THE OHIO STATE UNIVERSITY

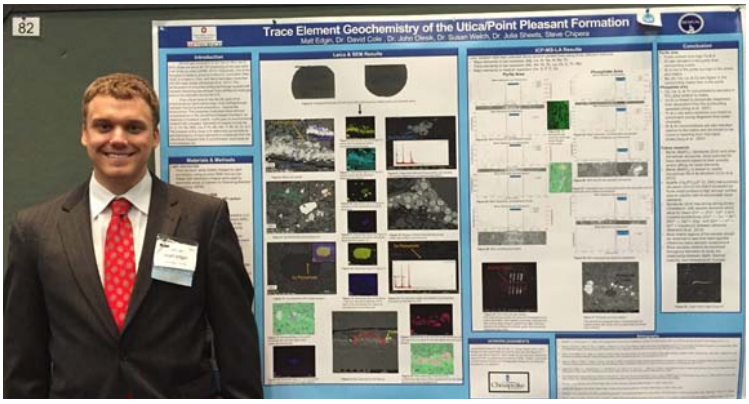
SCHOOL OF
EARTHSCIENCES

April 2016 News Notes

- Alumni Change Lives
- GEOS Chapter Update
- Faculty Profile: Dave Cole
- Coral and Ocean Acidification
- SES Presenters at Denman Undergraduate Research Forum
- Field Camp's Lasting Legacy
- NSF Funds SES Professor Ian Howat's Lab
- Brevia

Alumni Change Lives

Matt Edgin is a graduating undergraduate student under Prof David Cole. Here, Matt describes how Friends of Orton Hall and other funds helped further his studies.



I was privileged to receive multiple scholarships and funding from the School of Earth Sciences throughout my career at Ohio State. I was awarded the Marcus J. & Lottie C. Lieberman Scholarship in Geological Sciences and the Sigma Gamma Epsilon Field Camp Scholarship. Both allowed me to devote more time to school and research as well as aid in funding for Field Camp in the summer of 2015. In the fall, I was able to attend the AAPG Student Expo in Houston, TX and the annual GSA meeting in Baltimore, MD. I wanted to attend both meetings because I thought it would be beneficial for networking with professionals since I aspired to pursue a professional career in the energy industry.

At the Student Expo and GSA, I presented a poster entitled, "Trace Element Geochemistry of the Utica-Point Pleasant Formations". I conducted my research with Prof David Cole and the goal of my study was to determine potential sources of trace elements from mineralogical and textural features of Utica-Point Pleasant rocks that could be released into hydraulic fracturing fluids. I found that elevated levels of barium in flow back waters could be related to dissolution mechanics with the clay mineralogy and elevated strontium levels could be related to dissolution mechanics with carbonates.

I received enough funds from FOH to pay for my airfare, lodging, and food while I attended both events. I attended many sessions in hopes of networking for a summer internship. I feel this is how I made a connection with the Department of Energy that lead to an internship this summer as part of the Mickey Leland Energy Fellowship Program. It will encompass researching rare earth elements in coal and fly ash as well as shale porosity for unconventional resources. I also was able meet several professors from other universities in hopes of pursuing a master's degree in graduate school. This fall I will be attending the University of Wyoming to pursue a master's degree with Dr. John Kaszuba studying unconventional resources in the Frontier and Niobrara Formations. None of this would have been possible without the support of the School of Earth Sciences or Friends of Orton Hall. I am extremely grateful for their sponsorship and encouragement.

GEOS Chapter Update

AAPG Distinguished Lecturer Short Course - Monday April 11th, 2016

Earlier this semester, the student chapter applied to partake in the AAPG Distinguished Lecturer Program for North America. On Monday April 11th, twenty students (graduate and undergraduate) attended a day long short course taught by retired Shell global geological advisor Dr. Larry Garmezy. Dr. Garmezy led students through the "Fundamentals of Basin Evaluation and Prospect Assessment". Students learned about evaluating the components of petroleum systems through a series of lectures and team exercises focused on the Oligocene play of the Campos Basin, Brazil. This IBA style course also covered prospect volumetrics and risk analysis. This great opportunity served as a great foundational introduction to the diverse and integrative aspects of geoscience in industry. We hope to use this experience as a stepping stone towards our individual and student chapter development!!

