STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

BUFF-BURNING CLAY RESOURCES OF SOUTHWESTERN AND SOUTHERN ILLINOIS

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ILLINOIS STATE GEOLOGICAL SURVEY
John C. Frye, *Chief*
URBANA

CIRCULAR 352
1963

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ABSTRACT

Some 66 samples of Pennsylvanian clays that occur in the Spoon and Abbot Formations in Calhoun, Cass, Gallatin, Greene, Jackson, Jersey, Johnson, Madison, Monroe, Pike, St. Clair, Saline, Scott, and Williamson Counties, Illinois, were tested to determine their potential uses. Their bonding and ceramic properties were determined.

INTRODUCTION

This report is another in a series of guides to locate new clay deposits (fig. 1) which may be used in the manufacture of china, drain tile, flower pots, flue liners, lightweight aggregate, paper, refractories, refractory cements, sewer pipe, stoneware, structural clay products (brick, hollow block, and tile), terra cotta and terra sigillata (a mixture of clay and pigments dispersed in water to be sprayed or dipped on ceramic ware), and which may be used as fillers and bonding clays. Tabulated data on the individual samples of clays tested are given in Appendix A; thickness of beds and stratigraphic sequence of clays are shown by the measured sections in Appendix B; and some supplemental references are given in Appendix C. The three previous reports on clays of this nature have been published for LaSalle (Parham, 1959), Knox (Parham, 1960), and Rock Island, Mercer, and Henry Counties (Parham, 1961).

Fig. 1 - Locations from which samples of clay were taken for ceramic tests.

GEOLOGY

Stratigraphy

Because most of the counties included in this report are covered by glacial deposits, exposures of the Pennsylvanian rocks are limited mainly to stream cuts, road cuts, and mines. Many of the samples reported here were taken from beds of clay that normally occur directly beneath layers of coal. Such beds of gray, fine-grained, nonbedded clay, called underclay, range in thickness from a few inches to about 20 feet. The remaining samples were from shales.

Classification of the Pennsylvanian strata of the area of this report is indicated in figure 2 (Kosanke et al., 1960). Only members that will aid in locating the samples stratigraphically are listed.

Throughout most of the area concerned in this report the Pennsylvanian rocks have a gentle regional dip. In western Illinois the rocks dip gently toward the east, but in the southern counties they have a slightly greater dip toward the north. In Saline and Gallatin Counties, however, where there has been a great deal of faulting, the direction and degree of dip of the rocks can vary greatly within short distances; nevertheless the regional dip is generally northward.

Many of the Pennsylvanian rocks, originally deposited in the Illinois Basin, now crop out near the eastern, southern, and western borders of Illinois and along a belt across the north-central portion of the state. Some of these rocks form continuous beds that extend from outcrops on one side of the Illinois Basin to the other, but in the deeper portions of the basin in south-central Illinois the same beds may be buried under several hundred feet of younger rocks.

Most of the samples of clay tested were taken from various beds of the Spoon Formation; some samples were taken from beds of uncertain stratigraphic position.

The detailed geology at each of the outcrops sampled is given in the measured geologic sections (appendix B), listed by counties arranged alphabetically. The sample numbers, location, stratigraphy, lithology, and thickness of each lithologic unit are given. The clay or shale sampled is indicated by the sample number, which is also the cross reference to the chemical data (table 1) and the tabulated ceramic tests and suggested uses (table 2).

For detailed geology of the area, see the references listed in the bibliography at the end of this report (appendix C).

Mineralogy

The mineralogy of the clay samples was determined by x-ray, differential thermal analyses, microscopic techniques, and by visual observation. The clay minerals common to many of the samples are illite, kaolinite, mixed-layer clay minerals, and chlorite. The nonclay minerals are chiefly quartz with minor amounts of pyrite, siderite, calcite, and gypsum.

The clays and shales vary in clay mineral composition from almost pure kaolinite to almost pure mixed-layer clay material. Most of the clays, however, are mixtures of two or more clay minerals.

System	Group	Formation	Members	
			Monroe County and north	south of Monroe County
Pleistocene Series				
Pennsylvanian	McLeansboro	Mattoon		
		Bond		
		Modesto		
	Kewanee	Carbondale	Pleasantview Ss	
			Purington Sh	
			Francis Creek Sh	
			Colchester (No. 2) Coal	Colchester (No. 2) Coal
		Spoon		DeKoven Coal
			Wiley Coal	Davis Coal
			Seahorne Ls	Seahorne Ls
				Vergennes Ss
			DeLong Coal	Mt. Rorah Coal
				Creal Springs Ls
			Brush Coal	
				Granger Ss
			Hermon Coal	
			Selville Ls	
			Rock Island (No. 1) Coal	Murphysboro Coal
				Bidwell Coal
	McCormick	Abbott	Bernadotte Ss	Murray Bluff Ss
			Pope Creek Coal	Delwood Coal
			Tarter Coal	Willis Coal
			Manley Coal	
				Grindstaff Ss
			Babylon Ss	
				Reynoldsburg Coal
		Caseyville		
Mississippian				

Fig. 2 - Modified stratigraphic section.

Quartz and pyrite occur in various concentrations in all the clays, whereas siderite, calcite, and gypsum are less common. Gypsum usually occurs only on or near the surface of the weathered clay outcrops.

During weathering of pyrite in the clays, iron sulfate and sulfuric acid are formed. The sulfuric acid reacts with any calcite present and/or the calcium on the exchange positions of the clay minerals to form gypsum. Pyrite-bearing calcareous clays are apt to have their weathered outcrops covered with this form of gypsum. In addition, products leached from overlying coal or other lithologic units may finally form gypsum in joints in an underlying clay bed.

REPORT OF TESTS

Information about the geology of the clay samples, their location, thickness, overburden, and type of underlying and overlying sediments, is given in Appendix B. Chemical data are given in table 1, and the results of tests for the physical and ceramic properties and the suggested uses for each sample are given in table 2. The ceramic test results include the drying and firing shrinkage, water of plasticity, fired color, and, where applicable, the bonding properties of the clay.

Formation and Firing of Test Bars

Samples collected in Madison County and to the north were formed into test bars by hand, but those collected in St. Clair County and to the south were made with a laboratory-size extrusion machine. The extruded samples are marked with an asterisk in table 2. The clay used for the hand-molded samples was ground to a powder in a disc grinder. Clays ground to $\frac{1}{4}$-inch in diameter and less were used for extruded test bars. The percentage of water necessary to hand form or extrude a satisfactory test bar is listed as water of plasticity. More water is needed in hand forming test bars and, as a result, water of plasticity and drying and total shrinkage values for any given clay are higher for hand-molded than for extruded test bars. Both methods were used for the preparation of test bars from a selected clay and a selected shale for comparison of results. Table 3 illustrates the variations in values obtained with the two techniques.

Three individual test bars were made from each sample of clay. The bars were measured after drying to determine the percentage of drying shrinkage. The first bar was fired to 1832°F. (1000 °C.), the second 2012° F.(1100° C.), and the third to 2200° F. (1205°C.). The test bars were measured after each firing to determine the percentage of firing shrinkage. The method of preparing the test bar, hand molding vs. extrusion, has little effect on the fired properties of a clay.

Those clays listed as having "good" extrusion properties are those that give sharp, even edges on the test bar during extrusion. Clays that show some tearing of the edges of the test bar during extrusion are considered as having "fair" extrusion properties, and those that show considerable tearing are listed as having "poor" extrusion properties.

