UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Descriptions of four measured outcrop sections of Upper Devonian and Lower Mississippian strata in Warren and Elk Counties, Pennsylvania

By

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Open-File Report 82 -133

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ILLUSTRATIONS

Introduction

This open-file report presents descriptive data from four surface sections that were measured during the Fall of 1980 in conjunction with field investigations carried out to evaluate the geology and coal resources of the Clarion River, Hickory Creek, and Allegheny Front Roadless Areas in the Allegheny National Forest of northwestern Pennsylvania (fig. 1). As required by the Wilderness Act (Public Law 88-577, September 3, 1964) and related acts, these three areas are being studied to determine their mineral-resource potential.

All four section were measured with hand level and pocket tape by S. P. Schweinfurth and N. L. Hickling. The sections are all outside the roadless areas studied, but each was close enough to one or another of the areas to be valuable in the interpretation of the stratigraphy within the area. No long, well-exposed (or even moderately well exposed) surface sections exist within the roadless areas. These descriptions are being released as supplemental material for the investigations on the three roadless areas and as a contribution to the general geology of northwestern Pennsylvania.

In the pages that follow, the description of each measured section is preceded by a map showing the location of the section (figs. 2-5). Metric and English equivalents in the descriptions may appear somewhat inexact because of rounding to the nearest tenth of a meter or foot.

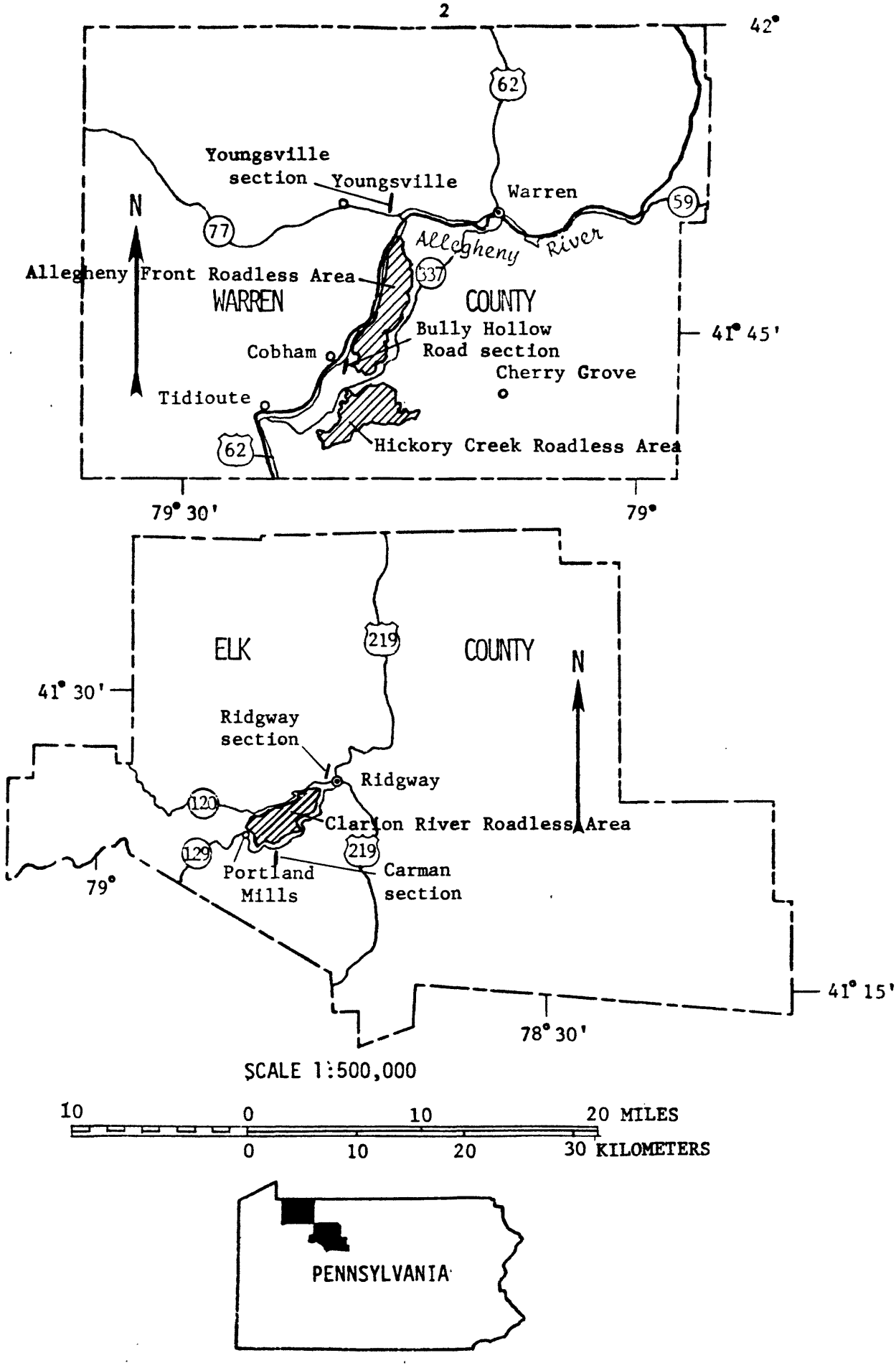
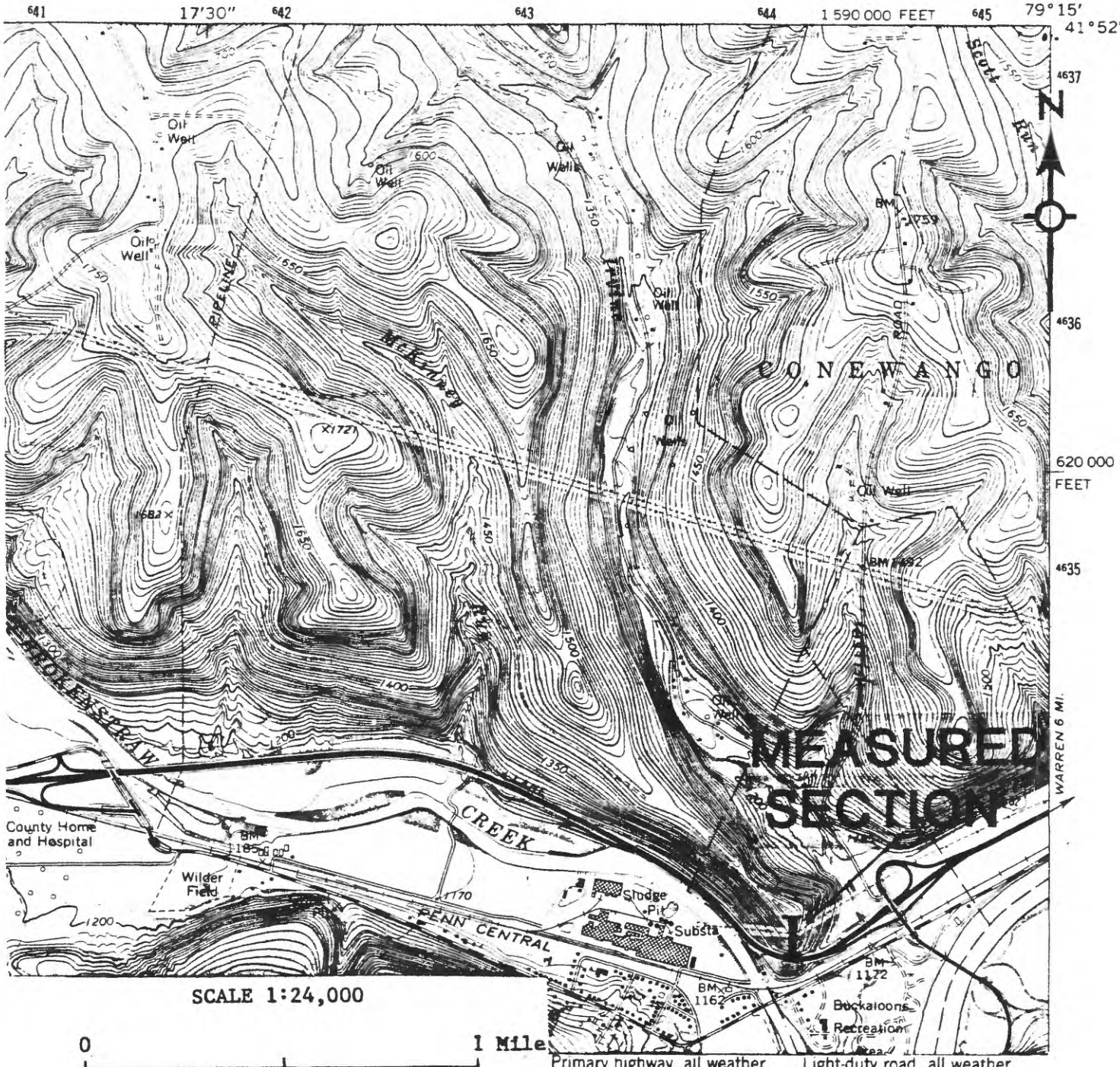


