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The Newsletter of the Department of Earth and Planetary Sciences at Northwestern University | 2015

JUDD A. AND MARJORIE WEINBERG COLLEGE OF ARTS AND SCIENCES



Message From the Chair



Greetings to Alumni and friends of the department,

I am happy to be writing this welcome message for our annual newsletter – once again, we apologize for the lapse last year. This edition contains information about the newest members of our faculty, exciting new research initiatives and awards, reflections on our past departmental home, highlights from our 2015 graduating class, and other news from the department. It has been a very busy

and exciting year and I continue to feel great pride in all the accomplishments of our departmental family. During this uncertain time in the world we feel so very fortunate that we are able to pursue research and teaching in Earth and Planetary Science, and we remain mindful of the opportunities to make contributions to human welfare wherever possible. I hope this message finds all members of our extended family healthy and safe. Wishing you all the best,

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EPS Welcomes and Goodbyes

Postdoctoral students **Xin Chen** and **Xiaobing Liu** welcomed their child, Alice, in April 2014. Professor **Matt Hurtgen** and his wife Amanda welcomed new son, Silas, in August 2014. Most recently, graduate student **Brian Kristall** and his wife Rebecca welcomed their daughter Lillianna to their family in March 2015.

Fall 2015 saw the addition of three new graduate students to the department: **Jiuyuan Wang**, **Vivian Tang**, and **Fei Wang**. In addition, we look forward to **Michelle Wenz** joining the department in the winter of 2016.

Pre-doctoral student **Fei Qin** joined the department this year from Peking University, where she is pursuing her PhD in Earth and Space Science. Fei is working with Prof. Steve Jacobsen on the P-V-T equations of state and sound velocities of humite minerals.

Grace Schellinger joined the Hogan lab staff full-time and has done work for Prof. Axford and Prof. Sageman. Grace arrived in the department in 2013 and manages a variety of duties including student safety instruction, sediment sample preparation, equipment maintenance, and mineral collection organization.

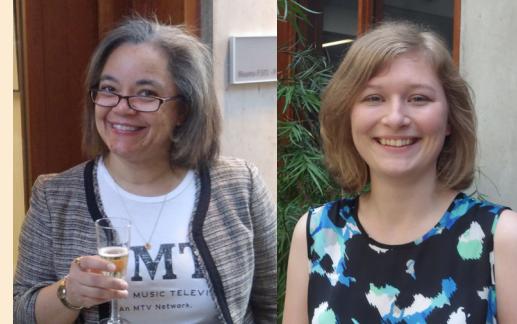
Our office experienced some personnel major changes this past year. Our business Administrator **Shelley Levine** followed her predecessor Reid Wellensiek to the Weinberg Dean's Office, where she is currently the Assistant Director of Graduate Studies. Program Assistant **Alison Witt-Janssen** departed for the Department of Classics, where she is now a Department Assistant. We wish them the very best of luck in their new positions!

In their stead, we welcomed **Lisa Jene Collins** and **Alexis McAdams** to the office, and they have settled into their positions nicely. Lisa arrived from the Department of Asian Languages and Cultures and is also an alumnus of Northwestern (B.A. Mathematics). Alexis came to us soon after graduating with a B.A. in Geology from Augustana College in Rock Island, Illinois.

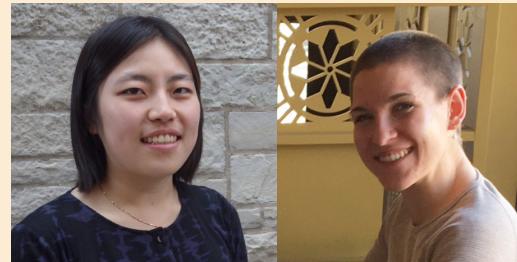
We said goodbye to our IT Consultant **Baudilio Tejerina** who is pursuing opportunities in academia. We wish him the best of luck!



Brian Kristall with daughter Lillianna



New Staff Lisa Collins and Alexis McAdams



Visiting Student Fei Qin and Lab Manager Grace Schellinger

Distinguished Alumni Award Established, Alumni Invited and Recognized

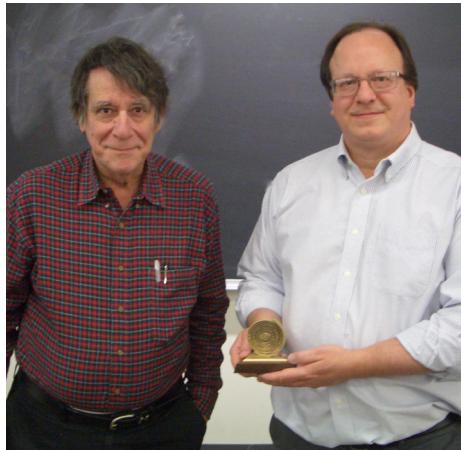
The department proudly presented its Distinguished Alumni Award to Professor Stephen Meyers (University of Wisconsin-Madison) this fall, following his seminar presentation to the department titled *Climate "Noise" and the Cryosphere: New Constraints on the Evolution of Ice Sheets during the Cenozoic*. Steve graduated with his PhD in Earth Sciences from Northwestern University in 2003 and went on to Yale University, where he held the Gaylord Donnelley Environmental Fellowship for work with Professor Mark Pagani. In 2006 he joined the faculty at the University of North Carolina-Chapel Hill as an Assistant Professor, but soon moved to the Department of Geosciences at UW-Madison (2010).

