Beloit College

GEOLOGY

ANNUAL NEWSLETTER

2022--ISSUE 6

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Faculty News

Jim Rougvie
Associate Professor of Geology
Chair of Geology

It has been a very successful year. After supervising several recent soils-related thesis projects, this year I developed a new course on soils and the critical zone to meet the students' substantial interests in the subject. In addition to geology students, the course attracted students from a variety of majors (including biology and environmental studies). Although the spring semester weather didn't cooperate much, we were still able to explore the soils of Big Hill Park and Newark Road Prairie in the field and the laboratory. I hope to continue the course on an every other year basis. In addition to that course, I kept busy teaching petrology and two sections of physical geology.

My research this year again focused on alteration in the White Mountains of eastern California and the Creede mining district in Colorado. During the summer I worked with Hanlin Zhang '21 to expand on the thesis work by Sally Klein '16 and John Tower Jr. '21 on the sodium metasomatism of the White Mountain Peak metavolcanic complex in the Mesozoic Cordillera arc. Emily Clinkscales'22 thesis work documented interface-controlled dissolution-precipitation reaction mechanisms of feldspar replacements in Creede and other localities of low-T K metasomatism. This work is a collaboration with Tirzah Abbott '12 of the Northwestern University Atomic and Nanoscale Characterization Experimental Center. Both projects were presented at GSA in Portland. I also supervised thesis research by Maddie Holicky'22 and Martina Pulido'22, who studied legacy sediments and dam impounded waters as part of a Keck Geology Consortium project that assessed ground and surface water quality in the Shenandoah Valley.

Sadly, continuing COVID-related travel restrictions in Japan once again delayed the next offering of our Rural Landscapes in Transition: Japan field course. The Luce Foundation, which funds the Landscapes in Transition project, has been very supportive and we are currently planning for an August 2023 collaboration with our partner Akita International University. We aim to visit the Oga Peninsula-Ogata Japanese National Geopark to study how geoparks and geoheritage play a role in sustaining rural communities.

Finally, this year ends my two-year term co-directing the college Teaching and Learning Initiative on campus. In addition to other faculty development activities, our group ran a series of sessions devoted to putting anti-racist pedagogy into practice.

Faculty News

Sue Swanson
Professor of Geology

I enjoyed a year-long sabbatical in 2021-22. It started out busy with a 5-week Keck Geology Consortium Gateway project in July and August 2021 (see page 11), but I soon settled into a more relaxed pace in the fall. To keep myself occupied, I started a new project involving groundwater and geological resource inventories and investigations of groundwater/surface water management issues within the Chequamegon-Nicolet National Forest of northern Wisconsin. I could hardly ask for more beautiful field sites, and I am enjoying the time and landscapes near the "Big Lake". The work is being done in collaboration with colleagues at the Wisconsin Geological and Natural History Survey, including Grace Graham '13.

Previous projects on thermal properties of springs were also completed, with a paper published in Hydrogeology Journal (Swanson and Graham, 2022) and contributions to a global review of the ecological integrity of spring ecosystems (Stevens et al., 2021). It was a great pleasure to find out that Monica Norton '15 was a co-author on the latter publication!

Although some of my original travel plans needed to be adjusted due to the ongoing pandemic, I still managed a few trips to conferences including the GSA Meeting in Portland, Oregon and the Joint Southeastern & Northeastern Section GSA Meeting in Cincinnati, Ohio, with a side trip to explore karst landscapes and Mammoth Cave in Kentucky. I enjoyed catching up with Beloit College alumni at both meetings and look forward to Denver, Colorado in fall 2022, where I hope to see many more Beloiters.

Faculty News

Jay Zambito
Associate Professor of Geology

This past year I taught a variety of courses in Geology, including the introductory course Evolution of the Earth, and the advanced courses Earth's Climate, Paleontology, and Stratigraphy. Field trips were once again a common and an integral part of courses and department events, and it was great to have the opportunity to learn on the outcrop again with the amazing students at Beloit! In the beginning of the Spring semester I took parental leave to spend time with my newborn daughter, Francesca "Frankie" Jo Zambito. As I write this Frankie can bring her feet to her head like an enrolled trilobite and drools like an artesian well. During my leave, the department and students were fortunate to have Dr. Liz Ceperley '12 teach classes and provide students career mentorship.

I worked with three students on their theses in geology this year, two of which were related to my ongoing Devonian paleoclimate project: Anna Weldon ’23 (Testing the Impact of Forest Evolution on the Organic Matter Composition of the Illinois Basin Devonian Marine Black Shale), Laura Hughson ’22 (Comparing Local and Basinal Patterns of Marine Black Shale Organic Matter Composition in the Devonian Appalachian Basin), and Ocean Clevette ’22 (Increasing Accessibility to Introductory Geology Courses Using Virtual Field Experiences). I also had the pleasure of continuing to work with Andy Rich ‘20, who published his senior thesis this past year in the journal PALAIOS (Insights from fossil fish taphonomy into the depositional environment of the lower Milwaukee Formation, https://doi.org/10.2110/palo.2021.040).

