1948

# A Phase of the Upper Devonian of Western Highland County, Virginia

Helen Pulver Foreman
*Oberlin College*

# A PHASE OF THE UPPER DEVONIAN
# OF
# WESTERN HIGHLAND COUNTY, VIRGINIA

By
Helen F. Pulver
A. B., Berea College, 1946

A thesis submitted to the Faculty of Oberlin College
in partial fulfillment of the requirements
for the Degree of Master of Arts
in the Department of Geology

1948

PLATE I

Chemung formation, Alleghany Mountain locality, 3145
A fossiliferous bed of arenaceous shale, containing predominantly Douvillina cayuta; Schizophoria striatula in the upper and lower right hand corners, and a part of Tylothyris mesacostalis and Camarotoechia eximia in the center.

PLATE 1

# PREFACE

This paper is a study of the Brallier and Chemung formations of west Highland County, Virginia. The limits of the Brallier formation are determined on the basis of faunal and lithological evidence, and correlations made with formations in New York, Pennsylvania, Maryland and West Virginia.

The field work was carried on during the latter part of the summer of 1947 and the identification and correlations worked out in the winter of 1947 and the spring of 1948.

I wish to thank Mr. Minor B. Long and Mr. Bruce Weber for help in measuring the section of the field. I am grateful to Dr. E. C. Stumm for his interest and original suggestion of the problem. To Dr. C. W. Carlston I should like to express my thanks for valuable suggestions in the field and in the preparation of this manuscript. Above all I should like to express my deep appreciation to Dr. Fred Foreman under whose direction this problem was completed, for his continued encouragement and constant assistance.

H.F.P.

CONTENTS


| | Page |
|---|---|
| Introduction | 5 |
| PART I. HISTORICAL SUMMARY AND DEFINITION OF TERMS | 6 |
| Historical Summary and Definition of Terms | 8 |
| New York | 8 |
| Pennsylvania | 10 |
| Maryland | 12 |
| West Virginia | 13 |
| Virginia | 14 |
| PART II. STRATIGRAPHY AND PALEONTOLOGY | 17 |
| Type Sections of Portage and Chemung | 18 |
| Localities | 18 |
| Section No. 1, Caldwell, Greenbrier County, West Virginia | 21 |
| Section No. 2, Alleghany Grove, Alleghany County, Maryland | 21 |
| Section No. 3, Blair and Huntingdon Counties, Pennsylvania | 23 |
| Section No. 4, Catawissa, Columbia County, Pennsylvania | 24 |
| Section No. 5, Watkins Glen-Catatonk, Schuyler County, New York | 26 |
| Section No. 6, Alleghany Mountain, Highland County, Virginia | 28 |
| Location and methods | 28 |
| Geologic section | 28 |
| Lithology and fauna | 34 |
| Summary | 45 |
| Notes on the Local Fauna of the Upper Devonian Sequence in Highland County, Virginia | 48 |
| Bibliography | 66 |

# LIST OF ILLUSTRATIONS


PLATES:

| | | Page |
|---|---|---|
| Plate I | Douvillina cayuta, Chemung formation | Frontispiece |
| Plates II & III | Brallier and Chemung lithology..... | 32 & 33 |
| Plate IV | Brachiopoda ..... | 62 |
| Plate V | Brachiopoda ..... | 63 |
| Plate VI | Brachiopoda, Scaphopoda and Bryozoa.... | 64 |
| Plate VII | Pelecypoda ..... | 65 |

FIGURES:

| | | Following page |
|---|---|---|
| Figure 1 | Physiographic divisions of Virginia and Index Map of the location of Highland County, Virginia ..... | 6 |
| Figure 2 | Correlation Chart of the Upper Devonian in the eastern United States ..... | 16 |
| Figure 3 | Base Map of Geologic Sections ..... | 20 |
| Figure 4 | Topographic Map showing location of Section No. 6 ..... | 27 |

CHART:

Correlation Chart of Upper Devonian Sections 1-6 Inside back cover

## INTRODUCTION

The actual field work covered in this report is limited to one section on the east slope of Alleghany Mountain in western Highland County, Virginia. (see Fig. 1)

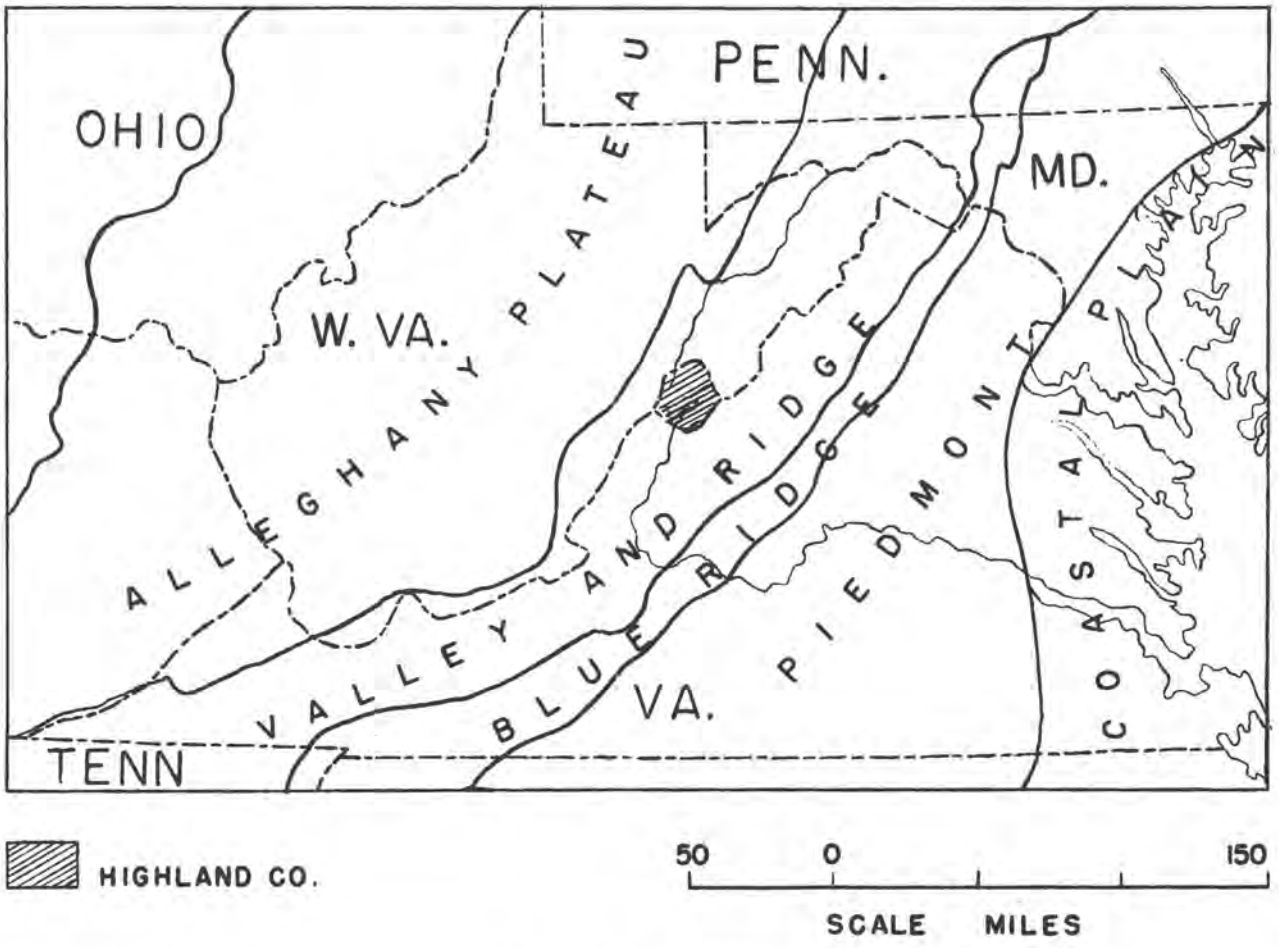
Highland County is in the northwestern part of Virginia. It borders West Virginia on the west and north, Augusta County on the east and Bath County on the south. It is in the western part of the Valley and Ridge Province and borders on the Alleghany Plateau to the west. (see Fig. 1)

This area has the typical valley and ridge type of topography with long linear ridges and valleys. The ridges are generally formed on the resistant Silurian sandstone formations and the valleys, if anticlinal, on the Middle Ordovician limestones, and, if synclinal, on the Upper Devonian shales.

Monterey valley is synclinal, formed on the soft Millboro shales with the ridges on either side of resistant Silurian Clinch sandstone. Crab Bottom Valley is an overturned anticlinal valley on Ordovician limestones of the Stones River and Black River groups, while Back Creek Valley is a monoclinal valley on the Upper Devonian Brallier shale. Whether the valley is primarily due to the shale or whether it is a possible fault structure has not been positively determined. Ridge elevations generally approximate 3900 feet, and valley floors, from 2400 to 2800 feet.

The drainage, as would be expected with this type of topography, is trellis. There are two main drainage divides in the region. Alleghany Mountain forms a divide between the waters flowing west to the Gulf of Mexico and the waters flowing east to the Atlantic Ocean.

The waters of the north flowing Potomac River are divided in a series of minor divides in Back Creek Valley, Crab Bottom Valley and Monterey Valley.




PHYSIOGRAPHIC DIVISIONS OF VA.

FIGURE 1

# PART I

## HISTORICAL SUMMARY AND DEFINITION OF TERMS

# PART I

## HISTORICAL SUMMARY AND DEFINITION OF TERMS

Upper Devonian sediments are represented in eastern North America by a series of marine shales and sandstones, grading to the east into terrestrial red beds. This series of deposits has been interpreted as representing conditions of a westward advancing shoreline with continental deposition at its easternmost border grading into a sandy and then shaley off-shore facies. Therefore, while red beds were being deposited in the east, marine shales and sandstones, contemporaneous in time but representing an entirely different type of sedimentation, were being deposited in the west.

### NEW YORK

In New York, where the Upper Devonian sequence was first studied, there appears to be no important break in sedimentation between the Middle and Upper Devonian. Instead, the base is marked by the sudden appearance of an immigrant fauna, Hypothyridina venustula, in the Tully limestone. This brachiopod marks the base of the accepted Upper Devonian of Europe (37*).[1] The Genesee, a black shale carrying what

---

*See bibliography.

[1]Cooper, G. A., and others (Devonian of North America, Geol. Soc. of America Bull. 53, pp. 1786-1788, 1942) restudied the Tully fauna and found a close relationship between the faunal elements of the Tully and the underlying Hamilton of Middle Devonian age. Because of this relationship they have placed the Tully at the top of the Middle Devonian and made the black Genesee shale the basal member of the Upper Devonian. The separation of the Middle and Upper Devonian is not the concern of the present problem and therefore only brief mention of this is made now. The Correlation Chart (Fig. 2) shows Cooper's interpretation of the division. The Tully, which has been identified outside of New York, only as far south as Bedford County in southern Pennsylvania (Willard, Bradford, Devonian of Pennsylvania, Pennsylvania Geol. Survey, 4th Ser. Bull. G 19, p. 222, 1939), and sediments considered equivalent in time have been placed in this paper for purposes of uniformity at the base of the Upper Devonian.

appears to be the forerunner of the Naples fauna, lies above the Tully.

The Portage and Chemung groups, with which this paper is primarily concerned, rise in ascending order over the black Genesee shale and are finally terminated by the westward transgression of Catskill terrestrial sediments which end the Upper Devonian.

In New York, James Hall (16), in 1843, proposed the name Portage for a series of dark shales and flaggy sandstones of post Gardeau age. It has since become a group name including all those beds between the Genesee and the Chemung. Chadwick[1] defines this as the Naples group, including the Naples fauna to the west and the Ithaca fauna to the east. It should be noted that the Naples fauna is not equivalent to the Naples group. The two facies of the Portage group recognized here are the sandy eastern Ithaca facies with its robust brachiopod fauna and the shaley western Naples facies with its tiny molluscan fauna. The overlying Chemung series of sandstones are generally considered to begin with the appearance of Cyrtospirifer "Spirifer" disjunctus. In the east, where the sandy Ithaca facies grades into the sandy Chemung with no marked change in lithology, this has been almost the only criteria used to differentiate the Portage-Chemung boundary. To the west, however, where the sandy Chemung directly overlies the dark shale of the Naples, the boundary between the Portage and the Chemung can be distinguished not only on a faunal basis but also by lithology.

---

[1]Chadwick, G. H., Faunal Differentiation in the Upper Devonian, Geol. Soc. America Bull., Vol. 46, pp. 313-314, 1935.

PENNSYLVANIA

A clear distinction between the beds of the Portage and Chemung groups was never made by early investigators in Pennsylvania. It was not until 1918, when Butts subdivided the Portage into the Burket, Harrell and Brallier, that a foundation was laid for the present day understanding of the Portage and Chemung groups of that state. Butts describes the following members.

Brallier shale: Fine grained, siliceous shale in thick, even layers revealing their fissility on weathering. Largely wavy or dimpled laminae, some even and slaty. A few thin fine grained sandstone layers. Fossils small and very scarce. Buchiola retro striata, Probeloceras lutheri, Bactrites aciculus, Phragmostoma natator. Upper Portage.

Harrell shale: Dove and black fissle (paper) shale. Black at bottom to west (Burket member). Black and dove interbedded to east. Buchiola retrostriata, Paracardium doris, Pterochaenia fragilis, Styliola Fissurela, Probeloceras lutheri. Lower Portage.[1]

Bradford Willard, in 1935, in his studies of the Portage of Pennsylvania (38) modifies Butts work at Altoona in this way.

| Willard, 1935 | Butts, 1918 |
|---|---|
| Portage group | Portage group |
| Fort Littleton formation | |
| Parkhead member | Brallier Shale |
| Brallier member | |
| Trimmers Rock member | |
| Losh Run member | |
| Harrell member | Harrell Shale |
| | Burket member |
| Rush formation | |
| Burket member | |
| Tully member | |

[1]Butts, Charles, Geologic section Blair and Huntingdon Counties Central Pennsylvania, Am. Jour. Sci., 4th Ser., Vol. 46, p. 631, 1918.

