

**THE CONEMAUGH FORMATION IN SOUTHERN OHIO.<sup>1</sup>**

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## INTRODUCTION.

During the summer of 1907, the writer was engaged by the Geological Survey of Ohio in tracing and mapping the Pittsburg and Pomeroy coals in southern Ohio. The seams were traced from the Ohio River in Lawrence County northeastward across Gallia, Meigs, Athens and into Morgan County. This field work gave the writer an extensive acquaintance with the Conemaugh as far down the section as the Cambridge limestone and is the basis of this paper.

## NOMENCLATURE OF THE FORMATION.

The term Conemaugh was first applied by Franklin Platt,<sup>2</sup> in 1875, to his so-called "Middle Barren Measures" and "Mahoning sandstone." Later the name was used in Maryland<sup>3</sup> to designate all the rocks between the base of the Pittsburg coal and the top of the Upper Freeport coal. With these limits, the name is today in general use throughout the Appalachian Basin. In 1901, Charles S. Prosser<sup>4</sup> adopted for Ohio the formation names Allegheny, Conemaugh, Monongahela and Dunkard of the Maryland Survey in place of Lower Productive, Lower Barren, Upper Productive and Upper Barren Coal Measures as adopted by Dr. Orton from Rogers' classification in Pennsylvania.

Generally, the Allegheny, Conemaugh, Monongahela and Dunkard are ranked as formations, but Dr. I. C. White, in his reports on the Coal Measures of West Virginia<sup>5</sup>, prefers to consider these as series.

## GENERAL DESCRIPTION.

The thickness of the Conemaugh in southern Ohio is usually 325 to 375 feet which is little more than half the thickness found along the northern outcrop in Pennsylvania.<sup>6</sup> A shaft at Canaanville, Athens County, shows the interval between the Pittsburg and Middle Kittanning coals to be 436 feet.<sup>7</sup> Although the base of the Conemaugh can not be conclusively located in this shaft section, it is probable that the formation is here less than 375 feet thick. The following general section shows the prin-

1. Published by permission of J. A. Bownocker, State Geologist.

2. *Sec. Geol. Surv. Pa.*, H. p. 8.

3. O'Harra: *Maryland Geol. Surv. Allegany County, 1900*, p. 86-118, and Prosser: *Jour., Geology*, Vol. IX, 1901, p. 426.

4. *Am. Jour. Sci.* 4th Ser. Vol. XI, March, 1901, p. 199.

5. *West Virginia Geol. Surv. 1908*, Vol. IIa, p. 622, and *Geol. Surv. Ohio*, 4th Ser., Bull. 7, p. 11.

6. J. J. Stevenson, *Carboniferous of the Appalachian Basin*, p. 346.

7. *Geol. Surv. Ohio*, 4th Ser., Bull. 9, p. 212. Depth of shaft should read 442 ft. instead of 412 ft.

cipal horizons as seen in southern Ohio. The succession in descending order is:

	Ft.	In.
PITTSBURG COAL		
Clay.....	3	
Pittsburg limestone.....	4	
Shales, sandy.....	45	
Sandstone, massive.....	35	
Coal blossom		
Limestone, nodular.....	0	8
Shales, sandy.....	50	
Shales, "Big Red," nodular ore and limestone.....	25	
Shale.....	5	
AMES LIMESTONE, fossiliferous.....	1	8
Coal blossom		
Shale.....	10	
Shale, "Pittsburg Red".....	40	
Ewing limestone.....	0	6
Shale.....	5	
PATRIOT LIMESTONE, fossiliferous....	0	6
Shale, black.....	3	
Patriot coal.....	1	6
Shale.....	15	
Sandstone, "First Cow Run".....	25	
Shale.....	10	
UPPER CAMBRIDGE LIMESTONE, fossiliferous.....	2	
Coal, thin.....	0	6
Shale.....	5	
LOWER CAMBRIDGE LIMESTONE, fossiliferous.....	1	0
Coal, thin.....		
Upper Mahoning sandstone.....	12	
Brush Creek Coal.....	1	
Clay.....	2	
Mahoning sandstone, often shaly....	50	
Clay, with iron ore.....	0	7
Shale.....	3	
UPPER FREEPORT COAL.		

