The Compass: Earth Science Journal of Sigma Gamma Epsilon

Volume 88 | Issue 3 Article 1

11-17-2016

Sigma Gamma Epsilon Student Research Poster Session, Geological Society of America Meeting 2016, Denver, Colorado, USA

Paula Even
University of Northern Iowa, even@sigmagammaepsilon.com

SIGMA GAMMA EPSILON STUDENT RESEARCH POSTER SESSION, GEOLOGICAL SOCIETY OF AMERICA MEETING 2016, Denver, Colorado, USA

Paula Even
Department of Earth Science University of Northern Iowa
Cedar Falls, IA 50614 USA
even@sigmagammaepsilon.com

ABSTRACT

The 2016 Sigma Gamma Epsilon Undergraduate Research (Poster Session) took place during the 2016, Geological Society of America annual meeting in Denver, Colorado on Tuesday, 27 September 2016: 9:00 AM-6:30 PM. The National Council of Sigma Gamma Epsilon awarded the Austin A. Sartin Best Poster Award to Alexa Harrison and Nicholas Schrecongost from Radford University. Jessica Robinson and Allison D. Jones, students at University of Pacific, were awarded the National Council's Best Poster Award.

KEY WORDS: Austin A. Sartin award, Sigma Gamma Epsilon National Counsel's best poster award

2016 Austin A. Sartin Best Poster Award

The recipients of the 2016 Austin A. Sartin Best Poster Award are Alexa Harrison and Nicholas Schrecongost. Both are students are members of the Epsilon Eta Chapter at Radford University in Radford, VA. SGE President Aaron Johnson presented the award to Alexa

Harrison. Their research poster was titled *Eruptive Sequence and Processes in a Neoproterozoic Intracontinental Rift: The Mount Rogers Formation, SW VA.*

Abstract. Convergence of supercontinents, and their subsequent rifting and breakup, is a major theme in the theory of plate tectonics. Two end-member models for rifted margins have been proposed: the active rift model, in which a rising plume of magma causes tension and rifting in the overlying crust, vs. the passive model in which stretching in the crust is caused by far-field stresses related to plate movements. In ancient rifts, the relative timing, sequence, and style of volcanic eruptions can help discriminate between these models. The supercontinent of Rodinia was assembled between 1.3-1.0 Ga. The eastern Laurentian margin of Rodinia began to extend at ca. 760-780 Ma, but did not completely break up until ca. 550 Ma, with the opening of the Iapetus ocean. In SW Virginia, the Neoproterozoic Mount Rogers Formation (MRF) records the eruption of bimodal volcanics during early stages of rifting, ~760-750 Ma. Geochemical analyses of basalts and rhyolites from the MRF show a plume 'geochemical signature' for the magmas, suggesting that the active rift model may be applicable. It is important to determine if the eruptive sequence and field relationships are consistent with this model.

Along with clastic sedimentary rocks and basalt, the MRF includes several rhyolite members: the Fees, Buzzard Rock, Whitetop, and Wilburn Rhyolites (Rankin, 1993). Each of these is distinguished by its phenocryst assemblage and distinctive textures that indicate emplacement by either lava flows or pyroclastic processes. Previous mapping by our research group has recognized an additional rhyolite body, informally named the Bearpen rhyolite. Based on field mapping, the Bearpen locally appears to occur stratigraphically between the Fees Rhyolite in the lower MRF and the Whitetop Rhyolite in the upper MRF, and is distinguished by clusters of reddish alkali feldspar phenocrysts, flow banding, and presence of fiamme. However, its U-Pb zircon age date of 756 Ma +/- 3.1 Ma overlaps with ages of the other rhyolite members (as reported by Tollo et al., 2012), except for the younger Wilburn Rhyolite. This study describes the petrographic and microscopic characteristics of the Bearpen, in order to understand its formation processes and place in the eruptive sequence.

2016 National Council Best Poster Award

Recipient of the National Council Best Poster Award were Jessica Robinson and Allison D. Jones. Sigma Gamma Epsilon President Aaron Johnson presented Jessica Robinson with the award. Both are students are members of Eta Upsilon Chapter at University of Pacific, Stockton, CA. Their poster was titled *Preliminary Outcrop-scale RF/PHI Petrofabric Analysis of Conglomerate from the Jurassic Tuttle Lake Formation: Mount Tallac Roof Pendant, El Dorado, County, CA.*

Abstract. A preliminary 3D Rf/phi analysis of outcrop-scale petrofabrics in near-orthogonal exposures of conglomerate reveals a heterogeneous pattern of penetrative strain within the southernmost Mt Tallac roof pendant. Our analysis was conducted in outcrops of the Jurassic Tuttle Lake Formation near Grass Lake in the Desolation Wilderness Area of Eldorado National Forest. The Tuttle Lake Fm contains a thick sequence of weakly metamorphosed volcaniclastic deposits cut by four sets of intermediate dikes, the Jurassic Keith's Dome granodiorite pluton, and an array of predominantly sinistral ductile shear zones and brittle faults. Observations of shapes and orientations of clasts in the Tuttle Lake Fm led to the hypothesis was the unit was deformed by the intrusion of the Keith's Dome pluton. To test this hypothesis, we examined petrofabrics at nine locations along a N-S transect between Grass Lake and the Keith's Dome pluton. Four near-orthogonal faces containing clasts with discernable boundaries were selected at each location. Outlines of at least 60 clast boundaries (color coded by clast composition) were traced onto clear plastic overlays. Photo-registration marks, location information, and the strike and dip of each face were also recorded onto overlays. Photographs of overlays were adjusted, rectified, and reoriented in Adobe Photoshop. The EllispeFit computer program (Vollmer, 2015) was used to conduct Rf/phi analysis of the clasts in each tracing and to compile fabric ellipsoids at each location. Our results reveal a range of fabric magnitudes and shapes (weakly oblate to moderately prolate, E 0.15 to 0.81, Nu -0.31 to 0.47). When bedding is restored to horizontal, oblate fabrics appear to be consistent with vertical flattening associated with deposition and compaction. Prolate fabrics record higher strains and subhorizontal long (X) axes that generally trend NE-SW. However, these X axes orientations correlate poorly with each other and with trends of dikes, shear zones, and faults in the Grass Lake area. Given fabrics measured in other Sierran Jurassic roof pendants, it is interesting that the Tuttle Lake Fm has not accumulated a more pervasive penetrative strain. Further study is needed to determine the cause of the fabric heterogeneities and their context in the regional host rock geology.

