TRAVELING THROUGH TIME AND SPACE: BRINGING GEOLOGY TO LIVES INSIDE AND OUTSIDE THE DA VINCI SCIENCE CENTER

Lafayette College Technology Clinic

Final Report, Spring 2015

Executive Summary

Identification of Objectives:

- Use feedback from the mid-year presentation to create detailed plans for physical and digital exhibits to teach geology.
- Create a means of connecting local geology back to the Da Vinci Science Center and encouraging visitors to want to learn more.

The Task

Our team was given the task of creating a potential exhibit that would display the earth history of the Lehigh Valley region. In addition we were given the challenge to find a way to generate more interest in local geology by connecting the Da Vinci Science Center with the local geology that visitors encounter everyday.

http://www.davincisciencecenter.org/

Areas of Exploration

- **Crawl-through Geologic Tunnel**: This tunnel would allow visitors to crawl through the geologic phases that represent the layers that exist in Pennsylvania's bedrock.
- **Virtual Elevator Through Geologic Time**: This virtual elevator will allow visitors to travel back in time and visit the different geologic phases Pennsylvania has experienced.
- **Large Interactive Geologic Map**: This map will display a geologic map of eastern Pennsylvania and western New Jersey. This map will allow visitors to visit different “geologic sites” that will be linked to the smartphone application.
- **Education Stations** (Sedimentation Spinners and Tectonic Plates): These education stations will teach visitors about certain aspects of geology, such as how tectonic plates work and how sedimentation occurs.
- **Geologic Passport** (Activity Book): This passport will provide younger patrons with the opportunity to learn about the different phases in kid-friendly terminology and also complete different activities such as coloring.
- **Smartphone Application**: The smartphone application will be geared to all audiences and will have different features to attract all audiences. This application will also connect visitors back to the Da Vinci Science Center (specifically with the large interactive geologic map).

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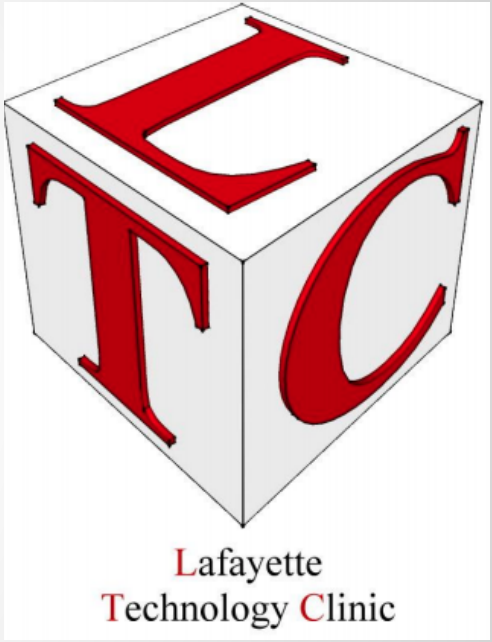
Technology Clinic

Lafayette's Technology Clinic was founded in 1986. The purpose of the clinic is for a group of five to six students and two faculty facilitators to partner with a company or community organization to address real-world issues. A key aspect of the Technology Clinic is to find effective solutions through an interdisciplinary approach. To find this unique solution, the clinic is composed of students from different disciplines and backgrounds. By having a diverse group each member of the Technology Clinic is able to bring their own expertise and perspective to the group culminating in critical thinking, troubleshooting, and an open flow of ideas.



The Team

From left to right: Sinan, Sarah, Dan, Kaitlin, Madison, Anna, Dave, Robin

The Team

- Sinan Dundar (’15) is a senior at Lafayette. He is pursuing a Mechanical Engineering major and an Economics minor. Throughout his four years at Lafayette, Sinan has been the president of Tau Beta Pi Engineering Honor Society, a member of the Men’s Club Volleyball team. After graduation, Sinan will pursue a master's degree in finance at Vanderbilt University.

- Robyn Henderek (’15) is a senior at Lafayette. She is studying Geology and Anthropology. At Lafayette, Robyn is the Teaching Assistant for Structural Geology, a Resident Advisor, and she is a member of the Lafayette Women’s Diving team. After graduation, Robyn will be working for the Grand Canyon National Park to study the paleontological remains in the caves of the canyon.

- Kaitlin Kinsella (’17) is a sophomore at Lafayette. She is pursuing a double major with Government and Law and Philosophy, with a minor in Women and Gender Studies. At Lafayette, Kaitlin is a member of the Speech Team, MOSAIC Staff (volunteering), and the Kirby Government and Law Society. Upon graduation Kaitlin hopes to work with human rights.

The Team (cont.)

- Madison Murray (’16) is a junior at Lafayette. She is a member of the Lafayette Women’s Soccer team, and is a double major in Studio Art and Spanish, with a minor in Art History and Architectural Studies. She is the Director of Studio Production for Ed Kerns, and hopes to attend graduate school for Architecture.

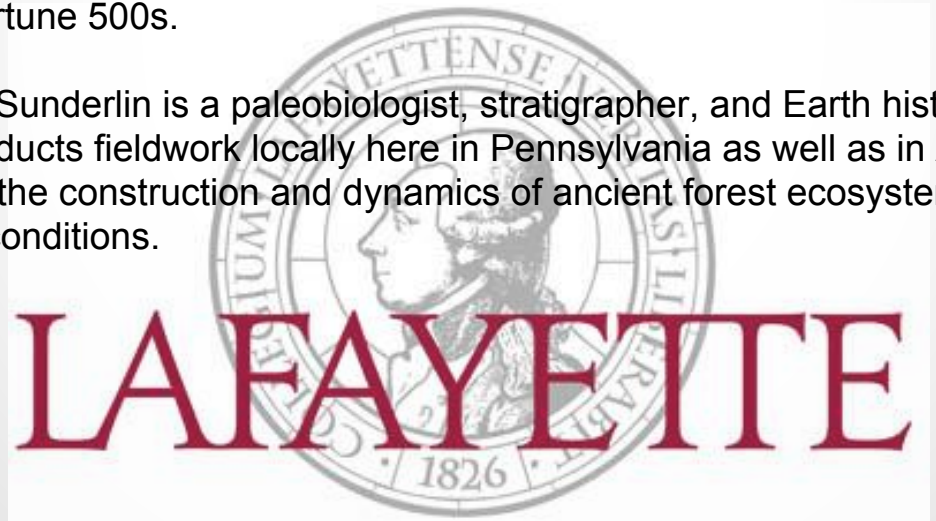
- Anna Wissler (’16) is a junior at Lafayette. She is pursuing an Economics major and Studio Art minor, and hopes to pursue interests in economic development after Lafayette. She is a member of the Lafayette Women’s Soccer team and gets involved on campus through the Peer Tutor and Peer Mentor programs.

- Sarah Woodruff (’15) is a senior at Lafayette. She is a program coordinator for Lafayette’s Landis Center for community outreach and is working towards a degree and Honors Thesis in Biology. In her spare time, Sarah volunteers as an intern at Safe Harbor homeless shelter, where she plans to work for six months before entering a Ph.D program in ecology.

The Team (cont.)

- Professor Dan Bauer founded the Tech Clinic in 1986. His undergraduate training was in engineering and journalism. He holds a PhD in social anthropology and has done research in Peru, Ethiopia and Mexico. He has remodeled houses in California, Pennsylvania and Germany. In his role as Tech Clinic Facilitator, he has worked with hydroelectric facilities, pharmaceutical companies, hospitals, museums, community development agencies, schools, colleges, and Fortune 500s.

- Professor David Sunderlin is a paleobiologist, stratigrapher, and Earth historian at Lafayette College. He conducts fieldwork locally here in Pennsylvania as well as in Alaska and New Mexico studying the construction and dynamics of ancient forest ecosystems under globally warmer climate conditions.



Our Client

DA VINCI SCIENCE CENTER™

http://www.davincisciencecenter.org/

This Technology Clinic partnered with the Da Vinci Science Center in Allentown, PA. The Da Vinci Science Center serves 16 counties in Pennsylvania and New Jersey. Over 120,000 people visit the Da Vinci Science Center annually. The Center connects “science to life and lives to science”. The Da Vinci Science Center aims at inspiring visitors to become the future scientists, engineers, and mathematicians of the world.