Pyrite, which is normally disseminated throughout the clay, will oxidize during weathering to form ferrous sulfate. The latter will, in turn, alter to limonite and sulfuric acid as weathering continues. The formation of iron sulfate and iron oxide tend to give the fired clay a dark color. For a better indication of the true ceramic properties and burning color, it would be necessary to obtain unweathered samples of the clay from drill holes in the area under consideration but at some distance from the outcrops.

If soluble salts are present in a clay, they will migrate outward to the surface of an unfired brick during the drying period. If ferrous sulfate is the soluble salt, the fired color is generally dark brick red, but if calcium sulfate is the soluble salt, a white scum forms on the surface during firing.

High-Temperature Properties

On the basis of mineralogical data, samples with the largest amounts of kaolinite were selected for tests to determine their fusion temperature P.C.E. (pyrometric cone equivalent).

Refractories are classified in the following manner (American Society of Testing Materials, 1958):

	Minimum P.C.E.
Super duty	33
High heat duty	31
Medium heat duty	29
Low heat duty	15

One Clay (996N) from Pike County can be assigned to the super duty heat class. Clays sampled in Madison, Jersey, Greene, Scott, and Calhoun Counties could be used for medium heat duty refractories; samples 1719 in St. Clair, 1806 in Jackson, 1809 in Gallatin, and 1813, 1814, and 1818 in Saline Counties would be most suitable for low heat duty refractories.

Bonding Tests

Some underclays have been found to be satisfactory for use as bonding clays for foundry sands. The clay mineralogy of an underclay may be used to predict its bonding properties. Clays that have poorly crystalline kaolinite and those that have large amounts of mixed-layer clay minerals are better bonding clays than the more crystalline clay mineral varieties.

Mixtures of 92 percent foundry sand and 8 percent clay were made and mixed with varying amounts of water. Bonding tests were then run in a manner described in the "Foundry Sand Handbook" (American Foundrymen's Society, 1952). The green compression strength of each sample tested, in pounds per square inch (GCS psi), is listed in table 1 under bonding properties. The maximum green strength is that strength developed by the clay at its optimum water content. Samples 958H and 958Z from Greene County, 393, 960C, and 960F from Madison County, and 1803 from Williamson County gave favorable green strengths in the bonding tests.

SUMMARY AND CONCLUSIONS

The clays and shales tested in this report may serve as raw materials for a wide variety of uses. Clays or shales can be mixed to enhance or develop certain desired properties or to minimize undesirable characteristics. For instance, a wide variation in fired color can be obtained in a product by the mixing of light and dark firing clays in varying proportions. Plasticity, drying shrinkage, firing shrinkage, and refractoriness also can be varied by the mixing process.

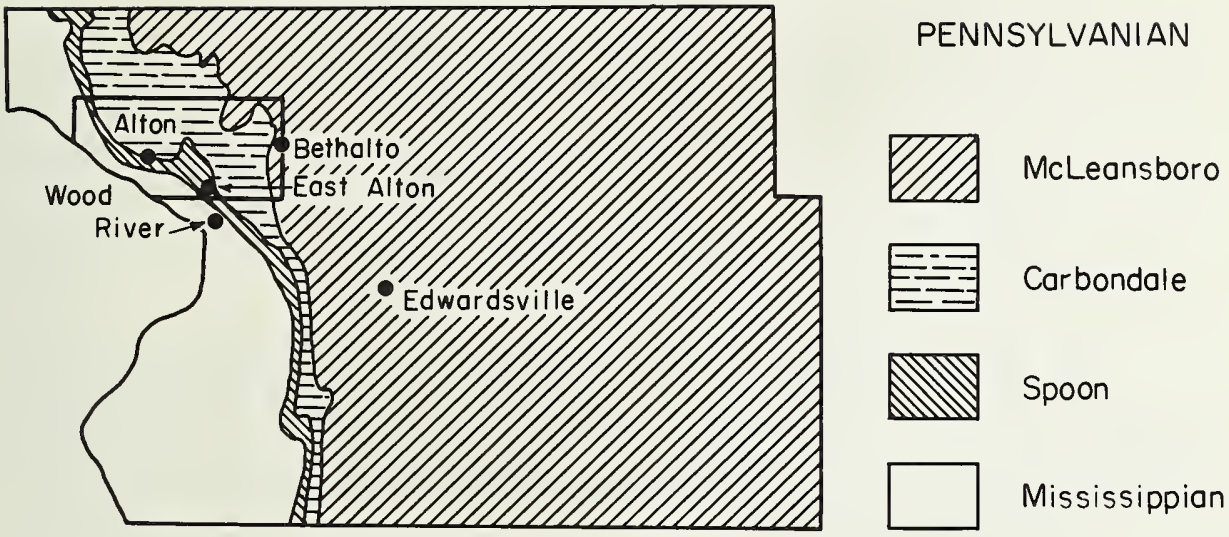

Fig. 3 - Generalized bedrock geology of Madison County and location of fig. 4.

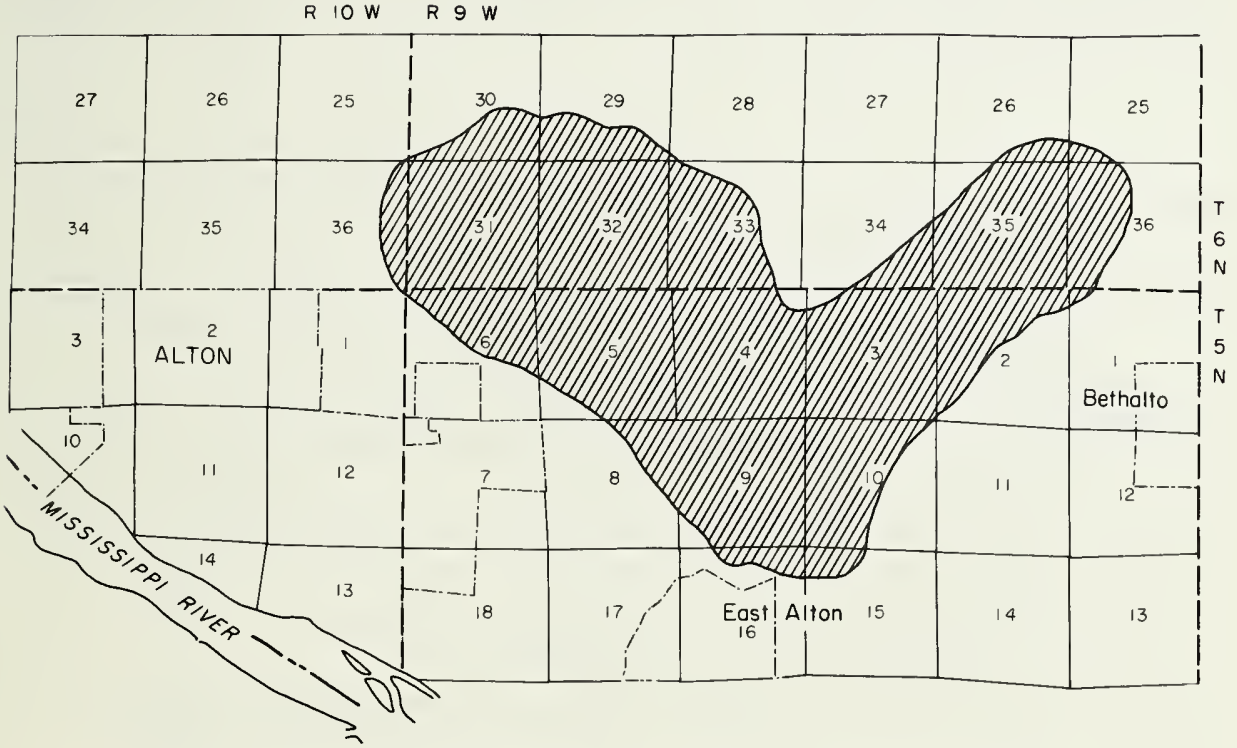

Fig. 4 - Location of samples studied and suggested area for prospecting for strippable clay resources.