Posters Presented at the 2016 Sigma Gamma Epsilon Poster Session

EFFECTS OF RAINFALL ON COMMUNITY COMPOSITION AND STRUCTURE OF CEDAR GLADES

SALONGA, Kirsten, Department of Ecology & Evolutionary Biology, University of Tennessee, Knoxville, TN 37996 and DEAL, Daniel, Department of Science Education, Central Washington University, Ellensburg, WA 98926, ksalonga@vols.utk.edu

Cedar glades are treeless ecosystems with shallow soil or exposed limestone and are a hotspot of plant endemism in the Southeast United States, predominantly in middle Tennessee. Soil depth is a major factor which influences glade vegetation, and annual rainfall and temperature have increased over time and are predicted to continue. This increase in rainfall has

occurred due to the "heat island" effect of Nashville. With an increase in water, we predicted that the number of species, plant growth, and reproduction will increase due to self-thinning and additional water supplies. We studied the effects of rainfall on community composition and structure of the Flat Rocks State Natural Area. Four treatments of varying water regimes were established and examined for differences in number of species, coverage, and flowers in plots with diameters of 50 centimeter. Data were analyzed by RMANOVA, and results showed that there was little variation among treatments, with the number of species and amount of coverage remaining constant. Results may be due to the inability of constructed shelters to restrict rainfall during some storms due to high amounts of surface flow.

CONSTRAINING A CHRONOSEQUENCE OF FLUVIAL TERRACES USING SOIL PROFILE ANALYSIS AND GIS MAPPING IN THE SANTA ROSALIA BASIN, BCS, MéXICO.

HARTKE, Samantha[1], PUGH, Andrew[2], CAMACHO, Daniel[3], ANTINAO, José Luis[4] and MARTINEZ GUTIERREZ, Genaro[3], (1)Department of Geosciences, University of Texas at Dallas, 800 W. Campbell Road, MC17, Richardson, TX 75080, (2)Mackay School of Earth Sciences and Engineering, University of Nevada, Reno, 1664 N. Virginia Street, Reno, NV 89557, (3)Earth Sciences, Universidad Autonoma de Baja California Sur, Carretera al sur km 5.5, La Paz, 23080, Mexico, (4)Division of Earth and Ecosystems Sciences, Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512, samantha.hartke@utdallas.edu

On the eastern coast of the Baja California Peninsula, marine terraces are incised by numerous arroyos, along which fluvial terraces have developed. Through the NSF-funded Baja Basins REU, fluvial terraces in Arroyo Santa Agueda and Arroyo Boleo of the Santa Rosalia region were mapped and analyzed to better understand regional tectonic geomorphology related to the Pleistocene evolution of the Santa Rosalia Basin. A soil chronosequence in these fluvial terraces will be used to understand this evolution. South of this basin, in Mulege and Bahia Coyote, previous work focused on marine terrace development, but not inland fluvial terraces. During the initial phase of study, fluvial terraces were mapped using GIS in the field while soil horizons of terraces lining each arroyo were observed, described, and sampled. Soil horizon compositions will be determined by grain size analysis, XRD, and thin section microscopy. Soil development indexes will be assigned to soil profiles characterized in the field following the method outlined by Harden (1982) on the basis of various soil properties. GIS analysis of relative soil development on terraces of varying elevations and locations will allow interpretation of regional tectonics during terrace formation. We expect to see varying levels of fluvial terrace soil development in Arroyos Santa Agueda and Boleo despite corresponding elevations. Relative rates of terrace uplift compared with terrace development will allow interpretation of differences in tectonic activity in the two catchments which limit the Santa Rosalia basin to the south and north, respectively. The constraints provided by this analysis will generate new insights into development of the Santa Rosalia basin. When combined with absolute geochronology, this will be the first fluvial terrace chronosequence developed for central Baja California, a powerful tool for regional paleoclimate and geochronology studies in the future.

HISTORIC LAND USE DISTURBANCES RECORDED IN SOIL PROFILES ALONG A SLOPE IN THE SOUTHERN APPALACHIANS, WESTERN NORTH CAROLINA

EARLE, Stephanie, VASCIK, Bryce, WALTON, Quentin, LORD, Mark and KINNER, David, Geosciences and Natural Resources, Western Carolina University, Cullowhee, NC 28723, saearle1@catamount.wcu.edu