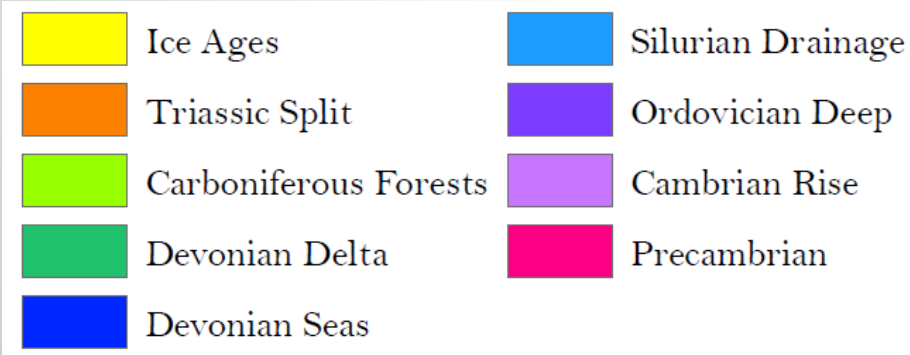
Mid-Year Presentation Findings

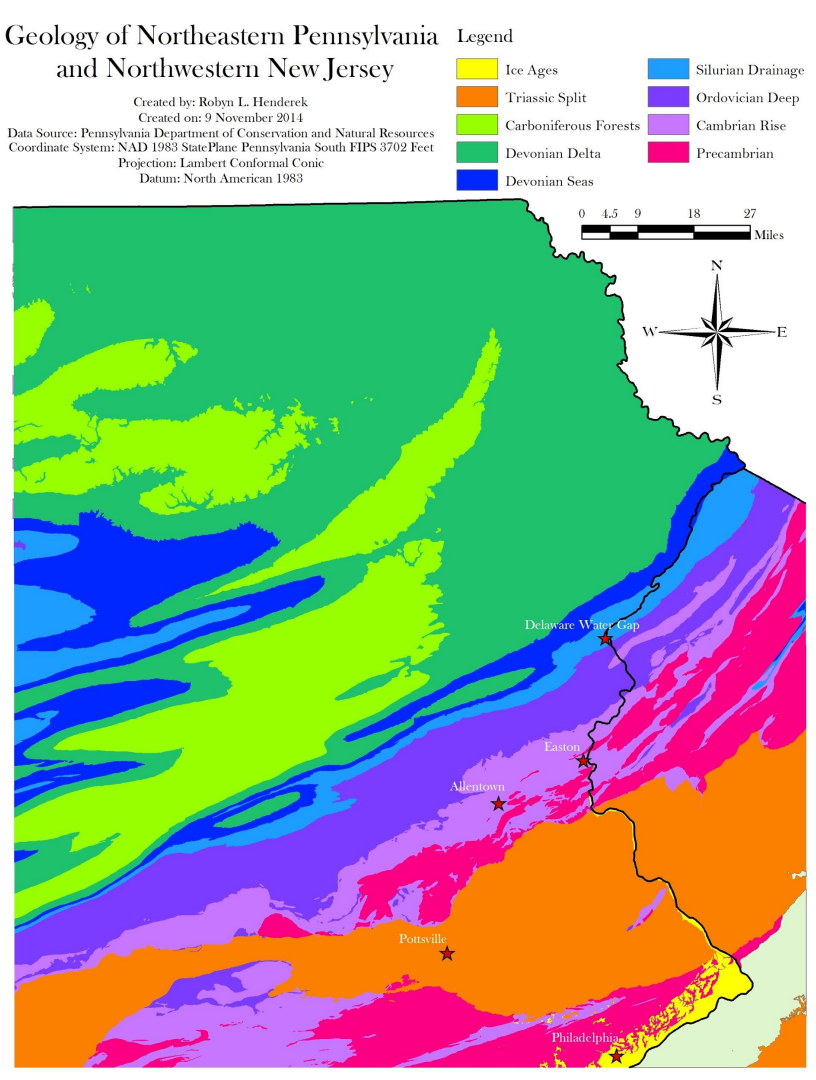
Da Vinci Science Center Staff suggested that:

- we try our exhibits/ideas with children
- we acknowledge space and money as concerns for the walk-through tunnel
- we make the passport more kid-friendly
- we look into potential sponsors
- we revamp the colors and incorporating them across the exhibit
- we think about marketing of the app

Color Code

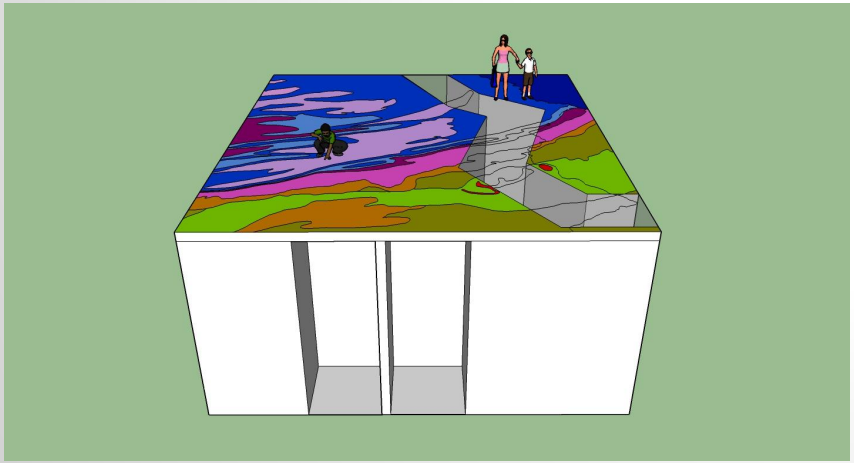
We changed the color scheme of the geologic phases to be more visually appealing. This same color scheme will be used to accent the different geologic phases throughout the many exhibits including the tunnel, elevator, passport, education stations, apps, and the interactive geologic map.

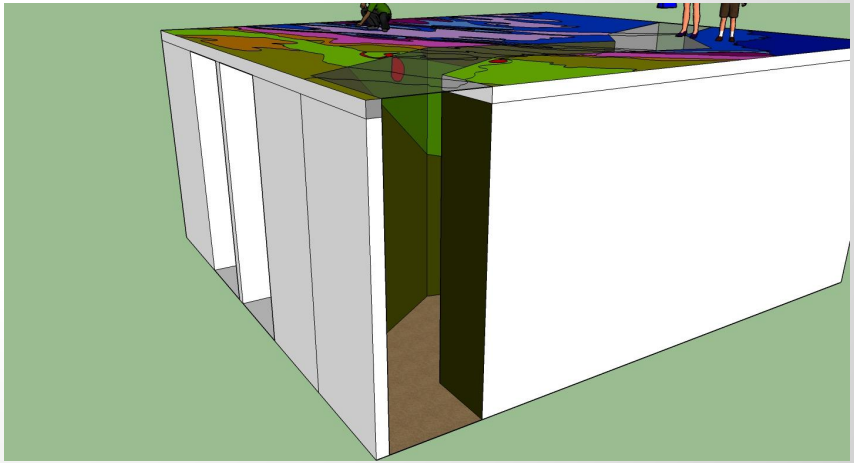




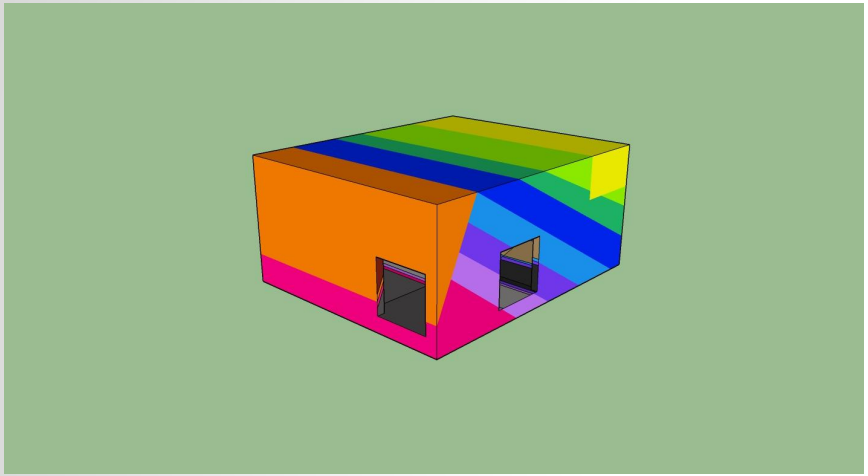
Crawl-through Geologic Tunnel

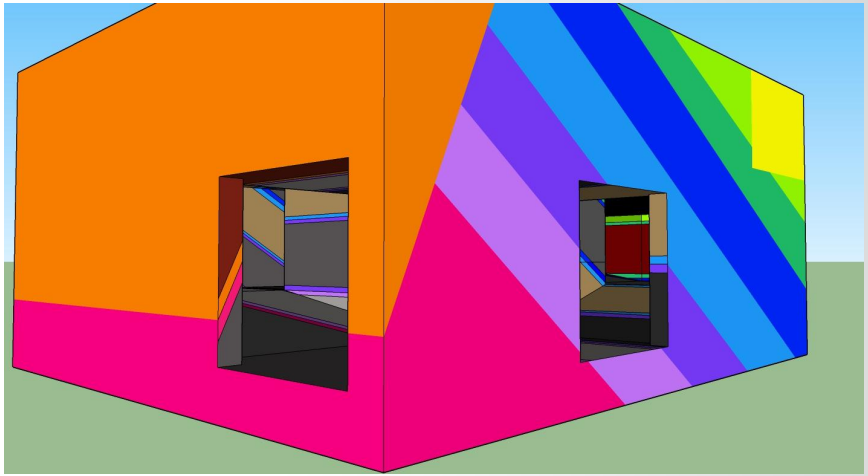
Last semester, we designed a geologic playhouse that offered a walk-through experience as well as interactive activities





