

The Outcrop 2014-15

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Save the Dates for these Alumni Events

Please join us:

Geobadger Alumni Receptions at national meetings:

- AAPG Calgary, Alberta, Canada; June 19-22, 2016
- GSA in Denver, September 25-28, 2016

Cover Illustration:

Magnified image of 56 million year old shell of a planktonic foraminifer grown near sea surface cemented to diagenetic crystals composed of optical grade calcite that precipitated on sea floor. Note numerous blades of secondary (diagenetic) calcite protruding from shell surface. Materials recovered from deep-sea core taken atop seamount located in central Pacific Ocean (image courtesy Reinhard Kozdon). **See page 17 for Clay Kelly's article.**

The Outcrop, 2014-15

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Alumni and Friends: Please notify the department if you have a mailing address or email address change. The UW Alumni Association or US Postal service may not share new information with us.

We'd like to hear from you! Send professional and personal updates, feedback, news and photos for *Outcrop 2015-16* (will be published fall 2016) to:

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The Outcrop on the web:

<http://geoscience.wisc.edu/geoscience/alumni-friends/outcrop/>

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From the Chair

Dear Alumni and Friends—

I am excited to be able to introduce this year's edition of The Outcrop recapping an eventful year in Weeks Hall and for GeoBadgers all over the world. You've likely heard about some of the budget challenges the UW faces with state government tightening its belt; Even though we face our share of the cuts, I am happy to be able to report that we have more than made up for them through ever-more-robust activity.

In the fall semester of 2015 we welcomed another large group of new graduate students, bringing the population up to 70 in all. Undergraduate numbers remain at highs not seen since the 1980s as well, with 56 bachelor's degrees granted in this past academic year! This continues to challenge us on the teaching front (how do you run a Mineralogy class, now with 90 students?!), but the generosity of our alumni and friends (you) has allowed us to keep offering those hands-on lab and field experiences.

We've had many highlights this past year inside and outside of the walls of Weeks Hall. We've welcomed Luke Zoet (glacial processes) as our newest faculty member. Shaun Marcott's team did a truly adventurous field project in Greenland (pg. 8), the Laguna del Maule project in Chile saw a very active field season with many faculty members and students riding in boats, on horses, and in 4WD trucks, not to mention on foot, to pull off the multi-disciplinary integrated study of this potentially awakening caldera system. GeoBadgers were seemingly everywhere, even featured as the cover story in GSA Today two months in a row with the Chile project followed by Richard Becker's Ph.D. project on the joint systems of Yosemite's Toulumne Meadows region in the High Sierra.

Field trips headed out to Greece, Vancouver and San Juan Islands, the St. Francois Mountains, and many other places. We hosted the North Central GSA meeting, as well as several other research conferences, reinforcing how central Madison is to our field. Our students garnered a record number of GSA field work grants, 13 in all. Our faculty and students were recognized with numerous awards, which you can read all about in these pages. And finally, a real highlight of the year came during our annual Spring Banquet, when John Morgridge regaled us with hilarious tall tales of roaming the Geology Department in the Science Hall

days with his geologist brother Dean. It was quite a finale for a celebration of a remarkable year.

Another real milestone: Professor Dana Geary retired in 2015 after 29 years on the faculty,

and immediately headed out to hike seemingly every trail in the Colorado Rockies and California's Sierra Nevada (more about Dana's retirement in the Outcrop for 2015-16). Her hiking boots will be hard to fill around here. The state budget cuts mean we'll have to be patient through a hiring freeze before we can seek a new faculty member to maintain our full strength.

Perhaps the most long-lasting highlights of this eventful year will be two major new endowed funds that we are happy to announce. First, the very generous sustained effort made by Sherry and David Lesar to endow the Geology Museum Directorship (see page 5), with a gift matched by the Morgridge Fund to make a total of nearly \$4 million, will finally place our gem of a museum on richly-deserved secure financial footing. Our stellar museum staff will be able to do even bigger and better things. Second, Jamie and Stella Robertson have just recently created a new Graduate Fellowship endowed fund that takes advantage of the Nicholas Family matching opportunity (still open!) to help us keep our graduate program as strong as it can be.

We are deeply appreciative of the generosity of the Lesars, the Robertsons, and every one of our many donors and supporters. I hope that they will inspire others to help us as we strive to be even better. Contributions to the Nania Fund will do exactly that, as will gifts to our Field Experience and Field Camp Funds, as well as all the other funds listed on the giving page.

Finally, speaking of Field Camp, if you are a Wasatch-Unita survivor (I mean alumnus!) and want to re-experience the glories of the Chateau Apres, stay tuned for announcements of the 50th Anniversary celebration coming in summer 2016!



Harold Tobin





The Board of Visitors meeting in Weeks Hall, October 18, 2015: Left to right: Martin Shields, Mark Solien, Mark Emerson, Kirt Campion, Charlie Andrews, Christine Griffith, Evan Franseen, Liz Clechenko (front), Bob Nauta (back), Jim Davis (front), Steve Johannsen (back), Harold Tobin (Department Chair), Tom Doe, Jeff Pietras, Doug Connell (BOV Chair). Photo, Mary Diman.

The Board of Visitors

Greetings GeoBadgers

As you'll see elsewhere in this edition of the Outcrop, it's been an eventful year, and one that highlights the importance and impact of alumni support for the Department. Your contributions and assistance continue to be a vital part of the experience and education of the geoscientists of the future and make a huge difference in the life of the Department.

The Department is continuing its focus on support for student field experiences and graduate education, as well as the continual refurbishment and upgrades to its facilities required as new faculty and their research programs ramp up in the Department. The Student Field Experience Fund continues to make the experiential learning so important to development of geologic skills possible; without it, the Department would have few resources to help students shoulder the costs of field trips as it gets no support from the University for those activities.

Graduate student support also remains vital in light of the reduced support for Teaching Assistantships and other student funding. Your donations to the Nania Fund will help the department meet its goal of sustainably funding multiple graduate students, and the new Nicholas Scholarship Match (which matches household donations of \$50,000 or more over five years for student support) can greatly expand the impact of your donation if you have the resources to give at that level. Please contact our new Development Director at the UW Foundation, **Troy Oleck** (troy.oleck@supportuw.org) if you want more information on the Nicholas matching program or other opportunities to support the Department.

We can all be proud of the recognition that the Department receives, and we particularly want to congratulate the Geology Museum's director **Rich Slaughter** for his new title as the "Sherry Lesar Distinguished Chair of Geological Wonder".

We're also excited as we begin planning for our next alumni event in conjunction with the 50th anniversary of the Wasatch-Uinta Summer Field Camp in Park City, Utah in late July 2016. Get more information in this Outcrop (page 31), via the Department's quarterly e-newsletter, and on the web.

Finally, we have added several alumni to our Board: **Liz Clechenko** (MS '02, PhD '07), **Christine Griffith** (MS '77), and **Tina Nielsen** (PhD '08), and welcome further nominations or expression of interest. Board members serve a four-year term and meet regularly with the Department's faculty, staff and students in Madison.

These are challenging times at the University and your involvement makes a difference in helping continue the amazing things that the Department is doing. The need for outside support is crucial to attracting and keeping world class faculty to teach and propel the research that makes the Department one of the best in the country. We appreciate the opportunity to represent you alumni to the Department, and so please let us know your ideas on how we can continue supporting its mission and reputation.

On behalf of my BOV colleagues, thank you for your support of the Department of Geoscience.

Doug Connell,
2015-2016 BOV Board Chair
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Gifts to the department in 2014: Thank you

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			Kathleen A Smith	

Distinguished Alumni Awards *for 2015*

KENNETH R. BRADBURY, *DISTINGUISHED ALUMNUS*

For distinguished research and sustained service and leadership in the management and protection of groundwater resources

KENNETH R. BRADBURY completed the Ph.D. in 1982 under funding from the Wisconsin Sea Grant Program working with Mary Anderson. After graduation he made the decision to stay in Wisconsin and accepted a position with the WGNHS and UW-Extension where he is currently a Research Hydrogeologist, Professor, and Assistant Director for Science. As an affiliated faculty member in our department, he regularly serves on student advisory committees and has co-advised 19 M.S. and Ph.D. theses.

With his Ph.D. research, Ken began a career devoted to groundwater resources protection focused on problems in the State of Wisconsin. Although applied to Wisconsin, his research has contributed important general insights into flow through fractured rocks, transport of viruses in the subsurface,



wellhead protection, regional hydrogeology, and recharge processes. Ken has the impressive ability to identify and answer important research

questions. His work is published in top ranked journals.

He has served on committees in Wisconsin as well as nationally. In Wisconsin, he is a member of the Technical Advisory Board for the Madison Water Utility; the Research

Subcommittee for the Groundwater Coordinating Council; the Groundwater Research Advisory Council for the UW; and the Joint Board of Professional Geologists, Hydrologists & Soil Scientists. Nationally, he has served on panels for the National Research Council and as a member of its prestigious Water Science and Technology Board. Ken was awarded a Fulbright grant to work in Cape Town, South Africa in 2008. He is a fellow of the Geological Society of America and received the 2007 Distinguished Service Award from the Wisconsin Section of the American Water Resources Association, the 2013 Chancellor's Award from the UW-Extension and the 2013 Research Award from the Wisconsin Water Association.

—Mary P. Anderson, Citationist

WILLIAM A. (BILL) MORGAN, *DISTINGUISHED ALUMNUS*

For distinguished scientific leadership in the petroleum industry and the discipline of sedimentary geology

WILLIAM A. (BILL) MORGAN (B.S. 1975; M.S. 1977) is a native of Wisconsin and Madison, and went on to a distinguished career at Conoco Phillips where he achieved the positions of Principal Stratigrapher and Geoscience Fellow, one of the highest technical positions in geoscience at Conoco Phillips. Bill completed his M.S. under the guidance of Dave Clark on the Triassic-aged biostratigraphy of the Great Basin. With this work and added inspiration from Lloyd Pray, Bill began a lifelong career focused on stratigraphy and carbonates. Bill has had a worldwide geologic experience that encompasses stratigraphy and carbonates from the Pre-Cambrian to the Holocene. Through collaborative work with a broad cross-section of the carbonate community, he has contributed to a deeper understanding of carbonate reservoirs, carbonate platform



growth, and most recently microbialite reservoirs through his many publications (47 and counting), and his editorship of countless SEPM special

publications and AAPG memoirs. He was awarded the Robert H. Dott, Sr. Memorial Award for authorship and editorship of the 2003 best SEPM-AAPG Special Publication entitled Permo-Carboniferous Carbonate Platforms and Reefs. Bill has been recognized throughout his career for his service to the AAPG and SEPM. He served on many committees for both organizations and

notably as Secretary-Treasurer and President of SEPM. He has been honored with the Distinguished Service Award from AAPG and is an Honorary Member of SEPM. Throughout his career, Bill has been a loyal supporter of the Geoscience Department in Madison and has always been a great example of the Wisconsin Way. During his membership on the Board of Visitors, Bill has actively supported the development of future generations of geoscience professionals. Bill has recently retired from Conoco Phillips, maintains an active consulting practice, and is planning on returning to Madison in his retirement. The department and Board are both very proud of Bill's accomplishments and grateful for all his efforts on our behalf; we feel great pride and pleasure in naming him a Distinguished Alumnus.

—Rick Sarg, Citationist

DEAN L. MORGRIDGE, *Distinguished Alumnus*

*For distinguished contributions to the field of petroleum geology
and to understanding of the geology of Alaska*

DEAN L. MORGRIDGE (B.S. Geology, 1952; M.S., 1954) was a consummate field geologist who had a long and notable career with Humble Oil and later Exxon Corporation. He was a key member of the team that did the pioneering development of Alaska's famous Prudhoe Bay field. Dean was a native of Wauwatosa, Wisconsin, and came to Madison to study geology, earning a bachelor's degree in 1952 and a master's in 1954, under the mentorship of Lowell Laudon. While working on his master's, Dean worked in the Pacific Northwest with Professor Laudon, where they encountered Humble employee Bob Dott, Jr. Subsequently, Dean and Bob worked



together in the company's Eugene field office in the mid 1950s. Dean Morgridge's long career with Exxon was focused on the geology of sedimentary basins in Alaska. He never lost sight of his roots in field geology, and after his retirement, the Dean L. Morgridge Distinguished Graduate Fellowship was

established in the Geology & Geophysics Department in his honor. That fellowship has been supporting graduate students in their field projects for more than 15 years. Dean passed away in 2010 and, to commemorate his life and career, John and Tashia Morgridge established the Dean L. Morgridge Distinguished Professorship in the department as well, endowing the chair now occupied by Professor Shanan Peters. The department celebrates the peripatetic career and many contributions to field geology of Dean L. Morgridge, and enthusiastically honors him as a Distinguished Alumnus.

—Harold Tobin, Citationist

Outstanding Gifts

JAMES D. AND STELLA M. ROBERTSON GRADUATE FELLOWSHIP

Inspired by the generosity and interest in supporting graduate students displayed by alumni including Ken Ciriacks, Mark Solien, and the family and friends of Jay Nania, Jamie Robertson (PhD, 1975) and his wife Stella are establishing a new graduate student fellowship. Jamie has served on the Board of Visitors of both the Geoscience Department and the Geological Engineering Program and remains a leading supporter of our educational and research missions. This fellowship is possible thanks to a gift from the Robertsons that is matched by the Nicholas Family and will support a 12-month research assistantship in Geoscience. Raising donor support for our world-class graduate program is among the Department's top priorities. We thank Jamie, Stella, and the Nicholas family for their generous and timely support. ●



Jamie and Stella Robertson during a recent trip to Svalbard.

SHERRY LESAR DISTINGUISHED CHAIR OF GEOLOGICAL WONDER

The Geology Museum has a legendary past and now thanks to a pair of record gifts, it will have an even better future. To bolster the museum, Dave and Sherry Lesar have given \$2 million which has been matched with \$1.5 million from John and Tashia Morgridge. These over-

whelmingly generous donations were used to establish **the Sherry Lesar Distinguished Chair of Geological Wonder**, which Rich Slaughter will hold as museum director.

This endowment will also be used to acquire specimens with amazing stories and then share them via exhibits and educational programs.

The other focus will be on

creating even more opportunities for UW students to get involved in the museum.

Of course, given their magnitude, these gifts will benefit all major aspects of the museum. This is fitting as the Lesars want the entire museum staff to have the resources to successfully pursue big ideas. In addition to Rich, the museum crew has grown over the last decade to include Brooke Norsted, Carrie Eaton and Dave Lovelace. They are all eager to make the museum an even more powerful conduit of curiosity. ●



One shell of a team. Brooke, Rich, Carrie and Dave pose with a glyptodon replica that the Geology Museum acquired in 1888.

Photo, Sarah Morton.

Spring Break 2015

Students in the Field

GeoBadgers trek to the St. Francois Mountains

Shanan E. Peters

Spring Break means lounging on beaches for some UW Badgers, but for GeoBadgers it provides a welcome opportunity to get out into the field and to see some new rocks. This year's GEO376 Spring Break course stayed comparatively close to home, both geographically and geologically. The St. Francois Mountains, just south of St. Louis, provide a fantastic opportunity to explore an approximately 1.4 billion year old, partially exhumed caldera system exposing both rhyolitic eruptive components and associated granitic plutons. The eroded caldera complex is covered by Cambrian shallow marine sandstones and carbonates quite similar to those making up the Sauk Sequence back in Madison, resulting in a paleotopographically complex Great Unconformity surface.

After loading the vehicles and our trusty trailer early Saturday, March 28th (minus one of student participants), we headed south. A leaking front differential on our trailer pulling vehicle nearly ended the trip, but thanks to a team effort led by undergrad **Luke Schranz**, we were able to limp along for the whole trip. This gave our wayward student a chance to catch up and meet us on the road, a happy side effect of the mechanical delays. After stretching our outcrop legs on Mississippian carbonates exposed along roadcuts flanking the Mississippi river, we arrived at Silver Mines Recreation Area and pitched camp. Geology started early the next day with Knob Lick lookout, which gave the group a good overview of topography and the margin of the Knob Lick Granite. Great Unconformity and



The Spring Break group in front of the Great Unconformity. A basaltic dike cuts through rhyolitic ash flow deposits, both of which sit beneath the bouldery Great Unconformity. Photo, Shanan Peters.