Last GEOS Monthly Meeting & New Officers Elected - Tuesday April 12th, 2016

On Tuesday April 12th, the chapter hosted the last meeting of the semester and elected new officers. We are very excited to announce our new leadership for 2016-2017

GEOS President/SEG President - Katie Treiber, 1st year M.S. Graduate Student.
GEOS Vice President/AAPG President - Jack Pelishek, 3rd year Undergraduate Student.
GEOS Secretary - Colin Whyte, 2nd year P.H.D. Graduate Student.
GEOS Treasurer - Brent Lary, 3rd year Undergraduate Student.

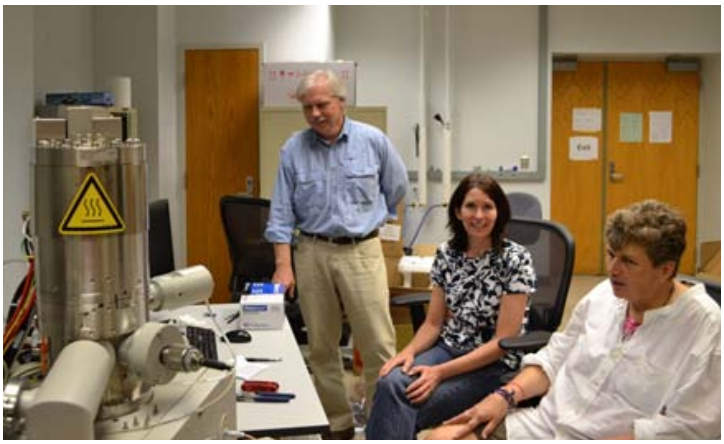
We are excited for new exciting steps for our chapter in the coming year under our motivated leadership of grads and undergrads. We will to build off the success of the last year and strive to develop our geophysical resources from SEG and our geological resources from AAPG to continue establishing a student chapter of foundational geoscience for our student members.

Contact us at **aapg@osu.edu** if you have interest in interacting with the chapter or for more information on all things GEOS as we approach fall!!

Stayed tuned and GO BUCKS !!!

Faculty Profile: Dave Cole

I grew up in the southern Adirondack Mtns. of New York and acquired an interest in rock and mineral collecting at a very early age. But it was not until I took high school freshman Earth Sciences (a requirement for a New York State Regents diploma) that I really became hooked. The mineral and fossil collecting field trips associated with this course sealed the deal for me. I attended the State University of New York College at Cortland graduating with a B.S. in Geology and an emphasis in Chemistry. It was a fortunate time to be at Cortland as they had two very active hard-rock geologists who focused their research efforts on hydrothermal, metamorphic and magmatic ore deposits and associated exploration strategies. My senior thesis was on geology and trace element geochemistry of the Katiniq sill, Ungava Nickle Belt, Quebec Canada with core provided by the International Nickle Company. I used this interest and modest background in geochemistry as a foundation for my graduate work at Penn State. With industry funding from St. Joe American, I conducted my M.S. research on the geology and lead and zinc geochemistry of an area in the southern Adirondack Mtns. which had many similarities to the area St. Joe was activity mining in the northwest portion of New York. It seemed as though I was destined to be an exploration geologist but at the time I finished the metals industry in the U.S. fell on hard-times. But again fate stepped in and luckily I was asked to do a Ph.D. study as part of a DOE-sponsored research project at Penn State designed to quantify the chemical and isotopic exchange associated with water-rock interaction relevant to hydrothermal ore deposits and geothermal systems. It was during my dissertation research that I became fully immersed in the application of stable isotopes as tracers of geochemical reactions both at and far from equilibrium. The lesson I learned was that Nature does not always titrate to an equilibrium state, and knowing this gives us a unique opportunity to quantify the timing of geochemical processes in the absence of being able to apply age-dating.



Prof. Cole with Research Associates Drs. Julie Sheets (middle) and Sue Welch (right) using the FEI Quanta 250 Field Emission Gun Scanning Electron Microscope located on the ground floor of Mendenhall Laboratory.