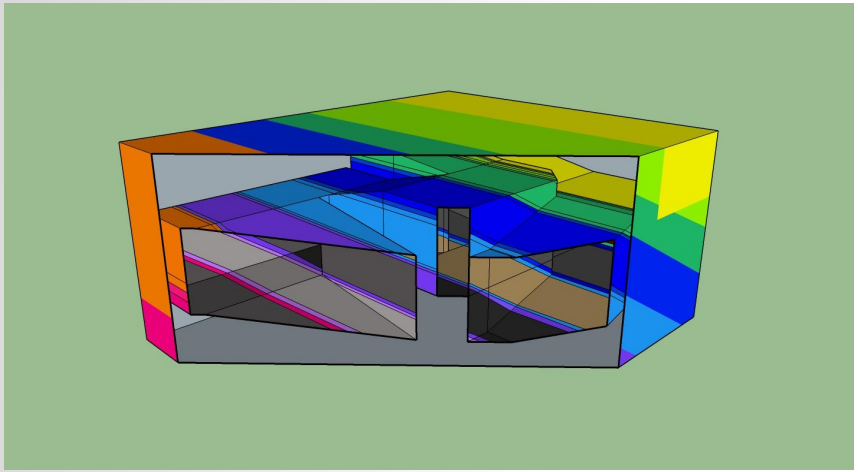
Tunnel

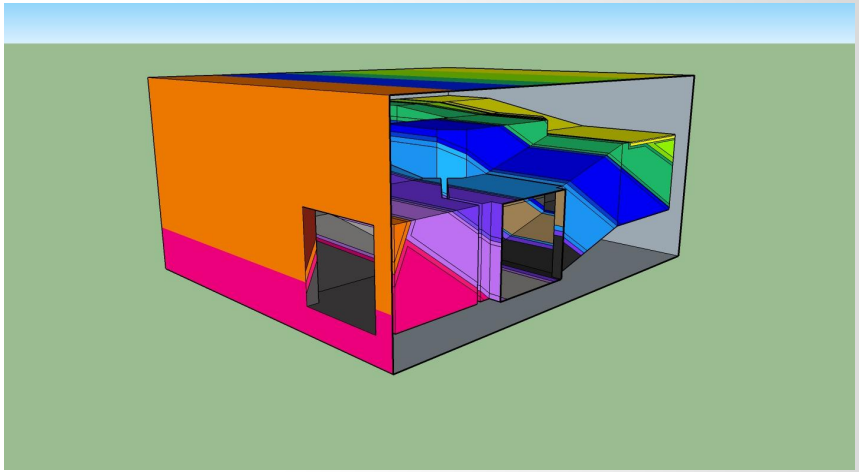




In consideration of space constraints, we have changed our design to incorporate the existing dark tunnel. This design plan offers the same interactive, immersive experience without the need to create space. We propose a design to retrofit the existing tunnel.

Tunnel





Using the measurements of the dark tunnel, we constructed and retrofitted a 3D model to illustrate simplified lithology of eastern PA. As visitors crawl through the tunnel, they will see what characterizes each geologic chapter and how the chapters relate to each other.

Tunnel: The Experience

The tunnel concept allows for a variety of components to enrich the experience:

- **Rock Walls:** Light, sculptable, customizable concrete will communicate the character of the rock. Walls can match rock color and be embedded with 3D fossils.
  - **Polygem Zoopoxy** is a commercial epoxy made for museum exhibits.
  - **Hypertufa Concrete** is a cost-effective alternative with longer cure time that still provides rock-like texture.

A sample hypertufa section

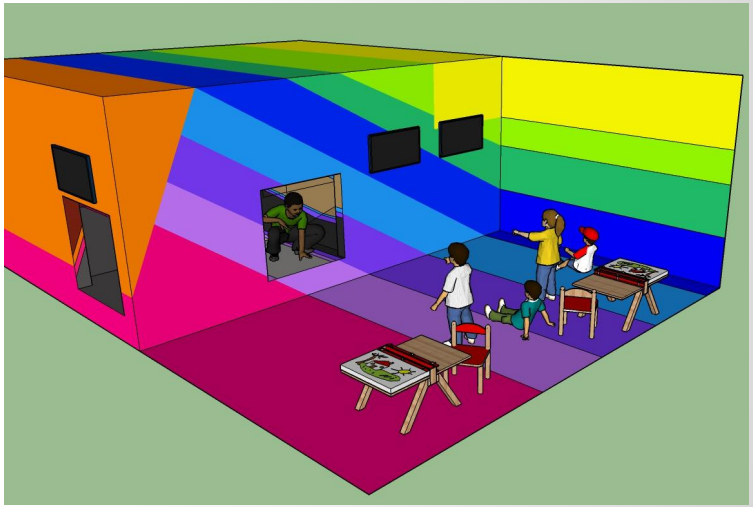
Tunnel: The Experience

- **Hardhats with headlamps**: Invite guests to feel like they are really exploring the bedrock.
  - **The Da Vinci logo** transforms hard hats into a great take-home.
  - **An alternate logo** invites outside funding/sponsorship.
- **CCTV**: Closed-circuit television allows parents to watch their children crawl through the tunnel, or entices other children to go exploring themselves.
  - **Mounted cameras** can screen tunnel interior on exterior walls.
  - **Wearable cameras** can broadcast visitors' personal experience.

Tunnel: Extension

The tunnel can easily be extended onto the adjacent floor and wall in an activity and waiting center. This will...

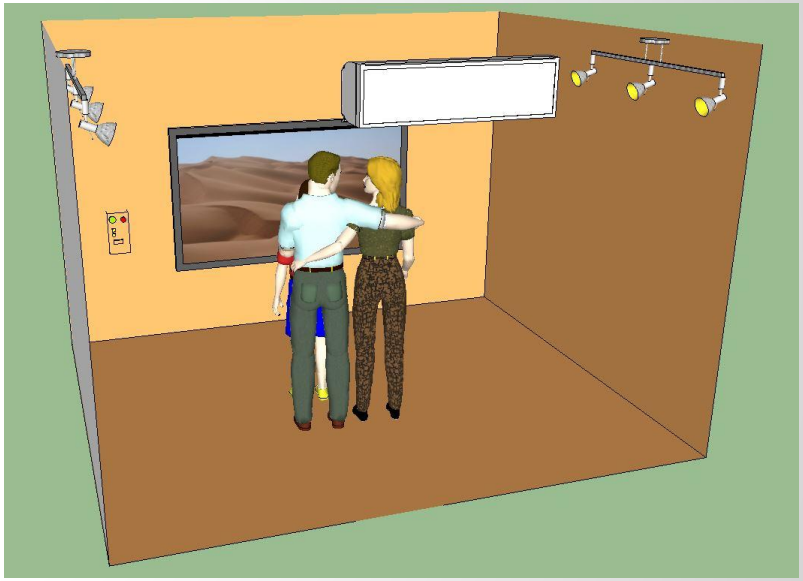
- extend the space allowing more room for geologic chapter-themed **education activities** (perhaps involving customized geology chapter colored *Crayola* crayons for visitors to use and take home).
- make for a natural **waiting area** for parents where they, too, can **engage with the content** in the exhibit.



Virtual Elevator through Geologic Time

Last semester we came up with the idea of a virtual, stationary elevator that would allow the visitors “to travel up and down” through Pennsylvania’s bedrock. During their “travel” the visitors would experience what it would be like to be in Pennsylvania in the different geologic phases.

This semester we worked on our ideas from last semester to make both “the elevator ride” and “the geologic phase visit” experiences more realistic.



Virtual Elevator: The Elevator Experience

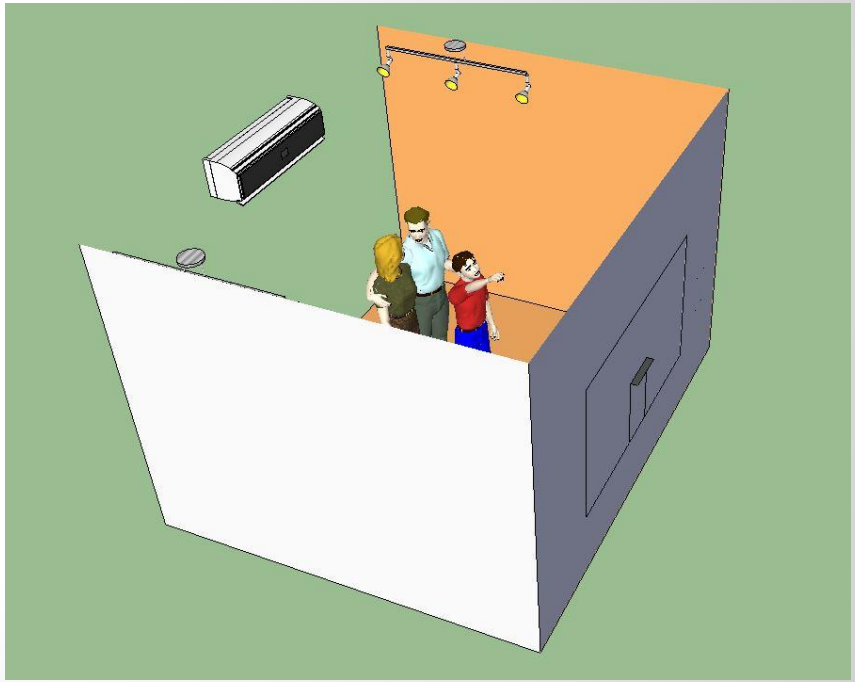
The virtual elevator design that we came up with aims to create a realistic experience of an elevator ride for visitors. Even before visitors enter the virtual elevator, the presence of a sliding door at the entrance and a real elevator button which lights up when pressed creates the impression of standing in front of an actual elevator.

When the visitors walk inside, they will encounter a small room, roughly at the size of a real elevator. There will be hand rails on the walls and a control panel, very similar to the ones inside elevators. The control panel inside the virtual elevator will be a touch screen. The visitors will use this touch screen to choose the geologic phase that they want to visit. Once they choose the phase that they want to visit, the woofers under the floor will mimic the initial movement of an actual elevator and the speakers on the walls will play sounds recorded from real elevators. The visitors will be able to witness “the movement” of the virtual elevator through “a window”, which will be represented by a big LCD screen.

Virtual Elevator: The Geology Experience

The geology experience will begin as soon as the visitors press a “floor” (geologic phase) button on the control panel. As the virtual elevator moves to the desired level, the LCD screen will show the rock layers passing by in a way that one would see floors moving up and down from an elevator window.

