

GUIDE BOOK

Fifth Annual

Indiana Geologic Field Conference

Pennsylvanian Geology
and Mineral Resources of
West Central Indiana

1951

GUIDE BOOK

Fifth Annual Indiana Geologic Field Conference

May 11, 12, and 13, 1951

on

PENNSYLVANIAN GEOLOGY AND MINERAL RESOURCES
OF WEST CENTRAL INDIANA

Conference Leader

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Sponsored by

Department of Geology, Indiana University, and
Geological Survey, Indiana Department of Conservation,
Charles F. Deiss, Chairman and State Geologist

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Indiana University

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INTRODUCTION

Objectives of Field Conference

During the recent period of oil and gas development, many petroleum geologists became interested in Pennsylvanian stratigraphy in Indiana. They hoped that the attitude of some of the key beds in the Pennsylvanian might indicate location of domes in deeper oil producing horizons. The sponsors of this conference hope that it will give the petroleum geologist not only a better understanding of Pennsylvanian stratigraphy, but also will be beneficial to coal producers, clay producers, and other interested persons.

The conference is planned to provide an opportunity to observe and discuss representative sections of the Pennsylvanian formations in western Indiana. Unfortunately, the best exposures are in the last cuts of strip mines. After several years, many of these exposures will be stripped over, covered by slumping, or concealed by water which fills abandoned mines. Similar adjacent sections, however, should be available for many years. The sections which have been selected are considered to be about average. The writers hope that the discussion both of the sections presented herein and of the problems connected with them will be mutually beneficial. The opportunity to become better acquainted and to exchange ideas is an important part of the conference

Program

Headquarters for the field conference is Canyon Inn, McCormick's Creek State Park, Spencer, Indiana (pl. 1).

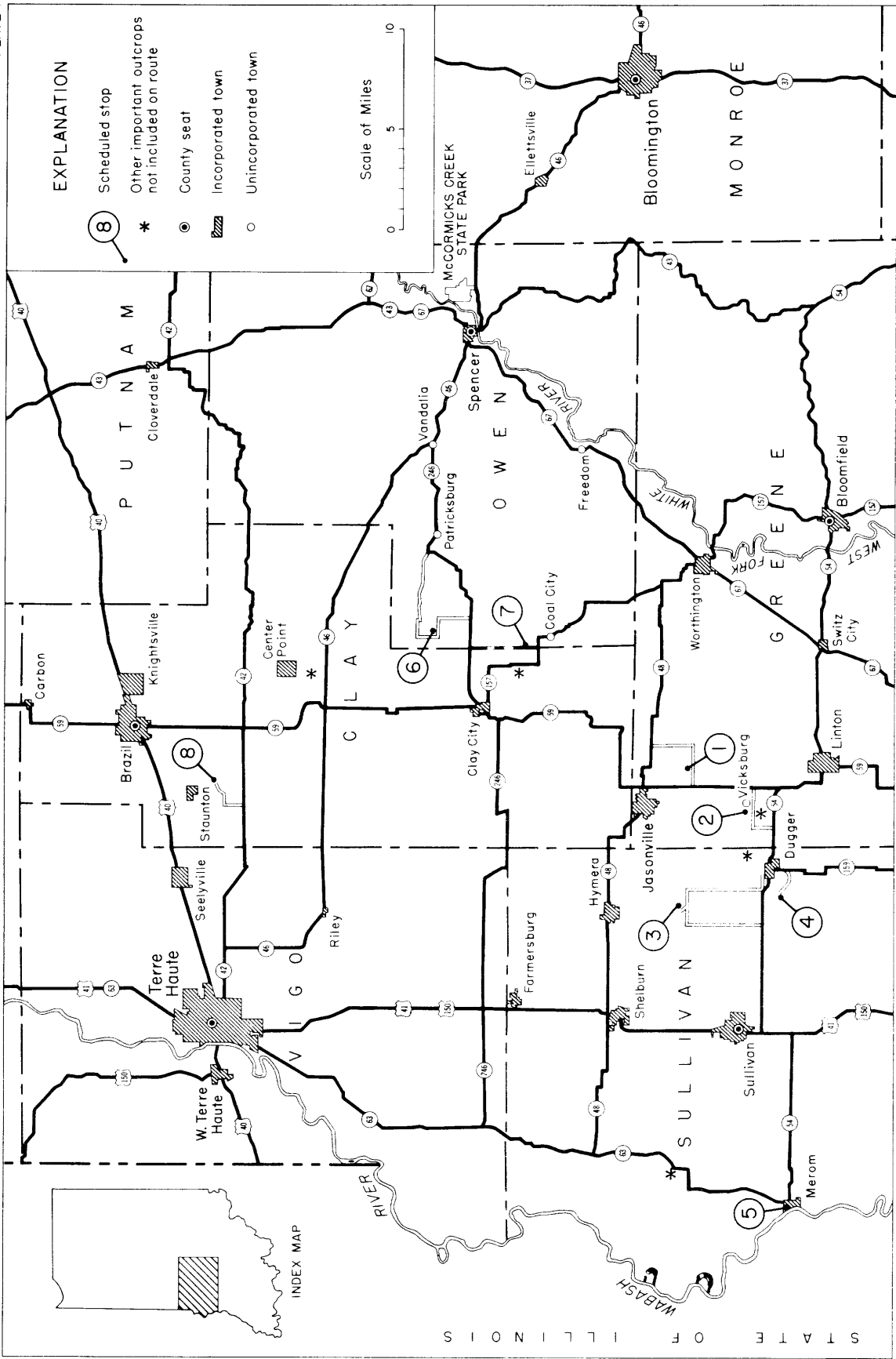
A short pre-conference tour of the geologic formations in the park has been arranged for interested persons. The excellent Mississippian exposures will be discussed. The group making this tour will leave the front entrance of Canyon Inn at 3:30 P. M (Central Standard Time).

The conference officially opens on Friday evening, May 11, at 7:30 (Central Standard Time), with discussions of Pennsylvanian stratigraphy and coals. Short talks will be given by Professor Harold R. Wanless, University of Illinois; Charles E. Wier, Geological Survey, Indiana Department of Conservation; and O. L. Scales, Vice President, Enos Coal Mining Company. After the talks, Professor Ralph E. Esarey will conduct an informal discussion in which all are invited to participate.

