

**REVISION OF THE UPPER DEVONIAN
IN THE CENTRAL-SOUTHERN APPALACHIAN BASIN:
Biostratigraphy and Lithostratigraphy**

Roderic Ian Brame

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Richard K. Bambach, Chair
John M. Dennison
J. Thomas Dutro, Jr.
Kenneth A. Eriksson
John Pojeta, Jr.
Stephen Scheckler

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(ABSTRACT)

The Upper Devonian of the central-southern Appalachians Valley and Ridge province of Virginia lacks stratigraphic resolution, revised formal nomenclature, and detailed biostratigraphic data. Eight of the most complete sections available in a three thousand square mile area were used to build a framework for revising the stratigraphy of the Upper Devonian strata in southwestern Virginia. Detailed lithologic descriptions of about four thousand feet (1.3 km) of rock were made at each outcrop. John Dennison's (1970 and 1976) nomenclature for the Upper Devonian along the Alleghany Front was successfully tested for its usefulness in Southwestern Virginia and are hereby applied to these rocks. The stratigraphic interval ranges in age from the Middle Devonian to the Lower Carboniferous. The stratigraphic units include the Middle Devonian Millboro Shale, the Upper Devonian Brallier, Scherr, Foreknobs (formally the "Chemung"), Hampshire, and the Lower Carboniferous Price Formation. The Brallier contains two members (Back Creek Siltstone and Minnehaha Springs), the Foreknobs is divided into five members (Mallow, Briery Gap, Blizzard, Pound, and Red Lick), and the lower Price is divided into three members (the Cloyd Conglomerate, Sunbury Shale, and the Ceres). 23046 fossils were collected and 160 taxa were identified. The biostratigraphic range of each taxon was compiled, analyzed, and then divided into biostratigraphic zones. 19 local biozones are described. The Frasnian/Famennian boundary is accurately placed based on occurrences of internationally known index fossils. The Frasnian/Famennian extinction event is recognized and is determined to have two pulses. The local biostratigraphic zonations doubled the resolution of previous studies. Lithostratigraphic and biostratigraphic data were combined to

look at the timing and rates of events. The lithostratigraphic divisions were tested to see if their boundaries are or are not time transgressive. The Brallier/Foreknobs, Blizzard/Pound, and Pound/Redlick boundaries are crossed by biozones.

Conversely the Frasnian/Famennian boundary crosses the lithologic boundary between the Pound and Red Lick Members. This documents the prograding nature of the clastic wedge. Composite biostratigraphic ranges correlate with ranges in New York and western Maryland. This detailed lithostratigraphic and biostratigraphic study documents a comprehensive and higher resolution understanding of the Upper Devonian in the Central-Southern Appalachian Basin.

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Chapter 1. INTRODUCTION

1.1 Purpose and scope

The purpose of this study was to revise the Upper Devonian stratigraphy of the central-southern Appalachian basin in Virginia and increase the resolution through a detailed biostratigraphic and lithostratigraphic investigation. Current stratigraphic nomenclature in southwest Virginia does not meet the standards of the Stratigraphic Code and is in need of revision. There have been no detailed studies of the local stratigraphy that provided data for a higher resolution. Data was collected from an area bounded by I-64, I-81, I-77, and the West Virginia/Virginia state line. John Dennison (1970 and 1976) described and named lithostratigraphic units for the Upper Devonian rocks along the Alleghany front in West Virginia. Dennison (1985) placed the units within a sequence stratigraphic model and correlated them to T-R sea level cycles recognized by Johnson, Klapper, and Sandberg (1985). This study compared the lithostratigraphy in this area to the descriptions by Dennison to determine if that nomenclature can be used or if new nomenclature is necessary. Eight sections, several of which had not been measured before and none of which have been systematically sampled for fossils, were measured and sampled in detail. Correlations were difficult and complicated because of folding and faulting that occurred during the Appalachian orogeny. Correlations were further complicated because of the long distances between sections and the extensive cover of vegetation. Outcrops are few and far between. Correlations were done using a compilation of biostratigraphic and lithostratigraphic data from each outcrop. The composite section serves as a correlation tool.

The stratigraphic units used on the 1994 geologic map of Virginia for the Upper Devonian are the Brallier, Chemung and Hampshire Formations. The “Chemung” is no longer used in New York and is therefore invalid as a stratigraphic unit in Virginia. Dennison (1970) introduced the Greenland Gap Group for the Upper Devonian stratigraphy along the Alleghany Front, near northern Virginia and western Maryland in West Virginia. He proposed the use of the Brallier, Scherr, and Foreknobs Formations.

Dennison (1970) divided the Foreknobs into the Mallow, Briery Gap, Blizzard, Pound, and Red Lick Members. Tom Rossbach (1992), one of Dennison's PhD. students, used Dennison's nomenclature southwest along the Alleghany Front to near I-64 and south to Salem Virginia. This study will determine if Dennison's nomenclature can be used in southwestern Virginia.

Past investigations of the stratigraphy have focused on the lithostratigraphy with little emphasis on systematic biostratigraphy. In this study macrofossils were collected at every possible horizon, identified, and logged in with their stratigraphic horizon. At each horizon the number of specimens of each kind of taxon were tabulated to facilitate future studies of diversity and abundance. Rossbach's study (Biostratigraphy of the Geeland Gap Group 1992) identified 63 taxa. This study discovered evidence for 160 taxa from 23046 fossils. The biostratigraphic ranges are divided into 19 assemblage zones. The 19 bizonas are used to correlate the stratigraphy.

Detailed biostratigraphic data defines relative time horizons for determining facies changes, timing and rates of progradation, and the relative age of each stratigraphic unit. Data from the measured sections and biostratigraphic ranges are combined into a local composite standard section. The composite section was used for high-resolution correlation of the eight measured sections. The correlations were then used to revise the stratigraphic nomenclature for the Upper Devonian in the study area. Establishment of the age for each unit was used to analyze Dennison's placement of stratigraphic units within the established sea-level curve for the Upper Devonian.

Products of this investigation include: placement of stage boundaries within the study area; recognition of the Frasnian/Famennian extinction event; higher resolution biozonation; a more complete list of taxon in the study area; and a tool for analyzing the sequence stratigraphy in the central-southern Appalachian basin.

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Chelsea McCraven for taking photos of the fossils.

I would like to share with all the readers a quote from a letter that John Dennison sent me

“It is the friendships we make along the way that are the most important”.

Thank you everyone!

Chapter 2. GEOLOGICAL SETTING

2.1 Geography and regional geology

Upper Devonian rocks in the study area consist of approximately 4,000 feet (~1220m) of clastic sedimentary rocks. The package of rocks is a coarsening upward sequence that represents the filling-in and progradation of sediment into the central-southern Appalachian basin (Figure 1). There are two main progradational factors to keep track of. One is the gross progradation of the shoreline from the east to the west of the southern expression of the Catskill delta complex and the other is building the Augusta delta lobe along the eroding edge of the Acadian Mountains (Figure 2). The source of the sediment filling in the basin is the result of the erosion of the adjacent Acadian Mountains. Imprinted on the coarsening up package is the evidence for eustatic sea-level changes, changes in localized deltaic deposition, and tectonic responses. The sedimentary package is the southwestern expression of the proximal shelf to near-shore sediments of the Catskill Delta complex.

Evidence for sea-level changes comes in the form of smaller fining upward and coarsening upward packages within the larger sedimentary package. The larger sedimentary package is the result of a variety of depositional environments that were proximal to the western shoreline of an epicontinental-sea located about 30° South of the equator (Figure 3). Depositional environments within the study area range from basinal slope edge, slope, slope/shelf break, outer-shelf, inner-shelf, near-shore, and shoreline. The gradient of the slope was very low. The epicontinental-sea was relatively shallow. Deposition was controlled by accommodation space produced from subsidence, sea-level changes, and the tectonic response of the crust during the Acadian Orogeny. Complicating the stratigraphic record is the building of deltaic lobes, nature of deltaic lobes, changing environment above sea level, supply of sediment, and proximity of sediment sources. The Upper Devonian package in the central-southern Appalachian basin in Virginia was subsequently disturbed by the Allegheny orogeny. Along with the older Paleozoic and Carboniferous rocks the Devonian sequence was folded and faulted. Palinspastic reconstruction shows approximately 50% shortening.

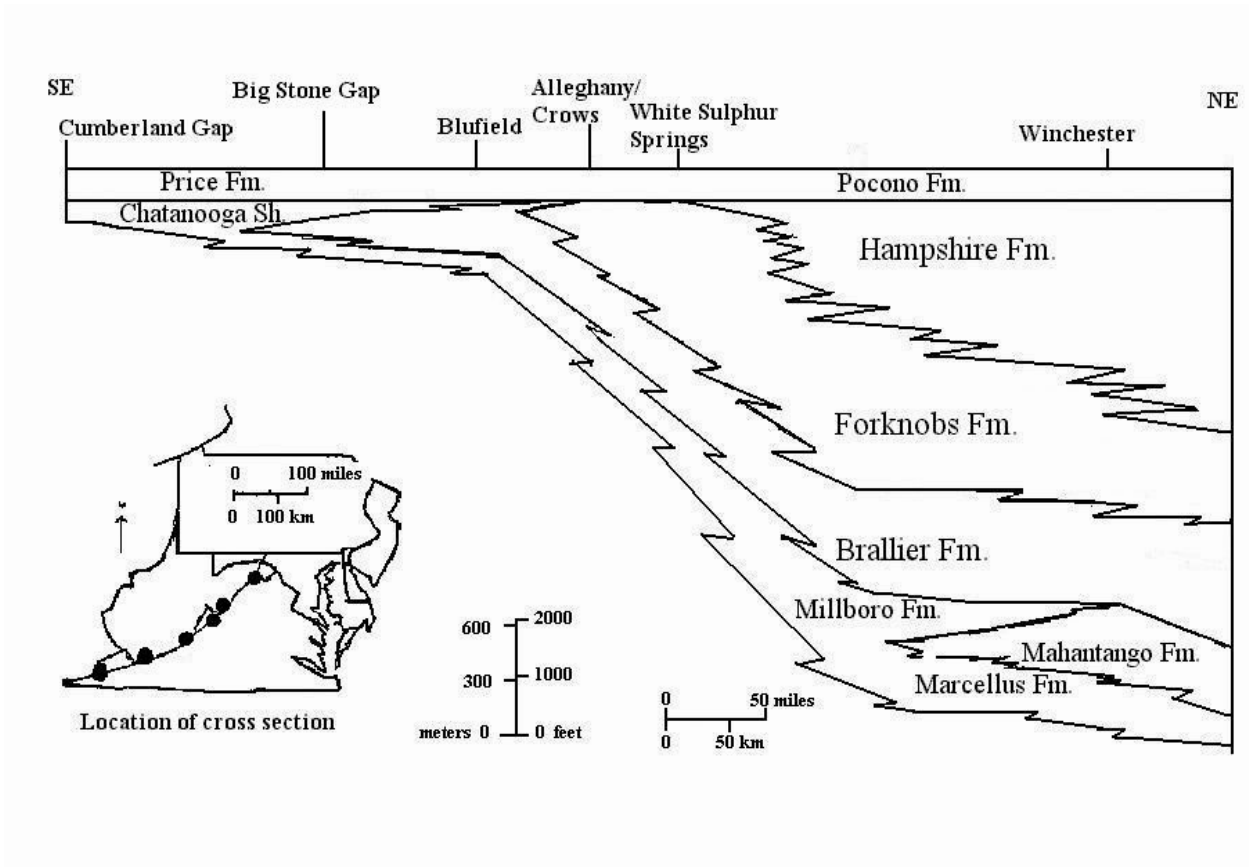


Figure 1. Generalized cross section of the Devonian stratigraphic units in the Central-Southern Appalachian basin.

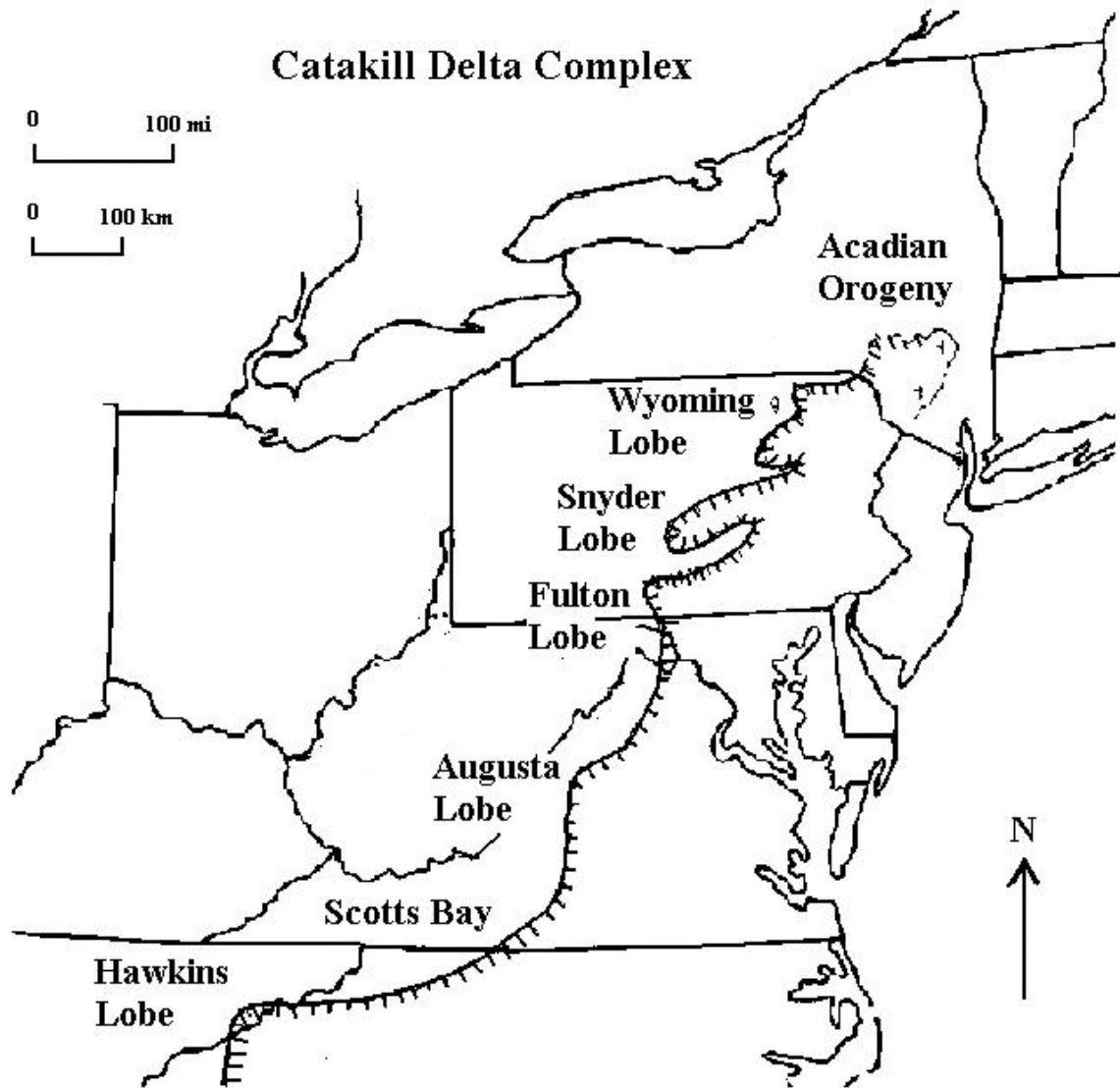


Figure 2. Lobes produced by the progradation of the Catskill Delta Complex.

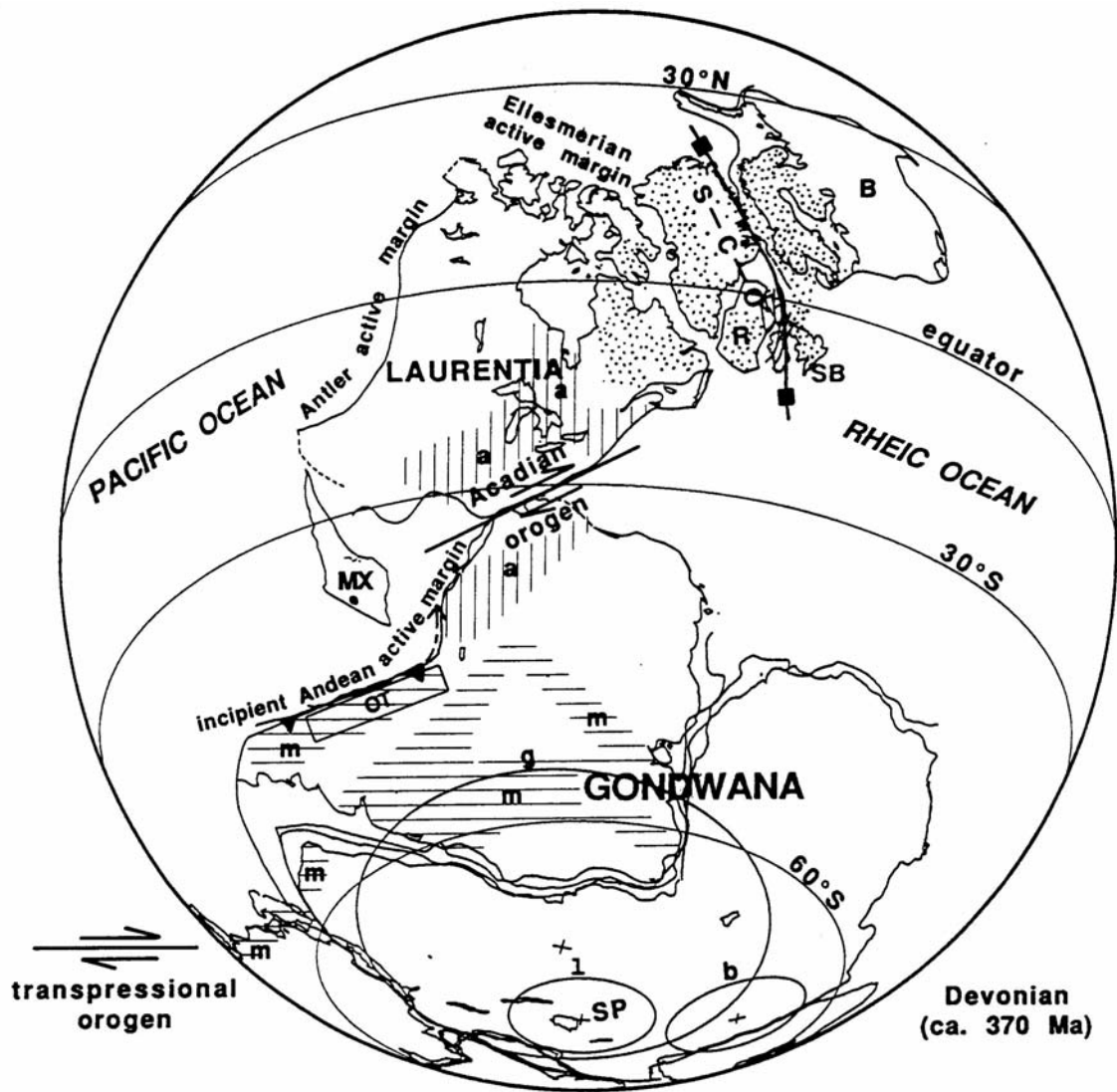


Figure 3. Paleogeography of the Appalachian basin 370 mya.

The continued uplift and erosion of the Appalachian Mountains since the Allegheny orogeny has exposed the Upper Devonian sequence in the Valley and Ridge province as well as the Appalachian plateau. The folded and faulted Upper Devonian stratigraphy is exposed on at least four thrust sheets in the Valley and Ridge Province and the edge of the Appalachian Plateau. It is a complicated package of sediment with a record of sea-level changes, large scale tectonics, localized tectonics of uplift and erosion, progradation, changes in the rheological response to sediment loading, changes in depositional centers, changes in delta lobe movement, changes of source area and volume, changes in climate, and a variety of episodic events like earthquakes, storms, slope failures, and volcanic activity.

The study area is bounded by I-64 to the North, I-81 to the Southeast, I-77 to the South, and the Virginia-West Virginia State line to the Northwest (Figure 4). The area is about 3,000 square miles (~7800 km²), all in Virginia. The locations of the eight sections are named using the closest geographic name or the two closest geographic names if the section lies between. The sections are as follows: Bland/Bastion, Long Spur/Alum Springs, Parrott, McCoy, Lick Run, Carvin Cove, Sulphur Spring, and Alleghany/Crows. The study area is just to the south and adjacent to the area where Dennison (1970), Dennison and McGhee (1976), and Rossbach (1992) have studied the Upper Devonian.

2.2 Stratigraphy

The formations recognized are the Millboro, Brallier, Scherr, Foreknobs, Hampshire, and Price (Figure 5). The Upper Millboro Formation (Upper most Givetian and Basal Frsanian) is a black to gray fissile shale with some pyritic zones. It was deposited in a relatively deep anoxic or low oxygen environment with little or no silt or sand. The Millboro is considered to be a prodeltaic black shale (Dennison 1971).

The Brallier Formation consists of thickly laminated grayish to tan shale and dark gray fine to medium siltstone coupled into turbidites. These are shelf-slope or shelf-edge sediments.

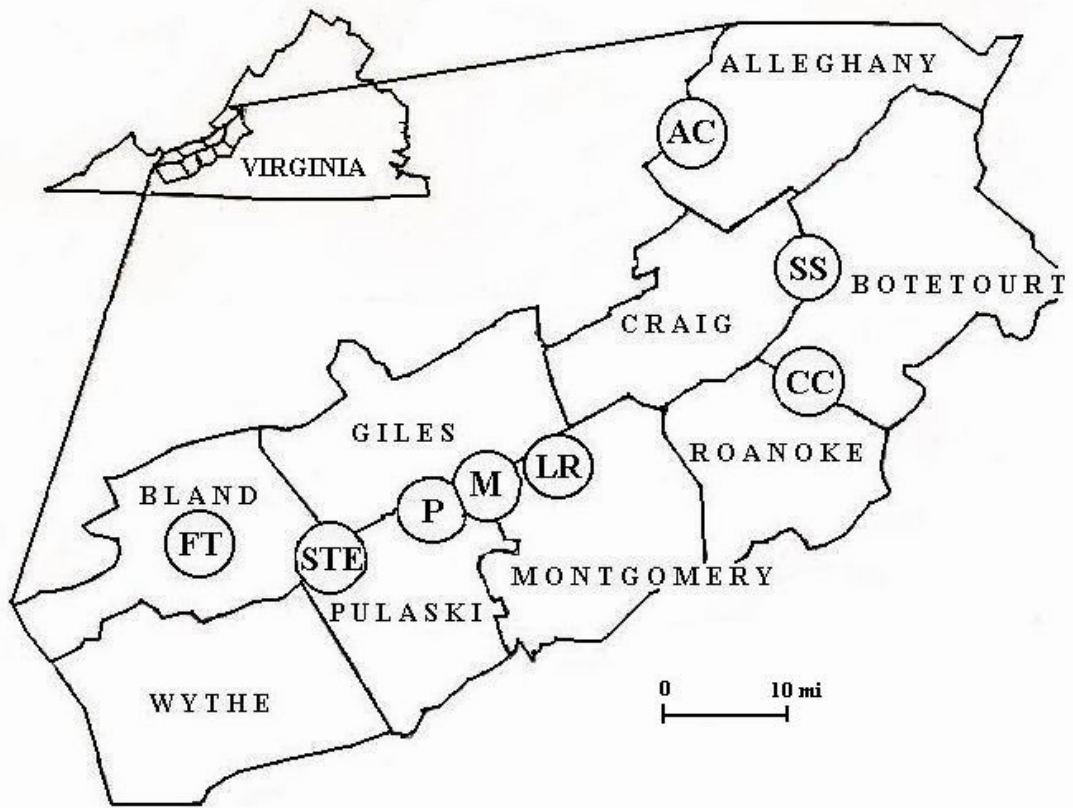


Figure 4. Location of the study area and the eight measured sections.

DEVONIAN	MISSISSIPPIAN	TOURNAISIAN	Price Formation	Ceres Member
				Sunbury Shale Member
				Cloyd Conglomerate Mbr.
	UPPER DEVONIAN	FAMENNIAN	Hampshire Fm.	Red Lick Member
				Pound Member
				Blizzard Member
		FRASNIAN	Foreknobs Formation	Briery Gap Member
				Mallow Member
				Minnehaha Springs Mbr.
				Backcreek Siltstone Mbr.
MIDDLE DEVON	GIVETIAN	Scherr Fm.	Brallier Formation	
			Millboro Formation	

Figure 5. Chart of the local stratigraphic units.

The Scherr Formation is a coarser and more fossiliferous unit that is lacking the turbidites of the Braillier. It is interpreted to be a shallower closer to shore unit than the Brallier but lacks the near shore sediments of the Foreknobs.

The Foreknobs Formation is a coarsening up package of siltstone and sandstone with intervals of micaceous mudstone and shale. The Foreknobs is divided into five members; the Mallow Member, Briery Gap Member, Blizzard Member, Pound Member, and Red Lick Member. The Mallow Member is dominated by silty mudstones with some coarse siltstone and fine sandstone bodies. The Briery Gap Member contains five or six reddish sandstone bodies that coarsen up. The Blizzard Member contains medium greenish-gray silty mudstone and gray siltstone. The Pound Sandstone Member is a fine to coarse light gray sandstone. The Red Lick Member is a package of massive reddish-maroonish siltstone and sandstone with a few shale, silty shale, and micaceous siltstone intervals. The Cleveland Shale is a remnant tongue of one of the Ohio shales. It is not an official stratigraphic name but is a recognizable shale package in the upper most part of the Red Lick Member. It is a dark gray silty-shale to shaley-siltstone. It occurs below the Cloyd Conglomerate near the top of the Red Lick Member in locations south of Blacksburg, Virginia where the Hampshire Formation is missing. The Foreknobs Formation's depositional environments consist of; proximal shore and below storm base for the Mallow, near shore sandstone below wave base but within storm-base for the Briery Gap, the Blizzard is below storm base for all but the larger storms but closer to shore than the Mallow, the Pound is within wave base and is near shore to shore-line, the sediment of the Red Lick is from wave base to storm base and some shore-line sediment.

The Hampshire Formation is a red to grayish red mudstone, siltstone, and sandstone with numerous terrestrial plant fossils. It is considered a paleosol and lies between the Red Lick Member of the Foreknobs Formation and the Cloyd Conglomerate Member of the Price Formation. The contact between the Red Lick Member and the Hampshire Formation is gradational and is recognized by the lowest significant red beds or the highest marine fossils.

The Price Formation is shoreline to deltaic coarse to very coarse dirty sandstone and conglomeratic deposit of clastic sediments. The basal member, the Cloyd conglomerate, has been interpreted as a barrier bar (Kreisa and Bambach 1973), shoreline deposit, river

channel, and proximal river meeting the shoreline deposit. The Sunbury Shale Member, Chatanooga Shale to the south, lies conformably on top of the Cloyd Conglomerate and represents a eustatic sea-level rise. The Ceres Member is deltaic shoreline sandstone with a mixture of non-marine beds and marine beds with marine fossils deposited within the prograding Catskill delta.

2.3 Nature of the outcrops

Outcrops are controlled by the attitude and petrology of the rocks. A general Appalachian strike of between about N65°E and N20°E is persistent throughout the study area. Dips range from about 40°SE to near vertical. Average dips are about 60° to 80°SE. There are a few intervals at Lick Run and Sulfur Springs where the rocks are overturned. At Carvin Cove dip angles get as low as 10° and dip direction wiggles around a bit as you get close to and pass through the fold axis of the Salem Synclinorium. Sandstone and well-cemented, “tight”, siltstone are erosionally resistant forming ridges and small waterfalls or cascades in the creeks and rivers. Mudstones, silty-shales, and shales are more easily eroded and are evident in flat places in the creeks, flat places up section of erosionally resistant sand/silt ridges, and at scarp type slopes down section of the sand/siltstone bodies. Shales make up the valleys and usually have meandering streams in a fluvial plane running parallel to strike.

Exposures of outcrops are primarily in creek beds, road-cuts, and railroad cuts. Road cuts and railroad cuts are the primary place to find continuous outcrops of the study interval. The dense vegetation and the movement of rocks down-slope in a hilly topography make it unrealistic to measure sections in the general countryside. Many partial sections are exposed as well as the eight most complete sections I was able to locate. On the outcrop sand/silt-stone tend to protrude while mudstone and shale tend to be eroded back a bit, sometimes requiring the removal of 2-6 inches (4-16 cm) of soil to get to the bedrock. One exception is the Pound Sandstone Member, which tends to be eroded back a bit but contains little soil, just sandstone regolith. This is because the Pound is a “tightly” silica cemented medium to coarse sandstone unit that is more brittle than the other units. When exposed to the tectonic forces of the Alleghany orogeny it

tended to fracture. It is also subject to breaking up when exposed to freeze thaw cycles. A small amount of detrital clay would have allowed the rock to be a more flexible and less brittle.

Outcrops exposed to the sun for most of the day have a different character than those that remain in the shade most or all of the day. Shady side outcrops don't suffer as extensive freeze-thaw or as extreme temperature differentiation in the summer as so the sunny side outcrops. Long southeasterly exposures tend to have bleached mudstone and shale. The shady side outcrops have silty mudstones, mudstones, and shale with darker colors and maintain a higher competency than their sunny-side counterparts which are lighter in color and tend to be weathered to a chippy regolith. Consequently, correlations based on rock descriptions in the finer sediment zones are almost impossible except for fossils, key beds, and their measured stratigraphic horizon (elevation).

Fossils are readily available at many intervals, but for high resolution and complete sampling a considerable amount of excavation and relentless bed-by-bed examination is required.

Chapter 3. PREVIOUS WORK

3.1 Physical stratigraphy

James Hall's study of the Fourth Geological District of New York in eastern and central New York provide the first detailed lithologic and biostratigraphic descriptions of the Upper Devonian and basal Mississippian rocks of the Appalachian basin in eastern North America. James Hall (1839) named the Chemung Formation for the rocks exposures in the Chemung valley in New York. Hall (1843) describes the "Genesee slate", "Portage" or "Nunda group", "Chemung group", "Old Red Sandstone" (all part of the "New York System"), and the "Carboniferous System". His 1843 book in the series "The Natural History of New York" contains a geologic map of the "Middle and Western States" which includes the state of Virginia. Between 1835 and 1841 Wm. B. Rogers made a geologic map of the Virginias, revised in 1881, which used the term Devonian for the same set of rocks with no formal formation names. In 1892 Darton carried the name "Chemung", named after the rocks at Chemung Narrows in New York, into West Virginia. By the 1930's the stratigraphy of the "Chemung" Formation in New York was divided into other named units and the name "Chemung" was lost in New York. Despite the lack of formal recognition of the unit Charles Butts (1933) carried its name into Virginia in his geologic map of the Valley and Ridge of Virginia. He also used the name Millboro for the Genesee type black shale and Brallier for the turbidites of the Portage facies. In 1940 Butts published "Geology of the Appalachian Valley in Virginia" which contains descriptions of the Millboro, Brallier, Chemung, Hampshire, and Price Formations. These names were used with great consistency until the 1962 when Dennison began to work on the Upper Devonian rocks along the Allegheny front in West Virginia. He realized that the name "Chemung" could not be used because it was no longer used in New York. Dennison (1970) abandoned the name "Chemung" and replaced it with the Greenland Gap Group, which is comprised of two formations, the lower Scherr Formation and the upper Foreknobs Formation (Figure 6). The Scherr Formation is only recognized at one outcrop within the study area, Sulphur Spring, but correlates with a relatively coarser unit near the top of the Brallier Formation within the

Stratigraphic Units along The Alleghany Fornt Dennison (1970, 1976)		1992 Virginia State Geologic Map Stratigraphic Units	Revised Stratigraphic Units for Virginia, 2001	
Price Formation		Price Formation	Lower Price Fm.	Ceres Member Sunbury Shale Cloyd Member
Hampshire Fm.		Hampshire Fm.	Hampshire Fm.	
GREENLAND GAP GROUP	Foreknobs Fm.	"Chemung" Formation	Foreknobs Fm.	Red Lick Mbr.
	Red Lick Mbr.		Pound Mbr.	
	Pound Mbr.		Blizzard Mbr.	
	Blizzard Mbr.		Briery Gap Mbr.	
	Briery Gap Mbr.		Mallow Mbr.	
Scherr Fm.	Brallier Formation	Brallier Fm.		
Minnehaha Springs			Minnehaha Springs	
			Backcreek Mbr.	
Brallier Formation				
Millboro Formation		Millboro Formation	Millboro Formation	

Figure 6. Changes in nomenclature of stratigraphic units from 1970 to 2001.

study area. The “Chemung” Formation was renamed the Foreknobs and divided into five members named in stratigraphic order; the Mallow, Briery Gap, Blizzard, Pound, and Red Lick (Dennison 1970; McGhee and Dennison 1976). Several of Dennison’s students completed Upper Devonian stratigraphic work along the Allegheny Front (White, Filer, Rossbach, and Like), but only Rossbach carried Dennison's nomenclature into Virginia within the Salem Synclinorium near Roanoke (Dissertation 1992). Rossbach studied the biostratigraphy of the Greenland Gap Group and measured several sections never measured before. He successfully used Dennison’s units along the Allegheny Front and at Salem Virginia. Even though it has been and is inappropriate to use the name “Chemung”, it is the name used on the 1993 Geologic Map of Virginia. Tom Rossbach’s work (1992) and this work clearly demonstrates that “Chemung” is Foreknobs and that it would be appropriate to use the most current and correct nomenclature available.

Darton (1892) named the Hampshire Formation, "Hampshire Red Beds", for the exposures in Hampshire County, West Virginia. Scheckler (1986 and 1989) used the Foreknobs and Hampshire nomenclature for the rocks in the Valley and Ridge of West Virginia and Virginia. Campbell (1894) named the "Price Sandstone" for the "coal-bearing clastic sequence bounded by the overlying Pulaski Shale (= Mccrady) and the underlying Kimberling Shale (= Brallier/"Chemung") at Price Mountain in Montgomery County, Virginia (Bartlett 1974). Campbell (1925) designated the unit the Price Formation but miss correlated the unit he used for the base, the "Ingles Conglomerate" which he thought was equivalent to the Conglomerate at Cloyds Mountain (Bartlett 1974). Butts (1940) reinvestigated the designation of the Price Formation and its underlying and overlying units. He clarified the description of the Price Formation by designating the Cloyd Conglomerate as the base and the Mccraddy Formation as the overlying unit. According to Butts (1940) it is practically synonymous with the Pocono Formation to the north in northern Virginia. Bartlett (1974) divided the Price into seven members. The lowest three are of concern for this study. They are the Cloyd Conglomerate Member (base of the Price), the Big Stone Gap Shale Member (equivalent to the Sunbury Shale (Cooper 1971, 1948), and then the Ceres Member.

The type section for the Price Formation was designated Price Mountain in Montgomery County. The Type section locality did not fit the criteria for a type section so Bartlett (1974) designated State Highway 100 in Pulaski County on Little Walker Mountain near Cloyds Mountain the type section. Bartlett (1974) used the Cloyd Conglomerate Member, the Big Stone Gap Shale Member, and the Ceres Member, which he introduced for the units in the basal Price. The Price formation was reexamined in West Virginia by Kammer and Bjerstedt (1986) who used the name Sunbury Shale Member instead of Big Stone Gap Shale in West Virginia. The type section for the Sunbury is in Sunbury, Ohio and was described by Hicks (1878). Roger and Price (1926) carried the Sunbury into southern West Virginia using subsurface correlations.

3.2 Biostratigraphy

James Hall began describing the Upper Devonian fauna in North America in 1839 and was followed by subsequent volumes in 1843, 1855, 1857, 1861, 1867 1888, and 1892. These volumes provide the most detailed systematic fossil descriptions for the Upper Devonian in the Appalachians. Hall and Clarke (1892 and 1894) added taxonomic descriptions of the fossils collected in New York. Clarke and Swartz (1913) add some significant systematic and biostratigraphic data from western Maryland, which has very similar fauna to the Central-Southern Appalachian basin. Butts (1941) published photographic plates of 50 Upper Devonian fossils from the Valley and Ridge of Virginia but did not describe them or provide any detailed biostratigraphic data. Other descriptions of additional Upper Devonian fossils and biostratigraphic data from North America can be found in Caster (1930), Greiner (1957), Schuchert and Cooper (1931), McAlester (1962), Oliver and Klapper (1981), and Cooper and Dutro (1982). McGhee (1975-76) illustrated many Upper Devonian fauna in animations of paleocommunities. McGhee and Dennison (1980) defined the Frasnian/Fammenian boundary by the highest *Spynatrypid* and the lowest *Athyris angelica*. Biostratigraphic relationships for Upper Devonian macrofaunas have been described by Cooper and Dutro (1982) in New Mexico, Day (1988 and 1995) in Iowa, and Dutro (1981) in New York.

Carter and Kammer (1990) published descriptions and photographs of Latest Devonian and Early Carboniferous Brachiopods from the Price Formation near or along the Allegheny Front. Scheckler (1989) described the paleobotany and biostratigraphic correlations of the Upper Devonian within the Foreknobs, Hampshire, and Price Formations. Rossbach's dissertation (1992) contains descriptions and photographs of 63 macrofossils of the Greenland Gap Group (Upper Devonian) along with biostratigraphic data.

Chapter 4. PROCEDURE

4.1 Measured sections

4.1.1 Choosing sections to measure

In order to choose the eight best sections to measure I completed a survey of every road and railroad cut that was perpendicular to strike and went across an area on the Geology of the Appalachian Valley map (Butts 1933) that showed a continuous interval from the Millboro Formation (Givetian) to the Price Formation (lower Tournaisian). Each possible outcrop was examined for continuous exposure and fossil content. Outcrops on roads or highways that had high traffic and high speeds were eliminated for my own personal safety or because of state laws. The remainder were narrowed down by choosing sections on at least four different thrust sheets and having five sections within one thrust sheet. The last consideration was proximity and spacing. I chose two sections (Parrot and McCoy) on opposite sides of the New River to guarantee correlation since I could follow resistant beds across the river with a pair of binoculars. Another (Lick Run) was just five miles away in order to establish a strong correlation of fossils and stratigraphy and have enough data to use for correlation at other more distant sections. Two more sections were chosen on the Saltville thrust sheet. Long Spur/Alum Springs along Route 738 in Pulaski Co., 30 miles (~48 km) to the southwest and the other Sulphur Spring, 50 miles (~80km) to the northeast. Making a total of five on the Saltville Thrust Sheet. A section was chosen to the south west of Long Spur/Alum Springs and on the next thrust sheet to the west, Narrows Thrust Sheet, at Bland/Bastian in Bland Co. Another section was chosen at Carvin Cove near Salem because it is on the Pulaski Thrust Sheet and it is near one of Rossbach's (1992) measured sections. The last section is the Allegheny/Crows section on the St. Claire Thrust Sheet, the last thrust sheet before the Allegheny Front and along depositional strike of the Sulphur Spring section.

Each of the sections were given symbols for labeling samples and for data collection, they are as follows:

- BB** for Bland/Bastion
- STE** for the section on route 738 near Long Spur and Alum Springs
- P** for Parrott
- M** for McCoy
- LR** for Lick Run
- CC** for Carvin Cove
- SS** for Sulphur Springs
- SSR** for a service road adjacent to Sulphur Springs
- AC/CA** for the section between Alleghany and Crows

4.1.2 Procedure for measuring sections

I walked each section in its entirety from the lowest (oldest) exposed strata (below the Givetian/Frasnian boundary) to the highest (youngest) (near or above the Famennian/Tournaisian Boundary) and back, observing the lithology, fossiliferous zones, and stratigraphic packaging. I measured each section with a Jacobs staff logging in rock type, grain size, color, and bed thickness. Fossil horizons were marked with surveyors tape. Strike and dip measurements were taken at the beginning and end as well as any place where the attitude changed significantly. Walking down section I searched for fossils and marked them with surveyors tape. The third time through the section every possible fossil horizon was examined and fossils were collected from those beds. Fossils were placed in cardboard boxes at the place of intersection between the bedding plane and the road. This process is repeated when coming back down section. The fourth time through the section was remeasured and every possible fossil horizon was identified with an elevation and each sample labeled with that elevation and the symbols for that locality. A few more fossil horizons were identified on the way back down section. They were collected and logged in with measurements off of key beds.

4.2 Fossil collections

4.2.1 Procedure for collecting fossils

At each horizon demolition of the bed was required to expose as much fossil material as possible. Because of the relatively high dip angle and the fact that outcrops are generally perpendicular to strike, the area of bedding surface exposed is low. Removal of rock above and below the fossil bed is required for adequate sampling. I attempted to collect enough material from each horizon to get a good representation of all the fossil species preserved and their abundance. The one exception was Carvin Cove where all the material collected had to be carried out several miles without the aid of any motorized vehicles. The limited amount of material collected certainly affected the number of taxa and the diversity of recorded from Carvin Cove. Rocks that appeared to contain more fossil material and useful data were split or broken to expose other fossils.

4.2.2 Taphonomy

Almost all the fossils collected are either internal or external molds. Chemical weathering has dissolved the original material and/or calcite casts. Beds recently exposed by road construction or exceptionally well-cemented rocks may contain original shell material or calcite replacement.

4.2.3 Preparation of fossil material

Preparation was done on any sample that needed it for proper identification. Preparation/excavation was done with a diamond tipped vibrating engraver and by hand with various sharp instruments.

4.2.4 Identification of fossils

Each collection of fossil material from a horizon was examined under a dissecting microscope. Pictures were drawn of each species to learn specific characteristics of each species. Fossils were compared with drawings, photographs, and/or descriptions from the following volumes.

Hall (1843, 1857, 1860, 1867, 1879, 1885), *The Natural History of New York*

Hall and Clarke (1892), *Paleontology of New York*

Clarke and Swartz (1913), *Devonian Plates, Maryland Geological Survey*

Schuchert and Cooper (1931), *Brachiopod genera of the suborders Orthidea and Pentameroidea*

Butts (1941), *Geology of the Appalachian Valley in Virginia: Fossil Plates*

Shrimer and Shrock (1944), *Index Fossil of North America*

Greiner (1957), “*Spirifer disjunctus*”: *Its Evolution and Paleoecology in the Catskill Delta*

Muir Wood (1962), *On the Morphology and Classification of the Brachiopod Suborder Chonetoidea*

McAlister (1962), *Upper Devonian pelecypods of the New York Chemung Stage*

Cooper and Dutro (1982), *Devonian Brachiopods of New Mexico.*

Pojeta (1986), *Devonian Rocks and Pelecypods of Guangxi, China, and of Michigan.*

Carter and Kammer (1990), *Late Devonian and early Carboniferous brachiopods (Brachipoda Articulata) from the Price Formation of West Virginia and adjacent area of Pennsylvania and Maryland*

Rosbach (1992), *Biostratigraphy of the Greenland Gap Group*

Linsley (1994), *Devonian Paleontology of New York*

Every species of each phylum was identified to the lowest possible taxonomic level. Comparisons were made with samples at the Smithsonian Institution and Virginia Tech. Identifications were confirmed by Tom Dutro (brachiopods), John Pojeta (mollusks), and Richard Bambach (mollusks and other fauna).

Note – All of the rocks-fossils in the study area were subjected to the tectonic affects of the Allegheny Orogeny as well as compaction stress so; all of the samples are deformed in some way.

4.2.5 Catalog of fossils

Every sample was logged into an excel data set with identification of each species, the number of specimens of each kind of species, the horizon elevation, and the location abbreviation.

4.2.6 Stratigraphic collection

Identified fossil material was placed in a soda pop case, cardboard tray. Each tray was labeled with the elevation of samples within the box and the location abbreviation. Each box was placed in stratigraphic order. The stratigraphic collection is stored at Wright State University in Dayton, Ohio.

4.2.7 Reference collection

The reference collection is reposited at the Smithsonian Institution National Museum of Natural History. Storage at the Smithsonian is intended for accessibility. Plates/photographs of 110 samples from the reference collection are contained within this volume.

Chapter 5. LITHOSTRATIGRAPHIC RESULTS

5.1 Upper-Millboro Formation

5.1.1 Type section and general stratigraphy

Cooper (1939) used the name Millboro without detailed description for the exposures at Millboro Springs, Virginia. The Millboro was formally introduced and described by Butts (1940). He described the Millboro Formation as black fissile shale in its unweathered condition, but bleaches as it weathers to a light gray color. Hasson and Dennison (1988) further described the type Millboro along with its extent, which is the eastern edge of Devonian outcrops in the Valley and Ridge in the southern half of Virginia westward across the state boundary into West Virginia. The Millboro Formation lies on top of the Needmore Shale and is usually separated by the Tioga Ash in the study area. The Brallier Formation overlies the Millboro conformably.

5.1.2 The Millboro in the study area

The Millboro is as described by Butts (1940) and Hasson and Dennison (1988) except for at Carvin Cove. About 300 feet below the top of the Millboro there is a zone of punky yellowish mudstone and light gray mudstone containing no silt. This zone appears to be shallower water or a change from generally anoxic conditions to aerobic. There are several beds that contain trilobites, ammonites and nautiloides, brachiopods, bivalves, and rugose corals. This is a diverse assemblage for a unit that usually only yields a few ammonites, gastropods, or very small bivalves. The assemblage is very similar to those found in the upper Mahantango near Capon Bridge, West Virginia and Gore, Virginia. The uppermost Millboro Formation correlates with the Harrell Shale to the north, which is sandwiched between the top of the Mahantango Formation and the base of the Brallier Formation (Dennison 1996). Conodonts from the Harrell Shale place the base of the Upper Devonian near the top of the Harrell Shale (Dennison 1996). There were no fossils collected in this study that either contradict or confirm the exact

placement of the Givetian/Frasnian boundary. Trilobites and ammonites found in this study from near the top of the Millboro are definitely Givetian but there are at least 260 feet of Millboro before the top of the formation with no definitive fossils for either the Givetian or the Frasnian. It could be an equivalent to the Tulley Limestone Member. The rest of the Millboro is an anoxic or dysaerobic black shale with only an occasional *Lingula* present. Thickness of the portions measured ranges from 0-625 feet.

5.1.3 Distribution of the Millboro

This study includes the upper most portions of the Millboro. It is not well exposed since it is the least erosionally resistant unit. There is good exposure of several hundred feet of Millboro Shale at Route 52 in Bland/Bastion and at Carvin Cove. There is moderate exposure at Parrott and McCoy and poor exposure, highly weathered, at Route 738 in Pulaski.

5.1.4 Depositional environment of the Millboro

The Millboro Formation is a prodelta black shale (Dennison 1971) probably dysaerobic or anaerobic due to water depth (Dennison 1996) and distance from shore. Anaerobic or dysaerobic conditions could be due to stratification in warm equatorial waters of the eperic sea (Ettensohn 1985). Water depth is predicted to be approximately 150ft (~50m) to 300ft (~100m), well below storm base. The timing of the deposition of the Millboro coincides with the Taghanic onlap, a major transgression (Ettensohn 1985).

5.1.5 Age of the Millboro

The majority of the Millboro Formation is Middle Devonian (Givetian) based on Trilobites (*Greenops boothi* and *Phacops rana*) and Ammonite (*Proboloceras lutheri*) with only the uppermost beds possibly being Upper Devonian (Frasnian) (Rossbach and Dennison 1994).

5.2 Brallier Formation

5.2.1 Type section and general stratigraphy

Butts (1918) named the Brallier Formation for exposures at Brallier Pennsylvania near a railroad station along the Broad Top Mountain Railroad near Everet, Bedford County. Butts (1933 and 1940) carried the name into Virginia. The Brallier is a rather monotonous mass of subfissile, silty and micaceous green and gray shale with uneven surfaces interbedded with layers of very fine-grained, evenly thin-bedded, siltstone and very fine sandstone (Butts 1940). The base of the Brallier can be recognized by locating the lowest siltstone beds just above the black fissile shale of the Millboro. The lithology of the Brallier varies from almost continuous shale to silt/shale turbidites (Lundegard et al. 1985). The shale intervals are thickly laminated medium to dark gray shale, which weathers to a yellowish-gray or rust color (Hasson and Dennison 1988). The Brallier lithology continues to the base of the Foreknobs without grading into the coarser silt/sand lithologies of the Foreknobs except for two siltstone bodies within the Brallier. The first one, in the lower third of the Brallier, is the Back Creek Siltstone Member. Avary and Dennison (1980) named the Back Creek Siltstone Member. The second, in the upper third, is the Minniehaha Springs Member. Lyke (1986) named the Minniehaha Springs Member. Butts (1940) placed the uppermost extent at the base of the first beds containing large “Chemung” type fossils. This convention is not acceptable for stratigraphic divisions. I used Dennison’s (1970) description for top of Brallier. The Brallier ranges from 575-2170 feet (~175-660m) in thickness (Dennison 1970)

5.2.2 The Brallier in the study area

The Brallier is dominated by turbidites except at Carvin Cove where the Brallier turbidites are interrupted by significant intervals of reddish mudstones. The Back Creek and Minnehaha Springs members are present. Both members can be traced throughout

the study area except for at Carvin Cove where the Back Creek Siltstone Member cannot be recognized. The Minnehaha Springs Member is within the Brallier in the field area but is overlain conformably by the Scherr Formation, of the Greenland Gap Group, at Sulphur Springs and in West Virginia along the Allegheny Front. This study recognizes the gradational contact between the Brallier and Foreknobs formations by the transition from tanish chippy weathered shales and turbidites to more competent siltstone and sandstone beds that are very fossiliferous. At Sulphur Springs the upper part of what might have been Brallier is considered to be the Scherr Formation. At Sulfur Springs there are significant amounts of siltstone and it contains many of the larger “Chemung Type” fossils. Rossbach (1992) did not recognize any Scherr component at route 311 Hanging Rock section in Salem Virginia.

The Brallier turbidites are as described by Butts (1918) and Hasson and Dennison (1988). The Brallier at Carvin Cove contains considerable amounts of reddish mudstones probably because it is a section closer to the paleo-shoreline. The Brallier facies extends higher up in the section at Bland/Bastion due to the distance from shore. Dennison (1997) did not have the Back Creek Member south of Pocohantas County, West Virginia in his correlation chart. I can correlate both members through the Sulphur Springs, McCoy, Longspur, and Bland/Bastion sections. With palinspastic reconstruction all of these sections except for Bland/Bastion would end up on or about depositional strike of sections where Dennison recognized the Back Creek and the Minnehaha Springs along the Allegheny Front. The two members, which contain coarser sediments than the rest of the Brallier Formation, are probably the result of the lowering of sea level. Thickness ranges from 855-1500 feet (~257-450m) with an average thickness of about 1150 feet (~345m).

5.2.3 Distribution of the Brallier

The Brallier is well exposed at every section except at Lick Run where it is covered and the road-cut does not extend to the base of the Brallier. At Sulphur Springs and Allegheny/Crows the severity of faulting and deformation within the Brallier made for unreliable measurements of stratigraphic elevations and detailed biostratigraphic

work. At Bland/Bastion the Brallier takes over at the lower half of the Mallow Member of the Foreknobs Formation due to the distance from shore. To the North at Allegheny Crows and Sulphur Springs the upper part of what might be the Brallier has coarser sediment that is recognized as the Scherr Formation lithology.

5.2.4 Depositional environment of the Brallier

The turbidite facies of the Brallier Formation are turbidite-slope facies (Lundegard, Samuels, and Pryor 1985) and are overlain by the delta-front facies of the Foreknobs Formation. The Back Creek Silt-stone Member has been interpreted to be a tectonically caused clastic wedge that can be traced across the Augusta Lobe and to the south in Scott Bay (Avary and Dennison 1980). The Minnehaha Springs Member has been interpreted as larger more erosive turbidity currents (Lundegard, Samuels, and Pryor 1985). This study interprets these siltstone packages as the result of eustatic sea-level regressions. Muddier zones with a few thin turbidites are interlobe-slope facies (Lundegard, Samuels, and Pryor 1985). Mudstone, silty mudstone, and silt laminae of the lower Brallier are from the lobe-margin facies (Lundegard, Samuels, and Pryor 1985). The over all picture is a very gradual filling in of a shallow intra-cratonic basin; the Brallier represents the slope of a very low gradient prograding clastic ramp. The timing of deposition and the gradient of the slope are gradual. Evidence of progradation can be seen by the continued sedimentation of slope turbidites, at Bland/Bastion, well into what would be the Mallow Member of the Foreknobs Formation, and the nearer to shore muddy and reddish shale intervals at Carvin Cove, a paleogeographic distance of about 60 miles. The facies of the delta slope at Bland/Bastion is the last to be taken over by the progradation of the Foreknobs siltstone and sandstone in the study area.

5.2.5 Age of the Brallier

The Brallier is lower Frasnian based on the Brachiopod assemblage and the lack of Givetian fossils.

5.3 Scherr Formation

5.3.1 Type section and general stratigraphy

Dennison (1970) named the Scherr Formation for the exposures west of the village of Scherr, Grant County, West Virginia. It is somewhat sandy turbidite that lies conformably on top of the more distal siltstone turbidites of the Brallier Formation (Dennison 1970). The Scherr is dominated by siltstone with considerable amounts of fine sandstone and shale all of which weather to a light olive gray. The grain size of the upper beds decreases and the lithology becomes more Brallier like until it grades into the Mallow lithology (Dennison 1970). The Scherr ranges from 456-2025 feet (~140-620m) thick (Dennison 1970).

