Bulletin

of the Eastern Section of the National Association of Geoscience Teachers

JUNE NAGT-ES SECTION MEETING INFO IN THIS ISSUE!

Volume 71, Issue 1: Winter 2021

Annual June meeting will be via Zoom

by Michael O'Donnell, NAGT-ES President
Blue Ridge Community and Technical College

Greetings to all from my basement bunker in the "Wilds of West Virginia"! We have spent almost a year now learning about how masks should and should not be worn, figuring out when to social distance, and trying to get to a point when we are able to gather together in the same place again. Well, unfortunately, it will not happen with this year's annual meeting.

However, Chris Roemmele is planning a virtual conference that I personally want to encourage everyone to attend!

If you are like me, you did not know what a Zoom was a year ago, except for the sound that a child might make when playing with toys, or perhaps words to the opening song of a PBS show (anyone?). Others of our group probably were very experienced with the idea of remote learning and have met the challenges with grace and innovation. In the past year I have learned not only how to hold a live meeting through Zoom, but have even figured out how to share my screen (at least that portion the students need to see) and record the lesson so other students can go back and hear it all again! We adapt, we evolve, we change in order to best meet the needs of our learners.

So, look at the outline of this year's meeting and make some time in your schedule to attend all or part of it. There will be something of interest for everyone. We are even hoping to include the GeoAuction!

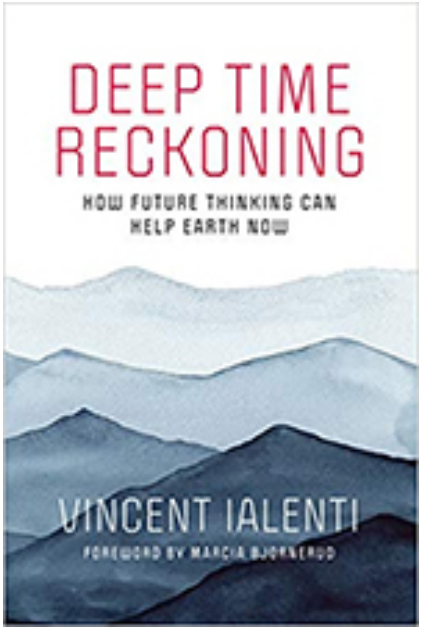
Two new geo-relevant book reviews

by Callan Bentley
Piedmont Virginia Community College

***Deep Time Reckoning*, by Vincent Ialenti**

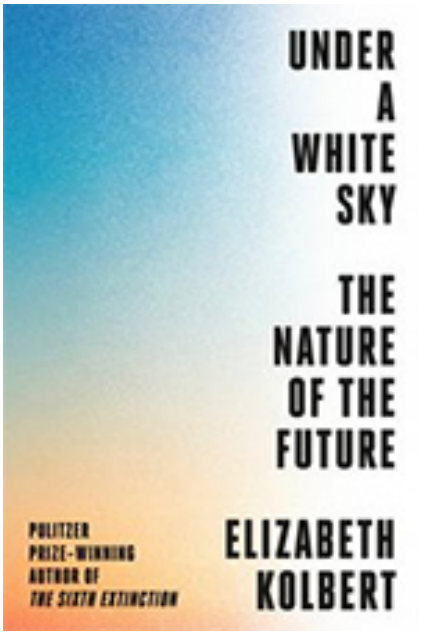
Stereotypically, I think of anthropologists as scholars who head off into years-long sojourns embedded with indigenous peoples, learning their cultures, practices, and insights. Vincent Ialenti has shown me that modern anthropologists can study other groups too. Ialenti's population of interest is a modern group of European geoscientists, nuclear engineers, and planners. Together, they are charged with planning for the integrity of a Finnish nuclear waste repository. But studying this group, called "the Safety Case," has led the author into a non-traditional direction. His dissertation research inspired him, for his subjects thought about time differently from "normal" people. Geologists won't

find this shocking, to think in Deep Time – both backward and forward over millions of years, but it appears to have been profoundly insightful to Ialenti. He reworked his anthropological documentation into an unusual book that simultaneously attempts to report on the nitty-gritty of a very specialized academic study but also spin off grand lessons for humanity at large. I picked it up for the latter, but was willing to indulge in the former. I felt the book was at its strongest when it articulated a vision for the future where Deep Time thinking is integrated into educational curriculum, if not into the wider culture, but the academic anthropological descriptions of Finnish bureaucrats didn't engage me as much as Ialenti appears to think it should. Similarly, the end-of-chapter exercises in practicing Deep Time thinking (which he calls "reckonings") didn't feel especially novel to me, but I am a geologist who is quite comfortable toggling back in time to the Cambrian, or forward 10 million years into the future. I'm probably not the target audience because I'm already sold on the main conclusion, and I would be curious to hear whether novices find these activities mind-expanding. I agree with Ialenti's premise: that our species and our world benefit if we think about the very, very long-term consequences of our actions or inactions. Replacing short-sightedness with looooooooooooong-sightedness is an unalloyed benefit, I'd argue too. How can we be responsible ancestors to the future of our species; the future of life? *Deep Time Reckoning* comes at this question from a unique direction, and offers clear guidance for our common future. The book has a forward by Marcia Bjornerud, author of the superb *Timefulness*, which explores a similar conclusion from a more decisively geological perspective. Of the two, I'd recommend *Timefulness* over Deep Time Reckoning, but I appreciate Ialenti's contribution.



