Trip B1

PALEONTOLOGICAL RESEARCH INSTITUTION'S MUSEUM OF THE EARTH AND TAUGHANNOCK STATE PARK AS TEACHING RESOURCES

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INTRODUCTION

A central goal of geoscience education, at both the secondary and college levels, is to help students understand how we know about geologic history, and to be able to interpret for themselves how particular places and organisms came to look the way they do through past geological and biological processes. Visits to the Paleontological Research Institution's Museum of the Earth and to Taughannock State Park, both located near Ithaca, New York, can be used as complementary experiences with any audience – the general public, K-12 students, and college students – to address the geological history of New York State and to show how we know about that history. PRI's research collections of fossils are fundamental to the development of our knowledge of the events that shaped Taughannock Park's strata and those collections are sources for most of the specimens used to tell the story of the history of the Earth and its life at the Museum of the Earth.

PALEONTOLOGICAL RESEARCH INSTITUTION & ITS MUSEUM OF THE EARTH

What is PRI?

The Paleontological Research Institution is a natural history museum with programs in research, specimen collections, publications, and public education. PRI cares for a collection of more than 7 million specimens (one of the 10 largest collections in the U.S.), and publishes *Bulletins of American Paleontology*, the oldest continuously published paleontological journal in the Western Hemisphere, begun in 1895. PRI is a national leader in the development of informal Earth and environmental science education resources for educators and the general public. PRI opened the Museum of the Earth, an 18,000 square foot education and exhibits facility, in 2003. In 2013, PRI absorbed the nearby Cayuga Nature Center, a 100-acre site and historic lodge focused on environmental education about the Cayuga Lake Basin, and Smith Woods, a 32-acre old-growth forest.

PRI was founded in 1932 by Cornell Professor of Geology, Gilbert Harris (1865-1952), who was unsatisfied with the University's commitment to support the extensive collections, libraries, and journals that he had built over the course of his career (Allmon, 2004b, 2007). PRI remains separate from, but is formally affiliated with, Cornell University, and works closely with numerous University departments in research, teaching, and public outreach.

Though colloquially most people think of museums as locations with public exhibits, for most of its history, PRI was a museum in a narrower sense, a large scientific research collection with few displays and little public outreach. PRI's public education program was invented in 1992, necessitating the need for significant space for public exhibits and education programs. The Museum of the Earth was built to serve this need. The exhibits in the Museum tell the story of the history of the Earth and its life, focusing especially on New York State and, more broadly, the Northeastern U.S., the home of most Museum visitors.

PRI Research Collection

The PRI Research Collection contains representatives of most major groups of organisms from many parts of the world over the Phanerozoic, but like all museums it has particular strengths for which it is known. PRI's major strengths are Cenozoic marine mollusks of the Western Hemisphere and Paleozoic marine invertebrates of New York State, and the collection also includes outstanding collections of Recent mollusks, and Cenozoic benthic foraminifera of the U.S. Coastal Plains and Caribbean, as well as more than 15,000 type and figured specimens. Parts of the collection are available online (www.priweb.org/index.php/collections).

The history of PRI and its collections are reviewed in *The First 75 Years: A History of the Paleontological Research Institution* (Allmon, 2007). The PRI Research Collection had its start when Cornell's founder Ezra Cornell and first President Andrew Dixon White purchased for Cornell the fossil collection of Colonel Ezekiel Jewett (1791-1877), one of the largest collections in the nation at the time. Gilbert Harris and his students added large quantities of Cenozoic mollusks, especially from the U. S. Gulf and Atlantic coastal plains, but also the Caribbean and Central and northern South America.

Harris founded his own journal, *Bulletins of American Paleontology* (1895), and printed it himself on his own press (Figure 1). Because many new species were named in the early issues of the *Bulletins*, numerous type specimens were also added to the collections.

Figure 1: Gilbert Harris' original 1895 printing press, restored and on exhibit in the lobby of the Museum of the Earth.

The fossil collections were housed in McGraw Hall, where Cornell had a museum of natural history. That museum displayed fossils and plaster casts of large fossil skeletons (several of which are on display at the Museum of the Earth; see below), as well as displays of modern mammals, birds, and other specimens.

As Harris prepared to retire, he got into a bitter spat with the University over future care for the research collections, leading him to found the Paleontological Research Institution in part to help insure these paleontological materials would be conserved. He constructed a two-story cinderblock building and on June 28, 1932 laid the cornerstone with family, students, and colleagues. He took about half the Cornell collections with him, including most of the type specimens.

In 1952, Katherine Palmer took over as Director of PRI. She had received her PhD under Harris in 1926 and continued her research with him in the first two decades of PRI's existence. The PRI collections continued to grow under Katherine Palmer, and in October 1966 the current Tudor-style stone PRI building on Ithaca's West Hill, now known as Palmer Hall, was purchased.

In 1995-1996, PRI took over responsibility for all of the modern mollusks and remaining nonbotanical fossils from Cornell University. These fossils included those that Harris had not taken in 1932, as well as many added by later faculty and students. These included many important specimens from the original Jewett collection, as well as those collected by John Wells (1907-1994) during his long career as a Cornell professor. Collections acquired from other organizations over the past 25 years include those from Syracuse University, SUNY Buffalo, SUNY Binghamton, SUNY Fredonia, University of Rochester, Purdue University, University of North Carolina Wilmington, University of Delaware, Rutgers University, Tulane University, Alfred University, and Wells College.

Also in the mid-1990s, the Cornell University malacology collection was moved to PRI on long-term loan. These Cornell collections came particularly from two 19th century shell collections: the Newcomb Collection (collected 1845-1874) and the Maury Collection (collected 1880-1900). The Newcomb Collection was purchased from Albany physician Wesley Newcomb (1808-1892) in 1868 by Ezra Cornell, shortly after founding Cornell University (1865). At the time, the Newcomb Collection was considered one of the best modern mollusk collections in North America. The collection was formally transferred to PRI in 2018.

A major new direction of growth of the PRI Research Collection is in the field of conservation paleobiology (Dietl and Flessa 2011, 2017; Dietl et al., 2015; Dietl 2016), which applies geohistorical data (primarily from the relatively recent fossil record) and approaches to the conservation and restoration of biological diversity and ecosystem services—the benefits people obtain from natural systems. These collections provide vital and at times irreplaceable information and research opportunities in this rapidly developing field (Dietl et al., 2019).

Teaching using the Museum

In addition to their role in research—including as the basis for published undergraduate and graduate research projects by students from Cornell and other colleges and universities—specimens from the PRI collection are also the basis for the permanent exhibits at the Museum of the Earth. The Museum displays about 650 specimens from the research collections in the permanent exhibits in order to tell the story of the history of the Earth and its life, and dozens more are used in changing special exhibits. Such exhibits provide resources that are not easily replicated in classrooms or in printed or online materials (e.g., Allmon et al., 2012). The exhibits contain almost exclusively authentic specimens; those that are casts are identified as such and are used only when essential to fulfill the narrative of the exhibits. The Museum specimens on display are more diverse, of higher quality, and historically more significant than those that would be found in even the best teaching collections. In the Museum of the Earth, complementary ways of enjoying the exhibits, such as original artwork, information on the history of specimens, and tailor-made videos are associated with many of the specimens on display.

Before the Museum of the Earth, PRI staff provided science outreach via open houses in the collections in order to explain to the general public the work of PRI and of natural history museums generally. With modern collections standards and a much larger public profile, PRI now gives behind-the-scenes tours only occasionally for modest-sized groups of college students and teachers. Such tours help educators and future scientists understand the nature of museum collections, why they are important, and what sort of care is necessary. Exhibits at the Museum of the Earth provide a way to share specimens and their stories more effectively and at a vastly greater scale than is feasible through a collections tour alone.