Figure 1.-Index maps showing approximate locations of measured sections and roadless areas.

YOUNGSVILLE QUADRANGLE
PENNSYLVANIA—WARREN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



YOUNGSVILLE, PA.

N4145—W7915/7.5

1969

AMS 5167 IV SE—SERIES V831

Figure 2.-Location of the Youngsville section.

Description of The Youngsville section

Location (figs. 1,2): North side of roadcut for combined U.S. Route 6 - State Route 27 about 4.7 km (2.9 mi) east of Youngsville in Youngsville 7 1/2- min quadrangle, Warren County, Pennsylvania.

Approximate coordinates of base of section: Latitude - 41°50'16" N
Longitude - 79°15'43" W
UTM* grid - 4,633,400 m N, 644,210 m E

Altitude of base: about 369 m (1,210 ft)

Height of section: about 74.4 m (244 ft)

Section measured: October 17, 1980

Lithologic unit Late Devonian: Venango formation of Lesley (1892), lower part:	Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
35. Sandstone, light-gray; weathers dark yellowish-orange; is very fine grained, quartzose, slightly feldspathic, thin- to massive-bedded, unevenly bedded; contains low-angle crossbeds, a few marine invertebrate fossils, and tracks and trails on bedding planes. Base abrupt.....	2.0 (6.4)	2.0 (6.4)
34. Clay shale, medium-gray; contains a few very thin beds of siltstone and thin, concretionary layers of siderite(?). Base gradational.....	11.5 (37.8)	13.5 (44.2)
33. Clay shale, grayish-red. Contact abrupt.	1.2 (3.9)	14.7 (48.1)
32. Sandstone, medium-gray, very fine grained to silt sized, orthoquartzitic. Base gradational.....	0.5 (1.5)	15.2 (49.6)

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* UTM, universal transverse mercator