Once the virtual elevator reaches the desired level, the LCD screen will show a sequence of animated images of the general environment, fauna/flora, and the fossils from that phase. These images will be supported by sound effects played by the speakers on the walls.



Stationary Elevator: Sample Sequence (Cambrian Rise)

Carbonates (Allentown Formation)

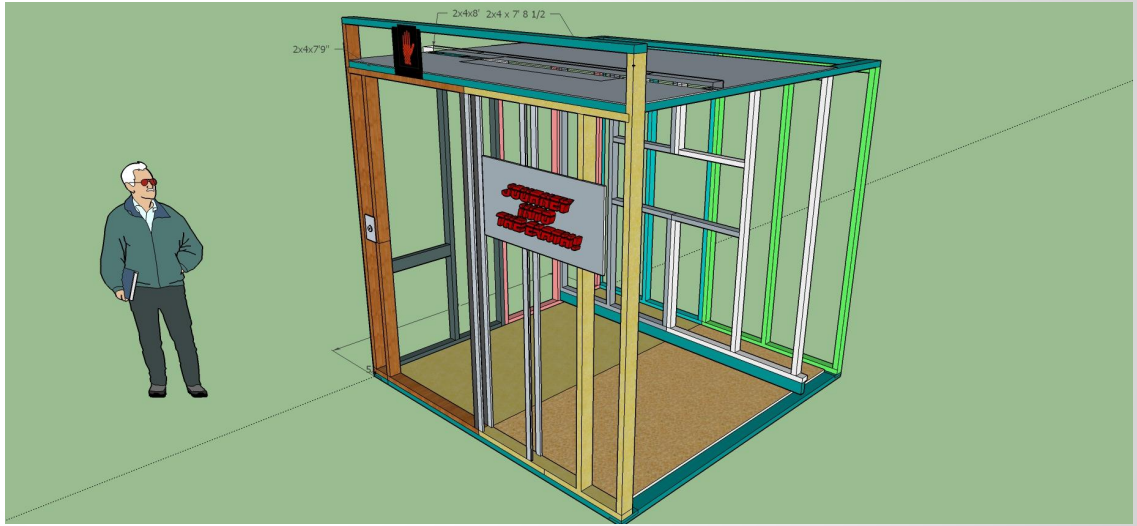
Modern Analog of Cambrian environment, Bahamas (https://www.flickr.com/photos/55497864@N00/8025842375)

Stromatolites (http://static.panoramio.com/photos/large/34194162.jpg)

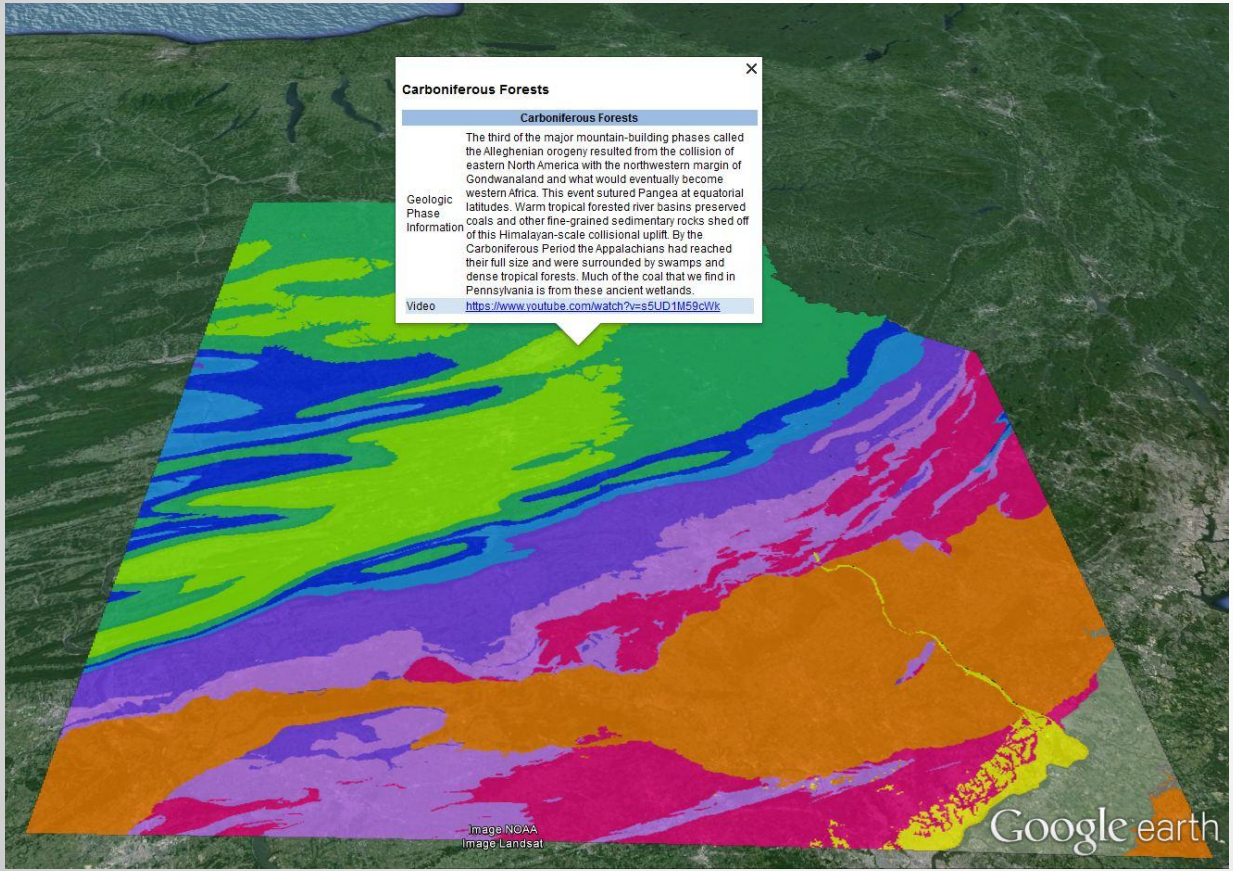
Stromatolite Fossils, (http://upload.wikimedia.org/wikipedia/commons/thumb/7/7d/StromatoliteUL03.JPG/1280px-StromatoliteUL03.JPG)

Virtual Elevator Unique Features

- Easy to assemble and disassemble: components that can be carried by two men
- Door will be hand operated to prevent the sense of being trapped
- Use of stock materials to minimize the cost
- The colors of the buttons on the control screen will match the colors of other exhibits to allow the visitors to make connections with other exhibits
- Hand symbol to indicate that it is occupied
- The videos will be stored electronically

