	10	76	19	4.6L	2.4	61	22L	40	6.2	83	w189008
w189009	5.6	82	15L	5.8	3.2	63	22L	21	9.1	100	w189009
w194469	10	74	22L	10L	2.3	44	7.0L	2.0L	5.8	62	w194469
w195565	B	B	B	B	B	B	B	B	B	B	w195565
w195566	B	B	B	B	B	B	B	B	B	B	w195566
w195567	B	B	B	B	B	B	B	B	B	B	w195567
w193854	10	79	32L	10L	2.5	68	7.0L	21	6.4	69	w193854
w188873	12	82	15L	4.6L	2.7	42	22L	4.7	8.7	81	w188873
w188874	3.7	90	15L	7.3	4.4	85	22L	18	3.7	47	w188874
w188875	11	84	15L	4.6L	3.5	96	22L	9.7	6.7	75	w188875
w188876	3.8	62	15L	7.7	3.8	55	22L	5.9	5.1	100	w188876
w188877	7.2	28	15L	9.0	2.7	77	22L	56	6.1	67	w188877
w188878	7.8	54	15L	4.6L	1.9	52	22L	6.5	6.1	66	w188878
w189007	9.4	72	15L	4.6L	3.0	60	22L	5.1	6.8	94	w189007
w193853	4.8	120	32L	10L	3.2	41	15	65	4.8	67	w193853
w193855	8.8	140	32L	10L	3.9	60	8.0	160	7.5	100	w193855
w193856	8.2	96	32L	10L	2.5	52	7.0L	17	7.9	72	w193856
w193857	2.1	96	32L	10L	3.8	58	20	84	5.3	53	w193857
w194471	38	100	22L	10L	17	37	13	2.0L	62	680	w194471
w194472	8.6	98	22L	10L	2.8	58	13	5.0	5.6	71	w194472
w194473	17	150	22L	10L	5.0	51	12	27	9.0	140	w194473
w195568	B	B	B	B	B	B	B	B	B	B	w195568
w195569	B	B	B	B	B	B	B	B	B	B	w195569
w195570	B	B	B	B	B	B	B	B	B	B	w195570
w195571	B	B	B	B	B	B	B	B	B	B	w195571
w194467	12	120	22L	10L	2.6	53	14	5.0	7.7	77	w194467
w194466	9.0	150	22L	10L	5.2	48	18	2.0L	7.9	100	w194466

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Li (ppm)	Lu (ppm)	Mn (ppm)	Mo-S (ppm)	Nb-S (ppm)	Nd-S (ppm)	Ni-S (ppm)	Pb (ppm)	Pr-S (ppm)	Rb (ppm)	Sample number
w189015	280	0.8	80	9.2	15L	68L	130	44	10L	320	w189015
w189014	70	.8	180	19	15L	68L	90	32	10L	150	w189014
w189016	100	2	120	21	15L	68L	190	54	10L	400L	w189016
w189011	170	.7	260	4.9	15L	68L	85	36	10L	210	w189011
w189012	220	1	83	5.6	26	68L	120	60	12	410L	w189012
w189013	360	1	210	47	15L	68L	180	44	10L	320L	w189013
w189010	160	1	320	34	15L	68L	87	32	10L	390L	w189010
w189005	170	.8	930	5.2	15L	68L	250	60	10L	130	w189005
w189006	140	.8	180	17	15L	68L	94	32	10L	110	w189006
w194468	310	1	70	11	13	46L	78	81	68L	160	w194468
w194474	110	.4	53	15	18	46L	50	47	68L	120L	w194474
w195563	B	B	B	B	B	B	B	B	B	B	w195563
w195564	B	B	B	B	B	B	B	B	B	B	w195564
w189008	290	.7	100	100	15L	68L	100	52	10L	100	w189008
w189009	310	.7	110	18	15L	68L	100	44	11	77	w189009
w194469	210	.9	210	5.0	11	46L	61	35	68L	210L	w194469
w195565	B	B	B	B	B	B	B	B	B	B	w195565
w195566	B	B	B	B	B	B	B	B	B	B	w195566
w195567	B	B	B	B	B	B	B	B	B	B	w195567
w193854	100	1	34	16	10	46L	83	52	68L	2	w193854
w188873	120	1	97	5.6	17	68L	110	84	11	170	w188873
w188874	120	2	74	36	15L	68L	240	150	13	190L	w188874
w188875	120	1	81	21	15L	68L	120	110	10L	120	w188875
w188876	120	1	92	17	15L	68L	120	160	15	230L	w188876
w188877	170	1	68	51	16	68L	120	170	16	120	w188877
w188878	260	.8	210	12	15L	68L	36	130	13	110	w188878
w189007	190	.9	93	37	15L	68L	220	44	10L	160	w189007
w193853	97	1	42	51	5	47	81	72	68L	220	w193853
w193855	110	1	25	40	13	59	210	68	68L	270L	w193855
w193856	340	1	52	17	20	46L	50	74	68L	100	w193856
w193857	62	1	34	49	15	53	300	220	75	230L	w193857
w194471	200	5	880	24	8	46L	71	46	68L	1,400L	w194471
w194472	150	1	42	15	12	82	79	49	68L	170	w194472
w194473	160	1	39	14	11	46L	82	62	68L	370L	w194473
w195568	B	B	B	B	B	B	B	B	B	B	w195568
w195569	B	B	B	B	B	B	B	B	B	B	w195569
w195570	B	B	B	B	B	B	B	B	B	B	w195570
w195571	B	B	B	B	B	B	B	B	B	B	w195571
w194467	200	.9	68	6.0	20	46L	110	51	68L	230L	w194467
w194466	80	2	440	5.0	13	46L	120	62	68L	400L	w194466

