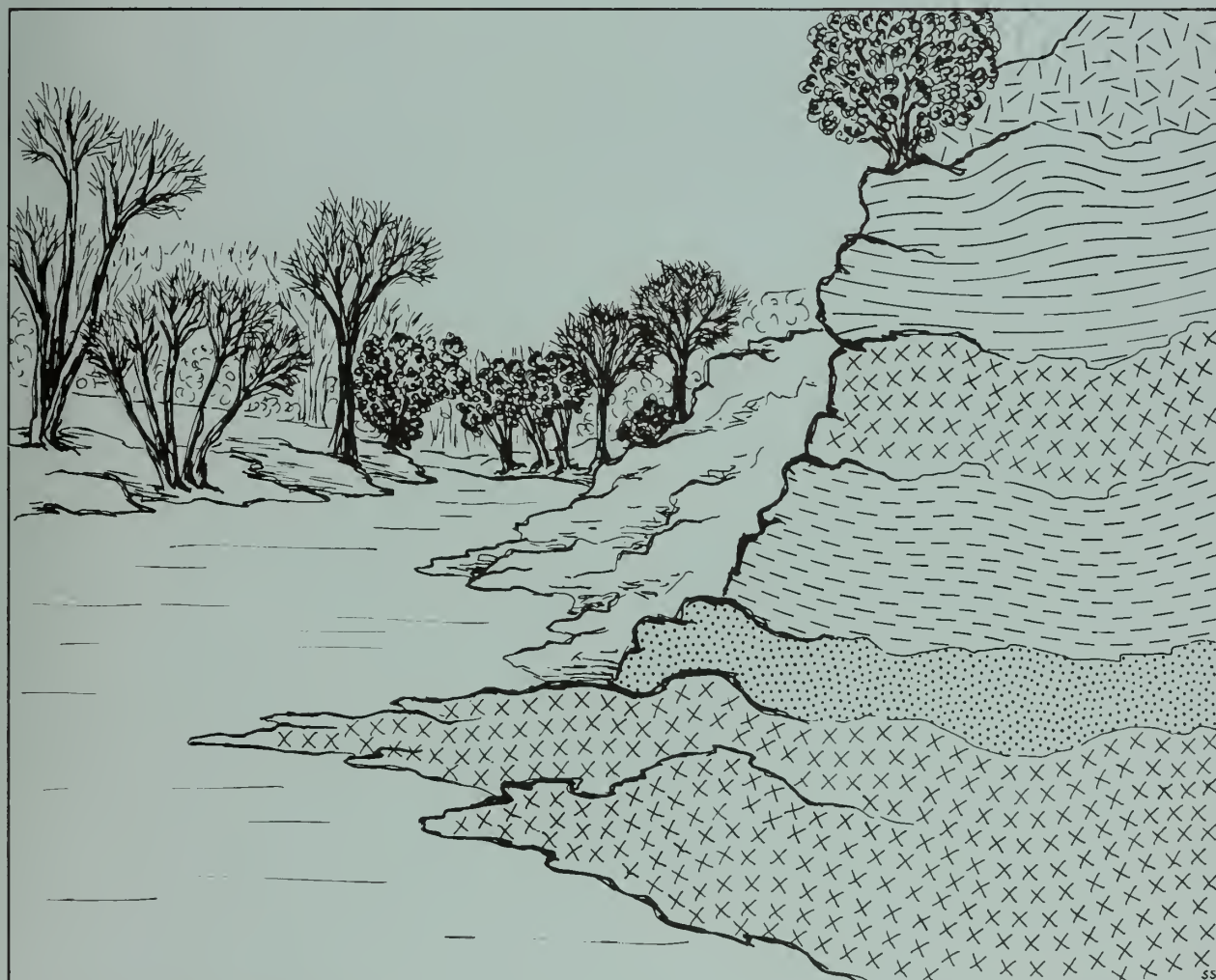


Chemical analyses of western Illinois clay materials

compiled by
W. Arthur White





COVER: This sketch by Sandra Stecyk is a graphic representation of an outcrop from which clay samples were taken. Clay deposits are indicated by the X symbol.

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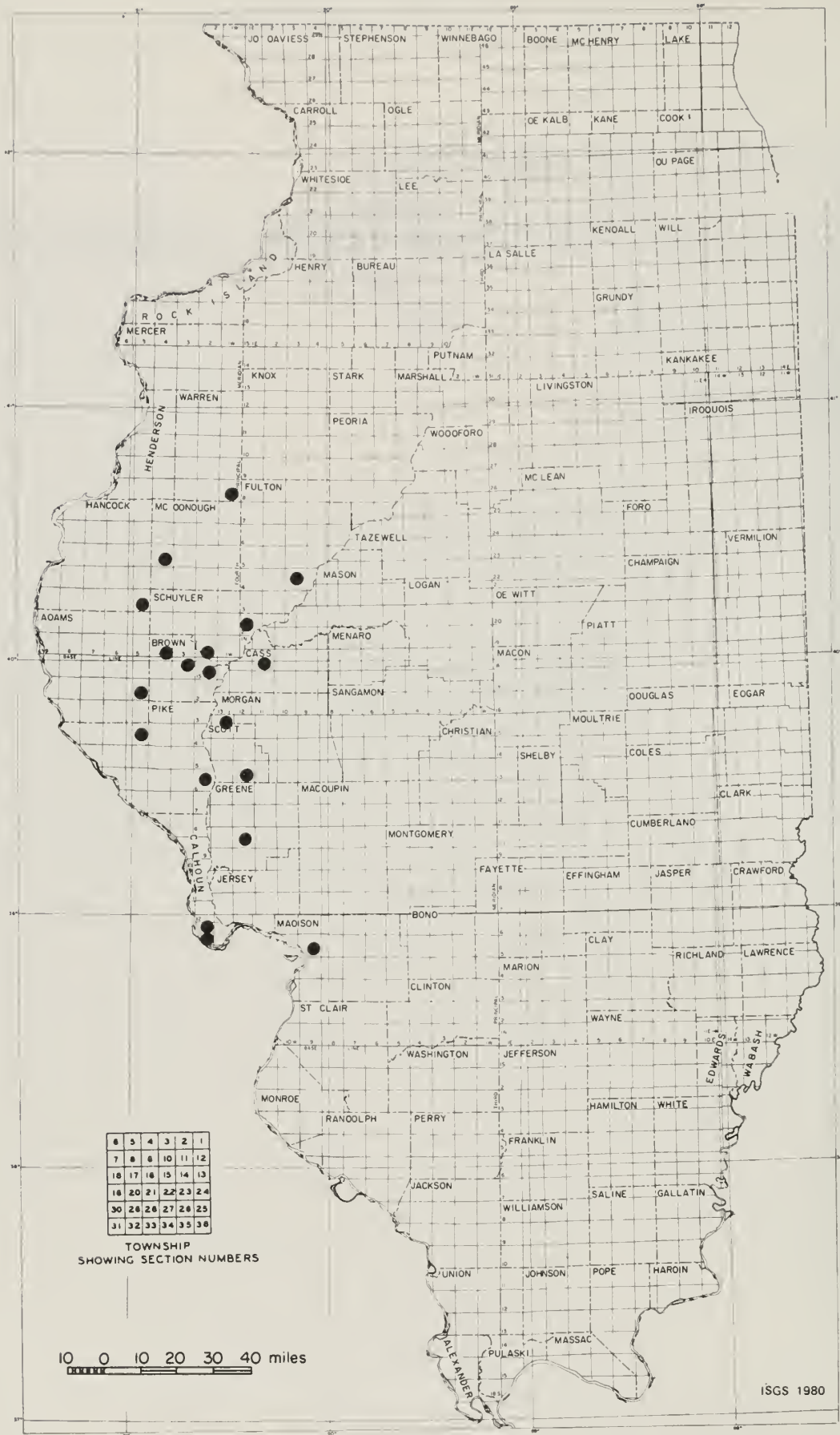


Figure 1. Location of outcrops from which samples were taken for chemical analysis.

