THE OHIO STATE UNIVERSITY

SCHOOL OF
EARTHSCIENCES

August 2017 News Notes

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Alumni Change Lives

Ally Brady is an undergraduate student working with Prof Frank Schwartz. Here she describes how the Friends of Orton Hall fund helped further her studies. If you are interested in giving to support the Friends of Orton Hall or other funds, please visit our giving page (link).

Iceland is the most volcanically diverse location on the planet, as nearly every type of volcano can be found on this island. Magma chambers that feed these vast volcanic chains are complex and have been mapped using geophysical and geochemical data. Currently, research is being done to develop a novel way to map these chambers with goals ranging from improving the accuracy of volcanic eruption predictions to understanding crustal differentiation and accretion. This new method, adapted by Dr. Michael Barton and his then graduate research assistant Daniel Kelley, involves using the weight percentage of major oxides to calculate the depth of magma crystallization. To accurately calculate these weight percentages, lavas that have been recently erupted and quickly cooled must be collected and analyzed. Iceland's glacial history and unique volcanic diversity make it an excellent candidate to test this new mapping method. Through the generosity of Friends of Orton, I was granted the opportunity to travel to Iceland and assist Collin Oborn in collecting samples for research. We traveled around the entire island, experiencing every part of the country while gathering rocks from multiple localities. This trip allowed me to conquer fieldwork independently, problems and all.

After graduating in Spring of 2018, I hope to attend graduate school and continue my education as an earth scientist. Although I only assisted in the collection and this research was done apart from my thesis project, I still learned many valuable lessons through my experience in the field that I will carry with me through my career as an earth scientist. One of the main reasons I became a geologist was because I wanted to travel the world as part of my job. Up until my fieldwork in Iceland, I had never left the United States. I was only able to partake in this amazing opportunity because of the funds provided by FOH.

Message from Incoming Director Matthew Saltzman

Greetings Alumni of the School of Earth Sciences, Department of Geological Sciences, and all earlier renditions! As the campus once again leaps in population to become a small city this Fall I am excited to take over as the next Director. Our School is making inspired progress in all areas of research, education and service. Our faculty, staff and students continue to garner prestigious national and international awards, and we are also making great strides in our diversity. We look forward to the challenges and opportunities in the broadly defined discipline of Earth Science in the years ahead. Our emphases are wide ranging and include water and climate studies, energy science, geomicrobiology, solid earth dynamics, deep Earth and deep time investigations, and geodesy, among others. Research in our School is being funded at the highest levels and published in all the top journals, and we are rising in the rankings thanks to the quality of our students and support of our staff.

Our educational mission is strong, with nearly 75 graduate students and 140 undergraduate majors. We teach many general education courses in a variety of topics spanning everything from National Parks to Natural Hazards. In the transition to semesters, we developed four tracks of emphasis in our School and these continue to serve our undergraduate majors well. Field Camp in Ephraim remains a capstone course, and its long history of educating thoughtful, disciplined and successful graduates remains a point of pride in our School.

Thanks to Alumni support, we can move forward with our mission of research, teaching and outreach. The Orton Geological Museum alone reaches countless members of our community. The Friends of Orton Hall fund and Field Camp Experience funds are among those that are the lifeblood of our program, funding student research and field camp scholarships, respectively. There are so many other endowed funds and gifts that we are all grateful for. I hope we can continue to foster these relationships with alumni and friends.

I very much look forward to seeing you all at one of our future planned events, whether it be an alumni reception at GSA, AGU, or AAPG, a field camp reunion, or a gathering here on campus such as the Oklahoma game event planned for September 9. Please feel free to contact me as I'm always happy to talk about our School and our alumni. You can reach me at saltzman.11@osu.edu

Annals of the Faculty Profiles

Many of our alumni have not had the chance to meet some of the newer faculty members. Thus, we have been providing short introductions to Faculty Members sporadically for the past three years. We have been doing these in roughly reverse chronological order of when faculty joined the department. See the list at right, if you're interested in perusing back issues. Note that you can get all back issues of the News here (link).