Digital Atlas of Ancient Life

Recently, PRI has begun a project to share specimens from both the research collections and on exhibit at the Museum of the Earth in an all new way: online in three dimensions. PRI's Digital Atlas of Ancient Life project (https://www.digitalatlasofancientlife.org/) is creating a host of new online resources to help teachers, their students, and members of the public (especially avocational paleontologists) identify fossils and learn about the history of life. In addition to online field guides to fossils (see Hendricks et al., 2015), an open access college-level "textbook" about paleontology (the Digital Encyclopedia of Ancient Life: https://www.digitalatlasofancientlife.org/learn/), and online virtual versions of previous Museum of the Earth temporary exhibits (e.g., Living Fossils;

https://www.digitalatlasofancientlife.org/ve/living-fossils/), the Digital Atlas project is also creating 3D models of PRI specimens and museum exhibits using a technique called photogrammetry. To date, over 480 interactive 3D models have been created and posted to the Digital Atlas project Sketchfab page (https://sketchfab.com/DigitalAtlasOfAncientLife/models). In turn, these models are being incorporated into online Virtual Collections (https://www.digitalatlasofancientlife.org/vc/) organized around themes, ranging from taxonomic groupings (e.g., brachiopods or trilobites; Figure 2), to differing styles of fossil preservation, to overviews of fossil faunas, including Devonian fossils from New York State. Some of the large wall exhibits on display at the Museum of the Earth have also been scanned and added to these virtual collections (Figure 3).

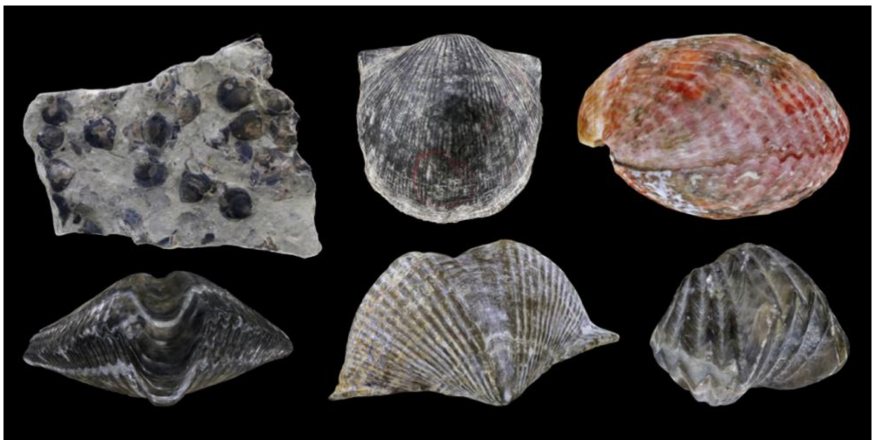

Figure 2: Some of the fossil and modern brachiopod specimens from the PRI collections that have been incorporated into the online Virtual Collection. Explore the virtual collection of brachiopod specimens at: https://www.digitalatlasofancientlife.org/vc/brachiopoda/.

Figure 3: Interactive 3D model of the Devonian "Life in an ancient sea" display at the Museum of the Earth (explore this model at: https://sketchfab.com/3d-models/new-yorks-devonian-sealife-349b0f22f8d843dfb4730ebe1091f972).

The scanned fossils that comprise the Virtual Collections represent most major groups of macrofossils and scans of modern specimens are also included for comparison. The vast majority of these are specimens that are otherwise generally unavailable for teaching purposes, either because they are "behind the scenes" in the research collections, or because they are under glass in the public exhibits. Most were selected for 3D photogrammetry because they either represent a key component of ancient biodiversity, or because they show exceptional preservation of certain features (many of which are digitally annotated), making them especially useful for teaching paleontology. 3D models of fossil specimens are not better than the real thing, but they have a place in modern teaching environments, allowing educators who teach online to bring fossils into their online classrooms, permitting students to study at home, and facilitating discussions about fossils in classrooms that lack physical specimen collections. Even when physical specimen collections are available in classrooms, virtual specimens—when projected on a display at the front of a classroom—allow fine features of specimens to be viewed at large size, making them a useful supplement to traditional teaching specimen collections, particularly in large classroom settings.

History and Approach of the Museum of the Earth

Although PRI was chartered by the State of New York in 1936 as an educational organization, PRI had relatively little in the way of public outreach for most of its history. Harris himself was an inspiring teacher of advanced students, but otherwise had little interest in education. When PRI moved into its current facilities, Katherine Palmer created what she called a "mini-museum: in a room on the north end of the building that is now collections working space, and she occasionally met K-12 classes in this space in the 1970s.

When Allmon arrived as Director at PRI in 1992, part of his directive and intention was to make PRI's collections an educational resource to the broader community, which was first manifested in outreach to the public and local school and community groups. The idea to build a new museum building had been floated informally in the early 1990s by Ray Van Houtte, a PRI Board member with significant influence in the Ithaca community (Allmon, 2007), and was taken up enthusiastically by Allmon. During the mid- and late 1990s initial funds were raised, feasibility studies made, consultants hired, and focus groups held. In 1999 the New York architecture firm Weiss/Manfredi began work on designing the new building. Jeff Kennedy Associates of Boston was hired to coordinate design of the exhibits. The Museum opened in September 2003 and has since received national and international media attention, including several architectural awards.

The exhibits in the main exhibit hall are built around four "major messages":

(1) the Earth is a set of interconnected systems (atmosphere, hydrosphere, lithosphere, biosphere);

(2) paleontology/Earth science is not something only for professional scientists; it is accessible to everyone, and you (the visitor) can do it yourself;

(3) humans have a major impact on the Earth; and

(4) the Earth has a history.

These four main messages remain central to all of the Museum's exhibits and programs.

The exhibits were designed following a set of conceptual guidelines:

(1) the specimens are paramount and should be used to illustrate ideas whenever possible;

(2) exhibits should have multiple points of intellectual access — not everything need be accessible to everyone, but each and every visitor, regardless of age or background, should be able to take away something of value from almost every exhibit;

(3) exhibits should strive for a middle path between the classical specimen-rich approach of the best traditional natural history museum with the hands-on dynamism of the best interactive science center; and

(4) exhibits should emphasize how we know, as well as what we know.

The Museum welcomes around 30,000 visitors annually, including classes from pre-K to 12 and area colleges and universities, regularly including Cornell University, Ithaca College, Wells College, SUNY Cortland, SUNY Potsdam, Colgate University, Syracuse University, Elmira College, Hobart & William Smith Colleges, and several community colleges (Allmon et al., 2012). In addition to serving classes in biology and geology, classes also visit to consider topics such as exhibit design and public communication of science. PRI also provides workshops to educators, especially secondary school science teachers, on topics connected to the Museum exhibits, fieldwork experiences, climate and energy, and others.

<u>Layout of the Museum</u>

The Museum building was designed to avoid architectural conflict with the adjacent historic stone building (Palmer Hall) to the north. Much of the structure is built into the slope of the land, implicitly reflecting its function as an Earth museum, providing additional vertical height without rising above Palmer Hall, and adding energy efficiency associated with stable below-ground temperatures.

The Museum is split into two wings, the above-ground space between them echoing Ithaca's famous gorges. The space is oriented at the same perpendicular angle to Cayuga Lake as nearby streams. Entering the lobby is thus metaphorically entering a gorge.

The lobby and admission desk are in the east wing known as the "Park Education Hall," which also contains the Museum store, a ramp down to the main level, the 2500 square foot BorgWarner gallery for changing exhibits under a hanging modern whale skeleton, and the Museum classroom (Figure 4). The "exhibits wing" to the west contains the permanent exhibits. A passageway that connects the two wings contains a working Preparation Laboratory on display to the public, a small theater, and an exhibit on anthropogenic climate change (under re-design as of this writing). The climate change exhibit, *Dynamic Climate*, will cover both the science of climate change and mitigation strategies.