The caravan will leave McCormick's Creek State Park on Saturday morning, May 12, at 8:00 (Central Standard Time). Stops will be made at strip mines where Coals IV, V, VI, and VII are exposed, and at the Merom Bluff section. A picnic lunch will be provided for guests by the Canyon Inn staff and will be served at the City Park, Dugger, Indiana. Members of the conference staying elsewhere are urged to carry a lunch, as lunch facilities are limited in Dugger. The caravan will disband at Merom Bluff, the last stop of the day. A formal program is not planned for Saturday evening.

On Sunday morning, May 13, at 8:00 (Central Standard Time), the caravan will assemble again at the park entrance. Stops will be made at strip mines in Block coal, Minshall coal, and Coal III. A tour through the preparation plant of the Chinook mine will complete the conference at noon.

Guests of Canyon Inn should check out before leaving on Sunday morning, unless they plan to return to the Inn for dinner.



April, 1951

ROUTE MAP OF FIELD CONFERENCE ON PENNSYLVANIAN GEOLOGY AND MINERAL RESOURCES OF WEST CENTRAL INDIANA

ITINERARY AND STRATIGRAPHIC SECTIONS

Saturday, May 12

Start: The caravan leaves McCormick's Creek State Park (Pl. 1), Spencer, Indiana, at 8:00 A. M.

At the park entrance the caravan turns west (right) on Highway 46, proceeds 3.5 miles through Spencer to the junction of Highways 46 and 67, and then turns south (left) on Highway 67. Check speedometer reading.

Travel 32 miles to stop no. 1. Mississippian formations exposed along the highway are labeled to permit checking the geology en route.

The quarry and crusher to the right are operated by the France Stone Products Company. The quarry face shows 50 feet of Ste. Genevieve lime stone. Products are crushed stone and agricultural lime.

Slowdown: 3.3 miles south of the road junction, south of the stream. Ste. Genevieve limestone crops out along the roadside.

Slow down: 4.1 miles south of the road junction. Cypress sandstone is exposed in the road cut.

Slowdown: 9.0 miles south of the road junction and at the south edge of Freedom, Indiana. Beech Creek limestone overlain by Cypress sandstone is exposed in the hillside. Mansfield sandstone crops out near the top of the hill.

Slowdown: 10.2 miles south of the road junction. Cypress sandstone crops out along the roadside.

Slowdown: 12.1 miles south of the road junction. Beech Creek limestone is exposed in an abandoned quarry.

The caravan continues south on Highway 67 to Worthington, Indiana, and the junction of Highways 67 and 157. Turn west (right) on Highway 157 and continue 2.9 miles to the junction of Highways 48 and 157, thence 8.5 miles west on 48 to the crossroad. The strip mines along Highway 48 mined Block coals. At the crossroad turn south (left) and proceed 2.1 miles to the second crossroad, and then turn west (right) for 1 mile to stop no. 1 (Pl. 1).

The machine shops are in the large buildings near the railroad crossing, and the tipple to the left at the first stop is the preparation tipple of the Maumee Collieries Company.

Stop no. 1. Linton no. 28 strip mine, Coal IV, Maumee Collieries Company, in the SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 15, T. 8 N., R. 7 W.

Time allotted: 45 minutes.

The stripped area of Coal IV extends 1½ miles to the north. Some of the individual cuts were more than a mile in length. As much as 80 feet of overburden has been removed to mine 3 to 4 feet of coal.

The Pleistocene slumping to the left at the south end of the cut should be observed. Illinoian till is 10 to 40 feet thick over the entire area and is present under the slumped block of Coal IVa and the overlying rocks.

Section of Dugger and Linton formations. --The following section was measured in the SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 14, T. 8 N., R. 7 W., when the last cut was a quarter of a mile to the east.

Allegheny

Dugger formation	Feet
21. Shale, black, carbonaceous; almost fissile shale at bottom grading into softer shale a little lighter in color	2.2

	Feet
20. Limestone, black, hard, dense, impure; weathers brown.....	2.2
19. Shale, black, fissile; contains pyrite concretions	3.1
18. Coal, black, chunky, shiny; several thin pyrite streaks occur in middle and thin smutty streaks occur every 4 to 6 inches; coal grades into black fissile shale above. (Coal IVa)	1.4
17. Coal, dirty, soft, black, shaly.....	0.25
16. Shale, gray to pale greenish gray, soft; grades upward into a dark gray harder shale	10.0
15. Sandstone, gray, micaceous, massive	0.8
14. Shale, blue gray, hard, greasy.....	5.3
13. Sandstone, gray, massive, micaceous	2.3
12. Sandstone, dark gray, shaly, micaceous.. ..	2.7
11. Sandstone, gray, massive, laminated, micaceous	3.8
10. Sandstone, gray, shaly, laminated, micaceous	4.5
9. Shale, dark gray to brownish gray, argil laceous; weathers quickly	3.8
8. Sandstone, gray, micaceous, massive, laminated	2.2
7. Shale, dark gray, thinly bedded; hard are- naceous beds approximately 1/2 inch thick are scattered through shale from 2 to 10 inches apart	8.3
6. Shale, black, carbonaceous	0.8
Thickness of exposed Dugger formation.....	53.65

Linton formation	Feet
5. Coal, black, thinly bedded; contains streaks of hard, shiny, conchoidally fractured coal (Coal IV)	0.4
3. Shale, black, carbonaceous; contains plant fossils; "dirty band"	0.1
2. Coal, black, chunky; bottom has abundant thin streaks of vitrain and conchoidal fracture	2.6
1. Shale, gray, arenaceous, micaceous; contains plant remains. Base covered	0.2
Thickness of exposed Linton formation.....	<u>3.3</u>
Total thickness of section.....	56.95

Continue west 1 mile to Highway 59, turn south (left) and proceed 3 miles to the crossroad, and then turn west (right) and continue 1.2 miles to stop no. 2.

Stop no. 2. Vicksburg strip mine, Coal V, Central Indiana Coal Company, in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 32, T. 8 N., R. 7 W. , Greene County, Indiana

Time allotted: 60 minutes.

