

THE PENN DIXIE SITE: A CLASSIC AND UNIQUE PALEONTOLOGICAL & OUTDOOR EDUCATION CENTER

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The Hamburg Natural History Society, Inc. (HNHS) is a nonprofit educational corporation that owns and operates The Penn Dixie Paleontological and Outdoor Education Center in Hamburg, New York (Fig. 1). The HNHS was founded in 1993 to promote the study of the natural sciences, with a particular emphasis on field activities associated with the geological and biological sciences. The HNHS offers a wide variety of hands-on educational programming to students of all ages, both at the Penn Dixie Site and off-site at local schools, libraries, and civic group meetings. Since its inception, the HNHS has expanded its educational curriculum to include public educational programming in astronomy and ornithology to complement its core study in geology and fossil collecting and identification. Unlike conventional museums or research facilities, the Penn Dixie Site is a hands-on outdoor educational facility—one at which visitors of all ages are encouraged to actually collect and keep 380-million-year-old fossils – “*Where Science Comes Alive*”.

The site of a former quarry operation that was 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 until the late 1960s, during which time 9 to 10 feet of shale was removed from the surface. A gray, somewhat flat “desert-like” or “lunar landscape-appearing” surface now occupies a majority of the site. After quarry operations ceased, weathering forces began to expose 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 outcrop on the surface. The Wanakah Shale is also exposed, underlying the Tichenor Limestone, in a tributary that flows into Rush Creek and in cliffs along Rush Creek on the northern section of the site. All of these units contain a variety of fossils.

PRESERVATION OF THE PENN DIXIE SITE

The HNHS administers and maintains the Penn Dixie Site, a 32.5-acre former shale quarry that was purchased by the Town of Hamburg in 1995 and deeded to the HNHS in 1996. The HNHS then took immediate steps to clean up the site and establish plans for its transformation into a