***Under a White Sky*, by Elizabeth Kolbert**

Elizabeth Kolbert's third book is now out! *Under a White Sky* is "a book about people trying to solve problems created by people trying to solve problems." These problems are environmental problems – they are instances of nature becoming less natural. As humans build cities and plant crops and make waste, we alter the world we live on, the ecology we live within. In Kolbert's previous book, the Pulitzer Prize-winning *The Sixth Extinction*, she examined ongoing crises with ocean acidification, invasive species, and novel diseases, all set against the geologic context of extinction, and the causes of mass extinction trauma in Earth's deep history. *Under a White Sky* continues that work, but the direction of Kolbert's gaze is different. The new book's attention is focused instead on attempts to intentionally alter the future. From genetic engineering to pest control and nurturing of endangered species to carbon capture and solar radiation management, she examines strategies being taken by some humans in our world to try and make the planet of tomorrow better than it would otherwise be. Like all of her writing, the new book strikes a readable balance of background, reportorial anecdote, interviews with leading thinkers, and clever wordplay. It's a delight to read, informative across a wide range of anthropogenic environmental issues and various attempts at solutions. This is a book about the Chicago River, the Devil's Hole pupfish, the Greenland ice sheet, and calcite filling basaltic amygdules. It's about coral spawning and gene drives and forest albedo and volcanic eruptions, and how all of these things are case studies in the human control of nature, in the continued existence of human civilization on this planet, and the other species with which we will be sharing our altered planet. Recommended.



Tentative schedule for the meeting:

by Christopher Roemmele, NAGT-ES vice pres.
West Chester University of Pennsylvania

Proposed/Planned Tentative Schedule

Friday, June 4

9:00 – 10:15 Welcome and Keynote (hoping **Dorothy Merritts** Franklin & Marshall College can do this but not confirmed as of 2/14)

11:00 – 12:00 "Drones, Geophysics, and Robotics to Support Geoscience Education and Research in a Pandemic" Presenter: Dr. **Martin Helmke**, West Chester University

1:00 – 2:00 "Promoting Argument-Driven Explanations in Earth and Environmental Science: Model-Evidence Link, Claim-Evidence-Reasoning, NGSS and 3-dimensional teaching and learning." Presenters: Dr. **Margaret Holzer**, Great Minds PBC and Rutgers University, Dr. **Insook Han**, Temple University

2:30 – 3:30 Piedmont geology, environmental concerns, stormwater management, invasive species. Presenters: Drs. **Tim Lutz** and **LeeAnn Srogi,** West Chester University

4:00 – 5:00 "Impact of Sea Level Rise on Heritage Resources in the Delaware Bay; Geoarcheological Applications. Presenter: Dr. **Daria Nikitina**, West Chester University

5:30-8:00 Presentation of **OESTA winners** Snap talks: Theme – "Growing a beard" What worked well and helped to meet the needs of students and faculty during virtual instruction. Networking and virtual happy hour. Geo-auction.

Outcrops, *Winter 2021*

by Steve Lindberg
University of Pittsburg at Johnstown

During the March, 2018 spring break at the University of Pittsburgh at Johnstown, a small group of our geology club students and professors embarked on an eight-day trip to explore the geology of Scotland. Organized and led by Energy and Earth Resources Dept. Chair Dr. **Ryan Kerrigan**, our trip included the cities and surrounding areas of Glasgow, Edinburgh, Stirling, Inverness and Glencoe. Geological sites included Siccar Point and the North Sea coast near Dunbar; Cairngorms National Park, Loch Ness and the Isle Of Skye.

A most memorable field stop is pictured here; Glen Roy (from the Scottish Gaelic meaning "red glen") and what are known as the "Parallel Roads" or "Darwin's Parallel Roads" visible along the hillside in the distance. Following his return from the voyage on the *Beagle*, Charles Darwin visited Glen Roy and published a paper in 1839 in which he interpreted the lines to be ancient marine shorelines which were subsequently uplifted to this present position. In 1840 Louis Agassiz visited Glen Roy and proposed the lines were created by a glacial lake which filled the valley. In 1863 Darwin finally accepted this alternative theory; which today we know to be correct.

Our drive up to Glen Roy on the narrow, winding, partially snow covered dirt road was both exciting and somewhat nerve-racking. The view from this overlook was well worth the effort to travel here.

Photo by S. Lindberg, 2018

It's All About Time

Set That Darn "Golden Spike"

(Continued late night musings)

by Steve Lindberg
University of Pittsburg at Johnstown

"Geology is the study of pressure and time. That's all it takes, really. Pressure and time".
Morgan Freeman, "The Shawshank Redemption", 1984.

2020 is now behind us, and what a year to remember. I'm not even going to mention Covid-19 but instead focus on the interactions between friends, family, co-workers, fellow geoscience educators, professionals and researchers. I think about all the arguments, conflicts and disagreements between us over the big issue of 2020. I've witnessed heated debates between long time friends, getting to the point of being "unfriended" on Facebook; how could I possibly face another day after being removed from someone's Facebook friends list?