Section of Dugger and Petersburg formations.--

Allegheny

Dugger formation	Feet
17. Shale, gray, soft, excellent, NW jointing about 1 inch apart	0.2
16. Shale, black, hard, fissile; weathers massive	5.5
15. Shale, dark gray soft; contains 0.07 feet of coal in middle of shale. (Coal Vb).....	0.3
14. Shale, gray, soft, thin; contains 0.01 streak of coal.....	1.2

	Feet
13. Limestone, red to gray, conglomeratic, hard, cherty, dense, conchoidal fracture	2.6
12. Shale, gray, soft, thinly bedded; weathers quickly.....	1.1
11. Sandstone, gray, micaceous, massive	3.6
10. Shale, gray, soft, thin-bedded, arenaceous; streak of sandstone in middle 0. 5 foot thick	1.4
9. Sandstone, gray, micaceous, massive, fine- ly banded	2.2
8. Sandstone, gray, micaceous, thin-bedded; contains a few red calcareous concretions	0.9

Thickness of exposed Dugger formation.....	19.0
 Petersburg formation	 Feet
7. Shale, gray, thin-bedded, calcareous in bottom 1 foot; calcareous streaks through-- out; contains many thin bands of silty nod- ules; thin-bedded.....	8.0
6. Limestone, light gray, hard, dense, mas- sive, fossiliferous; conchoidal fracture, (Alum Cave)	2.0
5. Shale, brownish gray, soft, calcareous, crinoidal; concretionary band about 0. 1 foot thick near the middle	0.8
4. Shale, black, soft, thin-bedded; weathers quickly.....	0.9
3. Shale, black, hard, fissile; appears mas- sive on weathered surface	2.9
2. Coal V, covered, approximate thickness.....	5.1
1. Underclay, dark gray; weathers light gray. Base covered	2.0

Thickness of exposed 'Petersburg formation.....	21.7

Feet

Total thickness of exposed section..... 40.7

Coal VI was mined in the strip mines which are along the road and uphill from the Coal V pit. The remaining coal which lies between the two Coal VI pits and under the road is mined in the Hart mine, a small drift mine located on the south side of the road in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 5, T. 7 N. , R. 7 W.

Section at Hart mine, Coal VI. --

Allegheny

Dugger formation	Feet
12. Sandstone, tan, massive, micaceous, fine-grained, laminated; bottom part of sandstone forms irregular rolls in the roof of Coal VI.....	32.0
11. Shale, black, soft	0.2
10. Coal, black, hard, banded (Coal VI); locally cut out by sandstone rolls	1.8
9. Shale, gray, soft, "dirty band"	0.08
8. Coal, black, hard, banded.....	0.6
7. Shale, gray, soft, "dirty band"	0.06
6. Coal, black, hard, banded.....	2.1
5. Clay, dark gray soft	0.2
4. Coal, black, thin-bedded	1.0
3. Clay, dark gray, soft.....	0.6
2. Coal, black, thin-bedded	0.4
1. Shale, black, soft, fissile. Base covered.. ..	4.0
Total thickness of measured section.....	43.04

The two shale partings (“dirty bands”) in units 7 and 9 are characteristic of Coal VI in Sullivan County, Indiana.

The caravan continues west 0.8 miles to the crossroad where it turns south (left) and proceeds 1.1 miles to Highway 54, and then turns west. (right) 2.5 miles through Dugger (Pl. 1) to City Park for the lunch stop.

After lunch the party reassembles and proceeds 0.3 miles north along the west side of City Park. At the crossroad it turns west (left) and continues 0.5 miles to T road. The caravan turns north (right) and continues 3.8 miles to the stripped area, and thence west (left) and follows the road around to stop no. 3 (Pl. 1).

Stop no. 3. Robin Hood strip mine, Coal VI, Sherwood-Templeton Coal Company, in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 15, T. 8 N., R. 8 W.

Time allotted: 40 minutes.

Section of Dugger formation.--Note the difference in the overburden between the Robin Hood and the Hart mines.

Allegheny

Dugger formation	Feet
5. Shale, light gray, thin, irregularly bedded, soft; contains sandstone lenses and thin sandstone beds	4.0
4. Sandstone, light gray, micaceous, laminated, massive to thin-bedded; usually massive	23.9
3. Shale, light to medium gray, thin and irregularly bedded, slightly calcareous, micaceous; upper part contains many thin sandstone laminations	4.1
2. Coal, black, thick-bedded, banded, vitreous to dull, blocky cleavage; contains thin irregular shale beds and lenses and pyrite	

	Feet
and marcasite concretions; three shale beds, 0.03 to 0.06 feet thick, are present at 1.5, 2.0, and 2.4 feet below the top	5.8
1. Underclay, light to medium gray, hard. Base covered	1
Thickness of exposed Dugger formation.....	37.9

The party returns to the east-west road and travels west (right) 1.0 mile to T road, and then turns south (left) and continues 4 miles to Highway 54. The mine on the west (right) side of the road about 0.3 miles north of Highway 54 is the Regent mine, Linton-Summit Coal Company. Here Coal VI is being mined.

The party now turns east (left) and continues 2.4 miles to Dugger, Indiana, and then turns south (right) and continues 0.9 miles to a private road. Follow this road west (right) 1.4 miles to stop no. 4 (Pl. 1).

Stop no. 4. Sullivan no. 27 mine, Coal VII, Maumee Collieries Company,
in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 10, T. 7 N., R. 8 W.

Time allotted: 40 minutes.

Section of Dugger formation. --

Allegheny

	Feet
Dugger formation	
5. Sandstone, yellow brown, micaceous, thin-bedded; contains limonite laminations and mematic concretions	6.4
4. Sandstone, light gray, thin-bedded; alternates with tan and black micaceous shaly laminations	0.4

	Feet
3. Sandstone, light gray, shaly, medium-bedded, marked with black laminae.....	28.4
2. Shale, medium gray, thin-bedded, arenaceous	1.0
1. Coal, black, brown stained, thin-bedded, banded, vitreous, blocky; contains two thin laminae of marcasite; (Coal VII).....	3.2
Thickness of exposed Dugger formation.....	39.4

Time and inaccessibility will prevent a visit to many excellent out-crops. These additional points of interest are shown on Plate 1 by asterisks.

The following section shows the sediments between Coals VI and VII which are not present in the strip mine here at stop no. 4.

Section of Shelburn and Dugger formations.--The following section was measured in the abandoned New Hope pit, in the SW¹/₄SE¹/₄ sec. 36, T. 8N., R. 8 W., Greene County, Indiana.

