Bulletin

of the Eastern Section of the National Association of Geoscience Teachers

Volume 72, Issue 3: Summer / Fall 2022

NCGE GeoCamp Iceland:

Nature and humans converge on a divergent plate boundary

by Ellis Pawson and Wendy Grimshaw
Virginia Beach City Public Schools & Salem City Schools

Each year the National Council for Geographic Education (NCGE) hosts GeoCamp Iceland, a 9-day field methods course providing an opportunity for educators to experience the unique geology, ecology, culture, and history of Iceland alongside local expert guides. The program explores the Reykjanes Peninsula, the Capital Region, and the Southern Region of the island. Two Virginia educators experienced first-hand the unique geologic processes, environmental considerations, and cultural highlights that illuminate the Icelandic way of living in nature, not on it.

Iceland spans the North American - Eurasian plate boundary just below the Arctic Circle and its position in the North Atlantic provides an ideal climate for the formation of glaciers.

Eleven percent of Iceland's landmass is covered in glacial ice, including many of the volcanoes that shape the island. The island sits above sea level due to a hotspot positioned under the plate boundary. The solidification of molten rock, coupled with the destructive power of weathering and erosion, produce the magnificent Icelandic landscapes. It was the interaction between volcanoes and glaciers that long ago earned Iceland its moniker: Land of Fire and Ice, but it was the Icelandic promotion of living with nature, not on it, that inspired NCGE GeoCampers.

While the interactions of Earth's spheres in such dramatic discord produce magnificent landscapes, Iceland's natural processes also produce unique challenges and opportunities for its people. In addition to its isolated location in the North Atlantic, Iceland is an environment of extremes where volcanic eruptions, earthquakes, flooding, severe weather, landslides, and other natural events are a constant threat. These challenges are highlighted in Icelandic culture, and centuries of Saga stories depict a way of life that dovetails well with the harsh environment. The volcanic landscape provides a seemingly endless supply of geothermal energy and raw building material, while glacial meltwater provides plentiful fresh surface and groundwater resources. Amazingly, Icelanders continue to develop innovative ways to live more harmoniously with the natural environment.

<u>Day 1: Keflavik and Fishing in Iceland</u>

Our first day of GeoCamp began in Keflavik on an abnormally warm and sunny summer day. Shortly after checking into our hostel - a renovated former U.S. Naval Air Station barracks - we boarded a bus and trekked off to explore the surrounding region. The Reykjanes Peninsula located on the southwestern corner of the island. Our trek took us through miles of treeless, moss-covered basaltic lava flows, to several historically and culturally significant destinations, including Sandgerði, a small fishing village Northwest of Keflavik where we explored the Sudurnes Science and Learning Center.

The center is not only an educational museum highlighting the natural history of Reykjanes, but also a working marine biology and ornithology research center affiliated with the University of Iceland. One exhibit highlighted various rock types from the bottom of Faxaflói Bay, foundational stones used in the construction of churches and lighthouses. Icelanders have used such natural resources to establish and build a thriving society for hundreds of years.

The museum exhibits also demonstrated that fishing in Iceland's coastal waters has long been an essential element of life. While Norse settlers over-hunted the Icelandic Walrus for its valuable ivory, leading to its extinction, the contemporary Icelandic fishing industry aims to reduce their impact on local fisheries. Iceland sets quotas not necessarily based on profit, but fishery health. They work with businesses to develop innovative ways to use one hundred percent of every fish caught.

<u>Day 2: The Reykjanes Geopark</u>

We ventured out into a typically cool, misty, rainy Icelandic summer day donning extra layers to keep us warm and dry. Our destination was the Reykjanes UNESCO Global Geopark, one of two geoparks in Iceland. The Geopark straddles the spreading center of the North American - Eurasian plate boundary, and was marked by the fissures and basaltic lava fields of several volcanic systems that

make up the region. Excellent examples of ‘a’ā (Icelandic: helluhraun) and pāhoehoe (Icelandic: apalhraun) were found throughout the region. As we traversed the landscape, mounds of lava rock stretched for miles, and steam rose from active geothermal areas, demonstrating the contrast between periods of destruction and renewal.

Our journey took us to Gunnuhver Hot Springs, an area rife with sulfur rimmed fumaroles and bubbling mud pits. As we hiked up a small hill to the spring’s viewing platform, an older twisted and broken viewing platform was seen teetering over a gushing geyser.

An earthquake in the not-too-distant past altered the underlying geology and changed the processes of the hot spring. Early settlers used active geothermal areas like this to plant potato beds and bake bread in makeshift pit ovens using the Earth’s energy to provide them with sustenance. Not far away was the Bridge Between Continents, a popular tourist attraction in the Geopark. The fifty-foot journey across the bridge connects the Eurasian side of a rift to the North American side--a fun photo opportunity for visitors.

Day 3: Reykjavik, Iceland: Modern Context

At 64 degrees north latitude, Iceland’s largest city, Reykjavik, is the most northerly capital city in the world. The name ‘Reykjavik’ is derived from the Icelandic ‘Reykur’, meaning ‘smokey’, and ‘Vik’, meaning ‘Bay’, combined to reference the “Smokey Bay” the first Viking, Ingolfur Arnason, described upon arriving in Iceland in 800 AD. Of course, the smoke he described was steam being emitted from the geothermal pools scattered throughout the area. Much has changed since those days, and we found Reykjavik to be a modern city with a robust history and diverse architecture, people, and commerce.

The Hallgrímskirkja Church sits at the top of a hill in Reykjavik. It is an awe-inspiring reminder of the influence of the natural environment on Icelandic life. The church was designed to imitate the jointing found in basalt columns across the island. The main spire reaches 244 feet and houses the church bells. We journeyed up the tower to the observation deck and were amazed by the views of the city, the bay, and the surrounding landscapes on a remarkably clear, warm day.

Day 4: Glaciers: From Hafnarfjordur to Hvolsvöllur

Iceland’s Ring Road circumnavigates the entire island and takes travelers past awe-inspiring views of glaciers, basalt cliffs, ocean vistas, volcanoes, and waterfalls. We drove the Ring Road through the southern glacial floodplains of Skeidararsandur, foothills pulled back like curtains revealing the jagged blue and white ice covering the mountains.

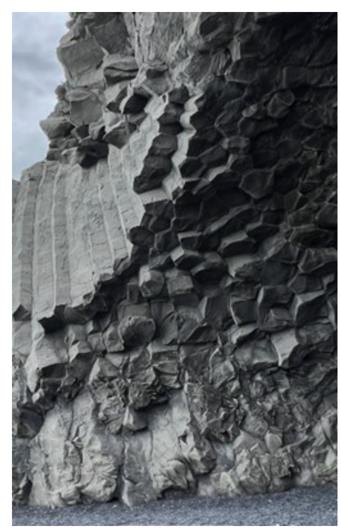
We viewed the glacier-capped volcano that erupted in 2010, Eyjafjallajokull, with its horsetail and plunge waterfalls seen veiling the cliffs. Seasonal meltwater and meltwater from volcanic eruptions poured over the southern part of Iceland, carrying and depositing sediment as it emptied into the North Atlantic. The water flowing over the region had clearly shaped the flat, sediment-covered landscape, a stark contrast to the rocky lava fields we left behind to our west.

We stopped to visit the twisted remains of the Skeiðará Bridge Monument at the base of three outlet Glaciers which originate Vatnajokull ice cap. The bridge was once part of Iceland's Ring Road but was destroyed by a flood in 1996 when the volcano below the ice cap erupted, melting the underside of the glaciers. As meltwaters flowed from underneath the glaciers, large icebergs broke free. The bridge was no match for the water and ice's might. The beauty of the glacier tongues juxtaposed against the twisted steel was a stark reminder of nature's power and impact on life in Iceland.

Later we boarded inflatable boats on the shore of Fjallsárlón, the glacial lagoon located at the base of the Fjallsjökull, another outlet glacier on the southeastern side of Vatnajokull. As we journeyed toward the glacial ice shelf that hung over the lagoon, our boat operator navigated around large chunks of sky-blue ice, some the size of two-story buildings, and some contain swirls of black ash deposited by past volcanic eruptions. Periodically, we heard thunderous claps of breaking ice echoing through the mountainous terrain above, a reminder of the ever-shifting ice slowly flowing toward us. Just east of Fjallsárlón was Diamond Beach, adjacent to a small inlet where icebergs traveled from the Jokulsárlón glacial lagoon to the North Atlantic. Massive crystalline ice, washed ashore by ocean waves, created a dazzling view as it came to rest on the ebony sands.

Day 5: Glaciers and Rocks

Formed from the weathering of basalt, black sand beaches were common throughout Iceland. We began our day with a visit to Reynisfjara beach near Vik. Mindful of the potentially dangerous surf, we explored spectacular examples of columnar basalt at the base of the cliffs (14). The beach was composed of well-sorted black pebbles and coarse sand, products of wave action weathering the basalt cliffs. Further evidence of wave action could be seen at the eastern end of the beach, where large sea stacks majestically stood just off the coast.



Weathering was just one example of the inevitability of change inherent to life in Iceland. We visited Solheimajokull, an outlet glacier of the fourth largest ice cap in Iceland, Mýrdalsjökull. As we hiked to the glacier, we passed several markers alongside the glacial valley. These markers were a haunting reminder of the fragility of these magnificent ice flows. Since 2010, local students have measured the glacier's retreat using these markers and GPS devices. Since measurements began, the glacier has lost 4.5 football field lengths of ice and continues to retreat.

