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Sigma Gamma Epsilon student research poster session, Geological Society of America Annual Meeting 2023, Pittsburgh, Pennsylvania, USA

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News Update

Sigma Gamma Epsilon student research poster session, Geological Society of America Annual Meeting 2023, Pittsburgh, Pennsylvania, USA

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ABSTRACT

The Society of Sigma Gamma Epsilon sponsors an annual poster session at every Annual Meeting of the Geological Society of America. The 35th Sigma Gamma Epsilon undergraduate research poster session took place during the 2023 Geological Society of America Annual Meeting in Pittsburgh, Pennsylvania, USA, on Monday, October 16, 2022. Sixty-three (63) posters were presented in Exhibit Hall B at the David L. Lawrence Convention Center between 8:00 AM and 5:30 PM at the poster session. Titles, authors (italics for the presenting author), affiliations, and abstracts for each poster are listed in this report.

KEYWORDS

Sigma Gamma Epsilon, poster session, student research, Pittsburgh, Pennsylvania, Geological Society of America

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Poster 96-1, Abstract 396248, Booth 38

ASSESSING CHANGES IN THE DAKOTA AQUIFER POTENTIOMETRIC SURFACE IN NORTHWEST IOWA BETWEEN 2008 AND 2023

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In northwest Iowa, demands on the Dakota aquifer have increased due to the declining quality of surface water, lack of other productive aquifers in the area, and increases in pumping for municipal, rural, and private water supply, ethanol production, and confined animal feeding operations. The last study focused on the Dakota aquifer in Iowa was completed in 2008 by the Iowa Geological Survey. The objective of this current study was to collect water levels from existing wells across the Dakota aquifer extent to update the regional scale potentiometric surface for the unit. In Iowa, the Dakota aquifer exists primarily across a 16-county area in the northwest corner of the state. It is composed primarily of sandstone and conglomerate units of the Nishnabotna Member of the Dakota Formation and the sandstone-rich portions of the overlying Woodbury Member. To identify wells suitable for water level measurements across the study area we used the GeoSam database maintained by the Iowa Geologic Survey. There are 1,302 Dakota aquifer wells in Iowa. However, the precise hydrostratigraphic characterization for many of these wells is uncertain because of a lack of well construction data, stratigraphic picks, or both. For example, the stratigraphy defined for many of the Dakota aquifer wells was simply described as 'Cretaceous' which means the well could be open to the Nishnabotna Member, the Woodbury Member, and/or the overlying upper Cretaceous units. Consequently, we focused on a set of 52 wells that were deliberately drilled for a Dakota aquifer study conducted in the early 1980s. Water levels were collected from all measurable wells and used to generate a potentiometric surface representative of 2023 conditions. A

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preliminary comparison to the 2008 potentiometric surface shows spatial variability in the changes in magnitude and inferred regional groundwater flow directions likely related to areas where more or less pumping has occurred. Currently, continuous water level data collected from three USGS Dakota aquifer monitoring wells are being used to assess the rate of change between the 2008 and 2023 potentiometric surfaces. These analyses help to quantify the impacts of increasing use on the Dakota aquifer and will be valuable to help determine new Dakota aquifer drilling and monitoring well locations for future phases of the study.

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POSTER 96-2, ABSTRACT 390238, BOOTH 39
GEOMORPHOLOGICAL AND VEGETATION CHANGES AROUND BEAVER DAM ANALOGUES, RED CANYON CREEK, WY

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Beaver Dam Analogues (BDAs) are an inexpensive, biodegradable form of stream restoration that function similarly to natural beaver dams. BDAs are expected to help redistribute water spatially into the floodplain to return the stream and surrounding floodplain to a more natural state. Geomorphic changes are expected with the implementation of BDAs, including increased sediment retention, aggradation, increased sinuosity, and reduced slope. Coupled with this, vegetation changes are also anticipated. However, evaluations of morphological and vegetation changes associated with BDA restoration sites are limited. Here we show geomorphic changes in the streambed and vegetation changes in the surrounding floodplain around 45 BDAs in Red Canyon Creek, Lander, WY. Our analysis builds on multiple years of observations, as well as recent data acquisition in summer 2023. Vegetation changes are observed in terms of NDVI around the BDAs, with imagery collected via drone in late July of 2017, 2019, and 2022. Geomorphic changes build on observations from 2022 and 2023. This work offers an understanding of what changes may occur when BDAs are implemented as a restoration technique.

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POSTER 96-3, ABSTRACT 391099, BOOTH 40
ARCGIS PRO BASED HYDROGEOLOGICAL VULNERABILITY MAPPING OF GROUNDWATER RESOURCES IN EASTERN KENTUCKY

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Groundwater is vital as a reliable water supply due to its continuous availability, reasonable natural quality, and ease of diversion to underserved communities at a lower cost and with greater speed. To ensure the preservation of this valuable resource, it is crucial to identify and protect areas with high groundwater potential. In this research conducted in the Eastern Kentucky study area, remote sensing data and geographic information system (GIS) techniques were employed to assess groundwater potential. The methodology employed in this study offers a rapid, precise, and practical approach. Key parameters influencing groundwater potential and recharge, such as land use/cover, soil characteristics, lithology, rainfall patterns, drainage density, lineament density, slope, and elevation, were derived from datasets including the Operational Land Imager 9, digital elevation models, soil data, lithological data, and rainfall data. To validate the results, borehole data was utilized. The analysis was conducted using ArcGIS Pro 3.1 software, facilitating the design of various digital thematic maps. The parameters affecting groundwater potential were mapped and analyzed using spatial analysis tools. The relative influence of each parameter was determined by applying the Analytical Hierarchy Process, thereby assigning weights according to their percent of influence on groundwater potential and recharge. The consistency ratio obtained for the weight allocation was 0.033, below the threshold of 0.1, indicating an acceptable weight allocation. Weighted overlay analysis found that slope, land use/cover, and lithology contributed equally, each accounting for 24% of the overall influence

on groundwater potential. This study shows that the soil group exhibited negligible influence, comprising only 2% of the total weight allocation. The resulting groundwater potential map classified areas into five ranks (1, 2, 3, 4, and 5) representing Very Low, Low, Moderate, High, and Very High potential, respectively. This classification was based on the availability of groundwater potential within each rank and class. The outcomes of this scientific study hold great promise for regional planners and policymakers involved in sustainable groundwater development and management.

POSTER 96-4, ABSTRACT 395482, BOOTH 41

GEOSPATIAL ANALYSIS OF ST. LAWRENCE UNIVERSITY CAMPUS ROAD NETWORK TO ASSESS IMPACT ON EMERGENCY RESPONSE TIMES

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Collegiate emergency medical service (EMS) agencies provide valuable services to college and university campuses across the United States through quick response times and peer-to-peer assistance. However, the unique layout and road network of a college campus can provide unique challenges, such as limited vehicle access to inner campus and indirect routes to high volume call areas. Geospatial analysis of the St. Lawrence University campus in Canton, NY was used to gain a better understanding of the impact of these factors on the response time of St. Lawrence University Emergency Medical Services (SLU EMS).

GPS points were acquired at every entrance to buildings on the main campus, using an EOS Arrow 100 mobile GPS unit and the Esri Field Maps app on an iPhone 13. This data collection was performed in a feature layer designed in ArcGIS Online. Other feature layer datasets, used to account for the designated parking locations of the SLU EMS response vehicle, were created within ArcGIS Online. All datasets were migrated into ArcGIS Pro for spatial analysis. Data will be combined with pre-existing roadway feature layers to analyze routes through the campus with the lowest travel times.

The entrances dataset contains 406 collected GPS points. Within the two feature layers for vehicle locations, 62 points were created. High call volume areas of campus were determined by assessment of SLU EMS call records (2,126 calls) in the period between August 2014 and May 2023. The data was entered into Excel and transferred into ArcGIS Pro. Spatial analysis was then performed to determine areas of high volume.

Preliminary results suggest that the fixed gates on the north end of campus may increase response times. Further data processing will provide more insight as to the extent of this effect. Future work may consider additional factors such as travel on foot as well as by vehicle when delineating the most efficient response routes.

POSTER 96-5, ABSTRACT 392036, BOOTH 42

ANALYSIS OF HYPERSPECTRAL VERSUS MULTI-SPECTRAL DATA FROM DRONE-BASED ACID MINE DRAINAGE MONITORING IN PERRY CANYON, NV

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Remotely operated aerial systems (drones) are effective for monitoring temporal change at remediated acid mine drainage sites (Cramer et al. “Mapping Potentially Acid Generating Material on Abandoned Mine Lands Using Remotely Piloted Aerial Systems”. Minerals, 2021, 11, 365). In June of 2021, hyperspectral data of Perry Canyon, NV was acquired in 271 spectral channels in the visible and near-infrared (VNIR) and 270 spectral channels in the short-wave infrared (SWIR). This project seeks to evaluate whether the increased spectral fidelity justifies the increased cost for the hyperspectral analysis of acid mine drainage sites. These hyperspectral images were analyzed using Environment for Visualizing Images (ENVI) software to map different spectral signatures throughout the site. This analysis provides

evidence of three unique spectral signatures that could be associated with potentially acid generating material (PAGM). These spectra are classified as Yellow Soil (jarosite), White and Blue Soil (efflorescent mineral salts), and Red Soil (iron oxides and secondary iron-rich coatings indicative of acid mine drainage). Jarosite is an iron-bearing sulfate used to locate areas of PAGM, and red soils can isolate heavy metals that generate acidic water. Both jarosite and iron-oxide bearing soils have a diagnostic spectral reflectance which makes them useful at locating PAGM. Classification models such as Spectral Angle Mapper (SAM), Maximum Likelihood (ML), and Band Math Ratios (BMR) delineate areas where these spectra are observed. These classification models will be used to corroborate both VNIR and SWIR datasets as well as to compare spectral fidelity. Inclusion of SWIR data will increase knowledge of possible benefits or setbacks when using these data to map PAGMs. SWIR data also provides a greater range of spectral wavelengths that can lead to increased accuracy when determining pixel choice for PAGMs because most have stronger absorption and reflectance features in SWIR. These new surface compositional maps allow the comparison of our results to those of the previous 5-channel data, which were only analyzed using VNIR. It is expected that the increased spectral fidelity will offer more information, and greater detail, of PAGM at this site.

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POSTER 96-6, ABSTRACT 395390, BOOTH 43

ANALYSIS OF HYPERSPECTRAL VERSUS MULTI-SPECTRAL DATA FROM DRONE-BASED ACID MINE DRAINAGE MONITORING IN PERRY CANYON, NV

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The Big Bend region of Texas is located in far west Texas, west of the Pecos River and north of the Rio Grande. The region includes a diverse natural habitat and varied geologic and other natural and cultural attractions. Several state parks and the Big Bend National Park are located in the region, as well as the towns of Marfa, Alpine, Marathon, Fort Davis, Terlingua, Lajitas, and Presidio. The region is located in the Chihuahuan desert and receives ~ 17 inches of annual precipitation. All public water supply in the region comes from aquifers; these aquifer sources include the "igneous" aquifer, the "west Texas bolsons" aquifer, and an unnamed Cretaceous carbonate aquifer. The three counties in the region (Brewster, Jeff Davis, and Presidio) have Groundwater Conservation Districts (GCDs) as enabled by the state Water Code Chapter 36. These districts and the Texas Water Development Board are the primary means of monitoring and regulating groundwater use.

Increased tourism in the Big Bend region in recent years has caused concern regarding the sustainability of the groundwater resources. The population within the region is not expected to increase significantly, but the number of transient water users is clearly increasing and is presumably resulting in increased groundwater consumption. Our research is focused on estimating this increase in water usage. We are gathering various data on vacation rentals by reviewing local hotel tax logs and internet advertising, conducting verbal surveys, and analyzing repeat aerial imagery to identify structures constructed for rental purposes only. The results of this data-gathering effort, combined with estimates of per-user consumption, will allow us to provide local water managers, such as the GCDs, with valuable information regarding this otherwise undocumented increase in groundwater use.

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POSTER 96-7, ABSTRACT 391114, BOOTH 44

REFINING THE POLLUTION HISTORY OF THE FORMER MUNROE FALLS DAM IMPOUNDMENT, CUYAHOGA RIVER, OHIO

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The Munroe Falls Dam was first built on the Cuyahoga River, Ohio in 1817. The dam created a low-velocity impoundment that trapped the river's sediment load and led to poor water quality. In 2005 the dam was removed in order to improve water quality and ecosystem health. Prior to the dam's removal the impoundment sediment was cored and measured by Atomic Absorption Spectrophotometer (AAS) to characterize heavy metal concentration. This present study remeasured the cores by X-ray Fluorescence (XRF) to characterize more elements than had been measured by AAS

in order to provide additional details of the pollution history. The prior study had identified a buried oily layer, having elevated Cu, Pb, Cr, and Zn concentrations and ^{210}Pb-dated to the time of the Great Flood of 1913. This contaminated layer was likely sourced from the inundated Erie Shops railroad repair facility located upstream in Kent, Ohio. The new XRF results show elevated Cd, Fe, and S in the oily layer. The elevated Cd and Cr are likely due to their use in electroplating train components. The elevated Fe concentration is likely due to increased metal particles washed in from the Erie Shops site. The elevated S concentration is likely due to the oil in the flood layer and thus the sulfur profiles provide an additional means of identifying the oily flood layer throughout the dam impoundment. Because the XRF method is more rapid and inexpensive than the AAS method, a greater number of samples were measured, thus allowing the spatial extent of the 1913 flood layer to be better characterized.