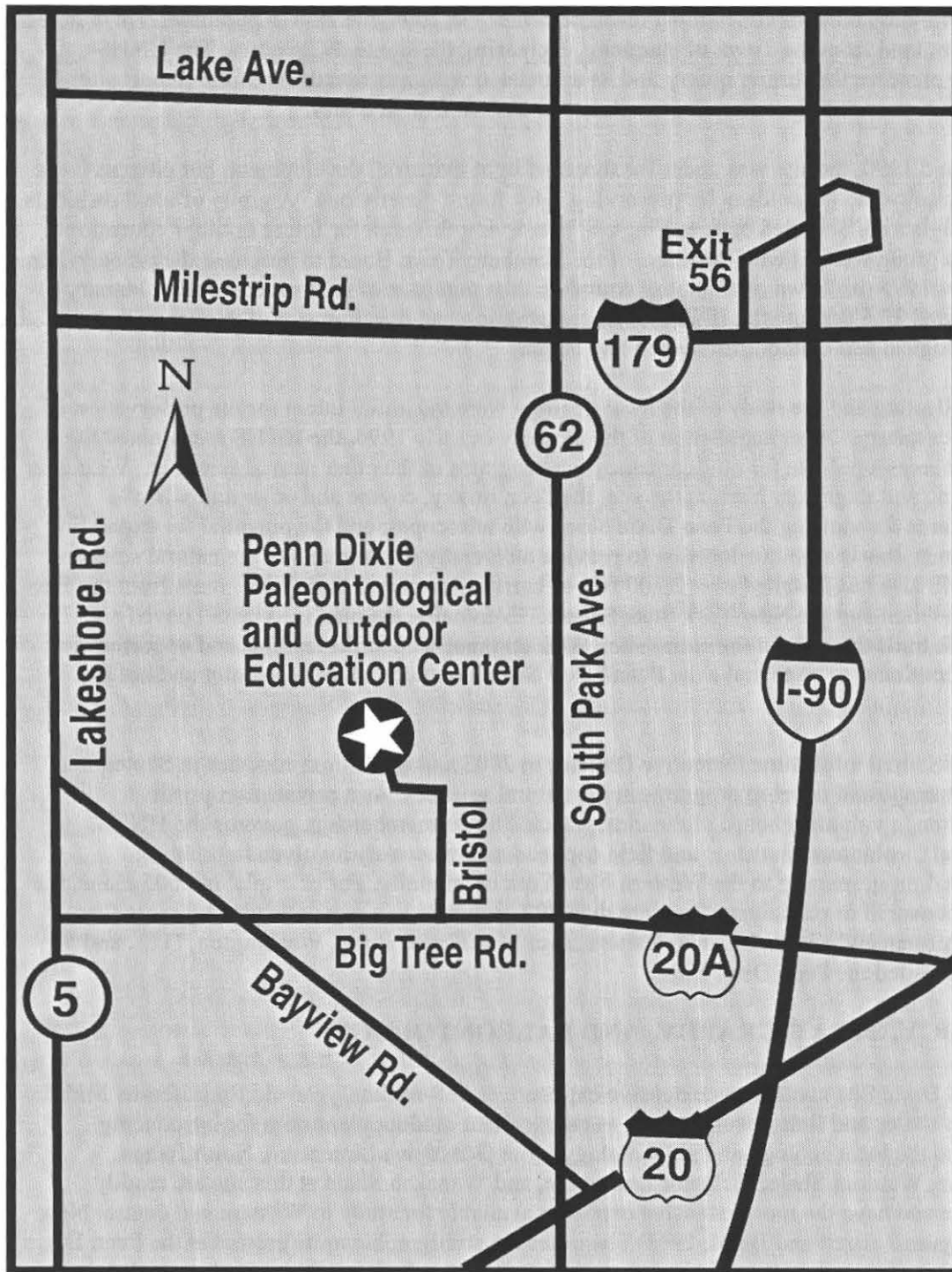


Figure 1. Location of Penn Dixie Paleontological and Outdoor Education Center in Hamburg, New York.

truly world-class outdoor educational resource center. In 2004, the HNHS purchased 16.75 acres of adjacent land from the Town of Hamburg, increasing the site to 49.25 acres. The HNHS' efforts to preserve the former quarry and its associated wetlands saved one of the richest sites of 380-million-year-old Devonian Era fossils in the eastern United States.

In 1989 and 1990, the site was under the threat of light industrial development, but citizens from the community had other ideas for preserving it for future generations. A group of local residents and geologists collaborated on acquiring and preserving this area for future outdoor educational use. This group worked with members of the Hamburg Town Board to purchase the property. In December 1995 the Town of Hamburg completed the purchase of the property and in January 1996 deeded 32.5 acres to the HNHS. The preservation and development of the Penn Dixie Paleontological and Outdoor Education had begun.

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 the other natural sciences. With over 143 nesting and migratory birds at the site; the deer, turkey, coyote and other animals; the spacious area for viewing the Penn Dixie Skies with telescopes; and the potential for expanding the wetlands, this is a unique location to provide a diversity of programs in the natural sciences. The HNHS also has installed over 2,100 feet of barrier-free paved trails with grants from the East Hill Foundation and the New York State Senate. Eventually, the plan is to install paved and boardwalk trails throughout the entire site. With all these wonderful features and opportunities, the goal continues to be to make the Penn Dixie Site an outdoor education center and not a museum.

The HNHS hired a full-time Executive Director in 2003 and a full-time educator in September 2004 to manage and develop programs in the natural sciences. As a private non-profit organization, a volunteer board of directors, elected by its membership, governs the HNHS. HNHS staff, volunteer educators and field trip leaders are actively involved in bringing educational programming to the Western New York community. For example, in 2005 alone, the HNHS sponsored or participated in more than 392 programs that were attended by more than 77,081 children and adults. In 2005, visitors from 34 different states, Washington, D.C., and 5 countries visited the Penn Dixie Site.

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 Genudewa 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 Western and central New York. Figure 2 (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 by overburden at the south end of the site). Brett (1974) and Baird and Brett (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 to 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