Day 6: The Golden Circle

The Golden Circle is a route that allows tourists easy access to three major geologic attractions outside of Reykjavik. Our first stop was Gullfoss, a magnificent waterfall whose name means 'golden falls.' Meltwater from the Langjökull glacier travels through the Hvítá river before cascading over Gullfoss. As we hiked into the canyon we were drenched by the fall's chilly spray and impressed by the water's thunderous roar. While Gullfoss exemplified the power of runoff, our next stop illustrated the powerful intersection between water and geothermal energy.

As glacial meltwater and precipitation infiltrated Iceland's groundwater systems, magma below heated the water. We visited the first known geyser to the modern world. Called Geysir or The Great Geysir, the name is derived from the Icelandic verb 'geysa' meaning 'to gush'. The area was a high temperature geothermal area riddled with geysers, fumaroles, and hot springs which Icelanders have used for centuries to heat buildings, wash laundry, bathe, and even cook.

Day 7: Vestmannaeyjar Islands: Pompeii of Iceland

Our day to the Vestmannaeyjar Islands started with a ferry ride to Heimaey, the largest of the 15-island archipelago. As we approached, large cliffs, weathered by pounding waves and littered with seabirds, funneled us into the harbor. A short, drizzly stroll through the city led us to the Eldheimer Museum and the ominous, ghost-like, cone shape of the volcano - Helgafell – began to appear through the misty fog just outside the museum entrance.

Museum exhibits described the six-month eruption of Eldfell. The volcano erupted without warning on January 23, 1973. More than 5,000 inhabitants of the island were evacuated as ash blanketed the town and lava flows threatened to consume the entire town. Afraid the lava would cut off access to the town's harbor, ocean water was pumped from the ocean and sprayed over the molten rock. The efforts ultimately saved the harbor. After the eruption, most residents returned to the island, and pipes were embedded into the cooling basalt rock to heat water for the town. Outside of the museum, buildings were partially covered by lava and plaques listed latitude and longitude coordinates to identify where additional buildings once stood.

Day 8: Þingvellir National Park

With two days remaining of our epic Iceland adventure, we travelled to Þingvellir National Park.

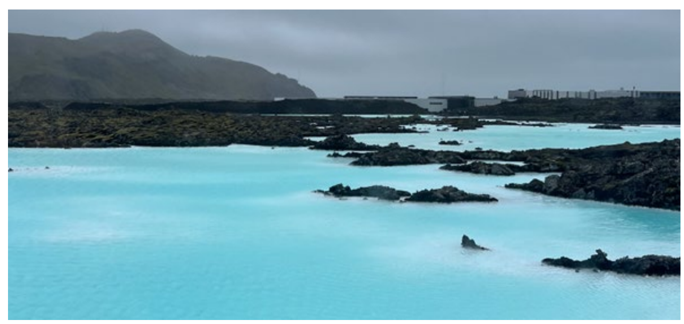
The park features noteworthy geological and historical features which meet UNESCO's World Heritage Committee's criteria for a World Heritage Site. Situated in a rift valley where the Eurasian and North American Plates diverge, massive rifts, cracks, and faults scar the valley. The landscape was largely composed of green plains covered in moss and other low-lying vegetation. Streams poured from the surrounding mountains into Þingvallavatn, Iceland's largest natural lake, but surface water sources only represent about ten percent of the lake's water. Ninety percent of the lake's water is derived from springs, which maintain clarity and a year-round temperature of 3-4°C.

We hiked through Almannagjá gorge, one of the many scars found across the valley. Volcanic rock cliffs towered on either side of the path. Rectangular mounds lined the pathway just in front of the cliffs—remnant footprints of buildings erected for these gatherings. Beginning in 930 AD, early settlers gathered here to host an annual general assembly called the Alþing. Each summer thousands would descend upon Þingvellir - meaning 'assembly field'- to discuss important issues, make national announcements, hold important diplomatic meetings, share stories, and trade goods with others from around the island. While divergence has shaped the natural landscape, convergence has shaped the social landscape of Iceland at Þingvellir.

<u>Day 9: Volcanoes, Geothermal Energy, and Health</u>

In March of 2021, the first volcanic eruption on the Reykjanes Peninsula in 800 years began. An eruptive fissure on the Fagradalsfjall volcano opened and produced a lava flow that continued through September 2021. Its proximity to the island's population center, and its less violent effusive fissure eruptive characteristics led to its unofficial designation as a "tourist eruption" It produced lava fountains and flows that flooded the surrounding valleys, including Geldingadalur, where we began our day with a hike. Newly formed black rock had flowed like a river out of the mountains and into the valley before us. We saw steam rising from parts of the cooling lava field, and admired the ropey texture of the basalt rock.

After our hike, we met with Albert Albertsson, the expert on geothermal energy in Iceland and the concept creator of the Resource Park, at the Svartsengi geothermal power plant. Located just outside the power plant, the Resource Park is designed to fully utilize geothermal resources in a sustainable manner. Underground water heated to extreme temperatures is brought to the surface for energy use, and runoff water from the process is stored in ponds. It was believed that porous volcanic rock under the pools would absorb the water. Instead, minerals from the water settled out and formed brilliant ghostly-blue, silica-rich lagoons. Today, these lagoons are repurposed as a recreational and therapeutic spa, and the Resource Park is dedicated to finding value in the minerals, brine, carbon dioxide, steam, and even pure air trapped in the vesicles of underground rock.



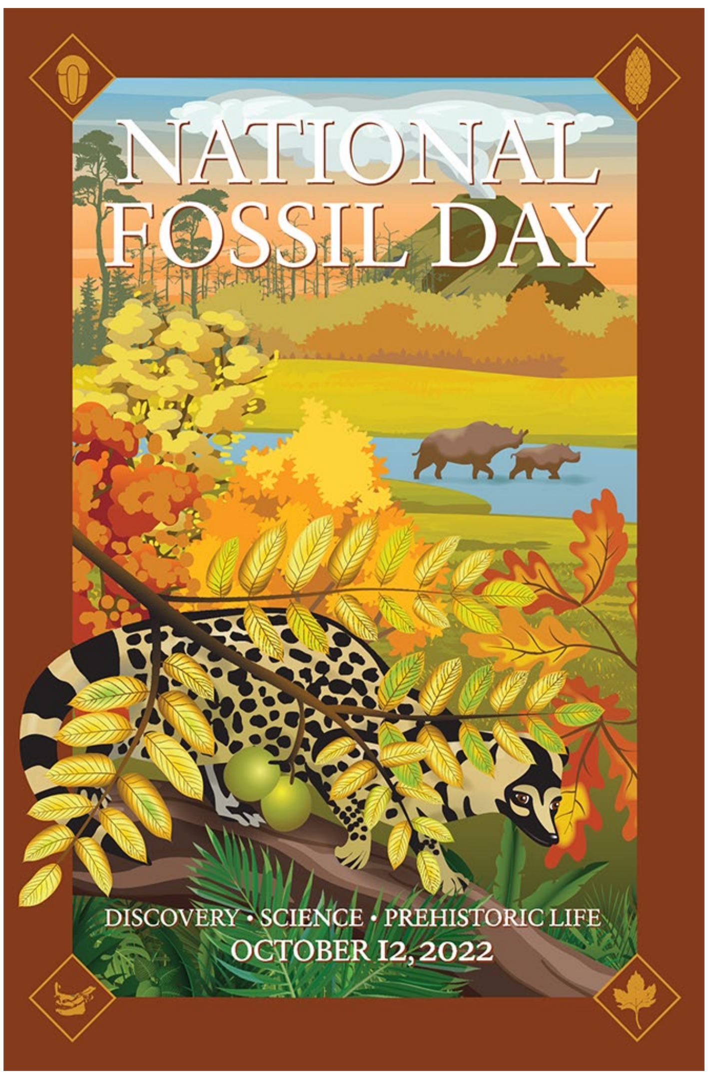
We spent a few leisurely hours at the Blue Lagoon spa while reflecting on Albertsson's belief that there is no waste, only valuable resources, a hallmark of Icelanders' experiences with nature. The Icelandic connection between humans and their environment has led to the development of sustainable living ideals and technologies across the geography of the island nation. If necessity is the mother of invention, then mother nature has provided the necessity. Icelanders continue to be inspired by in their natural environment. Their goal is not only creating value from nature, but also creating a wasteless society that "revives spiritual contact between man and nature" (Albert Albertsson, 2022).

National fossil day

NATIONAL FOSSIL DAY is on Wednesday, October 12. Plan an activity with your students, geology club, rock and mineral club, or other organization. Let us know what you did so we can include a summary of activities in our next newsletter!

The theme for 2022 is the Eocene forest, in celebration of the 150th year of Yellowstone National Park and its fossil heritage.

https://www.nps.gov/subjects/fossilday



Stitch Your Science 2022

by Laura Guertin
Penn State Brandywine

Following on the success of Quilt Your Science 2021, Betsy Wilkening and Laura Guertin are continuing their quest to bring together crafters of all ages and skill levels to share their passion for communicating about earth science. With the new name of Stitch Your Science 2022, the program encourages not just quilters but knitters, crocheters, weavers – any craft that involves a "stitch" – to create a product that tells a story about climate. Pieces can focus on a climate experience, solution, or even be a data visualization. Crafters are asked to submit a photo of their finished product with a description that will be posted in Google Earth and presented at a live Zoom session. Submission deadline is November 15. For more information, please contact Laura (guertin@psu.edu) and visit: https://bit.ly/stitchsci22 Collaborative group/classroom projects are also invited to submit!

An Alternate Approach:

Teaching Minerals & Rocks as a Single Unit

by Martin Schmidt
The McDonough School

Over time, I have become unsatisfied with the way minerals & rocks are traditionally taught in geology class, along several lines. So I will pass along some observations of trying a different approach in case it's of use.