To the Portage of Butts, he gives two formational names, Fort Littleton and Rush. These represent respectively the replacing overlap phase when sediments from the Catskill delta were pushing the shoreline to the west and the earlier standing still period of maximum marine inundation. He defines members within these formations using Butts original classification and adding some terms to cover facies variation in the cycle of marine sedimentation. Thus he recognizes the Parkhead sandstone of the Maryland classification occurring at the top of the Portage in eastern and southern Pennsylvania, and below it, the Brallier shale as originally defined with the Trimmers Rock sandstone representing its sandy on-shore facies. The Losh Run member Willard identifies as a faunal zone occurring a short distance above the base of the Brallier in central Pennsylvania in a very restricted area.

The main difference in Willard's classification lies in the separation of the Harrell and Burket as respective members of the Fort Littleton and Rush formations. This he does on the basis of lithology and fauna showing how the Harrell intergrades lithologically with the Brallier, and how survivors from its (the Harrell) Naples fauna continue into younger beds. The Burket, which Butts describes as a phase of the Harrell, is separated and placed in the basal Portage, Rush formation. This, on the basis of a distinct difference in lithology and a faunal affinity with the underlying Tully formation, rather than with the overlying Naples. It should be noted that the Portage of Willard is expanded and includes all beds from the top of the Middle Devonian Hamilton to the base of the Chemung, while the New York Portage includes only those beds between the top of the Genesee and the Chemung.

MARYLAND

Upper Devonian sediments of Maryland were studied in 1913 by Prosser and Swartz, who used the following classification for sediments of that state.

Jennings formation
- Chemung member
- Parkhead member
- Woodmont member
  - Ithaca fauna
    - Liorhynchus globuliforme zone
    - Cladochonus-Reticularia laevis zone
  - Naples fauna
- Genesee member

From the above table can be seen that the Jennings formation is a much more inclusive term than any of the formational names used in Pennsylvania or New York. It includes all the beds from the top of the Hamilton to the base of Catskill sedimentation.

The Chemung member, limited at the base by Cyrtospirifer disjunctus is considered the equivalent of Chemung beds in New York and Pennsylvania.

The Parkhead and Woodmont members are correlated with the Portage group. The Parkhead consists of shale and interbedded sandstones and conglomerates (23) and carries an abundant Hamilton fauna. Its thickness is about 400 to 600 feet.[1] The lower Woodmont, 1200 to 1600 feet thick, consists mainly of greenish argillaceous and arenaceous shales alternating with thin sandstones of similar color all of which weather to a yellowish green. (23) The scarcely populated lower beds contain a Naples fauna, while in the upper strata occurs a profuse

[1]Woodward, H. P. (Devonian system of West Virginia, West Virginia Geol. Survey, Vol. 15, pp. 461 and 463) in his restudy of the Maryland Survey sections at Hancock and Little Orleans, Maryland, considers the Parkhead, even without Cyrtospirifer disjunctus as the basal member of the Chemung. (see p. 13 )

Ithaca assemblage.

The black shales occurring at the base of the Jennings carry a sparse Naples fauna and are believed to be correlative with the Genesee of New York.[1] Concerning this Prosser says, "The time of its deposition may not have been precisely identical with that of the Genesee shale of New York, however, it is believed that the difference in time was not great."[2]

WEST VIRGINIA

Upper Devonian sediments in West Virginia of Portage and Chemung time have been classified by Woodward,[3] using a modification of Willard's classification of the Pennsylvanian sediments.

| Willard, 1935 | Woodward, 1943 |
|---|---|
| Chemung | Chemung |
| Fort Littleton formation | (includes sandy Trimmers |
| Trimmers Rock member | Rock facies where present) |
| Brallier member | Brallier Shale |
| Losh Run member | |
| Harrell member | Harrell Shale |
| Rush formation | |
| Burket member | |
| Tully member | |

Facies variations are not present in West Virginia to the same extent that they are in Pennsylvania and Maryland because of its geographical location in relation to the source of sediments (Appalachia). It is further to the west and therefore the Trimmers Rock facies, equal

[1]Woodward, H. P. (ibid.) considers the Genesee of Maryland as equivalent of the Pennsylvania Harrell shale.

[2]Prosser, C. S., Middle and Upper Devonian, Maryland Geol. Survey, p. 347, 1913.

[3]Woodward, H. P., op. cit.

to the Maryland Parkhead sandstone and representing the on-shore equivalent of the Brallier shale, is present only in the northern portion of the state, the panhandle. Because of its limited distribution, Woodward has chosen to include these arenaceous beds which carry an Ithaca fauna in his Chemung formation rather than delimiting them with a separate facies name or including them in the Brallier, where faunal evidence would place them. He has then drawn his Chemung-Portage boundary on lithological criteria, which over the greater part of the state where the sandy facies is not present, coincides with the change from a Naples or Ithaca fauna of the Bralliers to the Chemung fauna containing Cyrtospirifer disjunctus without any problem arising. Mr. Woodward explains his problem, discusses several solutions, and defends his choice in a very thorough and clear manner.[1] He summarizes his solution in this way. "Restated in simplest terms, the Upper Brallier contact is here drawn at the lithologic boundary between shales and thin sandstones below, and sandstones and thin shales above. At most localities this boundary is confirmed by a change from Naples to Chemung faunas; but even where it is not, the boundary is maintained at the lithologic break for purposes of convenience. That an ultimate or adequate paleontologic solution has not been reached is perfectly apparent to the writer."[2]

The Brallier and the Harrell below are defined as in Pennsylvania, except that the Burket black shale has not been distinguished from the Harrell. No evidence of Tully limestone is found. The Harrell, therefore, rests disconformably on Middle Devonian sediments.

---

[1]Woodward, H. P., ibid. pp. 424-426.

[2]Woodward, H. P., ibid. p. 426.

VIRGINIA

In Virginia, the base of the Chemung, as in New York, Pennsylvania, Maryland and part of West Virginia, is marked by the appearance of a Chemung fauna characterized by Cyrtospirifer disjunctus. Below this is the Brallier shale, described by Butts as " ... a rather monotonous mass of subfissle, stiff, more or less sandy and micaceous green shale, commonly with uneven or dimpled surfaces in which are interbedded layers of very fine-grained, evenly thin-bedded, and blocky-jointed greenish sandstone."[1] According to Butts,[2] the Brallier succeeds beds of Naples age and is equivalent to the Hatch-Gardeau shales of New York. In the light of recent work by Chadwick (8,9) Willard (38), and Cooper (12), it would seem that the Brallier is the equivalent of sediments below these shales. Woodward states: "In view of what is now known about the New York formations named by Butts, it seems likely that the actual New York correlatives of the Brallier shale lie at a lower level than he has postulated. Rather than an equivalent of the Hatch and Gardeau beds, the writer suggests that the Brallier should be aligned with the Upper Ithaca and Enfield members of the Naples group at a horizon below that of the Grimes sandstone, which is basal Chemung. If Butts correlation is accepted, then the Brallier is partly Chemung in age."[3]

Butts (5) in his discussion of Devonian sedimentation makes no mention of the Upper and Middle Devonian contact, but maps a unit which he calls the Millboro shale that includes the Hamilton age Marcellus and the basal Portage beds.

---

[1]Butts, Charles, Geology of the Appalachian Valley in Virginia, Virginia Geol. Survey, Bull. 52, Pt. 1, p. 317, 1941)

[2]Butts, Charles, loc. cit.

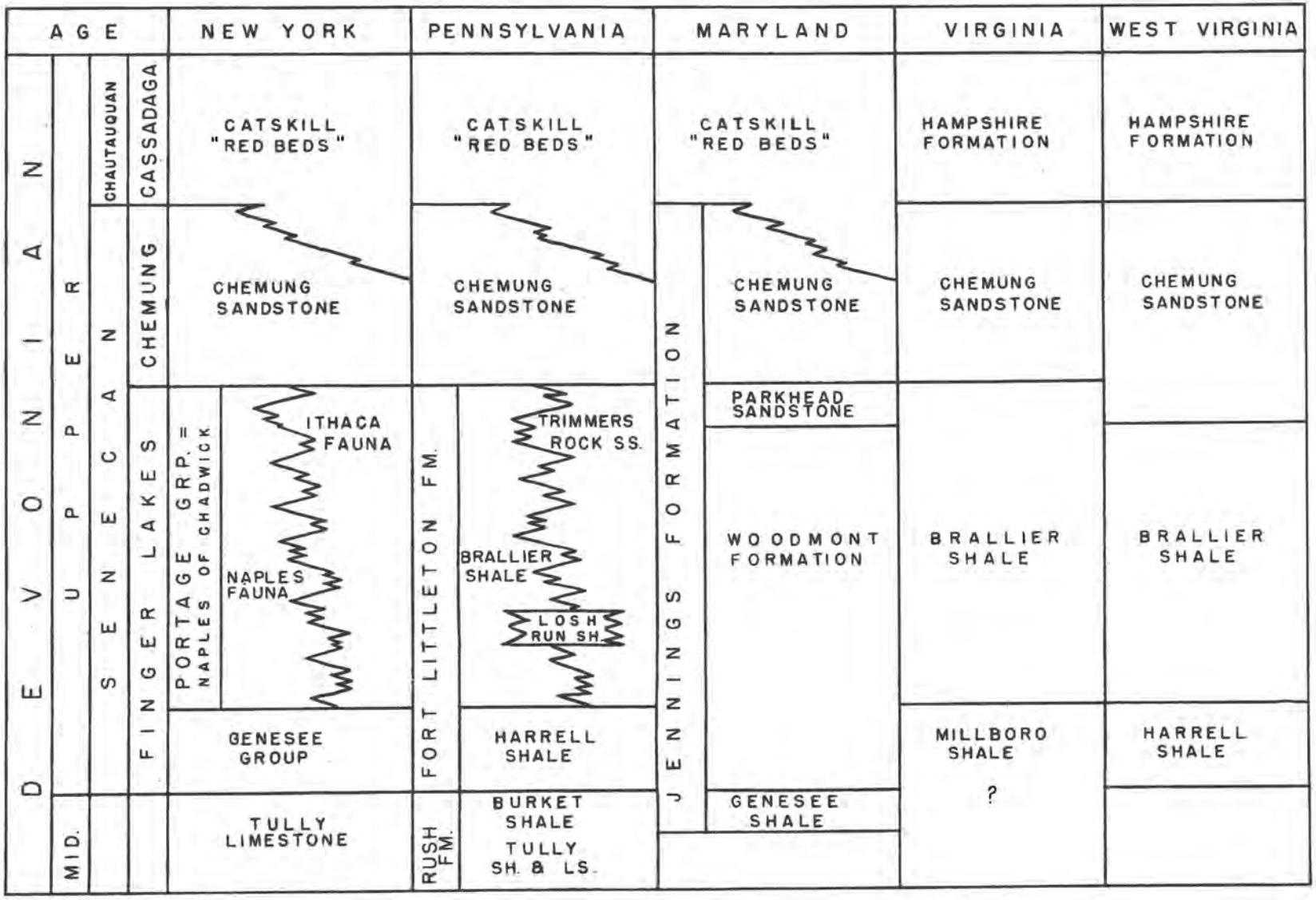
[3]Woodward, H. P., op. cit. p. 445.

In the section measured on Alleghany Mountain, I have used the terminology suggested by Woodward for West Virginia. This differs from Butts only in so far as the classification of the lower black shales is concerned. These I have correlated with the Harrell of West Virginia, rather than classifying them as part of the more inclusive term of Butts, the Millboro shale.

FIGURE 3

# CORRELATION CHART

MODIFIED AFTER G. A. COOPER 1942



# PART II

## STRATIGRAPHY AND PALEONTOLOGY

## PART II

## TYPE SECTIONS OF PORTAGE AND CHEMUNG

Typical sections describing Portage and Chemung age sediments have been studied and analysed in relation to the section measured on Alleghany Mountain, Highland County, Virginia, Section No. 6. The location of these sections can be seen in Figure 3. Columnar sections, giving details of lithology and faunal range, are given on the chart inside the back cover.

LOCALITIES:

Section No. 1. Caldwell, Greenbrier County, West Virginia.

This section is located directly east of the junction of Monroe Run and Howard Creek, extending east along the Chesapeake and Ohio Railway tracks.[1] This section is about 50 miles south, and a little to the west of the strike from Section No. 6.

Section No. 2. Alleghany Grove, Alleghany County, Maryland.

This section begins at the center of the trestle work over the Winchester Road, which leads southwest to Cresaptown, and extends westward 3433 feet, ending at the east of the first tunnel.[2] It is about 100 miles to the north and is east of the strike from Section No. 6.

---

[1]Price, P. H., and Heck, E. T., Greenbrier County; West Virginia Geol. Survey, pp. 203-204, 1939, in Woodward, H. P., op. cit., p. 475-6.

[2]Prosser, C. S., and Swartz, C. K., Middle and Upper Devonian, Maryland Geological Survey, pp. 523-527, 1913.

Section No. 3. Blair and Huntingdon Counties, Pennsylvania.[1]

This is a generalized section for the two counties. It was in this section, which is along the strike, about 160 miles north of Section No. 6, that Butts originally delimited the Brallier, Harrell and Burket shales. Blair and Huntingdon Counties are in the south central part of the state.

Section No. 4. Catawissa section, Columbia County, Pennsylvania.

It is located along the Susquehanna River, between the town of Catawissa and East Bloomsburg Station.[2] This section, to the east of Section No. 3, shows the variation in sedimentation across the strike. Its position in relation to the sediments, is about 75 miles across the strike from Blair County. Actually, it lies to the northeast, a distance of approximately 120 miles.

Section No. 5. Watkins Glen-Catatonk section, Schuyler County, New York.[3]

This is a generalized section for the Watkins Glen and Catatonk quadrangles. It is the type area where Hall, and Clarke and Luther did much of the original work on the Upper Devonian of New York State. These two counties are located in the south central part of the state.

---

[1]Butts, Charles, Geologic section of Blair and Huntingdon Counties, Central Pennsylvania, Am. Jour. Sci., 4th Ser., Vol. 46, pp. 523-527, 1918.