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
31.	Shale, sandstone, and siltstone, interbedded, medium-gray, thin- to medium-bedded. Shale is dominant at base of unit (as much as 50%), but sandstone becomes dominant near the top of unit (as much as 65%). Sandstone is very fine grained and quartzose, and some beds are very resistant. Siltstone is argillaceous and micaceous and contains worm(?) burrows. Base gradational.....	4.9 (16.2)	20.1 (65.8)
30.	Siltstone and shale, interbedded, grayish-red, thin-bedded; siltstone to shale ratio is 60/40. Base gradational.....	1.2 (3.8)	21.3 (69.6)
29.	Clay shale, medium-gray. Base gradational	4.6 (15.0)	25.9 (84.6)
28.	Sandstone and shale, interbedded, medium-gray, thin-bedded; sandstone to shale ratio is 70/30. Sandstone is very fine grained to silt sized and contains marine invertebrate fossils and tracks and trails on bedding planes. Base gradational.....	0.6 (2.0)	26.5 (86.6)
27.	Clay shale, as in unit 34. Base gradational	2.2 (7.1)	28.7 (93.7)
26.	Siltstone and mudstone, interbedded, medium-gray, thin-bedded.....	0.8 (2.5)	29.4 (96.2)
	Covered interval.....	0.3 (1.0)	29.8 (97.2)
25.	Siltstone, medium-olive-gray, argillaceous, thin-bedded.....	0.3 (1.0)	30.0 (98.2)
	Covered interval.....	1.0 (3.3)	31.0 (101.5)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
24.	Sandstone, conglomeratic, light- to medium-gray, medium- to coarse-grained, and quartzose. Pebbles are quartz and quartzite as much as 4 cm (1.5 in.) in diameter, well rounded, but commonly flat. This unit is either a lens or a channel fill because it is absent from the eastern end of the roadcut. Base abrupt.....	2.3 (7.4)	33.3 (108.9)
23.	Shale, medium-olive-gray, contains layers of thin, discoidal siderite(?) concretions and a few thin interbeds of siltstone. Base gradational.....	2.8 (9.2)	36.1 (118.1)
22.	Sandstone, light- to medium-gray, very fine grained, quartzose, thin- to medium-bedded, unevenly bedded, resistant; contains abundant marine invertebrate fossils and borings. Base gradational.....	1.0 (3.3)	37.1 (121.4)
21.	Shale, medium gray, poorly exposed.....	1.2 (3.8)	38.3 (125.2)
	Covered interval.....	2.5 (8.3)	40.8 (133.5)
20.	Sandstone; weathers light olive gray; is very fine grained, micaceous, thin to medium bedded, ripple bedded, resistant.....	0.6 (2.0)	41.4 (135.5)
	Covered interval.....	1.3 (4.2)	42.7 (139.7)
19.	Sandstone, light-gray, very fine grained, very quartzose, micaceous on bedding planes, thin-bedded; has a 2.5-cm (1-in.) -thick, medium-gray, clay-shale bed in the middle. Base gradational.....	0.2 (0.6)	42.9 (140.3)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
18.	Shale, mudstone, and siltstone, interbedded, moderate-grayish-red grading to light-olive-gray in the uppermost part. Base gradational.....	0.2 (0.8)	43.1 (141.1)
17.	Siltstone, moderate- to grayish-red, very ferruginous. Base gradational.....	0.1 (0.3)	43.2 (141.4)
16.	Shale, moderate-grayish-red. Base gradational.....	0.6 (1.9)	43.8 (143.3)
15.	Siltstone, mottled grayish-red, medium-gray, and light-olive-gray, contains vertical borings in the middle of the unit 1.3 to 2 cm (1/2 to 3/4 in.) in diameter and as much as 15 cm (6 in.) in length; borings are filled with the same kind of siltstone. Base gradational	0.5 (1.5)	44.3 (144.8)
14.	Mudstone, siltstone, shale and clay, interbedded, light- to medium-gray, thin-bedded. Base gradational.....	0.3 (1.1)	44.6 (145.9)
13.	Sandstone, grayish-orange, very argillaceous, very fine grained, thin- and uneven-bedded. Base gradational.....	0.2 (0.5)	44.8 (146.4)
12.	Siltstone and mudstone, interbedded, light-olive-gray; weathers moderate yellowish brown; is thin bedded; ratio of siltstone to mudstone is 60/40; abundant plant fragments on bedding planes. Base gradational.....	0.6 (2.0)	45.4 (148.4)
11.	Siltstone, medium-gray, very argillaceous. Base gradational.....	0.1 (0.3)	45.5 (148.7)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
10.	Shale, moderate- to dark-reddish-brown; grades up to medium-gray at top; slightly siliceous. Base gradational.....	2.6 (8.6)	48.1 (157.3)
9.	Clay shale, medium-gray, slightly siliceous; contains a few thin interbeds of siltstone; shale blocky in upper part. Siltstone is light to medium gray, quartzose to argillaceous, slightly to moderately resistant; contains burrows, tracks, and trails. Base gradational.....	9.8 (32.2)	57.9 (189.5)
8.	Clay shale, medium-gray, slightly siliceous; contains a few very thin beds of siltstone. Base gradational.....	3.1 (10.3)	61.0 (199.8)
7.	Siltstone, medium-gray, thin- to medium-bedded, resistant; contains low-angle cross beds. Base gradational.....	0.6 (2.0)	61.6 (201.8)
6.	Shale and siltstone, interbedded, medium-gray, thin- to very thin bedded; ratio of shale to siltstone is 60/40. Siltstone contains marine invertebrate fossils. Base gradational.....	3.6 (11.7)	65.2 (213.5)
5.	Siltstone, medium-gray, thin-bedded; contains marine invertebrate fossils and worm(?) burrows. Base gradational.....	1.1 (3.5)	66.4 (217.0)
4.	Shale and siltstone, interbedded, as in unit 6 except that ratio of shale to siltstone is about 75/25. Base gradational.....	2.6 (8.8)	68.9 (225.8)
3.	Siltstone; contains lenses as much as 10 cm (4 in.) thick of abundant brachiopod shells, interbedded with shale as in unit 6. Base gradational.....	0.6 (2.0)	69.5 (227.8)
2.	Shale, as in unit 29. Base gradational..	1.6 (5.4)	71.1 (233.2)

	Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
1. Shale, medium-gray, siliceous; contains a few very thin beds of siltstone, a lenticular bed as much as 10 cm (4 in.) thick containing abundant brachiopod shells, and one thin bed of discoidal siderite(?) nodules. The siltstone is medium gray, micaceous, and ripple bedded.....	2.5 (8.1)	73.6 (241.3)

The fossils of unit 1 were examined by J. T. Dutro, Jr., U.S. Geological Survey, and found to be mostly rhynchonelloid and cyrtospiriferoid brachiopods. Many of the cyrtospirifers fall within the range of variation of Cyrtospirifer inermis (Hall). The rhynchonelloid is probably Camarotoechia contracta Hall. Scraps of productellids, fish, bryozoans, and inarticulate brachiopods are also present. The age of the fossils is Late Devonian, probably early or middle Famennian (Dutro, written communication, 1981).