Steve won an NSF-CAREER award in 2012, was tenured in 2014, and was selected as the 2016 recipient of the Wilson Award by the Society for Sedimentary Geology.

Past recipients of the alumni award include Professors Michael Wysession (Washington University, shown at right) and Jeremy Fein (Notre Dame University, pictured at left).



Department Chair Brad Sageman presents Stephen Meyers with the Distinguished Alumni Award



Dr. Emile Okal (left) presents Dr. Michael Wysession with the first Distinguished Alumni Award



Detail of the Award

Professor Steve Jacobsen Receives Humboldt Foundation Award

In March 2014, Professor Steve Jacobsen received the Friedrich Wilhelm Bessel Research Award of the Alexander von Humboldt Foundation. Award winners are honored for their outstanding research record and are invited to spend a period of up to one year cooperating on a long-term research project with colleagues at a research institution in Germany.

Jacobsen's research on the Earth's deep water cycle was carried out at the Bayerisches Geoinstitut, University of Bayreuth Germany, where he stayed during the 2014-2015 academic school year. Using a unique 5000 ton high-pressure multi-anvil press, Jacobsen synthesized minerals analogous to those deep within the earth's mantle.



Professor Seth Stein Receives Price Medal

The Royal Astronomical Society has awarded Professor Seth Stein the 2014 Price Medal for investigations of outstanding merit. The society wrote, "Prof. Stein has a 35-year history of ground-breaking achievements in earth sciences of global importance in numerous fields including plate tectonics, seismology, and space geodesy."

In addition to an extraordinary plethora of service on international committees, he is an outstanding teacher, with much of his influence having been through his popular graduate-level geophysics textbook, "Introduction to Seismology, Earthquakes, and Earth Structure."



Professor Yarrow Axford Awarded NSF CAREER Grant to Support Paleoclimate Research in Southern Greenland

Dr. Yarrow Axford, an assistant professor in the Department of Earth and Planetary Sciences, was recently awarded a Faculty Early Career Development (CAREER) award by the National Science Foundation's Office of Polar Programs. The CAREER award recognizes junior faculty members who demonstrate outstanding abilities in both academic research and educational outreach.

The five-year CAREER grant will provide over \$590,000 plus field logistics support for Prof. Axford to advance and apply innovative paleolimnological methods for reconstructing the recent climate history of southern Greenland. Axford and her students will aim to develop quantitative temperature reconstructions for the Holocene based on subfossil insect assemblages and reconstructions of precipitation isotopes from lake sediment cores. Graduate student Everett Lasher is focusing his dissertation research on testing and refining the method for reconstructing precipitation isotopes. A third approach – reconstructions of alpine glacier fluctuations using sediments from lakes that receive meltwater and sediments from nearby glaciers – will provide independent evidence for climate change through the Holocene.

"The award of an NSF-CAREER grant in support of this research is a resounding and definitive endorsement of the quality and care she has put into her research," remarked Brad Sageman, Chair of the Earth and Planetary Sciences Department. "I believe she was awarded this grant in part because, in addition to the high quality of her published work, she is one of the most gifted teachers and mentors in our department."

Yarrow and her students will travel to southern Greenland for the first of three project field seasons in summer 2016. In addition to research funding, the grant will also provide support for K-12 science teacher development workshops and training for Northwestern graduate students in science communication and public engagement.

Prof. Axford's research has been attracting attention in recent months, as evidenced by recent profiles by Northwestern's Weinberg College of Arts and Sciences and The Graduate School. Additionally, Prof. Axford's graduate student Jamie McFarlin was recently granted a NSF Graduate Research Fellowship for her research in Greenland, which is done in collaboration with assistant professor Maggie Osburn.



(L to R) Graduate students Everett Lasher, Jamie McFarlin and Prof. Yarrow Axford in Greenland.

Axford's Award Continues Tradition of Junior Faculty Recognition

Junior faculty members of the Department of Earth and Planetary Science have continued a tradition of exceptional performance in early career awards for research and teaching excellence. For example, the most recent folks to be recognized with prestigious grants and awards include the following: NSF-CAREER award (Suzan van der Lee, Matt Hurtgen, Yarrow Axford); the Presidential Early Career Award for Scientists and Engineers (Steve Jacobsen); the Packard Fellowship (Andy Jacobson and Steve Jacobsen); the ISEN Early Career Investigator Award (Yarrow Axford); the Clarke Medal of the Geochemical Society (Andy Jacobson); the Friedrich Wilhelm Bessel Research Award of the Humboldt Foundation (Steve Jacobsen); and the Weinberg College Distinguished Teaching Award (Steve Jacobsen).

Academic life gets so busy that we often forget to stop for a moment and applaud the stellar accomplishments of our colleagues. We are so thankful to have such talented and dedicated junior faculty members.

2015 Graduation Spotlight

Spring 2015 saw the departure of many students from Earth and Planetary Sciences. Our department graduation reception was held on June 19, 2015 and recognized our graduates and their families.

Graduate Students

Allison Bacynski
Maya Gomes
Jeremy Gouldey

Undergraduate Students

Anna Hopkins
Margaret Isaacson
Mitchell Kirshner
Alex Layng
Kayleen McMonigal
Andrew Pfeiffer
Henrik Westerkam

Students recognized with departmental awards included Emily Wolin (Marion Sloss Award for Outstanding Graduate TA), Ashley Gilliam (Horace A. Scott Award for Excellence in Graduate Research), and Kayleen McMonigal (Seymour Schlanger Undergraduate Earth Science Award).

