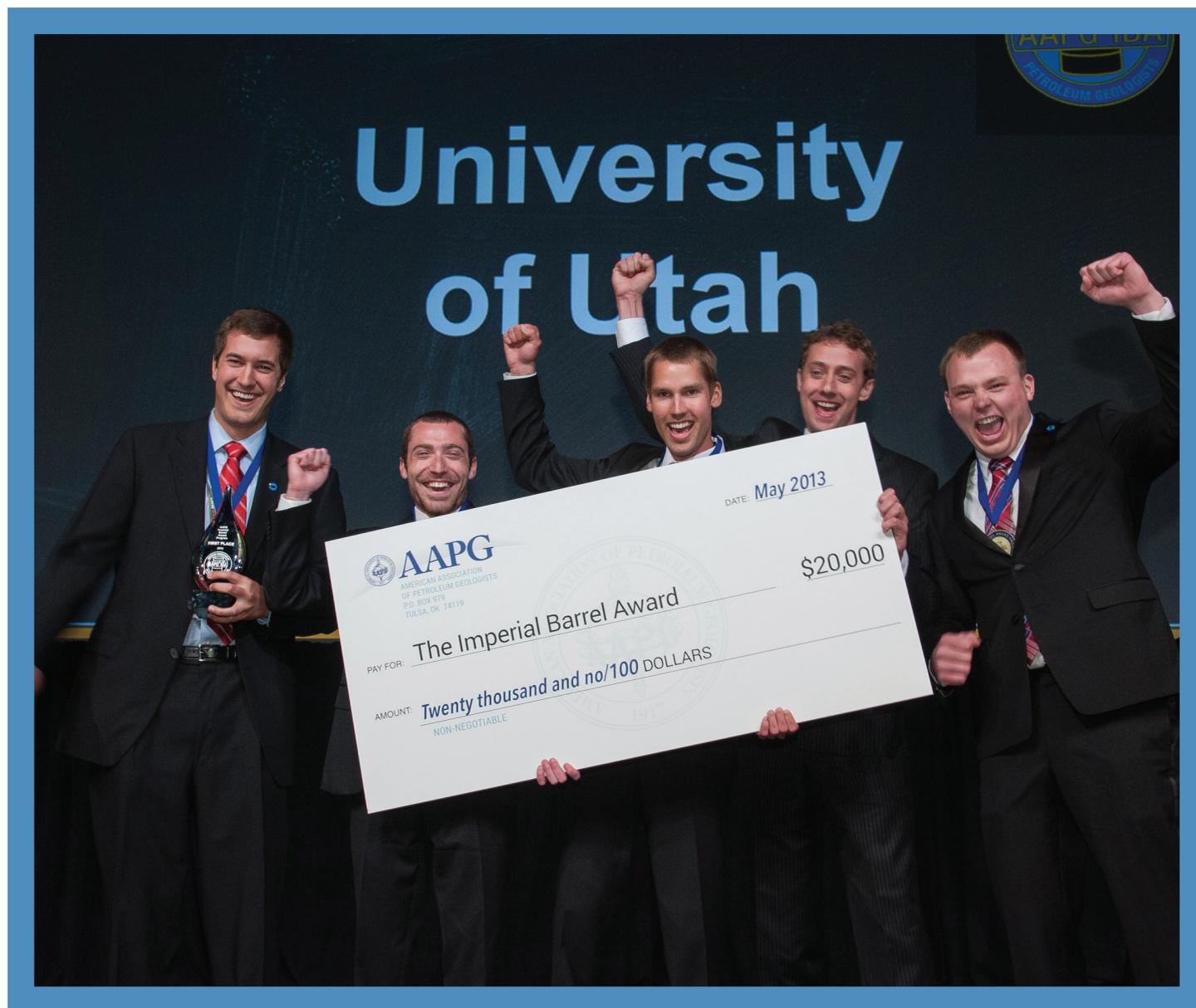


# Down to Earth



Newsletter of the Geology and Geophysics Department  
University of Utah, Salt Lake City, Utah

Fall 2013



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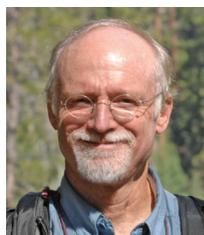
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Fossil frog - Eocene, Catlin Shale found in Elko County, Nevada. Donated by G.B. and C.G. (Gil) Mull

## Message from the Chair

This is an exciting time to take over as chair of the Department of Geology and Geophysics, as should be apparent from the contents of this newsletter. Excellent and diverse research has long been a hallmark of the Department, and the diversity and impact of research in GG has never been greater: from the ages of elephant tusks to tectonics of the core-mantle boundary to the discovery of new dinosaur species. Truly amazing.



We have regretfully seen the retirements of several long-serving and trusted faculty members, but we have in turn added a cadre of brilliant young scientists who are leading the department in new and exciting directions. Most recently, these include Jeff Moore and Lowell Miyagi who joined us last January, and Fan-Chi Lin who will arrive later this fall.

One direction of marked growth is our burgeoning program in energy-related geoscience. Not only is our research funding strong, student numbers up, and competition to hire our graduates intense, but this year UUGG entered a student team in the Imperial Barrel Award competition for the first time—and garnered first prize among an international field of 104 teams! The spoils of victory included a \$20,000 check from AAPG, which has been used as the lead donation to set up a new endowed fund in support of energy-related education at Utah...

...and this is only one of several new endowed funds for student support. New funds have recently been established in honor of two of our recent faculty retirees and their spouses, Dave and Inga Chapman, and Ron and Sandy Bruhn, and at least one or two more are on the way (I can't say more just yet, but keep an eye out for more information of this sort in the near future).

All in all, an exciting time indeed.

--- John Bartley, Department Chair



Geology of the Alps Ambassadors (see story on page 6)

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**Front Cover:** Award winners: Alexandre Turner, Morgan Rosenberg, Tyler Swarcz, Mason Edwards, and Marko Gorenc (see page 1 for details).

**Back Cover:** Professor Marjorie Chan (pictured in the front row) hosted the EarthCube workshop in March which brought together 57 sedimentary geoscientists to the U Campus (see page 6 for details).

**Down To Earth Editor:** Anita Austin Tromp

## Departmental Activities

### GG Students Win International Oil Exploration Prize

A team of University of Utah geology and geophysics graduate students took the top prize – the Imperial Barrel Award – on May 19th in Pittsburgh during the American Association of Petroleum Geologists' annual convention.

"This comes with major bragging rights -- plus a \$20,000 check," says Cari Johnson, an associate professor and recent associate chair of Geology and Geophysics. "In the Department's very first try, we won."

The five students on the winning U team were Alexandre Turner, Marko Gorenc, Morgan Rosenberg, Tyler Szwarc, and Mason Edwards (pictured below).



They were advised by Lauren Birgenheier and Lisa Stright, both assistant professors of geology and geophysics. Aksel Quintus-Bosz of Chevron and Matt Heumann of ConocoPhillips served as the team's industry consultants.

"The team won the regional Rocky Mountain competition in Denver against seven other teams, which advanced them to the international finals in Pittsburgh," says Birgenheier. "On May 19th they competed against 10 other teams (five U.S. regional teams and five international teams). They placed first in the final competition, beating the University of Oklahoma."

There were 107 teams with 535 students competing in the event. Each team had eight weeks to work up and present a detailed assessment of a parcel's potential for hydrocarbon production using real seismic-imaging and well data, in this case from Australia's Cooper-Eromanga Basin. The teams each made a 25-minute presentation to a panel of judges on their technical recommendations, followed by a question-and-answer session.

### Fighting Poachers Using Carbon-14 Dating

University of Utah researchers have developed a new weapon to fight poachers who kill elephants, hippos, rhinos and other wildlife. International agreements have banned most trade of raw ivory from Asian elephants after 1975 and African elephants after 1989. Tons of illegal ivory still are sold because dealers claim the ivory was taken before the ban and until now there has been no test to prove them wrong. By measuring

radioactive carbon-14 that was generated by nuclear bomb tests and then deposited in tusks and teeth, the method reveals when an animal died and thus whether the ivory was acquired legally.

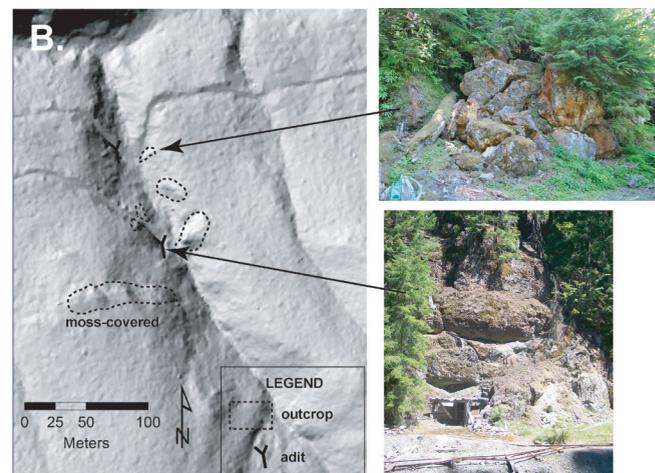


"The dating method is affordable and accessible to government and law enforcement agencies," says Dr. Kevin Uno, who did the research for his University of Utah Ph.D. thesis ('12). "It has immediate applications to fighting the illegal sale and trade of ivory that has led to the highest rate of poaching seen in decades. Currently 30,000 elephants a year are slaughtered for their tusks, so there is a desperate need to enforce the international trade ban and reduce demand."