ABSTRACT

This report includes (1) chemical data on Pennsylvanian and Mississippian clay materials in Western Illinois determined since 1959 and (2) descriptions of the outcrops from which the analyzed samples were taken. Each of the outcrops described represents a clay resource ranging from 5 to 100 million tons per square mile. The information in this report should be useful to industries interested in exploring the commercial possibilities of clay materials or locating large deposits of clay with a particular chemical composition.

INTRODUCTION

A supplement to Circular 282, *Chemical and spectrochemical analyses of Illinois clay materials*, published by the Illinois State Geological Survey in 1959, this report includes all the unpublished chemical data on western Illinois clay materials obtained since 1959.

Chemical data are presented in table 1, which lists the percentages of the major elements (SiO_2 , TiO_2 , Al_2O_3 , Fe_2O_3 , MgO , CaO , K_2O , and Na_2O) in the samples, the thickness each sample represents, and the locations and sample numbers corresponding with those in the outcrop descriptions.

Outcrop information includes the name and location of the outcrop, a brief description of each lithologic member, sample numbers for the lithologic members sampled, the thickness of each member, and the geologic formation and geologic age. All the outcrops described are located in western Illinois (fig. 1). Some outcrops may contain one thick lithologic member (25 to 80+ feet); other outcrops may contain one or more thin lithologic members which may range in thickness from less than 1 inch to more than 10 feet. The outcrops listed for Brown, Green, and Warren Counties are composites of two or more outcrops in the area. Unless designated otherwise, outcrops are from the Pennsylvanian System (Carbondale, Spoon, and Abbott Formations).

DESCRIPTIONS OF OUTCROPS

ADAMS COUNTY

LOCATION 1 (SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 13, T. 1 N., R. 5 W.); outcrop at mouth of gully below calcareous seat rock (underclay).

	ft	in.
CARBONDALE FORMATION		
Limestone, light gray, dense, massive; nodular upper surface, weathering yellow brown; fossils (Hanover Limestone Member)	2	-
Shale, greenish gray, slightly calcareous, with small rounded dark gray, slightly calcareous concretions	-	8
Claystone, coaly, dark gray (horizon of Sumnum [No. 4] Coal Member)	-	1
Seat rock, light gray, poorly exposed, somewhat rusty on joint surfaces, non-calcareous, grading down into sandy shale at base (<i>Sample 991-A</i>)	9	-
Sandstone, light gray with small brownish specks, slightly calcareous, fine grained; evenly bedded, beds 2 to 3 in. thick; micaceous in non-channel development (Pleasantview Sandstone Member)	3	-

LOCATION 2 (SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 18, T. 2 S., R. 5 W.); southwest bank of Coal Creek.

CARBONDALE FORMATION		
Shale, gray, thickness not obtained.		
Coal (Colchester [No. 2] Coal Member)	1	7
SPOON FORMATION		
Claystone, medium gray, somewhat laminated, with dark carbonaceous streaks (<i>Sample 991-0</i>)	-	9 $\frac{1}{2}$
Claystone, light gray, blocky fracture, not notably plastic, stained rusty on fracture surfaces; some selenite crystals (<i>Sample 991-0</i>)	1	7
Claystone, light gray, not rusty, with darker gray masses, not calcareous (<i>Sample 991-0</i>)	1	-
Claystone, light gray, blocky fracture, very rusty along joint surfaces (<i>Sample 991-0</i>)	1	6
Claystone, light gray, very rusty, with large blue gray limestone concretions surrounded by a deeply oxidized zone about 1 in. in diameter penetrated by dark gray masses—probably iron sulfide (probably Seahorne Limestone Member) (<i>Sample 991-0</i>)	-	10
Claystone, gray, hard, blocky fracture, oxidized, slightly sandy (<i>Sample 991-0</i>)	3	-

Covered interval 2 6
 Sandstone, yellow gray, knobby upper surface,
 hard; root traces; recrystallized grains 8 -

LOCATION 3 (NE¼SW¼ Sec. 18, T. 2 S., R. 5 W.)

CARBONDALE FORMATION

Shale, gray, Purington Shale Member - -
 Shale, black, fissile 1 6
 Coal, Colchester (no. 2) Coal Member 1 -

SPOON FORMATION

Seat rock, dark gray (Sample 991-G) 2 -
 Claystone, gray, iron stained (Sample 991-G) 2 6
 Claystone, gray, iron stained on joints (Sample
 991-H) 4 6
 Claystone, gray, selinite crystals and calcareous
 (Seahorne Limestone Member) (Sample 991-H) - 6
 Claystone, black (Sample 991-D) 5 6
 Covered interval 6 -
 Claystone, dark gray (Sample 991-J) 4 -
 Claystone, gray (Sample 991-K) 3 -
 Siltstone, light gray (Sample 991-K) 1 -
 Sandstone, light gray (Sample 991-K) 1 -

LOCATION 4 (NE¼NW¼NE¼ Sec. 30, T. 2 S.,
 R. 5 W.); east cutbank just south of road.

CARBONDALE FORMATION

Claystone, variegated purple, green, and orange
 (Sample 991-L) 6 6
 Shale, variegated purple, green and red (Sample
 991-M) 15 -
 Shale, green, sandy (Sample 991-N) 6 -

BROWN COUNTY

LOCATION 1 (NW¼SE¼SW¼ Sec. 33, T. 1 N.,
 R. 2 W.); tributary to La Moine River, east of
 Ripley.

Loess and till (Quaternary System) 25 -

SPOON FORMATION

Claystone, blue - 3
 Claystone, light gray (Sample 990-A) 2 6
 Coal - 11

ABBOTT FORMATION

Claystone, brownish gray (Sample 990-E) - 7
 Claystone, light gray (Sample 990-E) 3 2
 Coal - 1
 Claystone, purplish gray, hard, sandy (Sample
 990-D) - 6
 Sandstone, light brownish gray; *Stigmaria* present
 (Sample 990-D) - 6
 Claystone, brownish or olive gray, sandy (Sample
 990-D) 2 3

Claystone, gray, stained rusty brown on joint faces;
 grading down into shale (Sample 990-D) - 11
 Shale, light blue gray (Sample 990-C) - 11
 Shale, dark blue gray, poorly laminated (Sample
 990-C) - 9
 Claystone, light gray to rusty gray, sandy, blue
 gray, sandy calcareous concretions (Sample 990-C) 1 9
 Claystone, light gray, rusty along joints, sandy
 (Sample 990-C) - 10

LOCATION 2 (NW¼SE¼SW¼ Sec. 33, T. 1 N.,
 R. 2 W.); cutbank of La Moine River 100 feet
 downstream from junction with tributary east of
 Ripley.

ABBOTT FORMATION

Claystone 2 -
 Sandstone, thick bedded - 8
 Shale 1 6
 Coal, same as 1-inch coal in Section 1 - 9
 Claystone, blue gray, slightly sandy (Sample 990-B) 2 -
 Coal, shaly (Sample 990-B) - 0.25
 Clay, dark gray (Sample 990-B) - 5
 Sandstone, irregularly bedded, massive, coarse
 grained, *Stigmaria* 6 -
 Shale, black, fissile, hard 1 -
 Coal - 6
 Coal, black, fissile, carbonaceous, false bottom - 3
 Claystone, blue gray with coaly streaks, sandy - 3
 Claystone, light gray, sulfurous, sandy,
Stigmaria 1 9
 Sandstone, yellow gray with carbonaceous streaks 2 6
 Limestone, light gray, fine grained, finely laminated,
 rusty 2 6
 Shale, greenish gray, sulfurous, sandy, sandstone
 in lower part 1 10

LOCATION 3 (NW¼NE¼NE¼ Sec. 1, T. 1 S.,
 R. 3 W.); south side of stream before stream turns
 north.