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Sc (ppm)	Sm (ppm)	Sn-S (ppm)	Sr-S (ppm)	Tb (ppm)	Th (ppm)	Tl-S (ppm)	U (ppm)	V-S (ppm)	W-S (ppm)	Sample number
w189015	36	1.6	15L	430	1.5	23L	4.6L	10	210	10L	w189015
w189014	33	1.7	15L	240	2.4	24	4.6L	8.7	150	10L	w189014
w189016	54	.81	15L	160	1.8	53L	4.6L	14	180	10L	w189016
w189011	25	2.8	15L	3,400	1.4	29	4.6L	7.2	180	10L	w189011
w189012	36	1.2	15L	410	2.7	41L	4.6L	11	240	10L	w189012
w189013	38	1.6	15L	380	2.8	42L	4.6L	17	300	10L	w189013
w189010	20	1.1	15L	300	.96	29	4.6L	4.8	120	10L	w189010
w189005	28	4.5	15L	160	1.8	33	4.6L	7.6	200	10L	w189005
w189006	24	2.4	15L	150	1.3	17	4.6L	6.3	180	10L	w189006
w194468	41	16	2.0L	280	3.0	10L	3.0L	11	160	10L	w194468
w194474	11	3.9	3.0	260	.71	11L	3.0L	7.1	150	10L	w194474
w195563	B	B	B	B	B	B	B	B	B	B	w195563
w195564	B	B	B	B	B	B	B	B	B	B	w195564
w189008	31	1.9	15L	350	2.1	48	4.6L	8.3	230	10L	w189008
w189009	34	10	15L	530	2.1	21	4.6L	7.7	200	10L	w189009
w194469	25	11	2.0L	580	1.3	13L	3.0L	8.0	110	10L	w194469
w195565	B	B	B	B	B	B	B	B	B	B	w195565
w195566	B	B	B	B	B	B	B	B	B	B	w195566
w195567	B	B	B	B	B	B	B	B	B	B	w195567
w193854	41	11	7.0L	440	2.5	20	10L	9.3	140	10	w193854
w188873	28	40	15L	140	1.7	17L	4.6L	8.7	180	10L	w188873
w188874	50	64L	15L	180	3.7	75	4.6L	15	130	10L	w188874
w188875	48	51L	15L	220	3.0	67	4.6L	9.0	220	10L	w188875
w188876	33	110	15L	1,600	2.6	38L	4.6L	5.2	140	10L	w188876
w188877	41	40	15L	180	2.2	17L	4.6L	9.4	240	10L	w188877
w188878	25	28L	15L	200	1.2	12L	4.6L	2.5	110	10L	w188878
w189007	31	1.8	15L	360	2.6	43	4.6L	7.7	180	10L	w189007
w193853	24	13	7.0	150	3.8	29L	10L	7.7	86	10L	w193853
w193855	36	18	7.0L	620	3.8	38L	14	11	160	10L	w193855
w193856	33	11	9.0	180	2.2	11L	10L	9.7	160	10L	w193856
w193857	41	14	9.0	290	2.1	32L	10L	8.4	110	10L	w193857
w194471	190	84	2.0L	380	11	81L	3.0L	76	100	10L	w194471
w194472	29	13	3.0	1,500	1.9	11L	3.0L	8.6	210	10L	w194472
w194473	46	24	2.0L	820	2.8	21L	3.0L	14	160	10L	w194473
w195568	B	B	B	B	B	B	B	B	B	B	w195568
w195569	B	B	B	B	B	B	B	B	B	B	w195569
w195570	B	B	B	B	B	B	B	B	B	B	w195570
w195571	B	B	B	B	B	B	B	B	B	B	w195571
w194467	34	12	2.0L	230	1.7	13L	3.0L	9.4	160	10L	w194467
w194466	52	25	6.0	1,300	4.5	34L	3.0L	15	120	10L	w194466

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Y-S (ppm)	Yb (ppm)	Zn (ppm)	Zr-S (ppm)
w189015	41	5.4	170	100
w189014	38	6.3	210	110
w189016	45	7.0	140	180
w189011	52	4.7	110	110
w189012	100	6.8	88	250
w189013	65	8.5	250	99
w189010	22	3.8	140	67
w189005	40	4.1	100	81
w189006	46	3.8	200	92
w194468	22	7.7	100	91
w194474	22	1.8	110	160
w195563	B	B	B	B
w195564	B	B	B	B
w189008	76	6.2	96	200
w189009	70	6.3	84	220
w194469	18	4.9	170	85
w195565	B	B	B	B
w195566	B	B	B	B
w195567	B	B	B	B
w193854	21	5.9	180	56
w188873	54	5.8	190	190
w188874	76	9.3	330	75
w188875	32	8.2	240	140
w188876	53	6.4	150	86
w188877	69	6.7	380	260
w188878	18	4.5	51	59
w189007	57	6.0	280	100
w193853	38	6.7	250	63
w193855	61	10	280	69
w193856	20	5.4	77	83
w193857	54	7.4	620	91
w194471	30	43	240	76
w194472	61	6.7	350	100
w194473	30	11	230	97
w195568	B	B	B	B
w195569	B	B	B	B
w195570	B	B	B	B
w195571	B	B	B	B
w194467	45	6.4	72	180
w194466	66	12	590	190

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Ash (percent)	SiO2 (percent)	Al2O3 (percent)	CaO (percent)	MgO (percent)	Na2O (percent)	K2O (percent)	Fe2O3 (percent)	TiO2 (percent)	P2O5 (percent)	Sample number
w195560	B	B	B	B	B	B	B	B	B	B	w195560
w195561	B	B	B	B	B	B	B	B	B	B	w195561
w195562	B	B	B	B	B	B	B	B	B	B	w195562
w188871	7.8	48	30	2.1	.88	.54	2.2	6.2	1.6	1.0L	w188871
w188872	23.8	51	26	.51	.85	.34	3.2	12	1.4	1.0L	w188872

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	SO3 (percent)	Ag-S (ppm)	B-S (ppm)	Ba-S (ppm)	Be-S (ppm)	Bi-S (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Sample number
w195560	B	B	B	B	B	B	B	B	B	B	w195560
w195561	B	B	B	B	B	B	B	B	B	B	w195561
w195562	B	B	B	B	B	B	B	B	B	B	w195562
w188871	2.9	.81	120	520	16	5L	.50L	370	37	430	w188871
w188872	.86	.62	99	670	16	5L	.70	120	13	140	w188872

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Cs (ppm)	Cu (ppm)	Dy-S (ppm)	Er-S (ppm)	Eu (ppm)	Ga-S (ppm)	Gd-S (ppm)	Ge-S (ppm)	Hf (ppm)	La (ppm)	Sample number
w195560	B	B	B	B	B	B	B	B	B	B	w195560
w195561	B	B	B	B	B	B	B	B	B	B	w195561
w195562	B	B	B	B	B	B	B	B	B	B	w195562
w188871	41	42	15L	12	7.6	70	22L	11	22	210	w188871
w188872	13	62	15L	8.3	2.3	84	22L	14	5.5	67	w188872

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Li (ppm)	Lu (ppm)	Mn (ppm)	Mo-S (ppm)	Nb-S (ppm)	Nd-S (ppm)	Ni-S (ppm)	Pb (ppm)	Pr-S (ppm)	Rb (ppm)	Sample number
w195560	B	B	B	B	B	B	B	B	B	B	w195560
w195561	B	B	B	B	B	B	B	B	B	B	w195561
w195562	B	B	B	B	B	B	B	B	B	B	w195562
w188871	150	3	120	27	21	95	82	48	17	580	w188871
w188872	120	.8	97	28	16	68L	55	88	13	200	w188872