[2]Williams, H. S., and Kindle, E. M., Contributions to Devonian Paleontology, U. S. Geol. Survey Bull. 244, pp. 67-86, 1903.

[3]Williams, H. S., Tarr, R. S., Kindle, E. M., Watkins Glen-Catatonk folio, New York, U. S. Geol. Survey, folio no. 169, 1909.

Section No. 6. Alleghany Mountain section, Highland County, Virginia.

This section is located along U. S. route 250, on the east slope of Alleghany Mountain and the valley of Back Creek. All other locations of sections have been described in relation to this one.

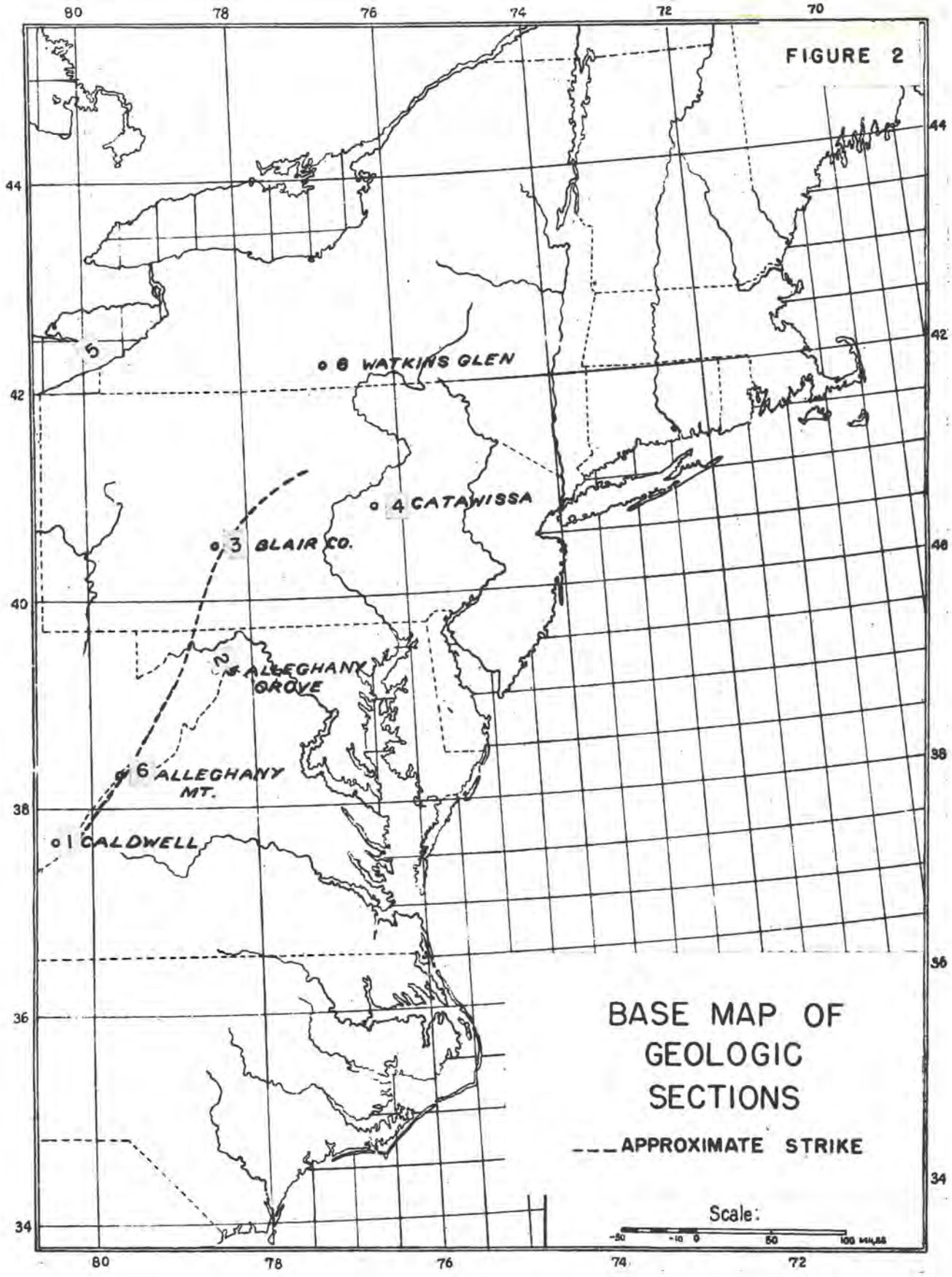


FIGURE 2
80
78
76
74
72
70
44
42
40
38
36
34
5
6 WATKINS GLEN
4 CATAWISSA
3 BLAIR CO.
ALLEGHANY GROVE
6 ALLEGHANY MT.
1 CALDWELL
BASE MAP OF GEOLOGIC SECTIONS
---APPROXIMATE STRIKE
Scale:
-50
-10
0
50
100 MILES

Section No. 1. Caldwell, Greenbrier County, West Virginia

Most of the work on correlations has been done to the north of Highland County, Virginia. This section to the south of Highland County is poor in that covered intervals comprise over half of the stated thickness. However, it does serve to show the character of the sediments and the faunal elements present.

Only the upper 602 feet of the Brallier shale are measured, and of these the uppermost 338 feet are covered, except for the very top four feet which consist of shale and grey flagstones. Above this is another covered interval of 538 feet before Chemung type sediments occur. Price and Heck, who measured the section, appear to have placed their boundary rather arbitrarily at the top of the four foot shale and sandstone layer. They give no faunal list for the Brallier, but do mention that fossils were found. As this section is taken from H. P. Woodward's, Devonian System of West Virginia, and not the original Survey Report by Price and Heck, this criticism is perhaps unjustified.

This section shows the southward thinning of the Chemung. In Highland County, Butts (5) and Woodward (46) give a total thickness of approximately 3000 feet for the Chemung. In this section, it is almost 2450 feet, and Woodward (46) gives a thickness of 450 feet in Pulaski County, southwestern Virginia.

Section No. 2. Alleghany Grove, Alleghany County, Maryland

The approximate contact between the Romney[1] and the Jennings marks the base of the section. This is in a concealed interval. No mention is made of the Genesee member of the Jennings, and the first

[1]The Maryland Survey has used the term Romney, proposed by Darton in 1894, for dark shales equivalent in time to the Onondaga, Marcellus and Hamilton formations of the Middle Devonian.

outcrop begins with sediments of the Woodmont shale member. In this area the Woodmont shale member of the Jennings formation, equivalent to the Brallier of Virginia, is abnormally thin; only 738 feet are present. This, Swartz says,[1] is probably due to compression, rather than lack of deposition. Only Ambocoelia umbonata and Chonetes are reported. The section in western Maryland, located to the north and to the east of the strike from Highland County, shows the beginning of sandstone deposition of the Parkhead type. However, the increase of arenaceous sediments is very slight. Concerning its separation from the Woodmont shale, Swartz writes:

> "The presence of the Parkhead is shown by the occurrence of a number of its characteristic species and by a slight development of sandstone .... The percentage of sandstone is, however, so slight as scarcely to distinguish this portion of the section from the strata of the Woodmont shale member."[2]

The Parkhead-Chemung boundary is drawn at the top of a 127 foot covered interval. The base of the Chemung is described as consisting of green fissle and hackly shale with thin sandstone bands. It is interesting to note that, although Prosser has written concerning this boundary,

> "The only assured criterion for the separation of the Chemung and Parkhead is the incoming with the Chemung of the Spirifer disjunctus fauna, the most distinctive members of which are Spirifer disjunctus and species of the genera Douvillina and Dalmanella."[3]

Swartz has drawn the boundary on what appears to be a lithological

---

[1]Swartz, C. K., Succession of the Portage and Chemung of Maryland, Jour. Geology, Vol. 16, p. 337, 1908.

[2]Swartz, C. K., Middle and Upper Devonian, Maryland Geol. Survey, p. 527, 1913.

[3]Prosser, C. S., op. cit., p. 421.

basis, as Cyrtospirifer disjunctus does not appear in the section for 208 feet after the contact has been marked. Douvillina cayuta and Leptodesma medon, diagnostic fossils of the Chemung (8) are given with a very short range. Douvillina cayuta occurs through about 500 feet, and Leptodesma medon through only about 200 feet. After 1829 feet of marine beds, the Chemung formation is terminated by "Catskill" terrestrial sediments described as reddish-brown, arenaceous shale and some green shale.

Section No. 3. Blair and Huntingdon Counties, Pennsylvania

This section contains beds of Cambrian through Pennsylvanian age. Only the Upper Devonian sediments will be discussed here. As this is a generalized section, there is no information concerning details of lithology and fauna.

Butts has recognized at the base of the section, in some localities only, a one foot band of limestone, containing Chonetes aurora, a characteristic fossil of the Tully of New York. Above this is the Harrell shale consisting, in Blair County, of 75 feet of black, fissle shale, the Burket member; and above it 200 feet of soft, dove-colored, highly fissle paper shale, forming the main portion of the Harrell. To the east, in Huntingdon County, the Harrell shale is about 250 feet thick and consists of the soft, dove-colored fissle shale interbedded with layersof the black shale. These are lower Portage sediments. A detailed discussion of correlation has been given in Part I of this paper and will not be repeated here. The Brallier shale above is given as varying in thickness from 1350 to 1800. The Brallier lithology is described as fine-grained, siliceous shale with a few thin, fine-grained sandstone layers. No mention is made of a sandy

type of sedimentation that might represent the Trimmers Rock facies of Willard, or of any Ithaca faunal elements. Willard, however, in an Upper Devonian section in Huntingdon County, which is in the same area, gives 165 ± feet of Trimmers Rock sandstone. His description is as follows:

> " ... sandy with Ithaca fauna which may include elements of the Maryland Parkhead. Fauna: Camarotoechia congregata var. parkheadensis, Tropidoleptus carinatus, and Tylothyris mesacostalis."[1]

Both men use Cyrtospirifer disjunctus to delimit the base of the Chemung. Butts gives a variable thickness of 2400 to 3300 feet, and Willard gives 3500 feet.

At the top of the Chemung the Catskill formation is given containing Cyrtospirifer disjunctus, Camarotoechia contracta, Grammysia elliptica, and Pteronites rostratus. This marine faunal assemblage differs from the usual interpretation of the term "Catskill" as indicating terrestrial sedimentation.

Section No. 4. Catawissa, Columbia County, Pennsylvania

This section, together with Butts work near Altoona (Section No. 3), gives a good example of the difference in sedimentation across the strike. In contrast to the more western section with its Naples fauna, this locality shows the development of the sandy facies of the Portage with an abundant well-developed Ithaca fauna. Kindle states:

> "During the interval represented by the shales and sandstones of the Nunda (Portage), two marine faunas, entirely distinct in origin and composition, occupied that portion of the Devonian sea which extended over the present area of central and western New York, central Pennsylvania and western Maryland. The habitat of these faunas extended southward into Virginia and West Virginia to a point not

[1] Willard, Bradford, Devonian Sequence near Huntingdon, Pennsylvania, Pennsylvania Acad. of Sci. Proc., Vol. 19, pp. 126-133, 1945.

> yet determined. In New York, where those contemporary faunas have been very thoroughly studied, one of them, usually called the Ithaca fauna, is found occupying an area lying in general to the eastward of that held by the other. The eastern fauna was the in-shore fauna while the western facies was the more pelagic and probably lived in deeper waters. That the two faunas were limited to their respective areas solely by marine conditions, such as ocean currents, or differences in depth or temperature, is indicated by the frequent interweaving and intermingling of the faunas located near the general boundaries between the two faunal provinces. The two Nunda (Portage) sections of Pennsylvania clearly show this differentiation. The dominance of the Ithaca fauna of the Catawissa section is as clear as is that of the Naples fauna of Butts' Altoona section. (Section No. 3)"[1]

At the base of the section, 25 feet of dark calcareous shales, containing a Hamilton fauna, have been correlated with the Tully. Above this, 225 feet of black fissle, unfossiliferous shales have been referred to the Genesee on the basis of lithology and position.

Sediments above this are described as dark, olive brown to bluish, sandy shales containing a Nunda fauna, (Naples fauna of later writers.) These extend upward, gradually grading, after about 200 feet, into sediments described as dark grey, greenish and bluish, sandy shales and sandstones, containing an abundant Ithaca fauna. Portage beds extend for 1800 feet before the advance of "Catskill" terrestrial sediments ends the marine type of deposition. No typical Chemung fauna is found below the red beds. Williams writes, concerning the encroachment of these terrestrial red beds from the east, before or during Chemung time:

> "The evidence for this conclusion is found in the appearance of the Ithaca fauna immediately below the lowest red beds. This Ithaca fauna occupies the section down to within 200 feet of the black shale beds of the Genesee, where the typical Nunda (Naples) fauna

---

[1] Kindle, E. M., Faunas of the Devonian Section Near Altoona, Jour. Geol., Vol. 14, pp. 633-634, 1906.

> occurs. Below the Genesee a typical Hamilton fauna is seen. No characteristic Chemung fossils appear in the whole section at Catawissa. The successive appearance of the Hamilton, Genesee, lower Nunda (Naples) and Ithaca fauna, terminated above by red beds, demonstrates the important fact that the Catskill type of sedimentation began in this region before the Chemung epoch opened."[1]

This is in distinct contrast to Section No. 3, Blair and Huntingdon Counties, where up to 3300 feet of Chemung are recorded before "Catskill" terrestrial sedimentation begins; and Highland County, where 3000 feet of Chemung are found before terrestrial sediments appear.

Section No. 5. Watkins Glen-Catatonk, Schuyler County, New York

The stratigraphic sections worked in this area are the original types for the Upper Devonian of the eastern United States.

The generalized section given by Williams designates at the base, the Genesee shale, as 100 feet of black, fissle shale, with a somewhat concretionary and argillaceous limestone near the top. (No mention is made of this being a possible representative of the Tully limestone.) Above this, the Portage formation, 1200-1300 feet, is divided into the Sherburne flagstone member, 180-260 feet of flaggy, thin-bedded sandstone and dark grey shale; the Ithaca shale member, 80-400 feet of dark, bluish, grey shale and interbedded sandstones; and the Enfield shale member, 750-900 feet of dark bluish grey shale, and thin-bedded sandstone. The Chemung formation, 1200-1300 feet thick, is divided into two members. The basal Cayuta member is 600 feet thick and the upper Wellsburg member is 600-700 feet thick.

