

SOME LOCATIONS FOR FOSSIL PLANTS IN OHIO

WILBER STOUT,
Geological Survey of Ohio

TABLE OF CONTENTS

	PAGE		PAGE
INTRODUCTION.....	129	Barton coal.....	144
PENNSYLVANIAN SYSTEM.....	129	Harlem coal.....	145
Pottsville Series, Horizon of.....	130	Upper Part of Conemaugh Series.....	146
Sharon coal.....	130	Silicified wood.....	146
Sciotoville clay.....	131	Hematite nodules.....	147
Guinea Fowl ore.....	133	Monongahela Series, Horizon of.....	147
Quakertown coal.....	133	Pittsburgh coal.....	147
Lincoln or Jackson Sand Block ore.....	134	Redstone or Pomeroy coal.....	149
Vandusen coal.....	134	Meigs Creek or Sewickley coal.....	152
Upper Mercer coal.....	135	PERMIAN SYSTEM.....	153
Bedford coal.....	135	Washington Formation.....	153
Tionesta coal.....	136	Paines Run localities.....	154
Allegheny Series, Horizon of.....	136	Clarington localities.....	155
Clarion coal.....	137	Vallonia locality.....	156
Lower Kittanning coal.....	137	Becket Station locality.....	157
Strasburg coal.....	138	Crabapple locality.....	157
Snow Fork ore.....	139	Tunnel Station locality.....	158
Middle Kittanning coal.....	139	Waynesburg coal horizon.....	158
Conemaugh Series, Horizon of.....	140	Waynesburg "A" coal horizon.....	159
Mahoning coal.....	140	Grotto of Plants.....	160
Mason coal.....	141	Indian Run.....	160
		CONCLUSIONS.....	161

INTRODUCTION

The object of this paper is not an intrusion on the field of the botanist but is simply the listing of places favorable for the collecting of plant fossils in Ohio and the recording of the geology of such beds so that the botanist will know the position of the stratum in the geological column. The localities are definitely recorded (by number) and the place of contact is mapped on the topographic sheets (filed with the Botany Department, Ohio State University). The work of the geologists, as here defined, extends over a period of more than one hundred years (1836-1944) hence the actual exposure may now (1944) be hidden but the rock formations are still there. Diligent search may be necessary to uncover the fossil beds.

The tools for exploration should be: topographic map of the area, hand level, 6-foot ruler to determine position of the bed, a good geologist's hammer, pick and shovel, and, in some cases, a breast auger and a few sticks of dynamite. Coal mines usually yield some plant fossils, in the roof shales, in the bony partings, in the "mother coal" bands, and in the underclays. The treatment of the horizons is, in general, in ascending order, that is, from the Sharon coal of the Pottsville Series of the Pennsylvanian system to the Hundred sandstone of the Washington formation of the Permian system.

PENNSYLVANIAN SYSTEM

Throughout the geological ages the great period for plant species was during the time of the deposition of the thick mass, over 1,100 feet in Ohio, of sediments constituting the Pennsylvanian system. Then the coal beds, mainly of organic matter, were deposited, cycle after cycle, and on the average about 35 feet apart.

Some of these beds are quite thick over extensive areas and hence took great masses of vegetable matter to form them. The underclays, purified largely through the action of organic acids, bear much evidence of plant roots and stems. The shales overlying the coal beds are locally rich in plant remains, often in a fine state of preservation. However, the coal forming stages were closed frequently by subsidence, letting in the sea with the deposition of limestones and calcareous shales with a wide range of animal fossils.

POTTSVILLE SERIES

Pottsville time evidently opened with an abundance of plant species, as is indicated by the thickness and number of coal beds and by the numerous plant markings in the overlying shales. This series of rocks in Ohio is, on the average, about 256 feet in thickness and contains twelve recognized coal beds, some of which are of major importance. These rocks extend from Scioto County on the Ohio River to Trumbull and Mahoning Counties on the Ohio-Pennsylvania line.

SHARON COAL HORIZON

The Sharon coal is found chiefly in three fields:

- (a) Jackson field, in Jackson, Pike and Scioto Counties.
- (b) Massillon field, in Stark, Wayne, Summit and Portage Counties.
- (c) Mahoning Valley field, in Trumbull and Mahoning Counties.

In general the roof shales of the Sharon coal contain plant fossils and locally they are very rich in well preserved material.

Reference: Geological Survey Ohio Vol. 1, Paleontology, Plant Fossils by J. S. Newberry, pages 359-385.

Location: See Akron, Kent, Massillon, Warren and Youngstown sheets for old mine locations.

The plant fossils were gathered largely from Coal Hill near Tallmadge, from Mineral Ridge south of Warren, and from the Massillon field near Massillon. Although the mining of coal is small at present in these areas, yet a few mines are found. Further, some outcrop exposures are available for collecting.

Reference: Second Annual Report on the Geological Survey of Ohio, 1838, page 60.

Location: A detached hill, one mile west of the center of Tallmadge, Summit County, overlies at least 500 acres of accessible coal. Kent topographic sheet.

"The coal (Sharon) is somewhat undulating, varies in thickness from two to five feet, and cokes well. The shale and sandstone roof contains an abundance of vegetable fossils."

Reference: Section 70, field notes, Jackson County, Stout.

Location: Shaft mine of the Jackson Iron and Steel Company, west of Jackson, in the southwest corner of Section 30, Lick Township, Jackson County. Jackson topographic sheet.

	Ft.	In.
Ore, <i>Lincoln</i>	1	0
Sandstone, flaggy.....	42	0
Shale, gray.....	5	0
Coal, <i>Anthony</i>	0	6
Clay, soft, <i>Sciotoville</i>	3	0
Covered.....	63	0
Top of shaft.		
Shales and covered.....	25	0
Shale, with plant fossils.....	5	0
Coal, <i>Sharon</i>	3	3
Shale, sandy.....	2	10
Conglomerate, <i>Sharon</i>	60	0

Many Sharon coal mines of the Jackson district yield plant fossils in the overlying shales. Some mines show flattened stems and trunks, a few of rather large size. As this is the oldest coal in Ohio these plants represent the life at the beginning of the great coal forming period, the Pennsylvanian system.

Reference: Section 91, field notes, Jackson County, Stout.
Location: Shaft mine of the Globe Iron Company, located one and one-fourth miles southeast of Jackson in the east central part of Section 28, Lick Township, Jackson County. Jackson topographic sheet.

	Ft.	In.
Sandstone.....	10	0
Ore, Kidney, <i>Upper Mercer</i>	0	6
Covered.....	77	0
Shales, parts covered.....	10	0
Coal blossom, <i>Vandusen</i>	0	4
Covered.....	28	0
Coal, <i>Bear Run</i>	0	8
Clay, siliceous.....	1	0
Shale, gray.....	1	0
Covered.....	20	0
Sandstone, massive, <i>Massillon</i>	10	0
Top of shaft.		
Shale and sandstone.....	100	0
<i>Shale, gray, with many plant fossils</i>	10	0
Coal, bony.....	} Sharon {	0
Coal, good.....		1
Coal, bony.....		3 1/2
		4

Reference: Geological Survey Ohio, Fourth Series, Bulletin 20, page 594.
Location: "Sharon conglomerate—In the sandy layers of the Sharon conglomerate in eastern Harrison and Madison townships, Scioto County, well preserved trunks and stems of Coal Measure plants were seen and in a few places observed even in the pebbly layers." "Sharon coal horizon—As would be expected, plant remains are common at this horizon, especially in the regions where the coal is well developed. Many root markings are present in the clays below the coal, while in the shales above the impressions of plant trunks and stems are common. The leaves are not usually well preserved."

SCIOTOVILLE CLAY HORIZON

The Sciotoville clay is widely distributed, but in patches across the State. The chief productive field is in eastern Scioto County. Small bodies of clay are also worked in Jackson, Vinton and Hocking Counties.

Reference: Geological Survey Ohio, Fourth Series, Bulletin 20, page 596.
Locality: largely Scioto County: "Sciotoville Clay Horizon—The clay contains impressions of roots of Coal Measure plants, but no evidence of animal life was found. The shales and shaly sandstone above the clay in many localities in Scioto and Jackson Counties contain fossil *Conostichus* and *Asterophycus* in large numbers. A few places for collecting are: the old clay mine on Daum Hill, in Section 33, Harrison Township, Scioto County; on the land of Dr. Keyes, in Section 28, Harrison Township; along the cut of the Baltimore and Ohio South-western Railroad, near Gephart; and on the point of the hill just north of the plant (abandoned) of the Buckeye Fire Brick and Clay Company at Scioto Furnace. At the last named locality worm tracks are also found in the shaly sandstone."

Reference: Section 1, field notes, Scioto County, Stout.
Location: Munn Hill, southwest Section 33, Harrison Township Scioto County. *Conostichus* and *Asterophycus* found in shales and shaly sandstone above the Sciotoville clay. Clay horizon marked by old strip mines near the top of the hill. Sciotoville topographic sheet.

Pottsville formation:	Ft.	In.
Shale and shaly sandstone, with plant fossils.....	20	0
Coal, Anthony.....	0	6
Clay, flint, many root impressions, Sciotoville.....	3	6
Shale and covered.....	38	0

Erosion interval:

Flint, pebbles and ore, Harrison.....	2	0
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Waverly formation:

Shales and shaly sandstones.

Such fossils are also present on the narrow ridge in the southeastern part of Section 32, along the ridge in southeastern Section 29, and along the main ridge in the southern part of Section 28, Harrison Township, Scioto County.

Reference: Section 55 L. field notes, Scioto County, Stout.

Location: Cut of Baltimore and Ohio Railroad, northeast of Gephart, in the east central part of Section 30, Bloom Township, Scioto County. Sciotoville topographic sheet.

	Ft.	In.
Shales, thin bedded, blue, with <i>Conostichus</i> in cut of railroad.....	27	0
Coal, dense, bright, good.....	} Anthony {	4
Shale, impure.....		2
Coal, dense, bright, good.....		7
Clay, flint and semiflint, good, with root impressions, Sciotoville.....	5	6
Conglomerate, Sharon.....	20	0

Reference: Section 246, field notes, Scioto County, Stout.

Location: Section at Scioto Furnace, on point of hill in southwestern Section 21, Bloom Township, Scioto County, Sciotoville topographic sheet.

	Ft.	In.
Sandstone, shaly.....	10	0
Shales, with thin sandstone and flag ore layers, sandstone layers with worm tracks.....	4	0
Covered.....	5	0
Shale with thin sandstone layers.....	6	0
Covered.....	16	0
Shales with thin sandstone layers, also <i>Conostichus</i> fossils.....	21	0
Coal smut, Anthony.....	0	2
Clay, flint, sandy, Sciotoville.....	10	0

Reference: Section 258, field notes, Jackson County, Stout.

Location: Up road one mile west of Riegel School, just south of crossroads, in the central part of Section 4, Hamilton Township, Jackson County. Oak Hill topographic sheet.

The Sciotoville clay very frequently, contains many root impressions, locally giving the name "Calico clay" to the material. At this place this condition prevails:

	Ft.	In.
Shales and covered.....	20	0
Sandstone, flaggy, red colored, very ferruginous, horizon of Lincoln ore.....	3	0
Shale, gray.....	3	0
Shales and covered.....	8	0
Sandstone, medium bedded.....	19	0
Covered.....	15	0
Sandstone.....	1	0
Coal, dense.....	} Huckleberry {	8
Shale, dark.....		3
Coal, dense.....		2

Clay, dark, sandy.....	2	0
Clay shales.....	5	0
Ore, siliceous, <i>Guinea Fowl</i>	1	6
Shale, gray.....	1	3
Coal blossom, Anthony.....	0	1
Clay, very siliceous, light, root marked.....	} <i>Sciotoville</i> {	4
Clay, very siliceous, light.....		3
Clay, siliceous, with ore nodules.....		1
Sandstone, irregularly bedded, red colored.....		5
		8

GUINEA FOWL ORE HORIZON

The Guinea Fowl ore is local in distribution and is confined largely to Scioto, Jackson, and Vinton Counties. It was worked for iron smelting only in Scioto County. Locally the shale, sandstone, and iron ore at this horizon are sparingly fossiliferous.