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Sc (ppm)	Sm (ppm)	Sn-S (ppm)	Sr-S (ppm)	Tb (ppm)	Th (ppm)	Tl-S (ppm)	U (ppm)	V-S (ppm)	W-S (ppm)	Sample number
w195560	B	B	B	B	B	B	B	B	B	B	w195560
w195561	B	B	B	B	B	B	B	B	B	B	w195561
w195562	B	B	B	B	B	B	B	B	B	B	w195562
w188871	90	150	15L	510	5.1	77	4.6L	6.4	280	10L	w188871
w188872	29	30	15L	300	1.7	42	4.6L	5.0	180	10L	w188872

Table 7.--Major and minor oxide and trace element composition of the laboratory ash of 45 coal samples from Maryland.--continued

Sample number	Y-S (ppm)	Yb (ppm)	Zn (ppm)	Zr-S (ppm)
w195560	B	B	B	B
w195561	B	B	B	B
w195562	B	B	B	B
w188871	80	17	180	320
w188872	54	5.9	69	270

Table 8. -Content of 22 trace elements in 45 coal samples from Maryland..
[Analysis performed on whole coal. Values in parts-per-million (ppm). L, less than the value shown. B, not determined.]

Sample number	As (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Eu (ppm)	F (ppm)	Hf (ppm)	Hg (ppm)	La (ppm)	Sample number
w189015	0.8	17	4.3	26	2.1	0.28	85	1.1	0.010	10	w189015
w189014	5.6	14	2.8	16	1.5	.31	120	.8	.021	8	w189014
w189016	.8	7.0	6.8	11	.8	.13	50	.5	.030	4	w189016
w189011	12	35	9.0	40	3.6	.75	280	2.0	.11	19	w189011
w189012	2.7	14	2.3	16	.7	.22	51	.9	.080	8	w189012
w189013	1.1	13	2.7	14	.9	.29	55	.6	.025	8	w189013
w189010	9.3	12	3.6	13	.6	.22	54	.4	.18	7	w189010
w189005	9.0	53	23	49	4.8	.86	270	2.0	.14	29	w189005
w189006	7.8	25	6.9	33	2.1	.50	120	1.2	.12	13	w189006
w194468	24	54	15	44	3.1	.96	150	2.1	1.3	26	w194468
w194474	14	12	5.9	12	.2	.23	34	.5	.15	6	w194474
w195563	27	50	15	44	2.6	.89	B	2.0	1.1	27	w195563
w195564	11	36	9.5	33	2.0	.65	B	1.3	.17	19	w195564
w189008	3.4	23	7.9	24	1.5	.35	66	.9	.31	12	w189008
w189009	13	25	6.3	33	.8	.46	110	1.3	.17	15	w189009
w194469	10	26	4.7	26	2.3	.52	100	1.3	.26	14	w194469
w195565	41	32	17	37	2.1	.65	B	1.4	.33	18	w195565
w195566	15	28	16	33	2.2	.51	B	1.7	1.1	16	w195566
w195567	10	26	4.7	26	2.3	.47	B	1.4	.31	14	w195567
w193854	65	27	9.9	43	2.1	.50	120	1.3	.59	14	w193854
w188873	6.0	24	9.0	27	2.0	.46	78	1.5	.045	14	w188873
w188874	19	12	23	22	.4	.47	38	.4	.47	5	w188874
w188875	35	21	6.2	27	1.5	.47	100	.9	.12	10	w188875
w188876	27	15	9.2	9.7	.3	.30	140	.4	.31	8	w188876
w188877	39	21	8.7	36	1.3	.48	110	1.1	.64	12	w188877
w188878	13	28	4.7	29	1.9	.46	100	1.5	.32	16	w188878
w189007	28	20	11	24	1.1	.35	68	.8	.32	11	w189007
w193853	90	13	6.5	13	.5	.33	32	.5	.53	7	w193853
w193855	12	14	4.9	14	.7	.31	37	.6	.20	8	w193855
w193856	14	36	9.2	42	2.3	.71	120	2.2	.34	20	w193856
w193857	52	11	20	13	.2	.36	26	.5	.76	5	w193857
w194471	14	42	5.0	33	1.4	.63	20L	2.3	.20	25	w194471
w194472	31	36	17	40	2.3	.75	120	1.5	.37	19	w194472
w194473	10	37	9.3	33	2.4	.72	210	1.3	.050	20	w194473
w195568	9.0	24	4.1	25	1.9	.42	B	1.2	.13	13	w195568
w195569	31	49	17	38	2.4	.85	B	2.0	.88	26	w195569
w195570	15	29	14	32	2.2	.51	B	1.7	.95	17	w195570
w195571	2.0	17	5.3	22	.9	.40	B	.7	1.0	10	w195571
w194467	12	34	14	35	2.8	.60	100	1.8	1.2	18	w194467
w194466	2.0	18	6.1	20	.8	.46	44	.7	1.6	9	w194466

Table 8.--Content of 22 trace elements in 45 coal samples from Maryland.--continued