---

[1] Williams, H. S., op. cit., p. 83.

Williams writes:

> "The Portage-Chemung line in the western half of the Watkins Glen quadrangle is recognized where the first traces of the Chemung Spirifer disjunctus fauna appear. This is indicated here and there in the western half and at many places in the eastern half of the quadrangle by the Dalmanella danbyi fauna."[1]

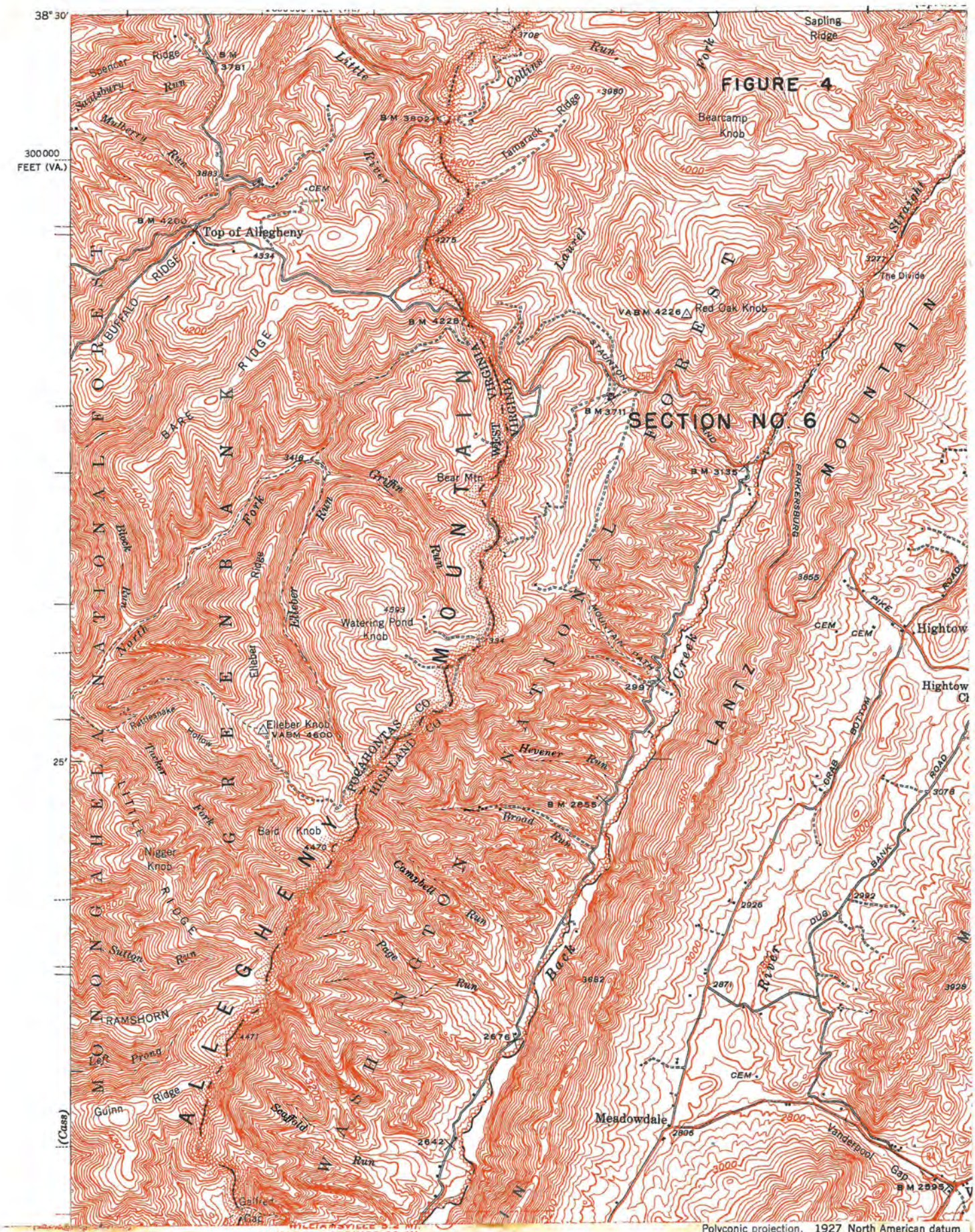
Faunal zones have been marked on the chart inside the back cover. Detailed faunal ranges can not be given, as the paleontologic chart which accompanies this section in the Watkins Glen-Catatonk folio appears to contain some errors. Cyrtospirifer disjunctus, which is given in the text as marking basal Chemung sediments, is given in the table as extending down through the Spirifer mesistrialis zone of the Ithaca shale member of the Portage and extending up only to the Spirifer disjunctus zone of the Cayuta shale member. Another discrepancy occurs with Spirifer pennatus var. posterus, which is described in the text as being so common that the Ithaca fauna might be called the Spirifer pennatus var. posterus fauna. This species is listed in the table, but no horizons are marked.

In this section the earlier appearance of "Catskill" sediments in the eastern quadrangles, as compared to its later appearance in the western quadrangles, is also noted.

The thicknesses are thinner than those given in the sections to the south. It is interesting to note that Tropidoleptus carinatus, a common zone fossil, reported in abundance in the New York and Pennsylvania Portage and Chemung was not found at the Alleghany Mountain locality in Virginia, although Butts (5) does find it in his report of the Virginia Chemung. Also Spirifer pennatus var. posterus = S. mucronatus var. posterus was not identified at the Alleghany Mountain locality, although it is a common Ithaca form.

---

[1] Williams, H. S., Watkins Glen-Catatonk Folio, New York, U.S. Geol. Survey, folio no. 169, 1909.




Scale $\frac{1}{62500}$

1 2 3 4 Miles

000 3000 4000 5000 6000 7000 Yards

000 9000 12000 15000 18000 Feet

2 3 4 5 Kilometers

Polyconic projection. 1927 North American datum
5000 yard grid based on U. S. zone system, B
10000 foot grids based on Virginia (North) and
West Virginia (South) rectangular coordinate systems

ROUTES USUALLY TRAVELED
HARD IMPERVIOUS SURFACES
OTHER SURFACE IMPROVEMENTS
U. S. ROUTE 1943
STATE ROUTE

MONTEREY, VA.-W. VA.
Edition of 1944

ntour interval 40 feet

N3815-W7930/15

## SECTION NO. 6 ALLEGHANY MOUNTAIN, HIGHLAND COUNTY, VIRGINIA

### Location and Methods

This section is located on the east slope of Alleghany Mountain, along U. S. route 250. It includes the valley between Alleghany Mountain and Lantz Mountain. The section was measured by plane table from 0 to 1115 feet and from there to 3275 feet by tape. Covered intervals were taped along the road. As the beds dip vertically over the greater part of the section, it is believed that the measurements taken along the road and given as thicknesses in this section are fairly accurate. All distances given in the section and in the discussion are vertical distances.

### Geologic Section No. 6 East Slope of Alleghany Mountain

| | | Thickness Feet | Vertical dist. from base at top of bed |
|---|---|---|---|
| | CHEMUNG shale (top not measured 1985 + ) | | |
| 31. | Sandstone and shale interbedded, ripple marks not so prominent and sandstone not so massive, Tylothyris mesacostalis, Cyrtospirifer disjunctus, Camarotoechia eximia, Atrypa spinosa, Cypricardella sp.?, Paleoneilo sp? ..... | 85 | 3590 |
| 30. | Shale and sandstone interbedded, ripple marks on top of almost all sandstone beds, occasional quartz pebbles, 2-4 mm. are found in the coarse sandstone beds. At 3470 feet, Cyrtospirifer disjunctus, Camarotoechia eximia, Cypricardella sp.? Paleoneilo sp.? and Atrypa spinosa..... | 37 | 3505 |
| 29. | Sandstone, massive with concretionary structures ..... | 5 | 3468 |
| 28. | Shale, thin bedded, grey green, with a few sandy layers; cylindrical structures, Fucoides ? ..... | 40 | 3463 |

| | | Thickness Feet | Vertical dist. from base at top of bed |
|---|---|---|---|
| 27. | Sandstone, massive, grey green; 1 foot knotty concretionary layer at base .... | 8 | 3423 |
| 26. | Shale, fine, grey green, interbedded with 2 to 8 inch sandstone beds with shaley parting, shale blue to dark red in phasss, occasional 1 to 3 feet bands of sandstone. At 3385 feet, tiny plant fragments ..... | 85 | 3415 |
| 25. | Covered interval ..... | 55 | 3330 |
| 24. | Shale, brownish grey, sandy interbedded with sandstone bands, occasional dark red phases in both shale and sandstone. At the base of the shale occurs a pocket with many Cypricardella bellastriata; at 3046 feet, concretionary structures appear in a 1 foot sandstone band. At 3065 feet, Leptodesma lichas, L. sociale, L. sp.? Tentaculites spiculus, Grammysia cf. arcuata, and many Chonetes scitulus and Ambocoelia umbonata; at 3145 feet, one Atrypa spinosa, Tylothyris mesacostalis, and small Schizophoria striatula, many Schuchertella chemungensis and Douvillina cayuta ..... | 235 | 3275 |
| 23. | Covered interval ..... | 155 | 3040 |
| 22. | Shale, sandy, dark red and grey green interbedded in equal proportions ..... | 78 | 2885 |
| 21. | Sandstone, dark red ..... | 1 | 2807 |
| 20. | Shale, grey green, sandy ..... | 18 | 2806 |
| 19. | Sandstone, grading from dark red to grey green, weathering black to purple and rusty, interbedded with grey green shale | 18 | 2788 |
| 18. | Sandstone, massive to shaley parting, dark red to grey green interbedded with grey green, sandy shale with blue phases due to weathering. At 2725 feet, 41 feet of massive sandstone beds are divided by a 2 foot band of shale which forms a gully between the two halves. At 2667 feet a sandstone bed with many Tylothyris mesacostalis occurs ..... | 180 | 2770 |
| 17. | Covered interval..... | 87 | 2590 |

| | | Thickness Feet | Vertical dist. from base at top of bed |
|---|---|---|---|
| 16. | Slumped ..... | 30 | 2503 |
| 15. | Shale, sandy, micaceous, grey green, interbedded with sandstone beds with shaley parting; at base for first 35 feet sandstone dominant. Up to about 2415 feet, many of the sandstone beds contain 1 inch bands crowded with fossils, mostly Ambocoelia umbonata ..... | 320 | 2473 |
| 14. | Covered interval ..... | 128 | 2153 |
| 13. | Shale and interbedded sandstone, green, shale soft at base, becoming sandy and micaceous at top, red weathering phase again prominent at base, stops near the middle and does not appear again. Beds slumped at top ..... | 110 | 2025 |
| 12. | Shale, grey green, interbedded with sandstone bands of same color; at 1892 feet a 1 foot band of sandstone with an 8 inch layer of yellow weathering sandy shale above. At 1875 feet a bed of reddish brown sandstone containing Schizophoria striatula, Cornellites chemungensis, Productella cf. onusta, P. speciosa Tylothyris mesacostalis and many Cyrtospirifer disjunctus ..... | 145 | 1915 |
| 11. | Shale, becoming arenaceous and micaceous, sandstone bands 2 to 6 inches again becoming prominent, in lower half weather purple to dark brown; at 1675 feet a 1 foot band of sandstone. At 1645 feet a very fossiliferous sandstone band containing Schizophoria striatula, Atrypa spinosa, Tylothyris mesacostalis Fenestrellina ?, and Cyrtospirifer disjunctus which appears for the first time at this point in the section; at 1720 feet Schizophoria striatula, Carniferella tioga, Grammysia subarcuata Douvillina sp.? Mytilarca sp.? at 1770 feet (culvert), Schizophoria striatula, Mytilarca chemungensis, Paleoneilo sp? Edmondia subovata, Paracyclas tenuis, Productella lachrymosa, P. hystricula and many Leiorhynchus mesacostale and Atrypa spinosa ..... | 165 | 1770 |

| | | Thickness Feet | Vertical dist. from base at top of bed |
|---|---|---|---|
| BRALLIER shale 1405 ± | | | |
| 10. | Shale, fine grained olive green weathering pink ..... | 61 | 1605 |
| 9. | Shale, fine grained, green, weathering purple to pink ..... | 9 | 1544 |
| 8. | Shale, green, becoming very sandy, few sandstone bands ..... | 135 | 1535 |
| 7. | Shale interbedded sandstone now both olive green, weathering to a dull grey green, in places yellow to red; contains at 1360 feet Schizophoria striatula, Tylothyris mesacostalis, Productella speciosa, Ambocoelia umbonata, and crinoid stems; at 1377 feet Carniferella sp.? Leiorhynchus cf. mesacostale, Tylothyris mesacostalis, and Productella lachrymosa ..... | 55 | 1400 |
| 6. | Shale, grey blue phase less, predominantly green, sandstone bands have shaley parting | 90 | 1345 |
| 5. | Shale, very fine grained, almost claylike, green to grey blue, weathers light blue to pink with brilliant red to orange phases. Sandstone bands 2 to 9 inches interbedded ..... | 140 | 1255 |
| 4. | Partly covered, few small exposures of green shale ..... | 335 | 1115 |
| 3. | Covered interval (bridge over Back Creek). | 430 ± | 780 |
| 2. | Sandstone beds, 6 to 8 inches thick, green, interbedded with greenish grey sandy shale. After about 50 feet the sandstone beds give way and the shale predominates. Occasional beds of black shale still present. Buchiola retrostriata, Probeloceras lutheri.... | 150 | 350 |
| HARRELL shale (base not exposed 200 + ) | | | |
| 1. | Shale, hard, thin bedded, dark grey to black with occasional sandstone bands..... | 200 | 200 |

PLATE II

A Harrell-Brallier contact marked by hammer, lower west slope of Lantz Mountain, 200. Black shales of the Harrell give way to sandstone beds and green shales of the Brallier.