5.3.2 The Scherr in the study area

The only place where the Scherr lithology is evident is at Sulphur Springs. It has more sandy turbidites and lacks the reddish chippy muddy siltstones and silty mudstones of the overlying Mallow Member of the Foreknobs. It contains the *Cyrtospirifer chemungensis* facies fauna, just as Dennison (1970) described for his introduction of the Scherr Formation. It is 325 feet (~100m) thick. Dennison's, Filer's, and Rossbach's sections get thicker to the north and northeast.

The Scherr Formation is recognized at Sulphur Springs. The base of the Scherr is equal to the base of the Minnehaha Springs Member. The Scherr is present at Alleghany/Crows below the part of the section that is severely deformed and faulted, which I considered unreliable data for this study. The Scherr indicates shallower water closer to shore environment than the places where the Minnehaha Springs is recognized. It is supportive evidence for the southwestern extension of the Augusta lobe described by Dennison (1985).

5.3.3 Distribution of the Scherr

The Scherr can only be recognized at Sulphur Springs and Alleghany/Crows. It exists at Alleghany/Crows but the lower part of the section that contains the Scherr is too deformed for accurate measurement or for collecting biostratigraphic data.

5.3.4 Depositional environment of the Scherr

The abrupt coarsening from fine and medium siltstone turbidites to fine sandstone turbidites is thought to be a pulse of uplift or a lowering of sea level (Dennison 1970). The *Cyrtospirifer chemungensis* facies certainly represents shallower conditions closer to shore than the Brallier turbidites.

5.3.5 Age of the Scherr

Dennison (1970) assigns the Scherr as lower Cohocton Stage based on occurrences of *Cyrtospirifer chemungensis* and *Cornellites chemungensis*. The Scherr is Lower Frasnian based on the brachiopod assemblage of this study.

5.4 Foreknobs Formation

5.4.1 Type section and general stratigraphy

Dennison (1970) named the Foreknobs Formation for the rocks at Foreknobs of the Allegheny Front, Grant County, West Virginia. The Foreknobs is a coarsening up package of siltstone and sandstone near-shore sediments in the Upper Devonian of the Catskill delta. The package grades from two to four inch beds of fine to medium siltstone into massive four to five foot beds of medium to coarse sandstone. The Foreknobs was divided into five members named in stratigraphic order; the Mallow, Briery Gap, Blizzard, Pound Sandstone, and Red Lick (Dennison 1970; McGhee and Dennison 1976).

The Foreknobs has a thickness that ranges from 1,321-2,264 feet (~400-690m) (Dennison 1970).

5.4.2 The Foreknobs in the study area

The strata within the study area, that covers the interval that was previously known as “Chemung”, has the same pattern and is very close to the same lithologic descriptions of the Foreknobs. I would say they are equal except that the sediment size is slightly but distinctively smaller. I do not believe it would be useful to give this stratigraphic interval in Virginia a new name. So, despite the slight variation in sediment size, the pattern of the stratigraphy and the gross lithologic descriptions of Dennison (1970) hold true and is attributed to the same nomenclature. In general all of the sediments in the study area are one notch finer (Such as a medium sandstone is a fine sandstone and very fine sandstone is a coarse siltstone etc.). My sections are just a bit farther offshore and farther from the core of the Catskill delta receiving a smaller sediment size. This study recognizes a consistent difference in descriptions made by Dennison (1970). Units in which he describes several conglomeratic beds contain coarse sands, other units are described as non-marine red-beds which are usually reddish-brown marine units. Thickness ranges from 750-2820 feet (~225-850m) and has an average thickness of about 2400 feet (720m) if you exclude the Bland /Bastian section.

5.4.3 Distribution of the Foreknobs

The Foreknobs is exposed at every outcrop within the study area. It is relatively thin at Bland/Bastion and thickens to the northeast.

5.4.4 Depositional environment of the Foreknobs

The Foreknobs Formation represents the prograding shoreline from the Catskill delta and is dominated by prodelta sandstone and siltstone. The coarsening up package

of near-shore sediments prograded from New York through Pennsylvania and Virginia and into Maryland and West Virginia.

5.4.5 Age of the Foreknobs

The Foreknobs ranges from middle Frasnian through the Famennian into the basal Tournaisian. The Foreknobs is exceptionally fossiliferous and contains valuable paleontological information including the placement of the Frasnian/Famennian stage boundary and Frasnian/Famennian extinction event. It is Upper Devonian except for possibly the upper most part of the Red Lick, which in some places is Lower Carboniferous.

5.5 Mallow Member

5.5.1 Type section and general stratigraphy

Dennison (1970) named the Mallow Member for exposures along Briery Gap Run in Pendleton County, West Virginia. The sequence is dominated by siltstones and sandstones with some intervals of shale. The siltstones are muddy siltstones to clean siltstones that weather to an olive gray color (Dennison 1970). Sandstones come in bundles several feet thick and may contain some conglomeratic intervals in beds commonly less than a foot thick. Some of the beds are brownish gray to almost brick red. The Mallow Member ranges from 741-1100 feet (~225-335m) in thickness (Dennison 1970).

5.5.2 The Mallow in the study area

The Mallow is recognized throughout the study area. There are two distinctive “red-beds” zones of reddish colored silty mudstones and muddy siltstones. These can be correlated throughout the study area. These two “red-beds” were recognized by

Dennison (1970) and mentioned when he described the Mallow. Dennison (1970) calls for some quartz conglomerate and conglomeratic sandstones. None were observed in this study perhaps because my sections are a bit farther from shore than the Allegheny Front sections. The mallow is slightly younger to the southwest (Dennison 1970). This is confirmed in this study. At the southwestern most section, Bland/Bastion, the Mallow is thinner due to the distance from the sediment source. Recognizance farther to the Southwest at Hungry Mother State Park revealed an even thinner interval for the Mallow. Distinction of the top of the Mallow is less obvious at Bland/Bastion and is not obvious at Hungry Mother State Park. Thickness ranges from 175-945 feet (~53-284m) with an average of about 840 feet (~245m) thick if Bland/Bastian is not included.

5.5.3 Distribution of the Mallow

The Mallow Member is exposed at every outcrop. The lower portion was not measured at Alleghany/Crows because it was severely deformed and contained numerous folds and faults. I did not think I could make an accurate measurement of stratigraphic thickness. At Bland /Bastion on Route 52 the lower part of the Mallow is taken over by the Brallier turbidites because of the relative distance form shore, being farther out into the basin.

5.5.4 Depositional environment of the Mallow

The Mallow sediments represent the deepest water and farthest from shore environment of the Foreknobs Formation. The *Ambocoelia-Chonetes* community (McGhee 1974) is considered offshore deeper water shelf edge paleoenvironment. Reddish beds within the Mallow are probably the result of some sort of influx of meteoric or brackish water.

5.5.5 Age of the Mallow

The Mallow is Middle Frasnian based on the brachiopod assemblage.

5.6 Briery Gap Sandstone Member

5.6.1 Type section and general stratigraphy

Dennison (1970) named the Briery Gap Sandstone Member for exposures along Briery Gap run in Pendleton County, West Virginia. The lithology is dominated by fairly well sorted medium sandstone and may contain some conglomeratic layers. It is a coarser unit sandwiched between the muddy siltstones of the Mallow and Blizzard Members. The Briery Gap can be recognized by the coarseness of the sediment and the massiveness of its beds. It ranges from 28-133 feet (~10-40m) thick (Dennison 1970).

5.6.2 The Briery Gap in the study area

The Briery Gap is recognized throughout the study area. There are five coarsening up sequences that are capped by 1-2 foot medium to coarse reddish sandstone beds. At the top of the interval there are two coarsening up packages that end in 2-4 foot thick beds of fairly clean medium gray siltstone. There is one bed at the top of the Briery Gap that is 8-12 feet (~2.5-3.5m) thick and has a peculiar surface on the bottom. It can be traced through all the sections except Carvin Cove and Bland/Bastion. In the study area there are no conglomeratic layers. Thickness ranges from 65-300 feet (~20-90m) with an average of about 200 feet (~60m).

5.6.3 Distribution of the Briery Gap

The Briery Gap Sandstone Member is exposed at every outcrop and can be recognized throughout the area. It is most difficult to recognize at Bland/Bastion where there is a very gradational contact between the Mallow/Briery Gap and the Briery Gap/Blizzard. Sort of a more blended or blurred looks at the units. At Bland/Bastion the Briery Gap seems to be lacking in its most prominent sand bodies making it difficult to

discriminate the Briery Gap from the Mallow and the Blizzard. A quick survey at Hungry Mother State Park south of the study area revealed a package of rocks above the Brallier Formation and below the Red Lick Member that cannot be readily broken down into members. I could not distinguish any particular characteristics that would define the Briery Gap. This is the southern extent that this member can be used.

5.6.4 Depositional environment of the Briery Gap

The coarser sediments of the Briery Gap are within storm base and indicate an overall sea-level drop. Within the member there are a series of smaller sea-level rise and falls. The Briery gap contains a series of 5 medium to coarse reddish sandstones. These fall under the category of Dennison's "red beds and are thought to be responses to drops in sea-level. The top of the Briery Gap has a conspicuous massive 8-12 foot gray siltstone which has a peculiar undulating surface at the base and a planar top. They might be some sorts of rollover structures formed as this slug of silt was moving into deeper water. The bed is very much out of character since there are no other beds thicker than a couple of feet. Following the "seizmite" 12 to 20 feet (~3.5-6m) stratigraphically above is an ash bed. A neat story is that an earthquake happened producing a seizemite and was soon followed by volcanic activity. Samples from the ash bed were collected and are being analyzed for zircons with the hope of establishing a chronostratigraphic marker with an absolute age date. This pair of key beds can be traced to several outcrops (STE, P, M, and LR) in the southern half of the study area.

5.6.5 Age of the Briery Gap

The Briery Gap is Middle Frasnian to Upper Frasnian based on the brachiopod assemblage.

5.7 Blizzard Member

5.7.1 Type section and general stratigraphy

Dennison (1970) named the Blizzard Member for exposures along Briery Gap run in Pendleton County, West Virginia. The Blizzard Member is dominated by muddy siltstones and silty-mudstones. They are greenish gray and medium gray not very well sorted. Beds are generally planar. The Blizzard ranges from 278-580 feet (~85-175m) in thickness (Dennison 1970).

5.7.2 The Blizzard in the study area

Bed Thickness ranges from 1/2 inch (~1.3cm) to 3 inches (~8cm) for much of the member. This package has beds that thicken up to 14 inches (~35cm) and grain size increases to coarse silt. The lower half of the Blizzard is a coarsening up sequence going from thinly bedded fine silty-mudstone and muddy siltstone to medium grained thickly bedded siltstone. The coarsening up package in the middle of the member is referred to by John Dennison (personal contact) as the “Mid Blizzard Siltstone”. At all of the locations south of Blacksburg except Bland/Bastion the Mid Blizzard Siltstone contains two smaller coarsening up sequences within the one overall coarsening up sequence. A rare fining up sequence follows the Mid Blizzard Silt. Thickness ranges from 90-660 feet (~27-200m) and has an average thickness of about 550 feet (~1605) if Bland/Bastian is not included.

5.7.3 Distribution of the Blizzard

The Blizzard Member is exposed at every outcrop and can be recognized throughout the study area. The least confident discrimination is between the Briery Gap and Blizzard at Bland/Bastion where the contact is very gradational. It cannot be separated from the Briery Gap at Hungry Mother State Park, which expresses the southern limit to which the Blizzard can be used.

5.7.4 Depositional environment of the Blizzard

Overall the Blizzard is dominated by silty mudstone and muddy siltstone. This fin grain sediment with considerable amounts of mud/clay grains is interpreted as delta front-delta platform facies (Ettensohn 1985). This represents a slow sea level fall. The middle of the unit contains the "Mid Blizzard Silt". It is a zone of semi-clean medium and coarse thickly bedded siltstone that is packaged into two smaller coarsening up sequences. I believe this represents two quick sea-level drops. The "Mid Blizzard Silt" is followed by the upper portion containing a fining up sequence followed by a relative coarsening up sequence. The overall package has a relatively large but slow sea-level regression culminating with two small quick sea-level drops followed by a gradual transgression and then a mild regression just before the major regression represented by the Pound Sandstone Member.

5.7.5 Age of the Blizzard

The Blizzard is Upper Frasnian based on the brachiopod assemblage, *Tentaculites*, and the absence of any strictly Famennian fossils. It contains the Frasnian/Famennian extinction event near the top of the Member.

5.8 Pound Sandstone Member

5.8.1 Type section and general stratigraphy

Dennison (1970) named the Pound Sandstone Member for exposures along Briery Gap run in Pendleton County, West Virginia. It is dominated by light gray silica cemented clean medium to coarse quartz arenite sandstone. The unit sometimes contains conglomeratic beds. Dennison (1985) placed the pound at a major regression in the Devonian sea-level curve. The relatively very coarse sediments of the Pound Sandstone are underlain by the greenish gray muddy siltstones of the Blizzard Member and overlain

by the fine siltstones and shaley siltstones of the base of the Red Lick Member. The Pound ranges from 23-193 feet (~7-60m) in thickness (Dennison 1970).

5.8.2 The Pound in the study area

Bedding is somewhat uneven and 2 to 6 inches thick. The tops of the coarser and thicker beds are frequently hummocky cross-bedded or asymmetrically cross-bedded and sometimes containing ripple marks with a measurable paleo-current direction. At Sulfur Springs I recorded a paleo-current direction of N28W. The Pound Sandstone typically makes waterfalls in the creek beds because it is so resistant to chemical weathering. Outcrops with exposures that stay in the shade have pronounced exposure due to its competence. At sunny side exposures the Pound Sandstone is reduced to little more than rubble, perhaps because the quartz cemented sandstone is brittle when it comes to freeze thaw. Several locations (LR, SS, STE, M, P, and AC) show two pulses of the coarse silica cemented sandstone. At LR, M, and P the pulses were so distinct I wrote in my field notebook "Pound and Pseudo-Pound". I later decided to bundle them together as the Pound. I did this because the fine sediment package of the lower Red Lick was so persistent throughout the study and the "Pseudo Pound" lithology was the same as Pound lithology. Thickness ranges from 30-125 feet (~9-38m) with an average of about 90 feet (~27m).

5.8.3 Distribution of the Pound

The Pound Sandstone Member is exposed at every location and can be recognized throughout the study area. It is the most difficult to recognize at Carvin Cove where the Pound is interbedded with more micaceous dirtier sands.

5.8.4 Depositional environment of the Pound

The Pound is rarely thicker than 150 feet (~45m). The pound is interpreted as a near-shore deposit within wave base because of its coarse grain size, lack of finer

sediments, and the types of fossils it contains. For this type and thickness of a sedimentary unit to be deposited during a sea-level drop it is estimated that it would take about half-a-million years for it to prograde 60 miles (~96km) (USGS Charleston). The near shore sections of this study, Carvin Cove and Sulfur Springs, have Frasnian fossils near the top of the Pound and all the other sections have the last Frasnian fossils disappear at the base of the Pound or the top of the Blizzard. Also the first occurrence Famennian fossils in the Pound are near the base at all the sections farther from shore and at the near shore sections there are no Famennian fossils until the top or just above, as is the case at Carvin Cove. The Pound is the only Member that has a biozone boundary cross a lithologic boundary. These observations are interpreted as evidence for progradation. McGhee and Dennison (1980) placed the Frasnian/Famennian boundary within the Pound. Dennison still places it there in his 1996 and 1997 charts correlating the Upper Devonian from Pennsylvania to Bluefield West Virginia. It was a remarkable pick because along the Allegheny Front and sections along depositional strike to the south the F/F boundary is within the Pound. It is only the sections closer to shore (Carvin Cove and Sulfur Springs) that have the boundary near the top or slightly above indicating the Pound is slightly older and must have been deposited first at these sections. The two pulses of sediment, the “pseudo Pound” and Pound, represents a smaller sea-level rise and fall within this major regression.

5.8.5 Age of the Pound

Tentacullites descissus, a Frasnian fauna, is found at the top and within the Pound Sandstone Member at Carvin Cove. *Athyris angelica*, a Famennian fauna, is found near the base and within the Pound at Log Spur/Alum Ridge, Lick Run, and Alleghaney Crows. The Pound contains the Frasnian/Famennian boundary based on the latest occurrence of *Spinatrypa* and first occurrence of *Athyris angelica*.

5.9 Red Lick Member

5.9.1 Type section and general stratigraphy

The Red Lick Member was named by Dennison and McGhee (1976) and was described as the Unnamed Member (Dennison 1970) for exposures along Briery Gap run in Pendleton County, West Virginia. The unit is dominated by light olive gray marine sandstones and siltstones with some brownish gray “redbeds” and rare conglomeratic layers (Dennison 1970). Some of the beds are massive. The Red Lick goes through a facies change laterally into the non-marine redbeds of the Hampshire formation to the north and northeast (Dennison 1970). Consequently the Foreknobs thickens to the south and southwest of the type section of the Foreknobs. The Red Lick ranges from 0-700 feet (~0-215m) in thickness (Dennison 1970).

5.9.2 The Red Lick in this study

The base of the unit within the study area has a zone of fine sediment containing silty mudstones and muddy siltstones that eventually coarsen up to the more characteristic beds of the Red Lick. This zone is persistent through the study area and was also recognized by Rossbach (1992) at his Hanging Rock section. Above this first portion there are three sandstone bodies ranging from 50 to 150 feet (~15-45m) thick each. At the sections south of 460 near Blacksburg the top of the Red Lick has a 30 to 70 feet (~9-20m) interval of micaceous silty very thinly bedded siltstone and shale. The Red Lick is easily recognized because of its massive, 2-5 feet (~.6-1.5m), beds of reddish maroon sandstones. The “red beds” are not like the red shale paleo-soils of the Hampshire formation but are marine siltstones and sandstones with a reddish brown or maroonish tint to them. The Red Lick Member lies conformably on top of the Pound Sandstone and is succeeded by the overlying Price Formation except to the north of Poverty Creek, near Blacksburg, where the Hampshire Formation is present.

If there is any stratigraphic interval in this study that should be considered a new member it is this zone of smaller beds and sediment size between the Pound Member and

the overlying distinctively massive siltstone beds of the Red Lick. This study and Rossbach's (1992) observed the fine sediment package of the lower Red Lick. Filer (1994) and van Tassel (1994) correlate this with the Dunkirk Shale in New York based on conodonts and the tracing of shales through the sub surface. The top of the Red lick contains another fine sediment package. It is in the right stratigraphic position to be equivalent to the Cleveland Shale. Thickness of the Red Lick ranges from 140-1030 feet (~42-310m) with an average of 950 feet (~285m) excluding data from Carvin Cove and Bland/Bastian.

5.9.3 Distribution of the Red Lick

The Red Lick is exposed and can be recognized at every location throughout the study area. The lower fine sediment unit (the "McCoy Shale Zone") can be recognized throughout the study area. The three sand bodies can be found at every outcrop except at Carvin Cove, Sulfur Springs, and Bland/Bastian. At Carvin Cove and Sulfur Springs the upper parts of the Red Lick are taken over by the Hampshire red-beds. Carvin Cove has only the lowest one of the three sand bodies preserved while Sulfur Springs has the lower two. Bland Bastion has two but I am unable to determine if it is the lowest and the middle or if it is the middle and the highest. I went as far south as Hungry Mother State Park in Smyth County to see if I could still recognize the Red Lick. The massive sandstone beds are still recognizable there but the separation between the three sandstone bodies is not apparent. It is probably the farthest south you can go and still comfortably use Dennison's nomenclature. To the north the Red Lick can be recognized along Route 50 and Route 522 in Virginia near the West Virginia line. At both locations I was able to find *Cyrtospirifer sulcifer* at the base of the 3 and 4-foot beds just like in the study area. I would say you could recognize it in the entire valley and ridge of Virginia that contains near shore sediments of the Upper Devonian. At the Alleghany/Crows section the Red Lick is about 400 feet (~120m) thick and is overlain by about 400 feet (~120m) of Hampshire red beds. This would be expected, because the Catskill delta system progradation from east to west begins in New York and moves south-southwest. South of route 460 near Blacksburg the Hampshire Formation is not present and the Cloyd

Conglomerate Member of the Price Formation overlies the Red Lick Member conformably.

5.9.4 Depositional environment of the Red Lick

Most of the sediments are near shore shallow marine within wave base except for the lower fine zone and the Cleveland Shale equivalent. The lower part of the Red Lick is fine grained and thinly bedded and probably represents a time of transgression. It is followed by massive four and five-foot beds of maroonish gray marine siltstones and sandstones as the progradation of sediment overcomes the rate of subsidence. These beds contain numerous fossil hashes of near shore fauna commonly containing *Cyrtospirifer sulcifer*, large *Leptodesma*, and *Grammysioidea*. This is followed by the fluvial deltaic sediments of the Price Formation or the redbeds of the Hampshire Formation. Overall the Lick run represents a sea-level rise and a subsequent filling in of the near shore and shoreline with deltaic marine and non-marine sediments. The three distinctive sand bodies above the fine sediments of the lower Red Lick are probably the result of smaller sea-level drops even though the Red Lick as a whole is the rapid progradation of the Catskill delta. The increased rate of progradation is most likely due to lack of subsidence (Devonian of the World, 1967).

5.9.5 Age of the Red Lick

Famennian to basal Tournaisian based on the brachiopod assemblage.

5.10 Hampshire Formation

5.10.1 Type section and general stratigraphy

Darton (1892) named the Hampshire Formation for the rocks in Hampshire County, West Virginia. The sequence is dominated by red to reddish-brown shale and

silty-shale. The Hampshire has a gradational contact with the underlying Red Lick Member of the Foreknobs Formation. The Price Formation overlies the Hampshire and is recognizable by the Sharp contact with the Cloyd Conglomerate Member or the coarse marine sandstone of the Ceres Member. The Hampshire Formation ranges from 1000 – 2070 feet (~300-630m) (Dennison 1970).

5.10.2 The Hampshire in the study area

In this study the highest marine bed of the Red Lick Member determines the contact. In the study area the Hampshire Formation is about 500 feet (~150m) thick at the sections that are closest to the pale-shore and tapers down to 0 feet (0m) just south of Blacksburg along Brush Mountain. South of Blacksburg the Hampshire Formation is missing because the sediments are marine well into the Price Formation.

5.10.3 Distribution of the Hampshire

There is no recognition of the Hampshire Formation south of Route 460 Near Blacksburg, Montgomery County. The Upper parts of the Red Lick Member are taken over by the Hampshire Formation at Carvin Cove, Sulfur Springs, and at Allegheny/Crows.

5.10.4 Depositional environment of the Hampshire

The Hampshire beds are deposited in alluvial and fluvial environments (Sheckler 1986). They are the result of the progradation of the Catskill delta into the shallow near-shore marine environments of the central-southern Appalachian basin.

5.10.5 Age of the Hampshire

The Hampshire is time transgressive due to the progradational nature of the red beds of the Catskill delta. The Hampshire is not equal in time to the “Catskill” Formation

in New York, which is older (Oliver et al 1968). The Hampshire is middle Late Famennian at Elkins and valley Head, West Virginia, based on microfossil spore zonation (Scheckler 1986).

5.11 Basal-Price Formation

5.11.1 Type section and general stratigraphy

The type section for the Price Formation was designated Price Mountain in Montgomery County. The Type section locality did not fit the criteria for a type section so Bartlett (1974) designated State Highway 100 in Pulaski County on Little Walker Mountain near Cloyds Mountain the type section. According to Butts (1940) it is practically synonymous with the Pocono Formation to the north in northern Virginia. Campbell (1894) introduced the name Price. The Price extends upward from the Hampshire Formation where it is present, from the Foreknobs Formation south of 460 near Blacksburg, and from the top of the Brallier in Bluefield, West Virginia (Butts 1940). The Mccrady Formation made up of non-marine predominantly red shale overlies the Price. The Price Formation is dominated by brown to gray sandstones, siltstones, and shales (Kammer and Bjerstedt 1986). The base of the Price can be recognized in areas where it is underlain by the Foreknobs or the Hampshire Formation by the distinctive Cloyd conglomerate or the Sunbury shale where the Cloyd is absent (Kammer and Bjerstedt 1986).

5.11.2 The Price in the study aarea

The basal Price Formation is as described. The type section is within the study area and retains many of the characteristics used to describe the formation. The Price above the Cloyd Conglomerate and the Sunbury Shale is a yellowish micaceous medium to coarse sandstone that grades into brown and gray sandstones. There are a few marine fossils and many plant fossils.

5.11.3 Distribution of the Price

The Basal-Price Formation can be found at every location of this study except at Carvin Cove where it has been eroded off and is missing.

5.11.4 Depositional environment of the Price

The Price is the southwestern extent of the Catskill delta complex. It is time transgressive. The Price is older to the north and northeast and is progressively younger to the south and southeast.

5.11.5 Age of the Price

The Price is Mississippian in the study area based on the occurrence of *Subglobosochonetes acutiliratus*, *Macropotamorhyncus durbenensis*, and *Syringothyris randalli* (Carter and Kammer 1990). In the region the Price has been traditionally used as a general base of the Mississippian. Carter and Kammer (1990) found the lower Price Formation to contain upper-most Devonian (Frasnian) at Caldwell, West Virginia.

5.12 Cloyd Conglomerate Member

5.12.1 Type section and general stratigraphy

The type area for the Cloyd Conglomerate is Cloyd Mountain, part of Little Walker Mountain southwest of the New River in Pulaski County (Butts 1940). Bartlett (1974) re-designated the type section location to be Route 100 where it crosses over Little Walker Mountain in Pulaski County. Strangely the Cloyd Conglomerate Member is not exposed at the Type section locality for the Price Formation (Butts 1940). The Cloyd is often used in the study area to indicate the base of the Price Formation. The Cloyd is

underlain by the Foreknobs Formation except where the upper part of the Foreknobs is taken over by the Hampshire Formation, then the Cloyd lies on top of the Hampshire. The Sunbury Shale succeeds the Cloyd in the study area. The Cloyd is dominated by orthoquartzite quartz conglomerate that is quartz cemented. It ranges from moderately sorted to poorly sorted. The maximum clast collected in the Cloyd is 14 cm. The Cloyd ranges from 50 to 150 feet (~15-45m) in thickness.

5.12.2 The Cloyd in the study area

The Cloyd is readily recognized in the study area especially where it is underlain by the Hampshire redbeds. Where the Cloyd overlies the Foreknobs it is easy to identify because it sits on a zone of finer sediment possibly equivalent to the Cleveland Shale. The Sunbury Shale overlies the Cloyd. The contact is sharp between the top of the Foreknobs/Hampshire Formations and the overlying Cloyd Conglomerate. There are other conglomeratic beds associated with the Foreknobs that could be misidentified as the Cloyd, especially in areas where the section was incomplete.

The type of conglomerate varies in the study area. At Longspur in Pulaski the Cloyd has ripple marks that are 3-6 feet (~1-2m) between troughs. At McCoy, Parrott, and Lick Run the Cloyd is cross-bedded with a dip-direction, east-northeast, towards the epic sea and contains numerous marine fossils. At Sulfur Springs and Allegheny/Crows the Cloyd is much finer grained, not near as clean, is very micaceous, and has cross-bed dip directions towards the shore. The Cloyd around the New River area appears to have to pulses of conglomerate or a faulted section. Recognizance, after new road construction at route 100, where (Bartlett 1974) designated the type section, revealed a tightly folded and faulted Cloyd Member at the top of Cloyds Mountain.

The Cloyd is easily recognized in the study area except where it has been eroded away (Carvin Cove) and where it is not preserved (Bland/Bastion). It is very thin and has lenticular nature of becoming thicker and thinner. Thickness ranges from 30 to 60 feet and averages about 40 feet.

5.12.3 Distribution of the Cloyd

The Cloyd Conglomerate can be recognized at every outcrop location except at Carvin Cove and Bland/Bastion. Even though there are conglomeratic beds at both places they are not in the position of the Cloyd Conglomerate. The Cloyd should be above the Hampshire Red-beds to the north of Blacksburg and above the Red Lick Member south of Blacksburg.

5.12.4 Depositional environment of the Cloyd

The Cloyd is a shallow water near-shore or at shore deposit. It contains a variety of sedimentary structures and lithologic differences that make a single depositional environment analogy impossible. The Depositional environments are nearshore marine (Bland/Bastian), beach front/shoreline (Longspur/Alum Spring, Parrott, McCoy, and Lick Run), and near shore bar (Sulphur Spring and Alleghaney/Crows). At Parrott and Lick Run the Cloyd has abundant fossil material. A significant amount of the brachiopods found are whole fully articulated. Long crinoid columns and whole cephalopods were found. A complete articulated starfish was found in the conglomerate! My explanation is that the Cloyd fauna was living in the gravel. The starfish was cruising along eating whatever it came across. A storm came and flushed a bunch of meteoric water into the sea where the starfish was. The starfish was stunned and a slug of sediment from the storm wash covered it up. The Cloyd is certainly a near shore or shoreline sediment. It must have been deposited during a significant sea-level drop.

2.5 Age of the Cloyd

The Cloyd Conglomerate Member is lower Tournaisian based on the occurrence of *Macropotamorhynchus durbenensis* and *Syringothyris extenuata*. Colton (1970) found the Cloyd to be slightly younger than the base of the Berea Sandstone in southeastern West Virginia (Bartlett 1974).

5.13 Sunbury Shale (=Big Stone Gap) Member

5.13.1 Type section and general stratigraphy

The Big Stone Gap was described by Stose (1923) for a 320 foot section of black shale overlain by the Price Formation in a series of measured sections near Big Stone Gap and Slatville, Virginia (Bartlett 1974). There is a great deal of literature about this unit and its correlations with other shale units that can be found in Bartlett's (1974) dissertation. Correlations are summarized as the Sunbury is equivalent to the Big Stone Gap and they correlate to the upper part of the Chattanooga Shale. The Sunbury is the name used for a larger region and is the accepted recent nomenclature. The Sunbury lies between the Cloyd and the Ceres Members. It is a dark gray to black fissile shale with some dull black argillite units (Stose 1923).

5.13.2 The Sunbury in the study area

The Sunbury is recognized everywhere that the Cloyd is recognized except at Longspur/Alum Ridge where the slope of the mountain is equal to the dip of the beds. At this location the shale is so badly weathered it could not be sampled.

5.13.3 Distribution of the Sunbury

The Sunbury Shale can be best recognized at Lick Run, McCoy, Parrott, and Alleghany/Crows. At Long Spur/Alum Springs (STE) the dip of the rocks is close to the slope of the hill and the Sunbury is deeply weathered and mostly weathered away. I could not recognize it at Sulfur Springs and it is missing at Carvin Cove. Bland/Bastion it is there but there is no typical Cloyd Conglomerate to help you be sure it is the Sunbury rather than the fine silty-shaley zone (Cleveland Shale?) at the top of the Red Lick.

5.13.4 Depositional environment of the Sunbury

The Sunbury Shale was deposited in relatively deeper water and distal to shore compared to the underlying Cloyd and the overlying Ceres. The presence of inarticulate brachiopods and thin shelled in faunal bivalves indicate low energy water with a significant amount of food resources in the sediment. The shale is dark and appears to be organic rich. There is no pyrite or other reducing minerals to indicate anaerobic conditions. The sea floor was probably dysaerobic with low energy. Could have been an estuary or bay near the open ocean but, I say near open ocean because Bartlett (1974) found conodonts in the Sunbury. It is evidence of a relative sea-level rise and represents the first major transgression after the end of the Devonian.

5.13.5 Age of the Sunbury

Hass (1956) and Bartlett (1974) found conodonts from the Sunbury Shale (= Big Stone Gap Shale Member) that are Kinderhookian. This study found occurrences of *Ptychopteria euginia* and *Lingula n.sp.*, neither of which are index fossils. The member is sandwiched between two units with ages that agree with the findings of Hass and Barlett. The Sunbury is Tournaisian (Early Carboniferous).

5.14 Ceres Member

5.14.1 Type section and general stratigraphy

Bartlett (1974) named the Ceres for the exposures near the Ceres community in southwestern Bland County. It is bounded below by the Sunbury (=Big Stone Gap Shale) or by the Cloyd Conglomerate where the Sunbury is missing and above by the Broad Ford Sandstone Member. The Ceres ranges from 245 feet (~75m) at interstate 77 too as much as 430 feet (~130m) at Lick Run (Bartlett 1974).

5.14.2 The Ceres in the study area

The Ceres is a yellowish to brownish gray micaceous medium and coarse sandstone. It contains a few beds with marine fossils and has an abundance of plant debris. The Ceres is followed by the Broadford Sandstone Member, which is a zone of olive gray siltstones and sandstones that have 2 to 6 inch (~5-15cm) beds in a series of cut and fill channels that can be easily recognized. The Ceres Member is as Bartlett (1994) described it.

5.14.3 Distribution Ceres

The Ceres is exposed at Bland/Bastion, Parrott, McCoy, Lick Run, and Alleghany/Crows. At Long Spur/Alum Spring and Carvin Cove the Ceres is eroded away. At Sulphur Spring it could not be distinguished as a member but is recognized as the basal Price.

5.14.4 Depositional environment of the Ceres

The Ceres is deltaic sediment comprised of both marine and non-marine sediments. The abundance of mica and the sub-angular shape of the grains indicate fairly immature dirty sediment typical of near-shore delta lobes. The important fact about this member is that it is mostly marine and is exposed at all the sections south of Blacksburg.

5.14.5 Age of the Ceres

The Ceres Member is Upper Tournaisian based on occurrences of a Mississippian *Shcizodus sp?* and *Subglobosochonetes acutiliratus*. Further collecting in this unit at other locations should supply needed biostratigraphic information for a better understanding of the Devonian/Carboniferous boundary.

Chapter 6. PALEONTOLOGICAL RESULTS

6.1 Taxonomy

This is a comprehensive list of all identified taxa compiled from the fossils collected in this study. The Phyla are in the order of the most abundant to the least abundant. Each identified taxa is accompanied with the following: plate number and figure number if figured in this volume; location and stratigraphic elevation the sample came from; a brief description of characters used to identify the taxa and/or discriminate it from other taxa (diagnosis); references to sources of comparisons used; and comments. Each sample has a symbol that represents the location from which it was collected and a number that represents its stratigraphic horizon:

- BB** for Bland/Bastion
- STE** for the section on route 738 near Long Spur and Alum Springs
- P** for Parrott
- M** for McCoy
- LR** for Lick Run
- CC** for Carvin Cove
- SS** for Sulphur Springs
- SSR** for a service road adjacent to Sulphur Springs
- AC/CA** for the section between Alleghany and Crows

KINGDOM ANIMALIA

PHYLUM **BRACHIOPODA**

Class **INARTICULATA** Huxely, 1869

Order **LINGULIDA** Waagen, 1885

Superfamily **LINGULACEA** Menke, 1828

Family **LIGULIDAE** Menke, 1828

Genus **Lingula** Bruguiere, 1797

Lingula complanta Hall, 1892

Material from LR 1515

Diagnosis: This larger *Lingula* is distinguished from *Lingula ligea* by its much larger and its overall shape. The shell is broader at the anterior end.

References Examined: Figure 2, Plate 131 *Lingula complanata* in *Devonian Paleontology of New York*, by David Linsley, 1994.

Comments: 2 specimens were found each at a different location (STE, LR).

Lingula ligea Hall, 1860

Material from M 1344

Diagnosis: This taxon is identified by its ratio of being 2 times as long as it is wide. It is distinguished from *Lingula complanta* by its smaller size, consistency of its width, and fine concentric striae.

References Examined: Figure 2, Plate 1 *Lingula ligea* in *Geological Survey of New York. Paleontology, Volume IV, Part 1*, by James Hall, 1867; Figure 6, Plate VIII and Figures 6 and 7, Plate XLVII *Lingula ligea* in *Maryland Geological Survey, Devonian Plates*, by Clarke and Swartz, 1913; Figure 1, Plate 131 *Lingula ligea* in *Devonian Paleontology of New York*, by David Linsley, 1994.

Comments: 13 specimens and were found at 3 locations (STE, M, SS).

Lingula sp.?

Plate 1, Figure 1

Material from M 3336

Diagnosis: Like *Discina doria* but has a distinctive pedicle opening like *Lidostroemella aspidum* on the ventral valve pseudointerarea and an overall shape like *Lingulodiscina exilis*.

References Examined: Figures 10 and 11, Plate 131 *Discina doria* in *Devonian Paleontology of New York*, by David Linsley, 1994; Figures 8-10, Plate 114 *Lidostroemella aspidum* in *Devonian Paleontology of New York*, by David Linsley,

1994; and Figures 11 and 12, Plate 114 *Lingulodiscina exilis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 18 specimens were found all at one location (M). They were found with 28 individuals of the bivalve *Ptychopteria eugenia*, also only occurring at that location.

Order **ACROTRETIDA** Kuhn, 1949

Suborder **ACROTRETIDINA** Kuhn, 1949

Superfamily **DISCINACEA** Gray, 1840

Family **DISCINIDAE** Gray, 1840

Subfamily **ORBICULOIDENAE** Schuchert, 1929

Genus **ORBICULOIDEA** d'Orbigny, 1847

Orbiculoidea newberryi Hall, 1867

Plate 1, Figure 2

Material from STE-3064

Diagnosis: Distinguished by its subcircular shape and surface ornamentation of concentric growth rings. The pedicle valve is concave and has an elongated foramen.

References Examined: Figures 10 and 11, Plate 1 *Discina newberryi* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-5, Plate 114 *Orbiculoidea newberryi* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 16 specimens were found. Specimens were collected from 4 locations (STE, M, CC, and AC/CA).

Suborder **CRANIIDINA** Waagen, 1885

Superfamily **CRANIACEA** Menke, 1828

Family **CRANIIDAE** Menke, 1828

Genus **CRANEA** Hall, 1867

Cranea leoni Hall, 1867

Plate 1, Figure 3

Material from STE-2970

Diagnosis: Like *Orbiculoidea* but has an irregular outline and lacks an elongated foramen. Its preservation indicates that it was probably a calcitic shell or had a calcitic attachment.

References Examined: Figures 25 and 26, Plate 3 *Crania leoni* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 8 and 9, Plate 131 *Cranea leoni* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from 1 location (STE).

Genus **PETROCRANIA**

Petrocrania hamiltoniae Raymond, 1911

Plate 1, Figures 4 and 5

Material from STE-3131

Diagnosis: Identified by its irregular shape that is somewhat orbicular and having a pedicle valve that is attached to a foreign shell. There is a small ridge where the shell is thickened along the margin of the attached shell. The attached valve is completely attached and conforms to the host shell.

References Examined: Figures 17-23, Plate 3 *Crania hamiltoniae* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 12-18, Plate 131 *Petrocrania hamiltoniae* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: All of the individuals found in this study were attached to *Mytilarca chemungensis*. 8 specimens were found. Specimens were collected from 2 locations (STE, M).

Class **ARTICULATA** Huxely 1869

Order **ORTHIDA** Schuchert and Cooper, 1932

Superfamily **ENTELETACEA** Waagen, 1884

Family **ENTELETIDAE** Waagen, 1884

Genus **SCHIZOPHORIA** King, 1850

Schizophoria impressa Hall, 1843

Plate 2, Figure 1 and 2

Material from P -65 and AC-1

Diagnosis: This species has a very narrow interarea, a narrow acute beak, and rounded cardinal extremities. The brachial valve is convex, rotund with a full and rounded umbo, a broad gentle sulcus, and large diductor muscle scars in the shape of an upside down heart. The hingeline is less than half its width. The pedicle valve is also convex but much less rotund than its counterpart. Its width is greater than its length. The exterior has fine uniform costellae and narrow striae

References Examined: Figures 11-19, Plate 8 *Orthis impressa* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figure 26, number 3 and 4 *Sciizophoria striatula* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-9, Plate 115 *Scizophoria impressa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 20 specimens were found. Specimens were collected from 6 locations (STE, P, M, LR, SS, AC).

Schizophoria sp?

Diagnosis: Identified as a *Schizophoria* because of the overall shape of the outline, the width being much greater than its length, and the shape of impressions of the diductor muscle scars are the same as other *Schizophoria*. This species is much larger than *S. impressa*, has more strongly divergent diductor scars, an even greater width to length ratio, and lacks the rotundness of the brachial valve. Characters are consistent with Missippian *Schizophoria*.

Comments: Only impressions of brachial valves were found. The specimens are much larger and broader in width than *S. impressa*. 21 specimens were found. Specimens were collected from 2 locations (SS, AC/CA).

Superfamily **RHIPIDOMELLACEA** Alichova, 1960

Family **ONNIELLIDAE** Opik, 1933

Genus **AULACELLA** Schuchert and Cooper, 1931

Aulacella eifelensis? De Verneuil, 1850

Diagnosis: Generally round outline, biconvex, and a relatively short hinge line. Surface has fine radiating costellae. Internal molds of the pedicle valve have relatively large diductor and adductor muscle scars. The diductor scars are larger than the adductor muscle scars. The scars make a pattern similar to the shape of a butterfly and are separated by a low forked ridge.

References Examined: Figures 7, 8, 10, 11, and 13, Plate 19, *Aulacella eifelenensis* in Brachiopod genera of the suborders Orthoidea and Pentameroidea, by Schuchert and Cooper, 1932.

Comments: 40 specimens were found. Specimens were collected from 1 location (SS).

Genus **CARINIFERELLA** Schuchert and Cooper, 1931

Cariniferella carinata Hall, 1843

Plate 2, Figure 3 and 4

Material from AC-1

Diagnosis: This species is biconvex with a very convex brachial valve and a slightly convex to almost flat pedicle valve. It has a hinge line three quarters of its width with commonly preserved impression of regularly spaced hinge teeth. It has fine radiating costellae with narrow striae. Characterized by deep sulcus on the brachial valve and an angular elevated fold on the pedicle valve. *C. carinata* is much more robust and has a much more pronounced fold and sulcus than *C. tioga*. Its striae are different from *D. cayuta* in that they are regular and fine striae instead of the alternating pattern of differing strength striae.

References Examined: Figures 30-32, Plate 8 *Orthis carinata* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figure 5, Plate LII *Dalmanella carinata* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 26, number 8 *Cariniferella carinata* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 13-15, Plate 115 *Cariniferella carinata* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 58 specimens were found. Specimens were collected from 5 locations (STE, P, M, CC, AC).

***Cariniferella tioga* Hall, 1843**

Plate 2, Figure 5 and Plate 3, Figure 1

Material from STE-3100 and STE-3245

Diagnosis: *C. tioga* has a somewhat round outline but has a broader width than its length. It has fine to very fine costellae that curve up towards the hingeline laterally and a very gentle fold and sulcus. It is differentiated from *C. carinata* by its shallower valves, a much more conservative fold and sulcus, and smaller average size.

References Examined: Figures 20-29, Plate 8 *Orthis tioga* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-4, Plate LII *Dalmanella tioga* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 26, number 6 and 7 *Cariniferella tioga* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-12, Plate 116 *Cariniferella tioga* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 185 specimens were found. Specimens had occurrences at 7 locations (FT, STE, P, M, LR, SS, AC/CA).

***Cariniferella elmira* Williams, 1908**

Plate 3, Figures 2 and 3

Material from SS-3529 and SSR-369

Diagnosis: *Cariniferella elmira* is very similar to *Cariniferella tioga* and *Thiemella leonensis*. Length is slightly greater than width; it has a less distinctive fold and sulcus than *C. carinata*, *C. tioga*, and *Thiemella leonensis*. Internal molds exhibit quadrate muscle scars divided by a medial septa and strong plications on the anterior margin.

Comparisons: I examined several specimens of *Cariniferella Elmira*, collected by James Hall from Chemung Narrows, at the Smithsonian next to specimens of the other *Cariniferella*.

Comments: 90 specimens were found. Specimens had occurrences at 6 locations (FT, STE, LR, CC, SS, AC).

Genus **THIEMELLA** Williams, 1908

Thiemella leonensis Hall, 1867

Plate 3, Figure 4

Material from CA-302

Diagnosis: *T. leonensis* has a more strongly differentiated sulcus than *C. tioga*. It has two series of radial costellae, which separates it from the patterns of *Cariniferella* and *Douvillina*. Adductor muscle scars reach half the valve length and are separated by a distinct medial septum.

References Examined: Figures 3-8, Plate 8 *Orthis leonensis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 26 number 9 *Dalmanella* cf. *Dalmanella leonensis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 13-20, Plate 116 *Thiemella leonensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 172 specimens were found. Specimens were collected from 1 location (SSR).

Family **RHIPIDOMELLIDAE** Schuchert, 1913

Genus **RHIPIDOMELLA** Oehlert, 1890

Rhipidomella penelope Hall, 1860

Plate 3, Figure 5 and Plate 4, Figure 1

Material from SS-3994

Diagnosis: It has a rounded outline, a relatively small hinge line, and fine costellae radiating from the beak to the anterior. It has a distinctive muscle scar pattern on the internal molds of the pedicle valve. The scars form a diamond shape from the interarea of the beak towards the anterior. The flabelliform diductor scars extend slightly more than half the length of the valve. The two edges exposed to the anterior exhibit a series of 3 to 4 small lobes with fine separations extending towards the median septa. This orthid is large compared to *Cariniferella elmira*, *Cariniferella tioga*, and *Tropidoleptus carinatus*.

References Examined: Figure 2, Plate 6 *Orthis penelope* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 6-9, Plate XIV

Rhipidomella penelope in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; and Figures 1-11, Plate 65 *Rhipidomella penelope* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 12 specimens were found. Specimens were collected from 3 locations (M, SS, AC/CA).

Family **TROPIDOLEPTIDAE** Schuchert, 1896

Genus **TROPIDOLEPTUS** Hall, 1857

Tropidoleptus carinatus Conrad, 1839

Plate 4, Figures 2 and 3

Material from SS-4398 and SS-4390

Diagnosis: This species has a semi-elliptical outline and a straight hinge line equaling the shell width. *T. carinatus* has simple broad and low radial costae, almost half as many costae per millimeter than *Cariniferella Elmira* or *Cariniferella tioga*. A median rib on the ventral valve is broader than the rest and produces carination of the valve.

References Examined: Figures 2 and 3, Plate 62 *Tropidoleptus carinatus* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 7-14, Plate XVI and Figures 1-5, Plate LV *Tropidoleptus carinatus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 27, number 2 and 3 *Tropidoleptus carinatus* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 10-24, Plate 66 *Tropidoleptus carinatus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 93 specimens were found. Specimens were collected from 4 locations (STE, M, LR, SS).

Order **STROPHMENIDA** Opik, 1934

Suborder **STROPHOMENIDINA** Opik, 1934

Family **STROPHODONTIDAE** Caster, 1939

Subfamily **LEPTOSTROPHINAE** Caster, 1939

Genus **NERVOSTROPHIA** Caster, 1939

Nervostrophia nervosa Hall, 1843

Plate 4, Figure 4 and Plate 5, Figure 1

Material from SS-3695 and SSR-38

Diagnosis: *N. nervosa* has a semicircular outline and is slightly wider than its width except for geroentric forms, which can be slightly longer than its width. The broad strophic hinge line is equal to the width of the shell and usually has well preserved denticulate. The deltidium is narrow and short. The boundary of the muscle scars, papilose ridges, shows a distinctive “V” shape pointed toward the beak having an angle of 70-80°. The surface is covered by fine radial costellae, which are irregularly thickened and bifurcating, giving the surface a scraggly appearance. The costellae have different orders of size; between two larger costellae are 2-5 lesser costellae.

References Examined: Figures 13-16, Plate 19 *Strophodonta perplana*, var. *nervosa* in Geological Survey of New York, Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-4, Plate XLVIII *Leptostrophia perplana* var. *nervosa* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 27, number 6 and 7 *Nervostrophia nervosa* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; and Figure 1, Plate 117 *Nervostrophia nervosa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 109 specimens were found. Specimens were collected from 4 locations (M, SSR, SS, AC).

Nervostrophia plana Cooper and Dutro, 1982

Material from SSR-369

Diagnosis: This taxon is very similar to *N. nervosa* except it is flatter, less convex, and a hinge line is extremely mucronate. I would identify this as *Nervostrophia extensa* except the cardinal extremities are more like mucronation of the hinge than large ears.

References Examined: Figures 1-6, Plate 6 *Nervostrophia plana* in Devonian Brachiopods of New Mexico, by G. A. Cooper and J. T. Dutro, Jr., 1982; Collections at the Smithsonian.

Comments: 11 specimens were found. Specimens were collected from 2 locations (SSR, AC/CA).

***Nervostrophia nervosa* var. A "megastrophia"**

Plate 5, Figures 2 and 3

Material from P-318

Diagnosis: Similar to *N. nervosa* and *N. plana* except much larger.

Comparisons: Figures 1-6, Plate 6 *N. plana*, Figures 7-14, Plate 6 *N. extensa*, and Figures 1-16, plate 7 *N. mucrospina* in Devonian Brachiopods of New Mexico, by G. A. Cooper and J. T. Dutro, Jr., 1982; Collections at the Smithsonian.

Comments: 10 specimens were found. Specimens were collected from 1 location (P).

Subfamily **DOUVILLININAE** Caster, 1939

Genus **DOUVILLINA** Oehlert, 1887

Douvillina cayuta Hall, 1867

Plate 6, Figure 2

Material from SSR-680 and AC-540

Diagnosis: Shell is convexo-concave in the umbo region. The hinge line is denticulated and fully developed in both valves. There are distinctive bilobed diducter muscle scars and two elevated plates in front of the adductor muscle field. *D. cayuta* is less inflated and considerably larger than *D. graciliora*. *D. cayuta* has a very distinctive pattern of costellae consisting of two larger costellae with 3-4 lesser capillae between.

References Examined: Figures 1-5, Plate 19 *Strophodonta cayuta* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 8-17, Plate XLVIII and Figures 1 and 2, Plate XLIX *Douvillina cayuta* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 27, number 8 and 9 *Douvillina cayuta* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 2-7, Plate 117 *Douvillina cayuta* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 399 specimens were found. Specimens were collected from 8 locations (STE, P, M, LR, CC, SSR, SS, AC).

***Douvillina cayuta* var. *extensa* Butts, 1941**

Plate 5, Figures 4 and 5

Material from P-64

Diagnosis: This variety of *D. cayuta* is identical except for the hinge line, which is very mucronate, adding 20 to 50% to the hinge length and valve width.

References Examined: Figures 23 and 24, Plate 123 *Douvillina extensa* in Geology of the Appalachian Valley in Virginia Part II Fossil Plates and Explanations, by Charles Butts, 1941

Comments: 79 specimens were found. Specimens were collected from 5 locations (P, CC, SSR, SS, AC).

***Douvillina graciliora* Clarke and Swartz, 1913**

Plate 6, Figure 1

Material from AC-545

Diagnosis: *D. graciliora* is more convex or inflated, somewhat smaller, and has larger and less numerous denticulate than *D. cayuta*. Internal molds exhibit prominent adductor and diductor muscle scars that are marked by a granulated surface on the brachial valve.

References Examined: Figures 3-13, Plate XLIX *Douvillina cayuta* var. *graciliora* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 28 number 1 *Douvillina graciliora* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 24 specimens were found. Specimens were collected from 4 locations (P, M, LR, AC).

Genus DOUVILLINARIA Stainbrook, 1945

***Douvillinaria variabilis* Calvin, 1878**

Plate 6, Figure 3

Material from LR 1054

Diagnosis: *D. variabilis* is distinguished from *D. cayuta* and *D. graciliora* by its variation in strength of costellae, the rapid fanning out of the costellae from the beak area

(fasciculate), less convex brachial valve, and having a broader posterior compared to the hinge line.

References Examined: Figures 6-10, Plate XI *Schuchertella variabilis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 38-44, Plate 9 *Douvillinaria variabilis* in Devonian Brachiopods of New Mexico, by G. A. Cooper and J. T. Dutro, Jr., 1982; Figures 8-10, Plate 117 *Douvillina variabilis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 18 specimens were found. Specimens were collected from 3 locations (LR, SSR, SS).

Superfamily **DAVIDSONIACEA** King, 1850

Family **SCHUCHERTELLIDAE** Williams, 1953

Subfamily **SCHUCHERTELLINAE** Williams, 1953

Genus **SCHUCHERTELLA** Girty, 1904

Schuchertella chemungensis Conrad, 1842

Plate 6, Figures 4 and 5

Material from LR-1355 and LR-1515

Diagnosis: *S. chemungensis* generally has a greater width than length, a subovate outline, strophic hinge line, very flat pedicle valve, convex brachial valve, and fine costellae that are more or less regular with occasional concentric interruptions by growth lines. The pedicle valve is often distorted changing its slope at prominent growth lines. The deltidium is prominent and adds elevation to the beak area of the valve. The convex brachial valve is strongly inflated and generally not deformed. *S. chemungensis* can be distinguished from *D. cayuta* and *D. graciliora* by its lack of distinctive muscle scars, pattern of striae, less prominent denticulate, and the interrupting concentric growth lines.

References Examined: Figures 1 through 26, Plate 10 *Stretorhynchus chemungensis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 19-22, Plate XLIX *Schuchertella chemungensis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 4-21, Plate 118 *Schuchertella chemungensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: *S. chemungensis* is abundant; frequently found in Upper Frasnian and Lower Famennian horizons; is often associated with *Cyrtospirifer chemungensis*, *C. inermis*, and *C. sulcifer*; and can be found at every outcrop. 302 specimens were found. Specimens were collected from 8 locations (STE, P, M, LR, CC, SSR, SS, AC).

