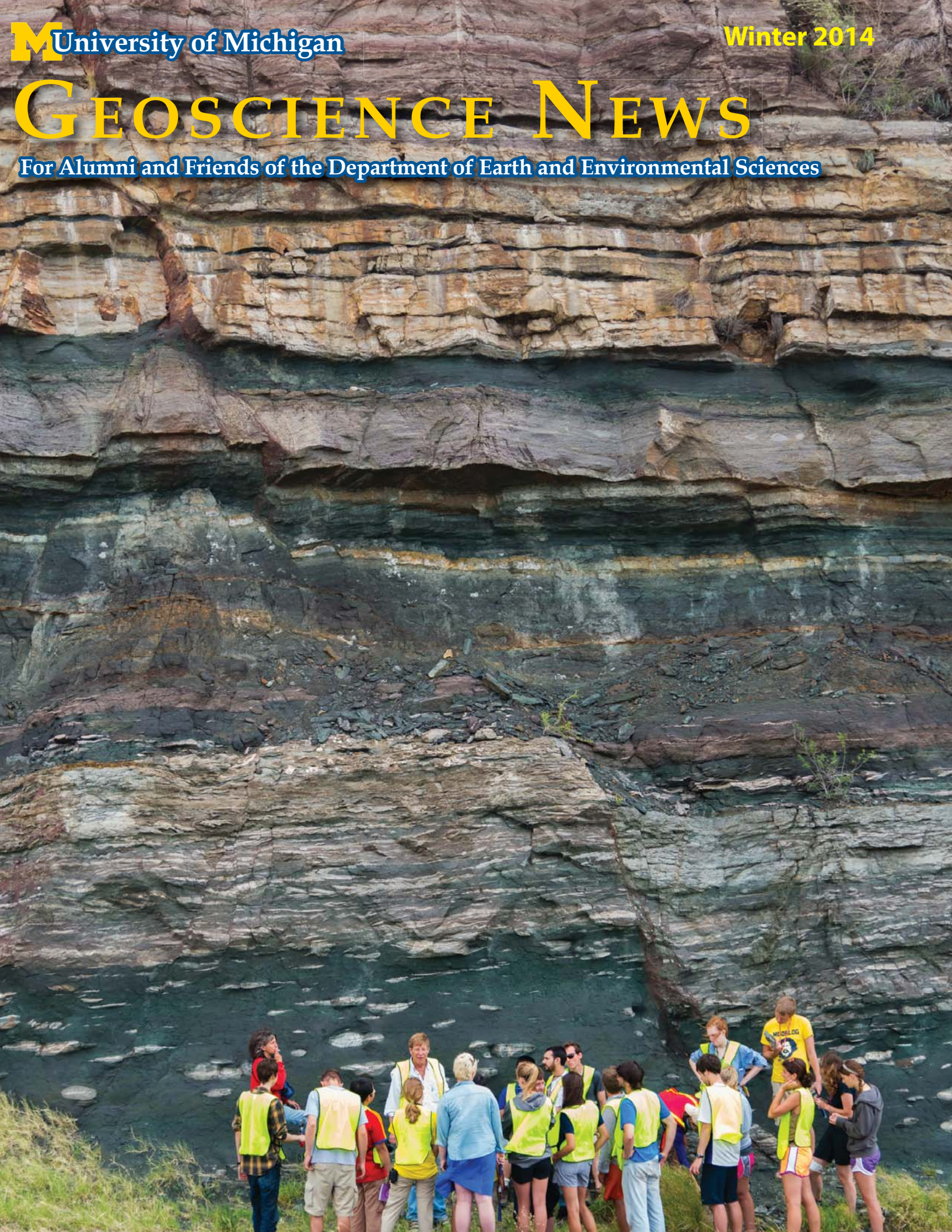


# GEOSCIENCE NEWS

For Alumni and Friends of the Department of Earth and Environmental Sciences







Dear Alumni and Friends,

It is with pleasure that I once again send warm greetings in my fourth and final year as department chair. I'm happy to announce that our next chair will be Chris Poulsen, who has established a high-profile research reputation in the area of climate modeling and is one of our most accomplished teachers. This year, he was awarded the College of Literature, Science and Arts *2013 John Dewey Award* for his long-term commitment to the education of undergraduate students. We are all excited at the prospect of Chris' leadership in the coming years.

I'm delighted to report that the department had a successful 2012-2013 year by nearly every measure. Highlights include: (1) surging growth in our undergraduate program (currently 130 declared majors); (2) a new high of \$6 million in our external research funding levels (doubling over a three-year period); (3) continued faculty recognition: Sarah Aciego received a prestigious *Packard Fellowship*, Greg Dick received a *Sloan Fellowship*, and Joel Blum was awarded the *2013 Patterson Medal*

from the Geochemical Society, and (4) a successful faculty search in the area of aqueous geochemistry.

I am pleased to announce that we successfully recruited Assistant Professor Rose Cory (see profile on page 9), who received her Ph.D. in 2006 from the Institute of Arctic and Alpine Research at the University of Colorado, Boulder. After a postdoctoral fellowship at Los Alamos National Laboratory, Rose became a faculty member at the University of North Carolina, Chapel Hill 2009-2013, where she developed an active research program examining the detailed molecular-scale pathways that dissolved organic matter is broken down in rivers and lakes in the Arctic. She is working to unravel how quickly organic carbon is transformed into greenhouse gases and thus the timescales by which the thawing of permafrost impacts global warming. Rose's research has synergies with that of several other faculty in our department, and we are very excited that she has joined us.