"Support your fellow GeoBadgers." A demonstration by undergrads at Elephant Rocks State Park, Missouri. Photo, Shanan Peters.

ignimbrite exposures along the road back to camp filled the rest of the day. From there it was a classic tour around the St. Francois, from Elephant Rocks State Park and Taum Sauk Mountain to the Iron Mountain Trap Rock active operation. We were all fortunate to make a good Wisconsin contact at the Mingo National Wildlife Refuge, who gave us a fantastic tour of the famous Pilot Knob exposures (thanks Lindsey Landowski!). Veteran (in all senses of the word) Spring Breaker Jim Senn gave some of the group a tour of the Civil War battle site at the base of the knob. The trip finished in the Sauk sequence, with carbonates and MVT-style mineralization, along with some spectacular specimens of drusy quartz. The Weeks courtyard also gained a new ~300 pound addition: a beautiful flat pebble conglomerate from the Davis Formation.

All in all, the weather was fantastic, the camp sites pleasant, and the rocks outstanding. Our student participants **Adam Albers, Daniella Assing, Justin Brown, Kayla Gosz, Lisa Haas, Eric Huffman, Aaron Kutz, Connor Lauzon, Yang Shape Lor, Salsabila Nazari, Luke**

Rykoskey, Morgan Sanger, Luke Schranz, Jim Senn, Sayazana Tuan Ab, Alex Walker, David Wang, were all great and made the trip a success, and a lot of fun. And of course, it's all made possible the **Alumni Student Field Experiences Fund**. Thanks GeoBadgers! ●

A Seminar Field Trip

Students in the Field

When in Greece explore geology

In May 2015, a group of 11 Weeks Hall residents went on a fieldtrip in the Aegean (Greece), as a follow-up of a semester-long seminar. The organizers of the fieldtrip (post-doctoral fellow **Vasileios Chatzaras** and **Professor Basil Tikoff**), graduate students (**Hannah Bartram**, **Nicolas Garibaldi**, **Saurabh Ghanekar**, **Jack Hoehn**, **Maureen Kahn**, **Zach Michels**, **Nicolas Roberts**, **Crystal Wespestad**), and undergraduate student **Hannah Maas** explored the geology of the Cycladic islands of Naxos, Syros, and Andros. In the field, we were joined by **Seth Kruckenberg** (Boston College; former postdoctoral fellow in Weeks Hall), and the Greek colleagues Paris Xypolias and Ioannis Koukouvelas (University of Patras). Highlights



The Aegean Sea distracts the group doing field work.
Photo, Vasileios Chatzaras.

included hiking at Naxos migmatite dome, finding spectacular eclogites and blueschists in the world-class exposures of northern Syros, discussing the role of extensional detachment faults on Andros, and eating delicious Greek food. Of course, we never allowed the Aegean Sea or the beautiful weather to distract our attention from the geology (photo). Going one step further our Greek geological quest, we lived our geomyth in the ancient site of Delphi, searching for faults, CO₂, and oracles. We had 10 wonderful days in the field, seeing great geology and beautiful islands, and interacting with nice people.

Support was provided by the department's alumni-supported Field Experiences Fund. ●

Undergrad GeoClub

Geoscience starts with W



Undergrad GeoClub members camped in Ottawa National Forest and explored Jasper Knob, Champion Mine, and a staurolite schist outcrop in the Upper Peninsula of Michigan during the club's fall September 2015 field trip.

On Jasper Knob in Ishpeming, MI: Top row, from left to right: Adam Albers, Elise Penn, Luke Schranz, Zach Lauridsen. Middle Row: Zach Olson, David Cheng, Kevin Hernandez, Alli Starry, Alex Walker, John Steinle. Bottom Row: Daniella Assing, Cailee Luther, Salsabila Nazari, Briana Phibbs, Morgan Sanger, Cameron Evans, Lisa Haas. Photo, Luke Schranz.

The trip was supported by alumni gift funds. ●

Summer Field Work:

A Report from the 81st Parallel North

Shaun Marcott

The road to Greenland is paved with good intentions, but sea ice and broken airplanes can complicate any field excursion and potentially spoil a good adventure—especially when being delayed home means one of the field members is faced with the reality of missing their own wedding!

This past summer I spent six weeks with my new students, **Elizabeth Ceperley** and **Melissa Reusché** (Figure 1), in northwest

Greenland as part of a large collaborative project that involved researchers from Oregon State University, the University of Colorado-Boulder, the University of New Hampshire, the British Antarctic Survey, and the Geologic Survey of Denmark and Greenland. The goal of the project is to understand the glacial history of the northwestern sector of the Greenland Ice Sheet (GIS) in order to establish a detailed accounting of the underlying mechanisms that control the ice sheet distribution on land and in the ocean. The project is unique because it involves oceanographers, geophysicists, and atmospheric scientists working on modern observational data from the ocean and atmosphere, and geologists working with the sediments and glacial deposits from marine cores and on land. The focus of the project is centered on the Petermann Glacier system, which drains a marine-based sector of the GIS and terminates in a large floating ice shelf that is sensitive to ice-ocean interactions. This particular section of the GIS has undergone significant change in the last 10 years, with major portions of the floating ice tongue breaking



Figure 1: Melissa, Shaun, and Elizabeth preparing to catch a lift.
Photo, J. Rosen.

off into the ocean. One goal of this project is to understand why these events occurred and how they relate to the record of the ice sheet in the past.

Getting to northwest Greenland is no easy feat. Traveling by commercial plane from Madison, we arrived in Schenectady, New York a few days prior to catching an Air National Guard flight to the small town of Kangerlussuq in western Greenland at 67°N. From “Kanger,” we took a second Air National Guard flight to Thule Air Base (the northernmost U.S. military base at 76.5°N), where we then boarded the Swedish icebreaker *Oden* (Figure 2). At a cruising speed of 5-10 mph (depending on sea ice conditions), *Oden* was our floating home while we slowly maneuvered our way through the sea-ice-infested waters of Nares Strait. After about a week of motoring our way north, we finally arrived at

the mouth of Petermann Glacier fjord. At last, nearly two weeks since stepping onto the plane in Madison, we were helicoptered to our field site (Figure 3) ~50 miles away in the interior of Washington Land along the margin of Petermann Glacier. From our camp, we got to work: this included frequent helicopter trips all around the interior of Washington Land, hunting for the elusive glacial erratics that pepper the landscape surface, and hiking along the glacier margins collecting moraine boulders. In addition

to our science-related duties, we also kept a vigilant eye in order to protect ourselves from polar bears. This meant obsessively checking the electric fence that surrounded our tents, and diligently cleaning our rifles in preparedness for an imminent bear attack, which thankfully never materialized.

During the expedition, the operational goal of our team was to obtain rock samples from sites ranging across Washington and Hall Land (Figure 4), which included sites near the Petermann Glacier itself, coastal sites near Nares Strait, and sites along the GIS land-terminating margin. The scientific goal of the research will be cosmogenic surface exposure dating of moraines and erratic boulders to understand the ice sheet retreat history over the last 15,000 years. To determine the glacial history of Washington Land, we targeted geo-

logic deposits suitable for cosmogenic surface exposure dating with the isotope ^{10}Be , which will provide a history of the horizontal and vertical retreat of the ice sheet in the past. Rock samples from the tops of erratic granite, gneiss,



Figure 2: The Swedish icebreaker *Oden* waiting in port at Thule Air Base. *Photo, E. Ceperley.*

and sandstone boulders (Figure 5) deposited by the inland ice sheet onto Washington Land were primarily sampled because of their quartz-bearing lithology, which produce sufficient ^{10}Be concentrations in the rocks for surface exposure dating. Samples were collected from moraines along the lateral margins of Petermann Glacier and the inland Greenland Ice Sheet, as well as from boulders deposited along the landscape in the interior of Washington Land.

In total, we collected nearly 170 samples from 40 different locations across the ice-free interior along the Petermann Glacier system. The majority of the remaining work involves crushing the rock samples and dissolving them in strong acids back at my new lab on the 4th floor of Weeks Hall (see accompanying write up). This work will make up Melissa's (M.S.) and Elizabeth's (PhD) graduate theses and, eventually, will be incorporated into the larger project structure. This will provide a detailed glacial history of the GIS in northern Greenland to better understand the mechanisms that control the spatial and temporal structure of the ice sheet and how it has contributed to sea level changes, both in the past and at present.

Traveling from Greenland back to Madison posed a more challenging feat than getting there, as the Boeing C-17 military transport that was to take us home experienced a major mechanical issue with its navigational system. The only other replacement system was back in the United States and Amazon unfortunately does not deliver to 75°N , even if you are a Prime member (drat!). Luckily,

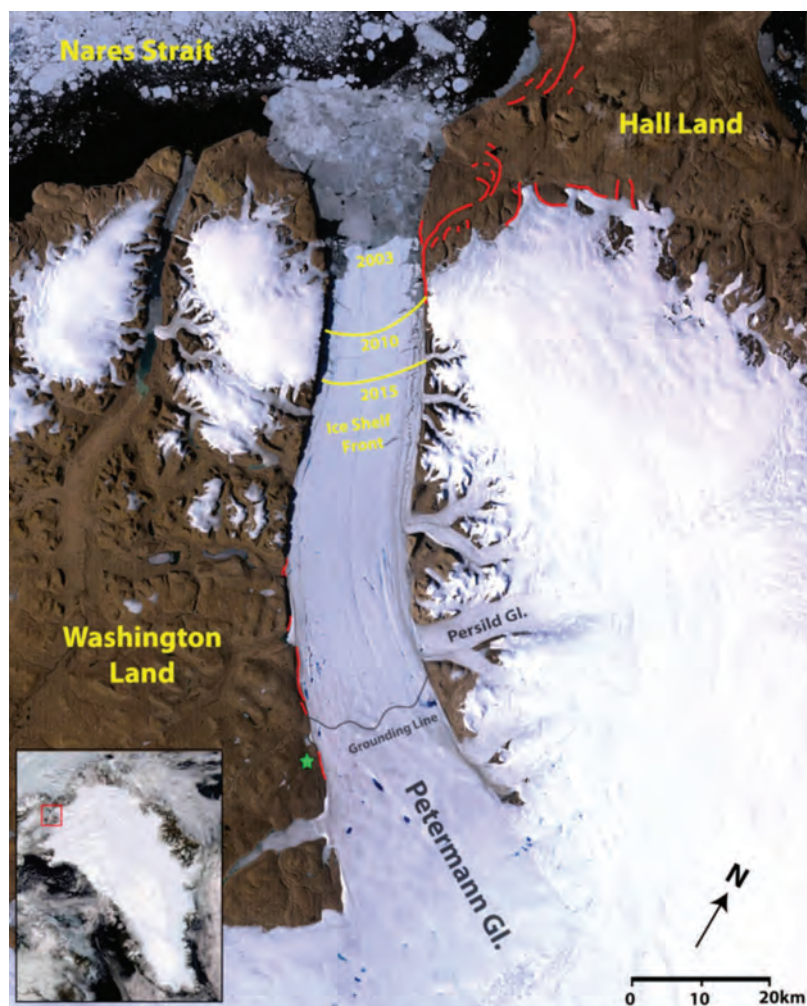


Figure 4: Field location map for the 2015 expedition on Washington and Hall Land near Petermann Glacier in northwestern Greenland. Red arcuate lines outline moraine crests. Green star is location of field camp. NASA Landsat, 2003.

divine-intervention—extending as far up as the Pentagon—was able to send a second C-17 to bring the right parts to the broken plane. In the end, although we arrived home nearly on time, the events leading up to our return were a little distressing, particularly for

Melissa who was to be married in less than a week. Fortunately, Melissa made her wedding and we concluded an excellent field season that will almost-certainly provide fruitful results and make for some excellent thesis projects for the students. Stay tuned. ●



Figure 3: Field camp along the Peterman Glacier margin. Photo, J.Rosen.



Figure 5: Erratic boulder sampled for cosmogenic surface exposure dating. Photo, J.Rosen.

Cosmogenic Isotope Lab Renovation

Keeping the Department of Geoscience on the cutting edge

Alumni gift funds provided generous support in the creation of a new lab in the northwest corner of Weeks Hall. Construction began in April of 2015.

The project is part of a significant upgrade to former lab and office space, a suite of four rooms, which will become the new Cosmogenic Isotope Lab directed by new Assistant Professor **Shaun Marcott** (see p. 8-9). This new lab will include two brand new HF-rated hoods,

increased chemical storage cabinets, additional bench top space, new lighting, and an epoxy floor. The upgrade to the lab will significantly increase the throughput of samples in the lab and will also increase general lab safety. In the past, the procedures for doing the chemical extractions took place in three separate labs on three different floors across Weeks Hall. This new lab provides a continuous space for performing all of the chemical procedures, increasing efficiency in processing samples for

cosmogenic isotopes and leading to better data quality by eliminating potential contamination between labs. The space is also equipped with four new windowed doors and two new windowed walls to provide a brighter work environment and help enhance the overall lab safety. New and former members of the lab include **Elizabeth Ceperley** (Ph.D.), **Melissa Reusche** (M.Sc.), **Richard Becker** (Ph.D.), and **Alexander Horvath** (B.Sc.). ●

April 2015



Weeks 480

June 2015



September 2015



Weeks 474



Congratulations to these undergrad students who received awards and scholarships at the Spring Banquet. See their listing on page 14. Photo, Neal Lord.

Degrees Awarded, December 2014–August 2015

Ph.D. Degrees

December 2014

Ankney, Meagan E., Johnson, *Isotopic records of deep and shallow magmatic evolution of Mount Mazama, Crater Lake, Oregon*

May 2015

Ohlendorf, Summer J., Thurber, *Investigation of Volcanic Processes Using Seismology and Geodesy at Okmok Volcano, Alaska*

Sellwood, Stephen M., Bahr, *Characterization of groundwater flow in sandstone aquifers using heat as an in-well tracer*

August 2015

Shen, Zhizhang, Xu/Brown, *The effects of catalysts in dolomite growth at low temperatures and the study of nano-precipitates in sedimentary dolomite*

Master's Degrees

December 2014

Byerly, Ad, Tikoff, *Dated Magmatic Fabrics as a Record of Variations in Regional Tectonism, Idaho Batholith, Idaho, USA*

Deng, Xin, Xu, *Investigation on Kinetics of Hydromagnesite-to-Magnesite Reaction in Aqueous Solutions*

Liu, Minglu, Xu, *Study on microbial crystallization of dolomite in a hypersaline lake*

May 2015

Fortney, Nathaniel W., Roden, *Microbial Fe(III) oxide reduction potential in Chocolate Pots hot springs, Yellowstone National Park*

Lehrer, Malia L., Brown, *Constraining the relationships among the Asba, San Blas, and El Durazno plutons, Sierra Velasco Sn-W district, Argentina*

Muehlbauer, Robert P., Kelly, *Late Cretaceous Planktic Foraminifera from the Eastern Margin of the Western Interior Seaway*

August 2015

Baldwin, J. Alex, Wang, *Developing a Multichannel Analysis of Surface Waves (MASW) Method for Application to Distributed Acoustic Sensing (DAS) Array and Co-Located Seismometers at Garner Valley, California*

Birsic, Erin M., Singer, *Petrology and $^{40}\text{Ar}/^{39}\text{Ar}$ Chronology of the Laguna Sin Puerto and Bobadilla Ignimbrites, Laguna del Maule Volcanic Field, Chile*

Stetson-Lee, Tor A., Tikoff, *Using kinematics and orientational statistics to interpret deformational events: Separating the Absaroka and Dent shear zones near Orofino, ID*

Undergraduate Degrees in Geoscience (GLE=double major)

December 2014

Bahrmasel, Michael J.
Boutaghou, Zarek Y. (GLE)
Chojnowski, Eric T. (GLE)
Dvorak, Jeremy R. (GLE)
Fang, Yihang
Jordan, Nicholas B. (GLE)

Kahnk, BreAnne N. (GLE)
Kainz, Nathan O.
Kurey, Luke (GLE)
Mogulowsky, Julia R.
Mosbrucker, Ian J. (GLE)
Olson, Emma L.