Sample number	Lu (ppm)	Na (ppm)	P (ppm)	Rb (ppm)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Tb (ppm)	Th (ppm)	Sample number
w189015	0.1	87	570L	42	28	4.7	1.0	0.21	0.2	3.0L	w189015
w189014	.1	320	550L	19	.35	4.1	.7	.21	.3	3.0	w189014
w189016	.1	42	250L	23L	.28	3.1	1.0L	.05	.1	3.0L	w189016
w189011	.2	620	2,300	59	.70	6.9	2.4	.78	.4	8.0	w189011
w189012	.1	440	320L	30L	.26	2.7	1.4	.09	.2	3.0L	w189012
w189013	.1	170	310L	23L	.56	2.7	1.5	.11	.2	3.0L	w189013
w189010	.1	480	450L	41L	.22	2.1	1.4	.11	.1	3.0	w189010
w189005	.3	1,000	1,700L	52	1.5	11	5.1	1.8	.7	13	w189005
w189006	.2	420	1,000L	26	.85	5.6	1.6	.57	.3	4.0	w189006
w194468	.4	400	220	48	1.3	12	11	4.7	.9	3.0L	w194468
w194474	.1	100	240	33L	.30	3.1	4.0	1.1	.2	3.0L	w194474
w195563	.3	B	B	67L	1.3	12	11	4.6	.7	B	w195563
w195564	.2	B	B	53L	.70	6.1	2.0	3.3	.5	B	w195564
w189008	.1	280	630L	15	.77	4.5	4.8	.28	.3	7.0	w189008
w189009	.1	300	620L	11	.48	4.8	6.6	1.4	.3	3.0	w189009
w194469	.2	400	170	48L	.40	5.6	3.1	2.5	.3	3.0L	w194469
w195565	.3	B	B	51L	1.1	7.1	4.9	3.2	.5	B	w195565
w195566	.2	B	B	54L	.70	7.0	8.8	2.5	.3	B	w195566
w195567	.2	B	B	46	.40	5.8	3.0	2.4	.3	B	w195567
w193854	.2	300	370		1.6	8.3	2.8	2.3	.5	4.0	w193854
w188873	.2	400	760L	30	.44	4.9	1.9	6.9	.3	3.0L	w188873
w188874	.2	240	470L	20L	1.1	5.3	2.1	6.8L	.4	8.0	w188874
w188875	.2	620	590L	16	.83	6.4	1.9	6.8L	.4	9.0	w188875
w188876	.1	160	380	18L	.37	2.6	1.6	8.9	.2	3.0L	w188876
w188877	.2	310	790L	21	1.8	7.3	3.0	7.2	.4	3.0L	w188877
w188878	.2	420	1,100L	28	.69	6.2	11	6.8L	.3	3.0L	w188878
w189007	.1	230	510L	19	.50	3.6	1.9	.21	.3	5.0	w189007
w193853	.1	150	52	23	1.5	2.5	2.5	1.3	.4	3.0L	w193853
w193855	.1	180	110	22L	1.0	2.9	1.4	1.4	.3	3.0L	w193855
w193856	.3	330	140	29	.90	9.1	4.8	3.0	.6	3.0L	w193856
w193857	.1	160	39	22L	1.8	3.9	2.0	1.3	.2	3.0L	w193857
w194471	.2	400	120	51L	.50	7.2	5.5	3.1	.4	3.0L	w194471
w194472	.3	400	740	45	1.1	7.7	4.6	3.4	.5	3.0L	w194472
w194473	.2	300	240	54L	.70	6.6	1.5	3.4	.4	3.0L	w194473
w195568	.2	B	B	50L	.40	4.8	3.0	2.3	.4	B	w195568
w195569	.3	B	B	53L	1.6	11	14	4.5	.8	B	w195569
w195570	.2	B	B	51L	.70	7.0	8.1	2.5	.4	B	w195570
w195571	.2	B	B	16	.20	4.2	1.1	2.0	.3	B	w195571
w194467	.2	290	83	53L	.60	7.9	6.2	2.8	.4	3.0L	w194467
w194466	.2	99	170	36L	.20	4.6	1.2	2.2	.4	3.0L	w194466

Table 8.--Content of 22 trace elements in 45 coal samples from Maryland.--continued

Sample number	U (ppm)	Yb (ppm)
w189015	1.3	0.7
w189014	1.1	.8
w189016	.80	.4
w189011	2.0	1.3
w189012	.80	.5
w189013	1.2	.6
w189010	.50	.4
w189005	3.0	1.6
w189006	1.5	.9
w194468	3.2	2.3
w194474	2.0	.5
w195563	B	1.8
w195564	B	1.2
w189008	1.2	.9
w189009	1.1	.9
w194469	1.8	1.1
w195565	B	1.4
w195566	B	1.1
w195567	B	1.0
w193854	1.9	1.2
w188873	1.5	1.0
w188874	1.6	1.0
w188875	1.2	1.
w188876	.40	.5
w188877	1.7	1.2
w188878	.60	1.1
w189007	.90	.7
w193853	.80	.7
w193855	.90	.8
w193856	2.7	1.5
w193857	.80	.7
w194471	2.8	1.6
w194472	2.3	1.8
w194473	2.0	1.6
w195568	B	.8
w195569	B	2.0
w195570	B	1.2
w195571	B	.8
w194467	2.2	1.5
w194466	1.3	1.1

Table 8.--Content of 22 trace elements in 45 coal samples from Maryland.--continued

Sample number	As (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Eu (ppm)	F (ppm)	Hf (ppm)	Hg (ppm)	La (ppm)	Sample number
w195560	2.0	13	5.2	15	0.5	0.37	B	0.5	0.80	7	w195560
w195561	11	36	9.6	34	2.3	.68	B	1.3	.19	19	w195561
w195562	31	35	17	41	2.3	.71	B	1.5	.33	20	w195562
w188871	76	29	2.9	34	3.2	.59	54	1.7	1.4	16	w188871
w188872	79	28	3.0	32	3.1	.54	160	1.3	1.3	16	w188872

Table 8.--Content of 22 trace elements in 45 coal samples from Maryland.--continued

Sample number	Lu (ppm)	Na (ppm)	P (ppm)	Rb (ppm)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Tb (ppm)	Th (ppm)	Sample number
w195560	0.1	B	B	34L	0.20	3.6	1.2	1.8	0.3	B	w195560
w195561	.2	B	B	56L	.70	6.4	1.8	3.4	.5	B	w195561
w195562	.3	B	B	62L	1.1	7.6	5.1	3.5	.6	B	w195562
w188871	.2	310	340L	45	1.7	7.0	2.3	12	.4	6.0	w188871
w188872	.2	600	1,000L	47	1.6	6.9	2.2	7.1	.4	10	w188872

Table 8.--Content of 22 trace elements in 45 coal samples from Maryland.--continued

Sample number	U (ppm)	Yb (ppm)
w195560	B	0.8
w195561	B	1.3
w195562	B	1.5
w188871	.50	1.3
w188872	1.2	1.4

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.. [Values in percent or parts-per-million. 22 values are from direct determinations on whole coal; all other values calculated from analyses of ash. S means analysis by emission spectrography; L, less than the value shown; N, not detected; B, not determined.]