In usual geology course and textbook organization, many intro classes teach minerals, then sequentially chapters on igneous rocks (& volcanoes), sedimentary rocks, and metamorphic rocks. Spread out over book chapters, these subjects take time to get through, thus creating a somewhat disjointed view of the rock classes (this is the term I use for igneous, sedimentary, and metamorphic rocks, not rock "types" - that's for individual types - what do you call them? Groups? Families?). Also, students can forget whatever they learned about one rock class by the time they get to the next one, and heaven forbid they should have to connect knowledge of one with another. And for my high school class in one semester, time is tight and we use (online) geology textbooks for reference rather than for sequence anyway.

So instead I tried teaching minerals, then the 3 rocks classes, together. To keep it from being too much, I limited the study to 7 common minerals, and 6 or 7 important rock types in each rock class (see selections at the end of this article); they also had quizzes along the way to "chunk" the learning. But we start with the rock cycle and use that as scaffolding throughout, and see that all rocks are identified by texture and composition, even though those vary in the different rock classes. I'm less worried about them memorizing all the rock characteristics, but instead they can use information given in a table - like the one for NY Regents, with some editing. They do look at real rocks in lab, but mostly to make the words have visual meaning. We all know it takes time to learn to ID rocks on sight, and a few labs aren't really enough.

The study also includes an introduction to processes that would normally be in the rock chapters of a textbook, building on the rock cycle: For igneous rocks understand volcanic vs. plutonic, for sedimentary understand weathering & sediment maturity, and for metamorphic understand protoliths and qualitative metamorphic grade.

At the end, we return to the rock cycle to see connections to integrate all the rocks and begin to see rock systems evolution. We can also connect rocks to local & regional landforms for similarity: sandstone and quartzite are usually at higher elevations in our eastern U.S. landscapes, for the same mineral composition reason (quartz), while limestone and marble are usually lower (calcite) - and then there's the protolith connection for these pairs (not a coincidence!). Having discussed all this, they are ready for later work on where the rocks are found in plate tectonics, and ready to see meaning in what's under their house (in the Piedmont or Coastal Plain). In short, I find I can ask much better conceptual & integrative questions about minerals & rocks if they are studied together rather than apart.

It does require going back to study some subjects & details that would have been in a textbook chapter, such as specifics on volcanoes to get more of the picture for igneous rocks, or more on sedimentary stratigraphy to see how that tells us geologic sequences. Still, I find it to be a better systems approach.

Of course some of our NAGT members may have been doing this for years. If so, I welcome more tips on improving this method.

Materials selected - It's only an intro course, but if they learn these, they have a good start, and know lots more than those who haven't had a geology course.
Minerals: quartz, K-feldspar, plagioclase, mafics (as a group), micas, calcite, clay
Igneous: rhyolite, andesite, basalt, granite diorite, gabbro
Sedimentary: breccia, conglomerate, sandstone, shale, limestone, coal
Metamorphic: slate, phyllite, schist, gneiss, quartzite, marble, serpentinite (because it's local!)

Sign up for live ship-to-shore broadcasts from *JOIDES Resolution*

by Laura Guertin
Penn State Brandywine

While the scientific ocean drilling vessel *JOIDES Resolution* (https://joidesresolution.org/) is at sea, classrooms and community groups can sign up for free Zoom sessions to connect with the ship. An Onboard Outreach Officer walks around the ship with an iPad to show you the research laboratories, discuss how we sample sediment and basement material from the deep sea, and moderates question and answer sessions with the scientists on board. You can request your tour focus on specific topic areas, such as plate tectonics, geology, oceanography, careers, how science is conducted at sea, etc.

The full expedition schedule, with links to descriptions of the scientific objectives of each two-month expedition, is available at: http://iodp.tamu.edu/scienceops/index.html The expeditions for the remainder of the calendar year include:

- Transit and Return to Walvis Ridge Hotspot (Exp. 397T, Sept. 10 – Oct. 11, 2022)
- Iberian margin Paleoclimate (Exp. 397, Oct. 11 – Dec. 11, 2022)
- Hellenic Arc Volcanic Field (Exp. 398, Dec. 11, 2022 – February 10, 2023)

To check for available days/times of tours and to book your class/group tour, visit: https://joidesresolution.org/about-the-jr/live-video-events-with-the-joides-resolution/

If you have any questions about a virtual JR experience for your students, feel free to reach out to Laura Guertin (guertin@psu.edu, Onboard Outreach Officer for Expedition 390, South Atlantic Transect I (April-June 2022)).

Field photo

by Martin Schmidt
The McDonough School

Cliff along a fiord northeast of Nuuk, the relatively bustling capital of Greenland. Boat access is the only way to get to this cliff, at about lat/long 64.221948, -51.315977 . Like a lot of Greenland, the rocks here have obviously been through the wringer over geologic time - Macrostrat puts the age of the rock in this area at 4000 - 3200 Ma.

The *Bulletin* is edited by Callan Bentley, Piedmont Virginia Community College. Please get in touch with your feedback, contributions, or if you would be interested in helping out with editing.

Thoughts on Magazines & other Collections

by Martin Schmidt
The McDonough School

I consider myself fortunate to not have had to move my residence a lot over the years, though you might say a downside is that I haven't cleaned out my stuff much, so it accumulates. Specifically for this article and where it appears, I find I have about 30 years (1981 to 2010) of paper copies (the only kind there were in that time period) of the Journal of Geological/Geoscience Education. So the first question of this article is this: Does anyone want these or have other ideas what to do with them?

When I look through them, there are some nice cover photos (OK, I have 6 covers with pictures I took over the years that I'd like to save), and I'd probably find some articles of interest if I read some of them again. But like everyone, I don't have much time for that, which is the reason they have sat in pretty much undisturbed piles for all these years.

I will check with NAGT National to see if they want them - but they probably get these offers frequently. Send them to a school/college library could be a suggestion, but the reality is the magazines are old and students want to and should be reading more up-to-date information, which also likely won't be on paper these days. So is "recycle" the only thing to do?

A bright spot for however long it might last: When we manage to have an in-person Eastern Section meeting again, our Archivist Steve Lindberg has said he can take the stacks of old paper Eastern Section Bulletin issues, so they won't get recycled yet. OK for now.

And then I also have stacks (perhaps less complete) of Earth in Space (AGU), Earthquakes & Volcanoes (USGS), Geotimes >> Earth Science >> Earth Magazine (AGI - I think that's the order of the name changes), The Earth Scientist (NESTA), NCSE Reports, and In The Trenches (recent NAGT). Again, I can check with source organizations but they probably already have all they need. Interesting as they may be, I doubt if I have need or time for them for current reference.

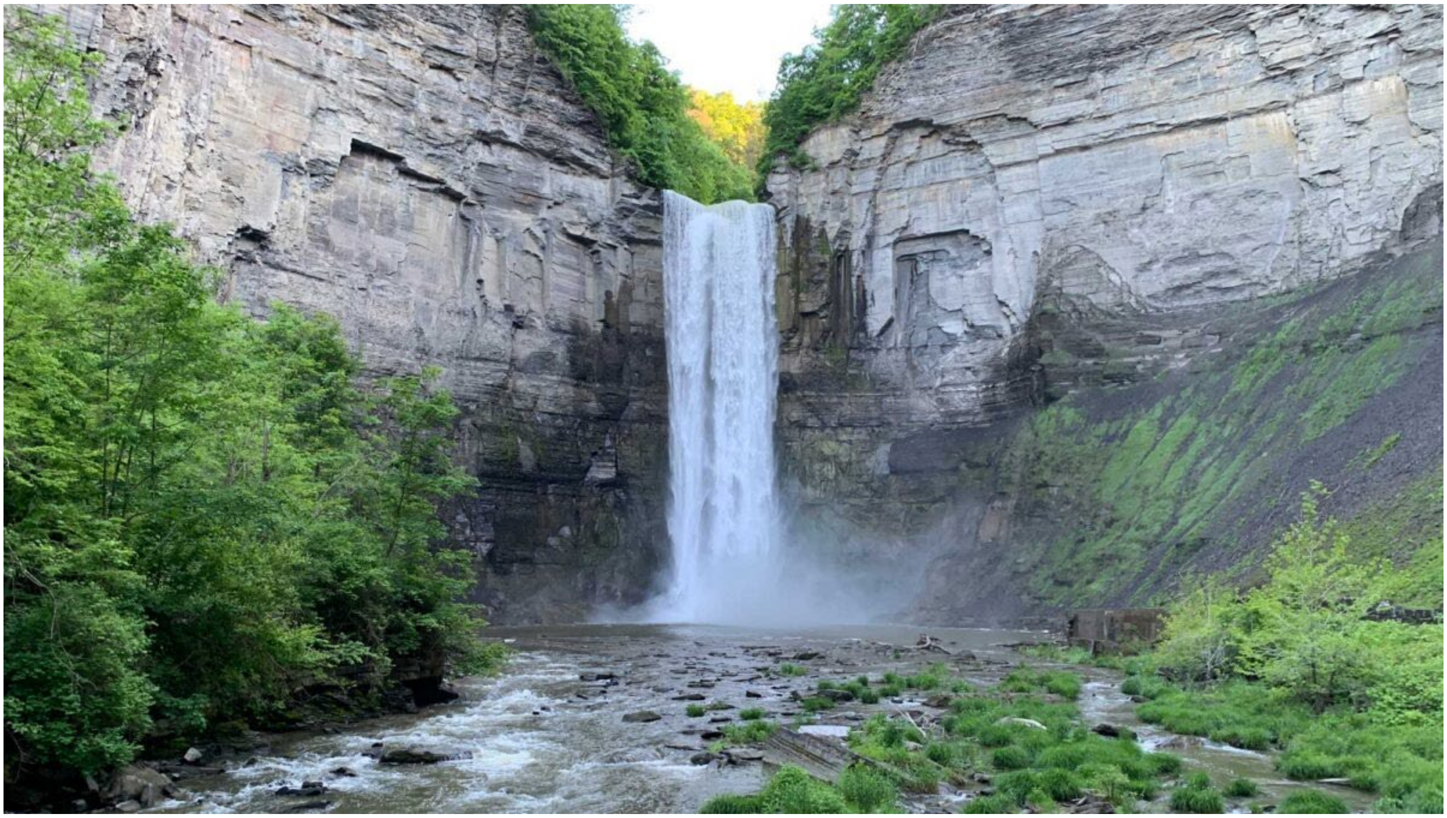
The fundamental fact may be that print magazines we might label as meso-temporal, lasting longer than newspapers (we get rid of those easily & quickly), but ultimately less-lasting than books. So we just have to accept that we will discard/recycle our paper magazines after a while because they lose their value over time, and move on. Even all those National Geographics (I gave those to the school Art Department for students to cut up). Attractive for a while, but ultimately passing. *C'est la vie*. Anyone have other thoughts on this?