Reference: Section 65, field notes, Scioto County, Stout.

Location: Record taken along the road, just east of the center of Section 10, Madison Township, Scioto County, on the property of Sampson Spriggs. Sciotoville topographic sheet.

	Ft.	In.
<i>Sandstone, many plant fossils</i>	2	0
Ore, blocky, good, <i>Guinea Fowl</i>	0	5
Sandstone, ferruginous.....	0	8
Shale and covered.....	10	0
Clay, good, light, plastic, <i>Sciotoville</i>	2	0

QUAKERTOWN COAL HORIZON

The Quakertown coal is widely distributed across Ohio from Scioto County on the Ohio River to Mahoning County on the Ohio-Pennsylvania line. Locally it bears plant fossils, occasionally in abundance and well preserved.

Reference: Section 52, field notes, Scioto County, Stout, also Geological Survey Ohio, Fourth Series, Bulletin 20, pages 551 and 596.

Location: On land of Henry Moore, south of Frederick Creek, in the northeastern part of Section 20, Bloom Township, Scioto County. Sciotoville topographic sheet.

	Ft.	In.
<i>Shale, with plant fossils</i>	2	0
Shale, black, with thin coal bands.....	} <i>Quakertown</i> {	0
Coal, solid block, good.....		4
Shale and covered.....		1
		5
Ore, <i>Guinea Fowl</i>	31	0
Shale.....	0	6
Coal, <i>Anthony</i>	6	6
Clay, flint and semi-flint, <i>Sciotoville</i>	0	2
	3	0

Reference: Geological Survey Ohio, Vol. 2, Paleontology. Description of Fossil Plants from Lower Carboniferous Strata, E. B. Andrews, pages 413-426.

Location: "Plants found in a thin band of bituminous shale located a little above the base of the Coal Measures, in Perry County, about two miles east of Rushville. This layer of shale is from 25 to 30 feet above the top of the Maxville limestone. The shale containing the plants I (Andrews) have never found except at one spot, where it is exposed in a ditch by the roadside, and all the plants were found within the limits of a few square yards." The probable location of this spot is in the west central part of Section 26, Reading Township, Perry County. The horizon is the Quakertown or possibly Bear Run coal. Thornville topographic sheet.

LINCOLN OR JACKSON SAND BLOCK ORE HORIZON

This ore is very uncertain in distribution and in character. The chief field is in southern Ohio. Locally it bears plant fossils, some well preserved.

Reference: Geological Survey Ohio. Fourth series, Bulletin 20, page 597.

Location: Worked in southeastern Section 16, Bloom Township, Scioto County. Scioto-ville topographic sheet.

"Lincoln ore.—The deposits of Lincoln ore north of Scioto Furnace contain plant fossils."

Reference: Section 88, field notes, Jackson County, Stout.

Location: The largest mine of Jackson Sand Block ore was on the property of John W. Corn, in the northwestern part of Section 2, Scioto Township, Jackson County. Jackson topographic sheet.

In this area the Lincoln or Jackson Sand Block ore contains some plant fossils. Seeds and seed pods are present but not common. The deposits formerly worked were southwest of Jackson in southwestern Lick, southeastern Liberty, and northeastern Scioto Townships, Jackson County.

	Ft.	In.
Shale, blue.....	6	0
Ore, good.....	1	2
Shale, blue.....	0	11
Ore, solid block.....	5	10
Clay shale, sandy.		

At this place the ore lies 115 feet above the Sharon coal.

VANDUSEN COAL HORIZON

The Vandusen coal is irregularly but rather widely distributed. It is always thin, seldom reaching one foot in thickness. In southern Jackson County the overlying shales are rich in plant fossils, well preserved.

Reference: Section 266, field notes, Jackson County, Stout.

Location: Record taken along the stream on the Marion Vandusen property and along the road in the east central part of Section 1, Hamilton Township, Jackson County. Coal seen in bank of Little Scioto River. Oak Hill topographic sheet.

	Ft.	In.
Ore, <i>Upper Mercer</i>	0	6
Covered.....	37	0
Ore, <i>Lower Mercer</i> or <i>Little Red Block</i>	0	3
Covered.....	77	0
Shale, dark blue.....	7	0
Shale, light blue, with many plant fossils well preserved.....	2	0
Shale, bony.....	0	6
Coal, good.....	0	11

Reference: Section 285, field notes, Jackson County, Stout.

Location: Plant fossils are also abundant in the shales above the Vandusen coal along the stream in the south central part of Section 13, Scioto Township, Jackson County, on the property of W. T. Plummer and that of H. A. Wykle. Oak Hill topographic sheet.

	Ft.	In.
Ore, <i>Upper Mercer</i>	0	4
Covered.....	43	0
Sandstone and covered.....	20	0
Covered.....	14	0
Coal and bone shale, <i>Lower Mercer</i>	4	0
Covered.....	9	0
Shale, gray.....	11	0
Shale, blue, many plant fossils.....	7	0
Coal, <i>Vandusen</i>	0	11

Reference: Section 308, field notes, Jackson County, Stout.
Location: Record taken near the Grange Hall, east central Section 19, Franklin Township, Jackson County, seen along road on Four-mile Creek, near Portsmouth-Jackson Pike. Oak Hill topographic sheet.

	Ft.	In.
Shales and shaly sandstone.....	8	0
<i>Shale, dark, with many plant markings.....</i>	1	0
Shale, coaly, <i>Vandusen</i> coal horizon.....	0	5
Clay, light, shaly.....	1	0
Sandstone.....	5	0

UPPER MERCER COAL HORIZON

The mineable deposits of Upper Mercer coal are confined largely to southern Ohio, in Jackson, Scioto, and Lawrence Counties. The roof shales frequently bear plant fossils and locally are rich in such material. The chief area for collecting is north of Jefferson Furnace in Jackson County.

Reference: Section 169, field notes, Jackson County, Stout.
Location: On the property of Stephen Jones in south central Section 8, Jefferson Township, Jackson County, the Upper Mercer coal is mined for local use. The overlying shale is rich in plant fossils. Oak Hill topographic sheet.

	Ft.	In.
Sandstone and shale.....	17	0
Shales.....	8	0
Clay and clay shales, light, <i>Brookville</i>	7	0
Sandstone.....	8	0
Covered.....	6	0
Sandstone, massive.....	18	0
Ore, <i>Upper Mercer</i>	0	2
Shale and covered.....	8	10
Ore, <i>Sand Block</i>	0	4
<i>Shale, rich in plant fossils.....</i>	9	8
Coal, good, <i>Upper Mercer</i>	1	10
Clay, light.....	2	0
Sandstone, massive.....	25	0

BEDFORD COAL HORIZON

In general, the Bedford coal is overlain by the Upper Mercer limestone, flint, or ore, all of marine origin. Locally, however, these are absent and shale is found on the horizon. In a few places this shale bears plant fossils.

Reference: Section 63, field notes, Vinton County, Stout.
Location: Record taken along the road in the south central part of Section 17, Elk Township, Vinton County. Zaleski topographic sheet.

	Ft.	In.
Sandstone, soft.....	15	0
Coal, good.....	} <i>Winters</i> {	6
Clay, impure.....		3
Coal, good.....		7
Clay, dark.....		5
Coal, good.....		2
Covered, with flint.....	7	0
Top of road on ridge.		
Soil.....	4	6
Shale, gray.....	6	0
Shale, badly weathered, fossiliferous, <i>Putnam Hill</i>	0	6
Coal blossom, <i>Brookville</i> or <i>Newland</i>	4	0

	Ft.	In.		
Clay, light, plastic.....	4	0		
Shale, gray.....	13	0		
<i>Shale, dark, plant fossils, Bedford coal horizon.....</i>	1	0		
Clay, dark, impure.....	2	6		
Shale, siliceous.....	7	0		
Sandstone, soft, part shaly.....	6	0		
Clay shale, siliceous, <i>Upper Mercer coal horizon.....</i>	2	0		
Covered.....	19	0		
Limestone, shaly, part covered.....	Lower Mercer {	{	5	0
Limestone, hard, blue.....			0	7

TIONESTA COAL HORIZON

The Tionesta coal is widely distributed but usually thin and shaly. Its position is close below the Brookville clay. Where shale intervenes between the Tionesta coal and the Brookville clay this shale often bears plant fossils, locally in abundance.

Reference: Section 16, field notes, Muskingum County, Lamborn.

Location: Section taken at the old stone quarry near the plant of the Zanesville Stoneware Company in Putnam, a suburb of Zanesville, Muskingum County. Zanesville topographic sheet.

	Ft.	In.
Limestone, <i>Putnam Hill.....</i>	2	0
Clay and covered, <i>Brookville.....</i>	3	0
Shales, sandy.....	8	0
<i>Shales, gray to dark, plant fossils abundant.....</i>	9	6
Coal, <i>Tionesta.....</i>	1	10
Clay, siliceous.....	1	2
Sandstone, shaly.....	1	0
Sandstone, <i>Homewood.....</i>	21	0

Reference: Second Annual Report on the Geological Survey of Ohio, 1838, page 101, J. W. Foster.

Location: At Zanesville.

"Few places in the world, perhaps, afford plant fossils in such abundance and perfection as the mines about Zanesville. Many of the plates in the splendid work, "Histoire des Vegetaux Fossile," by M. Adolphe Brongniart, were figured from specimens furnished him by the late Ebenezer Granger, Esquire, or from drawings sent by W. A. Adams, Esquire, all of which were procured near Zanesville. Among that collection were the *Neuropteris Grangeri*, named in honor of the first gentleman; and the *Poacites lanceolata*, vegetables which have been found only at Zanesville."

Further, for the Tionesta horizon on Putnam Hill, near Zanesville see Observations on the Bituminous Coal deposit of the valley of the Ohio, and the accompanying rock strata; with notices on the fossil Organic remains and the relics of Vegetable and Animal bodies, illustrated by a Geological map, by numerous drawings of plants and shells, and by views of interesting scenery; by Dr. S. P. Hildreth; of Marietta, Ohio, the American Journal of Science, and Arts, Vol. XXIX, January, 1836, pages 30-38.

ALLEGHENY SERIES

In Ohio the Allegheny series has a thickness of close to 212 feet and in the section bears thirteen coal beds, some of which are exceptionally well developed. Plant fossils are common in many localities but only a few of the richer fields will be noted here.

CLARION COAL HORIZON

In most of the field the Clarion coal is overlain by the Vanport limestone of marine derivation. Locally this limestone is replaced by shale which occasionally bears plant fossils.

Reference: Section 53, field notes, Vinton County, Stout.
Location: On the Orval Lewis property, just east of Prattsville, in north central Section 26, Madison Township, Vinton County. Wilkesville topographic sheet.

	Ft.	In.
Sandstone, soft, friable.....	10	0
Shale, gray.....	12	0
Coal, shaly, <i>Scrub Grass</i>	1	5
<i>Shale, black, carbonaceous, plant fossils</i>	4	2
Coal, with partings, <i>Clarion</i>	4	0

Reference: Section 93, field notes, Columbiana County, Lamborn.
Location: Section along the paved road, west side of California Hollow, just north of the center of Section 24, Liverpool Township, Columbiana County. Wellsville topographic sheet.