Throughout the southern Appalachians, anthropogenic land disturbances in the late 1800s through much of the 1900s caused extensive soil erosion. Landscape and soil recovery rates from these past disturbances influence vegetation, water pathways, and water quality today. The purposes of this study were to determine the relation of soil physical and hydrologic properties to slope position, and to historic land covers and uses. A specific goal of the study was to determine the basic physical traits of soil profiles, including any evidence of soil truncation by erosion. The study area, the Gribble Gap catchment (0.4 km^2), is located in the headwaters of the Little Tennessee River watershed in the mountains of western North Carolina. Soil parent materials are saprolite developed from biotite-amphibole gneiss and colluvium. Logging and conversion of woodlands to pasture in the early 1900s led to extensive soil erosion through the mid-1900s; this land use history is common across the region. Five soil profile sites were examined on a transect perpendicular to a slope from a ridgeline to the valley floor, and an additional site was downstream on a fan surface. Soil horizons were defined in the field, including depth to saprolite where present. Samples were analyzed for color, percent of clay-silt-sand-gravel, and organic carbon content. Soil moisture sensors were installed at each slope transect site at depths of 15, 35, and 75 cm. At five sites, saprolite was found at depths of 75 to 185 cm. At the sixth site, on the valley floor abutting the slope and 1.6 m from a small creek, gleyed soils from 90 to 115 cm deep sit on coarse gravel, likely an old creek bottom. Soil profiles, especially on the upper slope, show evidence of truncation as indicated by a thin A horizon and a shallow, reddish, clay-rich B horizon. The valley-floor soil profile, however, is younger and appears to have a paleosol at 80 cm depth as indicated by a strong brown color (7.5YR 4/6) and high carbon content. We interpret most of the upper slope to be truncated by historic soil erosion and the valley floor profile to be a site of rapid deposition by products of soil erosion. Soil moisture data will be used to examine soil properties and make inferences about hydrologic pathways and groundwater recharge potential.

TESTING THE YOUNGER DRYAS IMPACT HYPOTHESIS USING ELEMENTAL AND MAGNETIC SPHERULE ANALYSIS OF 12.9KA LAKE SEDIMENT FROM LAGUNA CHAPALA, BC, MEXICO

THOMAS, Kaylee A., Department of Geosciences, University of Missouri at Kansas City, Kansas City, MO 64110 and MUROWCHICK, James B., Geosciences, University of Missouri - Kansas City, 5100 Rockhill Road, Room 420 Flarsheim Hall, Kansas City, MO 64110, katr56@mail.umkc.edu

Lacustrine sediments deposited in Laguna Seca Chapala, located in central Baja California, Mexico, span the Younger Dryas stadial. The Younger Dryas was an abrupt change in climate that occurred approximately 12.9 ka and is hypothesized to have been triggered by a cometary airburst or impact. Evidence of the impact has been found by others at nearly 40 localities in North America. In North America, the YDB is coincident with the extinction of more than 40 species of megafauna and the demise of the Clovis paleoIndian culture. This

research examines the elemental composition and magnetic fraction of the lacustrine sediments for indicators of an impact fallout horizon in the sedimentary sequence. We collected 49 samples (spanning 2 cm each) across two distinct grain-size boundaries that were bracketed by optically stimulated luminescence (OSL) and radiocarbon dating reported by Davis (2003) to be between 15 ka and 8 ka. X-ray diffraction analysis shows the sediment contains dominantly quartz, sodic plagioclase, a small amount of microcline, and minor calcite. The samples were homogenized and leached using double-distilled nitric acid and microwave digestion.. After digestion, the leachates were diluted with 18MΩ water and analyzed by ICPMS for Ir, Fe, Ni, Co, Mn and Ti. Results show that the samples have high concentrations of Fe, likely due to detrital magnetite. All samples contained <0.1ppb of Ir with no apparent spikes in concentration. Mn, Co, and Ni do show spikes in concentration at two sample intervals (162-164 and 174-176cm below the base of the overlying modern dune sands). The cause of those spikes is not known, but they do not appear to be related to a possible fallout layer. Both of the spikes fall above a layer dated at 12.79±0.78ka by OSL dating. Results indicate that Laguna Chapala sediments do not preserve evidence of meteoric impact.

ENVIRONMENTAL BASELINE STUDY FOR MANAGED SEDIMENT RELEASE FROM THE LOWER RESERVOIR, ONEONTA CREEK, ONEONTA, NY

RICHARD, Emilie M.[1], PLATT, Andrew S.[2] and BRUNSTAD, Keith A.[1], (1)Earth & Atmospheric Sciences, SUNY Oneonta, 108 Ravine Pkwy, Oneonta, NY 13820, (2)Earth & Atmospheric Sciences, SUNY Oneonta, 108 Ravine Pkwy., Oneonta, NY 13820, emiliemichelle5@gmail.com

The Lower Reservoir in Oneonta, NY is one of the city's main sources of drinking water. Storage capacity of the reservoir has decreased significantly over the years due to the increasing sediment infill behind the dam. The city management is considering flushing sediment downstream to restore the storage capacity of the reservoir. Limited research has been done to assess the impact of dam removal or reservoir flushing on downstream ecosystems and water quality. The goals of this study are to generate a comprehensive baseline data set for the conditions of the stream prior to sediment release, and predict the potential impacts associated with this practice. Sedimentology, geomorphology, water chemistry, and biology of the stream were analyzed at sample sites above and below the reservoir using standard methods. Water chemistry and stream biology were assessed every 2-3 weeks to count for seasonal variations. Pebble counts reaffirmed that the streambed and bar deposits contain primarily small boulders to fine gravels. During dry conditions, there is little to no aggradation of sediments. After heavy rain or snowmelt, discharge is so high that any accumulated fine sediments are carried out to the Susquehanna River. Electrical conductivity and total suspended solid concentrations increase downstream during both low and high flow conditions, which is likely attributed to the increased anthropogenic influences downstream and input from drainage ditch runoff. Nitrate concentration is 0.26 mg/L in the reservoir, drops to zero directly below the dam, then increases to 0.64 mg/L farther downstream. The pH remains consistently around 6.40 at all sites. Preliminary analysis of aquatic insect taxa data suggests greater species richness above the reservoir with 7 orders and 28 different families identified, and only 5 orders and 18 families downstream. The decreased stream flow below the reservoir and the increased anthropogenic influence at downstream sites potentially cause this trend. The Lower Reservoir represents a common problem of many small reservoirs around the country. Abruptly flushing large amounts

of sediment accumulated behind the dams could cause an unexpected response of the river ecosystem. Thus, long-term studies are needed to understand the potential consequences of this reservoir management practice.