And this goes on: What's everyone doing with the photographic slides from their geologic travels? Scanning can happen but takes time - will we just toss all those slides out? Once having moved to digital photos, it's easier to use those in class if we have the time, but a question down the road will be what happens to all those files when we're through with them. And of course there are lots of pictures on the internet of places we haven't been, often tied to 3D views in Google Earth, so even our own pictures we are proud of will be deleted one day.

And our rock collections - got a place for those? I'm a volunteer curator at the Natural History Society of Maryland so there is a local museum striving to grow and where I can send my collection when I'm through with it. But even they have limits and don't need all I have. Spreading the minerals and rocks out to needy schools sounds good but isn't easy to pull off. What are other people thinking and doing about this?

All this is meant to stimulate conversations, as that's what the N**Association**GT is for. There's a risk this becomes similar to old people discussing their health, but it would be good to hear some new perspectives as well. My email is mschmidtgeo1@gmail.com.

***You* can contribute to the *Bulletin*!**
Consider writing up your recent teaching triumphs, field trip locations, geoscience-themed travels, or essays. This issue offers a wealth of examples you might emulate for future editions of ***our*** newsletter.



Eastern Section spring 2023 meeting

The spring, 2023 meeting is tentatively scheduled to be held at the ***Museum of the Earth*** of the ***Paleontological Research Institute,*** in Ithaca, New York. The exact date remains to be fully ironed out.

More information will be included in our winter eastern section newsletter. The Museum of the Earth will serve as the base of operations for presentations and other on-site activities. The museum has spectacular displays of the Earth's geologic history and life through time.

Planning for the meeting has just started and we hope to offer an exciting venue of field trips that include Taughannock Falls State Park, Robert Treman State Park and Enfield Glen Gorge, and the O.D. von Engeln Preserve and Esker at Malloryville.

https://www.museumoftheearth.org

Eagle Harbor, Keweenaw Peninsula, Michigan.
View towards the west across Lake Superior.
Mesoproterozoic basalt lava flows of the Lake Shore Traps Member of the Copper Harbor Conglomerate, Keweenawan Supergroup.
Basalt flows dipping to the west-northwest create a dramatic contrast with the waters of Lake Superior.
Photo by Steve Lindberg. June, 2022

Outcrops #8

by Steve Lindberg
University of Pittsburg at Johnstown

Our fall, 2022 “Outcrops” comes from the famous copper mining region of the Keweenaw Peninsula, Michigan; and it’s billion-year-old flood basalts, conglomerates, and other formations that form the Keweenawan Supergroup.

The Midcontinent Rift, also known as the Keweenawan Rift, is a failed continental rift that extends approximately 1,200 miles through the North American continent. Dating to the Mesoproterozoic era about 1.09 billion years ago; the rifting period in part overlaps the timing of the Grenville Orogeny taking place further to the east.

The Midcontinent Rift extends from Kansas to Minnesota, Michigan and Lake Superior. Thick sequences of flood basalts that include the Portage Lake Volcanic Series filled the rift valley; with the period of copper mineralization taking place at approximately 1.05 billion years ago. The flood basalts of the Portage Lake Series are overlain by the Copper Harbor Conglomerate; which contains a sequence of basalt lava flows called the Lake Shore Traps. The famous Keweenaw Peninsula of Michigan and its flood basalts, conglomerates, and associated copper deposits are exposed at many locations along the entire length of the peninsula. At Eagle Harbor on the northwest shoreline of the Keweenaw, The Copper Harbor Conglomerate and Lake Shore Traps are exposed along the waters edge; while the vastness of Lake Superior extends beyond the horizon.

Virginia's New River Trail:

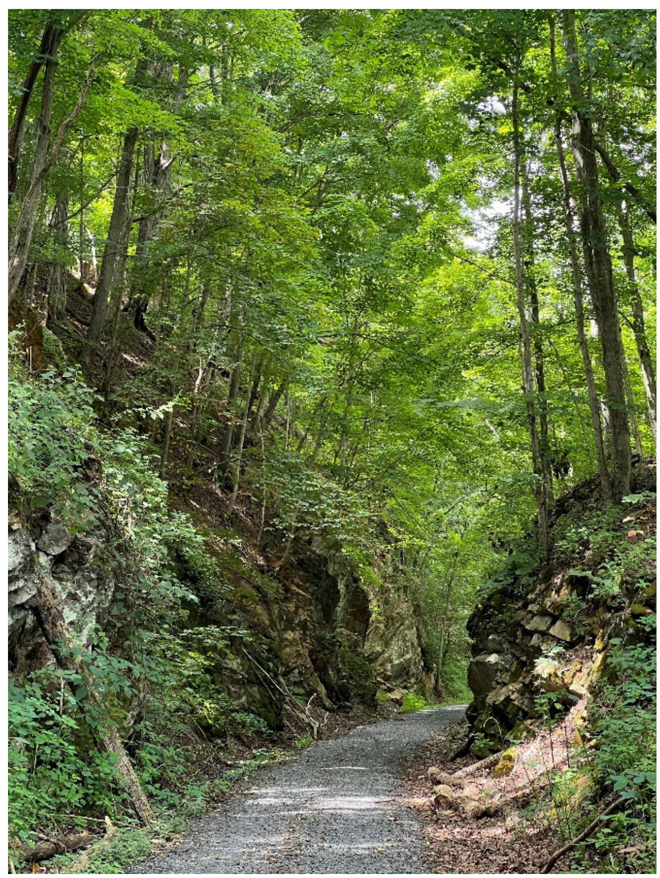
Millions of Years in the Making

by Wendy Grimshaw
Salem City Schools

The narrow 80-foot-wide corridor of Virginia's New River Trail State Park is ideal for hiking, bike riding, horseback riding, and—yes—geology! The easily accessible and mildly inclined Rails-to-Trails path reveals wildlife habitat, impressive outcrops, and a rejuvenating 57-mile peek into the trail's storied past. As it winds through four counties of the Blue Ridge and Valley and Ridge physiographic regions, this Millennium Legacy Trail connects communities, landforms, and millions of years of geologic history.

Not far from the trail's northern terminus in Pulaski, an abandoned railway signal stands adjacent to a relatively small outcrop of rock, hinting at a tale that predates its locomotive history. Much of the exposed rock was revealed during the cutting of the Norfolk and Western railbed in the late 1800's. At the time of construction, the primary freight for this rail line was iron ore, although it also transported agriculture and forest products, coal, oil, cotton, and passengers as it followed the river's path.

The New River Trail parallels the scenic and historic north-flowing New River for 39 miles of its 57-mile linear path. As it has cut through the crests of the emerging Appalachian Mountains, the New River has exposed rock that is over a billion years old; however, most of the outcrops along the former railway display rock formations that are about half as old.



The underlying rock formations along the trail vary frequently in relatively short distances to reveal their marine origins, with calcite being a common ingredient. When passing through the comparatively younger trail formations, the outcrops are largely limestone or dolostone. Metamorphosed quartz-rich rock formed the gneiss predominantly visible in the older formations.

Just south of the Hiawassee River Bridge, the central region of the trail begins a meandering path through the Cambrian Rome (513-508 Ma.) and Shady Dolomite (515-503 Ma.) Formations, pictured in shades of green on the *Rockd* app geologic map (https://rockd.org/) (6). Along this stretch, the layering and folding of rock strata stands in stark contrast to the surrounding riparian buffer vegetation.

Nearly halfway between Pulaski and Galax, the trail intersects Virginia's Foster Falls State Park. Visitors can appreciate the shale and sandstone cliffs of the Early Cambrian Erwin and Hampton Formations (526-515 Ma.) on the New River's opposite banks, while relaxing in the cool waters at their base.

South of Virginia's Shot Tower Historical State Park and the I-77 overpass, through one of two impressive rock tunnels, the trail continues past several historic communities.

Ivanhoe was once a small but thriving town where limestone was crushed to extract carbide, lead and zinc were mined, and a blast furnace converted ore to liquid iron. Upriver a few more miles, the trail passes by the Buck and Byllesby Dams. Constructed in 1912 by Italian immigrants, hydroelectric power has been generated for surrounding communities and industries by these dams for over 100 years.

Continuing south, the New River Trail weaves in and out of the Cambrian Unicoi (534-526 Ma.) and Neoproterozoic (Cryogenian) Ashe (720-686 Ma.) Formations, before reaching Fries Junction where it splits in two directions. One spur continues along the New River to the town of Fries, originally founded as a full-service, company-owned cotton mill town.