	Ft.	In.
Sandstone, gray, siliceous.....	20	0
Coal, on outcrop, <i>Rogers, Lower Freeport</i>	2	0
Clay, siliceous.....	2	0
Shale, gray, siliceous.....	25	0
Sandstone and covered.....	50	0
Coal blossom, <i>Lower Kittanning, No. 5</i>	2	0
Clay and covered.....	5	0
Sandstone, shale and covered.....	83	0
Sandstone, heavy ledge.....	2	0
Shale, gray, siliceous.....	1	8
Sandstone.....	1	1
Shale, gray, siliceous, ferruginous.....	1	3
<i>Shale, dark, carbonaceous, with plant fossils</i>	0	5
Clay, gray, plastic, a little siliceous.....	} <i>Clarion</i> {	0
Clay, gray, very siliceous at base.....		9
Sandstone.....		5
	20	0

LOWER KITTANNING COAL HORIZON

The Lower Kittanning coal is very persistent across the State, seldom being absent from the section. The overlying shales frequently yield some plant fossils but locally offer good collecting.

Reference: Section 179, Geological Survey Ohio. Report of Progress, 1870, page 179, Gallia County.
Location: Record taken in Section 7, Huntington Township, Gallia County, about 1½ miles east of Keystone Furnace. Wilkesville topographic sheet.

	Ft.	In.
<i>Clay shale, blue, rich in coal plants</i>	6	0
Coal, upper 8 inches shaly, <i>Lower Kittanning</i>	4	0
Covered.....	50	0
Ore, <i>Ferriferous</i>	1	0
Limestone, Vanport.....	4	0

This coal is exposed along the valley in the southwestern part of Section 7, at an elevation close to 700 feet.

Reference: Section 150, field notes, Vinton County, Stout.
Location: Section taken along the road to the ridge in the northeastern part of Section 22, Elk Township, Vinton County. (See Bulletin 31, Geol. Survey Ohio, page 294.) Zaleski topographic sheet.

		Ft.	In.
Shale, gray.....		5	0
Coal, bony.....	} <i>Middle Kittanning</i> mine of Jacob Morgan, elevation 900 feet	0	6
Shale, dark.....		0	3
Coal, good.....		2	8
Shale, impure.....		0	1
Coal, good.....		0	4
Clay shale, sandstone and covered.....		38	0
Shale, gray, with well preserved plant fossils.....		5	0
Clay shale, dark, with papery coal.....		1	3
Coal, good.....	} <i>Lower Kittanning</i>	0	4
Clay shale.....		0	4
Coal, hard, bony.....		2	5
Clay shale.....		0	4
Coal, poor.....		0	6
Covered.....		6	0
Sandstone.....		25	0
Covered, Vanport limestone in interval.....		6	0
Coal, rough.....	} <i>Clarion</i>	1	0
Clay, impure.....		0	6
Coal, good.....		1	7
Clay shale.....		0	1
Coal, good.....		1	1

STRASBURG COAL HORIZON

In Ohio the Strasburg coal is only locally well defined, best in the Strasburg area of Tuscarawas County. However, the horizon may be traced over a wide area.

Reference: Section 34, field notes, Muskingum County, Stout.

Location: At the pit of the Burton-Townsend Brick Company, No. 2 plant, east of Zanesville, Muskingum County. Philo topographic sheet.

		Ft.	In.
Sand, used for molding sand.....		20	0
Shale, gray, used for brick.....		40	0
Coal, bony.....	} <i>Middle Kittanning</i>	0	7
Coal, good.....		2	2
Shale, dark.....		0	1
Coal, good.....		0	10
Clay, plastic, shaly.....		5	6
Sandstone, ferruginous, shaly.....		2	6
Shale, with very fine plant fossils well preserved.....		4	6
Coal, hard, bony, Strasburg.....		0	2
Clay, plastic.....		5	0
Clay, part flint, with limestone nodules.....		7	0
Coal smut, Lower Kittanning.....		0	1
Clay, light, plastic.....		7	0
Clay, very siliceous.....		7	0
Sandstone.....			

In the following section the shale bearing plant fossils is not well identified but evidently belongs to the Strasburg coal horizon.

Reference: Section 77, Thesis, Ohio State University, 1929, Theodore Ralph Meyers, The Geology of Jefferson and Bedford Townships, Coshocton County, page 77.

Location: Coal mine one-fourth mile northeast of McCurdy School in the southeastern part of Section 19, Bedford Township, Coshocton County. Brinkhaven topographic sheet.

		Ft.	In.
Sandstone, massive, yellowish-brown, <i>Lower Freeport</i>		25	0
Shale, blue-gray.....		1	6
Coal, shaly.....	} <i>Middle Kittanning</i> }	0	7
Shale, dark.....		0	2½
Coal, good.....		2	7
Clay shale, gray.....		0	½
Coal, fair.....		0	3
Clay, plastic, light colored.....		0	4
Shale, siliceous, with plant fossils.....		1	6

SNOW FORK ORE HORIZON

Locally across the State and from 5 to 15 feet below the Middle Kittanning coal a limestone or an iron ore makes its appearance. In eastern Ohio in Columbiana and Mahoning Counties the limestone, the common phase, is known as the Salem and in the Hocking Valley of Athens and Hocking Counties the iron ore, there important for iron smelting, was known as the Snow Fork.

Reference: Record 600, Second Annual Report of the Geological Survey of Ohio, 1838, pp. 143-4. C. Briggs, Jr. Also Geol. Survey Ohio, Volume 111, pages 866 and 906-907, Andrews.

Location: Chief field on Snow Fork east of Buchtel, in Section 6, York Township, Athens County.

"The most continuous, and probably the most valuable, deposits of iron ore in this county (Athens), is a few feet below the Nelsonville (Middle Kittanning) coal. This is a very heavy, compact ore, of a bluish color, and varies in thickness, from 6 to 10 inches. It contains impressions of ferns and other extinct vegetation. It is well disclosed at Whittimore's (one mile east of Buchtel) on the Snow Fork of Monday Creek, resting on a bed of shale, which disintegrates into a yellowish, ochrey clay. Split in the line of cleavage, it often reveals beautiful impressions of vegetable."—Briggs.

"On lower Monday Creek, and on Snow Fork, the ore is in flat discs, which contain coal plants in a state of beautiful preservation. The ore is recognized by all familiar with the geology of this district (Hocking Valley) from its relation to Coal No. VI, (Middle Kittanning) with which it is closely associated, underlying it at an interval of two to ten feet. It is a very compact and close-grained, blue carbonate, lying in large blocks and kidneys, in the clays that support the coal. It is also characterized from the Hocking Valley to the Ohio River by holding beautifully preserved coal plants. Leaflets of ferns, bits of bark, and branches are found throughout its substance, often in an exquisite state of preservation. Insect remains are to be expected here. The ore was first recognized with all of these peculiarities by the geologists of the First Survey (1838). The locality at which they found it is one of the best known today (1878), viz., the Whitmore farm on Snow Fork, a mile east of Bessemer (Buchtel). It is designated in the section as the Snow Fork ore."—Andrews.

MIDDLE KITTANNING COAL HORIZON

The Middle Kittanning is one of the great coal beds of Ohio. It is persistent and maintains good thickness and quality across the State. In large areas in eastern and central Ohio it is overlain by shales and limestones with marine fossils. However, in the Hocking Valley around New Straitsville, Shawnee, Hemlock, and Buckingham the overlying shales provide one of the best collecting grounds for plant fossils in Ohio. Other areas in southern Ohio yield some material of fair quality.

Reference: Section 6, field notes, Jackson County, Stout.

Location: Record taken in the northeastern part of Section 4, south, Madison Township, Jackson County, on the Thomas Davis property just west of Sardis Church. Oak Hill topographic sheet.

		Ft.	In.
Shale, siliceous.....		5	0
Shale, very fossiliferous, <i>plant types</i>		2	0
Shale, "draw slate".....		0	2
Coal, good.....	} <i>Middle Kittanning</i> {	1	11
Clay and bony coal.....		0	2
Clay, siliceous.....		4	0

Reference: Section 841, Geological Survey Ohio, Report of Progress, 1869, page 100; Ibid, Volume 111, pages 841-842.

Location: "On the farm of Benjamin Sanders, Monroe Township, Perry County, on the west branch of Sunday Creek the coal (Middle Kittanning) measures 11 feet." This section was taken a little below Hemlock. New Lexington topographic sheet.

		Ft.	In.
Soil.....		..	..
Shale, with coal plants.....		..	..
Coal.....	} <i>Middle Kittanning</i> {	1	1
Slaty streak.....		0	3
Coal.....		5	9
Clay parting.....		0	1½
Coal.....		3	0
Fire clay.....		..	..

Reference: Geological Survey Ohio, Report of Progress 1869, page 99.

Location: "At Gaver's mill, and on the adjacent land at L. M. McDonald, Esquire, near the Coal Dale, P. O., Salt Lick Township, Perry County, the seam (Middle Kittanning) measures 6 feet, 2 inches. Location north of New Straitsville, not definitely placed. New Lexington topographic sheet.

		Ft.	In.
Sandstone, heavy.....		40	0
Shale, blue, rich in coal plants.....		4	6
Coal, slaty.....	} <i>Middle Kittanning</i> {	0	2
Coal, good.....		0	8
Shale, with pyrite.....		1	0
Coal, good.....		2	4
Clay, black.....		0	0½
Coal, good.....		0	10
Clay, black.....		0	1
Coal, good.....		1	10½

"Here there is a good slate roof, very rich in plant fossils."

CONEMAUGH SERIES

The last invasion of the ocean during Pennsylvanian time occurred at the horizon of the Skelley limestone about midway in the Conemaugh series. Above that member the strata are entirely fresh water and below it both marine and fresh water. This group of rocks in Ohio averages about 400 feet in thickness. It bears eleven named coal beds but all of them are thin, some mere soot streaks. However, they afford good collecting for the paleo-botanist. The outstanding horizons are the Mahoning, Mason, and Harlem, each of which will yield much good material.

MAHONING COAL HORIZON

The Mahoning coal near the base of the Conemaugh group of strata is one of the outstanding horizons in Ohio for plant fossils. The coal is of importance only in the eastern part of the State. A few of the better places will be listed.

Reference: Section 318, field notes, Gallia County, Stout.

Location: Taken along road, from the valley to the ridge crest in Section 34, Morgan Township, Gallia County. Bidwell topographic sheet.

	Ft.	In.	
Shale, gray.....	11	0	
Clay shales, red.....	7	0	
Limestone, very fossiliferous, <i>Ames</i>	2	0	
Shale, gray.....	18	0	
Clay shale, red.....	15	0	
Shale, gray.....	9	0	
Clay shale, red.....	10	0	
Sandstone, shaly.....	6	0	
Covered.....	16	0	
Limestone, <i>Cambridge</i>	2	0	
Coal, <i>Wilgus</i>	1	0	
Clay, light.....	1	0	
Shales and covered.....	7	4	
Sandstone, shaly, ferruginous.....	0	8	
Shale, siliceous.....	9	0	
Covered.....	6	0	
Limestone, shaly.....	} <i>Brush Creek</i> {	1	0
Shale, calcareous.....		6	0
Limestone, irregular.....		1	0
Sandstone, calcareous, ripple marked.....		33	0
Coal, <i>Mason</i>		1	0
Shale, blue.....		15	0
<i>Shale, very rich in plant fossils</i>		4	0
Coal, good, <i>Mahoning</i> , on John Spires property.....		0	10
Clay, light.....		3	0
Clay, mottled.....		5	0
Shales, gray, calcareous.....		6	0
Clay shales, light, parts covered.....		10	0
Sandstone, massive, <i>Mahoning</i>		10	0
Coal, <i>Upper Freeport</i> , below sandstone but not seen.....	