Sample number	Si (percent)	Al (percent)	Ca (percent)	Mg (percent)	Na (percent)	K (percent)	Fe (percent)	Ti (percent)	Ag-S (ppm)	As (ppm)	Sample number
w189015	3.7	1.9	0.022	0.056	0.009	0.11	0.28	0.11	0.06L	0.8	w189015
w189014	3.4	1.4	.033	.063	.032	.10	1.3	.081	.06L	5.6	w189014
w189016	1.4	.81	.020	.026	.004	.047	.36	.043	.03L	.8	w189016
w189011	7.0	3.5	.20	.094	.062	.23	1.7	.21	.13L	12	w189011
w189012	1.9	1.3	.024	.026	.044	.062	.33	.078	.04	2.7	w189012
w189013	1.6	1.2	.035	.031	.017	.059	.62	.052	.05	1.1	w189013
w189010	1.9	1.1	.13	.073	.048	.087	1.8	.054	.05L	9.3	w189010
w189005	9.2	5.8	.065	.23	.10	.33	2.2	.26	.18L	9.0	w189005
w189006	5.4	2.7	.047	.15	.042	.20	2.6	.14	.11	7.8	w189006
w194468	6.5	4.4	.091	.15	.040	.25	2.9	.27	.09	24	w194468
w194474	7.6	3.4	.18	.076	.010	.23	1.7	.32	.23	14	w194474
w195563	B	B	B	B	B	B	B	B	B	27	w195563
w195564	B	B	B	B	B	B	B	B	B	11	w195564
w189008	3.8	2.3	.10	.072	.028	.12	.28	.13	.33	3.4	w189008
w189009	3.8	2.1	.13	.069	.030	.12	.68	.15	.07L	13	w189009
w194469	5.7	2.4	.15	.18	.040	.19	1.9	.16	.02L	10	w194469
w195565	B	B	B	B	B	B	B	B	B	41	w195565
w195566	B	B	B	B	B	B	B	B	B	15	w195566
w195567	B	B	B	B	B	B	B	B	B	10	w195567
w193854	4.4	2.3	.14	.080	.030	.17	3.4	.16	.06	65	w193854
w 88873	4.6	2.1	.049	.066	.040	.14	.99	.18	.10	6.0	w188873
w188874	1.4	.91	.084	.034	.024	.089	2.8	.047	.11	19	w188874
w188875	2.8	1.8	.064	.067	.062	.11	1.7	.10	.11	35	w188875
w188876	1.3	.99	.16	.032	.016	.065	1.3	.040	.04	27	w188876
w188877	3.6	2.0	.090	.076	.031	.15	3.0	.13	.17	39	w188877
w188878	4.6	2.6	.059	.095	.042	.20	4.8	.16	.11	13	w188878
w189007	2.5	1.7	.079	.056	.023	.097	.78	.088	.07	28	w189007
w193853	1.5	1.0	.10	.026	.015	.087	3.0	.048	.07	90	w193853
w193855	1.8	1.1	.10	.032	.018	.067	.67	.062	.04	12	w193855
w193856	7.6	4.0	.12	.11	.033	.23	2.1	.33	.08	14	w193856
w193857	1.5	.80	.12	.021	.016	.079	2.7	.057	.10	52	w193857
w194471	.71	.41	.048	.014	.040	.031	.59	.024	.00L	14	w194471
w194472	6.7	4.1	.18	.12	.040	.22	1.2	.23	.08	31	w194472
w194473	3.4	1.8	.074	.057	.030	.12	1.2	.12	.07	10	w194473
w195568	B	B	B	B	B	B	B	B	B	9.0	w195568
w195569	B	B	B	B	B	B	B	B	B	31	w195569
w195570	B	B	B	B	B	B	B	B	B	15	w195570
w195571	B	B	B	B	B	B	B	B	B	2.0	w195571
w194467	5.1	3.1	.088	.10	.029	.19	2.3	.25	.07	12	w194467
w194466	1.4	1.4	.40	.071	.010	.074	.42	.069	.04	2.0	w194466

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	B-S (ppm)	Ba-S (ppm)	Be-S (ppm)	Bi-S (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Sample number
w189015	18	140	1.9	0.6L	0.22	17	4.3	26	2.1	9.9	w189015
w189014	18	120	2.0	.6L	.13	14	2.8	16	1.5	9.6	w189014
w189016	9.6	20	2.3	.3L	.06	7.0	6.8	11	.8	4.7	w189016
w189011	45	460	2.2	1.3L	.13	35	9.0	40	3.6	17	w189011
w189012	18	70	.8	.3L	.05	14	2.3	16	.7	5.2	w189012
w189013	8.9	58	1.3	.3L	.09	13	2.7	14	.9	19	w189013
w189010	18	57	1.1	.5L	.10	12	3.6	13	.6	6.4	w189010
w189005	58	240	3.1	1.8L	.09	53	23	49	4.8	40	w189005
w189006	29	330	2.0	1.1L	.17	25	6.9	33	2.1	15	w189006
w194468	18	100	2.7	4.5L	.15	54	15	44	3.1	56	w194468
w194474	23	76	1.1	4.2L	.26	12	5.9	12	.2	37	w194474
w195563	B	B	B	B	B	50	15	44	2.6	B	w195563
w195564	B	B	B	B	B	36	9.5	33	2.0	B	w195564
w189008	16	110	2.6	.7L	.07	23	7.9	24	1.5	11	w189008
w189009	19	120	1.4	.7L	.07	25	6.3	33	.8	12	w189009
w194469	16	100	1.4	3.4L	.17	26	4.7	26	2.3	17	w194469
w195565	B	B	B	B	B	32	17	37	2.1	B	w195565
w195566	B	B	B	B	B	28	16	33	2.2	B	w195566
w195567	B	B	B	B	B	26	4.7	26	2.3	B	w195567
w193854	11	67	2.7	4.5L	.08	27	9.9	43	2.1	16	w193854
w188873	18	55	2.6	.8L	.09L	24	9.0	27	2.0	14	w188873
w188874	3.7	16	2.8	.5L	.16	12	23	22	.4	9.6	w188874
w188875	18	58	1.6	.6L	.07L	21	6.2	27	1.5	11	w188875
w188876	8.2	56	1.3	.4L	.05	15	9.2	9.7	.3	4.8	w188876
w188877	15	61	2.8	1.1	.23	21	8.7	36	1.3	5.0	w188877
w188878	20	70	1.5	1.1L	.17	28	4.7	29	1.9	13	w188878
w189007	13	65	2.5	.5L	.13	20	11	24	1.1	8.4	w189007
w193853	1.0	10	1.6	2.3L	.06	13	6.5	13	.5	12	w193853
w193855	6.6	19	2.2	1.8L	.08	14	4.9	14	.7	11	w193855
w193856	26	45	3.3	6.1L	.12	36	9.2	42	2.3	27	w193856
w193857	1.4	7	2.6	2.1L	.08	11	20	13	.2	9.1	w193857
w194471	.6	7	.2	.6L	.04	42	5.0	33	1.4	3.7	w194471
w194472	18	160	2.7	4.0L	.09	36	17	40	2.3	26	w194472
w194473	8.2	71	1.3	2.2L	.14	37	9.3	33	2.4	22	w194473
w195568	B	B	B	B	B	24	4.1	25	1.9	B	w195568
w195569	B	B	B	B	B	49	17	38	2.4	B	w195569
w195570	B	B	B	B	B	29	14	32	2.2	B	w195570
w195571	B	B	B	B	B	17	5.3	22	.9	B	w195571
w194467	10	77	1.9	3.5L	.05	34	14	35	2.8	28	w194467
w194466	6.2	85	.9	1.3L	.35	18	6.1	20	.8	13	w194466