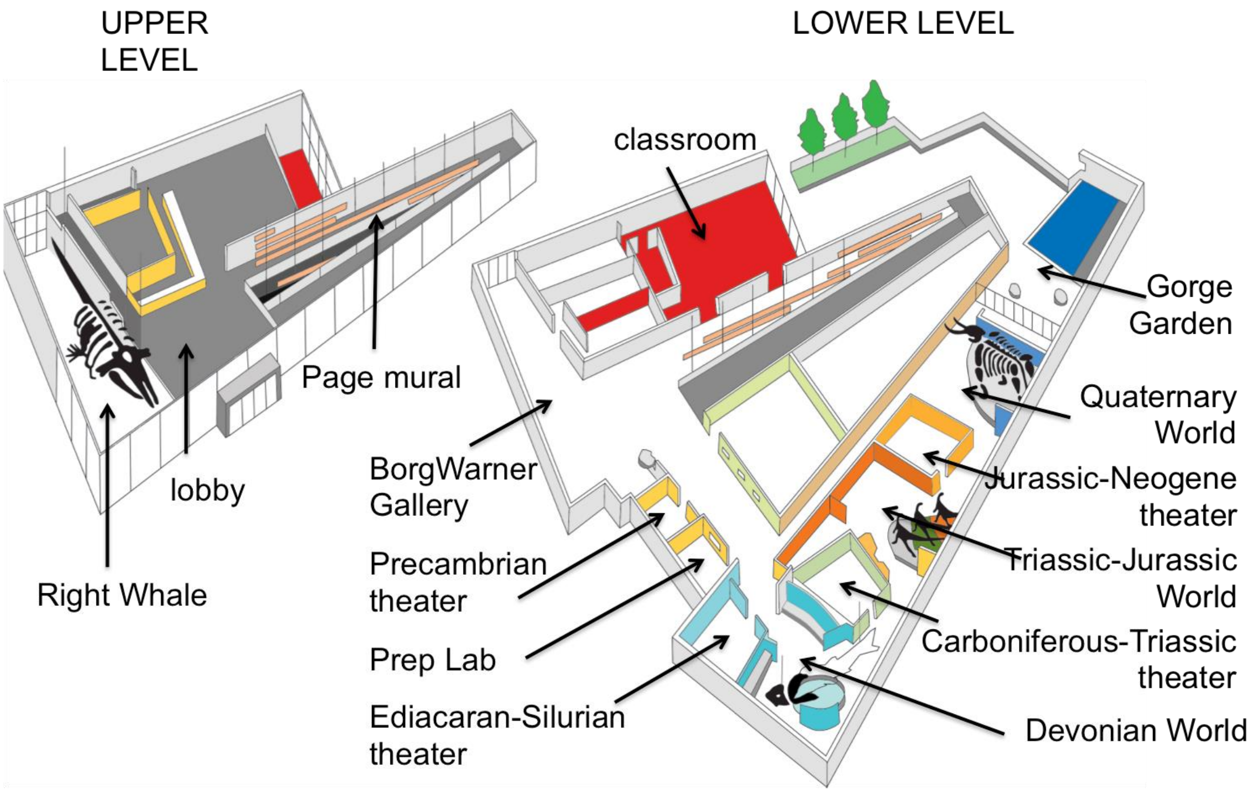

Figure 4: Layout of the Museum of the Earth.

The permanent exhibition, "Journey through Time," is organized as a chronological walk through the history of Earth and its life. The exhibits emphasize the fossils and geology of the northeastern United States, the home of most of the Museum's visitors, but are global in scope. Most of the specimens on permanent exhibit in the museum are invertebrates, reflecting both the strengths of the PRI research collections and the fossil faunas of the northeastern US.

Behind the Museum is the "Gorge garden," a small water feature with plants native to local gorges and glacial erratic boulder excavated on-site during Museum construction, which is visited primarily in warm weather months.

North Atlantic right whale #2030: The skeleton on display in the lobby, visible through the large glass windows when approaching the Museum, is a North Atlantic right whale (Figure 5). The whale epitomizes major themes of the Museum education, including evolution, interactions between Earth and life, and humanity's relationship with nature. Visitors, some of whom assume the skeleton is a fossil, are surprised to learn that the 44-foot long skeleton was salvaged in 1999 by PRI staff at Cape May in New Jersey, after the animal had died tragically tangled in fishing gear. North Atlantic right whales are critically endangered, with only about 400 surviving individuals. The skeleton is therefore an opportunity to highlight conservation. The story of the whale is told in detail in the book *A Leviathan of Our Own* (Allmon, 2004a).

Figure 5: The skeleton of North Atlantic right whale #2030 hanging in the lobby of the Museum of the Earth.

***Rock of Ages Sands of Time* mural:** Barbara Page's *Rock of Ages Sands of Time* mural of the history of life (Page and Allmon, 2001) is a 500-foot long work of art on display along the ramp from the lobby to the exhibit halls (Figure 6). PRI commissioned Page to create the mural, which took her more than 7 years to complete. It contains 544 11-by-11-inch masonite tiles (one for each of the last 544 million years of Earth history) on which are painted images of fossils from each of interval of time. Walking down the ramp transports the visitors back through time, from the present to the start of the Cambrian. The images of fossils on the tiles represent actual specimens and are depicted life-size, and in some cases in 3-D relief. Walking along the mural from bottom to top one can recognize the origin of new taxa, major extinctions, and trends in the history of life. The mural is a unique combination of realistic scientific illustration and impressionistic interpretation.

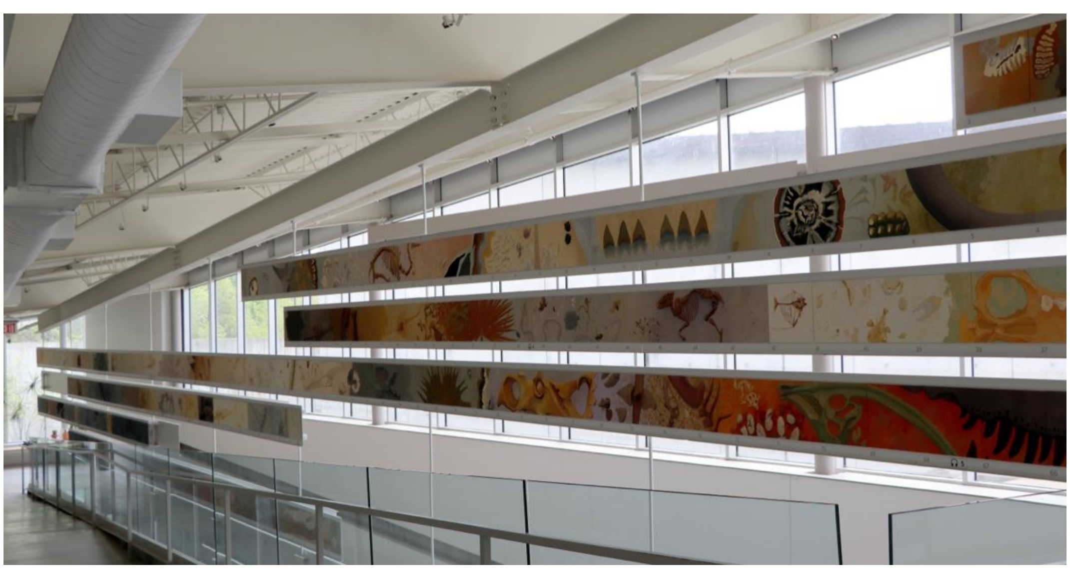

Figure 6: Barbara Page's mural "Rock of Ages. Sands of Time" lines the ramp connecting the upper and lower levels of the Museum.

The BorgWarner gallery: The area under the whale is used for a series of special exhibits, two or occasionally three per year, that attract new audiences and encourage return visits from local audiences. Recent examples have included evolution and diversity of skulls, the evolution and fossil record of "living fossils," and the evolution and global diversity of bees. Some of the exhibits are rented from other institutions, but most have been developed, designed, and built by PRI staff. Some of our exhibits have been in collaboration with colleagues with NSF grants who are doing outreach ("Broader Impacts" in NSF parlance) through a Museum of the Earth exhibit (such as the bee exhibit, with Cornell entomologist Bryan Danforth). Such exhibits often include a teacher workshop and public programs. Starting in 2019, these exhibits have been accompanied by an online exhibit that lives on after the exhibit has been removed (e.g., the exhibit "Survivors: Up Close with Living Fossils" is available at https://www.digitalatlasofancientlife.org/ve/living-fossils/). Spaces near the classroom are used for smaller exhibits highlighting PRI research and collections (such as conservation paleobiology), Earth science events in the news (e.g., volcanoes), or the theme of our annual Darwin Days celebration (e.g., hominin evolution).

Preparation laboratory: The visual "Prep lab" contains standard paleontological equipment for removing matrix from fossils, such as air abrasion equipment, microscopes, and a lab hood for chemicals such as for gluing specimens (Figure 7). The lab is staffed entirely by volunteers, who are trained by a paid staff member. We try to have preparators working in the space on high traffic days such as Saturdays. We offer a one-credit class for Cornell students in the prep lab. Because PRI's collection does not contain many large vertebrate specimens, we have made arrangements with other natural history museums to borrow their unprepared specimens. For the past few years, for example, we have benefitted from an arrangement with the Carnegie Museum of Natural History in Pittsburgh, which has loaned us many unprepared dinosaur specimens, still in plaster jackets after more than a century. The specimens are opened, prepared, and then returned to the Carnegie.