Interval from base of section in drainage ditch to lowest exposed stratum.....	0.8 (2.7)	74.4 (244)

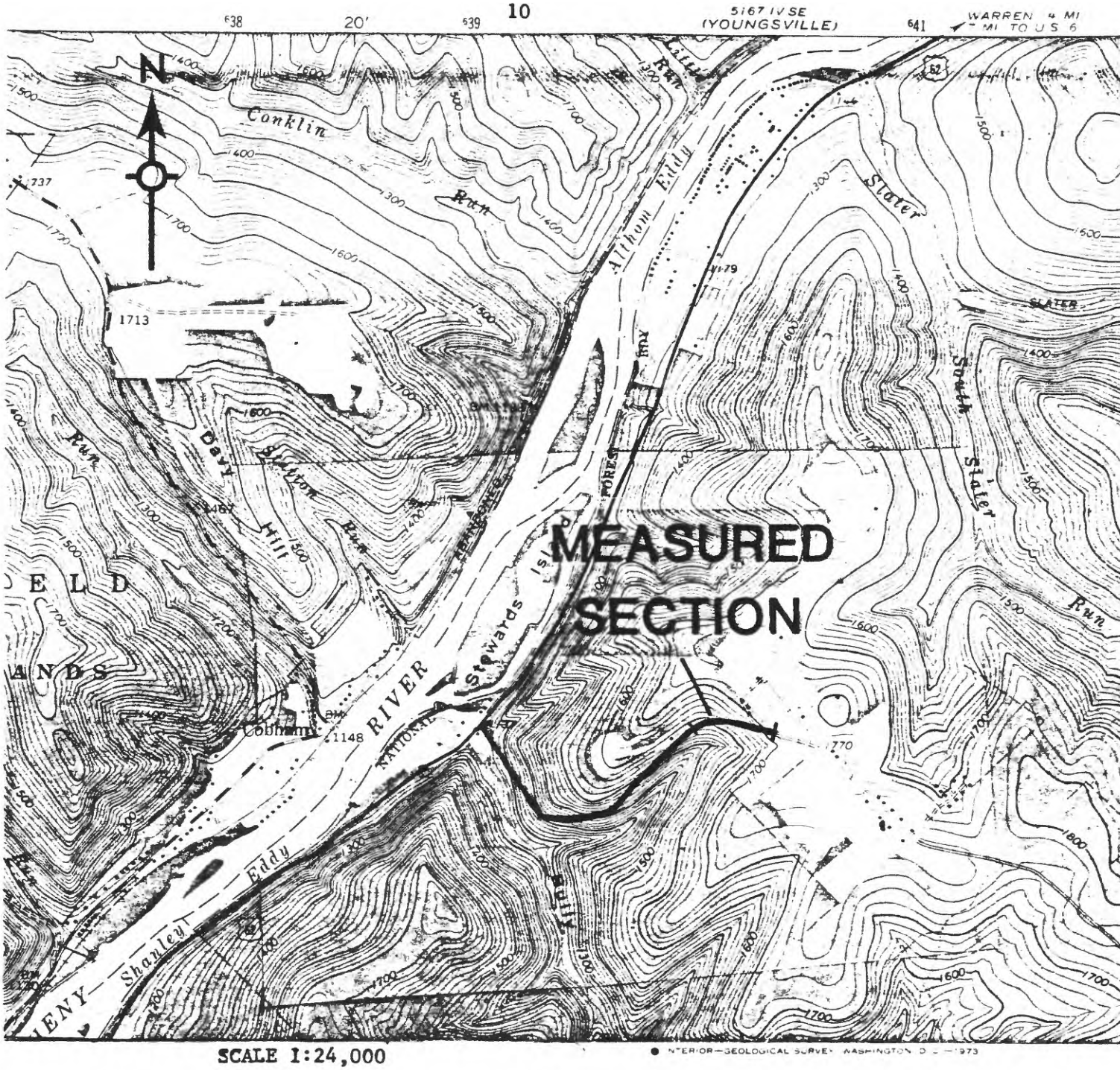


Figure 3.-Location of the Bully Hollow Road section.

Description of The Bully Hollow Road section

Location (figs. 1,3): Roadcuts along the road up Bully Hollow for a distance of about 1.6 km (1.0 mi). Base of section is at the junction of Bully Hollow Road and U.S. Route 62 in the Cobham 7 1/2-min quadrangle about 22.4 km (14 mi) south-southwest of Warren, Warren County, Pennsylvania.