Both awards are made possible by the generous support of our alumni. Thank you!



(L to R) Graduates Maya Gomes, Allison Bacynski, and Jeremy Gouldey are recognized by Prof. Matt Hurtgen



Department Chair Brad Sageman addresses the guests



Undergraduate Mitchell Kirshner with Prof. Andy Jacobson

EPS Plays A Starring Role in Bringing Earth Science Education to the Silver Screen

This year saw the inclusion of two members of our department in the development of educational documentaries. Graduate student Emily Wolin appeared in the NOVA documentary "Making North America," and Prof. Seth Stein produced and appeared in "Lake Superior and the Midcontinent Rift: The Billion Year Story."

Both educational videos tell the story of a geological period of millions of years in which earthquakes and volcanic eruptions were normal throughout what is now Minnesota, Wisconsin, and Iowa. This tectonic activity was symptomatic of the Earth's attempt to split North America roughly along the northern branch of the modern Mississippi River. Around two million cubic of lava rose up through the crust, but for unknown reasons, this rift failed to pull North America apart.

In "Making North America," Emily Wolin demonstrates how seismology is used to investigate and image the Earth's interior, including these large lava deposits. "Lake Superior and the Midcontinent Rift" showcases and explains the stunning scenery around Lake Superior that is a direct result of this tumultuous period in Earth's history. This video was also produced in collaboration with Abigail Foerstner from Northwestern's Medill School of Journalism.



(L to R) Medill Undergraduate Jia You, Carol Stein and Seth Stein



Graduate Student Emily Wolin

Professor Daniel Horton Joins the Department

In September, the Department welcomed its newest member to the faculty, Assistant Professor Daniel Horton. Dan is a climate scientist with expertise in (i) the detection and attribution of recent climatic change, (ii) the near-term meteorological, societal and public health impacts of anthropogenic climate change, and (iii) the evolution of Earth's climate system through geologic time. To address this diversity of topics, his research incorporates environmental observations, numerical models, statistical analyses, and machine learning techniques. Dan's "laboratory" consists of computational processors on Northwestern's Quest High Performance Computing cluster, in addition to personal workstations from which his group remotely interacts with the cluster.

As an instructor, Dan plans to develop courses that cover a broad range of topics, including weather, climate, sustainability, and computational modeling. His pedagogical philosophy leans heavily on the scientific method and encourages students to develop a problem solving skill set with wide applicability. Despite his computational research background,

Dan enjoys getting outside, and particularly enjoys getting students outside to observe the world around them. And while the erratic Chicagoland weather is often disparaged, Dan looks forward to the plethora of meteorological variety with which to engage his students.

Prior to joining our faculty, Dan investigated the impact of climate change on heat waves, air quality, and infectious disease while a postdoctoral research scholar in Stanford's School of Earth, Energy, and Environmental Sciences. His PhD thesis on the Late Paleozoic Ice Age was completed in the Department of Geological Sciences at the University of Michigan, Ann Arbor. Dan's meteorological career began in the United States Air Force, where he served as a weather officer at duty stations located in Germany and Italy. He earned his Bachelor of Science degrees in Physics at Tulane University and in Atmospheric Science at Texas A&M University. He grew up in upstate New York, but since departing there has lived all over the map.

Department Chair Brad Sageman comments that the department is



thrilled to welcome Dan: "In addition to the fact that his research and teaching initiatives directly address one of society's most pressing challenges, Dan's numerical earth system modeling expertise adds a key dimension to the department's research capabilities. We are really happy that we were able to recruit Dan to Northwestern."

The Osburn Geobiology Lab Continues to Add Equipment, Attract Students

From its inception in the fall of 2014, the subsequent year has been a time of exciting growth and change for the Osburn Geobiology Lab. New equipment has been acquired and installed in the OrgGeoLab, increasing the scope of possible analyses and sample types, now ranging from ancient rocks to modern microbes. One new piece of equipment is the Picarro cavity ring down spectrometer, which precisely measures the isotopes of water and produced its first batch of data mere weeks after installation.

The newest laboratory addition to EPS is the microbial geobiology lab (also known as the BugLab), which now allows for the cultivation, visualization, and analysis of all sorts of environmental microbes. Construction ended in the spring, marked by a well-attended "lab warming" event. Available equipment includes an anaerobic chamber, gas mixing sta-

tions, incubators, a Zeiss Epifluorescence microscope, and DNA extraction facilities. Samples being studied here include material from Yellowstone National Park, Sanford Underground Research Facility, and the Yucatán Peninsula. These samples promise to produce exciting results as well as valuable learning opportunities for our students.

The ILEPS Stable Isotope Lab is the third node of Osburn Lab activity. The Stable Isotope Lab boasts two isotope ratio mass spectrometers with a range of peripherals. Prof. Osburn is an expert in the analysis of compound-specific organic isotopes, particularly those of microbial lipids. Currently, she is troubleshooting and perfecting hydrogen and carbon isotope measurements of sedimentary lipids using gas chromatography coupled to mass spectrometry. The first round of data from the GC-IRMS was just presented at the 2015 Fall AGU meeting.

Brand new courses also follow this new departmental expertise, including Geobiology (Spring 2015), Microbial Ecology (Winter 2016), and more to come! The Osburn Geobiology Lab now includes graduate student Jamie McFarlin (joint with Axford lab), undergrad majors Dana Johnson and Jordan Todes, and high school student Abby Stein.