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Dy-S (ppm)	Er-S (ppm)	Eu (ppm)	F (ppm)	Ga-S (ppm)	Gd-S (ppm)	Ge-S (ppm)	Hf (ppm)	Hg (ppm)	La (ppm)	Sample number
w189015	1.9L	0.6	0.28	85	6.1	2.8L	1.3	1.1	0.010	10	w189015
w189014	1.9L	.9	.31	120	5.8	2.7L	.40L	.8	.021	8	w189014
w189016	.8L	.4	.13	50	3.7	1.2L	.74	.5	.030	4	w189016
w189011	4.1L	1.9	.75	280	14	6.0L	.96	2.0	.11	19	w189011
w189012	2.4	.3L	.22	51	5.3	1.6L	.35	.9	.030	8	w189012
w189013	1.0L	.3L	.29	55	4.4	1.5L	.37	.6	.025	8	w189013
w189010	1.5L	.7	.22	54	4.8	2.2L	1.1	.4	.18	7	w189010
w189005	5.8L	1.8L	.86	270	19	8.5L	2.7	2.0	.14	29	w189005
w189006	3.5L	1.1L	.50	120	15	5.1L	13	1.2	.12	13	w189006
w194468	6.5L	3.0L	.96	150	18	3.0	3.9	2.1	1.3	26	w194468
w194474	6.2L	2.8L	.23	34	9.9	2.0L	.56L	.5	.15	6	w194474
w195563	B	B	.89	B	B	B	B	2.0	1.1	27	w195563
w195564	B	B	.65	B	B	B	B	1.3	.17	19	w195564
w189008	2.8	.7L	.35	66	8.9	3.1L	5.8	.9	.31	12	w189008
w189009	2.1L	.8	.46	110	9.0	3.1L	3.0	1.3	.17	15	w189009
w194469	5.0L	2.3L	.52	100	9.9	1.6L	.45L	1.3	.26	14	w194469
w195565	B	B	.65	B	B	B	B	1.4	.33	18	w195565
w195566	B	B	.51	B	B	B	B	1.7	1.1	16	w195566
w195567	B	B	.47	B	B	B	B	1.4	.31	14	w195567
w193854	6.5L	2.0L	.50	120	14	1.4L	4.3	1.3	.59	14	w193854
w188873	2.5L	.8L	.46	78	7.2	3.7L	.82	1.5	.045	14	w188873
w188874	1.6L	.8	.47	38	9.1	2.3L	1.9	.4	.47	5	w188874
w188875	2.0L	.6L	.47	100	13	2.9L	1.3	.9	.12	10	w188875
w188876	1.1L	.6	.30	140	4.3	1.7L	.46	.4	.31	8	w188876
w188877	2.6L	1.6	.48	110	14	3.9L	10	1.1	.64	12	w188877
w188878	3.6L	1.1L	.46	100	13	5.2L	1.6	1.5	.32	16	w188878
w189007	1.7L	.5L	.35	68	7.1	2.5L	.59	.8	.32	11	w189007
w193853	3.3L	1.0L	.33	32	4.3	1.6	6.8	.5	.53	7	w193853
w193855	2.6L	.8L	.31	37	4.8	.64	13	.6	.20	8	w193855
w193856	8.9L	2.8L	.71	120	15	2.0L	4.7	2.2	.34	20	w193856
w193857	3.0L	1.0L	.36	26	5.5	1.9	8.0	.5	.76	5	w193857
w194471	.8L	.4L	.63	20L	1.4	.48	.07L	2.3	.20	25	w194471
w194472	5.9L	2.7L	.75	120	16	3.5	1.3	1.5	.37	19	w194472
w194473	3.2L	1.4L	.72	210	7.3	1.7	3.9	1.3	.050	20	w194473
w195568	B	B	.42	B	B	B	B	1.2	.13	13	w195568
w195569	B	B	.85	B	B	B	B	2.0	.88	26	w195569
w195570	B	B	.51	B	B	B	B	1.7	.95	17	w195570
w195571	B	B	.40	B	B	B	B	.7	1.0	10	w195571
w194467	5.1L	2.3L	.60	100	12	3.3	1.2	1.8	1.2	18	w194467
w194466	2.0L	.9L	.46	44	4.3	1.6	.18L	.7	1.6	9	w194466

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Li (ppm)	Lu (ppm)	Mn (ppm)	Mo-S (ppm)	Nb-S (ppm)	Nd-S (ppm)	Ni-S (ppm)	P (ppm)	Pb (ppm)	Pr-S (ppm)	Sample number
w189015	36	0.1	10	1.2	1.9L	8.9L	17	570L	5.7	1.3L	w189015
w189014	8.8	.1	23	2.4	1.9L	8.6L	11	550L	4.0	1.3L	w189014
w189016	5.7	.1	6.8	1.2	.84L	3.9L	11	250L	3.1	.6L	w189016
w189011	47	.2	73	1.4	4.1L	19L	24	2,300	10	2.8L	w189011
w189012	16	.1	6.1	.42	1.9	5.0L	8.7	320L	4.4	.9	w189012
w189013	26	.1	15	3.3	1.0L	4.8L	12	310L	3.1	.7L	w189013
w189010	17	.1	33	3.6	1.5L	7.1L	9.0	450L	3.3	1.0L	w189010
w189005	67	.3	370	2.1	5.8L	27L	100	1,700L	24	4.0L	w189005
w189006	33	.2	43	4.0	3.5L	16L	22	1,000L	7.6	2.4L	w189006
w194468	92	.4	21	3.3	3.9	14L	23	220	24	20L	w194468
w194474	31	.1	15	4.2	5.1	13L	14	240	13	19L	w194474
w195563	B	.3	B	B	B	B	B	B	B	B	w195563
w195564	B	.2	B	B	B	B	B	B	B	B	w195564
w189008	42	.1	15	15	2.1L	9.9L	15	630L	7.5	1.5L	w189008
w189009	44	.1	16	2.6	2.1L	9.7L	15	620L	6.3	1.6	w189009
w194469	47	.2	47	1.1	2.5	10L	14	170	7.9	15L	w194469
w195565	B	.3	B	B	B	B	B	B	B	B	w195565
w195566	B	.2	B	B	B	B	B	B	B	B	w195566
w195567	B	.2	B	B	B	B	B	B	B	B	w195567
w193854	20	.2	6.9	3.3	2.0	9.4L	17	370	11	14L	w193854
w188873	21	.2	17	.96	3.0	12L	20	760L	15	1.9	w188873
w188874	13	.2	7.9	3.9	1.6L	7.3L	26	470L	16	1.4	w188874
w188875	16	.2	11	2.8	2.0L	9.1L	17	590L	15	1.3L	w188875
w188876	9.4	.1	7.1	1.3	1.1L	5.3L	9.2	380	12	1.2	w188876
w188877	31	.2	12	9.1	2.9	12L	23	790L	31	2.8	w188877
w188878	63	.2	52	2.9	3.6L	17L	8.8	1,100L	32	3.3	w188878
w189007	22	.1	11	4.3	1.7L	8.0L	25	510L	5.1	1.2L	w189007
w193853	10	.1	4.4	5.3	.52	4.9	8.4	52	7.5	7.1L	w193853
w193855	8.8	.1	2.0	3.2	1.0	4.7	17	110	5.4	5.4L	w193855
w193856	95	.3	15	4.7	5.6	13L	14	140	21	19L	w193856
w193857	5.9	.1	3.2	4.7	1.4	5.0	29	39	21	7.1	w193857
w194471	7.4	.2	33	.89	.30	1.7L	2.6	120	1.7	2.5L	w194471
w194472	40	.3	11	4.0	3.2	22	21	740	13	18L	w194472
w194473	23	.2	5.6	2.0	1.6	6.6L	12	240	8.9	9.8L	w194473
w195568	B	.2	B	B	B	B	B	B	B	B	w195568
w195569	B	.3	B	B	B	B	B	B	B	B	w195569
w195570	B	.2	B	B	B	B	B	B	B	B	w195570
w195571	B	.2	B	B	B	B	B	B	B	B	w195571
w194467	47	.2	16	1.4	4.7	11L	26	83	12	16L	w194467
w194466	7.1	.2	39	.45	1.2	4.1L	11	170	5.5	6.1L	w194466