POSTER 96-8, ABSTRACT 391132, BOOTH 45

PALEOFIRE AND PALEOENVIRONMENTAL DYNAMICS REVEALED IN JACKSON LAKE SEDIMENTS (GRAND TETON NATIONAL PARK, WYOMING, USA)

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Jackson Lake, located in the Grand Teton National Park (Wyoming), is characterized by an alpine climate that is influenced by the Teton range, which receives heavy winter precipitation annually. The lake is surrounded by coniferous forest and shrublands, and seasonal wildfires are common. Despite its unique geological setting, which includes earthquakes, hydrothermal activity, and a history of extensive late Quaternary glaciation, much remains unknown about environmental changes in Grand Teton National Park, including the paleofire history. This study analyzes a 13.83 m sediment core from Jackson Lake in order to reconstruct the fire history using fossil charcoal, as well as signals of limnological change using bulk organic geochemistry. The core, dated using radiocarbon, covers the Early Holocene (~10.4 cal ka BP) to the present, with an average sedimentation rate of 0.14 cm/yr. Samples of known volume were collected every 5 cm along the length of the core, yielding ~300 samples for analysis. Given the age-depth model, this sampling provides decadal temporal resolution for the charcoal and geochemical proxies. The samples were pretreated using standard techniques and washed through a 106 µm sieve to separate charcoal fragments. The residues were examined under a stereomicroscope in gridded petri dishes, counted, and statistically enumerated. Charcoal morphological characteristics, such as size and shape, were also documented. These parameters provide insights on the intensity and scale of paleofire events, and the identification of the plant types involved (e.g., grasses versus trees). In addition, samples underwent geochemical analyses, focusing on TOC, TN, δ^{13}C, and δ^{15}N. Preliminary results indicate TOC variability over time, with lower concentrations near the bottom of the core (~2 wt. %), and higher concentrations at the top (3.6 wt. %). Research is ongoing, and the outcomes of this study seek to significantly contribute to our understanding of the history of fire dynamics in Grand Teton National Park. This knowledge will have implications for broader ecological studies and management strategies related to fire in this alpine environment.

POSTER 96-9, ABSTRACT 393489, BOOTH 46

HUMAN IMPACTS OF LARGE CHANNEL MOVEMENT IN EFFINGHAM COUNTY, EAST-CENTRAL ILLINOIS, USA – A PRELIMINARY STUDY

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The Little Wabash River, a tributary to the Wabash River, originates in Coles County and is around 240-mile (390 kilometers) long. The meanders of the Little Wabash River found in Effingham County have been researched for everything from acreage changes to agricultural usage of the surrounding land (e.g., Rhoads et. al, 2009), but there was little investigation into how much of the land was impacted in human terms. This includes changes to tax parcel sizes/levies as well as usage of the land – agricultural, forested or similar. Using USGS and USDA maps as well as parcel documentation from the Effingham County Supervisor of Assessments, this project extends the previous work on identifying meanders by investigating the human impacts resulting from a large channel migration in Effingham, Illinois.

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POSTER 96-10, ABSTRACT 395892, BOOTH 47

"LEGACY ISLANDS"- UNINTENTIONAL ANTHROPOGENIC ARTIFACTS FORMING IN THE SUSQUEHANNA RIVER (NORTH BRANCH)

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"Legacy Islands" formed in the Susquehanna River from both glacial and legacy sediments deposited upstream from manmade fish weirs. These islands are distinct from other alluvial islands due to their low elevation, V-shaped structure, sparse vegetation, and length to width ratio. The name "Legacy Islands" is proposed here to describe these landforms due to their anthropogenic origin.

Aerial imagery (1939-present) was used to locate buried fish weirs where islands formed. This study examined an unnamed island near Beach Haven, PA in the North Branch of the Susquehanna River. It was surveyed, and sediment cores were drilled to determine the stratigraphy. Samples were analyzed for grain size, mineralogy, and chemistry. Sand to sandy loam was deposited on top of medium to coarse-grained gravel; the gravel represents high-energy flood events. This sediment was periodically rooted between floods. The finest sediment (clay and silt) was composed of vermiculite, chlorite, muscovite, and quartz. Sand size sediments potentially associated with glaciation consisted of quartz, quartz with magnetite inclusions, andradite, pyrope, chromite, ferroan enstatite, spinel, zircon, and magnetite. Sand size sediments from coal production included anthracite coal, magnetic glass, metallic industrial waste, shale fragments, ferric oxyhydroxide, hematite, and coke. The distribution of fine grain sizes corresponded to trends observed in some of the major oxides (Fe_2O_3, K_2O, Na_2O, MgO, and TiO_2). Increases in these major oxides may be due to high water levels or hydromorphic processes. This is represented by mottled and iron-rich layers in the cores.

Historical aerial images help resolve how these islands form: 1. gravel bars may form upstream from fish weirs, 2. vegetation colonizes gravel and may trap sediment, allowing the island to stabilize, and 3. significant floods may reset the process. There may be more "Legacy Islands" in the Susquehanna, and they may not be restricted to this river. Despite being an unintentional manmade feature comprised of mining waste, these islands provide a valuable habit for many types of organisms. These habits may be threatened by future global climate change due to stronger flood and weather events.

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POSTER 96-11, ABSTRACT 395301, BOOTH 48

COMPARING RIVERBED SEDIMENT CHANGES IN RESPONSE TO THE PALEOCENE-EOCENE THERMAL MAXIMUM EVENT, PYRENEES MOUNTAINS, SPAIN

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The Paleocene-Eocene Thermal Maximum (PETM) event occurred 56MA, when the average global temperature increased between 5-9 degrees Celsius. With the increase in global temperature today (July 2023 broke temperature records around the globe), we can look at the PETM to determine what could happen if global temperatures continue to increase, including how landscapes may respond to rising temperatures and changing precipitation patterns. The Paleocene Esplugafreda and Eocene Claret formations

exposed in the Pyrenees Mountains, Spain, provide an opportunity to evaluate how ancient rivers responded to the PETM climate change. Using field photos of ancient riverbed deposits from before, during, and after the PETM, I measured attributes of sediment from three study areas and determined paleo-river flow conditions before, during, and after the PETM. In each study area I traced sediment grains on >50 photographs to determine sizes, roundness, aspect ratio, solidity, and circularity of sediment before, during, and after the PETM and used this information to interpret paleoflow conditions throughout the study area. The preliminary results show that there was a significant amount of scatter and overlap for bed-sediment attributes in space and time. An increase in sorting and aspect ratio (more elongated) of grains in the Claret Formation might suggest more sustained floods, but similarity in the 90th percentile of grain size suggests the floods could have had similar peak discharges. These results suggest that changes in interannual discharge variability may play an important role in river activity during global warming events.

POSTER 96-12, ABSTRACT 394991, BOOTH 49

USE OF DRONES (UAVS) TO CHARACTERIZE LARGE WOODY DEBRIS ON THE WHITEWATER RIVER, INDIANA

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Large woody debris (LWD) is critical to the health and function of stream systems and integral to stream restoration design. LWD, consisting of wood >10 cm in diameter and >1 m in length, influences habitat structure, flow patterns, sediment deposition, and pool formation. Although much work has been done on the role of LWD in streams in the western U.S., few studies have been conducted in the Midwest and the Ohio River Valley, in part due to the limited supply of LWD. The Whitewater River in southeastern Indiana and southwestern Ohio, however, has a wide riparian corridor and few dams or bank stabilization measures, allowing for the recruitment and transport of LWD. Collecting data on these logjams has, in the past, been quite labor intensive. It is typically difficult to get to large log jams on the river, often entailing multi-day trips to collect quantitative data on the wood (e.g. size, species, measure of decay, etc.) and stream morphology. The use of unmanned aerial vehicles (UAVs), or drones, to survey LWD could greatly reduce the amount of time it takes to complete these surveys. This study aimed to test the viability of using Phantom 4 drones and Pix4D software to generate high-resolution 3-dimensional images (i.e. point clouds) of large log jams to quantify the lateral dimensions of the jam itself and key members (large logs that are structural to the jam). Log jams were initially surveyed and inventoried via canoe float on the Whitewater River from May 30, 2021 to June 01, 2021. Log jams were categorized based on their position (meander, bar apex and bar top jams) and the number of key members contained. We returned to the site of a few of the large log jams in August of 2022 and 2023 to assess the capability of using the Phantom 4 drones to more easily characterize LWD. As efforts increase to improve water quality in the Ohio River Valley, it will be important to integrate LWD in stream restoration design.

POSTER 96-13, ABSTRACT 394002, BOOTH 50

ESTABLISHING A BASELINE OF STREAM CHARACTERISTICS IN INDIANA COUNTY, PA: LEVERAGING COMMUNITY CONNECTIONS

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Indiana county is located in Western Pennsylvania and is part of the Allegheny Plateau. Almost all of the waterways are headwater streams of the Allegheny River where water quality has been significantly impacted by resource extraction for decades. The Evergreen Conservancy nonprofit organization (based in Indiana, PA) has been focused on the water quality in Indiana County since the founding in 2003, which led to the installation and maintenance of stream data loggers starting in 2011. These locations have been monitored for a variety of stream characteristics that consists of water temperature (celcius), water level (meters), conductivity (microsiemens, converted to TDS in mg/L). Over the past 12 years they have monitored critical water characteristics in 40+ locations in Indiana County with in-stream data loggers to address and look for evidence of pollution and specific

water quality degradation events. This data set has been underutilized and we have started working on leveraging it as well as working with the network of knowledgeable volunteers of the Evergreen Conservancy to guide us in future steps of our research that works to improve the overall health of the streams that reside in Indiana County. As of now, our first step in analyzing and monitoring this data is to assess the quality and quantity of the data and to develop automation of this with python coding. We have started from square one to learn python coding to automate data processing and utilization and have created graphs and other visuals to start our process of correlations and pattern recognition in our data for future research. Preliminary findings show typical seasonal temperature changes for cold water streams (average summer temperatures of <19C) at all seven stream locations we have analyzed so far. We also see little to no change throughout the year in overall average water volume, as would be expected in this region (steady rainfall year round). As well, we find that some of the streams show increased TDS values in the winter months, which seem to indicate possible road salt impacts. Additionally, we see that the daytime temperature ranges are greatest during the month of April. Further studies will expand these analyses to all 40 locations throughout Indiana County to develop a baseline understanding of these headwater streams.

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POSTER 96-14, ABSTRACT 394831, BOOTH 51

HYDROLOGIC RESPONSE OF THE GALLINAS RIVER TO THE 2023 SPRING SNOWMELT POST-2022 HERMITS PEAK/CALF CANYON FIRE

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Forest fires are well known to impact the quality of water in a watershed from hillside erosion and fire sedimentation as well as the quantity of water entering the system from decreased soil infiltration, lessened vegetation interception, and increased catchment evapotranspiration. The Gallinas Watershed in northern New Mexico was impacted by the 2022 Hermits Peak/Calf Canyon (HP/CC) Fire, the largest wildfire in New Mexico's history (>340,000 acres). Approximately 115,542 acres burned in the Headwaters Gallinas River Watershed, 21% of which were classified by the USFS Burned Area Emergency Response team as high burn severity. While much research focuses on the increased flooding from monsoonal rains after a forest fire, little data exists about the hydrologic impacts from spring snowmelt runoff. This study tested the hypothesis that post-fire conditions would lead to earlier snow disappearance in the burned watersheds and flashy runoff on the spring hydrograph. We monitored in near real-time the snow water equivalent (SWE), air temperature, and soil moisture in the Gallinas Watershed headwaters (Wesner Springs SNOTEL site) and compared them to amounts and trends in discharge within Gallinas Creek near Montezuma, NM (USGS gaging station 08380500). We looked at historical data as well, with emphasis on the period during the spring snowmelt (March through May) to assess what if any impact the 2022 HP/CC fire had on hydrologic conditions. Historically, the Gallinas Creek hydrograph shows a shallow slope during the winter low-flow period, increases stepwise in response to spring warming, then decreases broadly and diffusely during late spring to early summer with intermittent peaks related to rain events. The 2023 Gallinas River hydrograph pattern is consistent with its historical trend suggesting that post-fire, the watershed has maintained resiliency to snowpack retention and water storage. Continued monitoring in near real-time is imperative to forecast flood stages, manage fire sedimentation, and protect water supplies.

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POSTER 96-15, ABSTRACT 390693, BOOTH 52

THE EVOLUTION OF FAULT DAMAGE ZONES WITHIN THE SEVIER NORMAL FAULT SYSTEM, UTAH

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Understanding the development and geometry of fault damage zones is important because these fracture networks control subsurface fluid flow and add to our knowledge of fault dynamics and landscape evolution. We examine the dimensions of and fracture intensity within damage zones in the Jurassic Navajo Sandstone associated with the Orderville Salient of the Sevier normal fault system in southern Utah.

The Orderville Salient is a zone of complex fault linkage where well-exposed damage zones formed in a variety of structural settings. We surveyed damage zone fracture networks in the hanging wall and footwall of isolated fault segments as well as in fault blocks between segments. We gathered data via ground-based scanline surveys as well as using Structure from Motion (SfM) software to generate 3D models of the ground surface from imagery captured by unmanned aerial vehicle (UAV) flights. We used both scanline and 3D model data to analyze fracture orientation, spacing and intensity. Our data show that there is asymmetry in the dominant fracture orientation across the fault – with the dominant fracture set striking ESE in the hanging wall and SSW in the footwall – as well as asymmetry in damage zone width, with the hanging wall damage zone being ~2.5 times wider than in the footwall. We also find that the footwall damage zone can be divided into an inner zone (~5m wide) and outer zone (~40m wide) based on fracture intensity and resulting topographical development, which is consistent with previous research on fault systems in similar lithologies. In our comparisons of footwall damage zone widths within the Navajo Sandstone, we found widths ranging from ~34m to 44m, meaning that the width does not vary significantly based on fault displacement. This work has implications for fields including groundwater, geothermal energy, and oil and gas production, because the intensity and orientation of fractures in a fault system control the movement of subsurface fluids. Our work can also be applied to understanding the impacts of fault dynamics on landscape evolution.