On the downside, I'm sorry to report that we are losing Assistant Professor Dave Lund to the University of Connecticut and Professor Rod Ewing to Stanford University. Rod has a joint appointment at Stanford, beginning January 1, 2014, in the School of Earth Sciences and the Center for International Security and Cooperation. Thus Rod will continue his thriving research program on materials at extreme conditions as well as his national service as chair of President Obama's Nuclear Waste Technical Review Board. Rod spent an extraordinarily productive 16 years in our department, becoming a University Professor in 2009 in recognition of his outstanding research and teaching. Fortunately, Rod is not so much leaving us as retiring from the University of Michigan, and he plans continue his close connection to our department as an Emeritus Professor.

This fall, the University of Michigan launched a new capital campaign in celebration of its 200th anniversary in 2017. In the department, our fund-raising priorities are focused on programs that provide our students with a rich educational experience and employable skill sets. As a consequence, Camp Davis has emerged as our flagship priority. Camp Davis provides students with an immersive, and often transformative, educational experience. Our course offerings currently include: (1) the capstone, EARTH 440, a field mapping course for students pursuing a "traditional" geology curriculum, (2) an equivalent course, EARTH 450, for undergraduates pursuing a curriculum focused on the environment, (3) two sessions of EARTH 116, introductory geology, (4) an equivalent introductory course, EARTH 202, that focuses on environmental geology, and (5) a course on energy, EARTH 344, "Sustainable and Fossil Energy: Options and Consequences". With our rapidly growing number of declared majors, we will soon face the need to offer additional sections of the required upper-level field courses at Camp Davis, which means expanding the season over which courses are taught. This, in turn, requires upgrading the student cabins to accommodate this growth in enrollment. This year, we appointed a new Camp Davis Director, Associate Professor Nathan Niemi, who is taking over after several years of superb leadership from Professor Joel Blum. Nathan is deeply committed to Camp Davis and eager to work strenuously to ensure that the successful renovation of the student cabins occurs under his watch.

Our next two fund-raising priorities are focused on our commitment to continue to offer extended field trips and research opportunities for our undergraduates. First, we would like to double the number of field trips being offered, so that both an international and domestic field trip are run every year. There is a limit on how many students can be included



on such extended field trips and, therefore, to ensure that as many students as possible have the opportunity, we need to expand our field trip offerings. Second, we would like to initiate a new undergraduate research fund, which will allow faculty to mentor and engage many more undergraduates in their research. Currently, most of our faculty mentor several undergraduates in their research activities, and our goal is to ensure that this opportunity is available to all interested students.

Given our focus on undergraduates, I am pleased to announce that one of our undergraduates from the mid 1960's, Robert (Bob) Garwood, MD, and his wife, Christy, have bequeathed \$1 million to the department. Bob had a rich undergraduate experience in our department, with various opportunities to engage in research and field expeditions with different faculty. He was admitted to Harvard to pursue a graduate degree in mineralogy, but decided to switch careers to psychiatry. He returned to Ann Arbor and graduated from the University of Michigan School of Medicine. Bob has specialized in child and adolescent treatment and has served as medical director for numerous agencies and organizations. He has had a flourishing psychiatry practice here in Ann Arbor for nearly 30 years. We are profoundly grateful that he and his wife, Christy, have chosen to reconnect with our department!

Finally, I am delighted to announce a new annual departmental tradition, associated with the Alumni Advisory Board meeting each year, which is the Distinguished Alumni Seminar. We are keenly interested to have our alumni share with us the joys and challenges, along with the twists and turns, of their illustrious careers. This year, we were honored to have **John Amoruso (MS '57)** give the inaugural Distinguished Alumni Seminar on October 18, 2013. The first ten minutes were spellbinding as he spoke compellingly about how lucky he has been, and indeed all of us are, in absolutely loving what we do for a living! He then went on to explain how he arrived at his important discovery, the Amoruso gas field - a classic example of the power of "outside the box" thinking. We are very grateful to John and Camille (who obtained her degree in Pharmacy at the University of Michigan) for taking the time to visit us and to share their story.

In closing, let me ask all of you to keep in touch, as we love to hear from you and learn how your lives and careers are unfolding. We are deeply grateful for your continued generosity. Your gifts to the department make all the difference! That you share our commitment to our students and their future success is greatly appreciated. I wish you and your family a wonderful holiday season!

Warmest best wishes,  
Becky

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*COVER PAGE PHOTO*  
**Students exploring the Cambrian, Lion Mt. Ss. at Marble Falls in the Llano Uplift of Texas as part of the Spring Softrock Field Trip (see pages 16 - 17)**  
**Photo: Peter Knoop**

You might have heard that the kickoff of the **VICTORS FOR MICHIGAN** capital campaign began in November 2013, with goals of strengthening the Department's endowments to provide our graduates and undergraduates with the best educational experience in the country. Our priorities include: Graduate and Undergraduate Scholarship Support (page 14); funds for Field Excursions (page 15); and funds for the Phase II Renovation of Camp Davis facilities (page 19).