The Pittsburg limestone lies from 2 to 20 feet below the Pittsburg coal. It is white or grayish in color and contains a few minute fossils. In southern Athens County a thickness of over 15 feet is attained but farther south 3 feet is uncommon.

The massive sandstone, the base of which lies about 90 feet below the Pittsburg coal, is probably the equivalent of the "Mitchell"<sup>8</sup> oil sand near Marietta. Sections in the Pan Handle

area of West Virginia show a heavy sandstone known as the Connelsville,<sup>9</sup> with a base about 110 feet below the Pittsburg coal. It is possible that the sandstone under discussion belongs to this horizon. This rock is very conspicuous along the Hocking River Valley east from Athens, where an unusual thickening brings it up close to the base of the Pittsburg coal.

Below the sandstone is a coal blossom underlain by a few inches of nodular limestone. This horizon was frequently crossed in five different counties, but workable coal was found at only one place near the head of Shade River, in Athens County.

The succeeding portion down to the Ames limestone is rather variable, consisting of variegated shales with occasional thinbedded sandstones. A short distance above the Ames, however, there is often a red clay which thickens much in some localities. It is known to oil drillers as the "Big Red." When weathered, there results a sticky red gumbo which lends a ruddy aspect to the country roads of Gallia, Meigs and other counties.

The Ames limestone receives its name from a village in Ames Township, Athens County, where the rock is well exposed in numerous outcrops. The interval between the Ames and the Pittsburg coal is about 150 feet, although it may run as low as 130 or as high as 175 feet. The limestone is seldom over 30 inches thick. From place to place, a great variation in composition and appearance is noticed. In Rutland Township, Meigs County, the Ames horizon is represented by 10 to 15 feet of calcareous shale with imbedded fossiliferous limestone nodules. In the same township the bed changes to a calcareous, fossiliferous, sandstone overlain by a ferruginous chert. Careful search across Mason and Windsor Townships in Lawrence County failed to reveal any trace of the Ames, but it was found outcropping in its proper place at Burlington, Union Township, in the southern part of the County.

Beneath the Ames there is often a coal blossom. This is wanting in many places and is not known to be of workable thickness anywhere.

Some ten feet below the Ames occur variegated green, bluish and red shales with zones of hematite ore and nodular limestone. These shales are found everywhere by the oil driller and are known as the "Pittsburg Reds."

The next persistent horizon is the Patriot lying about half-way between the Ames and Cambridge. It consists of a thin, nodular, fossiliferous limestone underlain by coal.

Lovejoy<sup>10</sup> has given the name "Patriot" to the coal. If the practice of applying the same name to more than one member of

9. W. Va. Geol. Surv., County Rep'ts and Maps, Ohio, Brooke and Hancock Counties, 1906, p. 113.

10. Geol. Surv. Ohio, Vol. VI, p. 631.

a formation be permissible, then the term Patriot would be very appropriate for the limestone also, and is proposed. The coal is persistent across entire counties with a thickness of about 18 inches. At several points along Leading Creek in Rutland Township, Meigs County, a workable thickness is found.

The "First Cow Run" sandstone is massive and coarse-grained and contains conglomerate zones. At Burlington, in southern Lawrence County, the river bluffs show an exposure of over 60 feet. This is unusually thick, an average being about 25 feet.

The Cambridge limestone lies from 240 to 300 feet below the Pittsburg coal and from 90 to 145 feet below the Ames limestone. In typical outcrops it is a gray rock forming a single bed about 28 inches thick. The stone is very hard and when struck gives a metallic ring. In places there is a double structure consisting of two beds of limestone interlain by several feet of shale containing a thin coal. Toward the south both beds are often cherty.