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Rb (ppm)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn-S (ppm)	Sr-S (ppm)	Tb (ppm)	Th (ppm)	Tl-S (ppm)	Sample number
w189015	42	28	4.7	1.0	0.21	1.9L	56	0.2	3.0L	0.60L	w189015
w189014	19	.35	4.1	.7	.21	1.9L	31	.3	3.0	.58L	w189014
w189016	23L	.28	3.1	1.0L	.05	.84L	9.0	.1	3.0L	.26L	w189016
w189011	59	.70	6.9	2.4	.78	4.1L	950	.4	8.0	1.3L	w189011
w189012	30L	.26	2.7	1.4	.09	1.1L	30	.2	3.0L	.34L	w189012
w189013	23L	.56	2.7	1.5	.11	1.0L	27	.2	3.0L	.33L	w189013
w189010	41L	.22	2.1	1.4	.11	1.5L	31	.1	3.0	.48L	w189010
w189005	52	1.5	11	5.1	1.8	5.8L	65	.7	13	1.8L	w189005
w189006	26	.85	5.6	1.6	.57	3.5L	36	.3	4.0	1.1L	w189006
w194468	48	1.3	12	11	4.7	.59L	83	.9	3.0L	.89L	w194468
w194474	33L	.30	3.1	4.0	1.1	.85	73	.2	3.0L	.85L	w194474
w195563	67L	1.3	12	11	4.6	B	B	.7	B	B	w195563
w195564	53L	.70	6.1	2.0	3.3	B	B	.5	B	B	w195564
w189008	15	.77	4.5	4.8	.28	2.1L	50	.3	7.0	.67L	w189008
w189009	11	.48	4.8	6.6	1.4	2.1L	77	.3	3.0	.66L	w189009
w194469	48L	.40	5.6	3.1	2.5	.45L	130	.3	3.0L	.68L	w194469
w195565	51L	1.1	7.1	4.9	3.2	B	B	.5	B	B	w195565
w195566	54L	.70	7.0	8.8	2.5	B	B	.3	B	B	w195566
w195567	46	.40	5.8	3.0	2.4	B	B	.3	B	B	w195567
w193854		1.6	8.3	2.8	2.3	1.4L	90	.5	4.0	2.0L	w193854
w188873	30	.44	4.9	1.9	6.9	2.5L	25	.3	3.0L	.80L	w188873
w188874	20L	1.1	5.3	2.1	6.8L	1.6L	19	.4	8.0	.50L	w188874
w188875	16	.83	6.4	1.9	6.8L	2.0L	30	.4	9.0	.62L	w188875
w188876	18L	.37	2.6	1.6	8.9	1.1L	120	.2	3.0L	.36L	w188876
w188877	21	1.8	7.3	3.0	7.2	2.6L	33	.4	3.0L	.84L	w188877
w188878	28	.69	6.2	11	6.8L	3.6L	49	.3	3.0L	1.1L	w188878
w189007	19	.50	3.6	1.9	.21	1.7L	42	.3	5.0	.54L	w189007
w193853	23	1.5	2.5	2.5	1.3	.73	16	.4	3.0L	1.0L	w193853
w193855	22L	1.0	2.9	1.4	1.4	.56L	50	.3	3.0L	1.1	w193855
w193856	29	.90	9.1	4.8	3.0	2.5	50	.6	3.0L	2.8L	w193856
w193857	22L	1.8	3.9	2.0	1.3	.86	28	.2	3.0L	.95L	w193857
w194471	51L	.50	7.2	5.5	3.1	.07L	14	.4	3.0L	.11L	w194471
w194472	45	1.1	7.7	4.6	3.4	.81	400	.5	3.0L	.81L	w194472
w194473	54L	.70	6.6	1.5	3.4	.29L	120	.4	3.0L	.43L	w194473
w195568	50L	.40	4.8	3.0	2.3	B	B	.4	B	B	w195568
w195569	53L	1.6	11	14	4.5	B	B	.8	B	B	w195569
w195570	51L	.70	7.0	8.1	2.5	B	B	.4	B	B	w195570
w195571	16	.20	4.2	1.1	2.0	B	B	.3	B	B	w195571
w194467	53L	.60	7.9	6.2	2.8	.47L	54	.4	3.0L	.70L	w194467
w194466	36L	.20	4.6	1.2	2.2	.53	120	.4	3.0L	.27L	w194466