Conemaugh

Shelburn formation	Feet
17. Sandstone, gray; weathers brown.....	10.0

Allegheny

Dugger formation

16. Shale, gray to brown, sandy, thin-bedded; thickness variable	4.3
15. Shale, light gray,, soft, thin-bedded.....	0.2
14. Coal, black, shiny, hard, high in vitrain, medium-bedded; Coal VII.....	0.4
13. Shale, gray, soft, thin-bedded; contains a few red non-calcareous concretions	1.0

	Feet
12. Coal, black, medium-bedded, dull with bands of vitrain; contains a few thin, dirty streaks.....	0.9
11. Coal, black, thin-bedded; contains thin shaly bands of coal.....	2.1
10. Coal, black, hard, vitreous, cubic cleavage, conchoidal fracture, thick-bedded.....	0.7
9. Underclay, dark gray at bottom; grades in to light gray at the top	5.3
8. Shale, dark gray, calcareous; contains many weathered limestone pebbles and boulders; grades upward into non-calcareous shale; weathers quickly into clay	3.6
7. Shale, gray, sandy, micaceous; weathers rapidly	2.9
6. Limestone, light gray, silty, hard, micaceous, thin-bedded; (Providence.....	1.0
5. Shale, light gray, soft, calcareous, thin bedded, micaceous	1.0
4. Limestone, gray, hard, silty; appears massive but splits into beds 0.1 to 0.5 foot thick; micaceous along bedding plane	1.2
3. Shale, light gray, soft, calcareous, thin; contains red hard calcareous concretionary band in the middle	0.2
2. Limestone, gray, slightly mottled red, silty, slightly micaceous, thin-bedded; contains a few thin streaks of slightly micaceous calcareous gray shale	1.7
1. Shale, light gray, thin-bedded; contains many calcareous concretions and calcareous siltstone streaks. Base covered	2.5
Pit is filled with approximately 30 feet of coal washings.....	

Total thickness of section	39.0

The caravan now goes back 1.4 miles to the north-south road, then turns north (left) 0.9 miles to Highway 54, and then west (left) and follows the highway west and southwest 19 miles to Merom, Indiana, where it continues west 3 blocks to Merom Park, which is stop no. 5 (Pl. 1).

Stop no. 5. Merom Bluff, in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 7, T. 7 N., R. 10 W.

Time allotted: 30 minutes.

Merom Bluff is an outlier of Merom sandstone whose nearest outcrop to the south is 20 miles from this bluff, in the Wolf Hills, about 7 miles north of Vincennes. Many exposures are present 5 miles north of Merom Bluff along the south bank of Turman Creek.

Composite section of Merom sandstone.--The following section is modified from the Ashley (1899, pp. 907-909) report "The coal deposits of Indiana." This section includes data taken from a measured outcrop, a shaft mine, and a drill hole located in the bottom of the shaft.

Section at Merom Hill, in sec. 7, T. 7 N., R. 10 W.

Section from outcrop

	Thickness feet
Quaternary	
1. Loess and drift	30.0
Conemaugh	
Merom sandstone	
2. Sandstone, soft; upper beds disinte- grating	25.0
3. Sandstone, massive; contains fer- ruginous seams and veins	25.0

Thickness feet

- | | |
|--|-----|
| 4. Conglomerate, composed of pieces of shale, coal, pebbles, and sandstone, bedded in calcareous materials | 8.0 |
|--|-----|

Total thickness of Merom sandstone	<u>58.0</u>
--	-------------

West Franklin limestone

- | | |
|--|-----|
| 5. Limestone, fossiliferous | 4.0 |
| 6. Shale, dark, clayey..... | 2.0 |
| 7. Coal..... | 2.0 |
| 8. Shale, black | 1.2 |
| 9. Fireclay and pyritized pebbles | 4.5 |
| 10. Shale, light drab clay | 5.0 |
| 11. Shale, bituminous; contains small iron nodules | 7.5 |
| 12. Limestone; crinoid fragments abundant | 2.0 |

Total thickness of West Franklin limestone	<u>28.2</u>
--	-------------

Shelburn formation

- | | |
|---|-----|
| 13. Clay, marl | 1.5 |
| 14. Clay, drab, marly | 1.2 |
| 15. Shale, dark, bituminous, soft, calcareous | 6.1 |
| 16. Shale, black, sheety..... | 1.5 |
| 17. Coal, fat, caking | 1.5 |
| 18. Fireclay, good | 2.7 |

Thickness feet

19. Fireclay, pyritiferous	1.5
20. Shale, dark, clayey; contains ironstone pebbles	3.0
21. Flagstone, siliceous	2.0
22. Flagstone, light blue, argillaceous	2.0
23. Shale, light blue, clayey, with nodules.....	5.0

Section from shaft mine

24. Sandstone, laminated	6.0
25. Sandstone, quarry.....	10.0
26. Shale, hard, sandy, large nodules....	6.0
27. Shale, gray, sandy.....	4.0
28. Clay, shaly	5.0
29. Coal.....	4.0

Section from bore hole

30. Fireclay.....	4.0
31. Hard rock (double limestone)	2.0
32. Clay shale	0.3
33. Hard rock (double limestone)	6.0
34. Shale and clay shale	18.8
35. Hard rock	4.5
36. Clay shale	4.0
37. Soft rock	1.0
38. Clay shale	1.5
39. Sand rock	9.0

	Feet
Total thickness of exposed Shelburn formation	114.1
Total thickness of section.....	230.3

Composite section of Merom sandstone, Ditney formation, West ,Franklin limestone, and Shelburn formation.--The following is a composite section taken from the abandoned quarry in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1.6, T. 8 N., R. 10 W., and from outcrops in adjacent streams.