Suborder **CHONETDINA** Muir-Wood, 1955

Superfamily **CHONETACEA** Bronn, 1862

Family **CHONETIDAE** Bronn, 1862

Subfamily **DEVONCHONETINAE** Muir-Wood, 1962

Genus **DEVONCHONETES** Muir-Wood, 1962

Devonochonetes coronatus Conrad 1842

Plate 7, Figure 1

Material from AC-540

Diagnosis: This larger Chonetid is broadly elliptical, some approaching rectangular in form. The hinge line has 5-7 oblique cardinal spines on each side of the apex. The pedicle valve has a shallow undefined sinus. Internal mold exhibit a well-defined medium septum. The surface is covered with an average of 12 costellae in 5mm in the middle of the shell and stronger costellae on the margin.

References Examined: Figures 10, Plate 21 *Chonetes coronata* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 18-21, Plate XI *Chonetes coronatus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 9 and 10, Plate 118 *Chonetes coronatus* in Geology of the Appalachian Valley in Virginia Part II Fossil Plates and Explanations, by Charles Butts, 1941; Figures 1 and 2, Plate 10 *Devonochonetes coronatus* in On the Morphology and Classification of the Brachiopod Suborder Chonetoidea, by Helen M. Muir-Wood, 1962; and Figures 1-15, Plate 75 *Devonochonetes coronatus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 38 specimens were found. Specimens were collected from 1 location (AC).

***Devonochonetes scitulus* Hall, 1867**

Plate 7, Figures 2-4

Material from STE-3254, M-2692, and FT-1865

Diagnosis: *D. scitulus* has a semioval outline with greater width than length and generally 4-5 cardinal spines oblique to the cardinal process on each side of the apex. The surface has fine subequal costellae that are less equal towards the margin. At the margin there are short intercalated striae. Internal molds exhibit a well-developed ridge around the margin of the diductor muscle scars and a strongly plicated margin.

References Examined: Figure 4, Plate 21 and Figures 6 through 11, Plate 22 *Chonetes scitula* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-8, Plate XII and Figures 11-13, Plate L *Chonetes scitulus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 11-20, Plate 76 *Devonochonetes scitulus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 4146 specimens were found. Specimens were collected from 8 locations (STE, P, M, LR, CC, SSR, SS, AC).

Genus **SINOCHONETES** Wang, Boucot, and Rong, 1981

***Sinochonetes lepidus* Hall, 1867**

Diagnosis: *S. lepidus* is semielliptical to hemispherical in outline, has a hingeline that equal to its width, and curved cardinal spines. The convex pedicle valve has a well-developed sinus (depression) that extends to the margin within a raised part of the valve. Within the sinus the costellae are stronger. Can be distinguished by its well developed sinus and the character of the costellae within the sinus.

References Examined: Figure 5, Plate 21 and Figures 12 and 13, Plate 22 *Chonetes lepida* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 9-13, Plate XII *Chonetes lepidus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 27-33, Plate 76 *Sinochonetes lepidus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1300 specimens were found. Specimens were collected from 7 locations (FT, STE, P, LR, CC, SS, AC/CA).

Genus **STRIATOCHONETES** Mikryukov, 1968

Striatochonetes setigera Hall, 1843

Plate 8, Figure 1

Material from M-1450

Diagnosis: *S. setigera* is distinguished by its higher density of costellae that are more frequently bifurcated, having only 3-4 cardinal spines which are perpendicular to the cardinal process. It has greater convexity and has a greater proportional length than *D.scitulus*. and *S. setigera* lacks the sinus and character of the costellae of *S. lepidus*.

References Examined: Figure 2, Plate 21 and Figures 1 through 5, Plate 22 *Chonetes setigera* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 22-25, Plate XI *Chonetes setiger* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; and Figures 21-26, Plate 76 *Striatochonetes setigera* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 28 specimens were found. Specimens were collected from 1 location (M).

Family **ANOPLIIDAE** Muir-Wood, 1962

Subfamily **TORNQUISTIINAE** Afanasjeva, 1976

Genus **SUBGLOBOSCHONETES** Afanasjeva, 1976

Subglobosochonetes acutiliratus? Girty, 1928

Plate 8, Figure 2

Material from LR-2980

Diagnosis: This Chonetid is semicircular in outline and has a hingeline equal to the greatest width of the shell. The brachial valve exhibits two diverging septa. Pedicle valve has narrow septum and few cardinal spines (usually only one or two per side) at high angle to the hinge. Surface has 10-11 costellae per 3mm.

References Examined: Figures 6.1-6.7, page 90 *Subglobosochonetes acutiliratus* in Late Devonian and Early Carboniferous Brachiopods from the Price Formation of West Virginia and Adjacent Areas of Pennsylvania and Maryland, by John L. Carter and Thomas W. Kammer, 1990.

Comments: *S. acutiliratus* is usually found in coquina bed as the most abundant species. This species first occurrence is in the upper portion of the Red Lick Member of the Foreknobs Formation and is evidence for the considering the possibility that the top of the Foreknobs is Carboniferous. 237 specimens were found. Specimens were collected from 3 locations (FT, M, LR).

Subfamily **RUGOSOCHONETINAE** Muir-Wood, 1962

Genus **RUGOSOCHONETES** Sokolskaya, 1950

Rugosochonetes celticus? Muir-Wood?, 1962?

Plate 8, Figure 3

Material from FT-2059

Diagnosis: This larger Chonetid is semicircular in outline and has a hingeline equal to the greatest width of the shell. The pedicle valve has knife-edge median septa and 2-3 cardinal spines at an angle of 20-30° to the hinge. The brachial valve has median septa that extend two-thirds shell length. The surfaces of both valves are covered with fine costellae (24 per 5mm) with numerous bifurcations with no regular arrangement giving it a finely rugose appearance under a dissecting microscope.

References Examined: Figures 3-14, Plate 7 *Rugosochonetes celticus* in On the Morphology and Classification of the Brachiopod Suborder Chonetoidea, by Helen M. Muir-Wood, 1962.

Comments: 431 specimens were found. Specimens were collected from 4 locations (FT, STE, P, LR).

Suborder **PRODUCTIDINA** Waagen, 1883

Superfamily **PRODUCTACEA** Gray, 1840

Family **PRODUCTELLIDAE** Schuchert, 1929

Subfamily **PRODUCTELLINAE** Schuchert, 1929

Genus **PRODUCTELLA** Hall, 1867

Productella boydi Hall, 1857

Diagnosis: *P. boydi* has a semielliptical outline, hinge line shorter than shell width, ears that are not well defined, transition from umbo to ears very gradual, and narrow median

sulcus from the edge of the umbo area to the anterior margin. Intersections of growth lamellae and costae are dominated by growth lamellae giving the location of spines a concentric linear alignment. *P. boydi* has fewer spines than similar species.

References Examined: Figures 10 through 16, Plate 24 *Productella boydii* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 11-17, Plate 119 "*Productella*" *boydi* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 8 specimens were found. Specimens were collected from 1 location (CA).

Productella speciosa Hall, 1857

Plate 8, Figure 4

Material from SS-3695

Diagnosis: *P. speciosa* has a hinge line that is shorter than the shell width, is moderately inflated, and is abundantly spinous. *P. speciosa* has more closely spaced spines and a smaller umbo than *Whidbornella lachrymose* and has a shorter hinge line than *P. spinulacosta*.

References Examined: Figures 1 through 11, Plate 25 *Productella speciosa* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 13-15, Plate LI *Productella speciosa* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 29, number 1 *Productella spiciosa* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-10, Plate 119 "*Productella*" *speciosa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 124 specimens were found. Specimens were collected from 8 locations (STE, P, M, LR, CC, SSR, SS, AC).

Productella spinulacosta Hall, 1857

Plate 8, Figure 5

Material from SSR-43

Diagnosis: *P. spinulacosta* has abroad elliptical outline, a hingeline that is just slightly less than the width, and a strongly incurved beak. On either side of the beak are strongly

wrinkled ears. The surface has fine concentric costae with several rows of interrupted ridges that support spines where growth lines and radial costae intersect.

References Examined: Figures 25 through 34, Plate 23 *Productella spinulicosta* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 18-20, Middle Devonian Plate XIII *Productella spinulacosta* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913.

Comments: 15 specimens were found. Specimens were collected from 3 locations (LR, SS, SSR).

Genus **STROPHOPRODUCTUS** Nalivikin, 1937

Strophopproductus hystricula Hall, 1867

Diagnosis: The hinge line of *S. hystricula* is significantly shorter than the width of the shell. It is smaller than the other Productids and has an abundance of finer hair like spines.

References Examined: Figures 16-19, Upper Devonian Plate LI *Productella hystricula* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-8, Plate 120 *Strophopproductus hystricula* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 2 specimens were found. Specimens were collected from 1 location (STE).

Subfamily **CHONOPECTINAE** Muir-Wood and Cooper, 1960

Genus **STEINHAGELLA** Goldring, 1957

Steinhagella membranacea? Phillips, 1841

Plate 8, Figure 6

Material from LR-1335

Diagnosis: *Steinhagella* has a similar outline to other productids, a small conservative umbo, and is significantly wider than it is long. The surface has distinctive well developed fine to medium concentric rugae which intersect with less prominent radial rows of spine bases. The combination gives the surface a concentric pattern of irregular waves, almost wrinkles, with fine spines.

References Examined: Figure 29, number 6 *Steinhagella sp?* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 11 specimens were found. Specimens were collected from 2 locations (M, LR).

Genus **WHIDBORNELLA** Reed, 1943

Whidbornella hirsuta Hall, 1857

Diagnosis: Similar to *P. speciosa* but has broader more prominent ears and a more inflated umbo. Internal molds of the brachial valve exhibit a median septum and numerous papillae near the margins.

References Examined: Figures 17 through 29, Plate 24 *Productella hirsuta* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 28, number 8 *Productella hirsuta* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-12, Plate 121 *Whidbornella hirsuta* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 16 specimens were found. Specimens were collected from 1 location (STE).

Whidbornella lachrymosa Conrad, 1842

Plate 9, Figure 1 and 2

Material from SS-3947

Diagnosis: *W. lachrymose* is subhemispheric with a subelliptical outline. It has a narrow interarea, a moderately to highly inflated umbo area, which extends beyond the hinge line and has distinctive lateral ears along the hinge line. Internal molds display a weak septum. Spine bases are elongated in a radial orientation. *W. lachrymosa* can be distinguished from other Productids by having fewer spines and elongated bases.

References Examined: Figures 23 through 28, Plate 25 *Productella lachrymosa* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 20-22, Plate L and Figures 1-3, Plate LI *Productella lachrymosa* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 28, number 9 *Productella lachrymosa* in Biostratigraphy of the Greenland Gap Group in Virginia and

West Virginia, by Thomas Rossbach, 1992; and Figures 13-30, Plate 121 *Whidbornella lachrymosa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 469 specimens were found. Specimens were collected from 8 locations (FT, STE, P, M, LR, SS, SSR, CA).

Family **LEIOPRODUCTIDAE** Muir-Wood and Cooper, 1960

Subfamily **DEVONOPRODUCTINAE** Muir-Wood and Cooper, 1960

Genus **DEVONOPRODUCTUS** Stainbrook, 1943

Devonoproductus walcotti Fenton 1924

Plate 9, Figure 3

Material from AC-326

Diagnosis: *D. walcotti* is slightly longer than it is wide, has few scattered spines and fine costellae on the brachial valve. The pedicle valve has regular concentric lamellae.

References Examined: Figure IV., Plate 3 *Devonoproductus walcotti* in Brachipoda of the Independence Shale of Iowa, by M. A. Stainbrook, 1945.

Comments: 3 specimens were found. Specimens were collected from 1 location (AC).

Family **OVERTONIIDAE** Muir-Wood and Cooper, 1960

Subfamily **OVERTONIINAE** Muir-Wood and Cooper, 1960

Genus **SEMIPRODUCTUS** Bublichenko, 1956

Semiproductus onustus Hall, 1867

Plate 9, Figures 4 and 5

Material from SS-6473

Diagnosis: *S. onustus* (*onusta*?) is greatly inflated having a thickness half its width. Internal molds show very short and narrow teeth and sockets protruding slightly but obviously beyond the hinge line and a distinctive median septum extending at least two-thirds its length with two round muscle scars adjacent to the septum.

References Examined: Figures 29 through 42, Plate 26 *Productella onustus* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figure 29, number 2 *Productella* cf. *Productella onusta* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 6-16, Plate

122 *Semiproductus onustus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 72 specimens were found. Specimens were collected from 4 locations (LR, SS, SSR, CA).

Order **RHYNCHONELLIDA** Kuhn, 1949

Superfamily **RHYNCHONOLLACEA** Gray, 1848

Family **TRIGONIRHYNCHIDAE** McLaren, 1965

Genus **CUPULAROSTRUM** Sartenaer, 1961

Cupularostrum congregata Conrad, 1841

Diagnosis: Subtriangular to transversely oval and globose in outline, well-developed fold and sulcus and becoming conspicuous on the margin. Deep sulcus with 3 coarse sub-rounded to sub-angular costae in the middle with seven to eight fine costae on each lateral slope.

References Examined: Figures 44-59, Plate 54 *Rhynchonella congregata* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 11 and 12, Plate 121 *Camarotoechia congregata* in Geology of the Appalachian Valley in Virginia Part II Fossil Plates and Explanations, by Charles Butts, 1941; Figures 1-15, Plate 82 *Cupularostrum congregata* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 22 specimens were found. Specimens were collected from 3 locations (FT, LR, AC).

Cupularostrum contracta Hall, 1843

Plate 10, Figures 1 and 2

Material from LR-1540 and LR-1550

Diagnosis: Like *C. congregata* except not as inflated with relatively shallow valves and more angular costae.

References Examined: Figures 26-39, Plate 55 *Rhynchonella contracta* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 18-20, Plate LIII *Camarotoechia contracta* in Maryland Geological Survey, Devonian

Plates, by Clarke and Swartz, 1913; Figure 29, number 7 *Camarotoechia contracta* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 16-29, Plate 123 *Cupularostrum contracta* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1395 specimens were found. Specimens were collected from 8 locations (FT, STE, P, M, LR, CC, SS, CA).

***Cupularostrum exima* Hall, 1843**

Diagnosis: *C. exima* is triangular ovate in outline, length and width subequal, and valves are subequally convex. It has a wide sulcus that is less defined, 24-28 costae of which 4-5 are in the sulcus and corresponding fold. The pedicle valve has a medial septum. It is distinguished from other *Cupularostrum* by its finer costae and ill-defined fold and sulcus.

References Examined: Figures 1-8, Plate 55 *Rhynchonella exima* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-4, Plate LIV *Camarotoechia exima* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-8, Plate 123 *Cupularostrum exima* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 22 specimens were found. Specimens were collected from 4 locations (FT, SS, AC/CA).

***Cupularostrum orbicularis* Hall, 1860**

Plate 10, Figure 3

Material from FT-1904 and FT-1827

Diagnosis: Suborbicular in outline, width greater than length, gently depressed broad and strongly defined median sulcus. There are 24 or more subangular costae being strong and elevated in the central portion. There are 4-5 costae in the sulcus and 4-6 on the fold. It is distinguished by its suborbicular shape and its strongly defined sulcus.

References Examined: Figures 40-46, Plate 55 *Rhynchonella orbicularis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 26 and 27, Plate LIII *Camarotoechia orbicularis* in Maryland Geological Survey, Devonian

Plates, by Clarke and Swartz, 1913; Figures 9-15, Plate 123 *Cupularostrum orbicularis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 207 specimens were found. Specimens were collected from 5 locations (FT, STE, P, LR, CA).

***Cupularostrum sappho* Hall 1860**

Plate 10, Figure 4

Diagnosis: *C. sappho* is abruptly pointed at the beak, has a well defined fold and sulcus with 4-6 strong costae on each. The fold and sulcus start out narrow near the beak area and become quite broad towards the anterior margin.

References Examined: Figures 33-43, Plate 54 *Rhynchonella sappho* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; and Figures 16-31, Plate 82 *Cupularostrum sappho* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found. Specimen was collected from 1 location (LR).

Genus **MACROPOTAMORHYNCHUS** Sartenaer, 1970

***Macropotamorhynchus durbinensis* Carter and Kammer, 1990**

Plate 10, Figures 5 and 6

Material from LR-2760

Diagnosis: *M. durbinensis* is transversely subtrigonal to subovate in outline, unequally biconvex, and width greater than length. Fold and sulcus are moderately well developed becoming well defined at the anterior margin, the sulcus has 4-6 strong simple subangular costae, the fold has five, and there are 7-8 costae on the flanks that become weaker posterolaterally. Distinguished from *C. orbicularis* by its less orbicular outline, lack of strong definition of the fold and sulcus, and fewer costae.

References Examined: Figures 7.5-7.20, page 92 *Macropotamorhynchus durbinensis* in Late Devonian and Early Carboniferous Brachiopods from the Price Formation of West Virginia and Adjacent Areas of Pennsylvania and Maryland, by John L. Carter and Thomas W. Kammer, 1990.

Comments: 130 specimens were found. Specimens were collected from 5 locations (FT, STE, P, M, LR).

Genus **SINOTECTIROSTRUM** Sartenaer, 1961

Sinotectirostrum alleganium Hall, 1867?

Diagnosis: Subtriangulate to suborbicular in outline, very tall shell with height subequal to its width. It has 26-30 well-developed subangular costae. Side view shows costae curving down to the margin on the posterolateral margins in a hemispherical shape. The side view and the height become important for identifying this species because it is not common to find them in normal orientation.

References Examined: Figures 13-19, Plate 124 *Sinotectirostrum alleganium* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: Many specimens were found lying on their sides do to the height and instability. 20 specimens were found. Specimens were collected from 1 location (LR).

Family **UNCERTAIN** (?aff.**PUGNACIDAE**)

Genus **PUGNOIDES** Weller, 1910

Pugnoides duplicatus Hall, 1867

Diagnosis: Subtriangulate in outline, width greater than length. Sulcus usually has one costa rarely two that are subangular to rounded and are flanked by 2-3 rounded costae of lesser and unequal sizes. Fold has two medial subrounded costae and is flanked by 2-3 ill formed broad rounded costae. The shell is easily deformed and is, lacks the regular costae, and is lacks the thickness of other rhynchonelids.

References Examined: Figures 17-25, Plate 55 *Rhynchonella duplicata* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 20-28, Plate 124 "*Pugnoides*" *duplicatus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: This species is usually suffers greater deformation than other brachiopods it is found with, probably because it has a much thinner shell. 81 specimens were found. Specimens were collected from 2 locations (FT, CA).

Family **CAMAROTOECHIA** Schuchert and LeVene, 1929

Subfamily **CAMAROTOECHINAE** Schuchert and LeVene, 1929

Genus **LEIORHYNCHUS** Hall 1860

Leiorhynchus lesleyi Hall and Clarke, 1894

Diagnosis: Subtriangular ovate in outline, somewhat narrow rounded posterior, and rounded sides. Fold and sulcus are gently defined, have 5-6 slightly broader costae and 10-12 lesser narrower costae on the flanks.

References Examined: Figures 8-10, Plate 124A *Leiorhynchus lesleyi* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 2 specimens were found. Specimens were collected from 1 location (M).

Leiorhynchus mesacostalis Hall, 1843

Plate 11, Figure 1

Material from AC-1

Diagnosis: Shape is similar to *L. lesleyi* but the sides are less rounded. Well-defined but not prominent fold and sulcus are low and bare 3-4 rounded costae, which do not reach the beak area. Costae become obscure or obsolete latterly as do the costae in the fold and sulcus towards the margin. *L. mesacostalis* is smaller and more finely costate than *E. multicostum*.

References Examined: Figures 18-25, Plate 57 *Leiorhynchus mesacostalis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 5-8, Plate LIV *Liorhynchus mesacostale* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 30, number 2 *Leiorhynchus mesacostalis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 145 specimens were found. Specimens were collected from 3 locations (P, LR, AC/CA).

Leiorhynchus quadricostalis Vanuxem 1842

Plate 11, Figure 2

Material from STE-1354

Diagnosis: Like *L. mesacostalis* but has slightly rounded sides, 4 costae in the sulcus that extend closer to the beak, larger size, greater length to width ratio, and more angular costae.

References Examined: Figures 44-49, Plate 56 *Leiorhynchus quadricostata* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 20-24, Plate 84 in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Alleghany.

Genus **EUMATABOLATECHIA** Sartenaer, 1970

Eumetabolatechia multicosum Hall, 1860

Plate 11, Figure 3

Material from LR-1515

Diagnosis: Subtriangular ovate but more ovate outline than *L. lesleyi*, robust umbo, depressed medially towards the anterior forming a broad sulcus. Brachial valve is more convex. The surface is marked by 6-10 sub angular costae in the fold and sulcus, 5-10 medium to strong costae on the lateral flanks, and fine concentric growth lines intersecting the costae.

References Examined: Figures 26-40, Plate 56 *Leiorhynchus multicosum* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figure 9, Plate LIV *Liorhynchus multicosum* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 30, number 3 *Leiorhynchus multicosum* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-19, Plate 84 *Eumetabolatoechia multicosum* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 43 specimens were found. Specimens were collected from 4 locations (P, M, LR, CA).

Order **SPIRIFERIDA** Waagen, 1883

Suborder **ATRYPIDINA** Moore, 1952

Superfamily **ATRYPACEA** Gill, 1871

Family **ATRYPIDAE** Gill, 1871

Subfamily **ATRYPINAE** Gill, 1871

Genus **ATRYPA** Dalman, 1828

Atrypa reticularis Linne', 1758

Plate 11, Figure 4

Material from LR-1350

Diagnosis: Suborbicular to oval in outline, depressed or slightly convex pedicle valve, and convex inflated brachial valve. It has a narrow beak projecting slightly past the hingeline. Surface marked by strong radial costae and fine well defined concentric variances giving the surface a reticulate pattern. Can be distinguished form *S. spinosa* by its closer spacing of radial and concentric ornament.

References Examine: Figures 10 through 24, Plate 51 and Figures 3 through 19, Plate 53 *Atrypa reticularis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 4-6, Plate XVI and Figures 6-11, Plate LV *Atrypa reticularis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 30, number 4 *Atrypa reticularis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 39 specimens were found. Specimens were collected from 2 locations (M, AC).

Genus **PSEUDOATRYPA** Cooper, 1973

Pseudoatrypa devoniana Webster, 1921

Plate 11, Figure 5

Material from AC 436

Diagnosis: Similar to *A reticularis* but has a finer costellate reticulate pattern, an almost flat pedicle valve, and a highly inflated brachial valve. Some specimens exhibit a small frill 6-7mm wide around the anterior margin.

References Examined: Figures 1-16, Plate 22 *Pseudoatrypa devoniana* in Devonian Brachiopods of New Mexico, by G. A. Cooper and J. T. Dutro, Jr., 1982; Figures 1-23, Plate 86 *Pseudoatrypa devoniana* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 93 specimens were found. Specimens were collected from 8 locations (STE, P, M, LR, CC, SS, AC/CA).

Genus **SPINATRYPA** Stainbrook, 1951

Spinatrypa aspera Hall, 1867

Diagnosis: More inflated and robust than *S. hystrix*, spines not as pronounced, not as large, and typically not hollow. The beak area is more inflated than *S. hystrix*. The surface marked by irregular radial costae and coarse irregular concentric growth lines giving it a rugose texture.

References Examined: Figures 19-21, Plate 53A *Atrypa aspera* var. *occidentalis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-3, Plate 125 *Spinatrypa aspera* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 37 specimens were found. Specimens were collected from 2 locations (M, AC/CA).

Spinatrypa hystrix Hall, 1843

Plate 11, Figure 6 and Plate 12, Figure 1

Material from P-293 and P-318

Diagnosis: *S. hystrix* is distinguished from other *Spinatrypa* by its large sometime hollow spines that are both thicker and longer than *S. spinosa* and *S. aspera*. The surface is marked by very coarse irregular radial costae and very coarse irregular radial growth lines with spines at the intersection giving this species a more rugose surface than other *Spinatrypa*.

References Examined: Figures 15-17, Plate 53A *Atrypa hystrix* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 14-19, Plate LV *Atrypa hystrix* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 30, number 5 and 6 *Spinatrypa hystrix* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 4-6, Plate 125 *Spinatrypa hystrix* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 375 specimens were collected. Specimens were collected from 7 locations (STE, P, M, LR, CC, SS, AC).

***Spinatrypa spinosa* Hall, 1843**

Plate 12, Figure 2

Material from LR-1540

Diagnosis: Radial costae and concentric growth lines are close together, intersections with spines more regular creating a more regular and finer reticulate pattern than *S. hystrix* and *S. aspera*. The brachial valve is less inflated and has a narrower beak than *A. reticularis*.

References Examined: Figures 1-14, 18, 24, 25, Plate 53A. *Atrypa spinosa* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 12 and 13, LV *Atrypa spinosa* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 30, number 7 *Spinatrypa spinosa* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-15, Plate 85 *Spinatrypa spinosa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 141 specimens were found. Specimens were collected from 7 locations (STE, P, M, LR, SS, SSR, AC).

Spinatrypa n.sp.? "rugosa"

Diagnosis: Like *Spinatrypa aspera* but larger and more rugose. This is a very large *Spinatrypa*, twice the size of any of the others Atrypids from this study. Very coarse, broad, rounded, and irregular radial costae and very coarse, broad, and irregular concentric growth lines makes an extremely rugose surface but, it lacks the massiveness of the spines on *S. hystrix*.

Comments: Its spines are broken off but if they had the massiveness of those on the *S. hystrix* I would expect at least a few to be in place. 33 specimens were collected. Specimens were collected from one location (M).

Suborder **ATHYRIDIDINA** Boucot, Johnson, and Staton, 1964

Superfamily **ATHYRIDACEA** M'Coy, 1844

Family **ATHYRIDIDAE** M'Coy, 1844

Subfamily **ATHYRIDINAE** M'Coy, 1844

Genus **ATHYRIS** M'Coy, 1844

Athyris angelica Hall, 1861

Plate 12, Figure 5

Material from STE-2970

Diagnosis: Subpentagonal in outline, biconvex, fold becoming more prominent anteriorly, sulcus becoming deep and more defined on anterior half of valve. Surface marked by fine concentric growth lamellae. The most distinguishing characters are the lack of any radial ornamentation and the primary ornamentation being concentric growth lamellae.

References Examined: Figures 9 through 20, Plate 47 *Athyris angelica* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 8-10, Plate LIX *Athyris angelica* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 30, number 8 *Athyris angelica* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 7-17, Plate 125 *Athyris angelica* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 176 specimens were found. Specimens were collected from 5 locations (STE, P, M, LR, CA).

Suborder **SPIRIFERIDINA** Waagen, 1883

Superfamily **CYRTIACEA** Fredriks, 1919 (1924)

Family **AMBOCOELIIDAE** George, 1931

Genus **AMBOCOELIA** Hall, 1860

Ambocoelia gregaria Hall, 1867

Diagnosis: Subpentagonal in outline, small with strongly incurved beak. The pedicle valve is strongly convex with a narrow sulcus that extends from the umbo to the anterior margin; the umbo and median region are inflated. The brachial valve is flatly convex with

a distinctive fine ridge on the anterior margin. *A. gregaria* is slightly larger, has a more distinctive ridge on the pedicle valve, and is more elongated than *A. umbonata*.

References Examined: Figures 19 through 25, Plate 44 *Ambocoelia umbonata* var. *gregaria* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-7, Plate 126 *Ambocoelia gregaria* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: This species is so similar to *A. umbonata* it is difficult to distinguish the difference. 407 specimens were found. Specimens were collected from 5 locations (STE, P, M, LR, CA).

***Ambocoelia umbonata* Conrad, 1842**

Plate 12, Figure 3 and 4

Material from M-1450 and CC-116

Diagnosis: Similar to *A. gregaria* but smaller, not as elongated, less inflated in the umbo and median regions, and lacks a well defined ridge on the brachial valve.

References Examined: Figures 7 through 18, Plate 44 *Ambocoelia umbonata* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1 and 2, Plate XX and Figures 3-7, Plate LIX *Ambocoelia umbonata* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-10, Plate 95 *Ambocoelia umbonata* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: Specimens generally occur in coquina type deposits where they make up 90 percent or more of the assemblage. 4314 specimens were found. Specimens were collected from 8 locations (FT, STE, P, M, LR, CC, SS, AC/CA).

Superfamily **CYRTINACEA** Fredericks, 1912

Family **CYRTINIDAE** Frederiks, 1912

Genus **CYRTINA** Davidson, 1858

***Cyrtina hamiltonensis* Hall, 1867**

Plate 12, Figure 6

Material from M-2011

Diagnosis: Transversely rectangular outline and hemipyramidal in lateral view; higeline equal to shell width; cardinal extremities acuminate; incurved interarea extremely tall, height almost equal to length of the brachial valve. Fold and sulcus are broad, have no costae within them, and are flanked by 7-9 costae.

References Examined: Figures 1 through 4, Plate 27 and Figures 26 through 33, Plate 44 *Cyrtina hamiltonensis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-9, Plate XVII and Figures 1-3, Plate LVI *Cyrtina hamiltonensis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913. Figures 1-21, Plate 96 *Cyrtina hamiltonensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 11 specimens were found. Specimens were collected from 2 locations (M, SS).

Superfamily **SPIRIFERACEA** King, 1846

Family **MUCROSPIRIFERIDAE** Pitrat, 1965

Genus **ELEUTHEROKOMMA** Crickmay, 1950

Eleutherokomma extensa? n.var. “rodan” Cooper and Dutro, 1982

Plate 12, Figure 7

Material from SS 6430

Diagnosis: Like *Eleutherokomma extensa* but much larger. Width three times length, cardinal extremities are pointed but not mucronate, and interarea moderately long and gently curved. Pedicle valve is convex; sulcus originates at the beak and is deep and narrow. Brachial valve is convex; fold originates at the beak, is narrow throughout its length, forming a rounded arch anteriorly, and is only slightly higher than the flanks. The surface is marked by 16-18 costae on each side of the fold and sulcus, costae and the surface of the fold and sulcus are covered with fine concentric growth lamellae.

References Examined: Figures 30-35, Plate 27 in Devonian Brachiopods of New Mexico, by G. A. Cooper and J. T. Dutro, Jr., 1982.

Comments: Personal communication with Jed Day suggests that I may have misidentified this. These specimens are assigned it to this genus because of its morphological similarity to the genus. The sulcus has a small medial costae which is not consistent with

E. extensa. The number of costae on the flanks is more than *E. extensa* and *T. mesacostalis*. The species identification is in question. 5 specimens were found. Specimens were collected from 1 location (SS).

Genus **TYLOTHYRIS** North, 1920

Tylothyris mesacostalis Hall, 1867

Plate 13, Figure 1 and 2

Material from STE-1922

Diagnosis: Semicircular to subtriangular in outline, cardinal extremities approaching mucronate. Pedicle valve has conspicuous medial costa within a well formed sulcus. Brachial valve has a moderately high fold with two strong medial costae. The fold and sulcus are flanked by 8-15 costae. Surface is marked by well defined subangular to sub rounded costae that are crossed by numerous regularly spaced imbricated concentric growth lamellae. This gives the surface a very ornate pattern.

References Examined: Figures 1 through 13, Plate 40 *Spirifer mesacostalis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 11-23, Plate LVIII and Figures 1 and 2, Plate LIX *Spirifer mesacostalis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 6-20, Plate 127 *Tylothyris mesacostalis* in Devonian Paleontology of New York, by David Linsley, 1994

Comments: 2363 specimens were found. Specimens were collected from 8 locations (FT, STE, P, M, LR, CC, SS, AC/CA).

***Tylothyris mesacostalis* var. *mucronatus* (*Spirifer mucronatus*)** Conrad 1842

Plate 13, Figure 3

Material from STE-1933

Diagnosis: Like *Tylothyris mesacostalis* but extremely mucronate.

References Examined: Figures 4-7, Plate 118 *Spirifer muconatus* in Geology of the Appalachian Valley in Virginia, Part II-Fossil Plates and Explanations, by Charles Butts 1933.

Comments: This species is so similar to *Tylothis mesacostalis* that it belongs in this genus. The mucronation could be a growth stage or an ecophenotypic variation. 5 specimens were found at Long Spur/Alum Spring (STE).

Family **SPINOCYRTIIDAE** Ivanova, 1959

Genus **SPINOCYRTIA** Frederiks, 1916

Spinocyrtia granlosa Conrad, 1839

Diagnosis: Large spirifer with moderately high cardinal area, a conservative fold compared to the sulcus, which deepens toward the anterior into an exaggerated state. The fold and sulcus have 18 low rounded costae on their flanks. Perfect specimens exhibit radial costae interrupted by fine concentric growth lamellae giving it a granulose texture.

References Examined: Figures 1-6, Plate XVIII *Spirifer granulosus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 31, number 8 and 9 *Spinocyrtia granlosa* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 1-12, Plate 105 *Spinocyrtia granlosa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Lick Run (LR).

Genus **EOSYRINGOTHYRIS** Stainbrook, 1943

Eosyringothyris sp?

Plate 13, Figure 4

Material from FT-1865

Diagnosis: Semiovate in outline, subpyramidal in lateral view, width twice the length, cardinal area is tall and broad, cardinal extremities are acute but not mucronate or sharp. Brachial valve has a beak that broadens within the umbo area; fold is broad and rounded only becoming slightly flattened in the median of the fold. The surface is marked by 16-17 round to subrounded costae on each side of the folds and sulcus, there are no costae in the fold or sulcus.

References Examined: Index Fossils of North America.

Comments: 12 specimens were found at Bland/Bastion (BB).

Genus **MEDIOSPIRIFER** Bublichenko, 1956

Mediospirifer audaculus Conrad, 1842

Plate 13, Figure 5

Material from SS-4390

Diagnosis: Transversely subtriangulate in outline, medium high cardinal area, cardinal extremities are acute to slightly mucronate, hingeline equal to the shells width, widest at the hingeline getting narrower towards the anterior margin. Interior molds exhibit a strong medial septum. The fold and sulcus are well formed and have no costae, there are 20-26 finer costae on each side of the fold and sulcus; the fold rises sharply but is somewhat flattened for most of the fold width. Its number of fine costae and lack of radial growth lamellae distinguish it from *S. granulosa* and *O. mesaestrialis*.

References Examined: Figures 1-7, Plate 28 *Spirifer audaculus* in Report of the State Geologist for the Year 1893, Vol. II. Paleontology, by James Hall 1894; Figures 7-9, Plate XVIII *Spirifer audaculus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 11 and 12, Plate 118 *Spirifer audaculus* in Geology of the Appalachian Valley in Virginia Part II Fossil Plates and Explanations, by Charles Butts, 1941; Figures 1-26, Plate 103 *Mediospirifer audaculus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from 2 locations (LR, SS).

Family **SYRINGOTHYRIDIDAE** Frederiks, 1926

Genus **ORTHOSPIRIFER** Pitrat, 1975

Orthospirifer mesaestrialis Hall, 1843

Plate 13, Figure 6

Material from CC-3364

Diagnosis: Similar in shape to *M. audaculus*, fold is slightly broader and does not rise as high or as sharply, and it has less costae on the flanks. There are 16-20 broad low costae on the flanks of the broad low fold and deeper sulcus. The fold and sulcus are covered in fine radial capillae. Identified by its number of costae, fine capillae in the fold and sulcus, and a broad somewhat flat fold.

References Examined: Figures 14-22, Plate 40 *Spirifer mesastrialis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 2-5, Plate LVII *Spirifer mesastrialis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 31, number 10 *Orthospirifer mesastrialis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992; Figures 6-13, Plate 130 *Orthospirifer mesastrialis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 45 specimens were collected. Specimens were collected from 3 locations (P, LR, CC).

Genus **SYRINGOTHYRIS** Winchell, 1863

Syringothyris texta Hall 1867

Plate 14, Figure 1

Material from FT-2059

Diagnosis: Subrectangular in outline, width about twice length, broad umbo, very tall apsacline interarea, rounded cardinal extremities. Fold and sulcus are well defined somewhat narrow and bare no costae. Surface is covered with broad rounded crowded costae, there are 14-18 on the lateral flanks, concentric growth lamellae are present but not prominent except for a strong pair at least 2/3 of the way to the anterior margin that are so strong they cause a minor deflection in surface of the shell. Less numerous costae than *S. randalli*

References Examined: Figures 1-9, Plate 124 *Syringothyris texta* in Geology of the Appalachian Valley in Virginia, Part II-Fossil Plates and Explanations, by Charles Butts 1933.

Comments: 14 specimens were found. Specimens were collected from 2 locations (FT, P).

Syringothyris randalli Simpson, 1890

Diagnosis: Large width greater than length, height equal to or greater than length with greatest width at the hingeline. Semipyramidal pedicle valve with very tall apsacline interarea. Syrinx is supported by a strong short septum. Fold and sulcus are well

developed and well defined and do not have any costae within them. The surface has 18-20 rounded to subrounded costae on each side of the fold and sulcus; concentric growth lamellae are evident but not regular and not pronounced.

References Examined: Figures 10 and 11, Plate 30 *Syringothyris randalli* in Report of the State Geologist for the Year 1893, Vol. II. Paleontology, by James Hall 1894; Figures 1-5, Plate 130 *Syringothyris randalli* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 4 specimens were found at Crows/Allegheny.

Family **CYRTOSPIRIFERIDAE** Termier and Termier, 1949

Genus **CYRTOSPIRIFER** Nalivikin, 1919 (1924)

Cyrtospirifer altiplicus Greiner, 1957

Plate 14, Figure 2

Material from LR-1355

Diagnosis: *C. altiplicus* has higher and narrower fold and has a greater width to length ratio compared to *C. chemungensis*. The fold is so tall and narrow that some specimens had them folded over during compaction.

References Examined: Figures 9-12, Plate 1 and Figures 1-5, Plate 2 *Cyrtospirifer altiplicus* in "*Spirifer disjunctus*": Its Evolution and Paleoecology in the Catskill Delta, by Hugo Greiner, 1957; Figure 32, number 3 *Cyrtospirifer altiplicus* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: At Lick Run there is a lagerstaten of *C. altiplicus* that contains juveniles, adults, and geroetric forms. 83 specimens were collected. Specimens were collected from 3 locations (M, LR, AC).

Cyrtospirifer chemungensis Conrad, 1842

Plate 14, Figure 3

Material from SS-3822

Diagnosis: Medium to large *Cyrtospirifer*, width two to four times its length, hingeline is straight and equal to the greatest width of the shell, mucronate to extremely mucronate, moderate well developed fold and sulcus. Surface is covered with rounded to subrounded

radial costae that are bifurcate on the fold and sulcus and fine concentric irregular spaced but not prominent growth lamellae. There are 30-50 costae lateral of the fold and sulcus. It is important to note that the fold and sulcus are covered by radial costae.

References Examined: Figures 1-8, Plate 1 and Figures 1-6, Plate 3 *Cyrtospirifer chemungensis* in "*Spirifer disjunctus*": Its Evolution and Paleoecology in the Catskill Delta, by Hugo Greiner, 1957; Figure 32, number 1 and 2 *Cyrtospirifer chemungensis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992

Comments: This is an extremely variable and common species. Sizes range from medium small to quite large, some are extremely mucronate while others are only slightly. The number of costae on a valve can range from 60 to 100. 500 specimens were found. Specimens were collected from 7 locations (P, M, LR, CC, SS, SSR, AC/AC).

***Cyrtospirifer inermis* Hall, 1843**

Plate 14, Figure 4

Material from SS-6097

Diagnosis: Medium sized, width two times length, hingeline appears to have a very slight angle at the apex of the beak, cardinal extremities are slightly mucronate to acute.

Pedicle valve has a well-defined fairly wide sulcus; brachial valve has a fairly wide moderate but well defined fold. The surface is covered with simple rounded costae, 20-24 lateral of the fold and sulcus with bifurcating costae on the fold and sulcus.

References Examined: Figures 1-16, Plate 4 and Figure 4, Plate 10 *Cyrtospirifer inermis* in "*Spirifer disjunctus*": Its Evolution and Paleoecology in the Catskill Delta, by Hugo Greiner, 1957; Figure 32, number 5 *Cyrtospirifer inermis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 351 specimens were found. Specimens were collected from 6 locations (FT, STE, M, LR, SS, CA).

***Cyrtospirifer preshoensis* – *hornellensis* Greiner, 1957**

Plate 15, Figure 1

Material from CA 36

Diagnosis: Similar in shape to *C. inermis* except hingeline is straight. Internal molds of the brachial valve have a distinctive groove outlining the fold; external molds exhibit a fold that protrudes sharply from the surface with a thickened first costae lateral of the fold.

References Examined: Figures 7-16, Plate 3 *Cyrtospirifer preshoensis* and Figures 1-7, Plate 7 *Cyrtospirifer hornellensis* in "*Spirifer disjunctus*": Its Evolution and Paleoecology in the Catskill Delta, by Hugo Greiner, 1957; Figure 32, number 4 *Cyrtospirifer hornellensis* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: I could not distinguish *C. preshoensis* from *C. hornellensis* using Greiner's (1957) characters so; I am identifying them as them *Cyrtospirifer preshoensis*. 92 specimens were collected. Specimens were collected from 6 locations (STE, P, M, CC, SS, CA).

***Cyrtospirifer sulcifer* Hall, 1894**

PLate 15, Figure 2 and 3

Material from LR-2050 and STE-3254

Diagnosis: Similar in shape to *C. inermis* and *C. preshoensis* but with a width only slightly greater than length and never mucronate. *C. sulcifer* can be distinguished from the other *Cyrtospirifer* by the distinguishing characteristics of its fold; the fold is bisected by a medial groove giving it the appearance of having two subfold, the fold begins at the anterior edge of the umbo, the fold is narrow and becomes broad at the anterior margin, each subfold has four simple rounded costae. It is also not mucronate and has a broader shape with its length almost equal to its width.

References Examined: Figures 1-13, Plate 5 and Figures 5 and 6, Plate 6 *Cyrtospirifer sulcifer* in "*Spirifer disjunctus*": Its Evolution and Paleoecology in the Catskill Delta, by Hugo Greiner, 1957; Figure 32, number 6 *Cyrtospirifer sulcifer* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 889 specimens were collected. Specimens were collected from 6 locations (FT, STE, P, M, LR, CA).

***Cyrtospirifer chemungensis* n.var. “godzillas”**

Plate 15, Figures 4 and 5

Material from LR-1355

Diagnosis: Like *Cyrtospirifer chemungensis* but larger and more mucronate being at least four times wider than long. This may be a geriontric version of *C. chemungensis*.

Comments: At Lick Run (1355) there is a fossil bed that is almost entirely made up of this species. 49 specimens were found. Specimens were collected from 2 locations (M, LR).

Cyrtospirifer n.sp.?”mothra”

Plate 16, Figures 1-3

Material from M-2100 and LR-1355

Diagnosis: This species appears to have characters of both *Spinocyrtia granulosa* and *Cyrtospirifer chemungensis* but has distinctively different shell structure in the umbo and adjacent hinge area. The sockets are narrow and point directly towards the apex of the beak at about a 10° angle to the hinge. The overall shell shape is similar to *C. chemungensis* and *S. granulosa*; it does not have the mucronate cardinal extremities of *C. chemungensis* and is not as inflated as *S. granulosa*, it has rounded cardinal extremities like *W. laevis*.

Comments: 2 specimens were found. One specimen is very large and is most probably an adult the other is small juvenile. Both exhibit the same structures in the umbo area and have similar shapes of the overall shell. Specimens were collected from 2 locations (M, LR).

Family **SPIRIFERIDAE** King, 1846

Genus **SPRIFER** Sowerby, 1816

Spirifer williamsi Hall and Clarke, 1894

Diagnosis: Similar to *T. mesacostalis* but pedicle valve extends well beyond the hingeline, umbo is broader and slightly more inflated, taller interarea. The surface is covered with radial subangular costae; concentric growth lamellae are barely visible. *S.*

williamsi lacks the prominent medial costae and distinctive ornamentation produced by prominent growth lines intersecting costae.

References Examined: Figures 15-17, Plate 130 "*Spirifer*" *williamsi* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 36 specimens were found. Specimens were collected from 3 locations (STE, LR, AC/CA).

Superfamily **RETICULARIACEA** Waagen, 1883

Family **RETICULARIIDAE** Waagen, 1883

Genus **WARRENELLA** Crickmay, 1953

Warrenella laevis Hall, 1867

Diagnosis: Biconvex, inflated broad umbo, shallow broad poorly defined sulcus, wide undefined fold. Shell is somewhat flattened approaching the cardinal extremities, cardinal extremities are rounded.

References Examined: Figures 1 through 12, Plate 39 *Spirifer laevis* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 8 and 9, Plate 25 *Spirifer laevis* in Report of the State Geologist for the Year 1893, Vol. II. Paleontology, by James Hall 1894; Figures 4-6, Plate LVI *Reticularia laevis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 8-17, Plate 126 *Warrenella laevis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Lick Run (LR).

Order **TEREBRATULIDA** Waagen, 1883

Suborder **CENTRONELLIDINA** Stehli, 1965

Superfamily **STRINGOCEPHALACEA** King, 1850

Family **CENTRONELLIDAE** Waagen, 1882

Genus **CENTRONELLA** Billings, 1859

Centronella sp?

Diagnosis: Small, ovate in outline, length greater than width, height $2/3$ to $3/4$ width, widest halfway to the anterior margin. Pedicle valve is much deeper than brachial valve. Surface is marked by faint concentric growth lines.

References Examined: Figures 1-49, Plate 61A. *Centronella*, several species in Geological Survey of New York, Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 1-3, Plate XVI *Centronella* cf. *ovata* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913. Figures 1-19, Plate 107 *Centronella glansfagea* and Figures 20-30, Plate 107 *Centronella impressa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from 2 locations (P, LR).

Suborder **TEREBRATULIDINA** Waagen, 1883
Superfamily **DIELASMATACEA** Schuchert, 1913
Family **CRANAENIDAE** Cloud, 1942
Subfamily **CRANAENINAE** Cloud, 1942
Genus **CRANAENA** Hall and Clarke, 1893
Cranaena eudora Hall and Whitfield, 1873

Plate 16, Figures 4 and 5

Material from STE-3100 and M-2692

Diagnosis: Ovate to subovate rhombohedral in outline, a strongly curved beak, inflated umbo and central portion of the midvalve. Larger than *Centronella* and broader more inflated than *C. harmonia*.

References Examined: Figure 23, Plate LIV *Cryptonella* cf. *eudora* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 9-17, Plate 109 *Cranaena eudora* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 2 specimens were found at Long Spur/Alum Spring (STE).

Cranaena harmonia Hall, 1867

Plate 16, Figure 6

Material from LR-1900

Diagnosis: Subovate to rhombohedral, triangular beak area narrowing to an almost pointed beak, semicircular rounded anterior margin. Surface covered by faint concentric growth lamellae. Less inflated and significantly smaller than *C. eudora*

References Examined: Figures 11-16, Plate 60 *Terebratula harmonia* in Geological Survey of New York. Paleontology: Volume IV, Part 1, by James Hall, 1867; Figures 17-24, Plate 110 *Cranaena harmonia* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Long Spur/Alum Spring (STE).

PHYLUM MOLLUSCA

Class BIVALVIA

Subclass **PALEOTOXODONTA** Korobkov, 1954

Order **NUCULOIDA** Dall, 1889

Superfamily **NUCULACEA** Gray, 1824

Family **NUCULIDAE** Gray, 1824

Genus **NUCULOIDEA** Williams and Breger, 1916

Nuculoidea corbuliformis Hall and Whitfield, 1869

Diagnosis: Small valve, nearly central or slightly posterior umbo, broadly rounded ventral margin. 12-16 Relatively large hinge teeth that are usually evident. Surface covered by closely spaced concentric lamellae.

References Examined: Figures 6-10, Plate XXIII and Figures 19-23, Plate LX *Nucula corbuliformis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-20, Plate 3 *Nuculoidea corbuliformis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-12, Plate 133 *Nuculoidea corbuliformis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: ? specimens were found. Specimens were collected from 2 locations (SS, CA).

Superfamily **NUCULANACEA** H. Adams and A. Adams, 1858

Family **MALLETHIDAE** Adams and Adams, 1858

Genus **PALAEONEILO** Hall and Whitfield, 1869

Palaeoneilo constricta Conrad, 1842

Diagnosis: Small, ovate-cuneate, beaks at anterior third. Umbonal ridge rounded with radial groove below it extending from just behind the beak to the margin. Fine regular

spaced concentric ridges cover the surface. Distinguished from *N. corbuliformis* by its more numerous denticulation and the radial groove just to the anterior of the umbo.

References Examined: Figures 9-12, Plate XXVI and Figures 7-10, Plate LXI *Paleoneilo constricta* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-18, Plate 1 *Nuculoidea corbuliformis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-37, Plate 136 *Paleoneilo constricta* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 9 specimens were found. Specimens were collected from 3 locations (FT, LR, CC).

Family **NUCULANIDAE** Adams and Adams, 1958

Genus **PHESTIA** Chernyshev, 1951

Genus *Phestia diversa* Hall, 1883

Plate 17, Figure 1

Material from FT-94

Diagnosis: Small, falciform, length twice its width; cardinal margin convex, umbo one third the length from the anterior end. Distinguished by its convex cardinal margin and lack of surface ornamentation.

References Examined: Figures 16 and 17, Plate LXI *Leda* cf. *diversa* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1 and 2, Plate 6 *Phestia diversa* in Devonian Rocks and Lower and Middle Devonian Pelecypods of Guangxi, China, and the Traverse Group of Michigan, by John Pojeta, Jr., 1986; Figures 1-7, Plate 134 *Phestia diversa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 4 specimens were found at Bland/Bastion (FT).

Subclass **CRYPTODONTA** Neumayr, 1884

Order **PRAECARDIOIDA** Newell, 1969

Superfamily **PRAECARDIACEA** Hornes, 1884

Family **PRAECARDIIDAE** Hornes, 1884

Subfamily **PRAECARDIINAE** Hornes, 1884

Genus **BUCHIOLA** Barrande, 1881

Buchiola retrostriata von Buch, 1832

Diagnosis: Semicircular, equivalved, Umbo extends well beyond the cardinal margin, beak at the anterior third. 12-15 radial ribs that have elevated margins and flat summits that are crossed by retrally curved ridges arranged in a somewhat concentric pattern relative to the margin that extend from the umbo to the margin cover the surface.

Distinguished by its unusual ornamentation.

References Examined: Figures 1-3, Plate LX *Buchiola retrostriata* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-10, Plate 145 *Buchiola retrostriata* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 30 specimens were found. Specimens were collected from 2 locations (FT, CC).

Subfamily **CARDIOLINAE** Fischer, 1886

Genus **ONTARIA** Clarke ? = **OPISTHOCOELUS** Beushausen, 1895

Ontaria suborbicularis Hall, 1843

Diagnosis: Suborbicular in outline, equivalved, length and height almost equal, very thin shell, beak is central or slightly posterior, beak is turned slightly posterior and is not prominent. Surface is marked with fine concentric and radial striae. This species lacks the ears of *Pseudoaviculopecten* and *Crenipectin* and distinguished from other *Ontaria* by its suborbicular shape.

References Examined: Figures 12-14, Plate 145 *Ontaria suborbicularis* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 1-15, Plate 146 *Ontaria suborbicularis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 22 specimens were found. Specimens were collected from 3 locations (STE, M, CA).

Ontaria clarkei Beushausen, 1895

Diagnosis: Like *O. suborbicularis* but not as orbiculate, the umbo is distinctly posterior, and there are slight radial undulations of the surface.

References Examined: Figures 1-8, Plate 147 *Ontaria clarkei* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 2 specimens were found at Long Spur/Alum Spring (STE).

***Ontaria accinta* Clarke, 1903**

Diagnosis: Smaller than *O. suborbicularis* and *O. clarkie*, has a distinctive radial depression at the edge of the umbo area, and concentric growth striae are more prominent than radial striae.

References Examined: Figures 17-20, Plate 146 *Ontaria accinta* in Devonian Paleontology of New York, by David Linsley, 1994

Comments: 1 specimen was found at Parrott (P).

Subclass **PTERIOMORPHIA** Beurlen, 1944

Order **PTERIOIDA** Newell, 1969

Superfamily **AMBONYCHIACEA** Miller, 1877

Family **AMBONYCHIIDAE** Miller, 1877

Genus **MYTILARCA** Hall and Whitfield, 1869

Mytilarca chemungensis Conrad, 1842

Plate 17, Figure 2

Material from P-1994

Diagnosis: Large, valves moderately inflated, broadly rounded ventral margin, anterior and posterior margins ranging from gently curved to almost straight, the anterior margin is usually straighter, lacks anterior lobe, umbo is slightly oriented towards the anterior. Surface marked with faint concentric lines.

References Examined: Figures 1-18, Plate 15 *Mytilarca chemungensis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 8-18, Plate 37 *Mytilarca chemungensis* in North America Ambonychiidae (Pelecypod), by John Pojeta, Jr., 1966; Figures 1-11, Plate 164 and Figures 1-5, Plate 38, *Mytilarca chemungensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 131 specimens were found. Specimens were collected from 6 locations (FT, STE, P, M, LR, CA).

Superfamily **PTERIACEA** Gray, 1847

Family **PTERINEIDAE** Miller, 1877

Genus **LEPTODESMA** Hall, 1883

Leptodesma cadmus Hall, 1884

Plate 17, Figure 3

Material from CA-1280

Diagnosis: Valves posteriorly elongate, hingeline is straight, angular anterior auricle, anterior lobe makes a slightly concave margin opposite the beak, posterior margin is gently rounded and then straight to an acute intersection with hingeline, hingeline has no protruding spine. Surface is marked by concentric growth lamellae and has no radial ornamentation. It is distinguished from other *Leptodesma* by its angular anterior auricle and acute transition from the posterior lobe to the hinge line.