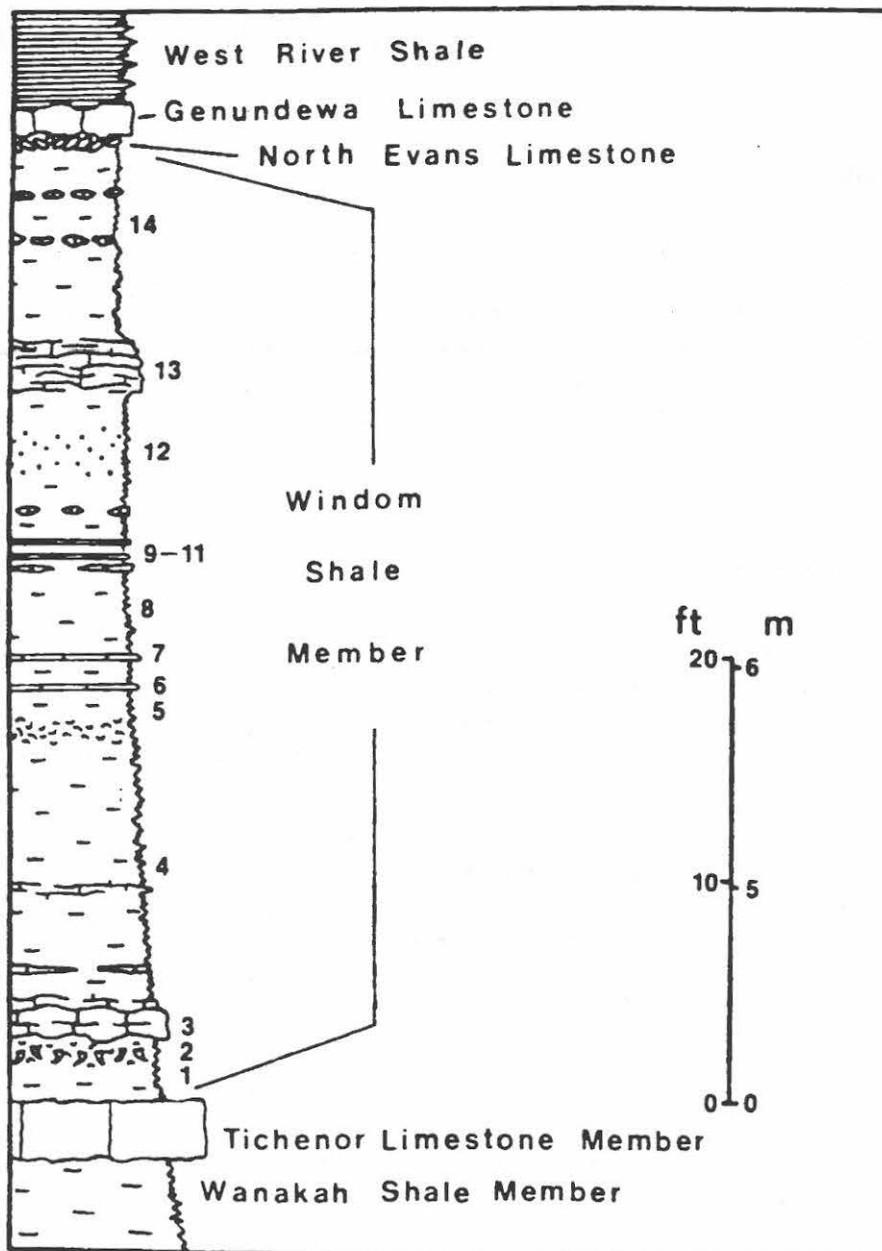


Figure 2. Stratigraphic units present at the Penn Dixie Site. Stratigraphic subdivisions of the Windom Shale Member; standard section at Penn Dixie and unnamed creek near Big Tree; Units include: 1) *Ambocoelia umbonata* beds; 2) Bay View coral bed; 3) Smoke Creek bed; 4) barren shale interval; 5) Big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

fauna that occupied these seas. The following brief discussion of the units present on the 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 to Rush Creek and in the high banks on the south side of Rush Creek. The tributary is a popular area for fossil collecting, viewing the large calcareous concretions, and some pyritized burrows, rather than the steeper cliffs along Rush Creek. Brachiopods, bryozoans, trilobites, gastropods, pelecypods, echinoderms, corals, sponges, ostracodes, and some pyritized fossils may be found. Limited area in the tributary does not provide 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. This feature is not believed to be a result of the quarrying operation, but possibly from glacial rebound. A large exposure of the eroded limestone surface is adjacent to this feature and extends 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, all of which are 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 pyretic horizons (Beuhler and Tesmer, 1963). In addition, at the southwest portion of the site there is an excellent exposure of phosphate nodules covering the surface. 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 (Fig. 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 more rarely fish remains, plant material, and blastoid and crinoid calices. The upper Windom has a variety of pyritized fossils, burrows, and most-likely fecal remains weathering out on the surface. Some of the pyritized fossils include brachiopods, pelecypods, cephalopods, trilobites, and blastoids (Fig. 3). The weathering shale exposes thousands of specimens lying on the surface, waiting to be found after 380 million years.