Conservation groups say 70 percent of smuggled ivory goes to China. The U.S. is the next biggest illegal market. Rising ivory prices have drawn organized crime and spurred militias in Darfur, Uganda, Sudan and Somalia to kill elephants and sell tusks so they can buy guns. (See **POACHERS**, Page 14)

### LiDAR Technology Making Inroads in the Field of Mineral Exploration

Paul Jewell, associate professor in the GG Department, has been working to apply LiDAR technology to more traditional areas of earth science. LiDAR has the capacity to digitally "see through" areas of heavy vegetation and reveal heretofore-unknown geologic features. In January 2013, Jewell and



Hillshade of LiDAR-derived DEMs showing location of outcrops and adits in the area and field photographs of these features.

two students published a front-page story in the Society of Economic Geologists Newsletter. His abstract states: “The relatively new technology of Light Detection and Ranging (LiDAR), whereby surface outcrop patterns suggestive of economic mineralization can be identified, has the potential to join other remote sensing techniques employed by the exploration geologist. Successful application of LiDAR relies on rigorous, high-quality data collected under strict QA/QC standards and is most useful for delineating linear features such as faults or resistant rock types such as silicification. If used judiciously, LiDAR can join the toolbox of the modern exploration geologist working in heavily vegetated areas that contain many of the most prospective terrains left on Earth.” The article highlighted field areas in the Alta and San Francisco mining districts of Utah and the central Cascades of Oregon.

### **GG Alum Lindsay Zanno Seeks Clues to the Future From Dinosaur Fossils**

During the summer of 2012, GG alumna Lindsay Zanno (MS’04, PhD’08) prospected for dinosaur bones in the Mussentuchit Flat area near Cedar Mountain in Utah’s Emery County. She hit pay dirt with a new discovery the same way that she always does: by looking down. “Someone else on the team called me over to the other side of a hill and, as I was walking over there, I looked down and saw bits of brown bone sticking out of the ground,” says Dr. Zanno. “I got very excited right away because I could tell it was a theropod bone—they’re very thin, with a big cavity on the inside, just like the bones of a bird. That’s how you know you’ve found theropod leg bones, by the thinness.”

Dr. Zanno’s team collected what they could and tagged the area for further excavation in 2013, in a process that can take a couple of years before the new species is named and its significance assessed. Then it will go into the database that she has been amassing for years, to help fill out an ancient family tree of feathered dinosaurs that stretches from hundreds of millions of years ago to present-day bird species. “When it comes to dinosaurs, the most common public misconception is that they’re extinct,” Dr. Zanno says. “That’s something I say on a daily basis to any audience I can, because it’s a tidbit of information that can be transformative. Explaining to somebody that dinosaurs are still here and you interact with them whenever you see a bird, something clicks. It opens up a new fascination with the world we live in.” (See **ZANNO**, Page 14)



*Lindsay Zanno*

### **Collision Tectonics Atop Earth’s Core: Source Of A Future Mantle Plume?**

Geology and Geophysics seismologist Michael Thorne used seismic waves diffracted along the core-mantle boundary to map out low velocity zones at the base of the mantle. In a paper published earlier this year in *Earth and Planetary Science Letters*, Dr. Thorne with coauthors Allen McNamara and Edward Garnero of Arizona State University and Gunnar Jahnke and Heiner Igel of the University of Munich analyzed

SPdKS arrivals in 4221 seismograms from 51 deep earthquakes. The results of the NSF-funded study define two or more continent-sized rock bodies at the bottom of Earth’s mantle under the Pacific Ocean that are colliding and may be generating a new mantle plume.

“We may be detecting the start of one of these large eruptive events that – if it ever happens – could cause very massive destruction on Earth,” says Dr. Thorne, the study’s principal author and an assistant professor in GG. But disaster is “not imminent,” he adds, “This is the type of mechanism that may generate massive plume eruptions, but on the timescale of 100 million to 200 million years from now. So don’t cancel your cruises.”

Zones of partial melt at the bottom of the mantle are widely regarded as the sources of mantle plumes, and many researchers infer plumes to cause two kinds of large volcanic eruptions: massive pyroclastic eruptions like those during the past 2 million years that formed Wyoming’s Yellowstone caldera and covered North America with volcanic ash; and plateau basalt eruptions that flood the earth’s surface with lava to form “large igneous provinces” like the Pacific Northwest’s Columbia River basalts 17 million to 15 million years ago and India’s Deccan Traps some 65 million years ago.

“These very large eruptions may be tied to some extinction events,” Dr. Thorne says. (See **PLUME**, Page 14)

### **Ancient Climate Patterns Revealed by Lake Bonneville**

Fifteen thousand years ago, Lake Bonneville covered 30-40 percent of Utah. Paul Jewell, one of our associate professors of geology and geophysics, studies its remnants in an effort to better understand how the climate in Utah has evolved since that time. Wind and water move the earth’s sediment from one place to another. By looking closely at that sediment in areas where Lake Bonneville once existed, much can be discovered about ancient weather and climate patterns. “You can say something about the strength of the storm of that time [and] which direction the wind came from,” Jewell says. “The water balance points to Utah having a much wetter, colder climate in the past.” (His work was recently highlighted in an article titled, “Weather Patterns” in *Wasatch Magazine* (March 2013, vol. 1, no. 6)



*Paul Jewell on the shores of Lake Bonneville (now the Great Salt Lake)*

## Grasses in Human Ancestors' Diets

Most apes eat leaves and fruits from trees and shrubs. Carbon-isotope studies of fossil tooth enamel spearheaded by the University of Utah show that human ancestors expanded their diets 3.5 million years ago to include grasses and sedges, setting the stage for our modern diet of grains, grasses, and meat and dairy from grazing animals. Grassy savannas and woodlands in East Africa were widespread by 6-7 million years ago and it is unclear why human ancestors didn't seriously start to exploit them for millions of years.

"We know much better what they were eating, but mystery does remain," says Prof. Thure Cerling. "We don't know if they were pure herbivores or carnivores, if they were eating fish [which leave an isotopic signal that looks like grass-eating], if they were eating insects, or if they were eating mixes of all of these."



The earliest human ancestor to eat substantial amounts of grassy food from dry savannas "may signal a major and ecological and adaptive divergence from the last common ancestor we shared with African great apes" writes University of South Florida geologist Jonathan Wynn (U of U M.S. '98). "Diet has long been implicated as a driving force in human evolution," says Matt Sponheimer, University of Colorado anthropologist and former Utah postdoctoral fellow. He notes that changes in diet have been linked to larger brain size and to the advent about 4 million years ago of upright walking in hominins, which include humans, their ancestors, and extinct relatives that split from the other apes roughly 6 million years ago. Human brains were larger than those of other primates by the time our genus, *Homo*, evolved 2 million years ago. "If diet has anything to do with the evolution of larger brain size and intelligence, then we are considering a diet that is very different than we were thinking about 15 years ago," Dr. Cerling says.

Ancient creatures' diets are inferred from carbon-isotope compositions of tooth enamel based on the idea "you are what you eat." Tiny amounts of enamel were drilled from teeth and the carbon-isotope ratios of the powder were measured by mass spectrometry. The new data comes from 173 fossil teeth from 11 hominin species.

The ratio of carbon-13 to carbon-12 reveals whether a plant uses the C3, C4, or CAM photosynthetic pathway to convert sunlight to energy. C3 plants include trees, bushes and shrubs; most vegetables; cool-season grasses and grains; soybeans; non-grassy herbs; and forbs. C4 plants include warm-season or tropical grasses; grains such as corn and millet; and sedges, which include water chestnut, papyrus and sawgrass. CAM plants include succulents such as cactus, salt bush and agave.

C4 and CAM plants are enriched in carbon-13 and therefore so are animals who eat them. Today, North Americans eat about half C3 plants, including vegetables, fruits and grains such as wheat, oats, rye and barley, and about half C4, largely from corn and sorghum and from meat of animals fed on C4 grasses and grains. The highest human C3 diets today are found in northern Europe, where only C3 cool-season grasses grow so meat animals there graze on C3 rather than C4 grasses. The highest C4 diets likely are in Central America because of the heavily corn-based diet.