By coincidence, Prof and Director Matthew Saltzman was next on the list to contribute a Profile; see following story for an introduction to Director Saltzman's research.

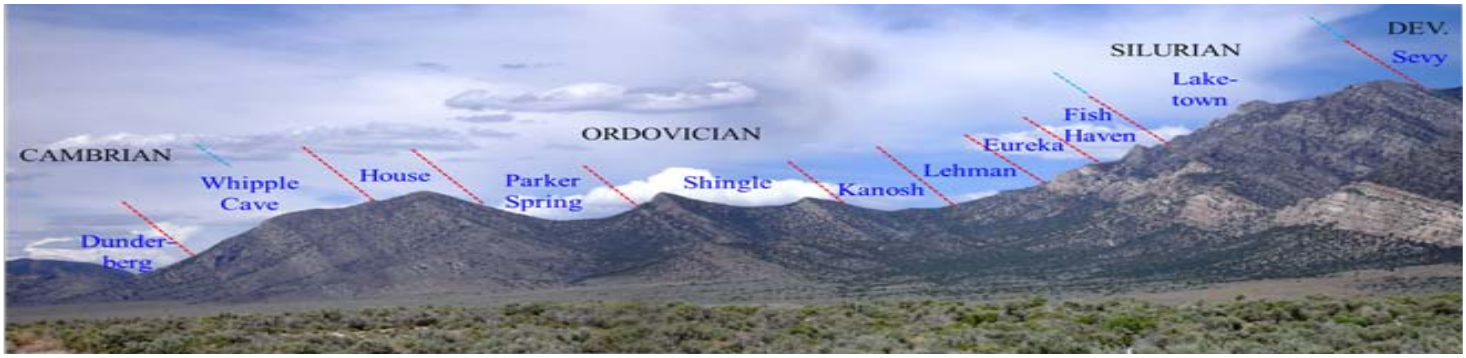
Faculty Member	Date of Profile
Joachim Moortgat	March, 2014
Michael Wilkins	April, 2014
Thomas Darrah	May, 2014
Joel Barker	June, 2014
Ann Cook	July, 2014
Audrey Sawyer	September, 2014
Derek Sawyer	October, 2014
Michael Durand	August, 2015
Ian Howat	September, 2015
Dave Cole	April, 2016
Andrea Grottoli	August, 2016
Wendy Panero	October, 2016
Doug Alsdorf	January, 2017
Steven Lower	July, 2017

Faculty Profile: Professor Matthew Saltzman

Growing up in the Boston area, geology was probably the farthest thing from my mind. The rocks in eastern Massachusetts, which I now know to be the accreted Avalonia terrane (peri-Gondwanan), are strongly deformed and really just messed up. Seeking to knock out general education science credits while an undergraduate at The University of Michigan, I took an 8-week, field-based 'rocks' course out in the Grand Teton area of Wyoming (Camp Davis). I was hooked almost immediately, and very sunburned. I returned to Michigan, switched my major - thanks largely to Profs. Bruce Wilkinson and Kacey Lohmann – and graduated in 1991 with a B.S. in geology. I moved on to a PhD at the University of California - Los Angeles in Fall 1991. Searching for a project, I decided to try my luck in Wyoming again, and studied the causes of trilobite extinction events ('biomere boundaries') in the Cambrian Snowy Range Formation in Yellowstone National Park and adjacent Montana. I graduated in 1996, and made my way to the University of Iowa as a Visiting Assistant Professor. I joined Ohio State's Department of Geological Sciences in Fall 2000, answering a position ad for Assistant Professor in 'Genetic Stratigraphy'.