References Examined: Figures 14-17, Plate 176 *Leptodesma cadmus* in *Devonian Paleontology of New York*, by David Linsley, 1994.

Comments: 27 specimens were found. Specimens were collected from 4 locations (FT, M, LR, CA).

Leptodesma lichas Hall, 1884

Plate 17, Figure 4

Material from CA-830

Diagnosis: Similar to *L. cadmus* but has a well developed umbo ridge; umbo is more prominent and extends well beyond the hingeline. *L. lichas* has auricle wings on both valves; umbonal ridge is more distinct and developed nearer to the hinge making a shorter cardinal slope and a broader anterior and ventral slope, and no posterior spine,

References Examined: Figures 18 and 19, Plate LXIII *Leptodesma lichas* in *Maryland Geological Survey, Devonian Plates*, by Clarke and Swartz, 1913; Figures 7-10, Plate 176 *Leptodesma lichas* in *Devonian Paleontology of New York*, by David Linsley, 1994.

Comments: 36 specimens were found. Specimens were collected from 2 locations (FT, CA).

Leptodesma matheri Hall, 1884

Plate 17, Figure 5 and 6

Material from CA-1208 and STE-3184

Diagnosis: Like other *Leptodesma* except broader more inflated umbo extended farther towards the margin.

References Examined: Figures 8-11, Plate 177 *Leptodesma matheri* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 51 specimens were found at Allegheny/Crows (AC).

Leptodesma naviforme Hall, 1884

Diagnosis: Like other *Leptodesma* except it is slightly more subovate and have faint radial striae and undulating concentric growth lamellae.

References Examined: Figures 16 and 17, Plate LXIII *Leptodesma naviforme* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-18, Plate 7 *Leptodesma naviforme* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 3 and 4, Plate 177 *Leptodesma naviforme* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 21 specimens were found. Specimens were collected from 3 locations (FT, LR, CA).

Leptodesma patulum Hall, 1884

Diagnosis: Similar in shape to other *Leptodesma*, elongated, undulating concentric growth lamellae.

References Examined: Figures 1 and 2, Plate 177 *Leptodesma patulum* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 10 specimens were found at Allegheny/Crows (AC).

Plate ***Leptodesma propinquum*** Hall, 1884

18, Figure 1

Material from AC-1

Diagnosis: Similar in shape to other *Leptodesma*, getting narrower towards the posterior margin, posterior wing poorly developed.

References Examined: Figures 1 and 2, Plate 176 *Leptodesma propinquum* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 3 specimens were found. Specimens were collected from ? locations (?).

***Leptodesma spinigerum* Conrad, 1842**

Plate 18, Figure 2 and 3

Material from STE-3184 and LR-2650

Diagnosis: Valves posteriorly elongate, hingeline is straight forming a very prominent posterior spine. Distinguished from other *Leptodesma* by its greatly extruded posterior spine, sharper indented posterior margin, its more elongated shape, and its lack of fine radial striae.

References Examined: Figures 11 and 12, Plate 8, Figures 1-22, Plate 9, and Figures 1-27, Plate 10 *Leptodesma spinigerum* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-36, Plate 175 *Leptodesma spinigerum* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 90 specimens were found. Specimens were collected from 7 locations (STE, P, M, LR, CC, SS, AC/CA).

Genus *PTYCHOPTERIA* Hall, 1883

***Ptychopteria eugenia* Hall, 1884**

Plate 18, Figure 4

Material from M-3336

Diagnosis: Similar to *L. cadmus* but has more well defined anterior auricle, a steeper slope from the posterior to the hingeline, and has both multicostate radial and concentric growth lamellae ornamentation. Costellae are absent from the anterior auricle. Well developed anterior auricle and posterior wing.

References Examined: Figures 4-7, Plate 191 *Ptychopteria eugenia* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 22 specimens were found at McCoy (M).

Genus **CORNELLITES** Williams, 1908 = **PTYCHOPTERIA**

Cornellites chemungensis Conrad, 1842

Plate 18, Figure 5 and 6

Material from M-1537 and SS-3785

Diagnosis: Large to very large, obliquely subovate, hingeline straight almost equaling the length of the shell. Beak is anterior with short anterior wing. Surface is covered with subequal alternating rays crossed by concentric striae that are interrupted by distinctive growth varicies.

References Examined: Figure 22, Plate LXI *Pterinea chemungensis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-6, Plate 12, Figures 1-7, Plate 13, and Figures 1-9, Plate 14 *Cornellites chemungensis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-18, Plate 188 *Cornellites chemungensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 56 specimens were found. Specimens were collected from 9 locations (FT, STE, P, M, LR, CC, SS, SSR, AC).

Superfamily **PECTINOIDEA** Rafinesque, 1815

Family **PTERINOPECTINIDAE** Newell, 1969b

Genus **PTERINOPECTEN** Hall, 1883

Pterinopecten suborbicularis Hall, 1843

Diagnosis: Large suborbicular, anterior wing is missing; the posterior wing is small and has educed ornament. The surface is covered with numerous radiating costae interrupted by concentric ridges forming small nodes at intersections giving it a crenulated appearance. Auricles are not equal between left and right valves and auricles are not as well defined as *Pseudoaviculopecten*.

References Examined: Figures 9 and 10, Plate 23 *Pterinopecten suborbicularis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-7, Plate 196 *Pterinopecten suborbicularis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Long Spur/Alum Spring (STE).

Genus **PTERINOPECTEN (VERTUMNIA)** Hall, 1844

Vertumnia reversa Hall, 1883

Diagnosis: Similar to *Cornellites chemungensis* but not as inflated, more pointed auricle wings, and much stronger radial ribs and concentric varicies.

References Examined: Figures 1-7, Plate 24 *Vertumnia reversa* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 12-16, Plate 197 *Vertumnia reversa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Sulphur Spring (SS).

Genus **PSEUDOAVICULOPECTEN** Newell, 1937

Pseudaviculopecten duplicatus Hall, 1884

Plate 19, Figure 1

Material from STE-3190

Diagnosis: Medium sized, subovate, beak slightly anterior, auricles subequal and well differentiated from the body of the shell. Surface is covered with fine radial costellae and faint concentric growth lamellae; posterior wing lacks radial costellae.

References Examined: Figures 15-22, Plate 205 *Pseudaviculopecten duplicatus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 4 specimens were found at Long Spur/Alum Spring (STE).

Pseudaviculopecten fasciculatus Hall, 1883

Plate 19, Figure 2

Material from P-1207

Diagnosis: Larger than *P. duplicatus*, suborbicular slightly elongated posteriorly, beak anterior, auricles have more angular intersection with hingeline, transition from umbo to auricles is more subtle.

References Examined: Figures 11-13, Plate 20 *Pseudaviculopecten fasciculatus* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 13-

19, Plate 204 *Pseudaviculopecten fasciculatus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 16 specimens were found. Specimens were collected from 4 locations (STE, P, LR, CC).

***Pseudaviculopecten patulus* Hall, 1884**

Plate 19, Figure 3

Material from P-1207

Diagnosis: Similar to *P. fasciculatus* but more equal suborbicular shape, auricles are much more equal, and radial costae are stronger and fewer. Concentric growth lamellae are just as evident but are less obvious because of the dominating radial costae.

References Examined: Figures 1 and 2, Plate 206 *Pseudaviculopecten patulus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Parrott (P).

Family **AVICULOPECTINIDAE** Meek and Hayden, 1864

Subfamily **AVICULOPECTININAE** Meek and Hayden, 1864

Genus **AVICULOPECTEN** M'Coy, 1851

***Aviculopecten* sp?**

Diagnosis: Similar to *Pseudoaviculopecten* in shape, anterior auricle slightly tilted back from the hingeline, both auricle wings are well formed. Surface has alternating radial costae with one set being stronger; costae are intersected with regularly spaced concentric growth lamellae. Can be distinguished from *Pseudoaviculopecten* by its ornamentation.

References Examined: Figures 5-8, Plate 58, and Figures 4-9, Plate 59 *Aviculopecten ornatus* in Devonian Rocks and Lower and Middle Devonian Pelecypods of Guangxi, China, and the Traverse Group of Michigan, by John Pojeta, Jr., 1986

Comments: 2 specimens were found. Specimens were collected from 2 locations (SS, CA).

Subfamily **EUCHONDRIINAE** Newell, 1937

Genus **CRENIPECTEN** Hall, 1883

Crenipecten amplus Hall, 1884

Diagnosis: Medium small, suborbicular ovate, beak central to slightly anterior, auricle ears well developed. Surface is marked by faint concentric radial growth lamellae.

References Examined: Figure 12, Plate 160 *Crenipecten amplus* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 12-14, Plate 208 *Crenipecten amplus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Long Spur/Alum Spring (STE).

Crenipecten obsoletus Hall, 1884

Plate 19, Figure 4

Material from LR-1054

Diagnosis: Like *C. amplus* but smaller, more elongated, auricle ears are larger compared to the rest of the valve.

References Examined: Figures 15-16, Plate 208 *Crenipecten obsoletus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from LR.

Subclass **PALAEOHETERODONTA** Newell, 196a

Order **MODIOMORPHOIDA** Newell, 1969a

Superfamily **MODIOMORPHACEA** Miller, 1877

Family **MODIOMORPHIDAE** Miller, 1877

Genus **MODIOMORPHA** Hall and Whitfield, 1869

Modiomorpha angusta Hall, 1885

Diagnosis: Small, elongate and narrowly elliptical, length 2.5 to 3 times height, widest posteriorly. There is a shallow undefined depression extending from the umbo to the base slightly constricting the basal margin.

References Examined: Figures 16 and 17, Plate LIX *Palaenatina angusta* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 15-20, Plate

159 *Modiomorpha angusta* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 4 specimens were found. Specimens were collected from 3 locations (STE, M, LR).

***Modiomorpha chemungensis* Hall, 1885**

Plate 19, Figure 5 and 6

Material from STE-3100

Diagnosis: Medium sized, unequally subrhomboidal, rounded anterior margin, posterior margin sub rounded to straight forming a sub angular to subrounded transition to the margin opposite the beak. Surface covered with irregular rugose growth increments. Larger and broader than *M. angusta*.

References Examined: Figures 1-7, Plate 151 *Modiomorpha chemungensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 8 specimens were found. Specimens were collected from 4 locations (FT, STE, CC, AC).

***Modiomorpha mytiloides* Conrad, 1841**

Diagnosis: Similar in shape to *M. chemungensis* but larger, has a more prominent anterior lobe, beak sits much farther back from the anterior margin, is more inflated, posterior margin is more rounded, and the transition from the posterior margin to the margin opposite the beak is rounded.

References Examined: Figures 14 and 16, Plate 19 *Modiomorpha mytiloides* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 6 and 7, Plate 19 and Figure 2, Plate 20 *Modiomorpha mytiloides* in Devonian Rocks and Lower and Middle Devonian Pelecypods of Guangxi, China, and the Traverse Group of Michigan, by John Pojeta, Jr., 1986; Figures 1-16, Plate 149 *Modiomorpha mytiloides* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 2 specimens were found. Specimens were collected from 2 locations (STE, M).

Modiomorpha subalata Conrad, 1841

Diagnosis: Smaller than *M. mytiloides*, umbo is better developed than *M. chemungensis*, posterior is more flattened along the cardinal area; posterior margin is rounded and has a broad rounded transition into the margin opposite the beak.

References Examined: Figures 1-13, Plate 150 *Modiomorpha subalata* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at Allegheny/Crows (AC).

Genus **GONIOPHORA** Phillips, 1848

Goniophora chemungensis Vanuxem 1842

Plate 20, Figure 1

Material from M-2011

Diagnosis: Elongated unequally subrhomboidal, area above the umbonal ridge is flat or concave, prominent angular umbo. There is a sharp angular change in the surface extending forming a ridge from the beak to the posterior margin. Surface is marked by fine concentric growth lamellae, which has a sharp angular change in direction along the ridge. Distinguished by its ridge and angular beak.

References Examined: Figures 1-11, Plate 17 *Goniophora chemungensis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-12, Plate 153 *Goniophora chemungensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at McCoy (M).

Order **TRIGONIOIDA** Dall, 1889

Superfamily **TRIGONIACEA** Lamarck, 1819

Family **MYOPHORIIDAE** Bronn, 1849

Genus **EOSCHIZODUS** Cox, 1969

Eoschizodus chemungensis Conrad, 1842

Diagnosis: Large rhomboidal ovate, length a little greater than height. Anterior margin broadly rounded curving into an almost straight basal margin; posterior margin obliquely truncate.

References Examined: Figures 3-5, Plate LXIV *Schizodus chemungensis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-12, Plate 28 *Eoschizodus? chemungensis* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-23, Plate 210 *Eoschizodus chemungensis* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from 3 locations (FT, STE, SS).

Genus **SCHIZODUS** de Verneuil and Murchison, 1844

Schizodus sp?

Plate 20, Figure 2

Material from FT-1827

Diagnosis: Semielliptical, ovate anterior margin broadly rounded curving into a semi straight basal margin; posterior margin obliquely truncate. The surface is somewhat smooth with minor concentric growth lamella.

References Examined: Figures 1-7, Plate 23 *Schizodus* aff. *S. cuneus* and *Schizodus* aff. *S. appressus* in Devonian Rocks and Lower and Middle Devonian Pelecypods of Guangxi, China, and the Traverse Group of Michigan, by John Pojeta, Jr., 1986.

Comments: 2 specimens were found at Long Spur/Alum Spring (STE).

Subclass **HETERODONTA** Neumayr, 1884

Order **VENEROIDA** H. Adams and A. Adams, 1856

Superfamily **LUCINACEA** Fleming, 1828

Family **MACTROMYIIDAE** Cox, 1969

Genus **PARACYCLAS** Hall, 1843

Paracyclas rugosa Goldfuss, 1837

Plate 20, Figure 3

Material from STE-3131

Diagnosis: Subequant suborbicular, subcentral beak. Surface covered with pronounced rugose growth variances.

References Examined: Figures 1-9, Plate 21 and Figures 3-8, Plate 22 *Paracyclas rugosa* in Devonian Rocks and Lower and Middle Devonian Pelecypods of Guangxi, China, and the Traverse Group of Michigan, by John Pojeta, Jr., 1986; Figures 1-18, Plate 213 *Paracyclas rugosa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at STE.

Subclass **ANOMALODESMATA** Dall, 1889

Order **PHOLADOMYOIDA** Newell, 1965

Superfamily **PHOLADOMYACEA** Gray, 1847

Family **GRAMMYSIIDAE** Miller, 1877

Genus **GLOSSITES** Hall, 1885

Glossites sp?

Plate 20, Figure 4

Material from P-318

Diagnosis: Medium size, elliptical, small beak, hingeline long and arcuate. Anterior very short with poorly developed anterior lobe; large rounded posterior extremity. Surface marked by concentric growth lamellae and stronger irregular growth lamellae.

Distinguished by its overall shape and its arcuate hingeline.

References Examined: Figures 4-13, Plate 18 *Glossites depressus* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-21, Plate 236 several *Glossites* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at P.

Genus **GRAMMYSIOIDEA** Williams and Breger, 1916

Grammysioidea subarcuata Hall, 1885

Plate 20, Figure 5 and 6

Material from FT-1725 and CA-1065

Diagnosis: Medium size, elongated unequal suboval, widest posteriorly. Anterior to the middle of the shell there is a depression extending from the umbo to the basal margin.

There is a very gently rounded moderate to poorly developed anterior lobe; posterior is broadly rounded. Fine concentric growth lamellae and regular strong subangular

concentric ridges mark surface. Distinguished from *G. arcuata* by its noticeable depression and its less ovate shape.

References Examined: Figure 13, Plate LIX *Grammysia subarcuata* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1-7, Plate 25 *Grammysioidea subarcuata* in Upper Devonian Pelecypods of the New York Chemung Stage, by McAlester, 1962; Figures 1-12, Plate 229 *Grammysioidea subarcuata* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 11 specimens were found. Specimens were collected from 6 locations (FT, STE, P, LR, CC, CA).

Genus **SEDGWICKIA** M'Coy, 1844 = **SPHENOTUS**

Sedgwickia attenuata

Diagnosis: Complete shell is almost cylindrical, beak very near the anterior, well defined umbonal ridge and a broad sinus. Umbonal ridge has one or two radial ribs extending from the umbo to the posterior margin. Posterior margin is obliquely truncate.

References Examined: Figures 10-12, Plate 233 *Sphenotus subtortuosus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 3 specimens were found. Specimens were collected from 2 locations (STE, LR).

Sedgwickia calvulus Hall, 1885

Plate 21, Figure 1

Material from M-2702

Diagnosis: Similar to *S. attenuata* but beaks are more subtle, umbonal ridge is not as well defined, and the posterior margin has subrounded to subangular truncation.

References Examined: Figures 1-8, Plate 235 *Sphenotus calvulus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 4 specimens were found. Specimens were collected from 3 locations (P, M, LR).

Class **GASTROPODA** Cuvier, 1797
Subclass **PROSOBRANCHIA** Milne Edwards, 1848
Order **ARCHAEOGASTROPODA** Thiele, 1925
Suborder **BELLEROPHNTINA** Ulrich and Scofield, 1897
Superfamily **BELLEROPHONTACEA** M'Coy, 1851
Family **BELLEROPHONTIDAE** M'Coy, 1851
Subfamily **CARINAROPSINAE** Ulrich and Scofield, 1897
Genus **PHRAGMOSTOMA** Hall, 1861 = **CARINAROPIS** Hall, 1847

Phragmostoma incisum Clarke, 1903

Diagnosis: Bellerophontid with rapidly expanding body whorl and small involute coil. Ornamentation consists of a selenizone ridge, fine growth lines, and some fine lamellae parallel to the selenizone ridge.

References Examined: Figures 1-10, Plate 242 *Phragmostoma incisum* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from 2 locations (SS, CA).

Phragmostoma chautauque Clarke, 1903

Plate 21, Figure 2 and 3

Material from CC-3353

Diagnosis: Like *P. incisum* but no carinate ornamentation, only growth lines transverse to the whorl and a stronger selenizone ridge.

References Examined: Figures 18-23, Plate 242 *Phragmostoma chautauque* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 12 specimens were found. Specimens were collected from 3 locations (STE, M, CC).

Suborder **MACLURITINA** Cox and Knight, 1960
Superfamily **EUOMPHALACEA** de Koninck, 1881
Family **EUOMPHALIDAE** de Koninck, 1881

Genus **STRAPAROLLUS** DeMontfort, 1810

Straparollus laxus? Hall, 1879

Diagnosis: Discoidal shell, almost planar spiral, about two whorls. Seems to be a space between whorls such that they are not touching.

References Examined: Figure 2, Plate 188 *Straparollus laxus*. In Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 10-12, Plate 247 *Straparollus laxus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 2 specimens were found at M.

Genus **PLEURONOTUS** Hall, 1879

Pleuronotus decewi Billings, 1860?

Diagnosis: Subplanar spiral, subangular whorls with well developed carinate on edge of shoulder. Ornamentation consists of growth lines.

References Examined: Figures 10 and 11, Plate 189 *Pleuronotus decewi* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 1-4, Plate 248 and Figures 1 and 2, Plate 249 *Pleuronotus decewi* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at FT.

Suborder **PLEUROTOMARIINA** Cox and Knight, 1960

Superfamily **PLEUROMARIACEA** Swainson, 1840

Family **EOTOMARIIDAE** Wenz, 1938

Subfamily **EOTOMARIINAE** Wenz, 1938

Tribe **EOTOMARIIDES** Wenz, 1938

Genus **BEMBEXIA** Oehlert, 1888

Bembexia nitella Hall, 1879

Diagnosis: Turbinate shell, with angular whorls and a concave selenizone lying between two sharp revolving carinae. Distinct ornamentation and ridges on whorls.

References Examined: Figures 17, Plate 253 "*Bembexia*" *nitella* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at P.

***Bembexia* sp?**

Diagnosis: Like *Bembexia nitella* but does not have enough detail preserved for species identification.

References Examined: Figures 1-17, Plate 253 "*Bembexia*" *nitella* and other *Bembexia* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 24 specimens were found. Specimens were collected from 3 locations (M, LR, SS).

Family **GOSSELETNIDAE** Wenz, 1938

Subfamily **COELOZONINAE** Knight, 1956

Tribe **COELOZONIDES** Knight, 1956

Genus **EURYZONE** Koken, 1896

Euryzone itylus Hall, 1879

Diagnosis: Turbinate shell with subrounded whorls and less complicated ornamentation.

Differentiated from *Bembexia* by its subrounded whorls and simple ornamentation.

References Examined: Figures 6-14, Plate 254 *Euryzone itylus* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 9 specimens were found. Specimens were collected from 2 locations (LR, SS).

Family **PLEUROTOMARIIDAE** Swainson, 1840

Genus **PLEUROTOMARIA** DeFrance, 1826

Pleurotomaria ella Hall, 1879

Diagnosis: Turbinate shell with subrounded whorls and distinctive striae perpendicular to growth.

References Examined: Figures 5-8, Plate 252 "*Pleurotomaria*" *ella* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at M.

***Pleurotomaria* sp?**

Diagnosis: Like *P. ella* but not enough detailed preserved for species identification.

References Examined: Figures 1-12, Plate 252 "*Pleurotomaria*" *ella* and other *Pleurotomaria* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found at STE.

Suborder **TROCHINA** Cox and Knight, 1960

Superfamily **PLATYCERATACEA** Hall, 1859

Family **HOLOPEIDAE** Wenz, 1938

Subfamily **GYRONEMATINAE** Knight, 1956

Genus **GYRONEMA** Ulrich in Ulrich and Scofield, 1897

Gyronema concinnum Hall, 1879

Diagnosis: Low spired, carinate revolving angulations about the whorls.

References Examined: Figures 5-6, Plate 258 *Gyronema concinna* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found at CC.

Family **PLATYCERATIDAE** Hall, 1859

Genus **PLATYCERAS** Conrad, 1840

Platyceras platystomum Hall, 1861

Diagnosis: Naticiform, 3 or so whorls expanding rapidly. Characterized by irregularities of growth and fine revolving elements.

References Examined: Figures 2-6, Plate 265 *Platyceras "platystomum"* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at STE.

Suborder **MURCHISONIINA** Cox and Knight, 1960

Superfamily **MURCHISONIACEA** Koken, 1896

Family **MURCHISONIIDAE** Koken, 1896

Genus **MURCHISONIA** D'Archiac and DeVerneuil, 1841

***Murchisonia* sp?**

Diagnosis: High spired, many whorled shell with a midwhorl selenizone producing a groove perpendicular to growth lines.

References Examined: Figures 16-18, Plate 276 *Murchisonia desiderata* and Figure 10, Plate 276 *Murchisonia micula* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 6 specimens were found at AC/CA.

Genus **MICHELIA** F. A. Roemer, 1852

Michelia egrigium Billings, 1860?

Diagnosis: High spired, 7 or more subangular to unevenly subround whorls, slight carinate on the lower shoulder of whorl.

References Examined: Figures 19-20, Plate 276 *Michelia egrigium* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found. Specimens were collected from 2 locations (M, LR).

Michelia tenue Clarke, 1909

Diagnosis: Smaller, high spired, 7 or more rounded whorls with midwhorl selenizone. Differentiated from *M. egrigium* by its more equally rounded whorls and midwhorl selenizone.

References Examined: Figures 11-13, Plate 276 *Michelia tenue* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 19 specimens were found at M.

Superfamily **PALAEOTROCHACEA** Knight, 1956

Family **PALAEOTROCHIDAE** Knight, 1956

Genus **PALAEOTROCHUS** Hall, 1879

Palaeotrochus praecursor Clarke, 1885

Diagnosis: Turbinate shell, apical angle about 50°, 5 whorls, short spiral with broad body whorl. Surface ornamented with 9-10 subequal turbicled rows crossed by fine concentric lines giving it a crenulated surface dominated by turbicled rows.

References Examined: Figures 15 and 16, Plate LXIX *Trachydomia praecursor* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913. Figures 33, Plate 120 *Palaeotrochus praecursor* in Geology of the Appalachian Valley in Virginia Part II Fossil Plates and Explanations, by Charles Butts, 1941; Figures 5-12, Plate 277 *Palaeotrochus praecursor* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at SSR.

Order **CAENOGASTROPODA** Cox, 1959

Superfamily **LOXONEMATACEA** Koken, 1889

Family **PALAEOZYGOPLURIDAE** Horny, 1955

Genus **PALAEOZYGOPLURA** Horny, 1955

Palaeozygopleura hamiltoniae Hall, 1879

Diagnosis: High spired, spire rapidly ascending, 8-11 round to subrounded whorls. Surface marked by curved concentric striae parallel to the shape of the aperture opening.

References Examined: Figures 1 and 2, Plate LXIX *Loxonema hamiltoniae* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 16, Plate 186 *Loxonema hamiltoniae* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 6 and 7, Plate 278 *Palaeozygopleura hamiltoniae* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 1 specimen was found at M.

Palaeozygopleura styliola Hall, 1879

Diagnosis: High spired, rapidly ascending spire, 6-8 subrounded whorls that are slightly flattened at the apex. Surface marked by rarely preserved fine sigmoidal striae.

References Examined: Figures 8-10, Plate LXIX *Loxonema styliolum* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 1 and 2, Plate

278 *Palaeozygopleura styioloa* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 5 specimens were found at CA.

Class **CEPHALOPODA** Leach, 1817
Subclass **NAUTILOIDEA** Agassiz, 1847
Order **ORTHOCERIDA** Kuhn, 1940
Superfamily **ORTHOCERATACEAE** M'Coy, 1844
Family **ORTHOCERATIDAE** M'Coy, 1844
Subfamily **ORTHOCERATINAE** M'Coy, 1844
Genus **ORTHOCERAS** Bruguiere, 1789

***Orthoceras* sp?**

Diagnosis: Straight shelled nautiloid, regularly spaced semispherical septa. Only a few specimens had evidence for the siphuncle tube.

References Examined: Figures 12 - 18, Plate LXXI *Orthoceras filosum*, *O. demum*, and, *O. consrtale* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures in Devonian Paleontology of New York, by David Linsley, 1997

Comments: 71 specimens were found. Specimens were collected from 5 locations (FT, M, LR, CC, SS).

Subclass **AMMONOIDEA**
Order **AMMONOIDEA** Zittel, 1884
Suborder **ANARCESTINA** Miller and Furnish, 1954
Superfamily **PHARICERATACEA** Hyatt, 1900
Family **GEPHUROCERATIDAE** Frech, 1901
Genus **PROBELOCERAS** Clarke, 1899

***Probeloceras lutheri* Clarke, 1898**

Diagnosis: Small, characteristic acutely lobed septation.

References Examined: Figures 4 and 5, Plate LXXII *Probeloceras lutheri* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 13-19, Plate 124 *Probeloceras lutheri* in Devonian Paleontology of New York, by David Linsley,

1994; and Figures 27-31, Plate 120 *Proboloceras lutheri* in Geology of the Appalachian Valley in Virginia, Part II-Fossil Plates and Explanations, by Charles Butts 1933.

Comments: 9 specimens were found. Specimens were collected from 2 locations (FT, CC).

INCERTA SEDIS

Class **TENTACULOIDEA** Lyashenko, 1957

Order **TENTACULITIDA** Lyashenko, 1957

Family **TENTACILITIDAE** Walcott, 1886

Genus **TENTACULITES** Schlotheim, 1820

Tentaculites descissus Clarke and Swartz, 1913

Diagnosis: Elongate acute cones characterized by differential markings in successive growth stages. The early shell is a third to one half its length and bares subequal and closer spaced annulations; in the latter part the rings become coarser with larger spacings until spaces between annuli bare one or two lesser rings.

References Examined: Figures 20-23, Plate LXX *Tentaculites descissus* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figure 35, number 3 *Tentaculites descissus* in Biostratigraphy of the Greenland Gap Group in Virginia and West Virginia, by Thomas Rossbach, 1992.

Comments: 428 specimens were found. Specimens were collected from 5 locations (M, LR, CC, SS, AC).

PHYLUM ARTHROPODA

Class **TRILOBITA** Walch, 1771

Order **PHACOPIDA** Salter, 1864

Suborder **PHACOPINA** Struve

Superfamily **PHACOPACEA** Hawle and Corda, 1847

Family **PHACOPIDAE** Hawle and Corda, 1847

Subfamily **PHACOPINAE** Hawle and Corda, 1847

Genus **PHACOPS** Emmrich, 1839

Phacops rana Green, 1832

Diagnosis: Inflated glabella, subcranial furrow continuous, narrow marinal rim, genial angles rounded, large compound eyes, cephalon has the appearance of a frogs face,

References Examined: Figures 8-12, Plate XLIII in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 2-5, Plate 276 *Phacops rana* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 1-25, Plate 293 *Phacops rana* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 7 specimens were found at CC.

Superfamily **DALANITACEA** Vogdes, 1890

Family **DALMANITIDAE** Vogdes, 1890

Subfamily **ASTEROPYGINAE** Delo, 1935

Genus **GREENOPS** Delo, 1935

Greenops boothi Green, 1837

Plate 21, Figure 4 and 5

Material from CC-116

Diagnosis: Moderately convex cephalon, compound eyes raised sharply above the surface of the cephalon, large genial spines extending to at least the midpoint, pygidium has wide flat ribs extending into narrow sections that look like spines and protrude past the margin.

References Examined: Figures 1-4, Plate XLIV *Dalmanites boothi* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913; Figures 11 and 12, Plate 274 *Greenops boothi* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 1-4, Plate 297 *Greenops boothi* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: 9 specimens were found at CC.

Class **MEROSTOMATA** Dana, 1852

Subclass **EURYTERIDA** Burmeister, 1843

Superfamily **EURYTERACEA** Burmeister, 1845

Family **EURYPTERIDAE** Burmeister, 1845

Genus **EURYPTERUS** De Kay, 1825

Eurypterus remipes

Plate 21, Figure 6

Material from M-2011

Diagnosis: Broad cephalon with narrow marginal furrow, eyes bean shaped situated somewhat in front of the middle cephalothorax.

References Examined: Figure 1 and 2, Plate 299 *Eurypterus remipes* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944; Figures 1-5, Plate 319 and Figures 1 and 2, Plate 320 *Eurypterus remipes* in Devonian Paleontology of New York, by David Linsley, 1994.

Comments: These are only fragments of *Eurypterus remipes*. Identification was confirmed by the arthropod specialist at the Smithsonian. 5 specimens were found. Specimens were collected from 4 locations (STE, M, CC, SS)

Subclass **OSTRACODA** Latreille, 1806

Order **LEPERDITICOPIDA** Scott, 1961

Family **LEPERITIIDAE** Jones, 1856

Genus **LEPERDITIA** Rouault, 1851

Leperditia britannica? Oehlert, 1877?

Diagnosis: Very large, suboblong with oblique backward swind, dorsal edge is straight, small tubercle or eye-spot present on antedorsal fourth, large rounded subcentrally situated muscular imprint.

References Examined: Treatise of Arthropods by R.C. Moore; Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944

Comments: 3 specimens were found. Specimens were collected from 2 locations (CC, SS).

Leperditia sp?

Diagnosis: Significantly smaller than *L. britannica*.

References Examined: Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944

Comments: 2 specimens were found. Specimens were collected from 2 locations (STE, CA).

PHYLUM **ECHINODERMATA**

Class **CRINOIDEA** Miller, 1821

Subclass **CAMERATA** Wachmuth and Springer, 1885

Order **MONOBATHRIDA** Moore and Laudon, 1943

Suborder **COMPSOCRININA** Ubaghs, 1978

Superfamily **HEXACRINITACEA** Wachmuth and Springer, 1885

Family **HEXACRINITIDAE** Wachmuth and Springer, 1885

Genus **HEXACRINITES** Wachmuth and Springer, 1885

Hexacrinites interscapularis? Austin and Austin, 1843-49

Plate 21, Figure 7 and Plate 22, Figure 3

Material from FT-1656 and STE-2855

Diagnosis: The genus is identified by having pentamerous star shaped columnals. Two almost complete specimens were found with the calyx still connected to the column.

References Examined: Treatise of Echinodermata by R. C. Moore.

Comments: 2 specimens were found. Specimens were collected from 2 locations (FT, STE).

Genus **ARTHROACANTHA** Williams, 1883

Arthroacantha ithacensis? Wachmuth and Springer, 1897

Plate 22, Figure 1

Material from M-1735

Diagnosis: It is identified based on having articulated spines on the plates of the dorsal cup. Plates contain sockets like an echinoid.

References Examined: Figure 10, Plate 78 *Arthroacantha ssp. in* Index Fossils of North America, Shimer and Shrock 1944.

Comments: Some specimens have a litter of spines around them. 11 specimens were found. Specimens were collected from 4 locations (P, M, SS, AC).

Suborder **GLYPTOCRININA** Moore, 1952
Superfamily **PLATYCRINITACEA** Austin and Austin, 1842
Family **PLATYCRINITIDAE** Austin and Austin, 1842
Genus **PLATYCRINITES** Miller, 1821

Platycrinites saffordi? Hall, 1885

Plate 22, Figure 3

Material from STE-2855

Diagnosis: Identified by having a small ill defined cup, several arms extending out of the cup area in a branching fashion.

References Examined: Figure 27, Plate 78 *Platycrinites saffordi* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944.

Comments: 1 specimen was found at M.

Subphylum **ASTEROZOA** Zittel, 1859
Class **STELLEROIDEA** Lamarck, 1816
Subclass **ASTEROIDEA** de Blainville, 1830
Order **OEGOPHIURIDA**
Suborder **LYSOPHIURINA**
Family **PROTOASTERIDAE**

Genus ?

n.sp? "ray"

Plate 22, Figure 4

Material from LR-2760

Diagnosis: The overall shape, length of the arms, and lack of ophioroid type central area distinguish it from other Devonian ophioroids. Features of the ampual groove and mouth area are similar to other Protoasteridae.

References Examined:

Comments: (much of this discription came from personel communication with Fred Hotchkiss 2000) A complete articulated starfish with preservation of external and internal features was collected. The mold of the oral surface has five rays that converge at the

mouth frame. The mouth angle plates that form the jaws have left a very deep and large mold. Although not equally visible on all rays, the center of the ray has a mold of the canal for the radial water vessel (rwv) and molds of the branches from the rwv to the tube feet. This is the so-called auluroid or cryptosyringid condition and is found in somasteroids and in the ophiuroid orders Stenurida and Oegophiurida. The typical ophiuroid appearance of the fossil points clearly to the Oegophiurida. The canal for the radial water vessel is excavated on the adradial surfaces of the ambulacrals, and the branches pass through pores in the substance of the ambulacrals to reach the cups for the tube feet. The molds of the cups of the tube feet stand up as hemispherical mounds. It can be seen that the branches to the tube feet are in different positions on the two sides of the ray, so they alternate on the two sides of the ray, as do the cups for the tube feet. This is characteristic of the Suborder Lysophiurina. The molds of the radial water vessel and of the lateral branches and of the cups for the tube feet are molds of certain surfaces of the ambulacral plates. The characteristic part of the ambulacral plates that is seen in the open ambulacral groove of Lysophiurina is the boot-shaped ventral surface of the ambulacral plates. Molds of these boot-shaped surfaces are present as fairly deep impressions located between the radial water vessel and the cups of the tube feet. Molds of the lateral plates are present as negative impressions that border the ray and define the abradial portion of the cups of the tube feet. The molds of the lateral plates show that these plates have a thin profile that is typical of the Protasteridae. Distal parts of some rays show molds of arm spines that border the rays, and such arm spines also are typical of the Protasteridae. In contrast, if the lateral plates had a thick profile they would present a broad border to the ray typical of the Encrinasteridae, and the Encrinasteridae generally do not have conspicuous arm spines bordering the rays. The overall appearance is that of a protasterid. 1 specimen was found at Lick Run (LR).

PHYLUM CNIDARIA

Class ANTHOZOA

Subclass ZOANTHARIA

Order RUGOSA

Genus Zaphrenitis?

Plate 22, Figure 2

Material from P-61

Diagnosis: The best identification possible was made based on similarities to the gross morphology and features of the specimens identified by Clarke and Swartz (1913).

References Examined: Figures 1-6, Plate XLV *Zaphrenitis marylandicus* and *Zaphrenitis chemungensis* in Maryland Geological Survey, Devonian Plates, by Clarke and Swartz, 1913.

Comments: Accurate identification cannot be made without a thin-section of the original material. Specimens collected in this study are only internal molds. 7 specimens were found. Specimens were collected from 5 locations (FT, P, M, CC, AC).

PHYLUM PORIFERA

Class HEXACTINELLIDA

Genus HYDNOCERAS Conrad, 1842

Hydnoceras tuberosum Conrad, 1842

Diagnosis: Rapidly expanding from acute base developing prismatic faces, nodes are well developed in horizontal and vertical rows are present at the intersections of the prismatic faces.

References Examined: Figures 11, Plate 122 *Hydnoceras tuberosum* in Geology of the Appalachian Valley in Virginia Part II Fossil Plates and Explanations, by Charles Butts, 1941; Figure 19, Plate 16 *Hydnoceras tuberosum* in Index Fossils of North America, by Hervey W. Shimer and Robert R. Shrock, 1944.

Comments: 1 specimen was found at STE.

6.2 FOSSIL CONTENT OF THE STRATIGRAPHIC UNITS

In this section the fossil content of each stratigraphic unit is described, and a list of the species that were present in that unit is provided. In the list taxa in **bold** have their first occurrence, taxa underlined have their last occurrence, and taxa both **bold** and underlined occur only in that unit.

6.2.1 Fossil content of the Millboro Formation

The upper most Millboro has a moderately fossiliferous zone about 240 feet (~75m) below the Millboro-Braillier contact. Originations of these taxa cannot be discussed here because there was no attempt to collect farther down into the Millboro (Givetian). These fossils were collected in an attempt to determine the end of the Givetian and the base of the Frasnian.

Orbicularis newberryi
Cariniferella tioga
Devonochonetes scitulus
Ambocoelia umbonata
Cranaena sp?
Palaeoneilo constricta
Phestia diversa

Buchiola retrostriata
Eurypterus remipes
Proboleceras lutheri
Phacops rana
Greenops boothi
Rugose corals

6.2.2 Fossil content of the Brallier Formation

The Brallier contains few, sparse amount of fossils. It is basically unfossiliferous except for a few small invertebrates. A few beds containing mostly small inarticulate brachiopods, small pelecypods, and an occasional articulate brachiopod can be found with persistence. Almost all of the fossils from the Brallier have occurrences above or within the Minniehaha Springs Member and would be equivalent to the Scherr Formation along the Allegheny Front.

Lingula ligea
Orbiculoidea newberryi
Cariniferella carinata
Cariniferella tioga
Schuchertella chemungensis
Devonochonetes scitulus
Cupularostrum congregata
Leiorhynchus mesacostalis
Pseudoatrypa devoniana

Spinatyrpa hystrix
Ambocoelia umbonata
Cytospirifer chemungensis
Spinocyrtia granulosa
Mediospirifer audaculus
Orthospirifer mesastrialis
Buchiola retrostriata
Leptodesma spinegerum

6.2.3 Fossil content of the Scherr Formation

At Sulfur Springs the Scherr Formation is recognized and it contains "Chemung Type" fossil beds. This is very similar to fossil collections from the Scherr Formation in West Virginia. These fossils would correlate with the stratigraphic zone of the Brallier from the base of the Minnehaha Springs Member to the top of the Brallier.

Aulacella sp?
Cariniferella elmira
Thiemella leonensis
Nervostrophia nervosa
Nervostrophia nevosa var. mucronata
Douvillina cayuta
Douvillina mucronatus
Douvillina variabilis
Productella speciosa

Productella spinulacosta
Whidbornella lachrymosa
Pseudoatrypa devoniana
Spinatyrpa spinosa
Cytospirifer chemungensis
Cornellites chemungensis
Vertumina reversa
Eoschizodus sp?
Arthroacantha ithacensis

6.2.4 Fossil content of the Foreknobs Formation

The Foreknobs as a whole is extremely fossiliferous. Walking through each section many fossil beds are easily recognized from several feet away. They commonly occur on the bottoms of more massive beds as fossil hashes. Butts used this aspect in his recognition and description of the then "Chemung Formation". Many authors have commented on the abundance of fossil material in this Formation. Further examination up close and extensive demolition exposes many more fossil beds.

6.2.5 Fossil content of the Mallow Member

The mallow is mildly fossiliferous. Fossils are scattered through muddy-siltstone and silty-mudstone intervals preserving fine detail of some delicate material. Typical *Ambocoelia-Chontes* (McGhee 1976) community fauna can be found. There are few obvious fossil beds. No storm deposits and few fossil lags were evident. Significant amounts of fossils were collected from the Mallow at every outcrop. 38 species of brachiopods were found. 5 species begin at the base and 1 ends at the top of the Mallow. 19 species range through the Mallow.

Lingula ligea

Schizophoria impressa

Cariniferella carinata

Cariniferella tioga

Cariniferella elmira

Rhipidomella penelope

Tropidoleptus carinatus

Nervostrophia nervosa

Nervostrophia n.sp.

Douvillina cayuta

Douvillina graciliora

Douvillina mucronata

Douvillina variabilis

Schuchertella chemungensis

Devonochonetes scitulus

Sinochonetes lepidus

Striatochonetes setigera

Productella speciosa

Productella spinulacosta

Whidbornella hirsuta

Whidbornella lachrymosa

Whidbornella sp?

Cupularostrum congregata

Cupularostrum contracta

Leiorhynchus mesacostalis

Eumatobolatoechia multicostatum

Pseudoatrypa devoniana

Spinatrypa hystrix

Spinatrypa spinosa

Ambocoelia umbonata

Tylothyris mesacostalis

Mediospirifer audaculus

Orthospirifer mesastrialis

Cytospirifer chemungensis

Spirifer williamsi

Palaeoneilo constricta

Leptodesma spinigerum

Cornellites chemungensis

Aviculopecten sp?

Glossites sp?

Grammysioidea subarcuata

Tentaculites discissus

Arthroacantha ithacensis?

6.2.6 Fossil Content of the Briery Gap Sandstone Member

The Briery Gap is more fossiliferous in the upper part of the member. Fossil material in the upper half can usually be found in the base of coarser beds of siltstone. The reddish sandstones contain little or no fossil material. Fossils can be found in the

lower half but they are in blocky mudstones and are scattered within the beds rather than on a particular surface.

Schizophoria impressa
Cariniferella carinata
Cariniferella tioga
Nervostrophia nervosa
Douvillina cayuta
Douvillina graciliora
Douvillina variabilis
Devonochonetes scitulus
Sinochonetes lepidus
Devonochonetes walcotti
Striatochonetes setigera
Pseudoatrypa devoniana
Spinatrypa aspera

Spinatrypa hystrix
Spinatrypa spinosa
Ambocoelia umbonata
Tylothyris mesacostalis
Orthospirifer mesastrialis
Cyrtospirifer altiplicus
Cyrtospirifer chemungensis
Cranaena harmonia
Nuculoidea corbliformis
Leptodesma spinigerum
Cornellites chemungensis
Tentaculites descissus
Arthroacantha ithacensis?

6.2.7 Fossil content of the Blizzard Member

The Blizzard is very fossiliferous. It contains the most fossils of any unit in this study. Fossils tend to be in the silty mudstones and fine siltstones. Coarser medium and coarse siltstone have little fossil material. There are two very fossiliferous zones, one just below the Mid-Blizzard Siltstone and the other just above. The lower fossil zone contains large *Cyrtospirifers* in fossil hashes. The upper fossil zone contains smaller fossils of *Atrypids* and *Cariniferellas* with exceptional preservation of details.

Lingula complanta
Orbiculoidea newberryi
Petrocrania hamiltoniae
Schizophoria impressa
Schizophoria sp?
Cariniferella carinata
Cariniferella tioga
Cariniferella elmira
Rhipidomella penelope
Tropidoleptus carinatus
Nervostrophia nevosa
Nervostrophia mucronata
Douvillina cayuta
Douvillina graciliora
Schuchertella chemungensis

Devonochonetes coronatus
Devonochonetes scitulus
Sinochonetes lepidus
Striatochonetes setigera
Productella boydi
Productella speciosa
Productella spinulacosta
Steinhagella sp?
Whidbornella hirsuta
Whidbornella lachrymosa
Whidbornella sp?
Semiproductus unustus
Cupularostrum congregata
Cupularostrum contracata
Cupularostrum exima

Cupularosrtum sappho?

Leiorhynchus mesacostalis

Leiorhynchus quadricostalis

Eumatabolatechia multicosstum

Pugnoides duplicatus

Pseudoatrypa devoniana

Spinatrypa aspera

Spinatrypa hystrix

Spinatrypa spinosa

Spinatrypa "rugosa"

Ambocoelia umbonata

Cyrtina hamiltonensis

Tylothyris mesacostalis

Orthospirifer mesastrialis

Syrigothyris randali

Cyrtospirifer altiplicus

Cyrtospirifer chemungensis

Cyrtospirifer inermis

Cyrtospirifer n.sp. "godzillas"

Cyrtospirifer preshoensis

Spirifer williamsi

Warrenella laevis

Palaeoneilo constricta

Mytilarca chemungensis

Leptodesma spinigerum

Cornellites chemungensis

Pseudoaviculopecten fasciculatus

Modimorpha chemungensis

Modiomorpha mytiloides

Phragstoma incisum

Phragstoma chautauque

Arthroacantha ithacensis?

Tentaculites descissus

Eurypterus remipes

6.2.8 Fossil content of the Pound Sandstone Member

The Pound Sandstone is not very fossiliferous and where you can find fossils they are preserved in silicate cemented quartz sandstone. It is extremely hard to excavate and or prepare samples from this unit. However persistence paid off with many identifiable samples from this unit.

Cariniferella tioga

Tropidoleptus carinatus

Schuchertella chemungensis

Devonochonetes scitulus

Strophopproductus hystriacula

Whidbornella lachrymosa

Whidbornella sp.?

Cupularostrum contracta

Leiorhynchus mesacostalis

Eumatabolatechia multicosstum

Athyris angelica

Ambocoelia gegaria

Ambocoelia umbonata

Tylothyris mesacostalis

Cyrtospirifer inermis

Mytilarca chemungensis

Leptodesma spinigerum

Ontaria suborbicularis

Cornellites chemungensis

Pseudoaviculopecten fasciculites

Tentaculites descissus

Eurypterus remipes

6.2.9 Fossil content of the Red Lick Member

The Red Lick is very fossiliferous with many beds of fossil hashes, some of them several inches thick. The fossil hashes can be found at the base of massive 2 to 4 foot (~.

6-1.2m) sandstone beds. Other material can be excavated from finer beds of 1 to 3 inches (~2.5-8cm) in which the fossil material is on the tops.

Lingula complanta
Lingula ligea
Orbiculoidea newberryi
Cranea leoni
Petrocrania hamiltoniae
Schizophoria sp?
Cariniferella tioga
Tropidoleptus carinatus
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Subglobosochonetes acutiliratus?
Rugosochonetes sp?
Productella speciosa
Whidbornella lachrymosa
Whidbornella sp?
Cupularostrum contracta
Cupularostrum orbicularis
Macropotamorhynchus durbinensis
Sinotectirostrum alleghanium
Leiorhynchus lesleyi
Eumatabolatechia multicostum
Athyris angelica
Ambocoelia gregaria

Tylothyris mesacostalis
Eosyringothyris sp?
Cyrtospirifer inermis
Cyrtospirifer sulcifer
Cranaena eudora
Cranaena harmonia
Nuculoidea corbliformis
Ontaria suborbicularis
Mytilarca chemungensis
Leptodesma cadmus
Leptodesma lichas
Leptodesma spinigerum
Cornellites chemungensis
Pseudoaviculopecten fasciculatus
Modiomorpha angusta
Modiomorpha chemungensis
Modiomorpha mytiloides
Eoschizodus chemungensis
Schizodus sp?
Paracyclas rugosa
Grammysioidea subarcuata
Sedwickia calvulus
Arthroacantha ithcensis?

6.2.10 Fossil content of the Hampshire Formation

The Hampshire contains many reported plant fossils. This study found no fossils other than plant debris.

6.2.11 Fossil content of the Price Formation

The Price is predominantly non-marine and is not expected to be abundantly fossiliferous with marine fossils. The lower price does have some marine beds that have fossils. The Price is abundant with plant fossils. This study only revealed a few plant fragments.

6.2.12 Fossil content of the Cloyd Conglomerate Member

For a conglomerate the Cloyd is very fossiliferous. Fossil material can be found at Allegheny/Crows, Lick Run, Parrot, and McCoy. The Cloyd is a quartz cemented orthoquartzite conglomerate and does not give up fossil material easily. It is quite remarkable that it contains any fossils at all. Much of the material is rather well preserved. The Brachiopods are generally whole specimens. A complete starfish mold was removed from the Cloyd.

Rugosochonetes sp?
Macropotamorhynchus durbinensis
Syringothyris texta?

Sedwickia attenuata
Protoasteridae? Genus? sp.? "ray"

6.2.13 Fossil content of the Sunbury Shale Member

The Subury Shale contains numerous fossils at the McCoy location. The specimens from McCoy have exceptional preservation of detail. Other locations have no evidence of fossils.

Lingula n.sp.
Sedwickia attenuata

Ptychopteria eugenia

6.2.14 Fossil content of the Ceres Member

The ceres member contains several fossil horizons. Many of the samples are of whole articulated brachiopods or coquinas of Chonetids.

Rugosochonetes sp?
Sbglobosochonetes acutiliratus
Macropotamorhynchus durbinensis

Syringothyris texta?
Ptychopteria eugenia

6.3 BIOSTRATIGRAPHIC ZONES

Biostratigraphic zones are based on a composite biostratigraphic chart of the all of the ranges of taxa from each of the measured sections of this study. The thickness from each member or formation for each measured section was normalized to a common more or less average thickness. Biostratigraphic elevations for each taxon were also normalized to coincide with the normalized thickness of each stratigraphic unit. The result was a composite biostratigraphic range chart. Fossil Zones are described based on biostratigraphic data collected in this study with emphasis on specific taxa found in this study that have been used by others to define biostratigraphic boundaries or bizones. Zonations are restricted to beginning and ending ranges of brachiopods and bivalves and a few other well-known index fossils. The zones are heavily biased toward brachiopod ranges due to their sheer numbers compared to the number of bivalves. Taxa in **bold** type have their first occurrence in that specific zone. Taxa, which are underlined, have their last occurrence in that zone. Taxa neither **bold** nor underlined occur in that zone but have been found in at least two other zones. Some zones follow lithostratigraphic boundaries and others may straddle in either case a brief description of that relationship will be given for any such zone.

19 local biozones are defined. They are grouped into their appropriate stages according to regional and worldwide index fossils found in this study. The first zone is the End of Givetian Zone (EG) and is grouped into the Givetian Stage of the Middle Devonian. The EG Zone is Givetian based on the Trilobites *Greenops* and *Phacops* of the Middle Devonian of New York. The next ten are in the Frasnian Stage of the Upper Devonian and are the Frasnian 1-10 Zones (FR1-10). They are in relative time order, FR1 being the oldest and FR10 being the youngest. The FR1-10 Zones are Frasnian based on the occurrences of many brachiopod fauna of the Frasnian of New York, Maryland, Iowa, New Mexico. The next six are in the Famennian Stage of the Upper Devonian and are the Famennian 1-6 Zones (FA1-6). They are in relative time order, FA1 being the oldest and FA6 being the youngest. The FA1-6 Zones are Famennian based on the occurrences of the many brachiopod fauna of the Famennian of New York, Maryland, Canada, and New Mexico. The last two are in the Tournaisian Stage of the Lower

Carboniferous and are the Tournaisian 1-2 Zones (T1-2). They are in relative time order, T1 being the oldest and T2 being the youngest. The T1-2 Zones are Tournaisian based on the occurrences of a few brachiopod fauna of the basal Mississippian from West Virginia.

The divisions of the 19 local zones are based on the first occurrence of taxa for the most part. The taxa used for zonation are common within the study area and have been found in New York and Western Maryland. The FR8/FR9 and the FR9/FR10 boundaries are based on the ending ranges of common taxa because so many significant taxa are ending at these boundaries and little or no originations are occurring. The FA3/FA4 boundary is also based on the ending ranges of a few very significant taxa and cannot be based on beginning ranges because there is only one and it has a onetime occurrence at only one location.

In the discussion section of this text I will document correlations and discuss the relevance of these zones for the Upper Devonian of this continent and possibly for locations in Europe where the Frasnian and Famennian strato-types are.

6.3.1 G End Givetian Zone

The End Givetian Zone contains 5 genera and 5 species of brachiopods, 3 genera and 3 species of bivalves, 1 species of cephalopod, 2 genera and 2 species of trilobites, and 1 species of Eurypterid. The 2 trilobites are Givetian and there are no more occurrences stratigraphically above them. Origination of these taxa cannot be discussed here because there was no attempt to collect farther down into the Millboro (Givetian). These fossils were collected in an attempt to determine the end of the Givetian and the base of the Frasnian. Although the latest Givetian fossils are found 300 feet (~90m) below the top of the Millboro it is not until the base of the Brallier that significant numbers of Frasnian fauna appear so this zone extends to the base of the Brallier.

Orbicularis newberryi
Cariniferella carinata
Devonochonetes scitulus
Ambocoelia umbonata

Cranaena sp?
Palaeoneilo constricta
Phestia diversa
Buchiola retrostriata

Proboleceras lutheri
Phacops rana
Geenops boothi

Eurypterus remipes
Zaphrenitis

6.3.2 FR1 Zone (Frasnian 1)

The FR1 Zone has 10 genera and 14 species of brachiopods 12 of which have their first occurrences and 1 that has its last occurrence. It contains the first occurrence of the only bivalve found in the zone. The base of this zone is based on the first occurrences of *Douvillina mucronata*, *D. variabilis*, *D. cayuta*, *Spinatrypa spinosa*, *Nervostrophia nervosa*, and *Cyrtospirifer chemungensis*. The FR1 Zone extends from the base of the Brallier Formation to the top of the Back Creek Siltstone Member.