The tables of this report may serve as a general guide to predict the properties, uses, and values of combined samples. However, the actual commercial value of a sample or combination of samples is dependent not only upon the qualities listed in the table but also upon a complex of factors involving local geologic, geographic, and economic conditions at the site of the deposit.

In Madison County, because outcrops below the Colchester No. 2 Coal are rare, sampling was limited to two locations. However, the outcrop areas of sediments above the coal and below the clay suggest an area (figs. 3 and 4) in which the overburden may be thin enough to permit mining the clay by stripping operations. Core drilling will be necessary to reveal the thickness of the overburden, thickness of the clay, and quality of the clay.

Sample 996N from Pike County, compared with other samples, is unusual in its measured physical properties. It is composed primarily of the clay mineral kaolinite, which gives the fired clay a white color. Because of its high kaolinite content it is the only sample with a P.C.E. high enough (P.C.E. 33) to be assigned to the super heat duty refractory class and may have some potential for use in the china or paper industries.

Samples taken from Scott County south to Madison County could be used for medium heat duty refractories. A few samples in the counties studied to the south and east can be classed in the low heat duty class.

Samples 958H and 958Z in Greene County and all of the samples of Madison County produced satisfactory green strength in the bonding tests. This group of samples is of the poorly crystalline kaolinite variety and, therefore, would be more refractory. Samples 954D of Cass County and 1803 of Williamson County have good bonding strength but are rich in the mixed-layer clay mineral component and, therefore, are less refractory.

REFERENCES

American Foundrymen's Society, 1952, Foundry sand handbook: 6th ed., p. 17-28, 85-89, 93-95.

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Kosanke, R. M., Simon, J. A., Wanless, H. R., and Willman, H. B., 1960, Classification of the Pennsylvanian strata of Illinois: Illinois Geol. Survey Rept. Inv. 214, 84 p.

Parham, W. E., 1959, Light-burning clay resources in LaSalle County, Illinois: Illinois Geol. Survey Circ. 277, 27 p.

Parham, W. E., 1960, Lower Pennsylvanian clay resources of Knox County, Illinois: Illinois Geol. Survey Circ. 302, 19 p.

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TABLE 1 - CHEMICAL ANALYSES AND DATA

Sample 393		Sample 996N	
Oxide	Percent	Oxide	Percent
SiO_2	56.92	SiO_2	53.11
TiO_2	1.40	TiO_2	1.98
Al_2O_3	26.80	Al_2O_3	32.39
Fe_2O_3	2.51	Fe_2O_3	0.36
FeO	0.35	FeO	0.09
MgO	0.51	MgO	0.30
CaO	0.17	CaO	0.13
Na_2O	0.50	Na_2O	0.28
K_2O	0.48	K_2O	0.29
Ign.	10.41	Ign.	11.49
Total	100.05	Total	100.42
H_2O-	2.06	H_2O-	0.84
P_2O_5	trace	P_2O_5	trace
SO_2	0.00	SO_2	0.00

Exchangeable cations (Sample 393):

Al^{+3}	0.00 me/100 gm.	Na^{+}	9.07 me/100 gm.
Fe^{+3}	0.00	K^{+}	0.75
Mg^{++}	3.85	$SO_4^{=}$	1.25
Ca^{++}	5.35		

Cation exchange capacity 17.5 me/100 gm.; pH 8.1

TABLE 3 - COMPARISON OF DATA FOR HAND-MOLDED AND EXTRUDED SAMPLES

	Clay		Shale	
	Molded	Extruded	Molded	Extruded
Water of plasticity	24.5	18.0	21.5	19.0
Linear drying shrinkage	6.25	4.68	4.17	2.34
Linear firing shrinkage				
1832°	1.04	1.05	2.08	4.95
1922°		2.09	6.25	6.51
2012°	4.17	3.13	8.33	8.64
Total firing shrinkage				
1832°	7.29	5.73	6.25	7.29
1922°		6.77	10.42	8.85
2012°	10.42	7.81	12.50	10.98

TABLE 2 - CERAMIC AND OTHER DATA

Sample no.	Thickness	Extrusion properties and workability	Water of plasticity (%)	Linear drying shrinkage (%)	Firing temperatures in degrees Fahrenheit: Linear firing shrinkage (%) 1832°	2012°	2200°	Total linear shrinkage (%) 1832°	2012°	2200°	Fired color 1832°	2012°	2200°	Bonding properties: GCS (psi)	Opt.** H_2O(%)
							Calhoun County								
1067B	3' 6"	sticky	36.6	10.4	2.1	3.1	5.2	12.5	13.5	15.6	Buff	Buff	Buff		
1067D	2'	good	21.4	5.2	1.0	8.3	5.2	6.2	13.5	10.4	Buff	Buff	Gray		
							Cass County								
994D	2' 1"	good	54.3	16.7	8.3	—	—	25.0	—	—	Salmon				
994C	5' 3"	good	36.8	10.4	2.1	6.3	8.3	12.5	16.7	18.7	Buff	Buff	Brown		
994B	2' 9"	good	26.6	6.3	1.0	7.3	5.2	7.3	13.6	11.5	Salmon	Salmon	Salmon		
							Gallatin County								
1809	5'	fair*	22.0	4.5	1.1	2.7	3.8	5.6	7.2	8.3	Pink	Salmon	Tan		
1810	2'	fair*	23.0	3.5	4.3	6.7	6.3	7.8	10.2	9.8	Salmon	Tan	Tan		
							Greene County								
958F	1'	good	33.8	9.4	2.3	2.3	6.2	11.7	11.7	15.6	Pink	Buff	Buff	6.2	1.5
958H	4'	good	36.4	10.9	+3.9	4.7	5.8	7.0	15.6	16.7	Pink	Buff	Buff	8.0	1.9
958K	1'	good	23.8	8.6	0.7	1.8	2.9	9.3	10.4	11.5	Pink	Buff	Buff	6.5	1.3
958U	6'	good	20.8	5.5	0.0	0.0	2.3	5.5	5.5	7.8	Buff	Buff	Buff		
958W	3½'	good	23.4	7.8	2.3	4.7	7.8	10.1	12.5	15.6	Pink	Buff	Buff		
958X	5'	good	24.6	6.3	3.1	5.2	7.3	9.4	11.5	13.6	Pink	Buff	Buff		
958Y	5'	good	22.0	4.7	1.6	2.6	3.6	6.3	7.3	8.3	Pink	Buff	Buff		
958Z	6'	good	26.6	7.8	3.1	4.2	6.8	10.9	12.0	14.6	Pink	Buff	Buff	9.2	1.4
958V	5'	good	21.5	3.9	2.4	8.3	9.6	6.3	12.2	13.5	Pink	Buff	Buff		
958BB	2'	good	34.7	10.9	2.4	4.7	5.9	13.3	15.6	16.8	Pink	Buff	Buff	6.4	1.3
958VV	2'	good	22.2	5.5	+0.8	2.8	4.9	4.7	8.3	10.4	Pink	Buff	Buff		
958FFF	5'	good	31.3	9.4	3.1	5.2	6.2	12.5	14.6	15.6	Pink	Buff	Buff		
955	6'	good	—	5.5	0.8	3.9	7.0	6.3	9.4	12.5	Pink	Buff	Buff		
956	5'	good	24.0	6.3	1.5	2.7	5.4	7.8	9.0	11.7	Pink	Buff	Buff		
957	5'	good	26.0	7.0	0.8	1.6	4.7	7.8	8.6	11.7	Pink	Buff	Buff	5.7	1.3
							Jackson County								
1800	3'	good*	18.1	4.7	1.5	3.6	5.0	6.2	8.3	9.7	Buff	Salmon	Tan		
1801	1'-3'	fair*	22.3	5.0	2.7	6.0	6.7	7.7	11.0	11.7	Buff	Salmon	Tan		
1806	3'	good*	14.0	2.5	0.8	3.3	5.0	3.3	5.8	7.5	Buff	Buff	Buff		
							Jersey County								
959E	7'	good	26.9	7.0	1.6	3.4	—	8.6	10.4	—	Buff	Buff		3.8	1.3
959F	5½'	good	26.5	7.8	2.4	4.7	4.7	10.2	12.5	12.5	Buff	Buff	Buff	6.8	2.4
959G	2½'	good	23.5	4.0	0.7	8.0	8.5	4.7	12.0	12.5	Buff	Buff	Buff	7.8	1.4
							Johnson County								
1807	2½'	poor*	22.8	3.8	1.4	6.4	6.9	5.2	10.2	10.7	Buff	Salmon	Tan		
							Madison County								
393	6'	good but good	31.6	8.9	0.5	3.6	4.6	9.4	12.5	13.5	Cream	Cream	Gray	11.5	1.8
960C	1' 3"	stiff	35.0	9.4	1.0	6.2	6.2	10.4	15.6	15.6	Buff	Buff	Buff	10.0	1.4
960D	1' 3"	good	31.6	9.4	1.0	5.2	6.2	10.4	14.6	15.6	Gray	Buff	Buff	9.2	1.7
960E	3'	good	30.8	8.3	1.6	6.3	7.3	9.9	14.6	15.6	Buff	Buff	Buff	10.4	1.7
960F	3'	good but stiff	27.8	7.8	0.5	6.8	7.8	8.3	14.6	15.6	Buff	Buff	Buff	9.5	1.4