My research this past year has mostly focused on Devonian stratigraphy and paleoclimate, more specifically looking at how forest evolution in the Devonian increased the flux of vegetative biomass from continents to the oceans and profoundly changed the global carbon cycle. The goal of this study is to constrain the timing and magnitude of these carbon fluxes and determine the effect of forest evolution on Earth's climate. I am currently in the third and final year of American Chemical Society funding for this project, and plan to spend most of this coming summer and fall submitting results with student co-authors for publication. I also wrapped up a Cambrian sandstone project with colleagues at the University of Wisconsin, which was published in the Journal of Contaminant Hydrology (Identifying the source of groundwater contaminants in West-Central Wisconsin, U.S.A.: Geochemical and mineralogical characterization of the Cambrian sandstone aquifer, https://doi.org/10.1016/j.jconhyd.2022.103966).

Student Awards

Richard C Stenstrom Prize in Environmental Geology

Martina Pulido & Maddie Holicky

Walter S. Haven Geology Prize

Emily Clinkscales & Anna Weldon

Sarah Wallbank Memorial Prize in Geology

Martina Pulido

Left to right: Isabel Johnson, Martina Pulido, Ocean Clevette, Maddie Holicky, Anna Weldon, and Emily Clinkscales (not pictured: Olivia Farbarik)

Outstanding Teaching Award as a Laboratory Assistant

Ocean Clevette & Olivia Farbarik

Ferwerda Scholar rising Senior

Olivia Farbarik

Ferwerda Scholar rising Junior

Isabel Johnson

Majors, Minors and GEO Club Officers

Geology Majors

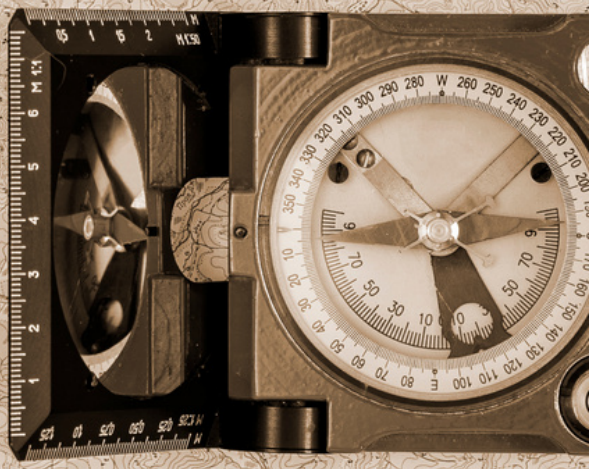
Daniel Bolin
Jack Collier
Gabian Durussel
Olivia Farbarik
Morgan Fries
Sam Hall
Isabel Johnson
Victor Long-Sires
Alyssa Luna
Emma May
Lila Ryter
Willow Teipel
Desmond Turner
Anna Weldon
Caedyn Wells
May Willison

Environmental Geology Majors

Ocean Clevette
Emily Clinkscales
Mikaila Davis
Ryan Deany
Georgia Fanthorpe
Maddie Holicky
Laura Hughson
Martina Pulido

Geology Minors

Alex Eber
Toryn Seeberger
Chris St George
Michelle Stevens



GEO Club Officers

FALL 2021

PRESIDENT
Martina Pulido

DEPARTMENT REPRESENTATIVE
May Willison

SPRING 2022

PRESIDENT
Emma May

DEPARTMENT REPRESENTATIVE
Olivia Farbarik

GSA Annual meeting in Portland, Oregon 2021

The 2021 Annual Meeting of the Geological Society of America was held in Portland this year and 11 Beloit students attended, supported in part by the Metcalf Fund. Beloit students presented a large number of talks and posters. Although we decided to forego our annual luncheon this year due to COVID, we look forward to hosting it again next year in Denver.

Beloit College Geology Student Presentations 2021

Groff, M., *Holicky, M.G., Larkin, K., *Pulido, M., Wilde, K., Hinkle, M.A., and Lyon, E. (2021)
CHARACTERIZING LAND USE HISTORY AND ASSESSING POTENTIAL GEOCHEMICAL CONTAMINANTS FROM LEGACY SEDIMENTS AND IMPOUNDED WATER IN ROCKBRIDGE COUNTY, VA.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper371052.html

Ergh, I., Morgan, M., *Teipel, W., Telgen, P., *Clevette, O., and Swanson, S. (2021)
GEOCHEMICAL PROPERTIES OF SEEPAGE-FILTRATION AND FRACTURE SPRINGS IN WISCONSIN.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper370439.html

Zhang, H., *Klein, S.P., *Tower Jr., J. and Rougvie, J. (2021)
ALTERATION IN THE WHITE MOUNTAIN PEAK METAVOLCANIC COMPLEX, EASTERN CALIFORNIA.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper370417.html

*Clinkscales, E., Abbott, T. and Rougvie, J. (2021)
INTERFACE-COUPLED DISSOLUTION-PRECIPITATION MECHANISMS IN K FELDSPAR REPLACEMENTS PRODUCED BY LOW T K-METASOMATISM: CREEDE, CO.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper370481.html

*Clevette, O. and Swanson, S. (2021)
INCREASING ACCESSIBILITY TO INTRODUCTORY GEOLOGY COURSES USING VIRTUAL FIELD EXPERIENCES.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper370570.html