Conemaugh

	Feet
Merom sandstone	
19. Sandstone, brown,, massive, cross-bedded, medium- to coarse-grained	50.0
18. Conglomerate; contains limestone and jasper pebbles, fragments of coal, and rounded quartz grains	2.5
Ditney formation	
17. Shale, dark gray to black, soft; contains a thin streak of coal.....	2.0
West Franklin limestone	
16. Limestone, gray, hard, crystalline; contains abundant crinoid stems, brachiopods, and bryozoans; large brachiopods, Echinoeochus semipunctatus, are abundant	3.0
15. Shale, gray, soft; grades into shaly siltstone	4.0
14. Shale, black, soft	2.5
13. Shale, black, fissile; contains conodonts.....	1.5
12. Coal, black	0.9
11. Underclay, light gray, plastic	5.8

	Feet
10. Limestone, gray, dense, hard, sandy; usually non-fossiliferous and locally cloddy.....	2.5
Total thickness of West Franklin limestone	20.2
Shelburn formation	
9. Shale, gray.....	5.0
8. Sandstone, tan, flaggy	2.0
7. Shale, gray to green.....	31.0
6. Limestone, black, hard, fossiliferous; con- tains abundant gastropods	1.0
5. Shale, gray, soft.....	0.5
4. Shale, black, fissile; contains conodonts; black fossiliferous limestone lenses in lower part	3.0
3. Coal, black, banded.....	0.5
2. Underclay, gray, soft.....	3.5
1. Shale, gray, soft, silty; contains loaf shaped concretions	19.0
Total thickness of Shelburn formation.....	56.5
Total thickness of section.....	131.2

The caravan returns to McCormick's Creek State Park. The following route is suggested: Highway 54 (Pl. 1) east to the junction with Highway 67 at Switz City, north(left) on 67 to Spencer, and then southeast on Highway 46 to McCormick's Creek State Park.

Sunday, May 13

Start: The caravan will assemble at the entrance to McCormick's Creek State Park and will leave promptly at 8:00 A. M.

It turns west (right) at the park entrance and proceeds 9.2 miles on Highway 46 to Vandalia (Pl. 1).

Ste. Genevieve limestone was quarried on the right side of the highway, 1.8 miles northwest of Spencer. The sandstone outcrops are Mansfield sandstone.

At Vandalia the party turns west (left) on Highway 246 and goes 5.9 miles through Patricksburg to the road junction where Highway 246 turns south. Here the caravan leaves Highway 246 and travels 4.3 miles west to T road, and turns south 1.1 miles to the crossroad, and finally east (left) to stop no. 6. Lower Block coal was stripped near Patricksburg. Some of the earliest strip mining of Upper Block coal in the state occurred near stop no. 6.

Stop no 6. Old Glory no. 17 strip mine, Upper Block coal, Maumee Collieries Company, in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 10 N., R. 6 W.

Time allotted: 30 minutes.

Section of Brazil formation in Old Glory mine.--

Pottsville

Brazil formation	Feet
5. Coal, black, banded, chunky; coal splits to the south (Minshall?)	2.2
4. Bone coal, black, thin-bedded; contains pyrite on joints	1.8
3. Shale, gray, sandy, massive, laminated; upper 5 feet contains small limestone	

	Feet
concretions; shale is replaced northward by tan fine-grained argillaceous sandstone	30.0
2. Coal, black; breaks in 6- to 12-inch blocks; contains pyrite on joints	3.2
1. Underclay, light gray, soft. Base covered.....	.1
 Total thickness of exposed section.....	<u>37.2</u>

Two additional sections in the Block coals are included here for comparison.

Section of Brazil formation in Log Cabin strip mine.--This mine is in the NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 16, T. 11 N., R. 6 W., Clay County, Indiana.

Pottsville

Brazil formation	Feet
7. Sandstone, tan, micaceous, fine-grained	3.0
6. Coal (Upper Block), black; breaks into 6 to 8-inch blocks	3.3
5. Underclay, light gray, soft, plastic	2.1
4. Underclay, light gray silicious	3.0
3. Shale, dark gray, sandy, laminated	9.0
2. Coal, black, chunky	0.8
1. Coal (Lower Block), black; breaks into 2 foot block across.....	2.2
 Total thickness of exposed section.....	<u>23.4</u>

Section of Brazil formation in Commodore strip mine. --This mine is in SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 4, T. 9 N., R. 6 W., Clay County, Indiana, Pottsville

Brazil formation	Feet
9. Sandstone, tan, fine-grained	5.0
8. Coal (Upper Block)	2.5
7. Underclay, light gray, soft, plastic; contains small limestone concretions and a thin sideritic streak about 2 feet below the top	3.0
6. Sandstone, tan, fine-grained, medium-bedded	5.3
5. Shale, dark gray; contains laminated silty bands	11.6
4. Shale, black, micaceous	1.0
3. Limestone conglomerate; rounded pebbles of tan finely crystalline limestone in dark gray shale matrix	0.8
2. Shale, black, hard, fissile	1.8
1. Coal (Lower Block)	2.5
Total thickness of exposed section.....	<u>33.5</u>

The caravan continues east 1 mile to the first crossroad, turns south (right) 1.5 miles to Highway 246, west (right) 1.5 miles to the crossroad, and fence south (left) 3 miles to stop no. 7 (Pl. 1).

Stop no. 7. Abandoned strip mine, Minshall coal, Mariah Hill Coal Company in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 2, T. 9 N., R. 6 W., Owen County, Indiana

Time allotted: 30 minutes.

The Upper Block coal was mined in this strip mine. The Minshall coal and limestone are present in the highwall.

Section of Brazil formation. --

Pottsville

Brazil formation	Feet
14. Sandstone, light brown, thin-bedded, fine to medium-grained; basal 0.2 foot is fossiliferous calcareous shaly clay resembling a limestone soil.....	9.4
13. Limestone (Minshall), gray to blue gray; contains abundant fragments of small crinoid columnals and fusulines; one thick bed; weathers reddish brown.....	2.4
12. Siltstone, light gray, calcareous fossiliferous, sandy, thin-bedded; many casts and molds of brachiopods	1.3
11. Shale, dark gray and blue gray, calcareous, fossiliferous	1.0
10. Limestone, brown to blue, argillaceous, somewhat sandy, lower part shaly; grades laterally into calcareous siltstone; abundant brachiopod fauna	3.5
9. Shale, dark gray, soft, fossiliferous	3.3
8. Shale, gray, fossiliferous; contains knobby, slightly calcareous concretions, 1½ to 3 inches in diameter	0.6
7. Shale, gray, platy; weathers to small nodules	3.9
6. Shale, black, sheety; forms large blocks along joints	3.4
5. Shale, black, carbonaceous, paper-thin laminae; contains much marcasite; "Blackjack"	0.3
4. Coal (Minshall), semi-block, much vitrain; two sets of joints strike N. 10° W. and N. 75° E	1.1
3. Shale, dark gray, thin- and wavy-bedded; weathers light gray; contains coal laminae.....	1.4

Feet

2. Sandstone, gray, thin-bedded, lenticular, concretionary.....	0.2
1. Shale, light gray to dark gray, sandy, micaceous; weathers light gray tinged with brown limonite; contains thin sandstone lenses, many sandy concretions, and near the top thin coal laminae. Base covered	6.1
Total thickness of exposed section.....	<u>37.9</u>

The caravan continues south 0.5 miles to Highway 157 and turns west (right) 6.5 miles northwest to Clay City. The strip mine on the right and the tippie on the left are of the Commodore mine. The caravan turns north (right) on Highway 59 and proceeds 13 miles to the junction of Highways 59 and 42, then turns west (left) on Highway 42 4 miles to the crossroad, and finally turns north (right) 2.5 miles to the preparation tippie at stop no. 8 (Pl. 1).