Peret, Mitchell T. (GLE)
Ruetten, Andrew J. (GLE)
Schallinger, Matthew L.
Zasadzien, Martin P. (GLE)

May 2015

Adoe, Philip K. (GLE)
Anderson, Nicholas J. (GLE)
Bloom, Eleanor F. (GLE)
Buyarski, Natalie C. (GLE)
Cook, Joshua N. (GLE)
DeBruyne, Jaclyn M.
Dorsey, Matthew T.
Hagar, Nathan S.
Hasseldeck, Bennett R. (GLE)
Javes, Alexander M. (GLE)
Kahrilas, Miranda E. (GLE)
Krause, Michael B. (GLE)
Krech, Joel L. (GLE)
Kresl, Chase J.
Liu, Junzhe (GLE)
Lor, Yang Shape
Lower, Mark E.
Luepke, Adam J. (GLE)

McDaniel, Adam L. (GLE)
Meyer, Melissa J. (GLE)
Mitchell, Levi D. (GLE)
Mohrbacher, Michael J.
Nor Azminuddin, Mohd Izzuddin
Pawlow, Robert M.
Peterson, Connor M.
Pflughoeft, Benjamin R.
Reybrock, William S. (GLE)
Ruegsegger, Katelyn D.
Schiltz, Michael K.
Schroeder, Alia E. (GLE)
Schubbe, Calvin B. (GLE)
Sellner, Spencer W.
Strasser, Sean F. (GLE)
Thornton, Erin M.
Wang, Liangquan (GLE)
Zauner, Matthew D. (GLE)
Zhang, Han
Zimmermann, Joshua T. (GLE)

August 2015

Covert, Olivia R. (GLE)
Rykoskey, Lucas A.



Linda and Ken Ciriacks with Clark Johnson and Marty Pernokas at the Spring Banquet April 17, 2015. Photo, Neal Lord.

BAILEY (贝利) IN CHINA: A PRECIOUS BENEFIT

Huifang Xu (徐惠芳)

After the decade-long “Cultural Revolution” in China, that had shut-down and nearly destroyed Chinese higher education, Chinese universities resumed teaching in 1978. The “Cultural Revolution” resulted in a huge gap between China and developed countries in the areas of scientific research. In early 1980’s, international professors, lecturers and scientists were rarely seen in Chinese universities. Listening to lectures given by foreign experts would have been an unimaginable experience at Chinese universities because the paperwork and processes for inviting a western professor to China was very complicated. The field of geology was deeply affected by the isolating effects of the “Cultural Revolution”. Professor Chengyi Lin (林承毅), a professor at Nanjing University stayed at UW-Madison as a visiting professor in early 1980’s. During his visit Lin became acquainted with **Professor S.W. (Bull) Bailey**, and later initiated an invitation for



Professor Bailey, his wife Marilyn, and Professor Lin in Nanjing, China.



S.W. Bailey, his wife Marilyn (center), and Professor Lin together with some non-local mineralogists who attended the short course.



Bailey and some senior Chinese Mineralogists in Beijing. Front row, left to right: Chengyi Lin, Zongshan Guo, S.W. Bailey, Zhi Zheng (former graduate student, Hong Zheng’s father), and Zhizhong Peng.

Bailey to visit China with support from the Chinese University Development Project of International Advisory Panel, in Washington, D.C.

While in China, Bailey gave a short course in clay mineralogy at Nanjing University from September 7 to 19, 1985. This is the 30th anniversary of that important course, which was attended by more than 50 scientists, professors, teachers, and graduate students from a variety of Chinese research institutes and universities. Bailey’s short course was quite extensive. He covered all areas of phyllosilicates, from kaolin to very complicated

(modulated) structures of greenalite and minnesotaite. These crystal structures had just been solved by Bailey and his former students **Stephen Gugenheim** and **Richard A. Eggleton**. Bailey’s lecture notes later were translated into Chinese by Professor Lin and were widely used as teaching materials in Nanjing University and other institutes in China. Professor Bailey got a Chinese name 贝利 from an official letter sent by then Nanjing University president. 贝利 means precious benefit.

I was fortunate enough to be able to attend the short course as a second-year graduate student at Nanjing University. Bailey’s lectures have inspired many mineralogists and soil scientists in China. His lectures impacted my life, and interested me to study silicate minerals using both X-ray diffraction and electron microscopy. To this day, I attribute my successes to Professor Bailey. It is his wonderful comprehensive teaching that prompted my desire to pursue graduate study in the United States. ●

All the photos were provided by Professor Chengyi Lin of Nanjing University.

In the News: Honors and Acknowledgements

ALUMNI:

- Badgers are heavily represented in the leadership at GSA. Four alumni are on the GSA Foundation Board: **Charles Andrews**, **Carl Fricke**, **Robert Sterrett** and **Vicki McConnell**. Vicki is also Executive Director, **Bill Simkins** is a Councilor and **Claudia Mora** is the Vice President. Next year, Claudia will be the 8th Badger President of GSA, following **Jean Bahr** (2009-10).
- **Joanne (Jody) Bourgeois**, won the Laurence L. Sloss Award for 2015 from the GSA Sedimentary Geology Division. http://geosociety.org/sed/SGD_Awards2.html
- **Ken Bradbury** Distinguished Alumnus for 2015 (see page 4), was appointed State Geologist and director of the Wisconsin Geological and Natural History Survey, as of September 1, 2015. <http://wgnhs.uwex.edu/director-and-state-geologist-ken-bradbury/>
- Board of Visitors' member **James Davis** was awarded the American Geosciences Institute's (AGI) most distinguished award, the 2014 Ian Campbell Medal, for superlative service to the Geosciences and in recognition of outstanding performance in and contribution to the profession of geology. <http://www.americangeosciences.org/awards/iancampbell>
- **Dona Dirlam** received the Accredited Gemologists Association (AGA) Lifetime Achievement Award in February 2015. As Director of the Gemological Institute of America (GIA) Library and Information Center, she is "recognized for incomparable contributions to the gemological community through an enduring commitment to securing and safeguarding the written works of researchers and scholars, both past and present, for the benefit of the global gemological community." Dona is only the second person to receive the Lifetime Achievement Award. <http://roskingemnewsreport.com/dona-dirlam/>
- Distinguished Alumnus (2006) **Fred Frey** received the Distinguished Geologist Career award at the 2014 GSA meeting in Vancouver. The award emphasizes a geologic and multidisciplinary approach.



Ken Bradbury, center, with Mary Anderson and Harold Tobin at the NCGSA courtyard tailgate. Mary presented Ken with his Distinguished Alumnus Award during the evening's festivities. Photo, Michelle Szabo.

- UW-Milwaukee is raising funds for the new **Dr. Tom Hooyer Scholarship** (Hooyer was faculty for many years in the WGNHS Quaternary Program). It will support fieldwork for Geoscience students.
- **Maureen Muldoon** is a newly elected 2015 GSA Fellow. New Fellows were recognized on Nov. 1 at the GSA national meeting in Baltimore.
- **Fangfu Zhang's** article, "The catalytic effect of bound extracellular polymeric substances excreted by anaerobic microorganisms on Ca-Mg carbonate precipitation: Implications for the "dolomite problem" was selected as a "Notable Paper" by American Mineralogist, the Journal of the Mineralogical Society of America.

FACULTY:

- Professor Emerita **Mary Anderson** received the 2014 College of Arts and Sciences Dean's Award from the University of Buffalo, as a distinguished alumna.
- **Jean Bahr** will be the President-Elect of the American Geosciences Institute in 2015-2016 (to be followed in 2016-2017 as AGI President).
- **Mike Cardiff** will receive the 2015 GSA Hydrogeology Division Kohout (Early Career) Award in November at the GSA meeting in Baltimore. This award recognizes Mike's significant research

accomplishments, publications and his contributions to teaching and service as an early career faculty member.

- **Stephen Meyers** will receive the 2016 James Lee Wilson Award from the Society for Sedimentary Geology (SEPM). It will be presented at the 2016 SEPM Annual Meeting in Calgary on June 21, 2016. The James Lee Wilson Award is bestowed in recognition of "Excellence in Sedimentary Geology by a Young Scientist."
- **Stephen Meyers** received The Distinguished Alumni Award from the Department of Earth and Planetary Sciences at Northwestern University on October 2, 2015.
- **Carol Ormand** and co-authors (including **Basil Tikoff**) will receive the Outstanding Paper award from the Journal of Geoscience Education and the National Association of Geology Teachers (NAGT) for their article "Evaluating Geoscience Students' Spatial Thinking Skills in a Multi-Institutional Classroom Study." Laurel Goodwin facilitated this study, as part of her ongoing efforts to improve undergraduate education in the department. <http://nagt-jge.org/page/awards>
- **Shanan Peters** is the recipient of the Charles Schuchert Award from the Paleontological Society, awarded to "a person under 40 whose work early in his or her career reflects excellence and promise in the science of paleontology."

STUDENTS:

- Congratulations to 13 UW geoscience graduate students who received GSA 2015 research grant awards: **Hanna Bartram, Christine Barsewski, Saurabh Ghanekar, Erik Haroldson, Jack Hoehn, Michael Johnson, Maureen Kahn, Nick Leavitt, Sharon McMullen, Nicholas Roberts, Frances Saylor, Allen Schaen, Randy Williams, and Jody Wycech.**
- **Richard Becker** received a Robert & Carolyn Maby Memorial grant from the American Association of Petroleum Geologists (AAPG) Foundation.

(Continued, next page)

- **Adam Denny** received a M. Ray Thomasson grant from the American Association of Petroleum Geologists (AAPG) Foundation for his research on carbonate diagenesis in the Illinois basin.
- **Andria P. Ellis** is the recipient of a COCONet (Continuously Operating Caribbean GPS Observational Network) Fellowship from UNAVCO. The project is a collaboration between the NSF, UNAVCO and the University Consortium for Atmospheric Research (UCAR). Andi is undertaking research on the tectonics of Guatemala.
- **Saurabh Ghanekar** received Outstanding Mention for her GSA grant proposal. Only 10

of the 391 awards in 2015 received this special distinction.

- **Chelsea Lancelle** received the Outstanding Student Paper Award at the 2014 AGU Fall Meeting. Her poster, "Directivity and Sensitivity of Fiber-Optic Cable Measuring Ground Motion using a Distributed Acoustic Sensing Array", is part of the PoroTomo project directed by Kurt Feigl and sponsored by DOE. <http://geoscience.wisc.edu/geoscience/people/faculty/feigl/porotomo/>
- **Nick Levitt** was selected to receive GSA's Division of Mineralogy, Geochemistry, Petrology, and Volcanology (MGPV) Student Research Award for his proposal to investigate the "Temperature and Geochemical

Composition of the Archean Ocean by Clumped Isotope Analysis of Stromatolitic Carbonates". The MGPV reception and award ceremony will be held jointly with the Mineralogical Society of America and the Geochemical Society at the 2015 Annual Meeting of GSA.

- **Elisabeth Schlaudt** received a scholarship award from the Minnesota Ground Water Association in 2015. ●

Presented at the Spring Banquet: Student Awards and Scholarships for 2015

The Wasatch-Uinta Field Camp Scholarships

David Cheng, Matt Dorsey, Beau Howes, Toni Kramer, Aaron Kutz, Anthony Labrasca, Mark Lower, Julia Moglowsky, Salsabila Nazari, Connor Peterson, Hannah Podzorski, Alli Starry, John Steinle, Syazana Tuan Ab Rashid

The Outstanding Sophomore Award Morgan D. Sanger

The Carl and Val Dutton Scholarship Luke S. Schranz

The Paull Family Undergraduate Scholarships
Adam L. McDaniel, Brandon S. Suchomel, Matt R. Houde, Kelley C. Korinek

The Lowell R. Laudon Outstanding Junior Scholarships
Susan M. Richmond, Kalle J. Kutschera, Lauren J. Silverstein

The Mack C. Lake Outstanding Senior Scholarships
Eleanor F. Bloom, Margaret L. Butzen, Patrick J. Heiman

The Laurence Dexter Environmental Scholarship
Alia E. Schroeder

The Eugene Cameron Scholarships Lisa D. Haas, Michael K. Schiltz

The Paull Family Distinguished Undergraduate Student Award Hannah L. Podzorski

The Stanley A. Tyler Excellence in Teaching Award Jody B. Wycech

The Thomas E. Berg Excellence in Teaching Awards
Christine E. Barszewski, Tyler B. Blum, Bridget C. Garnier, Benjamin J. Linzmeier

The James J. and Dorothy T. Hanks Graduate Student Awards in Geophysics
Chelsea E. Lancelle, Stephen M. Sellwood

The Mark & Carol Ann Solien Research Assistantship Randolph T. Williams

The Dean L. Morgridge Distinguished Graduate Fellowships in Geology
Michael R. Johnson, Chelsea E. Lancelle

The George J. Verville Awards In Geology & Geophysics
Michael R. Johnson, Sharon K. McMullen

Kenneth and Linda Ciriacks Distinguished Graduate Fellowship
Zachary D. Michels

The William H. & Virgie Twenhofel Graduate Student Award Jody B. Wycech

The Jay C. Nania Graduate Student Awards
Hanna C. Bartram, Sharon K. McMullen

The S.W. Bailey Distinguished Graduate Student Richard A. Becker

C.F. Schiesser Outstanding Student Research Paper Awards—First Author
Richard A. Becker
Becker, R.A., Tikoff, B., Riley, P.R., & Iverson, N.R. (2014). Preexisting fractures and the formation of an iconic American landscape: Tuolumne Meadows, Yosemite National Park, USA. *GSA Today*, 24(11).

Shannon E. Graham
Graham, S.E., DeMets, C., Cabral-Cano, E., Kostoglodov, V., Walpersdorf, A., Cotte, N., & Salazar-Tlaczani, L. (2014). GPS constraints on the Mw= 7.5 Ometepe earthquake sequence, southern Mexico: coseismic and post-seismic deformation. *Geophysical Journal International*, 199(1), 200-218.

Zhizhang Shen
Shen, Z., Liu, Y., Brown, P.E., Szulfarska, I., & Xu, H. (2014). Modeling the Effect of Dissolved Hydrogen Sulfide on Mg²⁺-Water Complex on Dolomite {104} Surfaces. *The Journal of Physical Chemistry C*, 118(29), 15716-15722.

GLE

William J. Likos

Professor and Chair of Geological Engineering (likos@wisc.edu).

Greetings from Geological Engineering (GLE) It is an exciting time for Geological Engineering (GLE) at UW-Madison! We have more students than ever, energetic new faculty, and students and alumni who continue to excel and make us proud.

I am writing this update as the new Chair of GLE, a role I took over from **Craig Benson** in April of this year. I can confidently speak for our entire program when I say how grateful we are for Craig's outstanding leadership and contributions to the success of GLE over the past several years. We wish him the very best in his new role as Dean of Engineering and Applied Science at the University of Virginia.

Undergraduate enrollment in GLE at UW-Madison is at an all-time high. We now have 140 students, which, amazingly is almost triple the number of students enrolled in our program when I joined it only three short years ago. Each of these students receives a dual degree in GLE and Geoscience and is exposed to the huge variety of experiences characteristic of a truly interdisciplinary degree. Unprecedented growth in our program reflects exceptional demand for our graduates from a range of industries, highly competitive starting salaries, our continued efforts to recruit the best and brightest freshman, and concurrent growth in the broader world of geoscience education. In light of such growth and the challenges that come along with it, GLE faculty are currently working with the Department of Civil and Environmental Engineering to examine the administrative structure of our program and place it on a clear



Members of the Spring 2015 GLE graduating class. Student enrollment in GLE at UW-Madison is at an all-time high. Photo, Eleanor Bloom.

track for more growth and success.