*Stevens, M., and Deng, R. (2021)
USING QUAGGA MUSSEL SHELLS TO REMOVE HEAVY METAL IONS FROM CONTAMINATED WATER.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper370706.html

Zambito IV, J., McLaughlin, P., *Holicky, M.G., *Farbarik, O.B., *Clinkscales, E.N. and *Fries, M.A (2021)
EXTREMELY NEGATIVE δ13CCARB VALUES ASSOCIATED WITH THE LATE GIVETIAN TAGHANIC BIOCRISIS IN THE NORTHERN APPALACHIAN BASIN.
https://gsa.confex.com/gsa/2021AM/webprogram/Paper369999.html

*indicates Beloit student presenters

GSA Regional meeting and side field trip in Cincinnati, Ohio 2022

Anna Weldon '23 presented her senior thesis research at the NC-SE joint section meeting of the Geological Society of America in Cincinnati, OH in April 2022.

*Weldon, A., Zambito, J., and McLaughlin, P. (2022) TESTING THE IMPACT OF FOREST EVOLUTION ON THE ORGANIC MATTER COMPOSITION OF ILLINOIS BASIN DEVONIAN MARINE BLACK SHALE

ttps://gsa.confex.com/gsa/2022NC/webprogram/Paper375775.html

Also at the NC-SE joint section meeting of the Geological Society of America in Cincinnati, OH in April 2022.

*Hughson, L., Zambito, J., and *Farbarik, O. (2022) COMPARING LOCAL AND BASINAL PATTERNS OF MARINE BLACK SHALE GEOCHEMISTRY IN THE DEVONIAN APPALACHIAN BASIN, KENTUCKY

https://gsa.confex.com/gsa/2022NC/webprogram/Paper375778.html

After the meeting in Cincinnati, students took advantage of the opportunity for world-class fossil collecting in the (very muddy) type Cincinnatian.

Keck Gateway Project

Keck Geology Consortium Gateway project to Explore the Spatial Distribution of Geochemical Properties of Springs

In July/August 2021, Sue led a four-student Keck Geology Consortium Gateway project to evaluate relationships between the spatial variation of geochemical conditions and spring source geomorphology. Students selected six springs from over 400 springs inventoried in Wisconsin (Swanson et al., 2019). Some springs in Wisconsin exhibit more than one type of source geomorphology. Those selected for this study were exclusively fracture or exclusively seepage-filtration springs, the two most common spring source geomorphologies in the region and those which have distinct differences in spatial distribution of temperature (Swanson and Graham, 2022). Students hypothesized that if there are differences in the spatial distribution of temperature, there may also be differences in the spatial distribution of geochemical conditions, contributing to differences in the diversity of spring biota. Willow Teipel ‘24 participated in the project, and Ocean Clevette ‘22 served as the teaching assistant. The students presented their findings in October at the Geological Society of America meeting in Portland, Oregon.

Fall Skip Trip

Fall Skip Trip Explores Glacial Geology and Springs in SE Wisconsin

In August the Geology Department ran the annual “Skip Trip” funded by Mary Ann and Richard "Skip" Davis '59. This year 27 students, including majors and non-majors alike, and three faculty members explored glacial geology and Silurian dolomite in Southeastern Wisconsin. Highlights included glacial deposits at a Lake Michigan beach at Cudahy Bluff in Sheridan Park and Schoonmaker Reef where students explored a 425 million-year-old fossilized coral reef deposit. At Kettle Moraine State Forest students observed Pleistocene glacial features including drumlins, moraines, kettles, and even a kame from the top of Lapham Peak Observation Tower. We made a quick stop to see Scuppernong Springs on the journey back to the college. A short hike led the group to a bubbling spring where students were able to stick their hands into the frigid water and learn about how the spring shapes the surrounding area.

Photo credit: Eric Brooks Reiner Schilling

Photo credit:Jay Zambito

Photo credit: Eric Brooks Reiner Schilling

Fall Skip Trip


Photo credit: Jim Rougvie


Photo credit: Jim Rougvie


Photo credits: Eric Brooks Reiner Schilling


Photo credit: Jim Rougvie

Spring Skip Trip

In early April we held our first-ever Spring "Skip Trip". Faculty and 30 students headed west to investigate the Paleozoic Stratigraphy of southwest Wisconsin. Our first stop was Blanchardville to see the dunes of the Ordovician St. Peter Sandstone overlain by the Ordovician Platteville Formation dolomite and Ocean Clevette '22 discussed a portion of her thesis. Following lunch at the Dickeyville Grotto, we visited Church Road Quarry to see the Platteville, Decorah, and Galena Formations. Hardground features and many trace and body fossils (including trilobites) were discovered. Finally, we visited the Dickeyville roadcut to put our hands on bentonites in the Platteville-Decorah-Galena succession. We hope to continue to run a spring trip in the future.

