

# PENN DIXIE PALEONTOLOGICAL AND OUTDOOR EDUCATION CENTER: Visit to a Classic Geological and Outdoor Education Center

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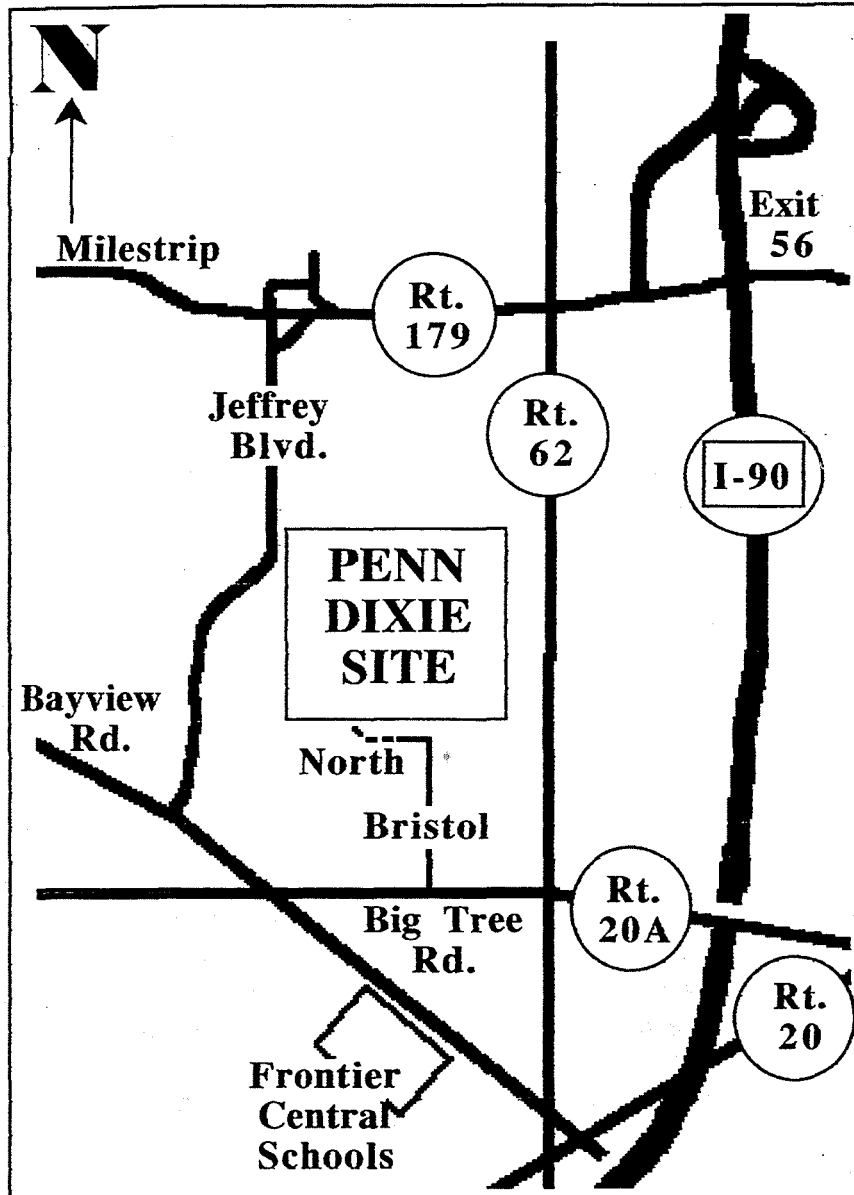
## INTRODUCTION

The site of a former quarry operation in Hamburg, New York (Fig. 1), was once the source of calcareous shale excavated and used for cement aggregate by the Penn Dixie Cement Company. A majority of the 57-acre site was quarried from the early-to-late 1960s, during which time 9 to 10 feet of shale was removed from the surface. A gray, somewhat flat "lunar landscape-appearing" surface now occupies a majority of the site. After the quarry operations ceased, weathering forces began to reveal 380-million-year-old Devonian fossils preserved within the Windom Shale. This highly fossiliferous unit underlies the entire site and provides an inexhaustible supply of fossils. In addition to the Windom Shale, several limestone units (the Genundewa, North Evans, and Tichenor) that outcrop on the site are also fossiliferous.

Professional and amateur paleontologists began visiting the Penn Dixie Site, which has often been referred to as the Bay View Quarry, in the early 1970s on a regular basis. Classes from numerous regional universities and the Buffalo Museum of Science began to regularly visit the site to collect the well-preserved, diverse, and highly abundant numbers of invertebrate fossils. Fossil fish and carbonized plant remains have also been collected, but with more difficulty. During the 1970s, 1980s, and early 1990s, the Penn Dixie Site changed ownership, and at times it was difficult acquiring access. It was also during this time period that the former quarry served as a "playground" for all-terrain vehicle (ATV) driving, target-shooting, and youth parties, and as a dumping area for stolen cars and other materials. Many who visited the site during this time period will remember ducking for cover, jumping out of the path of ATVs, and avoiding the broken glass and debris left over from parties.

## PRESERVATION OF THE PENN DIXIE SITE

In 1989 and 1990, the site was under the threat of light industrial development, but the community had other ideas for preserving it for future generations. A group of local citizens and geologists collaborated in 1990 to work on acquiring and preserving the site for future outdoor educational use. Initially, the plan was to acquire the property and leave it in its natural state for everyone to have an opportunity to study the local geology