Reference: Section 1 C, Geological Survey Ohio, Fourth Series, Bulletin 17, Condit. Page 231.

Location: Shale pit in southeast Section 7, Center Township, Carroll County. Carrollton topographic sheet.

"The Deckman-Duty Brick Company, Carrollton.
"This brick plant is situated on the north side of the Wheeling and Lake Erie Railroad, about one mile southwest of Carrollton.

"At the hill top is a coarse-grained sandstone, 12 feet thick, which is stripped. The underlying shale, 54 feet thick, is bluish-gray in the unweathered portion, and near the surface shows greenish or rusty-brown tints. Irregular carbonaceous streaks, having abundant plant impressions, are plentiful in the lower portion, together with occasional carbonate concretions. The lower portion of the pit exposing the Mahoning coal ('Strip Vein' of Salineville) with a thickness of about 1 foot, and the Upper Freeport coal, lying 40 feet lower, is mined in a neighboring hollow."

MASON COAL

As a coal bed the Mason is of little importance in Ohio. The usual mark is a few inches of shaly coal or a mere soot streak. Locally, however, it offers good collecting for fossil plants.

Reference: Section 350, field notes, Gallia County, Stout.
Location: Section taken along the road in the northwest corner of Section 34, Raccoon Township, Gallia County, Bidwell topographic sheet.

	Ft.	In.
Shales, gray.....	8	0
Shale, hard, bony.....	0	4
<i>Shale, many plant fossils</i>	2	8
Coal, bony.....	} <i>Mason</i> {	0
Coal, good.....		
		5
		1
		2

Reference: Section 1045, Geological Survey Ohio, Fourth Series, Bulletin 35, page 125, Lamborn.

Location: Section taken at the Quarry of the General Stone Company, above the river road, in the northern part of Section 25, Island Creek Township, Jefferson County. Steubenville topographic sheet.

	Ft.	In.
Shale, arenaceous, estimated.....	40	0
Clay, bluish-gray, with limestone nodules.....	4	0
Clay shale, red.....	20	0
Coal blossom, <i>Wilgus</i>	0	1
Clay, gray, arenaceous.....	6	2
Clay shale, red, with ore nodules.....	18	0
Sandstone, massive, <i>Buffalo</i>	35	0
Covered.....	32	0
Shale, gray, calcareous.....	8	0
Clay, dark, shaly.....	1	4
Clay, grayish-brown, arenaceous.....	5	4
Shale, calcareous.....	18	8
<i>Shale, dark, with plant impressions</i>	1	2
Coal, shaly, <i>Mason</i>	0	3
Clay, gray, plastic.....	8	0

Reference: Section 964, Geological Survey Ohio, Fourth Series, Bulletin 35, pages 25 and 26, Lamborn.

Location: Section secured along Croxton Run, in the central part of Section 32, east, Knox Township, Jefferson County. Steubenville topographic sheet.

Conemaugh Series:	Ft.	In.
Limestone, greenish, fossiliferous, <i>Ames</i>	1	9
Shale, gray, arenaceous.....	8	0
Clay shale, red, <i>Round Knob</i>	28	2
Clay, shaly, dark, <i>Barton</i>	10	4
Clay, with nodules of limestone.....	} <i>Ewing</i> {	2
Limestone, nodular, fossiliferous.....		
		6
Sandstone, shaly, <i>Cow Run</i>	28	6
Shale, arenaceous.....	2	0
Shale, black, with thin coal bands.....	2	0
Shale and covered.....	46	0
Limestone, blue, arenaceous, fossiliferous, <i>Cambridge</i>	0	11
Clay shale, blue to yellow in color.....	14	4
Shale, black, with shaly coal, <i>Wilgus</i>	1	10
Clay, dark, arenaceous.....	3	0
Clay shale.....	23	10
Limestone, black, fossiliferous, <i>Brush Creek</i>	1	3
Shale, dark, fissile.....	1	10
Shale, bony.....	1	2
<i>Shale, black, with many plant impressions</i>	4	6
Coal, bony, <i>Mason</i>	0	8
Clay, dark, with iron ore nodules.....	5	0

Reference: Section 1,008, Geological Survey Ohio, Fourth Series, Bulletin 35, pages 108-109, Lamborn.

Location: Record taken in the south central part of Section 34, Ross Township, Jefferson County. Salineville topographic sheet.

	Ft.	In.
Sandstone and arenaceous shale.....	26	0
Shale, dark, fossiliferous, <i>Brush Creek</i>	17	2
<i>Shale, dark, with many plant fossils</i>	3	0
Clay and covered, <i>Mason</i> horizon.....	14	10
Limestone, impure, ferruginous.....	1	2
Clay, with limestone nodules.....	15	8
Shale, gray to pink.....	28	4
Coal blossom, <i>Mahoning</i>	2	6
Clay, gray, plastic.....	2	0
Covered.....	9	4
Shale, gray, arenaceous.....	25	10
Shale, black, and shaly coal. <i>Upper Freeport</i>	0	6
Shale and covered.....	29	6
Coal, not entire thickness, <i>Lower Freeport</i>	2	0

Reference: Section 912, Geological Survey Ohio, Fourth Series, Bulletin 35, pages 22 and 23, Lamborn.

Location: Record taken in the ravine and along the road in the south central part of Section 12, Brush Creek Township, Jefferson County. Salineville topographic sheet.

Conemaugh Series:		Ft.	In.
Sandstone, thin bedded, <i>Cow Run</i>		40	0
Clay, blue, arenaceous.....		2	2
Clay, yellow, <i>Anderson</i> horizon.....		3	0
Shale, arenaceous.....		1	2
Sandstone, shaly.....		4	7
Shale, drab-colored, arenaceous.....		16	1
Limestone, bluish.....	} <i>Cambridge</i> {	1	2
Shale, bluish, fossiliferous.....		2	2
Shale, with thin coal bands, <i>Wilgus</i>		0	1
Clay, gray.....		5	0
Covered.....		5	4
Shale, bluish-gray, arenaceous.....		30	0
Shale, black, with iron ore nodules.....	} <i>Upper Brush Creek</i> {	5	4
Shale, black, fossiliferous.....		5	0
Limestone, black.....		1	2
Shale, black, micaceous.....		4	0
Clay shale, dark, fossiliferous.....		7	8
Coal, bony, <i>Brush Creek</i>		0	9
Clay, bluish-gray, arenaceous.....		6	8
Shale, bluish-gray, arenaceous.....		12	10
Shale, sandy, fossiliferous.....	} <i>Lower Brush Creek</i> {	0	3
Limestone, black, ferruginous.....		0	3
Shale, black.....		0	10
Shale, black, ferruginous, fossiliferous..		0	2
Shale, black, sparingly fossiliferous.....		2	9
Shale, black, very fossiliferous.....		2	2
Shale, gray, arenaceous.....		12	2
Shale, black, with plant impressions, <i>Mason</i> coal horizon.....		0	8
Clay, bluish-gray, arenaceous.....		4	8
Sandstone, heavy bedded, <i>Upper Mahoning</i>		9	5

	Ft.	In.
Clay, bluish-gray, arenaceous.....	5	0
Covered.....	15	8
Sandstone, cross-bedded, <i>Lower Mahoning</i>	44	4
Allegheny Series:		
Shale, black, with thin coal bands, <i>Upper Freeport</i>	0	7
Clay, bluish-gray, arenaceous.....	4	0
Sandstone.....	1	0
Clay, ferruginous, arenaceous.....	2	6
Clay shale, blue.....	10	6
Sandstone, heavy bedded.....	5	0
Sandstone, platy.....		
	<i>Upper Freeport</i>	31 0

Reference: Section 907, Geological Survey Ohio, Fourth Series, Bulletin 35, page 119, Lamborn.

Location: An excellent exposure of the Brush Creek beds occurs in the southern part of Section 13, Brush Creek Township, Jefferson County. Salineville topographic sheet.

		Ft.	In.
Limestone.....	} Cambridge {	1	2
Shale, blue, fossiliferous.....		2	2
Shale, with coal bands, <i>Wilgus</i>		0	1
Clay, bluish.....		5	0
Covered.....		5	4
Shale, bluish gray, arenaceous.....		30	0
Shale, black, carbonaceous, with ore nodules.....		5	4
Shale, black, arenaceous, fossiliferous.....		5	4
Limestone, black.....		1	2
Shale, black, micaceous.....		4	0
Shale, dark, fossiliferous.....		7	8
Coal, bony, <i>Brush Creek</i>		0	9
Clay, bluish-gray, arenaceous.....		6	8
Shale, bluish-gray.....		12	10
Sandstone, dark, fossiliferous....	} Lower Brush Creek {	0	3
Limestone, black, ferruginous....		0	3
Shale, black.....		0	10
Shale, black, fossiliferous.....		5	5
Shale, gray, arenaceous.....		12	2
Shale, black, with plant impressions.....		0	8
Clay, bluish-gray, <i>Mason</i>		4	8

BARTON COAL HORIZON

Throughout most of the field in Ohio, the Barton coal is overlain by sandstones and shales with little or no evidence of either plant or animal life. The coal is poorly developed and very patchy in extent.

Reference: Section 43, field notes, Muskingum County, Lamborn.

Location: Section along north and south road in the southeastern part of Section 14, Union Township, Muskingum County. Philo topographic sheet.

	Ft.	In.
Sandstone, shaly.....	5	0
Shale, gray, sandy.....	10	0
Coal blossom, <i>Pittsburgh</i>	1	0
Clay shales and covered with lumps of limestone.....	2	0
Shales and covered.....	31	0
Shales, gray, sandy.....	36	0
Covered.....	10	0

	Ft.	In.
Shales, gray, sandy.....	44	0
Limestone, <i>Ames</i>	0	10
Shales, gray, sandy.....	21	0
Covered.....	10	0
Shales, with layers of shaly sandstone.....	5	0
Shales, rather siliceous.....	5	0
Covered.....	10	0
<i>Shale, bony, black, fissile, plant fossils numerous, Barton coal horizon</i>	0	10
Covered.....	0	6
Clay, gray, rather plastic.....	4	6

HARLEM COAL HORIZON

The Harlem coal, lying about the middle of the Conemaugh series, is the highest coal of any importance in this group of rocks. It is easily placed as it lies not far below the Ames limestone.

Reference: Section 151, field notes, Muskingum County, Stout.

Location: Record taken along the deep ravine in the east central part of Section 28 and the southwestern corner of Section 27, Bluerock Township, Muskingum County. Philo topographic sheet.

	Ft.	In.
Shales, grayish yellow.....	1	0
Clay, limestone and covered.....	30	0
Shales, red, part covered, "Big Reds".....	83	0
Sandstone, shaly.....	3	0
Clay shale, red, part covered.....	6	0
Limestone, ferruginous, fossiliferous, <i>Skelley</i>	0	4
Clay shales, red, part covered.....	22	8
Sandstone, calcareous, fossiliferous, <i>Gaysport</i>	1	0
Shales, gray.....	21	0
Limestone, <i>Ames</i>	1	7
Sandstone, shaly.....	2	0
Shale, siliceous, blue.....	26	0
<i>Shale, dark, with thin bone bands, plant fossils abundant</i>	1	0
Coal, bony.....	} <i>Harlem</i> {	0
Shale, dark.....		5
Coal, good.....		10
Clay, siliceous.....	2	0
Sandstone, shaly.....	2	0
Shale, gray.....	4	0
Coal.....	} <i>Barton</i> {	1
Shale.....		3
Coal.....		2
Clay shales.....	2	0
Sandstone, shaly.....	3	0
Shales, gray.....	8	0
Shales, black, with thin coal bands.....	2	0
Clay, very siliceous.....	1	6
Sandstone, with ore nodules.....	3	0

Reference: Section 1,134, Geological Survey Ohio, Fourth Series, Bulletin 35, page 198, Lamborn.