Below the Cambridge, a thin coal is often found. This is especially true in the southern counties. Here it sometimes reaches a thickness of 3 feet.

The Brush Creek or No. VIIa coal is of little importance in southern Ohio. It is usually represented by little more than a blossom.

The Mahoning sandstone is frequently shaly and does not show the persistent characteristics of the same horizon in Pennsylvania.

#### ECONOMIC FEATURES.

The few coal seams of the Conemaugh are too thin to be worked except in a very small way. Occasionally a local thickening gives a deposit which is stripped by the farmers for home use. Of these thin coal seams, the Patriot is probably the most persistent.

Limestone and iron ore deposits are very scant. Nowhere is there a limestone thick enough to play any part in the cement industry. The few thin outcrops are stripped by the farmers for use on the roads. The Ames and Cambridge are well suited for this purpose, being very hard and durable. The clays contain numerous zones of hematite nodules, but the deposits are too thin and scattered to be of any importance.

Beautiful laminated sandstones are not unknown in the formation but most of these are too friable for building purposes. Some of the more resistant rock is used for bridge abutments and foundations.

Most of the Conemaugh belt is not well adapted to agricultural purposes. The topography is very broken especially in the counties bordering on the Ohio River. The more resistant sandstone layers form abrupt ledges, while the thick beds of soft shale

are easily cut through by the streams. As a result there are numerous gorge-like valleys with narrow flood plains. The steep shale hills are much given to landslides. This unstable state of affairs makes much of the country of little use except for grazing purposes.

Although the preceding statements would seem to indicate that the Conemaugh is "barren" as its old name suggests, still there are certain redeeming features. The area was once covered with valuable forests and could be reforested. In addition it contains an inexhaustible supply of clay shale and is also an oil producer.

Formerly the region was clothed with unbroken forests of oak, tulip, walnut and other valuable timber. Very little of this former growth remains. In its place one finds large tracts of land overgrown with sumach, sassafras and blackberry bushes. It is a question whether it would not be well to convert such land into a forest reserve.

There is an unending supply of shale suitable for the manufacture of the rougher wares. At Athens, the shale of the Ames horizon is utilized in the making of an excellent grade of paving brick. At a few points, the clay below the Pittsburg coal becomes of economic importance, but at present it is not developed in the southern part of the state.

Two sandstone horizons have been demonstrated to be oil reservoirs, namely the massive sandstone with a base 90 feet below the Pittsburg coal and the "First Cow Run" sandstone lying above the Cambridge limestone. The former is not of great importance. A few pay wells in it have been put down near Marietta. The "First Cow Run" sand serves as a reservoir for the Chesterhill field<sup>11</sup> located in the adjoining corners of Athens, Morgan and Washington Counties. This field is ranked among the important oil territories of the state. It has been a producer since 1860. A narrow oil belt extends eastward from the Chesterhill field to the Ohio River in the vicinity of Marietta.

#### THE CAMBRIDGE AND AMES LIMESTONES.

The Cambridge and Ames limestones are valuable guides to the geologist, lying as they do in a section made up of a featureless monotony of shales and sandstone. There are certain lithological peculiarities about the two limestones by which one may be distinguished from the other by a person familiar with the two.

In addition to the lithological peculiarities it is probable that a study of the fauna of each horizon will reveal more striking differences. Although the writer has collected material from only a few places, yet a study of these fossils seems to warrant this inference.

Collecting was done in the Cambridge at Northup, Gallia County and at Langsville, Meigs County, twenty miles to the

11. Geol. Surv. Ohio, 4th Ser., Bull. I, pp. 126-139.

north. The Ames was visited at Carpenter, Meigs County, and at the shale quarry of The Athens Paving Brick Co., in the town of Athens.