Approximate coordinates of base of section: Latitude - 41°30'57" N
Longitude - 79°19'35" W
UTM grid - 4,620,400 m N,
639,120 m E

Altitude of base: about 346.8 m (1,137 ft)

Height of section: about 174.2 m (571.4 ft)

Section measured: October 15 and 16, 1980

Lithologic unit Mississippian and Devonian: Cuyahoga and Oswayo Formations, undivided:	Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
36. Sandstone; weathers grayish orange to moderate yellowish brown; is fine grained, very quartzose, thin to medium bedded, moderately resistant(Shenango sandstone(?) as used by Cathcart and others, 1938)....	1.8 (5.8)	1.8 (5.8)
Covered interval.....	39.9 (130.8)	41.7 (136.6)
35. Sandstone; weathers dark yellowish brown to olive gray; is very fine grained, micaceous, thin bedded, resistant.....	0.2 (0.8)	41.9 (137.4)
Covered interval.....	3.4 (11.2)	45.3 (148.6)
34. Sandstone, as in unit 36 except for a 10-cm (4-in.) -thick bed containing very abundant brachiopod.....	1.7 (5.4)	47.0 (154.0)
Covered interval.....	9.9 (32.4)	56.9 (186.4)

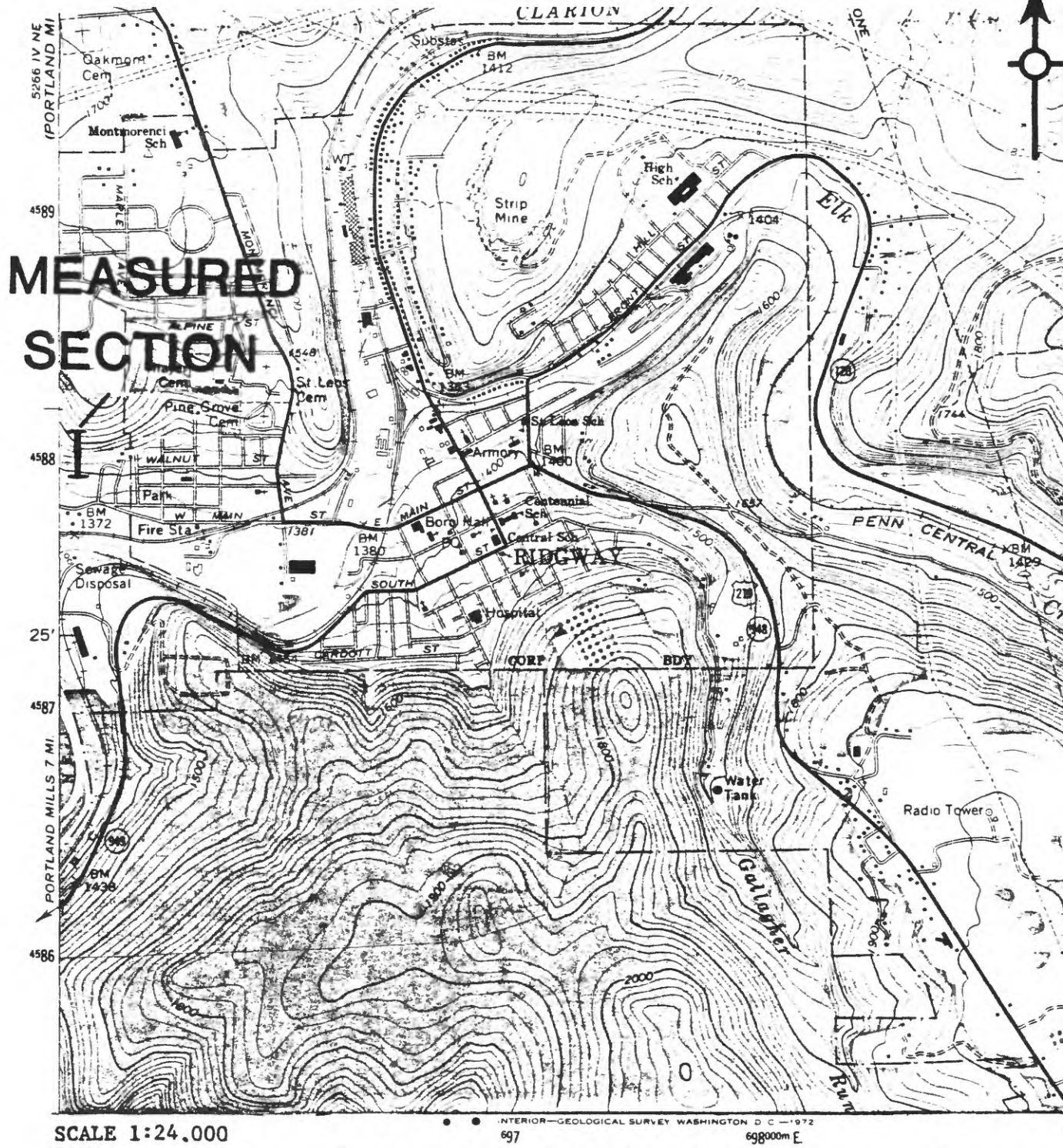
		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
33.	Clay shale, siltstone, and siltstone mudstone, interbedded; weathers dark yellowish brown to medium olive gray; is micaceous along bedding planes, thin bedded.....	4.9 (16.2)	61.8 (202.6)
	Covered interval.....	0.3 (0.9)	62.1 (203.5)
32.	Sandstone, as in unit 35.....	1.8 (6.0)	63.9 (209.5)
	Covered interval.....	1.2 (3.9)	65.1 (213.4)
31.	Shale, as in unit 33, poorly exposed.....	3.3 (10.8)	68.4 (224.2)
	Covered interval.....	0.8 (2.7)	69.2 (226.9)
30.	Siltstone and shale, interbedded, as in unit 33, poorly exposed.....	5.8 (18.9)	75.0 (245.8)
	Covered interval.....	2.5 (8.1)	77.5 (253.9)
29.	Clay shale, as in unit 33, poorly exposed. Base gradational.....	2.5 (8.1)	80.0 (262.0)
28.	Siltstone; weathers dark yellowish brown to medium olive gray; is thin bedded, resistant.....	0.3 (1.0)	80.3 (263.0)
	Covered interval.....	1.0 (3.4)	81.3 (266.4)
27.	Sandstone; weathers dark yellowish brown to moderate olive brown; is very fine grained, thin bedded, ripple bedded, resistant; contains marine invertebrate fossils and a few thin interbeds of shale. Base gradational.....	1.8 (5.8)	83.1 (272.2)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
26.	Sandstone; weathers medium grayish green; is very fine grained, slightly micaceous, thin to medium bedded; contains abundant brachiopod shells. Base gradational.....	0.6 (2.1)	83.7 (274.3)
25.	Siltstone and shale, interbedded, thin-bedded with equal portions of siltstone and shale as in unit 33.....	0.4 (1.4)	84.1 (275.7)
	Covered interval.....	5.7 (18.7)	89.8 (294.4)
24.	Siltstone and clay shale, interbedded, poorly exposed, weathers medium olive gray; is thin bedded; locally contains marine invertebrate fossils.....	6.0 (19.6)	95.8 (314.0)
	Covered interval.....	0.6 (2.0)	96.4 (316.0)
23.	As in unit 24.....	0.3 (1.0)	96.7 (317.0)
	Covered interval.....	1.3 (4.4)	98.0 (321.4)
22.	As in unit 24. Base gradational.....	3.3 (10.8)	101.3 (332.2)
21.	Mudstone and siltstone, interbedded, poorly exposed; weathers medium olive gray; is thin-bedded.....	0.2 (0.8)	101.5 (333.0)
	Covered interval.....	1.1 (3.6)	102.6 (336.6)
20.	As in unit 24. Base gradational.....	0.3 (1.1)	102.9 (337.7)
19.	Sandstone; weathers dark yellowish brown to medium olive gray; is very fine grained, thin bedded, "flaggy"; contains fossils including brachiopods and crinoid columnals in the lower part. Base gradational.....	0.3 (1.1)	103.2 (338.8)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
18.	Siltstone and shale, interbedded; weathers medium to dark olive gray; is thin bedded. Siltstone is very argillaceous.....	1.3 (4.3)	104.5 (343.1)