Location: The different members of the Pennsylvanian system from the Wilgus coal horizon to the Pittsburgh sandstone are shown along the tributary of Wells Run which heads near

Altamont Park in Section 28, Steubenville Township, Jefferson County, where the following section was measured. Steubenville topographic sheet.

	Ft.	In.
Sandstone, coarse, friable, <i>Pittsburgh</i>	24	0
Shale, gray, arenaceous.....	2	6
Coal blossom, <i>Pittsburgh</i>	3	0
Shale and covered.....	20	8
Clay, light, plastic.....	5	0
Shale, gray, arenaceous.....	51	8
Clay, calcareous.....	5	0
Limestone, light, <i>Clarksburg</i>	0	8
Clay, greenish-gray.....	2	0
Shale, calcareous, arenaceous.....	3	2
Shale, mottled.....	21	0
Shale and covered.....	25	10
Sandstone, <i>Morgantown</i>	27	0
Limestone, <i>Ames</i>	1	0
Shale and covered.....	23	10
<i>Shale, black, with plant impressions</i>	0	2
Coal, <i>Harlem</i>	1	6
Clay and covered.....	5	0
Sandstone, shale and covered.....	51	6
Shale, gray, arenaceous.....	20	0
Shale, with nodules of very ferruginous, calcareous, fossiliferous limestone, <i>Cambridge</i>	2	0
Coal smut, <i>Wilgus</i>	0	1
Clay, red to green.....	10	0

UPPER PART OF THE CONEMAUGH SERIES

In Ohio the interval from the Ames limestone to the Pittsburgh coal varies from 155 feet in Meigs County to 220 feet in Jefferson County. In general the formations in this section are extremely variable and locally wanting. The replacement may be 50 to 100 feet of clay shales, red in color and soft and structureless in character. These are known collectively to the geologist and driller as the "Big Reds." Such deposits in some areas appear to yield silicified wood and in others they contain many nodules of hematite, a few of which will yield well preserved plant remains.

SILICIFIED WOOD

Silicified wood in the red shales above the Ames limestone is abundant along the streams in Morgan Township, Gallia County.

"Near the head of Middle Branch of Shade River, in Section 1, Athens Township, Athens County, many specimens of silicified wood were seen in the bed of the creek, and many fine museum specimens have been taken from this locality. No blocks were seen in place in the hills, but it is probable that they have weathered out from shales lying a little higher [?] than the Pittsburgh coal."¹

"Specimens of silicified wood are common in the hills of this region, (northwestern Homer Township, Morgan County) but none was seen in place. Loose blocks were found well up in the hills, and it is probable that they have weathered from shale lying a little above the Ames limestone."²

¹Geological Survey Ohio, Fourth Series, Bulletin 17, pages 119-120.

²Geological Survey Ohio, Fourth Series, Bulletin 17, page 140.

HEMATITE NODULES

Hematite can be found in some quantity in most of the streams in eastern Athens, eastern Perry, and western Morgan Counties. In some areas there are only a few scattered nodules; in others it is so thick that from one to two pounds may be picked from a square foot of surface. Some favorable places are: on the headwaters of Bryson Run, Section 36, Ames Township, Athens County; another is near Sayre in Bearfield Township, Perry County; and near Ringgold in Union Township, Morgan County. Similar deposits are found in eastern Lawrence and western Gallia Counties. Only a few of the nodules contain plant fossils. The plant fragments, however, are exceptionally well preserved.

MONONGAHELA SERIES

The Monongahela series, averaging about 245 feet in thickness, is made up largely of fresh-water limestones, calcareous shales, and sandstones. It contains seven coal beds some of which, Pittsburgh, Pomeroy, and Meigs Creek, are of great economic importance. The period was thus of organic origin and in some of the strata much evidence of the plant life prevails. Only a few of the better localities will be considered.

PITTSBURGH COAL HORIZON

In Ohio the Pittsburgh is a well marked horizon from Jefferson County on the north to Lawrence County on the south. The chief productive fields are the Eastern Ohio field in Jefferson, Harrison, Belmont, Monroe, and Guernsey Counties, the Federal Creek field in Athens and Morgan Counties, and the Swan Creek field in Gallia County. The roof shales in many mines bear some plant fossils.

Reference: Section 810, field notes, Athens County, Stout.
Location: Up the Marietta road at the Sharpsburg Hill, northeast Section 29, Berne Township, Athens County. Chesterhill topographic sheet.

	Ft.	In.
Sandstone, shaly.....	2	0
Shale, siliceous, gray.....	1	6
Coal, shaly, <i>Little Waynesburg</i>	0	2
Clay, calcareous, grainy, gray to pink, parts marly.....	10	9
Sandstone and shale, gray.....	22	1
Limestone, nodular, pinkish.....	0	8
Shale, pink, calcareous, parts gray.....	22	1
Sandstone, shaly, gray.....	2	0
Shale, pink, sandy.....	2	0
Coal smut, <i>Uniontown</i>	0	$\frac{1}{16}$
Shale, pink to gray, calcareous, parts marly.....	21	9
Shale and shaly sandstone.....	10	0
Shale, pink.....	2	6
Coal smut, (<i>Arnoldsburg?</i>).....	0	$6\frac{1}{4}$
Shales, calcareous.....	10	5
Limestones and calcareous shales, <i>Arnoldsburg-Benwood</i>	48	0
Sandstone, massive, irregular, <i>Upper Sewickley</i>	6	2
Shale, gray, siliceous.....	3	4
Coal smut, <i>Meigs Creek</i>	0	$0\frac{1}{2}$
Shale, calcareous, blue to buff.....	8	8
Shale, gray, parts very sandy.....	9	4
Clay, dark, smutty, <i>Fishpot</i> coal horizon.....	0	2
Clay shale, dark.....	1	0
Limestone, thin to massive, with thin shale partings.....	7	0
Shale, pink, marly.....	19	6
Limestone, sandy, yellowish.....	1	10

	Ft.	In.
Shale, calcareous, gray to green to pink, marly with thin limestone layers.....	22	2
Shale and shaly sandstone.....	15	4
<i>Shale, with plant fossils, roof of coal</i>	1	0
Coal, good.....	Pittsburgh, mine of Eckard and Day, elevation 915 feet	5
Clay, soft, gray.....		4
Coal, good.....		0
		11
		3
		9

Reference: Section 812, field notes, Athens County, Stout.

Location: Mine of L. E. Harris on the G. W. Selby land, northeast Section 30, Berne Township, Athens County. Chesterhill topographic sheet.

	Ft.	In.
Sandstone, massive, <i>Upper Pittsburgh</i>	20	0
<i>Shale, dark, with plant fossils</i>	1	5
Coal, with thin partings.....	Pittsburgh	3
Shale, with pyrite.....		0
Coal, good.....		0 1/4
Shale, hard, bony.....		0
Coal, good.....		1
Coal, good.....		0
Clay, gray, soft.....		11
Coal, good.....		0
		4 1/2
		1
		2 1/2
		3
		9

Throughout most of the Federal Creek field the roof of the Pittsburgh coal yields plant fossils in fair abundance and with good detail.

Reference: Section 299, Geological Survey Ohio, Volume 1, page 298.

Location: In Section 34, Homer Township, Morgan County, on land of Mr. Bishop, the following section was taken (coal near top of high knob). New Lexington topographic sheet.

	Ft.	In.
Limestone, buff.....	1	0
Covered.....	27	0
Coal.....	Pittsburgh	3
Clay, with coal plants.....		0
Coal.....		1
Covered.....		4
		0
		142
		0
Limestone, <i>Ames</i>	2	6

Reference: Section 298, Geological Survey Ohio, Volume 1, page 298.

Location: The following section of the (Pittsburgh) coal was taken on the land of J. Stinchcomb, Section 29, Homer Township, Morgan County. (This coal lies close to the top of the high ridge). New Lexington topographic sheet.

	Ft.	In.
Limestone, buff.....	1	0
Covered.....	12	0
Sandstone, <i>Upper Pittsburgh</i>	6	0
<i>Shale, with coal plants</i>	10	0
Coal.....	Pittsburgh	4
Clay.....		2
Coal.....		1
Covered.....		0
		4
		0
		143
		0
Limestone, <i>Ames</i>	2	0

Reference: Section 13, Washington County, Thesis, 1936, John C. Frye, State University, Iowa.

Location: On Cat Creek, about one mile southwest of the Noble-Washington County line, north of the stream, in the northeastern part of Adams Township, Washington County, the following rocks were exposed. Macksburg topographic sheet.

	Feet
Coal, <i>Meigs Creek</i>	2.0
Shale, gray, carbonaceous.....	4.0
Covered.....	35.4
Limestone, gray.....	0.8
Sandstone, fine grained, gray.....	3.5
Shale, calcareous, gray, fissile.....	3.8
Limestone, gray.....	0.2
Shale, calcareous.....	1.0
Shale and limestone, gray.....	3.5
Shale and covered.....	2.6
Shale, calcareous, gray, black and red.....	1.5
Sandstone, gray, fine grained.....	19.0
Covered.....	5.5
Shale, gray, calcareous.....	0.9
Shale, carbonaceous.....	0.08
Shale, very calcareous. The following plants collected: <i>Pecopteris</i> , several species; <i>Neuropteris</i> ; <i>Odontopteris</i> ; <i>Equisetides</i> ?.....	2.1
Shale and covered.....	8.0
Coal, <i>Pittsburgh</i>	0.2
Limestone, black, shaly.....	0.9
Base of section in Cat Run at an elevation of 780 feet.	

REDSTONE OR POMEROY COAL HORIZON

The Redstone or Pomeroy coal is widely distributed in Ohio but the field of economic importance is confined to southern Meigs and eastern Gallia Counties. In many localities the roof shales of this coal contain plant fossils in a fair state of preservation.

Reference: First Annual Report on the Geological Survey of Ohio, 1838, report of Dr. S. P. Hildreth, pages 42 and 43. Fossils which accompany "The Pomeroy Coal Bed" [Redstone].

Location: At Pomeroy, Meigs County.

"In the shale beds, which generally form the roof of this coal, we find innumerable casts and impressions of the foliage and stems of various coal plants, of which have been collected more than twenty species. Amongst them may be recognized of the *Equisetaceae*, the *Calamites* and *Equisetum* of *Filices*, the *Sphenopteris*, *Glossopteris*, *Neuropteris*, *Pecopteris*, etc. The Lycopodiaceae, such as *Lepidodendron*, *Sigillaria*, etc., are rare in this deposit, but are common in the earlier formed beds. The most interesting feature of the rocks connected with this coal, is the great abundance of fossilized stems and branches of trees, that are found to accompany the coarse sandrocks which lie over the coal, in several localities which have been visited. So few quarries, or excavations, have been yet opened in this rock, that we can only discover them in beds of streams, or situations where the rock has crumbled away by natural causes."

Reference: Section 253, Geological Survey Ohio, Volume 1, page 253.

Location: A section at Pomeroy shows the following strata. Pomeroy topographic sheet.

	Ft.	In.
Shale.....	6	0
Sandstone, laminated.....	6	0
Clay shale.....	10	0
Sandstone.....	16	0
Not exposed in detail.....	31	0
Shale, red.....	6	0
Sandstone, compact.....	9	0
Shale.....	18	0
Sandstone, heavy, (<i>Pomeroy</i>).....	64	0
Shale, sandy, with coal plants.....	9	0

		Ft.	In.
Coal, top.....	} <i>Pomeroy or Redstone</i>	1	0
Shale.....		0	2
Coal.....		4	0
Shale, bituminous, with streaks of coal.....		1	2
Clay.....		1	0
Sandstone.....		8	0
Shale.....		6	0
Sandstone.....		2	0
Shale.....		14	0
Pittsburgh coal not far below.			