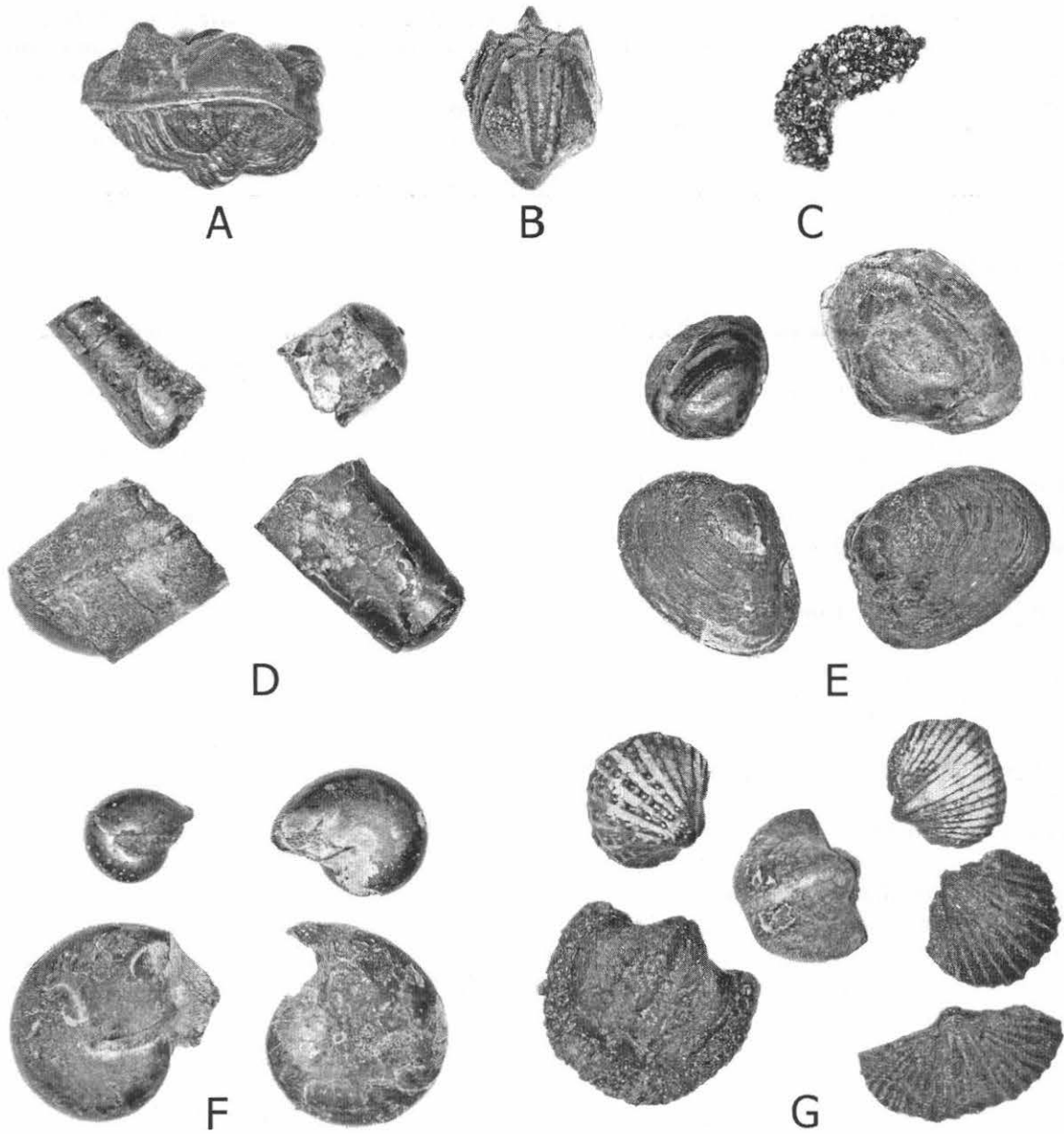


Figure 3. Pyritized fossils that weathered out of the Penn Dixie pyrite beds at the southern end of the site from the Upper Windom Shale. A-*Greenops* sp., enrolled, 0.7 cm wide; B- Blastoid calyx, 0.5 cm wide; C-pyrite, 1 cm long – burrows, nodules, or other shapes may weather out; D-Cephalopods, *Michlinoceras* sp. , largest 1 cm across; E-Pelecypods, largest 1 cm; F-Cephalopods, *Tornoceras* sp. , smallest is 0.4 cm across; G-Brachiopods, largest is 1 cm across; Blastoid was collected by Amanda Czechowski, pyrite specimens collected by Richard Spencer, and all other specimens collected by the author.

Enrolled trilobites can be commonly found washed out of the shale after a good rainstorm, along with horn corals, brachiopods, and pelmatozoan columnals. Multiple complete trilobites on a slab have been collected from the Lower Windom and complete specimens of *Phacops rana*, like the specimen in Figure 4, keep collectors returning for their perfect specimen. 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. In addition, Penn Dixie staff and volunteer guides will direct visitors to the better collecting areas on the site.

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). Carbonized plant remains are also found in this unit. Although a variety of fish remains have been found at the Penn Dixie Site (Fig. 4), 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 Limestone (Buehler and Tesmer, 1963). Carbonized wood can be frequently 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 Penn Dixie 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 (Buehler and Tesmer, 1963).

The preservation, diversity, abundance of fossils, and the extensive bedrock exposures at the Penn Dixie Site makes this an excellent outdoor classroom for students as well as amateur and professional paleontologists to be introduced to Western New York geology and paleontology. In addition, students and possible future scientists from pre-school through college are being introduced to the rich geologic history of Western New York by the thousands each year. 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 on the surface. Those who extend the effort to dig into 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. Many specimens found at Penn Dixie can be viewed on the web site at www.penn Dixie.org.

Plate 1
Fossils of the Penn Dixie Site

CORALS



Sterolasma rectum



Cystophyllum americanum



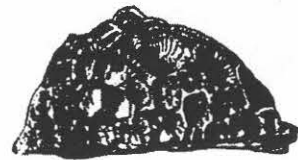
Amplexiphyllum hamiltoniae



Trachypora sp.