Sample no.	Suggested Uses: China	Drain tile	Fillers	Flower pots	Flue liners	Light weight aggregate	Paper	Pottery	Refractories & ref. cements	Sewer pipe	Stoneware	Structural clay products	Terra cotta	Terra sigillata	Bonding clay	Remarks (ox = oxidation; gd = good; drcd = drying conduct; diff = difficult)
Calhoun County																
1067B		X		X	X			X	X	X	X	X				ox, gd; too much water added to clay mix
1067D				X	X			X		X	X	X				ox, gd; overfired at 2200°F.
Cass County																
994D										X					X	ox, gd; drcd, warped and cracked.
994C				X				X		X	X					ox, gd; drcd, fair.
994B		X		X				X				X				ox, gd; drcd, gd; overfired at 2200°F.
Gallatin County																
1809		X		X					X	X		X				Surface scum at 1832 and 2012°F.
1810		X		X				X				X				Surface scum at 1832 and 2012°F; slightly rough edges during extrusion; overfired at 2200°F.
Greene County																
958F		X		X	X			X	X	X	X	X	X			ox, gd; drcd gd; weathered clay shows ferrous sulfate scumming.
958H		X		X	X			X	X	X	X	X			X	ox, gd; drcd, gd.
958K		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd.
958U		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd.
958W		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
958X		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
958Y		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd.
958Z		X		X	X			X	X	X	X	X			X	ox, gd; drcd, gd.
958V		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
958BB		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
958VV		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd.
958FFF					X			X	X	X	X	X				ox, gd; drcd, gd.
955		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd.
956		X		X	X			X	X	X	X	X	X			
957		X		X	X			X	X	X	X	X	X			
Jackson County																
1800		X		X	X			X	X	X	X	X	X			Normal
1801		X		X	X					X		X				Surface scum at 1832° and 2012; some tearing during extrusion
1806		X		X	X			X	X	X	X	X	X			Some tearing during extrusion
Jersey County																
959E		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
959F		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
959G		X		X	X			X	X	X	X	X				ox, gd; drcd, gd.
Johnson County																
1807		X		X								X				Surface scum at 2012°; tends to tear during extrusion.
Madison County																
393		X	X	X	X			X	X	X	X	X		X	X	ox, gd; drcd, gd. Chemical data in table 4.
960C					X			X	X	X	X	X			X	ox, diff; drcd, gd.
960D			X		X			X	X	X	X	X		X	X	ox, diff; drcd, gd.
960E			X		X			X	X	X	X	X		X	X	ox might be diff; drcd, gd.
960F			X		X			X	X	X	X	X		X	X	ox, gd; drcd, gd.