Photo credits:Jay Zambito

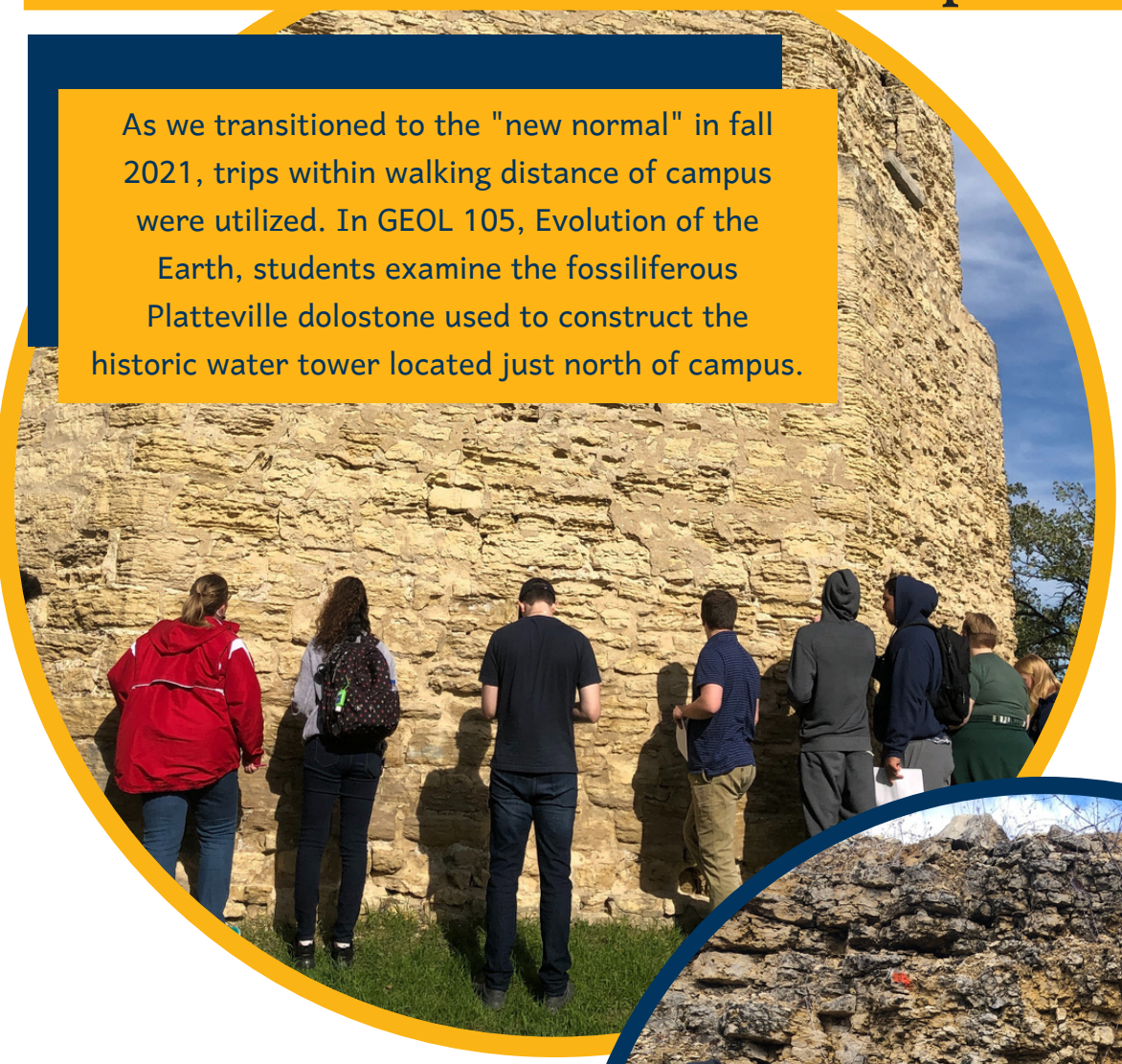
Photo credits:Jay Zambito

Photo credits:Jay Zambito

Photo credit:James Rougvie

Class field trips

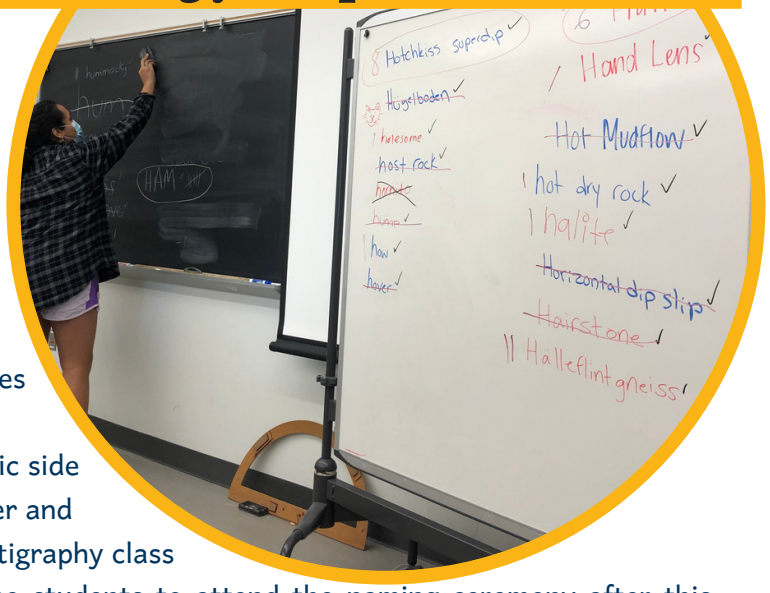
As we transitioned to the "new normal" in fall 2021, trips within walking distance of campus were utilized. In GEOL 105, Evolution of the Earth, students examine the fossiliferous Platteville dolostone used to construct the historic water tower located just north of campus.