Section of The Athens Brick Company's Quarry:

	Ft.	In.
Sandstone.....	5	
Shale.....	30	
AMES LIMESTONE.....	1	10
Shales, blue and red.....	35	
PATRIOT LIMESTONE.....	0	10
Shale, black, fossiliferous .....		

In the above section the Ames limestone is a single layer with numerous vertical divisions which cause the stone to come from the cliff in angular blocks. This is quite different from the Ames at Carpenter where it is shaly. The Patriot is a yellowish, nodular rock, cherty in places but highly fossiliferous. Large specimens of *Productus semireticulatus* and *Spirifer cameratus* are common. The underlying black shale is thickly spotted with *Chonetes verneuilianus* in all stages of growth from very small to large robust individuals.

List of fossils identified from the Ames limestone:

- Productus cora* D'Orbigny.
- Productus costatus* Sowerby.
- Productus semireticulatus* Martin.
- Productus pertenuis* ? Meek.
- Spirifer cameratus* Norton.
- Chonetes granulifer* Owen.
- Ambocælia planoconvexa* Shumard.
- Spiriferina kentuckyensis* Shumard.
- Lophophyllum profundum* ? Milne-Edwards & Haime.
- Petalodus destructor* Newberry & Worthen.

List of Cambridge fossils:

- Spirifer cameratus* Norton.
- Reticularia perplexa* McChesney.
- Spiriferina kentuckyensis* Shumard.
- Productus costatus* Sowerby.
- Productus cora* D'Orbigny.
- Productus punctatus* Martin.
- Productus semireticulatus* Martin.
- Derbya crassa* Meek & Hayden.
- Chonetes verneuilianus* Norwood & Pratten.
- Seminula subtilita* Hall & Clarke.
- Aviculopecten coxanus* Meek & Worthen.
- Lingula* sp.
- Pernopecten aviculatus* Swallow.
- Edmondia glabra* Meek.
- Phillipsia major* Shumard.

An inspection of the preceding lists shows that many species are common to both horizons but there are certain noteworthy exceptions. *Ambocælia planoconvexa* is abundant in the Ames but was not found in the Cambridge. *Chonetes granulifer* is so abundant as to form almost solid masses in the Ames but was not discovered in the Cambridge. On the other hand, *Chonetes verneuilanus* is extremely abundant in the Cambridge, while no specimens were found in the Ames. *Seminula subtilita* also common in the Cambridge, was not discovered in the Ames. Other species found only in the Cambridge are: *Reticularia perplexa*, *Productus punctatus*, *Derbya crassa*, *Aviculopecten carboniferus*, *Aviculopecten coxanus*, *Macrodon tenuistriata*, *Peronopecten aviculatus* and *Edmondia glabra*. No great importance is attached to this last list as only a few specimens of each species were found. Further search may reveal most of them in the Ames also.

Whether these faunal differences are representative of general widespread conditions or are only local variations in faunal distribution can only be determined by extensive collecting and thorough study. It is noteworthy, however, that faunal conditions are almost identical at the two collecting points in the Cambridge separated by a distance of more than twenty miles.

G. P. Grimsley, in his report on the Pan Handle district of West Virginia<sup>12</sup>, gives a list of fossils from the Ames limestone near Morgantown, as identified by Dr. J. W. Beede, of Indiana University. This list includes *Ambocælia planoconvexa* and *Chonetes granulifer*, so abundant in the Ames but not found in the Cambridge where the writer collected. Furthermore, the several species mentioned as occurring in the Cambridge limestone where visited, but wanting in the Ames, are also wanting in the Ames list of Morgantown, West Virginia, with the exception of *Derbya crassa* and *Aviculopecten carboniferus*.

The occurrence and non-occurrence of the above fossils in the Ames limestone at Athens, Ohio, and Morgantown, West Virginia, is probably more than a mere coincidence. It seems to indicate parallel faunal conditions at the time of deposition of the limestone, in the two rather widely separated regions.

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12. W. Va. Geol. Surv. County Rept., 1906, p. 127.