Faculty Highlights

Yarrow Axford and graduate students Jamie McFarlin and Everett Lasher continue to investigate the paleoclimate history of Greenland. Recent highlights of field work have included a Summer 2014 expedition to northwest Greenland, funded by NSF and ISEN's Early Career Investigator Award, a surprise request for Lasher and McFarlin to give a research talk to the U.S. Ambassador to Denmark, and coring lakes near Greenland's capitol town of Nuuk in Summer 2015. McFarlin and Lasher are each pursuing novel geochemical approaches to reconstructing Quaternary environmental changes in Greenland. Undergraduates continue to play important roles in the lab's research: Nora Richter completed an honors thesis that earned awards from ISP and our department in 2014, then moved on to a Fulbright Fellowship in Switzerland and now PhD studies at Brown University. Margaret Isaacson and Andrew Pfeiffer earned departmental honors for their senior theses in 2015, and Andrew is now conducting graduate studies at Colorado State. Undergrads Karalyn Berman and Peter Kotecki both won 2015 research grants to conduct summer research in the Quaternary Sediment Lab. A teaching highlight for Yarrow in Winter 2015 was taking her Advanced Topics in Paleoclimate class on a field trip with Prof. Maggie Osburn. An intrepid group of students endured sub-zero wind chills on two Wisconsin lakes to bring home sediment cores for studies of eutrophication. Field work in Wisconsin was colder than any of Axford's arctic adventures this year!

Patricia Beddoes - While continuing to support the department in a great range of administrative dimensions as the Assistant Chair, I am pleased to report that 2014-2015 has been an amazing time with a great number of successes. My co-authored publication in Science (June 2014) "Late Pleistocene human skeleton and mtDNA from Mexico links Paleoamericans and modern Native Americans" was well received in the international popular press reporting on the oldest documented human skeleton found deep in a flooded cave in the Yucatan Peninsula. In March 2015, it was a pleasure again to lead an exceptional group of 18 to the Yucatan Peninsula, this time with Profs. Maggie Osburn and Matt Rossi, to focus on carbonate platforms, and the hydrogeological, depositional, coastal, geomorphological, and geobiological dimensions. I was promoted in my position to Assistant Professor of Instruction by the college in 2014, and truly rejoiced in being awarded the 2015 WCAS Teaching Award from a nomination through students in Environmental Science and Environmental Policy & Culture who expressed their appreciation for my teaching and leadership in the Environmental Science program (including being Interim Director 2014-2015).

Craig Bina - In addition to teaching the ISP geophysics course, Craig revived Bob Speed's course on structural geology and taught an undergraduate introductory course entitled "Geological Impacts on Civilizations". Craig also taught Petrology, for which he led another field trip to the UP of Michigan in the Spring of 2015. Craig also accepted the position of Acting Associate Provost for Graduate Education & Interim Dean of The Graduate School for the duration of the 2015-2016 academic year. Craig recently gave a keynote lecture at a special workshop on "The Earth's Mantle and Core: Structure, Composition, Evolution" in Matsuyama, Japan this November 2015, and he plans to return to Charles University in Prague for more collaborative research in the Spring of 2016.

Neal Blair - A major emphasis of research has involved studying the sources and fates of eroded sediments and carbon in the agricultural Midwest as part of the recently formed Intensively Managed Landscapes - Critical Zone Observatory supported by NSF. Field studies have been in the corn and soybean fields of Iowa and Illinois. The objective of the research is to understand how landscape engineering for agriculture has altered fundamental biogeochemical processes. Neal has had two articles concerning "Source-to-Sink" perspectives accepted for publication this fall. One focuses on the Waipaoa River system in New Zealand and the other has a global perspective. Professor Blair traveled to the Goldschmidt Conference in Prague this summer to present results from the CZO study. He also visited the University of Bonn in the summer to evaluate Northwestern's Study Abroad program in Renewable Energy.

Daniel Horton - see previous page

Matt Hurtgen's research team seeks to better understand the couplings and feedbacks that link evolving ocean chemistry, oceanic anoxia and Earth-surface oxygen levels. Excitingly, PhD student Maya Gomes triumphantly defended her dissertation and was awarded a NASA Astrobiology postdoctoral fellowship to extend her studies at Harvard University. She and Hurtgen recently published a study that examined sulfur isotope fractionation in modern euxinic (anoxic and sulfidic) systems. Jeremy Gouldey also successfully defended his dissertation, which examined the link between Neoproterozoic seawater sulfate concentrations, extreme climate change (snowball Earth events) and the evolution of Earth surface redox. Graduate student Brian Kristall continues to reconstruct the chemical evolution of the Early Cretaceous oceans in order to better constrain the processes responsible for regulating the biogeochemical cycles of carbon, sulfur and oxygen during this time interval. And finally, former postdoctoral fellow Min Sub Sim and Hurtgen recently published a large suite of carbon and sulfur isotope data from Late Devonian-aged rocks that suggest that the development of sulfidic bottom waters in eutrophic epicontinental seas may have played a role in triggering mass extinction during this time.



Steve Jacobsen's research examines global geochemical and geophysical cycles from a mineral physics perspective. He was corresponding author on a paper in *Science*, finding evidence for oceans worth of H₂O in silicate melts trapped at the base of the transition zone, around 700-km depth. The research was featured in the *New York Times* and he appeared on the PBS *NewsHour*, *Weather Channel*, and *BBC*. He received the Bessel Research Award of the Alexander von Humboldt Foundation and was awarded a US Patent for his Optical Contact Micrometer. He serves on the Executive Committee of NSF-COMPRES, a DOE Beamline Advisory Team at the NSLS-II, and the Committee on Seismology and Geodynamics at the National Academy of Sciences.