FAULT-ASSOCIATED DOLOMITIZATION IN THE ONONDAGA LIMESTONE IN CENTRAL AND WESTERN NEW YORK

KITA, Andrew R., KREPPEL, Elizabeth, WILLIAMS, Lydia R. and NOLL, Mark R., Department of the Earth Sciences, SUNY College at Brockport, 350 New Campus Dr, Brockport, NY 14420, akita1@brockport.edu

One process for the formation of dolomite is the alteration of primary calcium carbonates with Mg-rich fluids. Several studies (eg. Nurkhanuly et al. 2014) have found significant dolomitization of limestones along faults. Fault networks control the flow of hydrothermal fluids, therefore, the distribution and extent of dolomitization may be highly variable. Recent studies in central and western New York State have identified networks of fault zones. One of the more prominent fault zones that has long been identified is the Clarendon-Linden Fault which runs approximately N-S through Batavia, NY. A total of 26 samples from 11 different quarries running along a E-W transect that roughly parallels I-90 were analyzed for molar ratios of Ca and Mg by ICP-AES. Most samples are not in close proximity to fault zones. These samples show molar Mg percentages ranging from 1.97% to 2.86%, indicating low-Mg calcite. Those more closely associated with faults, in particular the Clarendon-Linden fault show molar Mg percentages of approximately 37%. While this is not pure dolomite, it indicates a significant degree of alteration of the native limestone. The significance of the alterations associated with the Clarendon-Linden fault zone is not known at this time.

MINERALOGICAL EVIDENCE OF AN EPITHERMAL EXHALATIVE ORIGIN OF THE BOLEO CU-ZN-MN-CO MANTOS, SANTA ROSALIA, BAJA CALIFORNIA SUR, MEXICO

DUVAL, Charles L., Geology and Environmental Geosciences, Northern Illinois University, Dekalb, IL 60115, SUAREZ, Stephanie Elaine, Geological Sciences, University of Texas at Austin, Jackson School of Geosciences, Austin, TX 78712 and MUROWCHICK, James B., Geosciences, University of Missouri - Kansas City, 5100 Rockhill Road, Room 420 Flarsheim Hall, Kansas City, MO 64110, cduval@niu.edu

The Boleo Cu-Zn-Mn-Co manto deposits near Santa Rosalia, Baja California Sur, Mexico, are hosted in a series of Pliocene conglomerates, altered tuffs, limestones, and evaporates in the Santa Rosalia Basin. The mantos formed above coarse conglomerates at the bottom of the overlying tuffaceous sandstones of the Boleo Formation, with five main mantos and at least eight mineralized beds in detail. The ores have been mined since the mid-19th century, and advances in extractive solution chemistry have resulted in the current major mining activity in the district. Two models of formation of the manto mineralization have been presented. Wilson and Rocha (1955) concluded that hydrothermal fluid rose along faults from the underlying Comondu volcanics into the overlying Boleo Formation. The fluids spread laterally along conglomerate beds, trapped beneath the less permeable tuffaceous sandstones, and deposited the ore mineralization. A more recent model proposed by Conly *et al.* (2006, 2011) calls on venting of hydrothermal fluids at the surface with accompanying deposition of the ore

minerals both as chemical sediments and as cements and replacements of underlying sediments by infiltrating fluids in fluvial to near-shore marine environments. Our investigation of two of the mantos provides evidence supporting Conly's exhalative model. Detailed examination of Manto 1 reveals sedimentary features such as syneresis cracks, small ripples in laminated siltstones, and evidence of a highly oxidized evaporitic depositional environment (hematitic halite-bearing siltstone). In Manto 2, below Manto 1, we found sedimentary laminations, and deposits of laminated tufa with ore mineralization. In the rhythmically banded gypsum beds at the eastern edge of the district, several thin heavy mineral lag deposits of Cu-Co-Fe-Zn sulfides (possibly villimaninite and an unidentified Co-rich sulfide with Cu and Fe) were found during SEM/EDS examination. Based on the findings of the current investigation and those of previous studies, we conclude that an epithermal exhalative process is a better model for the formation of the manto mineralization than the dominantly subsurface lateral flow of fluids.

EVALUATING THE IMPORTANCE OF REGOLITH HETEROGENEITY ON CATCHMENT HYDROLOGY IN GARNER RUN, SUSQUEHANNA SHALE HILLS CRITICAL ZONE OBSERVATORY, PENNSYLVANIA, USA

SILVERHART, Perri H.[1], ZHI, Wei[2], XIAO, Dacheng[2], DEL VECCHIO, Joanmarie[3], DIBIASE, Roman A.[4] and LI, Li[2], (1)Geology Department, Middlebury College, Middlebury, VT 05753, (2)John and Willie Leone Family Department of Energy and Mineral Engineering, The Pennsylvania State University, University Park, PA 16802, (3)Department of Geosciences, Pennsylvania State University, University Park, PA 16802, (4)Department of Geosciences, Pennsylvania State University, University Park, PA 16802; Earth and Environmental Systems Institute, Pennsylvania State University, University Park, PA 16802, psilverhart@middlebury.edu

Soil hydrologic properties determine how water, solutes, and sediment move through the near surface environment and serve as important input parameters for watershed-scale hydrologic models. While robust methods exist for characterizing the hydrologic properties of homogeneous, fine-grained soils, it is less clear how to incorporate rocky soils into critical zone models. Here we analyze the influence of regolith heterogeneity on catchment hydrology in Garner Run, a sandstone subcatchment of Shavers Creek in the Susquehanna Shale Hills Critical Zone Observatory, Pennsylvania. As a result of Pleistocene periglacial modification, Garner Run exhibits a strong heterogeneity in surface cover ranging from clay-rich soils to unvegetated boulder fields, which is not well captured by existing soil maps. Using a combination of new high-resolution maps of surface cover, field measurements of hydrologic properties, and preliminary model runs using the Penn State Integrated Hydrologic Modeling System (PIHM), we evaluate model sensitivity to spatial heterogeneity in regolith cover characteristics of sandstone landscapes in central Pennsylvania. Our results have implications for the interpretation of local measurements of soil moisture in such landscapes, and for the application of large scale soil maps in hydrologic models of upland landscapes.