**Help Keep MICHIGAN STRONG**  
**Please consider giving to VICTORS FOR MICHIGAN**

*Geoscience News is compiled periodically for alumni and friends of the Department of Earth and Environmental Sciences at the University of Michigan, Ann Arbor, MI 48109-1005*

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# Honors and Awards

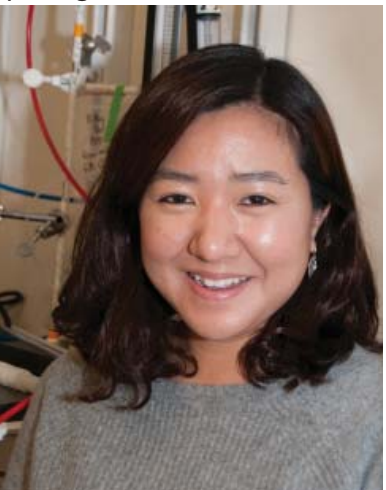
## Departmental Graduate Awards 2013



### **Rackham Dissertation Award and John Dorr Graduate Academic Achievement Award**

**Laura Sherman (PhD'13)** received a Rackham Dissertation Award for her dissertation on *Mercury Cycling using Stable Isotopes* which was advised by Prof. Joel Blum. The Rackham Dissertation Award is granted to a select few amongst the graduate students across the University each year. In addition, Laura received the Department's John Dorr Award which honors the outstanding academic

achievements of our graduate students each year and is considered our most prestigious award.



### **Outstanding Graduate Student Instructor Award**

**Sae Yun Kwon (PhD Candidate)** was recognized by the Department for her contributions to undergraduate education as a graduate student instructor. Sae has been a key part of our introductory oceanography course and our introductory environmental sciences courses. In addition, because of her effectiveness as an educator, she has served as one of the student mentors who guide their peers in techniques and approaches to teaching.



### **Outstanding Graduate Student Instructor Award**

**Ethan Hyland (PhD Candidate)** has been a mainstay of our undergraduate course offerings. In addition to his graduate instructor role in 4 major courses on campus, he has taught all three of our major courses at Camp Davis. These include: EARTH 116, the introductory level course; EARTH 341 Ecosystem Science; and EARTH 440, the capstone geology field methods class. His knowledge and dedication earned him the position for several years as one of our mentors for the other graduate student instructors.

## GeoClub Awards

GeoClub continues its tradition of honoring students and faculty through teaching awards, and to undergraduates to help defray the costs of textbooks and field equipment. Two recipients this year received awards from GeoClub.



**Petr Yakovlev (PhD Candidate)** was selected by GeoClub for the **Best GSI Award** for his outstanding instruction in EARTH 314 *Geophysics* and EARTH 440 *Field Geology of Rockies*.



**Becky Lange (Professor)** was selected as the recipient of the *GeoClub Outstanding Professor* for her excellent instruction in EARTH 310 *Geochemistry of the Solid Earth* (Petrology for those of us that have been around for awhile). Great Job!!



## Departmental Undergraduate Awards 2013

The Department recognizes its undergraduates with four awards each year. The *Academic Excellence Award* recognizes a senior for academic achievement. The *Camp Davis Field Geologist Award* is given to the student with the strongest performance in the EARTH 440 Geology Field Course. The *Singer Award for Academic Excellence in Geology* is awarded annually to a student of junior standing who has demonstrated the highest level of academic achievement in their class. The *Alumni Undergraduate Award* is given to a student who has made outstanding contributions to the Department through spirit and service.



**Nathan Kerns (BS '13)**  
**Academic Excellence Award**



**Sul Gi Ye Park (BS '12)**  
**Academic Excellence Award**



**Megan Mueller (BS '13)**  
**Camp Davis Field Geologist Award**



**Tess Nugent (BS '13)**  
**Alumni Undergraduate Award**



**Peter Chutcharavan (BS '14)**  
**Eugene and Elizabeth Singer Award for Academic Excellence in Geology**

### PACKARD FELLOWSHIP SARAH ACIEGO

**Sarah Aciego (Asst. Prof.)** received the prestigious Packard Fellowship in Science and Engineering for her pioneering research on cryospheric processes. Her research employs a range of field study, laboratory experiment work, and isotopic measurements to reconstruct the timescales of ice sheet evolution and the climate change dynamics. Sarah represents one of only sixteen recipients nationally.

### SLOAN RESEARCH FELLOWSHIP GREG DICK

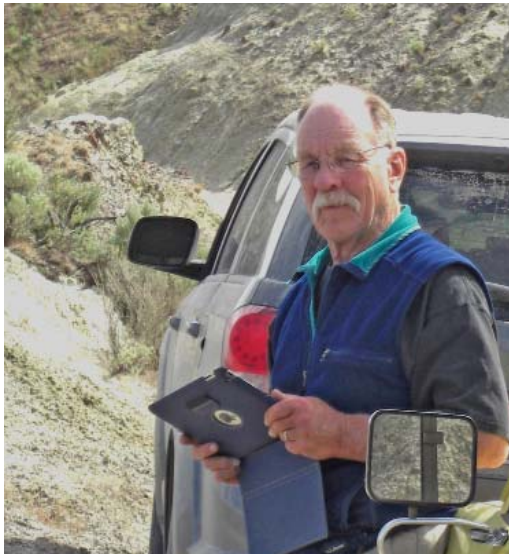
**Greg Dick (Asst. Prof.)** was awarded the highly competitive Alfred P. Sloan Research Fellowship for his innovative research on microbial diversity in deep marine systems. Greg has added an important dimension to our Department through his integration of microbial studies with geological processes. In addition to his work on oceanic systems, he is also undertaking unique studies of microbial communities within the Great Lakes.