Figure 7: The Museum's prep lab is both a functioning lab space supporting staff research (left) and also an interactive exhibit for the public (right).

J*ourney through Time* and the permanent exhibits: *Journey through Time* is the name of the primary exhibit experience at the Museum, covering the 4.5 billion year history of Earth and its life. It begins in a theater in the passageway between the two wings of the Museum and occupies the main exhibit hall.

Philosophically, the experience begins with the limestone block directly across from the bottom of the ramp (Figure 8). The block contains numerous silicified rugose corals weathering from the rock. The rock is the outcome of a complicated set of processes involving biosphere, lithosphere, atmosphere, and hydrosphere – the product of the interaction of Earth systems. It illustrates the approach taken in *Journey through Time*, which was to relate the history of the Earth as a system – the exhibits integrate all aspects of the Earth system rather than separating them into different areas. The Museum uses fossils to tell much of the Earth system story, given PRI's strengths in collections and expertise, but one can also extract stories of changing seas, climates, and continents throughout (Allmon and Ross, 2004).

Figure 8: Devonian limestone block with fossil corals from Honeoye, NY.

The first element of the journey is a theater showing a short film that tells the story of the origin of the Earth and its life, and covers most of the Precambrian. This is the only specimen-less part of the journey. A panel outside the next theater introduces the interrelatedness of all life, and contains two specimens of Precambrian stromatolites.

Journey through Time is organized such that, in principle, one can follow a variety of threads throughout the exhibit using consistent layouts and iconography. Just as with the natural world, it's possible to experience the Journey through the lens of climate change, biodiversity, presence of lagerstatten, local research, New York fossils, and many more.

- In the main hall, there are three "object" theaters, rooms with large numbers of specimens and a video summarizing the temporal span of the theater, and three "worlds," large open areas representing smaller intervals of time (Devonian marine, late Triassic-early Jurassic rift valley, and Quaternary glacial) that are relatively well-represented by the rock record of the northeastern U.S.
- Each theater and world contains a summary diagram that shows the position of that display relative to the Phanerozoic (Figure 9). The sign contains simplified plots of biodiversity, sea level, and global temperature, with images of changing positions of the continents.
- In each theater time runs clockwise (a wall or two per geologic period). The "worlds" represent smaller units of geologic time, and are mostly not organized temporally.

- Phylogenies of major fossil groups are found throughout the exhibits.
- Look for thin black panels with skull and crossbones; these represent each of the five major mass extinctions. There is one in each of the object theaters and in the Devonian and Triassic-Jurassic worlds. Interpretations of dominant causes of these extinctions have changed somewhat in the years since these panels were written.
- Themes that run through the exhibits are "exceptional preservation," "trace fossils," and "research at Cornell," and small icons throughout the exhibits communicate these ideas.
- "Postcards" integrated into the labels through the exhibits highlight important sites such as the Ediacara, Burgess Shale, and Solnhofen Limestone.
- The short films in all four of the theaters were produced specifically for the Museum and feature the mellifluous voice of Frank Rhodes, beloved former Cornell President and conodont paleontologist.
- Four large background murals in the three worlds were commissioned from Doug Henderson, a paleoartist best known for his work on dinosaurs.

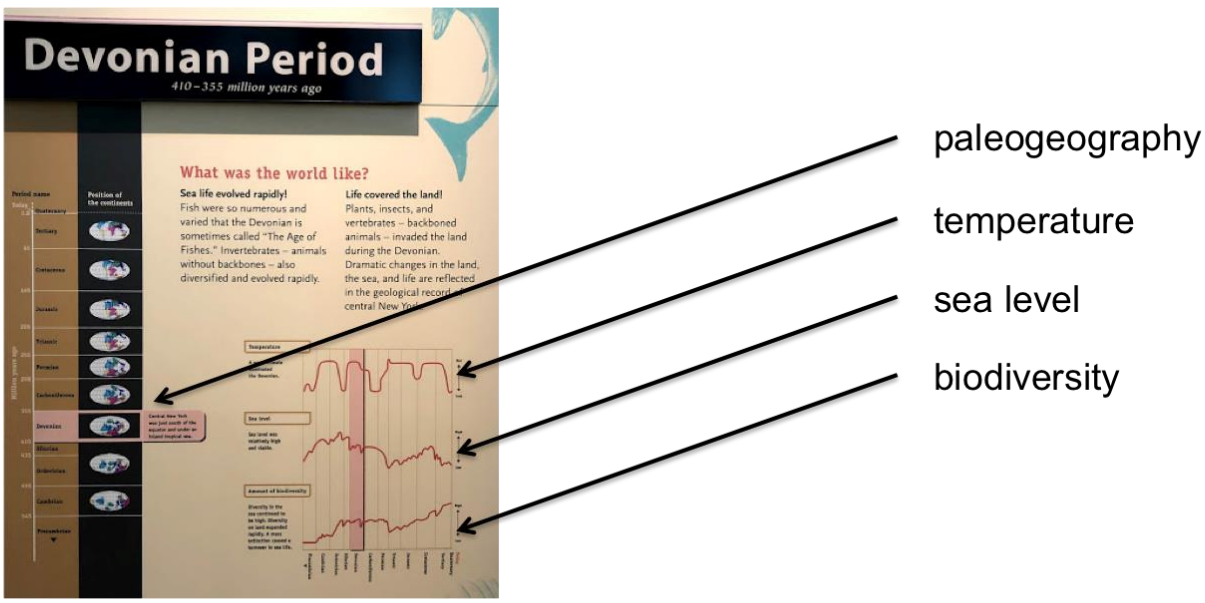

Figure 9: Example of the sign greeting visitors entering the "Devonian World" part of the permanent exhibit. The same series of graphics are present at the entry to each theater and "world."

Journey through Time Exhibition components

The main exhibit hall, introduction to fossils, and the Cambrian explosion wall: The main exhibit gallery contains most of *Journey through Time*, focusing on the Phanerozoic. Visitors encounter a large graphic that introduces Cambrian diversification of animal life and an adjoining case explains the nature of fossils as the basis for our understanding. A second case explains "exceptional preservation."

Ediacaran-to-Silurian object theater: This space contains a rich set of Paleozoic invertebrates. Notable specimens of particular value in teaching include the following:

- Several specimens and casts from Ediacara in Australia.

- Specimens from the Burgess Shale, acquired in a trade made by Gilbert Harris with Charles Walcott at the Smithsonian in the 1920s. A set of lights set obliquely highlights the carbonaceous films. Also present are three pieces of Chengjiang shale (from China), among the only legally collected such specimens on public display in the U.S. (Figure 10).
- Two large slabs from the Cambrian of Wisconsin, featuring the enigmatic (possibly molluscan) trace fossil *Climactinites* (Figure 10) and a large medusoid.

Figure 10: The "Cambrian wall" in the first "object theater," featuring Ediacara, Burgess Shale, *Climactinites*, and other specimens.

- The world's largest complete eurypterid specimen, a 1.25 m long *Acutiramus macrophthalmus* from Late Silurian of Herkimer County, NY.
- A block of Silurian salt from the nearby Cargill salt mine, which extends under much of the south end of Cayuga Lake.

Devonian World: The Devonian World tells the story of life and major evolutionary events and on the geology – the process of plate tectonics — that explains the distribution of Devonian age rocks in the Northeastern US.

On the left side as one enters the hall is a display of the sort of marine invertebrates (Figure 3) that are common in the Appalachian basin, especially New York State. The wall was inspired in part by the biodiversity wall of the American Museum of Natural History. Note that there are modern representatives and model reconstructions of several invertebrates that may be difficult for students to interpret.

The *Dunkleosteus* head shield hanging from the ceiling (Figure 11) is a cast of a specimen at the Cleveland Museum of Natural History. The *Dunkleosteus* hangs in front of a Doug Henderson mural and above a diverse set of Devonian fish fossils to represent the concept that the Devonian is the "Age of Fishes."