The Fries Dam has supplied hydroelectric power since being built on Bartlett Falls in 1901. Constructed of bricks made from nearby clay deposits, the dam is situated on an area of the Mesoproterozoic (Grenville-Age) Elk Park Plutonic Group (1600-1000 Ma.), the oldest formation encountered on the trail.

Outcrops from this formation are also visible along the northern section of the alternate spur of the New River Trail leading to Galax, which parallels Chestnut Creek, a tributary of the New River.

The trail from Gambetta to the southern terminus at Galax (host of the famed Appalachian *Old Fiddler's Convention* since 1935) traverses predominantly through the Neoproterozoic (Cryogenian) Ashe Formation (720-686 Ma). Here, amidst the gneiss, park goers will experience the Chestnut Creek Falls trout fishing haven and possibly some of the other abundant native wildlife strolling by.

Communities along the New River Trail corridor have long made use of the rock and mineral resources formed millions of years ago and prevalent in the foothills of the Appalachian Mountains in Southwest Virginia. With plenty of access points, the well-maintained New River Trail offers recreational geologists and geoscience educators many opportunities to examine the lithology of these diverse rock formations, all the while enjoying one of Virginia's incredible state parks.

Summer/Fall 2022 edition of "FROM THE ARCHIVES"

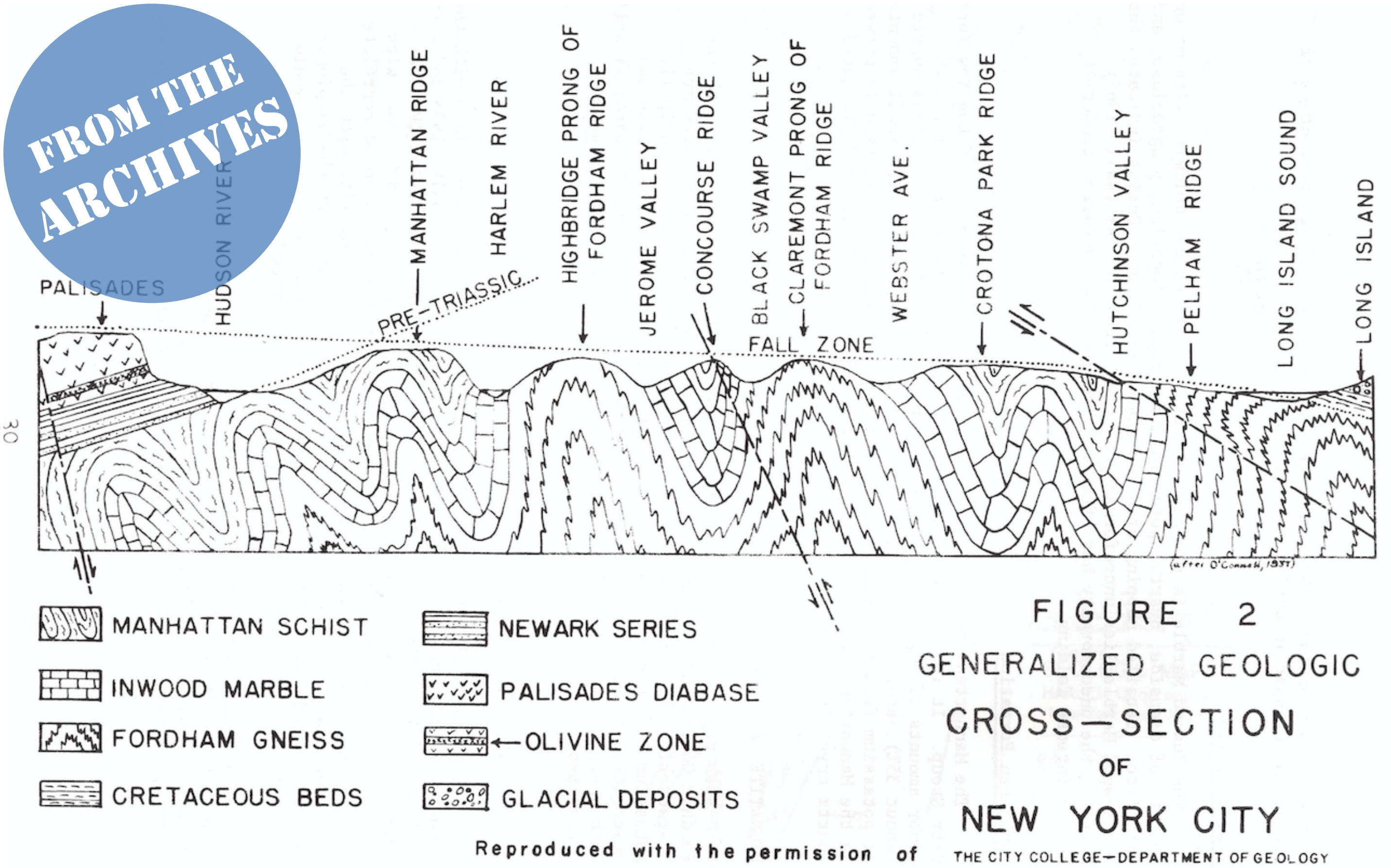


FIGURE 2 GENERALIZED GEOLOGIC CROSS—SECTION OF NEW YORK CITY

by Steve Lindberg
University of Pittsburg at Johnstown
Eastern Section Archivist

FOLDING OF THE ROCKS OF THE NEW YORK CITY GROUP

All of the rocks of the New York City Group are intensely folded (Fig. 2). The Lowerre Quartzite, the Inwood Marble, and the Manhattan Formation have been subjected to at least three periods of deformation. The first deformation produced isoclinal folds and a strong axial plane foliation (Scotford, 1956). The second deformation isoclinally folded these early folds. This produced folds plunging gently to the southwest on Manhattan Island and northwestward plunging folds in parts of Westchester County (Scotford, 1956). The third deformation produced southeastward plunging folds on Manhattan Island. Since the Fordham Gneiss lies unconformably beneath the rocks of the New York City Group, it must have been subjected to one additional deformation.

The 1966 eastern section meeting was sponsored by the Port Washington, New York Public Schools. The conference focused on the geology of Southeastern New York and included three main field trips. "Geology, Geomorphology, and Environments of Western Long Island"; trip leader Leslie A. Sirkin of Adelphi University, "Environment And Man At Garvies Point" ; trip leader Ronald Wyatt of the Nassau County Museum, and "Geology Of The New York City Area"; trips leaders Carl K. Seyfert of Queens College and David J. Leveson of Brooklyn College.

The field trip guidebook contains a wonderful cross section of the New York City region. Beginning in the west at the Palisades of New Jersey, it concludes in the east with a short section of Long Island Sound showing the Cretaceous sediments and glacial gravels of the Pleistocene that form Long Island. Here is the cross section as it appears in the 1966 guidebook, along with a brief description of the rocks from the New York City Group.

Tropical Seas and Volcanic Fire in Ancient New York

Two small parks preserve and reveal a once very different world.

Story and Photographs by Ed Landing

During the World War I years (1914-1918), paleontologist and geologist John M. Clarke (1857-1925), then the director of the New York State Museum, encouraged the donation of parcels of land to the Museum. These were designated “Scientific Reservations,” to be used for research, particularly in geology, and included sites from eastern to central New York. The larger tracts later became New York State Parks (e.g., John Boyd Thacher State Park with its limestone cliffs, located near Albany, and Green Lakes State Park with giant microbial mounds in shallow water, located in the Town of Manlius, east of Syracuse). Fortuitously, the two smallest parcels—Lester Park and Stark’s Knob, both in Saratoga County, remain as Scientific Reservations. The parcels were deeded to the Museum with the proviso of “preservation,” by, respectively, the estate of Willard Lester, Esq. and by a group of five women from Saratoga County.

Lester Park and Stark’s Knob illustrate two intervals in the geological evolution of eastern New York and of Laurentia—or “ancestral” North America before the Appalachian and Cordilleran mountains had evolved. They record a time when a land mass that included what is now Rhode Island through Atlantic Canada, and southern Britain through Belgium, was thousands of miles away and formed the Avalonia microcontinent.

When the rocks of Lester Park and Stark’s Knob were formed, the Iapetus Ocean lay offshore from an ancient, giant Y-shaped scar produced by the break-up of the Rodinia supercontinent. The scar parallels the modern St. Lawrence and Lake Champlain–Hudson River valleys. Stark’s Knob is in the Hudson River Valley and Lester Park is twelve and a half miles west. The Y-shaped scar was defined by the two arms of a so-called triple junction. It was similar in shape to today’s Eritrea–Djibouti–Somalia (“Horn of Africa”) coastline, formed by the rifting away of the Arabian Peninsula. Avalonia later collided with Laurentia along the track of the tectonic scar during the second Appalachian mountain-building event, the Acadian orogeny.

Lester Park is on both sides of Lester Park Road northwest of Saratoga Springs. It has about forty-five feet of flat-lying sedimentary rock. The broad area of ancient sea floor on the east side of Lester Park Road is low in the succession of geological layers that were laid down over time.

Cambrian sea floor with stromatolites at Lester Park.