I know, you're thinking the election, politics, political parties and possibly the second amendment, right? Sorry, but nope, that's not it. The issue that has divided our nation and the geoscience community more than any other is than that darn "Anthropocene"!

There, I said it; can't take it back. I can already hear the unfriend buttons clicking on Facebook (or possibly several requests for a new friend).

The Anthropocene (from the Greek *anthropo*, for "human," and *cene* for "new") was first proposed and made popular by biologist Eugene Stormer and chemist Paul Crutzen in 2000. The concept of the Anthropocene had actually been used as early as 1938 by Russian geoscientist Vladimir Vernadsky; and has been commonly used by Russian scientists since the 1960's as an alternative to the Quaternary.

Time for a disclaimer here. Since this is not a peer-reviewed paper for any formal type journal publication, you will find no references, no citations. For such a controversial subject my sources insisted on remaining anonymous.

In 2016 the Anthropocene Working Group (AWG), of the Subcommission on Quaternary Stratigraphy (SQS), a division of The International Commission on Stratigraphy (ICS) voted to proceed with a recommendation to the International Geological Congress that the Anthropocene be recognized as a new formal epoch to be added to the Geological Time Scale. The formal recognition of the Anthropocene Epoch would require a specific location and marker in "time" in which the "Golden Spike"; a Global Boundary Stratotype Section and Point (GSSP) marker is agreed upon as the reference point on a stratigraphic section which defines the lower boundary of the Anthropocene. And you thought the procedure in congress to make a bill into law was a lengthy and drawn out process!

It seems the greatest opposition to formalizing a new geologic epoch is the argument of when would it begin, what should the marker be and what "utility" would it serve? I've seen lengthy discussions on the GSA and other chat rooms about the uselessness of a new formal time interval on the geologic time scale; especially critical of the utility of it. My answer to this is simply, what is the utility of any other formal Global Boundary Stratotype Section and Point (GSSP) marker, other than for geologists, or others, to walk over and state "Here is the Cretaceous-Paleogene Boundary". I can hear the Facebook unfriending as a ringing in my ears.

I should state my position on the Anthropocene; simply put, we are in it. The Anthropocene is now, it began in 1945, 1950, 1960, 1980, 2018, 2019, 2020 or 2021. Pick any year from the last twenty or thirty, even the last hundred. There is no GSSP marker with that precision, the exact year does not matter, it's a moot point. We are in the Anthropocene; no debate, welcome to the Anthropocene. We're Anthropocene full tilt, the whole nine yards; lock, stock and barrel and the whole shebang. Want proof for the Anthropocene, just take a drive around your city or town. Entire regions paved over, loss of habitat and forest, and our garbage everywhere. Enormous strip mines that extend beyond the eyes reach, landfills that resemble natural hills now replanted and appearing as if they have always been there. And then there is plastic, plastic and more plastic, plastic everywhere.

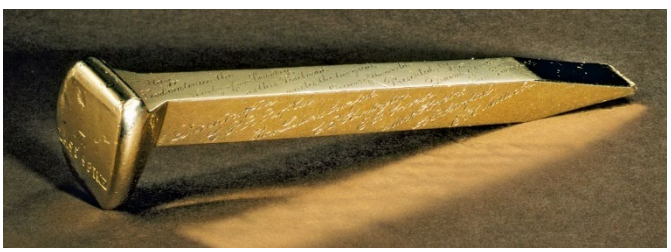
That is my choice for the marker that denotes the Anthropocene. Last week I took a hike through a remote wooded area outside of Johnstown. There were no roads or trails, just dense trees and brush in their winter barrens. Out here, in the middle of nowhere I came across no fewer than 12 pieces of assorted weathered plastic. From water bottles to backpack snaps and plastic tarps. Here was the elusive marker being searched for by the AWG and others for the beginning of the Anthropocene, plastic. I have decided on the exact placement for the Anthropocene GSSP marker. Just south of Johnstown, Pa. along state route 219 there is a huge landfill that now fills an entire valley; it contains lots of plastic.

I'm placing the Anthropocene marker at the base of this landfill where it contacts the former land surface consisting of the Pennsylvanian Period Conemaugh Group. This will create a wonderful stratigraphic section along a great unconformity between the Pennsylvanian Period Conemaugh Group and the Anthropocene; a geologic gap of approximately 300 million years. My marker will be a simple modified USGS brass benchmark (please don't ask how I came to possess it) stamped with the date 2021 a line indicating the Anthropocene. Perhaps my marker should be placed at the Holocene-Anthropocene boundary, but I favor the concept of the great unconformity much better. I'm running out of personal time and can no longer wait on the AWG, SQS or ICS to make a decision, so I had to take the initiative on this matter.

Consider the vast abyss of geologic time, incomprehensible for the human mind to visualize. Our present geologic time scale and established GSSP markers are temporal, meaningless across the expanse of time. It has been said that formalizing the Anthropocene is a prime example of our human arrogance. Considering that the Earth's population of approximately 7.8 billion humans have now transformed the entire planet to the point of being visible from low orbit, we deserve the Anthropocene because our arrogance has created it.