Figure 11: The “Age of Fishes” island in the Devonian world.

The Life on Land exhibit is also in front of a Doug Henderson mural, intended to convey a sense of the shoreline somewhere near the position of the Gilboa forest in the Catskill Mountains of New York, which would have been not far from Acadian orogeny. Specimens here include casts of early tetrapods *Sauripterus*, *Acanthostega*, and *Tiktaalik*.

Visitors often wonder how it is that marine organisms are found in Upstate New York; thus, plate tectonics is introduced here. The exhibit includes rocks from a series of tectonic contexts across New England, and also a short film featuring Cornell faculty who were involved in the early discoveries of the plate tectonics revolution, including Bryan Isacks and the late Jack Bird. There is a working drum seismograph; a seismogram of a recent earthquake in the news is always on display. The seismograph is connected to a digital seismometer behind the Museum, station “PRNY” of the Lamont-Doherty Cooperative Seismographic Network; you can get real-time and past data at https://www.ldeo.columbia.edu/cgi-bin/LCSN/WebSeis/24hr_heli.pl (select station PRNY at the bottom and click the “submit” button).

One of the most popular areas in the Museum is Fossil Lab (Figure 12), located in the back corner of the Devonian World. At this interactive lab bench, visitors of all ages can collect their own Devonian fossil to take home (supplied from outcrops in the Ithaca area) and identify it with the help of Museum docents (mostly volunteers).

Figure 12: Fossil Lab in the Devonian World area of the Museum.

Carboniferous-to-Triassic object theater: This theater focuses on Carboniferous coal swamp forests, the diversification of major tetrapod groups, dominant marine invertebrates, and the Permian-Triassic extinction.

The Carboniferous exhibit contains an extensive set of coal plant fossils, as well as models of lycopods, horsetails, and the enormous dragonfly-like insect *Meganeura* by Terry Chase Studios.

This theater contains casts and reconstructions of skulls that represent early diversification of vertebrates, including a large amphibian (*Mastodonsaurus*), therapsids (the pelycosaur *Dimetrodon*, gorgonopsid *Broomisaurus*, and cynodont *Thrinaxodon*), and early dinosaurs *Eoraptor* and *Herrerasaurus*, plus skulls of a modern alligator and opossum for comparison.

Late Triassic/Early Jurassic World: The most significant Mesozoic deposits in the Northeast, and the only ones in New York State, are the Newark Supergroup rift valley deposits, which are the focus of the Late Triassic/Early Jurassic World. The Museum does not focus on dinosaurs, but the Triassic-Jurassic area contains most of the Museum's dinosaur displays. An adjoining DinoZone area contains books and hands-on dinosaur-related activities for pre-K-age children and their caregivers.

A Henderson mural shows part of the Newark Rift Valley in the area near what is now central Connecticut (Figure 13). Notice that the end-Triassic extinction cuts through the middle of the mural: the left side shows a diversity of late Triassic reptile groups, while the right side shows only dinosaurs. *Coelophysis* shows up on both sides. The platform under the mural contains rocks and fossils from the Newark Rift basins, including a large section from the Triassic-Jurassic boundary collected in Reading, Pennsylvania and pieces of brownstown from buildings in New York City.

Figure 13: Exhibit of life and geology in the Connecticut and Hudson valleys during the Late Triassic and Early Jurassic.

The exhibit that most catches visitors' attention is "Steggy," a lifesize model of *Stegosaurus* (Figure 14). Not originally part of the permanent exhibits, Steggy came to PRI from the Smithsonian's National Museum of Natural History in 2014 when their fossil halls closed for major renovations (this exhibit re-opened in June 2019; Gramling, 2019). This life-size restoration of the iconic Jurassic armored dinosaur was commissioned by the Smithsonian for the 1904 World's Fair in St. Louis; in 1905 it was moved to the museum in Washington, D.C., where it had been seen by countless millions of visitors. It is made of paper mache and had to be cut into three pieces to get it through doors at the Smithsonian, transported, and brought into the Museum of the Earth. Professional art conservators reassembled and repainted it, and it was installed in front of a mural painted by Ithaca artist Mary Beth Inhken representing the biota of the Morrison Formation of Colorado and Wyoming, from which *Stegosaurus* is best known.

Figure 14: *Stegosaurus* model built by the Milwaukee Papier Mache Works, commissioned by the Smithsonian Institution for the World's Fair in 1904.

As is true for most dinosaur taxa, Recent interpretations of *Stegosaurus* are slightly different than those of the early 1900s, with a more agile posture and legs more underneath the body. The idea that scientific interpretations and reconstructions of ancient life change through time is also the theme of another exhibit in this area, which features three models of the small theropod dinosaur *Coelophysis*, sometimes referred to as "New York State's only dinosaur" because prints resembling its feet have been found in Rockland County, New York (Fisher, 1981) (Figure 15). These life-sized restorations reflect what paleontologists have thought *Coelophysis* looked like at different times, from the early 1960s to the 1990s. Exhibit panels ask visitor to consider why such changes of scientific view may have happened. Along the edge of the platform holding the *Coelophysis* sculptures is a case with an actual theropod footprint specimen from Rockland County. This story of *Coelophysis* led to its use in the PRI logo, its identity as a PRI mascot ("Cecil"), and the focus on *Coelophysis* in the sculptures and Newark Rift Valley mural. (In addition, a bronze cast of a *Coelophysis* stands in the plaza outside the Museum.)

Figure 15: *Coelophysis* sculptures made by three artists in three different decades (from top to bottom, approximately 1960, 1985, 1990) and cast of a *Coelophysis* skeleton mounted to the wall.

A large model that one may overlook (or underlook) is a life-size *Quetzalcoatlus*, a pterosaur and one of the largest known flying creatures, also acquired from the Smithsonian in 2014 (Figure 16). It hangs from the ceiling, peering over the top of the fourth and final theater.

Figure 16: Life-size *Quetzalcoatlus* model, originally on display in the Smithsonian Museum of Natural history.

Jurassic-to-Neogene object theater: Much of what the public hears about paleontology in the news – dinosaurs, large marine reptiles and pterosaurs, origin of birds, end-Cretaceous extinction, and diversification of mammals — took place in the interval of time represented in this space, which contains representations of all of these, together with marine invertebrates (particularly ammonites) and the first flowering plants and associated diversification of insects.

Two of the marine reptiles on display, a plesiosaur and ichthyosaur (Figure 17), are casts of famous specimens from Europe purchased by Cornell in the late 1800s from Ward's Natural Science Establishment of Rochester, New York (see Davidson, 2008). Numerous casts purchased from Wards were once on display in Cornell's Natural History Museum in McGraw Hall, and were an important teaching resource. Sadly, most disappeared from Cornell long ago, and these two are among the very few that survived.

Other notable exhibits include (Figure 17):

- a case with Solnhofen fossils (casts and real specimens);
- a very large heteromorph ammonite (*Diplomoceras maximum*) from Seymour Island, Antarctica;
- a cast of a *Tyrannosaurus rex* skull from the Museum of the Rockies in Bozeman, Montana;
- a block from the Cretaceous-Paleogene boundary in the Raton Basin in New Mexico;
- casts of two *Archaeopteryx* specimens and the related small theropod dinosaur *Compsognathus*.

Figure 17: Back half of Jurassic-to-Neogene theater, including: casts of *Ichthyosaurus communis*, *Plesiosaurus hawkinsi*, and jaws of *Mosasaurus hoffmanni*; heteromorph ammonite from Antarctica (foreground center); *Tyrannosaurus rex* skull; and *Archaeopteryx* casts.

Quaternary World: The last part of the Museum's permanent exhibits, the Quaternary World, focuses broadly on climate change, through the lens of megafauna, coral reefs, and glaciers. The original centerpiece of this area is the Hyde Park mastodon, but newer components include two 500-gallon coral reef aquaria and a walk-in glacier. There is also a display summarizing climate change through the Phanerozoic eon. In a tunnel leading through and out of the glacier, the exhibit covers the influence of current climate change on glaciers.