My field-based research at Ohio State generally examines biological extinction and diversification, climate change, and carbon cycling during the past half billion years of Earth history. The objective of this work is to understand the full range of natural variability in Earth's climate system and intertwined changes in life through time. Initially, most of my work was focused on sampling stratigraphic successions for stable isotope studies of carbon in carbonate rocks (inorganic and organic C) as a proxy for the burial of organic matter over and changes in atmospheric carbon dioxide over geologic time. My research group then developed a collaboration with Dr. Ken Foland and Jeff Linder to study strontium-isotope stratigraphy in the Radiogenic Isotope Lab at Ohio State. We now utilize strontium and neodymium isotopes in carbonate rocks and conodont apatite (in collaboration with Dr. Stig Bergström) to determine rates of chemical weathering of the continents, which complements the C-isotope studies. I'm very excited to continue this work in collaboration with Dr. Liz Griffith arriving in SES this Fall along with a new generation Triton TIMS. Ongoing investigations include the Late Ordovician glaciation and uplift of the Appalachian Mountains; and the Permian-Triassic mass extinction event.

I feel fortunate to have been able to conduct fieldwork on 7 continents measuring and sampling tens of kilometers of accumulated rock representing 300 million years of Earth history from the Neoproterozoic to the Triassic. But I'm most proud of the students who have graduated from my lab, gone on field trips with me, and sat through lectures. I continue to collaborate with PhD graduates Seth Young (Assistant Professor at Florida State), Brad Cramer (Assistant Professor at Univ of Iowa), Kate Tierney-Cramer (Lecturer and Adjunct Assistant Professor at Univ of Iowa), Alexa Sedlacek (Assistant Professor Univ Northern Iowa), and Cole Edwards (Assistant Professor Appalachian State Univ), and I look forward to the next adventure with new students Datu Adiatma, Chris Conwell and Teresa Avila.



Sawyer Basin Research Group Field Expedition to U.S.Virgin Islands

In Late July & early August, School of Earth Sciences Professor Derek Sawyer and two of his graduate students, Trevor Browning (PhD) and Paul Russell (M.S.) traveled to the U.S. Virgin Islands to acquire sediment cores for paleotsunami records in St. Croix and high resolution multibeam surveying in St. John.

The Caribbean has significant exposure to tsunamis from multiple sources, such as earthquakes, volcanoes, and landslides. Due to the limited historical record in the region, paleotsunami deposits provide important information about the size, location, and sources of these events. In turn, these data inform the public and policymakers about the tsunamigenic threat to their communities. A key challenge is that tsunami deposits are often poorly preserved. However, a good candidate for high preservation potential are coastal salt ponds commonly found on the perimeter of tropical islands. The US Virgin Islands have both high susceptibility to tsunamis and large, low lying salt ponds. The most prominent historical example of a tsunami in the US Virgin Islands is the 1867 event which caused widespread devastation throughout the region. One of the hardest hit locations was Frederiksted, on the western end of St. Croix, US Virgin Islands. Frederiksted is also in close proximity to a large coastal salt pond. We targeted this, and older, events by collecting a series of sediment cores at four sites in the salt pond during a summer 2017 field campaign. We are now conducting a detailed analysis of the cotes including age dating via radioisotope dating, X-Ray CT imaging, grain size, total carbon content.

In St. John, a new multibeam acoustic surveying system was used to acquire high resolution bathymetry within Coral Bay in eastern St. John. These data will become a major component of Trevor Browning's dissertation research. Trevor is analyzing and identifying sediment transport patterns and mechanisms from the watershed through the coastal zone in eastern St. John, which has been experiencing an increase in hillslope development that has in turn led to an increase in land-based sediment flux to the marine environment. The research will illuminate the fate of that sediment pulse and help guide best management practices.

This research travel was partially supported by the Friends of Orton Hall fund.

Left: Trevor Browning (left) and Paul Russell acquiring multibeam data in Coral Harbor, St. John. Right: Sediment coring in West End salt pond, St. Croix.