USING INDUSTRY SEISMIC DATA TO MAP THE DISTRIBUTION OF DEEP-SEATED FAULTS AND EVALUATE WHETHER THEY AFFECT HOLOCENE STRATA OF THE LAKE PONTCHARTRAIN BASIN, LOUISIANA

CLARK, Shara L.[1], FRANK, Joseph P.[1] and KULP, Mark A.[2], (1)Department of Earth and Environmental Sciences, University of New Orleans, 2000 Lakeshore Dr., University of New Orleans, New Orleans, LA 70148, (2)Department of Earth & Environmental Sciences, University of New Orleans, 2000 Lakeshore Drive, New Orleans, LA 70148, sgremill@uno.edu

Coastal land loss stemming from relative sea level rise (RSLR) is the most significant environmental topic currently faced by southern Louisiana, and understanding the mechanisms driving RSLR is fundamental to adapting effective, land loss mitigation efforts. For this reason, an array of investigations into the processes responsible for coastal land loss and RSLR have been conducted, yielding two distinct views. One position asserts that Holocene sediment compaction is the primary process driving land-surface subsidence, whereas another position contends that fault motion along deep-seated faults is a primary driving force. This study focuses on whether deep-seated Cenozoic faults extend up section to faults that are known to offset Pleistocene and Holocene strata within the Lake Pontchartrain Basin. Recently donated industry 2-D seismic data within Lake Pontchartrain provides an unique opportunity to map the distribution of deep-seated faults and determine if they are linked to well-known near surface faults that have been mapped previously with shallow, high-resolution seismic data. Work by Roth (1999), identified five, typically down-to-the-south Pleistocene faults within Lake Pontchartrain and provides a baseline of near surface fault distribution. To date this project has identified 20 faults at depths of several thousand meters and several of these deep-seated faults project upward to areas where Roth (1999) identified Pleistocene and Holocene fault offset. The significance of this project is the opportunity to use industry seismic data and evaluate the role of long-term geologic processes, such as faulting, in modern-day land loss of southern Louisiana.

DOES BIOCHAR IMPROVE DISTURBED, SANDY SOILS?

FAST, Kathleen M. and BODENBENDER, Brian E., Geological and Environmental Sciences, Hope College, 35 E 12th St, Holland, MI 49423, kathleen.fast@hope.edu

We studied whether adding biochar to sandy, carbon-poor soil impacts plant growth. Biochar is an organic compound composed mainly of black carbon and made by pyrolysis of organic matter. Biochar is of interest as a possible soil amendment to alleviate stresses on agricultural production due to its high water and nutrient retention capabilities, high cation exchange capacity, high porosity that increases mycorrhizal growth, and ability to sequester carbon dioxide. We examined the growth of three different plant types, *Avena sativa* (common oat), *Vigna radiata* (mung bean), and *Raphanus sativus* (cherry belle radish), in greenhouse and garden plot experiments. In the greenhouse we used five different treatments of soil from a demolition site: soil alone and soil mixed with 2%, 5%, 10%, and 20% biochar by mass. All biochar was washed to remove ash and inoculated with compost tea before mixing. Four replicates of each species were planted in individual pots of each of the five soil types for a total of 60 plants. Plants were grown for 5 weeks and watered every other day. At the end of the growth period, *A. sativa* and *V. radiata* plants were cut off at the soil surface and entire *R. sativus* plants were removed from soil, then dried in a plant press before weighing. All 60 replicates produced plants, with no statistically significant differences in oat and mung bean above ground

biomass or radish whole mass for any treatment. In the garden experiment at a grassed-over former building site, we planted 10 seeds of each plant in each of 5 plots: soil only, 3% compost by mass, 3% biochar by mass, and 3% and 5% biochar inoculated with compost tea. Oats had 100% germination in all plots, while radishes yielded 8, 7, 5, 9, and 7 plants respectively. For mung bean the control and compost plots yielded only 2 and 4 plants while the biochar treatments yielded 7, 3, and 9 plants. Whereas all soil treatments grew plants under controlled greenhouse conditions, the garden experiment, which is ongoing, suggests that under more natural conditions biochar may influence germination and survival.

FOLDING AS A POSSIBLE INDICATOR OF SUBSURFACE PALEOZOIC FAULTING, CENTRAL TENNESSEE

HAN, Amber, Department of Geological Sciences, California State University, Fullerton, CA 92831 and FLORES, Jonathan, Department of Geosciences, Middle Tennessee State University, Murfreesboro, TN 37132, JonathanFlores3000@gmail.com

The investigators searched for a subsurface fault in central Tennessee by searching for macroscale fault propagation folds and fault-related fractures. They georeferenced existing 7.5' geologic quadrangle maps, digitized the contact between the Ordovician Ridley limestone and the overlying Ordovician Lebanon limestone, and extracted the elevation of the contact at approx. 12,600 points from the National Elevation Dataset (NED). The investigators found a syncline involving 35 m of structural relief and having a length of approx. 16.3 km. They interpreted this syncline as a fold formed during the upward propagation of a north-side-down fault striking 283˚. Sub-vertical and moderately-dipping joints parallel the fault south of Murfreesboro, TN along Highway 231.