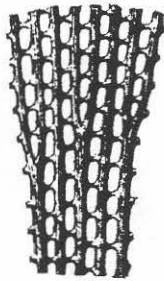


Favosites hamiltoniae



Pleurodictyum americanum

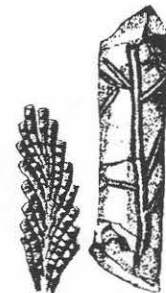
BRYOZOANS



Fenestella sp.



Hederella sp.



Reptaria stolonifera

Drawings from "Geology and Palaeontology of Eighteen Mile Creek" by Amadeus Grabau
Plates compiled by Scott Clark

Plate 2
Fossils of the Penn Dixie Site

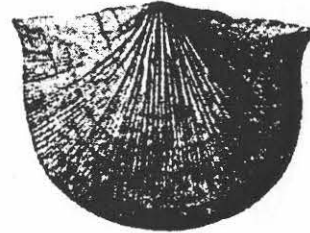
BRACHIOPODS



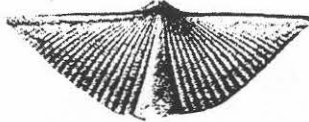
Orbiculiodea sp.



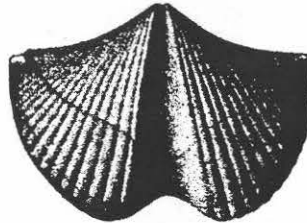
Rhipidomella sp.



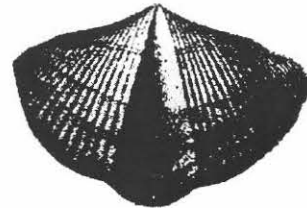
Stropheodonta demissa



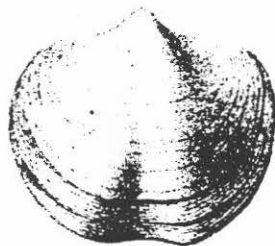
Mucrospirifer mucronatus



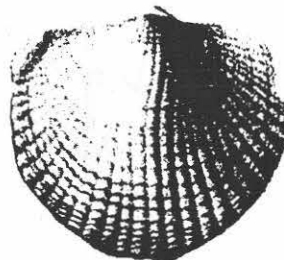
Spinocyrtia granulosa



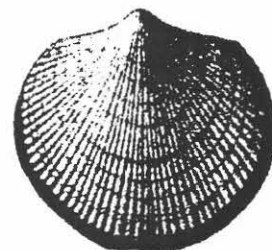
Mediospirifer auduculus



Athyris spiriferoides



Spinatrypa spinosa

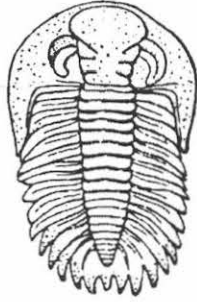


Pseudoatrypa devonica

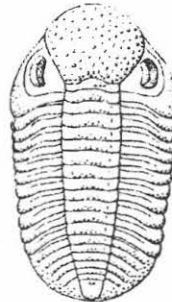
Drawings from "Geology and Palaeontology of Eighteen Mile Creek" by Amadeus Grabau
Plates compiled by Scott Clark

Plate 3
Fossils of the Penn Dixie Site

TRILOBITES

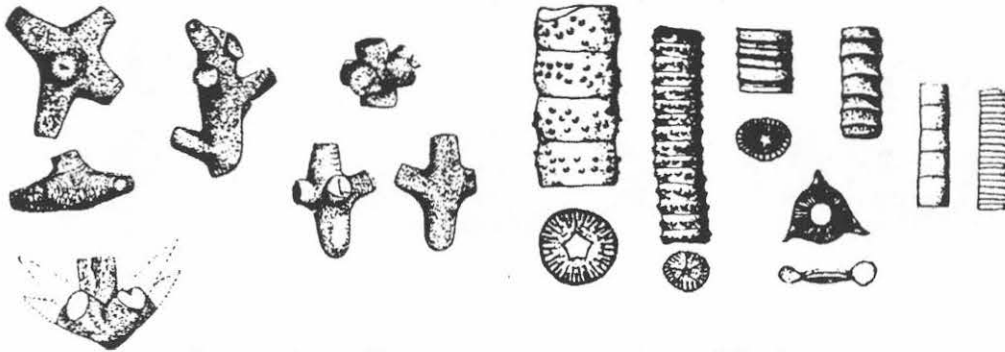


Greenops boothi



Phacops rana

CRINOIDS



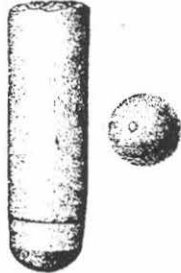
Ancyrocrinus bulbosus

Various Crinoid segments

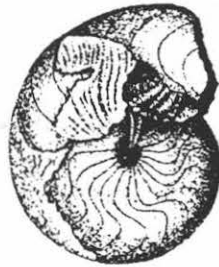
Drawings from "Geology and Palaeontology of Eighteen Mile Creek" by Amadeus Grabau
Plates compiled by Scott Clark

Plate 4
Fossils of the Penn Dixie Site

CEPHALOPODS



Michlenoceras sp.