POSTER 96-16, ABSTRACT 395374, BOOTH 53

QUARTZ C-AXIS DEFORMATION THERMOMETRY CONSTRAINS RETROGRADE DEFORMATION WITHIN THE CHUNKY GAL MOUNTAIN FAULT, WESTERN NORTH CAROLINA

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Quartz C-axis opening angle thermometry is used to determine the temperature of deformation in metamorphic rocks, using an empirically derived linear relationship between C-axis slip orientation and deformation temperature. Calibration equations were derived from both experimental and natural data. A recently developed calibration extends the relationship to higher deformation temperatures and documents a shift in slope with a change in mechanism from subgrain rotation (SGR) to grain boundary migration (GBM) at temperatures near 650°C.

This study estimates deformation temperatures from quartz-rich domains in mylonitic samples from The Chunky Gal Mountain Fault, Central Blue Ridge Province, western North Carolina. The fault zone preserves a range of deformation temperatures. Peak metamorphism within the shear zone is estimated at ~800°C with evidence of ductile deformation of K-feldspar porphyroclasts. Muscovite fish swim in the mylonitic matrix and quartz microstructures include both SGR and GBM textures. All study samples (n=5) were collected from the same shear zone. Samples from other shear zones did not preserve a girdle pattern that could be used with this method. C-axis orientation data, collected using Electron Backscatter Diffraction (EBSD) data is plotted on stereonets, referenced to sample foliation and lineation. For samples with a c-axis girdle pattern, opening angles were measured from the net center between girdle limbs in each direction. We employed 3 different opening angle calibration equations.

Opening angles from shear zone samples range from 51° to 71°. Temperature estimates from these angles range from 400 °C to 580 °C and are similar for the 3 different calibrations. Deformation temperature estimates from the opening angle fall within the SGR-related calibration and are distinctly lower than peak metamorphic conditions. Our results may indicate that quartz fabrics document the late stages of shear zone movement.

POSTER 96-17, ABSTRACT 394013, BOOTH 54

ANISOTROPIC MAGNETIC SUSCEPTIBILITY (AMS) FABRIC AS A PALEOGEODETIC MEASURE OF TECTONIC DEFORMATION IN QUATERNARY DEPOSITS: AN EXAMPLE FROM THE ITALIAN APENNINES

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The anisotropy of magnetic susceptibility (AMS) is a proven measure of tectonic strain for rocks that have reached temperatures > 50°C. We pursue the hypothesis that AMS tectonic fabrics can also be encoded in rocks or sediment that have experienced shallow burial (< 250 m) over Quaternary time scales in a neotectonic stress field. We use the well-known shortening to extension Quaternary strain history in the Italian Apennines as a natural experiment to explore AMS fabrics in surficial deposits as a paleogeodetic measure of strain histories. We sampled Quaternary deposits from ten sites in central Italy representing intermontane alluvial and lacustrine facies from active extensional, former wedge-top, and active wedge-top basins. At each site we sampled nine oriented specimens and recorded their AMS fabrics using fifteen position measurements on a Kappabridge KLY-3s. The total strain in all samples is low, typically 1-3%, the sample fabric is mostly oblate, and K1 axis plunges are shallow, typically <10°. No AMS fabric is recorded in samples buried less than 10 m. A compaction fabric emerges in most of the samples buried more than 10 m, but only a subset of these samples has a K1 direction consistent with a tectonic fabric. Samples buried deeply in the Gubbio and Colfiorito extensional basins have a NE-SW oriented K1 direction consistent with the dominant stretching direction. In contrast, surficial samples in the former wedge top basins typically have no tectonic fabric, but at least one sample has a weak compressional fabric consistent with previously published results. The ability of a specimen to acquire a tectonic fabric is linked to its magnetic mineralogy with magnetite particles displaying a range of maximum susceptibility orientations that contrast with more platy paramagnetic clays that typically are oriented near to the bedding plane yielding better defined compaction fabrics. Experiments are ongoing to determine the dominance of ferromagnetic and paramagnetic carriers. Despite the considerable noise of the nine specimens that constitute a sample, non-random K1 directions are always either consistent with extension or shortening, leading us to conclude that neotectonic fabrics can be encoded in these young deposits, with obvious implications for geodetic interpretations of accordant seismic hazards.

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POSTER 96-18, ABSTRACT 390755, BOOTH 55

THE ORIGIN OF CIRCUMFERENTIAL FAULTING ON THE FLANK OF ALBA MONS, NORTHERN THARSIS REGION, MARS

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The characteristics of circumferential faulting give us insight into how shield volcanoes, regional tectonics, and topographic relief interact to affect fault formation. Because Mars' erosion and sediment deposition rates are significantly lower than Earth's, fault morphologies are better preserved than on Earth. The Alba Fossae fault zone, on the western flank of the >500 km diameter shield volcano Alba Mons, is a circumferential system dominated by horst-graben structures. The fault network developed in the Middle to Late Amazonian, which post-dates Early to Middle Amazonian volcanic activity. With high-resolution image data from the CTX camera of the Mars Reconnaissance Orbiter (MRO) and a digital elevation model (DEM) from the Mars Orbiter Laser Altimeter (MOLA), we examine the geometric characteristics of the fault zone to assess its evolution and likely origin. We observed fault segmentation with both soft and hard segment linkage and en echelon geometries. Well-defined relay ramps are commonly intact but also display top- and/or base-breached forms. We subdivide the Alba Fossae fault system into northern, central, and southern zones for ease in description and analysis. The NE-trending northern region displays a ~100 km wide fault zone with 21 major faults (~4.9 km spacing) with a max. throw of ~500 m. The N-trending central region displays 13 major faults across a width of ~85 km (~6.5 km spacing) and a max. throw of ~300 m. The NW-trending southern region displays 11 major faults across a 63 km width (~6.2 km spacing) and a max. fault throw of ~300 m. The horst-graben structure of the Alba Fossae system accommodates extension on the flanks of the volcano, where crustal thickness decreases with distance from the volcanic peak. The fault system is also located along a topographic break between what appears to be a secondary, shield-like topographic high on the western margin of Alba Mons. Our

data and analysis, when integrated with previous studies, suggest that this circumferential fault system may have magmatic origins with fault orientations controlled by the local and regional stress field on the flank of Alba Mons. We suggest that the horst-graben fault network may represent strain that helps accommodate some combination of shallow subsurface dike injection and topographic relaxation of the Alba Mons dome.

POSTER 96-19, ABSTRACT 394773, BOOTH 56

MULTIFACETED STUDY OF THE RED ROCK FAULT, SOUTHWEST MONTANA - RUPTURE AGE, SEISMIC HAZARD, AND RISK ASSESSMENT

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The Red Rock Fault (RRF) in Beaverhead County, MT, is one of a system of NW-trending, range-bounding normal faults that relates to the Basin and Range-style extension as well as Yellowstone-Snake River Plane hydrothermal-magmatic extension. The RRF comprises northern (2.17 km), middle (2.00 km), and southern (4.37 km) segments which collectively separate the Tendoy Range fault-block from the Red Rock Valley graben. As part of the 2023 University of Houston summer field course, we conducted a multipronged study of the RRF at Chute Canyon to estimate its age of rupture, assess its seismic hazard and assess the shake risk to southwestern Montana. Our methods included 1) a literature review to understand context, basic geology, fault physics, and paleoseismology; 2) UAV imagery analysis and field mapping, focused on bedrock exposures, fault scarps, triangular facets, colluvial wedges, steep- and gentle-gradient alluvial fans, and stream terraces; 3) field characterization of soils in offset hanging wall fans and terraces; 4) dGPS fault scarp profiling and diffusion analysis; 5) cGPS velocity determinations from 6 GPS stations (Nevada Geodetic Laboratory GPS Network) spanning the fault; and 6) ShakeMap (USGS) to generate earthquake scenarios. The sharply-developed facets, fresh scarplets, and recent seismicity (M4.7 07/14/23) demonstrate that the fault is presently active. Soils correlated well across the fault with relatively older surfaces (T2) showing greater soil development than younger surfaces (T1). The dGPS and cGPS analyses indicate age of major rupture at 10.9-12.1 ka and slip rate average of 1.0 mm/y. Earthquake moment magnitude estimates range from M5.43 (segmented) to M6.18 (combined) and ShakeMap earthquake scenario predicts shaking intensities of VIII-III posing ground shaking, landslide and liquefaction hazards to the regional infrastructure (highways, railroads, reservoirs, and gas lines). This study provided hands-on instruction to a real-life situation that is geologically significant and societally relevant.

POSTER 96-20, ABSTRACT 394450, BOOTH 57

TRIGGERED SHALLOW FAULT SLIP BY THE 2017 MW 7.3 IRAN-IRAQ EARTHQUAKE

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Earthquakes can cause significant hazards particularly along active plate margins. Following a main shock, aftershocks with much smaller magnitudes generally occur within the same fault system. Sometimes an earthquake can also trigger other fault systems at distance to slip seismically or aseismically. This process is commonly explained by a change of dynamic or static Coulomb stress on the receiver faults from the main shock that decreases fault stability and promotes fault slip. In this study, we use interferometric synthetic aperture radar (InSAR) to map shallow fault slip that were likely triggered by the 2017 Mw 7.3 Iran-Iraq earthquake. Through mapping, we found 230 shallow triggered fault slips. There are two dominant fault orientations, the first (135 faults) oriented at 310 ° with a mean length of 4 km. A second orientation (48 faults) was found oriented at roughly 060 °

with a mean length of ~2 km. The expression of this second orientation is located due south from the epicenter ranging from 57.5-95.5 km in distance from the epicenter. Both static and dynamic Coulomb stress changes for this event were calculated using a coseismic slip distribution provided by the USGS NEIC finite fault solutions. The static Coulomb stress change model suggests that the receiver faults in this area were strengthened against slip, which is unlikely the cause of the triggered shallow slip. To estimate the dynamic Coulomb stress change, we first calculate ground motion during the main shock within 150 km radius from the epicenter using the same finite fault model with a 1D layered Earth structure same as in the USGS finite fault solution. We then calculate peak dynamic Coulomb stress using the same receiver fault geometry as for the static stress change case. The results show that in the region south of the earthquake, despite static Coulomb stress change strengthening the receiver faults, dynamic stress change in this area was estimated to be up to 1 MPa due to a southward directivity of the fault slip process during the main shock. The spatial extent and the amount of stress change could be the cause of these shallow triggered slip. This work demonstrates the importance of taking both static and dynamic stress change into account for earthquake events with unilateral slip history can better evaluate triggered slip in neighboring fault systems.

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POSTER 96-21, ABSTRACT 390759, BOOTH 58
THE ROLE OF FAULT DAMAGE ZONE DEVELOPMENT IN STRUCTURALLY CONTROLLED LANDSCAPE EVOLUTION, SEVIER FAULT ZONE, SOUTHERN UTAH

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The relationships between fault systems, weathering, and erosion strongly affect how local landscapes evolve. Fault damage zones, characterized by intense fracturing in the surrounding lithology, form as faults propagate. The Sevier normal fault, located in southern Utah, consists of several linked fault segments. We focused on the Spencer Bench segment, which displaces the Jurassic Navajo Sandstone. Because the Navajo Sandstone is located on both sides of the fault, we hold lithology constant to evaluate differences in damage zone distribution and resulting impacts on erosional processes. In addition, the headward erosion process permits us to use down-drainage cross-drainage profiles as temporal snapshots of valley hillslope evolution in order to evaluate how damage zone fracturing affects valley evolution.

We collected structural data including fracture orientation and spacing, and we used an Unmanned Aerial Vehicle to capture imagery of inaccessible outcrops. We used this imagery to construct virtual outcrop models from which we collected additional structural data. We documented fracture characteristics in the footwall and hanging wall and compared fracture intensity to topography. Cross-sectional topographic profiles constructed perpendicular to the Spencer Bench fault revealed correlations between structural data and slope. Near the uppermost reach of the fault-parallel canyon to the north, representing youthful valley erosion, the topographic profiles are relatively symmetric, with the slope of the hanging wall and footwall being similar (~37° and ~40°, respectively), and at the southern end of the canyon, which in our model represents a more mature landscape, the slopes of the hanging and footwall are ~23° and ~57°, respectively. As expected, this asymmetry is reflected in fracture intensity data, where fracture spacing is only ~1.4 m in the hanging wall relative to ~9.1 m in the footwall. Thus, we hypothesize that the evolution fault-controlled landscapes are strongly impacted by damage zone development, where fracturing associated with fault propagation and slip accumulation leads to the development of the fault-parallel valley, and the asymmetry in damage zone development will lead to an asymmetry in slope, with shallower slopes associated with higher fracture intensity.

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POSTER 96-22, ABSTRACT 391383, BOOTH 59
TRACE ELEMENT CHEMISTRY OF SALT SOURCES AND THEIR RELATION TO ANCIENT MAYAN SETTLEMENTS IN SOUTHERN MEXICO AND GUATEMALA

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The use of salt and the access to salt sources has been an extremely important aspect of understanding the health, the mobility, and connectivity of Maya populations of Southern Mexico and northern Central America. Due to the high altitude and inland locations of many settlements and the relative scarcity of meat in the traditional diet, salt was a necessary but difficult to acquire nutritional supplement. In several regions, salt springs can be found flowing from uplifted sedimentary rocks in the region containing salts representing past ocean chemistry result in differing trace element chemistry than modern created salt in the environments near the ocean. Using differences in trace element chemistry, assessing regional geography, and anomalies in bone chemistry from previous work by Friewald, et al., we seek to provide a clearer relationship and understanding of where salt was accessed for diets and the relationships between various Mayan settlements. Samples were collected from several salt water springs in the region and solid salt samples were collected from geologic deposits and modern Mayan villages where salt processing from the springs is still being done. Using Inductively Couple Plasma-Optical Emission Spectroscopy, we analyzed these samples for trace element chemistry of metals and metalloids and made comparative analysis between the brine and solid solutions to shed light on plausible relationships between the two.