### PATTERSON MEDAL GEOCHEMICAL SOCIETY JOEL BLUM 2013

**Joel Blum (Professor)** has been selected for the 2013 Clair C. Patterson Award for his recent breakthroughs in addressing mercury cycling in the environment. Such discoveries reflect his innovative and novel measurements of the isotopes of Hg in surface environments. (see photo on page 11)

### GEOLOGICAL SOCIETY OF AMERICA Research Grant Recipients 2013

**Carli Arendt (PhD Candidate)**  
**Richard Fiorella (PhD Candidate)**  
**Timothy Gallagher (PhD Candidate)**  
**Ethan Hyland (PhD Candidate)**  
**Yi-Wei Liu (PhD Candidate)**



**Gerry Smith (Prof. Emeritus)** was awarded the first lifetime achievement award by the American Society of Ichthyologists and Herpetologists for his research on fish paleontology and evolution.

**Thomas M. Brocher (BS'75)** was named a Fellow of the Geological Society of America.

**Gerald Dickens (PhD'95)** who is currently at Rice University was named a Fellow of the Geological Society of America for his transformative contributions to paleoclimate research. This includes his work on methane clathrates and their role in driving rapid excursions of global warming.

**Luis Gonzalez (MS'83 PhD'89)**, now Chair of the Department of Geology at University of Kansas, was named Fellow of the Geological Society of America.

**Francois Robert (Postdoc '83-84)** is now the President Elect (2014) of the Society of Economic Geologists. Francois spent two postdoctoral years (1983-84) at the U-M studying interesting H<sub>2</sub>O-CO<sub>2</sub> fluid inclusions in the Abitibi greenstone gold deposit. Robert succeeds Antonio Arribas, another former Michigan graduate student, who is currently serving as the elected SEG President.



**Ed Landing (MS'75, PhD'79)** was named Fellow of the Geological Society of America for his lifetime contributions in Avalonian Biostratigraphy and establishment of global stratigraphic standards for the Cambrian.

**Arlo B. Weil (MS'97, PhD'99)** was recognized for his comprehensive studies of fold-thrust belts and named a Fellow of the Geological Society of America.

*Fifty-Year Members* celebrated by the Geological Society of America this year include: **Norman Lasca Jr. (MS'61, PhD'65)** and **Fred Pessl Jr. (MS'55)**. We hope to see them celebrate their 100 year memberships.

**Robert A. Berner (BS'57, MS'58)**, currently a professor at Yale University, is the 2013 recipient of the Benjamin Franklin Medal in Earth Science for his legacy of research on geochemical processes that control the chemistry of the atmosphere and ocean.

### JOHN J. AMORUSO DISTINGUISHED ALUMNI AWARD 2013



*John J. Amoruso (MS,'57), Amoruso Petroleum Company*

**John Amoruso (MS,'57)** is the first awardee of the Department's *Distinguished Alumni Honor Award*. As part of this celebration, John presented the history and geology behind his grand discovery of the Amoruso Field to members of the Department and University. He began his presentation with a personal history of how he started with a lack of proficiency in math, and decided to pursue geology, a field where he could apply his intuitive skills with basic knowledge of the geological concepts to become successful. Not only was he skillful as a geologist, but his talents in business led to the almost wholesale leasing of properties to exploit what is known now as the Amoruso Field. John's outstanding contributions to both the petroleum industry and unwavering dedication to the Department highlight his long career.



# FACULTY NEWS

In early March, **Jie (Jackie) Li (Assoc. Prof.)** visited the Institute of Advanced Study and School of Physics at the University of Western Australia in Perth. She gave a public lecture -- "Cooling of Planets and Extra-Terrestrial Life".

In late March, she gave an invited talk on "Pressure-induced electronic and magnetic transitions in iron-bearing materials with applications for Earth-like planets and moons" at the Study of Matter under Extreme Conditions (SMEC) Conference, which was held on a "Celebrity Reflection" cruise ship through the eastern Caribbean islands. At the conference, she met Prof. Sergei Stishov from the Russian Academy of Sciences, for whom the mineral *Stishovkite* was named. First discovered in 1961 by Prof. Stishov through lab experiments, the high-pressure six-coordinated phase of SiO<sub>2</sub> was found later in nature, quenched to atmospheric pressure from high impact pressures and temperatures at Meteorite Crater in Arizona.



**Kacey Lohmann (Professor)** turned 63 years in October celebrating 34 years of teaching in the Department. His research program continues to discover new pathways in carbonate geochemistry with his current wanderings in mass-47 clumped isotope geochemistry of carbonate minerals. Currently, Kacey has two excellent PhD students, **Will Defliese (PhD Candidate)** and **Ian Winkelstern (PhD Candidate)**, both of whom are working on aspects of this research to evaluate the utility of this method for reconstructing deep-time paleotemperatures and diagenetic histories. Needless to say, he is skeptical of the validity of this technique, even though numerous other researchers are actively publishing on results that make no geological sense. Oh well, who needs geological evidence when new and innovative techniques can provide all of the answers? Teaching remains a vital part of



*Hot and Sweaty in Bermuda looking at vadose and phreatic carbonates*

Kacey's life, including the annual the Soft Rock Field Trip (see page 16): Last year the Permian Reef -- This year young carbonates of Florida. Expect Kacey to be here for awhile. He is still having too much fun at Michigan to retire.