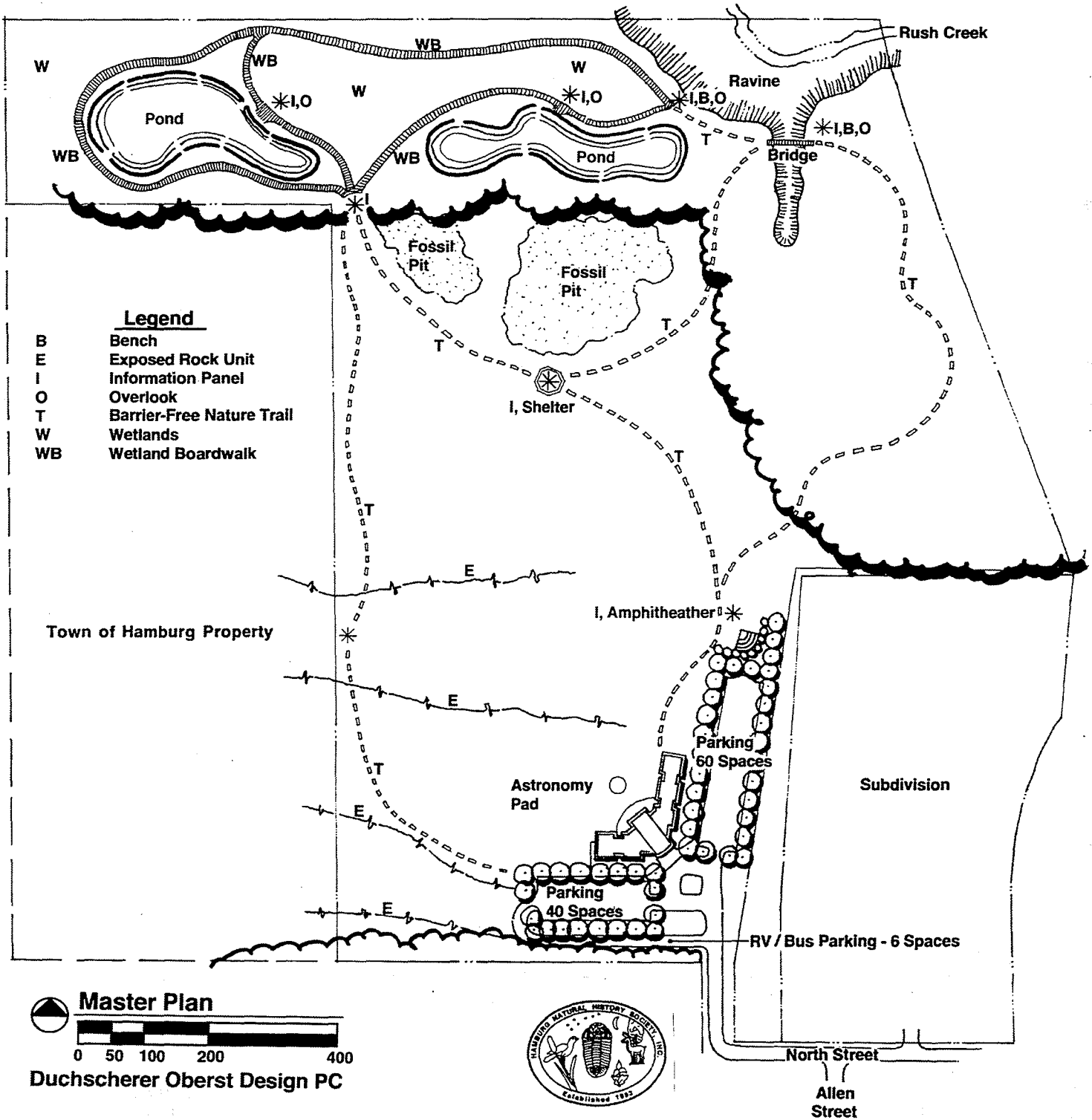
**Figure 1. Penn Dixie Paleontological and Outdoor Education Center  
Hamburg, New York**

and paleontology. The Hamburg Natural Society, Inc. (HNHS)-a non-profit 501 ( c ) ( 3 ) organization-was formed in 1993 to help with the purchase and development of the former Penn Dixie Site. The Town of Hamburg, under the leadership of Councilman Mark Cavalcoli (then a biology teacher at the Frontier Central High School ), worked with the HNHS to help buy the property. In December 1995, the Town of Hamburg successfully completed the purchase and deeded 32.5 acres to the HNHS in January 1996. The remainder of the acreage was deeded to the Hamburg Community Development Agency, which in turn used some of the land for affordable single-family homes. The development of the Penn Dixie Paleontological and Outdoor Education Center had begun. During two separate site cleanup efforts, one in 1996 and the second in 1998, five 30-yard dumpsters of garbage and debris, over 300 tires, five abandoned cars, two boats, a motorcycle, a golf cart, and a snowmobile were removed from the site.