ROCK WEATHERING OBSERVED IN OUTCROPS AND IN BEDROCK EXPOSED BY DEBRIS FLOWS: A PRELIMINARY INVESTIGATION OF GRANODIORITE WEATHERING IN A LANDSCAPE CONTEXT

ROSS, Sean L., Red Rocks Community College, Lakewood, CO 80228 and ANDERSON, Suzanne P., Department of Geography and INSTAAR, University of Colorado, UCB-450, Boulder, CO 80309, scross2@student.cccs.edu

Weathering of bedrock is a central facet of landscape development, yet surprisingly little is known about processes or their rates. Rock weathering is a precursor to mobile regolith formation, and hence sets the stage for sediment production, and therefore controls the pace of landscape evolution. We explore rock weathering in Boulder Canyon in the Colorado Front Range, where hillslopes comprise both bedrock outcrops and thin mobile regolith cover. The canyon results from upstream propagation of a knickzone from the contact between the Boulder Creek batholith and Mesozoic sedimentary rocks at the range front. Rock weathering is expected to increase with time that rock has been exposed at the surface, and to be promoted by burial under thin soil cover. We therefore made measurements at sites in Boulder Canyon to test differing surface exposure ages and covered versus uncovered conditions. We chose outcrops in the canyon from the mouth to the top of the knickzone to look for the effect of surface exposure age; we hypothesize that degree of weathering will increase with distance from the knickzone. To study the effect of soil cover, we examined bedrock exposed by debris flows on steep (>25°) slopes during the September 2013 Front Range storm. Based on models of soil production rate,

we expect greater weathering in rock that has been covered by mobile regolith, such as rock exposed by debris flows. At each sample site, we used a Proceq SilverSchmidt hammer to test rock strength, measuring rock rebound values along 5-20 m long transects. We also counted the number of fractures crossing each transect. At selected sites, we collected samples for XRD mineralogical analysis. In the survey of outcrops in the canyon, we found a slight decrease in rock strength with distance from the knickzone. This accords with rock weathering increasing with time since the passage of the knickzone. In the rock exposed by debris flows, however, we found that rock strength was often greatest in the thalweg of the debris flow channel. We observed decreasing rock strength from debris flow mouth to its initiation point. These observations suggest that debris flows scour their flowpaths, removing weakened rock where the flux of sediment is greatest, thus confounding our expectation of using the debris flow exposures to study rock weathering under regolith cover.

DENUDATION RATE ANALYSIS OF HOLOCENE CARBONATES FROM ELEUTHERA, BAHAMAS

JORDAN, Miranda M., Geology, Sam Houston State University, 1905 University Ave, Huntsville, TX 77340 and SUMRALL, Jeanne Lambert, Geology, Blinn College, 902 College Avenue, Brenham, TX 77833, MMJ021@SHSU.EDU

Denudation rates were calculated for three eolian dunes on Eleuthera, Bahamas through field measurements and lab analysis. One set of samples were gathered from North Twin Coves dune on the Eastern side of the island, and two sets of samples were gathered from two separate dunes located on the Southernmost tip of Eleuthera, collectively known as South Point and South Point Dune. One portion of the set of samples were chiseled above a truncation surface, and the second portion of the set of samples were chiseled from below the truncation surface. Five portions of the above gathered samples were carbon dated; the age of the oldest dune was 7,004 years old and the youngest portion of the youngest dune was 4,581 years old. It was determined that all three dunes fall within the Holocene, with a gap of 2,400 years. The carbon dates were then compared with field measurements to determine the rate of active denudation on the dunes present on Eleuthera. South Point Dune was utilized for this calculation due to the active denudation surface observed in the field. The calculated denudation rate for South Point Dune was found to be 76 centimeters every thousand years. Portions of the samples were then analyzed for pore space, grain size, grain shapes, and dominant allochems to determine if there were any biological differences. Lastly, using field measurements, it was determined that the dominant paleo-wind direction matches the Easterly Trade Winds present today. This data, along with all other observed and calculated data collected in this study, will expand research into how paleoclimate altered the carbonate topography within The Bahamas.

WINTER CHLORIDE BEHAVIOR IN OHIO RIVERS AND THE INFLUENCE OF LAND USE AND CLIMATE

SHAFFER, Leighane N.[1], ALEXANDER, Riley M.[1], HELTERBRANDT, Faith L.[1] and FORTNER, Sarah K.[2], (1)Environmental Science, Wittenberg University, Springfield, OH 45501, (2)Geology, Wittenberg University, Springfield, OH 45501, shafferl@wittenberg.edu

Studies suggest that an increase in salinity of a waterway can harm the habitat and the organisms living in that habitat. Chloride concentrations at or above 250 mg/L are toxic to

organisms. Sources of chloride to watersheds include fertilizer, sewage, and road salt. Chloride levels in urban areas are increasing, especially during the winter months. This study compares the average chloride concentration over a week in February of 2016 of the Mad River, in Springfield, Ohio, to the average chloride concentration for the winter of 2015 of the Scioto River, Muskingum River, Honey Creek, and the Great Miami River using 8 hour sampling data from the National Center for Water Quality Research at Heidelberg University, in Tiffin, Ohio. Mad River samples were collected from February 23, 2016 to March 2, 2016. The February 2016 samples from the Mad River contained less average chloride (25.3 mg/L) than all other samples in spite of having the most urban land use (9.0%). The Scioto, which has a 4.6% urban land use, had the highest average winter chloride concentration of 111.1 mg/L. There was no general relation between watershed specific discharge and chloride yield. The study was further expanded to include the analysis of chloride concentration and flow over a longer period (1996-2015). Flow generally increases through time for all sites. Honey Creek and the Great Miami River exhibit a larger increase in specific discharge over time. There is a general increase in chloride concentration over time for the Scioto River, but no trend for other sites. Chloride yields exhibited a slight decrease through time. Fewer snow events may have led to a decrease in road salt applications and associated runoff. This work suggests that while land use largely explains differences between comparisons made over the same time period, variation between years may reflect changing deliveries associated with climate conditions. Excess chloride can harm habitats and contaminate the ground water supply that humans depend on, and therefore more work should evaluate the interplay between land use, climate, and chloride response.