	Covered interval.....	6.6 (21.6)	111.1 (364.7)
17.	As in unit 18. Base gradational.....	1.7 (5.4)	112.8 (370.1)
	Venango formation(?) of Lesley (1892). Units 16 through 7 possibly correlate with the Woodcock sandstone member of Chadwick (1925).		
16.	Sandstone; weathers dark olive gray; is very fine grained to silt sized, micaceous along bedding planes, thin bedded, resistant. Base abrupt.....	0.6 (2.0)	113.4 (372.1)
15.	Clay shale, medium-gray, blocky. Base gradational.....	1.0 (3.4)	114.4 (375.5)
14.	Sandstone, as in unit 16, except for low-angle crossbeds, clay chips, brachiopod shells, and crinoid columnals in the lower part. Base abrupt.....	0.7 (2.4)	115.1 (377.9)
13.	Clay shale, medium-gray, blocky. Base gradational.....	1.7 (5.4)	116.8 (383.3)
12.	Sandstone; weathers mottled moderate yellowish brown to medium olive gray; is very fine to fine grained, micaceous, thin bedded, ripple bedded in part, resistant in part; contains clay pebbles, low-angle crossbeds, and carbonized plant fragments. Base abrupt.....	2.4 (7.9)	119.2 (391.2)
11.	Clay shale, medium-gray, very fissile, "splintery". Base gradational.....	0.5 (1.5)	119.7 (392.7)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
10.	Sandstone; weathers moderate yellowish brown; is fine grained, micaceous along bedding planes, thin bedded, ripple bedded; contains brachiopod fragments, a few thin interbeds of shale, and small clay chips. Base gradational.....	1.4 (4.6)	121.1 (397.3)
9.	Sandstone; weathers moderate yellowish brown to medium olive gray; is very fine grained, very micaceous on bedding planes, very thin bedded. Base gradational.....	0.2 (0.8)	121.3 (398.1)
8.	Sandstone, mudstone, and siltstone, interbedded; weathers moderate yellowish brown to medium olive gray; is micaceous on bedding planes, very thin bedded, ripple bedded; contains carbonized plant fragments on bedding planes. Base gradational....	2.7 (8.8)	124.0 (406.9)
7.	Sandstone; weathers mottled moderate yellowish brown and medium olive gray; is very fine to fine grained, very micaceous; contains abundant carbonized plant fragments on bedding planes; is thin bedded and ripple bedded in part; contains marine invertebrate fossils, low-angle crossbeds, and abundant iron cement in the upper part. Base abrupt.....	2.3 (7.4)	126.3 (414.3)
6.	Siltstone and mudstone, interbedded, as in unit 8, except for abundant trails on bedding planes. Base gradational.....	0.7 (2.4)	127.0 (416.7)
5.	Sandstone as in unit 7, except that marine invertebrate fossils were not found.....	2.5 (8.3)	129.5 (425.0)
	Covered interval.....	0.3 (1.0)	129.8 (426.0)
4.	Sandstone, as in unit 5. Base abrupt....	0.2 (0.6)	130.0 (426.6)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
3.	Clay shale; weathers mottled dark yellowish orange and moderate olive brown.....	0.1 (0.4)	130.1 (427.0)
	Covered interval.....	33.3 (109.1)	163.4 (536.1)
2.	Sandstone, light to medium gray; weathers moderate yellowish brown; is fine grained, orthoquartzitic, thin bedded.....	0.3 (0.9)	163.7 (537.0)
	Covered interval.....	6.6 (21.7)	170.3 (558.7)
1.	Sandstone, as in unit 2.....	0.1 (0.3)	170.4 (559.0)
	Interval from base of section at road intersection to lowest exposed stratum...	3.8 (12.4)	174.2 (571.4)



SCALE 1:24,000

0 1 Mile

1 Kilometer

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Primary highway, hard surface

Secondary highway, hard surface

Light-duty road, hard or improved surface

Unimproved road

Interstate Route U. S. Route State Route

QUADRANGLE LOCATION

RIDGWAY, PA.
NW/4 RIDGWAY 15' QUADRANGLE
N4122.5—W7837.5/7.5

1969

Figure 4.-Location of the Ridgway section.