Stop no. 8. Chinook strip mine, Coal III, Ayrshire Collieries Corporation, in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 22, T. 12 N., R. 7 W., Clay County, Indiana

Time allotted: 1 hour.

Half of the group will be conducted through the preparation tippie, and the other half will visit the section in the pit. After 30 minutes the group which went through the tippie will visit the pit, and those who visited the pit will see the tippie.

Section of Linton and Seelyville formations. --The following section s measured in the strip pit in the SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 21 T. 12 N., R. 7 W.

Allegheny

Linton formation	Feet
17. Coal (Coal IV), black, banded	3.5
16. Shale and sandstone: gray, sandy shale and alternating beds of tan micaceous sand stone	30.0
15. Limestone, blue gray, argillaceous, hard, fossiliferous	0.6
14. Shale, black, carbonaceous, fissile in bot tom 1foot	1.9
13. Coal (Coal IIIa), black, banded; contains much pyrite	0.4
12. Shale, gray, massive; contains abundant plant remains	4.1
11. Conglomerate; consists of fragments of tan, hard sandstone in a soft gray shale matrix.....	0.9
10. Shale, alternating bands of light brown and gray, sandy micaceous	10.3
9. Shale, dark gray, micaceous, sandy.....	0.5
8. Shale, gray, soft.....	1.1
	—
Total thickness of exposed Linton forma- tion.....	53.3

Seelyville formation

7. Coal (Coal III), black, banded; contains abundant pyrite streaks	2.1
6. Shale, black, carbonaceous	0.5
5. Coal, black, banded; large percent of vitrain	2.0
4. Shale, dark gray, carbonaceous	0.1

Feet

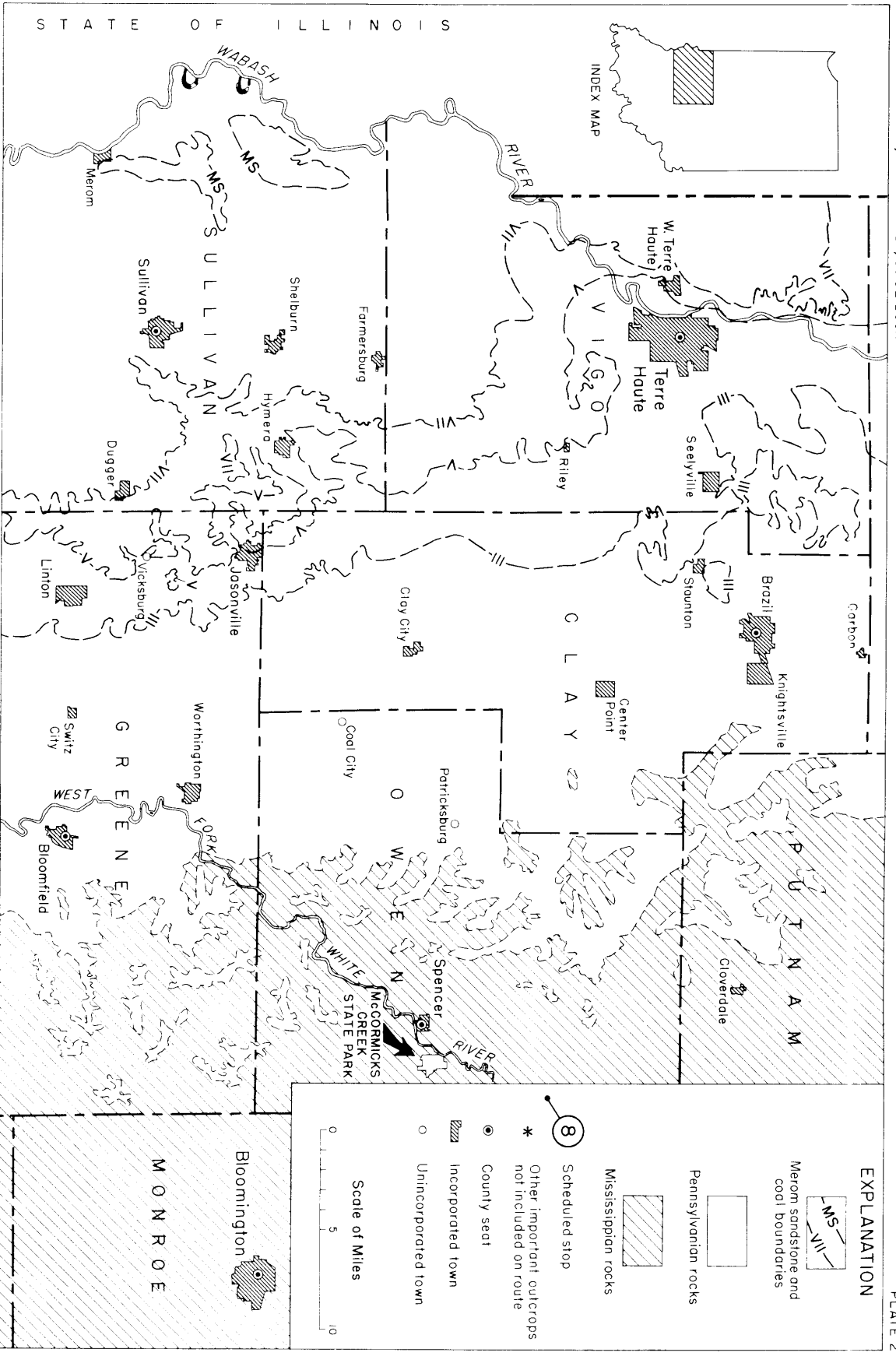
3. Coal, black, banded; contains a small amount of vitrain	0.3
2. Shale, dark gray, carbonaceous; contains much pyrite	0.2
1. Coal, black, banded; contains a small amount of pyrite	2.5
<hr/>	
Total thickness of exposed Seelyville formation.....	7.25
Total thickness of section.....	60.55

DESCRIPTION OF PENNSYLVANIAN FORMATIONS

The following descriptions of formations are included in the Guide Book to aid in their identification. The descriptions are generalized (Pl. 4), and thicknesses are taken from outcrops and coal tests in Vigo, Sullivan, Clay, reene, and Owen Counties, Indiana. Only abundant and index fossils are sted. The formations crop out in nearly north-south lines (Pl. 2) and dip gently to the southwest (Pl. 3).