Andy Jacobson, together with his students and collaborators, made advancements in several areas. Jacobson published an *EPSL* article concerning the Ca isotope geochemistry of basalt weathering in Iceland (Jacobson et al., 2015). In the same issue, he also published a paper providing Ca isotope evidence for ocean acidification during the mid-Cretaceous OAE 2 (Du Vivier et al., 2015). Graduate student Greg Lehn published an article concerning measurement of Ca isotope ratios by double-spike TIMS (Lehn and Jacobson, 2015). Graduate student Grace Andrews recently had an article accepted for publication, which uses the novel method of stable Sr isotope geochemistry to trace cation sources and biogeochemical cycling in the Milford Sound regions of New Zealand (Andrews et al., in-press). Former post-doctoral student, Joel Moore, published an article examining the sources and cycling of CO₂ in Chicago's atmosphere (Moore and Jacobson, 2015). Jacobson also published an EOS article highlighting his research in the Canadian Archipelago (Alkire et al., 2015), and he published another study using Sr and B isotopes trace water-rock interactions in the Wyodak-Anderson Coal Bed aquifer in the Powder River Basin (Lemarchand et al., in-press).

Donna Jurdy's research focuses on tectonic activity on terrestrial planets. Currently, along with graduate student Renee French, she is studying the enigmatic magnetization of Mars. The depth of magnetization of the martian crust that they find perplexes them, while the crustal structure and mineralogy as well as heatflow remain unknown for the Red Planet. Donna continues her work on topographic features on Venus and information on tectonics, while also working with the SPREE project studying seismic reflection data to provide velocities and structural information related to the North American Mid-Continent Rift. She continues her service on the Board of the Association for Women Geoscientists as the chair of the award committee, and regularly serves on NASA and NSF panels such as the Graduate Research Fellowships, and advises department students and others on their fellowship applications. Donna started AWG's Speakers Bureau in 1989 and it has been continuously funded by the energy industry since then. This year, she presented AWG Chevron Distinguished Lectures at the University of Puerto Rico in Mayaguez and at Lehigh University in Bethlehem, Pennsylvania.

Gil Klapper started teaching Earth System History (203; aka Historical Geology) in spring quarter 2007, after teaching and doing research on Paleozoic conodonts at the University of Iowa, starting in 1968 and retiring in 1998. A comprehensive study of Frasnian (Late Devonian) conodont taxonomy and biostratigraphy in the classic western New York sequence is in press with the *Journal of Paleontology*. The paper is a result of a long-term study with Bill Kirchgasser of SUNY Potsdam. Gil will continue to teach 203 this Fall and will continue research on Devonian conodonts.

Emile Okal pursued his work on various aspects of tsunami science. In collaboration with Professor Synolakis (USC/TUC), he published a paper explaining the "sequencing" of tsunami waves, i.e., why and when the maximum amplitude wave at a distant shore is or not the first one. This year, he will have given invited lectures in Sendai, Japan; Hanoi; Xiamen, China, conducted field work in Greece and visited Padang, Indonesia, as part of his collaborative work with the University of Pittsburgh.

Maggie Osburn is settling into her second year at Northwestern and is enjoying the transition from lab building/ construction back to active laboratory science and presentation. The Osburn Lab team is as diverse as ever, actively pursuing research projects on Greenland paleoclimate, deep subsurface geology, and modern microbialite development. The work in Greenland is the thesis project of Jamie McFarlin and in collaboration with Prof. Yarrow Axford (supported by Northwestern ISEN) and has been particularly rewarding. Maggie's work in the subsurface is now funded through grants from the NASA Astrobiology Institute and Exobiology programs and has included multiple trips to the former Homestake Gold Mine in the Black Hills of South Dakota. The ultimate goal is to establish a deep microbial observatory to monitor the composition and activity of microbes living deep underground. Undergraduates play a big role in the Osburn Lab with Dana Johnston working on modern carbonate microbialites from the Yucatan collected on the spring 2015 field trip and Jordan Todes completing a summer undergraduate research project on biomarker patterns from ancient carbonate concretions. Jordan and Dana presented posters this fall at the Midwest Geobiology Symposium and fall AGU respectively. Recent publications include work in *GCA* on Neoproterozoic carbonate chemostratigraphy, *Geobiology* on compound-specific organic isotopes of microbial consortia, and *Frontiers in Microbiology* on deep mine geology.

Brad Sageman has been very busy this fall with administrative work (e.g., two promotions to full professor), research (contributions to five co-authored manuscripts that have been, or soon will be submitted for publication), and advising (undergraduate advisee Tyler Kukla, who presented at the GSA meeting in Baltimore, and new PhD candidate Jiuyuan Wang, who came from Penn State where he completed a M.S. with Professor Michael Arthur). Brad has two active NSF grants supporting work on the Songliao basin of China, as well as the Cenomanian-Turonian of the U.S. Western Interior and his continuing doctoral student, Matt Jones, is doing most of the heavy lifting on these projects, in collaboration with departmental colleagues Matt Hurtgen and Andy Jacobson. Brad continues his work with the Institute for Sustainability and Energy at Northwestern, as well as the Sustainability Council, and he is happy to say that the long awaited Campus Sustainability Plan is almost ready to be submitted to the council.