Description of The Ridgway section

Location (figs. 1,4): Excavation into side of hill behind and north of the Ridgway Township building. Township building is on West Main Street about 1.4 km (0.9 mi) west of the Ridgway Boro Hall in the Ridgway 7 1/2 min quadrangle, Elk County, Pennsylvania.

Approximate coordinates of base of section: Latitude - 41°25'22" N
Longitude - 78°44'57" W
UTM grid: 4,587,850 m N,
687,900 m E

Altitude of base: about 418.7 m (1,373 ft)

Height of section: about 32 m (105 ft)

Section measured: November 3, 1980

Lithologic unit Mississippian: Cuyahoga Formation(?) (part):	Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
8. Mudstone, grayish-red, poorly exposed. Base gradational.....	0.1 (0.4)	0.1 (0.4)
7. Mudstone and siltstone, interbedded; weathers grayish orange; is thin bedded. Base gradational.....	1.5 (5.0)	1.6 (5.4)
6. Sandstone, light gray; weathers dark yellowish orange; is mostly fine grained but locally fine to medium grained, finer grained in uppermost part, very feldspathic, moderately micaceous; basal part contains abundant clay chips and clasts of recycled siderite(?) nodules; overall aspect is massive but actually thinly bedded and crossbedded. Base abrupt.....	18.1 (59.4)	19.7 (64.8)
5. Sandstone, fine-grained, and mudstone, interbedded; weathers moderate olive brown and grayish olive, is thin to medium bedded. Sandstone is quartzose to very argillaceous and micaceous. Base gradational.....	3.3 (10.8)	23.0 (75.6)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
4.	Mudstone, mottled grayish-red and grayish-green. Base gradational.....	0.7 (2.4)	23.7 (78.0)
3.	Sandstone and mudstone, interbedded; weathers moderate olive brown and grayish olive; is thin to medium bedded. Sandstone is quartzose to very argillaceous and micaceous. Base gradational.....	1.5 (5.0)	25.2 (83.0)
2.	Mudstone, mottled grayish-red and grayish-green. Base gradational.....	0.4 (1.3)	25.6 (84.3)
1.	Mudstone and siltstone, interbedded; weathers moderate-olive-brown and grayish-olive; is very thin bedded. Siltstone is argillaceous and micaceous. Base obscured.....	6.3 (20.7)	32.0 (105.0)
	Base of section		

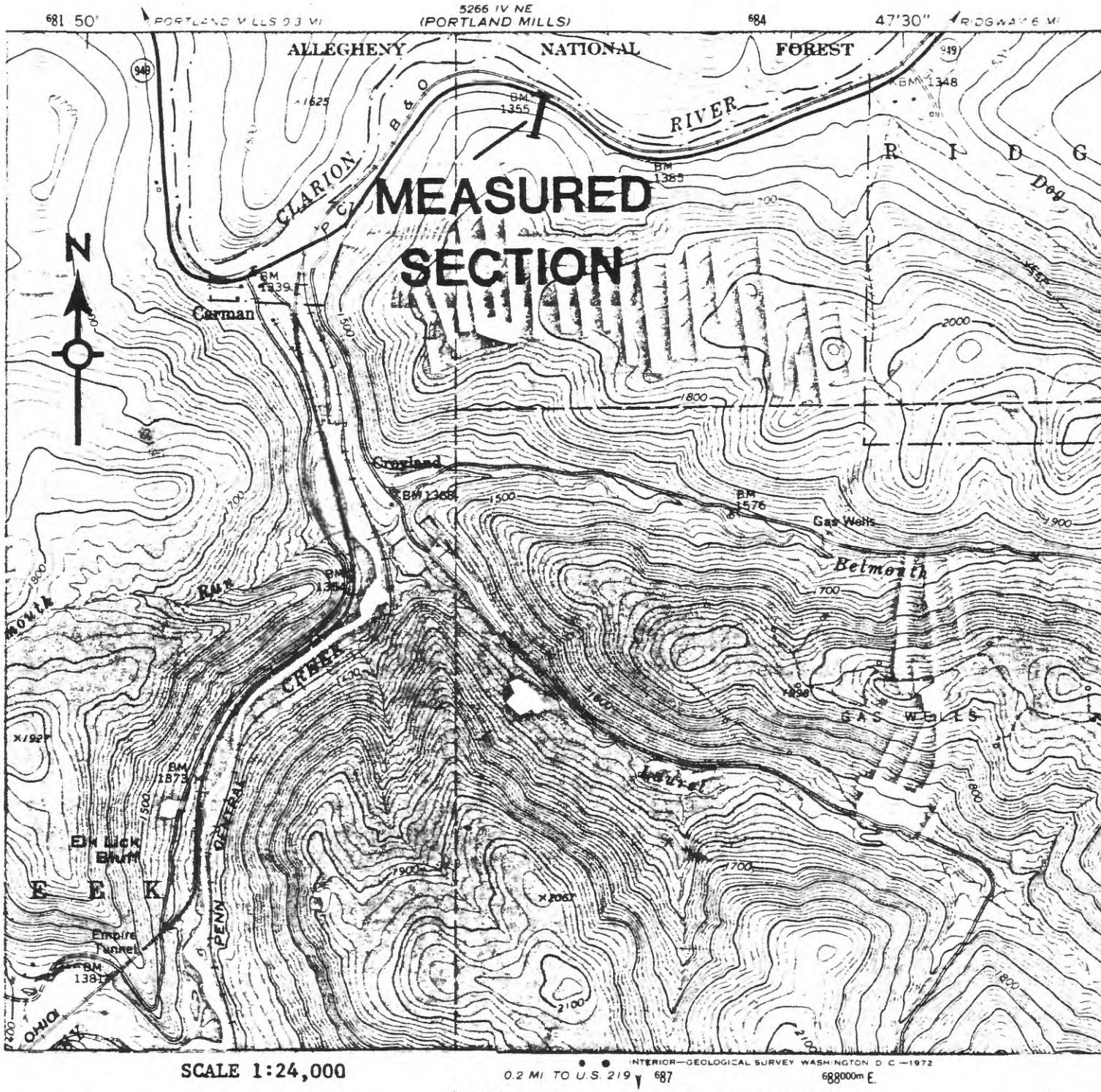


Figure 5.-Location of the Carman section.