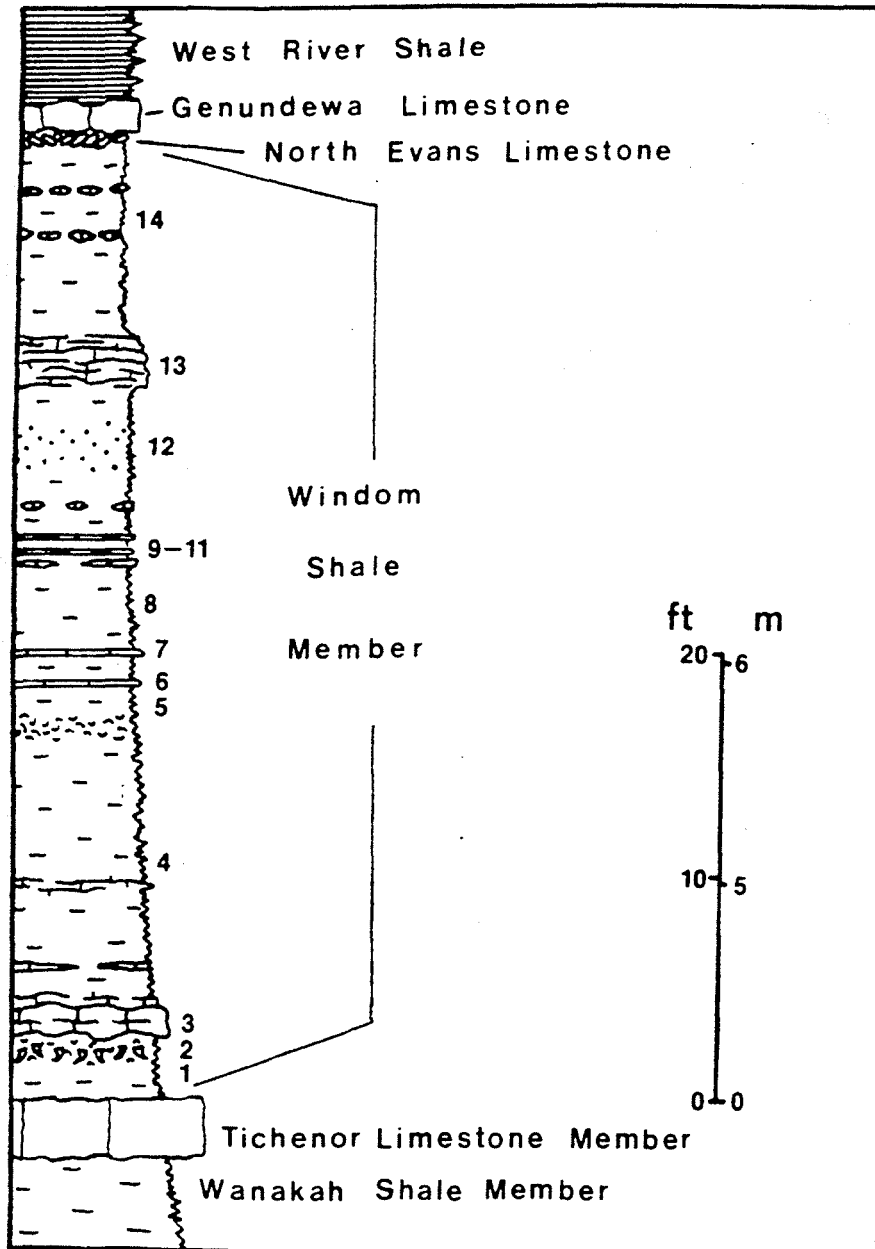
Fossil collecting and the study of the local geology were the initial intent for the preservation of this former quarry. After acquisition of the property in early 1996, the HNHS reexamined the other resources available for outdoor education programs in other areas of the natural sciences. The Society hired a development consultant and an architect to generate specific plans for the development of the Penn Dixie Site. Figure 2 illustrates the 32.5-acre site, which includes a new entrance way (now in use); parking area (temporary parking area currently in place); plans for barrier-free nature trails (hard surface and boardwalks); excavation, reconstruction, and revegetation of the wetland areas; shelters and outdoor classrooms; information panels; facilities for an astronomy pad; a 10,000-square-foot outdoor education center building with classrooms and meeting rooms; and a commitment from the National Weather Service to install a complete climatological station on site upon completion of building construction. These exciting and ambitious plans continue to be the goal of the HNHS and are helping draw students of classic geology, stratigraphy, and paleontology and visitors to the site from all over the U.S., Canada, and the world.

## **GEOLOGY, STRATIGRAPHY, AND PALEONTOLOGY**

The Penn Dixie Site contains an extensive exposure of 380-million-year-old fossiliferous Middle Devonian shales and limestones, serving as an excellent outdoor classroom for introducing students to the local geology and paleontology. The Genundewa Limestone, North Evans Limestone, Windom Shale, Tichenor Limestone, and Wanakah Shale at this site are readily accessible and have the most extensive exposure available for study in the Western and Central New York area. Figure 3 (Brett and Baird, 1982) illustrates the stratigraphic units present at the Penn Dixie Site. Prime exposures of these units are present (except for the West River Shale, which is mostly covered at the south end of the site). Brett (1974) and Brett and Baird (1982), along with Beuhler and Tesmer (1963), provide a detailed discussion of the stratigraphy and paleontology of these units. The warm tropical seas that covered this region of Western New York 380 million years ago, when the region was 20 to 30 degrees south of the equator, provided an environment conducive for a variety of invertebrate and vertebrate animals. The shales and limestones that formed during this time period preserved the remains of the diverse and abundant fauna that occupied these seas. The following brief discussion of the units present on the



**Figure 2. Proposed site plans for 32.5 acre Penn Dixie Paleontological and Outdoor Education Center in Hamburg, New York.**



**Figure 3. Stratigraphic units present at the Penn Dixie Site.** Stratigraphic subdivisions of the Windom Shale Member; standard section at Penn Dixie and unnamed creek near Big Tree; Units include: 1) *Ambocoelia umbonata* beds; 2) Bay View coral bed; 3) Smoke Creek bed; 4) barren shale interval; 5) Big Tree bed; 6,7) A-B limestones; 8) Buffalo pyritic beds; 9-11) C, D, and E limestones; 12) Penn Dixie pyritic beds; 13) Amsdell bed; 14) upper *Ambocoelia? praeumbona*-bearing Shales. (Modified from Brett and Baird, 1982).

site begins with the lower Wanakah Shale at the north end through the West River Shale to the south.

### **Wanakah Shale**

The Wanakah Shale is a medium gray to light-blue gray calcareous shale that weathers to a sticky clay. The Wanakah is exposed in the northeast section of the site in a tributary of Rush Creek and in the high banks on the south side of Rush creek. The tributary is a popular area for fossil collecting, as opposed to the steeper cliffs along Rush Creek. Brachiopods, bryozoans, trilobites, gastropods, pelecypods, echinoderms, corals, sponges, ostracodes, and some pyritized fossils may be found. Limited outcrop area in the tributary does not provide sufficient access for large groups.

### **Tichenor Limestone**

The Tichenor Limestone overlies the Wanakah shale and outcrops at the northern end of the site. Pyrite coating the surface of the Tichenor has weathered, exhibiting a reddish-rusty color that stands out from the surrounding overlying gray Windom Shale. At the northeast section of the site, an unexplained domal feature of the Tichenor, with several feet of relief, is present. A large exposure of the eroded surface is adjacent to this feature and extends to the north to one of the on site ponds. This area is often referred to as "crinoid heaven" due to the countless number of pelmatozoan columnals that are found lying on the surface. The Tichenor Limestone contains corals, brachiopods, pelecypods, trilobites, bryozoans, and echinoderms, which are offer difficult to remove from the hard limestone. The Tichenor Limestone is approximately 1.5 to 2 feet thick and underlies most of the site, dipping to the south-southwest along with the other units on site.