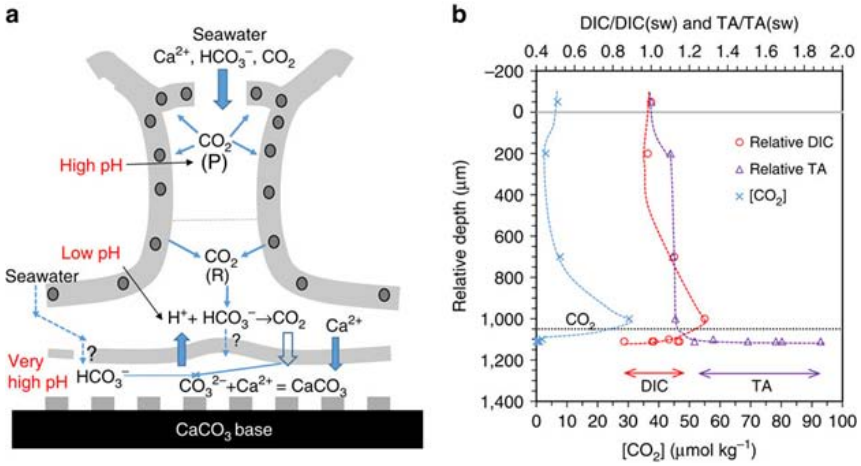
Upon completion of my Ph.D. I took a research faculty position with Earth Science Laboratory (ESL) of the University of Utah in Salt Lake. This was a DOE and NSF funded lab of approximately 30 researchers which was spun off from geothermal research originally funded through the Geology Department. My three years at ESL allowed me to apply what I had learned at PSU doing bench scale water-rock experiments and modeling to active geothermal systems throughout the west including Yellowstone, a remarkable natural laboratory for the geosciences as well as ecology. I was lured back east to take a staff position in the Chemistry Division at Oak Ridge National Laboratory in Tennessee to start up a stable isotope lab in support of DOE funding centered on quantifying hydrothermal process at elevated temperature and pressure. I spent close to 29 years in Oak Ridge rising through the ranks to Distinguished Scientist and head of the Geochemistry and Interfacial Science Group. I joined the SES faculty in the fall of 2010 as an Ohio Research Scholar with a mandate from the university to build a research program in subsurface energy and sustainability. Early on Prof. Jeff Daniels (ret.) and I established the Subsurface Energy Materials Characterization and Analysis Laboratory (SEMCAL) as a user facility that collected under "one roof" the capability to interrogate the geophysical, petrophyscal, mineralogical and geochemical properties of any earth material but with special emphasis on rocks that host energy resources such as

hydrocarbons and geothermal fluids. Our research portfolio is anchored by the inescapable fact that interfacial phenomena – i.e., mineral surfaces as well as buried interfaces such as microfractures, pores, grain boundaries and even mineral dislocations at the atomic scale – control the exchange of matter and energy, and impact the nature of multiphase flow and reactive transport in geologic systems regardless of the temperature-pressure range. It is gratifying to note that the research program we have established with funds from DOE, NSF, the Sloan Foundation and industry not only helps support the training of our next generation of scientists but also allows access to our state-of-the-art facilities by anyone across campus who needs research support. In fact SEMCAL is only one part of a remarkable array of analytical instrumentation housed in SES that puts us at the forefront of conducting cutting edge science. To say the least, it is a great time to be part of the SES family.

Coral and Ocean Acidification

An interdisciplinary team of researchers led by researchers at the University of Delaware, Ohio State University, and the University of Georgia has successfully measured both pH and carbonate ion concentration directly inside the calcifying fluid found in coral using microelectrodes, an important development in the study of how ocean acidification will affect marine calcifying organisms such as corals and shellfish. Dr. Grottoli, Professor in the School of Earth Sciences at Ohio State University was the lead-PI on the project and Dr. Wei-Jun Cai, Professor at the University of Delaware was the lead-author on the publication.
Their findings were reported on 4 April in the journal *Nature Communications* (link).

Figure 1



The researchers' results confirmed what other scientists have measured before – the pH inside the coral's calcifying layer is high. This finding supports the idea that coral are equipped with a proton pump that force protons away from this site in order to regulate pH and allow calcification to occur. The team also measured high carbonate ion concentrations and determined that the dissolved inorganic carbon concentration at the site of calcification was much lower than had previously been hypothesized (see Figure 1), indicating that coral have strong control over their internal calcifying chemistry. These findings could help to explain why the calcification rates of many species of corals are not affected by ocean acidification.

This work was funded by the National Science Foundation. Image of coral polyps by Andrea Grottoli, Ohio State University. The figure above is from the *Nature Communications* publication discussed here.