Our current and former students continue to excel and to be recognized for their outstanding work. **Chelsea Lancelle** received the Outstanding Student Paper Award at the 2014 Fall Meeting of the American Geophysical Union for a presentation entitled, "Directivity and Sensitivity of Fiber-Optic Cable Measuring Ground Motion using a Distributed Acoustic Sensing Array." Her work was co-authored with GLE Professors **Herb Wang** and **Dante Fratta**. **Brigitte Brown** received one of the very first scholarships awarded from the The American Coal Ash Association Educational Foundation for her research on beneficial use of coal combustion products. **Kelly Del Ponte** and **Bharat Natarajan** won the Barton A. Thomas Memorial Award for Best Technical Paper at the 2015 World of Coal Ash conference for their life cycle analysis research conducted with Professor of Practice and GLE alum **Angela Pakes-Ahlman (BS 1996)** and **Emeritus Professor Tuncer Edil**. Former students **Chris Bareither (MS 2006, PhD 2010)** and **Joe Scalia (MS 2009, PhD 2012)** are now both faculty members

in the Department of Civil and Environmental Engineering at Colorado State University. These two make a formidable academic duo to say the least. Our students and alumni continue to make us all very proud members of the GLE family.

In faculty news, **Hiroki Sone** joined GLE as a new assistant professor in July of this year. Hiroki brings expertise in experimental rock mechanics and geomechanics. Assistant Professor **Matt Ginder-Vogel**, who has held an appointment in Civil and Environmental Engineering at UW-Madison since 2012, has also recently joined GLE. Matt brings new expertise in soil and environmental biogeochemistry to our faculty. We are very excited for the enthusiasm and energy that these two bring to our group and look forward to their success.

GLE at UW-Madison continues to grow, excel, and change in positive ways. I am quite excited about the future. I am also looking forward to meeting as many alumni from our past as I possibly can. Please stop by for a visit if you are in Madison. Please also check out our website (www.gle.wisc.edu) and feel free to reach me at likos@wisc.edu or (608) 890-2662. ●



Melissa Reuché and Marshall Tofte (vice-president of GGSA) at the Spring Banquet.



Three Distinguished Alumni at the Spring Banquet: Bill Morgan (2015), Rick Sarg, (2009) and Mark Solien (2014). Photos, Neal Lord.

Geofuels: Energy and the Earth

Alan Carroll

Everyone knows that fossil fuels will eventually run out, but that renewable energy sources are unlimited. This foundational belief has shaped public debate over energy use and its impact on the environment for many decades. The problem however is that it is wrong! Expert warnings of impending crude oil shortage began to appear at least a century ago, yet known oil reserves are larger today than they have ever been. Fossil fuel supplies are undeniably finite, but their practical availability has exceeded our expectations with almost eerie consistency. In fact we have never actually “run out” of any non-living natural resource, and fossil fuel supplies appear more than adequate to sustain current trends of greenhouse gas emissions and atmospheric warming for many decades (or even centuries) to come.

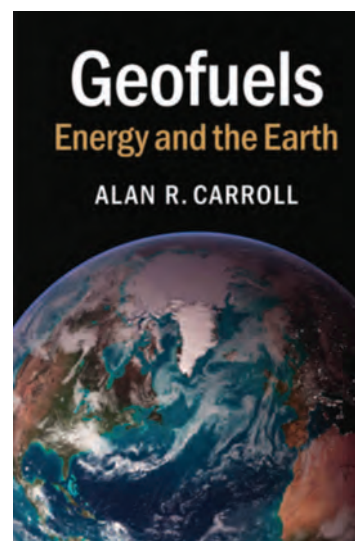
Renewable energy systems offer a way out of the climate conundrum, and are inexhaustible to boot. The means of collecting renewable energy are not however. All practical renewable energy relies in one way or another on the use of finite Earth resources, causing inevitable economic and environmental trade-offs. These trade-offs are already painfully apparent for biofuels, and are slowly becoming more so for other systems.

My recently published book *Geofuels: Energy and the Earth* explores these and related topics from the unique perspective of a geoscientist, based on the premise that

the natural history of the Earth can provide a unifying theme for an otherwise fractious debate. The book is based on ideas that evolved during my teaching of Geoscience 411 (Energy Resources), a course originated by John Steinhart and subsequently taught by Herb Wang and economist Richard Shaten. The course and book both aim to provide a balanced treatment of renewable and non-renewable energy, expressed in a clear, engaging, and occasionally humorous manner. I take no sides except to emphasize the obvious: Geoscience is the one discipline to rule them all!

The book also established the framework for a Massive Open Online Course (MOOC) offered by UW-Madison last summer, cleverly titled *Energy and the Earth*. For those not familiar with MOOCs, they are online courses that are offered free of charge. They also do not carry academic credit, but participants can earn a certificate of completion. UW-Madison MOOCs are high quality productions that feature professional video and graphics, supported by the Division of Continuing Studies. Six MOOCs were offered in 2015; each spanned a four-week period and featured an environmental theme. *Energy and the Earth* attracted about 12,500 registrants; 70% live outside the U.S. and over 2000 were not previously familiar with UW.

The results of the MOOC depend on whether you view the glass as half empty or half full. On the glass half empty side, about 6000 of the registrants actually visited the course, 4000 watched at least one video,



and only about 1000 received a Certificate of Completion. On the glass half full side, ten times more students completed the online course than have completed any of my face-to-face offerings! Another possible interpretation, as George Carlin once said, is that the glass is simply “too big”. Recent research has shown that many students never intend to view all of the content in a MOOC, but instead pick and choose according to their interest. It is apparent however that we scored a success with those who completed the post-course survey. Over 95% indicated that the course “met or exceeded their expectations”, and over 90% felt they “were better prepared to discuss energy resources and better understand the science associated with renewable and non-renewable energy systems”. ●



Department Chair Harold Tobin was Master of Ceremonies at the Spring Banquet. These grad students were presented with awards and scholarships. See the listing on page 14. Photos, Neal Lord.

Getting the Big Picture from Small Spots in Tiny Microfossils

Clay Kelly

The deep-sea sedimentary record is a rich archive of Earth's climate history that contains myriad microfossils of which the planktonic foraminifera are among of the most abundant (Fig. 1). The fossil record of these microscopic (<1 mm) organisms spans the last 170 million years of Earth history, and is punctuated by numerous extinction events from which the planktonic foraminifera have recovered to reestablish their prominent role in modern marine ecosystems. This tumultuous evolutionary history has resulted in a fossil record replete with numerous extinct species, and the sequential order in which these species appear/disappear in the rock record is widely used by the energy industry and scientific community to correlate marine sediments deposited around the world.

In addition, laboratory experiments performed on living planktonic foraminifera have shown that the chemical compositions of their calcite shells reflect the environmental conditions under which they grew. Thus, the shell chemistries of fossil planktonic foraminifera are commonly used as tracers for reconstructing past changes in sea-surface temperature, levels of primary productivity in the ocean, and even the size of polar ice-sheets. Stable isotope ratios of oxygen ($\delta^{18}\text{O}$) and carbon ($\delta^{13}\text{C}$) in foraminiferal calcite are the two geochemical proxies most widely used for reconstructing past environmental conditions. Conventional techniques used to measure the stable isotope compositions of foraminifera require the analysis of entire

shells. However, such "whole shell" analyses are predicated upon the assumption that these microfossils are pristinely preserved and have homogeneous chemistries when, in fact, they are aggregate mixtures of multiple carbonate phases that formed under very different environmental and physiological conditions.

In recent years, pitfalls associated with this 'signal mixing' have been overcome with the use of innovative in situ techniques developed by the WiscSIMS Laboratory at UW-Madison. The ultra-high spatial resolution of secondary ion mass spectrometry (SIMS) permits the measurement of stable isotope ratios on ~3-10 micrometer spots within an individual shell (Fig. 2). The stable isotope ratios acquired from these in situ analyses are being used to distinguish between primary calcite reflecting surface-ocean conditions and secondary calcite added to the same shell via chemical reactions that occur within the sediment column (i.e. diagenesis). The pioneering work of former UW-Madison Research Scientist **Reinhard Kozdon**, now a Research Professor at Columbia University, laid the foundation for this new avenue of research. In addition, two GeoBadgers, **Jody Wycech** (Ph.D. dissertator) and **Lindsey Shanks** (M.S. graduate student), are currently applying these same in situ analytical techniques to reconstruct environmental conditions that prevailed during past climate states in Earth history. This novel approach to acquiring stable isotope ratios from fossil foraminifera holds much promise for enhancing the fidelity of geochemical records of past climate change. ●

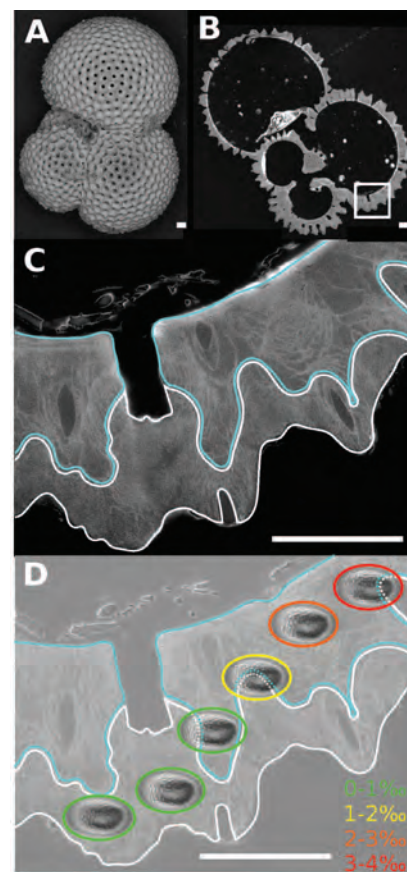


Figure 2. (A) Magnified image of planktonic foraminiferal shell. **(B)** Magnified image of cross-section through same shell mounted in epoxy (box delimits part of shell shown in panels C and D). **(C)** Highly magnified image of cross-section through shell wall showing internal layering. **(D)** Highly magnified image of shell wall in cross-section showing traverse of SIMS analysis pits. Note intra-shell carbon isotope gradient delineated by traverse of SIMS analysis pits showing $\delta^{13}\text{C}$ ratios decrease from 3-4‰ in inner layer to 0-1‰ in outer layer. All scale bars = 20 micrometers (image courtesy Jody Wycech).

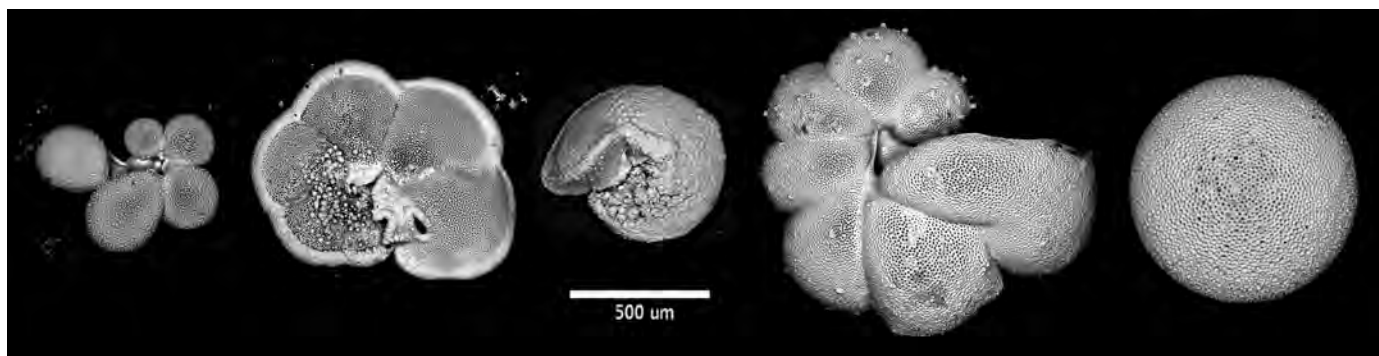


Figure 1. Magnified images of shells belonging to five different species of modern planktonic foraminifera.

Alumni News—2014-15

1950s

James Rankl, BS 1957

After graduating I went to work in Texas for an oil well mud logging company. Late in 1959 I joined the USGS in Wyoming as a hydraulic engineering technician. In 1972 I was reassigned as a research hydrologist concentrating on infiltration rates of rainfall into semi-arid soils and bed load transport mechanics of mountain streams. I retired from USGS in 1994. In retirement I had several contacts with USGS ranging from open channel hydraulics to reviewing Honduras flood computations. In 1994 I traveled to Eritrea East Africa as a 3-person team to establish a stream-flow gaging network.

60s

Don Soholt, BS 1960

After my BS in Madison I went to Minnesota for my MS. While there, in 1964, I participated in a National Science Foundation project in Antarctica. The project included mapping the Ellsworth Mountains and was directed by Campbell Craddock. I retired from Texaco/Chevron after serving as a mineral, alternate energy and petroleum geologist for 26.5 years. I also spent time in Siberia, Russia with White Knights in 1992-93 working in oil production, which was the first joint venture between Russia and the US after the Cold War. Other ventures included serving as geologist on an oil rig in the South China Sea while at Texaco. This duty enabled my wife and I (we have been married 58 years) to travel expensively in China and Hong Kong before Americans began touring these areas on a routine basis. We live in Parker, CO.

David M. Hite, MS 1964, PhD 1968

hiteconsult@broadband.com

I continue to consult on Alaskan oil and gas issues, including evaluation of oil and gas resources for state and corporate clients. I am an expert witness in court cases and participate in educating newly involved companies about Alaska's oil and gas basins. I am the co-editor of AAPG Memoir 104.

Thomas Waddell, BS 1967

xbn165@mocs.utc.edu

Many thanks for continuing to send me The Outcrop. I was a student of Dr. Lauden and Dr. Dott during the 1960's. I graduated from UW with a BS in Chemistry along with 24 hours

of great Geology. After a PhD at UCLA and a Berkeley postdoc I was on the faculty of the University of Tennessee in Chattanooga for 36 years. My research in the origin of metabolic pathways was clearly influenced by my wonderful UW geology experience.

Interestingly, I live very near the outcropping near Dunlap, Tennessee that was featured in the latest Outcrop. It brought back great memories of our field trip in 1965 to the Iowa Devonian sites.

Please give my best to Dr. Dott who may remember me.

70s

James Dawson, PhD 1970

dawsonjc@plattsburg.edu

2014 completed my year as past-chair of the History and Philosophy of Geology Division of GSA. I am now in my 45th year as a Distinguished Service Professor at SUNY Plattsburgh and my 22nd year as a New York State Regent.

Thomas M. Johnson, PhD 1976

thomasjohnsonassociates@gmail.com

In May 2014 I left a large environmental consulting firm to form my own expert services consulting firm, Thomas Johnson Associates with offices in Susalito, CA, and Middleton, WI.

Mark Meyers, BS 1977; MS 1981

Forward from Margie Chan: I'm the principle investigator for the NSF cooperative agreement that funded the activities and development of the sandbox. We are also working on a decision theater for analysis and structured decision making for adaption to environment change. I have been at UAF for four years and have been enjoying it. About a month ago I got asked by the new governor of Alaska if I would be his Commissioner for Natural Resources and given everything it was hard to say no. I will start that job on Jan 16. It will require moving back from Fairbanks to Anchorage.

80s

Charles Hornaday, BS 1983

Chuckh@vadoseremediation.com

In January I formed a new company; Vadose Remediation Technologies™ is a provider of technologies for the remediation or mitigation of effects from contaminated soil, groundwater and sediments. Our mission is to ensure the proper design consideration and application of

our technologies leading to the most effective remedies. I have worked for over 25 years in the environmental and construction industry.

Michael Bittner, BS 1984

michael.bittner@erm.com

I am a senior partner in the Boston offices of Environmental Resources Management (ERM). I specialize in environmental, health and safety compliance programs, management systems, strategic planning, auditing, and sustainability services. I am a former member of the Auditing Roundtable, and I edit the EHS Journal, an on-line magazine for EHS professionals (<http://ehsjournal.org>).

Michael I. Emang, BS 1985

emang@qp.com.qa

Since leaving UW in 1985 I continue to work the oil patch, contributing to field development plans and managing national hydrocarbon resources. 2015 and beyond promise to be very busy as we implement 4D seismic to locate bypass reserves. For good or for bad, I am not keeping track of the multi-billion dollars worth of projects I have been involved in.