70 Years of Field Camp - Related Theses and Dissertations

Because of OSU's 70 years of field camps in Utah, many earth sciences undergraduate, masters, and PhD theses/dissertations have been written about Utah over the years. The OSU Libraries has a guide about these works (link), which includes the theses/dissertations sorted by author, by advisor, and also some followup works about Utah in journals, books, and other publications. One note - a few works don't have an advisor listed. If it's yours and you can help us update the information, please contact the librarian featured on the page.

Brevia

Prof Emeritus Dan Leavell of OSU Newark passed away on June 18. Prof Leavell taught Geology courses at the Newark regional campus for many years prior to his retirement in 2015. His obituary is available here (link). We plan to run a tribute to Prof Leavell in a future issue of the News. He will be missed.

Prof Frank Schwartz's research group was recently covered in researchfeatures.com. You can read the online version of this piece here (link). The print layout version of the article is attached to this months' News as an appendix; scroll down to read more.

An intense storm on July 10th damaged a number of trees and buildings in Columbus. A 100 year Turkish Filbert Tree, *Corylus colurna* fell within feet of Mendenhall. If the tree was 20 feet closer to the building, the steps would have been damaged. Based on the photos, the tree's root structure and the pith density were diseased; the tree had not been healthy for some time. This tree was number 24 on OSU's tree walking tour (link).

Pressures on wetland connectivity in the Great Plains

Dr Frank Schwartz is a Professor of Earth Science at Ohio State University, where his research focuses on hydrology, pollution and health. He is part of a research group that primarily studies the effects of climate on wetlands in the Great Plains region.

Wetlands are extremely important ecosystems – they are defined as land areas that are either permanently or seasonally saturated with water, and cover approximately 3% of the Earth's surface. Despite their small coverage, they store about a third of the world's carbon and have great biodiversity, but their presence is dependent on climatic and weather conditions.

They support a wide range of species and provide a wide range of services to our population. Thousands of resident bird species use wetlands as feeding and breeding grounds and many more use them as a stop off during migration. Wetlands, therefore, support a diverse range of species and contain many vital habitats.

Connectivity among these habitats is essential, as it enables passage for various animals. Wetland areas are vulnerable to human activity, and are often located in areas where such activity is prominent (e.g. ports, farmland, industrial areas, etc.). Human activities often lead to the destruction of wetlands and changing land covers that can affect connectivity, adding barriers to movement, and limiting network connections among wetlands. Ultimately animal habitats are destroyed, as well as their ability to move between them. This could consequently reduce the numbers of ecologically favourable settings for breeding or feeding, seriously impacting animal populations.

Dr Franklin Schwartz and his colleagues are currently studying how certain groups of animals move between patches of wetland habitat in order to understand how this is affected by human activities and how connectivity could be affected by future changes.