B Chemung formation, 2235. Typical alternation of shales and thin sandstones of the lower Chemung. Sandstone bands often contain thin zones of Ambocoelia umbonata.

C Chemung formation, 2725. Massive sandstone on either side of 2 foot layer of soft easily weathered shale.

D Detail of lower right corner of C showing massive sandstone.

PLATE II

A

B

C

D

PLATE III

A Chemung formation, 2795. Thin bedded grey green, arenaceous shale, interbedded with thin sandstone bands with shaley parting.

B Chemung formation, 3363. Concretionary weathering effects in thin bedded shale, center is blue and outside red.

C Chemung formation, 3472. Psuedo-concretionary effects in massive sandstone, "storm rollers" of Willard.

D Chemung formation 3502. Ripple marks on massive coarse grained sandstone.

PLATE III

A

B

C

D

Lithology and Fauna

The base of the section is at the beginning of the black shale outcrops on the lower slopes of the west side of Lantz Mountain. This shale has been called the Harrell shale, after Woodward's classification in West Virginia, rather than using Butts' all inclusive term, the Millboro shale. (see page15) It is a hard, dark grey to black, rather thin-bedded shale carrying occasional sandstone bands and a very sparse fauna. Buchiola retrostriata and Pterochaenia fragilis were identified.

The contact between the Harrell and the overlying Brallier is drawn 200 feet from the base of the section, where dark grey to black, thin-bedded shale gives way to green sandstone beds, 6 to 8 inches thick, with interbedded greenish grey, sandy shale; still, however, with a few beds of black shale present. (See Plate II A). After about 50 feet, the ~~shale~~ SANDSTONE gives way, and ~~shale~~ beds predominate. Woodward describes the Brallier-Harrell contact in this way.

> "The upper Harrell contact is patently gradational, and the dark members of the black-shale facies interfinger along this contact with olive-green shales and thin sandstones of the overlying Brallier shale, which carries, in its basal members, approximately the same fauna."[1]

This contact is not altogether satisfactory, as after the first 150 feet of sediments a covered interval of 735 ± feet occurs. This covered interval is in the valley of Back Creek which could not be thoroughly investigated when the section was measured.

In the first 150 feet of Brallier, on the east side of the valley, below the covered interval, Probeloceras lutheri and Buchiola

---

[1]Woodward, H. P., op. cit., p. 391.

retrostriata are found in the green shale beds. The sandstone beds yield only very small, badly weathered crinoid stems. Pteridichnites biseriatus, listed as a guide fossil to the lower Brallier, by Butts[1] and Willard,[2] was not identified. Fossils are generally scarce.

On the west side of the valley, above the covered interval, the shale becomes very fine, light grey to blue, to olive green, with some brilliant red to orange weathering phases. The shale is soft and clayey. No fossils were found in the first 245 feet of the section after the covered interval. At 1360 feet from the base of the section, or 1160 feet from the base of the Brallier, an Ithaca assemblage appears carrying Schizophoria striatula, Productella speciosa, P. lachrymosa, Tylothyris mesacostalis, and Ambocoelia umbonata.

Of these forms, none are listed by Chadwick[3] as diagnostic. Tylothyris mesacostalis is given as making its first appearance, but going on through the Chemung. Ambocoelia umbonata is listed as making its last appearance. This disagrees with Butts (5), Woodward, (46) and myself, who have all identified Ambocoelia umbonata as a common fossil in the Chemung. After this, the beds become more and more arenaceous and micaceous, until at 1605 feet above the base of the section, or 1405 feet from the base of the Brallier, the Brallier-Chemung boundary is drawn. The boundary is not distinct lithologically, but grades from soft shale beds to harder and more arenaceous shales with a greater percentage of sandstone bands. Forty five feet above

---

[1]Butts, Charles, Geology of the Appalachian Valley in Virginia, Virginia Geol. Survey, Bull. 52, Pt. 1, p. 320, 1941.

[2]Willard, Bradford, Devonian of Pennsylvania, Middle and Upper Devonian, Pennsylvania Geol. Survey, 4th Ser., Bull. G 19, p. 216, 1939.

[3]Chadwick, G. H., Faunal Differentiation in the Upper Devonian, Geol. Soc. America Bull., Vol. 46, pp. 313-318, 1935.

this, the first appearance of Cyrtospirifer disjunctus is recorded. Actually, the boundary is difficult to draw on a lithological basis, as the change, from shaley beds with thin sandstones to sandstone beds with interbedded shale, is gradational. Concerning the Brallier-Chemung contact Butts writes:

> "The Brallier passes by imperceptible lithologic stages into the overlying Chemung formation, which is also composed of greenish or bluish clay-shale and mudrock with thick beds of sandstone. The Chemung and Brallier are fairly distinct lithologically a moderate distance either below or above the boundary between them, which is fixed at the horizon at which the large fossils of the Chemung appear, such as Ambocoelia umbonata, "Spirifer" disjunctus Leiorhynchus mesacostale, and species of Productella and Leptodesma. These fossils afford a criterion for the boundary which gives consistent results throughout the Appalachian Valley."[1]

Even after the appearance of Cyrtospirifer disjunctus, sandy shale beds predominate, and it is not until 2725 feet from the base of the section, or 1120 feet from the base of the Chemung that massive sandstone beds appear. (see Plate II D)

A typical Chemung faunal assemblage occurs throughout the shale and sandstone beds identified as Chemung. The following is a list of the Chemung fauna identified from the Alleghany Mountain locality.

Chemung fauna, identified from Alleghany Mountain locality

Echinodermata:

crinoid stems

Brachiopoda:

Douvillina cayuta (Hall)
Schuchertella chemungensis (Conrad) =
Schellwienella chemungensis (Conrad)
Chonetes scitulus Hall

---

[1]Butts, Charles, Guidebook 3, Southern Appalachian region; XVI Internat. Geol. Congr., U. S. A., p. 21, 1932, in Woodward, H. P., op. cit., p. 420.

Productella lachrymosa (Conrad)
Productella hirsuta Hall
Productella cf. onusta Hall
Carniferella tioga (Hall)
Schizophoria striatula (Schlotheim)
Camarotoechia eximia (Hall)
Leiorhynchus mesacostale (Hall)
Atrypa spinosa or hystrix Hall
Cyrtospirifer "Spirifer" disjunctus (Sowerby)
Tylothyris mesacostalis Hall
Ambocoelia umbonata (Conrad)

Bryozoan:

Fenestrellina ? Orbigny

Pelecypoda:

Edmondia subovata Hall
Grammysia subarcuata Hall
Paleoneilo sp. ?
Cornellites chemungensis (Conrad)
Leptodesma lichas Hall
Leptodesma sociale Hall
Mytilarca chemungensis (Conrad)
Cypricardella bellastriata (Conrad)
Paracyclas tenuis Hall

Schaphopoda: (Incertae sedis)

Tentaculites spiculus Hall

Plantae:

Abundant fragmentary material not specifically identified. Appear to be algal remains. Some Thallus-like flattened remains of land plants.[1]

Of these Chadwick[2] lists only Douvillina cayuta as being diagnostic of the Chemung. The following species he lists as making their first appearance in the Chemung, but going on through to other formations: Cyrtospirifer disjunctus, Dalmanella tioga, Atrypa hystrix and Leptodesma lichas.

Productella onusta and Mytilarca chemungensis, according to

[1]Identification of plant fragments by Mrs. H. V. Bartoo, Oberlin College.

[2]Chadwick, G. H., op. cit., pp. 318-323.

Chadwick,[1] make their first appearance in the Canadway group, which is above the Chemung, and Tentaculites spiculus is given as a diagnostic species of the Naples. Probably the identifications of the above three species should be questioned. However, Butts[2] also lists Mytilarca chemungensis as occurring in the Chemung.

The fossils, throughout the measured Chemung, are found in pockets or along a bed with one or two species predominating and a few, usually small specimens, of other forms represented, Thus, there occur many small communities of fossils within the larger Chemung fauna. Some beds show evidence of the shells having been broken and transported to their present position by wave and current action.

Forty feet above the base of the Chemung, a weathered, very fine-grained, micaceous sandstone carries the first specimen of Cyrtospirifer disjunctus. Only one specimen was found, although the band contains many specimens of Atrypa spinosa, and Schizophoria striatula. Tylothyris mesacostalis is also common. Some bryozoans are present. Internal and external molds of both valves of these brachiopods are found. It is interesting to note that no pelecypods occur in this assemblage.

Not all beds, however, contain such a limited, although well-preserved, fauna. At 1720 feet from the base of the section, or 115 feet from the base of the Chemung, there are a series of arenaceous green shales containing a great variety of fossil forms, distributed rather sparsely through the beds. Specimens of bryozoans and tiny, unidentifiable pelecypods are common, but larger forms such as productids, Carniferella tioga, Schizophoria striatula, and Grammysia subarcuata are represented by only an occasional specimen.

---

[1]Chadwick, G. H., loc. cit.

[2]Butts, Charles, Geology of the Appalachian Valley, Virginia Geol. Survey, Bull. 52, Pt. 1, p. 331, 1941.

Fifty feet above these shales occurs a fossiliferous group of sandstones and arenaceous shales. One bed of the shales contains specimens of only Leiorhynchus mesacostale, in places very closely packed and crowded, one on top of the other. Another shaley, but more arenaceous, bed is crowded with specimens of Atrypa spinosa, Schizophoria striatula, and productids. These are the common forms. Paracyclas tenuis, Edmondia subovata, Mytilarca chemungensis and Paleoneilo sp? also occur, but less frequently. Three feet above, is a bed of light yellow to brown, micaceous sandstone with thin layers of soft shale. It contains many Cyrtospirifer disjunctus and Atrypa spinosa.

At 1875 feet from the base of the section, or 270 feet from the base of the Chemung, is found a fossiliferous weathered, reddish brown, sandstone band containing many large brachiopods and pelecypods. Cyrtospirifer disjunctus is the most common form. With it occur the ever present Atrypa spinosa and fragments of Tylothyris mesacostalis and Cornellites chemungensis. This is the last bed where, with the exception of Tylothyris mesacostalis, large brachiopods occur for 1270 feet. Specimens of Cyrtospirifer disjunctus have, up to this bed, been of the variety with long alate hinge line and mucronate cardinal extremities.

Above this occur unfossiliferous beds of shale interbedded with sandstone with a red to orange weathering phase of some surfaces. Above is a 128 foot covered interval.

A hard, dark, almost blue, fine, sandstone layer, at 2170 feet above the base of the section, or 570 feet above the base of the Chemung, contains broken fragments of Tylothyris mesacostalis and Ambocoelia umbonata. This is the first appearance of Ambocoelia in the Chemung,

although a few single specimens have been found in the upper part of the Brallier shale. This is followed by 250 feet of shale interbedded with sandstone. At the base of many of the sandstone beds are thin fossil zones, one-half inch to one inch thick, almost completely filled with Ambocoelia umbonata. These small Ambocoelia are found either alone or associated with other small brachiopods, except, as mentioned above, when they are found with fragments of the large brachiopod Tylothyris mesacostalis. Shale interbedded with sandstone continues for 257 feet with only fragments of fossils found. This distance includes 117 feet of slumped beds and covered interval.

The next fossil zone is a medium-grained, dark sandstone found at 2672 feet from the base of the section, or 1067 feet from the base of the Chemung. Here is a bed of large unbroken Tylothyris mesacostalis, larger than any of the specimens found in the shale beds below. This is the only species present here. It is not certain whether this represents a community group of Tylothyris, excluding all other fauna, or whether it is the result of the sorting action of waves bringing these large shells together. The former explanation seems to be the most likely, for, although only single valves are found, there is an apparent equal distribution of both dorsal and ventral valves, as might be expected in a community group. About a half inch above, still in the same bed of sandstone, occurs a layer of small broken fragments of this same brachiopod.

Above this bed are 372 feet of unfossiliferous beds. This includes, at the top, a 155 foot covered interval. The lithology of these beds is so varied that a detailed section is given below from the top of the 117 foot covered interval, which is 2590 feet from the

base of the section, to the base of the 155 foot covered interval, which is 2885 feet from the base of the section. This section includes the Tylothyris mesacostalis zone.

| | | Thickness in feet |
|---|---|---|
| | Base of covered interval, vertical distance from base of section is 2885 feet | |
| 32. | Shale, alternating equally in color change between brownish grey to green shale and dark red shale. Each color band varying 2 to 4 feet in width ..... | 49 |
| 31. | Shale, dark red, interbedded about every 2 feet with 2 inch layers of greyish green shale ..... | 12 |
| 30. | Shale, dark red ..... | 17 |
| 29. | Sandstone, dark red ..... | 1 |
| 28. | Shale, arenaceous, greyish green ..... | 18 |
| 27. | Sandstone, massive, grading in color from dark red to grey green, weathering black to purple and rusty Interbedded with grey green shale ..... | 18 |
| 26. | Shale, grey green ..... | 1 |
| 25. | Sandstone, dark red, with psuedo-concretionary structures ..... | 2 |
| 24. | Sandstone, dark red, grading into shale over the last three feet ..... | 4.5 |
| 23. | Shale ..... | 1 |
| 22. | Sandstone ..... ..... | 4 |
| 21. | Shale, dark, grey green ..... | 11 |
| 20. | Sandstone, shaley grey, weathering purple ..... | 3 |
| 19. | Sandstone, massive, shaley parting in places ..... | 18 |
| 18. | Shale, weathers out and forms gully between sandstone beds ..... | 2 |
| 17. | Sandstone, massive, in places shaley parting ..... | 20 |
| 16. | Shale, weathers out and forms gully between sandstone beds ..... | 1 |

| | | Thickness in feet |
|---|---|---|
| 15. | Sandstone ..... | 4 |
| 14. | Shale, green with blue weathering effects that are not continuous along the beds ..... | 8 |
| 13. | Shale, maroon ..... | 1 |
| 12. | Sandstone ..... | 1 |
| 11. | Shale ..... | 4 |
| 10. | Sandstone, massive, containing psuedo-concretionary structures ..... | 4 |
| 9. | Shale, grey green, sandy phases give appearance of sandstone beds ..... | 7 |
| 8. | Sandstone, grey green, contains Tylothyris mesacostalis ..... | 5 |
| 7. | Shale, olive green, with light blue weathering phases which are not continuous along the beds. Shale is so arenaceous it gives the effect of sandstone bands in places..... | 18 |
| 6. | Sandstone, dark blue, weathers rusty ..... | .5 |
| 5. | Shale, 2 feet green, 1 foot blue and green ..... | 3 |
| 4. | Sandstone ..... | 1 |
| 3. | Shale ..... | 4 |
| 2. | Sandstone, maroon with shaley parting, appears massive ..... | 12 |
| 1. | Shale, arenaceous, grey green, interbedded with sandstone showing shaley parting ..... | 31 |

Top of covered interval, vertical distance, 2590 feet from base of the section

Immediately after the covered interval, a small pocket of Cypricardella bellastriata occursin a bed of soft, fine shale. This is 1439 feet from the base of the Chemung. Specimens show both valves, some closed and some partially open. Preservation is particularly good, and the specimens do not seem to be damaged in any way that

would indicate that they were carried to their present position by wave and current action. The evidence seems to point to this being merely a small colony of this species, entombed in position of growth.