## Faculty Focus

**Ronald Bruhn** retired as of January 2013 after 37 remarkable years of distinguished teaching and service and has been awarded Professor Emeritus status. His record has been amazing. Not only has he been incisive, informative, and a popular lecturer at all levels of instruction, but he has also served on 170 graduate committees. Since he joined the faculty in 1976, the Department has awarded 643 advanced degrees, and Ron was a member of over one-quarter of the thesis committees. Since Ron's first students graduated in 1979, 580 advanced degrees have been completed in the Department, and Ron advised 29% of those. By any measure, this record is extraordinary.



Not surprisingly, Ron's former students organized a Ronald and Sandra Bruhn Scholarship Fund which now exceeds \$34,000. To honor his accomplishments, his former students held a Ron Bruhn Retirement Event in March, which included a Symposium and a banquet. Ron said he and his wife, Sandy, are at last enjoying living by the ocean in Washington State and having time to use their sailboat.

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**Richard Jarrard** retired on January 1, 2013 after serving as a professor of geology and geophysics since 1991. He has been awarded Professor Emeritus status.



Dr. Jarrard was an immense help to many students throughout his career here, particularly in instructing them on the use of instruments important in geophysical investigations. Further, he has been a very active, concerned departmental citizen, in many cases forcing faculty to think clearly about what it is they want to accomplish in courses. As part of his teaching load, he (jointly with Dr. Halgedahl) crafted popular, high-enrollment online courses, such as "Living with Earthquakes and Volcanoes", which are very well regarded by students. Finally, he has been instrumental in keeping much research equipment functioning at a high level. Dr. Jarrard's research activities included working on fluid flux within subduction zones.

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**Sue Halgedahl** retired from the teaching faculty after twenty years of service (July 2011) and is now a Research Associate Professor. She has continued research into the magnetic properties of magnetized particles that contribute to the paleomagnetic record. In addition, she has also team-taught the online course GEO 3030 "Living with Earthquakes and Volcanoes" with Professor Richard Jarrard. This course has been gratifyingly successful, attracting well over 120 undergraduates for several semesters. The course fulfills the international requirement to graduate from our university. She and Dr. Jarrard have published electronic books for their online courses "Earthquakes and Volcanoes" and "Living With Earthquakes and Volcanoes."



For more than 18 years, she and Professor Jarrard have been avid collectors of fossils from the Middle Cambrian rock

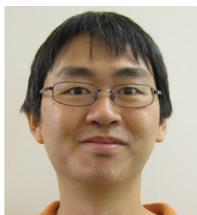
sections of west-central Utah. They have discovered a number of new species, including several soft-bodied fossil arthropods. One of these was a new trilobite named after her, which was found in the Marjum Formation: *Burlingia halgedahlae*. This fossil is described in a technical paper by R. A. Robison and L. E. Babcock, *Paleontological Contributions*, University of Kansas, Nov. 30 2011, No. 5.

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**Peter Roth**, micropaleontologist and oceanographer, retired at the end of the 2012-2013 school year after 38 years on our Department's faculty. Since joining our faculty in 1975, he taught a wide variety of courses in paleontology, marine geology and general earth science, and he supervised several graduate students. His long record of research focused on biostratigraphy and paleoceanography of calcareous plankton in many parts of the world, including Siberia, Egypt and of course the Swiss Alps (his native country). Over the years, he taught many Utah students about the science of the oceans that cover three-fourths of our planet's surface, and he introduced many students to the amazing microscopic world of tiny life forms that are preserved abundantly throughout the fossil record.

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**Fan-Chi Lin** has recently been hired as an Assistant Professor to fill the exploration geophysics opening vacated by Gerard Schuster. He will begin October 2013. Dr. Lin received a Ph.D. from the University of Colorado Boulder (2009), an M.S. from Drexel University (2005) and a B.S. from the National Tsing Hua University, Taiwan (2000). Dr. Lin was recently a Post Doctoral Scholar at the Seismological Laboratory, California Institute of Technology. Dr. Lin is a geophysicist with an outstanding record of research. In 2009 he received the Outstanding Student Paper Award from the American Geophysical Union (Fall Meeting). Dr. Lin currently has 21 peer-reviewed publications in top journals such as *GJI*, *JGR*, *GRL*, *Nature Geoscience*, *Nature*, and *Geophysics*. His papers have been cited an incredible number of times. Much of Fan-Chi Lin's work is published in *GJI* – which is the top journal for theoretical seismology.



Fan-Chi Lin

Fan-Chi Lin's research is in seismic interferometry. This is one of the hottest topics in exploration seismology in the past decade. In the petroleum industry, imaging has typically been confined to using body waves with the surface wave ignored. Fan-Chi has started with the surface waves and has shown their applicability to petroleum exploration-scale problems at Long Beach, California. Our geophysics faculty members feel that his research has greater potential for being revolutionary in earthquake seismology than any technique yet developed.

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**Peter Lippert** has been hired as an Assistant Professor to fill the open position in structural geology and active tectonics vacated by the recently retired Ron Bruhn. Dr. Lippert received his Ph.D. in Earth and Planetary Science from the University of California, Santa Cruz (2010) and holds a B.S. in Geological Sciences (2003) from the University of Rochester. In 2010 he was appointed as a post-doctoral fellow at the University of

Santa Cruz and from 2011 to the present he has been a post-doctoral fellow at the University of Arizona.

Dr. Lippert has a remarkable record of research in paleomagnetism and rock magnetism and their applications in tectonics, paleoclimate, and surface processes. His research has focused on the dynamics of convergent orogenic systems and timing of continental deformation. Dr. Lippert has published on a broad range of topics including the formation of orogenic plateaus and environmental change, and on understanding the timescales and forcing mechanisms of environmental and ecological responses to rapid climate change recorded in marine and terrestrial systems. Although Dr. Lippert received his Ph.D. just two years ago, he has authored or co-authored 12 papers in peer reviewed journals. Dr. Lippert has considerable teaching experience and has won numerous awards for being an outstanding teaching assistant. He has either been a teaching assistant or a lecturer in seven different courses including *Geology of the National Parks*, *Introduction to Physical Geology*, *Structural Geology*, and *Field Geology*. This teaching experience is a very good fit for the teaching needs of our Department. He will begin July 1, 2014.



Peter Lippert

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*The following faculty have received awards this year:*

**Marjorie Chan** was selected as the 2013-2014 *Geological Society of America (GSA) Distinguished International Lecturer*. One lecturer is chosen each year to represent GSA globally and present cutting edge science lectures. Prof. Chan will be the second lecturer of this new program. She is excited about this opportunity to represent GSA and the University of Utah, and hopes to visit many countries over the upcoming academic year.

**Thure Cerling** was one of 10 winners of the 2012 *Utah Governor's Medal for Science and Technology* (a total of four winners from the U of U).

Professor Cerling is a geochemist and a distinguished professor of geology and biology. He uses isotopes to study the ancient environments and diets of human ancestors; how global changes in climate and plant ecosystems influenced human and animal evolution; the dating of landscapes from tropical to arctic zones; animal physiology for wildlife conservation purposes; and for forensic purposes such as helping identify murder victims. His fieldwork has taken him to all seven continents. He has served on federal and state boards that review nuclear waste disposal plans.



Thure Cerling

**Michael Zhdanov** received an honorary membership in the Society of Exploration Geophysicists recognizing his outstanding intellectual contributions to his profession which has included 300 plus refereed publications, 16 books, 12 patents, 3 languages, and 60 plus students mentored. He is the director of the Consortium for Electromagnetic Modeling and Inversion (CEMI).



Michael Zhdanov

## Student News

**Jamie Farrell**, a PhD student, won a prestigious Seismological Society of America Student Presentation Award for his presentation at the national SSA meeting in Salt Lake City in 2013. His presentation was on seismic Vp tomographic imaging of the Yellowstone magma reservoir that showed it to be 50% larger than previously believed. This result has implications for the active volcanic capability and volcano hazard of Yellowstone National Park. Jamie's research findings have been highlighted on Live Science, Discover News, MSNBC and Fox News across the web, newspapers, and TV news programs.



Jamie Farrell

**AAPG Student Chapter** – Our University of Utah AAPG Student Chapter (American Association of Petroleum Geologists) has become one of the nation's most active. Their success can be directly attributed to the time and effort put forth by student officers, faculty and student members. By consistently providing chapter members with the option to participate in fun and fulfilling activities, they have helped increase chapter enrollment to an all-time high of around 40 graduate and undergraduate students. This has allowed their group to organize events that include a spectrum of interests in geology, industry, fun activities and goodwill including volunteer work in the local community and geology department, sending students to AAPG meetings, educating students in the form of short courses and field trips and holding events like the annual ski weekend. Their events have helped to further educate students, faculty and staff about the petroleum industry and AAPG.