TABLE 2

Sample no.	Thickness	Extrusion properties and workability	Water of plasticity (%)	Linear drying shrinkage (%)	Firing temperatures in degrees Fahrenheit: Linear firing shrinkage (%) 1832°	2012°	2200°	Total linear shrinkage (%) 1832°	2012°	2200°	Fired color 1832°	2012°	2200°	Bonding properties: GCS (psi)	Opt.** H_2O(%)
							Monroe County								
1797	5'	good*	22.6	7.2	4.3	5.0	3.0	11.5	12.2	10.2	Red	Red	Brown	6.4	2.0
1798	3' 4"	fair*	17.6	4.5	2.3	6.0	4.1	6.8	10.5	8.6	Red	Red	Red	4.8	1.5
1799	3' 3"	good*	18.6	5.5	1.3	4.7	5.2	6.8	10.2	10.7	Red	Red	Red	4.3	1.7
							Pike County								
G17	2'	good	26.7	5.9	1.4	0.9	1.4	7.3	6.8	7.3	Cream	Cream	Buff		
G18	1'	good	29.8	6.3	1.0	4.1	7.2	7.3	10.4	13.5	Cream	Cream	Cream		
G19	2' 6"	good	26.5	5.2	1.6	2.1	5.2	6.8	7.3	10.4	Pink	Pink	Tan		
G20	3' 2"	good	20.8	5.2	2.1	6.3	8.9	7.3	11.5	14.1	Pink	Buff	Tan		
996E	4' 6"	poor	23.0	5.2	0.0	2.1	3.1	5.2	7.3	8.3	Cream	Cream	Cream		
996D	5'	good	57.4	12.5	3.1	7.3	12.5	15.6	19.8	25.0	Cream	Cream	Tan		
996B-C		good	30.0	6.3	+1.1	4.1	7.2	5.2	10.4	13.5	Cream	Cream	Tan		
996N	8'	good	46.0	12.5	2.1	2.1	11.5	14.6	14.6	24.0	White	White	White		
996F	6'	good	29.5	7.3	2.1	5.2	8.3	9.4	12.5	15.6	Cream	Cream	Tan		
							St. Clair County								
1719	3'	good*	23.9	8.5	0.1	0.9	1.5	8.6	9.4	10.0	Salmon	Salmon	Salmon	3.8	1.3
							Saline County								
1804	5'	fair*	11.4	4.7	1.8	5.0	5.3	6.5	9.7	10.0	Salmon	Red	Tan		
1805	3'	good*	23.0	6.0	5.3	5.6	+12.2	11.3	11.6	+6.2	Salmon	Red	Tan		
1808	3'	good*	18.7	6.0	1.3	3.7	4.2	7.3	9.7	10.2	Buff	Buff	Buff	5.5	1.8
1811	2' 4"	poor*	18.9	3.0	0.6	4.4	6.0	3.6	7.4	9.0	Buff	Tan	Buff		
1812	3'	fair*	14.0	4.5	1.3	2.9	2.3	5.8	7.4	6.8	Cream	Buff	Buff		
1813	6'	good*	18.4	5.0	1.6	2.4	4.1	6.6	7.4	9.1	Cream	Buff	Buff		
1814	3'	good*	14.1	4.0	1.6	2.9	3.5	5.6	6.9	7.5	Pink	Buff	Cream	3.4	1.3
1815	3'	good*	22.0	6.0	3.8	5.7	+0.8	9.8	11.7	5.2	Salmon	Red	Red	6.6	1.3
1816	3' 6"	fair*	20.0	4.5	1.3	5.2	6.5	5.8	9.7	11.0	Salmon	Red	Brown		
1817	2' 8"	good*	20.0	4.0	1.0	5.7	5.1	5.0	9.7	9.1	Salmon	Salmon	Buff		
1821	8'	fair*	17.6	4.0	4.5	7.3	6.0	8.5	11.3	10.0	Red	Red	Brown		
							Scott County								
995A	6'	good	35.3	8.3	3.2	6.3	11.5	11.5	14.6	19.8	Buff	Buff	Buff		
995B	8'	good	49.9	12.5	4.2	9.4	11.5	16.7	21.9	24.0	Buff	Buff	Tan		
995H	4' 8"	good	40.2	10.4	2.1	6.3	8.4	12.5	16.7	18.8	Buff	Buff	Buff		
							Williamson County								
1802	5'	good*	19.3	4.5	1.9	5.0	5.7	6.4	9.5	10.2	Pink	Buff	Tan	5.1	2.0
1803	3'	fair*	25.0	5.3	4.7	8.3	3.2	10.0	13.6	8.5	Salmon	Red	Red	8.4	1.8
1818	3'	fair*	21.0	5.0	1.3	3.7	4.1	6.3	8.7	9.1	Cream	Buff	Buff		
1819	5' 6"	good*	21.5	5.5	4.3	6.7	5.2	9.8	12.2	10.7	Red	Red	Red	6.7	2.0
1820	4'	fair*	27.8	4.0	1.8	7.4	6.7	5.8	11.4	10.7	Red	Red	Red		

* Extruded sample

** Optimum water content for maximum strength

– continued

Sample no.	Suggested Uses: China	Drain tile	Fillers	Flower pots	Flue liners	Light weight aggregate	Paper	Pottery	Refractories & ref. cements	Sewer pipe	Stoneware	Structural clay products	Terra cotta	Terra sigillata	Bonding clay	Remarks (ox = oxidation; gd = good; drcd = drying conduct; diff = difficult)
Monroe County																
1797		X		X		X		X		X		X				Overfired at 2200°F.
1798		X		X		X		X		X		X				Overfired at 2200°F.
1799		X		X		X		X		X		X				Overfired at 2200°F.
Pike County																
G17		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd.
G18		X		X	X			X	X	X	X	X	X	X		ox, gd; drcd, gd.
G19		X		X	X			X	X	X	X	X	X	X		ox, gd; drcd, gd.
G20		X		X	X			X	X	X	X	X				ox, gd; drcd, gd; Samples G18 through G20 can be mined together
996E		X		X	X			X	X	X	X	X	X			ox, gd; drcd, gd; would have to be worked with 996D in order to have sufficient plasticity.
996D		X	X	X	X			X	X	X	X	X		X		drcd, poor; should be worked with 996E to reduce shrinkage
996B & C		X		X	X			X	X	X	X	X		X		ox, gd; drcd, gd.
996N	X		X				X?	X	X		X			X		ox, gd; drcd, gd. Chemical data in table 5.
996F			X		X			X	X	X	X	X		X		ox, gd; drcd, gd.
St. Clair County																
1719		X		X	X			X	X	X	X	X				Iron sulfate scumming showed at 1832 and 2012°F.
Saline County																
1804		X		X				X		X		X				Surface scum at 1832 and 2012°F for weathered clays; tends to tear during extrusion.
1805		X		X				X		X		X				Surface scum at 1832 and 2012°F for weathered clays. Overfired at 2200°F.
1808		X		X				X		X	X	X	X			Overfired at 2200°F.
1811		X		X				X		X	X	X	X	X		Normal.
1812		X		X				X		X	X	X	X			Overfired at 2200°F.
1813		X		X				X	X	X	X	X	X			Overfired at 2200°F.
1814		X		X				X	X	X	X	X	X			Normal.
1815		X		X		X		X		X		X				Surface scums at 2012°F; overfired at 2200°F.
1816		X		X		X		X		X		X				Surface scum at 1832 and 2012°F for weathered clay; tends to tear when extruded.
1817		X		X		X		X		X		X				Overfired at 2200°F.
1821		X		X		X		X		X		X				Overfired at 2200°F. Tends to tear when extruded.
Scott County																
995A			X					X	X	X						ox, gd; drcd, tending to crack.
995B			X					X	X	X						ox, gd; drcd, gd.
995H			X					X	X	X	X	X				ox, gd; drcd, gd.
Williamson County																
1802		X		X	X			X	X	X	X	X	X			Normal.
1803		X		X		X		X		X		X			X	Overfired at 2200°F.
1818		X		X	X			X	X	X	X	X	X	X		Normal.
1819		X		X		X		X		X		X				Surface scum at 1832 and 2012°F; overfired at 2200°F.
1820		X		X		X		X		X		X				Overfired at 2200°F.