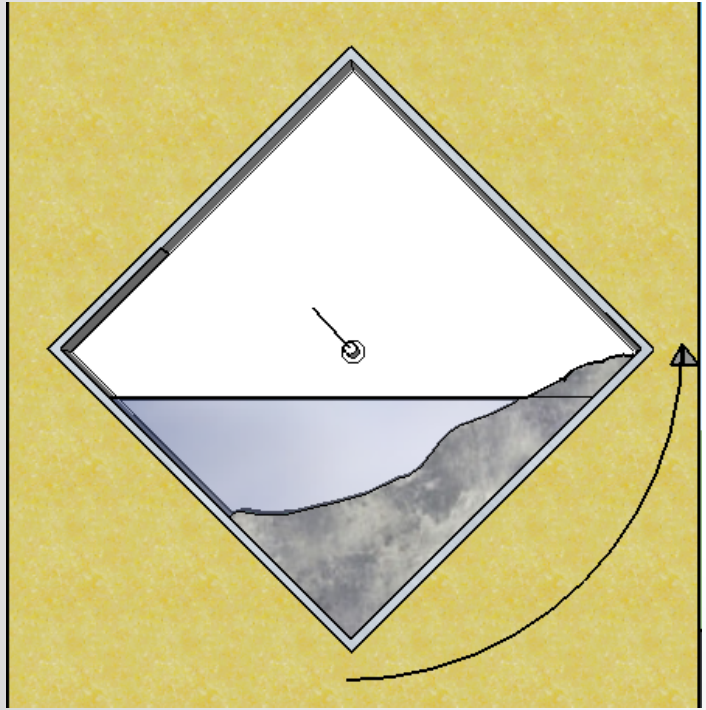


Large Interactive Geologic Map

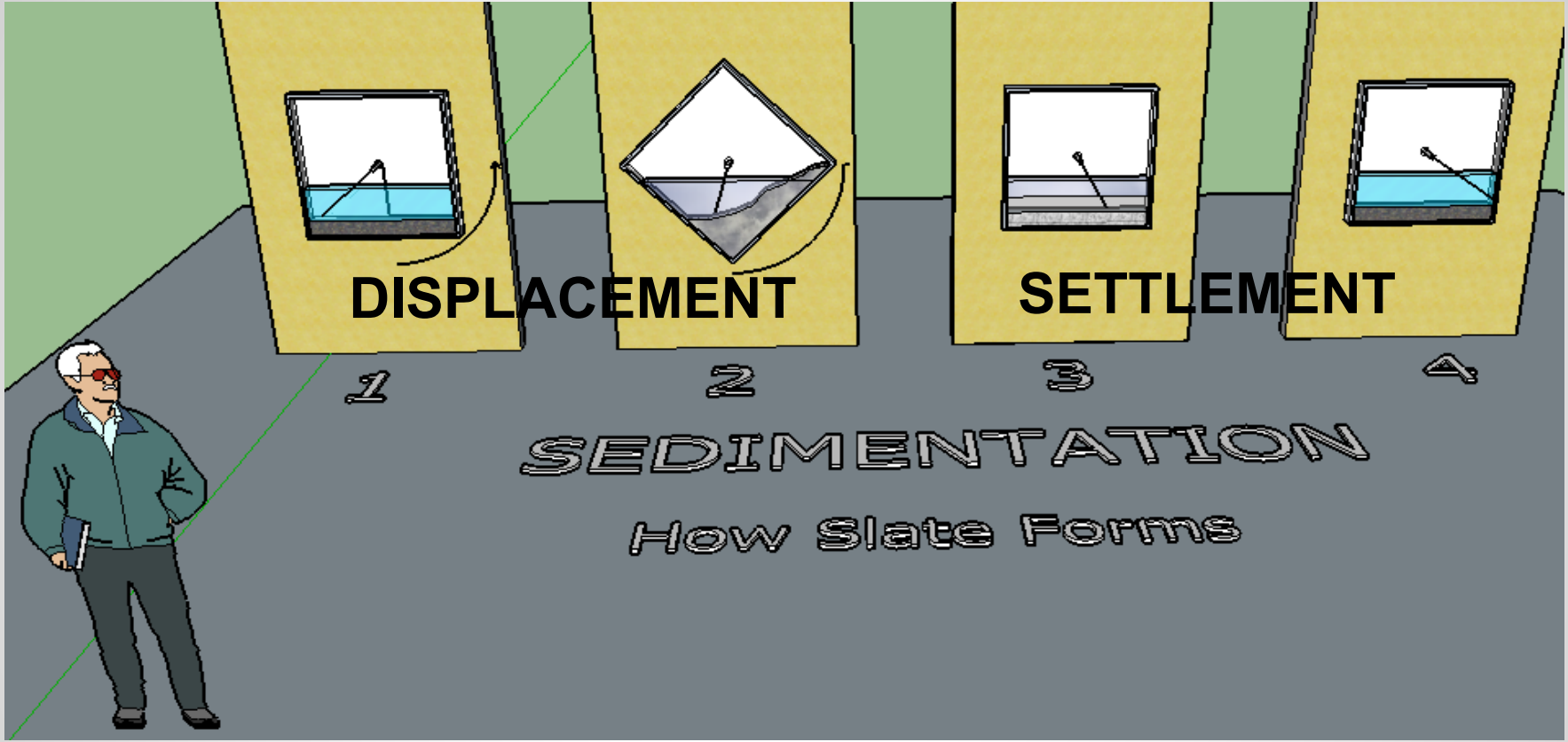


Using ArcGIS and Google Earth, we have made an interactive map which aims to engage patrons with the structure of the local geology. It is formatted in a .kmz file and can be used on any computer with Google Earth. Patrons can click anywhere in the map to display information about that particular geologic phase and a video that can be played through an embedded YouTube link.

Education Station: Sediment Spinners



This education station will show how sediments settle differently based on particle size. To demonstrate the differences there will need to be several spinners with different sediments from a variety of phases in the region's geologic history.



This illustration demonstrates what visitors would see with one sediment spinner. Visitors would be able to learn about the process of sedimentation for selected geologic phases and watch the sediment settle in a particular environment.

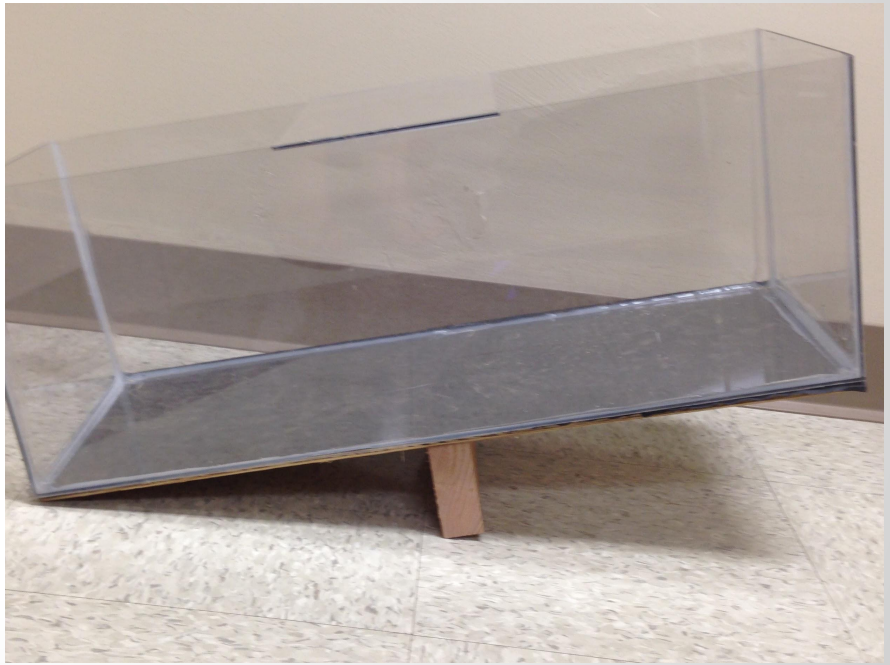
Sediment Spinners (cont.)

Supply List:

- PlexiGlass - Lexon
- Sealer- Silicon Caulk
- Water
- Gravel (or other sediment)

Options:

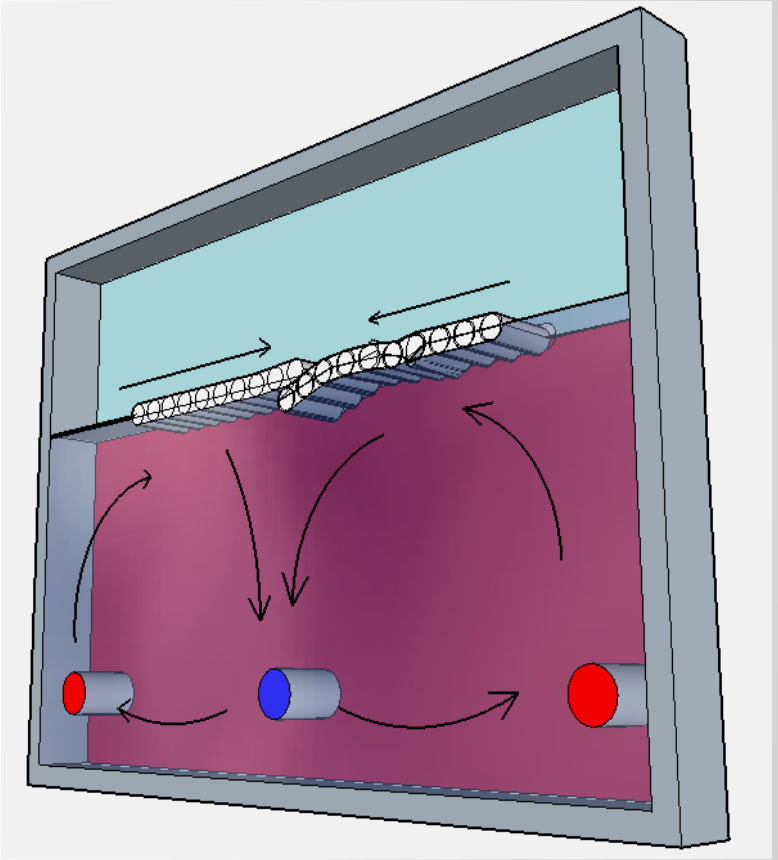
You can have the the spinners mounted to a wall or be hand held.



Tectonic Plates

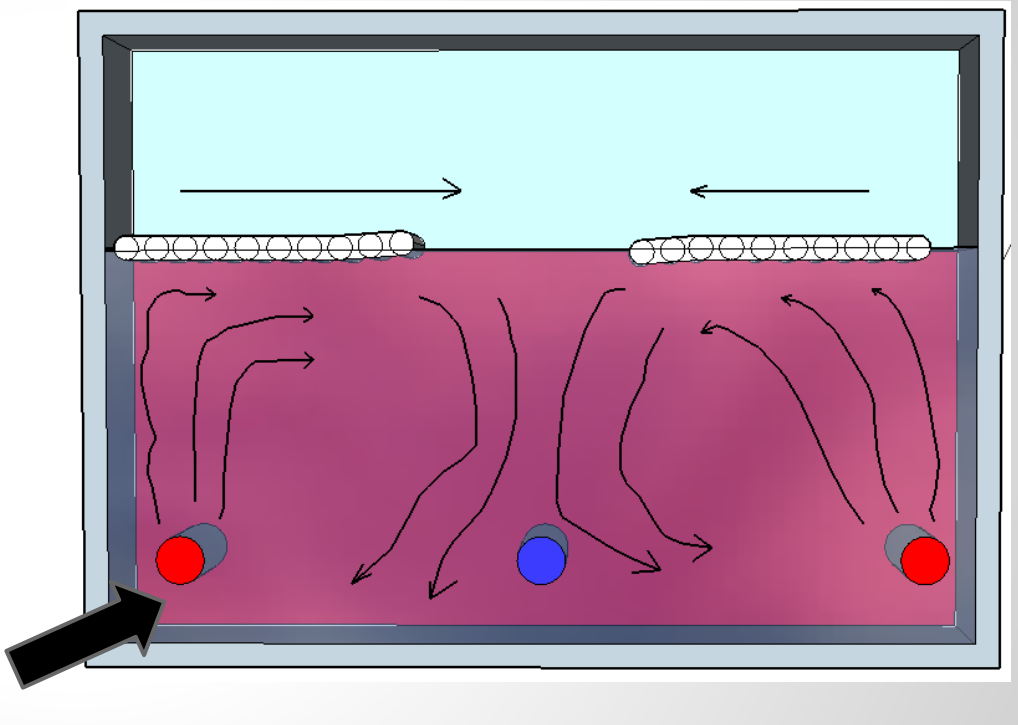
- This education station will show the general dynamics of convergent and divergent plate boundaries. As a result, visitors will be able to learn about subduction and convection.