SPOON FORMATION

Cover, coal and shale in dump 20 -
 Claystone, gray (Sample 990-G) 3 -
 Limestone (Seahorne Limestone Member) 4 6
 Claystone, gray (Sample 990-G) 10 -
 Coal - 2
 Claystone, gray (Sample 990-F) 9 8

LOCATION 4 (SE¼SE¼NW¼ Sec. 29, T. 1 S.,
 R. 1 W.); roadcut.

Loess (Quaternary System)

CARBONDALE FORMATION

Shale, fossiliferous 2 -
 Shale, black, ironstone concretions in top 6 inches
 (Sample 990-J) 3 -

Shale, gray	-	3
Limestone	-	3
Shale, dark gray	1	-
Shale, black, fissile, papery	1	-
Shale, gray	-	6
Coal, Colchester (No. 2) Coal Member	2	5

SPOON FORMATION

Claystone gray (<i>Sample 990-H</i>)	6	-
Limestone (Seahorne Limestone Member)	4	-
Claystone and shale (<i>Sample 990-I</i>)	15	-
Sandstone	2	6

LOCATION 5 (S½NE¼SE¼ Sec. 1, T. 1 N., R. 4 W.); roadcut north of creek north of east-west road.

CARBONDALE FORMATION

Claystone, variegated purple and greenish gray (<i>Sample 990-O</i>)	5	6
Claystone, greenish gray (<i>Sample 990-P</i>)	4	6
Sandstone	-	4
Claystone, mottled (<i>Sample 990-Q</i>)	2	6
Claystone, light gray (<i>Sample 990-Q</i>)	3	-
Claystone, light gray, sandy (<i>Sample 990-Q</i>)	1	6
Claystone, dark gray, coal horizon (<i>Sample 990-R</i>)	-	3
Shale, gray, poorly laminated, sandy and limy at base (<i>Sample 990-R</i>)	3	-
Limestone, red	1	-
Shale, brownish gray (<i>Sample 990-S</i>)	2	-
Shale, gray, poorly laminated (<i>Sample 990-T</i>)	11	-
Siltstone, light gray (<i>Sample 990-U</i>)	5	-

CALHOUN COUNTY

LOCATION 1 (SE¼SW¼NE¼ Sec. 26, T. 13 S., R. 2 W.) along ravine.

Loess (Quaternary System)	50	-
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CARBONDALE FORMATION

Limestone	2	-
Shale, gray (Purinton Shale Member) (<i>Sample 1067-C</i>)	30	-
Shale, black, fissile (<i>Sample 1067-A</i>)	1	-
Coal (Colchester [No. 2] Coal Member)	3	6

SPOON FORMATION

Claystone, gray, stained, yellow on the surface (<i>Sample 1067-B</i>)	3	-
Claystone, gray (<i>Sample 1067-B</i>)	-	6
Limestone (Seahorne Limestone Member)	-	1
Claystone, green	-	2
Claystone, gray, yellow stained	1	-

LOCATION 2 (SE¼NW¼ Sec. 1, T. 14 S., R. 2 W.); high cut wall of the Golden Eagle Clay Pit.

CARBONDALE FORMATION

Limestone, light gray, fine grained, massive below and nodular above	6	-
Claystone, light gray to white mottled with yellow, brown, red, maroon, and purple (<i>Sample 1067-G</i>)	5	-
Shale, mottled red and blue gray, micaceous, sandy (<i>Sample 1067-F</i>)	25	-
Shale, blue gray, micaceous and sandy (<i>Sample 1067-E</i>)	25	-
Shale, black fissile, hard, fossiliferous and nodular	3	-
Coal (Colchester [No. 2] Coal Member)	3	-

SPOON FORMATION

Claystone, gray to white (<i>Sample 1067-D</i>)	2	6
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CASS COUNTY

LOCATION 1 (NE¼ Sec. 15, T. 18 N., R. 11 W.); tributary to Illinois River along East Bluff.

CARBONDALE FORMATION

Sandstone, gray, shaly at top, massive	50	-
Shale, black, soft, micaceous, poorly bedded, fossiliferous	2	2
Limestone, blue gray, hard, fine grained, fossiliferous, massive	2	-
Shale, black, fissile, hard, pyrite concretions, fossiliferous	2	-
Shale, dark gray, soft, thinly bedded, slightly sandy	2	+''
Shale, gray, conchoidal fracture, soft, pyrite concretions, slightly sandy (Francis Creek Shale Member)	11	8
Coal (Colchester [No. 2] Coal Member)	2	9

SPOON FORMATION

Claystone, dark gray, shaly	-	5
Claystone, blue gray, hard, shaly bedded and fractured	1	2
Claystone, gray, very rusty with reddish weathered calcareous concretions; sandy	2	3
Claystone, gray, hard; sandy, calcareous concretions	3	4
Claystone, gray, very sandy, blocky, calcareous	1	9
Claystone, purplish gray, blocky	-	3
Coal, shaly and flaky	-	2
Claystone, dark purplish gray, soft, blocky	-	3
Claystone, gray, rusty on fracture surfaces	1	-
Limestone, light blue gray, nodular bedded, pyritic, fossiliferous (Seahorne Limestone Member)	2	6
Claystone, gray, calcareous, hard, blocky	2	1
Coal	-	0.5
Claystone, gray to purplish gray, blocky (<i>Sample 994-D</i>)	-	3
Claystone, gray, hard, blocky (<i>Sample 994-D</i>)	2	-
Cover	-	3
Claystone, gray, blocky (<i>Sample 994-D</i>)	1	2
Claystone, dark gray, shaly (<i>Sample 994-C</i>)	3	6

Claystone, gray, shaly (<i>Sample 994-C</i>)	1	1
Claystone, dark gray, shaly (<i>Sample 994-C</i>)	-	1
Claystone, gray, sandy, blocky (<i>Sample 994-C</i>)	2	-
Sandstone, blue-gray, fine grained, hard	1	7
Claystone, gray, yellowish on fracture surfaces, sandy	2	6
Coal	-	3
Claystone, purplish gray, sandy, blocky (<i>Sample 994-B</i>)	-	4
Claystone, gray, rusty on fracture surfaces, hard, blocky (<i>Sample 994-B</i>)	2	2
Shale, gray, thinly bedded, sandy	1	-
Limestone, dark blue gray, pyritic	-	2
Shale, dark blue gray, thin, sandy; large concretions (<i>Sample 994-A</i>)	1	6

FULTON COUNTY

LOCATION 1 (E½ Sec. 16, T. 4 N., R. 3 E.); outcrops along cutbanks of ravine.