Seth Stein has worked with collaborators to develop a new model for the evolution of the Midcontinent Rift System, a 3000km long scar across North America which began to tear apart 1.1 billion years ago. However, for reasons we do not yet understand, this rifting event failed to form a new ocean. Seth worked with Prof. Abigail Foerstner and students from the Medill School of Journalism to produce an educational short about this system (see pg. 5). Seth also gave the graduate address at Virginia Tech's geology class in the Spring of 2015. Seth continues to work with grad student Eddie Brooks and statistics Professor Bruce Spencer to test the utility of maps used to predict shaking and other hazards in Japan.

Suzan van der Lee was on research leave last year while working at Géoazur, a geosciences laboratory in southern France. Suzan continued working with her Northwestern graduate students Emily Wolin, Trevor Bollmann, Michael Witek, and postdoc, Hao Zhang on research projects ranging from the mechanisms of earthquakes and the analysis of ambient noise, to the deep structure beneath North America's Mid-continent Rift. Suzan also worked with students and colleagues at Géoazur on a new earthquake swarm in a formerly seismically quiet region, comparing tomographic models, errors in ISC delay times, and seismic data from floating hydrophones that roam the Earth's oceans. Suzan is looking forward to publishing an overview and a major batch of exciting results from the SPREE project.

Looking Back at Locy Hall



A return to the department's former home of Locy Hall reveals many changes underway on Northwestern's South Campus.

Locy Hall was originally constructed in 1928 and was named after William Locy, a Professor of Zoology at Northwestern from 1896 until his death on October 9, 1924.

Though many in the department consider Locy to be the department's ancestral home, a dive into the University Archives finds this is not quite true. As confirmed by University Archivist Patrick Quinn, the original location of the Department of Geology was in University Hall, a decorative Victorian Gothic-style building that still stands at 1987 Sheridan Road. The Department of Geology moved from University Hall to Locy Hall in 1958, which required major downsizing of the department's rock, fossil, and mineral collections. Some specimens were given to the Chicago Academy of Sciences, some were sent to the Field Museum of Natural History, but many more continue to reside in the department's private collection, which has followed us to the Technological Institute, the current home for our department.

Many alumni and friends may remember classes, seminars, and facilities in Locy with fond memories, but since our departure the space has been radically changed. The building now houses the Department of Theater Design and staff offices for the Math Department (overflow from Lunt Hall - one of the oldest buildings on campus, where a picture of Teddy Roosevelt still hangs in the hallway). Other areas of Locy have been "repurposed" for office space and classrooms. The first floor hosts 4 classrooms seating over 100 students; the second floor has 4 more classrooms, and the third floor has 3 small classrooms. One classroom occupies Brad Sageman's old office - the one formerly shared by Geology Professors Bob Speed and Larry Sloss. Currently classrooms on Northwestern's campus are heavily scheduled and much in demand. Although we miss those high ceilings and windows that one can actually open, we are pleased that Locy continues to fill student needs, and will continue to do so in the near future.

The L.L. Sloss seminar room, ringed with windows on the South and West sides, remains largely the same as when we left, with the traditional blackboard and speaker's podium now on the east wall. In the first floor stairwell near the side exit, an office that was once occupied by Professor Finley Bishop now houses the *One Book One Northwestern* community reading program.

Walking through the building, Prof. Donna Jurdy discovered her old office on the second floor still features her name on the door. It seems that not all remnants of our department have faded from the halls of Locy.

Just to the west, Kresge Hall is undergoing extensive renovations. Kresge housed many humanities departments and classrooms, and the improvements to the building promise to help accommodate Northwestern's growing student population. To the east of Locy, the Segal Visitors Center was completed just last year. This building hosts prospective students and their families during their visits and tours of the campus. This building also contains a multi-story parking garage, which easily accommodates more than 400 cars. This structure now blocks most of the wonderful Lake Michigan views that Locy once enjoyed.

What will the future bring for Locy Hall? We've heard that in Northwestern's long-range plans it will be demolished to make room for a new wing of the adjacent Fisk building. Meanwhile, Locy endures amid the new construction and continues to bustle with student activity.



The 2007 EPS Department Photo outside of Locy Hall

Graduate Student Updates

This year saw students **Jamie McFarlin**, **Eddie Brooks** and **Everett Lasher** pass their qualifying exams to become PhD Candidates. We also welcomed new graduate students **Vivian Tang**, **Fei Wang**, and **Jiuyuan Wang** this Fall, and we are excited to also welcome new graduate student **Michelle Wenz** in the Winter of 2016. We also said farewell to our Graduate Students **Allison Baczynski**, **Maya Gomes**, and **Jeremy Gouldey** who all completed their PhD studies.



John Lazarz just outside of Los Alamos, New Mexico

Grace Andrews spent the last year analyzing Greenland Ice Sheet subglacial discharge samples collected during Summer 2014 for carbon and strontium isotopes. She also worked on calculating Ice Sheet CO₂ fluxes and major ion geochemistry. Grace also spent three months in Kangerlussuaq, Greenland this past summer. Drone footage of the fieldwork was featured in a New York Times digital article in November.

Trevor Bollmann is continuing work on his tomographic model of the Mid-Continent Rift using teleseismic P and S-waves. Over the summer, Trevor was a Professional Intern at Chevron in Midland Texas working on Asset Development in the Permian Basin. In October, Trevor along with other grad students successfully removed the SPREE seismic stations in Northern Ontario.