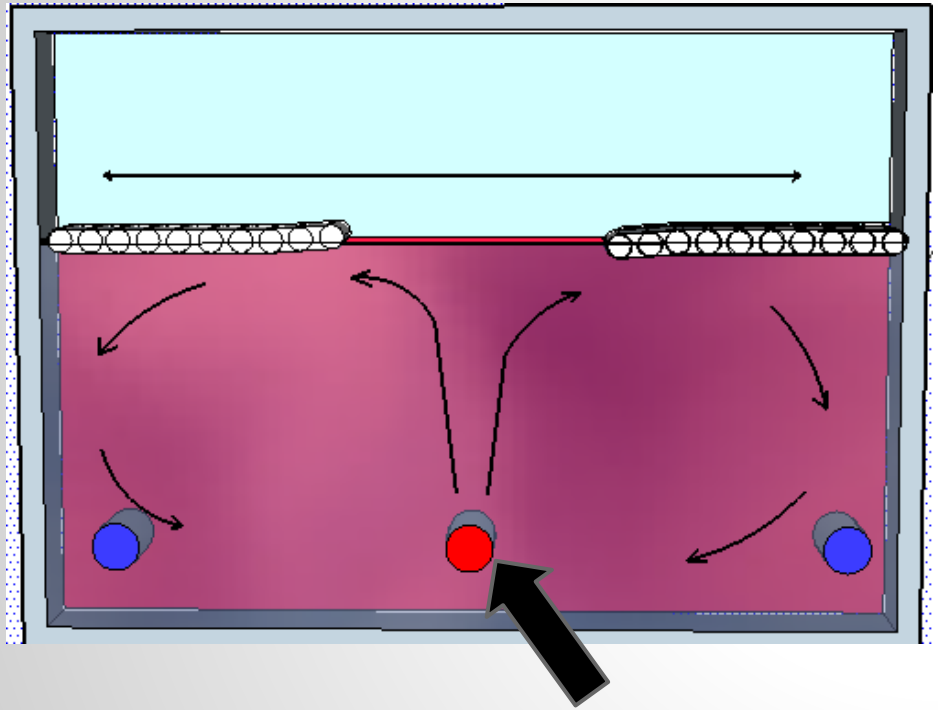
- The way that this display would work is that patrons would be able to choose to turn on either the outer or the middle heaters.



Convergent Plates

In this image the outer heaters are turned on. As a result, the two plates come together, imitating the movement of actual plates at a convergent plate boundary. This simulation will demonstrate subduction.





MIDDLE HEATER ON

Divergent Plates

In this image the middle heater is turned on. As a result, the two plates move apart showing what plates would like at a divergent plate boundary.

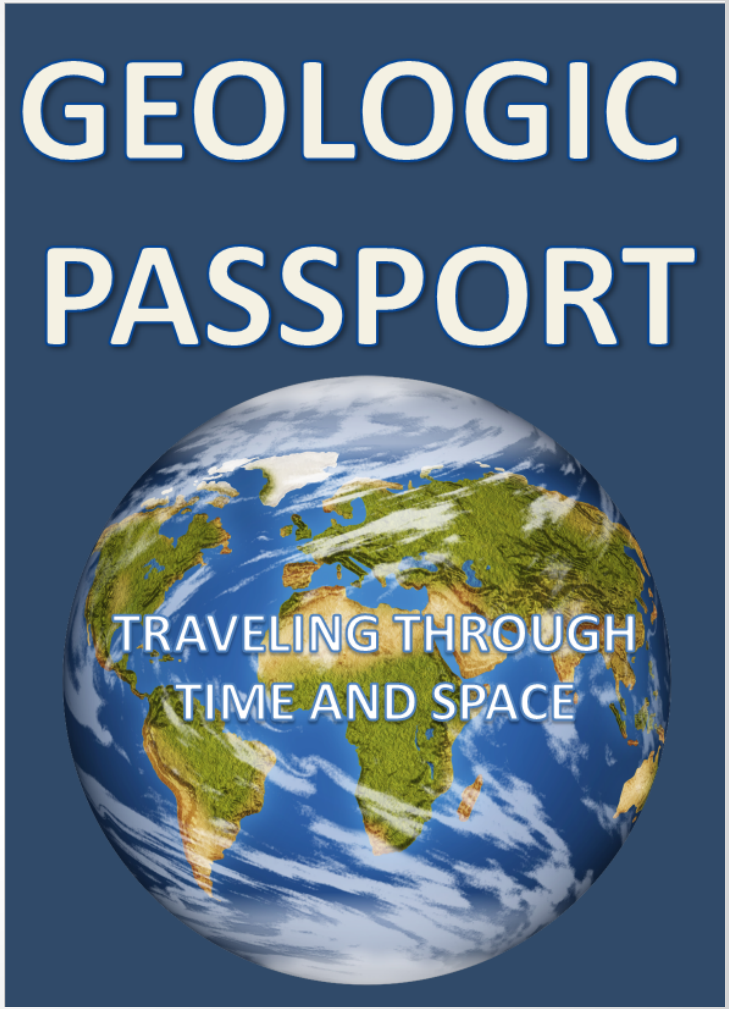
Tectonic Plates (cont.)

Supply List:

- Three diesel block heaters
- Propylene glycol (a common food additive)
- Styrofoam and weights (for the tectonic plates)
- Glass case

Geologic Passport

After hearing feedback from the mid-year presentation we realized we needed to modify the passport to make it more kid-friendly.



STOP ONE:

PRECAMBRIAN

The PreCambrian phase happened over 570 million years ago!

The rocks formed during this phase are hard metamorphic rocks. To form these hard metamorphic rocks there must have been very high temperatures and pressure.

Question: How did these metamorphic rocks form?

High temperatures and pressure

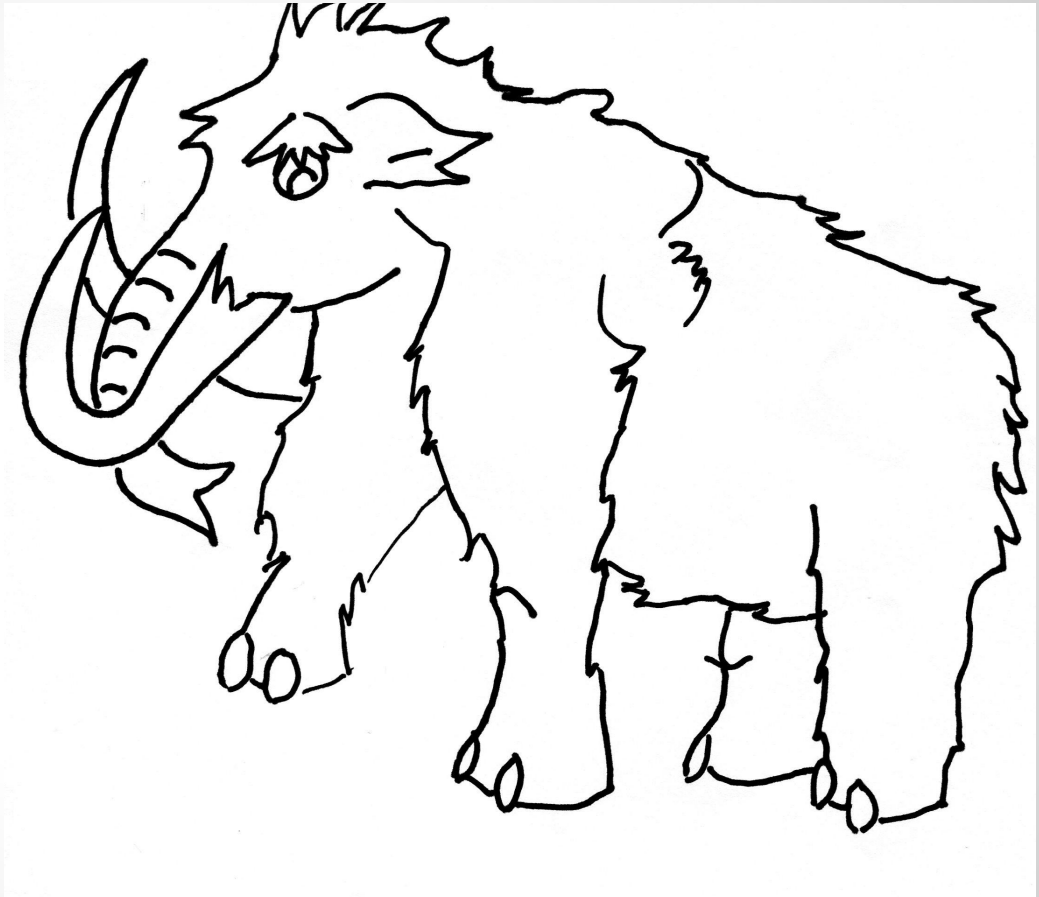
When the phase happened

Characteristics of the phase

Reading Quiz Question

The Geologic Passport gives kids a quick summary of the different phases that they will learn about in the elevator and the crawl-through tunnel.

Another way that we have attempted to make the passport more engaging and kid-friendly is by including a series of activities, such as the quiz questions and coloring pages. The various coloring pages all correspond to a specific time frame and include a brief description of what the picture is.