Students measured and sampled various successions of Ordovician Platteville dolostone for the GEOL 331: Stratigraphy class project on litho- and chemostratigraphy.

Excerpt from an Anthropology class paper about the culture of the Geology Department

Spring Geology Club Naming Ceremony
By: Julia Hwang '22, Anthropology Major



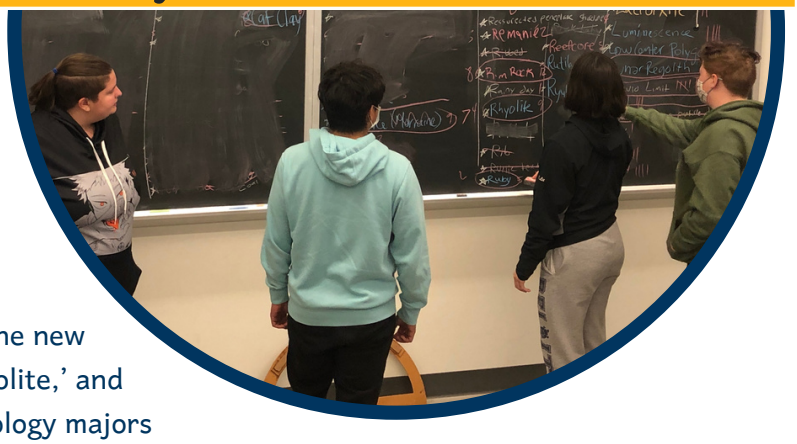
The hallway leading up to the classroom highlights an ichthyosaur replica, colorful minerals, and petrified wood. The geology room (Science Center 444), is brightly decorated with wall-to-wall rocks, geology posters, and lab equipment. This room is where most upper-level geology classes are conducted and where the best view of campus lies. Windows are large and display the southern tip of the academic side of Beloit College. The cloudy skies made the room even brighter and louder as students asked each other about their day. The Stratigraphy class is about to start, and the geology club president reminds the students to attend the naming ceremony after this class. The class's excitement for the naming ceremony causes a burst side conversation. As the professor starts the class, students work on the class research project centered around the field data collected through two different field trips. Backpacks were laid on the floor and computers were pulled out, slowly opening the shared drive.

In this research assignment, students had to analyze the local geological history by applying lithostratigraphy and elemental chemostratigraphy. The professor divided the class into small groups to learn how to discuss and interpret the pXRF data we collected, which would contribute to the class project. When the professor briefly steps out, students continue to talk about their excitement of being a geology department senior, the naming ceremony, and painting their senior mug. Volume continued to increase with more excitement. It was enough to bring the professor back into the room to re-center our focus to the assignment. As excited as they were, everyone returned to their work, diligently making their stratigraphic columns, and writing their report. As class ended, many students left their belongings in the room in anticipation of the event. Most of the students have left to stretch, walk, and physically symbolize the end of our class.

When I re-entered the room at 4:30 pm, food and drinks were scattered where the professor usually teaches, and potential geologic names for newly declared geology majors were already being drafted on the board. A messy list of last names was followed by red, blue, white, and yellow chalked scribbles of geologic terms added by people holding thick geology glossaries. The geology club president shouts "Everyone take a snack! I bought way too many. Also hurry up and write your suggestions!" There is a sense of urgency now, as more people enter the room, their bags immediately toppled on the floor to write something on the board. As much as I was aware of my position as an observer, I wanted to bean active participant in this event. I am a senior, new to this field, department, and club. The geology department has become a new familiar in my life. I wrote a few names I found in online geology databases such as 'dump' under the last name that started with a 'D.'

Some seniors in the room were deciding what paint to use to decorate their mug. Their name, year, and silly drawing were carefully articulated on a mug of their choosing