Ryan Purcell, Bianca Maibauer, Alex Turner, Tyler Szwarc, and Brenton Chetnik in Death Valley, California (AAPG trip)

**Student Advisory Committee** - SAC was a big asset to the Department again this year for a variety of reasons. This committee provided student input to searches for new faculty members in structural tectonics and exploration seismology. They were also responsible for the refreshments for the weekly Distinguished Lecture Series Meet and Greet events. Their committee collected student votes for Outstanding T.A. and Outstanding Faculty Award. (See the Awards section.) And finally, they held social events like a pumpkin carving contest in October and the Department Christmas party (both co-hosted



SAC held a Pumpkin Carving event in October (2012).

with the AAPG Student Chapter). A new role they will take on in the future is as an umbrella organization to handle Department fund requests as a sort of clearinghouse for those wishing to use the limited funds the department has for student use. The SAC Committee for 2012 - 2013 was as follows: Carrie Welker and Julia Mulhern (graduate) and Cory Dinter, Heather Judd, and Mallory Millington (undergraduate).

*Notes on their awards picks are as follows:*

**Outstanding T.A.** – Kelly Good and Neil Swanson both received this award. Students appreciated the time and effort these TAs spent in teaching, answering questions and taking time out of their own schedules to ensure students understood the class material.

**Outstanding Faculty** – John Bartley won this award. His “superior intellect and dedication to research and education is recognized by both students and faculty” stated the SAC report. When asked about Dr. Bartley's structural geology course, an undergraduate student commented, “after taking structural from Dr. Bartley, I felt like I could be an actual geologist.” Congratulations Dr. Bartley! You have mentored, inspired and shared your expertise with a grateful Geology and Geophysics Department.

**SAC Volunteer Award** – this was granted to not one, but two SAC members who consistently offered their time and resources for SAC-related activities – Robyn Lyons and Brittney Thaxton. They volunteered multiple times for providing DLS food, and never failed to help out when an extra hand was needed. Their service to the G&G student body was truly appreciated by the SAC officers.

**DLS Food Competition winners** – The award for “Best DLS Food” was awarded to Cory Dinter, Amy Steimke, and John Carricaburu. After much deliberation based on student ratings and comments, this group of gallant volunteers was chosen to receive this award which recognizes the tastiest and most well-displayed food served before each weekly Distinguished Lecture Series. Awardees were given vouchers for free coffee from the Two Creeks Coffee House.

**SEG Student Chapter** (Society of Economic Geologists) under the leadership of Patrick Loury (President) and Andrew McCauley (Vice-president) was extraordinarily active in the past year with members visiting three continents. They participated in field trips to local destinations such as Yellowstone (WY) and Great Basin National Park (UT), the Stillwater Pt-Pd (MT), Gold Hill and Turquoise Ridge gold mines (NV) and international destinations and field courses (sponsored by the



SEG field trip to Antofagasta, Chile sea stack. Left to right: Katie Bradbury, Patrick Loury, Theresa Zajac, Nick Kerr, Daniella Anquita, and Erich Petersen (faculty advisor)

SEG Foundation) such as six porphyry copper and gold mines (Chile), six massive sulfide deposits (Spain/Portugal) and five porphyry copper mines (Peru). The field trips provided students with the opportunity to network with peers in other countries, appreciate the international nature of the minerals resources business, interact with industry mentors and experience various cultures and cuisine. Eight students participated in the AME BC Roundup Conference (Vancouver, BC), a conference dedicated to new mineral discoveries and mining practices. Conference guest speakers included John Muir (Barrick), Patrick McCandless (Imperial Metals), and Jay Gatten, Stephen Mckay, Katie Bradbury (North American Exploration).

Student chapter members Thomas Etzel, Patrick Loury and Theresa Zajac received SEG Fellowships in a worldwide competition. Seven mining and exploration companies visited the Department to recruit students for both summer internships and permanent jobs.

### Students Study the Geology of the Alps

This summer students of the Geology and Geophysics Department had the opportunity to study the geology of the Bavarian and Swiss Alps. Anke Friedrich (M.S. 1993), Professor and director of the masters program at Ludwig-Maximilians University (LMU) in Munich organized the trip. Thanks to the generous support of funds from the Cooper-Hansen Trust, nine undergraduates and recent graduates were able to attend accompanied by faculty advisor Thure Cerling. The students were hosted by LMU students for one night and had the opportunity to tour the LMU Geology Department before embarking on the field trip.

The field trip was an intense study of the geomorphology of the continent/continent collision of the African and Eurasian tectonic plates. It began with a stop at the Ries Crater impact site near the town of Nordlinger. The students had the opportunity to observe the local suevite that was used in the construction of the town church. A stop at a local quarry allowed further study of the sedimentary layers of the molasse in this basin. The team followed a chronological tectonic progression through the Helvetic nappes, Penninic nappes, and discussed the paleogeography and the thrust faults of the region.

Activities included a hike from Switzerland to Austria on the old trade route to view the Peri-Adriatic line. Crystalline basement rocks were examined in the higher central region, including a day trip to the Matterhorn. After three days of rain, the party arrived at the Matterhorn observation center under magnificent blue skies.

Bern University Geology Department invited the group for a tour of their facilities and the city. The final days included mapping exercises using Brunton compasses, LIDAR maps and outcrops in the Jura Mountains that rim the northwest edge of the molasse basin. (Written by Paris Morgan)



Inside the Rhone Glacier ice cave. (Pictured left to right) Casey Root, Stephen Ruegg, Anke Friedrich, Brad Smithson, Paris Morgan, and Scott Frankenberger

## Moving Forward

### EarthCube Workshop hosted by Dr. Chan

New global information technology, tools, and access have dramatically changed our lives and how we communicate. It can similarly transform how we conduct our science. **EarthCube** ([earthcube.ning.com](http://earthcube.ning.com)) is a new National Science Foundation (NSF) initiative with the goal of building a comprehensive data and knowledge management system in the earth, atmospheric, and oceanic sciences within a decade. Through this initiative, information and data will be integrated into a single geovisualization and management portal, accessible through the internet to all scientists and the public. In March 2013, Prof. Chan and co-convenor Dr. David Budd (U Colorado Boulder) hosted an EarthCube Sedimentary Geology Community workshop that brought together 57 sedimentary geoscientists to the U's campus.

Geology students from the U put together a short 2-minute, informational video on the EarthCube initiative ([www.youtube.com/watch?v=mFBrULWYXL0](http://www.youtube.com/watch?v=mFBrULWYXL0) or search "YouTube EarthCube Introduction"). This student-produced video can be shown in classes to spark discussions on the potential transformations in future earth science collaborations, data collection, management, and research. EarthCube is the wave of the future! (See the group photo on the back cover.)

### Isotope Short Course Gathers Participants from Around the World

An intensive, 2-week short course called "Isotopes in Spatial Ecology and Biogeochemistry" was held in the Sutton

Building from June 17th – June 28th (pictured below). The graduate level course, hosted by Gabe Bowen (one of our new faculty members), was organized as a component of the NSF-supported “Inter-university Training for Continental-scale Ecology” project, which is a UU-led 5-year, \$4.3M effort to advance next-generation, global-scale ecology and Earth science research through student training and resource development.



*Participants in the Isotopes in Spatial Ecology and Biogeochemistry Short Course take a breather from their hectic schedule in front of the Sutton Building.*

The course enrolled 27 graduate students, postdocs, and professionals from across the USA, Canada, Africa, Asia and Australia. Lectures from 19 faculty, including 6 University of Utah professors, provided students with background in stable isotope geochemistry, GIS, data management, and modeling and introduced a wide range of cutting-edge applications of environmental chemistry to spatial problems in fields ranging from atmospheric science to forensics. Afternoon labs allowed students to develop and conduct week-long research projects that involved field work, data collection, database development, and spatial and statistical modeling.

Throughout the two weeks, the students, faculty and staff involved in the course enjoyed the ambience of the Sutton Building and many opportunities for informal interaction and networking through evening social events, Wasatch Mountains hiking, and visits to the Utah Arts Festival. It was an exhausting and exhilarating two weeks. Although everyone has now moved on to their next thing, many participants are keeping in touch and new friendships and collaborations have emerged!

### ***New Masters Degree Program Addresses New Teacher Education in Earth Science***

The Department of Geology & Geophysics, in collaboration with the Center for Science and Mathematics Education, launched a new degree program for middle and high school teachers of earth science in 2012. The new **Masters of Science for Secondary School Teachers (MSSST)** in earth science degree aims to elevate teachers' understanding of geology and earth science and their ability to prepare K-12

students for the challenges of an increasing population, dwindling energy and water resources, changing climate conditions, and the impacts of natural hazards.

The new degree addresses a critical need for highly trained and effective earth science teachers. While most secondary school (middle and high school) science teachers are required to have a BS degree in science, the vast majority obtain degrees in Biology and have little or no training in geology or earth science. The result of this is that earth science and Geology are often taught as a series of facts that have little relevance to societal issues or the scientific method. This misrepresentation of earth science has impacts that extend beyond the K-12 classroom. Students that have an aptitude for science are often steered away from earth science classes by counselors and teachers, and those that do take these courses come away with little knowledge of the applications of the discipline. The Utah System of Higher Education's prestigious “Regents' Scholarship” does not recognize earth science or geology as a “lab-based” science and teachers that teach earth science do not qualify for the science Teacher Salary Supplement Program (TSSP) run by the Utah Department of Human Resource Management. All of these factors lead to a poorly educated populous of teachers, K-12 students, future scientists, citizens, and even future legislators about the importance of understanding the Earth we live on.