Aulacella sp?
Cariniferella carinata
Cariniferella elmira
Thiemella leonensis
Nervostrophia nevosa
Douvillina cayuta
Douvillina mucronata

Douvillina variabilis
Productella speciosa
Productella spinulacosta
Whidbornella Lachrymosa
Spinatrypa spinosa
Cyrtospirifer chemungensis
Cornellites chemungensis

6.3.3 FR2 Zone (Frasnian 2)

The FR2 Zone has 7 genera and 8 species of brachiopods 3 of which have their first occurrence. It contains 1 species of bivalve that has its first and last occurrence in this zone. The base of this zone is defined by the first occurrences of *Semiproductus onustus* and *Nervostrophia mucronata*. The FR2 Zone is in the middle of the Brallier and extends from the top of the Back Creek Siltstone Member to the base of the Minnehaha Springs Member. Where the Scherr is present the zone extends from the top of the Backcreek Siltstone Member to the base of the Scherr Formation.

Lingula complanta
Lingula ligea
Aulacella sp?
Cariniferella elmira
Nervostrophia mucronata

Productella speciosa
Semiproductus onustus
Spinatrypa spinosa
Buchiola retrostriata

6.3.4 FR3 Zone (Frasnian 3)

The FR3 Zone has 18 genera and 19 species of brachiopods, 10 of which have their first occurrence and 3 that have their last occurrence in this zone. There are 3 genera and 3 species of bivalves, all of which have their first occurrences in this zone. The base of this zone is defined by the first occurrence of *Cariniferella tioga*. Within the zone are the beginning ranges for several other significant taxa. They are *Pseudoatrypa devoniana*, *Orthospirifer mesastrialis*, *Cupularostrum congregata*, *Leiorhynchus mesacostalis*, and *Eoschizodus chemungensis*. The FR3 Zone is in the upper third of the Brallier it extends from the base of the Minnehaha Member to the base of the Foreknobs Formation. Where the Scherr Formation is present it extends from the base of the Scherr to the base of the Foreknobs.

Aulacella sp

Cariniferella tioga

Cariniferella elmira

Nervostrophia nervosa

Douvillina cayuta

Devonochonetes scitulus

Productella specios

Semiproductus onustus

Whidbornella lachrymosa

Cupularostrum congregata

Leiorhynchus mesacostalis

Pseudoatrypa devoniana

Spinatrypa spinosa

Ambocoelia umbonata

Spinocyrtia granulosa

Mediospirifer audaculus

Orthospirifer mesastrialis

Cyrtospirifer chemungensis

Centronella sp?

Cornellites chemungensis

Vertumnia reversa

Eoschizodus chemungensis

Arthroacantha ithacensis?

Zaphrenitis

6.3.5 FR4 Zone (Frasnian 4)

The FR4 Zone has 14 genera and 19 species of brachiopods, 6 of which have their first occurrence. There are 2 genera and 2 species of bivalves 1 of which has their first occurrence in this zone. The base of the FR4 Zone is defined by the first occurrence of *Tropidoleptus carinatus*, *Spinatrypa hystrix*, *Tylothyris mesacostalis*, and *Sinochonetes lepidus*. The first occurrence of *Cupularostrum contracta* and *Tentaculites discissus* are also in this zone. This zone has several fossil beds that are dominated by *Ambocoelia*

umbonata. The FR4 Zone starts at the base of the Mallow Member and extends to the middle of the member.

Cariniferella carinata
Cariniferella tioga
Cariniferella elmira
Rhipidomella penelope
Tropidoleptus carinatus
Douvillina cayuta
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Productella speciosa
Productella spinulacosta
Whidbornella lachrymosa

Cupularostrum congregata
Cupularostrum contracta
Leiorhynchus mesacostalis
Spinatrypa hystrix
Spinatrypa spinosa
Ambocoelia umbonata
Tylothyris mesacostalis
Cyrtospirifer chemungensis
Leptodesma spinigerum
Cornellites chemungensis
Tentaculites discissus

6.3.6 FR5 Zone (Frasnian 5)

The FR5 Zone has 20 genera and 24 species of brachiopods, 5 of which have their first occurrence. There are 4 genera and 5 species of bivalves 2 of which have their first occurrences in this zone. The base of the FR5 Zone is defined by the first occurrence of *Schizophoria impressa*. The zone also contains the beginning ranges of *Eumatobolatechia multicostratum* and *Striatochonetes setigera*. The FR5 Zone extends from the middle of the Mallow Member to the upper fifth of the member.

Schizophoria impressa
Cariniferella carinata
Cariniferella tioga
Tropidoleptus carinatus
Nervostrophia "megastrophia"
Douvillina cayuta
Douvillina mucronata
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Striatochonetes setigera
Productella speciosa
Whidbornella lachrymosa
Cupularostrum contracta
Cupularostrum exima

Leiorhynchus mesacostalis
Eumatobolatechia multicostrum
Pseudoatrypa devoniana
Spinatrypa hystrix
Spinatrypa spinosa
Ambocoelia umbonata
Tylothyris mesacostalis
Cyrtospirifer chemungensis
Cranaena sp?
Leptodesma patulum
Leptodesma spinigerum
Cornellites chemungensis
Glossites?
Palaeoneilo constricta

6.3.7 FR6 Zone (Frasnian 6)

The FR6 Zone has 16 genera and 22 species of brachiopods, 4 of which have their first occurrence and 3 that have their last occurrence in this zone. There are 3 genera and 3 species of bivalves 1, which has its first occurrences in this zone. The base of the FR6 Zone is defined by the first occurrence of *Douvillina graciliora* and *Spirifer williamsi*. The FR6 Zone extends from the upper fifth of the Mallow Member to the middle of the Briery Gap Member.

Schizophoria impressa
Cariniferella carinata
Cariniferella tioga
Cariniferella elmira
Nervostrophia nervosa
Douvillina cayuta
Douvillina graciliora
Douvillina mucronata
Douvillina variabilis
Devonochonetes scitulus
Sinochonetes lepidus
Striatochonetes setigera
Whidbornella hirsuta
Whidbornella lachrymosa

Devonoproductus walcotti
Pseudoatrypa devoniana
Spinatrypa hystrix
Ambocoelia umbonata
Tylothyris mesacostalis
Cyrtospirifer chemungensis
Spirifer williamsi
Centronella sp?
Palaeoneilo constricta
Cornellites chemungensis
Crenepectin obsoletus
Arthroacantha ithacensis?
Tentaculites descissus

6.3.8 FR7 Zone (Frasnian 7)

The FR7 Zone has 19 genera and 27 species of brachiopods, 6 of which have their first occurrence and 1 that has its last occurrence. It contains 3 genera and 3 species of bivalves. The base of the FR7 Zone is based on the first occurrences of *Atrypa reticularis* and *Cyrtospirifer altiplicus*. Other significant first occurrences in this zone are *Steinhagella sp?*, *Spinatrypa aspera*, and *Cyrtospirifer preshoensis*. The FR7 Zone extends from the middle of the Briery Gap to the bottom fifth of the Blizzard Member.

Schizophoria impressa
Cariniferella carinata
Cariniferella tioga
Cariniferella elmira
Nervostrophia nevosa

Douvillina cayuta
Douvillina graciliora
Devonochonetes coronatus
Devonochonetes scitulus
Sinochonetes lepidu

Striatochonetes setigera
Productella speciosa
***Steinhagella* sp?**
Leiorhynchus mesacostalis
Cupularostrum contracta
Atrypa reticularis
Pseudoatrypa devoniana
Spinatrypa aspera
Spinatrypa hystrix
Spinatrypa spinosa
Ambocoelia umbonata

Tylothyris mesacostalis
Orthospirifer mesastrialis
Cyrtospirifer altiplicus
Cyrtospirifer chemungensis
Cyrtospirifer preshoensis
Cranaena sp?
Leptodesma spinigerum
Cornellites chemungensis
Modiomorpha subulata
Arthroacantha ithacensis?
Tentaculites descissus

6.3.9 FR8 Zone (Frasnian 8)

The FR8 Zone has 27 genera and 41 species of brachiopods, 6 of which have their first occurrence and 13 that have their last occurrence in this zone. 3 of those brachiopods have their only occurrence in this zone. There are 6 genera and 7 species of bivalves all of which 3 have their first occurrences and one of those has its only occurrence in this zone. The base of the FR8 Zone is defined by the first occurrences of *Cyrtospirifer chemungensis* var. "godzillas", *Pugnoides duplicatus*, and *Warenella laevis*. The end of the FR8 Zone is defined by the last occurrence of *Scizophoria impressa*, *Douvillina graciliora*, *Cariniferella elmira*, *C. carinata*, *Productella spinulacosta*, and *Striatochonetes setigera*. The FR8 Zone extends from the top of the lower fifth of the Blizzard the top of the Mid Blizzard Silt.

Lingula complanta
Schizophoria impressa
Cariniferella carinata
Cariniferella tioga
Cariniferella elmira
Rhipidomella penelope
Tropidoleptus carinatus
Nervostrophia nervosa
Douvillina cayuta
Douvillina graciliora
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Striatochonetes setigera
Productella speciosa

Productella spinulacosta
Steinhagella sp?
Whidbornella hirsuta
Whidbornella lachrymosa
Semiproductus onustus
Cupularostrum congregata
Cupularostrum contracata
Cupularostrum exima
Cupularostrum sappho?
Leiorhynchus mesacostalis
Leiorhynchus quadricostalis
Eumatabolatchia multicostum
Pugnoides duplicatus
Pseudoatrypa devoniana
Spinatrypa aspera

Spinatrypa hystrix
Spinatrypa spinosa
Ambocoelia umbonata
Tylothyris mesacostalis
Orthospirifer mesastrialis
Cyrtospirifer altiplicus
Cyrtospirifer chemungensis
Cyrtospirifer "godzillas"
Cyrtospirifer n.sp. "mothra"
Spirifer williamsi
Warrenella laevis

Palaeoneilo constricta
Mytilarca chemungensis
Leptodesma patulum
Leptodesma spinigerum
Cornellites chemungensis
Modiomorpha mytiloides
Goniophora chemungensis
Arthroacantha ithacensis?
Tentaculites descissus
Eurypterus remipes

6.3.10 FR9 Zone (Frasnian 9)

The FR9 Zone has 25 genera and 34 species of brachiopods, 5 of which have their first occurrence and 15 that have their last occurrence in this zone. 3 of those brachiopods have their only occurrence in this zone. There are 3 genera and 3 species of bivalves of which 1 has its first occurrence. The base of the FR9 zone is based on the ending ranges of the taxa at the top of FR8. This zone contains the first occurrence of *Productella boydi* and *Cyrtospirifer enermis*. The end of the FR9 Zone is defined by the last occurrences of *Cyrtospirifer chemungensis*, *Cyrtospirifer altiplicus*, *Steinhagella sp?*, *Spinatrypa aspera*, and *Productella boydi*. Other significant taxa that have their last occurrences in this zone are *Spirifer Williamsi*, *Pseudoatrypa devoniana*, *Atrypa reticularis*, *Rhipidomella penelope*, and *Cupularostrum exima*. The FR9 Zone extends from the Mid Blizzard Silt to the base of the top fifth of the Blizzard.

Orbiculoidea newberryi
Petrocrania hamiltoniae
Cariniferella tioga
Rhipidomella penelope
Tropidoleptus carinatus
Nervostrophia mucronata
Douvillina cayuta
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Productella boydi
Productella speciosa
Steinhagella sp?

Semiproductus onustus
Whidbornella lachrymosa
Cupularostrum contracta
Cupularostrum exima
Leiorhynchus mesacostalis
Pugnoides duplicatus
Atrypa reticularis
Pseudoatrypa devoniana
Spinatrypa aspera
Spinatrypa hystrix
Spinatrypa "rugosa"
Ambocoelia umbonata
Tylothyris mesacostalis

Syringothyris randali
Cyrtospirifer altiplicus
Cyrtospirifer chemungensis
Cyrtospirifer inermis
Cyrtospirifer preshoensis
Cyrtospirifer var. "godzillas"

Cyrtospirifer n.sp. "mothra"
Spirifer williamsi
Mytilarca chemungensis
Pseudoaviculopecten fasciculatus
Modiomorpha chemungensis

6.3.11 FR10 Zone (Frasnian 10)

The FR10 Zone has 8 genera and 10 species of brachiopods, 1 of which has its first occurrence and 3 that have their last occurrence in this zone. There are 4 genera and 4 species of bivalves of which 1 has its first occurrence. The base of the FR10 Zone is based on the ending ranges of taxa in the FR9 zone. Significant taxa that have their last occurrence in this zone are *Douvillina cayuta*, *Pugnoides duplicatus*, and *Spinatrypa hystrix*. The last *Spinatrypa* has its last occurrence in the Frasnian in New York, Maryland, Iowa, New Mexico, and the Holy Cross Mountains in Poland and is accepted as an end of the Frasnian fauna. The FR10 Zone extends from the base of the top fifth of the Blizzard to the base of the Pound Member accept at Carvin Cove and Sulfur Springs where it extends to the top of the Pound.

Schuchertella chemungensis
Whidbornella lachrymosa
Cupularostrum contracta
Pugnoides duplicatus
Spinatrypa hystrix
Ambocoelia gregaria
Ambocoelia umbonata

Tylothyris mesacostalis
Cyrtospirifer preshoensis
Cyrtospirifer var. "godzillas"
Schizodus sp?
Mytilarca chemungensis
Cornellites chemungensis
Modiomorpha chemungensis

6.3.12 FA1 Zone (Famennian 1)

The FA1 Zone has 17 genera and 21 species of brachiopods, 4 of which have their first occurrence and 6 that have their last occurrence in this zone. There are 12 genera and 17 species of bivalves of which 9 have their first occurrence and 5 have their last occurrence. The base of the FA1 Zone is defined by the first occurrence of *Athyris angelica*. This is an accepted brachiopod for the base of the Famennian in New York, Maryland, Canada, Iowa, New Mexico, and the Holy Cross Mountains in Pola

Cariniferella tioga
Tropidoleptus carinatus
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Productella speciosa
Strophoproductus hystricula
Whidbornella lachrymosa
Semiproductus onustus
Cupularostrum contracta
Leiorhynchus mesacostalis
Eumatabolatoechia multicostum
Athyris angelica
Ambocoelia gregaria
Ambocoelia umbonata
Tylothyris mesacostalis
Cyrtospirifer inermis
Cyrtospirifer preshoensis
Cranaena eudora
Cranaena harmonia

Cranaena sp?
Ontaria clarkie
Mytilarca chemungensis
Leptodesma lichas
Leptodesma spinigerum
Ontaria suborbicularis
Cornellites chemungensis
Pterinopecten suborbicularis
Pseudoaviculopecten duplicatus
Pseudoaviculopecten fasciculites
Pseudoaviculopecten patulus
Aviculopecten sp?
Crenepectin amplus
Modiomorpha angusta
Modiomorpha chemungensis
Modiomorpha sp?
Schizodus sp?
Paracyclas rugosa
Tentaculites descissus
Eurypterus remipes

6.3.13 FA2 Zone (Famennian 2)

The FA2 Zone has 18 genera and 22 species of brachiopods, 4 of which have their first occurrence and 11 that have their last occurrence in this zone. There are 7 genera and 9 species of bivalves of which 1 has its first occurrence and 2 have their last occurrence.

Cranaea leoni
Schizophoria sp?
Cariniferella tioga
Tropidoleptus carinatus
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Productella speciosa
Whidbornella lachrymosa
Semiproductus onustus
Cupularostrum congregata
Cupularostrum contracta

Cupularostrum orbicularis
Leiorhynchus lesleyi
Athyris angelica
Ambocoelia gregaria
Eleutherokomma n.sp. "rodan"
Tylothyris mesacostalis
Cyrtospirifer inermis
Cyrtospirifer preshoensis
Cyrtospirifer sulcifer
Cranaena Sp?
Ontaria suborbicularis
Mytilarca chemungensis

Leptodesma matheri
Leptodesma lichas
Leptodesma spinigerum
Cornellites chemungensis

Pseudoaviculopecten fasciculatus
Eoschizodus chemungensis
Grammysioidea subarcuata
Arthroacantha ithcensis?

6.3.14 FA3 Zone (Famennian 3)

The FA3 Zone has 12 genera and 15 species of brachiopods, 1, which has its first occurrence, and 10 that have their last occurrence in this zone. There are 6 genera and 6 species of bivalves of which 1 has its first occurrence and 1 have its last occurrence.

Schizophoria sp?
Cariniferella tioga
Schuchertella chemungensis
Devonochonetes scitulus
Sinochonetes lepidus
Whdbornella lachrymosa
Semiproductus onustus
Cupularostrum congregata
Cupularostrum contracta
Cupularostrum orbicularis
Ambocoelia gregaria

Tylothyris mesacostalis
Eosyringothyris sp?
Cyrtospirifer inermis
Cyrtospirifer sulcifer
Leptodesma naviforme
Cornellites chemungensis
Modiomorpha angusta
Eoschizodus chemungensis
Grammysioidea subarcuata
Sedwickia calvulus

6.3.15 FA4 Zone (Famennian 4)

The FA4 Zone has 5 genera and 6 species of brachiopods, 1 of which has its first occurrence and 1 that has its last occurrence in this zone. There are 4 genera and 4 species of bivalves that occur.

Schuchertella chemungensis
Devonochonetes scitulus
Cupularostrum contracta
Cupularostrum orbicularis
Cyrtospirifer sulcifer

Leptodesma cadmus
Leptodesma naviforme
Grammysioidea subarcuata
Sedwickia calvulus

6.3.16 FA5 Zone (Famennian 5)

The FA5 Zone has 5 genera and 5 species of brachiopods, 1 of which has its first occurrence and 3 that have their last occurrence in this zone. There are 3 genera and 6 species of bivalves of which 2 have their last occurrence.

Lingula ligea

Cyrtina hamiltonensis

Devonochonetes scitulus

Cupularostrum orbicularis

Sinotectirostrum alleghanium

Cyrtospirifer sulcifer

Leptodesma cadmus

Leptodesma matheri

Leptodesma naviforme

Leptodesma spinigerum

Eoschizodus chemungensis

Grammysioidea subarcuata

6.3.17 FA6 Zone (Famennian 6)

The FA6 Zone has 4 genera and 4 species of brachiopods, 1 of which has its first occurrence and 3 that have their last occurrence in this zone. There are 6 genera and 8 species of bivalves of which 1 has its first occurrence and 8 have their last occurrence.

Sinotectirostrum alleghanium

Devonochonetes scitulus

Cupularostrum orbicularis

Rugosochonetes sp?

Modiomorpha chemungensis

Sedgwickia cavulus

Ontaria accinta

Grammysioidea subarcuata

Leptodesma cadmus

Leptodesma naviforme

Mytilarca chemungensis

Modiomorpha angusta

6.3.18 T1 Zone (Tournaisian 1)

The T1 Zone has 4 genera and 4 species of brachiopods, 3 of which have their first occurrence and 2 that have their last occurrence in this zone. There are 3 genera and 3 species of bivalves of which 2 have its first occurrence and 2 have their last occurrence.

Rugosochonetes sp?

Subglobosochonetes acutiliratus?

Macropotamorhynchus durbinensis

Leptodesma spinigerum

Ptychopteria eugenia

Sedgwickia attenuata

6.3.19 T2 Zone (Tournaisian 2)

The T2 Zone has 2 genera and 2 species of brachiopods, 2 that have their last occurrence in this zone. There are 2 genera and 2 species of bivalves of which 1 has its first occurrence and 2 have their last occurrence.

Macropotamorhynchus durbinensis

Subglobosochonetes acutiliratus

Sedgwickia attenuata

Schizodus sp?

Chapter 7. DISCUSSION

7.1 Discussion of the Lithostratigraphy

The lithologic data collected in this study presents evidence for answers to many questions about the nature of the stratigraphic units. It is clear that there is a recognizable pattern in the stratigraphy. The pattern can be correlated with adjacent studies to the north and northwest. Why is this pattern so consistent within such a dynamic depositional environment? How consistent is it? The hypothesis is that the consistency of the pattern is due sedimentary responses to sea-level changes. The answer requires chronological data and will have to wait for the discussion that involves the combination of lithostratigraphy and biostratigraphy. This study indicates consistent patterns yet states differences in the lithology. What are the differences and what is the magnitude of the differences? The most obvious overall difference is that the sediment size is one step finer except for the Millboro and Brallier Formation. Differences will be described for each stratigraphic unit in order from oldest to youngest.

The Millboro is very much the same as the type section descriptions except for the punky yellowish zone 260 from the top, at Carvin Cove, which does not fit the Millboro description. This section is the closest to the paleo shoreline and is the section that would be the most sensitive to changes in sea-level.

The Brallier is also very much the same as the type section descriptions except at Carvin Cove where it tends to be much muddier and lacks the domination of turbidites. The Back Creek and Minnehaha Members of the Allegheny Front, recognized by Dennison (1980) and Lyke (1986) are identified and carried into the study area. The two members, which contain coarser sediments than the rest of the Brallier Formation, are probably the result of the lowering of sea level. With palinspastic reconstruction all of these sections except for Bland/Bastion and Carvin Cove would end up on or about depositional strike.

The Scherr Formation can be recognized within the study area at two locations Sulphur Spring and Allegheny/Crows. Its sediments are not as coarse as Dennison's (1970) descriptions; sandstones are coarse siltstones. The Scherr correlates to the

Minniehha Springs Member of the Braillier Formation and is indicative of a shallower depositional environment.

Despite the noticeable difference in grain size, one step finer, the Foreknobs Formation has the same pattern Dennison (1970) described. The difference in grain size does not warrant a change in nomenclature. Recognition of the members does not come easy and they can easily be miscorrelated or misidentified if not understood in the context in which they were deposited. If they could be easily recognized and correlated over long distances they would be considered formations. It is the feeling of the author that it would be hindrance to future work to create new nomenclature based on a step finer sediment size. The general pattern is the same in the study area and its units can be correlated based on Dennison's (1970) descriptions.

The Mallow can be easily recognized by its reddish silty mudstones and zones. The "reddish zones all contain sufficient evidence to conclude that they are marine. The reddish zones occur at about the same stratigraphic interval. Dennison (1970) suggested they might be important time markers and may be some kind of event stratigraphy. There are five "reddish" zones of the Briery Gap that are fine to coarse sandstones with very high porosity. These reddish zones contain sufficient fossil evidence to determine that they were deposited in a marine environment. Given the variety of depositional environments required to produce these sediments I think the redness is a post depositional feature. I propose that when sea level was lower meteoric oxygenated water was flushed through the sediment as the hydraulic gradient increased due to a drop in base level. The oxygenated water caused any Iron in the sediment to oxidize and turn red. There is a seismite and an ash-bed at the top of the Briery Gap. The Blizzard contains the Mid Blizzard Siltstone. This could be considered a member if it could be found in other places. The Pound splits into two sandstone bodies showing minor changes in deposition at every outcrop except Carvin Cove where the pound is coarser. This provides more evidence that the Carvin Cove section is closest to the paleo-shoreline.

The Red Lick is easily distinguished by its massive two-four foot thick beds of reddish-maroon tinted gray coarse siltstone and sandstone. However those beds don't occur until after the much finer sediment and thinner bed thickness of the basal Red Lick.

The interval between the top of the Pound and the bottom of the massive beds of the Red Lick should be considered for recognition as a new member. The finer sediment unit of the lower Red Lick may not be preserved in the area where Dennison has done his work. It is suggested that this zone correlates with the Dunkirk Shale in New York (Filer 1994 and VanTassel 1994). Three persistent sandstone bodies follow it. These three sandstone bodies are probably the result of sea-level regressions even though the deposition of Red Lick, as a whole, is a result of the rapid progradation of the Catskill delta complex. The increase of progradation is likely due to a lower rate subsidence within the study area. The top of the Red lick contains another fine sediment package. It is in the right stratigraphic position to be equivalent to the Cleveland Shale. South of route 77 near Wytheville members of the Foreknobs Formation become more difficult to distinguish but the character of the Red Lick Member can still be recognized. North of Blacksburg the terrestrial Hampshire red-beds mark the evasion the non-marine sediments of the Catskill delta complex into the study area.

The Price Formation is the invasion of the shoreline and distributary lobes of the delta into the region. It is deposited on top of the Hampshire Formation north of Blacksburg and conformably on top of the Foreknobs Formation to the South of Blacksburg. The fact that the Price is on top of the Hampshire red beds to the north indicates a change in depositional strike. The Cloyd Conglomerate must have been deposited during a significant sea-level regression. In the study area it is definitely marine since it contained not only a variety of well preserved marine fossils but a spectacular fossil of a whole articulated starfish! The Sunbury Member is Mississippian and represents the first major transgression after the end of the Devonian. The Ceres Member is as Bartlett (1974) described it. The most important part of this member is that it is mostly marine and is exposed at all the sections south of Blacksburg and at Allegheny/Crows. Further collecting in this unit at other locations should supply needed biostratigraphic information to establish a much better understanding of the Devonian/Carboniferous boundary in the region.

7.2 Discussion of the Biostratigraphy

19 local bizones were recognized in this study and are intended to be used to help correlate the stratigraphy and increase the resolution of the Upper Devonian in the Central Southern Appalachian Basin. The composite biostratigraphic ranges correlate very well with Clarke's (1913) ranges from western Maryland and the established ranges in New York by Dutro (1980). They also correlate well with Rossbach's (1992) ranges from every section except the Huttonsville section, which I am convinced, is miscorrelated. I first examined the field notes from the section. There were question about the placement of the Pound Sandstone. This is very important because everywhere else in the region the Frasnian/Famennian boundary is at or near the base of the Pound. I completed a two-day survey of his Huttonsville section making a quick measurement of the section and collecting enough fossil material to recognize biozones in the section. Using the Dennison's (1970) description of the Pound Sandstone and the biostratigraphic data I decided this portion of the measured section was miscorrelated. So, I recommend moving the designation of the Pound Sandstone to the next sandstone body at the Huttonsville section. This places the Pound where Rossbach (1992) places the Frasnian/Famennian boundary. If correlations are made according to my observations then the entire region follows a very similar pattern of beginning and ending ranges. My point is not expose error but to validate a regional biozonation that can be used to correlate with other regions.

7.3 Discussion of Biozones and their Relationship to Stratigraphic Units

The highest resolution and the basis for biostratigraphic correlations in the Devonian are conodonts. Conodont zonations of the Upper Devonian were established by Klapper (1981), Klapper (1989), Klapper and Kirchgasser (1992), and Over (1997). This study revealed no conodonts even though Jeff Over and several of his students came to this field area and looked for three days in all the stratigraphic intervals that were most likely to contain conodonts. The next best zonation is based on ammonoids. The lack of

ammonoids in the study are eliminated the possibility of high-resolution biozonation with ammonoids. There were plenty of brachiopods, so biozones were based on them. The problem is the only brachiopod biozonation was defined by Dutro (1980) for brachiopods in New York and has 9 biozones for the Upper Devonian. The other problem is that there are not any studies that fully correlate brachiopod biozones with conodont biozones. 19 biozones are described in this study and offer the best and highest resolution biozonation for the region (Figure 7).

The EG (End of Givetian) Zone is not a true biozone it is only the zone where I found fossils that were without a doubt Givetian. The only reason to examine the strata containing the EG zone was to have some data to help establish the beginning of the Upper Devonian. Consequently it makes no sense to discuss any beginning ranges for this zone. The Givetian trilobites that characterize this zone are *Greenops boothi* and *Phacops rana*. There are no fossils indicative of the Givetian or Frasnian for the interval between the stratigraphic elevation of the Givetian Trilobites and the next three hundred feet, which is the uppermost part of the Millboro.

The Brallier is Frasnian and contains the FR1, FR2, and FR3 assemblage zones. The ammonites and trilobites below the Brallier are Givetian. The lack of fossils in the Brallier below the Minnehaha Springs Member makes it difficult to establish strong zonations. I divided it into three zones. The FR1 is from the base of the Brallier to the top of the Back Creek Siltstone Member and correlates with the lower half of the *Asymetricus* conodont zone (Van Tassell 1994). Some caution should be taken for FR1 zone because some first occurrences are likely to be because of facies dependents rather than originations. The FR2 Zone extends from the top of the Back Creek Siltstone to the base of the Minnehaha Springs Member and correlates with the upper part of the Middle-*Asymetricus* and the Upper-*Asymetricus* conodont zones. The FR3 Zone is the interval between the base of the Minnehaha Springs Member or Scherr Formation and the top of the Brallier or Scherr it correlates to the *Asymetricus triangularis* and the Lower-*Gigas* conodont zones (Van Tassell 1994).

The Mallow is Frasnian and contains the FR4, FR5, and lower-most FR6 assemblage zones of this study. Van Tassell (1994) shows this unit correlated with the Upper *Gigas* conodont zone. There are several beds dominated by *Ambocoelia*

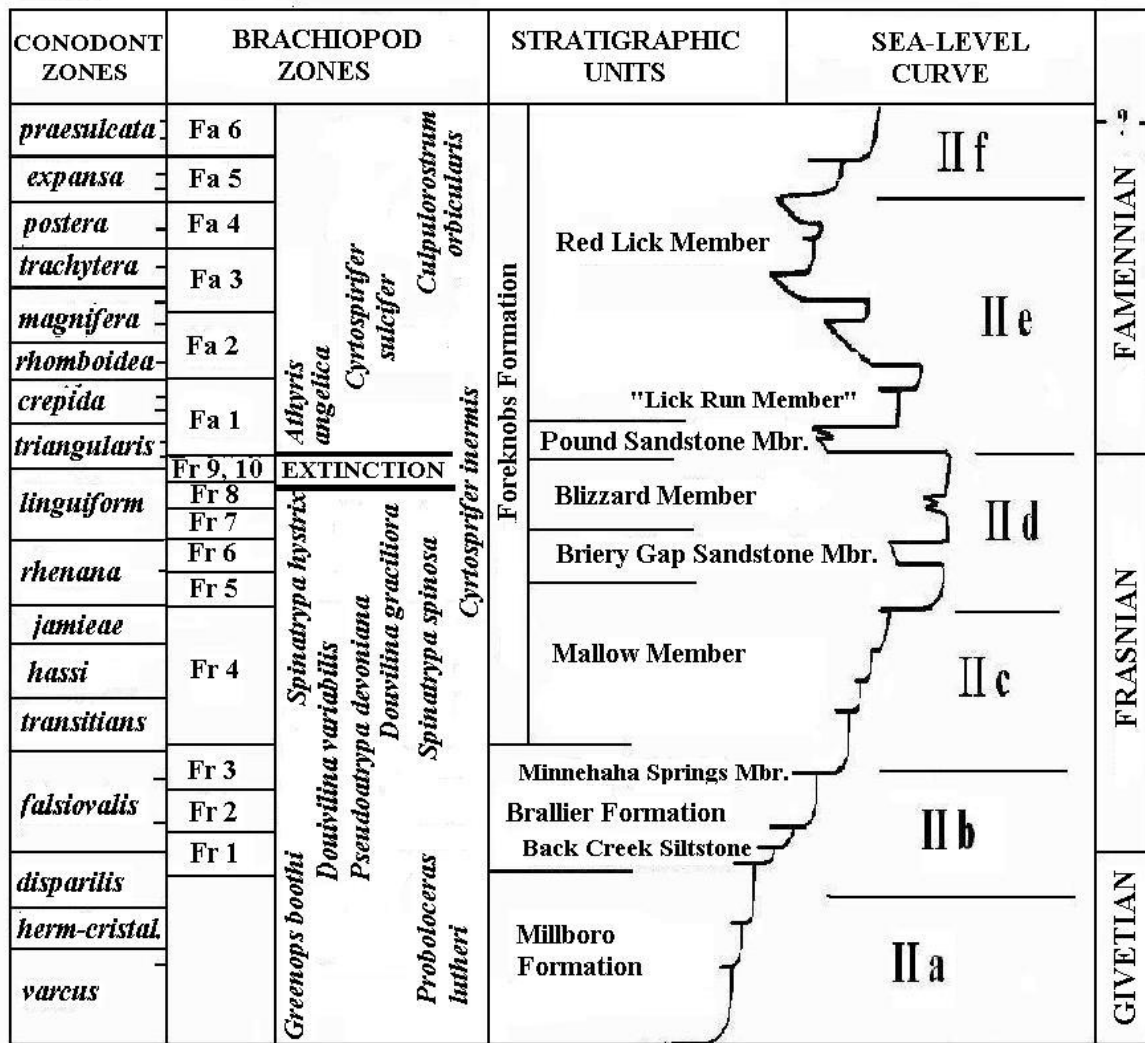


Figure 7. Correlation between brachiopod biozones, lithologic units, and the Devonian Sea-Level Curve (modified after Johnson, Klapper, and Sandburg 1985 and Dennison 1985).

umbonata. The mallow is slightly younger to the southwest (Dennison 1970). This study confirms this as biozones slightly cross the lithologic boundary between the Brallier or Scherr Formation and the Mallow Member of the Foreknobs. This is more evidence that depositional strike is trending north because as you trend east or west biozones are slightly cutting across lithologic boundaries.

The Briery Gap is Frasnian and contains the upper two thirds of the FR6 and the lower half of the FR7 assemblage zones. Van Tassell (1994) shows this unit correlated with the Upper-Most *Gigas* conodont zone. The boundary between FR6 and FR7 is not sharp. It spans over about 20 feet stratigraphically. It is a transitional boundary between the ending ranges of *Douvillina variabilis*, *Devonoproductus walcotti*, *Centronella sp?*, and the beginning ranges of *Atrypa reticularis*, *Cyrtospirifer altiplicus*, and *Spinatrypa aspera*. The Briery Gap part of the FR7 zone contains fossil assemblages that are dominated by *Tylothyris mesacostalis*.

The Blizzard is Frasnian and contains the upper-half of the FR7, the FR8, FR9, and FR10 assemblage zones. Van Tassell (1994) shows this unit correlated with the *Triangularis* conodont zone. The FR10 Zone is the latest Frasnian assemblage zone. FR10 has the last Frasnian *Spinatrypids* and the *Cyrtospirifers* that cross through to the Famennian but contains no *Cyrtospirifers* that are purely Famennian and no *Athyris angelica*.

The Pound Sandstone contains the Frasnian/Famennian boundary. McGhee (1987) places the F/F boundary between the latest *Spinatrypa* and the earliest *Athyris angelica*. The Pound is above the last *Spinatrypid* and contains the first *Athyris angelica* and the lower third of the FA1 assemblage zone. All the other sections have the last Frasnian fossils disappear before the base of the Pound except Carvin Cove and Sulfur Springs. All the other sections except at Carvin Cove and Sulfur Springs have the first occurrences of Famennian fossils at the base or in the middle of the Pound. This would be expected in a prograding environment. The Pound is only about 100 feet thick and it seems reasonable for about 100 feet of sediment to prograde out about 60 miles in less

than ½ a million years. It is only the sections closer to shore (Carvin Cove and Sulfur Springs) that have the boundary near the top or slightly above making the Pound slightly older at these sections.

The Red Lick Member contains the upper part of the FA1 Zone, the FA2, FA3, FA4, FA5, and FA6 Zones as well as the lower part of the T1 Zone. Most of the FA2 Zone is within the first of three sandstone bodies. The FA3 Zone is associated with the second sandstone body. The FA4 Zone is associated with the third sandstone body. The upper portions of the Red Lick Member that would contain zones FA4, FA5, and FA6 is taken over by the non-marine Hampshire Formation at Allegheny/Crows, Sulfur Springs, and Carvin Cove. The uppermost part of the Red Lick (=Cleveland Shale?) contains a few fossils that are Tournaisian but not Kinderhookian. Carl Sandberg (personal contact 2001) suggests that the first part of the Tournaisian is Upper Devonian. Even though the base of the Mississippian and Carboniferous are considered equal the age of the stages that represent them are not.

Traditionally the Cloyd conglomerate has been thought to either be Carboniferous or contain the Carboniferous/Devonian boundary. In the study area the Cloyd Conglomerate is Kinderhookian, which is Mississippian. Sunbury Shale Member is within the Upper T1 Zone and contains *Siphonodella duplicata* and other Mississippian conodonts (Bartlett 1974). The T2 Zone extends from the top of the Sunbury Shale Member into the Ceres Member. There is no description of the top of this zone because there was no attempt to collect very far past the Devonian/Carboniferous boundary.

7.4 Discussion of Frasnian/Famennian extinction

This study includes a detailed look at the Frasnian/Famennian extinction. The number of taxa and number of fossils collected through this interval gives way to an extraordinary close up view of the event. The Frasnian/Famennian extinction is easily recognized in this study. The extinction comes just before the end of the Frasnian. The Extinction comes in two pulses, one at the end of the FR8 Zone and the other at the end of the FR9 Zone. 28 brachiopod species have their last occurrence during this interval while 11 have their first appearances. In the FR8 Zone there are 27 genera and 41 species

of brachiopods. In the FR10 Zone after the extinction there are only 8 genera and 10 species of brachiopods present. Rossbach (1992) indicated that his data set did not show a significant extinction event and decided that the Franian/Famennian extinction could not be recognized in his study area. Rossbach's (1992) correlation of the Huttonsville section has Frasnian fossils extending several hundred feet into the Red Lick Member. Reexamination of the Huttonsville section suggests that it is miscorrelated. Correct correlation and the data from this study indicate that the Frasnian/Famennian extinction occurs just before the Frasnian/Famennian boundary along the Allegheny Front and in the Valley and Ridge of Virginia. The evidence of the Frasnian/Famennian extinction is so similar to the description of the event in Kellwaser Germany that it suggests a global signal (Plate 25).

7.5 Discussion of the Progradational Nature of the Delta Complex in the Region

According to the biostratigraphy biozones cross stratigraphic boundaries as sediments prograde to the west and southwest. The stratigraphy is generally younger to the west and southwest. At Carvin Cove biostratigraphic zones occur about 50-100 feet stratigraphically above where they occur at Bland/Bastion, Longspur, Parrott, McCoy, Lick Run, and Alleghany/Crows. At Sulfur Springs the biozones occur 100-125 feet above the common elevations. This is because Sulfur Springs and Carvin Cove are the sections closest to shore and as sediment progrades out into the basin the strata would be younger to the west and southwest. I had hoped I picked a large enough study area and collected enough fossils to document the facies changes and build some evidence for the rates of progradation (Plate 24).

Chapter 8. CONCLUSIONS

This study completes a comprehensive and detailed biostratigraphic and lithostratigraphic analyses of the eight chosen sections. The lithostratigraphic data determined that Dennison's nomenclature can be used in the Valley and Ridge province of Virginia from the Maryland/Virginia border to the end of Walker Mountain in Washington County (about 25 miles along strike from the Tennessee border). The biostratigraphic data collected produced a comprehensive biostratigraphic data set for the Upper Devonian in the Central-Southern Appalachian basin. 23,046 fossils were collected and 160 taxa identified. Biostratigraphic data was compiled and 18 local assemblage zones were established; 10 assemblage zones for the Frasnian, 6 for the Famennian, and 2 for the Tournaisian. Compared to the brachiopod zones for New York (Dutro 1981) this study doubles the resolution of the Frasnian and adds two more zones to the Famennian. The composite standard reference data is displayed on a biostratigraphic range chart within this volume (Plate 25). Lithostratigraphic data and biostratigraphic data were combined to find the answer to many questions about the nature of the stratigraphy, timing of deposition, and biological events

The first question was whether or not the sandbodies in the Foreknobs were diachronous or synchronous. Dennison (1970) thought they were synchronous while Rossbach (1992) thought they were diachronous. Enough detailed biostratigraphic data was collected to indicate they are synchronous at least to the level of progradation of the sandbodies. Along depositional strike they are very synchronous. Perpendicular to strike bizonal lines cross some of the lithostratigraphic divisions but only by 100 feet or so over 60 miles (Plate 24). The second question is why would the stratigraphy Dennison (1970) described have the same stratigraphic pattern over such a large area when it was deposited in an extremely dynamic depositional environment? I believe it is because the pattern in the stratigraphy has the signal of eustatic sea level changes imprinted upon it but are limited to second, third, and fourth order sequences. Correlations further establish the legitimacy of Dennison's claims that the "redbed" strata and the strata of sandbodies that exhibit sudden coarsening are synchronous and the result of lowering of sea level. Large-scale correlations indicate that the eustatic sea-level curve can be seen as an

overprint on the local stratigraphy despite being in a tectonically disturbed area undergoing dynamic deposition. The major sandbodies that make up the members in this study are the result of third order sea level changes.

The Frasnian/Famennian boundary can be placed accurately without conodonts. The Frasnian/Famennian extinction event can be recognized. It occurs just before the Frasnian/ Famennian boundary. 40% of the genera and 60% of the species of brachiopods go extinct. It comes in two very distinct pulses. Each pulse begins with a gradational decline. Not only can it be recognized, it occurs just below the Pound Member at every outcrop. It is not clear whether or not this is a major extinction because we do not have absolute age data for evidence of the duration of the extinction. The pattern of the Frasnian/Famennian extinction from this study is very similar to pattern found in the Kelwvasser events in Germany.

The study also extends into the basal Carboniferous, which is preserved in near shore marine sediments, without unconformities. This affords us with a rare look at the near shore macrofossil faunal transition of mollusks and brachiopods across the Devonian/Carboniferous boundary.

The revisions of the Upper Devonian in the Central-Southern Appalachian establish the usefulness of Dennison's nomenclature in Virginia. It increases the stratigraphic resolution by four fold by adding the members of the Brallier and the Foreknobs. The 16 local biozones described for the Upper Devonian further increases the time resolution. There is enough biostratigraphic data to correlate Dennison's units with the Devonian sea-level curve produced by Johnson, Klapper, and Sandburg (1985). Correlations further establish the legitimacy of Dennison units and more importantly address the claims that the "redbed" strata and the strata of sandbodies that exhibit sudden coarsening are synchronous and the result of lowering of sea level. My hope is that the data from this study could be combined with other data sets to test the local biozones and establish a regional bizonation; further analyze the Frasnian/Famennian extinction; and be used as a framework for a sequence stratigraphic analysis of the Upper Devonian.

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PLATE 1

1. *Lingula ligea* (Hall, 1860); Figure 1., sample M 3336, internal mold of a pedicle and brachial valve.

2. *Orbicularia newberryi* (Hall, 1867); Figure 2., sample STE 3064, external mold of the pedicle valve displaying its distinguishing orbicular shape and growth lamellae.

3. *Cranaena leoni* (Hall, 1867); Figure 3., sample STE 2970, internal mold of the pedicle valve with irregular shape and pronounced concentric growth lamellae.

4. *Petrocrania hamiltoniae* (Raymond, 1911); Figure 4., sample STE 3131, close up of an internal mold of the pedicle valve exhibiting a distinctive rim and irregular outline.

5. *Petrocrania hamiltoniae* (Raymond, 1911); Figure 5., sample STE 3131, internal mold of 6 pedicle valves that were attached to a *Mytilarca chemungensis*. This demonstrates how this species attaches to a hard substrate.

Plate 1

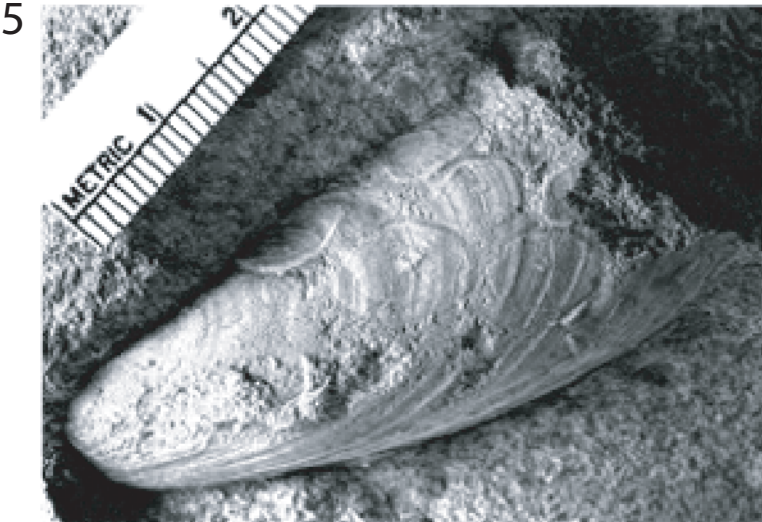
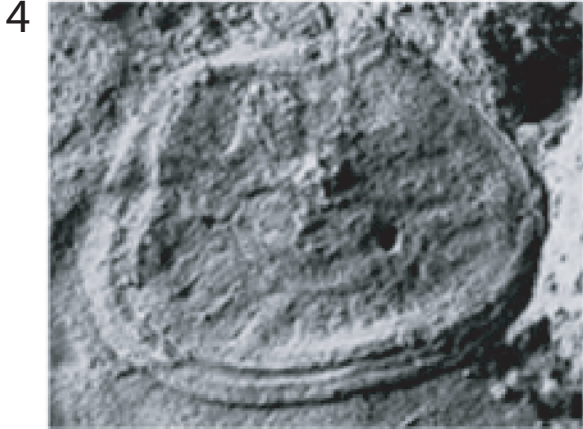
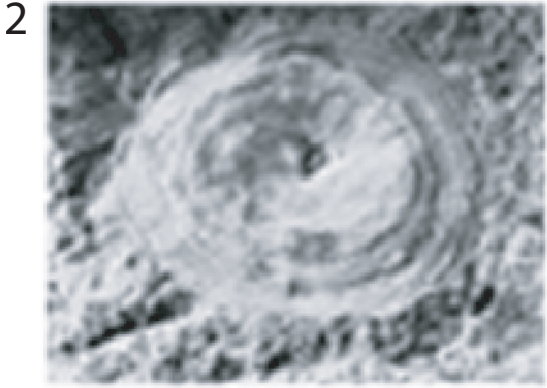
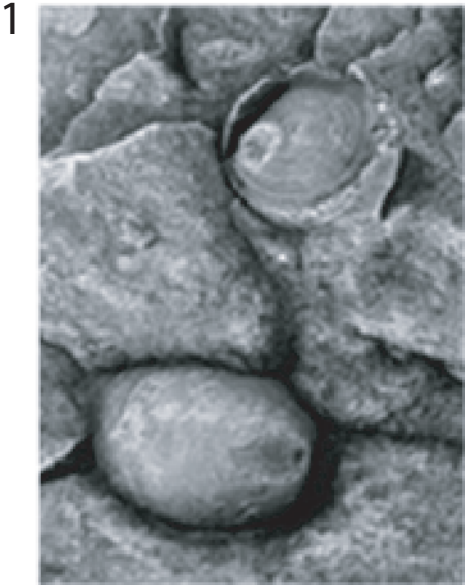


PLATE 2

1. *Schizophoria impressa* (Hall, 1843); Figure 1., sample P –65, internal molds of two pedicle valves displaying large slightly divergent diductor muscle scars.
2. *Schizophoria impressa* (Hall, 1843); Figure 2., sample AC-1, external mold of brachial with fine radial costellae.
3. *Cariniferella carinata* (Schuchert and Cooper, 1931); Figure 3., sample AC-1, external mold of pedicle valve showing characteristic alternating strength of costae.
4. *Cariniferella carinata* (Schuchert and Cooper, 1931); Figure 4., sample AC-1, internal mold of pedicle valve with evidence of shelf like structure used for adductor and diductor muscle attachment preserved.
5. *Cariniferella tioga* (Hall, 1843); Figure 5., sample STE-3100, external mold of pedicle valve showing broad gentle sulcus, regular radial costellae, and well defined concentric growth lamellae.

Plate 2

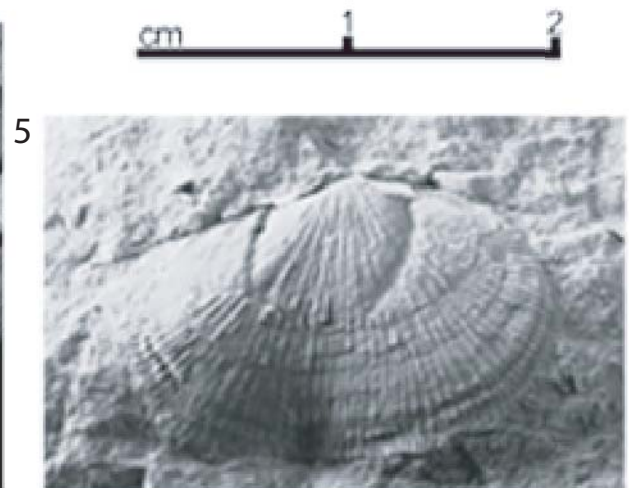
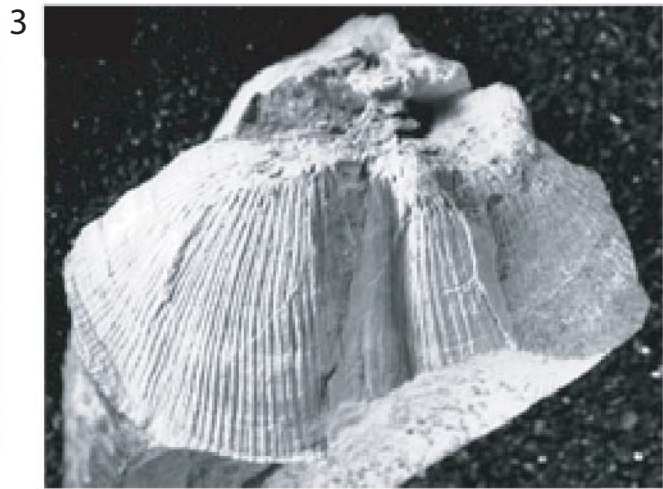
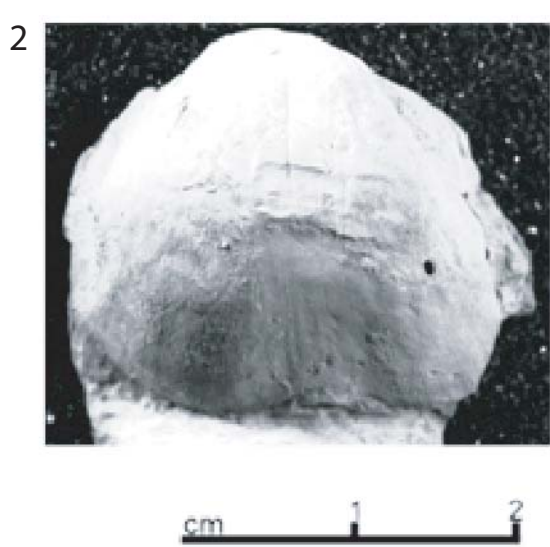


PLATE 3

1. *Cariniferella tioga* (Hall, 1843); Figure 1., sample STE-3245, external mold of brachial valve.

2. *Cariniferella elmira* (Williams, 1908); Figure 2., sample SS-3529, internal mold of brachial valve.

3. *Cariniferella elmira* (Williams, 1908); Figure 3., sample SSR-369, internal molds of brachial and pedicle valves. Pedicle valves show muscle field dominated by diductor scars.

4. *Thiemella leonensis* (Hall, 1867); Figure 4., sample CA-302, internal mold of pedicle valve showing well defined muscle field with impressions of adductor and diductor scars. Carinate margin is well preserved.

5. *Rhipidomella penelope* (Hall, 1867); Figure 5., sample SS-3994, internal mold of brachial valve.

Plate 3

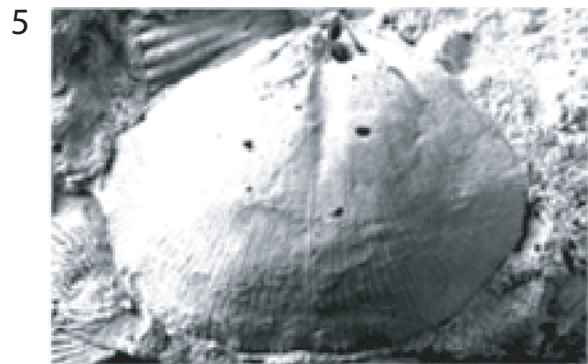
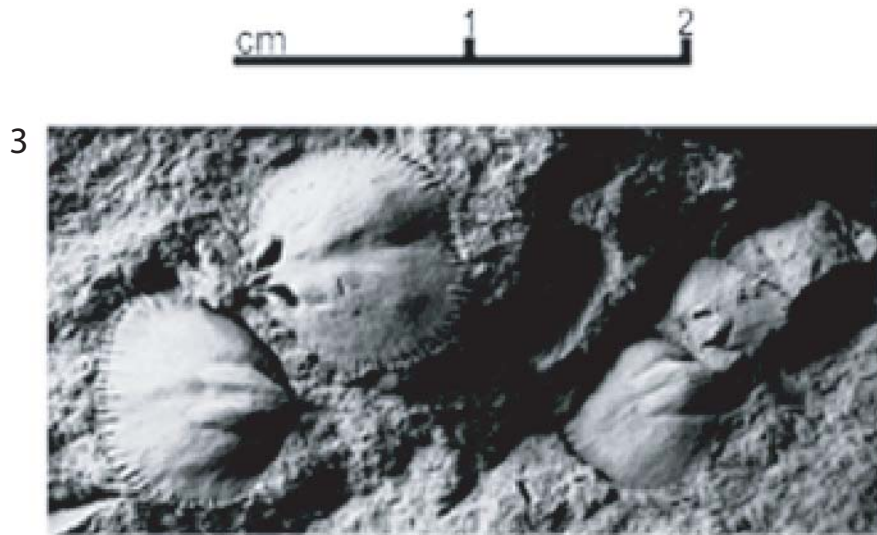
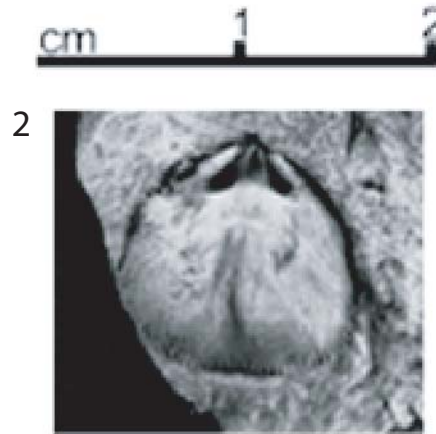
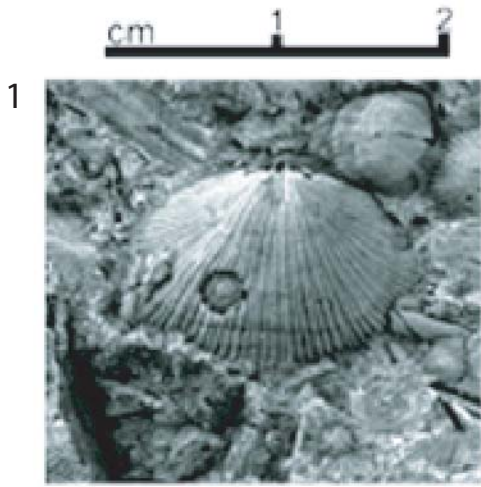


PLATE 4

1. *Rhipidomella penelope* (Hall, 1867); Figure 1., sample SS-3994, internal and external mold of pedicle valves. The internal mold shows well defined adductor and diductor muscle scars, impressions separating the muscle field, and a broad flabelliform shape of the diductor scars. The external mold shows fine radial costellae.