As soon as the snow melts and the temperatures warm, I'm heading out to the landfill with my Anthropocene marker. I'll have a new location to take my students and point out to them, "Here is the marker that indicates the beginning of the Anthropocene Epoch". Excuse any errors in my logic, presentation of facts and satire; I completed this essay in just a few short minutes. But that time is irrelevant compared to Earth history, or maybe not.

If you take issue with this, I can accept that. But please, don't unfriend me on Facebook.



Lab Swaps:

Perspectives Shift When Geology and Environmental Science Students Trade Places

by Elizabeth Doyle and **Bonnie Burgess**
Marymount University

Now more than ever, faculty collaboration can foster community, enliven learning and engage students, all while enriching the curriculum. Science course lab swaps exemplify this potential and we believe that similar class swaps would fit many disciplines. This model can be applied virtually as well.

For the past three semesters**,** Marymount University Environmental Science Professor Bonnie Burgess and Geology Professor Beth Doyle have each taught a lab session for the other's class. Introductory courses in geology and environmental science are offered as an elective and to meet the natural science requirement for non-science majors at this private university in Arlington, Virginia. For one lab per semester geology students take on an aspect of environmental science with Burgess and environmental science students study select geologic processes with Doyle.

Burgess initiated this exchange to deepen her students' understanding of the biogeochemical cycles and to explore the effect of the rock cycle and plate tectonics on the environment. Doyle wanted her students to tackle a mini-field project, a long-valued part of geology education.

Doyle's two-hour lab introduces these non-geology students to recycling processes of the lithosphere. This session focuses on the most vivid, attention-grabbing plate tectonic and rock-forming events that drive this recycling. Environmental science students are used to thinking in terms of the relatively quick bio-hydro- and atmosphere recycling instead of the rock cycle's span of tens to hundreds of millions of years. Zeroing in on signature features like fossils in sedimentary rocks and holes left by escaping gas (aka "vesicles") in igneous extrusive rocks, Doyle challenges students to identify samples. She then

moves onto the stickier topic of how rocky tectonic plates float, slide, clash and split.

Props help.

Everyone bounces and stretches their own blob of putty to gain a sense of the visco-elastic aesthenosphere supporting the lithospheric plates. Lava lamps give a time-lapse visual of the aesthenosphere convection currents that drive tectonic plate lateral movement. Students also observe that a thicker wood block sits lower than a thinner one in a water-filled plastic basin. With Doyle's guidance, this proxy of the rocky lithosphere buoyed by the flowing asthenosphere leads students to a key tectonic takeaway: The lithosphere moves up and down as well as sideways. While famously oozy, putty acts like a solid, too. Students discover that a quick yank fractures the putty much like the sudden rupture of a fault in the brittle lithosphere.

Holly Trakas looks on as Natalie Garbalosa manipulates putty to simulate the elasticity and viscosity of the aesthenosphere.

With the help of 3-D topographical ocean floor maps students dig into the mechanics of the seismically and volcanically active zone known as the Ring of Fire edging the Pacific Ocean.

Volcanoes are always a big hit.

Video clips command attention and prompt questions. Hawaii opens the topic of "Hot Spots," volcanically active zones unrelated to plate tectonic interaction. Examining ocean floor maps, students investigate how the island chain and the neighboring Emperor Seamounts can help predict plate movement. They're asked to predict where the next volcano will pop up. Most correctly guess "southwest of Hawaii" and the lesson ends with Doyle introducing students to "Loihi," the incipient island in-the-making.

A lava lamp is an effective way to demonstrate how convection currents work.

Burgess's multi-purpose water analysis lab immerses students in the local Donaldson Run watershed, an overlooked treasure in suburban Arlington County, Virginia. Up to this point in the semester, geology labs have covered rock and mineral identification and topographic map reading. Now, students are getting their feet wet and their hands dirty at the geology-biology interface located across the street from campus, a recovering successional forest area surrounding the start of Donaldson Run stream.

As the class walks along the stream channel, Burgess notes the debris on the forest floor, including massive fallen tree branches. The stream water, students observe, looks like rust. Burgess shares a report of high iron levels for this site as a possible explanation for the water's umber shade and asks students to hypothesize what else could redden the water. Nearby residential and commercial runoff, dissolved organics and even streambed clay could also contribute to color change. In case it's algae, Burgess offers some practical advice: "Don't wash your car at home" especially with algae-loving phosphate soap.

Burgess's review of the stream's connection to the Potomac River and Chesapeake Bay reminds all of a contaminant's broader impact and the possible effect that it could have on an entire region.

Prof. Doyle goes over rock properties as Jose Beltran Garcia looks on.

To a geologist, groundcover can be a clue to what's underneath, but it's usually considered a nuisance. Biologists see the world differently. Where the trail meets the stream, Burgess gives a primer on Arlington's invasive species. The focus shifts back to water when Burgess walks students through the tests they'll use to grade the stream. These include tests for oxygen content, pH, and for nitrates and phosphates.