Reference: Section 254, Geological Survey Ohio, Volume 1, page 254.

Location: At Coalport (midway between Pomeroy and Middleport) we find the coal (Pomeroy) and its associated strata as follows. Pomeroy topographic sheet.

		Ft.	In.
Sandstone, heavy, not measured.....		..	..
Shale, ferruginous, containing coal plants.....		15	0
Shale, bituminous.....		0	8
Coal.....	} <i>Pomeroy or Redstone</i>	1	6
Coal.....		3	7
Underclay and shale.....		6	0

Reference: Section 250, Geological Survey Ohio, Volume 1, page 250.

Location: At the Wells bank, a mile east of Pagetown, in the southeastern part of Section 17, Scipio Township, Meigs County, the following measurements were made. Pomeroy topographic sheet.

	Ft.	In.
Sandrock, seen.....	20	0
Shale, with coal plants.....	4	0
Coal, [<i>Pomeroy or Redstone</i>].....	3	6

Reference: First Annual Report on the Geological Survey of Ohio, 1838, Report of Dr. S. P. Hildreth, page 43.

Locations: Branches of Federal Creek, (Morgan and Athens Counties), Leading Creek (western Meigs County), Campaign Creek (northern Gallia County), head of Shade River, Lodi Township, Athens County.

"Fragments of fossilized trees are seen in several of the branches of Federal Creek; the beds of Campaign and Leading Creek, but more abundantly in the heads of Shade River, Township of Lodi, Athens County. The extreme northerly branch of this river, rises in that high ridge of land south of Athens, before noticed, and not more than a mile from the Hockhocking River. About three miles south, this branch becomes a rivulet of ten or twelve feet in width. In the bed of this rivulet, and also in one which heads with it, and puts into the Hockhocking, are found numerous tabular, oval masses of siliceous composition. They are from 4 to 10 inches in thickness, and from 2 to 3 feet in diameter, with others that are smaller. One of the sides is almost invariably concave, or depressed in the center, and the opposite one plane or slightly convex. They are evidently petrifications of some vegetable substance, as the traces of the fibrous structure is very apparent in all the specimens. The form of these masses very much resembles that of the base of the *Stigmara ficoides*, with the branches all broken off. They are composed of the hardest silicious matter, of a reddish, gray color. . . . Isolated masses are scattered along the bed of the branch for more than a mile, the bottom of which is composed of a slaty sand-rock, deposited in thin layers, highly inclined, and of slight coherence. No specimens were found in place, but they were doubtless originally imbedded in a coarse sand-rock, which lies over the coal. This opinion is strengthened by the fact that portions of the trunks and roots of the fossil trees found lower down the branch, are often ploughed up in the fields, on the hill sides, 50 to 80 feet above the bed. A few miles lower down, and six and a half miles from Athens, the beds of several small streams, all tributaries of Shade, and rising over a space of 8 or 10 square miles of surface, are found strewed with

the segments of trunks of fossil trees, varying in diameter from a few inches to 18 or 20 inches. The larger sections are generally perforated by a circular opening near the center, from 1 to 4 or 5 inches in diameter. The regular shape of the pieces, resembling transverse sections of a log of wood, seems to be the result of a peculiar mineral organization, disposing the fragments to assume a cubic form, had the exterior of the fossil been square instead of circular. The ligneous structure of the original tree was coarse, very distinct, and highly vascular; it is now replaced by silex, in many specimens beautifully agatized. Some of the pieces are filled with perforations, the size of a quill, and larger, which seem to have been made by a worm. This most probably was done by an ancient *Teredo*, after the trees were torn up, and floated down some river to the ocean. Fragments, three to four feet in length, are the longest yet discovered. The quantity of specimens is so great that we might be led to suppose a whole forest had originally been entombed in this place, covered with beds of a highly silicious quality, and consolidated into sand-rock. These rocks being less dense and compact than the fossilized wood, have, in the course of ages, crumbled into soil, and left the imbedded trees to fall out in fragments, and gradually wash down the slopes of the hills into the beds of the streams, where they are now found. As the age of this rock is long anterior to the Tertiary, these fossil remains are not likely to be allied to any living species of tree which now vegetates in the forests of Ohio. It most probably belongs to the tribe of *Gymosperma*, of Lindley; a race of plants whose seeds are naked or formed without a pericarpium, or envelope. From the great vascularity of the trunk, and the fact of the fragments almost entirely composed of the shafts of the trees, with few or no branches, we are led to conclude, they may be attached to the order *Cycadea*, the woody fibre of which is very similar in structure to the coniferae, or pine race, and which are only found in some of the more recent coal deposits."

Reference: Section 286, Geological Survey Ohio, Volume I, pages 287-288.

Location: The following is a section obtained on the land of Philip Haning in Section 32, Lodi Township, Athens County. Pomeroy topographic sheet.

	Ft.	In.
Sandstone, seen, <i>Pomeroy</i>	25	0
Sandstone, unevenly bedded, showing part of a silicified tree in place.....	5	0
<i>Shale, blue, with coal plants</i>	5	0
Coal, reported, <i>Pomeroy</i> or <i>Redstone</i>	1	6
Shale, with nodules of limestone.....	25	0
Coal, <i>Pittsburgh</i>	3	0
Shale and clay.....	12	0

"The above section is of great interest as showing the position of one of the trunks of petrified wood. These trunks are very often found on the upper branches of Shade River, lying in the bed of the stream.

"Great quantities, even tons, of specimens of silicified wood from Shade River, have been obtained to enrich cabinets in various parts of the country. No very minute investigation has as yet [1873] been made of the samples so far as I know. Mr. Leo Lesquereux is now engaged in the study of them, and it is believed that his results will be interesting and valuable. There are doubtless many different kinds of wood, and when specimens are properly prepared for microscopic investigation, the structural differences will be still more apparent. Mr. Lesquereux believes that the fragments of trunks are found in the shales between the two coals [Pittsburgh and Pomeroy], as well as in the sandstone above the upper coal [Pomeroy] where I [Andrews] found them. From repeated visits to this region, I am led to believe that the trees, after drifting about and many of them partly rotting away, were buried in the sand, and while thus buried, were slowly changed into silex from silica derived, probably, from the sand of the sandrock. The portion of a trunk seen in place on the Haning farm, had more than half rotted away before it was silicified. It lies in the sandrock in a horizontal position, and the false bedding of the sandrock around it indicates the rolling of waves upon a sandy beach.

"One of the most interesting of the Shade River petrifications is a peculiar disc, often three or four feet in diameter, composed of a mass of flattened rootlets, resembling somewhat those of *Stigmaria*. These rootlets radiate from a common center, and evidently grew in a dense

bunch around the Psaronius tree. The tree, however, is generally gone, either leaving a cavity in the center of the disc, or a depression upon both the upper and under sides. Many years ago, I [Andrews] found one of these discs, showing the remains of a central trunk. The tree had fallen and evidently pressed upon one side of the mass of rootlets, and had in that position partly rotted away before the whole had become silicified."

MEIGS CREEK OR SEWICKLEY COAL HORIZON

The main field of the Meigs Creek coal extends from the Muskingum River in Morgan County to Short Creek in southern Jefferson County. Locally the overlying shales bear some plant fossils and in a few places they contain much fine material.

Reference: Section 11, Thesis, 1936, John C. Frye, State University of Iowa.

Location: Section measured on west side of Big Run, one and one-fourth miles south of the mouth of Straight Run in western Adams Township, Washington County. Caldwell topographic sheet.

	Feet
Shales, mostly covered.....	27.5
Sandstone and covered.....	22.0
Sandstone, ferruginous, dark brown.....	0.9
Sandstone, gray, with shale partings.....	5.6
Shale, red, partly covered.....	7.7
Sandstone.....	5.0
Shale, mostly covered.....	15.2
Covered.....	20.0
Sandstone, fine grained, gray.....	7.5
Covered.....	3.0
Shale, red.....	8.0
Shale, gray.....	2.3
Sandstone, fine grained, gray.....	1.7
Shale, fissile, red and gray.....	7.7
Covered.....	66.0
Limestones.....	2.3
Shale, micaceous, dark green.....	7.5
Sandstone, tan, <i>Upper Sewickley</i>	21.5
Shale, dark gray, upper part fissile, contains <i>Callipteridium?</i> , <i>Neuropteris</i> , <i>Nematophyllum</i> , <i>Odontopteris</i> , <i>Pecopteris</i> , <i>Shenophyllum</i>	3.0
Coal.....	} <i>Meigs Creek</i> } 0.9
Shale, dark gray.....	
Coal.....	} <i>Meigs Creek</i> } 1.1
Covered.....	
Shale, gray and tan.....	1.6
	1.3
	5.0

Reference: Section 661, field notes, Noble County, Stout.

Location: Record located on the East Fork of Duck Creek, one and one-half miles north-east of Lower Salem, south of the stream, near the southwest corner of Section 36 (in part), Salem Township, Noble County, at the coal mine of A. H. Ullman. The record taken is given below. Macksburg topographic sheet.

	Ft.	In.
Sandstone, massive, <i>Upper Sewickley</i>	20	0
Shale, calcareous, with many plant fossils.....	1	1
Shale, coaly.....	0	1
Coal, good.....	2	0
Shale, gray.....	0	0½
Coal, fair.....	0	1
Clay shale.....	1	1
Coal, good.....	3	0½
Covered.....	73	0
Road level, elevation 730 feet.		

PERMIAN SYSTEM

In Ohio the Permian system of rocks extends in a narrow belt along the Ohio River from Jefferson County on the north to Meigs County on the south. The total area is close to 1,830 square miles and the maximum thickness about 625 feet. The system is divided into two major divisions, Washington and Greene series, and these are further subdivided into many members. The rocks of the Permian system, in Ohio, consist largely of shales, sandstones and freshwater limestones. While coal beds are present and about normally spaced they are usually impure and in some cases mere soot streaks of organic matter. As so far examined the fossil plants are confined to the lower or Washington series.

THE WASHINGTON FORMATION³

"As indicated elsewhere, the Washington formation begins with the Cassville shale and ends with the Upper Washington limestone or the horizon of the Jollytown "A" coal. This formation, in general, is not very prolific in fossils. It has, however, a better preservation of the Dunkard life than is to be found in the overlying beds. Plants are the most abundant fossils in the Dunkard series. At certain horizons the shales are crowded with plant remains in various stages of preservation. In West Virginia and Pennsylvania, William M. Fontaine and I. C. White found 107 different species of fossil plants in the Cassville shale. Fragments of many of these are to be found in the shales of the same horizon in Ohio.

"The shales of the Washington formation often contain fossil plants. These are usually more abundant in the beds associated with the coal. Most, probably all, of these plants have been found in correlative beds of Pennsylvania and West Virginia.

"The following list represents the more important ones found in Ohio.