SPOON FORMATION

Sandstone, shaly and, in place, massive (<i>Sample 1068-182</i>)	40	-
Shale, black grading into dark blue gray; siderite concretions (<i>Sample 1068-183</i>)	7	-
Coal (Greenbush Coal Member)	-	10
Claystone, light gray; some concretions (<i>Sample 1068-184</i>)	2	-
Cover	3	-
Sandstone, red at top, light gray at bottom; sugary	3	6
Claystone, yellowish brown	-	2
Claystone, dark gray	-	2
Claystone, greenish gray, yellow stained (<i>Sample 1068-186</i>)	-	6
Claystone, gray, hard (<i>Sample 1068-186</i>)	-	8
Claystone, gray, iron stained, hard (<i>Sample 1068-187</i>)	1	-
Claystone, light gray, blocky (<i>Sample 1068-188</i>)	1	6
Claystone, black (<i>Sample 1068-189</i>)	-	3
Claystone, yellow (<i>Sample 1068-189</i>)	-	5
Claystone, light to dark gray (<i>Sample 1068-190</i>)	1	6
Coal (Wiley Coal Member)	-	10
Claystone, light gray (<i>Sample 1068-191</i>)	2	-
Claystone, dark gray; calcareous concretions (<i>Sample 1068-192</i>)	1	6
Limestone (Seahorne Limestone Member)	1	6
Claystone, dark gray; selinite crystals (<i>Sample 1068-193</i>)	1	-
Limestone, nodular; in clay matrix	-	6
Claystone, dark to light gray (<i>Sample 1068-194</i>)	2	-
Limestone	2	-
Sandstone	2	-
Shale, gray, iron stained on joint surfaces and bedding planes (<i>Sample 1068-196</i>)	1	6

GREENE COUNTY

LOCATION 1 (C NW¼NE¼ Sec. 12, T. 10 N., R. 12 W.).

Cover

SPOON FORMATION

Claystone, gray (<i>Sample 958</i>)	3	-
Limestone (Seahorne Limestone Member)	1	-
Claystone, green	1	6

LOCATION 2 (NW¼NW¼NW¼ Sec. 12, T. 10 N., R. 12 W.) along Whitaker Creek.

Cover

SPOON FORMATION

Shale	5	6
Coal	1	-
Claystone, gray (<i>Sample 958-W</i>)	2	6
Claystone, gray (<i>Sample 958-X</i>)	5	6
Claystone, gray (<i>Sample 958-Y</i>)	5	6
Limestone	-	6
Shale, black	-	9
Shale, gray	5	6

LOCATION 3 (South of center NW¼ Sec. 12, T. 10 N., R. 12 W.); along east tributary to Whitaker Creek.

Cover

SPOON FORMATION

Shale	11	-
Coal	1	9
Claystone (<i>Sample 958-Z</i>)	6	-

LOCATION 4 (Center SE¼NW¼ Sec. 12, T. 10 N., R. 12 W.) along Whitaker Creek.

CARBONDALE FORMATION

Shale, gray (Francis Creek Shale Member) (<i>Sample 958-CC</i>)	12	0
Coal (Colchester [No. 2] Coal Member)	1	-

SPOON FORMATION

Claystone, gray	3	-
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LOCATION 5 (NE COR SW¼ Sec. 12, T. 10 N., R. 12 W.).

Loess and till (Quaternary System)	20	-
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CARBONDALE FORMATION

Sandstone (Pleasantview Sandstone Member)	2	9
Shale, gray, silty to sandy (Purinton Shale Member) (<i>Sample 958-MM</i>)	9	3

LOCATION 6 (SW¼NE¼ Sec. 11, T. 10 N., R. 12 W.); cut along ravine to Whitaker Creek.

CARBONDALE FORMATION

Sandstone (Pleasantview Sandstone Member) 11 -
 Shale, gray, non-sandy, thin bedded (Purington Shale Member) (Sample 958-RR) 3 4

LOCATION 7 (SE¼SE¼NE¼ Sec. 11, T. 10 N., R. 12 W.); cutbanks in Whitaker Creek.

CARBONDALE FORMATION

Sandstone, gray shaly and massive (Pleasantview Sandstone Member) 8 -
 Shale, gray, thin bedded (Purington Shale Member) 3 4
 Limestone, conglomeratic, sandy and soft clay matrix - 2
 Shale, black, fissile - 3
 Coal (Colchester [No. 2] Coal Member) 1 8

SPOON FORMATION

Claystone, gray (Sample 958-WW) 8 6

VALMEYERAN SERIES (Mississippian System)

Shale, gray, calcareous (Lower Mississippian System) 4 -
 Limestone, brownish to yellowish gray, fine grained, slabby 4 -

LOCATION 8 (Same location as Location 7, next outcrop upstream in Whitaker Creek).

SPOON FORMATION

Claystone (Sample 958-FFF) 5 -

HANCOCK COUNTY

LOCATION 1 (NE¼NW¼SE¼SW¼ Sec. 26, T. 3 N., R. 5 W.); high cutbank east side of Williams Creek south of east-west road.

Loess and drift (Quaternary System) 10 -

CARBONDALE FORMATION

Sandstone, massive, coarse, mealy 3 6
 Shale, black, fissile 1 3
 Sandstone, shaly, thin bedded 1 2
 Shale, gray, fairly hard 2 -
 Shale, light gray, soft, not very evenly bedded (Francis Creek Shale Member) 20 -
 Coal (Colchester [No. 2] Coal Member) 2 3

SPOON FORMATION

Claystone, light gray with yellow streaks, non-gritty; root impressions (Sample 992-C) 1 10
 Claystone, light gray, rusty on fracture, sandy (Sample 992-C) 1 9
 Sandstone, bluish to greenish gray, micaceous, slabby 2 3

Claystone, light gray, rusty on joint surfaces - 10
 Claystone, dark gray, irregular fracture 3 -
 Claystone, light gray, harder than above - 6
 Claystone, dark gray 2 -
 Concealed interval 2 -
 Claystone, greenish gray (Sample 992-E) 2 -
 Concealed interval 3 -
 Sandstone, red; contains calcium carbonate - 4
 Sandstone, brown - 6
 Shale, greenish gray, sandy, limy (Sample 992-F) 1 -

MADISON COUNTY

LOCATION 1 (SE¼NW¼NW¼ Sec. 15, T. 5 N., R. 9 W.); cutbank south side of branch of Wood River near Western Cartridge Company's shooting range.

Loess (Quaternary System) 12 -

CARBONDALE FORMATION

Shale, rusty brown, well bedded, micaceous (Purington Shale Member) 20 -
 Sandstone, light yellow gray, thin bedded, fine grained, shaly - 6
 Shale, gray to yellowish gray, micaceous, sandy, fairly well bedded; plant fossils 2 3
 Claystone, very ferruginous, brown, poorly bedded - 11
 Claystone, yellowish gray, more plastic than above, poorly bedded, fossiliferous - 3
 Shale, bluish gray grading into dark gray at base, fairly well bedded; concretions, fossil traces - 2
 Shale, black, soft, weathered - 1
 Shale, black, fissile, hard, fossiliferous 1 6
 Coal (Colchester [No. 2] Coal Member) 2 6

SPOON FORMATION

Claystone, dark gray to light gray (Sample 960-C and 960-D) 2 9
 Limestone, light to medium gray, conglomeratic, fossiliferous (Seahorne Limestone Member) 2 6
 Shale, blue-gray; limestone nodules - 2
 Shale, greenish gray, soft, poorly laminated, noncalcareous - 5
 Claystone, gray - 2
 Coal, bony - ¼
 Claystone, light gray grading to light lavender-gray; soft (Sample 960-E) 2 2
 Claystone, medium gray, slightly brownish or purplish, iron stained along joints (Sample 960-E) 1 -
 Claystone, medium gray, slightly brownish or purplish, iron stained along joints, harder than preceding sample (Sample 960-F) 1 -
 Claystone, similar to above but very rusty (Sample 960-F) 1 -
 Claystone, medium gray, very hard, slickensided (Sample 960-F) 1 -
 Cover to river 5 -

McDONOUGH COUNTY

LOCATION 1 (NW¼SE¼SW¼ Sec. 11, T. 5 N., R. 4 W.); old clay pit.

