Table 5.2. Geochemical data for rock samples.
[Total iron reported as Fe_2O_3; n.d., not determined]

Lithology				Shale				Sandstone		Coal refuse
Sample				HCS-IN	LKFC-PA	KBF-WV	BCS3-PA	MKSS	Wadesville #29	LRBT #2
Element	Units	Detection Limit	Method							
				Major elements as oxides						
SiO_2	%	0.01	FUS-ICP	38.27	50.44	57.44	47.59	75.36	49.43	19.01
Al_2O_3	%	0.01	FUS-ICP	12.59	17.77	16.04	20.45	11.12	9.08	9.28
Fe_2O_3(T)	%	0.01	FUS-ICP	9.09	11.07	8.77	9.52	3.22	6.83	7.55
MnO	%	0.01	FUS-ICP	0.05	0.23	0.13	0.13	0.06	0.37	0.01
MgO	%	0.01	FUS-ICP	1.61	1.88	1.81	2.41	0.89	3.84	0.38
CaO	%	0.01	FUS-ICP	2.25	0.87	1.03	2.25	1.81	11.23	0.12
Na_2O	%	0.01	FUS-ICP	0.5	0.21	0.74	0.25	0.14	0.36	0.12
K_2O	%	0.01	FUS-ICP	2.75	3.68	3.44	3.51	2.4	1.5	1.04
TiO_2	%	0.005	FUS-ICP	0.574	0.861	0.884	0.848	0.653	0.526	0.498
P_2O_5	%	0.01	FUS-ICP	0.35	0.42	0.22	0.3	0.08	0.12	0.01
LOI	%	0.01	FUS-ICP	31.84	12.26	8.86	11.93	4.58	16.58	59.97
Total	%	0.01	FUS-ICP	99.89	99.69	99.37	99.19	100.3	99.86	98
				Trace elements						
Ag	ppm	0.5	INAA	1.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
As	ppm	2	INAA	48	22	8	30	4	4	56
Au	ppb	5	INAA	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Ba	ppm	3	INAA	307	476	580	676	313	309	138
Be	ppm	1	FUS-ICP	4	4	3	4	2	2	2
Bi	ppm	2	TD-ICP	< 2	< 2	< 2	< 2	< 2	< 2	3
Br	ppm	1	INAA	< 1	< 1	< 1	< 1	< 1	< 1	6
Cd	ppm	0.5	TD-ICP	20	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ce	ppm	3	INAA	59	103	90	93	57	61	51
Co	ppm	1	INAA	19	24	16	23	11	15	5
Cr	ppm	1	INAA	179	88	77	101	87	45	51
Cs	ppm	0.5	INAA	6.6	6.6	4.6	8.2	1.9	1.1	4.3
Cu	ppm	1	TD-ICP	117	32	27	77	12	15	28
Eu	ppm	0.1	INAA	1.3	2.1	1.8	1.5	1.1	1	0.7
Hf	ppm	0.5	INAA	2.1	4.8	5.9	2.9	4.4	4.4	2.3
Hg	ppm	1	INAA	< 1	< 1	< 1	< 1	< 1	< 1	1
Hg	ppb	5	FIMS	227	63	11	65	11	< 5	952
Ir	ppb	5	INAA	< 5	< 5	< 5	< 5	< 5	< 5	< 5
La	ppm	0.2	INAA	35.4	53.2	52.6	52.7	31.7	35	25.5
Lu	ppm	0.05	INAA	0.36	0.63	0.6	0.53	0.36	0.34	0.3
Mo	ppm	5	INAA	165	< 5	< 5	< 5	< 5	< 5	< 5
Nd	ppm	5	INAA	26	38	43	40	24	28	18
Ni	ppm	1	TD-ICP	235	64	38	83	23	18	22
Pb	ppm	5	TD-ICP	27	24	22	46	20	15	22
Rb	ppm	20	INAA	80	100	110	120	70	70	50
Sb	ppm	0.2	INAA	13.2	0.9	0.5	0.9	0.4	< 0.2	0.8
Sc	ppm	0.1	INAA	11.9	18.5	15.1	19.4	8.8	9.3	9.9
Se	ppm	3	INAA	81	< 3	< 3	< 3	< 3	< 3	13
Sm	ppm	0.1	INAA	6	10.4	9.2	8.4	5.2	6.1	4
Sr	ppm	2	FUS-ICP	118	108	122	163	66	113	112
Ta	ppm	1	INAA	< 1	< 1	< 1	1	< 1	< 1	< 1
Tb	ppm	0.5	INAA	< 0.5	< 0.5	1.1	0.9	< 0.5	< 0.5	< 0.5