DESCRIPTION OF DEPOSITS SAMPLED

	Thickness (Ft. In.)
CALHOUN COUNTY	
Sample 1067B - SE¼ SW¼ NE¼ sec. 26, T. 13 S., R. 2 W.	
Pleistocene Series	
Loess	50±
Pennsylvanian System	
Carbondale Formation	
Limestone	?
Shale (Purington) (?) gray, silty	30±
Shale, black, clayey	1
Colchester (No. 2) Coal	3 6
Spoon Formation	
Underclay, gray, yellow-stained (sample 1067B)	3
Clay, gray (sample 1067B)	6
Clay, gray, calcareous (Seahorne Limestone zone)	2
Clay, green	2
Clay, gray, yellow-stained (exposed)	1
Sample 1067D - Old clay pit along Mississippi River, center of sec. 1, T. 14 S., R. 2 W.	
Pleistocene Series	
Loess	10-15
Pennsylvanian System	
Carbondale Formation	
Limestone, gray and tan	5
Covered interval	11
Clay, mottled red, yellow, and gray	4
Shale, mottled, red and green near top and gray below	50
Coal	4
Clay, dark gray, almost sandstone in places	1
Shale, black, soft	6
Colchester (No. 2) Coal	2 1
Spoon Formation	
Clay, gray with iron stains, noncalcareous, massive (sample 1067D) (exposed)	2
CASS COUNTY	
Samples 994B, C, and D - Tributary along east bluff to Illinois River NE¼ sec. 15, T. 18 N., R. 11 W.	
Pleistocene Series	
Glacial till and loess	80-100
Pennsylvanian System	
Carbondale Formation	
Sandstone (Pleasantview), gray, iron-stained on surface, shaly at top 15-20 feet, remainder massive, carbonaceous, and coaly at bottom	35
Shale, black, soft, micaceous, poorly bedded, fossiliferous	2 2
Limestone, blue-gray weathering to grayish brown, hard, fine-grained, fossiliferous	3-4
Shale, black, fissile, hard, with pyrite concretions	18-28
Shale (Francis Creek), gray, slightly sandy, conchoidal fracture, concretions, pyrite	11 8
Colchester (No. 2) Coal	2 9
Spoon Formation	
Clay, dark gray, shaly	5
Clay, blue-gray, hard, shaly	1 2
Clay, gray, very rusty with reddish weathered calcareous concretions near base, sandy	2 3
Clay, gray, hard, calcareous concretions, sandy	1 9
Clay, purplish gray, blocky	3-4
Wiley (?) Coal	1½-3
Clay, dark purplish gray, soft, blocky	3
Clay, gray, rust brown in fractures, blocky, hard	8-18
Limestone (Seahorne), blue-gray, weathering gray, nodular, bedded in clay, pyrite, fossiliferous	2-3
Clay, gray, hard, blocky (sample 994D)	2 1
Coal	½
Clay, gray to purplish gray, blocky (sample 994C)	3
Clay, gray, hard, blocky (sample 994C)	2
Covered interval	3-4
Clay, gray, blocky (sample 994C)	1 2
Clay, dark gray, shaly (coal zone) (sample 994C)	3-6
Clay, gray, shaly (sample 994C)	1 1
Clay, dark gray to black, shaly (coal zone) (sample 994C)	1-2
Clay, gray, sandy, blocky	16-34
Sandstone, blue-gray, fine-grained, hard, bedded to massive	14-24
Clay, gray, iron-stained on fracture surfaces shaly, sandy	2 6
Hermon (?) Coal	3-4
Clay, purplish gray, sandy, blocky (sample 994B)	4
Clay, gray rusty on fracture surfaces, sandy, blocky becoming shaly near base (sample 994B)	2 2

(CASS COUNTY Cont.)

	Thickness (Ft. In.)
Shale, gray, thinly bedded	1
Limestone (Seville), dark blue-gray, pyritic	1-2
Shale, dark blue-gray, well bedded, sandy, contains concretions	1 6

GALLATIN COUNTY

Sample 1809 - Outcrop south side of road in NE¼ NW¼ NE¼ sec. 19, T. 10 S., R. 8 E.

Pleistocene Series	
Soil	10±
Pennsylvanian System	
Carbondale Formation	
Rocks undifferentiated	10-30
Colchester (No. 2) Coal	4
Spoon Formation	
Underclay, gray, (sample 1809)	5
Shale	

Sample 1810 - SE¼ NE¼ NE¼ sec. 19, T. 10 S., R. 8 E.

Pleistocene Series	
Soil	10±
Pennsylvanian System	
Carbondale and Spoon Formations	
Rocks undifferentiated	50-70
Dekoven Coal	2 6
Underclay, gray	2
Shale, dark gray, micaceous	2

GREENE COUNTY

Sample 958 F - South cutbank of Birch Creek, NE¼ NW¼ NW¼ sec. 25, T. 12 N., R. 11 W.

Pennsylvanian System	
Carbondale Formation	
Sandstone (Pleasantview), upper part shaly, lower part massive and cross bedded	16-18
Pyrite zone	0-½
Shale, blue-gray, thin-bedded, noncalcareous	6-30
Shale, black, soft, noncalcareous	3
Shale, black, hard, fissile	1 5
Colchester (No. 2) Coal	2 8
Spoon Formation	
Clay, dark gray, noncalcareous	½-1
Clay, gray, noncalcareous (Sample 958F) (exposed)	1

Sample 958H - NW cor. SW¼ SW¼ sec. 28, T. 12 N., R. 11 W.

Pleistocene Series	
Drift	5±
Pennsylvanian System	
Carbondale Formation	
Shale, gray	10±
Shale, black, fissile	1 6
Colchester (No. 2) Coal	2
Spoon Formation	
Covered interval	2
Clay, gray (sample 958H)	4
Limestone, blue-gray (in creek bed)	

Sample 958K - N line of NE¼ SW¼ NW¼ sec. 28, T. 12 N., R. 11 W.

Pleistocene Series	
Alluvium	2-3
Pennsylvanian System	
Spoon Formation	
Limestone (Seahorne), blue-gray	1 6
Clay, gray (sample 958K) (exposed)	1

Sample 958U - Abandoned underground mine south of road in center NE½ NW¼ NW¼ sec. 31, T. 12 N., R. 11 W.

Pleistocene Series	
Till reported by owner	45
Pennsylvanian System	
Spoon Formation	
Clay, gray (sample 958U)	6

Samples 958W, X, Y - South cutbank of creek, NW¼ NW¼ NW¼ sec. 12, T. 10 N., R. 12 W.

Pleistocene Series	
Drift	15
Pennsylvanian System	
Carbondale Formation	
Shale, blue-gray	5 2
Colchester (No. 2) Coal	1
Spoon Formation	
Clay, gray, sample 958W top 3½ feet; 958X middle 5 feet; 958Y bottom 5 feet)	13 6
Mississippian System	
Shale, red	6
Shale, blue	9
Sandstone	4
Shale, gray (exposed)	5½

Sample 958Z - South of center NW¼ sec. 12, T. 10 N., R. 12 W.

Pleistocene Series	
Drift	10±
Pennsylvanian System	
Carbondale Formation	
Shale, gray	11
Colchester (No. 2) Coal	1 9
Spoon Formation	
Clay, gray (sample 958Z) (exposed)	6

(GREENE COUNTY Cont.)

	Thickness (Ft. In.)
Sample 958V - Outcrop on west side of creek south of road, center NW¼ NE¼ sec. 12, T. 10 N., R. 12 W.	
Pleistocene Series	
Drift	20±
Pennsylvanian System	
Spoon Formation	
Clay, gray (sample 958V) (exposed)	4-6
Sample 958BB - Outcrop in center of NW¼ sec. 23, T. 12 N., R. 11 W.	
Pennsylvanian System	
Carbondale Formation	
Pleasantview Sandstone	25±
Coaly layer	3
Shale, black, fissile	2 6
Coaly layer	1
Limestone	5
Colchester (No. 2) Coal	2 2
Spoon Formation	
Clay, gray (sample 958BB) (exposed)	2±
Sample 958VV - Along Sand Creek about 500 yards west of road, SW¼ SW¼ sec. 30, T. 10 N., R. 11 W.	
Pennsylvanian System	
Spoon Formation	
Clay, gray (sample 958VV) (exposed)	5
Sample 958FFF - Outcrop along creek, NE¼ SE¼ sec. 11, T. 10 N., R. 12 W.	
Pleistocene Series	
Drift	20-40
Pennsylvanian System	
Carbondale Formation	
Shale, black, fissile	6
Colchester (No. 2) Coal	1 9
Spoon Formation	
Clay, gray (sample 958FFF)	5±
Geodes, clayey matrix	6-12
Sample 955 - Shale pit and in creek close by in SW¼ NW¼ sec. 29, T. 12 N., R. 11 W.	
Pleistocene Series	
Silt	10
Pennsylvanian System	
Carbondale Formation	
Shale, blue-gray, silty	15
Colchester (No. 2) Coal	2 6
Spoon Formation	
Clay, gray (sample 955)	6
Mississippian System	
Limestone exposed in creek bed	
Samples 956 and 957 - Clay pit, NE¼ SW¼ sec. 18, T. 12 N., R. 10 W. along Marks Creek	
Pleistocene Series	
Loess	10
Pennsylvanian System	
Spoon Formation	
Clay, gray (sample 956 upper 5 feet; sample 957 lower 5 feet)	10