CARBONDALE FORMATION

Shale, gray, iron stained on surface (Francis Creek Shale Member)	16	-
Coal (Colchester [No. 2] Coal Member)	3	-

SPOON FORMATION

Claystone, dark gray (Sample 976-XX)	-	6
Claystone, light gray (Sample 976-XX)	1	6
Claystone, gray, rust stained on surface (Sample 978-XX)	1	-
Limestone, red, clayey	2	-
Shale, gray (Sample 976-YY)	2	9
Claystone, dark gray (Sample 976-ZZ)	-	11
Claystone, gray, rust stained, calcareous concretions (Sample 976-ZZ)	-	11
Limestone (Seahorne Limestone Member)	3	-
Claystone, dark gray (Sample 976-AAA)	5	-
Claystone, light gray, rust stained, sandy (Sample 976-BBB)	5	-
Ironstoned band	-	2
Shale, gray (Sample 976-CCC)	7	-
Claystone, gray, sandy (Sample 976-DDD)	2	-
Claystone, black (Sample 976-DDD)	-	4
Coal (Rock Island [No. 1] Coal Member)	-	4

ABBOTT FORMATION

Claystone, gray, sandy at base (Sample 976-DDD)	3	-
Coal	-	2
Claystone, gray, sandy (Sample 976-DDD)	1	-

PIKE COUNTY

LOCATION 1 (NW¼NW¼ Sec. 26, T. 4 S., R. 5 W.); east cutbank of creek south of road.

Cover

SPOON FORMATION

Claystone, dark gray (Sample 996-D)	5	-
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LOCATION 2 (NE¼NE¼SE¼ Sec. 4, T. 4 S., R. 5 W.); west side of roadcut.

Cover (Quaternary System) 20 -

SPOON FORMATION

Claystone, gray (Sample 996-F)	6	-
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LOCATION 3 (SW¼SW¼SW¼ Sec. 26, T. 4 S., R. 5 W.); east cut bank of Kiser Creek.

Chert, red, silty, clayey (Tertiary System)	1	6
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KINDERHOOKIAN SERIES (Mississippian System)

Shale, green, calcareous	50	-
Shale, blue, noncalcareous (Sample 996-O)	30	-

LOCATION 4 (SW¼NW¼NE¼ Sec. 23, T. 6 S., R. 2 W.); east cutbank of creek as creek bends north along south side of road.

Cover (Quaternary System)

KINDERHOOKIAN SERIES (Mississippian System)

Shale, gray, papery (Sample 996-J)	7	-
Cone-in-cone	-	2
Shale, gray, blocky, soft (Sample 996-I)	9	-
Shale, gray to dark at base (Sample 996-H)	1	6
Shale, dark gray, hard, fissile (like Sample 996-H)	3	-

SCOTT COUNTY

LOCATION 1 (NE¼ Sec. 14, T. 13 N., R. 12 W.).

CARBONDALE FORMATION

Sandstone (Pleasantview Sandstone Member)	5	-
Shale, black, sulfur compounds, soft	1	2
Shale, black fissile	2	9
Coal (Colchester [No. 2] Coal Member)	2	7

SPOON FORMATION

Claystone, gray	2	3
Limestone (Seahorne Limestone Member)	2	-
Claystone, gray (Sample 995-A)	6	-

LOCATION 2 (SE¼ Sec. 23, T. 15 N., R. 13 W.); high cutbank east side of ravine.

Loess and drift (Quaternary System) 15 -

SPOON FORMATION

Limestone (Seahorne Limestone Member)	4	-
Claystone, dark gray, noncalcareous, hard, blocky (Sample 995-H)	-	6
Claystone, light gray, rust stained on fracture surfaces, noncalcareous, blocky (Sample 995-H)	2	5
Claystone, olive gray, rust stain on fracture surfaces, noncalcareous, blocky (Sample 995-H)	1	3
Claystone, light gray streaked with yellow, noncalcareous (Sample 995-H)	-	9
Claystone, dark gray to black, blocky, slickensided (Sample 995-H)	-	2
Coal horizon, clayey, selinite crystals	-	1
Claystone, purplish gray with rust stains on fracture surfaces, noncalcareous, very slickensided (Sample 995-G)	1	2
Claystone, light brownish gray, noncalcareous, blocky (Sample 995-G)	-	4
Claystone, gray to light gray, rust stained on fracture surfaces, noncalcareous, softer than preceding sample (Sample 995-G)	-	4

Claystone, gray to olive gray, blocky, sandy, non-calcareous (<i>Sample 995-G</i>)	2	8
Claystone, gray to olive gray, less sandy than above (<i>Sample 995-F</i>)	3	-
Shale, dark gray, sandy, with melanterite, poorly bedded; plant impressions on bedding planes (<i>Sample 995-F</i>)	2	3
Sandstone, bluish gray, fairly coarse grained; plant impressions, shaly	-	5

SCHUYLER COUNTY

LOCATION 1 (NE¼ Sec. 31, T. 2 N., R. 1 E.);
Mill Creek Section in Section 31.

CARBONDALE FORMATION

Shale, olive gray, sandy, blocky, conchoidal fracture, limestone concretions	15	-
Covered interval	30	-
Limestone, gray, massive, fossiliferous (St. David Limestone Member)	1	8
Shale, gray, well bedded	3	-
Covered interval	2	-
Shale, black, fissile, large concretions	1	2
Coal (Springfield [No. 5] Coal Member)	3	6
Claystone, dark blue gray, soft	-	3
Claystone, gray, soft to hard, lower 8 inches rusty	1	3
Covered interval	1	-
Claystone, gray, hard, calcareous, blocky, calcareous nodules	1	4
Limestone, bluish to brownish gray, fine grained, nodular, massive, fossiliferous (Hanover Limestone Member)	1	10
Shale, gray to dark gray, sandy, fairly well bedded, calcareous near base	2	2
Claystone, carbonaceous, abundant pyrite nodules	-	2
Shale, black, coaly (horizon Summum [No. 4] Coal Member)	-	2
Claystone, dark gray (<i>Sample 978-MMM</i>)	-	3
Claystone, gray, rusty on fracture surfaces (<i>Sample 978-MMM</i>)	-	5
Claystone, light blue gray, hard, blocky, calcareous (<i>Sample 978-MMM</i>)	3	-
Covered interval	2	-
Claystone, blue gray, sandy, calcareous concretions	-	8
Shale, light blue gray, sandy, thinly bedded, with sandy calcareous concretions	2	2
Sandstone (Pleasantview Sandstone Member)	90	-
Limestone, gray to dark blue gray, fossiliferous at top, slabby, fine grained, massive	10	-
Shale, black, blocky	-	8
Shale, black, fissile, with large cannonball concretions	3	2
Shale, gray, to blue gray (Francis Creek Shale Member) (<i>Sample 978-NNN</i>)	20	-
Coal (Colchester [No. 2] Coal Member)	2	-

SPOON FORMATION

Claystone, gray, calcareous at base (<i>Sample 978-OOO</i>)	2	6
Claystone, black, coaly (<i>Sample 978-PPP</i>)	-	6