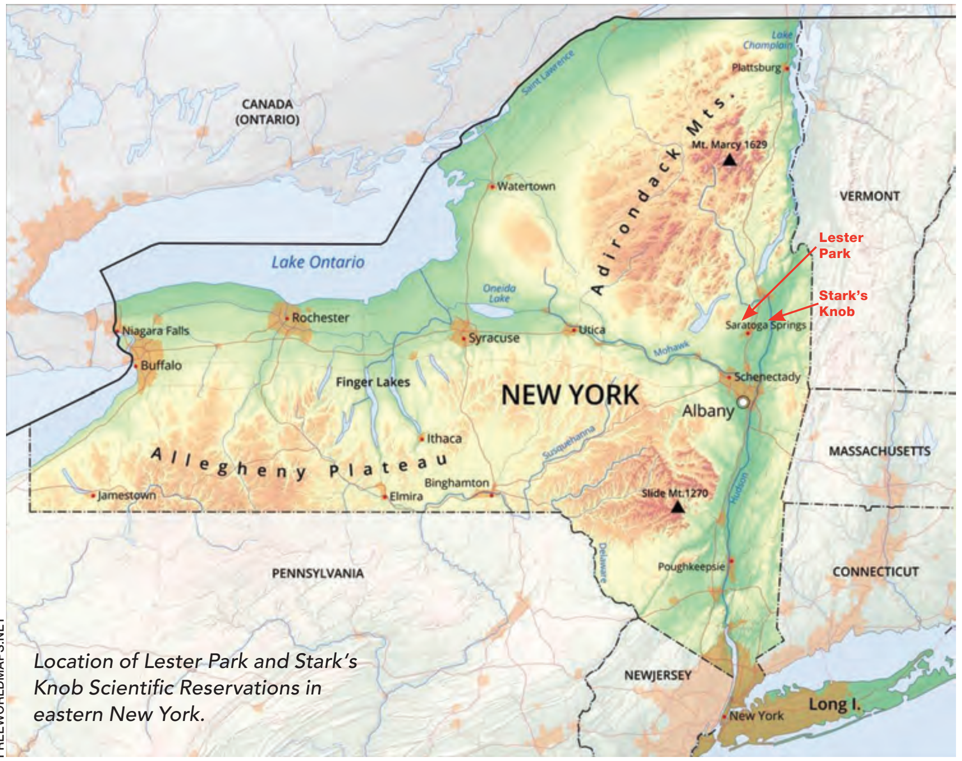
On the west side of the road is a sign marking where an old lime kiln had existed. It was built because local soils had been formed from sandy glacial outwash and lacked enough lime for successful agriculture. As a remedy in the 1800s, the Hoyt family dug a limestone quarry just west of Lester Park Road, and the limestone was calcined by burning in the kiln. The Hoyt quarry, with about thirty feet of limestone-dominated rock—now known as Hoyt Limestone—is at the end of the path that runs west of Lester Park Road.

The rock was deposited as sediment in shallow sea water on the Laurentian continental shelf about 100 kilometers (km) in from the deep Iapetus Ocean. Paleomagnetic work on similar-aged rocks as those of Lester Park shows that the ancient New York margin—the collective area that encompasses the continental shelf, continental slope, and continental rise—was tropical (about 35° south latitude). In addition, Laurentia was rotated almost ninety degrees from its modern orientation, which means the New York margin was oriented roughly east–west in the southern trade winds belt and subject to hurricanes. Since that time, Lester Park has had about a seventy-seven degree latitudinal shift—it is now 42° N.

Lester Park is one of the “One Hundred Most Important” geological sites in North America according to the Geological Society of America. This status reflects the significance of the broad rock surface on the east side of Lester Park Road. The surface was first illustrated by J. H. Steel in 1825 in the *American Journal of Science*. He thought the rounded structures were non-biological “concretions.” Almost a century later, the term “stromatolite” (from the Greek words, *stromatos*, “layered” and *lite*, “rock”) was applied to these laminated structures, which are now understood to reflect the activity of mat-producing organisms. The mats overgrow and trap sediment that is episodically swept over them by waves and currents to produce laminae. Layering in the Lester Park stromatolites also likely reflects hurricanes.

The growth in circumference of stromatolites should produce a laminated, hailstone-like build-up. However, the Lester Park stromatolites are truncated, and the growth laminae are exposed. Winifred Goldring (1888-1971), of the New York State Museum, the first female State Paleontologist in the United States, proposed in 1938 that glacial erosion planed off the Lester Park

 (From *Natural History*, October 2022, copyright Natural History Magazine, Inc., 2022, v. 130, no. 9, pp. 36 to 41)



Location of Lester Park and Stark's Knob Scientific Reservations in eastern New York.

FREEWORLDMAPS.NET

mounds—an interpretation also reported in *Geobiology* in 2020 by geologists Jeong-Hyun Lee, of Chungnam National University in Daejeon, South Korea, and Robert Riding, of the University of Tennessee, Knoxville. My research showed these mounds were beveled shortly after formation by submarine erosion that abraded them and left a coarse sand layer that overlies them. This thin, ten-centimeter thick, orange-colored layer is best seen close to Lester Park Road.

In sedimentary geologist terminology, the stromatolite bed is a "highstand facies," or rock type, that formed when sea level was high on the continental shelf followed by sea-level fall and the beveling of the stromatolites. This was followed by sea-level rise and deposition of muddy, nonlimy sediment. A ten-foot road cut just south at the curve on Lester Park Road shows these dark, muddy sediments (now shale) overlain by limestone with small stromatolites that mark a second highstand facies.

STROMATOLITES

The understanding of some layered structures as biotic, as those at Lester Park, had a problematic early history. John William Dawson (1820–1899) in 1864 named *Eozoön canadense* the laminated structures near Ottawa, Ontario, that he thought were biologic. They were soon understood to be abiotic and formed by metamorphism of approximately one billion-year-old marble by igneous intrusions.

New York State Paleontologist James Hall (1811–1898) later, in 1883, gave the name *Cryptozoön proliferum* to the domal structures of the Hoyt Limestone. He thought they were made by a "simple animal," as thin sections of them showed canal-like structures. Winifred Goldring also noted "peculiar branching tubes" in *Cryptozoön* in 1938.

By the 1960s and 1970s, Lester Park's *Cryptozoön* was a reference standard for ancient and modern stromatolites, which were seen as laminated structures that resulted from the interaction of cyanobacterial mat growth with such environmental factors as waves and currents that transported and eroded sediment. Thus, their forms reflected paleoenvironment, and assigning them to biological genera and species, as *Cryptozoön proliferum*, was discouraged.

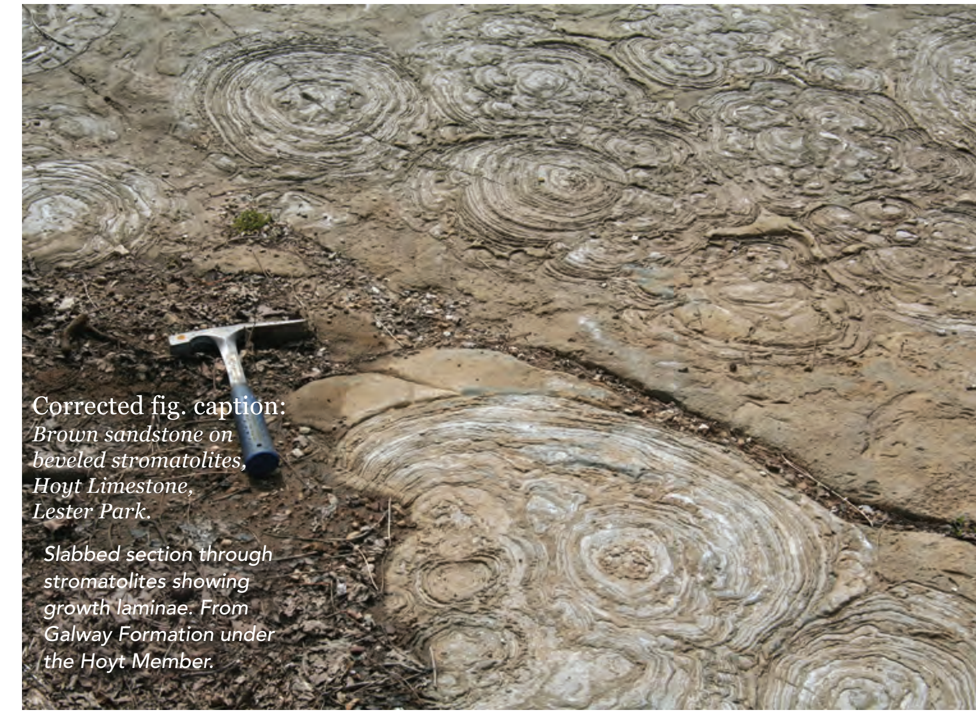
Stromatolites also came to be understood as the oldest known macrofossils. They are a type of trace fossil reflecting organism behavior and are similar to a track or trail. They are not a body fossil (i.e., a shell, tooth, feather, or bone). Their oldest appearance was vigorously debated as to whether or not this or that specimen was biotic or not. However, microbially derived organic chemicals in Australian stromatolites now show stromatolites in 3.5 billion year-old rock.

A common speculative comment is that stromatolite cyanobacteria were important in Earth's oxygenation. This is questionable. Quantitative models using what seems to be only locally abundant stromatolites in very ancient rocks have never been proposed to account for the early rise of atmospheric oxygen.

For over six decades, modern stromatolites are stated to occur at Shark Bay, Western Australia. Very high salinity excludes such animals as snails, which would feed on cyanobacterial films, and the absence of these animals allows growth of the Shark Bay "stromatolites." The argument following from this observation is that evolution of these grazing animals over the last 500+ million years has limited stromatolites to environments where browsers are rare/absent.

There are problems with the "Shark Bay stromatolites." The illustrated Shark Bay forms have a "Swiss cheese-like" internal structure, and are not laminated stromatolites. Biotic mounds in marine and lacustrine environments, such as those at Green Lakes State Park with internal voids are "thrombolites" (from "thrombos," clotted; "lite," rock). A Hoyt quarry layer shows thrombolites up to five feet high in fossiliferous rock that had normal marine salinity.