2014 was a busy year on the home front, with five international travels. As all our three children completed college, we attended their graduation ceremonies, starting in Perth Australia in February, then Newport Wales UK in September and finally Golden Colorado School of Mines in December. My wife and I enjoyed a white Christmas this year in Colorado, after 30 years for me, and first time for my wife. We took one week breaks to visit Phuket Thailand in August and Madrid Spain in October.

I am looking forward to another graduation ceremony in Golden at CSM this May, after which I hope to visit Madison my alma mater. I look forward to enjoying Babcock icecream on the Terrace with Badger friends.

90s

Eric Dott, MS 1990

edott@barr.com

I continue to work as a senior hydrogeologist and vice president at Barr Engineering Co., in our Duluth, Minnesota office overlooking the southwestern corner of Lake Superior. In fact our office stands on a post-glacial sand spit that extends from Minnesota across the mouth of the St Louis River and to the Wisconsin side of the Duluth-Superior harbor.

I have been busy working on a variety of

brownfield redevelopment sites (investigation and remediation), and other former industrial contamination projects. A particular focus, appropriate considering our office location, has been work on contaminated sediment sites—which often leads to interesting multidisciplinary teamwork with geoscientists, biologists, chemists, contractors, business owners and regulators.

Having fun raising two kids both teenagers, Helena and Collin, with my wife Deborah (also a UW Alum- Land Resources, 1989). We love the winters for skiing and the summers for camping and exploring. Look us up on your next trip north to the Boundary Waters.

Ann Fritz, MS 1995

I am an Environmental Scientist at the ND Department of Health-Environmental Health Section, Division of Water Quality. I have had that position for over 15 years. Over the years, however, my job duties have morphed into becoming the GIS Coordinator for the ND Department of Health. As such, I'm learning more about epidemiology, HIPAA practices and public health than I ever thought I would having a Geology degree. I am again co-chair of the North Dakota GIS User's Conference. This year's conference was held in Fargo, ND September 28th and 28th. More information

can be found here at <http://gis2015.ugpti.org>.

Jake Brown, BS, 1996

Re: Wasatch-Unita Field Camp Anniversary.

I have just received the Outcrop and was pleased to see that you are thinking of holding a reunion in Park City. Field camp was one of the pinnacle events during my time at the UW-Madison Geology department. I had the opportunity to go back to Park City on occasion for technical events or personnel travel. If you are planning to convene back in Park City I think I would be game July 23–26th. As a suggestion I would appreciate some sort of geologic review and potential mapping exercise or field trip to the area. It would be good to catch-up again.

As for me I am on the tip of exploration around the globe. I am just back from a three year posting to Angola working on the offshore presalt play. For my work I put together exploration programs utilizing cutting edge seismic technology and derived, interpreted reservoir characterization, play fairway analysis. In addition to my work in Angola I helped open up Mozambique, Ivory Coast and now I am back in the USA looking at frontier opportunities in North America.

I look forward in revisiting Park City and maybe sharing a brew or two discussing some

interesting geology.

Chris Jimieson, BS 1999 GLE

I am a project manager at SCD Engineers in Madison working on solid and waste and environmental compliance projects. I also volunteer with the Fitchburg Resource Conservation Commission. And I have organized Strides for Africa in Madison for the past five years which funded eight water projects in Ethiopia and Liberia.

00s

Penny Lancaster, MS 2007

I am a senior research associate at the University of Portsmouth. Last year included a major refurb to facilities here and we are finally back on line and getting data! I co-chaired a session at Goldschmidt Sacramento (it was good to see UW colleagues again) and I published a paper in Gondwana Research.

Ashley Russell, MS 2012

I have started my third year with Schlumberger; I am currently a full time consultant for Statoil. I became a member of the alumni board for my undergrad geology department at North Dakota.

I married a fellow GeoBadger Dylan Loss (BS 2011) at Devils Lake on August 8, 2015!! ●

In Memoriam

William (Bill) Laing, BS 1951

Bill Laing, died on November 22, 2014 in Kerrville TX. He grew up in Milwaukee. After serving in the army in World War II he came to Madison and studied geophysics with George Wollard. Bill worked for Conoco for 35 years, attaining the position of Director of Geophysics for North and South America. He was awarded a Life Membership to the Society of Exploration Geophysicists and was selected as a Distinguished Lecturer, while also a life member of the International Association of Geophysical Contractors. He received the Distinguished Alumnus Award from our department in 2000.

C. John Mann, PhD 1960

Dr. Mann died on September 2, 2015 in Urbana, IL. After earning his PhD he went to work for Chevron where he co-authored (with Bill Thompson) a major, well-cited paper in the GCAGS proceedings on how the Cotton Valley Sandstone (K) represented the ancestral Missis-

sippi River. In 1966 he joined the faculty at the University of Illinois at Urbana-Champaign. He taught geology for nearly forty years until his retirement in 1999. John was also a veteran of the United States Army Engineering Corp and was stationed in Guam during the Korean War.

Katrina Edwards, MS 1996; PhD 1999

Katrina J. Edwards passed away peacefully at the age of 46 on October 26, 2014, after a long illness.

Katrina was bright, vibrant and at the helm of her chosen field. A gifted scientist, she was professor of biological sciences, earth sciences and environmental studies at the University of Southern California. Prior to that, she was associate scientist in marine chemistry and geochemistry at Woods Hole Oceanographic Institution.



Katrina Edwards.
Photo, USC/Philip Channing.

A pioneer in oceanographic research, Katrina's discoveries centered on life forms beneath the ocean floor, also called "intra-terrestrial life." As an innovator in geomicrobiology, Katrina worked with other scientists on integrated ocean drilling, including spear-heading and leading an international deep biosphere project in the mid-Atlantic. She also headed the U.S. National Science Foundation-supported Fe-Oxidizing Microbial Observatory Project on Loihi Seamount. In 2012, she was recognized with the A.G. Huntsman Award for Excellence in Marine Science and was the third woman to receive this distinction in the foundation's 32-year history. Perhaps her most significant professional accomplishment was "raising" the next generation of geomicrobiologists through teaching and mentoring a multitude of students and post-doctoral professionals on expeditions and in her classes and research labs. ●

Faculty News—2014-15

JEAN BAHR

As I write this annual review I'm in the midst of a week of field exercises (nine of them led by me and two by TAs) for my hydrogeology class of 60 students. We continue to use the well field near Lake Waubesa that **Todd Rayne** established as part of his PhD work in the 90s. So far the weather has been cooperative. A rain-storm on Tuesday subsided just as we arrived at the site. Of course teaching students in the field is one of the most enjoyable parts of an academic career. I was fortunate to be able to share that type of experience last summer with **Mike Cardiff** and about a dozen enthusiastic students in the field hydrogeology three-week course (photos). Department gifts from alumni and from Barr Engineering made that possible, as no funding was available this year from the UW Summer Sessions budget.

Research projects in my group continued to span a range of hydrogeologic systems. Studies of groundwater flow and transport in the sandstone aquifer included **Steve Sellwood's** dissertation, successfully defended last summer, on downhole thermal testing to identify preferential flow zones and a new project with MS student **Josh Olson** on changes in groundwater chemistry induced by a century of municipal well pumping. **Elisabeth Schlaudt** is working to identify source areas for agricultural nutrients that contribute to eutrophica-

tion of groundwater fed sloughs along the Lower Wisconsin River and **Hangjian Zhao** is exploring the use of stable isotope data to explain patterns of vulnerability or resilience of lakes to drought conditions in national forests of Northern Wisconsin.

I continue to keep busy with professional activities on and off campus. I completed my term chairing the UW Physical Sciences Divisional Committee (tenure committee) last May, just in time for the GSA North Central Meeting in Madison that I helped organize as local committee chair. I'm now in my second year as an editor for Water Resources Research and believe I am starting to learn how to keep on top of my portfolio of manuscripts. The Nuclear Waste Technical Review Board is preparing for a workshop this fall on the potential for disposal of some types of radioactive waste in deep boreholes in crystalline rock. I'll be moderating a panel focusing on hydrogeologic conditions and characterization required to evaluate the feasibility and safety of such an approach. In November I will start a new adventure as President-Elect of the American Geosciences Institute.

MIKE CARDIFF

It's hard to believe that this marks the beginning of my 4th year here at UW-Madison. My how time – and the tenure clock – fly by! The

past year was eventful for the Cardiff group. One of the first students to join my group (**Yang Li, GLE**) successfully defended her MS thesis, while my first PhD student (**YaoQuan Zhou, Geoscience**) successfully passed her PhD preliminary exam. With the majority of her PhD work completed, YaoQuan is now finalizing her results, and has submitted her first paper to Water Resources Research, which we expect to see published in late 2015.

Past years have brought field work across the world—from Boise, ID, to Sardinia, Italy—so this summer, it was nice for my group to focus a bit closer to home. Working on a project funded by the Wisconsin Department of Natural Resources (and with supplemental funding from a GSA Student Research Grant), my student **Claire Sayler** and I performed experiments on flow and transport in local rock fractures, which we are using to better understand the vulnerability of Madison's water supply to contamination. This and other projects were integrated into the department's summer course, "Field Applications in Hydrogeology", co-taught by **Jean Bahr** and myself, with support from generous hydrogeology gift funds the department has received in the past.

In the coming spring, my PhD student **David Lim** and I will be looking forward to collaborating with **Kurt Feigl**, **Cliff Thurber**, **Herb Wang**, and **Dante Fratta** on the "PoroTomo"

Gifts from our alumni and Barr Engineering supported a summer course, "Field Applications in Hydrogeology." It was co-taught by Jean Bahr and Shaun Marcott. (Images, clockwise):

Conducting oscillatory flow tests at a site in Iowa County.

Describing core at the WGNHS core facility.

Examining geoprobe cores near the Lower Wisconsin River.

Gaging a stream in Iowa County.
Photos, Jean Bahr.





PoroTomo team overlooking natural laboratory at Brady Hot Springs, Nevada. Back, l to r: Mitch Plummer (Idaho National Lab), Sean Porse (DOE), Cliff Thurber (UW), Eric Matzel (Lawrence Livermore National Lab), David Lim (UW), Mike Cardiff (UW), Christina Morency (Lawrence Livermore National Lab), Whitney Trainor-Guitton (Colorado School of Mines), Elisabet Metcalfe (U.S. Dept. of Energy, BS 2005 UW-Madison, Geology & Geophysics). Front: Nick Davatzes (Temple University), Kurt Feigl (UW), Xiangfang Zeng (UW), Bill Vandermeer (U.S. Dept. of Energy), Neal Lord (UW-Madison), Paul Spielman (Ormat), Lauren Boyd (DOE). Photo, Dan Koetke/Neal Lord.

project to apply some of our aquifer characterization methods at the large scale of a geothermal reservoir – continuing the group’s push into the area of fractured rock and difficult, multi-method reservoir characterization problems.

Lastly, this past year brought the great honor of being selected as the recipient of the Kohout Early Career Award from the Hydrogeology division of GSA. I’ll be attending the Annual GSA meeting in Baltimore this November to accept the award, and look forward to meeting past Geo-badgers there!

CHUCK DEMETS

Every year offers different professional experiences. 2015 was no exception.

The highlight of my year was a several-day-long GPS workshop that I taught to roughly 20 scientists and students in the city of San Salvador (El Salvador). The workshop generated so much enthusiasm amongst its participants that I resolved, upon my return to the U.S., to solicit unused, but still-useful GPS equipment from my academic colleagues in the U.S. for use in a variety of new research projects lead by Central America scientists and students. Contrary to my hopes for 2-3 donated systems, my colleagues around the U.S. generously donated 15 equipment systems worth \$80,000! For a minimal cost, department technician **Neal Lord** is upgrading the equipment to modern standards, after which we will ship the renovated gear to scientists in El Salvador, Guatemala, and Honduras. Plans are already underway to deploy the gear in at least four

new field areas. In parallel with these new initiatives, my graduate students **Andria Ellis** and **Beatriz Cosenza**, the latter newly arrived from Guatemala, continue to push forward on our own NSF-funded study of Central America tectonics and earthquake hazards. Andria spent two months in Guatemala in early 2015 gathering new data at over 30 locations all over the country. In one location, where she encountered overly-suspicious locals, she and her field team were nearly imprisoned in a local jail. Who said that geoscience isn’t fun?

KURT FEIGL

The Laguna del Maule volcanic field on the crest of the southern Andes continues to deform at exceptionally rapid rates. As of November 2014, the rate of vertical uplift was still faster than 200 mm/yr, as it has been since some time before 2007, according to geodetic measurements analyzed by graduate student **Hélène Le Mével** and published in *Geophysical Research Letters* in a paper with Chuck DeMets and others.

The PoroTomo project is off to a strong start, thanks to clear thinking and hard work from **Tabrez Ali, Elena Baluyut, Mike Cardiff, Dan Koetke (OQI), Dante Fratta (GLE), Chelsea Lancelle, David Lim, Neal Lord, Lesley Parker, Cliff Thurber, Herb Wang, and Xiangfang Zeng**. With the (awfully long) title of “Poroelastic Tomography by Adjoint Inverse Modeling of Data from Seismology, Geodesy, and Hydrology”, the project aims to study Enhanced Geothermal Systems (EGS) with funding from the U.S. Department of Energy. The field trip to Nevada (photo) in September

saw us palpating diatomite, probing bore-holes, and sniffing fumaroles at Brady’s Hot Springs. “These are the Emigrant Springs of the Forty-Mile Desert,” according to the Online Nevada Encyclopedia. In the 1880’s, “Early travelers called it the Spring of False Hope. Coming across the desert, the oxen of the wagon trains smelled the moisture before reaching the springs and rushed forward to drink the scalding water. The emigrants collected water in casks to cool for later use, but pushed on to the Truckee River, as there was no livestock forage at the springs.” Following this tradition, we met with DOE reviewers and program managers at the geothermal-powered Peppermill casino in Reno. Now we are looking forward to field work in March 2016 to deploy some very high-tech geophysical imaging tools, including distributed acoustic and temperature sensing in fiber-optic cables and pulsed hydraulic testing, as well as imagery from satellites and uninhabited autonomous vehicles (UAVs, also known as drones).

LAUREL GOODWIN

Selected vignettes from a sabbatical leave:

Walking on exhumed accretionary prism rocks on an island in the arm of the Pacific sandwiched between Washington state and Vancouver. Sound: waves, wind, and shore birds. Smell: salt water and wet vegetation. Sights: spectacularly deformed metasedimentary and metavolcanic rocks, amazing scenery, a rainbow in the background. Field trip led by professor and chair **Harold Tobin**.

A text message arrives from one of the four undergraduate students (**Mike Schiltz, Matt Dorsey, Salsabila Nazari, and Luke Schranz**) working with my research group. Mike and Matt are at the University of Minnesota’s Institute for Rock Magnetism (IRM). Mike’s text includes a plot showing his first results. How lucky I am to be able to work with UW’s gifted undergrads!

A cloudless blue sky, visible from horizon to horizon, arches over the basin. Sound: the muffled crunch of our boots on sand. Smell: desert brittle bush heated by the sun. Sight: spectacular outcrops of cemented fault damage zone rocks. April in NM, scouting out faults with a diagenetic record of fluid flow in the Rio Grande rift with PhD student **Randy Williams** (check out our recent *Geology* paper!).

Standing on an overlook near Elephant Rock. Sound: discussion between field trip participants and leaders. Smell: quartzite and lake

(Continued, next page)

water. Sight: Devils Lake. GSA field trip What's New at Baraboo? A Field Trip for Educators, which I led with UW emeritus faculty **Gordon Medaris** and **Bob Dott**, University of Illinois professor Steve Marshak, UW-Milwaukee professor Dyanna Czeck, and Lawrence University professor (and UW-Madison alumna), **Marcia Bjornerud**.

The rock is hot, hot, hot—physically and geologically. The heat, and stillness of the air that commonly accompanies high temperature, overwhelms sensory input. It's not even 11:00 am, but we are about to bail for the day. PhD student **Jack Hoehn** is reluctantly climbing off the outcrop. Examining the rock record of ancient seismicity, South Mountains metamorphic core complex, Phoenix, Arizona, in a period of extreme heat warnings.