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POSTER 96-23, ABSTRACT 391394, BOOTH 60

CARBON STOCKS AND EROSIONAL PROCESSES ON SELECT ISLANDS OF THE TIMUCUAN ECOLOGICAL PRESERVE IN NORTHERN FLORIDA

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The Florida Department of Natural Resources designates "critical shoreline erosion" based partially on whether areas adjacent to the Atlantic Ocean or if areas have a value for recreation or development. Due to sea level rise and erosional forces, however, many inlets and estuaries in Florida are also being eroded and eaten away, altering carbon cycling, sedimentation rates, and the release of greenhouse gases into both the ocean and atmosphere. We are investigating Big and Little Talbot Island located in Duval County on the Atlantic Coast of Florida where we conduct research oriented around erosion, carbon stores, and carbon loss. These two islands are of special significance because due to a combination of development and sea level rise are eroding rapidly. High rates of erosion are occurring along the edges of Big Talbot Island (located in the Nassau Sound) and despite the rapid erosion rates and high concentrations of peat in the soils, they are not included as critical erosion shorelines. The soils here are typical spodosols with thick O horizons, often more than 7 cm thick. Vegetation transitions from old live oak hammock forests, to short palmetto dominated, to coastal dune pines and cedars as the elevation descends toward sea level. Our data collection so far indicates that even small islands such as this contain nearly 150,000 tons of below ground carbon and above ground carbon totaling near 100,000 tons. Shoreline erosion rates will be presented based on historical shore line locations.

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POSTER 96-24, ABSTRACT 391471, BOOTH 61

USING SOIL AND FOREST TYPE TO MAP BEDROCK AT NEMO, SOUTH DAKOTA

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Bedrock mapping can be used to locate economic deposits, assess natural disaster (e.g., landslide) risk, and decipher the geologic history of a region. Methods such as direct sampling, aeromagnetic surveys, changes in topographic relief and soil cover can be used to map bedrock. This study examines a site at Nemo, SD to assess whether two contrasting types of bedrock produce different soil that result in different types of forest cover. Although bedrock varied, other soil forming factors, including climate, slope, elevation, and the time for soil

development, were uniform. Within an approximately 1 km^2 area, quartzite and metagabbro bedrock, and ponderosa pine and quaking aspen forests were mapped. Samples of surface soil, soil profiles, and bedrock were collected. Elemental composition was measured by X-ray fluorescence. Soil organic content was measured by loss-on-ignition and soil nutrient content measured at a commercial soil testing lab. Both the quartzite and its overlying soil have less Mg and Fe, and greater Si content than the metagabbro and its overlying soil. The soil above the quartzite bedrock is thinner, sandier, has a lower cation exchange capacity, and lower phosphorus content than soil overlying the metagabbro bedrock. The forest above the quartzite is dominated by ponderosa pine (*Pinus ponderosa*). In contrast, the soil above the metagabbro bedrock is thicker, contains more clay, has a higher cation exchange capacity and more phosphorus than soil overlying the quartzite. The forest above the metagabbro is dominated by quaking aspen (*Populus tremuloides*) and contains an iris (*Iris germanica*). A soil with a higher cation exchange capacity holds more nutrients and water than a soil with a low cation exchange capacity. Phosphorus is an important nutrient needed for growth and development of plants. The increased cation exchange capacity and phosphorus content of the metagabbro-derived soil may account for the corresponding quaking aspen forest as quaking aspen require more water and nutrients to thrive than ponderosa pine. Ponderosa pine is more tolerant of nutrient deficient conditions such as the quartzite-derived soil. These preliminary data indicate that at this location soil properties and forest cover can aid in bedrock mapping.

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POSTER 96-25, ABSTRACT 394003, BOOTH 62

AUSTIN A. SARTIN OUTSTANDING POSTER AWARD WINNER

GEOLOGICAL INVESTIGATIONS OF BEDROCK AND SURFICIAL GEOLOGY IN THE SOUTHERN HALF OF THE RAWLEY SPRINGS QUADRANGLE, VIRGINIA

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This field mapping project studied the southern half of the 7.5' Rawley Springs Quadrangle in western Virginia in order to improve understanding of the North Mountain thrust fault system and structural and fluvial features in the area. The project identified lithologic contacts, structural fabrics, and surficial features in a region where existing geologic maps are at the 1:100,000 scale (Rader and Wilkes, 2000). The project also filled gaps in knowledge of the region where data was either lacking or needed to be reanalyzed and updated. Field data from this project was used to create new bedrock and surficial geologic maps at the 1:24,000 scale, which compliments ongoing mapping in the adjacent Singers Glen and Briery Branch Quadrangles (D. Doctor, M. Heller, R. Orndorff, personal communications). This project provided a capstone experience for senior undergraduate geology students. Early career undergraduate students also participated in the project as field assistants and gained hands-on experiences with fieldwork and geologic map preparation.

Field observations documented four formations in the region: the Hampshire, Price, Greenland Gap and Brallier Fms. Field data was collected using the StraboSpot app. Preliminary strike and dip data were used to infer lithologic contacts, which were subsequently evaluated in the field. Field data indicates shallowly southeast dipping sedimentary rocks throughout the majority of the quadrangle. However, in the southeast portion of the quadrangle, the bedrock is oriented subvertically and synclinally folded and complexly faulted in the footwall of the North Mountain thrust fault system. Surficial mapping used aerial LiDAR data to identify potential landforms with field checking to verify the presence of landforms and associated deposits. The surficial data shows dendritic drainage in the western part of the mapping area that exhibits subhorizontal bedding, which shifts to a trellis drainage pattern across the vertical beds in the southeast. Using field data collected with StraboSpot and aerial imagery, final maps were prepared using ArcGIS. Ongoing mapping continues to refine our geologic understanding of the Mid Atlantic Valley and Ridge region.

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Poster 96-26, Abstract 392095, Booth 63

FINDING SUSTAINABLE SOLUTIONS TO SHORELINE EROSION USING DETAILED SLOPE MEASUREMENT WITH A LASER TOOL

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Shoreline erosion is a very serious problem for anyone who lives next to an ocean or the great lakes. This problem has only gotten worse due to climate change causing rising water levels and increasing intense weather causing more erosion. Creating 3-dimensional maps of unstable slopes using devices like Leica's DISTO E7500I, helps us better understand the overall slope dynamics as well as what factors may be causing it to fail.

The focus of my research is to find a more environmentally conscious solution to shoreline erosion that does not negatively affect the existing ecosystems and provides long-term benefits for the people it affects. My current field area is along the shorelines of Lake Superior and Lake Michigan. I am using a Leica DISTO E7500I device to create maps of areas of erosion to better understand their structure. I have found this device incredibly useful as it is able to measure the length of a particular section as well as the angle between two points. Using this device also allows me to safely measure the slope at the bottom as opposed to having to climb a very uneven and unstable terrain. Using this device is also much cheaper and easier than using a drone to take aerial measurements.

Our approach might be able to provide detailed data for implementing remediation measures other than short-term "Hard stabilization" methods such as breakwaters and groins. Those measures often end up making the issue worse in the long run.

Our initial idea is that native plants can be used to help hold the soil in place as well as terracing the slope in order to reduce the undercutting that happens on slopes. We plan to test our hypothesis in small and large scale settings to see if these solutions might be beneficial for homeowners. Erosion will always be a problem and we are not attempting to completely solve the problem, just make it more manageable for homeowners to handle.

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Poster 96-27, Abstract 395320, Booth 64

ASSESSING THE STABILITY OF STATEN ISLAND'S EASTERN SHORE: A SEDIMENT ANALYSIS

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For years, the eastern beaches on Staten Island, New York have been undergoing coastal engineering and replenishment, especially after the devastation and inundation caused by Hurricane Sandy. Understanding the processes operating on these beaches is essential to assessing future risks and planning coastal defenses. In this study, sediment samples were collected at low tide from transects on the eastern beaches of Staten Island over the course of a year. Each transect included samples from 1m water depth (offshore), the low tide mark, and the beach face. These samples were analyzed for grain size distribution to confirm that the beaches have the characteristics of a reflective beach. The results show that there are minimal changes to grain size distribution over time. Offshore samples are the most variable, with mean grain size from fine sand to very coarse sand. The low tide mark is characterized by a ridge of sediment that is mostly sandy gravel and gravelly sand. Beach face sediments are generally medium to coarse sands, while medium sands are found higher on the beach profile. These characteristics indicate reflective beaches. Therefore, there should be minimal changes expected to the coastline year by year. One part of the beach that is subject to the most erosion is protected by an artificial dune, which erodes and supplies sand to the beach during storm events. In this area, we observed that the beach sediment is more fine-grained than elsewhere, suggesting that the artificial dune is not composed of sand that is typical of the natural beach. However, as a reflective coastline, it remains extremely vulnerable to storms, which would have the potential to significantly alter the beaches over a short amount of time.

Plans for the eastern coast of Staten Island include the construction of a buried seawall, covered in sand, to protect low-lying residential areas from the effects of future storms. Sea walls potentially increase beach erosion, although this design should "feed" the beach with sand when it is eroded. Future sample collection and analysis after the completion of the seawall will show if there are any significant changes to the Staten Island beaches as a result of this construction.

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POSTER 96-28, ABSTRACT 395926, BOOTH 65

COASTAL VULNERABILITY AND RESISTANCE: A YEARLONG STUDY OF STATEN ISLAND BEACHES

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On October 29th, 2012, superstorm Sandy made landfall on the mid-Atlantic coast causing severe damage throughout the region. The eastern coastline of Staten Island in particular showed its vulnerability to storm surges as the neighborhoods around the surrounding area were extremely inundated, resulting in lives lost and billions of dollars in damages. Surveying on the beach during previous studies has shown that the beach in question is reflective, suggesting limited seasonal changes but can experience significant erosion during major storm events. This current work expands on the initial surveying completed in 2018 by taking regular beach surveys over the course of a year. These surveys consist of measuring the slope of the beach in 2-meter intervals, using a ranging pole and a transit, as well as collecting sediment samples at the low tide ridge, the high tide mark, as well as other significant locations throughout the beach.

In this project, beach surveys were conducted between summer of 2022 to 2023 using comparable methodologies. Building upon previous studies, these measurements were also brought into ArcGIS to better understand the coastal morphology. Inverse distance weighted (IDW) interpolation was used to identify values between sampling transects to create a continuous dataset of the beach surface. This technique will help us understand how the coastline has responded to disturbances to better predict the future response of the coastline to storm events.

Results confirm that the beach is reflective, based on the beach face slope (5° to 9°), ridge of coarse sediment at the low tide line and lack of significant variation in morphology over the course of the year. Most of the variability is related to longshore currents interacting with groins, resulting in areas of erosion and deposition with movement of between 1-2 meters. Winter storms also move some beach face and berm sediment offshore, and it gradually builds back over the summer. Overall, this survey provides a useful baseline that can be used to understand changes that will occur after the construction of a buried seawall and the influence of future storms.

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POSTER 96-29, ABSTRACT 392370, BOOTH 66

ANALYSIS OF GLACIAL STRIAE AT THE TALCVILLE QUARRY, NY: TRACKING STRIAE PROVENANCE AND ICE DEFLECTION AROUND THE ADIRONDACK MOUNTAINS

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Evidence of a glacier's basal movement can be challenging to discover due to subsequent weathering and covering by the retreating glacier. Thanks to mineral prospecting, however, in Talcville, NY, an approximately 0.3-hectare site of striated talc-tremolite schist became exposed for striae analyses. This "pit", geologically, is part of the greater Frontenac Axis, which geomorphologically represents a hectometer-scale, northeast-southwest ridge-and-valley system (cf. Miller and Stewart, 2014). Using a compass, 2,901 azimuths of type-2 striations were measured across seven exposures (or pods) of polished whalebacks. In addition, 1,989 widths, 342 lengths, and 186 hardness measurements were collected using a caliper/measuring tape and hardness-testing kit. Using the EZ-ROSE program (Baas, 2000), all azimuths (n=2,901, mean of 011.6°, σ of 6.4°) were subjected to the Kuiper, Rayleigh, and Watson tests, all of which demonstrated a unimodal distribution with 99% confidence. Linear data were descriptively analyzed with mean striation length of 44mm (σ=7.0), width of 1.7 mm (σ=2.0), and Moh's hardness

of 5.1 (σ=2.1). Local joints and regional structure measure approximately 036-216° (Miller and Stewart, 2014) and are distinct from these striae suggesting the glacier flowed at an acute angle to the regional structure and topography. We estimate, by extrapolating our linear data, that at any one moment, 0.5-1.0m^3 of bedrock was removed from this site (approximately equal to the volume of a standard refrigerator's interior). Inclusion of Moh's hardness data suggests the striators must have been at least greater than the 5.1 hardness on average, but as high as 8.5, and, in conjunction with a 1-standard-deviation striae wedge up ice were likely sourced proximally from <35 km north or distally, from southern Quebec, CAN over 150 km away. Additionally, we infer that the flow of the glacier was not bedrock controlled, but likely deflected around the western Adirondack Mountains during an ice advance, as the glacier flow was more vigorous than topographic control, but not greater than the control of the western Adirondacks Mountain edge.

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POSTER 96-30, ABSTRACT 392424, BOOTH 67

CORRELATION OF DISTAL ~13-10 MA COUGAR POINT TUFF UNITS IN THE BIG DEVILS TABLE-SALMON FALLS CREEK AREA, KNOLL BASIN, NE NEVADA, USING MAJOR MINERAL ASSEMBLAGES

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Knoll basin is a Miocene extensional basin adjacent to the Bruneau-Jarbidge volcanic center, which erupted at least nine large-volume ash-flow tuffs known collectively as the ~13-10 Ma Cougar Point Tuff (CPT). The welded CPT XIII unit has been identified by tephrochronology in the eastern part of the basin where it marks the southeastern limit of the unit and typically contains augite as the only ferromagnesian mineral. Our new mapping in the NW portion of Knoll Basin, the Big Devils Table area, reveals the presence of six welded units of the CPT. These units are interbedded with clastic sediment of the Humboldt Formation and are informally referred to as units 1 through 6.