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	U (ppm)	V-S (ppm)	W-S (ppm)	Y-S (ppm)	Yb (ppm)	Zn (ppm)	Zr-S (ppm)	Sample number
w189015	1.3	28	1.3L	5.3	0.7	22	14	w189015
w189014	1.1	19	1.3L	4.8	.8	26	14	w189014
w189016	.80	10	.57L	2.6	.4	8.0	10	w189016
w189011	2.0	49	2.8L	15	1.3	31	30	w189011
w189012	.80	18	.74L	7.5	.5	6.5	19	w189012
w189013	1.2	21	.71L	4.6	.6	18	7.0	w189013
w189010	.50	12	1.0L	2.3	.4	15	7.0	w189010
w189005	3.0	79	4.0L	16	1.6	40	32	w189005
w189006	1.5	44	2.4L	11	.9	47	22	w189006
w194468	3.2	48	3.0L	6.5	2.3	30	27	w194468
w194474	2.0	42	2.8L	6.2	.5	31	45	w194474
w195563	B	B	B	B	1.8	B	B	w195563
w195564	B	B	B	B	1.2	B	B	w195564
w189008	1.2	33	1.5L	11	.9	14	29	w189008
w189009	1.1	29	1.4L	10	.9	12	31	w189009
w194469	1.8	25	2.3L	4.1	1.1	38	19	w194469
w195565	B	B	B	B	1.4	B	B	w195565
w195566	B	B	B	B	1.1	B	B	w195566
w195567	B	B	B	B	1.0	B	B	w195567
w193854	1.9	29	2.0	4.3	1.2	37	11	w193854
w188873	1.5	32	1.7L	9.3	1.0	33	33	w188873
w188874	1.6	14	1.1L	8.2	1.0	35	8.1	w188874
w188875	1.2	30	1.3L	4.3	1.1	32	18	w188875
w188876	.40	11	.78L	4.1	.5	12	6.7	w188876
w188877	1.7	44	1.8L	12	1.2	68	46	w188877
w188878	.60	26	2.4L	4.3	1.1	12	14	w188878
w189007	.90	21	1.2L	6.6	.7	33	12	w189007
w193853	.80	8.9	1.0L	4.0	.7	26	6.6	w193853
w193855	.90	13	.80L	4.9	.8	22	5.5	w193855
w193856	2.7	45	2.8L	5.6	1.5	21	23	w193856
w193857	.80	10	.95L	5.1	.7	59	8.6	w193857
w194471	2.8	3.7	.37L	1.1	1.6	8.9	2.8	w194471
w194472	2.3	56	2.7L	16	1.8	94	27	w194472
w194473	2.0	23	1.4L	4.3	1.6	33	14	w194473
w195568	B	B	B	B	.8	B	B	w195568
w195569	B	B	B	B	2.0	B	B	w195569
w195570	B	B	B	B	1.2	B	B	w195570
w195571	B	B	B	B	.8	B	B	w195571
w194467	2.2	37	2.3L	10	1.5	17	42	w194467
w194466	1.3	11	.89L	5.9	1.1	53	17	w194466

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Si (percent)	Al (percent)	Ca (percent)	Mg (percent)	Na (percent)	K (percent)	Fe (percent)	Ti (percent)	Ag-S (ppm)	As (ppm)	Sample number
w195560	B	B	B	B	B	B	B	B	B	2.0	w195560
w195561	B	B	B	B	B	B	B	B	B	11	w195561
w195562	B	B	B	B	B	B	B	B	B	31	w195562
w188871	1.7	1.2	.12	.041	.031	.065	.34	.075	.06	76	w188871
w188872	5.7	3.3	.087	.12	.060	.20	2.0	.20	.15	79	w188872

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	B-S (ppm)	Ba-S (ppm)	Be-S (ppm)	Bi-S (ppm)	Cd (ppm)	Ce (ppm)	Co (ppm)	Cr (ppm)	Cs (ppm)	Cu (ppm)	Sample number
w195560	B	B	B	B	B	13	5.2	15	0.5	B	w195560
w195561	B	B	B	B	B	36	9.6	34	2.3	B	w195561
w195562	B	B	B	B	B	35	17	41	2.3	B	w195562
w188871	9.5	40	1.2	.4L	.04L	29	2.9	34	3.2	3.3	w188871
w188872	24	160	3.8	1.1L	.17	28	3.0	32	3.1	15	w188872

Table 5.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Dy-S (ppm)	Er-S (ppm)	Eu (ppm)	F (ppm)	Ga-S (ppm)	Gd-S (ppm)	Ge-S (ppm)	Hf (ppm)	Hg (ppm)	La (ppm)	Sample number
w195560	B	B	0.37	B	B	B	B	0.5	0.80	7	w195560
w195561	B	B	.68	B	B	B	B	1.3	.19	19	w195561
w195562	B	B	.71	B	B	B	B	1.5	.33	20	w195562
w188871	1.1L	.9	.59	54	5.5	1.7L	.86	1.7	1.4	16	w188871
w188872	3.5L	2.0	.54	160	20	5.1L	3.3	1.3	1.3	16	w188872

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Li (ppm)	Lu (ppm)	Mn (ppm)	Mo-S (ppm)	Nb-S (ppm)	Nd-S (ppm)	Ni-S (ppm)	P (ppm)	Pb (ppm)	Pr-S (ppm)	Sample number
w195560	B	0.1	B	B	B	B	B	B	B	B	w195560
w195561	B	.2	B	B	B	B	B	B	B	B	w195561
w195562	B	.3	B	B	B	B	B	B	B	B	w195562
w188871	12	.2	9.4	2.1	1.7	7.4	6.4	340L	3.7	1.3	w188871
w188872	29	.2	23	6.7	3.7	16L	13	1,000L	21	3.0	w188872

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	Rb (ppm)	Sb (ppm)	Sc (ppm)	Se (ppm)	Sm (ppm)	Sn-S (ppm)	Sr-S (ppm)	Tb (ppm)	Th (ppm)	Tl-S (ppm)	Sample number
w195560	34L	0.20	3.6	1.2	1.8	B	B	0.3	B	B	w195560
w195561	56L	.70	6.4	1.8	3.4	B	B	.5	B	B	w195561
w195562	62L	1.1	7.6	5.1	3.5	B	B	.6	B	B	w195562
w188871	45	1.7	7.0	2.3	12	1.1L	40	.4	6.0	.36L	w188871
w188872	47	1.6	6.9	2.2	7.1	3.5L	71	.4	10	1.1L	w188872

Table 9.--Major, minor, and trace element composition of 45 coal samples from Maryland reported on whole coal basis.--continued

Sample number	U (ppm)	V-S (ppm)	W-S (ppm)	Y-S (ppm)	Yb (ppm)	Zn (ppm)	Zr-S (ppm)	Sample number
w195560	B	B	B	B	0.8	B	B	w195560
w195561	B	B	B	B	1.3	B	B	w195561
w195562	B	B	B	B	1.5	B	B	w195562
w188871	.50	22	.78L	6.2	1.3	14	25	w188871
w188872	1.2	42	2.4L	13	1.4	16	65	w188872

Table 10.-- Elements not reported in statistical tables 2, 4-5b. [Column A, elements not detected in any samples; column B, elements found in too few samples to yield meaningful statistics]

Column A	Column B
Cl	Dy
Au	Er
Bi	Gd
Ho	Nb
In	Nd
Ir	Pr
Os	Rb
Pd	Sn
Pt	Th
Re	
Rh	
Ru	
Ta	
Te	
Tl	
Tm	
W	

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