Burgess gives the students rubber gloves to guard against contamination and protect their skin from the chemicals they'll use. To prevent contamination, students rinse collection containers with the stream water that they'll hold and sample mid-channel in order to catch sediment-free water. These practices reveal another difference between environmental science and geology fieldwork. For rock collecting and strike and dip measuring geologists, gloves are rarely worn, and contamination is usually not a concern.

Under Burgess's direction students fix the oxygen in the sample. Water temperature is also noted since cooler temperatures increase the solubility of oxygen.

These introductory geology students appreciate that mapping and rock samples provide durable information. With flowing water, by contrast,

To fix oxygen, Professor Bonnie Burgess adds reagent to student Bruck Negash's water sample.

change quickens. Trees collapse and summer floods severely undercut stream banks. Donaldson Run gets a regular make-over, underscoring Burgess's reminder that only water testing over time provides an accurate picture of the stream's transient health.

Back in the lab, Burgess presents testing methods and standards. Students clear and clean the tables and once again don rubber gloves. Phosphate, nitrate, dissolved oxygen and pH testing stations are set up and students rotate in groups between each. Burgess connects the familiar concept of acidity with the health of the stream system. Students learn that the pH determines what ions are available to the myriad stream critters.

Student Amir Hall and Professor Bonnie Burgess compare the treated water sample to nitrate level color standards.

Justice Costanich adds a stream water sample to a test tube for nitrate testing.

In geology, time and place both tend to be vast. In environmental science, small matters. This water chemistry lab shows that just a dash of certain ions can wreak havoc.

Burgess guides students through the titration method for determining the dissolved oxygen (DO) concentration. Chemistry practices are a novelty to these geology students and they lock-in to the precision needed to gauge the DO amount. One drop at a time, they add just enough of the alkaline compound to clarify the sample, a sign that the acid is neutralized.

With the testing done, Burgess asks students to consider all aspects and assess the quality of the water in Donaldson Run as a habitat for living organisms at this time.

Preliminary Assessment of Lab Swaps

Lab swaps in environmental science and geology amplify core ideas, scientific methodologies and cross-cutting themes. For the student, this lab exchange illuminates the connections between disciplines. Geology students explore a real-world problem: stream water health. Environmental science students explore earth processes that influence climate and ecology.

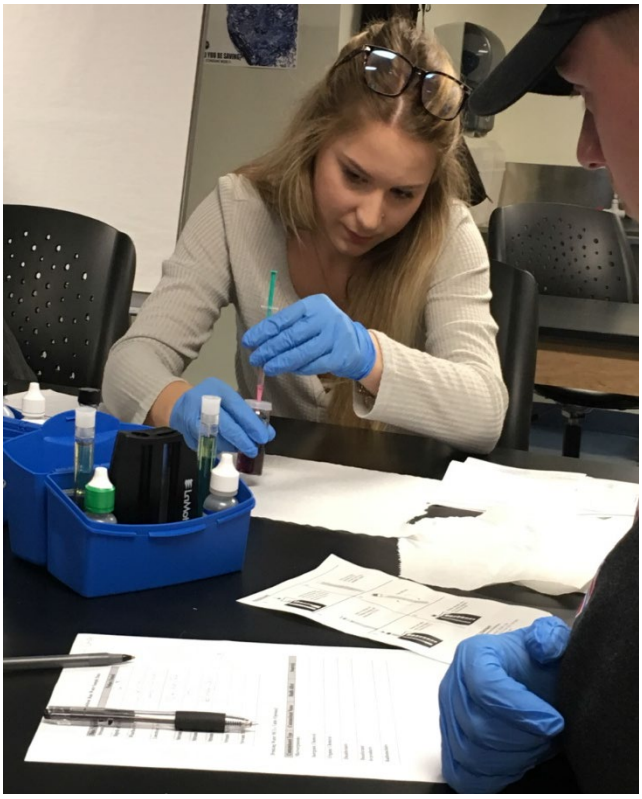
Animated discussions lock in students' understanding of stream health and water-test methods. Certain concepts like aesthenospheric viscosity and hot spots particularly challenge students and thus both exercise and, ultimately, reward their intellectual discipline.

For instructors, lab swaps are equally rewarding; in part, because they encourage adaptation and flexibility. Identifying pre-lab readings and exercises is necessary to bring students up to speed. Instructors must examine and appropriately modify their customary presentations to account for differences in student backgrounds. Watching a colleague perform provides both tips and inspiration.

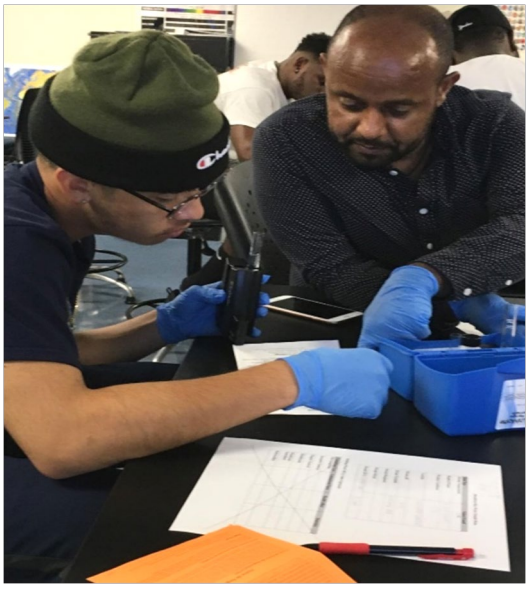
More broadly, this lab swap encourages good scholarly and citizenship practices. Since most of the students are liberal arts, or IT-related majors, both courses are probably the students' final chance to practice science. Their future careers, from public policy and cyber management to education, benefit from an understanding of environmental processes. Regardless of their role in society, these students will be better prepared to engage as informed citizens.