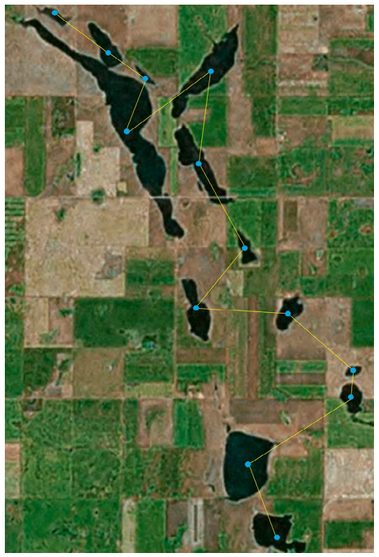
PRAIRIE POTHOLES

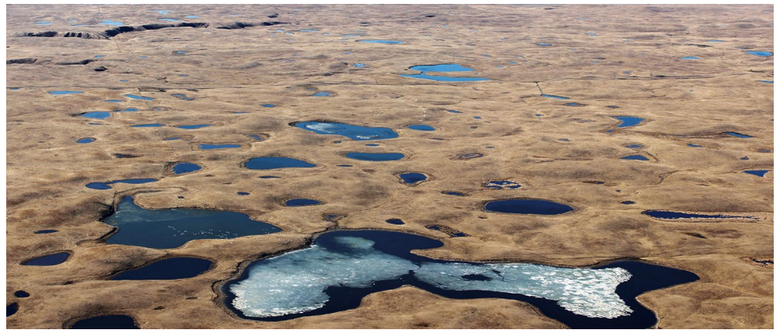
The northern part of the Great Plains region of North America is sprinkled with "prairie potholes" – shallow indentations on the ground surface that form pools and lakes when filled with water, mostly through snowmelt or rainfall. These potholes act as a brooding ground for many migratory waterfowl, such as ducks, in the Spring and Summer months. These small water bodies promote the growth of freshwater plants that act as a source of food, and enable ducks to safely rear their young before migrating south when the temperature drops.

Human activities can affect connectivity, adding barriers to movement, and limiting networks between wetland habitats – ultimately reducing animals' ability to move between them

Prairie potholes play a vital role in the life cycles of these ducks, so the extent of their presence directly affects the size of the population each year. Their presence here is dependent on weather conditions: in years when there is little rainfall, fewer pools are likely to form so the region can only support a smaller migratory bird population. These populations could therefore be vulnerable to climate change and other factors, such as changes in land use, that might affect the sustainability of these wetlands.

Grasslands in the Great Plains area are currently undergoing conversion into farmland, which means that the extent of grasslands surrounding prairie potholes is reduced. It has been found that some species prefer to settle in ponds that are surrounded by a large area of grassland, and the grasslands act as pathways between wetlands for species to move along. The reduction of their extent limits the ability of animals to move between these waterbodies and reach important habitat areas.





© Krista Lundgren/USFWS Mountain-Prairie

Top left: Prairie pothole wetlands and lakes are nodes (blue dots) on an interconnected ecological network (yellow lines)
Top Right: Shown here are examples of migratory birds, including mallard ducks with their distinctive green heads and black, American coots
Bottom Right: After a long, cold winter in North Dakota, ice on the ponds begins to melt anticipating the return of migratory waterfowl.

LINKING HABITATS

Connectivity between different habitats and patches within the same habitat is a critical factor affecting animal populations. Habitats are becoming more and more fragmented, as pressures, like urbanisation or crop production and related environmental changes, cause habitats to be destroyed. Connectivity among these fragments or patches is essential for species to disperse. So, for example, two different woodlands could be connected by a stream with riparian (wetland) vegetation along its banks, or two different patches of woodland within a field could be connected by a hedgerow.

In the case of the Prairie Pothole Region, waterbodies are connected by grasslands, which facilitate the travel of amphibians and other animals among them and protect nesting birds from predators. Native grasslands in this region were developed under a dry climate, on rocky, clayey soils, which are marginal for farmland. Now land is increasingly being converted for corn and soybean cultivation. This then leads to the destruction of pothole water bodies, leading to disconnections between remaining potholes, ultimately reducing the availability of these vital ecological refuges and the ability of species to move among them.

CLIMATE CHANGE

Climate change is a source of pressure on many ecosystems and ecological processes. The presence of prairie pothole wetlands is affected by the weather and the climate, and these potholes act as important nesting areas for many bird species, as well as small mammals and amphibians. The extent of the effect of climate change on these areas and the species that depend on them is currently unclear, as different species have different levels of dependence on these wetlands, and the hydrological processes and behaviour of these lakes are also poorly understood. As such, it would be difficult to try and determine how they would respond to climate change.

This is where the work of Dr Ganming Liu, Dr Nancy McIntyre, Dr Frank Schwartz and Dr Christopher Wright comes in. Their current collaborative study aims to understand the hydrological processes behind the prairie wetlands and how they respond to the current climate before modelling how they might respond to future changes in climate. They then hope to use this knowledge to further understand how waterfowl and amphibians disperse and move between wetlands, as well as determining how land use and climatic changes will affect this, identifying barriers to connectivity and establishing which habitats are less likely to be affected by environmental change. Their research involves mapping potholes and then visualising a network by connecting pools that are within a certain proximity to one another, which displays how these wetlands are connected through time. Connectivity varies for different groups of animals, depending on how far they can travel. If wetlands are still well-connected under the future climate for waterfowl, this may not be the case for amphibians, so this research is key for understanding how these different groups will be affected by climate change – identifying which areas would need a greater conservation effort.