<i>Pecopteris imbricata</i> , Fontaine and White	
Cassville shale, Paines Run, near Cameron.....	(1)
<i>Pecopteris dentata</i> (Bat)	
Cassville shale, Paines Run, near Cameron.....	(2)
<i>Pecopteris heeriana</i> , Fontaine and White	
Cassville shale, Paines Run, near Cameron.....	(3)
<i>Pecopteris subfalcata</i> , Fontaine and White	
Cassville shale, Clarrington [appears to be Uniontown].....	(4)
<i>Pecopteris tenuinervis</i> , Fontaine and White	
Cassville shale, Becket Station, also in shales above the Waynesburg 'A' coal.....	(5)
<i>Neuropteris flexuosa longifolia</i> , Fontaine and White	
Cassville shale, Clarrington [appears to be Uniontown].....	(6)
<i>Neuropteris</i> sp.	
Washington coal, Crabapple.....	(7)
<i>Callipteridium grandifolium</i> , Fontaine and White	
Cassville shale, Clarrington [appears to be Uniontown].....	(8)
<i>Callipteridium</i> sp.	
Cassville shale, Paines Run, near Cameron.....	(9)
<i>Callipteris</i> sp.	
Cassville shale, Vallonia.....	(10)
<i>Callipteridium dawsonianum</i> , Fontaine and White	
Cassville shale, Paines Run, near Cameron.....	(11)
<i>Rhacophyllum filiciforme majus</i> , Fontaine and White	
Cassville shale, Paines Run, near Cameron.....	(12)
<i>Alithopteris virginiana</i> , Fontaine and White	
Cassville shale, Paines Run, near Cameron.....	(13)
<i>Sphenophyllum latifolium?</i> Fontaine and White	
Upper shales of Washington formation, Tunnel Station.....	(14)

³Geological Survey Ohio, Fourth Series, Bulletin 22, pages 141, 142-143.

<i>Baiera virginiana</i> , Fontaine and White	
Washington coal, Crabapple.....	(15)
<i>Sigillaria</i> sp.	
Washington coal, Crabapple.....	(16)
Spore cases	
Washington coal, Crabapple.....	(17)
<i>Rhacophyllum filiciforme</i>	
Shales above Waynesburg 'A' coal, Clarington.....	(18)
<i>Annularia</i> sp.	
Shales above Waynesburg 'A' coal, Clarington.....	(19)
<i>Cordaites</i> sp.	
Shales above Waynesburg 'A' coal, Clarington.....	(20)
<i>Calamocladus</i> sp.	
Shales above Waynesburg 'A' coal, Clarington.....	(21)"

PAINES RUN LOCALITIES

Paines Run is located north of Cameron in southwestern Switzerland, northeast Adams and west central Salem Townships, Monroe County. The horizon of the Cassville shale is about 840 feet at the mouth of the stream and 885 feet in the northern part of Section 15, Switzerland Township, where it passes below drainage. Three sections are given below:

Reference: Section 424, field notes, Monroe County, Stout.

Location: In hollow west of the stream in the northeast part of Section 14, Adams Township, Monroe County, the following strata were exposed. Clarington topographic sheet.

		Ft.	In.
Shale, gray.....		2	3
Limestone, blue, hard.....	} Elm Grove	0	8
Limestone, blue, hard.....		0	7
Limestone, blue, nodular.....		0	3
Shale, blue.....		0	1
Limestone, blue, hard.....		1	2
Shale, gray, with fossils, <i>Cassville</i>		7	0
Covered.....		37	7
Shale, gray, siliceous.....		13	0
Shale, bony, dark.....	} Uniontown, not full thickness, elevation 790 feet	0	2
Coal, good.....		1	8

Reference: Section 422, field notes, Monroe County, Stout.

Location: On Paines Run east of the stream, north of the center of Section 15, Switzerland Township, Monroe County. Clarington topographic sheet. The record taken is given below:

		Ft.	In.
Shale, gray to dark.....		10	0
Limestone, hard, blue, blocky.....	} Elm Grove	0	7
Limestone, hard, blue, blocky.....		1	9
Shale, dark.....		0	5
Limestone, three layers.....		0	11
Shale, dark, soft, plant remains, <i>Cassville</i>		3	5
Shale, dark, carbonaceous.....		0	3
Shale, carbonaceous, hard, bony.....		0	1
Coal, rough, <i>Waynesburg</i> , elevation 880 feet.....		0	10
Shale, bony.....		0	0¼
Clay shale, blue to gray.....		5	9
Shale, blue, with ore nodules and thin sandstone layers.....		4	3

Reference: Section 421, field notes, Monroe County, Stout.

Location: In bed of stream near line of Section 15 and Section 16, Switzerland Township, Monroe County. Clarington topographic sheet. The record follows:

		Ft.	In.
Limestone, blue, blocky.....	} Elm Grove {	2	2
Limestone, blue, blocky.....		0	7
Shale, blue.....		1	7
Clay shale, dark.....	} Cassville {	0	6
Clay shale, bluish gray.....		1	0
Shale, coaly.....		0	2½
Coal, bony.....	} Waynesburg {	0	1
Coal, good.....		0	4¾
Clay, impure.....		1	0

CLARINGTON LOCALITIES

In this locality the Cassville shale is found at an elevation close to 700 feet and the Waynesburg "A" coal at 750 feet.

Reference: Section 154, field notes, Monroe County, Stout.

Location: Up the ravine at the west end of the bridge at Clarington, northwest corner Section 24 and the northeast corner of Section 30, Salem Township, Monroe County, the following beds were measured. Clarington topographic sheet.

Washington series, Permian system:		Ft.	In.
Coal prospect, <i>Washington</i>		3	0
Shales, gray, parts covered.....		28	0
Coal smut, <i>Little Washington</i>		0	1
Clay shale, dark.....		2	11
Sandstone, shaly.....		8	0
Shales, gray, mainly siliceous.....		29	4
Coal prospect and covered, <i>Waynesburg "A"</i>		5	4
Limestone, hard, dark.....		1	2
Covered.....		5	2
Shale and shaly sandstone.....		15	0
Sandstone, shaly.....		7	0
Covered, <i>Cassville shales here</i>		10	8
Monongahela series, Pennsylvanian system:			
Coal, bony, and shale, dark, <i>Waynesburg</i>		0	6
Shale, gray, and sandstone, shaly.....		18	4
Soot streak.....		0	1
Clay shale, dark.....		3	0
Shale, gray, parts very sandy.....		7	5
Shale, dark, argillaceous.....		1	0
Coal, shaly, <i>Little Waynesburg</i>		0	3
Clay shale, calcareous, dark.....		7	9
Shale and shaly sandstone, gray.....		18	0
Shale, gray, siliceous, with plant fossils.....		7	0
Coal, good.....	} Uniontown {	1	9½
Coal, shaly.....		0	2
Shale, coaly.....		0	2
Shale, gray.....		0	2
Coal, fair.....	} Uniontown {	0	3½
Shale, gray, calcareous.....		1	2
Limestone, irregular.....		1	6
Shale, gray, very siliceous.....		5	10
Sandstone, shaly, <i>Arnoldsburg</i>		1	4
Shales, gray to pink.....		5	8
Shale, dark.....		0	4
Limestone, shaly.....	} Arnoldsburg {	1	5
Limestone, hard, light.....		1	3
End of bridge, elevation 620 feet approximately.....			..

Reference: Section 152, field notes, Monroe County, Stout.

Location: Section taken along the road that leads from Stillhouse Run, near its mouth, to the ridge north, in the northeastern part of Section 20, Salem Township, Monroe County. Clarington topographic sheet.

	Ft.	In.
Coal blossom, <i>Washington</i>	3	0
Shales and covered.....	11	6
Sandstone, massive.....	18 4 19 13	0 0 0 0
Shale, gray.....		
Sandstone, massive.....		
Shales, gray.....		
Clay shale, dark.....	1	0
Coal, weathered, shaly, <i>Waynesburg "A"</i>	4	0
Shales, parts covered.....	29	0
Sandstone, shaly.....	10	0
Shale, gray, <i>Cassville</i>	8	0
Shale, dark, <i>Waynesburg</i> coal horizon.....	1	0
Shales and shaly sandstone.....	11	4
Shale, dark.....	0	8
Shale, gray.....	6	0
Sandstone, shaly.....	2	0
Shale, part calcareous.....	6	0
Covered.....	22	6
Sandstone, shaly.....	2	6
Shale, gray.....	6	10
Sandstone, shaly.....	1	2
Shale, gray, <i>plant fossils</i>	3	10
Coal, weathered, <i>Uniontown</i>	3	2
Shale, gray.....	12	5
Sandstone, massive.....	1	5
Shale, gray, siliceous.....	3	4
Limestone and calcareous shale.....	1	6
Limestone, hard, light.....	0	10
Shale, calcareous, with limestone nodules.....	1	6
Limestone, hard, light.....	1	6
Valley floor, elevation 650 feet.....	..	..

VALLONIA LOCALITY

Along Weegee Creek in the vicinity of Vallonia the *Cassville* shales are found at an elevation close to 950 feet. The *Cassville* shale is overlain by the *Elm Grove* limestone and underlain by the *Waynesburg* coal.

Reference: Section 31, field notes. Belmont County, Stout.

Location: Record taken at Vallonia, along Weegee Creek, south of the center of Section 14, Mead Township, Belmont County. St. Clairsville topographic sheet.

	Ft.	In.
Shale, dark, carbonaceous.....	2	0
Limestone, <i>Elm Grove</i>	1	10
Shale, gray, siliceous, <i>Cassville</i>	4	6
Coal blossom, <i>Waynesburg</i>	1	0
Shales, gray, part sandy.....	11	6
Coal, shaly, <i>Little Waynesburg</i> , elevation 938 feet.....	0	3½
Shale, light.....	0	3
Limestones, massive.....	3	4
Limestones, calcareous shales and covered.....	11	4
Sandstone, hard, blue, calcareous.....	2	0

BECKET STATION LOCALITY

In this locality the Cassville shales are present at an elevation of 1,060 feet. In this area both the associated Elm Grove limestone and the Waynesburg coal are present in good development and act as benches of reference.

Reference: Section 117, field notes, Belmont County, Stout.

Location: Section taken at the trestle of the Ohio River and Western Railroad (abandoned) along Rocky Fork, in the northeastern part of Section 12, Washington Township, Belmont County. Clarington topographic sheet.

	Ft.	In.
Limestone, hard, dark.....	1	4
Shale, gray.....	8	1
Limestone, dark, very siliceous.....	1	8
Shale, siliceous, dark, with plant fossils, Cassville.....	4	7
Sandstone, shaly.....	1	0
Shale, siliceous.....	0	6
Sandstone, micaceous.....	0	10
Shale, coaly.....	0	2
Coal, good, Waynesburg.....	2	3
Shale, gray.....	0	10
Sandstone, shaly.....	4	0

CRABAPPLE LOCALITY

North of Crabapple the Waynesburg coal is mined in a small way. It is present at an elevation of 910 feet and the Washington coal lies approximately 100 feet higher.

Reference: Section 70, Geological Survey Ohio, Fourth Series, Bulletin 22, page 70.

Location: Section located north of Crabapple in the north-central part of Section 26, Washington Township, Belmont County. Clarington topographic sheet.

	Ft.	In.
Sandstone, laminated, micaceous, gray, Lower Marietta.....	16	0
Shales, red and gray, argillaceous, with plant fossils.....	19	3
Coal and shale, Washington.....	3	5
Covered.....	26	8
Shale, argillaceous, blue, with sandy nodules.....	10	8
Covered.....	14	0
Limestone, dark.....	0	6
Shale, black, carbonaceous, and some coal. At some places this coaly portion thickens to a foot and has been mined, Waynesburg "A".....	1	10
Limestone, blue-gray, hard.....	0	10
Limestone, dark-gray, impure.....	1	1
Shale, dark-gray.....	1	6
Limestone, gray to yellow.....	3	3
Sandstone, massive, gray.....	4	7
Shale, gray.....	7	6
Limestone, gray, with an irregular base.....	1	6
Shale, soft, gray, with calcareous nodules and black carbonaceous streaks at base.....	4	5
Shale, gray, contorted, nodular, sandy, micaceous.....	5	4
Sandstone, gray, shaly, micaceous.....	2	6
Shale, gray, arenaceous, containing plant remains.....	4	5
Shale, gray, arenaceous.....	0	5
Sandstone, gray, arenaceous.....	0	6
Shale, blue, argillaceous, rather soft.....	2	0
Coal and carbonaceous shale, a small country mine, Waynesburg.....	3	8

TUNNEL STATION LOCALITY

Reference: Section 130, Geological Survey Ohio, Fourth Series, Bulletin 22, pages 130-131.