JACKSON COUNTY

	Thickness (Ft. In.)
Sample 1800 - Outcrop in bluff south of railroad, SW¼ SW¼ NE¼ sec. 9, T. 9 S., R. 2 W.	
Pleistocene Series	
Loess	15-20
Pennsylvanian System	
Spoon or Abbott Formation	
Coal (exposed)	6
Clay, gray, contains root traces (sample 1800)	3
Shale, tan	2-3
Coal	1±
Shale, tan	10
Sample 1801 - Abandoned strip coal mine west of Sycamore Creek, SE¼ NE¼ SW¼ sec. 36, T. 9 S., R. 1 W.	
Pennsylvanian System	
Spoon Formation	
Vergennes Sandstone	20
Coal	4
Shale, light gray, silty	4
Coal	3 6
Clay, gray (sample 1801)	1-3
Shale, dark gray to black, slickensides at top, contains ironstone nodules	6
Coal	4
Clay, gray	2
Ironstone nodule layer	6
Clay, gray (exposed)	1
Sample 1806 - West side of abandoned clay pit, SE¼ SW¼ SE¼ sec. 29, T. 8 S., R. 2 W.	
Pleistocene Series	
Loess	10
Pennsylvanian System	
Spoon Formation	
Shale, gray	10
Murphysboro Coal	2
Abbott Formation	
Clay, gray (sample 1806)	3
Shale, light gray	3

JERSEY COUNTY

	Thickness (Ft. In.)
Sample 959E - South side of west tributary to large tributary to Piasa Creek, N½ SE¼ SW¼ sec. 17, T. 7 N., R. 10 W.	
Pleistocene Series	
Drift	30±

(JERSEY COUNTY Cont.)

	Thickness (Ft. In.)
Pennsylvanian System	
Spoon Formation	
Clay, yellowish gray (sample 959E) (exposed)	7

Sample 959F - Exposed in road and west side of ditch, NE¼ NE¼ NW¼ sec. 20, T. 7 N., R. 10 W.

Pleistocene Series	30-40
Pennsylvanian System	
Spoon Formation	
Clay, gray, iron-stained (sample 959F) (exposed)	5 6

Sample 959G - In west ravine south of house, SE¼ NE¼ NW¼ sec. 20, T. 7 N., R. 10 W.

Pleistocene Series	30±
Pennsylvanian System	
Spoon Formation	
Clay, light gray, red and yellow stained, sandy (sample 959G) (exposed)	2 6

JOHNSON COUNTY

Sample 1807 - Stream in NW¼ SE¼ NE¼ sec. 8, T. 11 S., R. 4 E.

Pleistocene Series	
Alluvium	10
Pennsylvanian System	
Spoon Formation	
Sandstone	2
Bidwell Coal	0-½
Clay, shaly (sample 1807)	2 6

MADISON COUNTY

Sample 393 - Underground mine, SE¼ SE¼ sec. 35, T. 6 N., R. 10 W.

Pennsylvanian System	
Spoon Formation	
Seahorne Limestone	3±
Clay, gray, silty (sample 393)	4
Clay (floor of mine)	

Samples 960C, D, E, and F - South cutbank of East Wood River, NE¼ NW¼ NW¼, sec. 15, T. 5 N., R. 9 W.

Pleistocene Series	
Drift	20±
Pennsylvanian System	
Carbondale Formation	
Shale (Purington), gray, well bedded	20
Shale, black, fissile	1
Colchester (No. 2) Coal	2 6
Spoon Formation	
Clay, gray, iron-stained, (sample 960C)	1 3
Clay, gray, (sample 960D)	1 3
Clay, gray, iron-stained	6
Limestone (Seahorne), blue-gray	1½-5
Clay, gray, iron-stained (sample 960E)	2 6
Clay, dark gray, equivalent to coal member (sample 960E)	6
Clay, gray, iron-stained, (sample 960F) (exposed)	3

MONROE COUNTY

Sample 1797 - 200 yards from road up Andys Run at waterfall near junction of tributaries, SW¼ NE¼ NW¼ sec. 15, T. 2 S., R. 10 W.

Mississippian (?) System	
Sandstone, forms waterfall	5±
Clay, gray, green, maroon (sample 1797)	5±
Sandstone (covered)	

Samples 1798 and 1799 - South side of road, NW¼ NE¼ SW¼ sec. 26, T. 2 S., R. 10 W.

Pleistocene Series	
Loess	6
Mississippian (?) System	
Sandstone	8
Clay, purple and tan, shaly toward top (sample 1798)	3 4
Sandstone	6
Clay, purple and tan (sample 1799)	3 3

PIKE COUNTY

Samples G17, G18, G19, and G20- Cutbank south of tributary to branch of Kiser Creek, SE¼ SE¼ SW¼ sec. 25, T. 4 S., R. 5 W.

Pleistocene Series	
Soil	2
Pennsylvanian System	
Spoon Formation	
Clay, gray (sample G20)	3 2
Clay, dark gray, with 2-inch shaly zone near top	1
Clay, gray, iron-stained, hard and gritty (sample G19)	2½
Clay, purplish gray, hard, gritty (sample G18)	1
Clay, light gray with yellow sandy masses throughout (sample G17)	2
Covered interval	1 3
Sandstone, yellowish gray, clayey	8
Shale, sandy (exposed)	5

Samples 996B-C, D, and E - Outcrop in east bank of creek south of road, NW¼ NW¼ sec. 26, T. 4 S., R. 5 W.

Pleistocene Series	
Loess	6-12

(PIKE COUNTY Cont.)

	Thickness (Ft. In.)
Pennsylvanian System	
Spoon or Abbott Formation	
Sandstone, gray	1
Clay, gray, very sandy (sample 996E)	4 6
Clay, dark gray (sample 996D)	5
Sandstone layer	9
Shale, gray, hard, flinty (samples 996B-C)	4

Sample 996N - Outcrop in ditch along north-south road, NW¼ SW¼ NW¼ sec. 10, T. 4 S., R. 5W.

Pleistocene Series	
Soil	2
Pennsylvanian System	
Spoon or Abbott Formation	
Clay, gray, sandy near base (sample 996N)	8
Mississippian System	
Limestone	20

Sample 996F - Outcrop west side of roadcut, NE¼ NE¼ NE¼ sec. 4, T. 4 S., R. 5 W.

Pleistocene Series	
Loess	20±
Pennsylvanian System	
Spoon or Abbott Formation	
Clay, gray (sample 996F) (exposed)	6

Sample 1719 - Outcrop in east bank of Prairie du Pont Creek 150 yards southwest of bridge, SW¼ NW¼ NW¼ sec. 34, T. 1 N., R. 9 W.

Pennsylvanian System	
Carbondale Formation	
Shale, red to purple	5-10
Sandstone, gray, thinly bedded, micaceous with thin silty layers	15
Shale, black	1 5
Colchester (No. 2) Coal	2
Spoon Formation	
Clay, gray (sample 1719)	3
Siltstone, light gray	2-3
Sandstone at creek level	

SALINE COUNTY

Sample 1804 - High wall of coal strip pit, NW¼ NE¼ NW¼ sec. 26, T. 10 S., R. 7 E.