**Laura Bilenker (PhD Candidate)** and **Adam Simon (Assoc. Prof.)** visited Chile in May, 2013 where they started a collaborative project with alumnus **Martin Reich (PhD '06)**, Associate Professor of Geology at the University of Chile, to investigate the evolution of iron oxide – copper – gold ore deposits (IOCGs). This deposit type supplies the World with a significant quantity of our iron, copper, gold, rare earth metals, uranium, silver, and other metals on a deposit by deposit basis. IOCGs are known to exist on all continents (except Antarctica, although they are most likely buried under the ice) and have formed throughout geological time. IOCGs share some characteristics with ore deposits formed by magmatic-hydrothermal fluids, meteoric fluids, and immiscible iron-rich liquids. However, IOCGs lack a genetic model, which impacts negatively exploration strategies for IOCGs. Ms. Bilenker is combining laboratory experiments with detailed geochemical characterization from several Chilean IOCGs in an effort to genetically fingerprint the source reservoir for iron. Bilenker and Simon each presented talks to the department and had a wonderful time interacting with Dr. Reich and colleagues.



*Taken at the Los Colrados IOCG Mine. Adam Simon, Martin Reich, Laura Bilenker and Pablo Sanchez*

# GEOPRISMS AT MICHIGAN



View of the volcanic mountains of northern Atka Island in the central Aleutians showing three volcanoes --from right-to-left they are Korovin, Konia and Kliuchef. Kliuchef actually looks like two edifices due to glacial erosion. The Bering Sea is on the right. On the left, a University of South Carolina graduate student collects volcanic rock samples. Picture courtesy of Gene Yagodziniski taken in July, 2004.

The Department has just welcomed the GeoPRISMS Office to campus. GeoPRISMS is a \$5M/yr NSF funding initiative to study continental margins (geoprisms.org). It uses a combination of observational and modeling techniques to understand the dynamic evolution of active margins (such as the Cascadia or Alaska-Aleutian arcs) and that of passive or actively rifting margins (such as the East Coast of North America and the East African Rift system). The program is unique in combining NSF funding from traditional funding opportunities for ocean sciences and ocean drilling (OCE, ODP) and solid earth sciences (EAR). The amphibious, interdisciplinary and community-based investigation makes it possible to go beyond traditional disciplinary boundaries and build stronger collaborative research projects.

GeoPRISMS grew out of the decadal MARGINS program (margins.org) which provided the community focal point for studies of the origin and evolution of the continents and demonstrated the value of interdisciplinary research. The GeoPRISMS science program has two main initiatives: Subduction Cycles and Deformation (SCD) and Rift Initiation and Evolution (RIE). The science program has five overarching scientific topics and themes: Origin and evolution of the continental crust; Fluids, magmas and their interactions; Climate-surface-tectonic feedbacks; Geochemical cycles; and Plate boundary deformation and geodynamics.

Examples of GeoPRISMS funded research include combined marine and earth based seismic experiments at the Eastern American margin, heat flow measurements off-shore Cascadia, geochemical and petrological studies of plutons in the Aleutian arc, and a combined seismological-petrological-geodynamical study of the role of metamorphic dehydration reactions in subduction zones.

The GeoPRISMS community effort is supported by a Science Steering Committee and a national Office. The initial office was at Rice University directed by Juli Morgan. In the first three years significant effort has been put into the formulation of the broad science plan

and the implementation plans for research at the focus sites (which include Cascadia, Eastern North America, Alaska-Aleutians, Eastern Africa and New Zealand). As of October 1 this year the Office has moved to Michigan under direction of Peter van Keken. At the time of writing (early October) we should probably qualify that the office is technically still moving due to certain Congressional activities (or lack thereof).

Office activities are principally focused on community support, organization of meetings, facilitating the activities of the Steering and Education committees and interaction with NSF. The education and outreach activities include development of mini-lessons for the education and training of undergraduates and a distinguished lecturer program for graduate



Peter van Keken at Mount Hood, OR

institutions and public institutions. In the next three years the Office will also focus on the NSF-mandated review of the program (2015 or 2016) and the organization of large meetings for each of the RIE and SCD initiatives. These meetings help provide a mid-term review and analysis of critical gaps in research. They also provide a great educational vehicle for graduate students and early career investigators. At the annual meeting of the American Geophysical Union several mini-workshop are organized to further develop or initiate community activities at the focus sites and integration with other national initiatives. On the Monday evening of the AGU a town hall and community forum is held and we welcome all those interested to attend. Hopefully we'll see you there!