DUCTILE FABRIC ANOMALIES CONCERNING THE ALLEGED ALEXANDER CITY FAULT IN THE EASTERN BLUE RIDGE OF CENTRAL ALABAMA

BARKLEY, Morgan N. and HAWKINS, John F., Department of Geosciences, Auburn University, 210 Petrie Hall, Auburn, AL 36849, mnb0017@auburn.edu

The Alexander City Fault (ACF) is traditionally defined as a brittle-ductile strike slip fault propagating through the Eastern Blue Ridge (EBR), and serving as the contact between the Elkahatchee Quartz Diorite (EQD) and the Wedowee Group (WG). The trajectory and characteristics of this fault tends to become more enigmatic as it approaches the Alabama Coastal Plain. Detailed field mapping of a transect perpendicular to the contact of the EQD and WG in the Elkahatchee Creek, south of Alexander City, Alabama confirms this to be an intrusive contact rather than a fault emplacement. Shear fabric data (S and C) gathered along this transect from the EQD and WG have calculated slip lines that produce populations with concentrations at N33E, 11˚ and S27W, 05˚. These population's local maxima aligns with S and C fabric data previously reported for ductile portions of the ACF. Interestingly, this trend aligns with S and C slip line data collected in the adjacent Our Town quadrangle lithologies, the Wedowee and Emuckfaw Groups and the Kowaliga Gneiss. These data locations are not interpreted to have been influenced by movement of the ACF and the S and C data are contributed to other regional shearing events. This proves to be an interesting correlation. With the contact being intrusive and slip line data showing strong correlations to other regional slip line populations that are not fault related, where does this leave the ACF? Data suggests that the ACF does not cross this study area as a ductile fault. Local S and C fabrics seen in the EQD and WG are not produced by ductile movement along the ACF, but rather other regional shearing events are responsible; however, this does not rule out a narrow brittle ACF propagating through this transect. Ongoing

detailed field mapping along the ductile sections of the ACF will help to explain the interesting correlation between previously reported slip line data attributed to the ACF with other regional slip line data currently not connected with the ACF.

PHOSPHOROUS AND SEDIMENT FLUX ANALYSIS IN AQUIA CREEK A SUB-WATERSHED OF THE CHESAPEAKE BAY BASIN, VIRGINIA, USA

COXON, Taylor M., HOLLBERG, Coalter, ODHIAMBO, Ben K. and SOMERS, Hannah, Earth and Environmental Sciences, University of Mary Washington, 1301 College Avenue, Fredericksburg, VA 22401, tcoxon@mail.umw.edu

Aquatic systems are negatively affected by excess input of phosphorus bound to sediments generated by surficial and in-channel erosion and the release of P from wetland and floodplain soils. This study examines stream water and wetland soils phosphorous levels in the basin of Aquia Creek, a 3rd order tributary of the Potomac River (U.S.A). Bank erosion pins, analysis of LIDAR data and historic aerial images, along with the Revised Universal Soil Loss Equation (RUSLE) coupled with a sediment delivery ratio (SDR) were used in analyzing rill and inter-rill sediment fluxes as well as internally generated stream bank sediments. Soil core properties including pH, soil organic matter (SOM), cation exchange capacity (CEC), and sorption sites including Fe, Al, Ca, Mg, and Mn were analyzed to understand the physiochemical conditions that trigger release of P into the creek from its wetlands. Water samples were taken at six different locations bi-weekly and total P ranged from 0.05 to 95.88 ng g^{-1}, with elevated levels occurring during the autumn and spring seasons. RUSLE results estimate total surficial erosion losses of 55,082 Mg yr^{-1} with a total flux of 9,041.4 Mg yr^{-1}. Bank erosion pin measurements show that rates vary from 1.2 to 75.7 cm yr^{-1}, with the highest values incurred along downstream reaches draining urban areas. Stream bank soils total P content ranged from 2 to 16 µg g^{-1}. The preliminary result from 40 soil cores along 9 transects perpendicular to the stream flow in two wetland sites shows that percent SOM and CEC were higher in the downstream site (30.8 ± 11% and 16.8 ± 4.3 cmol/kg, respectively) compared to upstream site (2.56 ± 2.1% and 7.35 ± 1.3 cmol/kg). Soil total P was also greater in the downstream site with an average concentration of 17.9 ± 7.2 µg g^{-1} compared to 6.36 ± 4.3 µg g^{-1} upstream. The data suggests that acceleration of runoff due to urbanization and subsequent increases in internal erosion rates may significantly contribute to elevated phosphorus concentrations in Aquia Creek. Completion of this study will provide insight into the relationship between P supplied from surficial and in-channel erosion and P sorption-desorption dynamics in the wetland soils in a system affected by both urbanization and sea level rise.