Eddie Brooks is shifting the focus in his coursework to statistics in order to complete the requirements for a MS in Applied Statistics by Spring 2016. Eddie also was awarded an Institute for Policy Research Graduate Research Fellowship for the 2015-2016 academic year. Eddie also published his first major paper in August titled "Metrics for assessing earthquake hazard map performance" in the Bulletin of the Seismological Society of America.

Laurel Childress led extensive maintenance and repair of the pyrolysis-GCMS equipment, and since then has completed ~1 hour runs on over 120 samples (rock, marine sediments, plants), in addition to more than 40 standards. Processing of data from the samples continued through the spring and summer of 2015. Concurrent with this lab work, Laurel has continued work on three manuscripts including a Raman laser/kerogen manuscript with Steve Jacobsen, a manuscript covering work from the IODP 341 Expedition with Ken Ridgway (Purdue), and a manuscript on organic carbon in the Waipaoa River system New Zealand with Neal Blair. Laurel is anticipated to graduate in Spring 2016.

Renee French - In the past year or so, I have published my research about characterizing a recently discovered global population of small-scale lunar graben. Additionally, this past summer Donna Jurdy and I submitted a manuscript on comparing the magnitude and depth of magnetization of the Martian crust in Terra Meridiani and a large portion of the southern hemisphere. I'm currently working on a manuscript about the relation of slope with boulder size and density along lunar wrinkle ridges. Renee was recently awarded the National Association of Geoscience Teachers Outstanding Teaching Assistant Award and the Weinberg College Outstanding Graduate Student Teaching Award.



Renee French, Grace Andrews and Ashley Gilliam celebrating a classmate's successful thesis defense

Ashley Gilliam is investigating the evolution of Titan's atmosphere since accretion, focusing on the photolytic conversion of methane to ethane and the subsequent condensation and accumulation of liquid ethane on the surface and its interaction with Titan's porous crust. Ashley was awarded a 2015-2016 renewal for her NASA Earth and Space Science Fellowship, and she also received the 2015 Horace A. Scott Graduate Award for Outstanding Research. Ashley submitted her third paper for publication in Icarus and presented research at the 2015 Astrobiology Science Conference in Chicago in June.



Matt Jones pointing out an interesting formation during the Spring 2015 Baraboo Field Trip

Matt Jones - My third year in the EPS PhD program at Northwestern was comprised of a mix of traveling for fieldwork, serving as a teaching assistant, and continuing labwork for several projects relating to sedimentary geology and Earth history. One leg of fieldwork took me to N.E. China's Songliao Basin where a massive drilling effort (>6km total depth) is underway to probe the paleoclimate record of a long-lived lake once situated in the region. This Fall I traveled to the American Geophysical Union's annual meeting where I will present results from geochemical and stratigraphic research on a Late Cretaceous aged core drilled in Utah (2014). The core preserves a unique interval of rocks bearing evidence for potential ocean acidification at the

onset of Oceanic Anoxic Event 2, an episode of enhanced global volcanism, global warming, and widespread black shale deposition. This Winter I plan to travel to a collaborator's laboratory in Durham, U.K. to continue investigating evidence for changes in ocean acidity through time by analyzing trace metal concentration and isotopic composition in sediments.

Brian Kristall is continuing to expand the marine barite and pyrite sulfur isotope record for the Early Cretaceous. Brian is also working on improved coupled modeling of the sulfur and strontium cycles during the Early Cretaceous to provide better constraints for both systems. Brian also welcomed first daughter, Lillianna Maren Kristall, into the world on March 20th, 2015.

John Lazarz is working on a combination of materials research and technique development related to mineral physics. He has been primarily working on determining the elasticiy of majorite-garnet in the transition zone (TZ) with implications for TZ composition and mantle dynamics. John has also developed and implemented a new x-ray area detector system for the NU Mineral Physics Lab. John has spent this year working at Los Alamos National Laboratory in New Mexico and with collaborator Przemek Dera at the University of Hawaii. John will give a talk at the Carnegie/Department of Energy Alliance Center this December on the work performed at Los Alamos.

Everett Lasher is continuing research on Holocene climate and environmental change along Greenland's west coast as well as improving methods to decipher climate change using the isotopic composition of aquatic organic material in lake sediments. This past summer Everett participated in fieldwork in Nuuk, Greenland alongside his advisor, Yarrow Axford. Everett was also granted an Institute for Sustainability and Energy at Northwestern (ISEN) Cluster Fellowship for the 2015-2016 year.

Jamie McFarlin is currently focusing on building a record of paleoclimate in northwest Greenland through the Holocene and prior to the Last Glacial Maximum. To generate this record, she is pairing temperature reconstructions using chironomid (insect) assemblages with analyses on the distribution and δD of biomarkers preserved in lake sediments. This is a collaborative project that employs tools from both the Quaternary Sediment Lab and the Isotope Geobiology Lab and she is currently advised by Yarrow Axford and Maggie Osburn.