Links: [geoprisms.org](http://geoprisms.org); [earth.lsa.umich.edu/~keken](http://earth.lsa.umich.edu/~keken)





## Rose M. Cory

### Aqueous Geochemistry

PhD, 2006 - University of Colorado, Boulder

All water on earth contains naturally occurring organic carbon (DOC), from dissolved sugars to the decay products of complex plant polymers or other biomolecules. And all carbon entering surface waters, whether from soils and



vegetation, must pass through and interact with the DOC pool as it is respired and released to the atmosphere as carbon dioxide (CO<sub>2</sub>, a greenhouse gas), or transformed to other forms of carbon. Dr. Rose Cory, an assistant professor in the Department of Earth and Environmental Sciences at the University of Michigan, studies how the chemistry of aquatic DOC controls how and how fast it can be returned to the atmosphere as CO<sub>2</sub> by sunlight and microbes. Specifically, Cory's research is focused on redox reactions in water initiated by sunlight and microorganisms that ultimately control the conversion of DOC to CO<sub>2</sub> on a continuum of timescales spanning several orders of magnitude (seconds to thousands of years). Her team uses molecule-to-field approaches to connect the molecular signatures of different types of DOC in rivers or lakes to its rates and pathways of degradation. On-going work of Dr. Cory's is the investigation of the longitudinal dynamics of DOC within a river network using a combination of optical spectroscopy and mass spectrometry. Research on this project has demonstrated how the rate of DOC degradation is connected to the composition of the constituent molecules. Cory and her collaborators employed stream microbes as "analytical chemists" to quantify carbon turnover in a stream on an axis representing time or space. Such quantification helps to refine the geochemical meaning of the "recalcitrance" and residence time of different pools of carbon that spiral through a river network.

Much of Cory's research is in the Arctic where climate change is progressing rapidly and thawing permafrost that contains nearly half of the world's soil organic

carbon. When permafrost thaws, frozen soil carbon is flushed to surface waters where it becomes accessible to degradation by sunlight and microorganisms. Conversion of this currently frozen DOC pool to greenhouse gases has the potential to double the amount of CO<sub>2</sub> in the atmosphere on a timescale that is similar to human inputs of heat trapping gases. New research on the North Slope of Alaska is showing that permafrost soils are not "thawing quietly" in place. Instead, thawing of ground ice is causing massive land-surface subsidence called "thermokarst failures". These catastrophic failures release ancient carbon and bacteria that have been frozen for thousands of years, and thus are hotspots for conversion of DOC to CO<sub>2</sub>. Cory investigates specifically how sunlight affects DOC and in turn controls the transformation and fate of DOC as it moves from land to water. Cory finds that exposure to sunlight accelerates the return of this DOC to the atmosphere as CO<sub>2</sub>, which may further increase the rate of global warming. This was the first evidence of a synergy between sunlight and microbes which eventually controls the processing of once frozen carbon, and these findings will help frame a better answer of what role the Arctic will play in future climate change.



As the permafrost boundary deepens it may create conditions for redox reactions between iron-bearing minerals and DOC where those conditions did not previously exist. Cory and post-doc, Sarah Page, recently demonstrated that redox reactions of iron and DOC in arctic soil waters yield hydroxyl radical, a very potent radical implicated in the oxidation of organic molecules to CO<sub>2</sub>. Ongoing work is aimed at testing how important these reactions are in lake sediments and soil waters to understand carbon cycling in the Arctic under current and future warming scenarios.

## Penthouse Professors

**Ted Moore** and his colleague, Shin-ichi Kamikuri, published an extensive data report on radiolarians in over 600 samples from three tropical Pacific drill sites. These samples spanned the Eocene-Oligocene (E-O) boundary (~40 Ma to 30 Ma) in all three sites and each site included the complete recovery of the E-O boundary interval itself – unusual for Pacific deep-sea sediments. Ted used these data to take a detailed look at the reworking of older microfossils into younger sediment. Over 45 radiolarian species became extinct just before the E-O boundary. The sporadic last appearance of these species above their Last Appearance Datum, gives a measure of the amount of erosion and reworking of older sediments that was occurring locally. In all three sites the amount of reworked older material appears in a series of at least eight steadily increasing pulses, starting ~39 Ma and continuing into the lowermost Oligocene (~33.3 Ma). The two largest pulses are located at the two-step transition from the very warm Eocene into the colder Oligocene. The only plausible explanation that Ted came up with for this unusual amount of erosion and reworking in deep-sea sediments was the pulsed, climatically-driven formation of new, dense bottom waters and the associated formation of a deep pycnocline. Ted is now working with several colleagues on changes in the vertical structure of the tropical Pacific Ocean and associated changes in productivity through this E-O boundary interval.

**Steve Kesler** completed several research projects this year, including one that settled a long-standing controversy in his favor. That study was carried out with **Joaquin Ruiz (PhD'83)**, currently Vice President for Innovation and Strategy at the University of Arizona, **Adam Simon (Assoc. Prof.)**, **John Muntean (MS'89)**, currently Director of the Ralph Roberts Center for Research in Economic Geology at the University of Nevada, Reno, and Jason Kirk, a post-doctoral researcher in Joaquin's lab. It involved the age of the giant Pueblo Viejo gold deposit in the Dominican Republic, where Re-Os analyses indicated an age of about 112 Ma. This age shows that the deposit formed at about the same time as several ocean-anoxic events recently recognized in the area by **Luis Gonzalez (PhD'89)**. Better still, it totally undermines the alternative age of about 60 Ma suggested for Pueblo Viejo. Steve presented these results at the annual meeting of the Society of Economic Geologists in Lima, Peru, that included all of the participants in the controversy. The age is important because it shows that large gold deposits can form from convergent margin magmatism of a type that was originally thought to be unfavorable, and that large parts of the world containing these rocks are likely to contain similar, as yet undiscovered, deposits.