Tornoceras uniangulare



Spyroceras sp.

GASTROPODS



Naticonema lineata

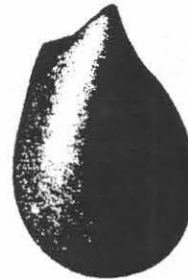
PELECYPODS



Pterinopecten sp.



Palaeoneilo sp.



Plethomytilus sp.

Drawings from "Geology and Palaeontology of Eighteen Mile Creek" by Amadeus Grabau
Plates compiled by Scott Clark

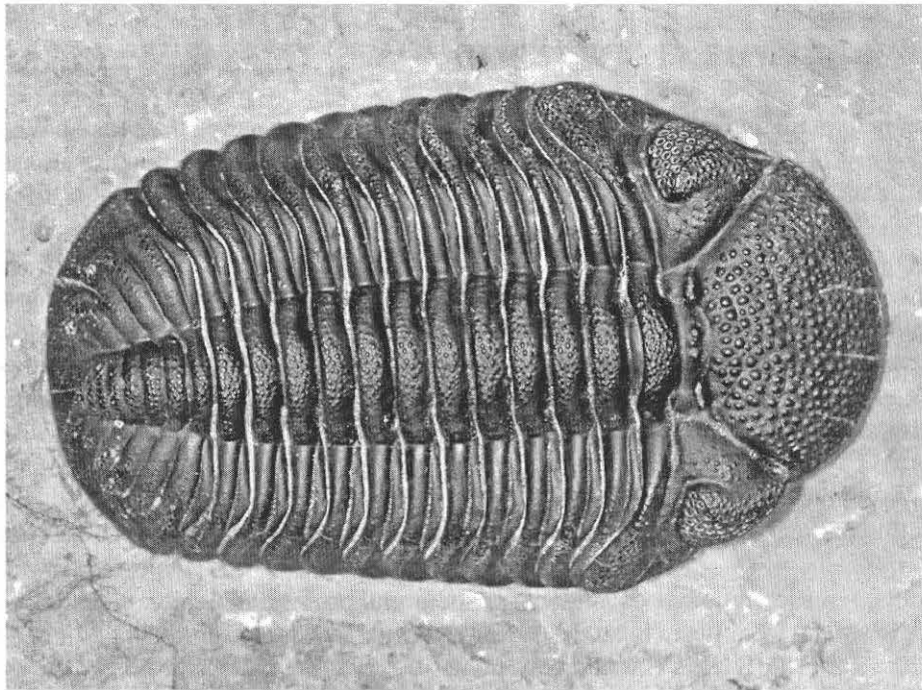


Figure 4. *Phacops rana* collected by Jon Luellen and prepared by Gerry Kloc. Collected during the Dig with the Experts in May 2005 from the Lower Windom Shale at Penn Dixie. Trilobite is 2 inches long.



Figure 5. Fossil fish bone material, 5.6 cm in the longest dimension, collected from weathered North Evans Limestone during August 2006 by the author.

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. Children are amazed that these fossils are older than the dinosaurs and their parents and that they can keep what they find! The Penn Dixie Site provides an opportunity to open a whole new world of geology and paleontology, along with the other natural sciences, to students, scouts, senior citizens, and the general public. It has provided an outdoor educational experience for many hearing impaired, visually impaired, totally blind, and physically challenged individuals. The preservation and continued development of this site is extremely important. Commercial and residential development, along with landowners restricting property access, have made many fossil collecting sites extinct or no longer accessible. In addition, Penn Dixie can accommodate large groups, whereas many streambeds, road and railroad cuts, and shoreline exposures cannot or are impractical. Attempts to preserve collecting sites, such as Penn Dixie, must be made, or many classic collecting and geologic locations will be lost for future generations to visit and study.

Students, scouts, families, summer day camps, amateur and professional geologists find this classic geologic site an ideal place to study geology, collect fossils, observe over 143 nesting and migratory birds, view the WNY skies and explore nature. Guided tours, astronomy programs, birthday parties, Boy and Girl Scout activities, corporate and civic picnics, and family outings are available by reservation.