About 10 feet above, are beds of arenaceous shale containing many Ambocoelia umbonata and Chonetes scitulus. These specimens of Ambocoelia are not as fragmentary as in the lower beds. This is the first appearance of Chonetes in the section, although, it is considered a common form in the Chemung. From here up it occurs in abundance. The presence, for the first time in the section, of a few small specimens, about one-third normal size, of Douvillina cayuta along with the Chonetes and Ambocoelia, is an interesting feature of these beds. These three genera, the small Douvillina and the normal-sized Ambocoelia and Chonetes are about the same size, which may indicate that this is grouping due to wave sorting. Large pelecypods, such as Leptodesma and Grammysia occur scattered throughout the shales, singly or in small groups. They were not found in the crowded beds of small brachiopods mentioned above. However, occasional specimens of Chonetes are found with the larger pelecypods.

Forty feet above, specimens of Tentaculites spiculus occur (see p. 38 ) in dark, very arenaceous shale beds.

At 3145 feet from the base of the section, or 1540 feet from the base of the Chemung, 3 feet of fossiliferous, brownish grey, arenaceous shales occur. The fossil zones contain, almost entirely, Douvillina cayuta and Schuchertella chemungensis, (see Plate I) but occasionally relatively small specimens of Schizophoria striatula, Tylothyris mesacostalis and Camarotoechia eximia are also found. These beds mark the first appearance in 1270 feet, with the exception

of Tylothyris mesacostalis, of the large brachiopod fauna found at the base of the Chemung. New elements, Douvillina cayuta and Schuchertella chemungensis, have been added to this fauna. Other forms, such as Atrypa spinosa, and productids, which were common in the lower beds, are now scarce or entirely absent. These reappear, further along in beds not included in this measured section.

The shale, interbedded with sandstone, continues with occasional poorly preserved fossil fragments. At 3385 feet from the base of the section, or 1780 feet from the base of the Chemung, plant fragments and cylindrical structures, Fucoides ? were found. Here, too, psuedo-concretionary structures begin to occur prominently. These are not concretions, but rounded effects, probably due to weathering in the shale. (see Plate III B) Sandstone beds are more massive, and knotty concretionary zones are present. These are figured by Willard[1] as "storm rollers." Again, these are not actually concretions, but probably due to pressure and weathering. On the under side of these so-called "storm rollers", the shale beds, when present, are often contorted as in a gouge zone. At 3472 feet from the base of the section, or 1867 feet from the base of the Chemung, a four foot bed of sandstone with this concretionary "storm roller" structure is found. (see Plate IV C)

Above this layer ripple marks are prominently displayed on the upper surface of the sandstone beds (see Plate III D). Large plant fragments, up to three inches long, are abundant on the bedding surfaces of the sandstone. When ripple marks are not present, the

[1]Willard, B., Devonian of Pennsylvania, Pennsylvania Geol. Survey, 4th ser., Bull. G 19, p. 211, fig. 52, 1939.

surfaces of the beds are in places covered with small circular depressions filled with a soft, fine silty type of deposit.

After about 40 feet, the sandstone beds are no longer so massive, ripple marks are not so prominent, and shale beds again predominate. Specimens of pelecypods and brachiopods are found. Specific identification is difficult because of poor preservation. Many of the sandstone beds containing fossils are dark, lumpy, coarse-grained, and very micaceous, with some beds containing small 2 to 4 mm. quartz pebbles. Cyrtospirifer disjunctus was identifiable from some of the sandstone beds. This form differs from those found in the lower beds in that it is more round, and does not have mucronate cardinal extremities.

In the upper beds, ripple marks, land plant fragments, and coarse sediments would seem to indicate shallow water, near shore deposition.

The measured section ends at the beginning of the covered interval before the quarry. This is 3590 feet vertically above the base of the section. Butts (5) and Woodward (46) give an approximate total thickness of 3000 feet for the Chemung in Highland County.

Summary

The Brallier shale, in this section, is 1405 feet thick, as compared with 2600-2700 feet for the Brallier in Pendleton County, West Virginia, which is directly along the strike to the north. This apparent thinning, together with the physiographic appearance of Back Creek Valley, (see Fig. 4) suggests a fault in the valley. An equivalent of the Trimmers Rock sandstone of Pennsylvania (Parkhead sandstone of Maryland), which represents near-shore deposition during Portage time, is not present in this section. This indicates the position of the section in relation to the source of the sediments to the east.

Instead, the Brallier shale type of lithology continues up to the Brallier-Chemung contact. This contact is placed 45 feet below the appearance of Cyrtospirifer disjunctus, where arenaceous shales become prominent, rather than at the exact bed where the first specimen of Cyrtospirifer disjunctus is found. As noted before, arenaceous shales continue for 1120 feet before massive sandstones of typical Chemung type appear.

Although the sandstone facies is not present, some of its Ithaca faunal elements are found in the shales of the upper Brallier, showing migration of these forms from beds where they are typically developed. Woodward[1] also notes Ithaca faunal elements in the upper part of the Brallier shale of West Virginia.

The Ithaca fauna of the Brallier, and the Chemung fauna of the lower part of the Chemung formation, appears to be of a distinctly smaller size than the same species figured by Hall in New York, and by Clarke and Swartz in Maryland. This small fauna is perhaps due to its development in the deeper off-shore facies of shale deposition, rather than in the near-shore sandstone facies where the forms are typically developed. In the upper portion of the Chemung section, where the proportion of sandstone is greater, fossil forms attain normal size.

I have tried in this discussion to present a picture of the faunal aggregates in relation to the sediments in which they were found. There has been little attempt to interpret specific conditions of sedimentation. This should wait until detailed sedimentary analyses of the section can be made and used in conjunction with the

[1]Woodward, H. P., op. cit., p. 424.

paleontological data, and until more information has been compiled concerning the paleoecological relationships of the fauna to their enclosing sediments.

## NOTES ON THE LOCAL FAUNA OF THE UPPER DEVONIAN SEQUENCE OF ALLEGHANY MOUNTAIN, HIGHLAND COUNTY, VIRGINIA

The corals are represented by one small cup coral, which was not identified.

Abundant fragments of crinoid stems are found throughout the section.

Two distinct forms of bryozoan are recognized. One has been referred to the genus Fenestrellina; the other, a small branching form, has not been identified. They are abundant in some beds.

Brachiopods are represented by the greatest number of species.

The mollusca are represented by a number of species of pelecypods.

Plant fragments are particularly abundant in the sandy beds of the Chemung formation. Some small fragments were noted in the upper beds of the Brallier.

The following is a catalogue of the more common fossils found on the east slope of Alleghany Mountain. This is not an exhaustive list. Further collecting will probably reveal many more species. All horizons are given in feet, vertical distance from the base of the section. No attempt has been made to give a complete synonymy of each species. In every case the references used in identification have been listed.

ANIMAL KINGDOM

Phylum BRACHIOPODA
Class ARTICULATA
Order PROTREMATA
Genus DOUVILLINA Oehlert

DOUVILLINA CAYUTA (Hall)

Plate V, fig. 6

Strophodonta cayuta Hall, 1867, Pal. New York, vol. iv, p. 110, pl. xix, fig. 1-5
Stropheodonta (Douvillina) cayuta Hall and Clarke, 1892, Pal. New York, vol. viii, pt. i, pl. xv, figs. 18, 19
Douvillina cayuta Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev. p. 555, pl. xlviii, figs. 8-17, pl. xliv, figs. 1, 2

Remarks: Internal molds of both valves are found extremely well preserved. This form was found in a sandy shale bed at 3145 almost to the exclusion of all other forms; an occasional Schuchertella chemungensis and Schizophoria striatula were found in the same bed. Below this one specimen, much smaller in size was found in a bed of Ambocoelia umbonata and Chonetes scitulus. Typical specimens measure: length 16 mm., width 26 mm. It is noted that this is smaller than the measurements of Clarke and Swartz which give average measurements of length 25 mm., width 45 mm.

Occurrence: Chemung formation. 3145 and 3055

Genus SCHUCHERTELLA Girty

SCHUCHERTELLA CHEMUNGENSIS (Conrad)

Streptorhynchus chemungensis Hall, 1867, Pal. New York, vol. iv, p. 67, pl. x, figs. 1-26
Orthotetes chemungensis Hall and Clarke, 1892, Pal. New York, vol. viii, pt. i, pl. x, fig. 9, pl. xia, fig. 14
Schuchertella chemungensis Grabau and Shimer, 1909, vol. i, p. 230, fig. 281a-b

Remarks: This genus is the same as Schellwienella of Caster (5) and Chadwick (7).

Occurrence: Chemung formation. 3145

Genus CHONETES, Fischer

CHONETES SCITULUS Hall

Plate V, figs. 1, 3

Chonetes scitula Hall, 1867, Pal. New York, vol. iv, p. 130, pl. xxi, fig. 4, pl. xxii, figs. 6-11
Chonetes scitula Hall and Clarke, 1892, Pal. New York, vol. viii, pt. i, pl. xvi, figs. 3, 4, 27, 32, 40, 44
Chonetes scitulus Grabau and Shimer, 1907, N. A. Index Fossils, vol. i, p. 237, figs. 289 a,b
Chonetes scitulus Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 150, pl. xii, figs. 1-8
Chonetes scitulus Shimer and Shrock, 1944, Index Fossils of N. A., p. 345, fig. 11

Remarks: This small brachiopod occurs in great profusion in the upper sandy beds of the Chemung formation. It makes its first appearance at 2275, which is 670 feet from the base of the Chemung, in an almost coquina like band of badly weathered sandstone containing broken specimens of Chonetes, Ambocoelia, and crinoid buttons, along with a few fragments of Spirifers. Typical specimens measure: length 6-5 mm.; width 8-7 mm. A small form measured: l. 3 mm.; w. 5 mm. Generally the specimens are smaller than the dimensions given by Clarke and Swartz in the Maryland Geological Survey Report, 1913.

Occurrence: Chemung formation. From 2275 up to the top of the section.

Genus PRODUCTELLA Hall

PRODUCTELLA LACHRYMOSA (Conrad)

Plate VI, figs. 1, 2

Productella lachrymosa Hall, 1867, Pal. New York, vol. iv, pl. xxv, figs. 23-28

Productella lachrymosa Clarke and Swartz, 1913, Maryland Geol. Survey Middle and Upper Dev., p. 564, pl. 1, figs. 20-22, pl. li, figs. 1-3

Productella lachrymosa Shimer and Shrock, 1944, Index Fossils of N.A., p. 347,

Remarks: This species is the most abundant representative of the genus Productella. Preservation is best in the soft shales of the upper Brallier, where this form is plentiful. In the higher sandy Chemung beds, preservation was such that species identifications of the genus Productella could not be made. "It differs from P. speciosa in possessing fewer spines, which are attached by elongated bases." Clarke and Swartz, 1913.

Occurrence: Abundant in the Upper Brallier, probably in the Chemung.

PRODUCTELLA HIRSUTA Hall

Plate VI, fig. 3

Productella hirsuta Hall, 1867, Pal. New York, vol. iv, p. 166, pl. xxiv, figs. 17-29
Productella hirsuta Butts, 1941, Virginia Geol. Survey, Bull. 52, pt. 2, p. 216, pl. 123, figs. 18, 19

Remarks: A flattened interior mold of a dorsal valve was found. "The interior of the dorsal valve is marked by numerous fine elongate papillae, and towards the margin these are very closely arranged. In the midst of these are the coarser pustules indicating the spine-bases of the exterior surface" Hall, 1867.

Occurrence: Chemung formation, 9-1770

Genus CARINIFERELLA Schuchert and Cooper

CARINIFERELLA TIOGA (Hall)

Plate V, fig. 8

Orthis tioga Hall, 1867, Pal. New York, vol. iv, p. 59, pl. viii, figs. 20-29

Schizophoria tioga Hall and Clarke, Pal. New York, vol. viii, pt. i, pl. vi, figs. 17, 18
Dalmanella tioga Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 569, pl. lii, figs. 1-4
Cariniferella tioga Schuchert and Cooper, 1932, Mem. Peabody Museum of Nat. Hist., vol. iv, pt. 1
Cariniferella tioga Shimer and Shrock 1944, Index Fossils of N. A., p. 353, pl. 138, figs. 34-38

Remarks: This species so closely resembles C. carinata that positive identification of the species is doubtful. Hall 1867, "Shell transverse broadly elliptical, about two-thirds as long as wide ... Surface striated; striae angular, often fasciculate, curving upwards on the hinge line. As stated before identification of this species was not always definite.

Occurrence: Upper Brallier and lower Chemung.