THERMOCHRONOMETRIC DATING OF MUSCOVITE AND ZIRCON FROM THE TALLULAH FALLS DOME, NE GEORGIA

FRASER, Kelley, Department of Geology, Appalachian State University, 572 Rivers Street, Boone, NC 28608, CASALE, Gabriele, Geology, Appalachian State University, 033 Rankin Science West, 572 Rivers Street, Boone, NC 28608 and LEVINE, Jamie S.F., Geology, Appalachian State University, 037 Rankin Science West, 572 Rivers Street, Boone, NC 28608, fraserki@appstate.edu

The Tallulah Falls Dome is a 35 km long-axis elliptical foliation dome cored by Neoproterozoic-Ordovician-aged metasedimentary rocks located within the Blue Ridge of

northeastern Georgia. Surrounding the dome are bodies of metasedimentary rocks of the Tallulah Falls Formation and elongated Grenvillian-aged gneissic plutons. Previous models suggest that formation of the Tallulah Falls Dome is the result of duplexing during Alleghanian collision. In order to better understand the deformational history of the Tallulah Falls Dome we used two thermochronometers: $^{40}Ar/^{39}Ar$ in muscovite, and fission track in zircon. These thermos-chronometers have closure temperatures of ~340 ˚C and ~240 ˚C respectively. $^{40}Ar/^{39}Ar$ cooling ages from this study and previously published data indicate that cooling below ~340 ˚C in and around the dome occurred between 321-317 Ma. Because of their age, zircon grains from the Tallulah Falls Dome contain high track densities, which makes the tracks indistinguishable from each other using standard optical counting methods. Instead we use low etching times and scanning electron microscopy to better distinguish fission tracks. We will use these zircon fission-track ages to determine a cooling rate through the zircon fission track closure temperature using both thermochronometers, as well as pre-existing hornblende $^{40}Ar/^{39}Ar$ data where available. This cooling rate will allow us to distinguish between steady and slow cooling rates consistent with erosion, or rapid cooling consistent with tectonic denudation processes.

A PRELIMINARY *IN SITU* AND BASIN-WIDE ^{10}BE TCN STUDY OF THE STE. FRANCOIS AND OZARK MOUNTAINS LANDSCAPE

REMINGA, Katy N., Department of Geology, Grand Valley State University, 001 Campus Drive, Allendale, MI 49401, WEBER, John C., Dept. of Geology, Grand Valley State University, 001 Campus Drive, Allendale, MI 49401, SEONG, Yeong Bae, Department of Geography Education, Korea University, 145 Anam-ro, Seongbuk-Gu, Seoul, 02841, South Korea and KIM, Dong Eun, Geography, Korea University, Anam-ro, Seongbuk-gu, Seoul, Korea, Seoul, 136-701, South Korea, remingak@mail.gvsu.edu

The Ozark Mountains, Missouri and Arkansas, pose a major geologic and geomorphic anomaly. They form a topographically high, structurally uplifted “block” that exposes buoyant (?) mid-Proterozoic granite-rhyolite basement rocks in the North American mid-continent. The Ste. Genevieve fault bounds the Ozarks on its steepest and structurally highest northeastern side. We are using 14 precisely surveyed *in situ* terrestrial cosmogenic ^{10}Be samples of multi-level strath terraces in “shut-ins” (Precambrian bedrock canyons) that span east to west the core of the Ozark dome (i.e. the Ste. Francois Mountains) to determine river incision rates and exposure ages and to test whether uplift is symmetric or asymmetric across the Ozarks. Sample analysis is in progress. We will then perform a basin-wide ^{10}Be analysis to compare the effects of lithology on erosion, and to gauge overall (basin-wide) versus local (shut-ins) erosion rates. We incorporate additional tectonic geomorphic data, obtained from DGPS surveys, high resolution DEMS, created using GIS, and detailed geomorphic maps, to identifying active knick-point migration, zones of anomalous stream steepness, etc. and to place the exposure ages, erosion/incision rates, and exhumation rates in the context of this unique landscape.

ANTHROPOGENIC EFFECTS TO SAND DUNES ON BARRIER ISLANDS: BRAZOS SANTIAGO PASS AND PORT MANSFIELD PASS, SOUTH PADRE ISLAND, TX

RUBIANO, Romeo R., ATKINSON, Andrew and HEISE, Elizabeth A., School of Earth, Environmental & Marine Sciences, UTRGV, 1 West University Blvd, Brownsville, TX 78520, romeo.rubiano01@utrgv.edu

Coastal dunes become well developed with onshore winds, sufficient sediment supply, and plentiful vegetation to assist in stabilization of sand particles (Atkinson et al., 2015). The impacts of large storms periodically change and affect topography and local structures (Pethick, 1984). Dune stability produced by vegetation helps to provide protection of leeward habitats during high storm surges (Tunnell et al, 2002). This study was conducted on Boca Chica Beach and on the beaches South Padre Island, Cameron County, Texas providing 14 topographic transects of sand dunes. The first set of seven of transects began on the most northern end of Boca Chica Beach near the jetties at Brazos Santiago Pass and continuing every kilometer southward for seven kilometers. The second set began near the jetties at the Port Mansfield Pass and continuing every kilometer southward for seven kilometers. Both of these areas are undeveloped areas of the Gulf Coast of Texas. A comparison of beach-face, berms, storm scalps and sand dune height was taken into account when comparing the data recorded. This study also compared 6 previously recorded profiles from the developed area of South Padre Island, Texas and is focused on the difference of sand dune height between undeveloped and developed locations on this barrier island. The dunes on South Padre Island near Port Mansfield are much larger and are more mature than the dunes on Boca Chica Beach. Overall, the displacements of dune profiles are shown to be rather similar between undeveloped Boca Chica Beach and undeveloped South Padre Island and a highly developed City of South Padre Island. We took into account natural longshore drift, anthropogenic influences for the locations: including and not limited to jetty construction, infrastructure, tourism, vehicular access to beaches, and beach nourishments that somewhat alter the natural profile. It appears that Boca Chica Beach and the undeveloped area of South Padre have healthy beach system with classic dune structures. The City of South Padre Island has attempted to replenish its beach system to a natural state. Although this comparison provides data that shows an ever-changing coastal environment, it is only natural that severe weather, i.e. hurricanes, or seasonal thunderstorms, will drastically change each profile in the future.