The goal of our research was to correlate units 1-6 to known eruptions of the CPT using the identification of major minerals. Major minerals were extracted from samples by crushing, sieving, and heavy liquid separation. Mineral identification was done using a petrographic microscope and a SEM with an EDS attachment. Our preliminary results indicate that two of the nine known eruptions of the CPT, CPT XII and CPT III, are not represented in the six units because they do not contain minerals diagnostic of those units. The stratigraphically highest and youngest unit, Unit 1, correlates to CPT XIII because of the occurrence of augite as the only ferromagnesian mineral. Units 2 and 3 contain the same mineral assemblage as Unit 1 and are also correlated to CPT XIII, indicating these units have been repeated by normal faulting. This correlation is corroborated by the occurrence of Paleozoic sedimentary and Mesozoic granitic lithic fragments present in units 1, 2, 3, and their absence in other units. The sample from unit 4 did not have enough ferromagnesian grains to conduct an accurate analysis. Units 5 and 6 both contain augite and pigeonite indicating they correlate to two of the following older CPT units: XI, X, IX, VII, and V. Augite in units 5 and 6 show increasing magnesium and decreasing iron content, typical of older CPT units.

In conclusion, testing for diagnostic mineral assemblages is useful for correlating CPT XIII between isolated outcrops. In turn, these correlations allow for recognition of faulting in areas with abrupt sedimentary facies changes and similar looking tuffs.

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POSTER 96-31, ABSTRACT 396072, BOOTH 68

LATE-STAGE (CA. 745-740 MA) FELSIC VOLCANISM IN THE MOUNT ROGERS AREA, SW VA: IMPLICATIONS FOR ABORTED RIFTING AND ONSET OF GLACIATION

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In southwest Virginia, along the border of North Carolina and Tennessee, is a relic of a Neoproterozoic failed rift-arm that formed on the (present-day) eastern Laurentian margin as the Rodinian supercontinent began to destabilize and break apart. A bimodal volcanic suite, the Mount Rogers Formation (MRF), erupted onto the rifted crust ~760-750

million years ago. In recent field research, we have identified a younger, late-stage rhyolitic complex, erupted ~745-740 Ma. The Rocky Hollow complex (RHC), as we have informally designated this unit, is comprised of porphyritic rhyolite, crystal and lithic rhyolitic tuff, and volcaniclastic conglomerate, with associated coarse arkosic sandstone. Basaltic dikes of uncertain age intrude the complex. In this study, we describe in detail the lithologies and textures of the Rocky Hollow complex using hand-sample and optical petrography. In addition, we will compare whole-rock geochemistry of the RHC rhyolites to the main MRF rhyolites.

The Rocky Hollow complex appears to fill a transitional period between the volcanics of the MRF and the overlying glaciogenic Konnarock Formation, the latter of which has been interpreted as deposited during the 717-635 Ma Sturtian "Snowball Earth" glaciation. Apparent interlayering of the RHC with the lower part of the Konnarock Formation calls this interpretation into question.

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POSTER 96-32, ABSTRACT 394708, BOOTH 69

GRAIN SIZE DISTRIBUTION AND POROSITY'S EFFECT ON URBAN SEDIMENT UNDER LAVA FLOWS

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The purpose of this study is to better understand how sediment characteristics, such as grain size distribution and porosity, affect heat transfer. A better understanding of the heat transfer properties of sediments and soils can help municipalities, urban planners, and private companies plan out projects which are sensitive to high temperatures. The study used an angular limestone sandy gravel, from which a 1 mm and 2 mm size fraction was separated. The sediment was sieved in order to determine grain size distribution and textural group. The size of the sieves used ranged from 4 mm to 0.063 mm. Water filled porosity was calculated by determining each sediment's Visual Pore Volume (VPV) and Different Weight Pore Volume (DVPV). Porosity (VPV) ranged from 23% to 28.75% for the limestone gravel. Porosity for 1 mm limestone gravel was between 43 and 44%, whereas porosity for the 2mm limestone gravel was at 45.75%.

Heat transfer tests were conducted in small laboratory experiments. Heat was applied in the form of remelted basalt (50-60 ml) which was poured on the surface of a dry sediment column above a vertical array of thermocouples at 0 (melt contact), 1, 3, 5, and 7 cm. Thermal measurements were collected for 2 hours after the pour. The time for a temperature of 100 C to be recorded at 3 cm depth was 17 minutes and 37 seconds for the poorly sorted limestone gravel, 19 minutes and 26 seconds for the 2 mm gravel fraction, and temperatures never reached 100 C at a depth of 3 cm for the 1 mm gravel. Max temperatures for 1 mm gravel at a depth of 3 cm were 92.7 C. That temperature was reached 24 minutes and 42 seconds after the start of the pour. Sediments with less pore space were better insulators with slower times for transmitted heat.

This focused study compliments experiments at the University at Buffalo that use larger volumes of melt to explore the heat transfer through sediments with a wider range of characteristics and moisture contents. Future small-scale studies could focus on the relationship between particle shape and heat transfer as particle shape is an important factor of the thermal conductivity of sediments. Quantification of the sensitivity of heat transfer to sediment characteristics is a fundamental first step to providing inputs to urban design and better reading of the geologic record.

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POSTER 96-33, ABSTRACT 394880, BOOTH 70

COUPLED ANALYSES OF SEDIMENT MAGNETIC PROPERTIES, TEXTURE, EROSION RATE, AND STRATIGRAPHIC PERIODICITY IN RAPIDLY ACCUMULATING FAN DELTAS

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We explore time series of magnetic susceptibility (χ) and anhysteretic remanent magnetization (ARM) in settings of rapid sediment accumulation rate (SAR) with the goals of partitioning exogenic forcings from autogenic processes and to better understand how these magnetic signals are encoded in sedimentary archives. Environmental signals of

periodic external forcings commonly operate at Milankovitch frequencies, but in rapid SAR settings autogenic processes including channel avulsions and delta lobe switching both shred high-frequency external forcings, or even impart their own quasi-periodic signals. We measure χ using both a hand-held KT-10 magnetic susceptibility meter and a lab-based Kappabridge KLY-3s, and ARM in the < 2 mm size fraction using a GSD-5 alternating-field and a 2G superconducting magnetometers, with all results mass normalized to SI units. We focus on 40 samples collected at 25 cm intervals from 10 m of propagating foresets in a Gilbert delta of the Provo stage of Lake Bonneville at High Creek, Utah. A luminescence-based age model in this delta establishes a mean SAR of 8 cm/yr and terrestrial cosmogenic nuclide concentrations of both delta sediment and alluvium in the source indicates modern and paleoerosion rates (E) ranging from ~60-100 m/Myr (0.006-0.01 cm/yr). Periodicities of 18 and 33 yrs in the rock magnetic time series are greater than twice the compensation time for these foresets where peaks in χ and ARM are positively correlated with fine-grained matrix. We interpret a positive correlation between E and χ as driven by stripping of soil-mantled hillslopes that harbor greater concentrations of magnetic minerals than the underlying bedrock. The encoding of the environmental signal, here interpreted as autogenic cascading of sediment on foreset surfaces, is primarily set by the SAR and depositional processes, which are decoupled from E. Nevertheless, the strength of the magnetic signal in our sedimentary archive varies with E which can be more widely explored as a E-proxy when locally calibrated. These results offer insight into how to isolate the impact of quasi-periodic tectonic forcings on stratigraphic archives at sub-Milankovitch frequencies, where autogenic processes dominate depositional processes but which also encode critical human-dimension natural hazard information.

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POSTER 96-34, ABSTRACT 393727, BOOTH 71
SURVEYING THE REACTIVITY OF DISSOLVED ORGANIC CARBON WITHIN THE STREAM-GROUNDWATER INTERFACE OF THE KALAMAZOO RIVER, ALBION, MI

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Dissolved Organic Carbon (DOC) is an important and abundant chemical and physical aspect of stream ecosystems. Urban environments, including infrastructure such as non-permeable concrete and storm drains, change how the landscape conveys water, and therefore DOC, to rivers like the Kalamazoo River. When DOC reaches the river, it interacts with the biogeochemical processes within the river, including within the hyporheic zone. The hyporheic zone is the highly bioreactive, shallow subsurface of the stream bed where stream and groundwaters mix. We hypothesized that DOC degradation will vary across different DOC sources. We created a variety of DOC leachates from deciduous leaves obtained across the Kalamazoo River Watershed. Then, we conducted push-pull tests with a solute that included environmental water, leaf leachates, and a conservative tracer to simulate the rapid input of landscape DOC into the hyporheic zone. Samples were withdrawn from the area in regular intervals over approximately four hours, then analyzed for both DOC and Chloride content. We assessed the reaction rates of each different carbon source and have found that rates do appear to vary across sources.

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POSTER 96-35, ABSTRACT 394811, BOOTH 72
EFFECTS OF NITRATE ON ARSENOPYRITE OXIDATION DURING AQUIFER STORAGE AND RECOVERY CONDITIONS

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An increasing number of regions are tasked with combatting groundwater availability and quality issues. A growing reliance on groundwater due to population growth and climatic changes have motivated the onset of groundwater enhancement techniques such as aquifer storage and recovery (ASR). ASR often involves injection of treated wastewater and later retrieval from a dual-purpose well. One the most observed issues with this technique is

contaminant mobilization, namely the release of arsenic species via oxidative dissolution of arsenic-bearing minerals. Consequently, previous research has focused on how oxygen, and other electron acceptors facilitate this reaction. However, few studies have thoroughly investigated the specific role nitrate has on arsenic release within ASR conditions. Appreciable amounts of nitrate can be introduced into groundwater via injection during ASR, and other anthropogenic sources. Thus, this research aims to characterize the geochemical changes occurring from nitrate induced oxidation of arsenopyrite during ASR conditions. To simulate ASR conditions, triplicate microcosms were created that contain arsenopyrite, partially treated municipal wastewater, and local Florida groundwater. Microcosms were then sparged with nitrogen gas and sealed to create an anoxic environment. Nitrogen gas bags were attached through tubing to maintain anoxic conditions, along with secondary tubing for sampling. Four additional microcosm triplicates were created as controls for this experiment. Changes in chemical species within the microcosms are being determined using ion chromatography. Preliminary data suggests that non-nitrogen species may preferentially facilitate arsenopyrite oxidation under ASR conditions. Samples are continuing to be analyzed to fully understand the temporal geochemical changes. Further results and analyses will be presented at the 2023 Geological Society of America Connects Meeting. This research will provide improved understanding of arsenopyrite oxidation during ASR that should be considered to assist in minimizing arsenic mobilization in groundwater. The findings of this study will have important implications for protecting human health, enhancing environmental engineering practices, and guiding future research.

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POSTER 96-36, ABSTRACT 394877, BOOTH 73
CHARACTERIZING RICE CROP HYDROLOGIC HISTORY AND IMPLICATIONS FOR ARSENIC UPTAKE THROUGH THE USE OF STABLE ISOTOPES

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Rice provides 20% of the calories consumed by humanity and is thus central to the global food supply and human nutrition. However, rice often contains elevated levels of arsenic, which is toxic to humans consuming the rice and to the rice crop itself. Thus, high concentrations of arsenic in rice represent a significant human health risk and a threat to rice yields, posing a risk to food security. The mobilization of arsenic from the soil is dependent on redox conditions which are strongly influenced by soil moisture conditions of the rice paddy. However, the role of soil moisture, which exhibits significant variation within and across growing seasons, on arsenic uptake into rice remains poorly understood. To address spatial and temporal variations in rice grain arsenic, we have collected paired rice and soil samples at approximately 80 field sites in Cambodia. Here we use in-situ and remotely sensed measurements of soil moisture throughout the growing season of the sampled rice, and we connect these soil moisture histories of each field to our measures of rice grain arsenic and stable isotopes of carbon and nitrogen in the rice grain. We aim to apply rice grain stable isotopes of C and N as proxies of the integrated environmental conditions experienced by the rice crop and to relate this to the uptake of arsenic into the grain – an important issue as a large fraction of Cambodians rely on rice farming for their livelihoods and more than 70% of calories consumed within the country come from rice.

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POSTER 96-37, ABSTRACT 394903, BOOTH 74
PHOSPHOROUS AND THE IREVIKEN BIOGEOCHEMICAL EVENT

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At least seven major biogeochemical events have been identified within the Silurian Period, with the Ireviken Biogeochemical Event (IBE), occurring at the Llandovery-Wenlock boundary, being the most well-known and well-studied. Previous carbon and sulfur isotope data from the Altajme core, drilled in Gotland, Sweden, demonstrate that this major positive carbon isotope excursion was likely driven by an expansion in reducing marine environments and an increase in organic carbon burial. However, these carbon isotope excursions can also be linked to changes in primary productivity. Whereas phosphorous is a critical nutrient for primary productivity, and therefore a good indicator of any potential productivity events, there are currently no phosphorous data available from this event. To investigate the role of primary productivity in the IBE, samples were taken through this interval in the Altajme core for P extraction.

Phosphorous exists in different phases, and therefore the total P concentration in the sediment cannot be used by itself as an accurate measurement of bioavailable P in the water column through time. As a result, the SEDEX sequential extraction method was used to isolate five different sedimentary P reservoirs for quantification, including Fe-bound P, authigenic P, detrital P, and organic-bound P. The data from these samples provide important information about the timing and magnitude of changes in marine nutrient cycling during this global biogeochemical event.