Pennsylvanian System	
Carbondale Formation	
Sandstone	20±
Shale, gray	20±
Shale, black	1 6
Colchester (No. 2) Coal	7
Spoon Formation	
Clay, gray (sample 1804)	5
Shale, gray	20-30
DeKoven Coal	2½-3
Clay, gray, micaceous (exposed)	1

Sample 1805 - Old coal strip pit on north side of road, SW¼ SW¼ SE¼ sec. 23, T. 9 S., R. 7 E.

Pennsylvanian System	
Spoon Formation	
Sandstone and shale	50±
Shale, black, ironstone concretions	2
DeKoven Coal	4
Clay, gray, shaly (sample 1805)	3
Shale	10
Sandstone	3

Sample 1808 - Outcrop along north side of east-west road, NE¼ NW¼ NW¼ sec. 25, T. 10 S., R. 7 E.

Pleistocene Series	
Loess and till	15
Pennsylvanian System	
Spoon Formation	
Sandstone, thinly bedded	2
Shale, sandy	5
Sandstone	2
Shale, sandy	1
Coal	4
Clay, gray, greenish toward base, shaly (sample 1808) (exposed)	3 6

Samples 1811 and 1812 - High wall of coal strip pit, center of sec. 4, T. 10 S., R. 7 E.

Pennsylvanian System	
Spoon Formation	
Palzo Sandstone	15
Shale	30
DeKoven Coal	3
Clay, gray, micaceous (sample 1811)	2 4
Siltstone, sandy	12
Shale, black	3
Davis Coal	4 5
Clay, gray (sample 1812) (exposed)	6

Sample 1813 - High wall of coal strip pit, SE¼ NE¼ SW¼ sec. 5, T. 10 S., R. 7 E.

Pennsylvanian System	
Carbondale Formation	
Sandstone and shale	15
Shale, coaly	6
Shale, dark gray	5
Colchester (No. 2) Coal	4
Spoon Formation	
Clay, gray, root traces (sample 1813)	6
Palzo Sandstone	15

Sample 1814 - Outcrop east of Battle Ford Creek, NW¼ SE¼ NW¼ sec. 21, T. 10 S., R. 6 E.

Pennsylvanian System	
Spoon Formation	

(SALINE COUNTY Cont.)

	Thickness (Ft. In.)
Sandstone and shale	15
Mt. Rorah Coal	1 5
Clay, gray, slightly shaly (sample 1814)	3
Sandstone	

Sample 1815 - Outcrop west of Battle Ford Creek, NW¼ SW¼ SE¼ sec. 20, T. 10 S., R 6 E.

Pennsylvanian System

Spoon Formation	
Sandstone, shaly at base	20
Shale, black, highly organic	2
Shale, brown	1
Clay, shaly (sample 1815) (exposed)	3

Sample 1816 - Abandoned coal strip pit, SW¼ NE¼ NW¼ sec. 21, T. 10 S., R. 5 E.

Pleistocene Series	
Loess	10
Pennsylvanian System	
Carbondale Formation	
Shale, black	5
Colchester (No. 2) Coal	9
Spoon Formation	
Shale, dark gray to black	1 6
Clay, gray, greenish toward base (sample 1816)	3 6
Shale	

Sample 1817 - Old coal strip pit SW¼ NE¼ NE¼ sec. 21, T. 10 S., R. 5 E.

Pennsylvanian System	
Spoon Formation	
Rocks, undifferentiated	25
Shale, black	3
DeKoven Coal	3
Clay, gray (sample 1817)	2 8
Sandstone (exposed)	4

Sample 1821 - Along roadcut on section line in NE¼ SE¼ NE¼ sec. 23, T. 10 S., R. 5 E.

Pennsylvanian System	
Spoon Formation	
Sandstone	15
Shale, black	2
Clay (sample 1821)	8
Coal	2
Clay (covered)	

SCOTT COUNTY

Sample 995A - Along ravine in E½ NE¼ sec. 14, T. 13 N., R. 12 W.

Pennsylvanian System	
Carbondale Formation	
Pleasantview Sandstone	5
Shale, black, soft, ferrous sulphate stained	1 2
Shale, black, fissile	2 9
Colchester (No. 2) Coal	2 7
Spoon Formation	
Clay	2-3
Seahorne Limestone	1-3
Covered interval	2
Clay (sample 995A) (exposed)	6

Sample 995B - Along stream east of road in NW¼ NW¼ sec. 14, T. 13 N., R. 12 W.

Pleistocene Series	
Drift	not measured
Pennsylvanian System	
Carbondale Formation	
Pleasantview Sandstone	50
Shale, dark gray to black, soft	1
Shale, black, fissile	2 6
Covered interval	5
Spoon Formation	
Limestone (Seahorne), blue-gray, knobby	4
Clay, gray, red-stained (sample 995B)	6
Clay, gray (sample 995B) (exposed)	2

Sample 995H - High cutbank east side of ravine in SW¼ SE¼ SW¼ sec. 23, T. 15 N., R. 13 W.

Pleistocene Series	
Loess and till	10-15
Pennsylvanian System	
Spoon Formation	
Limestone (Seahorne), gray, knobby	4
Clay, gray, rusty (sample 995H)	5
Clay, dark gray, coal horizon, gypsum	1
Clay, gray, purplish at top	6 6
Shale, dark gray, sandy, poorly bedded, iron sulphate	2 3
Abbott Formation	
Sandstone, bluish gray, fairly coarse-grained, shaly, plant impressions	0-10

WILLIAMSON COUNTY

Sample 1802 - Near top of east end of old quarry east of Creal Springs, SW¼ NE¼ SE¼ sec. 25, T. 10 S., R. 3 E.

Pennsylvanian System	
Spoon Formation	
Sandstone	3
Shale, gray	10
Mt. Rorah Coal	
Coal	1 4
Clay, shaly	9
Coal	5

(WILLIAMSON COUNTY Cont.)

	Thickness (Ft. In.)
Clay (sample 1802)	5
Siltstone	1
Shale, gray	5
Creal Springs Limestone	1 6
Shale, gray	5
Granger Sandstone	40

Sample 1803 - East side of road south of Palzo, NW¼ SW¼ NW¼ sec. 22, T. 10 S., R. 4 E.

Pennsylvanian System

Spoon Formation

Palzo Sandstone	6
Shale, black	2
Clay, shaly	6
Clay, gray, pale green toward base (sample 1803)	3
Clay, limonite	4
Shale	5

Samples 1818, 1819, and 1820 - West side of road at the NW edge of Stonefort, SW¼ NE¼ SE¼ sec. 25, T. 10 S., R. 4 E.

Pennsylvanian System

Spoon Formation

Sandstone and covered intervals	40
Shale, black	4-5
Clay (sample 1820)	4
Coal	2
Clay, gray to pale green at base (sample 1819)	5 6
Shale, black	1-1½
Shale, sandy	7 6
Shale	3
Clay, greenish gray (sample 1818)	3
Shale	

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Illinois State Geological Survey Circ. 352
24 p., 4 figs., 3 tables, 3 app., 1963

Printed by Authority of State of Illinois, Ch. 127, IRS, Par. 58.25..

CIRCULAR 352

ILLINOIS STATE GEOLOGICAL SURVEY

URBANA