On hands and knees, puzzling through complex structures. Sound: waves and laughter. Smell: salt water with a hint of cypress and seaweed. Sights: geologists on the rocks, people and dogs of all ages and sizes on the beach, waves sparkling in the sun. Studying the guts of a plate-bounding, subduction zone thrust fault, Rodeo Cove, California with M.S. student **Hanna Bartram** and **Harold Tobin**. Hope your year was as good as mine!

STEPHEN MEYERS

The past year was abuzz with astronomical endeavors. Doctoral student **Chao Ma** (Geoscience M.S., 2012) has been busy wrapping-up an evaluation of rhythmic sediments from the late Cretaceous, and testing the theoretical astronomical solutions using very long “continuous” records from the Western Interior basin. One of these cyclostratigraphic records was developed during an internship at Shell, and Chao will take a full-time job there in 2016 (congratulations Chao!). Masters student **Lindsey Shanks** (Geoscience B.S., 2014) is quickly finishing-up an investigation of Oligocene paleoceanography and astronomical signals at Rio Grande Rise (co-advised by **Clay Kelly**), and will depart for a full time job at Hess this coming summer (congratulations Lindsey!). Doctoral student **M'bark Baddouh** (Geoscience M.S., 2008) has been exploring a novel use of $^{87}\text{Sr}/^{86}\text{Sr}$ in carbonates to constrain astronomical influences on the Eocene hydrologic cycle (lead advisor **Alan Carroll**; Sr-isotope expertise from **Clark Johnson** and **Brian Beard**). And this fall we were delighted to welcome back alum **Andrew Walters** (Geoscience M.S., 2013), returning from a short stint at BP, to pursue a dissertation on astronomical-climate linkages in the Green River Formation (co-advised by Alan Carroll).

A major focus of this past year has been development of the software ‘Astrochron’, which makes new astrochronologic and computational methodologies available to the geoscience community. The software has been growing hand-in-hand with our research publications (e.g., Patterson et al., 2014; Laurin et al., 2015; Zeeden et al., 2015), and is more broadly expanding into radioisotope geochronology (with the guidance of $^{40}\text{Ar}/^{39}\text{Ar}$ experts **Brad Singer** and **Brian Jicha**) and the statistical analysis of paleoclimate. Astrochron is now publicly available on the R distribution website, CRAN (check it out!: <https://cran.r-project.org/web/packages/astrochron/>). Short courses and seminars on Astrochron during the past year included lectures at the Urbino Summer School in Paleoclimatology (Urbino, Italy), the University of Victoria-Wellington (Wellington, New Zealand) and Lamont-Doherty Earth Observatory (Columbia University, New York).

Finally, over the past year I was surprised and grateful to learn that I've been designated the recipient of two awards, the “James Lee Wilson Award” from the Society for Sedimentary Geology (SEPM; to be awarded in June 2016), and the “Distinguished Alumni Award” from the Department of Earth and Planetary Sciences at Northwestern University (awarded October 2015). I will strive to live up to them!

SHANAN PETERS

It has been yet another eventful year. Thanks to a proactive and supportive faculty here in the Department of Geoscience, I was promoted to full professor effective fall 2015. This is an important milestone that has deepened my sense of connection to the UW and to the department. It has also given me the foundation for beginning longer-term projects that I think may have real impact, but that also require longer timeframes to complete. Many of those projects involve systematizing geological data of all types. Programmer Analyst **John Czaplewski** has been instrumental in pushing the technical fronts of Macrostrat into amazing and fun-to-use tools. Geological maps, which are linked to Macrostrat and to the published literature via the GeoDeepDive infrastructure we are working on, are an important component of the system. You can check out the most fun to use geological map in the world and explore Macrostrat and the literature here: <https://macrostrat.org>. With these data, and new field data, I continue to explore the implications of the Great Unconformity on our understanding of Earth systems evolution.

I am fortunate to have two very talented

postdoctoral scholars in my group. **Jon Husson**, who comes to us from Princeton U., is working with Macrostrat to explore hypotheses in biogeochemical cycling, and **Andrew Zaffos**, from U. of Cincinnati, is working with everything, including modern biogeographic data, to tackle problems in paleobiology. **Sharon McMullen** has made great strides on her dissertation and spent the summer in the Morrison with undergrad assistant **Mike Schiltz**. **Ben Linzmeier** continues to produce WiscSIMS records of isotopic variability in mollusks and he now has in his possession the most analyzed ammonite in the world! Scott Hartman should be tackling prelims soon, and new graduate student **Ben Barnes** is starting to develop ideas about the carbon cycles that can be tested with measurements from carbonate cements, including those found in the rocks that **Dean L. Morgridge** studied in his UW Master's. The Paleobiology Database (<https://paleobiodb.org>) continues to be based here in our department, with Programmer Analyst **Michel McClennen** at the helm. Programmer Analyst **Puneet Kishor** makes contributions across the board sometimes too.

ERIC RODEN

Geomicrobiologists have been talking about the connections between genetics/genomics and geochemistry for almost two decades. Our ability to make these connections has advanced steadily, and as a discipline geomicrobiology is now at very exciting place in terms of being able directly link these disciplines in the context of environmental geochemistry, Earth history, astrobiology, etc. The advent of low-cost DNA sequencing and essentially free bioinformatics technologies now allows us to peer into the “black box” of the microbial communities and their diverse metabolic pathways that drive geochemical cycling in a myriad of environments on the modern Earth, and that may have been involved in some of the first forms of metabolism on the early Earth. The Geomicrobiology Lab has marched into the fray of this over the past few years, with a specific interest in “extracellular electron transfer”, a process whereby microbial cells transfer electrons to and/or from solutes and mineral phases external to the cell membrane. The main focus is on extracellular redox transformation of iron phases, including the utilization of ferric iron bearing minerals by dissimilatory iron-reducing microorganisms that transfer electrons to insoluble iron oxides and phyllosilicates during respiration; and the utilization of ferrous iron by chemolithotrophic iron-oxidizing that extract electrons from aqueous



Tasha and John Morgridge talk to Phil Brown at the Spring Banquet. John accepted our Distinguished Alumnus Award for his late brother Dean. (Please see page 5.)



Eric Roden and Shaun Marcott at the Spring Banquet. Photos, Neal Lord.

and mineral-bound Fe(II) sources for generation of metabolic energy. In several ways 2014 was watershed year for this line inquiry in the Geomicrobiology Lab, as we built-up our first solid combination of microbiological and geochemical studies of microbial iron metabolism paired with genomic analysis of the organisms carrying out the reactions. Graduate student **Nathan Fortney** (a Ph.D. student in the NASA Astrobiology Institute-supported Wisconsin Astrobiology Research Consortium) put together such a combination with his studies of microbial iron reduction in Chocolate Pots Hot springs in Yellowstone National Park, and Assistant Research Scientist **Shaomei He** with her genomic analysis of a chemolithotrophic iron-oxidizing cultures that has been used extensively as a model for how microorganisms can directly attack insoluble Fe(II)-bearing minerals. In addition, DOE's Joint Genome Institute completed a whole genome sequencing project with the Geomicrobiology Lab, which has generated a wealth of information on a suite of novel Fe(II)-oxidizing bacteria isolated by former Associate Research Scientist **Evgenya Shelobolina**. Papers from Nathan and Shaomei are starting to flow on this, and we look forward to many more as our entire group adopts genomic analysis as a key component of our geomicrobiological toolbox. The group now includes two students (**Jacqueline Meija and Noah Stern**) in the campus-wide Environmental Chemistry and Technology, who are funded through two different DOE projects for genomic-enabled studies of organic carbon metabolism and its connection to extracellular iron redox metabolism in water-saturated soils and sediments.

CLIFFORD THURBER

Looking back on the last year, so much has happened it is hard to know where to begin. Two major projects started up in late 2014,

the Laguna del Maule (LdM) "caldera in the making" NSF project, led by **Brad Singer**, and the Poroelastic Tomography (PoroTomo) geothermal stimulation DOE project, led by **Kurt Feigl**. The "pilot" array of 12 UW seismic instruments was deployed at LdM in January, with grad student **Crystal Wespestad** playing a major role in that effort. Grad student **Summer Ohlendorf** defended her thesis on seismic studies of Okmok cadera, Alaska, in January. After a brief period as a post-doc here, she has now started working at the Pacific Tsunami Warning Center in Palmer, Alaska. In August grad student **Bin Guo** successfully defended his M.S. thesis on the seismic tomography of the Alpine Fault region in New Zealand. Grad student **David Watkins** has continued his seismic tomography work on the Jalisco region of Mexico. New grad student **Lesley Parker** arrived in the fall; she will be working on the PoroTomo project. Assistant Scientist **Ninfa Bennington** has her hands full with three new projects supported by NSF, two that have begun on Alaskan volcanoes and a third waiting in the wings on Yellowstone. Two undergraduate students, Lauren Abrahams and **Ashley Dinauer**, worked with Ninfa on analyzing deep earthquakes in subduction zones. This fall, undergraduate student **Bethany Vanderhoof** has started to work on the study of local earthquakes at Laguna del Maule. My year was filled with travel, mostly for work but two trips for pleasure. On the work side, in addition to the usual fall AGU and spring SSA meetings, I visited the Chilean volcano observatory (OVDAS), a key collaborator in the LdM project, attended a Near Surface Geophysics meeting sponsored by SEG, and participated on an NSF panel. On the pleasure side, my wife took wildlife-oriented trips to Costa Rica in January and Borneo in July. I look forward to the deployment of the main seismic

array at LdM in January and a massive deployment of cool new seismic instruments for the PoroTomo project in March.

BASIL TIKOFF

Every year, I say to myself: "Surely, I can't get busier than this". But, it finally happened in 2014-5. It was all a bit much, although I enjoyed it as much as I could. Here are some highlights:

1. **Ad Byerly** and **Tor Stetson-Lee** both finished a Master's degree, working on different aspects of the tectonics of Idaho. They both did a nice job finishing up and are off to more adventures.
2. We had a truly great fieldtrip to Greece, mostly as a result of a lot of "leg-work" by post-doctoral fellow **Vasilis Chatzaras**. In fact, it was the best fieldtrip that I had been on as a professional (and it rivals a fantastic trip to the Whipple Mountains that I took when a graduate student). Former Weeks Hall resident **Seth Kruckenberg** (now faculty at Boston College) was a superb guide for our trip on the island of Naxos.
3. Both Vasilis Chatzaras and graduate student **Zach Michels** got first-authored articles published in *Geology*. Graduate student **Richard Becker** also got the lead article published in *GSA Today*, on his work in the Sierra Nevada. So, in terms of scientific publications, it was a good year.
4. Doug Walker (Kansas), Julie Newman (Texas A&M), and I are working on putting together a digital database for Structural Geology and Tectonics. I periodically wonder why I agreed to do that. But, they are both great to work with.
5. I got to teach Geo 202 with **Phil Brown**. Doing anything with Phil is always a good time.
6. The work at Laguna de Maule is getting more interesting (the large super-volcano project lead by **Brad Singer**), and the field logistics are ramping up. I got to ride around on horseback for a day, in the Andes, with a bunch of seismic equip-

(Continued, next page)



Professor Laurel Goodwin and graduate student Hanna Bartram ponder a remarkable chert breccia in the Marin Headlands terrane of California's Franciscan Complex.
Photo, Harold Tobin.

ment. I was saddle sore for a while after that adventure (hmmm, maybe that wasn't such a great plan). It was good fun to spend time with the Chilean colleagues and the LdM field crew (including UW graduate **Dana Peterson**, now at Cornell University) up at the Laguna: What a great bunch of people. 7. I've enjoyed continuing to work with graduate students **Richard Becker, Zach Michels, Bridget Garnier, Nico Garibaldi, Saurabh Ghanekar, Nick Roberts, and Maureen Kahn**. It is pretty lively down in the structure wing (aka isolation ward) these days. I look forward to slower times in the next academic year.

HAROLD TOBIN

It's been a year of new things and old: I'm still slowly learning how to do this Department Chair gig, while also returning to some old research roots in Cascadia and California. Having now put in one full year as Chair, I have a new appreciation for the complexity of the university as I peer beyond the ramparts of Weeks Hall. But it's also been a year of change and renewal on the research front.

In 2014, our NanTroSEIZE deep scientific drilling project (Nankai Trough, Japan) reached a milestone as we hit a record 3000 meters depth below the sea bed, with plans to return and deepen it to 5000 meters in a year. Those plans are now on hold until a projected 2017 return date for the drillship *Chikyu*, but my research group is busy in other parts of the world. Doctoral student **Tamara Jeppson** spent three months on site in Whataroa, New Zealand as part of the core team on the Alpine Fault drilling project; I was able to spend a very wet but enjoyable three weeks there helping Tamara sample fantastic outcrops of this

plate boundary fault zone. Tamara's been hard at work on those samples in the rock physics lab ever since coming back to the northern hemisphere, but found time to also publish her San Andreas fault work in *Journal of Geophysical Research* this summer.

Meanwhile, I have re-entered the world of Cascadia accretionary tectonics with PhD student **Susanna Webb**, who has been dealing with the complexity of seismic data processing and interpretation for new seismic lines acquired off the central

Washington coast, right in the heart of the potential tsunami source zone for a Cascadia megathrust earthquake. To complement these active but inaccessible faults, we are also putting new effort into exhumed examples of ancient subduction-related faults in California and Alaska. Second-year graduate student **Hanna Bartram** is pursuing her Master's research on the Rodeo Cove fault in the Franciscan of Marin County, California, where **Laurel Goodwin** and I joined her for a great week of field work a stone's throw from San Francisco.

Hanna and I also spent a week in the field in Alaska at the end of August, scouting out accretionary complex faults in the spectacular Turnagain Arm, Kachemak Bay, and Prince William Sound regions. The 25 foot "research vessel" and its Zodiac tender that we used to get around made for a pretty different (and definitely more fun!) marine experience than being on a drilling vessel. With expert guidance from Peter Haeussler of the USGS, we voyaged out to Montague Island (the largest uninhabited island in the USA) for a look at rocks and faults in the Orca Group. Based on what we found, I am optimistic that this won't be the last trip out there.

JOHN VALLEY

I belatedly completed my responsibilities as past-President of the Mineralogical Society of America this year by finally publishing my Presidential Address: "New Tools for Old Minerals". The paper reviewed the complimentary capabilities of two cutting-edge technologies (SIMS, secondary ion mass spectrometry, and APT, atom-probe tomography) as applied to the Earth with specific application to 4.4-billion-

year-old zircons. The original talk described only SIMS and was before the first mineral was studied by APT. The technological breakthroughs have been so amazing, frequent, and fun that I couldn't bring myself to summarize them before now, and they continue. Unlike my far shorter paper in 2014, this one was ignored by the media and left Beyoncé unimpressed. Professionally, however, the response has been gratifying, leading to more invitations than I could ever accept.

I'm lucky to work with so many wonderful people in Weeks Hall; space doesn't allow proper recognition. My PhD students, **Tyler Blum, Phil Gopon** (co-advised with **John Fournelle**), **Ben Linzmeier** (with **Shanan Peters**), and **Ryan Quinn** are investigating APT and age of lunar zircons, ultra-small-spot electron probe analysis of iron-silicide minerals in lunar regolith, ammonoids and paleoenvironment of the Cretaceous Seaway, and isotope thermometry of high-pressure metamorphic terranes, respectively. **Jake Cammack, Adam Denny** and **David McDougal** (with **Noriko Kita**) are on track to finish their MS theses this term on Archean cherts, carbonate diagenesis and chondrite meteorites. New students, **Evan Cameron** and **Rachelle Turnier**, started projects in September on Hadean zircons and Greek sapphires. All of this research critically depends on the WiscSIMS, electron microbeam and stable isotope labs, and many skilled research scientists and post-docs, including **John Fournelle, Noriko Kita, Kouki Kitajima, Navot Morag, Ian Orland, Maciej Sliwinski, and Mike Spicuzza**.