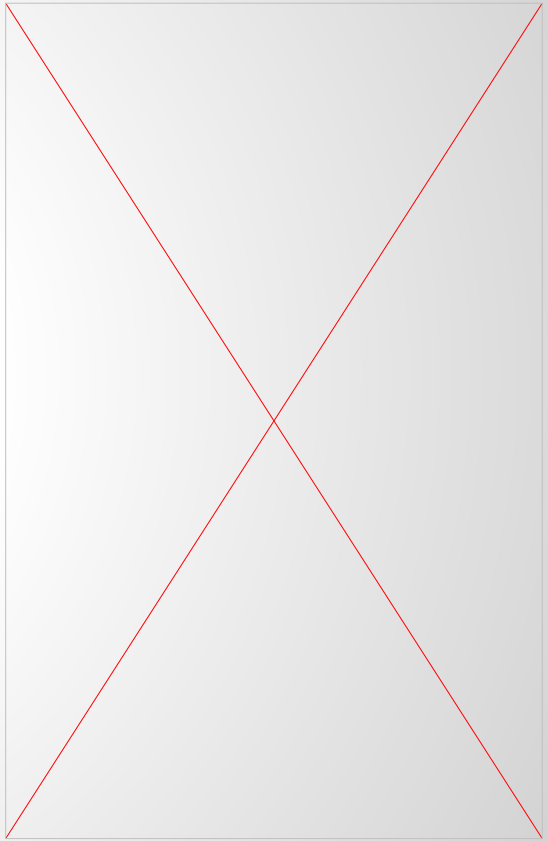
Smartphone Application

- The smartphone application allows the user to choose their own character from several cartoon animals dressed as explorers.
- The smartphone application menu will offer the following options:
  - to play minigames
  - access the interactive map of PA and NJ as found in the Da Vinci Science Center
  - access the Passport Companion (virtual version of the passport they receive when they visit the Center)
  - access their earned badges.

Minigames (App)

There will be 10 minigames to represent the geologic phases covered in exhibit components:

1. **Precambrian** - Rock sorting game. Different rock types (igneous, metamorphic, sedimentary) will “fall” down the screen in a line and the user will swipe left, right, or down to “sort” them into labeled boxes.

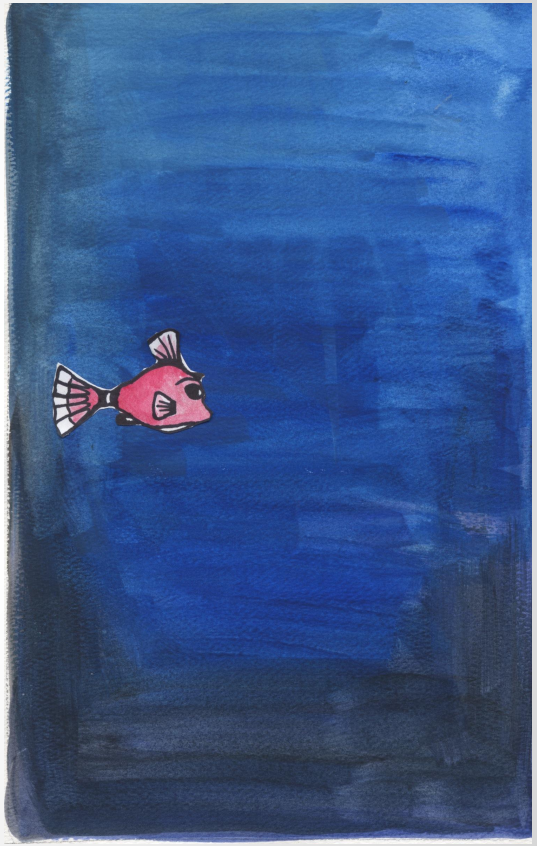


Minigames (App)

2. Cambrian - Stromatolite maze game. The user will guide a trilobite through a maze of stromatolites (characteristic of this phase) in order to collect food particles. Once swiped in a direction, the trilobite will move until it meets an obstacle, so users must use the stromatolites strategically.

Minigames (App)

3. Ordovician Deep - Falling objects game. An ostracoderm in the deep ocean must catch falling food particles but avoid falling debris and predators.



Minigames (App)

4. Silurian Drainage - Matching game. Sediments and fossils will fall, “draining” from the land into the sea. When three or more of the same type fall into line, the user can tap them to make them disappear. The surrounding objects then fall to fill their place and new objects appear at the top of the screen.

Minigames (App)

5. Devonian Seas - Bubble game. The user will try to blow bubbles to fill as much of the screen as possible. Bubbles initiate when the user touches the screen and grow until the user releases their finger. Advancement to the next level is initiated by reaching a certain percentage of screen coverage by bubbles. Bubble number is limited and three additional bubbles are given each round. Increasing levels also see increasing numbers of sharp nautiloids, which should be avoided because they can pop the bubbles.

Minigames (App)

6. Devonian Delta - Tree-climbing game. Tree climbing insects must hop from branch to branch of a swamp tree. The user must be careful not to linger on broken branches and to avoid branches covered in sticky sap.

Minigames (App)

7. Carboniferous Forest - Fossil hunter game. The user must fling an explorer across the screen to collect fossils. Higher levels include faster fossils, a greater number of fossils, and giant dragonflies to avoid.

Minigames (App)

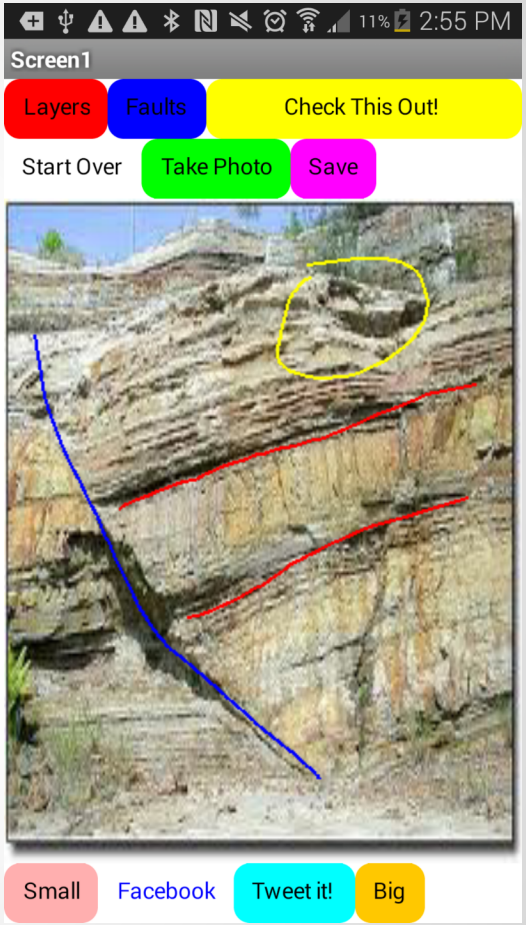
8. Triassic Split - Odd track out game. A group of dinosaur tracks will appear on the screen. One will be different from the others and the user must make the distinction. Increasing levels see increasing numbers of tracks that look more and more similar to each other. A timer will count down as the user tries to pick out as many “odd” tracks as they can.

Minigames (App)

9. Ice Ages - Bowling game. The user must fling an out-of-control mammoth across the ice into as many blocks of ice as possible to help him slow down. Points are awarded for how many ice blocks are set in motion per fling. Bonus points are awarded for additional collisions between blocks post-impact. Fling number is limited.

Minigames (App)

10. Anthropocene - Users can take pictures of local geologic POIs and mark features of note such as layers, faults, and Check This Out! (interesting features). They can then save the edited photo to their phone, share it on social media, or email it to the Da Vinci Science Center with coordinates attached to be considered for inclusion on the large interactive map.



Geotagging (App)

- The app will give users access to the interactive map of local geologic points of interest (POI).
- When a device nears a POI, it will send a notification to the lock screen.
- When a device enters a POI, the tag on that POI will turn from red to green on a user's map, signifying that they have visited this location.
- Users can also submit coordinates for new POIs upon approval of Da Vinci Center staff.
- Photos and comments may be attached to geotags, also upon approval.
- This interactive map will sync with a larger version to be displayed at the Center.

Passport Companion (App)

- The app will feature a digital version of the physical Geologic Passport that patrons receive when visiting the Da Vinci Science Center.
- It will also include virtual versions of activities that incorporate sound and animation.

Badges (App)

- Badges won for:
  - Achievements in minigames
  - Number levels of locations geotagged or visited
  - Number of visits to the Da Vinci Science Center
  - Number of passport activities completed

- Kept in Explorer Badge Book accessible from main screen

APPENDIX:

Third Street Alliance - Geology for Kids

Our team attended the STEM Afterschool Program at Third St. Alliance to present our concepts to the children. Some of the activities we did with the children included:

- A geology presentation on deposition of rock layers
- A cupcake activity that reinforced the concept of layering

CBLR Expo Poster Presentation

- We presented our current ideas at the Community Based Learning & Research Expo in April 2015.
- We received positive feedback from community members, such as excitement for the tunnel and smartphone app.