To gauge Donaldson Run nitrate levels, Hanna Gralinski and Glariani Herrara compare color shades of their sample with standards.

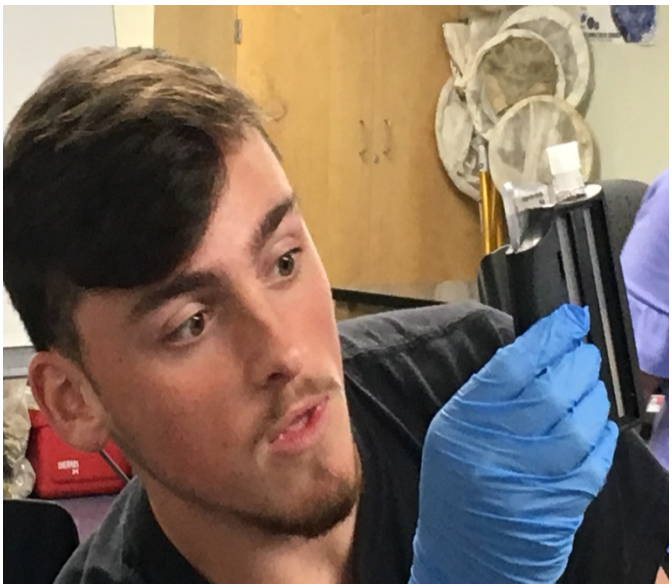
Not least, the field experience revealed boundless nature right next to a suburban college campus. Long after geology students have forgotten Donaldson Run's pH, they might recall how bats flew overhead at sunset and how a six-point buck appraised them on the trail home, while environmental science students may remember heated putty drooling down the lava lamp and the everlasting beauty of rocks.



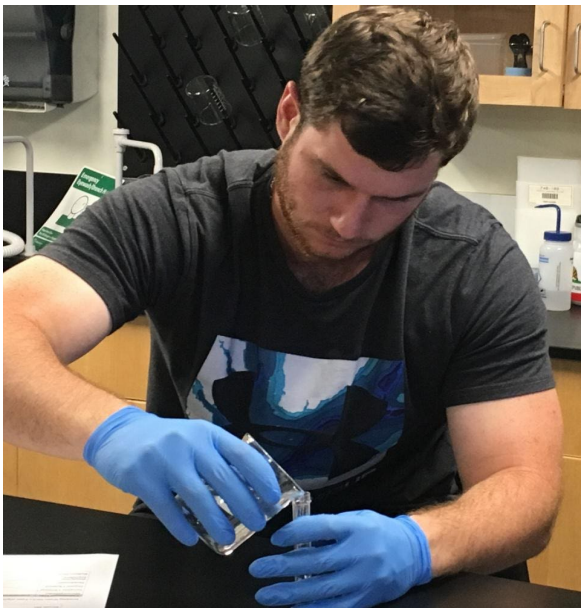
Savanna Lynch titrates the stream water sample.



Bruck Negash and Shawn Hernandez analyze the Donaldson Run stream sample.



James Diguliani eyes the phosphate check instructions for phosphate testing.



James DiGuliani titrates the stream water sample for nitrate testing.

Amir Hall and Randy Lynn prepare to add reagent to the water sample for phosphate testing.

AGU Bridge Program Application is now open: The AGU Bridge Program, part of the Inclusive Graduate Education Network, is an effort to increase the number of underrepresented students in geoscience graduate programs. The AGU Bridge program provides students, who have not previously applied or have applied but were unsuccessful, an alternative pathway to graduate school admission by giving them access to a common application system. As a professional member in the geosciences, **we hope that you will support this effort to increase diversity and support inclusive practices in our discipline by encouraging eligible students to apply**.

Submitted applications will be circulated to our AGU Bridge Partners that have committed to increasing diversity in their departments. The student application can be accessed by visiting the AGU Bridge Program website.

Students are encouraged to complete their application by March 31, 2021.

Open Access Educational Resources for Historical Geology:

by Amy Weislogel
West Virginia University

I wanted to let the ES NAGT community know about a project I'm working on to create an open access Earth History laboratory manual that will contain user-friendly inquiry-based activities that emphasize geological thinking (e.g., observations at wide ranging temporal and spatial scales in geographic context and as part of an integrated system) and application to current societal challenges (energy, hazards, sustainability).