Travel swelled my oversized carbon footprint once again this year with trips to Mumbai to tour the Indian diamond industry with the GIA Board, Prague for a meeting, and Paris (twice) to visit grand daughters and hike in the Dordogne. Andrée retired after 20 years at Madison College (MATC) last January so she could spend the spring in Paris with the girls, and in August she got a call to go back. This term she's teaching Art Welding and Ceramic Sculpture in the college exchange program. Did I mention last year that I cut down 3 large black walnut trees and milled the logs? The 5/4 boards have been air-drying in my shed and by last week were down to 10 wt.% water. The first project is a natural edge table, but I'm not sure I'll get to it before the end of the term.

HERB WANG

My spring semester started with a trip to Paradox Valley in Colorado where I served on a panel reviewing the very interesting case of

induced seismicity associated with deep injection of brine. On the field trip was UW physics alum, **Will Yeck**, who works as a seismologist for the Bureau of Reclamation while working also for his PhD in geophysics at the University of Colorado. Will performed some electrowetting experiments with GLE professor **Dante Fratta** and me when he was an undergrad. The main part of the spring semester was devoted to teaching Rock Mechanics and analysis of Distributed Acoustic Sensing (DAS) data we collected in September 2013 at Garner Valley in southern California. The data serve as a prototype for a larger field deployment at Bradys Hot Springs as part of Professor **Kurt Feigl's** "PorroTomo" project. **Alex Baldwin** completed his M.S. in May and **Chelsea Lancelle** is working on several aspects of the DAS data for her PhD.

Rosemary and I are living in Arlington, VA where I am serving as a rotator at NSF for two years in the Instrumentation and Facilities Program of the Earth Sciences Division. A fellow rotator is **Tom Burbey** (BS, 1981) in the Hydrologic Sciences Program. Let me know if you are willing to review proposals. It'll save me the grief of sending proposals to unwilling reviewers.



At Múlajökull glacier in Iceland, where Luke Zoet conducted research this summer, grad student Jacob Woodard stands atop an emerging supercooled englacial channel before it pours into a moulin. Photo, Luke Zoet

HUIFANG XU

Graduate student **Zhizhang Shen** (co-advised by **Prof. Phil Brown**, and **Prof. Izabela Szlufarska** of Materials Science and Engineering) has finished his PhD dissertation and moved to Pacific Northwest National Laboratory as a postdoctoral researcher. Zhizhang's final paper about the roles of polysaccharides in catalyzing dolomite growth at low-temperature was just published in journal of *Langmuir*. His molecular dynamics modeling shows that the hydrophobic space near the surface created by the non-polar -CH groups of a polysaccharide in the bridge conformation is the reason for the observed reduction of energy barrier. Graduate **Seungyeol Lee** continues on understanding behaviors of trace metals (Ba, As, Ni, Zn) in modern Fe-Mn-nodules and concretions from Green Bay. His findings may help us to better understand Fe-oxide precipitates and sediments on Mars. Graduate student **Shiyun Jin** has worked on solving crystal structures of intermediate plagioclase feldspars using transmission electron microscopy and single crystal X-ray diffraction. Graduate student **Nick Levitt** (co-advised by **Clark Johnson**) worked on synthesis of Mo-bearing calcite in order to understand partitioning of Mo between

calcite and solution. Nick also worked on isotopes of C and O in Archean stromatolites from Kaapvaal Craton, South Africa. New graduate student **Yihang Fang** has started his research on Ca-Mg-carbonate minerals in a modern stromatolite from Manito Lake, Canada. New graduate student **Franklin Hobbs** in Materials Science Program (co-advised by and **Prof. Izabela Szlufarska** of Materials Science and Engineering) is working on kinetics of Ca-Mg-ordering in dolomite at low temperatures. Visiting graduate student **Hanzhi Zhang** investigated clay minerals from a paleo-lake in central China in order to understand paleo-climate changes based on variations in clay minerals. Lab manager of the S. W. Bailey X-ray Diffraction Laboratory, **Dr. Rie Fredrickson** continues studying structural modulations

in intermediate plagioclase feldspars.

Finally, I have earned enough gray hairs and am promoted to full Professor. In the past year, I have worked on solving crystal structures of nano-minerals (that never grow big) and plagioclase feldspars. Our new findings from Z-contrast images show that Ca-Na ordering occurs in intermediate plagioclase feldspars in addition to well-known Al-Si ordering. Crystal structures of the intermediate plagioclase feldspars are very different from their end members of albite and anorthite. The observed Ca-Na ordering results in structural polarity in plagioclase. In the summer, I had field trips in Canada together with our astrobiology group and in Yellowstone National Park. I attended the 15th Bathurst Meeting (an international meeting for carbonate workers) at University of Edinburgh, UK.

LUKE ZOET

It's been a busy year but I'm finally situated in Madison. I spent the previous three years as a postdoc at Iowa State University. While at ISU, I worked on a range of projects related to glaciers. A majority of those projects used specially designed ring shear devices created to study the sliding mechanics of glaciers. In addition to this laboratory work, I was involved in a field project that investigated the formation processes of drumlins. The ice margin of Múlajökull glacier in Iceland is retreating and exposing a drumlin field as it goes. This is the only known active drumlin field in the world, so we're trying to use the unique opportunity to study both the drumlins that have already been exposed and those still partially or entirely under the ice in order to learn how they form (photos).

Since arriving at UW-Madison I've been getting my labs up and running, and teaching a new class called Glacier Mechanics. I have two new MS students who joined me at the time of my arrival. **Jacob Woodard** traveled with me to Iceland where we collected GPR (ground penetrating radar) data on exposed drumlins as well as some still under the ice. He will work to compare these drumlins' internal stratigraphy with the drumlins in Wisconsin. **Ian McBrearty** is working with passive seismic dataset collected on the North East Greenland Ice Stream. He is using the dataset to study the seismicity resulting from the flow of the ice stream emanating from both the bed and the shear margin. It's been a whirlwind start, but many exciting projects are underway with many more to come. ●

Emeritus Faculty News—2014-15

MARY ANDERSON

The big accomplishment this year was the publication of the 2nd edition of “Applied Groundwater Modeling: Simulation of Flow and Advective Transport” with hydrobadgers **Bill Woessner** and **Randy Hunt** as co-authors. After two years of intense (and sometimes tense) work, the book was finally published in mid-August by Elsevier and is available in both hard copy and as a pdf file with 564 beautiful pages, including many new figures in full color. The book was entirely rewritten and almost nothing of the text of the 1st edition remains. We had helpful reviews on the near final version from several reviewers, including hydrobadgers **Mike Cardiff**, **Charlie Andrews**, and **Kurt Zeiler**.

Other highlights of the year included presenting the citation for a 2015 Distinguished Alumni Award to hydrobadger **Ken Bradbury** in May (see article elsewhere in the Outcrop) and, later, toasting Ken on September 1—his first day as the new Director of the WGNHS and our new State Geologist. Congratulations, Ken!

Also memorable was a trip in October 2014 to the University at Buffalo, my old alma mater (undergrad), to accept an award and visit with hydrobadger **Chris Lowry**, an assistant professor there. Chris treated me to lunch and a tour of his lab and impressed me by all the good work he is doing. I also had most enjoyable extended visits in Wisconsin with **Xiangxue Cheng**, **Yu-Feng Lin** and his delightful family, and **Daniel Feinstein** and his equally delightful family. Trips for business are fewer now but I did travel to Irvine, California, in January for a committee meeting for the National Academy of Engineering. Charles and I continue to travel to our favorite haunts—Door County and New Orleans, as well as Stratford (Ontario), San Francisco, and New York City for opera and theater.

CARL BOWSER

It's been an interesting year for me, even after 15 years in retirement. Since moving to Tucson nearly five years ago, I'm establishing stronger geologic roots. Looking out our back window at the western end of the Catalina Mts., the source of so much pioneering work on metamorphic core complexes, I live in constant memory of the geologic work done there. Sadly, Bill Dickinson, one of those pioneers, passed away this year and I will miss talks with him at department seminars and

AGS meetings.

Long a member of the Arizona Geological Society I was elected to Councilor in January, a three-year term. Working with Mark Barton (UA) and a small committee from the AGS we have started a project to document and photograph the economic geology collection of Waldemar Lindgren, some 19,000 specimens, and to make them available to the geologic community on line. We're in the initial stages of setting up a database and getting volunteer help to undertake the tasks.

This past September I gave the evening talk at our monthly AGS meeting. Entitled “The Kramer Borax deposit: a 50 year retrospective”, it enabled me to dress up the talk I gave over 50 years ago when I interviewed for the geochemistry position at Wisconsin. I updated much of the material and incorporated recent work on boron isotopes from Kramer and other world-class borate deposits and recent thinking on B-As-Sb associations in thermal spring deposits. In the audience were several people who had, themselves worked in this small realm of geology and afforded a chance to catch up on their work over the past 40-50 years.

Sadly, I lost close colleagues and personal friends recently, Blair Jones, Bob Berner, and Joel Gat. Judy and I travelled to the Vancouver GSA last October to give the plenary paper in a session dedicated to Blair's work. Having worked with him for over 50 years I could speak to his many accomplishments and my collaborations with him.

I continue to help staff the booth of the Mineralogical Society of America at the Tucson Gem and Mineral show. A parade of mineralogists and former UW students stop by the booth, including **Bob Jenkins** and **Ken Dominik**. I occasionally see other UW linked people, **Pat Hartshorne**, **Ken Ciriacks**, and



Bob Dott, right, with Ian Dalziel at Van Hise Rock. Bob led a NCGSA field trip, *What's New at Baraboo?*, with Laurel Goodwin, Gordon Medaris, and Steve Marshak, University of Illinois, Urbana-Champaign. Photo, Steve Marshak.

Woody Brooks. It's the show of shows in the mineral collector's world. At last year's show I had the good fortune to be interviewed by “Crystal Clear Radio” on my long love for all things mineral. The interview can be heard at: <http://www.stitcher.com/podcast/crystal-clear-radio/e/professor-carl-bowser-msa-owner-of-silver-pixel-images-contributing-37085570>.

We continue to be active with the music world in Tucson; I'm presently the Secretary of the Board of Trustees, and season ticket holder to the Tucson Symphony Orchestra. Judy and I are members of the symphony league, and she volunteers with the League of Women Voters, Tucson Chapter. “Spare time” finds us playing golf, swimming in our pool, or enjoying time with local friends or family in Tempe. Weather permitting, I can be found in the evening peering through my 11-inch Schmitt-Cassegrain telescope trying to master knowledge of the skies or the intricacies of astrophotography.

DAVID L. CLARK

Together with UW grads **Scott Ritter** and **Bart Kowallis**, Ray Ethington (University of Missouri) and I are completing work on

an interesting Paleozoic section in west-central Utah. The formation, the Opopongia Limestone, has been tossed around from a Carboniferous assignment to our work which provides a "high resolution" Early Ordovician definition based on conodont biostratigraphy. Also, we have been able to show how this carbonate unit fits in with the Sauk-Tippicanoe sequence stratigraphic interpretations so eloquently described by former grad students **Bill Morgan**, a previous department Board of Visitors Chairman, and **Jim Miller** in the 2012 "Great American Carbonate Bank" volume.

So this old guy is still kicking and also happy that the sedimentary branch of the department is apparently doing as well as it did when **Bob Dott**, **Lloyd Pray**, **Lewis Cline**, **Charlie Byers**, and I were around. Also, many thanks to the former grad students who last year responded to my invitation to an email connection.

ROBERT H. DOTT, JR.

The Friedman Service Award from the History and Philosophy of Geology Section of GSA at the meeting in Vancouver was my most notable geological event of the past year. It was good to see many alumni there and I have been happy to see a few of you here in Madison over the past year. Most notable are a couple of visits by **Tom Doe**, who is now a member of our Board of Visitors. Like homing pigeons, Liz and **Bob Hickman** have retired from Houston and are now living here in Madison. My principal geological activities during the year involved writing. Former faculty member, **Ian Dalziel** (1963-66) and I have been working fitfully on a manuscript about Charles Darwin's significant geological work in southern South America during the Cruise of *HMS Beagle* (1831-1836). During our own research in the region we have stood on many of the same outcrops as he so we decided a few years ago to write a comparison of his geology with today's knowledge of that region. It has been a very rewarding project, but a difficult one because we are now far apart and Ian is such a peripatetic global traveler we have had many hiatuses in our efforts. At last we think we can see light at the end of the tunnel.

On the local front, **Charlie Byers** and I are writing a short piece on Cambrian geology for a GSA Guidebook for the Baraboo Hills, which is being organized by **Richard A. "Skip" Davis, Jr.**, who was a post-doc here in the 1960s. The

real highlight of 2015 for Nancy and me was a wonderful family reunion on the Oregon Coast during the first week of August. It was no small feat to get Nancy, her motorized chair, and a caregiver from Madison to the Pacific Coast, but it worked. Twenty of the Dott clan had a great time in a region our whole family has loved—and where I conducted research—for more than 50 years.

GORDON MEDARIS

For the first time since arriving in Madison in 1966, Nancy and I fled for the winter to warmer climes—snorkeling in Bonaire and biking and kayaking in Florida, where we paddled some crystal clear spring-fed rivers in central Florida and mangrove tunnels in the Everglades (photo below).

In July I headed for the Klamaths to rendezvous with **Zach Michels** and **Basil Tikoff** at the Seiad metaophiolite complex (my Ph.D. thesis area). After falling on a steep slope and being saved from injury (or worse) by a manzanita bush that caught my ankle and left me dangling upside down, I realized that this was my swan song for doing field work.

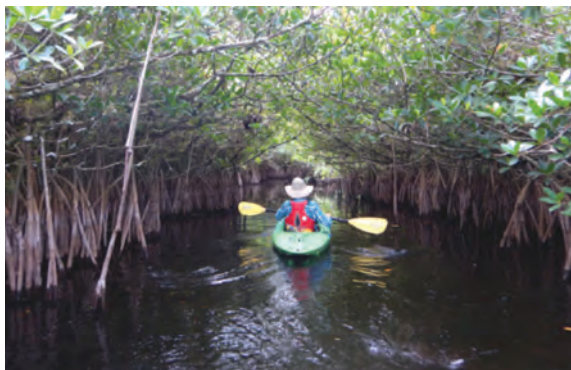
September found Nancy and me on our annual European bike tour, this time biking through the Austrian Tauern along the Saalach, Salzach, and Inn rivers to Passau on the Danube, followed by a few days in Linz, the home of Anton Bruckner, to hear some concerts at Brucknerfest.

2015 has been a busy year professionally, with two presentations at the North Central GSA meeting in Madison—one on Precambrian paleosols and another on the Baraboo Interval with **Bob Dott**—and three publications, including one on mantle xenoliths at the Kozákov locality in the Czech Republic (Int. Jour. Earth Sci.), another on a Saxothuringian orogenic peridotite in the Czech Republic (Lithos), and a third on "Metasaprolite in the McGrath Gneiss, Minnesota, USA: Viewing Paleoproterozoic weathering through a veil of

metamorphism and metasomatism" (Precambrian Research) with Terry Boerboom at the Minnesota Geological Survey, **Brian Jicha**, and **Brad Singer**. Research is continuing on eclogite and peridotite in Greenland (with Hannes Brueckner at Lamont), Czech peridotites (with my Czech colleagues Lukáš Ackerman and Emil Jelínek), and paleosols in the Lake Superior region (with **Esther Stewart** at the WGNHS and **Steve Driese**, a Madison PhD now at Baylor University).