The Lester Park stromatolite environment was very dissimilar to the hypersaline Shark Bay facies. The stromatolites at Lester Park are surrounded by limestone with a normal marine biota (trilobites, small mollusks, abundant echinoderms—echinoderms, as starfish, always occur in normal marine salinity). Lee and Riding's paper also showed that the "classic and standard" Lester Park stromatolites did not originate as simple cyanobacterial films. Many of the laminae are actually organic-rich keratose sponge layers. These are the canal-like and branching tubes seen by Hall and Goldring but disregarded in later stromatolite work. The new work means that ancient stromatolites cannot be presumed to mark restricted marine environments and must be investigated to determine if they are a sponge-cyanobacterial-sediment consortium. Finally, Lester Park shows that significant animal browsers were absent early in the Cambrian Evolutionary Radiation (about 540 million years ago) and that browsing became important only after the Cambrian.



Corrected fig. caption: *Brown sandstone on beveled stromatolites, Hoyt Limestone, Lester Park.*

Slabbed section through stromatolites showing growth laminae. From Galway Formation under the Hoyt Member.

In 1983, using trilobite fossils from the New York State Museum collections and from specimens from other Hoyt Limestone localities, geologists Rolf Ludvigsen (1944–2016) and Stephen R. Westrop, both then of the University of Toronto, determined a middle Late Cambrian age for the Lester Park stromatolites and Hoyt Limestone.

Biostratigraphy puts fossils and the rocks that contain them in a relative time sense (older to younger). Absolute time determination (best based on uranium-lead ratios in volcanic zircons in rocks of this age) is not possible for Lester Park because of the absence of volcanic rocks. In the Cambrian, Lester Park was located on what geologists call a "passive margin" without volcanism. The estimated age of Lester Park rocks is based on dating I did on Avalonian and West African volcanic ashes and then correlated the Lester Park trilobites into these successions, making the rocks about 490 million years old.

The Lester Park stromatolite surface extends one km south to the old Petrified Sea Gardens tourist attraction. The surface is far more extensive but is covered by vegetation and overlying rock. The ridge parallel to Petrified Gardens Road (which turns into Lester Park Road to the

Hoyt quarry with large domal thrombolites with clotted ("Swiss cheese") fabric circled to right and left of hammer.

north) is formed of rock overlying the stromatolite surface.

Lester Park has been a global standard for stromatolites. However, the research published in 2020 by Lee and Riding has changed the understanding of this standard and affects interpretations of all stromatolites for at least the last 540 million years.

Leaving Lester Park and driving twenty-three km (fourteen and a half miles) east to Stark's Knob just north of Schuylerville, New York, leads to a very different perspective of the later geologic evolution of eastern New York. Stark's Knob is named for General John Stark (1728–1822) of the Revolutionary War. His troops occupied the Knob at the end of the Battles of Saratoga (September 19–October 17, 1777), and blocked the British and Hessian army in an attempted escape to Canada. The east face of Stark's Knob was a quarry active in 1905–1918 with expansion of the Champlain Canal just to the east. The quarry face must not be climbed—it is composed of unstable fragmented rock.

The quarry supplied rock ballast for the Champlain Canal and revealed a peculiar igneous rock essentially unknown elsewhere in New York. The age and geologic significance of Stark's Knob were long problematical. Early twentieth-century comparisons were with the relatively young (Triassic–Jurassic) basaltic rock of the Palisades in the New York City area. However, the Palisades are sills (intrusions), not surface extrusions, such as Stark's Knob, which is a pile of basalt pillows and lava tubes through which molten rock poured. Rounded pillows dominate the face of Stark's Knob. The lava tubes are subtle features as they collapsed under the weight of overlying rock to form basalt fragment layers.

Stark's Knob is across the Hudson River from the eastern margin of the master thrust under the Taconic overthrust belt. A trail on the south side of Stark's Knob ends at an overlook at the top of the Knob. The rolling topography of the Taconic belt to the east is the western limit of the folded and faulted Appalachian Mountains.

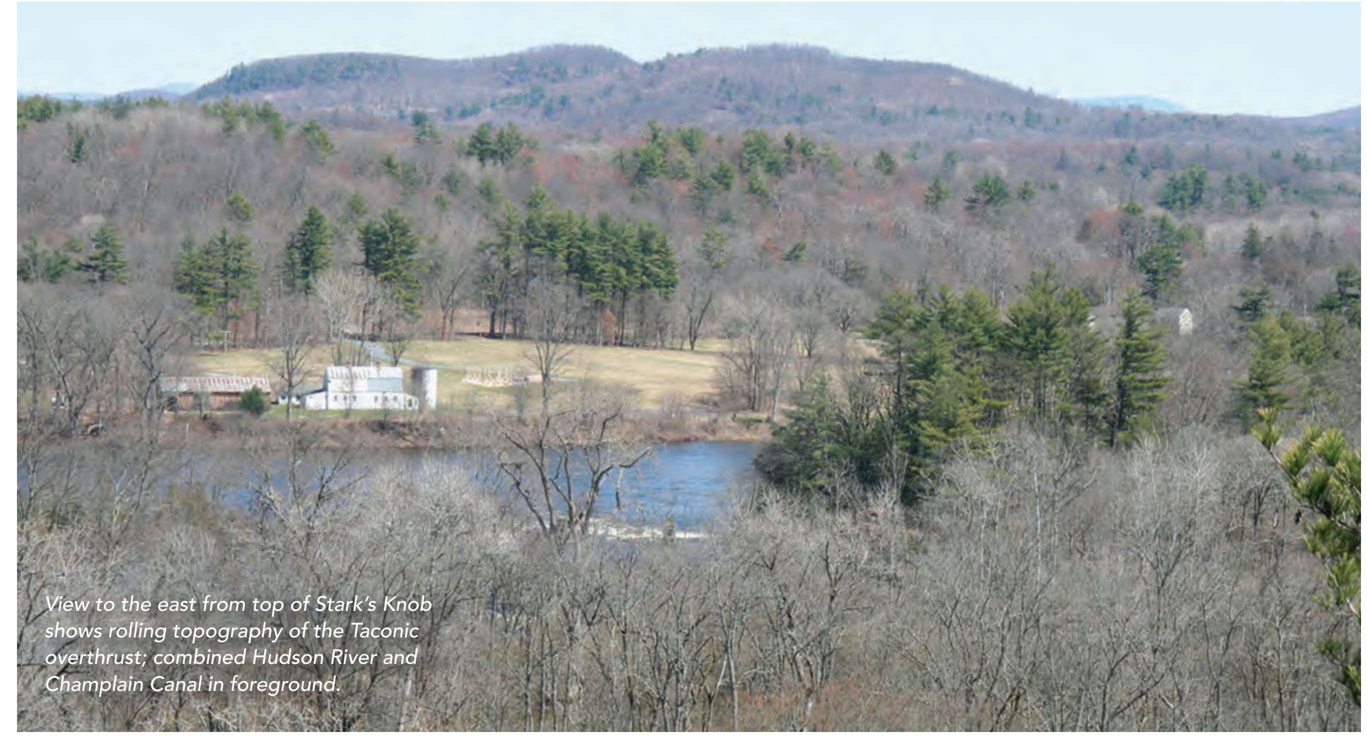
State Paleontologist James Hall recognized that the Taconic belt has older (Cambrian) rocks thrust over younger (Ordovician) rocks in the Hudson Valley. He used this evidence in 1860 to propose that mountains develop by geologic processes through time. By 1861, Hall's model of mountain formation was applied to the Alps.

With a number of coauthors, I proposed a synthesis of Stark's Knob that modified plate tectonics. The Knob was known to be related to developments in the first mountain-building episode (an orogeny) of the Appalachians. This is the Late Ordovician Taconic orogeny that extends from western Newfoundland to Georgia, and featured collision of eastern Laurentia with a volcanic island arc similar to modern Japan. In contrast to the passive margin during deposition of the Lester Park rocks, eastern New York became an "active margin" with collision with an off-Laurentian "ring of fire." The arc spewed volcanic ashes that blanketed New York and Laurentia as far as Ohio.

Stark's Knob was also known to be a giant block (about 39 meters thick and 125 meters long) in chaotic rocks (mélange) under the Taconic overthrust. Other mélange blocks

AMY FRAPPIER

Collapsed lava tube. Extrusion of molten basalt can form lava tubes; on modern Iceland these form long linear caves. At Stark's Knob, surges of liquid basalt at times largely filled the lava tubes, cooled to form a black, glassy, skin-like layer at its top on which white limestone accumulated; when the level of the lava fell with extrusion or by draining back underground, the frozen skim and limestone collapsed down onto the liquid rock. The picture shows five successive layers of black basalt capped with white limestone that collapsed downward (now to the left) in a lava tube.



View to the east from top of Stark's Knob shows rolling topography of the Taconic overthrust; combined Hudson River and Champlain Canal in foreground.

under the Taconic master thrust are up to 30 km (18 miles) long and are from about 1.0 billion years to Late Ordovician (about 450 million) in age. The unresolved questions have been the Knob's age and its tectonic significance.

Thin limestones cap many pillows—line shelves in lava tubes—and compose light gray to white areas in the black basalt. These fine-grained limestones are not made of fossil fragments and have the carbon-isotope chemistry of sea water. We concluded they are nonbiologic limestones created by lime precipitation with sea water heating by the submarine lavas and by loss of CO_2 from the sea water. Lime was deposited like a submarine snow on the pillows. Some limestones have reddened (baked) tops with rolling of hot pillows onto them.