In 2000 PRI was invited to look for mastodon remains in a pond in Hyde Park, NY, where several bones had been revealed during dredging of the pond. Once the rest of the skeleton was found, it became evident that the it was one of the best preserved mastodon skeletons ever found -- the "Hyde Park mastodon" had evidently died in the pond before bones had become scattered and weathered. It was excavated by PRI staff and volunteers in early Fall 2000. The Discovery Channel made a one-hour documentary film of the find ("Mastodon in Your Back Yard"); two brief clips are in the exhibit. The original skeleton is on display (Figure 18), held in place by a metal armature. Because of the weight and fragility of the tusks, they were replaced with fiberglass replicas; one of the original tusks is on the floor of the platform. Behind the skeleton is another Doug Henderson mural showing the Hudson Valley at the time the mastodon was alive, around 13,500 years ago.

Figure 18: Hyde Park mastodon skeleton and white spruce trunk.

The pond contained a rich sedimentological and paleontological record beyond the skeleton itself, and the excavation became a major research project on the late Pleistocene paleoecology at the site. PRI published a volume of this research by PRI staff, students, and specialists at other organizations (e.g., Allmon and Nester, 2008). For many years PRI ran a citizen science project, the Mastodon Matrix Project, in which school and community groups received sediment from which participants were requested to extract and return fossils in order to more fully inventory the fossil record of the site (Ross et al., 2003, 2008).

The coral reef tanks were added in 2013. They are unusual in contrasting Caribbean from Indo-Pacific reefs, which vary greatly in their taxonomic composition and diversity. The tanks were created from live corals that had been collected with permits by Cornell coral biologist Drew Harvell, who was studying them to better understand the influence of stresses such as climate change and disease on coral health.

Though disparate in topic, all of the exhibits in the Quaternary world are climate-related. Glaciers respond to climate change at high latitudes, and reefs are impacted at low latitudes; mastodons were influenced and perhaps at least in part driven extinct by changing climates. The adjoining glacier exhibit (Figure 19) is intended to help visitors ponder both the influence of the presence, influence, and disappearance of past glaciers from the Upstate New York area, and the current disappearance of glaciers globally from anthropogenic climate change.

Figure 19: Glacier exhibition with walk-through ice cave in Quaternary World area.

Other notable components of Quaternary world include:

- The white spruce trunk mounted to the wall behind the mastodon. The trunk was found at roughly the same stratigraphic level as the mastodon. It is now in three pieces and shrunken after drying, but when found was whole and at full girth in its water-logged state.
- The video "Glacial Ice sculpted New York's Finger Lakes Region," which plays inside the tunnel, just past the glacier. It was made for the exhibit in 2014 by Professor Bryan Isacks of Cornell Earth and Atmospheric Sciences. It is available on PRI's YouTube channel at https://www.youtube.com/channel/UCaP3mwxlJuVRPK1s9FX4iLg/videos.

PRI “gardens” and other outdoor specimens: Local erratics are found at the base of the glacier model and nearby in the Gorge garden area behind the main hall. Another is the large rock just in front of the Museum of the Earth sign on Route 96, which was on land west of Trumansburg.

Large rocks along the plaza as one approaches the Museum entrance include, for example, Onondaga limestone with chert-replaced corals, granitic gneiss from the Adirondacks, sandstone with glacial striations, and (under and behind the bronze *Coelophysis*) Jurassic brownstone from Middletown, Connecticut (Figure 20).

Figure 20: A block of Jurassic sandstone obtained from the last operating brownstone quarry in Portland, Connecticut.

Using the Museum and nearby resources for teaching

School groups use the Museum in many different ways and combinations, which may include one or more of the following (see Allmon et al., 2012):

1. allow students to explore on their own, without any particular structure;

2. give the students an assignment, which may include open-ended questions of analysis, documentation of Earth history through images and information about specimens, or requests to find and document specific specimens (which might be designed as a game, such as finding clues toward completing a puzzle);

3. teachers give students a tour or hire a PRI educator to provide a tour, sometimes with a specific theme emphasized;

4. hire a PRI educator to provide a presentation on local geology and paleontology (or other related topics); or

5. combine the Museum visit with another experience such as visiting PRI's other public venue, the Cayuga Nature Center, or Taughannock Falls State Park, explored further below.

Cayuga Nature Center: The Cayuga Nature Center (CNC), PRI's second public venue, is about four miles (6.4 km) northeast of the Museum of the Earth on Route 89, about 2.5 miles (4.0 km) south of the entrance to Taughannock Park. In its landscape, streams, forests and fauna, it is possible to explore dimensions of current Earth and environmental sciences that complement natural history experiences available in exhibits and programs at the Museum of the Earth (Allmon and Ross, 2011). In the lodge are exhibits on the Cayuga Lake Basin, including ecology, climate change, faunas, and soils. A live animal collection (mostly vertebrates) contains evolutionary trees and an introductory exhibit on constructing phylogenies. Two 600-gallon aquaria feature fishes of Cayuga Lake from the present and before the arrival of Europeans in the late eighteenth century, and have additional interpretation on the natural history of the Finger Lakes. The CNC property includes a creek that cuts through the Geneseo and Sherburne Formations. The modest-sized Denison Waterfall can be observed from a trail or from the top of a 6-story "treehouse" built next to the creek.

TAUGHANNOCK STATE PARK

Taughannock Gorge Geology Brief Overview

Taughannock Gorge has been a tourist attraction since the 1800s and outdoor natural laboratory for teaching geology. Taughannock Falls, the 65.5 m (215 foot) high drop of Taughannock Creek, is the primary attraction. The Falls is well complemented by steep gorge walls exposing over 100 m of strata (Genesee Group), the flat easy "Gorge Trail" along the Creek, a broad flat walkable creek bed (Tully Limestone), a "Lower Falls" (about 5 m high), and a delta at the mouth of the creek that is home to State Park public facilities. The gorge offers numerous features of interest for teaching Earth science to audiences from novice to expert.

For the context of this paper we have listed below only some of the general characteristics of Taughannock gorge that might be addressed with groups of students. An excellent overview of the geology of the Finger Lakes region can be found in *Gorges History* (2018). Related summary works of various lengths on or including Central New York geology and paleontology include Wilson (2014), Sang et al. (2013), Allmon and Ross (2008), Ansley (2000), and Linsley (1994).

Between the start of the Gorge Trail and the top of the cliffs at Taughannock Falls, Taughannock Creek cuts through a sequence of several hundred meters of strata, from the Middle Devonian Moscow Formation to the Upper Devonian Renwick Formation (Figures 21, 22).

FORMATION	GROUP	STAGE
Renwick	Genesee	Frasnian
Sherburne		Givetian
Geneseo		
Tully	Tully	
Moscow	Hamilton	

Figure 21 (right): Simplified stratigraphic section of Taughannock Park, based on Zambito et al. (2012).

The Tully Limestone forms the floor of the streambed of much of the stream. The first easy entry from the Gorge Trail onto the streambed is about a third of a kilometer from the trailhead; a flatter, wider access trail occurs at about half a kilometer. At Taughannock Park the Tully does not contain obvious fossils, but the unit is correlative with units formed during the Taghanic biocrises, a half-million year interval of turnover that precedes the eventual Fransnian-Fammenian extinction (Zambito et al., 2012).

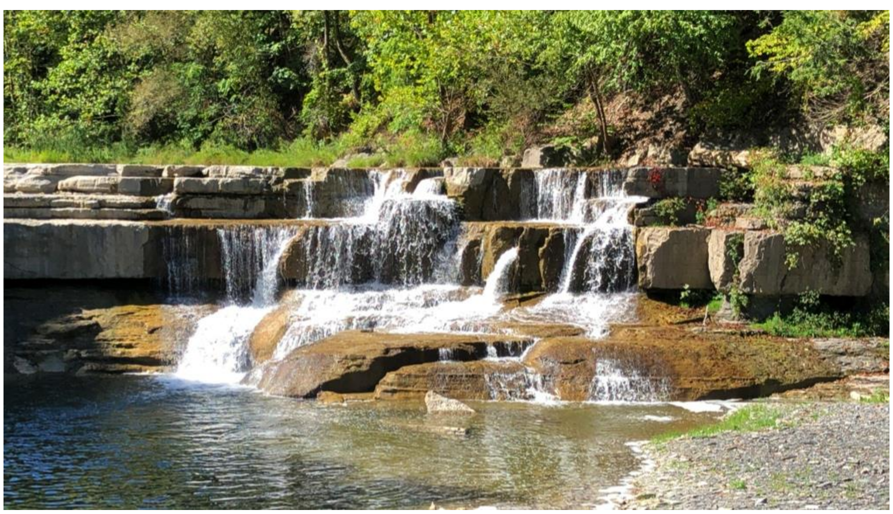

Figure 22: Lower Taugannock Falls, flowing over the Tully Limestone, and, below it, the Moscow Formation.