Location: "At Tunnel Station, on the Marietta, Columbus and Cleveland Railway, (abandoned) some very good outcrops of small portions of the Dunkard, (upper Washington Series) are to be seen. The grindstone quarries at this place are probably in the Jollytown sandstone although it may possibly be Hundred in age. Combined section of quarry and tunnel cut on the Marietta, Columbus and Cleveland Railway, near the head of Browns Run, southwest Section 16, Warren Township, Washington County. Parkersburg topographic sheet.

	Ft.	In.
Shales, red and gray, argillaceous, to the top of the Cleveland		
Stone Company's Quarry on Charles Treachel's land	4	0
Shale, gray, arenaceous	10	8
Sandstone, gray, micaceous, rather massive. This is the rock		
used for grindstones. Jollytown? sandstone	16	6
Covered interval to bottom of quarry	24	4
Sandstone, gray, micaceous, laminated	1	0
Shale, red and gray, arenaceous	5	0
Covered interval with some weathered red shale exposed	17	4
Shale, red, argillaceous, to top of tunnel cut	6	0
Sandstone, calcareous, shaly, greenish-gray	2	0
Shales, red to greenish-gray	6	4
Sandstone, micaceous, shaly, greenish-gray	3	0
Shale, arenaceous, gray, nodular	0	6
Shale, red, with streaks of gray	0	8
Shale, greenish-gray with streaks of red	1	2
Sandstone, micaceous, nodular	0	3
Shales, red and gray, with nodules	0	9
Shale, red, argillaceous, containing iron nodules	11	3
Sandstone, coarse, bluish to greenish-gray, laminated, this		
extends to the level of the track at the upper end of the		
tunnel	7	2

WAYNESBURG COAL HORIZON

Locally the Waynesburg coal is much broken by shale partings, that is, it consists of thin beds of coal in carbonaceous shales which may contain plant fossils.

Reference: Section 28, Thesis, 1936, John C. Frye, State University of Iowa.

Location: A section was measured up the creek bed and road cut from the road intersection, elevation 667 feet, 1.5 miles north of Watertown, Watertown Township, Washington County. Parkersburg topographic sheet.

	Feet
Cover to top of hill	4.0
Sandstone, medium grained, buff, <i>Lower Marietta</i>	33.0
Shale, gray and tan	2.7
Clay	0.5
Coal	0.15
Clay	0.5
Coal, shaly	0.4
Shale, maroon, partly covered	2.8
Clay shale, red, partly covered	16.5
Sandstone, lenticular, and shale, tan	8.4
Shale, fissile, tan and red	11.9
Shale, fissile, maroon	4.0
Shale, red and gray	5.3

	Feet		
Shale, arenaceous, tan.....	9.0		
Shale, ferruginous, black.....	0.15		
Shale, maroon.....	7.2		
Covered.....	2.2		
Sandstone, medium grained, gray.....	0.4		
Shale, hard, mottled, partly covered.....	4.8		
Shale, gray, passing upward into sandstone.....	5.2		
Shale, highly carbonaceous.....	1.0		
Shale, tan.....	3.0		
Underclay, blue-gray, and shale, tan.....	0.6		
Sandstone, fine-grained, cross-bedded.....	3.0		
Shale, fissile, tan.....	5.2		
Coal.....	Waynesburg {	{	0.25
Shale, tan, with abundant plant fossils.....			2.2
Coal, shaly.....			0.15
Shale, gray and tan.....			13.2
Limestone, hard, gray.....			5.4
Road intersection, elevation 667 feet.....			

WAYNESBURG "A" COAL HORIZON

The Waynesburg "A" coal horizon bears some plant fossils in many areas. Probably through careful search some rich deposits may be discovered.

Reference: Section 27, Thesis, 1936, John C. Frye, State University of Iowa.

Location: A section measured along road and draw, 1.5 miles east of Watertown, Central Section 2, Watertown Township, Washington County. Parkersburg topographic sheet.

	Feet		
Cover to top of hill.....	30.0		
Shale, arenaceous, tan.....	10.4		
Limestone, argillaceous, buff.....	0.2		
Shale, arenaceous, tan.....	5.2		
Shale and sandstone.....	3.0		
Covered.....	24.0		
Sandstone, fine-grained, buff.....	4.2		
Shale, fissile, maroon.....	0.5		
Shales, red, gray and tan.....	17.3		
Sandstone, fine-grained, light gray.....	2.0		
Shale, arenaceous, red and gray.....	3.4		
Shale, tan, parts covered.....	38.4		
Sandstone, highly micaceous, fine-grained, buff.....	5.5		
Shale, maroon, partly covered.....	11.6		
Shale, arenaceous, tan.....	2.0		
Shale, mostly maroon.....	12.4		
Coal, shaly.....	Waynesburg "A" {	{	0.5
Clay, tan.....			0.3
Coal, shaly, carbonaceous.....			0.7

Nematophyllum, Neuropteris and Pecopteris were collected from lower zone.

Clay shale, tan and gray.....	5.0
Covered to level of creek above Painter Run.....	6.0

HIGHER HORIZONS

Reference: Grotto of plants. Observations on the Bituminous Coal deposits of the valley of the Ohio, and the accompanying rock strata; with notices of the fossil Organic remains and the relics of Vegetable and Animal bodies, illustrated by a Geological map, by numerous drawings of plants and shells, and by views of interesting scenery; by Dr. S. P. Hildreth, of Marietta, Ohio. The American Journal of Science, Volume XXIX, January, 1836, pages 18-20.

Location: The grotto is seated on the side of a deep ravine, which the water in running from the hills, has gradually worn in the rocks, at an elevation of one hundred feet above the bed of the river (Ohio). Located two miles below the mouth of the Muskingum River and 660 feet northwest from the bank of the Ohio River, northeast corner of Section 3, Warren Township, Washington County. Marietta topographic sheet.

"At the southern outlet of the Muskingum Valley, two miles below the mouth of the river, and forty rods from the bank of the Ohio, an interesting grotto, has been formed in the sandstone from the gradual disintegration of the rock by a chemical process. The rock itself or rather this stratum (Hundred sandstone) is about 50 feet in thickness. It rests on a bed of argillaceous or slaty marl, (impure fresh-water limestone) two feet thick. The upper portion is ash colored and very heavy, (limestone) and the lower portion of the bed, fourteen inches in thickness, is of a deep rich brown, or red. Its structure is slaty, and it splits easily in the line of stratification into thin layers. It is completely filled with vegetable impressions of the most perfect and beautiful structure; many of them appear to be aquatic plants, but the most abundant are of the genus Neuroptera. If the slaty matrix were less fragile, very perfect specimens could be procured. As it is, they are, in the hands of any one versed in the botany of fossil plants, sufficient to determine the species. Several figures are given of the plants found here, from No. 23 to 26; (pages 10 and 11 of the wood cuts)⁴ No. 23 is one of the most beautiful and perfect branches of the arborescent fern that I have ever seen. The foliage is similar to that represented by N. Ad. Brongniart in one of his antediluvian trees, as he supposed they appeared when living. I have seen no similar species, described in his work on fossil plants. No. 24 was probably a very porous, thick leaved, aquatic plant, termination ovate, as fragments of the extremities were found, of that shape, cuticle scabrous. The leaf was replaced by a deposit of yellow ochre, one-eighth of an inch in thickness, leaving the outlines and markings of the cuticle on the red shale. A large proportion of the plants at the grotto are replaced by yellow ochre. Several other species are impressed on the same fragment. No. 25 is a very rich fern. Each leaflet appears to have been composed of, or margined by rounded grains, too large and too uniform, for the fruit. The beautiful oblong leaf, No. 26, resembles 'Neuropteris Scheuchzeri,' but is not sufficiently acuminate. Its structure is similar to that of the oleander leaf and is probably a new species. On the same fragment are two species of Neuroptera. Pods and seeds of plants are also common; with the leaf of a thick, aquatic plant, like that of the Nelumbium luteum, passing transversely through the bed, as if they had been inhumed in their growing and natural position. From their undisturbed and perfect condition I am led to conclude that they lived and vegetated on the spot where they are now found. Had they been transported by currents of water, the leaves and branches would have been more confused and broken."

Reference: Section B observations on the Bituminous coal deposits of the valley of the Ohio, and the accompanying rock strata; with notices of the fossil Organic remains and the relics of Vegetable and Animal bodies, illustrated by a Geological map, by numerous drawings of plants and shells, and by views of interesting scenery; by Dr. S. P. Hildreth, of Marietta, Ohio. The American Journal of Science, Volume XXIX, January, 1836, pages 23 and 24.

Location: Section of rock strata at Indian Run, at a point two miles northwest of Marietta, in south-central Muskingum Township, Washington County. Marietta topographic sheet.

⁴See Journal for Illustrations.

	Ft.	In.
1. Soil and residual.....	2	0
2. Sandstone, light colored.....	10	0
3. Sandstone, light colored, coarse grained, (Hundred).....	50	0
4. Shale, bituminous, with thin veins of coal of a few inches near the bottom.....	20	0
5. Limestone, gray.....	2	0
6. Sandstone, argillaceous, (Upper Marietta).....	50	0
7. Marl, brown, with nodules of red oxide of iron, with plant impressions.....	6	0
8. Sandstone, slaty, (Lower Marietta).....	9	0
9. Marl, brown, slaty, with plant impressions.....	10	0
10. Top of salt well.		

No. 7 is a brown marl, with nodules of red oxide of iron; many of the nodules and flattened pieces contain, when broken, fine impressions of arborescent ferns. Portions of the trunk, two or three feet in length, and three or four inches in diameter, much flattened, are also found on this branch, and probably from this bed. I have fragments, completely replaced by iron ore, in which the woody fibre is very distinct in its large longitudinal fracture. Figures are given at Nos. 27 and 28 (page 12 of the wood cuts) in iron ore from this place. They are both of the genus *Neuropteris*, but are probably undescribed species. No. 27 resembles *Anomopteris*, rather more than *Neuropteris*.

No. 9 is brown slaty marl, upper part of the bed ash colored, lower part, nearly that of Spanish brown, compact and heavy, filled with casts of a thick leaved plant, generally vertical as if buried in a living state. They are too much broken to give definite outlines of their forms, sufficiently correct for a drawing. The middle portion of the bed abounds with impressions of several species of *Neuroptera*. A figure of one of these species is given on No. 29 (page 12 of the wood cuts). The plant is replaced with yellow ochre, and belongs to the arborescent ferns. The upper or ash colored portion of the bed, for about two or three inches in thickness, is filled with the impressions of an asteroid blossom, arranged in rows, upon a stem, sometimes six or eight in a line, the lower half of one resting on the upper half of another. They are of different sizes, but all equal on the same stem, and generally, each floret contains twenty-four petals or rays. The broad leaf of some arundinaceous plant is sometimes seen impressed amongst them. Figure No. 30 (page 9 of the wood cuts) gives a very correct view of their forms and size.

CONCLUSIONS

From the evidence obtained in general field work it is thus apparent that plants were abundant through both the Pennsylvanian and Permian cycles of time. The section, with definite plant fossils, from the Sharon of the Pottsville series to the Jollytown of the Greene, is approximately 1,360 feet in thickness. Without search plant fossils are noted on some twenty-six horizons well distributed throughout the column. Careful inspection over wide field will most certainly produce results on each of the fifty-three coal horizons in the geological scale of Ohio.