Claystone, gray (<i>Sample 978-PPP</i>)	-	6
Limestone (Seahorne Limestone Member)	-	6
Claystone, gray	-	2
Coal, poor	-	1
Claystone, yellowish gray, weathered (<i>Sample 978-RRR</i>)	1	6
Claystone, gray (<i>Sample 978-SSS</i>)	1	-
Claystone, light gray (<i>Sample 978-TTT</i>)	1	-
Ironstone layer		1
Claystone, yellowish greenish gray (<i>Sample 978-UUU</i>)	1	-
Claystone, coaly	-	1
Claystone, gray, sandy (<i>Sample 978-VVV</i>)	1	-
Claystone, coaly	-	¼
Claystone, gray (<i>Sample 978-WWW</i>)	1	-
Claystone, coaly streak	-	1
Claystone, gray, sandy (<i>Sample 978-XXX</i>)	2	2
Sandstone, gray to blue gray (<i>Sample 978-YYY</i>)	1	6
Coal	-	1
Sandstone, gray/blue gray mottled	-	4
Coal (Rock Island [No. 1] Coal Member)	2	-

ABBOTT FORMATION

Claystone, dark blue gray, blocky	-	5
Coal, changes to black clay	-	½
Claystone, gray, blocky, with carbonaceous material (<i>Sample 978-ZZZ</i>)	1	5
Coal	-	7
Claystone, yellowish gray, hard, slabby	-	1
Coal	-	2

WARREN COUNTY

LOCATION 1 (NE¼ Sec. 24, T. 8 N., R. 1 W.);
south tributary to Swan Creek.

CARBONDALE FORMATION

Limestone, gray, cone-in-cone	-	2
Limestone, gray, very fossiliferous	-	9
Shale, dark gray (<i>Sample 977-T</i>)	1	4
Shale, dark gray, clod, very fossiliferous	-	7
Shale, black, fissile, large limestone concretions	1	5
Shale, light gray, soft, spheroidal fracture (Francis Creek Shale Member) (<i>Sample 977-U</i>)	7	-
Coal (Colchester [No. 2] Coal Member)	2	1

SPOON FORMATION

Claystone, light gray, yellowish brown on surface, calcareous (<i>Sample 977-V</i>)	2	+
Shale, light olive gray, weathering yellow, very sandy near base (<i>Sample 977-W</i>)	3	6
Sandstone, olive gray, slightly micaceous	-	3
Shale, light olive gray, sandy at top, evenly bedded (<i>Sample 977-X</i>)	7	-
Shale, gray, less sandy than above (<i>Sample 977-Y</i>)	8	-
Coal (Greenbush Coal Member)	-	1
Claystone, dark gray	-	2
Claystone, gray (<i>Sample 977-Z</i>)	2	-
Concretion layer	1	6
Claystone, gray, sandy	3	-

Sandstone, olive gray, micaceous, slabbly	4	6
Shale, gray, finely bedded (<i>Sample 977-AA</i>)	6	-
Coal (Wiley Coal Member)	1	3

LOCATION 2 (SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 24, T. 8 N., R. 1 W.); east bank of tributary to Swan Creek.

SPOON FORMATION

Coal, weathered	-	6
Claystone, yellowish gray	-	10
Shale, green, weathered	-	6
Coal	-	1
Claystone, dark and yellowish gray	-	8
Claystone, yellowish gray	-	3
Shale, light gray, sulfur stain on fracture surface (<i>Sample 977-EE</i>)	-	10
Coal	-	3/4
Claystone, light gray, iron stained on fracture surfaces (<i>Sample 977-FF</i>)	-	10
Shale, yellowish gray, hard (<i>Sample 977-GG</i>)	1	6
Limestone	-	1
Shale, black, iron and sulfur stained, soft, concretions (<i>Sample 977-HH</i>)	4	-

Sandstone, with concretions	-	8
Shale, black, sandy (<i>Sample 977-II</i>)	-	10
Sandstone	-	3
Coal	-	5
Claystone, dark gray, sandy (<i>Sample 977-KK</i>)	1	-
Coal	-	1/4
Claystone, dark gray, sandy (<i>Sample 977-LL</i>)	-	6

LOCATION 3 (N $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 24, T. 8 N., R. 1 W.); north bank of west tributary to south tributary to Swan Creek.

SPOON FORMATION

Coal	-	1
Claystone, brown (<i>Sample 977-MM</i>)	1	-
Claystone, olive gray (<i>Sample 977-NN</i>)	1	6
Coal	-	1
Claystone, dark gray, with yellow staining on fracture surface, sandy (<i>Sample 977-OO</i>)	9	6
Coal	-	1
Claystone, dark gray	-	1
Coal	-	1
Claystone, gray, concretions (<i>Sample 977-PP</i>)	1	6

TABLE 1. Chemical composition of clay materials.^a

Site no.	Formation	Thickness		Location	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O
		(ft)	(in.)									
ADAMS COUNTY												
991-A	Carbondale	9	-	SW SW NE 13, 1S-5W	50.85	0.98	17.04	6.83	0.36	2.10	2.47	0.44
991-O	Spoon	8	0	SE SE 18, 2S-5W	55.13	1.58	25.94	2.63	0.20	0.08	0.59	0.49
991-G	Spoon	4	6	NE SW NE 18, 2S-5W	54.74	1.40	23.22	2.40	0.23	0.24	0.33	0.88
991-H	Spoon	5	-	NE SW NE 18, 2S-5W	52.03	1.55	24.79	2.32	0.02	1.87	0.51	0.57
991-I	Spoon	5	6	NE SW NE 18, 2S-5W	60.48	1.68	23.83	1.89	0.28	0.73	0.72	0.61
991-J	Spoon	4	-	NE SW NE 18, 2S-5W	63.62	1.27	19.63	1.76	0.53	0.17	2.20	0.73
991-K	Spoon	5	-	NE SW NE 18, 2S-5W	64.26	1.20	19.27	2.32	0.20	0.08	2.26	0.69
991-L	Carbondale	6	6	NE NW NE 30, 2S-5W	57.07	1.23	21.88	5.83	0.85	0.55	1.07	0.13
991-M	Carbondale	15	-	NE NW NE 30, 2S-5W	60.97	1.00	16.68	7.42	2.25	0.74	2.78	0.80
991-N	Carbondale	6	-	NE NW NE 30, 2S-5W	64.67	1.05	14.57	5.56	2.92	0.84	2.45	1.90
BROWN COUNTY												
990-A	Spoon	2	6	NW SE SW 33, 1N-2W	68.35	1.05	18.44	1.17	0.05	0.15	1.42	0.01
990-E	Spoon	3	9	NW SE SW 33, 1N-2W	73.59	0.78	15.13	2.07	0.17	0.03	1.17	0.08
990-D	Abbott	4	3	NW SE SW 33, 1N-2W	68.18	1.03	18.12	1.77	0.35	0.49	1.14	0.38
990-C	Abbott	4	5	NW SE SW 33, 1N-2W	69.72	1.02	20.12	1.73	0.55	0.10	1.87	0.01
990-B	Abbott	2	5	NW SE SW 33, 1N-2W	66.68	1.48	22.49	1.39	0.35	0.15	0.78	0.32
990-F	Spoon	9	8	NW NE NE 1, 1S-3W	80.43	1.00	15.04	1.34	0.02	0.04	1.11	0.08
990-G	Spoon	13	-	NW NE NE 1, 1S-3W	56.60	1.40	26.66	1.66	0.17	0.14	2.40	0.13
990-J	Carbondale	3	-	SE SE NW 29, 1S-1W	56.30	0.90	18.57	5.90	1.86	0.38	3.52	0.37
990-H	Spoon	6	-	SE SE NW 29, 1S-1W	50.96	0.78	14.85	4.98	1.62	5.15	1.69	0.12
990-I	Spoon	15	-	SE SE NW 29, 1S-1W	62.61	1.10	22.96	1.93	0.56	1.19	2.51	0.42
990-O	Carbondale	5	6	NE SE 1, 1N-4W	60.71	1.18	20.50	2.30	0.76	0.27	0.77	0.14
990-P	Carbondale	4	6	NE SE 1, 1N-4W	69.84	1.18	19.10	1.83	0.02	0.03	1.99	0.13
990-Q	Carbondale	7	0	NE SE 1, 1N-4W	68.54	1.08	19.29	1.33	0.02	0.67	1.51	0.07
990-R	Carbondale	3	3	NE SE 1, 1N-4W	73.05	0.85	14.89	1.62	0.88	0.22	1.37	0.07
990-S	Carbondale	2	-	NE SE 1, 1N-4W	50.63	1.10	18.97	12.51	0.99	0.48	2.66	0.13
990-T	Carbondale	11	-	NE SE 1, 1N-4W	58.02	1.52	22.90	2.02	0.78	0.01	1.34	0.09
990-U	Carbondale	5	-	NE SE 1, 1N-4W	83.00	0.63	8.45	1.30	0.20	0.13	0.57	0.04
CALHOUN COUNTY												
1067-A	Carbondale	1	-	SE SW NE 26, 13S-2W	50.51	1.52	26.81	3.52	0.12	0.35	1.25	0.12
1067-B	Spoon	3	6	SE SW NE 26, 13S-2W	54.23	1.28	23.71	3.36	0.18	0.81	0.36	0.04
1067-C	Carbondale	30	-	SE SW NE 26, 13S-2W	56.67	0.98	22.30	5.69	0.58	0.34	3.34	0.50
1067-D	Spoon	2	6	SE NW 1, 14S-2W	63.96	1.28	19.71	1.87	0.45	0.38	1.00	0.06
1067-E	Carbondale	25	-	SE NW 1, 14S-2W	60.20	0.97	19.71	5.70	1.43	0.32	2.94	0.98
1067-F	Carbondale	25	-	SE NW 1, 14S-2W	57.29	1.00	18.69	8.18	1.09	0.39	3.07	1.54
1067-G	Carbondale	5	-	SE NW 1, 14S-2W	64.30	1.23	19.71	2.04	0.13	1.18	2.36	0.18
CASS COUNTY												
994-A	Abbott	1	6	NE 15, 18N-11W	59.17	0.93	19.16	4.09	0.85	0.22	3.31	0.42
994-B	Spoon	2	6	NE 15, 18N-11W	62.44	1.07	16.27	4.27	0.02	0.11	2.48	0.14
994-C	Spoon	6	8	NE 15, 18N-11W	57.61	1.35	22.09	2.83	0.02	0.34	1.63	0.10
994-D	Spoon	3	6	NE 15, 18N-11W	54.25	1.43	25.55	2.17	0.13	0.32	1.37	0.11