Emiliano Monroy-Ríos - My research involves the study of the carbonate geology and geochemical features of the hydrogeological system in the Yucatán Peninsula. It is mainly focused on the water-rock interactions and specifically on the role of Fe and P. In the pursuit of this understanding I realized that first I should understand the regional flow patterns on a broader scale. A pending and interesting question is the determination of the geological, geochemical, and structural processes that have led to the upwards propagation of voids on a super-deposited carbonate sequences to form an aligned arc of sinkholes, called the Ring of Cenotes (ROC). How were the morphological characteristics of the deeply buried crater ($>1\text{ km}$) transferred through a thick carbonate bed to create the pattern that we can observe today on the surface? Drawing from the published literature on drill core and geophysical surveys, numerical modeling, and general carbonate platform hydrothermal reactive transport simulations, I'm working to provide a robust conceptual model for the genesis of the ROC.

Nooshin Saloor is currently working on the earthquake scaling laws through studying various constraints on the THETA parameter (energy-to-moment ratio). Nooshin has done some work on calculating THETA for different distance & depth patterns in different tectonic settings. Nooshin has recently participated in the CIDER summer program and the 2015 OBS Symposium, and is looking forward to attending the 2015 AGU Fall Meeting.

Joshua Townsend has continued to research hydrogen partitioning between two lower mantle polymorphs of MgSiO_3 : Bridgemanite and postperovskite. Josh uses computational methods to calculate the vibrational properties of these phases, which requires significant computational resources from Northwestern's QUEST computing facility and Argonne National Laboratory's Center for Nanomaterials. In April, Josh published a paper in the journal "Physics of the Earth and Planetary Interiors" with Prof. Steven Jacobsen, Prof. Craig Bina, and Prof. Jun Tsuchiya at the Geodynamics Research Center in Japan on the structure and elasticity of hydrous postperovskite.

Michael Witek has been working on creating an S-wave velocity model of East Asia using Rayleigh wave group velocity dispersion curve mesurements from cross-correlations of ambient seismic noise. In August of 2014, Mike began his 10 month Fulbright fellowship in Busan, South Korea, where he worked with Professor Tae-Seob Kang at Pukyong National University. During that time, he presented research results at the 2014 Geological Society of Korea meeting in Korea, the 2014 AGU Fall meeting in San Francisco, the 2015 Japan Geoscience Union meeting in Chiba, Japan, and the 2015 Asia Oceania Geosciences Society meeting in Singapore, where he won the Best Student Poster Award. In November 2014, Mike published a paper detailing his work on Rayleigh wave group velocity distributions in Korea and Japan. Mike's Fulbright grant concluded in June, and he returned to Evanston this past August.



Aerial footage of Casa Cenote taken during the Yucatán Spring Break trip, 2015

Alumni News



Rebecca Fischer (BA 2009) accepted an offer to join the faculty of the Department of Earth and Planetary Sciences at Harvard University. She is currently participating in an NSF Postdoctoral Fellowship done jointly between the Smithsonian Institution and UC

Santa Cruz, and will begin the Harvard position in 2017. Rebecca also recently visited Evanston to give a seminar talk titled *Earth's accretion, core formation, and core composition*

Jim Riehle (PhD 1970) retired from USGS Alaska in 2001, and since then has been writing papers based on highway research in Oregon and other western states. His work has recently been published in *Geosphere* and the *Journal of Volcanology and Geothermal Research*. Jim's daughter graduated from Northwestern in 2010, and has since pursued a Master's degree in Analytics at George Washington University.

Brian Shiro (BA 2000) is continuing work as a geophysicist at NOAA's Pacific Tsunami Warning Center in Hawai'i. He, along with his colleagues, have moved from the center's longtime home of Ewa Beach to a new facility in Pearl Harbor. Brian is also continuing work with Scott Rowland at the University of Hawaii at Manoa, where he is pursuing a part time PhD related to the study of geophysical exploration in Mars analog environments



John Brodholt (MS 1988, pictured above with host Jon Culshaw and RAS President Professor Martin Barstow) was awarded the Price Medal from the Royal Astronomical Society. The Price Medal was established in 1992 to recognize merit in solid earth geophysics, oceanography or planetary sciences. John's work on developing molecular dynamics programs to simulate liquids in the crust and mantle has contributed greatly to continuing studies of the deep interior of Earth and the icy planets.

Katie Jaycox (BA 2014) has begun employment at Space X as a Manufacturing Engineer. Katie previously worked with Prof Steve Jacobsen.

Kathleen F. P. Davis (MS 1969) continues to run her translation business, concentrating on translating for the scientific and technical community, including engineers and geoscientists.

Mitchell Kirschner (BA 2015) currently works as an engineer at General Dynamics Electric Boat, working on test equipment for the propulsion plant of VIRGINIA class submarines. He is also continuing

his education through pursuit of an MS in Systems Engineering at Worcester Polytechnic Institute through a program offered by General Dynamics.

Fred Marton (PhD 1998) was recently promoted to Associate Professor at Bergen Community College, where he is a member of the Physical Sciences department.

Paul Stoddard (PhD 1989) is finishing up his 2nd year as a Faculty Personnel Advisor at Northern Illinois University, where he works in the Department of Geology. Paul also plans to run again for re-election to the DeKalb County Board, where he currently serves on the Executive and Finance committees.

Kayleen McMonigal (BA 2015) began graduate studies at the Rosenstiel School of Marine and Atmospheric Science at the University of Florida.

Stephen Meyers (PhD 2003) was selected as the 2016 recipient of the James Lee Wilson Award by the Society for Sedimentary Geology. The award is granted to scholars who have achieved a significant record of research accomplishments in sedimentary geology, including all aspects of modern and ancient sedimentology, stratigraphy, and paleontology, fundamental and applied, and in this case recognizes Steve's excellent contributions in the fields of astrochronology and paleoceanography.

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