DAVE MICKELSON

The year began with a complete shoulder replacement in early January. It was quite successful and after a few months of physical therapy I had almost complete mobility of my right arm. That meant I was ready to plant the garden in May. We were pleased to see **Pat Colgan** when he visited Madison for a week. A high point in late spring was having the GSA North Central meeting here in Madison. Lots of former students and friends attended, and I enjoyed going to talks and visiting with many alumni. Of course, that included a visit to Memorial Union Terrace to sip some beer with about 15 former students and friends one evening. Also, I enjoyed seeing many of you at the Weeks Hall courtyard picnic. **Eric Carson** and **Elmo Rawlings** (both now at WGNHS) led a one-day field trip down the Wisconsin River Valley, and it was a great chance to visit with many colleagues. Spring also saw the birth of another grandchild in Knoxville, and Vin spent some time there shortly after his arrival. Vin and I continue to go to Massachusetts a couple of times a year to stay at the cottage that my grandfather built in the 1940s. That is where we spent some time in July. I continue to work on a bluff stability project, and can clearly demonstrate that the low lake levels of the last decade have stabilized many of the bluffs. Another major effort this year was nearing completion of a book on the history of South Worcester, MA, the neighborhood where I grew up. My co-author (and cousin) and I have gotten to know each other again via the internet after many years with no contact. I just recently enjoyed the 50th anniversary of the Water Resources Management Program. Quite a few former geology grad students also did a degree in WRM, and it was great to visit with several of them including **Bob Sterrett**, **Jim Stark**, **Charlie Andrews**, **Doug Connell**, and **Monica Jaehnig**, who was in the very first class I taught at UW. ●



Nancy Korda explores the Everglades' mangrove tunnels by kayak. Photo, Gordon Medaris.

Give us five! The new CAMECA

John Fournelle

It has been an eventful year. The day after Thanksgiving 2014, around 6 pm, an 18 wheeler from O'Hare pulled into the Weeks Hall parking lot. The new **CAMECA SXFive** electron probe had arrived from Paris.

This culminated two years of effort, including a successful NSF-MRI grant (**Fournelle, Valley, Singer, Goodwin, Eom**) and support from the department's alumni gifts. This is the first CAMECA field emission probe in North America. The field emission electron probe is a relative newcomer to the field of electron probe microanalysis, with its forte being a much tighter beam. This theoretically makes possible analysis of sub-micron phases (down to perhaps 300 diameter nm vs. 3000 nm with the old probe), but it also requires a different analytical paradigm—operation



PhD student Phil Gopon is using the new CAMECA SXFive Field Emission electron probe to analyze lunar sub-micron minerals and metals (including Si metal and Fe-silicides). Photo, John Fournelle.

at much lower voltages (5-10 keV) relative to the traditional 15-20 keV. Very few labs have attempted this due to some complications. However, PhD student **Phil Gopon** and I are applying an innovative approach to this and made some breakthroughs, using "non-traditional" X-ray lines. Phil's focus is developing this technique and applying it to studying sub-micron iron silicides and native silicon which **Mike Spicuzza** discovered in a sample of lunar regolith he

and **John Valley** have been studying. I gave an invited talk at the May 2014 European Microbeam Analysis Society's conference in Slovenia, on low voltage field emission EPMA research. In June, we hosted the 3rd CAMECA SX-users meeting in Weeks Hall. ●

NCGSA

The Department, in collaboration with the Wisconsin Geological and Natural History Survey, hosted the North-Central GSA Section Meeting in May at the Monona Terrace Convention Center. **Jean Bahr** served as local chair and **Carol McCartney** of our BOV served as vice-chair of the local organizing committee. Student volunteers included many UW grads and undergrads, recruited by the capable team of graduate students **Elisabeth Schlaudt** and **Hangjian Zhao** and undergraduate major **Jackie Solie**. With over 700 attendees, including many UW-Madison students, faculty, staff and alumni, this was the largest NC Section meeting in the past decade (excluding meetings that were joint with other sections). The scientific program, organized by **Mike Cardiff** and alumnus **Eric Carson**, included a technical session on Quantitative Approaches in Stratigraphy and Paleontology organized by UW faculty **Steve Meyers** and **Shanan Peters** and another on Quaternary Paleocology of the Upper Midwest organized by Geology Museum's **Carrie Eaton** in which she revealed new findings related to the Anderson Mills Mastodon. **Phil Brown** and Esther Stewart of the WGNHS took charge of

coordinating five very successful field trips. These included "What's new in Baraboo?" led by **Laurel Goodwin, Gordon Medaris, Bob Dott** and colleagues (see p. 26) from five other institutions and "Late Cenozoic Evolution of the Lower Wisconsin River Valley" led by **Eric**

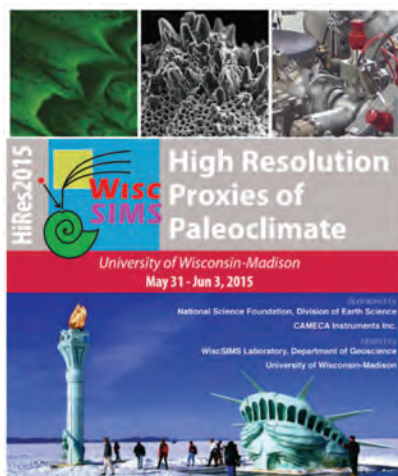
Carson and his WGNHS colleague J. Elmo Rawling. Social events included an evening open house in Weeks Hall and a courtyard tailgate dinner that provided an opportunity for Geobadger alumni from many decades to mingle and reconnect. ●



Eric Carson leading a NCGSA field trip to the Wisconsin River Valley in May. Photo, Jill Pongetti, WGNHS.

HiRes 2015

The NSF-funded HiRes2015 workshop (High Resolution Proxies of Climate Change) hosted by the WiscSIMS lab brought 65 scientists with diverse expertise to Weeks Hall to discuss existing proxy records and plan directions for future research. New *in situ* technologies for obtaining high-resolution data were a recurring theme, with an eye towards



enhancing data quality and synthesizing *in situ* geochemistry with imaging and structure of proxy materials. The workshop included eight keynote lectures and many volunteered presentations. The abstract volume and slides from talks are available on-line and a report will be published in EOS this fall (see below).

Workshop contributions demonstrate that the field of chemical and isotopic microanalysis is advancing quickly. Combined with increased societal awareness of future climate change, rising sea levels, and new monthly global temperature records, the window of opportunity is widening for the development of high-resolution records of past climate change.

<http://www.geology.wisc.edu/~wiscsims/HiRes2015/>

Orland IJ, Kita NT and Valley JW (2015) EOS, in press. ●

AbGradCon

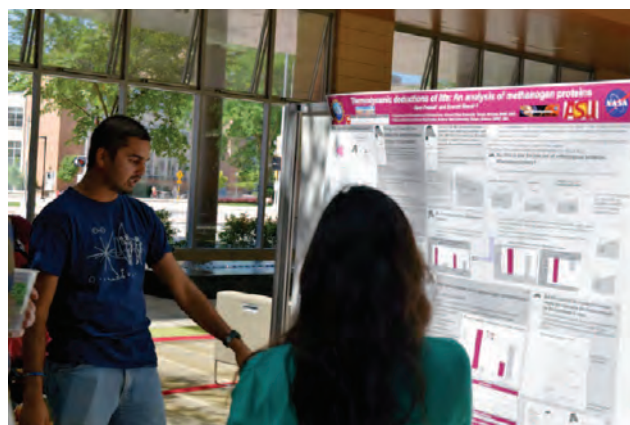
The Department of Geoscience hosted the 2015 Astrobiology Graduate Research Conference in Weeks Hall, the Wisconsin Institutes for Discovery (WID) and the Union on July 19 to 22, 2015. Fifty-five students and post-docs attended from twenty-seven institutions and three countries. The UW coordinating committee included graduate students **Adam Denny, Breana Hashman, Jake Cammack, Nathan Fortney, Nick Levitt (chair), and Thiru Reddy** ●.



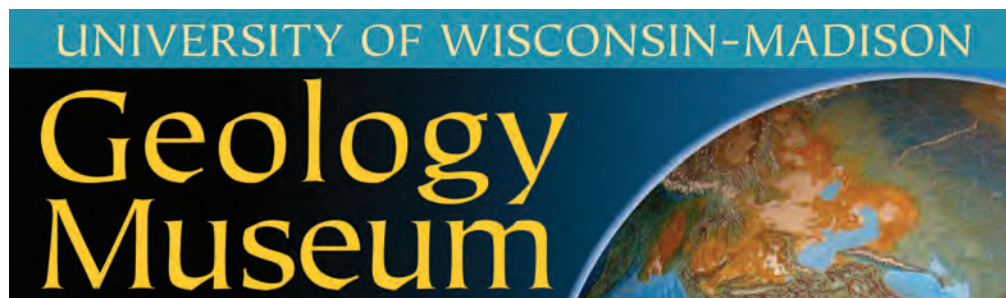
AbGradcon 2015 attendees enjoy a BBQ dinner in Weeks courtyard as part of the welcome events on the first night of the conference. The dinner capped an afternoon of laboratory and UW Geology Museum tours as well as an opening keynote presentation by Geoscience Professor John Valley.



The conference teamed with Wisconsin Union Directorate's Film Society to present Disney Pixar's 'WALL-E' for a movie night at the weekly Terrace After Dark summer event series. UW-Madison PhD student Breana Hashman took the opportunity to plug Astrobiology and space science before she introduced the film to an audience of 100's of people. The screening was complemented by activity stations at the Terrace where children could color cartoons of NASA's Mars rovers and satellites as well as send a 'postcard' to Curiosity via email.



Technical sessions at AbGradCon were held at the Wisconsin Institutes for Discovery (Discovery Building). Posters were set up in the beautiful Atrium area for viewing by conference attendees and public alike. Above, Arizona State University Ph.D. student Apar Prasad explains "Thermodynamic deductions of life: An analysis of methanogen proteins" (and rocks a Pioneer Plaque t-shirt). Photos, Nick Levitt.



Our Mastodonic Anniversary

This fall we are celebrating 100 years of our iconic mastodon being on display. In anticipation of this milestone, Curator **Carrie Eaton** began researching the skeleton's history two years ago. Over the course of her investigation she tapped into historical documents at both the Wisconsin Geological and Natural History Survey and the UW Archives, drilled cores of bone for radiocarbon dating, and took specimens to the Wisconsin Institutes for Medical Research for CT scanning. The story that emerged revealed our skeleton hails from not one, but two Wisconsin mastodon skeletons. Both discoveries were made by children in the late 1890's and then purchased by the University. In 1915, nearly two decades after their excavation, the bones were used to assemble to skeleton you can see in the museum today. Thanks to support from the Brittingham Trust, The American Girl Fund for Children, and the Friends of the Geology Museum we are upgrading the mastodon exhibit to reflect its new story. ●



Two UW-Madison students excavate fossils as part of our 2015 field season.

knows it's much bigger than originally thought and has a better strategy for tackling the cleaning of it. Also, the scan made it clear that there must be more back in the hill in Wyoming waiting for our crew to find it next summer. We are grateful to WIMR for their help with and enthusiasm for the variety of specimens we've brought over for imaging. ●

Ice Age Safari

As part of the effort to honor our mastodon's centennial, we took a one-hour long "Prehistoric Explorer" program on the road this summer. This interactive safari-style presentation introduced kids (and their parents) to the megafauna that lived during the Ice Age, especially those that roamed in Wisconsin. In sum, 763 people attended our programs in 14 Dane County libraries. This project was made possible with support from The American Girl Fund for Children and the Brittingham Trust. ●

A Powerful Partnership

As soon as he saw it in the field, Museum Scientist **Dave Lovelace** knew it was something special. Just the tip of a snout sporting small teeth can be seen peeking out of a cantaloupe-sized rock picked up by two UW students during our field expedition to Wyoming this summer.

Thanks to a relationship Lovelace has established with Dr. Guang-Hong Chen at the Wisconsin Institutes for Medical Research, within a week of returning from the field the rock was slid into a humming CT scanner to reveal its contents. While Lovelace knew there was an amphibian skull inside, now he



Carrie Eaton with the left thigh bone of our mastodon skeleton. It was removed from the display in order to drill a sample for radiocarbon dating and to be CT scanned. Photo, Jeff Miller.



UW-Madison junior Lee Bongey enchanted kids and adults with our Prehistoric Explorers program at local libraries this summer. She donned safari gear and made the Pleistocene megafauna come alive through stories, touchable specimens and images.



1986: Gathered in front of Chateau Après a group of students listens to an instructor.
Photo by Bob Dott, from the department archives.

50th Anniversary Celebration

Summer 2016 marks the 50th year of the award-winning Wasatch-Uinta Field Camp

1967-2016



Join us in a celebration of 50 years of nationally recognized,
 award winning field education.

We are putting together two great opportunities
 to remember the laughs (and possibly tears),
 return to the scene (of the crime?),
 reminisce, and reconnect with fellow campers.

Reunion

Chateau Après in Park City, UT
7/25/16–7/28/16

Featuring new field trips by local geologists, visits to old favorite field areas,
 and perhaps a walk or two up to watering holes on Main Street.

Evening celebration

**2016 National Meeting of the Geological Society of
 America in Denver, CO**

9/25/16–9/28/16

(exact date, time & location TBD)

Please visit this link for more information.
www.fieldcamp.org/anniversary

Please consider making a gift to the Nania Fund for graduate student research support, the Field Camp scholarship fund for undergraduates, or to your favorite fund.



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<http://geoscience.wisc.edu/geoscience/giving/>

SPEAKERS IN 2014

January 24–Clark Johnson–USGS Menlo Park–Volcanism and Magmatism of the Salton Sea area

January 31–Darin Croft–Case Western Reserve University–Adding a Chilean perspective to the story of South American mammal evolution

February 7–James Schmitt–Schmitt Technical Services, Black Earth WI

February 14–Kim Blisniuk–University of California Berkeley–Understanding Quaternary deformation across the San Andreas fault system

February 21–Lucas Zoet–Iowa State University–Experimental Simulations of Glacier Sliding

February 28–Isaac Larson–Cal Tech–Linking topography, erosion, and chemical weathering in Earth's most tectonically-active mountains

March 3–Dorthe Wildenschild–Oregon State University–Darcy Lecture: Optimizing Capillary Trapping as a Carbon Dioxide Mitigation Strategy: Pore-Scale Findings in Support of Larger-Scale Implementation

March 7–Shaun Marcott–Oregon State University

March 28–Jan Tullis–Brown University

April 4–Heather Wright–USGS Menlo Park–Holocene rhyolite eruptions; Salton Buttes, CA

April 11–Erica Bickford–AGU Congressional Science Fellow– Science Policy Careers for Geoscientists: Experience from a UW Grad

April 18–Michael Mann–Penn State University–Climate change and anthropogenic influences on atmosphere

April 25–Jennifer Eoff–USGS, Denver

April 29–Shirley Dutton–UT-Austin–Diagenetic controls on reservoir quality in deep to ultradeep sandstones

September 5–Harold Tobin–University of Wisconsin-Madison–Department Introduction

September 12–Brad Singer–University of Wisconsin-Madison–Is the next rhyolitic super eruption brewing in the Southern Andes?

September 19–Joanne Stubbs–University of Chicago–Synchrotron tools for geoscientists

September 26–Patricia Gregg–University of Illinois–The Mechanics of Triggering Catastrophic Caldera-Forming Eruptions

October 3–Rusty Riese–Rice University–Oil Spills, Ethics, and Society: How they intersect and where the responsibilities reside

October 10–Patrick Fulton–UC Santa Cruz–Twenty-Five Thousand Feet Under the Sea: Taking the Temperature of the 2011 Mw9.0 Tohoku-oki Earthquake Fault

October 24–Tomochika Tokunaga–University of Tokyo–Land subsidence and subsurface environmental changes in the Tokyo Metropolitan Area, and possible groundwater management for urban sustainability

October 31–Jay Zambito–WGNHS–Frac Sand in Wisconsin

November 7–Jessi Meyer–University of Guelph–A 'Hydraulics First' Approach to Delineation of a Hydrogeologic Units in Sedimentary Rock Flow Systems

November 14–Francis Macdonald–Harvard University–The tectonic context of Neoproterozoic glaciation and long term climate change

November 21–James Eldrett–Shell–Climate forcing of late Cretaceous sediments from the Western Interior Seaway

December 5–Larry Band–UNC-Chapel Hill (GSA Birdsall-Dreiss Distinguished Lecturer) Critical zone processes at the watershed scale ●

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Dave Lovelace
Brooke Norsted
Richard Slaughter
Klaus Westphal

Geology Library

Marie Dvorzak
Toby Lathrop