**Phil Meyers** participated in three geoscience activities this past year that he found especially interesting. In late March, he attended the 2013 German IODP/ICDP (Integrated Ocean Drilling Program/International Continental Drilling Program) Kolloquium that was held this year at Technical University Freiberg in Saxony. This gathering is an annual event at which about two hundred German scientists and a handful of international invitees present and discuss the results of their studies of deep cores, mostly drilled from the sea floor and ancient lakes but also a few from the continents. Because of Phil's longstanding interests in paleoceanography and paleolimnology, he has always enjoyed the previous half dozen meetings he's attended, and he again enjoyed reconnecting with his many German colleagues and learning about their newest work. In addition to the scientific pleasures he found in Freiberg, he spent a fair amount of his free time exploring the old part of the city, which retains most of its ancient walls and is a proposed World Heritage Site. Of special note, the city has a rich and long history founded on mining of the surrounding Erzgebirge (Ore Mountains). Among its many claims to mineralogical fame, argyrodite ( $\text{Ag}_8\text{GeS}_6$ ) was first described here (1886) and was the mineral in which Germanium was first identified.

In early May, Phil crossed the Atlantic to participate in the PhD defense of a student at the University of Namur in Belgium. The student, Jean-Yves Storme, had conducted carbon and nitrogen isotopic geochemical studies of the classic Paleocene-Eocene boundary sequences in Zumaia (Spain), Sidi Nasseur (Tunisia), and Vasterival (France), and Phil was invited to serve as the outside examiner at his defense. Namur was the coal capital of Belgium until the Belgian Coal Measures were depleted. However, the Namurian stage of the Carboniferous period, which was named after the city, lives on. It corresponds in absolute time to 326 to 313 Ma, straddling the Mississippian-Pennsylvanian boundary of North America. While in Namur, Phil was able to visit a clay pit that was mining a thick Wealden sequence. For those as unfamiliar with the Wealden Supergroup as Phil was before his visit, this deposit represents an extensive braided floodplain that



*The Oldies but Goodies "Emeritus Professors" Henry Pollack, Steve Kesler, Ted Moore and Phil Meyers. (Photo: Dale Austin)*



covered parts of southern England and Belgium during the Valanginian-Barremian stages of the Cretaceous. It is especially known for the abundant tree remains it preserves, some as large as whole tree trunks.

In late May, Phil went to Denmark, where he chaired the on-site evaluation of the Center for GeoGenetics at the University of Copenhagen. This research group develops and applies paleogenomic techniques to investigate topics such as the first peopling of North America, the timing of late Quaternary megafaunal extinctions, the origins and intermingling of paleohumans on Greenland, and the responses of polar ecosystems to global warming. It is supported by a substantial grant from the Danish National Research Foundation, which sought an outside evaluation of its achievements before considering a second period of funding. The evaluation team consisted of a paleogenomics specialist from Canada, a malacologist from England, and Phil, presumably because of his experience in multiproxy paleoclimate studies. The presentations from various investigators were fascinating and included such novel accomplishments as the genomic sequencing of the DNA recovered from a 700 ky-old bone from Canada and the first genomic sequencing of an Aboriginal Australian. You may have read about these and other notable results from this group in papers published recently in *Nature* and *Science*.

On a more routine but equally interesting level, Phil continues to collaborate with colleagues in China and Brazil on various types of organic geochemical paleoclimate reconstructions. The results of some of these studies have appeared in recent issues of *Geology*, *Geochimica et Cosmochimica Acta*, and *Organic Geochemistry*. Like last year, he hopes to see many of you at the December AGU meeting in San Francisco.

**Henry Pollack** has been working with undergrads **Gen Ito (BS '13)** and **David Levine (BS'15)**, looking at the effects of climate change on the hydrological regime of two different regions: the upper Colorado River basin (Ito) and Lake Michigan-Huron (Levine).

**Gen Ito** studied a century of Colorado River discharge as recorded at the Cisco, Utah gauge station, looking for changes in the timing and volume of the upper Colorado discharge over the past century. Results included a discharge spread more evenly over the year, a not surprising outcome under a warming climate and a shortened snow season, as more precipitation would fall as rain and contribute to the stream flow as it fell, as opposed to precipitation falling as snow and being stored over the winter in snowpack that would not melt and enter the river until springtime. A second result was that the peak discharge at the end of the century came 4-5 weeks

earlier than at the beginning of the century, and with a volume diminished by almost 30%. Gen is now pursuing a graduate degree at SUNY Stony Brook.

**David Levine** is studying changes in the timing of seasonal high and low water levels in Lake Michigan-Huron over the past four decades. His results show that both the high and low lake levels have shifted some three weeks earlier, resulting in part from earlier snow melt, and in part from a long term decline in ice cover on the lakes during the winter, with a concomitant increase in both winter and summer evaporation. The diminished ice cover in the winter allows more evaporation, as well as a warming of the lake water due to increased absorption of the solar radiation. This 'pre-heating' of the lake water in winter enables more vigorous evaporation during the summer, the usual time of maximum evaporation.

Henry continues to work with Al Gore's Climate Reality Project, training community volunteers around the world to talk about the reality of anthropogenic climate change in their own communities. A training program in Istanbul in mid-June proved interesting, in that it took place amid political demonstrations that added some considerable drama to the program. A second training in Chicago in early August drew some 1500 volunteers, the largest training ever undertaken by the Climate Reality Project. Henry also participated in the filming of *Project Ice*, a documentary featuring the role of ice in the creation of the Great Lakes, and in the history and culture of the region.