## Genus SCHIZOPHORIA King

### SCHIZOPHORIA STRIATULA (Schlotheim)

Plate V, figs. 2, 4, 7

Orthis impressa Hall, 1843, Geol. New York, pt. 4, p. 267, fig. 2
Orthis impressa Hall, 1867, Pal. New York, vol. iv, p. 60, pl. viii, figs. 11-19
Schizophoria striatula Schuchert, 1897, Bull. U. S. Geol. Survey, No. 87, p. 375
Schizophoria striatula Grabau and Shimer, 1909, N. A. Index Fossils, vol. 1, p. 268, fig. 321 d-f
Schizophoria striatula Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev. p. 572, pl. lii, figs. 14-18, pl. liii, figs. 1, 10
Schizophoria striatula Butts, 1941, Virginia Geol. Survey, Bull. 52, pt. 2, p. 215, pl. 123, figs. 14-17

Remarks: This common brachiopod occurs in a number of sizes and shapes. The small forms are generally flat while the larger specimens exhibit a highly arched umbo. Large forms are particularly common at the base of the Chemung, however, the form runs through from the Upper Brallier to the top of the section.

Occurrence: Upper Brallier and Chemung formation.

Order TELOTREMATA
Genus CAMAROTOECHIA Hall and Clarke

CAMAROTOECHIA EXIMIA (Hall)

Plate IV, figs. 1, 2

Atrypa eximia Hall, 1843, Geol. New York, pt. 4, tab. 66, fig. 4
Rhynchonella (Stenochisma) eximia Hall, 1867, Pal. New York, vol. iv, p. 348, pl. lv, figs. 1-8
Camarotoechia eximia Hall and Clarke, 1893, Pal. New York, vol. viii, pt. ii, p. 192, pl. lvii, figs. 44, 45
Camarotoechia eximia Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 579, pl. liv, figs. 1-4

Remarks: This small brachiopod occurs in the sandstone and shale layers. Preservation of most of the specimens from the sandstone are poor, however, they do show the surface plications, about 22, with 5 to 6 appearing in the fold and sinus. Clarke and Swartz characterize this species as possessing fine plications, finer than in the other species of the fauna; illy defined sinus and fold, and in being usually slightly convex. All the specimens exhibit these characteristics.

Occurrence: Chemung formation, 3470

Genus LEIORHYNCHUS Hall

LEIORHYNCHUS MESACOSTALE (Hall)

Plate IV, figs. 7, 8?

Leiorhynchus mesacostalis Hall, 1867, Pal. New York, vol. iv, p. 362 pl. lvii, figs. 18-25
Liorhynchus mesacostale Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 581, pl. liv, figs. 5-8
Leiorhynchus mesacostale Butts, 1941, Virginia Geol. Survey, Bull. 52, pt. 2, p. 215, pl. 123, figs. 7, 8
Leiorhynchus mesacostale Shimer and Shrock, 1944, Index Fossils of N.A. p. 313, pl. 119, fig. 4

Remarks: This little brachiopod occurs in profusion in the Lower beds of the Chemung. The specimens are well preserved. The surface of one bed from which specimens were taken consisted almost entirely of this

form. The description given by Clarke and Swartz applies to these specimens. "Shell of rhynchonelloid aspect with but moderately convex valves and quite low median fold and sinus. Fold and sinus bear three or four rounded plications which do not reach the beak, while on the lateral slopes of the valves plications are obscure or altogether obsolete leaving the surface smooth. In the dorsal valve a low medium septum reaches to about the middle of the shell. Length 18 mm; width 20 mm." Measurements of three forms found are: length 12, 17, 15 mm.; width 14, 20, 22 mm.

Occurrence: Chemung formation, 1770

Genus ATRYPA Dalman

ATRYPA SPINOSA Hall

Plate IV, figs. 3, 4, 5, 6

Atrypa spinosa Hall, 1843, Geol. of New York, pt. 4, p. 200, figs. 1, 2
Atrypa spinosa, vel aspera Hall, 1867, Pal. New York , vol. iv, p. 322, pl. 53a, figs. 1-14, 18, 24, 25
Atrypa spinosa Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 587, pl. lv, figs. 12, 13
Atrypa spinosa Shimer and Shrock, 1944, Index Fossils of N. A., p. 319, figs. 4, 5

Remarks: All forms of this genus have been referred to this species. Gradational forms moving toward A. hystrix at one extreme and A. reticularis at the other were observed. However the variations were not so great as to warrant species designations for them. Some of the specimens were excellently preserved showing the development of the spinose surface. Two typical specimens measured: length 30, 25 mm.; width 32, 24 mm.

Occurrence: Upper Brallier and Chemung formations. Abundant in the lower part of the Chemung formation; common throughout.

Genus CYRTOSPIRIFER Nalivkin

CYRTOSPIRIFER DISJUNCTUS (Sowerby)

Plate VI, figs. 6, 9, 10

Spirifera disjuncta Hall, 1867, Pal. New York, vol. iv, pl. xli, fig. 1-19, pl. xlii, figs. 1-20
Spirifer disjunctus Hall and Clarke, 1894. Pal. New York, vol. viii, pt. ii, pl. xxx, figs. 14, 15, 17
Spirifer disjunctus Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev. p. 593, pl. lvi, figs. [illegible] pl. lvii, fig. 1
Spirifer disjunctus Butts, 1941, Virginia Geol. Su[illegible]52, pt. 2, p. 208, pl. 121, figs. 18, 19
Cyrtospirifer disjunctus Shimer and Shrock, 1944, [illegible] N.A. p. 321, pl. 122, figs. 1-3

FIGURE 3

Remarks: "Spirifer" disjunctus may be at once distinguished from other Devonian Spirifers of this age by the fine ribs on its fold and sinus. However it may vary in its form and proportions from a short winged, plump shell to a narrow, slender form with greatly extended cardinal angles, this feature abides as its distinguishing characteristic." Clarke and Swartz 1913. Both forms described above were noted in the section. The more elongated forms occurring in the shales and sandy shales of the lower Chemung, while the plump forms occurred in the lumpy sandstone beds above. This species is possibly the most important and well known of the upper Devonian fauna, as it has long been used as a guide fossil to indicate the base of the Chemung. It is used even when lithological data shows no change in the type of sedimentation.

Occurrence: From the base of the Chemung upward. First occurrence, 1645

Genus TYLOTHYRIS North

TYLOTHYRIS MESACOSTALIS Hall

Plate VI, figs. 4, 5

Spirifera mesacostalis Hall, 1867, Pal. New York, vol. iv, p. 240, pl. xl, figs. 1-13
Spirifer (Delthyris) mesicostalis Grabau and Shimer, 1909, N. A. Index Fossils, vol. i, p. 332, fig. 424 a
Spirifer (Delthyris) mesacostalis Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 601, pl. lviii, figs. 11-23, pl. lix, figs. 1, 2
Spirifer (Delthyris) mesicostalis Butts, 1941, Virginia Geol. Survey, Bull, 52, pt. 2, p. 207, pl. 121, figs. 13-16
Tylothyris mesacostalis Shimer and Shrock, 1944, Index Fossils of N. A., p. 323, pl. 122, figs. 20, 21

Remarks: This form is the most abundant of the Spirifers. All specimens, whether internal or external molds are easily identifiable by the lamellose surface, the wide hinge with mucronate cardinal extremities, ventral sulcus with strong median costa, and a dorsal fold with corresponding median groove.

Occurrence: Upper Brallier and throughout the Chemung. At 2672 a sandstone band carrying only this species occurs.

## Genus AMBOCOELIA Hall

### AMBOCOELIA UMBONATA Conrad

Plate V, figs. 5, 3

Ambocoelia umbonata Hall, 1867, Pal. New York, vol. iv, p. 259, pl. xliv, figs. 7-18
Ambocoelia umbonata Hall and Clarke, 1893, Pal. New York, vol. viii, pt. ii, pl. xxix, fig. 15, pl. xxxix, figs. 4-9
Ambocoelia umbonata Clarke and Swartz, 1913, Maryland Geol. Survey, Middle and Upper Dev., p. 200, pl. xx, figs. 1, 2
Ambocoelia umbonata Butts, 1941, Virginia Geol. Survey, Bull. 52, pt. 2, p. 209, figs. 26-29
Ambocoelia umbonata Shimer and Shrock, 1944, Index Fossil of N. A., p. 320, figs. 21-26

Remarks: This small brachiopod is probably the most common fossil in the section. Its most common occurrence is in small half inch zones at the base of sandstone layers. Where it occurs in such profusion as to form almost a coquina. Generally it is associated with Chonetes scitulus, and crinoid stems. Specimens are generally smaller than those figured

by Hall, and Shimer and Shrock.

Occurrence: Upper Brallier and Chemung formations.

Phylum BRYOZOA
Class ECTOPROCTA
Order CRYPTOSTOMATA
Genus FENESTRELLINA Orbigny

FENESTRELLINA ? Orbigny

Plate VI, fig. 7

Fenestrellina Shimer and Shrock, 1944, Index Fossils of N. A., p. 263, pl. 99

Remarks: This bryozoan has doubtfully been referred to this genus.

Occurrence: Chemung formation.

Phylum MOLLUSCA
Class PELECYPODA
Order PRIONODESMACEA
Genus GRAMMYSIA Verneuil

GRAMMYSIA SUBARCUATA Hall

Plate VII, fig. 1

Grammysia subarcuata Hall, 1885, Pal. New York, vol. v, pt. i, p. 375, pl. lxi, figs. 10-21, pl. xciii, fig. 26.

Remarks: This excellently preserved specimen shows the surface characteristics noted by Hall. Fine, close concentric striae and strong subangular concentric ridges or folds. The surface is also marked by fine, radiating, pustulose striae.

Occurrence: Chemung formation 1720. Only one specimen was found.

Superfamily NUCULACEA
Genus PALAEONEILO Hall

PALAEONEILO ? Hall

Plate VII, fig. 3

Palaeoneilo Hall, 1885, Pal. of New York, vol. v, pt. i, pp. 333-348

Palaeoneilo Shimer and Schrock, 1944, Index Fossils of N. A., p. 377, pl. 146, figs. 22-24.

Remarks: Shimer and Schrock describe this genus, shell nuculoid, with extended anterior and posterior ends, and more or less defined depression along umbonal slope.

Occurrence: Numerous poorly preserved specimens are doubtfully referred to this genus. They occur in the upper horizons of the Chemung formation in dark lumpy sandy beds, very micaceous. 3529.

Superfamily PTERIACEA
Genus CORNELLITES Williams

CORNELLITES CHEMUNGENSIS (Conrad)

Plate VII, fig. 4

Pterinea chemungensis Hall, 1884, Pal. New York, vol. v, pt. i, p. 98, pl. xvi, figs. 3, 7, 10, pl. lxxxiv, fig. 21.
Cornellites chemungensis Shimer and Shrock, 1944, Index Fossils of N.A., p. 383, pl. 148, figs., 19, 20

Remarks: Shell large; surface of left valve marked by slender subequal or alternating rays continuing over posterior wing; interspaces flat.

Occurrence: Chemung formation. Only fragmentary specimens were found. Frequent from 1722 to 1875

Genus LEPTODESMA Hall

LEPTODESMA LICHAS Hall

Plate VII, fig. 9

Leptodesma lichas Hall, 1883, Pal. New York, vol. v, pt. i. p. 232, pl. xxi, figs. 35-39, pl. xci, figs. 19, 20

Remarks: Two external molds of this pelecypod were found at the same horizon. The molds show the fine concentric striae which are irregularly crowded producing an undulated aspect to the surface described by Hall. The shell is of medium size, sub-rhomboidal.

Occurrence: Chemung formation 3055

LEPTODESMA SOCIALE Hall

Plate IV, fig. 10

Leptodesma sociale Hall, 1883, Pal. New York, vol. v, pt. i, p. 187, pl. xxi, figs. 24-28, (33, 34 ?)
Leptodesma sociale Grabau and Shimer, 1909, N. A. Index Fossils, vol. i, p. 426, pl. 556, fig. c
Leptodesma sociale Butts, 1941, Virginia Geol. Survey, Bull. 52, pt. 2 p. 212, pl. 122, fig. 13

Remarks: This tiny pelecypod has the size and shape characteristics described by Hall, however, the specimens found show only faint traces of concentric striae and are not conspicuous and regular as noted in the description.

Occurrence: Chemung formation. 3055

Genus MYTILARCA Hall

MYTILARCA CHEMUNGENSIS (Conrad)

Plate VII, figs. 5, 6

Mytilarca chemungensis Hall, 1883, Pal. New York, vol. v, pt. i, p. 258, pl. xxxii, figs. 8-11, 13, 14
Mytilarca chemungensis Butts, 1941, Virginia Geol. Survey, Bull. 52, pt. 2, p. 211, pl. 122, fig. 9
Mytilarca chemungensis Shimer and Shrock, 1944, Index Fossils of N. A., p. 387, pl. 149, fig. 32, 33

Remarks: Hall describes this pelecypod: shell of medium size, much elongated from beak to posterior extremity; body narrow, elongate-ovate, sub-arcuate; length averaging twice the height but with considerable variation.

Occurrence: Chemung formation 1770. This is a common species in the lower part of the Chemung formation.

Order TELEODESMACEA
Superfamily CYPRICARDACEA
Genus CYPRICARDELLA Hall

## CYPRICARDELLA BELLASTRIATA (Conrad)

Plate VII, figs. 7, 8

Microdon (Cypricardella) bellistriatus Hall, 1885, Pal. New York, vol. v, pt. i, p. 208, pl. xlii, figs. 8b, 17-20, pl. lxxiii, figs. 7-22, pl. lxxiv, figs. 5-10
Cypricardella bellistriata Grabau and Shimer, 1909, N. A. Index Fossils, vol. 1, p. 535, fig. 727, c, d
Cypricardella bellastriata Shimer and Shrock, 1944, Index Fossils of N. A., p. 417, pl. 166, figs. 4, 5

Remarks: Many specimens were found in a pocket of soft fine shale. The specimens were well preserved, clearly showing the characteristic, strong, even surface striae. Considerable variation in the size and shape is believed due to compression. All specimens found are smaller than the smallest dimensions recorded by Hall for characteristic specimens of this species, length 28 mm; height 21 mm. Specimens found range from length 24, 21, 18, 15 mm; height 15, 10, 11, 11, mm. These specimens should perhaps have been referred to C. gregaria Hall, because of their small size, however because of their strong even striae they have been classified as C. bellastriata.