You can help support graduate and undergraduate participation in coral research by donating to the Coral Research Fund #313775 (link).

SES Presenters at Denman Undergraduate Research Forum

Pictured above are all the undergraduate students from Earth Sciences who were presenters at the Denman Undergraduate Research Forum on March 30, 2016. Pictured with the students are Anne Carey and Berry Lyons.

Will Evarts, advised by Michael Barton, "Mantle source regions and magma evolution along the Juan De Fuca Ridge, Pacific Ocean"

Mario Gutierrez, advised by Derek Sawyer, "Miocene ash beds in the central Gulf of Mexico"

Alex Grady, advised by Michael Barton, "Geochemical variations in basalts from the South East Indian Ridge"

Katherine Haines, advised by Michael Barton, "The pressures of being a ridge"

Ben Holt, advised by Thomas Darrah and John Olesik, "Trace element geochemistry of brine from the Marcellus shale"

Scott Hull, advised by Wendy Panero, "The petrologist's guide to the galaxy: a method for modeling Earth-like exoplanets" won honorable mention in the Mathematical and Physical Sciences Division.

Ryan Jones, advised by Joel Barker, "Hydrology and biogeochemistry of an urban wetland"

Annce Kadri, advised by Andréa Grottoli, "The effects of ocean acidification & heterotrophic feeding on M. capitata & P. compressa biomass after a mass bleaching event" won honorable mention in the Mathematical and Physical Sciences Division.

Laura Miller, advised by Sue Welch and Anne Carey, "Rock weathering along small mountainous rivers, Sierra de las Minas, Guatemala"

Yoko Miyakawa, advised by Michael Barton, "Magma evolution along the East Pacific Rise between 11°N and 15°N"

Sean Newby, advised by Matthew Saltzman, "Differences in 87Sr/86Sr of conodont elements (cones and blades): implications for correlating rocks using strontium isotope stratigraphy"

Bryan O'Reilly, advised by Ralph von Frese, "Lunar exploration for helium-3"

Samuel Perry, advised by Wendy Panero,
"Uranium and thorium storage in CaSiO3-perovskite in the Earth's lower mantle"

Tyler Rohan, advised by Derek Sawyer, "Particle size analysis of submarine landslide sediments in Nankai Trough, IODP Expedition 333 Site C0018" won first place in the Mathematical and Physical Sciences Division.

Lienne Sethna, advised by Michael Barton, "Geochemistry of magmas erupted along the Northern East Pacific Rise at 6-12˚N: Implications for mantle source regions and intracrustal evolutionary processes"

Katiri Snyder, advised by Andréa Grottoli, "Impact of ocean acidification and pH induced stress on chlorophyll a concentration in coral species Montipora capitata"

Adrien Van Wagenen, advised by Thomas Darrah, "The temporal evolution of helium isotopes in carbonatite lavas from the Colorado Plateau"

Michaela Wells, advised by David Cole, "Potential sources of salts from water-rock interaction during hydraulic fracturing: an experimental study"

Field Camp's Lasting Legacy

Ask any OSU undergrad what was the one thing that stands out in their mind about their experience as a Geology or Earth Science major and almost invariably the answer is Field Camp. "Many of my friends have described Field Camp as the best experience of their undergrad education," said Claire Mondro, a recent graduate in Earth Sciences. "The big-picture problem solving skills I learned help me in every aspect of my life." "Field Camp is an essential part of the learning experience in the School of Earth Sciences," said Anne Carey, professor and undergraduate coordinating advisor. "It's been said that the best geologist is the one who has seen the most rocks." In Utah, students are exposed to the rock record of geological events ranging from Proterozoic to Holocene. Since its inception, Field Camp has hosted over 1,000 students who have gone on to pursue successful careers in geology.

Edmund Spieker established Ohio State's field geology course in Ephraim, Utah, in 1947, to "put the responsibility to see, to think, to relate, and to conclude onto the student, rather than have teachers point and tell." For nearly 70 years, that is what the Field Camp experience has done, continuing to meet Dr. Spieker's goal of providing a unique environment for field-based research experiences for students and faculty. Research skills developed during field camp typically include collection and interpretation of geologic data, synthesizing geological histories, report writing, and geologic mapping. Now, for the past many summers, Prof. Terry Wilson and her support staff have led green-behind-the ears undergrads to Utah for an experience unlike they have had before, and one they will never forget. To say the experience is transformative is putting it mildly.