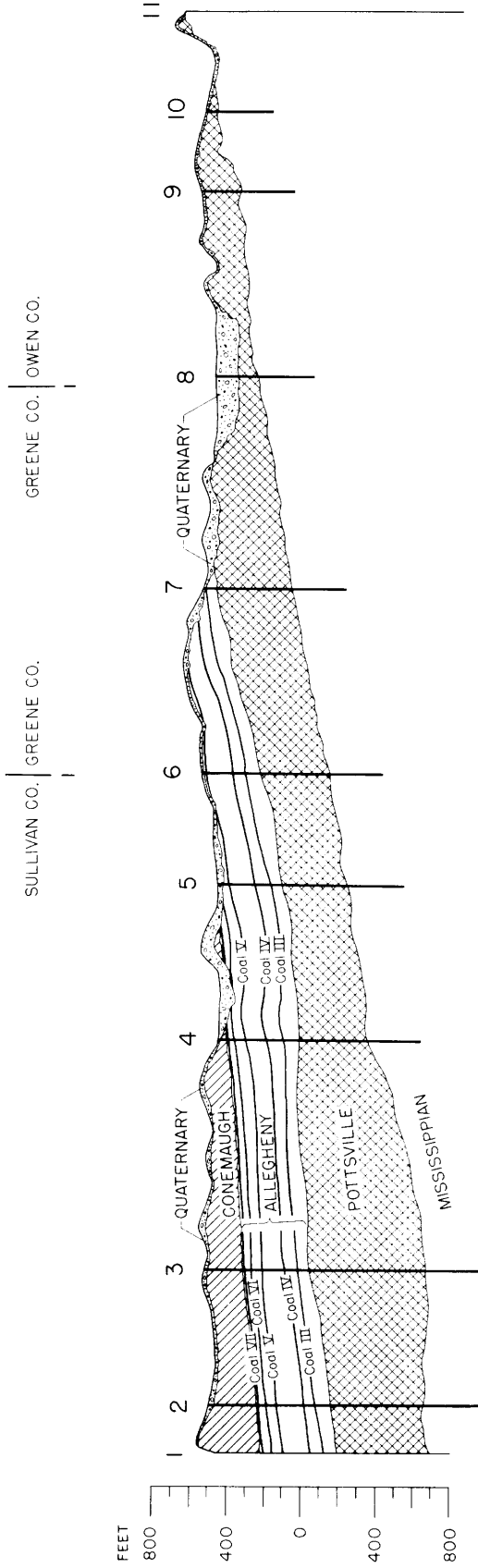
Pottsville

Mansfield formation. --Type locality is at Mansfield, Parke County, Indiana. The Mansfield formation, named by Hopkins (1896, p. 199), is coarse-grained, cross-bedded, massive sandstone which contains conglomerate and shale zones in some localities and thin coals and limestones in others. Locally the base is a coarse conglomerate of quartz and chert pebbles. The Mansfield usually is characterized by massiveness, cross-bedding, and abundant iron concretions, and ranges from 100 to 300 feet in thickness.

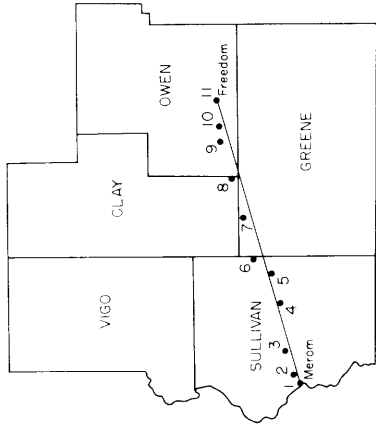
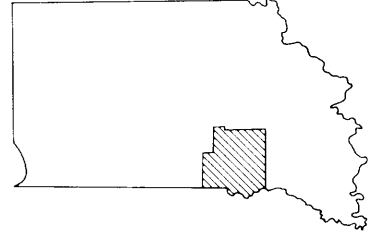


MAP SHOWING OUTCROP OF KEY BEDS IN AREA COVERED BY FIELD CONFERENCE

April, 1951



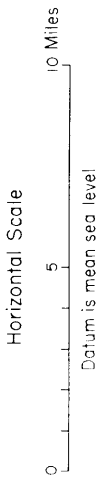
WELL NUMBER	NAME	SECTION	TOWNSHIP RANGE
1	Outcrop at Merom	7	10W
2	Fred Bays No.1 by Miami Operating Company	8	10W
3	John Springer No.1 by A. S. Reed	2	10W
4	Riggs No.1 by Felmont Corporation	36	9W
5	Hickory Grove No.1 by Kingwood Oil Company	27	8W
6	Clovis W. Terrune No.1 by Boyce and Lyons	12	8W
7	Sheets No.1	2	7W
8	Pete Duncan No.1 by H.C. Detrick	27	6W
9	Everhart No.1 by Schwartz	21	5W
10	Wilbur and Loren Light No.1 by Reed and Lowry	23	5W
11	Outcrop at Freedom	20	4W



Shallow information compiled from more than 100 additional coal tests and outcrops.

GENERALIZED CROSS SECTION SHOWING KEY BEDS DIPPING SOUTHWEST

Compiled by C. E. Wier
April, 1951



Brazil formation. --Type locality is near Brazil, Clay County, Indiana. This formation, formally named by Fuller and Ashley (1902, p. 2) and restricted by Cumings (1922, p. 525), consists of the following units in descending order: Coal II, underlain by 10 feet of interbedded sandstones and shales; 8 feet of limestone (Minshall); 3 feet of black fissile shale; 3 feet of coal (Minshall); 20 feet of alternating sandstones and shales; 3 feet of coal (Upper Block); 15 feet of clay or shale; and 3 feet of coal (Lower Block).