The MSSST Earth Science program hopes to remedy this by providing teachers with training in both geological and pedagogical (teaching) skills that will enable them to teach their students about the relevance, applications (See **MSSST**, Page 13)



*MSSST Earth Science teachers interpret the geologic processes that led to the formation of the Tintic Quartzite in Little Cottonwood Canyon.*

### ***Petroleum Industry Career Path (PICP) Update***

Our oil company recruiters for 2013 were: Anadarko, Apache, BP, Chevron, ConocoPhillips, EOG Resources, Hess, and Schlumberger.

Class sizes continue to grow in the PICP courses (Petroleum Industry Career Path). There has long been a need for a high-end computing facility, and to meet that need, we recently (with

the help of Department funds) were able to begin making this goal a reality. There is still work to be done however.

We continue to receive many generous donations in student, program, and fellowship support from companies.

ConocoPhillips has provided \$15K per year towards petroleum-related course sponsorship, specifically to support the Reservoir Characterization and Modeling course taught by Lisa Stright and as well a modern gulf coast trip to Galveston associated with the Advanced Depositional Environments course this spring. Thanks to CoP for this curriculum support.

Hess continues this year to provide financial and instruction support for the Sevier Fold Thrust Belt Basin Analysis field trip that serves as the culmination of the first PICP course. Many thanks to John Byrd (Hess) and Lee Shannon (Anadarko) who donate their time to making this trip a valuable learning experience for the students.

*2013 - 2014 ConocoPhillips Fellowship recipients:*

Aubry DeReuil (M.S. Advisor: Lauren Birgenheier)

Jonathan Primm (M.S. Advisor: Cari Johnson)

*2013 - 2014 Chevron Fellowship recipient:*

Mike Jugle (M.S. Advisor: Lowell Miyagi)

Brennan Young (M.S. Advisor: Margie Chan)

Our graduates continue to be recruited by our oil company recruiters:

*Recent Placements* - Conoco Phillips (3 M.S.), Chevron (2 M.S.), Apache (1 B.S.), BP (1 PhD), and Western Geco (1 PhD)

*Upcoming Placements* – Apache (1 B.S. and 1 M.S.), ExxonMobil (1 M.S.), and Chevron (1 PhD)

*Internships 2013* – Chevron (6 M.S. and 1 PhD), ConocoPhillips (1 M.S.), Anadarko (1 M.S.), Apache (1 B.S.), Hess (1 M.S.), and CNOOC (1 PhD)



*John Byrd, Hess, leads introductory petroleum geology students in outcrop description of the Hams Fork Conglomerate as part of the field trip that makes a west to east transect through the Sevier Fold-Thrust Belt."*

## **WEST and TGLL -- 10 years of Science Inspiration for 10,000 K-12 Students**

For the past 10 years, the University of Utah's WEST (Water, the Environment, Science and Teaching) and TGLL (Think Globally, Learn Locally) programs have provided fellowships to graduate students from the Geology & Geophysics, Biology, and Atmospheric Science departments to take their science to K-12 classrooms. The programs are funded through the National Science Foundation's "GK-12" program that was designed to train graduate students in communication skills that are critical for working with employers, legislators, and the public. Graduate student "Fellows" spend 15 hours per week engaging K-12 students in hands-on activities and explaining their own research in ways that are relevant to the students.



*Kevin Uno, a Fellow from the Dept. of Geology, helps a student identify a brine shrimp during a field trip to Great Salt Lake. Kevin is now a Postdoctoral Research Scientist at Lamont-Doherty Earth Observatory, Columbia University.*

The Fellows help K-12 teachers become more confident in their ability to teach science, while the teachers help the Fellows become better science communicators. Fellows also serve as mentors to K-12 students and are often the only "real" scientists that these students ever come in contact with. Without exception, the presence of the Fellows in the classroom has energized and inspired students about science and encouraged them to consider going to college at the University of Utah and pursuing a career in STEM (Science, Technology, Engineering and Math).

The WEST program originally started in the Geology & Geophysics Department in 2004 under the direction of Dr. Dave Chapman. Since that time, 91 graduate students have been supported by WEST or TGLL fellowships that have enabled them to complete their research while acting as ambassadors of science to the K-12 community. These Fellows have connected with more than 10,000 K-12 students in the state of Utah and have provided in-person professional development for more than 80 teachers. The two programs have spawned an after-school science program for K-12 students (WEST After-school Program), an undergraduate fellowship program (EAST), a graduate training fellowship program (TGLLT), an outdoor science program for teachers (CWEST), and most recently, a program that brings middle school students to campus on "Science Fridays" to experience lab work in the new Thatcher Chemistry Building.

Graduate students that have participated in WEST and TGLL have a 98% retention rate, far higher than the national average for PhD students (ca. 50%, even less for women and minorities). Fellows receive training in scientific communication, best-practices in teaching, interdisciplinary research, community engagement, and many other “soft” skills that make participants of WEST and TGLL stand out from traditionally trained graduate students and attractive to potential employers. Almost all of the graduates from the two programs have gone on to post-doctoral, research, or tenure-track faculty positions although two have chosen to become K-12 teachers. With so much of our nation’s prosperity relying on STEM graduates (see the Report to the President: [http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final\\_2-25-12.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_2-25-12.pdf)), programs such as WEST and TGLL, that support not only students currently in the pipeline but *future* STEM students as well, play a critical role in our educational system’s ability to produce the next generation of scientists.



*Ellen Ramirez, a Fellow from the Dept. of Atmospheric Sciences, trains K-12 teachers on how to use a hand-held weather station. Ellen is now a Physical Scientist at NOAA in Washington, D.C.*

Unfortunately, the National Science Foundation has cut funding to all “GK-12” programs and we are now looking to other sources from within the University of Utah, research organizations, local businesses, and the broader community to continue this phenomenal opportunity for graduate students, K-12 teachers, K-12 students, and the University of Utah sciences. For information on contributing to these programs please contact Holly Godsey at [holly.godsey@utah.edu](mailto:holly.godsey@utah.edu) or visit <http://umarket.utah.edu/ugive/level3.php?catid=34>.

### **Workshop Explores Navajo and Western Perspectives on the Geology of the Colorado Plateau**

K-12 teachers from Navajo Nation and Salt Lake City secondary schools gathered for three days in Blanding, Utah to learn about the Earth through the lens of both “western” science and Navajo traditional knowledge. Although the two viewpoints may seem incompatible, there are similarities in overarching themes and concepts. Traditional Diné (Navajo) knowledge teaches that the natural processes on Earth are a result of dynamic interactions between the great systems of the Sky (Yádilhil)

and the Earth (Nohosdzáán). Traditional “western” science also views earth processes as the interactions of several systems including the atmosphere, geosphere, biosphere, and hydrosphere. Similarly, the cycling of matter and equilibrium are important concepts in both modes of knowledge. By explicitly identifying where these perspectives intersect, teachers become better equipped to help students from diverse backgrounds reconcile what they know from Navajo teachings with what they are learning in school.



*Teachers still managed a few smiles after paddling for 10 hours on the San Juan River!*

Teachers in the workshop visited field sites in Natural Bridges National Monument, Monument Valley, and Comb Ridge where they made observations about the land, learned about the geology, and shared traditional stories. The last day of the workshop was spent paddling 27 miles down the San Juan River to view the Raplee Anticline, Mule’s Ear Diatreme and Pennsylvanian-age bioherms from the unparalleled perspective of the river corridor. The river trip turned out to be the most unifying aspect of the trip as the diverse group of teachers worked together for nearly 10 hours to paddle through the brilliant strata!

The workshop was taught by Steve Semken, Ethnogeologist and Geoscience Education Researcher from Arizona State University, and Will Tsosie, Archeologist for the Navajo Nation. Holly Godsey from the University of Utah Department of Geology organized and contributed to the program. Ten teachers from the Navajo Nation and 14 teachers from Salt Lake City participated in the workshop. The workshop was funded through a Math and Science Partnership (MSP) grant from the National Science Foundation and administered through the Utah State Office of Education. A second workshop will be held in June 2014. For more information or to apply for next year’s workshop, please contact Holly Godsey ([holly.godsey@utah.edu](mailto:holly.godsey@utah.edu)).



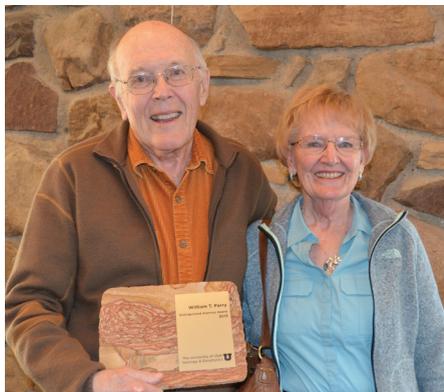
*Navajo Archeologist Will Tsosie, talks about the impact of uranium mining on the Navajo people. Many Navajo teachers has stories of their own to share about how their families were affected by industry politics or unmitigated mine tailings.*

## Annual Awards Salute Exceptional Achievement

The following awards were given out at the Spring Awards Banquet in April.