Take, for example, Mike Morgan (BS geology, 1969) who rode in a car caravan for three days to Ephraim, Utah to attend Field Camp, an experience he remembers vividly to this day. "I have worked with both large and small oil companies and there's one thing they all have in common: a demand for graduates with excellent analytical, problem solving, written, and verbal communication skills," Morgan stated. He goes on to say that "These skills are hard-earned through Field Camp and Ohio State University geologists can hit the ground running. They've got an advantage on just about anyone else coming out of school." Fast forward some 40 years later, Mike and his wife Cindy endowed a fund to ensure that generations of future students in the School of Earth Sciences are able to take advantage of the real-life laboratory. Their hope was that by endowing the Field Camp fund, others will come forward with support for the camp. Funding will help the School of Earth Sciences to purchase and maintain vans for transportation, to provide support for students to offset the costs of camp, and to support faculty who spend six weeks each summer at the camp.

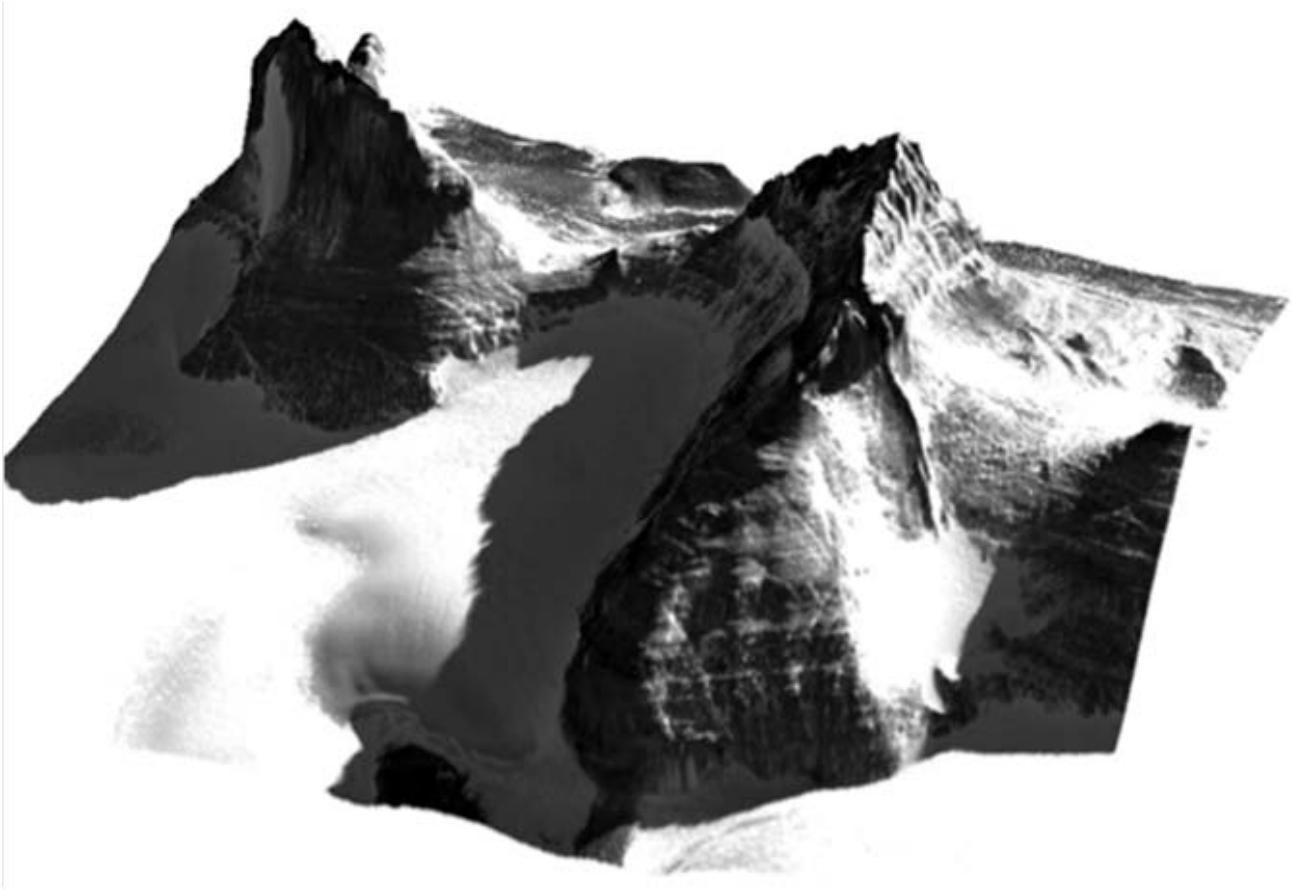
Mike knows full well, like many active alums, that through Field Camp and other worthy charitable needs that fund student learning in the School of Earth Sciences, Ohio State can blossom into a significant force in research in energy and related environmental sectors and allow thousands more to have the same once-in-a-lifetime experience that he had.