^aAnalyses by Larry R. Camp, Elizabeth Fruth, L. R. Henderson, John Kuhn, Mark Seifrid, and John D. Steele.

TABLE 1. (continued)

Site no.	Formation	Thickness		Location	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O
		(ft)	(in.)									
FULTON COUNTY												
1068-182	Spoon	40	-	E½ 16, 4N-3E	76.03	0.97	10.49	3.59	1.08	0.14	1.61	0.61
1068-183	Spoon	7	-	E½ 16, 4N-3E	57.69	1.00	17.67	6.72	1.76	0.13	3.19	0.40
1068-184	Spoon	2	-	E½ 16, 4N-3E	54.81	1.13	21.16	3.66	1.48	0.15	3.46	<0.01
1068-186	Spoon	-	8	E½ 16, 4N-3E	52.05	1.03	17.82	8.86	0.93	1.20	3.37	0.08
1068-187	Spoon	1	-	E½ 16, 4N-3E	56.58	0.98	19.59	6.91	1.23	0.06	3.43	0.28
1068-188	Spoon	1	6	E½ 16, 4N-3E	62.91	0.58	20.99	5.53	1.54	0.06	3.83	0.27
1068-189	Spoon	-	8	E½ 16, 4N-3E	49.37	1.05	17.10	11.29	1.14	0.10	3.36	<0.01
1068-190	Spoon	1	6	E½ 16, 4N-3E	62.76	1.20	21.96	2.34	0.80	0.03	2.67	<0.01
1068-191	Spoon	2	-	E½ 16, 4N-3E	73.40	1.22	16.00	3.03	0.73	0.07	2.10	<0.01
1068-192	Spoon	1	6	E½ 16, 4N-3E	54.91	0.97	18.72	4.42	1.26	4.00	2.65	0.01
1068-193	Spoon	1	-	E½ 16, 4N-3E	55.58	0.97	19.50	4.75	1.49	1.57	3.67	<0.01
1068-194	Spoon	2	-	E½ 16, 4N-3E	68.43	1.12	17.27	3.45	0.61	0.17	1.88	<0.01
1068-196	Spoon	1	6	E½ 16, 4N-3E	61.25	1.22	19.54	4.98	1.29	<0.01	3.19	0.39
GREEN COUNTY												
958-V	Spoon	3	-	C NW NE 12, 10N-12W	54.38	1.62	25.70	2.36	0.17	0.01	0.33	0.07
958-W	Spoon	2	6	NW NW NW 12, 10N-12W	52.30	1.62	26.59	4.82	0.15	0.07	0.19	0.05
958-X	Spoon	5	6	NW NW NW 12, 10N-12W	50.98	1.52	27.74	3.07	0.02	0.31	0.43	0.08
958-Y	Spoon	5	6	NW NW NW 12, 10N-12W	67.15	1.28	20.37	2.16	0.02	0.17	0.72	0.80
958-Z	Spoon	6	-	C NW 12, 10N-12W	51.60	1.63	28.17	2.43	0.02	0.41	0.17	0.50
958-CC	Carbondale	12	-	C SE NW 12, 10N-12W	51.32	0.97	22.39	6.09	0.88	0.45	3.45	1.47
958-MM	Carbondale	9	3	NE NE SW 12, 10N-12W	65.40	1.07	14.61	5.38	0.99	0.14	2.26	0.76
958-RR	Carbondale	3	4	SW NE 11, 10N-12W	51.15	0.93	22.52	6.91	1.43	0.25	3.53	0.50
958-WW	Spoon	8	6	SE SE NE 11, 10N-12W	52.32	1.65	28.64	2.00	0.02	0.11	0.17	0.05
958-FFF	Spoon	5	-	SE NE 11, 10N-12W	50.52	1.63	28.63	2.12	0.30	0.41	0.22	0.06
HANCOCK COUNTY												
992-C	Spoon	3	7	NW SE SW 26, 3N-5W	71.62	1.07	15.10	2.59	0.58	0.07	1.82	0.01
992-E	Spoon	2	-	NW SE SW 26, 3N-5W	66.36	1.00	16.34	2.95	0.65	0.10	2.59	0.01
992-F	Spoon	1	-	NW SE SW 26, 3N-5W	65.42	1.03	13.89	6.73	1.21	0.18	2.47	0.01
MADISON COUNTY												
960-C	Spoon	1	-	SE NW NW 15, 5N-9W	49.67	1.35	26.83	3.60	0.50	0.32	0.49	0.06
960-D	Spoon	1	9	SE NW NW 15, 5N-9W	42.19	1.02	20.39	9.39	0.02	0.06	0.39	0.04
960-E	Spoon	3	2	SE NW NW 15, 5N-9W	45.20	1.25	26.94	5.15	0.02	0.46	0.49	0.08
960-F	Spoon	3	-	SE NW NW 15, 5N-9W	46.85	1.65	31.20	1.80	0.07	0.36	1.11	0.18
McDONOUGH COUNTY												
976-XX	Spoon	3	-	NW SE SW 11, 5N-4W	51.92	1.03	22.77	5.92	0.45	0.14	2.87	0.16
976-YY	Spoon	2	9	NW SE SW 11, 5N-4W	55.26	1.00	20.10	7.43	0.78	0.59	3.07	0.33
976-ZZ	Spoon	1	10	NW SE SW 11, 5N-4W	47.83	0.75	15.29	3.95	0.46	9.86	2.35	0.05
976-AAA	Spoon	5	-	NW SE SW 11, 5N-4W	66.79	1.12	15.32	2.56	0.03	0.39	1.72	0.10
976-BBB	Spoon	5	-	NW SE SW 11, 5N-4W	71.88	1.22	14.15	2.06	0.02	0.10	2.17	0.08
976-CCC	Spoon	7	-	NW SE SW 11, 5N-4W	63.68	1.12	18.46	4.07	0.05	0.31	2.75	0.23
976-DDD	Abbott	4	-	NW SE SW 11, 5N-4W	69.48	1.10	14.95	1.89	0.02	0.11	1.70	0.10