Potential Sponsors

- PennEast Pipeline
  - Community Connector Grant Program
    - Potential funder for retrofitting the tunnel
- Crayola
  - Sponsor for custom crayons used for the Passport
- Hardhats
  - Have a company donate plastic hardhats with their logo and use these as a giveaway with Da Vinci Science Center logo

Scout Badge Guidelines

Areas of overlap with Webelo Cub Scout “Geologist Requirements”:

- Examples of rocks/mineral used in products
- Examples of geologic materials used in the building of homes
- Describe what a fossil is
- Take a field trip to a local rock show

School Curriculum

Areas of overlap with local elementary curriculum:

- How the Earth formed
- Continental drift and Plate Tectonics
- Geologic strata
- How different conditions form different rock types
- Different rock types
- How fossils form

Geologic Phases

Phase 1 - Precambrian

Age: 570+ million years ago
Geologic Formations: Reading Prong

- In the vastness of time before the Cambrian, Pennsylvania (and all of North America) saw many phases of tectonic convergence and divergence.
- The record of ancient surface conditions is poorly preserved from this phase due to intense tectonic and erosive activity over long timescales.
- The overlying sedimentary layers cover the Precambrian record.

Gneiss, this high grade metamorphic rock makes up most of the Precambrian basement rocks in eastern PA. (http://www.sciencekids.co.nz/pictures/earth/metamorphicrock.html)

Geologic Phases (cont.)

Phase 2 - Cambrian Rise

Age: 570-500 million years ago
Geologic Formations: Allentown-Jacksonburg Formations

- Global sea levels rose in the Cambrian Period.
- On many ancient continental shelves, beaches transgressed onto land, leaving sandstones and their wake and records of shallow marine conditions atop the sands.
- Stromatolites are well-preserved in these units and represent much of the life present during this phase.
    - Stromatolites are algal colonies that oftentimes form in the shape of a mushroom; they are some of the earliest forms of life on earth

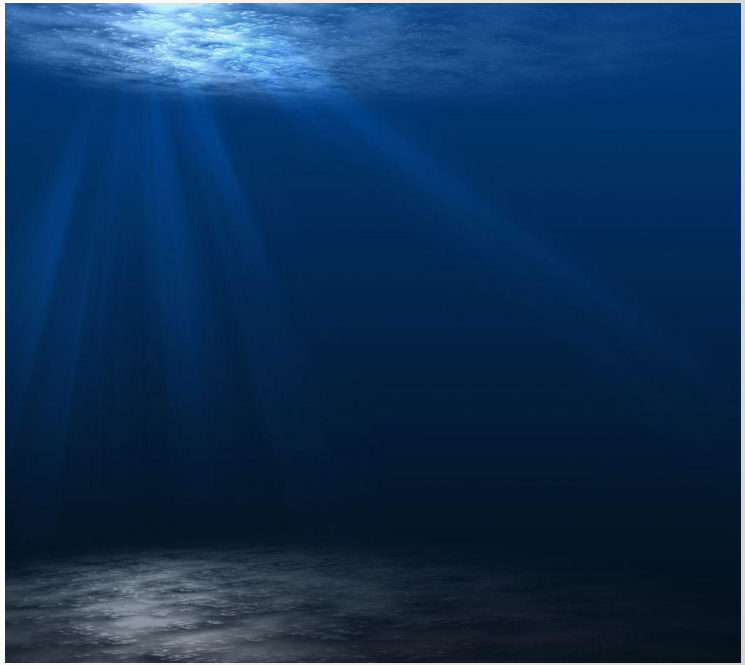
Modern stromatolite colonies in Shark Bay, Australia (http://en.wikipedia.org/wiki/Stromatolite)

Geologic Phases (cont.)

Phase 3 - Ordovician Deep

Age: 500-430 million years ago
Geologic Formations: Martinsburg Formation

- In the peripheral basin of the rising Taconic mountain building event, eastern Pennsylvania subsided to deep ocean conditions.
- The great thickness of fine-grained Ordovician strata, known as the Martinsburg Formation, makes up the “slate belt” in Eastern Pennsylvania.



Deep ocean environment (http://spotlightvalues.org/2012/02/01/diving-deep/)

Geologic Phases (cont.)

Phase 4 - Silurian Drainage

Age: 430-405 million years ago
Geologic Formations: Shawangunk - Palmerton Formations

- With the arrival of the Taconic mountain belt, uplands began to shed coarse gravelly and sandy sediments into Pennsylvania in river drainage systems off of the mountains.
- The Shawangunk and Bloomsburg formations start this succession, sometimes known as the ancient Queenston Delta.
- Some of the earliest land plants evolve during this time.

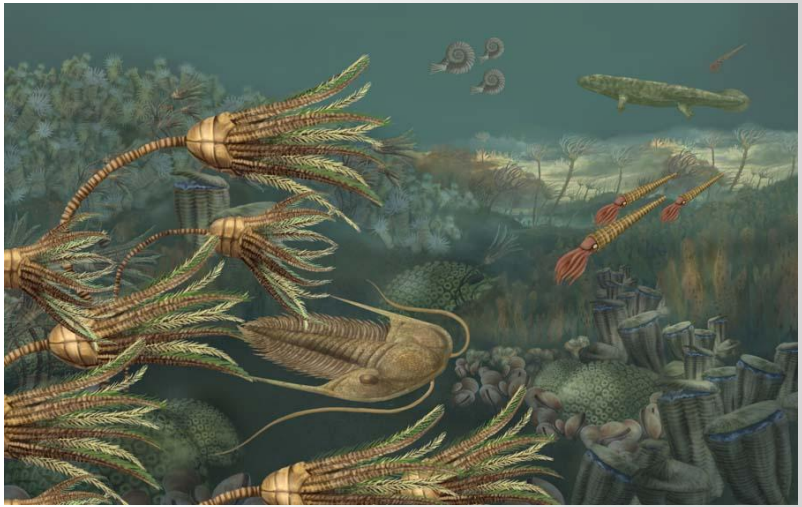
Weathering and erosion of sediments from highlands to basins. (https://www.studyblue.com/notes/note/n/streams-2/deck/1445574)

Geologic Phases (cont.)

Phase 5 - Devonian Seas

Age: 405-365 million years ago
Geologic Formations: Marcellus-Trimmers Rock Formations

- As the Acadian land mass neared the southeast coast of North America in the Devonian, the continental margin was depressed below sea level again.
- Marine mudrocks with abundant and diverse fossils represent continental shelf conditions just prior to the onset of the second major mountain-building event in Pennsylvania's stratigraphic record.



Life in the shallow shelf Early Devonian sea. (http://www.karencarr.com/portfolio-images/Marine-animals-and-fish/Devonian/Audubon-Institute-Insectarium/Audubon-Insectarium-Ancient-Seas-Mural/100)

Geologic Phases (cont.)

Phase 6 - Devonian Delta

Age: 365-330 million years ago
Geologic Formations: Catskill Group

- The Acadian collision and uplift to the southeast produced a mountain-scape that shed sediments westward across Pennsylvania in what is known as the Catskill Delta.
- The red rocks of the Catskill Formation and associated strata comprise this thick dump of sediment that mostly reflects terrestrial (land) environments in eastern PA, while western PA and central NY preserve offshore marine strata at the time.

Heavily wooded rivers as a modern analog to the Catskill Delta environment.
(http://www.audubon.org/images/photos/whiskey-bayou)

Geologic Phases (cont.)

Phase 7 - Carboniferous Forests

Age: 330-290 million years ago
Geologic Formations: Pocono-Lewellyn Formations

- The third of the major mountain-building phases, called the Alleghenian orogeny, resulted from the collision of eastern North America with the northwestern margin of Gondwanaland (an ancient continent which had parts of modern South America, Antarctica, and Africa) and what would eventually become western Africa.
- This event sutured Pangea at equatorial latitudes. Warm tropical forested river basins preserved coals and other fine-grained sedimentary rocks shed off of this Himalayan-scale collisional uplift.

Fossil ferns and seed ferns from the Lewellyn Formation (http://www.fossilera.com/fossils/fossil-seed-fern-plate-pennsylvania)

Geologic Phases (cont.)

Phase 8 - Triassic Split

Age: 250-180 million years ago
Geologic Formations: Newark Supergroup

- Long after North America's fusion with Africa in the Carboniferous and Permian, this suture tore open again sending each continent on a divergent path and opening up the modern Atlantic Ocean.
- Rift basins associated with this extension extend up and down the margins of each continent, one of which is the Triassic-Jurassic Newark Basin through New Jersey and southeastern PA.
- Red mudrocks and sandstones tell of seasonal lake and river systems with early dinosaur inhabitants.

Modern analog in the East African Rift Basin. (Robyn Henderek)

Geologic Phases (cont.)

Phase 9 - Ice Ages

Age: 2 million - 20 thousand years ago
Geologic Formations: Glacial till

Large Ice Age mammals, such as the woolly mammoth, ruled the tundra.
(http://www.earth4567.com/talks/ice.html)

- Since the demise of the dinosaurs at the end of the Cretaceous, erosion has been the dominant process in Pennsylvania. The rock units that contain the chapters of Pennsylvania's history are being exhumed by this erosion so that all the bedrock history described earlier can be read at the surface.
- The last major phase of deposition had to do with the Pleistocene ice ages and the tell-tale glacial till left on top of the bedrock in the northern reaches of the state.
- Mammoths, mastodons, and all sorts of other megafauna wandered these lands in tundra and boreal forest conditions just 20,000 years ago.

Anthropocene

- The Anthropocene is still an informal term for the time period when human activity begins to significantly affect local ecosystems, global climate, and Earth processes which will be reflected in the geologic legacy.
    - The exact time when the Anthropocene began is debated however, it is widely accepted as beginning during the start of the Industrial Revolution in the 19th century.
- Human activity has affected plant and animal biodiversity (which will be seen in the fossil record), climate, water systems, erosion from agriculture and other land-clearing activities as well as waste disposal.

As of 2006, for the first time in human history, the majority of people live in urban areas. (http://news.softpedia.com/news/The-Anthropocene-Began-in-the-18th-Century-200498.shtml)

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