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POSTER 96-38, ABSTRACT 394978, BOOTH 75

CHARLES J. MANKIN OUTSTANDING POSTER AWARD WINNER

INSECT HERBIVORY FROM THE MIDDLE EOCENE CLAIBORNE FORMATION AS AN ANALOG FOR FUTURE CLIMATE CHANGE

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Understanding past increases in atmospheric CO_2 and the potential concomitant shift in habitats is essential for assessing the future impacts of anthropogenic climate change. Despite filling incredibly important ecological niches, it is not well constrained how future climate change will affect insects and their corresponding impacts on the surrounding environment. The Middle Eocene is an interesting analog to future climate change as it is a time when CO_2 levels were two times greater than modern, and therefore offers a unique glimpse into a high CO_2 world. The Claiborne Formation in Kentucky contains fossil leaves with exceptional preservation which allows for a preliminary study of insect herbivory. Here we analyze the frequency as well as diversity of functional feeding groups, specifically specialized feeding, as laid out by Labandeira to gain insight into these interactions during periods of higher CO_2 concentrations. Statistical analysis allows us to correlate feeding groups and amount of insect damage to climate variables. A comparison to previous studies from different fossil localities throughout geologic time suggests that amount and diversity of insect damage are positively correlated with changes in the partial pressure of CO_2 and temperature. The high CO_2 world of the middle Eocene offers a unique analog to study the consequences of climate change on a very important group of organisms: insects.

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POSTER 96-39, ABSTRACT 395002, BOOTH 76

USING TESTATE AMOEBAE AS BIOINDICATORS OF WATER QUALITY AND ECOSYSTEM HEALTH IN THE STONES RIVER WATERSHED IN MURFREESBORO, TN

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Tennessee is one of the fastest growing states in the nation. Increasing populations can lead to issues with managing waste. Middle Point Landfill in Murfreesboro is an 808-acre facility that accepts 3,700 tons of waste a day from 34 counties across Tennessee. In 2022, the city of Murfreesboro filed suit in federal court against the owners of the landfill alleging that toxic substances had been released into the East Fork of the Stones River by the landfill. This claim has been denied by the owners of the Middle Point Landfill, who have blamed the adjacent smaller Rutherford County Landfill. In this project, we will analyze ecosystem health in the Stones River watershed by analyzing the populations of testate amoebae. These microscopic, unicellular protozoans are found in sediment from freshwater localities, produce a mineralized shell, and have been shown in numerous previous studies to respond to environmental changes. They are considered to be bioindicators that can serve as a proxy for ecosystem health.

Several other issues are affecting the water quality within the watershed, including urban and residential runoff and infestations of invasive aquatic plant species, including parrot-feather or *Myriophyllum aquaticum*; water primrose or *Ludwigia* sp.; and alligator weed or *Alternanthera philoxeroides*. A study within the waterbodies within the Stones River watershed in 2017 showed eutrophication and hypoxia with high ammonia and chlorine levels in the water. This project focuses upon eight locations within the watershed, including locations up- and downstream of the Middle Point Landfill on the East Fork of the Stones River.

Initial results from the East Fork of the Stones River show that testate amoebae were absent from the sample immediately downstream from the landfill. Further downstream we found both opportunistic species, such as *Centropyxis aculeata*, and species found in areas with high levels of organic content, such as *Difflugia oblonga*. This population is similar to the population found in a sample from the West Fork. Samples from the wetlands infested with invasive aquatic species show high abundances of *Difflugia*, indicating higher organic content. Final results will include statistical analyses of populations from each location.

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POSTER 96-40, ABSTRACT 395147, BOOTH 77

RELATIVE ABUNDANCE DISTRIBUTIONS OF BRACHIOPODS FROM THE LATE PALEZOIC OF NEBRASKA AND KANSAS

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Stratigraphic boundaries typically are defined by faunal turnover, but not necessarily by any major changes in general ecological structures in communities. Here, we use relative abundance distributions (RADs) to summarize basic ecological structure among Pennsylannian and Early Permian brachiopod communities from Nebraska and adjacent regions. In particular, we assess whether differences in faunal composition correspond to degrees of difference in types of best-fit abundance distributions. We use brachiopod specimen counts from 100+ collections found in 14 formations, from the oldest date to the youngest date. For each collection, we find the best-fit models for five basic models: Geometric, Log-Series, Zero-Sum Multinomial, Lognormal and Zipf. The first three models assume that species compete for the same general resources (e.g., all are suspension feeders) and that factors such as immigration rates, population growth rates have much greater effects on relative abundance than do ecological interactions. The final two models assume that ecological interactions such as niche-partition, niche construction, and direct interactions also have strong effects on community structure. We find the most likely distributions based on the probability of the observed numbers of species with 1, 2, etc., specimens given a hypothesized true number of species, a particular RAD and the sample size. We then contrast the distributions with differences in taxonomic composition and environment as indicated by rock lithologies.

Previous results and studies indicate that there is no clear temporal or environmental pattern in differences among RAD. There also is not a clear trend towards increasing "modernization" of RADs moving from the Pennsylvannian to the Permian, which is consistent with the notion that the major shift is concentrated in the Permian/Triassic transition. Our goal then is to see if any shift at all is occurring.

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POSTER 96-41, ABSTRACT 395534, BOOTH 78

PALEOBOTANICAL RECONSTRUCTIONS OF THE CLIMATE AND ECOLOGY OF THE CANADIAN HIGH ARCTIC DURING THE EARLY PALEOGENE

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The early Paleogene was characterized by multiple hyperthermal events, such as the Paleocene Eocene Thermal Maximum (PETM) and the Eocene Thermal Maximum 2 (ETM2), which caused marked increases in temperature that can be recognized in the fossil record by changes in flora and fauna. The Arctic is of significant interest during these hyperthermal events because warming and other climate changes were likely most pronounced in polar regions. We reconstruct climatic and ecological changes of the Arctic during the early Paleogene before and after the PETM using fossil leaves collected by the late L.J. Hickey from Ellesmere and Axel Heiberg Islands in the Canadian High Arctic. We photographed the entire Hickey Arctic collection housed at the Yale Peabody Museum and digitally measured a variety of morphological characteristics, such as blade area and perimeter, petiole width, and margin state, from all leaves that were at least 25% complete. We then reconstructed mean annual temperature (MAT) and mean annual precipitation (MAP) using the leaf physiognomic methods Digital Leaf Physiognomy (DLP), Leaf Margin Analysis (LMA), and Leaf Area Analysis (LAA), as well as reconstructed leaf mass per area (Ma) to estimate leaf lifespan. Preliminary results indicate that the climate of the Paleocene and Eocene was warm and relatively wet and that the floras were temperate forests with predominately deciduous taxa. Future work will assess differences between Paleocene and Eocene climate and floral community ecology. The results of this work help provide a better understanding of high latitude ecosystems. This in turn can help provide important insights into the climate of polar regions during warm times in Earth history which has important implications the future given the current global climatic warming trends.

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POSTER 96-42, ABSTRACT 395575, BOOTH 79

HOW THE HISTORY AND DEVELOPMENT OF CLEVELAND'S REDLINED AREAS AFFECT SOIL LEAD CONCENTRATIONS AND OTHER SOIL PARAMETERS

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Today Cleveland remains one of the most segregated large cities in the United States, where the legacy of redlining from the 1930s has been linked to persisting economic, social, and health inequities. Here, we ask whether Cleveland's legacy of redlining is connected to modern environmental metrics such as heavy metals in the soil and soil health. We sampled over 30 sites and 100 subsites evenly distributed among the four Home Owners' Loan Corporation (HOLC) neighborhood categories. Soil lead was quantified by XRF analysis. Other soil parameters, such as soil organic carbon and bulk density, were measured. We analyzed residential lots (near street, yard, and dripline), community gardens, and playground samples using ANOVAs and Linear models. Redlined (HOLC category "D") communities averaged higher lead concentrations but failed to be significant ($p = 0.305$). For residential properties, the best data model determined by AIC included the location within the property and house age ($p = 0.006$), with home age and yard location accounting for 20% of the variation. High-exposure locations such as playgrounds and food gardens generally had lower soil lead levels, with playgrounds having the lowest mean concentrations ($p=0.047$), regardless of the HOLC category. Additional results on other soil parameters, such as bulk density, soil organic carbon, and pH, are pending. We continue our work by exploring other explanatory factors, such as exterior building material and the role of gentrification. Our results are consistent with the historical use of lead-based paint and with those from other cities sampled as part of the Redlining Metal Network.

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POSTER 96-43, ABSTRACT 395586, BOOTH 80

INVESTIGATING THE STRUCTURE OF AGATES AS AN EARLY UNDERGRADUATE STUDENT RESEARCH PROJECT AT DELAWARE COUNTY COLLEGE

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Our goal was to analyze a fluid filled agate and note the structures that may be found when one is cut open. Using an electric saw to nick the surface and then a chisel to open and capture some of the fluid. What we found was an interesting needle-like structure within the agate that we wanted to analyze further. Using an electron microscope, to get close images of the structure that were not only beautiful but showed unique features along with an x-ray spectrum to determine the chemical makeup of the agate. Also observed inside were needle like structure that made of Manganese Oxide. These results can tell us the story of the agate and how it formed.

POSTER 96-44, ABSTRACT 395599, BOOTH 81
OAE2 AND THE EASTERN EXTENT OF THE WESTERN INTERIOR SEAWAY IN IOWA

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The Western Interior Seaway (WIS) expanded through much of west-central North America during the Cretaceous. The majority of research on the WIS has been conducted along the axis of the basin, or on the western margin proximal to orogenic events and radioisotopically dateable volcanic materials. By comparison, only a handful of studies have focused on the eastern margin of the WIS and the true geographic extent of the seaway remains a matter of debate.

Here, we produced high-resolution carbonate carbon isotope chemostratigraphy from a core drilled in Sioux County, Iowa, that includes Oceanic Anoxic Event 2 (OAE2) in clearly marine, carbonate-dominated strata from western Iowa. Additional cores in Iowa also preserve the Greenhorn Formation in marine strata and demonstrate that the WIS extended at least well into central Iowa during the maximum transgression during the Late Cretaceous.

POSTER 96-45, ABSTRACT 395831, BOOTH 82
HABITAT ASSESSMENT OF GREAT GRAY OWL (*STRIX NEBULOSA YOSEMITENSIS*) IN YOSEMITE NATIONAL PARK, CALIFORNIA

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Great gray owls (*Strix nebulosa yosemitensis*) in the Sierra Nevada are a genetically unique subspecies (*yosemitensis*) with a small population size and corresponding low genetic diversity. Most of this population resides in Yosemite and the habitat within the park is critical to the persistence of the subspecies. Fortunately, recent technological advances have greatly increased our ability to collect wildlife tracking data yielding precise location and movement information. This information will ensure that imminent habitat modifications meet our objectives of (1) improving great gray owl habitat in the park by producing better foraging habitat and (2) making roadsides less attractive to the owls, thereby reducing wildlife-vehicle collisions. Wildlife-vehicle collisions are the most known source of mortality for adult great gray owls in the park. Fine-scale tracking data will enable a better understanding of roadside conditions that attract or repel the owls, thereby designing tree removal to reduce the chance of future owl-vehicle collisions. In meadows, fine-scale data on habitat use can help inform restoration designs to favor optimal owl forage conditions.

My position title is biology assistant and field technician for the Great Gray Owl Project. The project's goal is to better understand great gray owl nesting and foraging use near roads and reduce owl mortality in Yosemite. Research methods include radio telemetry setup and vegetation protocols for habitat assessment.

Since my first workday (May 22) to my last workday (July 27), I have completed 202 vegetation plots and 101 observation/perch sites recorded from our 4 tagged great gray owls. I learned how to perform radio telemetry setup, VHF tracking, habitat assessment, and observe animals practicing the least invasive method possible. I learned how to complete vegetation protocols for habitat assessment. Through my volunteering in other projects, I was able to learn how to complete owl broadcasting, spotted owl surveys, bird

banding, bat netting, and bear roving. Although data analysis is still ongoing, 30% of the perch sites recorded from owls were less than a mile away from a main road. This proves that research like these is important for wildlife conservation and management in national parks and areas where human presence may alter natural behavior.

POSTER 96-46, ABSTRACT 395843, BOOTH 83

DETAILED STUDY OF UHP PHENGITE FROM A 10-METER TERRANE, TSO MORARI TERRANE, INDIA

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Phengite, the high-pressure form of muscovite, can preserve pressure-temperature conditions and chemical signatures of the fluids present during its growth. The Tso Morari Ultra-high Pressure (UHP) Terrane in NW India is largely made up of white-mica-bearing, quartzo-feldspathic gneiss, which have not experienced retrograde recrystallization, post-UHP, in a uniform manner. On the scale of a 10m traverse perpendicular to the dominant fabric direction, samples in close proximity do not have the same phengite composition. Phengite samples > 5 m from the contact with the eclogite preserved the highest silicon concentrations (6.98 Si p.f.u.) while samples at the contact (TM11) and 2-3 m away preserve intermediate compositions between muscovite and phengite (6.45 Si p.f.u.). If we consider the Si and FeT/Mg values as markers of pressure and temperature respectively, we have grains that grew both at near-peak P-T conditions and at lower pressures during exhumation. Phengite in TM2 have an average Si of 6.88 p.f.u., suggesting preservation of the grains that grew in the UHP event. The compositions of mica grains in TM3 and TM11 have lower counts of 6.42 Si p.f.u. suggesting recrystallization during exhumation. FeT/Mg data shows increasing values from TM2 to TM11, from 2.67 to 6.1 with TM3 at an intermediate value of 4.05. The meter-to-centimeter scale heterogeneity coupled with the strongly expressed banded fabric suggests that the gneiss experienced heterogeneous strain and incomplete recrystallization on its return to the crust. The samples with the UHP phengite preserved will be used in conjunction with another study of boron isotope and trace element data measured in situ on the same grains. White mica (phengite) is the primary mineral used because it is a hydrous, high-pressure phase that characteristically contains boron when tourmaline is absent and is sensitive to P-T changes and in UHP terranes is often preserved even after exhumation. Initial electron probe data has confirmed both high-pressure phengite and retrograde lower-pressure phengite in the samples. The next steps will compare this data to the boron data and see if the micas have distinct in situ δ11B concentrations. Previous studies suggest that the phengite would have low boron concentrations and highly negative δ11B values that are below the range of values expected by MORB basalts and the mantle.