Occurrence: Chemung formation 3044

## Superfamily LUCINACEA
## Genus PARACYCLAS Hall

## PARACYCLAS TENUIS Hall

Plate VII, fig. 2

Paracyclas tenuis Hall, 1885, Pal. New York, vol. v, pt. i, p. 443, pl. lxxii, figs, 20-22, pl. xcv, fig. 25

Remarks: This tiny pelecypod is characterized by its small size and very fine, concentric striae.

Occurrence: Chemung formation. Only one specimen referable to this genus was found. Hall records this species from the shales of the Hamilton Group.

Class SCHAPHOPODA (Incertae Sedis)
Genus TENTACULITES Schlotheim

TENTACULITES SPICULUS Hall

Plate VI, fig. 8

Tentaculites spiculus Hall, 1879, vol. v, pt. ii, p. 172, pl. xxxi, figs. 21-25
Tentaculites spiculus Grabau and Shimer, 1910, N. A. Index Fossils, vol. ii, p. 12

Remarks: This minute form of Tentaculites is described by Hall 1879, "Form slender-elongate, annulated cone; very gently expanding from the apex ... annulations abruptly elevated, sometimes rounded and oblique to the axis of the cone ... " Length 6 mm., dia. 1 mm. This form occurs frequently in the sandstone and sandy shale beds of the Chemung formation. Chadwick (7) gives it as an index fossil of the Naples.

PLATE IV
all figures are x2

Page

Figs. 1, 2. Camarotoechia eximia (Hall) ..... 53
Ventral and dorsal valve of same specimen
Chemung formation, 3470

Figs. 3-6. Atrypa spinosa Hall ..... 54
3, 4. Internal mold of dorsal and ventral valve of same specimen
Chemung formation, 1645
5, 6. Dorsal valves, note detail of teeth at beak.
Chemung formation, 1770

Fig. 7. Leiorhynchus mesacostale (Hall) ..... 53
Internal mold of dorsal valve
Chemung formation, 1770

Fig. 8. Leiorhynchus cf. mesacostale (Hall) ..... 53
Internal mold of dorsal valve. Specimen shows only three plications on fold and only two on sulcus.
Brallier shale, 1387

PLATE IV

1

2

3

4

5

6

7

8

PLATE V

Page

Fig. 1. Chonetes scitulus Hall ..... 50
Group of three, showing fine bifurcating striae. x2
Chemung formation 3063

Figs. 2, 4, 7. Schizophoria striatula (Schlotheim). 52
2. Internal mold of ventral valve.
Brallier shale, 1415
4. Internal mold of ventral valve.
Chemung formation, 3145
5. Internal molds of two ventral valves.
Chemung formation, 1645

Fig. 3. Chonetes scitulus Hall x2..... 50
Ambocoelia umbonata (Conrad) x2
Douvillina cayuta (Hall) small individual x2
Chemung formation, 3055

Fig. 5. Ambocoelia umbonata (Conrad) ..... 56
Internal mold of ventral valve x2
Brallier shale, 1415

Fig. 6. Douvillina cayuta (Hall) ..... 49
Internal mold of ventral valve
Chemung formation, 3145

Fig. 8. Carniferella tioga ? (Hall) ..... 51
Internal mold of ventral valve
Chemung formation, 1803

PLATE V

1

2

3

4

5

6

7

8

PLATE VI


| | Page |
|---|---|
| Figs. 1, 2. Productella lachrymosa (Conrad) ..... | 50 |
| 1. Ventral valve x2<br>Brallier shale, in float at 262 | |
| 2. Ventral valve<br>Brallier shale, 1360 | |
| Fig. 3. Productella hirsuta Hall ..... | 51 |
| Chemung formation, 1770 | |
| Figs. 4, 5. Tylothyris mesacostalis (Hall) ..... | 55 |
| 4. Internal mold of ventral valve, showing characteristic median septum<br>Chemung formation, 1645 | |
| 5. External mold of dorsal valve, showing lamellose surface.<br>Chemung formation, 2672 | |
| Figs. 6, 9, 11. Cyrtospirifer disjunctus (Sowerby). | 55 |
| 6. Dorsal valve, showing mucronate cardinal extremities<br>Chemung formation, 1875 | |
| 9, 11. Dorsal and ventral valves<br>Chemung formation, 1875 | |
| Figs. 7, 10. Fenestrellina ? ..... | 57 |
| 7. Chemung formation, 1722 | |
| 10. Chemung formation, 1645 | |
| Fig. 8. Tentaculites spiculus Hall x2 ..... | 61 |
| Chemung formation, 3105 | |

PLATE VI

1

2

3

4

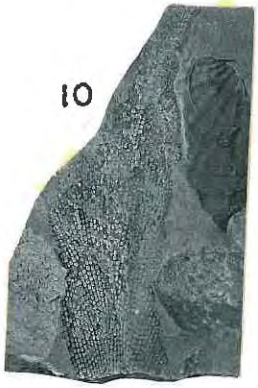
5

6

7

8

9



10

11

PLATE VII

Page

Fig. 1. Grammysia subarcuata Hall ..... 57
View, showing both valves
Chemung formation, 1720

Fig. 2. Paracyclas tenuis Hall x2 ..... 60
Chemung formation, 1770

Fig. 3. Paleoneilo sp. ? x2 ..... 57
Chemung formation, 3529

Fig. 4. Cornellites chemungensis (Conrad) ..... 58
Chemung formation, 1722

Figs. 5, 6. Mytilarca chemungensis (Conrad) ..... 59
6. Shows encrustations of bryozoan ?
both from Chemung formation, 1770

Figs. 7, 8. Cypricardella bellastriata (Conrad) ... 60
Specimens show variation in form. x2
Chemung formation, 3044

Fig. 9. Leptodesma lichas ..... 58
External mold, a portion of the hinge line is visable on the wing.
Chemung formation, 3055

Fig. 10. Leptodesma sociale ..... 59
Specimens show extended hinge line. x2
Chemung formation, 3055

PLATE VII

1

2

3

4

5

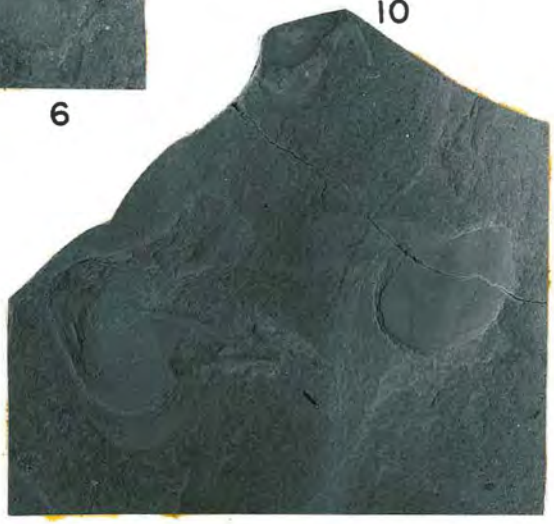
6

7

8

9

10



BIBLIOGRAPHY

1. Bunch, Rosella, The Stratigraphy and Paleontology of the Silurian system of parts of Highland County, Virginia, Masters Thesis, Oberlin College, 1940.

2. Butts, Charles, Devonian Section near Altoona, Jour. Geology, Vol. 14, pp. 618-630, 1906.

3. Butts, Charles, Geologic Section Blair and Huntingdon counties Central Pa., Am. Jour. Sci., 4th ser., Vol. 46, p. 531, 1918.

4. Butts, Charles, The Brailler Shale and Chemung Formation of Central Pennsylvania and Virginia and their Bearing on the Portage-Chemung Question (abst.), Virginia Acad. Sci. Proc., p. 67, 1935-36.

5. Butts, Charles, Geology of the Appalachian Valley in Virginia, Virginia Geol. Survey Bull. 52, pt. 1 and 2, 1941.

6. Caster, K. E., Higher Fossil Faunas of the Upper Alleghany, Bull. Am. Paleontology, Vol. 15, No. 58, 1930.

7. Caster, K. E., Review of the Devonian of Pennsylvania, Middle and Upper Devonian by Bradford Willard, Jour. Paleontology, Vol. 14, No. 7, pp. 605-610, 1940.

8. Chadwick, George Halcott, Faunal Differentiation in the Upper Devonian, Geol. Soc. America, Vol. 46, pp. 305-342, 1935.

9. Chadwick, George Halcott, Chemung is Portage, Geol. Soc. America, Vol. 46, pp. 343-354, 1935.

10. Chadwick, George Halcott, Summary of Upper Devonian Stratigraphy, The Midland Naturalist, Vol. 16, No. 6, 1935.

11. Cloud, Preston E., Jr., Terebratuloid Brachiopoda of the Silurian and Devonian, Geol. Soc. America, SP. 38, pp. 1-182, 1-26 pl., 1942.

12. Cooper, G. A., and others, Correlation of the Devonian Sedimentary Formations of North America, chart no. 4, Geol. Soc. America, Vol, 53, pt. 4, pp. 1729-1794, 1942.

13. Darton, N. H., Monterey, Virginia, U. S. Geological Survey, folio no. 61, 1898-1899.

14. Grabau, A. W., and Shimer, H. W., North American Index Fossils, Vol. 1, 1909.

15. Grabau, A. W. and Shimer, H. W., North American Index Fossils, Vol. II, 1910.

16. Hall, James, Natural History New York, Geology, Part 4, 1843.

17. Hall, James, Natural History New York, Paleontology, New York Geol. Survey, Vol. 4, pt. 1, 1867.

18. Hall, James, Natural History New York, Paleontology, New York Geol. Survey, Vol. V, pt. ii, 1879.

19. Hall, James, Natural History New York, Paleontology, New York Geol. Survey, Vol. 5, pt. 1, 1884 and 1885.

20. Hall, James, Natural History New York, Paleontology, New York Geol. Survey, Vol. 8, pt. 1 and 2, 1892.

21. Kindle, E. M., Faunas of the Devonian Section Near Altoona, Pennsylvania, Jour. Geology, Vol. 14, pp. 631-635, 1906.

22. Prosser, C. S., The Classification and Distribution of the Hamilton and Chemung Series of Central and Eastern New York, Part 1, New York State Museum, Annual Report 49, Vol. 2, 1898.

23. Prosser, C. S., Kindle, E. M., Swartz, Charles K., Middle and Upper Devonian, Text and Plates, Maryland Geological Survey, 1913.

24. Prosser, C. S., Swartz, C. K., Middle and Upper Devonian of the Romney West Virginia Region, Jour. Geology, Vol. 23, pp. 11-26, 1915.

25. Schuchert, Charles A., Directions for Collecting and Preparing Fossils, Bull. U. S. National Mus., no. 90, pt. K, 1895.

26. Schuchert, Charles A., A Synopsis of American fossil Brachiopoda, U. S. Geol. Surv., Bull. 87, 464 pp., 1897.

27. Schuchert, Charles and Cooper, G. A., Brachiopod Genera of the Suborder Orthoidea and Pentameroidea, Memoirs of the Peabody Museum of Natural History, Vol. 4, pt. 1, 1932.

28. Schuchert, Charles and Dunbar, C. O., A Textbook of Geology, Part II, Historical Geology (New York: John Wiley and Sons, 1941).

29. Shimer, H. W., and Schrock, R. R., Index Fossils of North America, (New York: John Wiley and Sons, 1944).

30. Stainbrook, Merril Addison, Brachiopoda of High Point Sandstone of New York, Am. Jour. Sci., Vol. 240, no. 12, pp. 879-890, 1942.

31. Stose, W. G., and Swartz, C. K., Pawpaw-Hancock, Maryland, West Virginia, Pennsylvania, U. S. Geol. Survey, folio no. 179, 1912.

32. Swartz, C. K., Succession of Faunas in the Portage-Chemung of Maryland, Jour. Geology, Vol. 16, pp. 328-346, 1903.

33. Twenhofel, W. H. and Shrock, R. R., Invertebrate Paleontology (New York: McGraw-Hill Book Company, 1935).

34. Willard, Bradford, Devonian Faunas in Pennsylvania, Pennsylvania Geol. Survey, Bull. G-14, 1932.

35. Willard, Bradford, The Devonian Section at Selinsgrove Junction, Pennsylvania, The Am. Midland Naturalist, Vol. 13, no. 4, 1932.

36. Willard, Bradford, Chemung of Southwestern Pennsylvania, Pennsylvania Acad. Sci. Proc., Vol. 7, pp. 148-159, 1933.

37. Willard, Bradford, Middle Upper Devonian Contact in Pennsylvania, Pennsylvania Acad. Sci. Proc., Vol. 9, pp. 39-44, 1935.

38. Willard, Bradford, Devonian of Pennsylvania, Middle and Upper Devonian, Pennsylvania Geol. Survey, 4th Ser., Bull. G-19, 1939.

39. Willard, Bradford, Devonian Sequence near Huntingdon, Pennsylvania, Pennsylvania Acad. of Sci. Proc., Vol. 19, pp. 126-133, 1945.

40. Williams, H. S., The Correlation of Geological Faunas, A Contribution to Devonian Paleontology, U. S. Geol. Survey, Bull. 210, 147 pp., 1903.

41. Williams, H. S. and Kindle, E. M., Contributions to Devonian Paleontology, U. S. Geol. Survey Bull. 244, 144 pp., 1903-1905.

42. Williams, H. S., Tarr, R. S., and Kindle, E. M., Watkins Glen-Catatonk Folio, New York, U. S. Geol. Survey, folio no. 169, 1909.

43. Wilmarth, M. Grace, Lexicon of Geologic Names of the United States, U. S. Geol. Survey Bull. 896, pt. 1 and 2, 1938.

44. Wood, G. M., Suggestion to Authors of Papers Submitted for Publication by the United States Geological Survey, U. S. Geol. Survey, 1935.

45. Woodward, Herbert P., Geology and Mineral Resources of the Roanoke Area, Virginia, Virginia Geol. Survey, Bull, 34, p. 65, 1932.

46. Woodward, H. P., Devonian System of West Virginia, West Virginia Geol. Survey, Vol. 15, 1943.