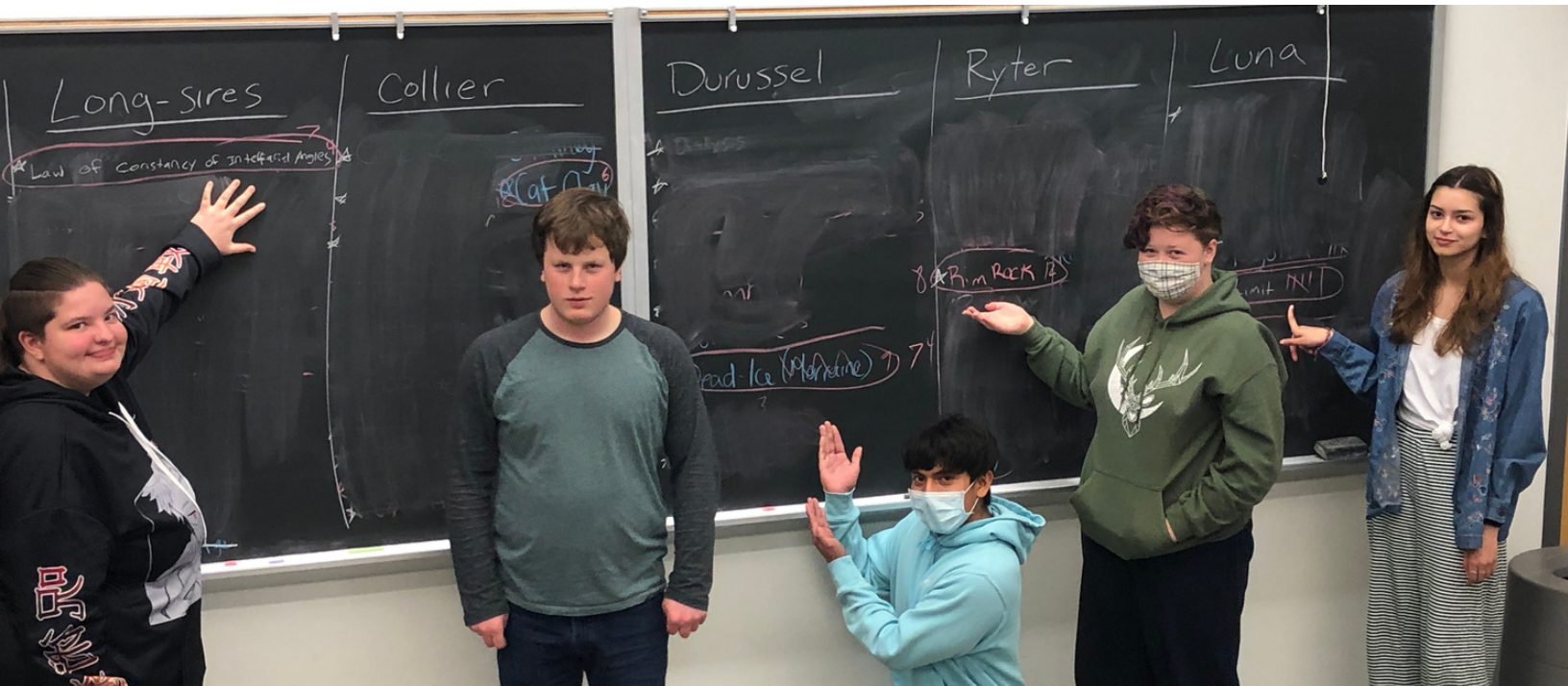
Naming Ceremony cont'd



which would get hung on the walls of the geology seminar room. The rest of the seniors, who have previously painted their mugs, were dedicated to finding these new majors a geology name. They were excited that the tables have turned since their naming ceremony and choose purposely long or vulgar–sounding names. Any names are considered valid if the first letter of their last name and the new geology name matches. Suggestions like 'discharge,' 'coprolite,' and 'cummingtonite' are quickly added. There are five new geology majors this academic year and they looked fresh, nervous, and excited to be a part of something like this. The suggestions make them giggle, even yell in denial, and hope that the crass ones do not get chosen.

One of the professors is searching through the catalog of geology names that dates back 70 years. Names get crossed out if they have been used already; no repeats are allowed. He was holding a laptop, dancing around students to cross out names as they were written. Meanwhile, the other professor is holding a small, bright, yellow book of a French geology glossary and adding more suggestions. After a while, the geology club president halts the addition of more names and starts the voting process.

The president reads the geology names as if it is their middle name and adds a tally to the voted names. Each person (except the new majors) gets three votes—they raise their hands enthusiastically to cast a vote and giggle at the silly ones. After the top three most voted names are chosen, the new majors are asking if they would like to veto a name. They take this time to define some geologic terms that are unclear. An echo of 'ooh' and 'what?' rings as they figure out if these names are reflective of the student's personality. All the students, except one, vetoes, and eliminates the most obviously obscene name. Then, one final vote is casted to finalize the name. These new geology students stood in front of the board with their new name, awkwardly smiling, pointing at their new name as a camera took a picture of this historic day for the department newsletter. The event quietly ends, and students pick up their heavy backpacks. Some shovel their leftover chips into their bags, while others congratulate the newcomers and say their departing remarks. This geology department legacy is continued, and the soon departing seniors are left proud.



Senior Theses- Clevette & Clinkscales

Ocean Clevette

Environmental Geology and Education & Youth Studies Major

Thesis Advisors:
Sue Swanson & Jay Zambito

Increasing Accessibility to Introductory Geology Courses Using Virtual Field Experiences

In response to the COVID-19 global pandemic, educators and schools all around the world were forced to adapt their curriculum and teaching practices to accommodate students in remote locations through online instruction. These accommodations addressed not only concerns about safety surrounding COVID-19, but also other ongoing accessibility issues within the field, such as travel constraints and creating equitable experiences for students with mobility impairments. Research on innovative uses of technology resources has shown that online and alternative field experiences can be useful tools to address these issues. Informed by this research, an existing glacial geology exercise used in introductory geology courses at Beloit College was enhanced to accommodate a wider range of students. The existing physical field trip was supplemented with an interactive Google Earth tour, as well as annotated photo and video guides. These data were used to compile a collection of best practices for accessibility to field experiences and incorporating virtual learning opportunities. These best practices, that balance field experiences and accessibility efforts, are being used to create an additional exercise about local sedimentary geology that focuses on building field skills of observation at the landscape, outcrop, and hand sample scales.