Allegheny

Staunton formation. --Type locality is near Staunton, Clay County, Indiana. This formation, named by Cumings (1922, p. 525) and restricted by Wier (1950), consists of the following units in descending order: Coal III, 6 feet thick, underlain by alternating sandstones and shales which contain a few thin calcareous zones; and several coals less than 1 foot thick. The Staunton formation ranges from 50 to 70 feet in thickness.

Linton formation. --Type locality is 4 miles north of Linton, Greene County, Indiana. This formation was named by Wier (1950). Coal IV, 24 feet thick, marks the top of the formation and is underlain in descending order by 29 feet of alternating sandstone and shale; 1 foot of black limestone; 1 foot of black fissile shale; Coal IIIa, 0.8 foot thick; and 20 feet of micaceous friable massive sandstone or sandy shale. The Linton formation ranges from 40 to 60 feet in thickness. The limestone above Ma contains numerous individuals of the brachiopod, Linoproductus prattenianus.

Petersburg formation. --Type locality is near Petersburg, Pike County, Indiana. This formation was named by Fuller and Ashley (1902, p. 2)

and was restricted by Wier (1950). The top of the formation consists of limestone (Alum Gave), which is 6 feet thick, hard, silicious, and fossiliferous; is separated into two benches by a few inches of calcareous shale; and is underlain by the following units in descending order: 6 feet of black fissile shale that contains many iron sulphide concretions; Coal V, 6 feet thick; 50 feet of massive sandstone with some shale; 1 foot of black hard limestone; 2 feet of black sheety shale; Coal IVa, 1 foot thick; and 40 feet of micaceous interbedded sandstone and shale which locally grades into massive sandstone. The Petersburg formation ranges from 90 to 120 feet in thickness.

The Alum Cave limestone member of the Petersburg formation contains the following fossils:

Chonetes mesolobus enampygus Girty

Composita subtilita (Hall)

Dictyoclostus americanus (Dunbar and Condra)

Dictyoclostus portlockianus (Norwood and Pratten)

Marginifera muricata Dunbar and Condra

Marginifera splendens (Norwood and Pratten)

Orthonychia purvum (Swallow)

Squamularia perplexa (McChesney)

Dugger formation.--Type locality is 2 miles northeast of Dugger, Sullivan County, Indiana. This formation was defined recently by Wier (1950). Coal VII, 4 feet thick, marks the top of the formation in most places; and it is underlain by the following units: 10 feet of alternating sandstones and shales; 1 to 4 feet of irregular argillaceous limestone (Providence); 20 feet of massive, sandstone or alternating sandstones and shales; Coal VI, 5 feet thick;

and 50 to 70 feet of alternating sandstone and shale containing two thin coals (Va and Vb); and locally a massive brecciated cherty limestone below Vb. The Dugger formation ranges from 90 to 120 feet in thickness.

Conemaugh

Shelburn formation--Type locality is near Shelburn, Sullivan County, Indiana. This formation, named by Cumings (1922, p. 525) and amended by Shrock and Malott (1929, pp. 1301-2), consists principally of alternating sandstones and shales and three or more intermittent beds of limestones and several of coal. The base is composed of 5 to 25 feet of massive sandstone called the Busseron sandstone. The Shelburn formation ranges from 210 to 300 feet in thickness.

The Maria Creek limestone, the lowest limestone member of the Shelburn formation (Pl. 4), contains the following fossils:

Composita subtilita (Hall)

Derbyia crosses (Meek and Hayden)

Linoproductus pratteneanus (Norwood and Pratten)

Marginifera splendens (Norwood and Pratten)

Squamularia perplexa (McChesney)

West Franklin limestone.—Type locality is at West Franklin, Posey County, Indiana. This limestone was named by Lesquereux (1862, pp. 294 and 297). The name was discarded by Fuller and Ashley (1902, p. 2), and the limestone was renamed by Shrock and Malott (1929, pp. 1301-2). The upper member of the West Franklin limestone is 3 feet thick and is dense, crystalline, and fossiliferous. The medial shale is 1 to 15 feet thick and locally contains a few inches of coal. The lower limestone member is 2.5 feet thick and is

brecciated and argillaceous. The West Franklin limestone ranges from 2 to 20 feet in thickness.

Ditney formation --Type locality is in the Ditney Hills, Knox County, Indiana. This formation, named by Fuller and Ashley (1902, p. 2), consists mostly of shale that contains ferrous carbonate concretions. Locally a 1-foot bed of coal and thin lenses of sandstone are present. The Ditney formation ranges from 1 to 35 feet in thickness.

Merom sandstone --Type locality is at Merom, Sullivan County, Indiana. This formation, named by Collett (1871, pp. 199-200), consists of sandstone that is soft, cross-bedded, and massive, and is composed of coarse, angular quartz grains, mica flakes, and intergranular kaolin, and allochthonous coal. The Merom sandstone ranges from 30 to 70 feet in thickness.

SYSTEM	SERIES			FORMATION	MEMBER	
	MID-CONTINENT	APPALACHIAN				
PENNSYLVANIAN	MISSOURI	CONEMAUGH		Merom sandstone 30-70 ft.		
				Ditney formation 1-35 ft.		
				West Franklin limestone 2-20 ft.		
	DES MOINES			ALLEGHENY	Shelburn formation 210-300 ft.	Hayden Branch Murphy's Bluff sandstone Vigo limestone
						Maria Creek limestone
						Busseron sandstone
					Dugger formation 90-120 ft.	Coal VII Providence limestone (Universal) Coal VI
					Petersburg formation 90-120 ft.	Alum Cave limestone Coal V (Petersburg) Coal IVa
					Linton formation 40-60 ft.	Coal IV (Linton) Coal IIIa
	ATOKA			POTTSVILLE	Staunton formation 50-70 ft.	Coal III (Seelyville)
Brazil formation 75-90 ft.		Coal II (Silverwood) Minshall limestone Minshall coal Upper Block coal Lower Block coal				
MORROW		Mansfield formation 150-300 ft.				
MISS.	CHESTER			Cypress sandstone 30 ft.		

GENERALIZED STRATIGRAPHIC COLUMN OF PENNSYLVANIAN FORMATIONS IN WEST CENTRAL INDIANA

Compiled by C.E. Wier
April, 1951

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