### **Windom Shale**

The Windom Shale is a medium to dark gray, variably calcareous mudstone with several thin argillaceous limestones, concretionary beds, and pyritic horizons (Beuhler and Tesmer, 1963). The Windom also weathers to a sticky clay. The Penn Dixie Site has the most complete and best exposure of Windom Shale in New York State, approximately 42 feet thick. Brett and Baird (1982) described 14 subdivisions within the Windom that could be recognized at this location (Figure 2). Fossil assemblage zones were described in Brett (1974) and Brett and Baird (1982). A disconformable basal contact with the Tichenor Limestone is exposed in the domal outcrop in the northeast section of the site. The upper Windom beds have been scoured, and shale clasts can be observed in the overlying North Evans Limestone. The Windom contains a variety of corals brachiopods, pelmatozoan columnals, bryozoans, trilobites, gastropods, pelecypods, cephalopods, and fish remains. The weathering of the shale exposes thousands of specimens lying on the surface, waiting to be found after 380 million years. Enrolled trilobites can be commonly found washed out of the shale after a good rain storm, along with horn corals, brachipods, and pelmatozoan columnals. Sections of the Windom are

not as fossiliferous as others, but careful study of the stratigraphic subdivisions identified by Brett and Baird (1982) will yield some interesting discoveries.

### **North Evans Limestone**

The North Evans Limestone is a buff-colored, weathered dark-gray crinoidal limestone that is 1.5 to 4 inches thick and contains angular clasts derived from the underlying Windom Shale. Erosional lag concentrations of hiatus concretions, pelmatozoan fragments, conodonts, fish plates, teeth, and mandibles, along with some brachiopod valves, are present (Brett and Baird, 1982). Although a variety of fish remains have been found at the Penn Dixie Site, they are difficult to find even with the good exposure of North Evans present. The buff-colored weathered surface of the North Evans and bone material make this unit easily recognizable.

### **Genundewa Limestone**

The Genundewa Limestone is a nodular, medium dark-gray, poorly bedded limestone that weathers to a light gray, which has been referred to as the "Styliolina Limestone" directly overlying the North Evans (Beuhler and Tesmer, 1963). This limestone unit is .5 to 1.2 feet thick, containing pelmatozoan columnals, cephalopods, brachiopods, wood fragments, and fish fragments (Brett and Baird, 1982). The carbonized wood can frequently be found, but other examples of the fauna are more difficult to obtain.

### **West River Shale**

The West River Shale is dark gray to black in color and overlies the Genundewa Limestone. Most of this unit is covered by overburden at the Penn Dixie Site and Eighteen Mile Creek provides a better opportunity to view this unit. Conodonts, cephalopods, pelecypods, and fish remains have been reported from the West River Shale at other localities in Western New York (Beuhler and Tesmer, 1963).

The preservation, diversity, and abundance of fossils at the Penn Dixie Site makes this an excellent site for students and amateur and professional paleontologists to be introduced to Western New York geology and paleontology. Plates 1 through 4 illustrate some of the more common fossils that can be found at the Penn Dixie Site. Weathering of the Windom Shale results in many corals, brachiopods, pelmatozoan columnals, and trilobites being continually exposed. Those who extend the effort to dig into the shale are rewarded with an extensive introduction to the variety of fossils preserved within the Windom. The northern section of the site provides an excellent outdoor classroom for students and visitors to be introduced to fossils and the local geology.