Emily Clinkscales

Environmental Geology Major

Thesis Advisor: Jim Rougvie

Interface-Coupled Dissolution-Precipitation Mechanisms in K feldspar Replacements Produced by Low T K-Metasomatism, Creede, CO

Interface-coupled dissolution-precipitation is an important pseudomorphic replacement process in the shallow crust that involves the simultaneous dissolution of an original mineral in the presence of a fluid and the precipitation of a new mineral retaining the original crystal shape and structure. Previous studies have experimentally observed characteristic criteria of these replacements such as the generation of porosity in the replacement minerals and retention of original mineral shape and structure (crystallographic controls) among others.

The secondary alteration process of low temperature K-metasomatism is common in a variety of diverse geologic settings such as Creede, CO, Socorro, NM, and the Harcuvar Mountains, AZ, and results in the replacement of igneous feldspars in K-metasomatism provides a good model mineral system in which to study the mechanisms of interface-coupled dissolution-precipitation involving K feldspars. Because K feldspars are a major constituent of the crust, understanding the mechanisms of interface-coupled dissolution-precipitation processes produced by low temperature K-metasomatism has important implications in our understanding of a wide variety of processes such as crustal deformation, element transport and redistribution during fluid rock interaction, environmental remediation, weathering processes, and the formation of building materials.

My project utilizes mineralogical and geochemical data from the investigation of naturally-occurring K feldspar replacements in the above three localities and the predetermined set of criteria to identify interface-coupled dissolution-precipitation as the replacement process and further understand its mechanisms. A variety microscopy techniques were applied with a focus on scanning electron microscopy (SEM) techniques such as energy dispersive x-ray spectroscopy (EDS) for major, minor, and trace element distributions and electron backscatter diffraction (EBSD) for comparisons of crystallographic orientation.

Senior Theses- Holicky & Hughson

Assessing Land Use Changes Using the Legacy Sediments in the James River Basin in Virginia

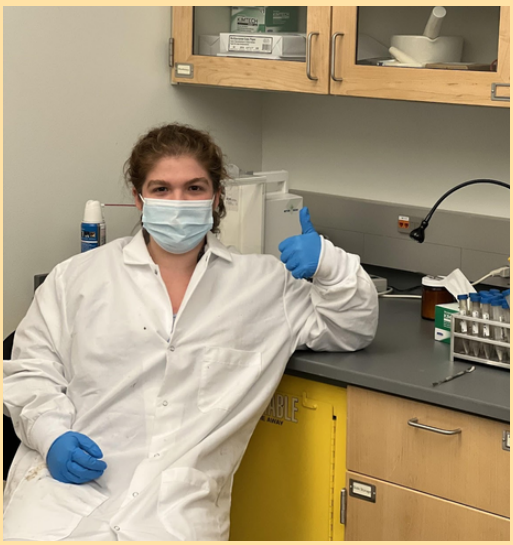
Maddie Holicky
Environmental Geology Major
Thesis Advisor: Jim Rougvie

My thesis project focuses on the land use change since colonial times within the James River Basin in western Virginia. This involves analyzing the sediments, which are more formally known as legacy sediments, from behind the dams that were constructed during the colonial period. Implementation of dams causes an increase of sedimentation which leads to an accumulation of sediments behind the dams. An accumulation of carbon and other chemicals from land uses occurs as well. When these dams are removed, these sediments remobilize, releasing harmful pollutants and excess carbon into the waterways.

Since the dams were removed, the banks behind them are easily accessible which makes collecting samples from vertical banks very easy. After the sediment was collected, it was analyzed for geochemical proxies that determine history of land uses in the area. These proxies include carbon and nitrogen isotopes, trace metals such as manganese, lead, and iron, and amount of total carbon. To understand these proxies, I have been plotting them stratigraphically according to the dates that the dams were in place. The variation in these specific proxies can inform us of shifts in the land plant species, increase of industrialization, and deforestation rates. Overall, this study aims to explain how human's impact through land use changes can be cataloged within the legacy sediments and how those changes can affect sediment for hundreds of years after industrialization and evolution of agriculture.

Comparing Local and Regional Patterns of Marine Black Shale Organic Matter Composition in the Devonian Appalachian Basin

Laura Hughson
Environmental Geology Major
Thesis Advisor: Jay Zambito



The evolution of forests during the Mid to Late Devonian (~375mya) drastically altered atmospheric composition, the Earth's climate system and disrupted the carbon cycle. The newly evolved forests, it has been proposed from previous studies, increased nutrient and organic material runoff which led to ocean eutrophication. These anoxic conditions resulted in increased black shale deposition, global-scale climate change, and related extinctions. In order to better understand this process, the following hypotheses are being tested based on organic geochemical data collected from the two closely positioned cores from the western Appalachian Basin:1) the stratigraphic patterns observed in the two cores used for this study should closely reflect one another, and, 2) the stratigraphic patterns observed in the two cores will be similar to those observed in previous studies of correlative Appalachian Basin black shale.