The limestones offered a way to date the basalt, which lacks zircons for analysis. Age-specific microfossils were not found after processing 36 kilograms (about 79 pounds) of limestone. A snail shell was found that indicated a Late Ordovician age, about the time of the Taconic orogeny. We concluded that Stark's Knob was part of a small volcanic edifice (a sea mount) overrun by thrusting of the Taconic rocks onto Laurentia.

Stark's Knob, like the coeval Jonestown volcanics in eastern Pennsylvania, confounded expectations of the time. Schematic cross sections of subduction zones show volcanism on the overriding tectonic plate. Stark's Knob and the Jonestown volcanics were on the subducting plate where volcanism had not been reported before. Stark's Knob and the Jonestown volcanics were not thrust onto Laurentia from the east and did not have an origin in New England as the Taconic overthrusts. Rather, they are essentially in situ and had punched through the Laurentian margin.

A model for these volcanics is that some subducting plates are not simply run over and pushed down subduction zones. Subducting plates consist of cold, dense rock that can be pulled down by sinking into hot, less dense lithosphere. "Pulling" extends and fractures the subducting plate (here the edge of Laurentia) with molten rock flowing up the fractures. Several years after our report, small igneous sea mounts were found on the subducting East Pacific plate west of Japan. They are a modern example of this process.

In summary, Lester Park and Stark's Knob have satisfied the purpose of Clarke's "Scientific Reservations." They allowed research that changed our understanding of what really comprises a stromatolite and which now must be applied to all "stromatolites" since the onset of the Cambrian Evolutionary Radiation and the origin of animals about 540 million years ago (Mya)—with some DNA evidence suggesting 800 Mya. Stark's Knob led to a revised understanding of how some volcanic rocks develop along subduction zones. With the preservation of unique areas like these, there is much that still may be learned.

Ed Landing*, New York State Paleontologist and Curator of Paleontology emeritus with the New York State Museum and a fellow of the American Association for the Advancement of Science and Geological Society of America, is the author of more than three hundred scholarly papers and eleven books. This article is in memory of Margie Cornblum, late of Inlet, NY, a schoolteacher who loved* Natural History.

Inspire Young Minds! Teach math or science.

Did you know?

Teachers rate their lives better than all other occupation groups, trailing only physicians.

Did you know….

- In addition to student loan forgiveness programs, there are programs that provide stipends for graduate certification programs for math and science teachers?
- Most teaching jobs have better retirement benefits than private industry?
- You can get a job almost anywhere in the U.S. especially in a high needs school, or abroad, as a science or math teacher?
- Mid-career teacher salaries typically range between $60,000 and $100,000?
- Behind every advance in medicine or technology is a teacher who left a lasting impression?

"I really like the ability to still explore higher level physics while being a teacher, whether it is through college level teaching or summer opportunities like the Quarknet group. Having summers off allows for time to go explore and still be involved with industry level physics" - T. Plantt, High school physics teacher

WISER Program at WCU

With funding from the National Science Foundation, NOYCE grant, West Chester University (WCU) offers the West Chester University Improving STEM Education through Residency (WISER) Program where candidates earn a Master's Degree and teaching certification in 13 months.

Courses Offered

Education Foundations, Teaching Methods, Field Experience and more!

WISER Candidates will explore the purposes and issues of public education. The courses also include research on adolescence development and the various societal issues that affect development. All courses are connected by themes of social justice culturally relevant pedagogy.

Earn a Master's Degree in Teaching!

Get real-world experience and gain valuable skills

The WISER Program offers a Master's Degree in Education to prepare fellows for teaching careers at the secondary level in science or mathematics. The degree is designed to support fellows with pedagogical coursework integrated with a teaching residency in a rural or urban high-needs school.

Career Opportunities

Gain valuable skills that will prepare you for a range of careers

Classroom teaching experience is one of the best ways to build confidence, leadership skills, and project management skills. Teachers often continue with the profession (83% in fact), but many also use the expertise they gained as a teacher to become a principal, go back to school for an advanced degree, and more.

Earn a Master’s Degree in Education!

❑ MS in Education with a STEM Teaching Focus Area

Master’s Degree with Teaching Certification (36 credit hours):

- Summer 1 – 6 Credits
- Summer 2 – 6 credits
- Fall – 12 Credits
- Spring – 12 Credits

- Coursework includes topics such as:
  - Secondary STEM Teaching and Learning Outcomes
  - Supporting Literacy Development
  - Supporting English Language Learners
  - Secondary Student Teaching

REAL WORLD EXPERIENCE

The WISER program lets you be part of a real classroom at a rural or urban high-needs school.

COMPLETION TIME

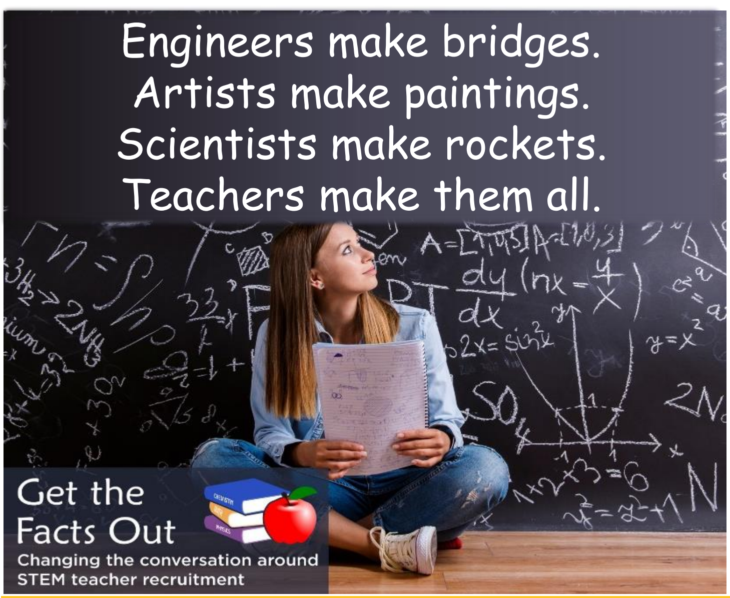
The WISER program is designed to be completed in 13 months.

MENTORSHIP

WISER graduates receive mentoring during program and for 4 years post-graduation.

Participants in this benefit from:

- A **$15,000 stipend** during the program and a **$5000 tuition credit**.
- A yearly **$11,000 salary supplement** during the first four years of teaching.



Additional benefits:

- Four-year induction / mentoring program post-graduation including in-class support, monthly mentoring experiences and yearly summer professional development opportunities.
- Funding for professional development experiences, travel, and classroom materials
- Summer research, industry externship and informal STEM experiences.
- Becoming part of a national network of Noyce scholars to share ideas about best STEM teaching practices

WISER Director: Daniel Ilaria, Ph.D. -- dilaria@wcupa.edu
Science Educator: Brett Criswell, Ph.D. – bcriswell@wcupa.edu
Science Educator: Christopher Roemmele, Ph.D. -- croemmele@wcupa.edu
Math Educator: Jenifer Hummer, Ph.D. – jhummer@wcupa.edu

The WISER program is supported by National Science Foundation award DUE-2151115

Nominate your peers!
(Nominate yourself!)

by Christopher Roemmele
West Chester University

Greetings to all educators of geology and earth science. I am Christopher Roemmele, your new Awards Chair for NAGTES. I teach at West Chester University in West Chester, Pennsylvania, and taught high school/middle school earth science for 15 years in New Jersey. I know how hard we all work as teachers and getting a proverbial pat on the back and thank you is nicely motivating. Perhaps you work with or know someone whom you feel deserves this recognition. In that case, I strongly urge you to nominate this person for one of our Eastern Section awards, or one of the National NAGT awards. The Eastern Section meeting is a wonderful time to heap praise upon those individuals who have excelled in the work and promoted geoscience education.

Information about all our Eastern Section awards can be found on our section website. Please note the deadline is being/has been changed to February 1! So start thinking and get those forms filled out now! Completed nomination forms should be sent to me at croemmele@wcupa.edu. However, you must place your nomination via the online forms found on the National NAGT web site at http://nagt.org/nagt/programs/oest.html

Here is a list of our awards. Perhaps there is one with your (or a colleague's) name on it!

OUTSTANDING EARTH SCIENCE TEACHER

The OEST Awards program was adopted by NAGT in 1971. Its purpose to honor pre-college teachers of earth science, their excellence and commitment to teaching and teaching earth science

DIGMAN AWARD FOR EXCELLENCE IN GEOSCIENCE EDUCATION

The Digman Award is designed to recognize an individual who works to bring geoscience to the general public. We look for individuals who are not teachers, but work in a capacity that educates the general public in areas of the geosciences. Museum directors, curators and assistants, state survey employees, mine and quarry public relations people would all qualify for this award. The nomination information for this award is also on our section website.

JAMES O'CONNOR MEMORIAL FIELD CAMP SCHOLARSHIP

The James O'Connor scholarship is given to a college geology or earth science major who is attending a geologic field camp course (typically over the summer) as part of their college degree program. The $500 scholarship assists the student in covering the expenses of their field camp. Nominate a student currently enrolled in your geology program. Nomination information appears on the section website.

DISTINGUISHED SERVICE AWARD FOR THE EASTERN SECTION

The Distinguished Service Award is given to a member of the Eastern Section (still actively teaching or retired) who has, over the years, contributed to the growth and activities of the Eastern Section. This person should have a history of continued service to the Eastern Section. Nomination information appears on our website.

JOHN MOSS AWARD FOR OUTSTANDING COLLEGE TEACHING

The John Moss award is reserved for instructors and professors who, at the college level, model and promote outstanding teaching in the geosciences. Nomination information appears on section website.