The HNHS has scheduled a variety of programs for the 2006 season. The Penn Dixie Site is open to the public every Saturday, from May through October 9 AM to 4 PM; Monday through Saturday, 9 AM to 4 PM, mid-June through August to collect fossils. Group, birthday party, corporate, visits, or other events may be scheduled by calling (716) 627-4560. Events are held rain or shine. Special Events, evening astronomy programs, bird walks, summer day camps, group and family tours are held throughout the year. Some of the Special Events and activities scheduled for 2006 include:

- “Dig with the Experts” on May 20th
- 12th Annual Children’s Day on June 4th
- 7th Annual Miss Buffalo Nature Cruise and Buffalo Lighthouse Tour on June 11th
- “Big Toys Event” on July 16th
- Mid-Summer’s Night Adventure on August 12th
- Special Event on September 11th
- 9th Annual WNY Earth Science Day Celebration on September 30
- 4th Annual Scare-assic Park Halloween Event – LOST TREASURE OF THE GHOSTLY PIRATES on October 7.

Evening astronomy programs are held at Penn Dixie one Saturday night a month April through November. Visits may be scheduled at other times by calling Penn Dixie at (716) 627-4560. Additional on-site and off-site events are open to the public, which are listed on the Penn Dixie website www.penn Dixie.org.

A GROWING MEMBERSHIP ORGANIZATION

The HNHS has experienced phenomenal growth since its inception only thirteen years ago. While most of the HNHS members come from Western New York, the society

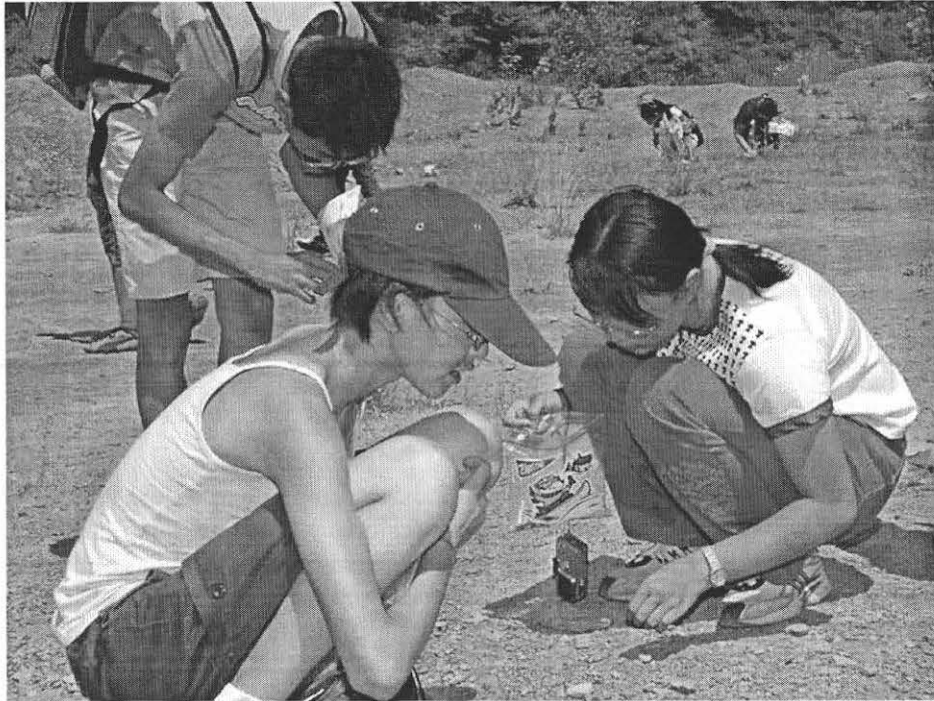


Figure 6. Chinese students introduced to fossil collecting with a group of 40 Chinese and Algerian students that visited Penn Dixie in 2005.



Figure 7. Visitors viewing solar flares and sunspots through filtered telescopes during the 8th Annual WNY Earth Science Day celebration at Penn Dixie in 2005.

counts among its membership residents from over 20 states, and Canada. Over 800 memberships, at a variety of levels, contribute to the daily operations of the HNHS and the Penn Dixie Site, along with increasing the HNHS endowment fund. Visitors from all over the U.S. and from Algeria, Australia, Canada, China, England, France, Germany, Israel, Italy, Japan, Lebanon, Mexico, New Zealand, Pakistan, Scotland, Spain, Sweden, and Switzerland have found the Penn Dixie Site a tremendous educational resource. **Penn Dixie was ranked No. 20 by attendance of the Top 25 Tourist Attractions in WNY in 2004 & 2005** by Business First of Buffalo, NY. The HNHS has a membership and corporate drive underway in 2006 to help attain a self-sustaining level in the near future.