### *Distinguished Alumnus Recognized*

**William T. Parry** was awarded the 2013 Distinguished Alumnus Award. He was nominated by Paul Jewell. Bill has a passion for earth sciences and a talent for conveying that passion to his students and all who know him. Beyond the bounds of the University, Bill has contributed greatly to the public's general understanding of Utah geology and its associated surroundings.



*Distinguished Alumnus Receptient Bill Parry with his wife Gayle.*

As a scientist, teacher, mentor and colleague, Bill has made consistent and important contributions to the understanding of a variety of earth science disciplines. Although Bill's research interests have ranged from surficial to magmatic earth science during his career, his emphasis on field settings in Utah has been constant. His Ph.D. work at the University of Utah centered on the geochemistry of porphyry copper deposits, specifically the Bingham Canyon deposit. This work led to a career-spanning endeavor to understand the nature of what is arguably Utah's most economically important geologic asset. Since his retirement, Bill has written a series of popular books about the geology of Utah including "A Hiking Guide to the Geology of the Wasatch Mountains" (2005) and "Geology of Utah Rivers" (2008).

Bill is an avid skier and fly fisherman and, despite his retirement from the faculty of the University of Utah, has a passion for all things scientific and non-scientific that he undertakes.

### **Scholarships, Fellowships, and Awards Given**

We thank the College, the Department and our many friends who made substantial and important support possible for the following students who have been selected to receive scholarships and fellowships for the 2013 - 2014 academic year:

**James A. and Ann S. Anderson Geological Engineering Scholarship:** Casey Elliott

**Thomas Parry Billings Scholarship:** Yeou Hui Wong

**AWG Susan Ekdale Memorial Field Camp Scholarship Award:** Vanessa Chavez and Britni Lowe

**AWG Outstanding Female Geoscience Student Award:** Amy Steimke



*AWG (Association of Women Geoscientists) award winners: (left to right) Britni Lowe, Vanessa Chavez, Heather Judd, and Amy Steimke*

**AWG Salt Lake Chapter Research Scholarship:** Heather Judd

**Ken and Nedra Bullock-Keller Scholarship:** Lindsay Decker, Hannah Durkee, Bradley Kirk, Stephen Ruegg, Logan Raming and Joseph Elick

**Chevron Exploration Scholarship:** Roger A. Quinonez

**Chevron Graduate Fellowship:** Michael Jugle

**Orlo Childs Field Camp Scholarship:** Jacqueline Farnsworth, Amy Steimke and John Carricaburu

**James A. Comstock Scholarship:** Ahmad Afandi Suhaimi

**ConocoPhillips Graduate Fellowships:** Jonathan Primm and Aubry Anne DeReuil

**Ken Cook Geophysics Award:** Jillian Rose Turner

**Cooper-Hansen Foundation Undergraduate Scholarship:** John Alder, Andrew Bell, Jacob Benson, Allison Boyer, Trent Clifford, Joseph Elick, Ian Feltt, Gregory Gavin, Marcel Gaztambide, Christian Gray, Brett Gregory, Audrey Grey, Abdul Hasif Halid, William Hugie, Trevor Keate, Brennan Loeffler, Elle McFarlane, Paul Nederhand, Nora Nelson, Ali Shearman, Ethan Slocum, Michael Starkie, Jacob Trauscht, Rachel Wootton, Eli Workman, Ziqiang Yuan, Kirby Anderson and Abbey Smith

**Departmental Scholarship Fund:** Afiq Mohd Mokhtar, Bradley Munk, Jon Whitney Peterson, Ian Feltt, Molly Ellowitz, Britni Lowe, Robyn Elizabeth Lyons, Raina A. Mahanes, Taylor Wessman, Nora Nelson, Alexander J. Lowe, Zachary G. Stebly, Brittney Thaxton, William Hurlbut and Cory Dinter

**Earls Family Scholarship:** Ali Shearman and Nicole Reid

**Etta Keith Eskridge Scholarship:** Abbey Smith

**Francis H. Brown Rosenblatt Prize Scholarship:** Benjamin White and Afiq Mohd Mokhtar

**Frischknecht Scholarship:** Audra Thomson

**Global Change and Sustainability Center (GCSC) Graduate Fellowship Award:** Logan Frederick

**Geology and Geophysics Scholarship:** Abdul Hasif Halid, Christopher Smith, Scott Frankenberger, Kevin Neville, Joshua David Johnston, Levi Huish and Carley Mayes

**Geophysics Scholarship:** Yeou Hui Wong, Nurul Shazana Jamaal, Ahmad Afandi Suhaimi and Tunku Tunku Kamaruddin

**Dorothy Rice Goode Scholarship:** Judy Harmon, Jessica Page and Rials Christensen

**Gerald W. Hohman Memorial Fund:** Kevin McCormack

**H. Honda Sedimentary Scholarship:** Cory Dinter and Heather Judd

**Earl S. Johnson Scholarship:** Andrew Bell, Rebecca Johnson and Olivia Watkins

**G. Frank and Pamela M. Joklik Scholarship:** Austin Anderson

**Kennecott Meritorious Scholarship:** Brandon Neibel and Taylor Witcher

**Kennecott Scholarship:** Mallory Millington and Eric Thomas

**Kenneth Larsen Scholarship Fund:** Adriana Garcia, Sabita Silwal and Paul Nederhand

**Jennifer Madsen and Tony Nissen Scholarship:** Audra Jean Thomson

**Mineralogical Society Scholarship:** Evan Allred, Ernest Cottle, Nathan Anderson, Tanner Morrill, Ali Shearman, Savannah Cunningham and Gennelyn Eldredge

**Mountain Fuel Scholarship:** Nurul Shazana Jamaal

**Alex G. Oblad Energy Scholarship:** Taylor Witcher and Christina Woltz

**Ricardo Presnell Scholarship:** Christina Woltz, Dolan Lucero, Kayla Weiser, Audrey Grey, Paris Morgan, Afe Uoleva Langi and Adriana Garcia

**William Lee Stokes Memorial Fund:** Cornelia Rasmussen

**Think Globally, Learn Locally (TGLL) Graduate Fellowships:** Tyler Huth and Luna Gonzalez Carlos Joao

**Marta S. Weeks Legacy Scholarship:** Deborah Grant and Allyson Harward

## Honors Awarded

*Outstanding Undergraduate Students:*

*Geology:* Leah Moelling

*Geophysics:* Yeou Hi Wong

*Geological Engineering:* Hailee Cox

*Environmental Earth Science:* Jacqueline Farnsworth

*Earth Science Teaching:* Iain Harvey

*Outstanding Teaching Assistant (T.A.):* Kelly Good and Neil Swanson

*Outstanding M.S. Student:* Thomas Good

*Outstanding PhD Student:* Samuel Brown

*Outstanding Faculty Teaching Award:* John Bartley

*Outstanding Faculty Research Award:* Gabriel Bowen



*Jacqueline Farnsworth was named the Outstanding Undergraduate Student in Environmental Earth Science.*

*Excellence in Undergraduate Research Award:* Hannah Durkee, Ryan Hillier and Casey Root

*Ronald Terrill Award:* Kevin Neville

*SAC Service Award:* Carrie Welker (SAC chair – graduate), Julia Mulhern; Mallory Millington, Heather Judd, and Cory Dinter (joint SAC chairs – undergraduate).

*Best SAC Volunteer Award:* Robyn Lyons and Brittney Thaxton

*Other Awards Received:*

*UROP/University of Utah Parent Fund Scholar for 2013-2014:* Stephen Ruegg

*UROP/University of Utah Super Scholar for 2013-2014:* Mallory Millington

## Other Awards Received

**Naomi Levin** (PhD 2008) won the 2013 Young Scientists Award (Donath Medal). This GSA award is given to a young scientist (35 or younger) for outstanding achievement in contributing to geologic knowledge through original research that marks a major advance in the earth sciences.



*Naomi Levin*

**Scott Sampson** will receive the GSA Public Service Award. Scott is an Adjunct Associate Professor in the Department.

**Michael Perkins**, a former adjunct associate professor, is slated to receive the Kirk Bryan Award in Quaternary Geology at GSA.

## The David S. and Inga M. Chapman Scholarship Fund

The David S. and Inga M. Scholarship Fund was established in 2012 to provide funding to students for educational and research opportunities beyond those possible through normal resources. Educational opportunities for students supported by this fund may include research visits to collaborative labs, attendance at focused workshops and conferences, opportunities that broaden their international experiences, and opportunities to participate in major endeavors such as collaborative field studies and research cruises. Who is eligible? Deserving graduate and undergraduate students majoring in Geology and Geophysics. Recipients will be determined by the Department of Geology and Geophysics.