2. *Tropidoleptus carinatus* (Conrad, 1839); Figure 2., sample SS-4398, external mold of pedicle valve showing strong broad costae, two prominent concentric growth lamellae, and a strong median rib.

3. *Tropidoleptus carinatus* (Conrad, 1839); Figure 3., sample SS-4390, external molds of brachial and pedicle valves.

4. *Nervostrophia nrevosa* (Hall, 1843); Figure 4., sample SS-3695, internal molds of three pedicle valves showing broad strophic hinge line, narrow beaks, and nervosic pattern of costae.

Plate 4

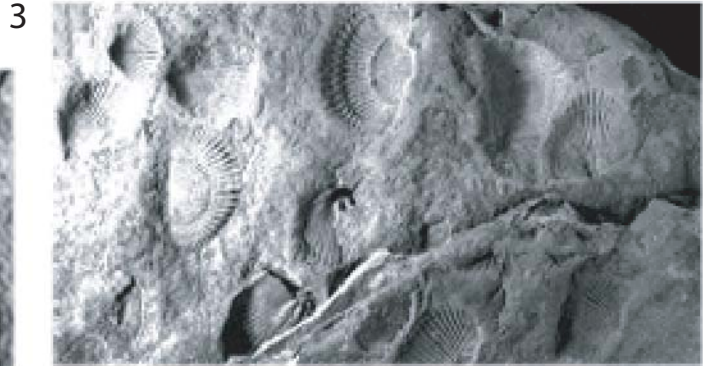


PLATE 5

1. *Nervostrophia nervosa* (Hall, 1843); Figure 1., sample SSR-38, internal mold of pedicle valve displaying its irregular strength of costae and its rugosic bifurcation of costae.

2. *Nervostrophia* (Hall, 1843) var. *A "megastrophia"*; Figure 2., P-318, external mold of pedicle valve showing its nervosic ornamentation.

3. *Nervostrophia* (Hall, 1843) var. *A "megastrophia"*; Figure 3., sample P-318, internal mold of pedicle valve showing faint muscle scars, granular texture in the beak area, and crenulated posterior margin.

4. *Douvillina cayuta* (Hall, 1867) var. *extensa* (Butts, 1941); Figure 4., sample SSR-680, external mold of brachial valve showing slight fold and alternating strength of costae.

5. *Douvillina cayuta* (Hall, 1867) var. *extensa* (Butts, 1941); Figure 4., sample SSR-680, enlarged version of Figure 4.

Plate 5

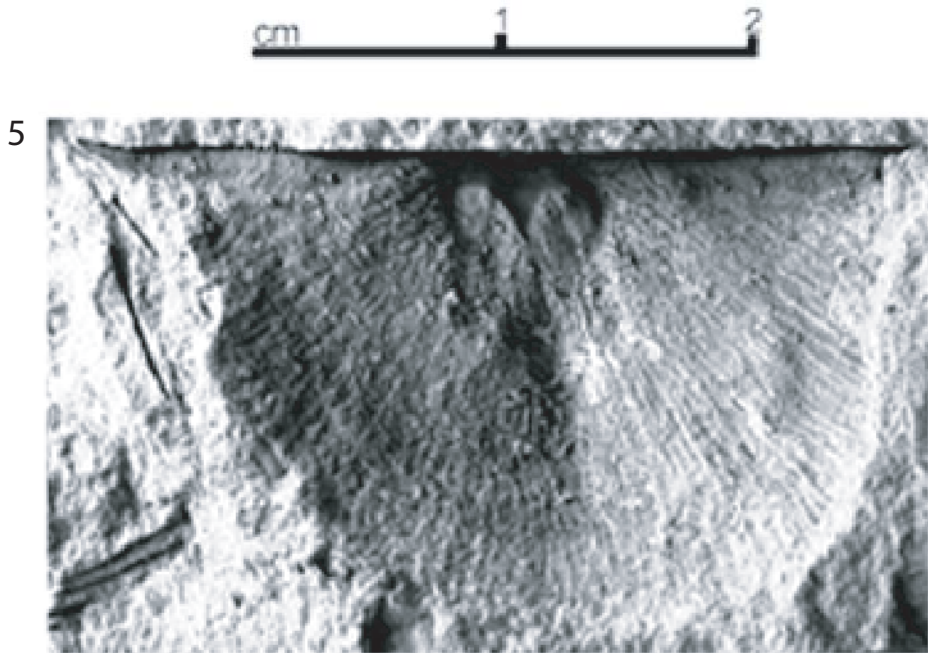
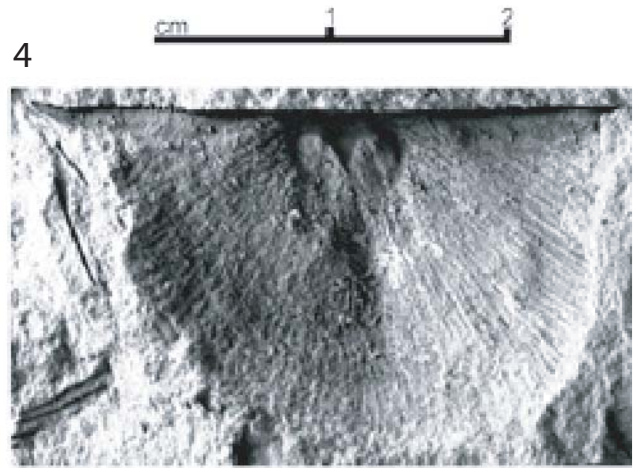
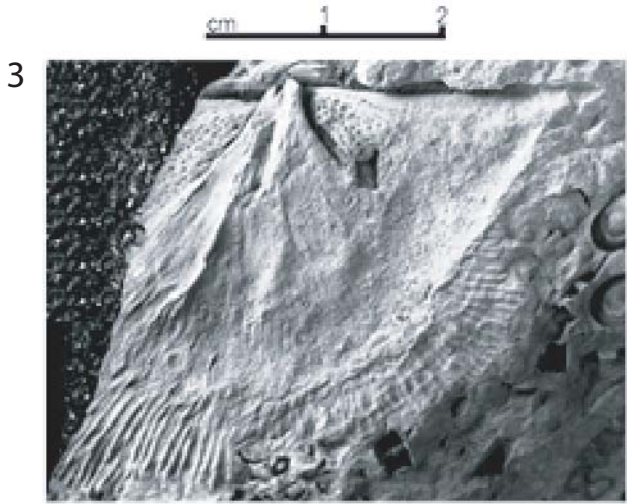
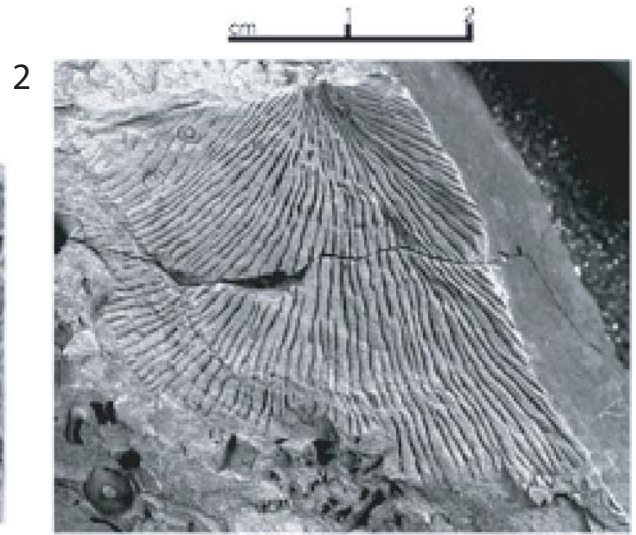
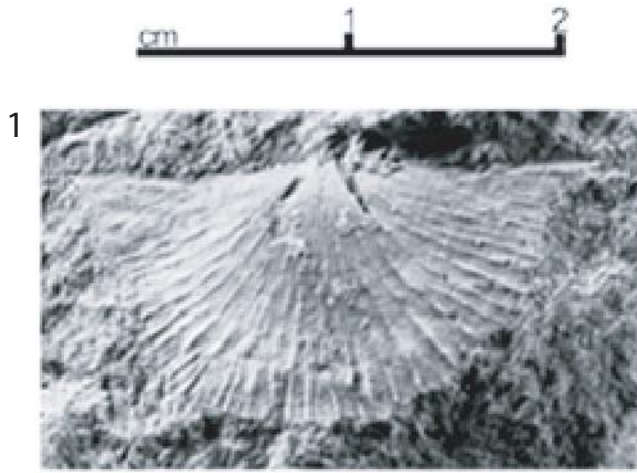


PLATE 6

1. *Douvillina gracilioria* (Clarke and Swartz, 1913); Figure 1., sample AC-545, internal mold of two pedicle valves showing well defined adductor and diductor muscle scars, granulated texture surrounding the muscle field, and denticulated hinge line.

2. *Douvillina cayuta* (Hall, 1867); Figure 2., sample P -64, internal mold of brachial valve.

3. *Douvillina variabilis* (Calvin, 1873); Figure 3., sample LR-1054, external mold of pedicle valve showing slight narrow fold and variable costae that fan out laterally from the median.

4. *Schuchertella chemungensis* (Conrad, 1842); Figure 4., sample LR-2100, external mold of brachial valve.

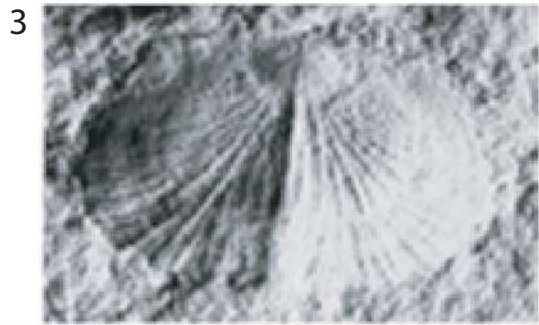
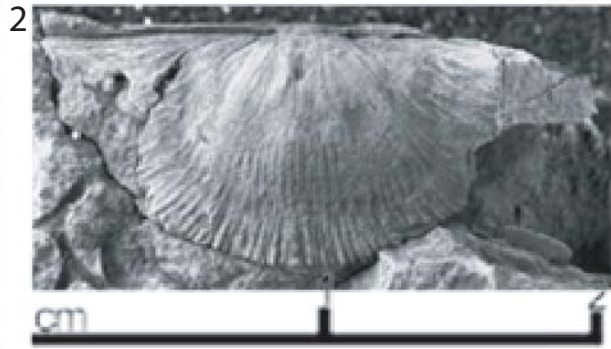
5. *Schuchertella chemungensis* (Conrad, 1842); Figure 5., sample LR-2100, external mold of pedicle valve showing prominent concentric growth lamellae and fine radial costae..

Plate 6

cm 1 2



cm 1 2



cm 1 2



cm 1 2



PLATE 7

1. *Devonochonetes coronatus* (Conrad, 1842) and *Douvillina cayuta* (Hall, 1867); Figure 1., sample AC 540, molds of several valves of *D. coronatus* along with the larger *D. cayuta*.
2. *Devonochonetes scitulus* (Hall, 1867); Figure 2., sample FT-1865, internal and external molds of pedicle and brachial valves.
3. *Devonochonetes scitulus* (Hall, 1867); Figure 3., sample FT-1865, enlarged version of Figure 2. showing spines along the hinge line of a pedicle valve
4. *Devonochonetes scitulus* (Hall, 1867); Figure 4., sample M-2692, close up view of internal mold showing median septa and crenulated margin of a brachial valve.
5. *Devonochonetes scitulus* (Hall, 1867); Figure 5., sample STE-3254, typical coquina type bed of *D. scitulus*.

Plate 7

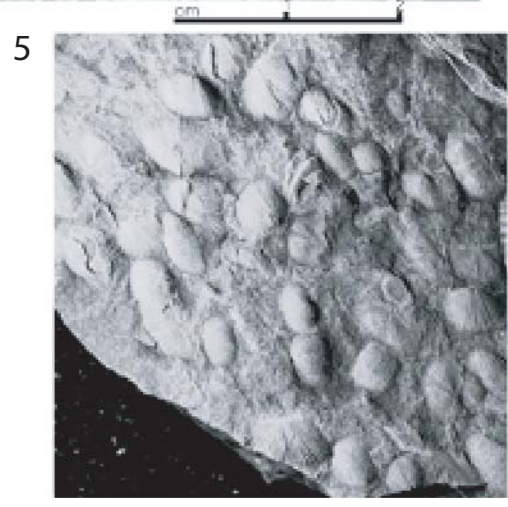
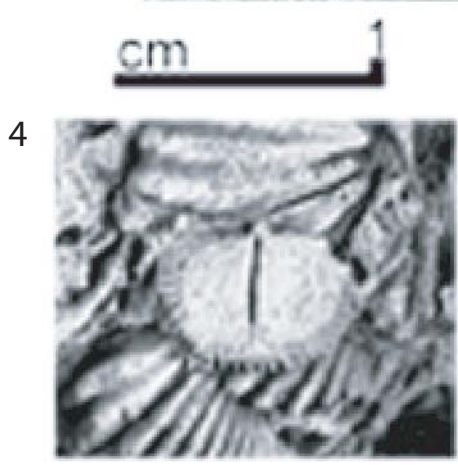
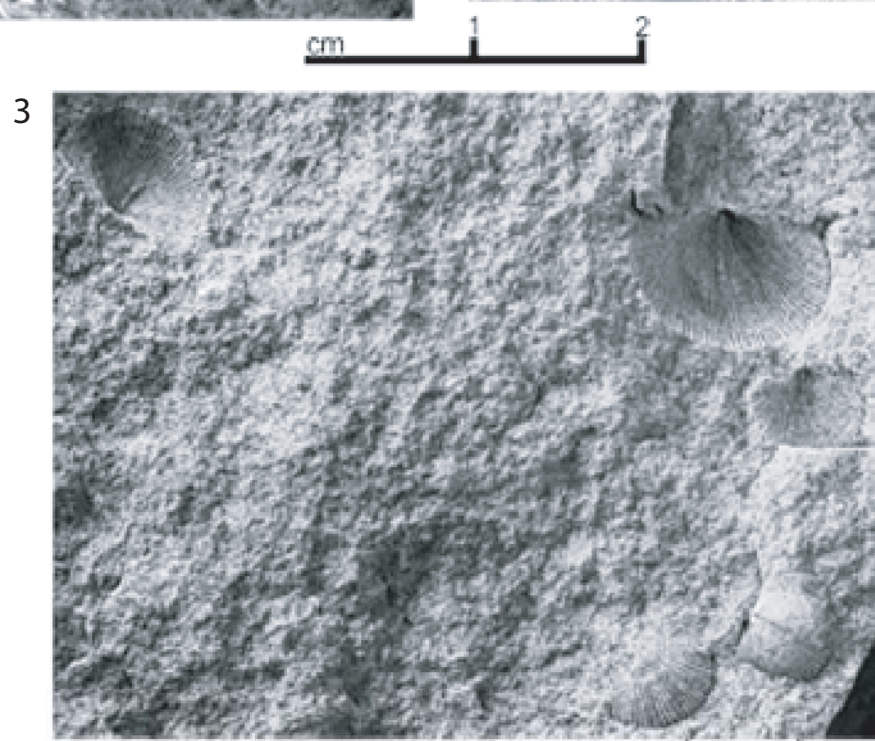
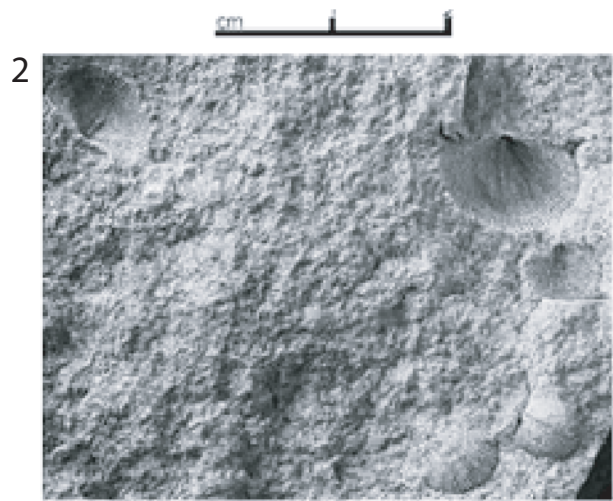
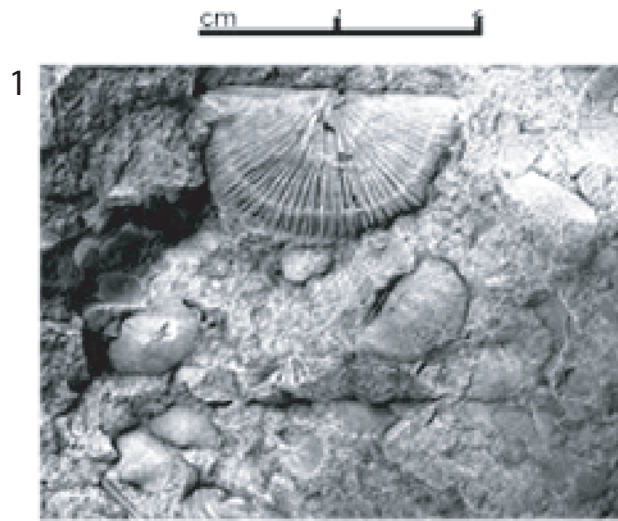


PLATE 8

1. *Striatochonetes setigera* (Hall, 1843); Figure 1., sample M-1450, internal mold of a brachial valve.
2. *Subglossochonetes acutiliratus?* (Girty, 1928); Figure 2., sample LR-2980, coquina of internal and external molds of both pedicle and brachial valves. Internal molds of the pedicle valve show divided septum.
3. *Rugosochonetes celticus ?* (Muir-Wood, 1962?); Figure 3., sample FT-2059, several external molds of mostly pedicle valves.
4. *Productella speciosa* (Hall, 1857); Figure 4., sample SS-3695, internal mold of pedicle valve.
5. *Productella spinulacosta* (Hall, 1857); Figure 5., sample SSR-43, internal mold of pedicle valve.
6. *Steinhagella membranacea?* (Phillips, 1841); Figure 6., sample LR-1335, external mold of Pedicle ? valve showing finely rugose texture with concentric crenulations.

Plate 8

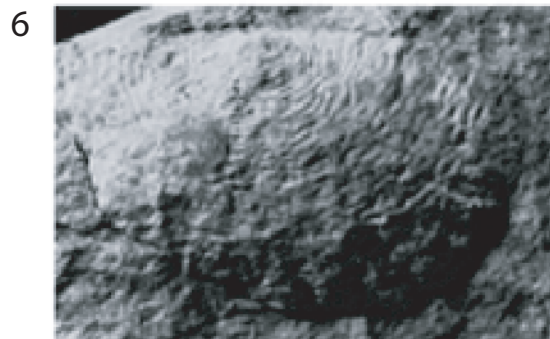
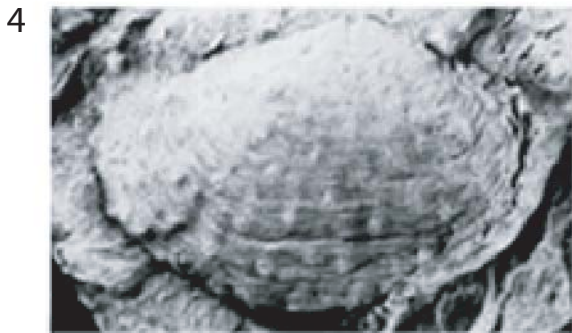
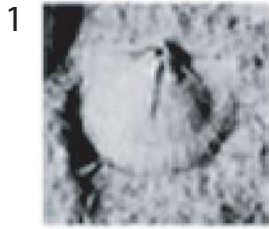


PLATE 9

1. *Whidbornella lachrymosa* (Conrad 1842); Figure 1., sample SS-3947, internal mold of a brachial valve showing prominent ears on either side of the beak area.

2. *Whidbornella lachrymosa* (Conrad, 1842); Figure 2., sample LR-1900, internal mold of a pedicle valve.

3. *Devonoproductus walcotti* (Fenton, 1924); Figure 3., sample AC-326, partly interior and partly exterior mold of a pedicle valve.

4. *Semiproductus onustus* (Hall, 1867); Figure 4., sample SS-6473, internal mold of a brachial valve.

5. *Semiproductus onustus* (Hall, 1867); Figure 5., sample SS-6473, external mold of a brachial valve.

6. *Cupularostrum contracta* (Hall, 1843); Figure 6., sample CA-34, internal mold of a pedicle valve.

Plate 9

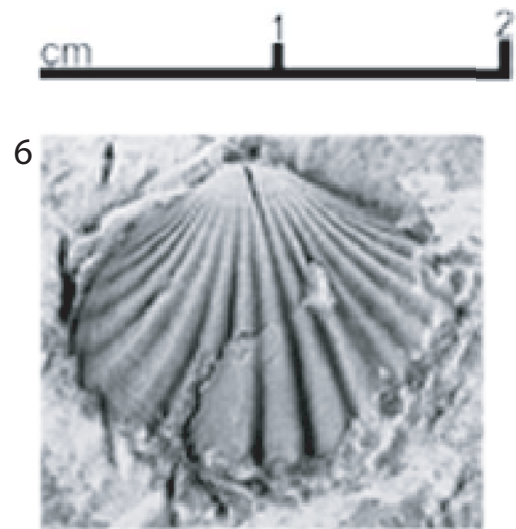
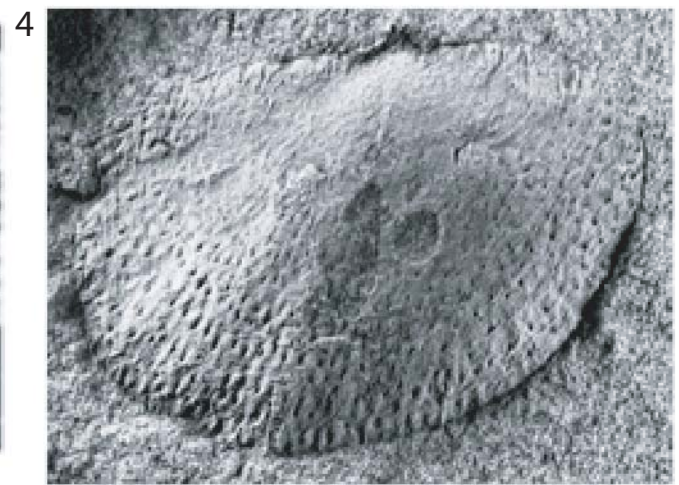
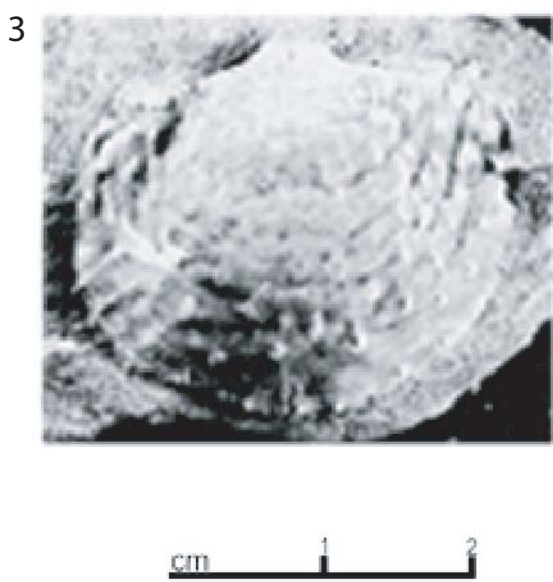
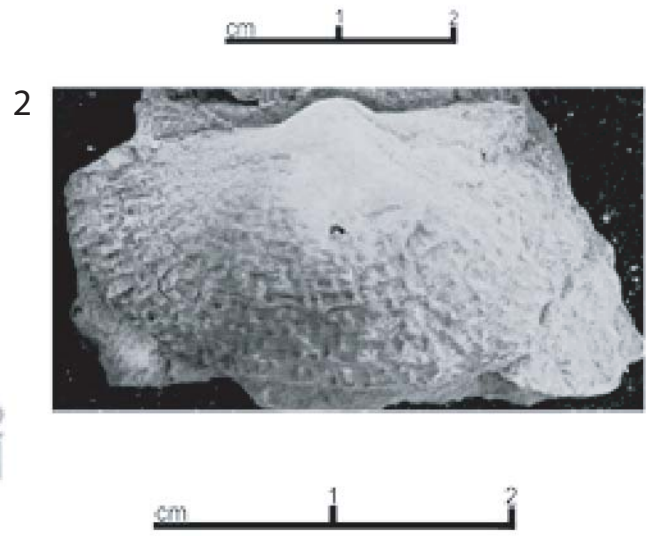
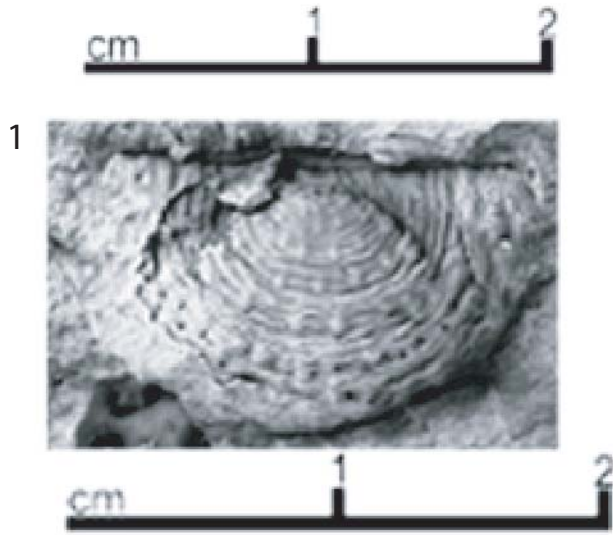


PLATE 10

1. *Cupularostrum contracta* (Hall, 1843); Figure 1., sample LR-1550, internal mold of a pedicle valve showing four prominent costae on the fold.

2. *Cupularostrum contracta* (Hall, 1843); Figure 2., sample LR-1540, internal mold of a brachial valve showing four costae in the sulcus.

3. *Cupularostrum orbicularis* (Hall, 1860); Figure 3., sample FT-1904, internal mold of a pedicle valve displaying its orbicular shape and lack of a well defined fold.

4. *Cupularostrum sappho* (Hall, 1860); Figure 4., sample LR-1515, internal mold of a brachial valve showing subangular costae.

5. *Macropotamorhynchus dubinensis* (Carter and Kammer, 1990); Figure 5., sample LR-2670, molds of two complete articulated specimens showing dorsal and ventral views.

6. *Macropotamorhynchus dubinensis* (Carter and Kammer, 1990); Figure 6., sample LR-2670, internal and external molds of both valves and several articulated specimens in a substrate of conglomerate.

Plate 10

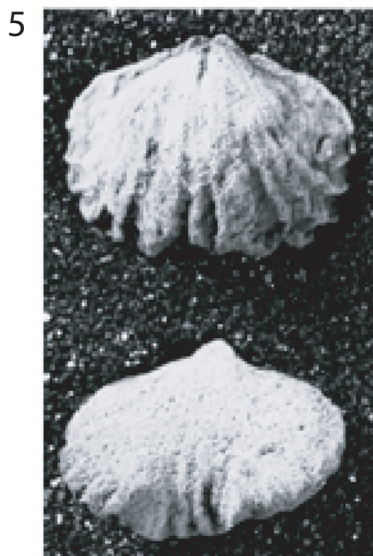
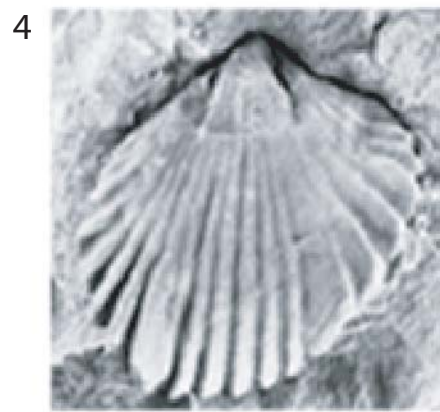
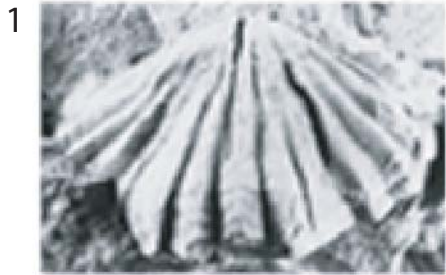


PLATE 11

1. *Leiorhynchus mesacostalis* (Hall, 1843); Figure 1., sample AC-1, internal mold of a pedicle valve.

2. *Leiorhynchus quadricostalis* (Vanuxem, 1842); Figure 2., sample LR-342, internal mold of pedicle valve.

3. *Eumatabolatechia multicostum* (Hall, 1860); Figure 3., sample LR-1515, internal mold of pedicle valve showing nine costae in the sulcus.

4. *Atrypa reticularis* (Linne', 1758); Figure 4., sample AC-436, internal mold of an articulated specimen showing the dorsal view.

5. *Pseudoatrypa devoniana* (Webster, 1921); Figure 5., sample M-1757, external mold of a pedicle valve.

6. *Spinatrypa hystrix* (Hall, 1843); Figure 6., sample P-293, internal mold of a pedicle valve showing rugose texture and bases for large spines.

Plate 11

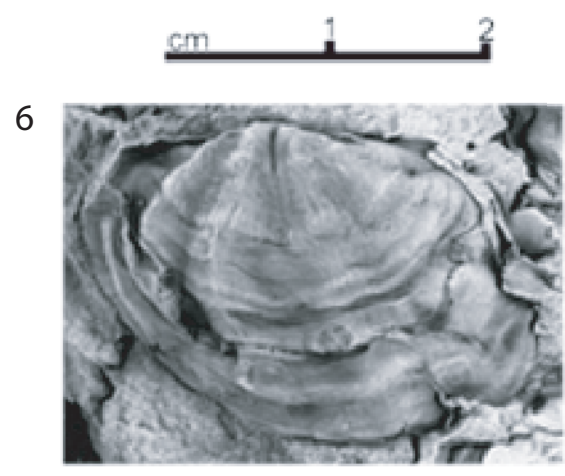
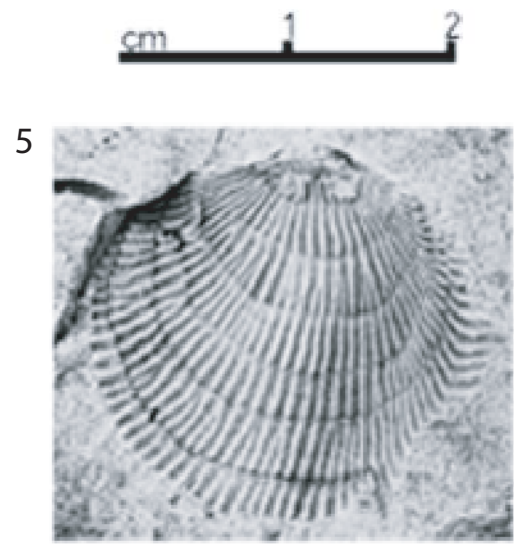
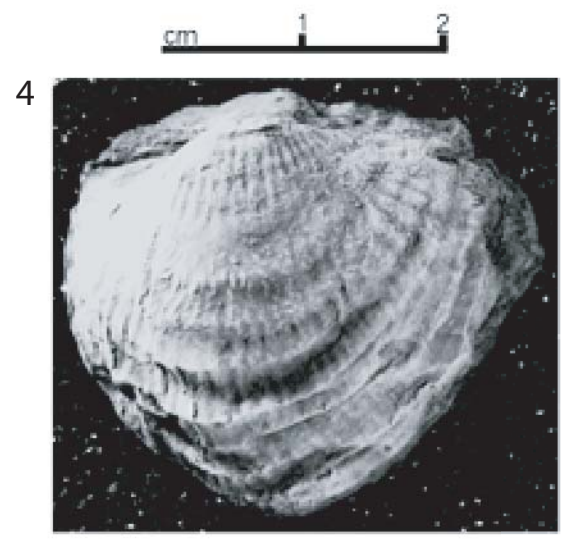
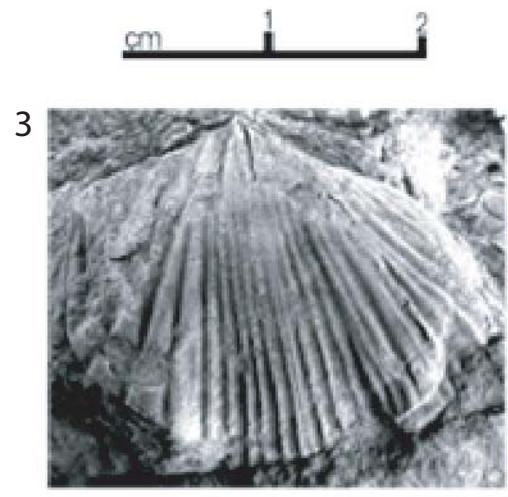
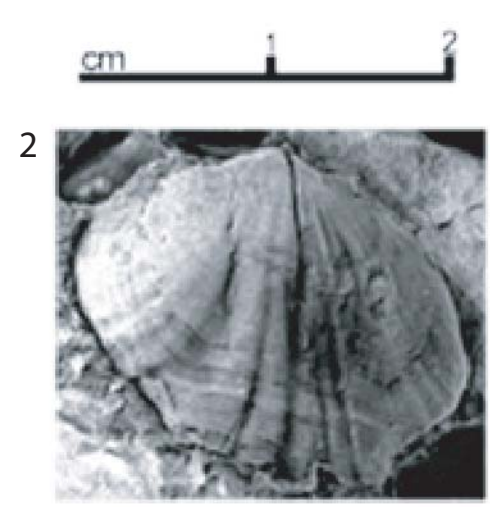
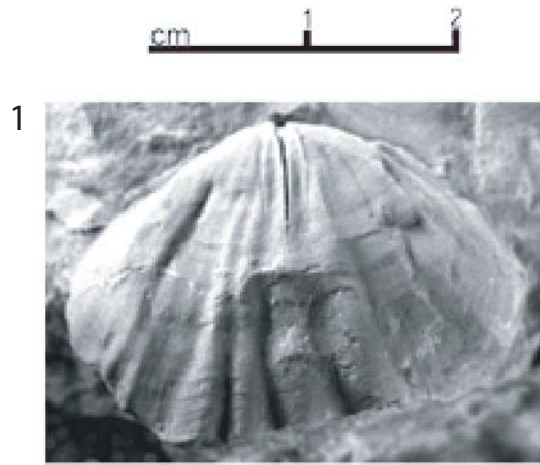


PLATE 12

1. *Spinatrypa hystrix* (Hall, 1843); Figure 1., sample P –318, internal mold of a pedicle valve showing well developed rugosic texture and spines.

2. *Spinatrypa spinosa* (Hall, 1843); Figure 2., sample LR-1540, internal mold of pedicle valve.

3. *Ambocoelia umbonata* (Conrad, 1842); Figure 4., sample CC-116, internal mold of a brachial valve.

5. *Athyris angelica* (Hall, 1861); Figure 5., sample STE-2970, internal mold of a pedicle valve showing concentric growth lamellae and a total lack of costae.

6. *Cyrtina hamiltonensis* (Hall, 1867); Figure 6., sample M-2011, external mold of a brachial valve.

7. *Elutherokomma extensa?* (Cooper and Dutro, 1982) *nv.sp. "rodan"*; Figure 7., sample SS-6430, internal mold of a pedicle valve. The small costae in the middle of the sulcus suggests it may not be *E. extensa*.

Plate 12

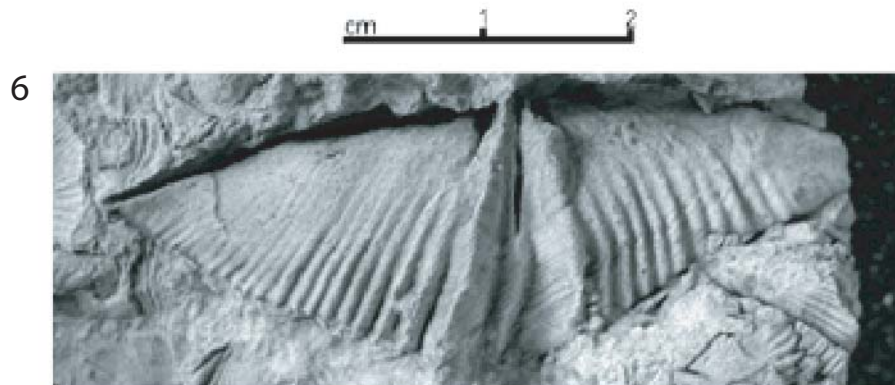
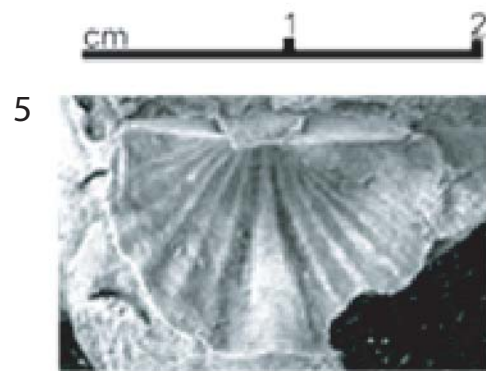
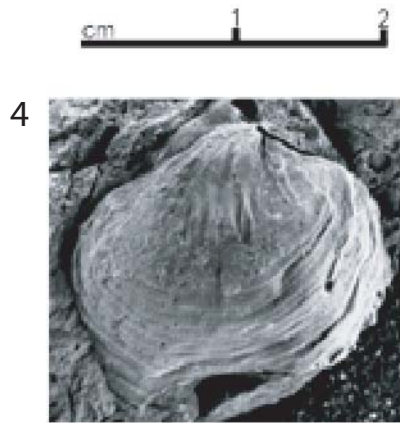
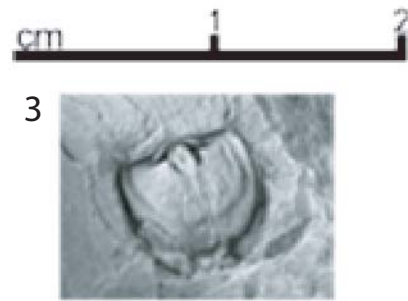
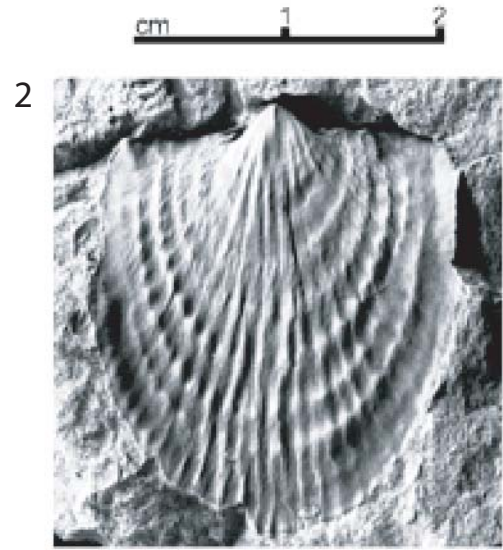
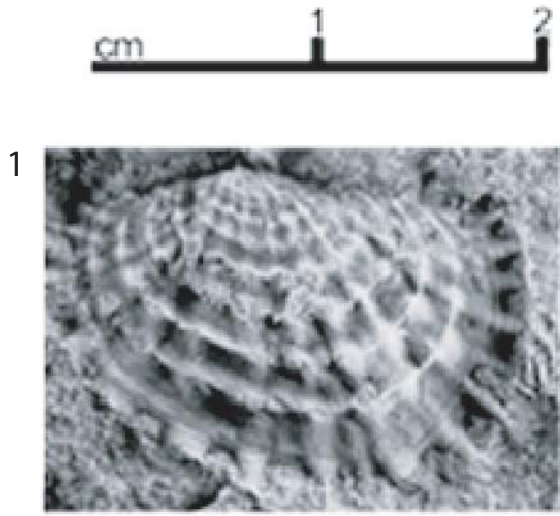


PLATE 13

1. *Tylothyris mesacostalis* (Hall, 1867); Figure 1., sample STE-1922, internal mold of a pedicle valve showing well defined medial costae in the sulcus.

2. *Tylothyris mesacostalis* (Hall, 1867); Figure 2., sample STE-1922, internal and external molds of brachial valves showing medial striae on the fold and fine ornamentation on the costae.

3. *Tylothyris mesacostalis* (Hall, 1867) **var. mucronatus**; Figure 3., sample STE-1933, internal mold of a pedicle valve showing extremely mucronate cardinal process.

4. *Eosyringothyris sp?*; Figure 4., sample FT-1865, internal mold of a brachial valve with approximately 18 costae lateral of the fold.

5. *Mediospirifer audaculus* (Conrad, 1842); Figure 5., sample SS-4390, internal mold of a brachial valve with approximately 22 costae lateral of the fold.

6. *Orthospirifer mesaestrialis* (Hall, 1843); Figure 6., sample CC-3364, internal mold of a brachial valve with approximately 12 costae lateral of the fold.

Plate 13



PLATE 14

1. *Syringothyris extenuata* (Hall, 1867); Figure 1., sample FT-2059, internal mold of a brachial valve with 17 broad sub rounded costae.
2. *Cyrtospirifer altiplicus* (Greiner, 1957); Figure 2., sample LR-1355, internal mold of a brachial valve with approximately 30 costae lateral of the fold which has a narrow groove on either side and faint impressions of costae on the fold.
3. *Cyrtospirifer chemungensis* (Conrad, 1842); Figure 3., sample SS-3822, internal mold of a pedicle valve showing well developed mucronate cardinal process.
4. *Cyrtospirifer inermis* (Hall, 1843); Figure 4., sample SS-6097, partly internal and partly external mold of a brachial valve with approximately 20 costae lateral of the fold.

Plate 14

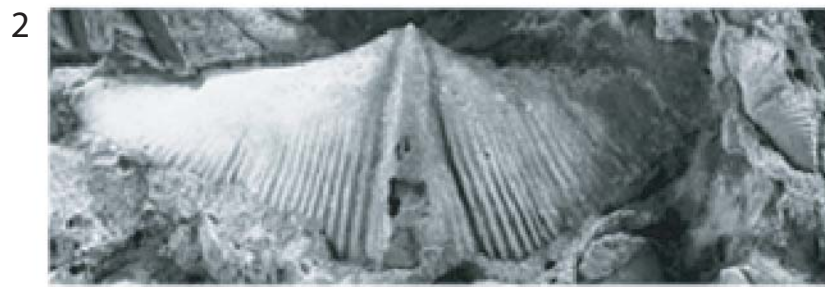
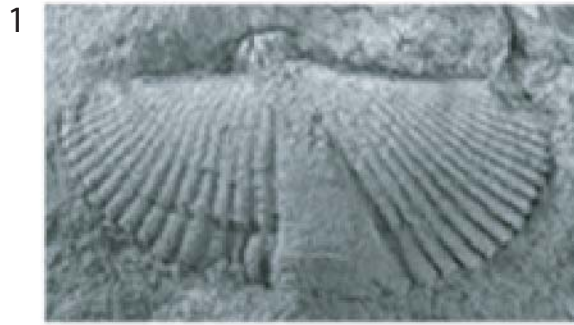


PLATE 15

1. *Cyrtospirifer preshoensis* (Greiner, 1957); Figure 1., sample CA 36, internal mold of a brachial valve showing well defined groove surrounding the fold, approximately 20 costae lateral of the fold, and 9 costae on the fold.

2. *Cyrtospirifer sulcifer* (Hall, 1894); Figure 2., sample LR-2050, internal mold of a brachial valve showing two sub folds with 14 costae on the fold and 20 costae lateral of the fold.

3. *Cyrtospirifer sulcifer* (Hall, 1894); Figure 3., sample STE-3254, internal mold of a pedicle valve showing characteristic beak structure.

4. *Cyrtospirifer chemungensis* (Conrad, 1842) *n.var.* “*godzillas*”; Figure 4., sample LR-1355, internal mold of a pedicle valve with approximately 28 costae lateral of the sulcus. Sample is large, extremely mucronate, and has approximately 12 costae on the sulcus.

5. *Cyrtospirifer chemungensis* (Conrad, 1842) *n.var.* “*godzillas*”; Figure 5., sample LR-1355, internal mold of a brachial valve with approximately 30 costae lateral of the fold. Sample is large, extremely mucronate, does not have a groove around the fold, and has faint impressions of costae on the fold.

Plate 15

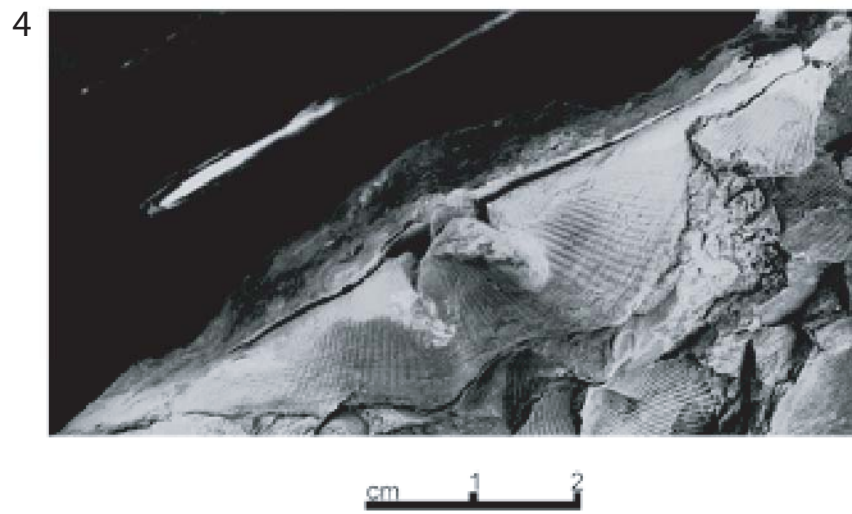
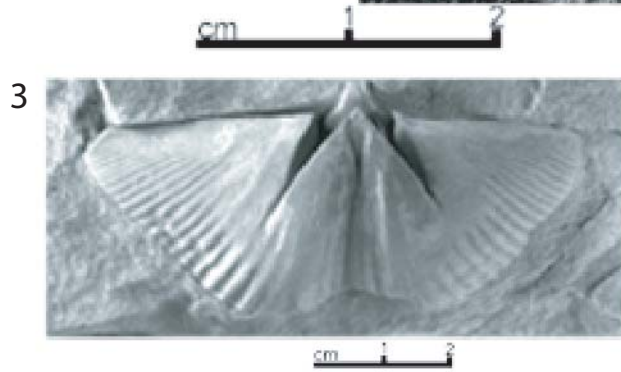
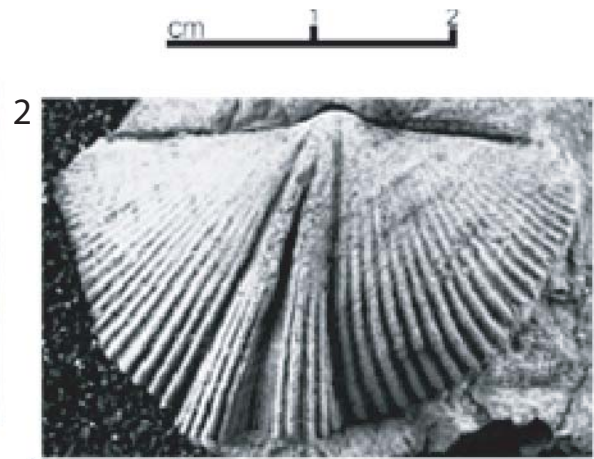
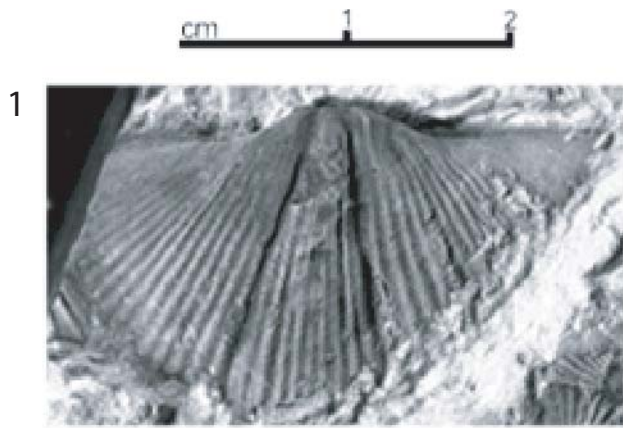


PLATE 16

1. *Cyrtospirifer n.sp. "mothra"*; Figure 1., sample M-2100, internal mold of an articulated specimen showing rounded cardinal process, ventral view of the pedicle valve, the diductor muscle field, and the gentle broad sulcus.

2. *Cyrtospirifer n.sp. "mothra"*; Figure 2., sample M-2100, internal mold of an articulated specimen showing rounded cardinal process, dorsal view interarea, and a poorly defined fold.

3. *Cyrtospirifer n.sp. "mothra"*; Figure 3., sample LR-1355, dorsal view of a juvenile brachial valve.

4. *Cranaena eudora* (Hall and Whitfield, 1873); Figure 4., sample STE-3100, internal mold of a pedicle and brachial valve.

5. *Cranaena eudora* (Hall and Whitfield, 1873); Figure 5., sample M-2692, internal mold of articulated specimen showing ventral view of the pedicle valve.

6. *Cranaena harmonia* (Hall, 1867); Figure 6., sample LR-190, internal mold of a brachial valve.