Currently, I'm planning activities for a combination of low-tech (i.e., paper and pencil) with some component of digital content or computer work that require internet connectivity or computing resources. I aim to structure these activities to improve accessibility, justice, equity, diversity and inclusion (AJEDI) in the geosciences, and so am following the work of Beane et al. (2019), who suggest AJEDI in geoscience education can be facilitated by several instructional design approaches: **1)** use diverse representations of geoscience to aid development of "science identity" and foster sense of belonging among diverse student groups, **2)** incorporate content and issues of societal relevance can positively impact students' attraction to and connection with the geosciences and environmental sciences, **3)** use learning strategies that promote metacognition, and **4)** include information about career pathways in geoscience. To AJEDI accessibility, each exercise will include 3 parts: **1)** Pre-lab content, including reading and associated reading quiz, **2)** Skills training content, **3)** Application/Inquiry content aligned with geoscience professional skill sets and **4)** Metacognition reflection/Attitude Inventory.

The instructional materials for each laboratory exercise will include: Laboratory Exercise guides (text, figures, key reference sheets, list of required materials to execute the lab, etc.), lecture slides, assessment rubric, exam question bank, and meta. Labs will be designed with flexibility so materials can be selected to reflect local geology if desired. If you have ideas for lab exercises that you think would be great to include, or have resources or ideas to share, please feel free to reach out to me (amy.weislogel@mail.wvu.edu) – I'd love to hear your input!

Provided by NAGT National, this link takes you to a list of geology field camps being offered this summer; in person, hybrid and virtual. The list will be updated by NAGT as more offerings come in.

GEOLOGY AND THE CIVIL WAR IN SOUTHWESTERN VIRGINIA*

The Wythe and Smyth Counties Lead and Salt Operations

Introduction

Welcome to beautiful southwestern Virginia and the NAGT Eastern Section annual meeting. This field trip affords an opportunity to examine the connections between geology, geography, and human history in one of the world's classic folded mountain belts. Here, in the Valley and Ridge of the southern Appalachians, salt and lead deposits of historic significance (both were mined prior to the Revolutionary War) became critical strategic mineral resources for the Confederate war effort in the 1860s (Figure 1). From Austinville in Wythe County came an estimated one-third of all the lead consumed by the South during the war (Robertson, 1993). Saltville in Smyth County produced an astonishing two-thirds of the entire Confederate salt supply (Lonn, 1933). No wonder, then, that North and South clashed repeatedly over these crucial mineral operations and the railroad that transported the lead and salt (Whisonant, 1996a, 1996b, 1997).

FROM THE ARCHIVES

Geology of the Lead Mines and Saltville Area

The geology and economic development of the lead mines and salt-producing regions are described in detail in the articles included in this guidebook (Bartlett, 1971; Whisonant, 1996a, 1996b). Briefly, lead production occurred in the Austinville-Ivanhoe mining district in southern Wythe County. The lead and zinc deposits here are fairly typical Mississippi Valley-type, carbonate-hosted occurrences (Sweet and others, 1989). The host rock is the Shady Formation, a thick carbonate unit of early Cambrian age; it is cut by a series of imbricate, steep thrust faults that help localize the ore. The ore mineralogy consists mostly of lenses of sphalerite, pyrite, and galena. All of the ore, which generally occurs as breccia fillings and thin lens-like replacements parallel to sedimentary layering, is within the dolomite that constitutes the principal Shady lithology.

The Wythe County lead mines were opened in 1756 by Colonel John Chiswell, a British army officer and explorer of southwestern Virginia. By the Revolutionary War, the mines were operated by the State of Virginia and produced significant amounts of ammunition for George Washington's Colonial Army (Austin, 1977). In the early 1800s, the Shot Tower was built by Thomas Jackson about three miles northeast of the lead mines on Shady dolomite bluffs along the New River. We will visit this interesting structure, one of the few historic shot towers still standing in the United States. Here, lead shot was produced by pouring melted lead through sieves and letting the droplets fall through the air to cool into nearly perfect little spheres.

By the Civil War, the lead mines were operated (ironically) by the Union Lead Mining Company. The mines and smelters were worked night and day during the conflict, eventually producing approximately 3,500,000 pounds of lead for the Confederate war effort. A number of Union raids were directed at the lead operations; however, the mines continued to operate throughout the war until destroyed in raids by General George Stoneman in late 1864 and early 1865.

Lead production resumed immediately after the war, but was overtaken by zinc manufacture in the late 1800s. Zinc continued as the main metal produced until the mines at last closed permanently on December 31, 1981. On that date, New Jersey Zinc ceased all operations at Austinville, thus ending the 225-year-long history of the oldest continuously operating mines in the United States.

*This section provided by Dr. Robert C. Whisonant, Department of Geology, Radford University, Radford, VA 24142 and Dr. Charles S. Bartlett, Jr., Bartlett Geological Consultants, Abingdon, VA 24210.

From The Archives; Winter 2021

This winter 2021 edition of "From The Archives" is taken from the "Geologic Excursions In Southwestern Virginia" guidebook for field trips that was prepared and edited by Ernst and Karen Kastning for the May 21-24, 1998 eastern section meeting. The meeting was hosted by The Department Of Geology and Institute For Engineering Geosciences, Radford University, Radford, Virginia. Several of the field trips were centered on the historic Smyth and Wythe Counties and the town of Saltville. Reproduced here from the guidebook is the introduction to the lead and salt deposits of this region.
Enjoy.