Prairie pothole wetlands are affected by the weather and the climate, and act as important ecological refuges for many species

Q&A

How specifically do humans impact wetland waterbodies of the Great Plains?
The continuing conversion of grassland to corn and soybeans impacts both wetland waterbodies and surrounding habitat. Smaller waterbodies are simply ploughed and farmed during drier years, which destroys their functional value as wetlands. Land-cover conversions from grassland to farmland also negatively impacts nesting success for ducks. Predicted increases in temperature and somewhat wetter conditions will promote the continuing loss of grasslands to corn and soy crops.

What strategies could be followed to protect these habitats if changes in land use and the climate have a detrimental effect on them?
US government programs e.g., Conservation Reserve Program (CRP), have been in place since 1985 to pay farmers to retire land from farming. This program has helped to protect wildlife habitat. However, the high commodity prices for corn and soybeans, wetter weather and subsidised crop insurance have promoted a modern expansion in farming. Thus, grasslands are actively being converted to corn and soybean production and lands are being removed from the CRP. There are few reasons to be optimistic for strategies to affect a turnaround.

What makes the Prairie Pothole Region an ideal area for migratory birds?
The Prairie Pothole Region is unique in the world because its large size, nearly three quarters of a million square kilometres, incorporates several million wetlands ponds and lakes within grassland and agricultural settings. These waterbodies are very productive for birds due to their relatively shallow and constantly changing water depths. These features facilitate nutrient cycling and a variety of aquatic plants and animals. Termed America's "duck factory", the Prairie Pothole Region is the most productive waterfowl habitat on the continent, perhaps even the world. It also supports shorebirds, grassland birds and other wildlife.

Of waterfowl and amphibians, which do you think is more vulnerable to changes in connectivity?
Amphibians are examples of animals that disperse over land. Unlike birds, they can't fly to find new habitats. So, they will be more sensitive to changes in connectivity, particularly those stemming from land use changes. Even during the breeding season, when most ducks are effectively tied down, waterfowl are able to interact with landscape at a larger scale than do amphibians, meaning that they potentially have more options.

Is climate change or human land use more likely to affect prairie pothole connectivity?
Land use conversion represents the greatest impact to prairie pothole connectivity. Smaller wetlands tend to disappear in the crop fields and nests in larger wetlands are more prone to predation with the loss of nearby grasslands. Climate change is expected to be a contributing factor no matter what climate ultimately emerges. Hotter and drier will reduce the wetland habitat as the numbers of pothole wetland decline from evaporation. Hotter and wetter appears to improve the prospects for farming but reducing waterfowl production.

Detail

RESEARCH OBJECTIVES

The research team studies climatic and anthropogenic forces affecting the wetland systems of America's Great Plains. At stake is the future of migratory birds and other animals that depend critically on the millions of water bodies dotting the plains.

FUNDING

This study was supported in the United States by National Science Foundation (NSF) awards 1340548, 1340648, and 1544083 (MacroSystems Biology Program).

COLLABORATORS

Other members of our research collective at South Dakota State University, Kansas State University, University of Minnesota Duluth, and the United States Geological Survey.

BIOS

Team members have expertise in ecology, complex systems, and hydrology. Franklin Schwartz at Ohio State University has interests in water, society and health. Ganming Liu is an assistant professor at Bowling Green State University with interests in modelling complex hydrologic systems. Professor Nancy McIntyre at Texas Tech University works at the intersection of community ecology, landscape ecology, and conservation. Chris Wright is a landscape ecologist and complex system analyst at the Natural Resources Research Institute, University of Minnesota Duluth.

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