Plate 1  
Fossils of the Penn Dixie Site

CORALS



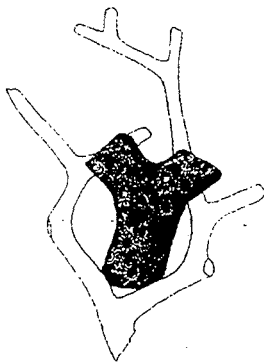
*Sterolasma rectum*



*Cystophyllum americanum*



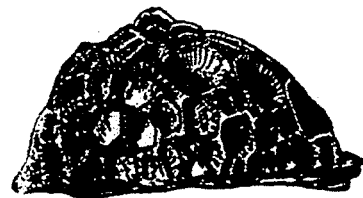
*Amplexiphyllum hamiltoniae*



*Trachypora sp.*

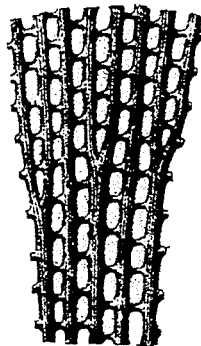


*Favosites hamiltomiae*



*Pleurodictyum americanum*

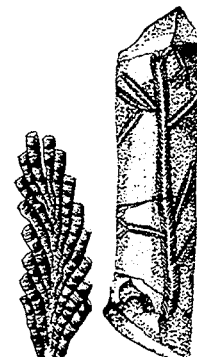
BRYOZOANS



*Fenestella sp.*



*Hederella sp.*

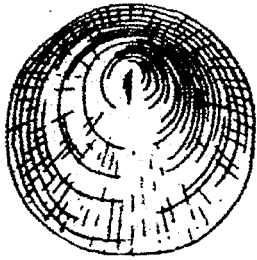


*Reptaria stolonifera*



Plate 2  
Fossils of the Penn Dixie Site

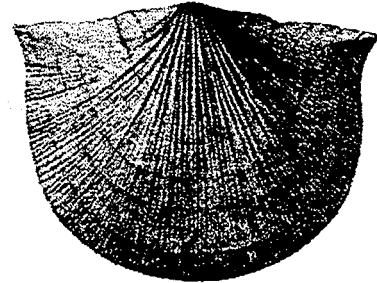
BRACHIOPODS



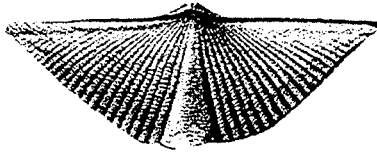
*Orbiculiodea sp.*



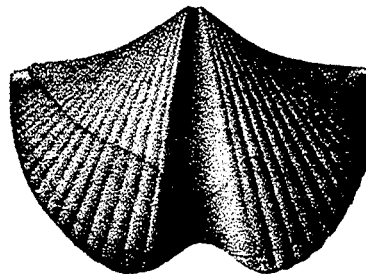
*Rhipidomella sp.*



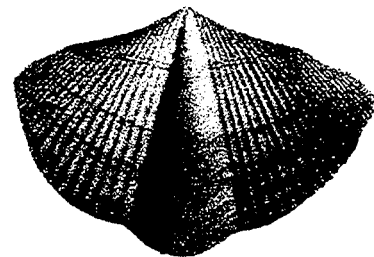
*Stropheodonta demissa*



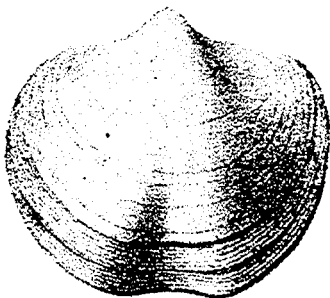
*Mucrospirifer mucronatus*



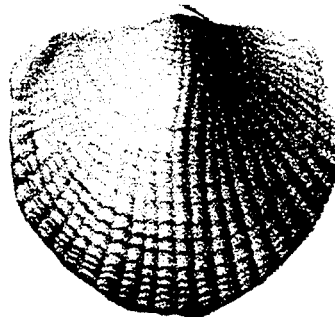
*Spinocyrtia granulosa*



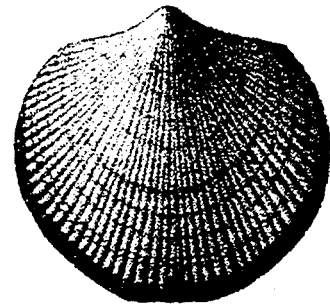
*Mediospirifer auduculus*



*Athyris spiriferoides*



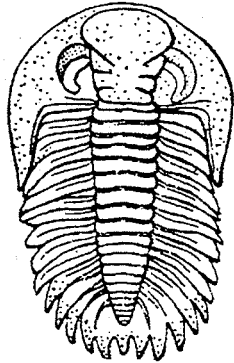
*Spinatrypa spinosa*



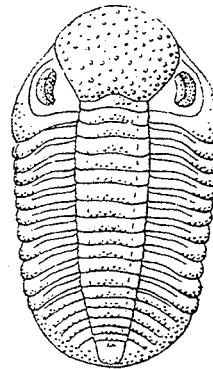
*Pseudoatrypa devonica*

Plate 3  
Fossils of the Penn Dixie Site

# TRILOBITES

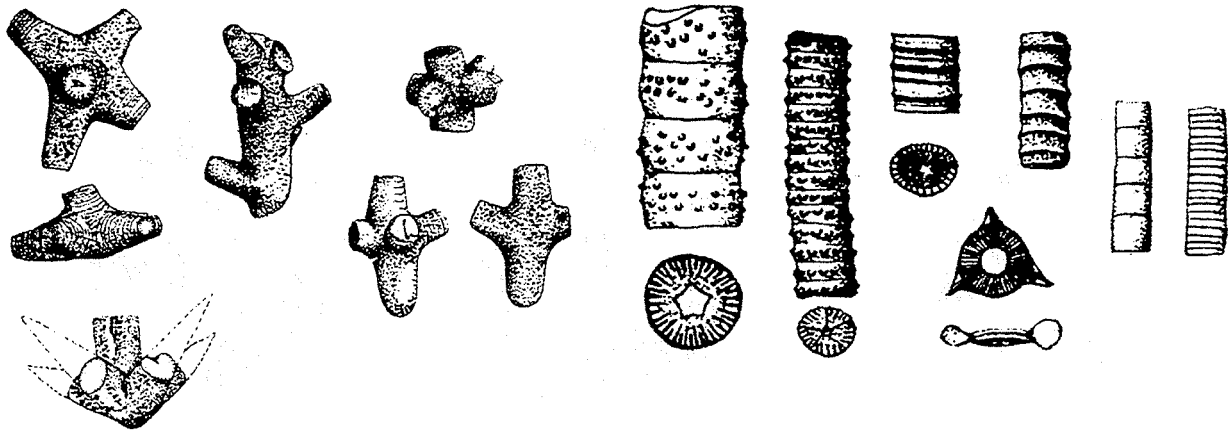


*Greenops boothi*



*Phacops rana*

# CRINOIDS



*Ancyrocrinus bulbosus*

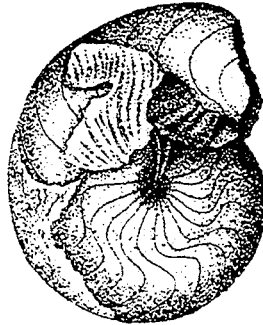
*Various Crinoid segments*

Plate 4  
Fossils of the Penn Dixie Site

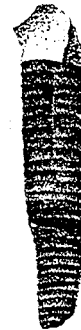
CEPHALOPODS



*Michlenoceras sp.*



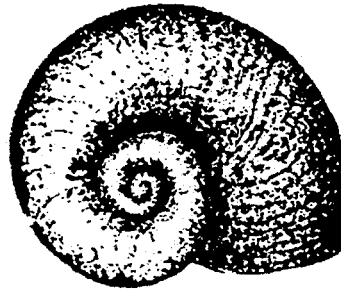
*Tornoceras uniangulare*



*Spyroceras sp.*

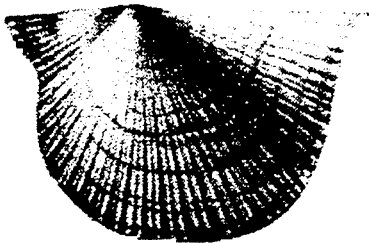


GASTROPODS

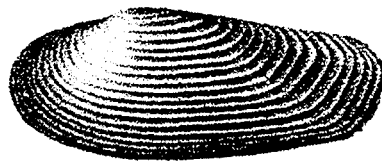


*Naticonema lineata*

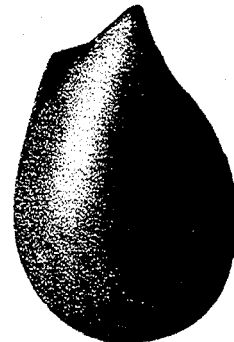
PELECYPODS



*Pterinopecten sp.*



*Palaeoneilo sp.*



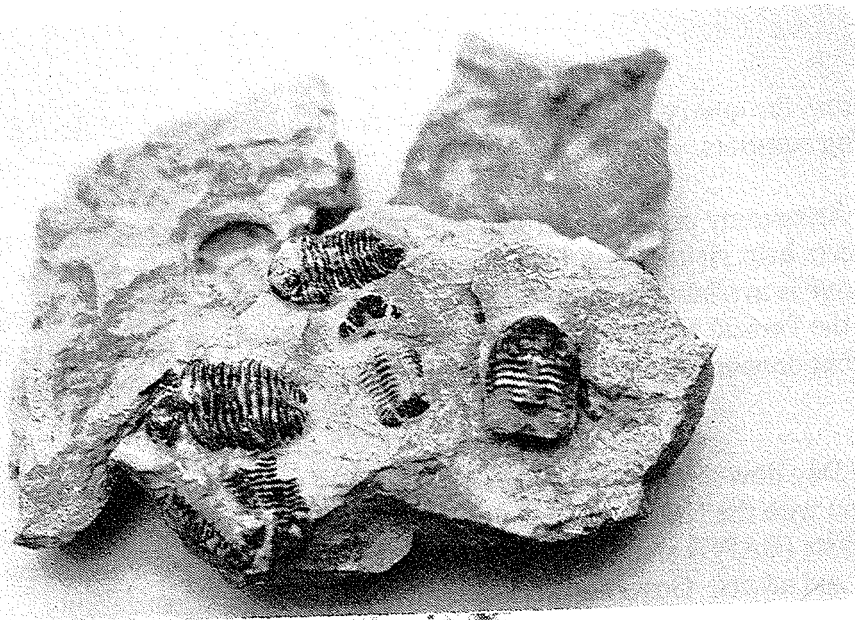
*Plethomytilus sp.*

## CURRENT PROGRAMS AT PENN DIXIE

The opportunity to actually find and collect ancient creatures that roamed the seas of Western New York 380 million years ago fascinates children and adults alike. The opportunity to collect and keep their fossil specimens amazes many visitors. The Penn Dixie Site provides an opportunity to open a whole new world of geology and paleontology to students, scouts, senior citizens, and the general public. It has also provided an outdoor educational experience for many hearing impaired, visually impaired, and physically disabled individuals. The preservation of this site has been extremely important. Commercial and residential development, along with landowners no longer permitting access to their property, have made many fossil collecting sites no longer accessible. In addition, the Penn Dixie Site can accommodate large groups, whereas many stream beds, road and railroad cuts, and shoreline exposures can not. Attempts to preserve collecting sites, such as Penn Dixie, must be made, or many classic collecting locations will be lost for future generations to visit and study.