TABLE 1. (continued)

Site no.	Formation	Thickness		Location	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	Na ₂ O
		(ft)	(in.)									
PIKE COUNTY												
996-D	Spoon	5	-	NW NW 26, 4S-5W	57.67	1.38	24.17	1.89	0.36	0.13	1.10	0.01
996-F	Spoon	6	-	NE NE SE 4, 4S-5W	66.68	1.10	18.29	1.94	0.45	0.20	2.30	0.59
996-O	Kinderhookian	30	-	SW SW SW 26, 4S-5W	61.59	0.72	15.51	4.45	1.84	0.29	4.73	0.80
996-H	Kinderhookian	7	-	SW NW NE 23, 6S-2W	52.77	1.12	26.59	1.67	0.27	0.28	0.94	0.47
996-I	Kinderhookian	9	-	SW NW NE 23, 6S-2W	59.13	1.00	16.08	4.66	2.24	0.55	4.96	0.23
996-J	Kinderhookian	4	6	SW NW NE 23, 6S-2W	52.35	0.97	16.99	4.49	1.82	0.20	5.00	0.78
SCOTT COUNTY												
995-A	Spoon	6	-	NE 14, 13N-12W	50.78	1.55	29.15	1.64	0.20	0.25	1.01	0.01
995-F	Spoon	5	3	SE 23, 15N-13W	63.66	1.22	17.08	2.36	0.18	0.06	1.07	0.43
995-G	Spoon	4	6	SE 23, 15N-13W	69.87	1.28	18.90	1.46	0.15	0.04	0.98	0.67
995-H	Spoon	5	1	SE 23, 15N-13W	48.94	1.10	27.32	2.30	0.18	0.17	1.00	0.47
SCHUYLER COUNTY												
978-MMM	Carbondale	3	8	NE 31, 2N-1E	56.41	1.23	22.52	3.55	0.86	0.42	0.48	0.01
978-NNN	Carbondale	20	-	NE 31, 2N-1E	59.96	0.92	13.19	5.82	1.31	0.14	2.55	0.61
978-OOO	Spoon	2	6	NE 31, 2N-1E	50.08	0.95	20.26	9.72	1.66	0.24	3.41	0.01
978-PPP	Spoon	1	-	NE 31, 2N-1E	50.06	0.95	21.35	5.30	1.36	0.22	3.60	<0.01
978-RRR	Spoon	1	6	NE 31, 2N-1E	59.38	1.32	19.92	2.95	0.56	0.15	2.55	<0.01
978-SSS	Spoon	1	-	NE 31, 2N-1E	61.40	1.37	21.65	2.40	0.95	0.32	2.72	<0.01
978-TTT	Spoon	1	-	NE 31, 2N-1E	54.53	1.20	21.88	3.29	1.18	0.53	3.31	<0.01
978-UUU	Spoon	1	-	NE 31, 2N-1E	57.18	1.08	18.61	5.03	1.26	0.20	3.79	<0.01
978-VVV	Spoon	1	-	NE 31, 2N-1E	79.11	1.13	12.60	1.03	0.30	0.03	0.71	<0.01
978-WWW	Spoon	1	-	NE 31, 2N-1E	63.66	1.40	21.37	1.27	0.40	0.04	1.69	<0.01
978-XXX	Spoon	2	2	NE 31, 2N-1E	74.08	1.23	14.83	1.33	0.38	<0.01	2.11	<0.01
978-YYY	Spoon	1	6	NE 31, 2N-1E	76.99	1.18	11.53	2.57	0.18	<0.01	1.93	<0.01
978-ZZZ	Abbott	1	5	NE 31, 2N-1E	53.52	1.43	22.81	2.26	0.53	<0.01	1.43	<0.01
WARREN COUNTY												
977-T	Carbondale	1	4	NE 24, 8N-1W	56.07	0.88	22.35	1.99	0.93	0.17	2.41	0.47
977-U	Carbondale	7	-	NE 24, 8N-1W	55.83	1.18	17.04	6.85	1.77	0.01	3.65	<0.01
977-V	Spoon	2	1	NE 24, 8N-1W	57.97	1.00	22.60	2.62	0.85	0.08	1.73	<0.01
977-W	Spoon	3	6	NE 24, 8N-1W	58.76	1.08	18.52	8.68	1.43	0.08	3.25	<0.01
977-X	Spoon	7	-	NE 24, 8N-1W	61.67	1.07	20.52	5.69	2.07	0.07	3.91	<0.01
977-Y	Spoon	8	-	NE 24, 8N-1W	63.77	1.02	18.59	3.86	1.59	0.13	3.26	0.18
977-Z	Spoon	2	-	NE 24, 8N-1W	64.07	1.18	18.65	5.05	1.89	0.01	3.13	<0.01
977-AA	Spoon	6	-	NE 24, 8N-1W	56.86	1.10	19.84	5.62	2.12	0.14	3.78	0.26
977-EE	Spoon	-	10	SE NW NE 24, 8N-1W	57.35	0.93	21.35	3.10	1.06	<0.01	4.40	<0.01
977-FF	Spoon	-	10	SE NW NE 24, 8N-1W	72.88	1.10	17.46	2.26	0.66	0.28	2.69	<0.01
977-GG	Spoon	1	6	SE NW NE 24, 8N-1W	58.10	0.98	16.34	10.07	0.83	0.42	2.95	<0.01
977-HH	Spoon	4	-	SE NW NE 24, 8N-1W	60.60	1.02	19.84	2.96	0.80	<0.01	3.88	<0.01
977-II	Spoon	-	10	SE NW NE 24, 8N-1W	68.56	0.98	16.10	2.20	0.75	0.06	3.00	<0.01
977-KK	Spoon	1	-	SE NW NE 24, 8N-1W	59.04	1.15	22.35	1.33	0.66	0.07	1.86	<0.01
977-LL	Spoon	-	6	SE NW NE 24, 8N-1W	61.44	1.08	20.77	1.30	0.55	0.04	2.13	<0.01
977-MM	Spoon	1	-	SW NE 24, 8N-1W	60.58	1.18	22.56	2.83	0.98	<0.01	2.77	<0.01
977-NN	Spoon	1	6	SW NE 24, 8N-1W	74.24	1.23	16.40	2.10	0.70	<0.01	2.05	<0.01
977-OO	Spoon	9	6	SW NE 24, 8N-1W	61.12	1.27	20.50	2.44	0.93	<0.01	3.51	<0.01
977-PP	Spoon	1	6	SW NE 24, 8N-1W	72.48	1.18	16.91	2.03	0.66	<0.01	2.69	<0.01

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