Solution pits cover the surface of the limestone (Figure 23). The numerous en echelon parallel vertical joints running through the Tully differ in shape from the smooth joints characteristic of those in clastic units through Central New York and in other units at Taughannock (see Engelder et al., 1987; Engelder et al., 2009).

Figure 23: Left: Bedding plane with solution pits of the Tully Limestone exposed in the bed of Taughannock Creek above Lower Taughannock Falls. Right: A weathered exposure of the Geneseo Shale on the south side of Taughannock Gorge.

Along the slope above the streambed is black shale of the Geneseo Formation. The shale is easily accessed on the side of the south side of the trail (away from the stream) starting several hundred meters from the trailhead (Figure 23). There are no macrofossils. Further up the streambed the upper part of the Tully becomes muddier and more finely bedded, associated with the deepening event leading to deposition of the Geneseo. The Tully-Geneseo contact is beneath the surface of the Falls plunge pool, with the Geneseo exposed in the streambed in the 200 m closest to the Falls.

Evidence of rock falls can be seen at numerous points along the trail, where it is possible to see blocks from higher in the section. Just past a 90 degree bend ("Big Bend") in the creek is a stretch of rock wall without vegetation where past rock falls have taken place, including one in July 2016 in which the NYS Park Service used hydraulic jacks to push over a pillar of rock that was about to topple on its own.

Taughannock Falls is reputed to be the highest freefalling waterfall east of the Mississippi. It is about 10 m higher than Niagara Falls. The plunge pool beneath the falls is about 9 m deep. The strata exposed along the cliff behind the Falls are the Geneseo, Sherburne, and Renwick Formations.

The caprock for the falls is a resistant siltstone bed within the Sherburne Formation, which overlies the weaker Geneseo. Further up Taughannock Creek, above Taughannock Falls, are outcrops of the overlying Ithaca Formation (deWitt and Colton 1978, Zambito pers. comm. 2019).

Jointing is well developed, and weathering occurs especially through large blocks that weather along joint and bedding surfaces. Over a century of photographs of the waterfall and cliff walls allow observation of rate and nature of weathering (see Figure 25 below).

Taughannock Falls and strata can also be viewed from from the Falls Overlook, on the north side of the gorge, which can be reached on Taughannock Park Road off Route 89. Here you can see from a different perspective the V-shaped notch of the stream and shape of the "amphitheater" of the gorge (Figure 24) around the Falls.

Figure 24: The view from Taughannock Falls Overlook.

The gorge is one of dozens in the Finger Lakes. The strata at the top of Taughannock are roughly correlative with the strata near the bottom of other well-known gorges around the southern end of Cayuga Lake.

Using Taughannock Park for Teaching

Taughannock Gorge, like all places, is the product of a complex set of processes that have occurred over many different time scales. Taughannock is an ideal setting for teaching because it has both an interesting variety of sedimentary rocks and paleoenvironments, as well as interesting topography. The geology has been the subject of numerous research publications over the years on topics ranging from stratigraphy to the formation of gorges to the formation of vertical joint systems in Central New York, providing a rich literature. The site is an excellent location for students to try to weave together geological history to make sense of why the Park and region look as they do.

Events that impact the landscape and stratigraphy are tied to geological events at either end of the timescale, from Precambrian boulders (glacial erratics) to Quaternary landforms to modern processes. While sediments were deposited that became the strata we see at Taughannock, the first forests and tetrapods were evolving, and the end-Devonian extinction took place within the time represented in the cliff walks at Taughannock. The rocks at Taughannock were deeply buried in the late Paleozoic when the joints that cut through these rocks were formed (e.g., Engelder et al., 1987). These other major events may not be seen in local rocks, but they can be explored in the Museum of the Earth (and in the research collections of PRI).

More generally, there is, of course, no one place where all of geologic history can be seen – we rely on different bits of history we find in different places. Museum research collections and exhibits bring specimens from many of those places together. The Museum of the Earth can in this way be used as a tool to help students provide context for the observations they make at Taughannock – what was happening to life in the Devonian, and what was happening before and after the strata at Taughannock were deposited?

Taughannock Falls and Virtual Fieldwork: How can students compile their disparate observations, at Taughannock and elsewhere, and how might a teacher revisit places such as Taughannock and the Museum within the context of their classrooms? New inexpensive technologies allow both teachers and students of any background to document their fieldwork experiences visually and with digital data that augment traditional field techniques.

Virtual Fieldwork Experiences (VFEs) are typically multimedia representations of actual field sites that can be used to extend experiences in the field, or, in a limited way, to replace them (Duggan-Haas, 2015; Duggan-Haas and Kissel, 2016; Duggan-Haas and Ross, 2017; Granshaw and Duggan-Haas, 2012; Kissel et al., 2013; Ross et al., 2007). Ideally, VFEs catalyze field experiences by motivating users to seek to visit field sites in person. Aspects of VFEs can also be used in the field to effectively travel through time, to shift perspective, and to aid in seeing details. The advent of smartphones and tablets have greatly expanded possibilities.

In a very real sense, VFEs offer a modern spin on ancient practices. Cave paintings are arguably a form of VFEs, and if you add stories told in front of those paintings, especially with sound effects, you have a multimedia experience that allows sharing experiences distant in time and space. The array of available media types has grown throughout human history and is now stunning in scope.

We have compiled an annotated list of apps and other technological tools useful for capturing and sharing aspects of field sites as part of the Eastern Pacific Invertebrate Communities of the Cenozoic (EPICC) project here: https://epiccvfe.berkeley.edu/for-educators/technical-tools-of-real-and-virtual-fieldwork-for-scientific-inquiry/.

A few examples of such technology applied to VFEs follow, using Taughannock Falls as an example.

Travel in Time Using Historic Imagery: While electronics are not required to show historic imagery, the capability to carry thousands of images in your pocket extends the realm of possibilities for using images in the field. The images in Figure 25, show Taughannock in 1888 paired with a more recent image. When sharing imagery in the field, whether printed or electronic, it is often helpful to hold up the image so it aligns with your view in the field. For example, hold the picture of Taughannock in 1888 up so it blocks your view of the falls and move the image in and out of the view to study the changes.

It is relatively simple to create animated gifs combining images using free online services. An animation of these two images, slightly cropped to align them, is available here: https://imgur.com/gallery/9MMqMHC.

Figure 25. Taughannock Falls on May 26, 1888 (top, photo by E. M. Chamot and featured on the cover of von Engeln's 1961 book) and March 12, 2008 (bottom, photo by Rick Allmendinger). Notice the projecting crest in the top photo, which broke off "[s]ometime before 1892" according to von Engeln (1961). These images and caption are from Figure 6.5 of Bloom, 2018, available at an online image gallery for the book: https://www.priweb.org/index.php/publications/special-publications/pubs-bloom-gallery.)

This particular pair of images not only travels across more than a century, it also shows the appearance in different seasons. Taughannock's flow varies tremendously throughout the year and both images above show higher than normal flow. Contrast the volume of water in these images with the flow shown in Figure 26, below.

Using Skitch to Annotate Photos: Skitch (https://evernote.com/products/skitch) allows for simple annotation of photos and maps in the field. It is also helpful for field instruction. Rather than pointing to some feature on a distant cliff face, for example, the instructor can snap a picture, label it in Skitch and show the phone to students to guide their eyes (Figure 26). For iPhone and Android. *Free.*

Figure 26. A photo of Taughannock Falls with some annotations added using Skitch (photo by RM Ross; annotations by Don Haas).

Create an Immersive Panorama Using Google Street View: Google Street View is both a feature in Google Maps and a free standalone app that allows users to create their own Street View Panoramas on their smartphones or tablets. (https://www.google.com/streetview/). As with any imaging technology, this too can be used to show changes over time. Figure 27, below, shows a screengrab of Street View Panorama taken in September 2017 and shows an area with a recent rock fall.