Table 5.2.—Continued.

Lithology				Shale				Sandstone		Coal refuse
Sample				HCS-IN	LKFC-PA	KBF-WV	BCS3-PA	MKSS	Wadesville #29	LRBT #2
Th	ppm	0.5	INAA	5.7	8.8	8.9	9.7	5.3	4.6	5.4
U	ppm	0.5	INAA	37.7	3.5	3	4.3	1.7	1.3	2.2
V	ppm	5	FUS-ICP	695	157	114	218	66	64	64
W	ppm	3	INAA	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Y	ppm	1	FUS-ICP	31	43	39	33	21	25	14
Yb	ppm	0.1	INAA	2.3	3.8	4.1	3.3	2.3	2.7	1.8
Zn	ppm	1	TD-ICP	456	151	126	171	86	50	33
Zr	ppm	2	FUS-ICP	92	182	248	132	199	183	67
CO_2	%	0.01	COUL	1.06	3.13	1.94	2.03	1.93	16.2	1.06
S	%	0.001	TD-ICP	4.33	0.815	0.207	0.538	0.089	0.017	5.54
Carbon and sulfur analyses on leach column residues										
C_{Total}	%	0.01	IR	18.1	2.53	1.07	1.69	0.79	n.d.	n.d.
$C_{Graphite}$	%	0.05	IR	4.32	0.47	0.19	0.43	< 0.05	n.d.	n.d.
$C_{Organic}$	%	0.05	IR	13.7	1.15	0.52	0.65	0.06	n.d.	n.d.
CO_2	%	0.01	COUL	0.41	3.34	1.3	2.24	2.52	n.d.	n.d.
S	%	0.01	IR	4.88	0.98	0.19	0.55	0.09	n.d.	n.d.
SO_4	%	0.1	IR	1.4	0.4	0.5	1	0.2	n.d.	n.d.

Rock Descriptions: Textures and Mineralogy

Mineralogical data are discussed by rock type. Mineralogy and rock textures for each lithology are illustrated by a series of photomicrographs and SEM images of polished thin sections. Shales and sandstones incorporate a variety of minerals, including different varieties of mineral groups (clays, feldspars). Ankerite, for example, is an iron-bearing variety of dolomite. The term ankerite is used for dolomite-group minerals that have $Fe^{2+}/(Mg+Fe^{2+}) \geq 0.2$. Table 5.3 lists nominal minerals compositions; however, many common rock-forming minerals such as feldspars and micas have variable compositions because they form solid solutions. Also, individual crystals of a single mineral may be compositionally zoned.

Pyrite occurs mainly as framboids in the samples. The term framboid (from the French "framboise") refers to the raspberry-like texture of the pyrite. Framboids are spherical structures made up of equant microcrystals of pyrite.

Estimated mineral abundances for the raw leach column starting material as determined by Siroquant are summarized in Table 5.4, along with data for samples after the low-temperature ash (LTA), leach column residues, estimated amorphous content and measured % LTA. Some trace minerals identified by SEM were not identified by XRD because of their low modal abundance. Estimates of low concentrations (<5 weight percent) of minerals by XRD are not very reliable; errors on individual minerals are on the order of $\pm$ 1 weight percent.