## Alumni News

Every year we are excited to hear about the many adventures our alumni have had this past year.

### 1950's graduates

**Howard F Bartlett** (B.S. 1955) is a consultant for DuPont Titanium Technologies, as a Research Geologist that includes field trips (U.S. and Foreign) for Source Rock Studies for TiO<sub>2</sub>. He says it is great to be working and thinking about rocks and involved in Geology at his age. Howard is enjoying his family, grandchildren, writing his life story, reading, and pondering world problems and what can be done to help solve them. He says, "Thanks to the University of Utah and University of Michigan for giving me a great education to ply my chosen field on five continents of the world."



Howard Bartlett

**Arthur Ehlmann** (PhD 1958) was hired by Texas Christian University in 1958 as an Assistant Professor of Geology. He retired in 1992. In retirement he is an Assistant to the Curator of the Oscar Monnig Meteorite Collection.

**Donald Runnells** (B.S. 1958) retired in 1993 as Chair of the Department of Geological Sciences, University of Colorado, Boulder, followed by environmental consulting for several years. He says he is now pretty well retired and "quite lazy" living in Fort Collins, CO. He still has great memories of the old Geology Department at the U of U.



Donald Runnells

### 1960's graduates

**John K. Costain** (PhD 1960) retired from Virginia Tech as Professor Emeritus of Geophysics in 1996. He was Assistant Professor of Geophysics at the U from 1960-1967 prior to moving to Virginia Tech in 1967. He has recently been enjoying investigations on hydroseismicity.

### 1970's graduates

**Edith Allison** (M.S. 1979) joined the American Association of Petroleum Geologists (AAPG) as their policy director in September 2012. She works with other science organizations to provide scientific information to Washington decision makers. She also keeps AAPG members informed about legislation and regulations that impact petroleum exploration and production. She continues to be located in the Washington DC area.

**Ron Blakey** (M.S. 1970) is in his fourth year of retirement from Northern Arizona University. This past year, he was a Distinguished Lecturer for AAPG and traveled for four weeks, mostly to the Midwest and West.

**Lewis Downey** (B.S. 1976) did fieldwork and data management in geothermal and mineral exploration until the early

1980's. He has been working in radio broadcast engineering since 1985 and is employed as the chief engineer at KUER at the University of Utah since 1995.

**Howard Fishman** (M.S. 1976) retired from Chevron in 2010 after 35 years of service (37 in the energy industry). He and his wife, Lynne, reside in Heber City, Utah. Howard spends winters skiing and the remainder of the year hiking. He is a substitute teacher at Wasatch High School, primarily in math and science, and a mountain host at Park City Mountain Resort.

**Kevin Kilty** (M.S. 1978, PhD 1982) is pictured with "a four year-old daughter, two year-old son, very old daddy, and even older remains of brontosaurus at Como Bluff, Wyoming this June." Kevin teaches in the engineering college at the University of Wyoming and serves as trustee of Laramie County Community College in Cheyenne.



Kevin Kilty and grandkids

**James D. Smith** (B.S. 1972) retired from the Utah Department of Natural Resources, Division of Oil, Gas, and Mining in July 2011.

**Roy Van Arsdale** (PhD 1979) has been at the University of Memphis Earth Sciences Department for 21 years, primarily conducting research in paleoseismology and active tectonics in the New Madrid seismic zone region. Roy says, "Exciting as that remains, I must say that my most exciting news is our new grandson, Jacob, who just turned one year old. My wife Stephanie and I met 35 years ago in Salt Lake City and our daughter Erica and son Christopher live in Memphis and so it appears that Memphis will remain our home."

**Ivan G. Wong** (M.S. 1976) received the Lifetime Service Award from the Utah Seismic Safety Commission "in recognition of outstanding contributions to the understanding and awareness of earthquake hazards in Utah." Ivan is the principal seismologist/vice president for the URS Corporation and has been there for the past 37 years.

### 1980's graduates

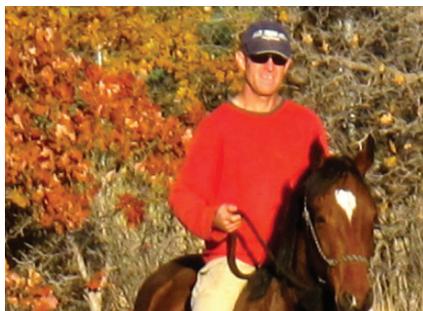
**Lon D. Abbott** (B.S. 1986) is currently a senior instructor in geological sciences at University of Colorado, associate chair for undergraduate studies in the department, and undergraduate advisor. He and his wife recently published their third book, "Geology Underfoot Along Colorado's Front Range" published by Mountain Press.

**Dawn Ackerman** (M.S. 1987) and **Dan Gallagher** (M.S. 1985) reside in California. Dan continues to work for the State of California (Department of Toxics) and Dawn is still a part-time instructor of Earth Science at Sierra College. Once both of their boys are in college, they look forward to spending time

collecting rocks, minerals and fossils for the Sierra College Natural History Museum.

**Bill DiGiuseppi** (M.S. 1988) is principal hydrogeologist for CH2M Hill in Englewood, Colorado. He enjoys the challenges of working on contaminant transport problems and recently was able to visit the Utah campus. (Yes, it has changed!)

**Perry Eaton** (PhD 1987, M.S. 1984) is the Chief Geoscientist and Group Executive for Global Exploration Solutions at Newmont Mining Corporation in Denver, CO. This year will be his 25th anniversary with this company.



*Perry Eaton*

**Pamela (Dehler) Egan** (B.A. 1985) graduated from Weber State University with a degree in Secondary Science Education in 1987. She moved to Las Cruces, New Mexico in 1987 to work at the NASA-Johnson Space Center – White Sands Facility to help develop an environmental restoration program. After an 8-year hiatus to raise her “3 amazing children,” she returned to work part-time. Pam says, “If any of my old college mates read this and want to come to Las Cruces for some fun-in-the sun and great green chili enchiladas, well, I’d be tickled to see ya!”

**Susan Fisher** (M.S. 1983) is now taking her grandson into the Great Basin looking for interesting rocks (at his request).

**Dale Julander** (M.S. 1982) just passed the 30-year mark with Chevron. He supervises the Petrophysics staff in the San Joaquin Valley Business Unit, Bakersfield. He has been married to **Kelsey (Smith) Julander** (MS 1984) for 27 years and counting.



*Dale and Kelsey Julander*

**Thom Little** (M.S. 1988) returned to Salt Lake City and took a new managerial position at TerraTek/Schlumberger (October 2012).

**Terry Massoth** (B.S. 1977, M.S. 1982) just completed a study of the salt and potash deposits of the Paradox Basin for the Utah Geological Survey, which has led to consulting work in potash exploration for an international company. He also does volunteer work for the Utah Geological Association as their secretary, golf chair, and signs chair.

**Steffen Ochs** (M.S. 1988) had the opportunity to participate in the EarthCube workshop in Salt Lake City in March. After many years, he says it was great to catch up with Margie Chan, Tony Ekdale, and Rip Langford again. And he finally got to see and appreciate the new Sutton building. He says, “It’s inspiring and makes you want to move back to Utah.”

## 1990's graduates

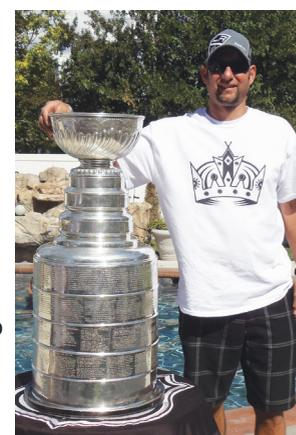
**Jonathan Caine** (PhD 1999) says life is great and it has been a challenging year! In 2012, he finished a steep and rocky single track run on his bike safely, only to hit a curb on a lighted street and tear every ligament in his knee. Thanks to the wonders of modern medicine, he is now back to normal and just finished a kayaking trip in the Aegean Sea in Greece. He has been with the USGS for 14 years in Denver.

**Jennifer Joyce** (M.S. 1996) works at the ExxonMobil Production Company in Sakhalin, Russia as a Geology Supervisor.

**Paula (Prudhomme) LaRose** (B.S. 1996) and her husband have a welding and roustabout business working in the oilfield in the Uintah Basin (pictured on the right).



**Steven A. Slack** (B.S. 1995) has been working at the State of Utah Department of Natural Resources Division of Water Rights since 2002. His work in the Western Regional Weber Office allows him to get involved in many different aspects of water rights. Steven is married to Dr. Caryn K. Slack and they are the parents of five children ranging in age from 17 to a set of 4-1/2 year old twins. He also tends goal for a local recreational hockey league.



*Steven Slack*

**Steve A. Young** (B.S. 1984, M.S. 1993) recently moved from Pipeline Systems Inc., to Director of Asia Pacific Sales for ValvTechnologies. He and his family have been living in Australia but enjoy getting back to Park City for family vacations.