-Steve Lindberg, NAGT-Eastern Section Archivist

The Saltville area, like Austinville, has a fascinating geologic setting and history of economic mineral development (Bartlett and Whisonant, 1997). The Saltville thrust sheet includes rock units from the Rome Formation (Lower Cambrian) up through the Maccrady Formation (Lower Mississippian). In the Greendale Syncline, just north of Saltville, the Mississippian section continues up through the Pennington Formation and includes over 6,000 total feet of rock, probably the greatest thickness for this time period in eastern North America.

The Saltville Thrust Fault is a major structural feature in the field trip area. In places, this fault cuts out as much as 18,000 feet of stratigraphic succession and involves lateral movement of as much as 20 miles. This movement affected the accumulation of salt and gypsum in the Mississippian footwall rocks. These evaporites attracted mineral extraction industries as early as the late 1700s. Salt was an especially vital product and during the Civil War the Saltville deposits supplied the majority of this product for the needs of the South. This did not go unnoticed by Union forces who tried a number of times to knock out this supply. Eventually, in late 1864, the salt works were seriously damaged in Stoneman's raid but soon came back into production. Salt was produced at Saltville until the very end of the war.

After the war, salt manufacture continued until the 1890s when production switched from salt to a variety of sodium and chlorine by-products (eventually ranging from baking soda to rocket fuel). Mathieson Alkali Works, which later became Olin-Mathieson, operated the chemical industry at Saltville until the 1970s. Economic and environmental concerns caused Olin-Mathieson to cease salt production in 1971, but it is estimated that over 8,000,000,000 cubic feet of salt reserves remain in place. Gypsum deposits have been mined just west of Saltville and at Locust Cove, a few miles northeast of Saltville, by U.S. Gypsum Company. Unfortunately, U.S. Gypsum has also announced plans to close operations in 1998.

Since 1782, vertebrate fossils have been extracted from the Pleistocene-aged shallow sands and clays of the Saltville Valley. Scientific excavations in 1917 by Carnegie Museum yielded remains of extinct Mastodon, Mammoth and other animals. Major excavations sponsored by Virginia Tech and the Smithsonian Institution added to the faunal list in 1966 and 1967. Further work by an Emory & Henry College class salvaged scattered bones prior to emplacement of recreational facilities in 1978. Discovery of *in-situ* remains of a nearly complete extinct musk ox in 1981 triggered continuing summer excavation in the western part of the valley.

Most of our field trip today is concentrated in the Saltville area. We will see the Saltville Valley historic brine fields, the Saltville thrust fault, the presently active dig site where paleontological and archeological work is on-going, and a display of materials recovered from the dig site. We will also visit a reconstructed "Salt Park" where the Civil War-era salt-making facilities have been restored. Lastly, we will walk some "hallowed ground" where soldiers from North and South fought for control of the irreplaceable salt works.

We hope you will enjoy this field trip which samples the fascinating geology and human history of the lead mines and Saltville locales.

FROM THE ARCHIVES

WVU Earth Science 'Earth LaUNCH'

Do you or your students have questions about Earth Science hot topics and current issues? Looking for new experiments, data sets and activities on Earth Science topics to share in your classroom?

We invite STEM educators in West Virginia/central Appalachia, who care about our home planet and are working to educate the next generation of Earthlings, to join in a weekly informal conversation with friendly WVU Earth Science faculty. We would love to get to know you, hear about your interests and your work as a STEM educator, and share some of our experiences as Earth Science researchers.

We will meet by Zoom every Wednesday from noon-1 PM through March 31st.
Zoom: https://wvu.zoom.us/j/98991938614?pwd=TktxTEV6WVVFUmZMUWpBdDI0YWthUT09

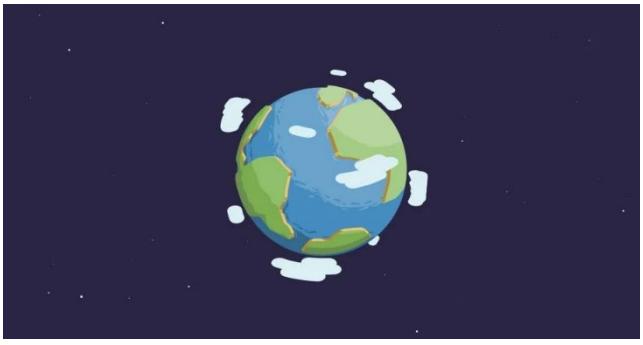
Feel free to join us for all or any part of the call and to bring your lunch along (we'll be having ours!).

Topics we are excited to discuss include:

- History of the Earth
- Quantitative Modeling of Earth System Interactions
- Weather and Climate Variability
- Human Sustainability
- Earth Science Careers of the Future

We hope to see you there!

- **Amy Hessl**, Professor of Geography. Expertise: climatology, climate change
- **Chris Russoniello,** Asst. Professor of Geology. Expertise: groundwater, rivers, quantitative modeling
- **Amy Weislogel**, Assoc. Professor of Geology. Expertise: sedimentary geology & earth history



For more information or questions, send inquiries to alweislogel@mix.wvu.edu