To join Mike and Cindy by supporting the Field Camp fund and directly helping School of Earth Sciences students on their trip to Utah, see The School of Earth Sciences Field Experience Travel Fund # 641882 (link).

NSF Funds SES Professor Ian Howat's Lab

Prof Howat received an NSF grant to map the topography of the Antarctic continent at high spatial resolution and precision to measure ice sheet change, constrain models, correct satellite observations and support logistics. Accurate and complete surface topography is essential for a wide range of scientific and logistical activities, but Antarctica remains the most poorly mapped landmass on Earth. The group will use a combination of very high-resolution satellite imagery, existing ground and airborne survey data and the NSF's supercomputer infrastructure to construct the Reference Elevation Model of Antarctica (REMA): a continuous, time-stamped reference surface that will be one to two orders of magnitude higher resolution than currently available.

REMA will be constructed from stereoscopic, submeter resolution imagery collected by the WorldView satellite constellation, obtained at no cost in partnership with the National Geospatial Intelligence Agency and the NSF-supported Polar Geospatial Center (PGC). The high spatial and radiometric resolution of the imagery enables photogrammetric digital elevation model (DEM) extraction over low contrast terrains such as snow, ice and shadows. These DEMs have horizontal and vertical offsets of up to several meters that can be reduced to the DEM relative accuracy of 0.2 meter with a single ground control point. We will use available control points from ground and lidar surveys to register individual DEMs and optimized, least-squares co-registration to provide control between overlapping DEMs over large regions. REMA will have a posting of 10 meter and accuracy better than 1 meter. It will be distributed openly by the Polar Geospatial Center. This project will involve substantial undergraduate participation, providing training in geospatial science and remote sensing, and REMA will be used extensively for the outreach programs of the Byrd Polar and Climate Research Center.



Three-dimensional surface view of peaks above the McMurdo Dry Valleys, Antarctica, created from a Worldview-1 image overlain on a Digital Elevation Model.

Brevia

Derek Foley successfully defended his M.S. thesis: "Analysis of the Point Pleasant/ Lexington/ Trenton Formations: Sulfides, Mineralogy, and Trace Element as Geochemical Proxies" Adviser: Prof Cole.

Congratulations to Cayman Unterborn upon completion of his PhD, "Before Biology: Geologic Habitability and Setting the Chemical and Physical Foundations for Life," and best wishes as he moves to Arizona State as an Exploration Fellow.

Wendy Panero was awarded the Distinguished Undergraduate Research Mentor at the OSU Denman Forum.

Current SES undergraduate Sean Newby was awarded an Undergraduate Research Scholarship ($7000) by the Arts and Sciences Honors Committee for his proposal to refine the age of the Middle Ordovician Knox unconformity in the central Appalachian Mountains using Sr isotope stratigraphy with Dr. Saltzman. Congratulations Sean!

Recent SES graduate Cole Edwards (PhD 2014 with Prof Saltzman) will begin a new tenure track faculty position in Sedimentology in the Department of Geology at Appalachian State University in Boone, North Carolina this Fall. Congratulations Cole!

Prof Lonnie Thompson was featured prominently in "Changing climate: 10 years after An Inconvenient Truth", published at Science News (link).

Congratulations to Dale Gnidovec, Collections Manager & Curator of Orton Museum. He has recently received an award for "Distinguished Achievement in the Field of Earth Sciences" from the American Federation of Mineralogical Societies!

SES graduate student Lena Cole (PhD Candidate) is featured in this month's FOSSIL Project newsletter regarding her use of art as a tool for outreach (link). Congratulations!