The HNHS is an all volunteer organization that provides monthly "public day" programs to collect fossils and evening astronomy events at the Penn Dixie Site. In addition, birding programs were initiated in 1999 to view the more than 148 migratory and nesting bird species documented on site. Society volunteers provide weekday programs to school groups, introducing students to the local geology and fossil collecting. Weekend trips are also scheduled for scouts, families, birthday parties, universities, and amateur groups that regularly visit the site from Michigan, New York, Ohio, Pennsylvania, and West Virginia. Along with visitors who have come from all over the United States, individuals and families from Australia, Canada, Ecuador, England, Germany, and Japan have found the site exciting and educational. Visitors are provided a brief introduction to the local geology and the best collecting areas on site. Fossil identification cards, an illustration of what the area was like 380 million years ago, and a stratigraphic cross section are provided to visitors. First-time visitors and/or those who are just beginning to be introduced to paleontology and fossils learn quickly to develop their eyes to recognize the fossil forms. Once this is accomplished, they are amazed at how many specimens are lying on the surface. The volunteers also provide an introduction to the site, help everyone locate fossils, and encourage the visitors to think about what the environment was like during the Middle Devonian, when there was no land mass present in Western New York.

Several of the Society's public day programs have become very popular with the public, drawing from between 240 to 1,400 children and adults at an event. The June Children's Day program has, for the past few years, attracted 400 children and adults annually. Fossil contests to find the largest horn coral, the pelmatozoan columnals with the most articulated segments, and the total number of fossils in the jar grasp the children's interest. Prizes are awarded to the winners and then all the other children attending receive prizes. *Dieonychus*, a 70-million year old dinosaur representative (Dr. Donald Bird) and "Tilly the Trilobite" (Peg Hermann) welcome visitors. The solar system is



**Figure 4.**  
Windom Shale slab  
containing 5 complete  
trilobites, *Phacops rana*  
(Green), collected in  
August 1996 by Lorraine  
Haibach of Pennsylvania  
at the Penn Dixie Site.  
(Photo by Candi Simmons  
of PA).

**Figure 5.**  
“Spring Birding at Penn  
Dixie” group led by  
Michael Morgante and  
Micahel Turisk on April 18,  
1999. (Photo by J. Bastedo).



**Figure 6.**  
HNHS Board Member  
Dr. Thomas Kinsey  
introducing *Dieonychus*  
(Dr. Donald Birdd) and  
“Tilly the Trilobite”(Peg  
Hermann) at the Annual  
June Children’s Day  
program.

laid out to scale across the quarry floor, and volunteers make a Dobsonian telescope available for viewing sunspots.

The August Fossil-Astronomy program starts in late afternoon during the cooler portion of the day. Volunteers help visitors find fossils and, prior to the evening astronomy program, the telescope is available to view sunspots. The main feature of the evening program is to view the Perseid Meteor Shower, which peaks in early to mid-August each year. The weather has cooperated for two of the four years, and meteors were seen each of those years.