Description of the Carman section

Location (figs. 1,5): Railroad cut on the north side and roadcut on the south side of State Route 949 about 1.65 km (1 mi) east of Carman, Carman 7 1/2-min quadrangle, Elk County, Pennsylvania. Base of section is at railroad grade.

Approximate coordinates of base of section: Latitude - 41°22'23" N
Longitude - 78°48'35" W
UTM grid - 4,582,095 m N
683,165 m E

Altitude of base: about 410.5 m (1,346 ft)

Height of section: about 47.8 m (156.6 ft)

Section measured: November 6, 1980

Lithologic unit	Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
Mississippian:		
Cuyahoga(?) and Knapp(?) Formations (part), undivided:		
19. Sandstone, siltstone, and shale, interbedded; weathers grayish orange and grayish olive; is thin to very thin bedded and unevenly bedded. Sandstone and siltstone are argillaceous and micaceous. Sandstone is very fine to fine grained. Base gradational..	12.3 (40.5)	12.3 (40.5)
18. Sandstone; weathers grayish orange; is very fine grained, argillaceous, micaceous, thin to medium bedded. Base gradational	1.3 (4.3)	13.6 (44.8)
17. Siltstone, mudstone, and shale, interbedded; weathers grayish olive; is thin to very thin bedded. Siltstone weathers grayish orange and grayish olive, is thin to very thin bedded and unevenly bedded.....	4.4 (14.6)	18.0 (59.4)
Covered interval.....	0.9 (2.9)	18.9 (62.3)
16. Sandstone, white, medium- to coarse-grained, quartzose, massive, contains scattered, small, white quartz pebbles, some flattened. Base abrupt.....	2.4 (7.9)	21.3 (70.2)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
15.	Siltstone and mudstone, interbedded as in unit 17. Base gradational.....	6.6 (21.6)	27.9 (91.8)
14.	Sandstone, light-gray, very fine to fine-grained, quartzose to moderately argillaceous, thin- to medium-bedded, contains conglomeratic lenses, as much as 0.3 m (1.1 ft) thick, of small, flat, white quartz pebbles and thin beds of medium-gray shale. Base gradational.....	3.3 (10.8)	31.2 (102.6)
13.	Sandstone, light- to medium-gray, very fine grained to silt sized, argillaceous, micaceous on bedding planes, thin- and irregularly bedded; contains a few scattered small, white quartz pebbles. Base gradational..	0.5 (1.6)	31.7 (104.2)
12.	Conglomerate, light-gray to white; consists of small, flat, white quartz pebbles in a matrix of fine- to medium-grained quartz sand. Base abrupt.....	0.2 (0.5)	31.9 (104.7)
11.	Siltstone, sandstone, and shale, interbedded, as in unit 19. Base abrupt.....	1.0 (3.3)	32.9 (108.0)
10.	Conglomerate, as in unit 12. Base abrupt	0.2 (0.5)	33.1 (108.5)
9.	Mudstone, shale, and siltstone, interbedded; weathers grayish olive; is thin to very thin bedded. Base gradational.....	4.7 (15.6)	37.8 (124.2)
8.	Siltstone and mudstone, interbedded; weathers grayish olive; is thin to very thin bedded. Base gradational.....	0.9 (3.1)	38.7 (127.3)
7.	Sandstone and mudstone, interbedded, medium gray, thin-bedded. Sandstone is medium gray, weathers medium olive gray, is very fine grained, argillaceous, and micaceous. Mudstone is blocky. Base gradational....	0.5 (1.5)	39.2 (128.8)

		Unit thickness in meters (feet)	Cumulative thickness in meters (feet)
6.	Sandstone, medium-gray; weathers medium olive gray; is very fine grained, argillaceous, micaceous; appears massive but actually is thin bedded. Base gradational..	1.9 (6.2)	41.1 (135.0)
5.	Mudstone, as in unit 7.....	1.2 (3.9)	42.3 (138.9)
	Covered interval.....	0.5 (1.5)	42.8 (140.4)
4.	Sandstone; weathers moderate brown; is coarse to very coarse grained, becoming fine grained at the top, quartzose, massive bedded, ferruginous; contains abundant flat, white quartz pebbles, as much as 2.4 cm (1 in.) in diameter, scattered throughout and as conglomeratic lenses, and some low-angle crossbeds. Base abrupt	1.0 (3.4)	43.8 (143.8)
3.	Sandstone; weathers light to moderate brown; is moderately feldspathic and micaceous, very fine grained, and very thin bedded; top scoured. Base gradational	0.6 (2.0)	44.4 (145.8)
2.	Sandstone, as in unit 4. Base gradational	1.7 (5.4)	46.1 (151.2)
1.	Sandstone; weathers dusky yellow and moderate brown; is quartzose, fine to very coarse grained, moderately feldspathic, thin to medium bedded; contains small, flat, white quartz pebbles and some ferruginous zones. Base obscured.....	1.7 (5.4)	47.8 (156.6)
	Base of section		

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