## 2000's graduates

**Grant Hurst** (M.S. 2008) is currently working for Geosyntec Consultants in Sacramento, CA. His branch opened in August 2011, and he joined the group in May 2012. He is working on several long-term groundwater-monitoring programs and is helping building a team of GIS and database specialists.

**Naomi Levin** (PhD 2008) See Awards section on page 9.

**Dan Neuffer** (B.S. 2002) is now in the graduate program at the University of Washington in Seattle.

**James H. Pearce** (B.S. 2004) left ExxonMobil in December and started working at Savage Services in Salt Lake City. His business unit has expertise in coal handling at coal-fired power plants – especially with the safety issues surrounding Powder River Basin coal.

**David Sheley** (M.S. 2001, B.S. 1999) is currently working for ConocoPhillips in Perth, Australia, but is likely moving back to the USA soon.

**Vaughn Thompson** (M.S. 2009) is Vice President and President of San Joaquin Geological Society (2012-2013). He is also currently senior geologist for Occidental at the Oak Hills oilfield in Bakersfield, California.

**Jacob Umbriaco** (M.S. 2004) and his wife had a son named Judah in January. He is starting a new exploration team focused on unconventional resources at Chevron beginning June 1, 2013. His official title is Permian Basin Exploration Team Lead. He is looking forward to visiting campus again this Fall for recruiting.



*Jacob Umbriaco with wife and son*

### 2010's graduates

**Will Gallin** (M.S. 2010) and Pam Moeller are new parents of a daughter, Laura Jean. Pam continues to work remotely for CH2M Hill, producing GIS maps for many Salt Lake area projects. Will continues to work as an exploration geologist for Hess Corp., currently in deep water in the Gulf of Mexico. They reside in Houston.

## Departmental Activities (continued from Page 1)

### POACHERS (continued from Page 1)

The method uses the “bomb curve,” a graph shaped like an inverted “V” that tracks elevated atmospheric carbon-14 caused by U.S. and Soviet atmospheric nuclear weapons tests from 1952 through 1962. This carbon has been absorbed by plants and animals in the food chain and remains measurable in plant and animal tissues. The method resembles telling a tree’s age by counting rings but, instead of annual rings, variations in carbon-14 level are measured along the lengths of tusks and teeth. Accelerator mass spectrometry allows very small samples to be analyzed.

The researchers now can use carbon-14 levels in ivory to determine its age within about a year.

Dr. Uno’s Ph.D. advisor, Dr. Thure Cerling, adds that “you can use the signature in animal tissues left over from nuclear weapons testing in the atmosphere to study modern ecology and to help us learn about fossil animals and how they lived.” While the method’s use against poaching is important, “the scientific part is the importance of understanding time in the formation of animal tissues and how diet and physiology are recorded in those tissues as they grow,” Cerling says. Therefore, another 41 samples were analyzed to determine the growth rates for tusks and teeth from elephants and hippos, and elephant tail hair. Extrapolating the growth rates to fossil or modern elephants and other animals “will help us improve the chronology of the diet history of an individual fossil or modern animal,” Cerling says.

### ZANNO (continued from Page 2)

Zanno, now a lab director at the Nature Research Center in Raleigh, North Carolina, is going back to the future in her field studies, trying to understand how dinosaurs responded to environmental changes similar to those happening today as the earth’s climate becomes warmer and dryer. Some people may debate the reasons for climate change but the way Zanno sees it, whether mankind is causing climate change is irrelevant. Whatever the causes, its potential consequences are ominous.

“There have been other periods of rapid climate change in the earth’s history— each associated with a mass extinction event,” she says. “Humans are adapted to a certain temperature range and sea level, and the temperature is getting hotter while the seas are rising. We have to deal with it. It doesn’t matter if this is natural or not. And paleontologists are the only ones looking back through the longest-running natural experiment, life on earth, with a historical perspective on how life changes in response to climate change.”

To that end, you’ll find Zanno spending summers at various dig sites for the foreseeable future, and the rest of the year trying to put it all together. The future is unknown, but the best way to predict it might be to look at the distant past. (*Source: Continuum Magazine, Winter 2012*)

### PLUME (continued from Page 2)

Since the early 1990s, scientists have known of two continent-sized “thermochemical piles” sitting atop Earth’s core and beneath most of Earth’s volcanic hotspots – one under much of the South Pacific and extending up to 20 degrees north latitude, and the other under volcanically active Africa. At the edges of the thermochemical piles, smaller (about 100 by 100 km) blobs of rock were imaged in which seismic shear waves move as much as 45 percent slower than in the surroundings. The smaller blobs, known as ultra low velocity zones (ULVZ’s), may be partly molten. Using the highest-resolution method yet developed to image structures along the core-mantle boundary, Dr. Thorne performed 200 days of supercomputer simulations at the University of Utah’s Center for High Performance Computing to simulate hundreds of possible shapes of the pile under the Pacific Ocean.

The shapes that best explain the observed seismic wave patterns suggest that the pile is the product of an ongoing collision of two or more thermochemical piles. The seismic image contains a central depression or “hole” that is interpreted to indicate that the piles have not yet fully merged. The hole contains the largest ULVZ ever observed, a blob of partly molten rock the size of Florida beneath the volcanically active Samoan hotspot. At about 800 km long by 250 km wide, it is “eight to 10 times larger than any ULVZ we observed before,” Thorne says. The large ULVZ thus is interpreted to form as smaller ULVZs merge in the hole. Dr. Thorne says that where the ULVZ blobs form seems to be related to where the hot rock starts convecting upward to begin the long, slow process of forming a plume that eventually causes massive eruptions.

“We are actually seeing that these piles are being shoved around,” Thorne says. “If hotspots actually are generated near the core-mantle boundary, where they are being generated seems related to where these piles and ULVZs are. So if we are pushing these piles around, we also are pushing around where hotspot volcanism may occur.”

**MSSST (continued from Page 7)**

and methods of geoscience. Teachers in the program take foundational courses in Physical Geology, Geophysics, Chemistry, and Field Methods, but the courses are specifically designed to incorporate teaching practice and classroom application. The courses also emphasize the ways that geoscience methods differ from the experimental procedures that are commonly taught in schools as the scientific method. Hypothesis testing in the geosciences relies on compiling multiple lines of evidence through observations and modeling. Geoscience thinking involves working with deep time, understanding the Earth as a complex system, spatial reasoning, and direct observations of the Earth in the field (see <http://serc.carleton.edu/integrate>). The capstone experience of the MSSST Earth Science program is a 6-week internship where teachers work with a Geology & Geophysics faculty member on geoscience research; an experience that past MSSST teachers have remarked was what helped them develop a true sense of the nature of science and was the best part of their master's training.

Currently, there are 17 teachers enrolled in the MSSST Earth Science program and these students will graduate from the Geology & Geophysics Department with a very different educational experience than that of our traditional master's students. However, the skills they develop will be well suited to their needs and professional goals as teachers. For teachers with the recommended prerequisites, the program will provide the necessary courses for endorsements in Earth Science and Physical Science, which certifies them to teach 7th and 8th grade Integrated Science, Earth Science, Physics and Chemistry. By engaging in the training of master Earth Science teachers, the Department of Geology & Geophysics will not only serve the K-12 educational system but will also impact the number of students seeking higher education and careers in the geosciences. Ultimately, we hope that the program will lead to a more well-informed society about the nature of geoscience and importance of understanding how our Earth works. (For more information, contact Holly Godsey at [holly.godsey@utah.edu](mailto:holly.godsey@utah.edu).)



*Kyle Brennan encounters a goat in the backyard of a coffee shop while they were looking for fossils in the Jura Mountains (Switzerland). Best look up Kyle! (See full story on page 6.)*



*Petrified metasequoia or juniper log from Oligocene near Heber, Utah, discovered by Dave Horrocks, and donated to our Department by Pat & Judy Beatie, with encouragement from veteran collector Ruth Jenkins (Pat's sister).*

**Dean Brown Builds Science Lab in Kenya**



Frank Brown and Fredrick Kyalo Manthi (Assistant Research Prof.) standing in front of the Francis Brown Science Laboratory which is being built at Thomeandu High School, Kikoko, Kenya. Funds for the laboratory are being contributed from family, friends, and former employees of Dr. Brown who has employed over 40 people from this village since 1966. This laboratory will be used in teaching chemistry, physics, and biology. Dr. Manthi is an alumnus of the school who has led the effort to improve teaching facilities at his alma mater. Additional funds are still needed.

Dear Alumni: Your fellow alumni and colleagues in the Department of Geology and Geophysics would like to hear about your professional accomplishments, job promotions or changes, address changes, or any other news you would like to hear. You can also update your information on our website at: [www.earth.utah.edu](http://www.earth.utah.edu) > Alumni > Update Information.

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*Red Beryl from the Wah Wah Mountains, Utah. Image courtesy of J. Marty.*

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