The core samples used for this thesis come from the western side of the Appalachian Basin (Powell and Estill counties, Kentucky). X-ray fluorescence and loss-on-ignition will be used to determine elemental composition and organic matter content, respectively; this will provide a deeper understanding of lithology, conditions present during deposition, and aid in chemostratigraphy. Organic carbon isotopic analysis will be used to differentiate marine and terrestrial organic matter and therefore constrain organic matter fluxes into the depositional environment and reconstruct any changes in organic matter composition through time. The data from this study will contribute to a deeper understanding of previous anoxic conditions and also serve as a reference for understanding future anthropogenic disruptions to the carbon cycle.

Senior Theses-Pulido & Weldon

Martina Pulido

Environmental Geology Major

Thesis Advisor: Jim Rougvie

Assessing Geochemical Characteristics of Dam Impounded Waters in the James River Basin of Virginia

Assessing dam usage and its influence on heavy metals in water systems is important in addressing changes in water quality to sustain safe drinking water, and aquatic ecosystems. Heavy metals, such as manganese (Mn) and iron (Fe), along with the contaminant phosphorus (P), are detrimental to human health, and to aquatic life. Children that are chronically exposed to Mn^{2+} are more likely to develop learning impairments. Increased phosphorus leads to eutrophication, creating anoxic water conditions ideal for Mn^{2+} solubility, as well as causing fish kills and algal blooms. Anoxic waters can also be found in mill ponds, or stratified reservoirs, found behind dams. Seasonally stratified reservoirs allow metals such as Mn and Fe to accumulate in the water column due to reducing conditions in sediments, and be released to downstream rivers through dam discharge. Additionally, dam removal can remobilize and release soluble contaminants from impounded sediments to water systems. The dam tailrace transports and accumulates the remobilized sediments, impounded waters, and soluble metals, allowing the downstream water and ecosystems to be polluted with Mn^{2+} and P. Could dam reservoirs in Rockbridge County react in a similar way, and how are they impacting water quality?

Through my research the aqueous geochemistry of mill ponds were assessed to determine the potential risk for contamination of Mn^{2+} and other contaminants as a result of dam presence. The hypothesis will test dam system potential to create an increased risk for Mn^{2+} contamination due to water stratification and the mobilization of contaminants in sediments and water through dams.The area of focus is the Maury River in Rockbridge County, Virginia (VA), located in the James Basin of the Chesapeake Bay Watershed. The Maury River holds approximately 10 structures; our focus is a combination of six demolished and operating dams. Furthermore, there will be an evaluation of change in water geochemistry with depth to evaluate the importance of stratification in reservoirs, and how these reservoirs change seasonally.

Testing the Impact of Forest Evolution on the Organic Matter Composition of Illinois Basin Devonian Marine Black Shales

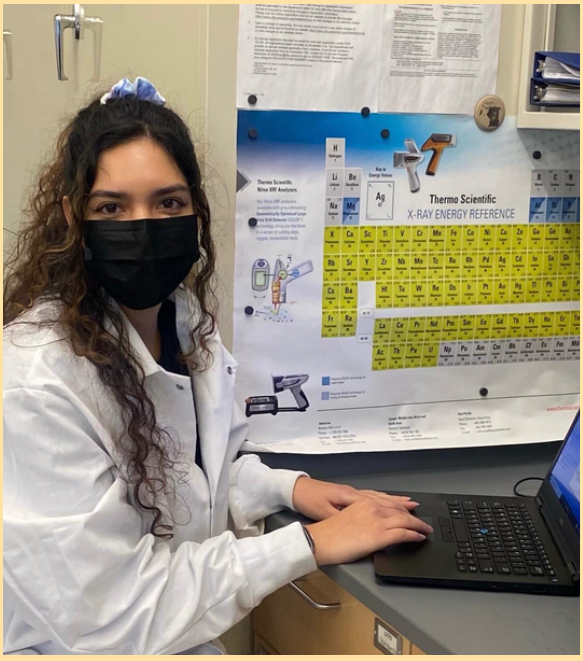
The evolution of forests during the Middle to Late Devonian (about 375 million years ago) acted as a catalyst for a variety of changes to atmospheric composition and the Earth climate system. Previous studies have proposed a relationship between the newly evolving forest ecosystems and enhanced nutrient runoff to oceans with ocean anoxia, black shale deposition, global climate change, and biotic crises. To better understand this relationship, my thesis uses samples collected from core and outcrop in the Illinois Basin to test the hypotheses that 1) terrestrial biomass input increases through time, and 2) as proximity to open ocean settings increases, terrestrial biomass decreases.

Samples were collected from two locations in the Illinois Basin and organic carbon isotopic analysis is being used to differentiate marine from terrestrial organic matter and test the proposed hypotheses. Additionally, x-ray fluorescence and loss-on-ignition techniques are being used to provide a better understanding of the lithology of the samples, paleoredox conditions during deposition, and sedimentation rate/organic matter dilution. Ultimately, the data from this study will provide a better understanding of past geologic events and a natural baseline for predicting the future impacts of anthropogenic climate and environmental change, and resulting carbon cycle perturbations.

Anna Weldon

Geology and Anthropology Major

Thesis Advisor: Jay Zambito



Rock Boot

Geo Club held its second annual Rock Boot Tournament during Spring Day. As one might expect, faculty were knocked out of the tournament in the early rounds.

Have a great summer and see you in the fall!

Beloit College Geology

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