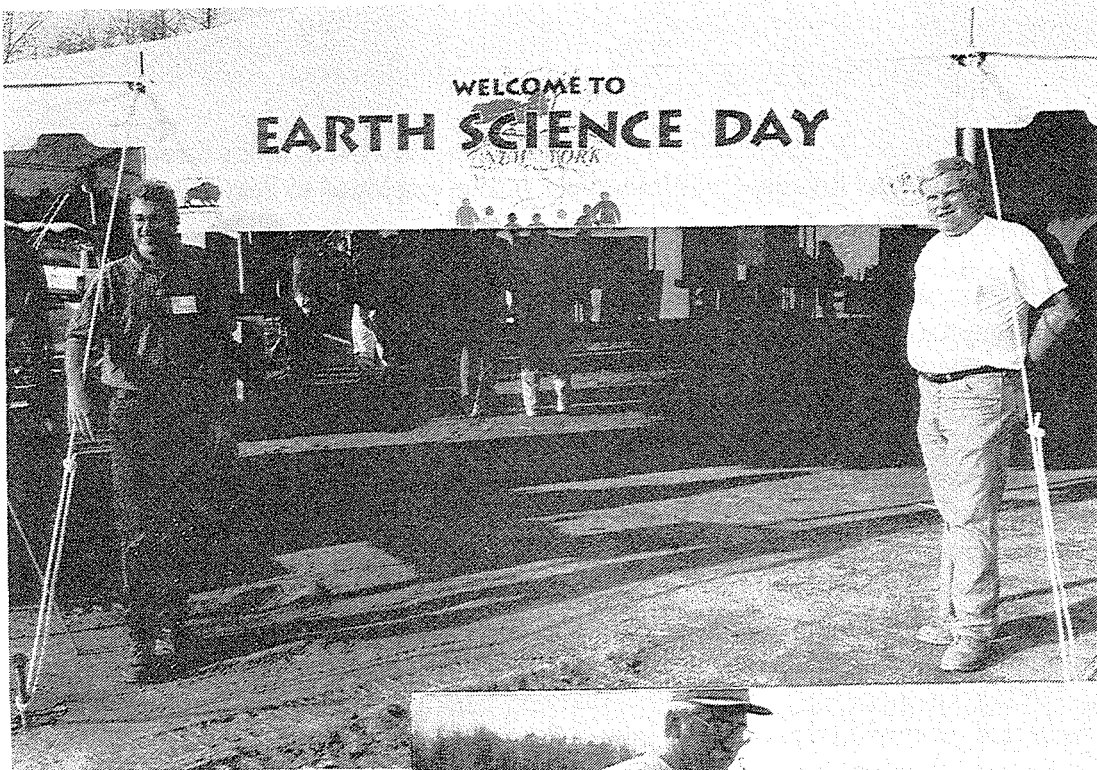
The October Public Day now features the Western New York Earth Science Day, which is held in conjunction with the National Earth Science Week. The Buffalo Association of Professional Geologists (BAPG) and the HNHS co-hosted this event in 1998 and drew over 1,400 children and adults. Governmental agencies, companies, organizations, schools, universities, and businesses that employ earth scientists or geologists were invited to offer an exhibit to explain what geologists do and answer questions from the public. A local drilling company provided a drill rig and crew to demonstrate installation of a groundwater monitoring well and rock-coring procedures. The exhibits and drilling demonstrations were free. Fossil collecting was also available for a nominal charge to non-members of the HNHS. The 2<sup>nd</sup> Annual Earth Science Day is scheduled for October 16, 1999, at the Penn Dixie Site from 9 AM to 3 PM with over 21 groups exhibiting, a drill rig providing demonstrations at 10:30 and 1:30 PM, and fossil collecting.

During May, July, and September, public day programs are held for fossil collecting that are becoming very popular with the public and groups visiting Western New York. The HNHS attempts to accommodate as many groups and individuals as possible with the volunteers available. Many families request an opportunity to visit the site, and the HNHS attempts to combine their visit with other groups or individuals. All visits to the Penn Dixie Site must be scheduled through the HNHS.

Many professionals now working in public schools, at universities, in the oil and gas field, as environmental geologists, at museums, and a variety of earth science or geological positions have passed through the Penn Dixie Site in the early development of their careers. In addition, many individuals who took an introductory geology course in college frequently return to the site to introduce their children to the geologic past.

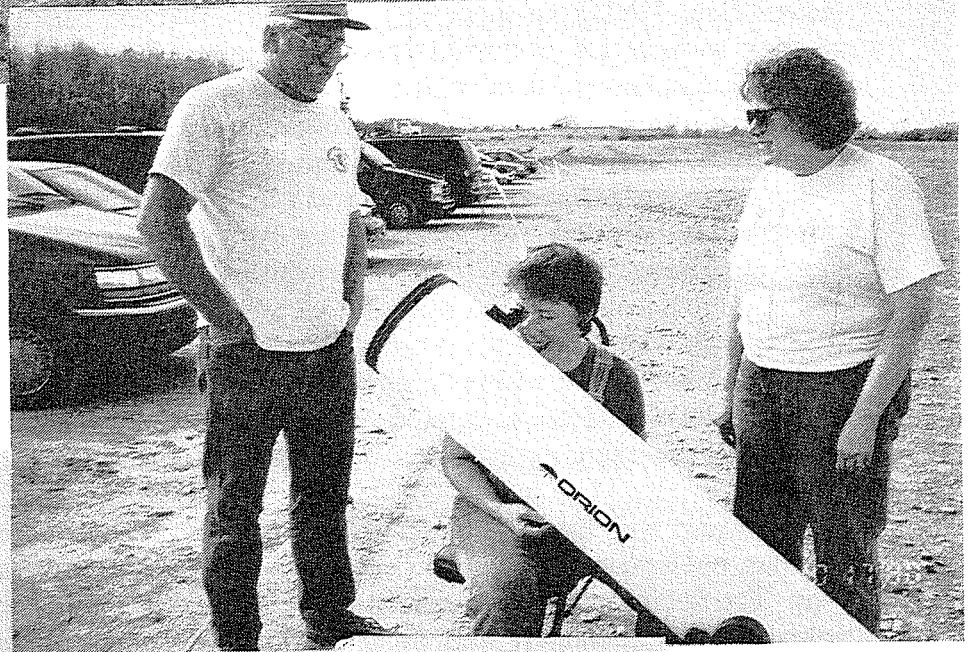
## **FUTURE PLANS**

The Penn Dixie Site is owned and operated by the HNHS. Four officers and eight directors administer the Society and are supported by 50 to 60 active volunteers and over 300 members. Twenty percent of the membership is from out of state, with some members in Canada and Japan. Seven membership categories—Student, Individual, Family, Associate, Corporate, School, and Life—help support the operations of the Society. All life membership dues are placed in an endowment fund to be used for operating the Penn Dixie Site. All the programs and activities of the HNHS are provided