Google Cardboard, is an inexpensive Virtual Reality (VR) headset that allows users to view Street View Panoramas in 3D. More information is available here: https://vr.google.com/cardboard/. These viewers can also be used for 3D models, like those hosted on Sketchfab.com. At this writing, there are not models from Taughannock, but the Digital Atlas of Ancient Life includes hundreds of fossil models. The Museum of the Earth's "Life in an ancient sea" exhibit – a wall of Devonian Fossils – is available as a 3D model here: https://skfb.ly/6NvpV. It may be viewed as an interactive 3D model on a computer screen or with a VR headset for a more immersive effect (as is the case with Street View Panoramas).

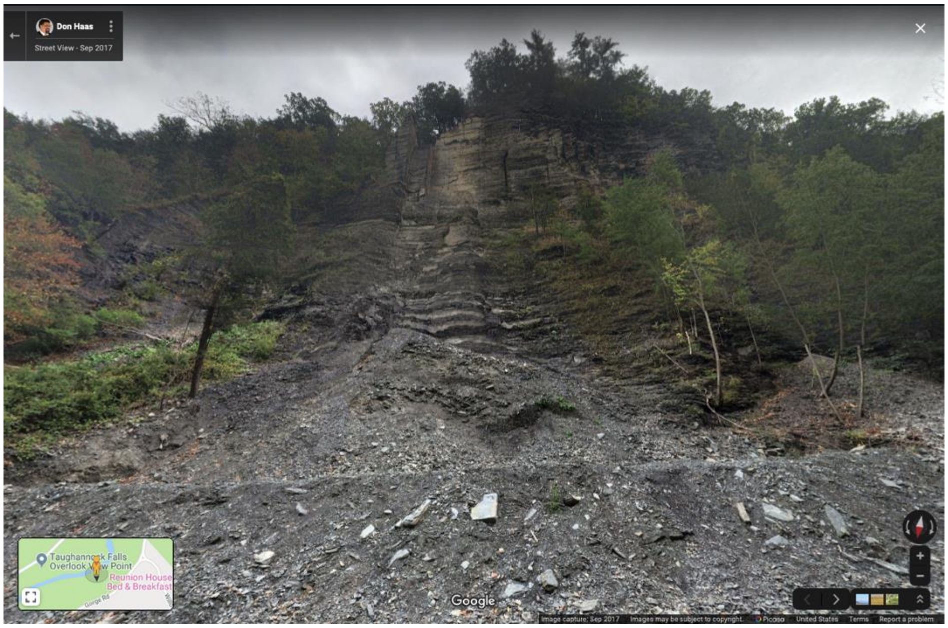

Figure 27. A screen grab of a Google Street View Panorama showing a fresh rock face after a 2017 rock fall. The full panorama is here: https://goo.gl/maps/G91WCJ2jVEoMqHS2A.

Technology to access and record geologic information: ROCKD, a free app developed by the University of Wisconsin Macrostrat Lab with support from the National Science Foundation, allows you to access key geologic facts about your location and record your observations.

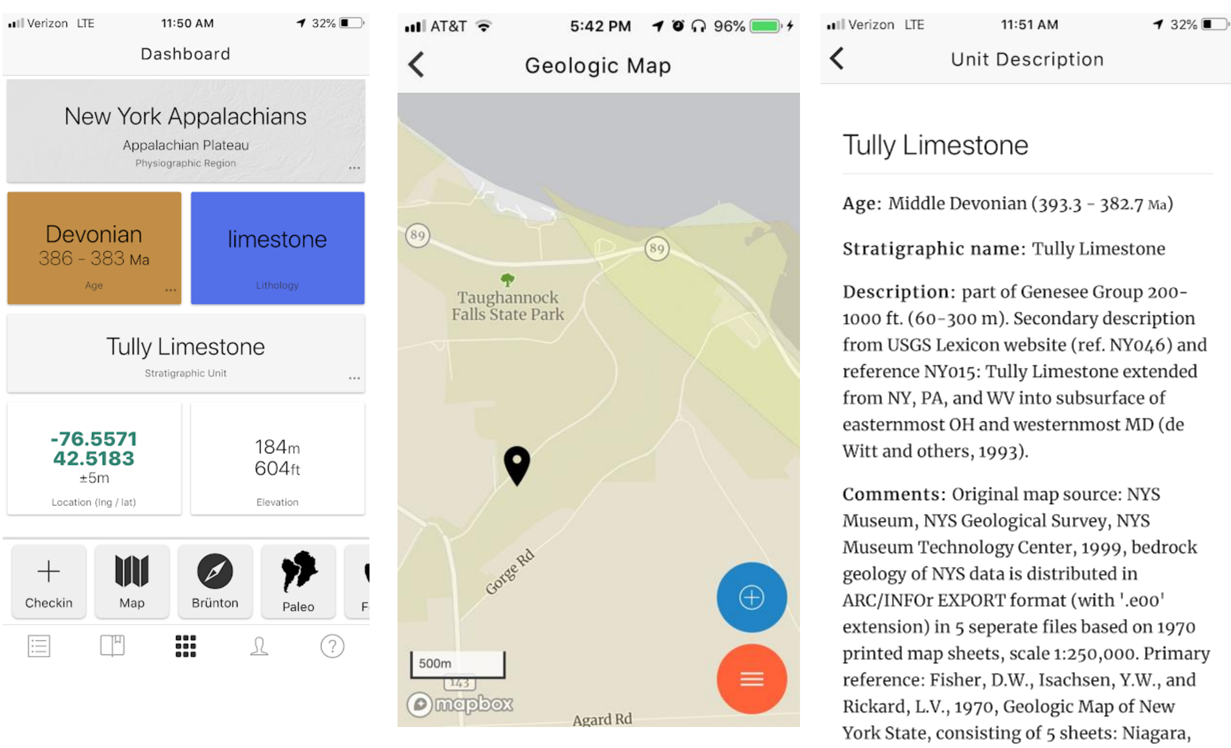

Figure 28. Screengrabs from the ROCKD app. The Dashboard automatically shows a basic description of the rock beneath you. The detailed description, excerpted in the third frame is several pages long and includes links to references.

In addition to viewing geologic maps of your location (see screengrabs of the app in Figure 28), ROCKD allows you to search for any locale, includes a virtual Brunton compass, allows you to view paleogeographic maps, and has a check-in feature that allows you to record your observations and site visits. It is available at: https://rockd.org/.

SUMMARY

Perhaps all geoscience educators would agree that learning Earth system science and history is best accomplished with authentic field experiences and specimens. We are, however, inevitably limited in our capacity to share such experiences with our students on a regular basis, given travel and collections resources that are typically available. Effective Earth science teaching mirrors in some respects doing Earth science research: it combines compelling questions and exploration of real-world settings (scientific fieldwork), using associated objects (research collections) and data (including digital imagery). By combining occasional visits to field sites (such as Taughannock Park) and to museums (such as PRI and its Museum of the Earth), accessing 3-D digital teaching collections made from collections specimens (such as on the Digital Atlas of Ancient Life), and developing virtual fieldwork experiences made for and by students, we add to our opportunities to teach in ways that reflect the richness of doing science.

ROAD LOG

Meeting Point = STOP1: Paleontological Research Institution, 1259 Trumansburg Road (Rt 96), Ithaca, NY

Meeting Time: Sunday, October 6th, 2019, 8:30 AM

Location Coordinates: 42.465790, -76.538103

We will meet in the lobby of PRI's Museum of the Earth. There is parking available in the parking lots in front of the Museum.

We will tour the exhibits of the Museum of the Earth and the research collections of the Paleontological Research Institution. We will be at PRI about 2 hours.

STOP 2: Taughannock Park, 1740 Taughannock Boulevard (Rt 89), Trumansburg, NY

Location Coordinates: 42.545242, -76.598511

Taughannock Park is a 6.6 mile (10.6 km) drive from PRI.

Meet in the parking lot on the west side of the road, adjacent to the start of the Gorge Trail.

We will walk the Gorge Trail to Taughannock Falls and back, a total of about 2 miles (3.2 km), which will take about 2 hours.

STOP 2a: Taughannock Falls Overlook and Visitors Center, Taughannock Park Road

Location Coordinates: 42.538821, -76.608126

We will drive 0.6 miles (1.0 km) from the Taughannock Park parking lot to the Falls Overlook parking lot. This stop will be brief.

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