Plate 16

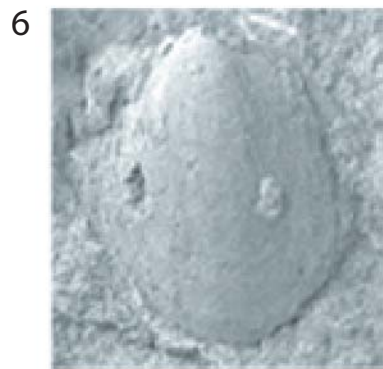
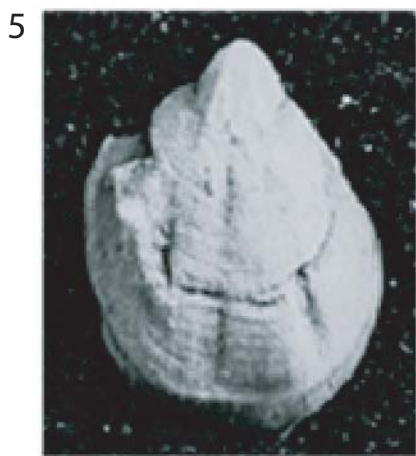
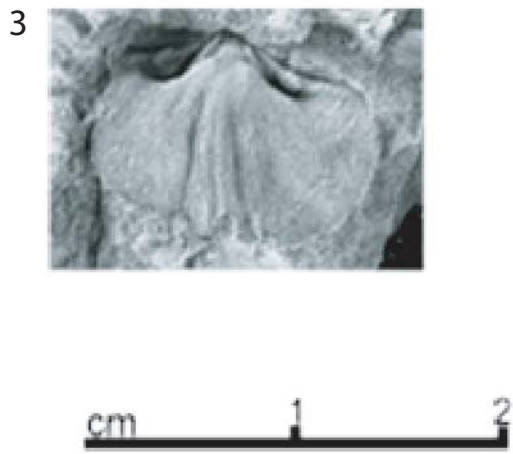
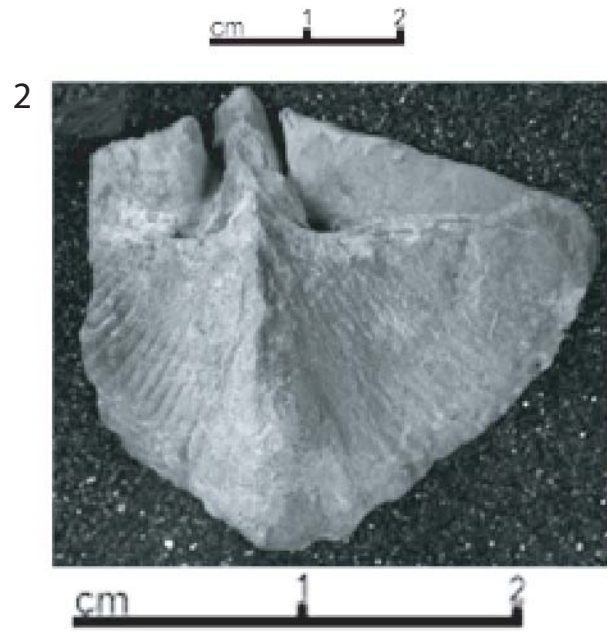
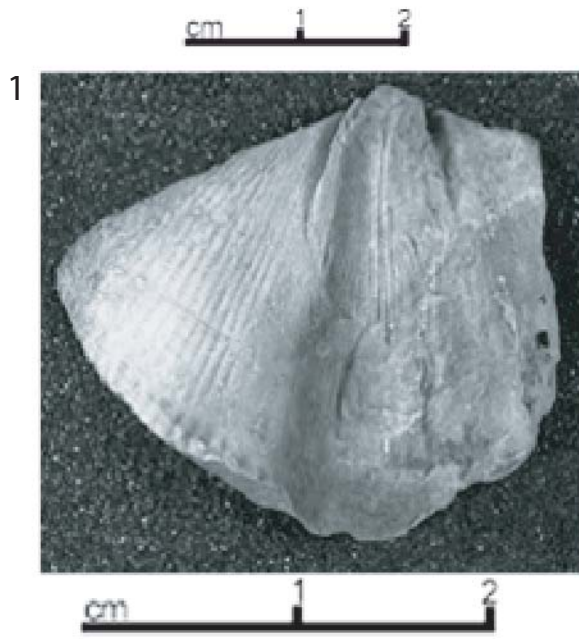


PLATE 17

1. *Phestia diversa* (Hall, 1883); Figure 1., sample FT-94, internal mold of the left valve.
2. *Mytilarca chemungensis* (Conrad, 1842); Figure 1., sample P-1994, internal mold of the right valve.
3. *Leptodesma cadmus* (Hall, 1884); Figure 3., sample CA-1208, external mold of the right valve showing well developed posterior wing and minor anterior lobe.
4. *Leptodesma lichas* (Hall, 1884); Figure 4., sample CA-830, external mold of the left valve showing small posterior wing and a broad anterior lobe.
5. *Leptodesma matheri* (Hall, 1884); Figure 5., sample CA-1208, external mold of the left valve showing broad posterior lobe and poorly developed anterior lobe.
6. *Leptodesma matheri* (Hall, 1884); Figure 6., sample STE-3184, external mold of the left valve showing well developed broad posterior lobe and a very poorly developed anterior lobe.

Plate 17

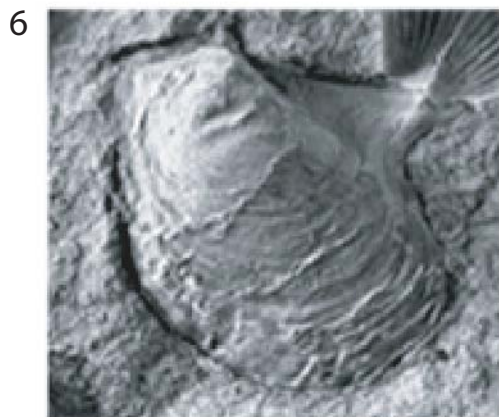
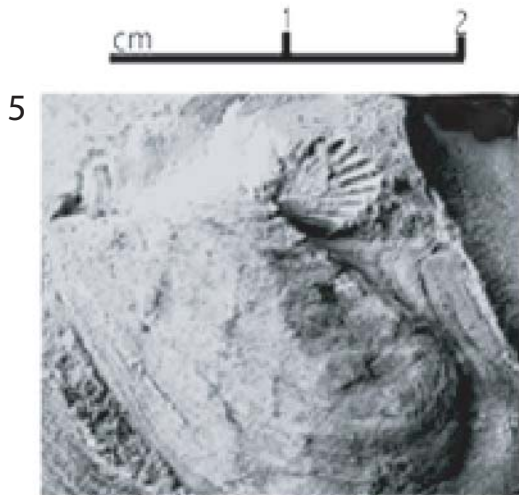
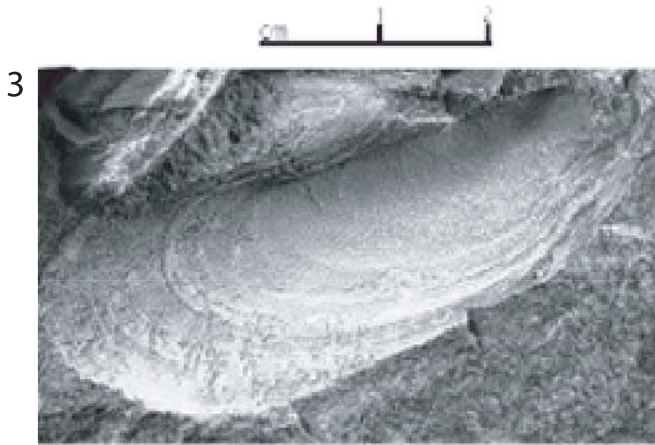
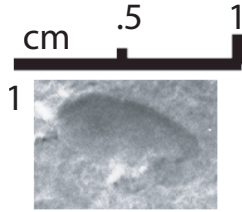


PLATE 18

1. *Leptodesma propinquum* (Hall, 1884); Figure 1., sample AC-1, external mold of left valve showing posterior wing extending the hingeline.

2. *Leptodesma spinigerum* (Conrad, 1842); Figure 2., sample STE-3184, external mold of an articulated specimen.

3. *Leptodesma spinigerum* (Conrad, 1842); Figure 3., sample LR-2650, external mold of the left valve.

4. *Ptychopteria eugenia* (Hall, 1884); Figure 4., sample M-3336, external mold of the left valve showing ornate pattern of fine radial ribs and concentric growth lamellae.

5. *Cornellites chemungensis* (Conrad, 1842); Figure 5., sample M-1537, external mold of a left valve belonging to a juvenile.

6. *Cornellites chemungensis* (Conrad, 1842); Figure 6., sample SS-3785, external mold of the left valve of an adult or geriatric form.

Plate 18

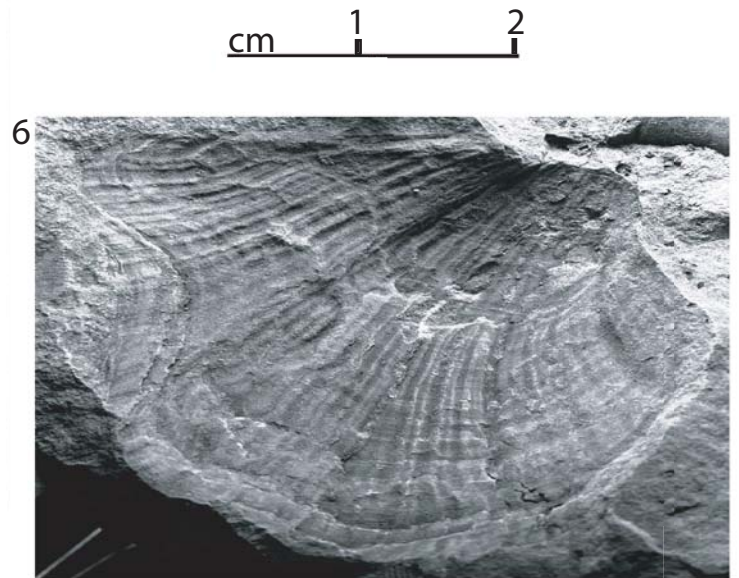
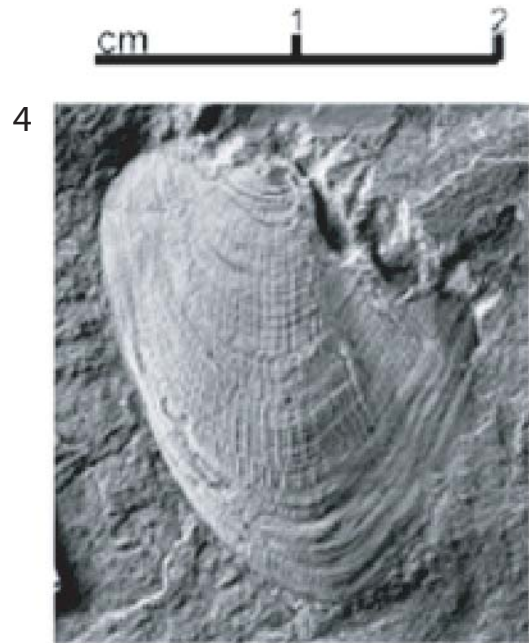
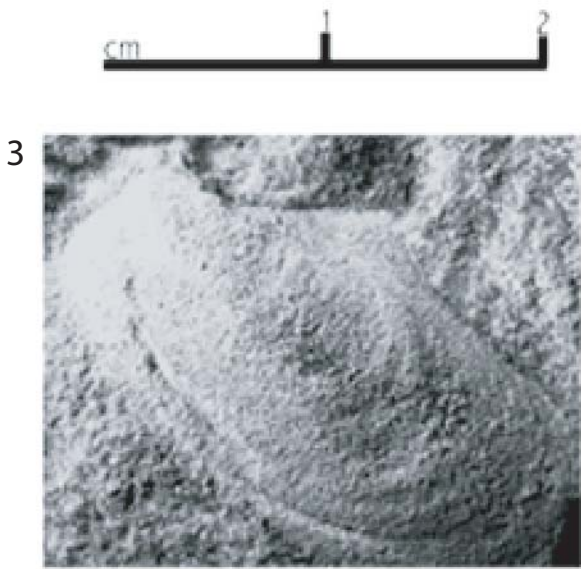
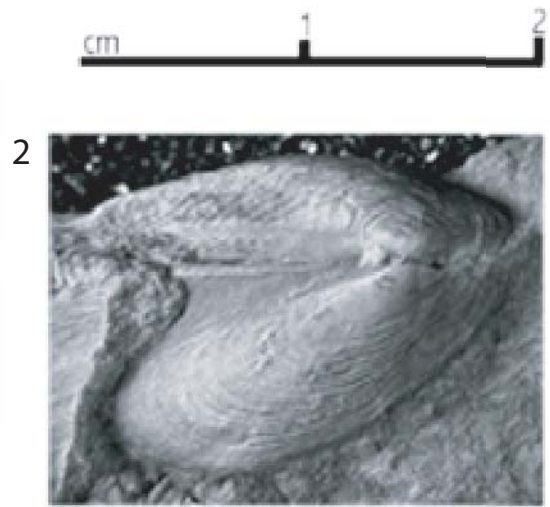
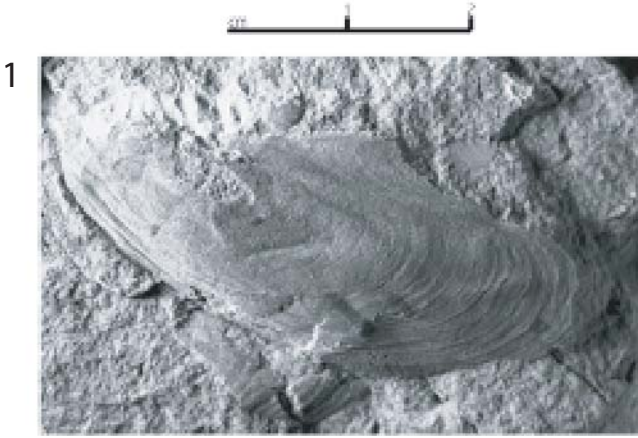


PLATE 19

1. *Pseudoaviculopecten duplicatus* (Hall, 1884); Figure 1., sample STE-3190, external mold of the right valve showing well developed posterior auricle ear and fine radial ribs.

2. *Pseudoaviculopecten fasciculatus* (Hall, 1883); Figure 2., sample P –1207, external mold of the right valve showing small auricle ears and very fine radial ribs.

3. *Pseudoaviculopecten patulus* (Hall, 1884); Figure 3., sample P –1207, external mold of the left valve showing well developed posterior auricle ear and radial ribs that alternate strength.

4. *Crenipecten obsoletus* (Hall, 1884); Figure 4., sample LR-1054, external mold of the right valve showing well developed posterior auricle ear and poorly developed anterior auricle ear.

5. *Modiomorpha chemungensis* (Hall, 1885); Figure 5., sample STE-3100, external mold of the left valve.

6. *Modiomorpha chemungensis* (Hall, 1885); Figure 6., sample FT-1611, external mold of left valve.

Plate 19

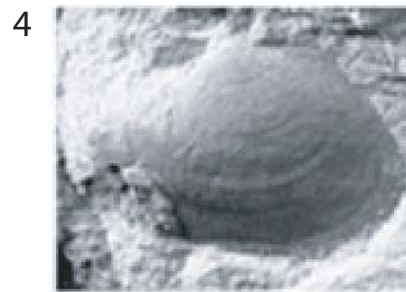
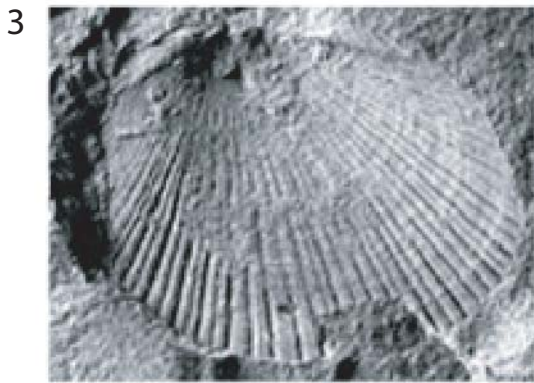
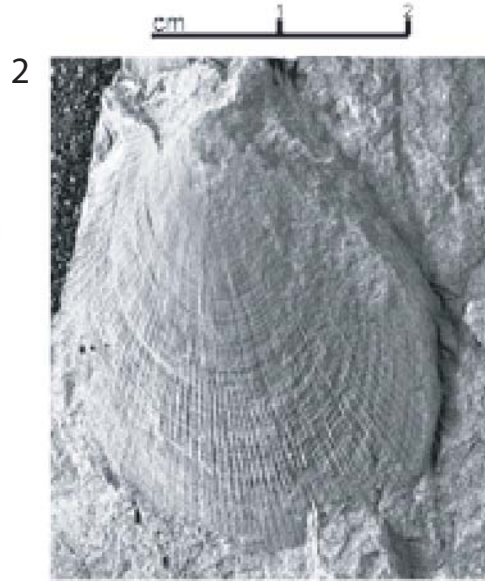
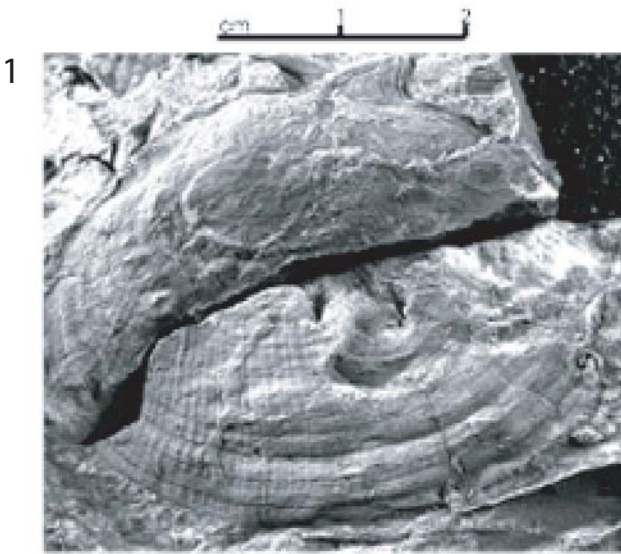


PLATE 20

1. *Goniophora chemungensis* (Vanuxem, 1842); Figure 1., sample M-2011, external mold of the left valve showing well defined ridge extending from the umbo to the posterior margin.

2. *Schizodus sp?*; Figure 2., sample FT-1827, internal mold of the left valve.

3. *Paracyclas rugosa* (Goldfuss, 1837); Figure 3., sample STE-3131, external mold of the left valve showing concentric rugosic texture.

4. *Glossites sp?*; Figure 4., sample P-318, external mold of right valve showing regular spacing of concentric growth lamellae.

5. *Grammysioidea subarcuata* (Hall, 1885); Figure 5., sample FT-1725, external mold of left valve showing sinus extending from the umbo to the margin.

6. *Grammysioidea subarcuata* (Hall, 1885); Figure 6., sample CA-1065, internal mold of the right valve with a small rhynchonellid brachiopod,

Plate 20

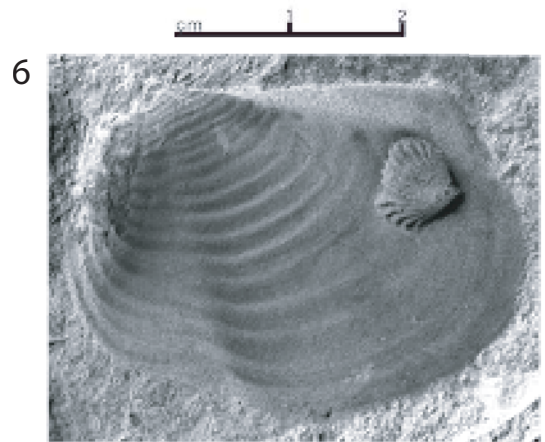
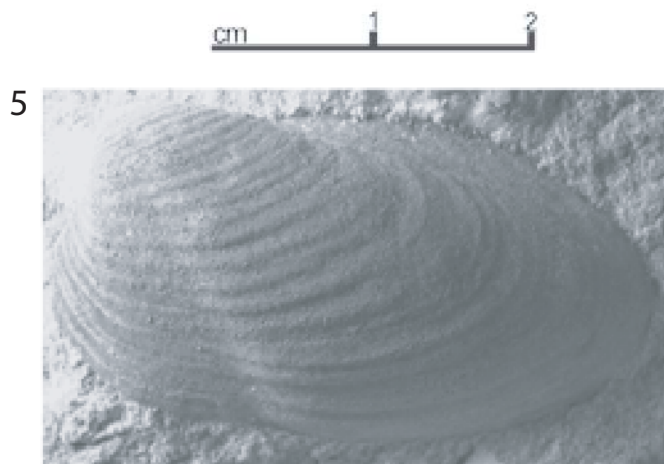
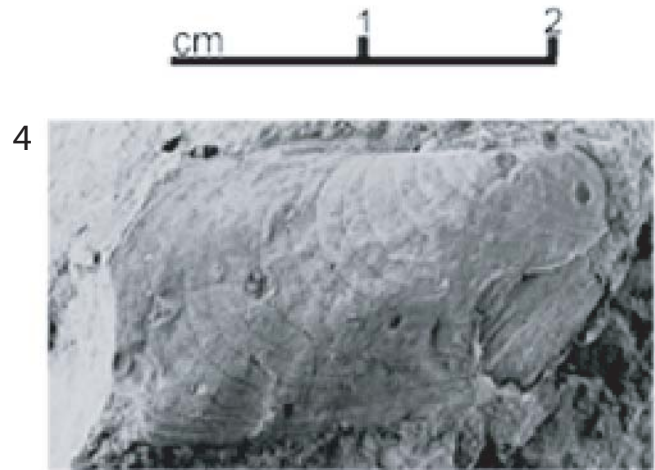
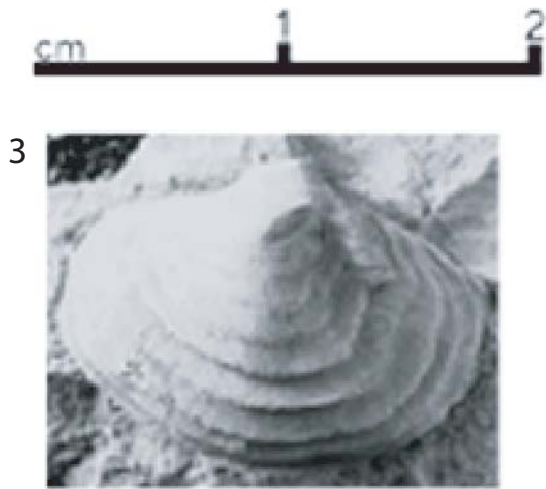
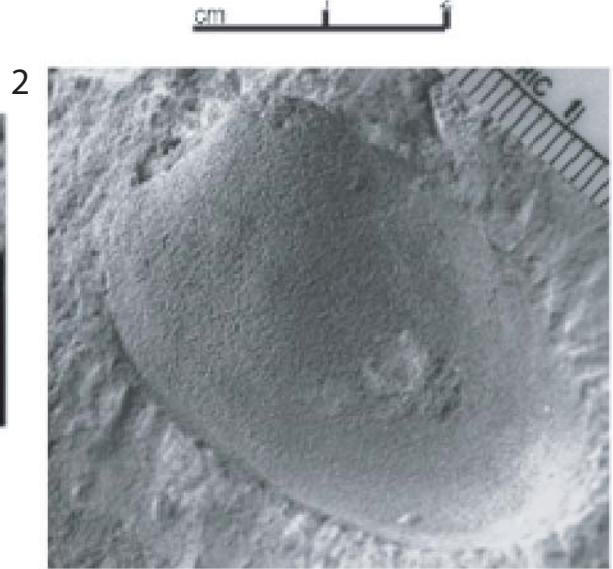
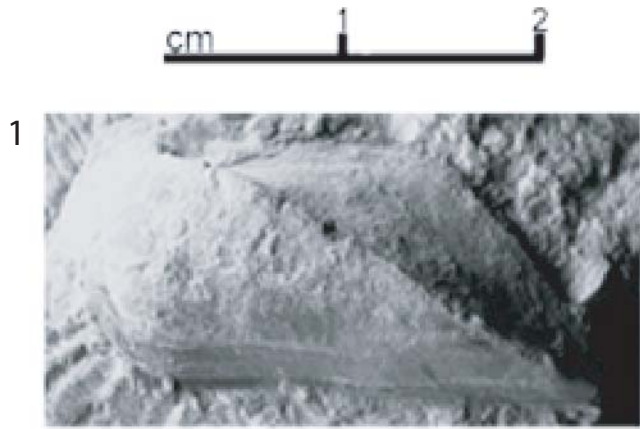


PLATE 21

1. *Sedwickia calvulus* (Hall, 1885); Figure 1., sample M-2702, external mold of the right valve showing gentle sinus extending from the umbo to the posterior margin.
2. *Phragmostoma chautuque* (Clarke, 1903); Figure 2., sample CC-3353, side view of an internal mold.
3. *Phragmostoma chautuque* (Clarke, 1903); Figure 3., sample CC-3353, anterior view of an interior mold showing medial ridge.
4. *Greenops boothi* (Green, 1837); Figure 4., sample CC-116, mold of a cephalon complete with genial spines.
5. *Greenops boothi* (Green, 1837); Figure 5., sample CC-116, mold of a pygidium showing spines extending past the margin.
6. *Eurypterus remipes* (Dekay); Figure 6., sample M-2011, segment of a thorax plate.
7. *Hexacrinites interscapularis?* (Austin and Austin, 1843-49); Figure 7., sample FT-1656, external mold of a whole articulated specimen in a sandstone.

Plate 21

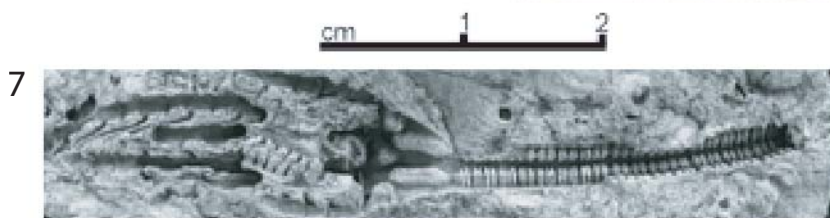
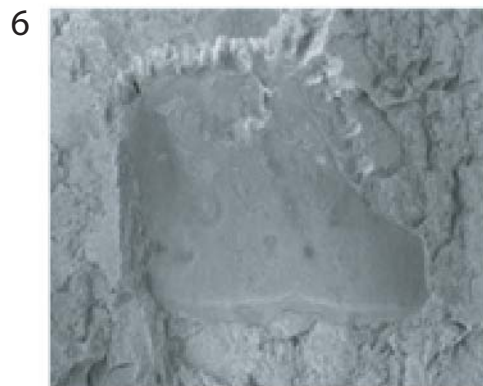
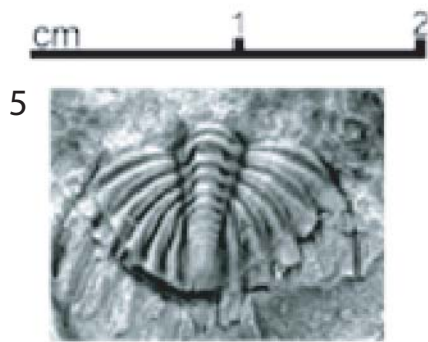
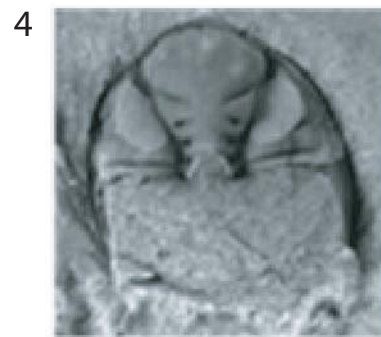
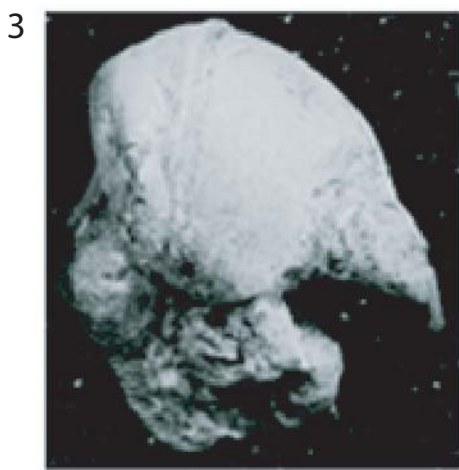
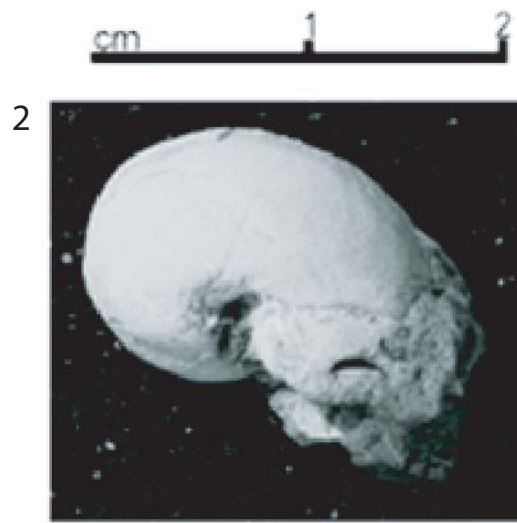
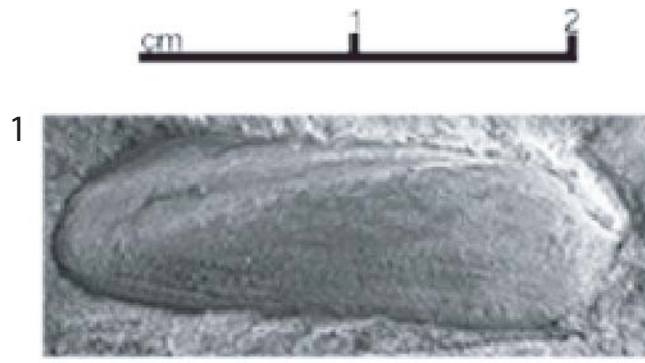


PLATE 22

1. *Arthroacantha ithacensis* (Wachmuth and Springer 1897); Figure 1., sample M-1735, molds of plates from the calyx showing sockets for articulated spines.

2. *Zephrenitis sp?*; Figure 2., sample P-61, casts of coral skeletons showing internal septa.

3. *Platycrinites sp?*, *Athyris angelica*, *Tylothyris mesacostalis*, and *Cyrtospirifer inermis*; Figure 3., sample STE-2855, several specimens that are representative of the beginning of the Famennian.

Plate 22

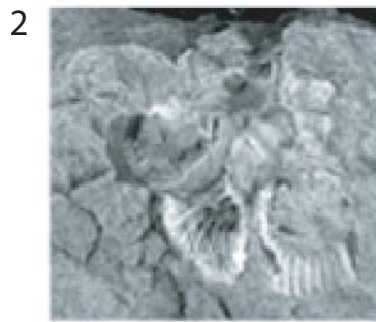
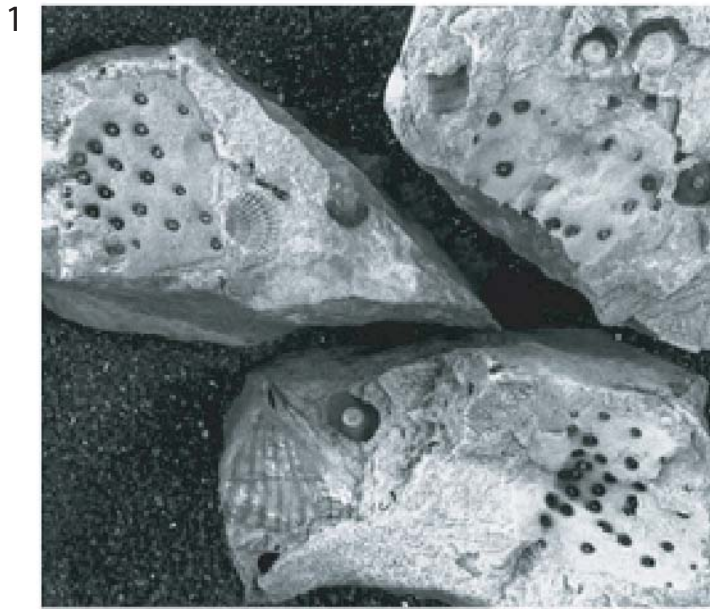


PLATE 23

1. **PROTOASTERIDAE, Genus?, sp?**; Figure 1., sample LR-2760, a complete articulated starfish with preservation of external and internal features in a conglomerate substrate. The mold of the oral surface has five rays, the center of the ray has a mold of the canal for the radial water vessel and molds of the branches from the radial water vessel to the tube feet, and molds of the cups for the tube feet which stand up as hemispherical mounds.

Plate 23

1



Data for Allegheny/Crows, "AC", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
AC-897	2972						3				2																
AC-896	2971						1				2																
AC-892	2969																									2	
AC-892	2968																										
AC-881	2958																										
AC-871	2949																2									2	
AC-870	2948																										
AC-851	2930																4									3	
AC-750	2838																2										
AC-747	2835																									6	
AC-743	2831																										
AC-742	2830																									5	
AC-740	2828																										
AC-697	2789										4						9									17	
AC-624	2722																										
AC-577	2679										5						1										
AC-547	2652						2				2																
AC-545	2650																8			2	6						
AC-540	2645																15			2					38		
AC-514	2621																4										
AC-506	2614											1					4										
AC-502	2611																										
AC-501	2610																			5							
AC-495	2604																			2							
AC-494	2603																			2							
AC-439	2540																			3							
AC-436	2536																			1							
AC-429	2528																14										
AC-403	2497																										
AC-326	2407																										
AC-276	2356																			5			31				
AC-217	2297										2																
AC-165	2245										4																
AC-111	2191																										
AC-1	2171						3				2																

Data for Allegheny/Crows, "AC", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolotechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana	
AC-897																													
AC-896																													
AC-892																													
AC-892																													
AC-881																													
AC-871																													
AC-870																													
AC-851																													
AC-750																													
AC-747																1													
AC-743																							1						
AC-742													5									6							
AC-740																							1						
AC-697																													
AC-624																										3			
AC-577																													
AC-547																										2			
AC-545																													
AC-540																									2				
AC-514												1																	8
AC-506																													
AC-502																													
AC-501												4																	
AC-495																													
AC-494																													
AC-439																													
AC-436										2																			
AC-429																												9	
AC-403																													
AC-326										1																			
AC-276																													
AC-217																													
AC-165																													
AC-111																													
AC-1																							1						

Data for Allegheny/Crows, "AC", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?
AC-897		5																	22								
AC-896		3																	9							2	
AC-892																			5								
AC-892																			6								
AC-881																		2									
AC-871																		16									
AC-870																											
AC-851			2				18												8								
AC-750										1																	
AC-747										16																	
AC-743							5			1																	
AC-742							61			32																	
AC-740							9			3																	
AC-697	3																										
AC-624																											
AC-577																											
AC-547																											
AC-545	8																										
AC-540	13																										
AC-514		11																									
AC-506		4																									1
AC-502																											
AC-501		11																									
AC-495		4																	3								
AC-494		6	4																5								
AC-439		5	3																								
AC-436		7	2																1								
AC-429			3																								
AC-403																											
AC-326							4																				
AC-276										6																	
AC-217							40			4																	
AC-165							21			2																	
AC-111							25																				
AC-1							32																				

Data for Allegheny/Crows, "AC", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?
AC-897																														
AC-896																														
AC-892																														
AC-892																														
AC-881																														
AC-871																														
AC-870																														
AC-851																														
AC-750																		5												
AC-747																		5												
AC-743																														
AC-742																					4									
AC-740																														
AC-697																					37									
AC-624																					17									
AC-577																							1							
AC-547																							1							
AC-545																														
AC-540																														
AC-514																					3									
AC-506																							1							
AC-502																														
AC-501																														
AC-495																														
AC-494																														
AC-439																														
AC-436																														
AC-429																														
AC-403																														
AC-326																						23								
AC-276																														
AC-217																														
AC-165																														
AC-111																							6							
AC-1																			3											

Data for Allegheny/Crows, "AC", Location

LOCATION and ELEVATION	Crenipecten amplius	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium		
AC-897																																	
AC-896																																	
AC-892																																	
AC-892					1																												
AC-881																																	
AC-871																															1		
AC-870																																	
AC-851																																	
AC-750																																	
AC-747																																	
AC-743																																	
AC-742																																	
AC-740																																	
AC-697																																	
AC-624																																	
AC-577																																	
AC-547																																	
AC-545																																	
AC-540																																	
AC-514																																	
AC-506																																	
AC-502																																	
AC-501																																	
AC-495							1																										
AC-494																																	
AC-439																																	
AC-436																																	
AC-429																																	
AC-403																																	
AC-326																																	
AC-276																																	
AC-217																																	
AC-165																																	
AC-111																																	
AC-1																																	

Data for Allegheny/Crows, "AC", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON
AC-897					1											X		X								33
AC-896																X		X								17
AC-892																X										7
AC-892																X		X								7
AC-881																X							1			3
AC-871																X	2X						1		X	22
AC-870																									X	0
AC-851																X		X								35
AC-750																										8
AC-747								1								X									X	29
AC-743																									X	7
AC-742																										113
AC-740																										13
AC-697																X										70
AC-624																										20
AC-577																				2						9
AC-547																										7
AC-545																										24
AC-540																										70
AC-514														2		X		X								29
AC-506																										11
AC-502																									X	0
AC-501																										20
AC-495																			X							10
AC-494																X		X								17
AC-439																										11
AC-436																		2X								13
AC-429																X										26
AC-403														1		X		X								1
AC-326																X										59
AC-276																X		X								11
AC-217																										48
AC-165																										27
AC-111																										31
AC-1																										41

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhidomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
CA-1813	4532																										
CA-1452	4186																										
CA-1208	3998																										
CA-1055	3879																										
CA-867	3733																										
CA-866	3732																								11		
CA-850	3720																										
CA-830	3704																									38	
CA-820	3696																									76	
CA-813	3691																										102
CA-807	3686																										249
CA-801	3682																										163
CA-797	3679																										7
CA-788	3672																										34
CA-787	3671																										
CA-786	3670											10												5		6	
CA-700	3603											1															86
CA-699	3602																										45
CA-687	3594																										216
CA-686	3593																										151
CA-608	3533																							3			
CA-597	3524																										31
CA-586	3515																							6			3
CA-574	3506																										55
CA-513	3459																										
CA-499	3448																										
CA-498	3447																										107
CA-493	3443																										11
CA-451	3411																										90
CA-444	3405																										
CA-439	3401																										
CA-311	3302																										
CA-302	3292											3															
CA-290	3276																										
CA-245	3216																										
CA-195	3165								2																		
CA-190	3160																										
CA-185	3155																										
CA-157	3129																										
CA-135	3109																										

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbiculares	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolotechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
CA-1813																												
CA-1452																												
CA-1208																	12											
CA-1055																	4											
CA-867																												
CA-866																	4											
CA-850																	1											
CA-830												1																
CA-820																												
CA-813																												
CA-807																												
CA-801																												
CA-797																												
CA-788																												
CA-787																												
CA-786																												
CA-700																												
CA-699																												
CA-687																												
CA-686																												
CA-608																												
CA-597																												
CA-586																												
CA-574																												
CA-513																												
CA-499																												
CA-498																												
CA-493																												
CA-451																												
CA-444					4																							
CA-439																												
CA-311												2		5														
CA-302														6											9			
CA-290									1																			
CA-245												3																
CA-195																					2							
CA-190																												
CA-185																												
CA-157																												
CA-135															17													

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothryis mesacostalis	Tylothryis mesacostalis var. mucronata	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?	
CA-1813																												
CA-1452																												
CA-1208																												
CA-1055																												
CA-867																							1					
CA-866																												
CA-850																												
CA-830																							2					
CA-820																							1					
CA-813																												
CA-807																												
CA-801																												
CA-797																												
CA-788																												
CA-787																												
CA-786																							37					
CA-700																												
CA-699																												
CA-687																												
CA-686																												
CA-608										32																		
CA-597										5																		
CA-586																												
CA-574										2																		
CA-513										7											9							
CA-499																												
CA-498										1																		
CA-493																												
CA-451					1																							
CA-444					3																2							
CA-439																												
CA-311					2	7				39																		
CA-302					1	61																						
CA-290						8				5																		
CA-245										9																		
CA-195						6				21																		
CA-190						5				4																		
CA-185										2																		
CA-157					2		54			68																		
CA-135							16														5							

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?	
CA-1813																															
CA-1452																															
CA-1208														2		5															
CA-1055																															
CA-867																															
CA-866																															
CA-850									9																						
CA-830														6																	
CA-820					3									5																	
CA-813																															
CA-807																															
CA-801																															
CA-797																															
CA-788																															
CA-787																46															
CA-786																															
CA-700																															
CA-699																															
CA-687																															
CA-686																															
CA-608																															
CA-597																															
CA-586																															
CA-574																															
CA-513																															
CA-499																															
CA-498																															
CA-493																															
CA-451																															
CA-444																															
CA-439																															
CA-311												5																			
CA-302																															
CA-290																															
CA-245																															
CA-195																															
CA-190																															
CA-185																															
CA-157																															
CA-135																															

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium	
CA-1813			1																													
CA-1452																																
CA-1208														6				29														
CA-1055																																
CA-867																																
CA-866															1																	
CA-850														3																		
CA-830																		1														
CA-820																																
CA-813																		1														
CA-807														3																		
CA-801																																
CA-797																																
CA-788																																
CA-787																																
CA-786																																
CA-700																																
CA-699																																
CA-687																																
CA-686																																
CA-608																		3														
CA-597																																
CA-586																																
CA-574																																
CA-513																																
CA-499																																
CA-498																																
CA-493																																
CA-451																																
CA-444																																
CA-439																																
CA-311																			4													
CA-302								1																								
CA-290																															5	
CA-245																																
CA-195																																
CA-190																																
CA-185																																
CA-157																																
CA-135																																

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON
CA-1813													30													31
CA-1452																								X		0
CA-1208																										54
CA-1055																										4
CA-867																X										7
CA-866																										28
CA-850																										19
CA-830																X										47
CA-820																X										103
CA-813																										105
CA-807																X										256
CA-801																										164
CA-797																										7
CA-788																										34
CA-787																										46
CA-786																X										74
CA-700																X										86
CA-699																X										46
CA-687																X										216
CA-686																										151
CA-608																X										38
CA-597																X										36
CA-586																X										9
CA-574																										57
CA-513																X										16
CA-499																X										0
CA-498																X										108
CA-493																X										11
CA-451																X										91
CA-444																X	X									14
CA-439																X										0
CA-311																X										65
CA-302																X	X									81
CA-290				5												X	X									24
CA-245																X										12
CA-195																X	X									31
CA-190																										9
CA-185																X	X									2
CA-157																X	X									124
CA-135																X										38

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION
NORMALIZED ELEVATION
Lingula complanta
Lingula ligea
Ligula n. sp.
Orbiculoidea newberryi
Cranea leoni
Petrocrania hamiltonidea
Schizophoria impressa
Schizophoria sp?
Aulacella sp?
Cariniferella carinata
Cariniferella tioga
Cariniferella elmira
Thiemella leonensis
Rhidomella penelope
Tropidoleptus carinatus
Nevostrophia nervosa
Nevostrophia mucronata
Nevostrophia "megastrophia"
Douvillina cayuta
Douvillina graciliora
Douvillina mucronata
Douvillinaria variabilis
Schuchertella chemungensis
Devonochonetes coronatus
Devonochonetes scitulus
Sinochonetes lepidus

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION
<i>Striatochonetes setigera</i>
<i>Subglobosochonetes acutiliratus</i>
<i>Rugosochonetes</i> sp?
<i>Productella boydi</i>
<i>Productella speciosa</i>
<i>Productella spinulacosta</i>
<i>Strophoproductus hystricula</i>
<i>Steinhagella</i> sp?
<i>Whidbornella hirsuta</i>
<i>Whidbornella lachrymosa</i>
<i>Devonoproductus walcottii</i>
<i>Semiproductus onestus</i>
<i>Productid</i> sp?
<i>Cupularostrum congregata</i>
<i>Cupularostrum contracta</i>
<i>Cupularostrum exima</i>
<i>Cupularostrum orbitales</i>
<i>Cupularostrum sappho</i>
<i>Macropotamorhynchus durbinensis</i>
<i>Sinotectirostrum alleganium</i>
<i>Pugnoides duplicatus</i>
<i>Leiorhynchus lesleyi</i>
<i>Leiorhynchus mesacostalis</i>
<i>Leiorhynchus quadricostatus</i>
<i>Eumatobolatechia multicosstatum</i>
<i>Rhynchonellid</i>
<i>Atrypa reticularis</i>
<i>Pseudoatrypa devoniana</i>

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION
<i>Spinatrypa aspera</i>
<i>Spinatrypa hystrix</i>
<i>Spinatrypa spinosa</i>
<i>Spinatrypa n.sp. "rugosa"</i>
<i>Athyris angelica</i>
<i>Ambocoelia gregaria</i>
<i>Ambocoelia umbonata</i>
<i>Cyrtina hamiltonensis</i>
<i>Eleutherokomma n.sp. "rodan "</i>
<i>Tylothyris mesacostalis</i>
<i>Tylothyris mesacostalis var. mucronatus</i>
<i>Spinocyrtia granulosa</i>
<i>Eosyringothyris sp?</i>
<i>Mediospirifer audaculus</i>
<i>Orthospirifer mesastrialis</i>
<i>Syringothyris extenuata</i>
<i>Syringothyris randali</i>
<i>Cyrtospirifer altiplicus</i>
<i>Cyrtospirifer chemungensis</i>
<i>Cyrtospirifer inermis</i>
<i>Cyrtospirifer preshoensis</i>
<i>Cyrtospirifer sulcifer</i>
<i>Cyrtospirifer n.sp. "godzillas"</i>
<i>Cyrtospirifer n.sp. "mothra"</i>
<i>Spirifer williamsi</i>
<i>Warrenella laevis</i>
<i>Spirifer genus? Sp?</i>

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION
Centronella sp?
Cranaena eudora
Cranaena harmonia
Cranaena sp?
Nuculoidea corbuliformis
Palaeoneilo constricta
Phestia diversa
Buchiola retrostriata
Ontaria suborbicularis
Ontaria clarkei
Ontaria accinta
Mytilarca chemungensis
Mytilarca sp?
Leptodesma cadmus
Leptodesma lichas
Leptodesma matheri
Leptodesma naviforme
Leptodesma patulum
Leptodesma propinquum
Leptodesma spinigerum
Leptodesma sp?
Ptychopteria eugenia?
Cornellites chemungensis
Pterinopecten suborbicularis
Vertumnia reversa
Pseudaviculopecten duplicatus
Pseudaviculopecten fasciculatus
Pseudaviculopecten patulus
Pseudaviculopectin sp?
Aviculopecten sp?

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION
<i>Crenipecten amplius</i>
<i>Crenipecten osboletus</i>
<i>Pectin</i> genus?sp?
<i>Modiomorpha angusta</i>
<i>Modiomorpha chemungensis</i>
<i>Modiomorpha mytiloides</i>
<i>Modiomorpha subulata</i>
<i>Modiomorpha</i> sp?
<i>Goniophora chemungensis</i>
<i>Eoschizodus chemungensis</i>
<i>Schizodus</i> sp?
<i>Paracyclias rugosa</i>
<i>Glossites</i> sp?
<i>Grammysioidea subarcuata</i>
<i>Grammysioidea</i> sp?
<i>Sedgwickia attenuata?</i>
<i>Sphenotus calvulus</i>
Clam
<i>Phragmostoma incisum</i>
<i>Phragmostoma chautauque</i>
<i>Straparollus laxus?</i>
<i>Pleuronotus deceni</i>
<i>Bembexia nitella</i>
<i>Bembexia</i> sp?
<i>Euryzone itylus</i>
<i>Pleurotomaria ella</i>
<i>Pleurotomaria</i> sp?
<i>Gyronema concinna</i>
<i>Platyceras platstomum</i>
<i>Muchisonia</i> sp?
<i>Michelia egigium</i>

Data for Crows/Allegheny, "CA", Location

LOCATION and ELEVATION
Michelia tenue
Palaeotrochus praecursor
Palaeozygopleura hamiltoniae
Palaeozygopleura styliola
Gastropod
Orthoceras sp?
Probelocertas lutheri?
Tentaculites
Phecops rana
Greenops boothi
Eurypterus remipes
Leperditia britannica?
Ostracod
Arthroacantha ithacensis
Platycrinites and/or Hexacrinites
Crinoid columnals present
Palasteriscus n.sp."ray"
Bryozoa present
Parasitic Bryozoa present
Rugose coral
Hydroceras tuber
Parasitic worm tubes present
Other
Conodont
PLANTAE
TOTAL for HORIZON

Data for Carvin Cove, "CC", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n.sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochoonetes coronatus	Devonochoonetes scitulus	Sinochoonetes lepidus
CC-4149	3424																										
CC-403	398				1																						
CC-3977	3211																									8	
CC-3976	3210																										
CC-3972	3203																										
CC-3940	3171																										
CC-3936	3168																										
CC-3936	3167																										
CC-3883	3117																										
CC-3871	3105																										
CC-3853	3088																										
CC-3839	3075																									6	
CC-3822	3059																										
CC-3592	2840																									1	
CC-3491	2743																										
CC-3485	2738																			1						1	
CC-3455	2709																			2						7	
CC-3449	2703																										
CC-3428	2683																										
CC-3427	2682																									1	
CC-3368	2626																			4						4	
CC-3364	2622																									21	
CC-3353	2612											2															
CC-3088	2413																									2	
CC-3010	2349																									2	
CC-3000	2340																			1							
CC-295	290									2																3	
CC-291	286																										
CC-286	281																										
CC-285	280																										
CC-2731	2113									12												3					
CC-2720	2103																										
CC-216	211			1																							
CC-1490	1176																										
CC-1221	997																										
CC-1170	963				3																						

Data for Carvin Cove, "CC", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolotechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana	
CC-4149																													
CC-403																													
CC-3977																													
CC-3976																													
CC-3972																													
CC-3940																													
CC-3936																													
CC-3936																													
CC-3883																													
CC-3871																													
CC-3853																													
CC-3839																													
CC-3822																													
CC-3592																													
CC-3491																													
CC-3485															28													2	
CC-3455																													
CC-3449																													
CC-3428																													
CC-3427					2																								
CC-3368					25																								
CC-3364					20								1																
CC-3353					2																								
CC-3088																													
CC-3010																													
CC-3000																													
CC-295																													
CC-291																													
CC-286																													
CC-285																													
CC-2731													1																
CC-2720																													
CC-216																													
CC-1490																													
CC-1221																													
CC-1170																													

Data for Carvin Cove, "CC", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyris mesacostalis	Tylothyris mesacostalis var. mucronata	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?	
CC-4149																												
CC-403																												
CC-3977																												
CC-3976										1																		
CC-3972																					1							
CC-3940										8																		
CC-3936																					1							
CC-3936																					1							
CC-3883										2																		
CC-3871										13																		
CC-3853										108																		
CC-3839							7			219																		
CC-3822							20			17																		
CC-3592		5								12					3													
CC-3491															5													
CC-3485										72																		
CC-3455																												
CC-3449																												
CC-3428										6																		
CC-3427										2																		
CC-3368															13													
CC-3364										4					10													
CC-3353		1					4								7													
CC-3088																												
CC-3010																												
CC-3000							3																					
CC-295							10																					
CC-291							1																					
CC-286							78																					
CC-285							97																					
CC-2731							2													22								
CC-2720																												
CC-216							25																					
CC-1490																												
CC-1221																												
CC-1170																												

Data for Carvin Cove, "CC", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?		
CC-4149																																
CC-403																																
CC-3977																																
CC-3976																																
CC-3972																																
CC-3940																																
CC-3936																																
CC-3936																																
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CC-3364																																
CC-3353																																
CC-3088																																
CC-3010																																
CC-3000																																
CC-295				2																												
CC-291						1																										
CC-286																																
CC-285																																
CC-2731				2																												
CC-2720						1																										
CC-216																																
CC-1490																																
CC-1221																																
CC-1170																																

Data for Carvin Cove, "CC", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium	
CC-4149																																
CC-403																																
CC-3977																																
CC-3976																																
CC-3972																																
CC-3940					1										1																	
CC-3936																																
CC-3936																																
CC-3883																																
CC-3871																																
CC-3853																																
CC-3839																																
CC-3822																																
CC-3592																																
CC-3491																													1			
CC-3485																																
CC-3455																																
CC-3449																																
CC-3428																													4			
CC-3427																																
CC-3368																																
CC-3364																					1											
CC-3353																					2											
CC-3088																																
CC-3010																																
CC-3000					1									1																		
CC-295																					1											
CC-291																																
CC-286																																
CC-285																																
CC-2731																																
CC-2720																																
CC-216																																
CC-1490																																
CC-1221																																
CC-1170																																

Data for Carvin Cove, "CC", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
CC-4149																										2	
CC-403																											1
CC-3977																											8
CC-3976								368																			370
CC-3972																											1
CC-3940																X											10
CC-3936																											1
CC-3936																											1
CC-3883																											2
CC-3871																											13
CC-3853																											108
CC-3839					2	1										X											235
CC-3822																X											38
CC-3592																X											22
CC-3491																											5
CC-3485																X											110
CC-3455												1				X											10
CC-3449																									X		0
CC-3428																											10
CC-3427																X											8
CC-3368																											46
CC-3364								2								X											59
CC-3353								5								X		X									30
CC-3088								44								X											47
CC-3010																X											2
CC-3000																											6
CC-295							1		7	5	1					X				3							35
CC-291							2			4																	8
CC-286																											78
CC-285																											97
CC-2731																X		X									42
CC-2720																											1
CC-216							3									X		X									29
CC-1490					1																						5
CC-1221																											8
CC-1170																											8

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
FT-2059	4409																										
FT-1904	3925																									144	
FT-1886	3879																								493		
FT-1881	3866																								2		
FT-1870	3838																								143		
FT-1865	3825																								53	11	
FT-1827	3728																								87		
FT-1813	3692																								117		
FT-1812	3689																								90		
FT-1808	3671																										
FT-1785	3620																										
FT-1776	3597																										
FT-1772	3587																										
FT-1759	3553																								1		
FT-1743	3512																										
FT-1736	3494																										
FT-1733	3487																										
FT-1725	3466																									1	
FT-1720	3453																										
FT-1712	3433																										
FT-1695	3389																										
FT-1693	3384																										
FT-1691	3379																										
FT-1687	3369																										
FT-1676	3341																										
FT-1670	3325																										
FT-1656	3286																										

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophopoductus hystricula	Steinhagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonopoductus walcottii	Semipoductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbiculares	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
FT-2059			93																1									
FT-1904																	30											
FT-1886																	28											
FT-1881																	21											
FT-1870																	3											
FT-1865														2														
FT-1827															4		7											
FT-1813															2													
FT-1812																	12											
FT-1808																	10											
FT-1785																	13											
FT-1776																	3											
FT-1772																	18											
FT-1759																	19											
FT-1743																	23											
FT-1736																	16											
FT-1733																	2											
FT-1725																												
FT-1720																	72											
FT-1712																	32											
FT-1695									14								17											
FT-1693									50								72											
FT-1691																	9											
FT-1687																	9											
FT-1676									2								166											
FT-1670																												
FT-1656									41								5											

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?
FT-2059																											
FT-1904																											
FT-1886																							5				
FT-1881																							1				
FT-1870																											
FT-1865													12														
FT-1827																											
FT-1813																											
FT-1812																											
FT-1808																											
FT-1785																											
FT-1776																											
FT-1772																											
FT-1759																											
FT-1743																											
FT-1736										1											1						
FT-1733																					1						
FT-1725																					1						
FT-1720																					1						
FT-1712																											
FT-1695																											
FT-1693																											
FT-1691																					2						
FT-1687																											
FT-1676																											
FT-1670																											
FT-1656																											