OUR PLANS FOR GROWTH

The HNHS has established an ambitious capital fundraising campaign to ensure that the HNHS can continue to share with the public the many unique features of the Penn Dixie Site and meet the ever-increasing demand for the outdoor educational programming that it has been providing to the public over the past eleven years. The primary focus of the HNHS growth plan is the complete transformation of the Penn Dixie Site into a state-of-the-art educational facility in the natural sciences. The HNHS has taken a phased approach toward this goal and has:

- Removed the accumulated trash and debris from years of neglect and illegal dumping
- Completed a new entrance roadway and welcome sign to the Penn Dixie Site
- Drafted architectural drawings created for an outdoor education center on site
- Constructed an all-season parking area
- Installed over 2,100 feet of paved barrier-free trails
- Constructed registration and educational shelters
- Installed six picnic tables and two bike racks
- Cleared more than a mile of nature trail through a wooded portion of the site surrounding the eastern and northern sections of the former quarry

Future plans for the site include:

- Additional paved and boardwalk trails throughout the site so that it is entirely wheelchair and handicapped accessible
- Build an outdoor education center building for year-round programming
- Construct an astronomy pad with facilities for evening and day programs
- Enlarge and enhance the wetland areas
- Install additional information panels on fossil identification, site stratigraphy, geology, and biology for self-guided tours
- Pave the entrance roadway and parking areas
- Construct an amphitheater for outdoor programming
- Formalize classes and programming in the natural sciences for year-round on-site visitors
- Develop adult education and children's programming
- Make the education center available for community meetings.

The current plans for the outdoor education center include a community room for large lectures and meetings, a room for exhibits, a media center that will house a library and other teaching materials, a gift shop, classrooms, a research lab, and an observation deck to view the site. More than 80% of the square footage of the center will be devoted to education. A seismographic and climatological station are also planned to be included in the center.

HOW CAN YOU HELP

The HNHS has some ambitious plans to further develop this site into a world class outdoor educational, recreational, and tourist attraction for the Niagara Region. In completing the first phase, the HNHS has effectively preserved a unique educational and green space resource for future generations. With the completion of the next phases of development, the HNHS will maximize the educational opportunities afforded by the Penn Dixie Site for all of Western New York and the region. The Penn Dixie Site is already proving a powerful draw for visitors from all across North America and, indeed, the world. Completion of the site's educational facilities will only enhance this draw and bring increased numbers of visitors to the site. Programs and events were made possible by the support of over 320 volunteers in 2005, a 5% increase in the number of volunteers over 2004.

The difficult economic conditions in Western New York are now impacting the HNHS and the Penn Dixie Site. Decreases in support from Erie County, New York State, the Federal Government, and foundations have cut funding needed to implement our programs. The HNHS (a non-profit organization) needs to secure additional funding to keep our current level of public programs at Penn Dixie. The economic climate affecting non-profit organizations in our region has placed some unparalleled financial challenges on them. Many groups are requesting limited funds from foundations and government resources. The HNHS is attempting to raise funds by increasing memberships, admissions, programs, donations, grants, and seeking corporate support. The HNHS' goal is to become self-sustaining. Many members and donors, who have not even been to Penn Dixie, are willing to support our cause to preserve and develop this classic site for future generations.

You can help continue the tremendous advances and accomplishments that have been made to date by:

- Sending a donation.
- Taking out a membership.
- Recruiting a new HNHS member.
- Bringing visitors to Penn Dixie.
- Recruiting a Corporate member.
- Enrolling your family in a program or summer day camp.

The HNHS is actively seeking financial support from a variety of sources to attain its goal of transforming the Penn Dixie Site into an educational resource that fully utilizes and shares the unique resources contained within the site. If you are interested in learning more about how you can help support the HNHS and the Penn Dixie Site, please call the HNHS at 716/627-4560. Visit our web site www.penn Dixie.org for program and membership information. We look forward to having you visit Penn Dixie in 2006.

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>
		Depart the Adams Mark Hotel and turn right
0.0	0.1	Proceed to first stop sign and turn right onto Lower Terrace Street.
0.2	0.1	Proceed to Bingham Street (next right) and turn right
0.4	0.2	Proceed under Rt. 190 bridge to next stop sign, stay in left lane. Make left following Rt. 190 S & thruway Rt. 90 signs.
0.7	0.3	Stay in right hand lane and take Rt. 5 west over the Sky Way Bridge.
0.7	7.6	Continue on Rt. 5 through Lackawanna (note former Bethlehem Steel Plant on right) and continue through Lackawanna to Bay View Road (first left after Ford Plant). Turn left on Bay View Rd crossing over RT 5 East bound traffic.
8.3	1.0	Proceed on Bay View to intersection with Big Tree Rd, first stop sign. Turn left onto Big Tree Rd.
9.3	0.4	Proceed East on Big Tree Rd, at the sixth street turn left onto Bristol Rd.
9.7	0.3	Proceed North on Bristol Rd to North St, turn left.
10.0	0.1	Proceed West on North St to Penn Dixie entrance.