POSTER 96-47, ABSTRACT 392781, BOOTH 84

3D RECONSTRUCTIONS OF AN EDIACARAN SPONGE-GRADE ANIMAL FROM THE PATOM UPLIFT OF SIBERIA

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As a basal metazoan group, sponges are thought to have been among the earliest multicellular animals to develop on Earth. However, the oldest widely accepted examples of sponges in the fossil record date back only to the Cambrian Period, despite estimates from molecular clocks that place their emergence deep into the Neoproterozoic Era. Although reports of Precambrian sponges have been numerous, definitive identification has been complicated by a lack of morphological details or diagnostic features. Here, we provide an update on new work describing recently discovered fossils interpreted as early biomineralizing sponge-grade animals. The fossils are from the Patom Uplift (~565 Ma) in central Siberia, stratigraphically a few hundred meters above the nadir of the Shuram carbon isotope excursion. The centimeter-scale fossil fragments make up a detrital hash, and are preserved three dimensionally in a limestone matrix through mineral replacement of the original tissue by carbonate and pyrite. Earlier descriptions of the fossils highlighted calcified structures interpreted as original biomineralization of a carbonate shell, as well as complex internal canals. We now describe new findings from 3D reconstructions generated via serial sectioning as well as acid maceration. These new analyses have provided an extremely detailed view of the morphology of the fossils. We have expanded upon observations made previously through petrography and microCT observations, and built a more complete model of the fossil organism as displaying mineralized surficial features, an internal lattice-like network of consistently shaped nodes and branches, and abundant exterior pores. These observations are most consistent with a sponge-grade animal assignment. This fossil discovery provides strong evidence for the presence of sponge-grade animals prior to the Cambrian Period, as well as a link between biological evolution and profound changes in the global carbon cycle as revealed by chemostratigraphic events. These observations have significant implications for our understanding of Ediacaran ecology and the evolution of animals.

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POSTER 96-48, ABSTRACT 395860, BOOTH 85

SEXUAL DIMORPHIC VARIATIONS AMONG CRETACEOUS HETEROMORPHIC AMMONITES OF A PIERRE SHALE NODULE

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In 2017, an investigative study was performed on an ammonoid specimen from a Campanian-aged nodule obtained from the Pierre Shale Formation in Montana. The specimen was determined to be a microconch of Hoploscaphites nodosus. The nodule also contains a significantly larger specimen encased in a highly indurated matrix of black shale. It is hypothesized that the large specimen may be a macroconch of H. nodosus. Using a microabrasion unit, the matrix will be removed from the larger specimen. Multiple abrasives will be tested to determine the ideal medium to remove the indurated matrix from the specimen. The specimen will then be examined using a camera lucida to image sutures and identify the species and the possibility of sexual dimorphism. The sample will also be measured, and conch characteristics will be quantified using standard calculations. Features, including ornamentation and any mature modifications, will also be identified. The study objectives are determining best practices in microabrasion of a fossil specimen and identifying the specimen as a possible sexual dimorph to the microconch from the 2017 study on the same nodule.

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POSTER 96-49, ABSTRACT 395949, BOOTH 86

SOIL CORE ANALYSIS OF THE ASHTON RESEARCH PRAIRIE, IOWA CITY, IOWA

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The Ashton Research Prairie (ARP) is a University of Iowa cross-campus project that is focused on the environmental changes that occur as a landscape is restored to prairie. Subsurface research at the ARP has been delayed because there is a lack of data about the Quaternary succession in the area. Detailed core descriptions, elemental characterization via portable X-ray fluorescence (pXRF), and grain size analyses were conducted on the sediments of the upland area of the ARP to delineate lithologic characteristics and create a basic stratigraphic framework. Using the most complete upland core available, we were able to constrain vertical changes within the succession and correlate sediment packages laterally. Descriptive core logging, monitoring well installation, and stratigraphic determinations were all completed by staff from the Iowa Geological Survey and faculty of the Department of Earth and Environmental Sciences at the University of Iowa. The most stratigraphically complete core was selected to conduct chemical analysis using an Olympus Delta pXRF, as well as grain size analyses using pipette methods and Camsizer. These data have helped better define and distinguish the sediment packages in the subsurface and evaluate water flow through these geologic units. Understanding the Quaternary geology of the Ashton Research Prairie is foundational for several of the hydrologic research projects that are being developed there, including the study of water table fluctuations and how groundwater flows through the Prairie.

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Poster 96-50, Abstract 396020, Booth 87
INDIGENOUS PLACE NAMES AS A WAY TO STUDY LAND CHARACTERISTICS

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Indigenous names of geographical locations and towns can grant insight into the area: whether that be the natural features or cultural significance. However, what if the meaning of the name changed? Due to the manner in which settlers from Europe and Native Americans interacted in the 17th-19th century, this was a common occurrence throughout North America. The Indigenous names can give us insight to what the area looked like before settlers arrived compared to now.

For this project my collaborators and I focused on locations in Wisconsin. The primary questions being: what were the original names of areas and how did they relate to the physiographic and environmental features of the area? Many of those features have changed through time due to climate change and/or human actions such as wetlands being drained for farming or forests being cut due to spread of urbanization.

Our project involves: taking the names of Wisconsin locations with original Indigenous names, finding the probable Anishinaabe language(s) in which the place was originally named, then finding possible name meaning(s) with help of a native Anishinaabe speaker. We then examined if the meaning of the original place name is still applicable. In our project, we display our findings with a story map to show the meanings of the original place names.

We hope our project can show how the land features have changed throughout history and learn more about our geologic past. Indigenous place names were originally used to transfer place-based knowledge, and with this story map we can help keep this tradition alive.

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Poster 96-51, Abstract 388495, Booth 88
HOW EROSION EFFECTS CARBON ISOTOPIC TRENDS: THE LATE PERMIAN MCKITTRICK LIMESTONE

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Carbon isotopic trends are an essential tool for understanding changes in the global carbon cycle over time and correlating rock units (chemostratigraphy). These applications assume that documented trends are primary and reflect an accurate record of changes through time. However, diagenetic processes and erosion can invalidate this assumption. In this project, we focus on the impact of relatively small-scale (<1 meter) erosion on documented carbon isotopic trends. To

accomplish this, we targeted the Late Permian McKittrick Limestone of the Bell Canyon Formation in Guadalupe Mountains National Park. This location is ideal for our study because the outcrop is continuous from crest to slope to basin and previous work allows us to correlate from shallow to deep water environments. We identified a small slump or paleochannel in the McKittrick Limestone that forms the basis of this study. By measuring and collecting samples from two sections within the outcrop, we were able to document how erosion impacted the signal. We have also compared our results to the corresponding rocks in the shallow water of the shelf crest to test for any cryptic erosional events that might have impacted the McKittrick Limestone carbon isotopic record at this location.

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POSTER 96-52, ABSTRACT 388514, BOOTH 89

HOW SEDIMENT MIXING AND TRANSPORT INFLUENCES RECORDED CARBON ISOTOPIC TRENDS: PERMIAN REEF TRAIL, GUADALUPE MOUNTAINS NATIONAL PARK

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Carbon isotope geochemistry is a method commonly deployed to help correlate stratigraphic units and to document changes to the global carbon cycle. These applications are based on the assumption that the carbon isotopic value recorded in carbonate sediments reflects the carbon isotopic value of the water at the time of deposition. However, there are possible scenarios where this assumption is not met. For example, allochthonous intraclasts as well as mixing of clasts during deposition could cause recorded values to depart from carbon isotopic values of the water during deposition. In this study we aimed to explore how sediment mixing and transport of clasts influenced carbon isotopic trends by focusing on the Late Permian Yates Formation, Tansil Formation and McKittrick Limestone Member of the Bell Canyon Formation exposed along the Permian Reef Trail in the Guadalupe Mountains National Park. We generated three carbon isotopic records, one for the shallow water shelf crest, one for the slope, and one for the basinal setting. By slabbing samples from the slope, we were able to target and generate carbon isotopic values of various clast types (e.g. intraclasts, transported fossils, micrite). We compared the slope carbon isotopic record to the other settings where mixing and transportation is predicted to be less. From these results, it is clear that transportation and mixing of clasts does impact the generated carbon isotopic trends. This study highlights the importance of choosing what is drilled for carbon isotopic values with care.

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POSTER 96-53, ABSTRACT 388572, BOOTH 90

DOES SEA LEVEL CHANGE INFLUENCE CARBON ISOTOPIC TRENDS IN THE LATE PERMIAN DELAWARE BASIN?

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Previous studies from modern and ancient carbonate settings have argued that stable carbon isotopic trends can be influenced by changes in relative sea level. Explanations for this relationship focus on sea level's control on processes like organic carbon burial, basin restriction, carbonate deposition/weathering/mixing, and freshwater input. As sea level rises, the basin becomes well mixed, organic carbon burial increases, aragonite deposition increases, and the influence of freshwater is diminished. This results in increasing carbon isotopic values in the carbonate rocks that form at the time. In contrast, when sea level falls, these processes work in reverse and carbon isotopic values progressively decrease. While previous studies have argued for such a systematic relationship between sea level and carbon isotopes, those interpretations have not been tested quantitatively. For this project we aimed to propose a statistical test for correlation between sea level and carbon isotopes in the Late Permian Delaware Basin. We focused our efforts on the Tansill and Yates Formations exposed in Guadalupe Mountains National Park and Carlsbad Caverns National Park. By pairing high resolution carbon isotopic records with the established sequence stratigraphic framework for these study locations, we performed a series of regression analyses to test for correlation between sea level change and carbon isotopic trends. Our results provide a new method for determining if

sea level is influencing carbon isotopes.

POSTER 96-54, ABSTRACT 38574, BOOTH 91

DO CARBON ISOTOPIC VALUES VARY ALONG THE LATE PERMIAN DELAWARE BASIN SHORELINE?

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In modern carbonate platforms like the Great Bahama Banks and Florida Bay, the carbon isotopic value of dissolved inorganic carbon (DIC) can vary by up to 2‰. This is due to a combination of factors like freshwater input, terrestrial organic carbon, and non-equilibrium conditions with the atmosphere. How these variations in the carbon isotopic value of DIC get recorded in the carbonates that form in these settings has important implications for our use of the record as a paleoclimatic and chemostratigraphic tool. In this study we explore how relative position along shoreline impacts the recorded carbon isotopic values in the Late Permian Delaware Basin. We targeted the Yates and Tansil Formation exposed in Walnut Canyon and the Permian Reef trail in Carlsbad National Park and Guadalupe Mountains National Park, respectively. These two sections represent roughly the same position relative to shore but were separated by ~40 km laterally. By examining the carbon isotopic records of these two sections we were able to demonstrate that there are not significant lateral variations in carbon isotopic values and trends.

POSTER 96-55, ABSTRACT 388581, BOOTH 92

DO CARBON ISOTOPIC VALUES VARY ALONG A DEPTH GRADIENT IN THE LATE PERMIAN DELAWARE BASIN?

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Carbon isotopes are important tools in paleoclimatic and chemostratigraphic studies. Tracing patterns in carbon isotopic trends can be useful for correlation and determining the relationship between different stratigraphic units. Significant fluctuations in carbon isotopic values can be used to infer changes in the global carbon cycle. These applications require that carbon isotopic trends roughly approximate global process and are not overwhelmed by regional/local signals. However, studies of ancient and modern carbonate platforms have demonstrated that carbon isotopic values are different in nearshore versus deep water environments. Nearshore environments tend to have lower carbon isotopic values and the magnitude of excursions are maximized while deep water environments have higher carbon isotopic values and the magnitude of excursions are minimized. This suggests that regional/local factors were contributing to recorded trends. This study explores the issue of depth gradients in carbon isotopes in the Late Permian Delaware Basin. We chose this study location because it is an ancient analog for the Great Bahama Banks (GBB), one of the modern carbonate settings where gradients in carbon isotopic values have been observed. We focused on the Yates Formation, Tansil Formation, and Lamar Limestone Member of the Bell Canyon Formation exposed at the Guadalupe Mountains National Park and Carlsbad Caverns National Park. We measured and described three sections along a depth gradient and placed these rocks into the existing sedimentological and sequence stratigraphic framework. Hand samples for carbon isotopes were collected and drilled to generate trends in the crest, toe of slope, and basin settings. Based on these results, we explore the relationship between carbon isotopic trends and position relative to shore.

POSTER 96-56, ABSTRACT 388610, BOOTH 93

SEQUENCE STRATIGRAPHY AND CARBON ISOTOPES FROM BENBOW MINE ROAD IN MONTANA: DID SEA LEVEL CHANGE INFLUENCE CARBON ISOTOPIC TRENDS IN THE MADISON SHELF?