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?	
FT-2059																															
FT-1904														8			2														
FT-1886													4																		
FT-1881																															
FT-1870																															
FT-1865																															
FT-1827																															
FT-1813																						2									
FT-1812																															
FT-1808													9																		
FT-1785											10										2										
FT-1776																					1		0								
FT-1772											5												0								
FT-1759											10																				
FT-1743																					5										
FT-1736																															
FT-1733																															
FT-1725																															
FT-1720																															
FT-1712														1																	
FT-1695														2																	
FT-1693													9										1								
FT-1691																					1										
FT-1687											2																				
FT-1676											14		13																		
FT-1670																															
FT-1656																															

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium
FT-2059																															
FT-1904							4								4																
FT-1886														1	3																
FT-1881																															
FT-1870																															
FT-1865																															
FT-1827									2					1																	
FT-1813																											1				
FT-1812															2												3				
FT-1808														16																	
FT-1785														2									3								
FT-1776																															
FT-1772																															
FT-1759																															
FT-1743																															
FT-1736																															
FT-1733																															
FT-1725														5																	
FT-1720																															
FT-1712															1																
FT-1695															1																
FT-1693														1																	
FT-1691																															
FT-1687																															
FT-1676																															
FT-1670																															
FT-1656																															

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probelocertas lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
FT-2059																X										96	
FT-1904																											192
FT-1886																											534
FT-1881																											24
FT-1870																X											146
FT-1865																X	X										78
FT-1827																											101
FT-1813																											122
FT-1812																											107
FT-1808																X											35
FT-1785																X											30
FT-1776																											4
FT-1772																X											24
FT-1759																X											29
FT-1743																											28
FT-1736																											18
FT-1733																											3
FT-1725																X											7
FT-1720																X											73
FT-1712																											34
FT-1695																X											34
FT-1693																X	X										135
FT-1691																X											10
FT-1687																X	X										11
FT-1676																X											195
FT-1670																									X		0
FT-1656														2													48

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n.sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
FT-1627	3180																										
FT-1618	3120																										
FT-1616	3106																										
FT-1615	3100																										
FT-1613	3086																									2	
FT-1611	3073																										
FT-1610	3066																							2			
FT-1609	3060																									3	
FT-1601	3006																										
FT-1598	2986																										
FT-1596	2973																										
FT-1594	2960											5															
FT-1574	2826																										
FT-1570	2800																										
FT-1566	2773																										
FT-1562	2746																										
FT-1551	2673																										
FT-1367	1906																									1	
FT-1240	1544										2																
FT-1048	1366										10																
FT-302	675																										
FT-275	650																										
FT-214	594																										
FT-193	573																										
FT-94	474																										
FT-31	411																										

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinhagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana	
FT-1627										12					5														
FT-1618										7					8														
FT-1616										2																			
FT-1615										10					28														
FT-1613										7																			
FT-1611															39	3													
FT-1610										7					7						4								
FT-1609										41					5														
FT-1601															248														
FT-1598															21														
FT-1596															12														
FT-1594												11									2								
FT-1574									31						134	7													
FT-1570																					49								
FT-1566																2					18								
FT-1562												2			4						6								
FT-1551															8														
FT-1367																													
FT-1240																													
FT-1048																													
FT-302																													
FT-275																													
FT-214																													
FT-193																													
FT-94																													
FT-31																													

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyris mesacostalis	Tylothyris mesacostalis var. mucronata	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?	
FT-1627							2																					
FT-1618							11																					
FT-1616							4																					
FT-1615							15																					
FT-1613																												
FT-1611							7																					
FT-1610																												
FT-1609							12																					
FT-1601							28																					
FT-1598																												
FT-1596																												
FT-1594							2																					
FT-1574																												
FT-1570							3																					
FT-1566							27																					
FT-1562							5																					
FT-1551																												
FT-1367																												
FT-1240																												
FT-1048																												
FT-302																												
FT-275																												
FT-214																												
FT-193																												
FT-94																												
FT-31																												

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?
FT-1627												11											3							
FT-1618																							2							
FT-1616																														
FT-1615												22																		
FT-1613												8																		
FT-1611																														
FT-1610																														
FT-1609																														
FT-1601																														
FT-1598																														
FT-1596																														
FT-1594																														
FT-1574																														
FT-1570																														
FT-1566																														
FT-1562																														
FT-1551																														
FT-1367																														
FT-1240																														
FT-1048																														
FT-302																														
FT-275																														
FT-214									1																					
FT-193									4																					
FT-94							2		3																					
FT-31					2				5																					

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium	
FT-1627																																
FT-1618					2																											
FT-1616																		1									1					
FT-1615																											1					
FT-1613																		1														
FT-1611					6																											
FT-1610																																
FT-1609																																
FT-1601																		3														
FT-1598																																
FT-1596																		1														
FT-1594																																
FT-1574																																
FT-1570																																
FT-1566																																
FT-1562																																
FT-1551																																
FT-1367																																
FT-1240																																
FT-1048																																
FT-302																																
FT-275																																
FT-214																																
FT-193																																
FT-94																																
FT-31																																

Data for Bland/Bastion, Route 52, "FT", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
FT-1627																X										33	
FT-1618																X											30
FT-1616																X											8
FT-1615																											76
FT-1613																											18
FT-1611																											55
FT-1610																											20
FT-1609																											61
FT-1601																											279
FT-1598																											21
FT-1596																											13
FT-1594																											20
FT-1574																											172
FT-1570																									X		52
FT-1566																											47
FT-1562																											17
FT-1551																											8
FT-1367																											1
FT-1240																											2
FT-1048																											10
FT-302																				1							1
FT-275									1							X				1							2
FT-214									2																		3
FT-193							1	2																			7
FT-94								1																			6
FT-31																											7

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
LR-2980	4600																										
LR-2760	4333																										
LR-2650	4195																									31	
LR-2640	4185																									540	
LR-2604	4147																										
LR-2390	3925																									3	
LR-2249	3778																							39		55	
LR-2247	3776																							6		18	
LR-2238	3766																									179	
LR-2215	3742																							12		6	
LR-2100	3622																							6		14	
LR-2050	3570															2								4		31	
LR-1950	3466										1				5											6	
LR-1920	3435																										
LR-1906	3420																										
LR-1900	3414																									17	
LR-1895	3409														1											10	
LR-1883	3396																										
LR-1858	3370																									1	
LR-1853	3365																							2			10
LR-1820	3331																										
LR-1750	3246														5											5	
LR-1543	2980											1															
LR-1515	2944	1									21				2					1				7			
LR-1355	2740																										
LR-1350	2734											1								5							
LR-1335	2727																			8	4						8
LR-1246	2601																										2
LR-1238	2591																										2
LR-1234	2586										6																
LR-1207	2553																										10
LR-1187	2529																			2			3			57	115

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganum	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
LR-2980	175																											
LR-2760		11																	88									
LR-2650														19	20													
LR-2640															41				3									
LR-2604																												
LR-2390															8				17									
LR-2249																												
LR-2247																												
LR-2238																												
LR-2215																												
LR-2100																												
LR-2050																												
LR-1950																												
LR-1920					1																							
LR-1906																												
LR-1900																												
LR-1895																												
LR-1883					1																							
LR-1858																												
LR-1853												1																
LR-1820																												
LR-1750																							29					
LR-1543					2																							
LR-1515				2					12					4			1					6		1				
LR-1355																												
LR-1350				5			2																					
LR-1335				2			6	7	1																			
LR-1246																												
LR-1238																												
LR-1234																												
LR-1207																												
LR-1187																												

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?		
LR-2980																													
LR-2760																													
LR-2650																													
LR-2640																													
LR-2604																													
LR-2390																													
LR-2249																							76						
LR-2247																							1						
LR-2238																													
LR-2215																							4						
LR-2100																							35						
LR-2050										2													33						
LR-1950						27				16																			
LR-1920																													
LR-1906										2																			
LR-1900					1	21				4																			
LR-1895						6				2											1								
LR-1883					2	3				1											8								
LR-1858						17																	1						
LR-1853					9	20				5											27								
LR-1820						21															5								
LR-1750						38																							
LR-1543	31						2			2										1						3			
LR-1515	23						10			14										20						6			
LR-1355																				1				1					
LR-1350	2																		15	59			7				1		
LR-1335	2						34												6	9			25	1					
LR-1246										9																			
LR-1238							8			18																			
LR-1234										49																			
LR-1207																													
LR-1187	19																	4											

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?
LR-2980																														
LR-2760																														
LR-2650												1																		
LR-2640													2			1														
LR-2604																														
LR-2390																					2									
LR-2249																														
LR-2247																														
LR-2238																														
LR-2215																														
LR-2100																														
LR-2050																														
LR-1950																											1			
LR-1920																														
LR-1906																														
LR-1900			2																	1										
LR-1895																														
LR-1883																														
LR-1858																														
LR-1853												1																		
LR-1820																														
LR-1750																														
LR-1543																														
LR-1515						2						1								4			3							
LR-1355																														
LR-1350																														
LR-1335																							2						1	
LR-1246																														
LR-1238																														
LR-1234			4																											
LR-1207																				2										
LR-1187																				6			1							

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium
LR-2980																															
LR-2760																1															
LR-2650				3																											
LR-2640														2																	
LR-2604				2																											
LR-2390																															
LR-2249																															
LR-2247																															
LR-2238																															
LR-2215																															
LR-2100																															
LR-2050																															
LR-1950																															
LR-1920																															
LR-1906																															
LR-1900																															
LR-1895																															
LR-1883																															
LR-1858																															
LR-1853																															
LR-1820																															
LR-1750																															
LR-1543																															
LR-1515																1								1							
LR-1355																															
LR-1350																															
LR-1335																															
LR-1246																									1						
LR-1238																									2						
LR-1234																															1
LR-1207																															
LR-1187																															

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON
LR-2980																									175	
LR-2760																	1									101
LR-2650																										74
LR-2640																										589
LR-2604																										2
LR-2390																X										30
LR-2249																X										170
LR-2247																X										25
LR-2238																X										179
LR-2215																										22
LR-2100																X										55
LR-2050																X										72
LR-1950																X	2X									56
LR-1920																										1
LR-1906																X										2
LR-1900																X	X									46
LR-1895																X	X									20
LR-1883																X	2X									15
LR-1858																X	X									19
LR-1853																X	X									75
LR-1820																X										26
LR-1750																										77
LR-1543																										42
LR-1515																X	2X									143
LR-1355																										2
LR-1350																X	2X									97
LR-1335																X	X									116
LR-1246																										12
LR-1238																X										30
LR-1234						16										X										76
LR-1207																X										12
LR-1187																										207

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n.sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus	
LR-1054	2373																										20	
LR-530	1835						1					2																7
LR-482	1786																			2								
LR-474	1778																											
LR-464	1768																											
LR-425	1728																											1
LR-419	1722																											
LR-406	1708																			1								
LR-400	1702																			1								
LR-392	1694											1															5	
LR-391	1693																						4		2	1		
LR-384	1686																											
LR-371	1672																											
LR-368	1669											1																
LR-342	1643																											
LR-295	1595																											
LR-248	1548																									20		
LR-175	1475																											
LR-160	1460																											

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinhagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
LR-1054																												
LR-530															1								24					1
LR-482																												
LR-474																												
LR-464																												
LR-425																												
LR-419																												
LR-406																							1					
LR-400																												
LR-392						1																	3					
LR-391					2																							
LR-384																												
LR-371															1								1					
LR-368																												
LR-342														2									59					
LR-295																												
LR-248					5									13														
LR-175																												
LR-160																							8					

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?	
LR-1054																												
LR-530							45			37																		
LR-482							8																					
LR-474							36																					
LR-464							32																					
LR-425							56																					
LR-419							4																					
LR-406			3				8			7																		
LR-400							191																					
LR-392										3																		
LR-391							4			2																		
LR-384																												
LR-371							2																					
LR-368			4				154																					
LR-342																												
LR-295																												
LR-248							3																					
LR-175												1																
LR-160														3	3													2

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?
LR-1054						3																								
LR-530																														
LR-482																														
LR-474																														
LR-464																														
LR-425																														
LR-419																														
LR-406																														
LR-400																														
LR-392																														
LR-391																														
LR-384																														
LR-371																														
LR-368																														
LR-342																					5									
LR-295																				7										
LR-248																														
LR-175																														
LR-160	4																													

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Crenipecten amplius	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium			
LR-1054		1																																
LR-530																																		
LR-482																																		
LR-474																																		
LR-464																																		
LR-425																																		
LR-419																																		
LR-406																																		
LR-400																																		
LR-392																																		
LR-391																																		
LR-384																																		
LR-371																																		
LR-368																																		
LR-342																																		
LR-295																																		
LR-248																																		
LR-175																																		
LR-160																																		

Data for Lick Run, "LR", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON
LR-1054																										26
LR-530																X										118
LR-482																										10
LR-474																										36
LR-464																X										32
LR-425																X										57
LR-419																X										4
LR-406																X										20
LR-400							2									X										194
LR-392																X										13
LR-391																X										15
LR-384																		X								0
LR-371																										4
LR-368																X										159
LR-342																										66
LR-295																										7
LR-248																X		X								41
LR-175																										1
LR-160																										20

Data for McCoy, "M", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n.sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhidomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus	
M-3336	4406			18																								
M-3227	4255																											
M-3004	4025																											
M-2932	3951																											
M-2919	3938																											
M-2900	3918																									14		
M-2888	3906																									1		
M-2878	3895																							2		39		
M-2866	3883																									3		
M-2831	3847																									3		
M-2761	3775																							4		1		
M-2754	3768																											
M-2709	3719																										4	
M-2702	3714																											
M-2701	3713																											
M-2700	3712																											
M-2697	3709																											
M-2692	3704																										24	
M-2685	3696																										18	
M-2682	3693																											
M-2674	3685																										1	
M-2666	3677																											
M-2660	3671																										3	
M-2645	3655																											
M-2632	3642																										10	
M-2623	3632																											
M-2609	3618																											
M-2605	3614																										2	
M-2603	3612																											
M-2595	3604																											
M-2584	3592																										1	
M-2582	3590																							2				
M-2574	3582																							1				
M-2451	3455																											
M-2419	3422																										1	
M-2405	3408																											
M-2399	3402																											
M-2362	3362																											
M-2315	3315												4															
M-2153	3170																											
M-2145	3159																											
M-2144	3158																							2				
M-2114	3118																				1							
M-2104	3105																				1				6			
M-2100	3100																											
M-2094	3091																							2				
M-2093	3090																				1						2	
M-2011	2981						1				2	3			4						3	2		5				
M-1989	2952																											

Data for McCoy, "M", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinhagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorrhynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
M-3336																												
M-3227		46																	6									
M-3004																												
M-2932																												
M-2919																												
M-2900																												
M-2888																												
M-2878																												
M-2866																												
M-2831																												
M-2761															1													
M-2754															3													
M-2709															14													
M-2702																												
M-2701																												
M-2700																												
M-2697																												
M-2692					3																							
M-2685									1																			
M-2682								1			3										2							
M-2674																												
M-2666																												
M-2660																												
M-2645																												
M-2632																												
M-2623																												
M-2609									3																			
M-2605																												
M-2603																												
M-2595																												
M-2584									1																			
M-2582																												
M-2574															1													
M-2451																												
M-2419									1																			
M-2405																												
M-2399																												
M-2362																												
M-2315															1													
M-2153																												
M-2145																												
M-2144																												
M-2114																												
M-2104					1		2																					
M-2100																												
M-2094																											21	
M-2093																											9	
M-2011	3																											1
M-1989																												

Data for McCoy, "M", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randall	Cyrtospirifer altipicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?		
M-3336																													
M-3227																													
M-3004																													
M-2932																							3						
M-2919																							7						
M-2900																													
M-2888																							2						
M-2878																							24						
M-2866																													
M-2831																													
M-2761										53																			
M-2754										3																			
M-2709					31					50																			
M-2702					1					11																			
M-2701					1					29																			
M-2700										5																			
M-2697					1					16																			
M-2692										42																			
M-2685										2																			
M-2682										17																			
M-2674																							1						
M-2666																			2										
M-2660										2									2										
M-2645																													
M-2632					2					3																			
M-2623										1																			
M-2609					1	1				9																			
M-2605																													
M-2603					1																								
M-2595					2																								
M-2584																				4									
M-2582																													
M-2574																													
M-2451																													
M-2419																													
M-2405					2	8																							
M-2399					4																	6							
M-2362										2																			
M-2315					7	2				1												7							
M-2153							3			8																			
M-2145		1					7			10													1						
M-2144		12								4																			
M-2114																													
M-2104		30		32						2								5	16				13						
M-2100		6																17						1					
M-2094		7																18											
M-2093				1			17												9										
M-2011	1						13	10		5																			
M-1989										10													2						

Data for McCoy, "M", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeoneilo constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?	
M-3336																						28									
M-3227																															
M-3004																				1											
M-2932																															
M-2919																															
M-2900																															
M-2888																															
M-2878																															
M-2866																															
M-2831																															
M-2761																															
M-2754																															
M-2709																															
M-2702																															
M-2701												1	1																		
M-2700																															
M-2697				1																											
M-2692																															
M-2685																															
M-2682																															
M-2674																															
M-2666																															
M-2660																															
M-2645																															
M-2632												1																			
M-2623																															
M-2609													1																		
M-2605																															
M-2603												1																			
M-2595												1										1									
M-2584												1																			
M-2582																															
M-2574									1													2	2								
M-2451																															
M-2419																															
M-2405																															
M-2399																															
M-2362																															
M-2315																															
M-2153																															
M-2145																															
M-2144																															
M-2114																															
M-2104																															
M-2100																															
M-2094																							1								
M-2093																							1								
M-2011													1																		
M-1989																															

Data for McCoy, "M", Location

LOCATION and ELEVATION	Crenipecten amplius	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytiloides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclas rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platstomum	Muchisonia sp?	Michelia egigium	
M-3336																																
M-3227																																
M-3004																																
M-2932																																
M-2919																																
M-2900																					1											
M-2888																																
M-2878																																
M-2866																																
M-2831																																
M-2761																																
M-2754																	1															
M-2709																										1						
M-2702				1																												
M-2701																																
M-2700																																
M-2697																																
M-2692																																
M-2685																																
M-2682																																
M-2674																																
M-2666																																
M-2660																																
M-2645																																
M-2632																																
M-2623																																
M-2609																																
M-2605																																
M-2603																																
M-2595																																
M-2584																																
M-2582																		2														
M-2574																																
M-2451																																
M-2419																																
M-2405																																
M-2399																																
M-2362																																
M-2315																																
M-2153																																
M-2145																																
M-2144																																
M-2114																																
M-2104																																
M-2100																																
M-2094																																
M-2093																																
M-2011						1		2												7	2			6							4	
M-1989																																

Data for McCoy, "M", Location

	LOCATION and ELEVATION																										
	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura stylifolia	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Phecopis rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp. "ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
M-3336																										46	
M-3227																											52
M-3004																											1
M-2932																X	X										3
M-2919																X	X										7
M-2900																X	X										15
M-2888																X	X										3
M-2878																X	X										65
M-2866																X	X										3
M-2831																											3
M-2761																X	X										59
M-2754																X	X										4
M-2709																X	X										90
M-2702																X	X										27
M-2701																X	X										32
M-2700																X	X										5
M-2697																	X							X			18
M-2692																X	X										69
M-2685																X	X										21
M-2682																X	X										23
M-2674																X	X										2
M-2666																X	X										2
M-2660														1		X	X										8
M-2645																X	X										0
M-2632																X	X										16
M-2623																X	X										1
M-2609																X	X										16
M-2605																X	X										3
M-2603																											2
M-2595																X	X										5
M-2584																X	X										10
M-2582																X											7
M-2574														1		X									X		3
M-2451																									X		0
M-2419																											2
M-2405																X	X							X			10
M-2399																X											10
M-2362																X	2X										2
M-2315																X	X										22
M-2153																											11
M-2145																											19
M-2144																											18
M-2114																		X									1
M-2104								1								X	2X										110
M-2100								2								X	X										26
M-2094																X	X										49
M-2093																X	X										40
M-2011	19	1			48					2			1		X												164
M-1989																							1				13

Data for McCoy, "M", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n.sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus	
M-1971	2928																			4						4		
M-1940	2886																				4						99	
M-1931	2874																											
M-1757	2642						2			2											9	2						
M-1740	2620																											
M-1735	2613																				3							
M-1732	2609																											
M-1662	2521																											
M-1652	2508																				1							
M-1645	2500																				1							
M-1632	2483																											
M-1555	2388																1				1							
M-1554	2387									2											23							
M-1549	2381																				15	2						
M-1545	2377																				4							
M-1538	2369																						3					
M-1537	2368																											
M-1504	2331																											
M-1470	2292									1																		
M-1468	2290									1	1										5							
M-1450	2270																											
M-1449	2269																											
M-1440	2259																											
M-1430	2247																											
M-1405	2219																											
M-1399	2212																											
M-1344	2150		1																									
M-1213	2003																											
M-1207	1996															12												
M-1201	1989															2												

Data for McCoy, "M", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinhagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbiculares	Cupularostrum sappho	Macropotamorrhynchus durbinensus	Sinotectirostrum alleganum	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana	
M-1971																												2	
M-1940																													
M-1931																													
M-1757	13				3		1																					30	
M-1740																													
M-1735																													10
M-1732																													3
M-1662																													
M-1652	1																											3	
M-1645																													
M-1632																													
M-1555																													
M-1554																													
M-1549																													
M-1545																													
M-1538																													
M-1537																													
M-1504	2											6																	
M-1470	1																												
M-1468												1																	
M-1450	8																												
M-1449																									6				
M-1440																													
M-1430																													
M-1405																													
M-1399					3																								
M-1344																													
M-1213																													
M-1207																													
M-1201																													

Data for McCoy, "M", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?
M-1971		15								7																	
M-1940																											
M-1931		1																									
M-1757		24								1									13								
M-1740		1																									
M-1735		10																	1								
M-1732																											
M-1662		1																									
M-1652		8																									
M-1645																											
M-1632		1																									
M-1555		4																									
M-1554		14					2												1								
M-1549							17																				
M-1545							12																				
M-1538							26																				
M-1537							56																				
M-1504							17																				
M-1470			1				203																				
M-1468							4																				
M-1450							62																				
M-1449																											
M-1440							1																				
M-1430							14																				
M-1405																											
M-1399			1				262																				
M-1344			5				2																				
M-1213																											
M-1207										1																	
M-1201			1																								

Data for McCoy, "M", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeoneilo constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?
M-1971																														
M-1940																					6									
M-1931																														
M-1757																							5							1
M-1740																							1							
M-1735																														
M-1732																														
M-1662																														
M-1652																														
M-1645																														
M-1632																														
M-1555																														
M-1554																														
M-1549																														
M-1545																														
M-1538																														
M-1537																							1							
M-1504																														
M-1470																														
M-1468																														
M-1450																														
M-1449																														
M-1440																														
M-1430																														
M-1405																														
M-1399																							1							
M-1344																														
M-1213																														
M-1207																														
M-1201																														

Data for McCoy, "M", Location

LOCATION and ELEVATION	Crenipecten amplius	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclas rugosa	Glossites sp?	Grammysioides subarcuata	Grammysioides sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platstomum	Muchisonia sp?	Michelia egigium			
M-1971																																		
M-1940																																		
M-1931																																		
M-1757																																		
M-1740																																		
M-1735																																		
M-1732																																		
M-1662																																		
M-1652																																		
M-1645																																		
M-1632																																		
M-1555																																		
M-1554																																		
M-1549																																		
M-1545																																		
M-1538																																		
M-1537																																		
M-1504																																		
M-1470																																		
M-1468																																		
M-1450																																		
M-1449																																		
M-1440																																		
M-1430																																		
M-1405																																		
M-1399																																		
M-1344																																		
M-1213																																		
M-1207																																		
M-1201																																		

Data for McCoy, "M", Location

	LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pheocops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp. "ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
M-1971																	X		X								32	
M-1940																	X											109
M-1931																	X											1
M-1757															1		X		2X									107
M-1740																			X									2
M-1735															8		X		2X									32
M-1732																			X									3
M-1662																												1
M-1652															2		X											15
M-1645																												1
M-1632																												1
M-1555																												6
M-1554																												42
M-1549																	X											34
M-1545																												16
M-1538																												29
M-1537																												57
M-1504																												25
M-1470																												206
M-1468						1																						13
M-1450																												70
M-1449																												6
M-1440																												1
M-1430																												14
M-1405																										X		1
M-1399							1										X		X									267
M-1344																												8
M-1213																						1						1
M-1207																	X											13
M-1201																												3

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Lingula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nevostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
SSR-369	969													93			37	7		1							
SSR-352	952													67													
SSR-313	913													9													
SSR-309	909													3													
SSR-109	709																2			4							
SSR-87	687																										
SSR-43	643																2										
SSR-38	638																					13					
SSR-29	629																1					28					
SSR-1	601																					1	12				
LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Lingula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nevostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus
SS-7230	4310																										
SS-7061	4179																										
SS-7030	4156																										
SS-6984	4121		3																								
SS-6884	4045																										
SS-6748	3942																									7	
SS-6547	3790																									47	
SS-6509	3761																										
SS-6474	3734								3																2		
SS-6473	3733								5																2		
SS-6470	3731																								1		
SS-6448	3715																								3		
SS-6432	3703																										
SS-6431	3702											1													9		
SS-6430	3701								1																29		
SS-6257	3570																										
SS-6205	3531								3																		
SS-6113	3461																								2		
SS-6097	3449								7																12		
SS-6068	3427																								7		
SS-5874	3256																										
SS-5810	3172																										
SS-5496	2887																										32
SS-5469	2862																										

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystriacula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
SSR-369																												
SSR-352					1					1		1																
SSR-313																												
SSR-309																												
SSR-109										48																		
SSR-87										4																		
SSR-43					8																							
SSR-38					3																							
SSR-29																												
SSR-1																												
LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystriacula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
SS-7230																												
SS-7061																												
SS-7030																												
SS-6984																												
SS-6884																												
SS-6748															3													
SS-6547										2					2													
SS-6509										12					10													
SS-6474													4		10													
SS-6473												12			13													
SS-6470												5	1		12													
SS-6448												21			2													
SS-6432																												
SS-6431												4			10													
SS-6430												15			5													
SS-6257																												
SS-6205													3															
SS-6113																												
SS-6097																												
SS-6068																												
SS-5874																												
SS-5810																												
SS-5496																												
SS-5469																												

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	LOCATION and ELEVATION
SSR-369	SSR-369
SSR-352	SSR-352
SSR-313	SSR-313
SSR-309	SSR-309
SSR-109	SSR-109
SSR-87	SSR-87
SSR-43	SSR-43
SSR-38	SSR-38
SSR-29	SSR-29
SSR-1	SSR-1
Centronella sp?	Centronella sp?
Cranaena eudora	Cranaena eudora
Cranaena harmonia	Cranaena harmonia
Cranaena sp?	Cranaena sp?
Nuculoidea corbuliformis	Nuculoidea corbuliformis
Palaeonello constricta	Palaeonello constricta
Phestia diversa	Phestia diversa
Buchiola retrostriata	Buchiola retrostriata
Ontaria suborbicularis	Ontaria suborbicularis
Ontaria clarkei	Ontaria clarkei
Ontaria accinta	Ontaria accinta
Mytilarca chemungensis	Mytilarca chemungensis
Mytilarca sp?	Mytilarca sp?
Leptodesma cadmus	Leptodesma cadmus
Leptodesma lichas	Leptodesma lichas
Leptodesma matheri	Leptodesma matheri
Leptodesma naviforme	Leptodesma naviforme
Leptodesma patulum	Leptodesma patulum
Leptodesma propinquum	Leptodesma propinquum
Leptodesma spinigerum	Leptodesma spinigerum
Leptodesma sp?	Leptodesma sp?
Ptychopteria eugenia?	Ptychopteria eugenia?
Cornellites chemungensis	Cornellites chemungensis
Pterinopecten suborbicularis	Pterinopecten suborbicularis
Vertumnia reversa	Vertumnia reversa
Pseudaviculopecten duplicatus	Pseudaviculopecten duplicatus
Pseudaviculopecten fasciculatus	Pseudaviculopecten fasciculatus
Pseudaviculopecten patulus	Pseudaviculopecten patulus
Pseudaviculopecten sp?	Pseudaviculopecten sp?
Aviculopecten sp?	Aviculopecten sp?
SS-7230	SS-7230
SS-7061	SS-7061
SS-7030	SS-7030
SS-6984	SS-6984
SS-6884	SS-6884
SS-6748	SS-6748
SS-6547	SS-6547
SS-6509	SS-6509
SS-6474	SS-6474
SS-6473	SS-6473
SS-6470	SS-6470
SS-6448	SS-6448
SS-6432	SS-6432
SS-6431	SS-6431
SS-6430	SS-6430
SS-6257	SS-6257
SS-6205	SS-6205
SS-6113	SS-6113
SS-6097	SS-6097
SS-6068	SS-6068
SS-5874	SS-5874
SS-5810	SS-5810
SS-5496	SS-5496
SS-5469	SS-5469
	1
	14
	2
	18

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platstomum	Muchisonia sp?	Michelia egigium		
SSR-369																																	
SSR-352																																	
SSR-313																																	
SSR-309																																	
SSR-109																																	
SSR-87																																	
SSR-43																																	
SSR-38																																	
SSR-29																																	
SSR-1																																	
LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platstomum	Muchisonia sp?	Michelia egigium		
SS-7230																																	
SS-7061																																	
SS-7030																																	
SS-6984																																	
SS-6884																1																	
SS-6748																		6															
SS-6547																	1																
SS-6509																																	
SS-6474																																	
SS-6473																																	
SS-6470																																	
SS-6448																																	
SS-6432																																	
SS-6431																																	
SS-6430																																	
SS-6257																																	
SS-6205																																	
SS-6113																																	
SS-6097																																	
SS-6068																																	
SS-5874																																	
SS-5810																																	
SS-5496																																	
SS-5469																																	

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probelocertas lutheri?	Tentaculites	Phecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON
SSR-369		-1														X										140
SSR-352																X										70
SSR-313																X										9
SSR-309																										3
SSR-109																										54
SSR-87																X										4
SSR-43																X										47
SSR-38																										31
SSR-29																X										13
SSR-1																										1
LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probelocertas lutheri?	Tentaculites	Phecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON
SS-7230																							1			1
SS-7061																									X	0
SS-7030																								X	0	
SS-6984																										5
SS-6884																								X	0	
SS-6748																X										17
SS-6547																X										52
SS-6509																X										36
SS-6474																X										20
SS-6473																										33
SS-6470																										22
SS-6448																										26
SS-6432																X								X	0	
SS-6431																X										33
SS-6430																X										91
SS-6257																X										35
SS-6205																										10
SS-6113																X										10
SS-6097																										51
SS-6068																										10
SS-5874																									X	0
SS-5810																										14
SS-5496																										34
SS-5469																X										18

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus	
SS-5022	2487																											
SS-4923	2416																											
SS-4922	2415																											
SS-4886	2387																											
SS-4871	2374							1																				
SS-4830	2339																											
SS-4812	2323											1																
SS-4701	2226																											
SS-4671	2200																											
SS-4623	2159																											
SS-4618	2154																										2	
SS-4603	2141																											
SS-4566	2109															6												
SS-4400	1965																											
SS-4398	1963															20											6	
SS-4231	1818																										15	
SS-4150	1747																											
SS-4106	1709																											
SS-4064	1655																											
SS-4036	1648															3												
SS-4015	1630																											
SS-3994	1612														6	30											3	
SS-3947	1576								10																			
SS-3844	1502																											
SS-3822	1486																				36							
SS-3819	1484											1																
SS-3814	1481																				1							
SS-3808	1476																				26							
SS-3778	1456																				6							
SS-3776B	1455																1				7							
SS-3776	1454																				6							
SS-3775	1453																				1							
SS-3773	1451																											
SS-3759	1441																											
SS-3750	1435																				2							
SS-3746	1432																				1							
SS-3734	1424																1				10							
SS-3733	1423																											
SS-3725	1418																				6							
SS-3725	1417																				6							
SS-3709	1406																				1							
SS-3707	1404																				2							
SS-3695	1395																2											
SS-3535	1281								8			11																
SS-3529	1277								14			13																
SS-2771	734																				4							
SS-2712	692											27																
SS-2647	648																				1							
SS-2583	601								8			24					1				20		1	1				

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbiculares	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolitechia multicosstatum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana	
SS-5022																													
SS-4923																													
SS-4922																													
SS-4886																													
SS-4871																													
SS-4830																													
SS-4812																													
SS-4701																													
SS-4671																													
SS-4623																													
SS-4618																													
SS-4603																													
SS-4566																													
SS-4400													2			2													
SS-4398																													
SS-4231						1																							
SS-4150																													
SS-4106																													
SS-4064																													
SS-4036																													
SS-4015																													
SS-3994																													
SS-3947									7																				
SS-3844																													
SS-3822									2			2																1	
SS-3819																													
SS-3814									1			1																	
SS-3808																													
SS-3778												2																	
SS-3776B																												2	
SS-3776																													
SS-3775																												1	
SS-3773												1																	
SS-3759																													
SS-3750																													
SS-3746												3																9	
SS-3734						8				6																			
SS-3733									14																				
SS-3725													1																
SS-3725																													
SS-3709																													
SS-3707																													
SS-3695													2																
SS-3535						4																							
SS-3529						3																							
SS-2771												2																	
SS-2712						11																							
SS-2647						1																							
SS-2583																													

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?	
SS-5022										106																		
SS-4923							13			4																		
SS-4922							4			10																		
SS-4886							114			4																		
SS-4871							15			54																		
SS-4830							39			35																		
SS-4812										28																		
SS-4701							8			5																		
SS-4671							X																					
SS-4623							29																					
SS-4618							16			17																		
SS-4603																												
SS-4566										3																		
SS-4400							49			25																		
SS-4398																												
SS-4231																												
SS-4150																												
SS-4106							32																					
SS-4064							7																					
SS-4036							4																					
SS-4015							11																					
SS-3994							73			2			2						13									
SS-3947																												
SS-3844																												
SS-3822																												
SS-3819			2																	27								
SS-3814																				18								
SS-3808																				40								
SS-3778																				6								
SS-3778																				21								
SS-3776B																				10								
SS-3776			3																	11								
SS-3775			3																	12								
SS-3773																				15								
SS-3759																				4								
SS-3750																				1								
SS-3746																				5								
SS-3734																				1								
SS-3733																				3								
SS-3725																				2								
SS-3725																				4								
SS-3709																												
SS-3707																												
SS-3695			2																									
SS-3535																												
SS-3529																												
SS-2771																												
SS-2712																												
SS-2647																												
SS-2583			1																	2								

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?	
SS-5022																															
SS-4923																															
SS-4922																															
SS-4886																															
SS-4871																							1								
SS-4830																														2	
SS-4812																															
SS-4701																															
SS-4671																															
SS-4623																															
SS-4618																															
SS-4603																				4											
SS-4566																															
SS-4400																															
SS-4398																															
SS-4231																															
SS-4150																															
SS-4106																															
SS-4064																															
SS-4036																															
SS-4015																															
SS-3994																															
SS-3947																															
SS-3844																							1								
SS-3822																															
SS-3819																							1								
SS-3814																															
SS-3808																							1								
SS-3778																															
SS-3776B																															
SS-3776																															
SS-3775																															
SS-3773																															
SS-3759																															
SS-3750																															
SS-3746																															
SS-3734																															
SS-3733																															
SS-3725																															
SS-3725																															
SS-3709																															
SS-3707																								1							
SS-3695																															
SS-3535																															
SS-3529																															
SS-2771																															
SS-2712																															
SS-2647																															
SS-2583																															

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium		
SS-5022																																	
SS-4923																																	
SS-4922																																	
SS-4886																																	
SS-4871																																	
SS-4830																																	
SS-4812																																	
SS-4701																																	
SS-4671																																	
SS-4623																																	
SS-4618																																	
SS-4603																																	
SS-4566																																	
SS-4400																																	
SS-4398																										6							
SS-4231																																	
SS-4150																																	
SS-4106																																	
SS-4064																																	
SS-4036																									1								
SS-4015																								2									
SS-3994																																	
SS-3947																				1													
SS-3844																																	
SS-3822																																	
SS-3819																																	
SS-3814																																	
SS-3808																																	
SS-3778																																	
SS-3776B																																	
SS-3776																																	
SS-3775																																	
SS-3773																																	
SS-3759										1																							
SS-3750																																	
SS-3746																																	
SS-3734																																	
SS-3733																																	
SS-3725																																	
SS-3725																																	
SS-3709																																	
SS-3707																																	
SS-3695																																	
SS-3535																																	
SS-3529																																	
SS-2771																																	
SS-2712																																	
SS-2647																																	
SS-2583																																	

Data for Sulphur Springs, "SS" and "SSR", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
SS-5022																X										106	
SS-4923																X											17
SS-4922																X											14
SS-4886																X	X										118
SS-4871																X											71
SS-4830																	X										76
SS-4812																X											29
SS-4701							1									X											14
SS-4671																											0
SS-4623																X											29
SS-4618				1												X											36
SS-4603																X											4
SS-4566																X											9
SS-4400																X	X										84
SS-4398																											26
SS-4231						1	4									X											21
SS-4150				3												X											3
SS-4106																X											32
SS-4064																X											8
SS-4036																X									X		9
SS-4015																X											11
SS-3994																X	X										129
SS-3947												1	2			X									X		21
SS-3844																											1
SS-3822												1				X	X										69
SS-3819																											22
SS-3814																X	X										43
SS-3808											1					X											34
SS-3778																X											29
SS-3776B																X											20
SS-3776																X											20
SS-3775																X											17
SS-3773																X											16
SS-3759																											5
SS-3750																X	X										3
SS-3746																	X										18
SS-3734																X	X										26
SS-3733																X	X										17
SS-3725																											9
SS-3725																											10
SS-3709																X											1
SS-3707																											3
SS-3695																											10
SS-3535																											22
SS-3529																											29
SS-2771																											15
SS-2712																X											28
SS-2647																											1
SS-2583													1			X											59

Data for Route 738, "STE", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n.sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus	
STE-4237	4702																											
STE-4171	4635																											
STE-4154	4619																											
STE-3710	4095																											
STE-3700	4084																											
STE-3691	4074																											
STE-3687	4070																											
STE-3549	3922																											
STE-3545	3918																											
STE-3542	3915																											
STE-3513	3883																											
STE-3425	3789											1														25		
STE-3413	3776																									3		
STE-3393	3754																									11		
STE-3348	3706																											
STE-3345	3703																										22	
STE-3340	3697																							17		47		
STE-3331	3688																							5		216		
STE-3320	3676																							1		34		
STE-3319	3675																											
STE-3314	3669																							19		23		
STE-3254	3604																										80	
STE-3252	3602											3													1		66	
STE-3250	3600											6													1		33	73
STE-3248	3598																								1		9	
STE-3245	3595																											
STE-3230	3579											1															14	
STE-3229	3578											6															32	
STE-3220	3568																										6	
STE-3211	3559																											
STE-3200	3547																										13	
STE-3190	3536																										216	
STE-3184	3530																										38	
STE-3160A	3505					2																					20	
STE-3160	3504					1																		12		56		
STE-3149	3492																											30
STE-3131	3473	1			1		6																				70	
STE-3109	3449																											
STE-3100	3439				5							3													4		66	
STE-3067	3404					2						8															16	
STE-3064	3401				3							4													3		125	
STE-3052	3388																										1	
STE-3036	3370																										6	
STE-3030	3364											4															3	
STE-2970	3300																								1			
STE-2969	3299																											
STE-2958	3290														2												3	
STE-2887B	3233																											
STE-2887A	3234																								1			

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbitales	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganum	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana
STE-4237	12																											
STE-4171																												
STE-4154	4																		29									
STE-3710																												
STE-3700		291														4												
STE-3691		4																										
STE-3687		3														3												
STE-3549																												
STE-3545																												
STE-3542																												
STE-3513																												
STE-3425									47					22														
STE-3413											9			20														
STE-3393														14														
STE-3348																												
STE-3345																												
STE-3340								2																				
STE-3331														1														
STE-3320																												
STE-3319																												
STE-3314					1																							
STE-3254					1									2														
STE-3252					1																							
STE-3250																												
STE-3248																												
STE-3245																												
STE-3230																												
STE-3229																												
STE-3220														2														
STE-3211																												
STE-3200																												
STE-3190														30														
STE-3184														25														
STE-3160A																												
STE-3160														2														
STE-3149																												
STE-3131														1														
STE-3109																												
STE-3100					1																							
STE-3067																												
STE-3064					6									1														
STE-3052																												
STE-3036																												
STE-3030																												
STE-2970																												
STE-2969																												
STE-2958												2																
STE-2887B																												
STE-2887A						2																						

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothyrus mesacostalis	Tylothyrus mesacostalis var. mucronatus	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?	
STE-4237																												
STE-4171																												
STE-4154																												
STE-3710																												
STE-3700																												
STE-3691																												
STE-3687																												
STE-3549																												
STE-3545																												
STE-3542																												
STE-3513																												
STE-3425																												
STE-3413						2				1																		
STE-3393																												
STE-3348																												
STE-3345																							2					
STE-3340																							38					
STE-3331					1																							
STE-3320																							42					
STE-3319																							8					
STE-3314																							89					
STE-3254																							22					
STE-3252																							50					
STE-3250																							31					
STE-3248																							37					
STE-3245																							6					
STE-3230																												
STE-3229																							1					
STE-3220																							31					
STE-3211																							33					
STE-3200																							26					
STE-3190																							1					
STE-3184																												
STE-3160A																						4						
STE-3160																						150						
STE-3149																						46						
STE-3131																												
STE-3109																												
STE-3100				2						21																		
STE-3067										110																		
STE-3064										114																		
STE-3052						17				20																		
STE-3036						32				7																		
STE-3030						81				6																		
STE-2970					31					48																		
STE-2969					13					20																		
STE-2958					48		17			98																		
STE-2887B																												
STE-2887A					8		4			12												12						

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?	
STE-4237																															
STE-4171																															
STE-4154																															
STE-3710																															
STE-3700																															
STE-3691																															
STE-3687																															
STE-3549																															
STE-3545																															
STE-3542																															
STE-3513																															
STE-3425												1																			
STE-3413																															
STE-3393																															
STE-3348																										1					
STE-3345																															
STE-3340												1																			
STE-3331																															
STE-3320																							1								
STE-3319																															
STE-3314																							1								
STE-3254																														2	
STE-3252																														1	
STE-3250																														1	
STE-3248																															
STE-3245																															
STE-3230																															
STE-3229																															
STE-3220																														1	
STE-3211																															
STE-3200																							1								
STE-3190												3																			
STE-3184																					11						4				
STE-3160A																															
STE-3160																							1								
STE-3149																														1	
STE-3131		1										5																			
STE-3109																							1								
STE-3100		1						1													1		2								
STE-3067																															
STE-3064			1										4									13									
STE-3052													9										2								
STE-3036									2			3																		1	
STE-3030												1																			
STE-2970												6											1				1				
STE-2969												3																			
STE-2958																															
STE-2887B									11			4									1										
STE-2887A																								1			2				

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytiloides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platistomum	Muchisonia sp?	Michelia egigium	
STE-4237											1					1																
STE-4171											13					3																
STE-4154																																
STE-3710																																
STE-3700																																
STE-3691																																
STE-3687				2																												
STE-3549																																
STE-3545									1																							
STE-3542																																
STE-3513																	1															
STE-3425																																
STE-3413									1																							
STE-3393																																
STE-3348																																
STE-3345																																
STE-3340																																
STE-3331																																
STE-3320																																
STE-3319																																
STE-3314																																
STE-3254																																
STE-3252																																
STE-3250																																
STE-3248																																
STE-3245																																
STE-3230																																
STE-3229																																
STE-3220																																
STE-3211																																
STE-3200																																
STE-3190					2			4																								
STE-3184																																
STE-3160A																																
STE-3160																																
STE-3149																																
STE-3131												3																				
STE-3109																																
STE-3100				4																												
STE-3067																																
STE-3064	1			1	1									27																		
STE-3052																																
STE-3036																																
STE-3030																																
STE-2970																																
STE-2969																																
STE-2958																																
STE-2887B																										1				1		
STE-2887A							1																									

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
STE-4237					1											X										15	
STE-4171																											16
STE-4154																											33
STE-3710																											0
STE-3700																											295
STE-3691																											4
STE-3687																											8
STE-3549																X		X			1						1
STE-3545															X		X										1
STE-3542																		X									0
STE-3513																		X									1
STE-3425																X		X									96
STE-3413															X		X										36
STE-3393																		X									25
STE-3348																											1
STE-3345																X		X									24
STE-3340																X		X									105
STE-3331																X		X									223
STE-3320																X		X									78
STE-3319																X											8
STE-3314																X		X									133
STE-3254																											107
STE-3252																X		X									122
STE-3250																X											145
STE-3248																X		X									47
STE-3245																X											6
STE-3230																											15
STE-3229																X		X									39
STE-3220																											40
STE-3211																X											33
STE-3200																X		X									40
STE-3190					1											X		X									261
STE-3184																											74
STE-3160A																X		X									26
STE-3160					2											X		X									224
STE-3149																X		X									77
STE-3131																											88
STE-3109																		X									1
STE-3100																X		2X									111
STE-3067																X											136
STE-3064																X		2X							X		304
STE-3052																X		X									49
STE-3036																X		X							X		51
STE-3030																X		X									95
STE-2970																											88
STE-2969																X		X									36
STE-2958																X		X									170
STE-2887B											1	12															31
STE-2887A																X		X									43

Data for Route 738, "STE", Location

LOCATION and ELEVATION	NORMALIZED ELEVATION	Lingula complanta	Lingula ligea	Ligula n. sp.	Orbiculoidea newberryi	Cranea leoni	Petrocrania hamiltonidea	Schizophoria impressa	Schizophoria sp?	Aulacella sp?	Cariniferella carinata	Cariniferella tioga	Cariniferella elmira	Thiemella leonensis	Rhodomella penelope	Tropidoleptus carinatus	Nervostrophia nervosa	Nevostrophia mucronata	Nervostrophia "megastrophia"	Douvillina cayuta	Douvillina graciliora	Douvillina mucronata	Douvillinaria variabilis	Schuchertella chemungensis	Devonochonetes coronatus	Devonochonetes scitulus	Sinochonetes lepidus	
STE-2857	3209										2																	
STE-2846	3201										21																	
STE-2685	3033															1												
STE-2679	3026															1												
STE-2660	3006										4															2		
STE-2650	2996															1												
STE-2593	2937										5																3	
STE-1954	2384										5																	
STE-1940	2371											2												7				
STE-1937	2368																										3	
STE-1934	2366																											
STE-1933	2365																			1								
STE-1922	2354						1													2								
STE-1346	1812																											
STE-1326	1793																				2							
STE-1320	1788																				1							
STE-1318	1786										2										1						9	
STE-1315B	1784																											
STE-1315A	1783																											
STE-1295	1764																											
STE-1292	1761																				11							
STE-1208	1682																											
STE-1175	1651									1	3									1								
STE-1117	1597									2																		
STE-649	1129	6																										

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Striatochonetes setigera	Subglobosochonetes acutiliratus	Rugosochonetes sp?	Productella boydi	Productella speciosa	Productella spinulacosta	Strophoproductus hystricula	Steinhagella sp?	Whidbornella hirsuta	Whidbornella lachrymosa	Devonoproductus walcottii	Semiproductus onestus	Productid sp?	Cupularostrum congregata	Cupularostrum contracta	Cupularostrum exima	Cupularostrum orbiculares	Cupularostrum sappho	Macropotamorphynchus durbinensus	Sinotectirostrum alleganium	Pugnoides duplicatus	Leiorhynchus lesleyi	Leiorhynchus mesacostalis	Leiorhynchus quadricostatus	Eumatobolatechia multicostratum	Rhynchoneid	Atrypa reticularis	Pseudoatrypa devoniana	
STE-2857																													
STE-2846																													
STE-2685																													
STE-2679																													
STE-2660																													
STE-2650																													1
STE-2593								15																					
STE-1954								1																					
STE-1940																													
STE-1937									6																				
STE-1934																													
STE-1933																													
STE-1922																													
STE-1346									3																				
STE-1326																													
STE-1320																													
STE-1318									1					1															
STE-1315B																													
STE-1315A									1																				
STE-1295																													
STE-1292																													
STE-1208																													
STE-1175									1																				
STE-1117				1																									
STE-649																													

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Spinatrypa aspera	Spinatrypa hystrix	Spinatrypa spinosa	Spinatrypa n.sp. "rugosa"	Athyris angelica	Ambocoelia gregaria	Ambocoelia umbonata	Cyrtina hamiltonensis	Eleutherokomma n.sp. "rodan "	Tylothryis mesacostalis	Tylothryis mesacostalis var. mucronata	Spinocyrtia granulosa	Eosyringothyris sp?	Mediospirifer audaculus	Orthospirifer mesastrialis	Syringothyris extenuata	Syringothyris randali	Cyrtospirifer altiplicus	Cyrtospirifer chemungensis	Cyrtospirifer inermis	Cyrtospirifer preshoensis	Cyrtospirifer sulcifer	Cyrtospirifer n.sp. "godzillas"	Cyrtospirifer n.sp. "mothra"	Spirifer williamsi	Warrenella laevis	Spirifer genus? Sp?		
STE-2857					3																								
STE-2846																													
STE-2685																													
STE-2679																													
STE-2660							7																						
STE-2650																													
STE-2593							32																						
STE-1954	5						6																						
STE-1940										19																			
STE-1937										9																			
STE-1934										1																1			
STE-1933											29																		
STE-1922							7			33																			
STE-1346							38																						
STE-1326		10					17			4																			
STE-1320		1					202			2																			
STE-1318		4					46			3																			
STE-1315B							120																						
STE-1315A										1																			
STE-1295																													
STE-1292		1					10																						
STE-1208							120																						
STE-1175		6					50																						
STE-1117	6						153																						
STE-649																													

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Centronella sp?	Cranaena eudora	Cranaena harmonia	Cranaena sp?	Nuculoidea corbuliformis	Palaeonello constricta	Phestia diversa	Buchiola retrostriata	Ontaria suborbicularis	Ontaria clarkei	Ontaria accinta	Mytilarca chemungensis	Mytilarca sp?	Leptodesma cadmus	Leptodesma lichas	Leptodesma matheri	Leptodesma naviforme	Leptodesma patulum	Leptodesma propinquum	Leptodesma spinigerum	Leptodesma sp?	Ptychopteria eugenia?	Cornellites chemungensis	Pterinopecten suborbicularis	Vertumnia reversa	Pseudaviculopecten duplicatus	Pseudaviculopecten fasciculatus	Pseudaviculopecten patulus	Pseudaviculopectin sp?	Aviculopecten sp?	
STE-2857																															
STE-2846																															
STE-2685																															
STE-2679																															
STE-2660																															
STE-2650																															
STE-2593																															
STE-1954																															
STE-1940																															
STE-1937																															
STE-1934																															
STE-1933																															
STE-1922																								1							
STE-1346																															
STE-1326																															
STE-1320																															
STE-1318																								1							
STE-1315B																															
STE-1315A																															
STE-1295																															
STE-1292																															
STE-1208																															
STE-1175																															
STE-1117																															
STE-649																															

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Crenipecten amplus	Crenipecten osboletus	Pectin genus?sp?	Modiomorpha angusta	Modiomorpha chemungensis	Modiomorpha mytilioides	Modiomorpha subulata	Modiomorpha sp?	Goniophora chemungensis	Eoschizodus chemungensis	Schizodus sp?	Paracyclias rugosa	Glossites sp?	Grammysioidea subarcuata	Grammysioidea sp?	Sedgwickia attenuata?	Sphenotus calvulus	Clam	Phragmostoma incisum	Phragmostoma chautauque	Straparollus laxus?	Pleuronotus deceni	Bembexia nitella	Bembexia sp?	Euryzone itylus	Pleurotomaria ella	Pleurotomaria sp?	Gyronema concinna	Platyceras platstomum	Muchisonia sp?	Michelia egigium		
STE-2857																																	
STE-2846																																	
STE-2685																	1		1														
STE-2679																																	
STE-2660																																	
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STE-1208																																	
STE-1175																																	
STE-1117																																	
STE-649																																	

Data for Route 738, "STE", Location

LOCATION and ELEVATION	Michelia tenue	Palaeotrochus praecursor	Palaeozygopleura hamiltoniae	Palaeozygopleura styliola	Gastropod	Orthoceras sp?	Probeloceras lutheri?	Tentaculites	Pelecops rana	Greenops boothi	Eurypterus remipes	Leperditia britannica?	Ostracod	Arthroacantha ithacensis	Platycrinites and/or Hexacrinites	Crinoid columnals present	Palasteriscus n.sp."ray"	Bryozoa present	Parasitic Bryozoa present	Rugose coral	Hydnoceras tuber	Parasitic worm tubes present	Other	Conodont	PLANTAE	TOTAL for HORIZON	
STE-2857																										5	
STE-2846																											21
STE-2685																											3
STE-2679																											1
STE-2660																											13
STE-2650																											2
STE-2593																									X		55
STE-1954															X												17
STE-1940															X												28
STE-1937																											18
STE-1934															X												2
STE-1933															X												30
STE-1922																											44
STE-1346																											41
STE-1326															X												33
STE-1320															X												206
STE-1318															X												68
STE-1315B															X												120
STE-1315A																											2
STE-1295															X										X		0
STE-1292															X												22
STE-1208																											120
STE-1175																											62
STE-1117																	X										162
STE-649																											6