**Figure 7.**  
**Earth Science Day**  
**October 17, 1998**  
**at the Penn Dixie**  
**Site. Co-Chairmen**  
**Richard Watt (L),**  
**BAPG President,**  
**And Jerry Bastedo,**  
**HNHS President.**

**Figure 8.**  
**HNHS members Paul**  
**Peg Zimmer**  
**insructing**  
**Bernadette Tomaselli**  
**on viewing sunspots**  
**at the**  
**October 17, 1998 Earth**  
**Science Day program.**



**Figure 9.**  
**Maxim Technologies,**  
**Inc. demonstrating**  
**drilling & coring**  
**procedures on Earth**  
**Science Day. The drill**  
**rig is in the back-**  
**ground and a direct**  
**push rig in the fore-**  
**ground.**

by volunteers. In addition to the development of site facilities, the HNHS looks forward to the day when part-time and full-time staff members will be employed to help provide outdoor educational programs.

The HNHS employs a part-time development consultant to raise funds for the educational programming and capital development of the Penn Dixie Site. The Society also has a part-time accountant on retainer to assist with the annual financial review and provide financial advice.

In 1997, the HNHS contracted an architectural firm to provide a design and cost estimate for a parking area, barrier-free nature trail, outdoor education center, outdoor classroom areas, and an astronomy pad for evening programs (see Figure 2). A \$1.75 million fund raising campaign began in November 1997 to raise funds for these capital improvements and provide the much-needed bathroom facilities. The Society initiated a \$1,000 Club pledge, with installments to be made over three years, designated for the construction of the building. HNHS members, corporations, foundations, banks, governmental funding sources, amateur and professional geological groups, and other funding sources have been, and continue to be, approached to aid in attaining the Society's capital fund goal. The officers were aware that this would be an ambitious road to travel, but progress is being made. A new entranceway was installed in May 1998 off of North Street; a locking gate was installed to keep dumpers and ATVs off the site; site cleanups were conducted in 1996 and 1998; a Penn Dixie entranceway sign was installed in July 1999; funds have been acquired to install information panels and a covered outdoor classroom (plans are to have installation begin in Fall 1999); funds have been obtained in 1998 and 1999 to help with educational programs; the barrier-free nature trail has been flagged; and in October 1999 the nature trail will be cleared through the leadership of an Eagle Scout candidate and his scout troop. Fund-raising efforts continue, and the officers are continually searching for additional opportunities to pursue funds.

Simultaneous with fund-raising efforts, educational programs for schools, scouts, families, public days, and amateur and professional geologists continue to increase every year. The Society anticipates expanding the educational programming with qualified volunteers, and eventually staff, to augment a variety of courses in the natural sciences. Upon completion of the outdoor education center building, the National Weather Service has committed to installing a complete climatological station at the Penn Dixie Site.

The HNHS appreciates the support it has received from volunteers, corporations, foundations, governmental agencies, and private individuals to offer outdoor educational programs and to develop the Penn Dixie Site. The HNHS has one of the finest and most dedicated groups of volunteers. The volunteers provide the programs, help develop and maintain the site, and provide the ideas that establish the future directions and goals of the Society. The HNHS is especially appreciative of the leadership efforts and support provided by Mark Cavalcoli, Hamburg Town Councilman, and the Hamburg Town Board for acquisition of the Penn Dixie Site. Their continued support of the educational programs and site development is greatly appreciated.



The HNHS was founded in 1993 to promote the study of the natural sciences with an emphasis on the field activities associated with the geological and biological sciences; to develop, administrate, and maintain the Penn Dixie Paleontological and Outdoor Education Center in Hamburg, New York; promote a regional fossil collecting site to foster and encourage a medium for the public to study and collect fossils; encourage and promote upper-level training of in-service and pre-service teachers; and to aid in obtaining and administering funds to promote the study of natural history in Western New York. The current plan for the Penn Dixie Site is to provide outdoor education programs in the natural sciences for students and visitors to have a hands-on experience. If you are interested in helping support the goals of the Society and visiting the Penn Dixie Site, contact the HNHS at (716) 627-4560 or P.O. Box 772, Hamburg, New York 14075. Your support of the outdoor educational programs offered by the HNHS will be greatly appreciated. As a non-profit organization, all donations are tax deductible.

### ACKNOWLEDGEMENTS

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## ROAD LOG FOR PENN DIXIE SITE VISIT

<u>Total Miles</u>	<u>Miles from last point</u>	<u>Route Description</u>
		Leave Fredonia Campus and take the NYS Thruway to Exit 56 where the road log begins.
0.0	0.0	BEGIN ROAD LOG AT INTERSECTION OF TOLL BOOTH EXIT & RT. 179.
0.2	0.2	At Rt. 179, turn right (north) to intersection of U.S. Rt. 62, South Park Avenue. Turn left (south) onto South Park Avenue.
1.3	1.1	Continue on South Park Avenue to intersection with Big Tree Rd. Turn right (west) onto Big Tree Rd.
1.6	0.3	Cross over single railroad track and at interesection of first road, turn right onto Bristol Road.
1.8	0.2	Continue north on Bristol Rd. to North St. Turn left (west) on to North St.
2.0	0.2	Continue west to entrance road of the Penn Dixie Paleontological and Outdoor Education Center and meet in the parking area on site. The field trip will begin with an introduction to the Penn Dixie Site and a visit to the important exposures and fossil areas present on the site. Representative fossils preserved in the Genundewa and North Evans Limestones, Windom Shale, Tichenor Limestone, and Wanakah Shale may be collected.