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The Early Mississippian Lodgepole Formation records a series of carbon isotopic excursions that have been linked to sea level

fluctuations on the Madison shelf. One of these excursions is the ~7‰ globally recognized Tournasian Isotope Carbon excursion (TICE). The possibility that one of the largest carbon isotopic excursions in the Phanerozoic was influenced by organic carbon burial associated with rising sea level has significant implications about the role sea level played in the global carbon cycle and Earth's climate history. However, the relationship between sea level and carbon isotopic trends in the Madison shelf is not without complications. Perhaps most important is the fact that there is debate about whether there are two or three sequences in the Lodgepole Formation. This discrepancy regarding the identification and placement of sequence stratigraphic surfaces complicates interpretations of the relationship between sea level and carbon isotopes. To address these issues, this study focused on the Benbow Mine Road section in southern Montana. The Benbow Mine Road section is ideal for this study because in previous studies it provides one of the best examples of correlation between carbon isotope and sequence stratigraphic framework, it is also one of the locations where the three-sequence model for the Lodgepole was first proposed, and despite appearing in multiple studies, a detailed stratigraphic analysis has not been conducted since the early 90's.

We measured and described 141 meters of exposure at Benbow Mine Road. We paired these field observations with targeted petrographic work to assign facies associations and establish the sequence stratigraphic framework. Our results are consistent with a three-sequence model for the Lodgepole Formation. With this framework established we used Spearman Rank Correlation to test for correlation between carbon isotopic trends and sequence stratigraphy. Our results demonstrate that there is no statistically significant relation, suggesting that sea level change was not the primary driver of carbon isotopic trends in the Madison shelf.

POSTER 96-57, ABSTRACT 388612, BOOTH 94

DEEP WATER PARASEQUENCES AND CARBON ISOTOPES IN THE LODGEPOLE FORMATION OF SOUTHERN MONTANA

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The Early Mississippian Lodgepole Formation records a series of carbon isotopic excursions driven by changes in sea level within the Madison shelf. These interpretations are based on the idea that carbon isotopic values rise and fall in accordance with sea level, reflecting a combination of organic carbon burial, freshwater input, and terrestrial organic carbon input. Here we examine the relationship between sea level and carbon isotopes at smaller scales of sea level change (e.g. parasequence level) from deeper water settings where we would expect the relationship to be weakest due to distance from the shoreline and mixing with the open ocean. To accomplish this goal, we addressed three research questions: 1) can we identify parasequences in deep water environments of the Madison shelf, 2) can we see systematic differences in average carbon isotopic values with depth, and 3) can we see any consistent carbon isotopic trends within parasequences? To investigate these questions, we focused on three deep water sections from southern Montana: Baker Mountain, Sappington, and Sacagawea Peak. For each section detailed sedimentological descriptions were paired with petrographic work to assign facies associations and develop a sequence stratigraphic framework. Paired carbon isotopic analyses allow us to directly tie our geochemical trends to sequence stratigraphic boundaries and therefore changes in relative sea level.

Our results suggest that sea level was not the primary control on carbon isotopic trends in deep water settings in the Madison shelf. We were able to confidently identify several parasequences in all three sections. There is evidence for consistently lower carbon isotopic values in the most proximal study location (Baker Mountain) relative to the most distal study location (Sacagawea Peak). These results are consistent with findings in modern carbonate platforms where near shore environments tend to have 2‰ lower

carbon isotopic values than distal settings. Despite this evidence that position relative to shoreline did influence carbon isotopic values, we found no evidence of consistent trends at the parasequence level.

Poster 96-58, Abstract 389277, Booth 95

UNDERSTANDING LAND USE AND CLIMATE CHANGES ON CONSERVED FARMLANDS IN NORTHEASTERN OHIO THROUGH COMMUNITY COLLABORATION

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Land use changes leave lasting impacts on the environment. The Killbuck Watershed Land Trust (KWLT) in Wooster, OH aims to conserve land and prevent development. KWLT emphasizes protecting farmland as a majority of this region's soils are considered prime by the USDA, however, they also manage prairies, wetlands, and woodlands. We examined how converting pre-settlement forests into agricultural land had consequences on the region by reconstructing past human interaction at two properties under easement with KWLT, the Biggio and Holtman properties.

We accomplished this with LiDAR mapping, field investigations, and tree ring analysis of trees from the properties. The tree ring data was compared with regional tree ring chronologies from NE Ohio and a barn sampled on the Biggio property. Our chronology shows most living trees dated to the early 1900s, whereas the barn ring-width series ends in 1840. This data also revealed a spike of growth in 1904, which is not seen in the Northeast Ohio chronology, indicating a logging event unique to the Wooster area. Also, on the Biggio property, we found evidence of a mill pond using LiDAR to identify a dam structure. The sediments are from the 1800s when early settlers primarily used mill ponds for hydropower, altering natural stream flow. These legacy sediments impounded by dams can give us clues to past land use, and the type of soil is key information for KWLT to know. The soil on the properties is prime agricultural soil and is well suited for crops, valuable to the region, and vital to conserve. KWLT preserves land because developments, buildings, logging, and land use change can disrupt the environment and surrounding climate. To investigate the climate, we correlated our tree ring chronology with records from the Ohio Agricultural & Research Development Center, with negative correlations for high summer temperatures, and positive correlations for high spring and summer precipitation. This indicates growth of these trees is limited by heat stress but benefits from wetter climate.

Through tree and sediment samples, we see effects of past human interaction with the landscape and climate of the area. Human actions and development interact with climate to generate records found in the soils and trees. It is beneficial to have organizations like KWLT to preserve land and prevent development.

Poster 96-59, Abstract 392156, Booth 96

ENHANCING ENVIRONMENTAL EDUCATION THROUGH VIRTUAL TOURS

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Virtual tours act as a means to explore diverse environments and phenomena from anywhere in the world. Particularly beneficial for individuals facing physical limitations or geographical barriers, virtual tours provide an opportunity to visit remote areas, historical sites, and other locations that may be challenging to access. They also serve as a safe and controlled environment for exploration, catering to individuals with limited mobility or those unable to undertake long-distance travel.

Beyond offering access to hard-to-reach locations, virtual tours can supplement field trips. While nothing can replace the in-person experience, virtual field trips enable those unable to attend physically to participate virtually, reducing anxiety and providing an opportunity to prepare for the trip. Such Virtual tours are already in use by the Stanford University

The project's primary focus is on creating virtual tours for

the University of Wisconsin Whitewater's (UWW's) Nature Preserve, the Whitewater Effigy Mounds Preserve, the Koshkonong Effigy Mounds, and the UWW's campus garden. UWW Nature Preserve will be promoted by demonstrating the changes the prairie undergoes, benefiting the UWW Sustainability Office. Furthermore, the virtual tour of the two effigy mound preserves will foster respect for the area and aid in its preservation. Finally, the tour of the campus garden will highlight the efforts to address food insecurities. Future work involves enhancing these tours by adding more information and tailoring them to specific classes or projects. We also plan on creating virtual tours to showcase human impacts on environmentally sensitive locations which might be inaccessible by the general population to ensure their effectiveness, feedback from users will be gathered using a Google form.

In conclusion, virtual tours offer invaluable opportunities for individuals with physical or medical limitations to participate in field trips and explore hard-to-reach locations. While nothing can fully replace the in-person experience, virtual field trips reduce anxiety, help individuals prepare for the trip, and boost confidence.

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POSTER 96-60, ABSTRACT 395516, BOOTH 97

SIMULATING CONDITIONS OF SLOPE FAILURE IN THE LAB WITH SAND AND WATER USING A MULTIMODAL MONITORING DEVICE FOR DATA COLLECTION

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Loss of life and property damage can be caused by slope failure. Slope failure is becoming increasingly common along the Great Lakes due to high wave action and increased rainfall caused by climate change. Our main goal is to understand the precursors to slope failure so we can better monitor and predict them. A few benefits of our research include raising public awareness of the dangers of slope failure and protecting communities near shorelines.

We conducted our lab experiments on unsorted sand using a multimodal monitoring device consisting of a strain gauge sensor, four moisture sensors, and eight temperature sensors. The strain gauge sensor, collecting one data point per 0.03 seconds, is run on its own Raspberry Pi platform. The moisture and temperature sensors, each collecting one data point per 10 seconds, are all run by a separate Raspberry Pi platform. We run both platforms simultaneously during our experiments.

Our setup consists of a plastic container to hold sand with a 45-55-degree sloped surface. A buried sandbag (0.05kg) attached to the strain gauge communicates strain information to the Raspberry Pi. Our experiments consist of 10-second intervals of pouring 60 cc of deionized water at the top of the slope. We let the sand settle for one-minute intervals and repeat until failure occurs.

The strain gauge data has been consistent for each test. In the first half, we get negative (push) readings before rapidly rising to positive (pull) readings. The correlation between soil moisture data and strain gauge data is inconclusive, perhaps due to the difference in data collection frequency. Our future work will involve sand layers with different grain sizes to mimic real-life scenarios as much as possible and also to better control water permeability along different layers.

Our project will ultimately lead to designing a system for collecting reliable field measurements for monitoring different triggers of slope failure and remotely transmitting the data in near-real time. This will allow continuous slope monitoring to help protect the public from the aftermaths of slope failure.

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POSTER 96-61, ABSTRACT 395115, BOOTH 98

VIRTUAL OUTCROP MODEL OF THE BLAKELEY DAM OUTCROP, BEAR, ARKANSAS: ASSESSMENT AND APPLICATIONS FOR GEOEDUCATION

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This study presents a field based lab learning module for introductory geology students using a rendered 2.5-dimensional photogrammetric virtual outcrop mode (VOM) from the Blakely Sandstone Formation in the area of Lake Ouachita State Park, Bear, Arkansas. The outcrop is a highly-deformed quartz arenite body located at the top of the Blakely Dam, approximately 40 miles northwest of Hot Springs, Arkansas. The structure of the outcrop is the result of the Ouachita Orogeny. The folds present in the outcrop generally trend to the northwest and range from primarily tight and isoclinal folds to less frequent openfolds. Fracture sets are also common within the outcrop with a notable conjugate set that correlates to a maximum stress in the now sub-horizontal direction, consistent with the nearly upright to moderately tilted folding expressed in the rocks. Field work was conducted with a DJI Mini 2 to collect 267 aerial images from different viewpoints within the outcrop vicinity. These images were optimized and modeled in Agisoft Metashape Standard. The accuracy of the 3D model was measured in CloudCompare against field data that was taken on visible joints and fractures in the outcrop using a Brunton compass. Using the Blakely Dam VOM an interactive class activity was created which focused on basic structural geology. This activity is aimed at introductory students and has them analyze geometries within the outcrop and allows students to visualize geologic concepts without requiring in-person field work. The lesson involves finding individual folds in the outcrop, labeling the components,and measuring their orientations. This workflow and ability to navigate a realistic outcrop model allows for student development in recognizing fold components and using those components to identify fold types in outcrops. Our hope is that the process of working with and analyzing a realistic VOM will allow students to gain better spatial awareness and, potentially, an increased competency in the field.

Poster 96-62, Abstract 394464, Booth 99

ARCHIVES AND OUTREACH: THE EASTERN KENTUCKY UNIVERSITY PUCHSTEIN COLLECTION

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A curated fossil collection is an extraordinary resource for a university that may be used to spark interest through outreach, education, and research for students, faculty, and the community at large. In 2019, amateur paleontologist Richard Puchstein posthumously donated an impressive collection of vertebrate and invertebrate fossils to Eastern Kentucky University. These included mostly Paleozoic marine invertebrates, assorted pieces Cenozoic vertebrates, and Mesozoic freshwater invertebrates, in addition to an assortment of Phanerozoic fossils from all over the world. Unfortunately, the collection was donated in a mostly uncurated state, requiring extensive work. While some may have been previously identified some of the data on those specimens have been lost due to improper storage. Some were misidentified, with a fair bit being undiagnosed. Fossil identification has unsurprisingly been a focus, using in house and collaborative resources to diagnose specimens to our highest degree of certainty. After identification the specimen gets an identification number on a card that has all of the definitive information we have on it (taxon, horizon, locality, and age.) This is followed by storage, both where and how must be considered as to preserve both the fossil itself and the information about the specimen. These data are recorded in both a logbook housed in the collection center and in an online database. Specimens are stored in numbered and secured cabinets in both the collections designated room and within classrooms. Certain specimens also require special housing precautions such as needing humidity control, being extreme fragile, or just due to large size. After the work has been done to preserve both the specimen and the information about it the goal then becomes visibility. There are three ways the collections serves the University by being more visible: with poster shows and an online presence it becomes known to more universities so more research could be done using these fossils, outreach programs getting K-12 students interested in paleo sciences, and by using the specimens as teaching aids in the classroom at Eastern Kentucky University.

Poster 96-63, Abstract 393262, Booth 342

GEOCHEMISTRY AND MAGNETIC SUSCEPTIBILITY OF UPPER DEVONIAN CATSKILL FORMATION PALEOSOLS, NORTH-CENTRAL PENNSYLVANIA

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The Catskill Formation redbeds in the northern Appalachian foreland basin (north-central Pennsylvania) record Late Devonian (Famennian) terrestrial paleoclimate. Major element geochemical data from Catskill Formation paleosols preserve evidence of moderate silicate weathering (chemical index of alteration values 63-79), with an up-section increase that perhaps reflects enhanced Upper Famennian seasonality related to the onset of end-Devonian glaciation in the subtropics. To test whether this trend is consistent with a temporal shift to more humid climate conditions overall, or instead, an intensification of seasonality in the Upper Devonian, X-Ray Fluorescence (XRF) geochemical data and magnetic susceptibility (MS) data were acquired on two ~15-20 m-thick mudstone-paleosol intervals from core (Lackawanna County, Pennsylvania). Both datasets were measured at a 20-cm sampling interval with handheld XRF and MS instruments. Preliminary results show a correlation between XRF and MS records. These new data, together with companion detailed (cm-scale) stratigraphy, allow for a high-resolution evaluation of variation in the chemical weathering signal related to climatic change during the uppermost Famennian. Further analysis is necessary (1) to evaluate whether increased seasonality is consistent with pre-to-early mountain glaciation in the Appalachian hinterland, and (2) to assess the influence of geodynamic effects on the chemical weathering signal, especially given the tectonically dynamic and orogen-proximal setting of the Appalachian Basin during this time.

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