*Joel Blum enjoying the weather while sampling for Hg in the Arctic. His innovative breakthroughs in studying the cycling of Mercury in the environment is the basis for his recent award of the Patterson Medal by the Geochemical Society.*



*Jackie Li leading the The Mineralogy New Mexico Crew after visiting the Valles Caldera in the Jemez Mountains*

## Mineralogy Excursion to New Mexico

As part of the Department's efforts to increase the exposure of our students to more geological landscapes, it has now become part of our tradition for the Mineralogy course to visit localities out west during our Fall break. In October 2012, Jackie Li led the trip to New Mexico with 14 students. The four-day trip included visits to Valles Caldera, Jemez Mountains featuring Soda Dome Travertine Deposits, Bandelier Tuff, and Battleship rock, Harding Pegmatite Mine, the Santa Fe impact site, and the Meteorite Museum and Geology Museum at the University of New Mexico. The group camped in San Deigo Canon, Harding Mine,

and Hyde Memorial State Park. Guest instructors include Prof. Berry Kues from University of New Mexico, Dr. Barbara Lavina from University of Nevada, Dr. Jamie Gleason from the department, the discover of shatter cones at the Santa Fe impact site Dr. Tim McElvain, and the caretaker of the Harding Mine Mr. Gilbert Griego. Highlights of the trip include a book-signing event with Prof. Kase Klein and viewing of rare meteorites with Prof. Carl Agee, the Director of the Institute of Meteoritics at the University of New Mexico.

*This trip was made possible with funding from several sources, including the Alumni-supported Field Excursion Fund which was established with generous gifts by an anonymous donor.*



*Students taking gravity measurements during their Fall Geophysics field trip*

## GRAVITY OF MICHIGAN

More field experiences are being incorporated into many of our courses in the Department to provide hands-on learning for students in classes at both the graduate and undergraduate levels. For example, our Applied Geophysics class, taught this year by Prof. Marin Clark, undertook gravity measurements across Michigan. After learning the technical aspects of operating the gravimeters through exercises on campus, students departed on a several day field excursion to document the gravity anomalies across the Michigan Basin. Such interactive learning experiences provide the students with practical knowledge which compliments the theoretically-based classroom discussions.



# Aquatic Adventures: Great Lakes Field Trip

Winter semester EARTH professors **Brian Arbic** and **Michela Arnaboldi** took their classes, Introduction to Physical Oceanography (421) and Geology of the Great Lakes (417) respectively, on a joint field trip. The trip was optional for both classes, and about 22 students chose to participate.

The field trip consisted of an oceanographic cruise on Lake Michigan during which students could observe and carry on, first hand, real operations and measurements necessary to collect oceanographic and limnologic data.

The ship that we sailed on is the R/V Laurentian, an 80-ft steel-hulled vessel built in 1974 by the University of Michigan. Today, GLERL (Great Lakes Environmental Research Laboratory) leases and runs the Laurentian but, luckily for us, offers vessel access and support to University of Michigan scientists. The ship operates out of the NOAA/GLERL Lake Michigan Field Station in Muskegon, where we arrived on Friday, April 12. There we met NOAA chief scientist Dennis Donahue for a briefing and an introduction to NOAA's operations on the Great Lakes.

As an added bonus, we spent the night at the USS Silverside Submarine Museum. There we were given a wonderful

tour of the WWII era submarine USS Silversides and slept on the USCGC McLane, a 1920's era Coast Guard cutter.

The research cruise took place on Saturday April 13. Although we had originally planned to go out on Lake Michigan, due to high winds (it turns out April is not yet Spring on the Great Lakes!), we had to go out on Lake Muskegon instead. Students were given the opportunity to choose the tasks they led onboard, including taking bottom samples with PONAR grabs (these are bottom grabs developed at the University of Michigan), taking water samples using Niskin bottles, taking biological samples with vertical net tows, and taking temperature profiles using CTD sensors.

The students greatly enjoyed the trip. In fact one Masters student said that it was the highlight of all of the classwork he had done at University of Michigan

And, by the way, if you ever sail on the Laurentian, you'll have to go through a drill and wear your safety suit! (check out our picture)

*Special thanks to Dennis Donahue and his NOAA crew and to the staff and tour guides at the USS Silverside Submarine Museum for their generous help with a trip enjoyed by all.*



*Transformation of the Geology of the Great Lakes and Physical Oceanography classes as they donned their protective gummy suits for their trip on the USCGC McLane (Photo courtesy of Sang Chen, UM graduate student).*



# Victors for Michigan

## *Undergraduate Research Experiences and Scholarships*

**VICTORS FOR MICHIGAN - UNDERGRADUATES**



The educational and scientific mission of the Department of Earth and Environmental Sciences is to understand the origin, evolution and future of the Earth. We are educating students in unique areas of expertise that are needed for both the development and stewardship of Earth's energy, mineral and water resources. The Department has been recognized for its excellence with top national ranking in a number of areas. To remain in the forefront of this rapidly expanding discipline focused on the critical natural resources that sustain a modern industrial civilization, we need to provide students with opportunities to gain field experience, to undertake research utilizing the best tools available, and to pursue their college degrees without assuming the burden of a crippling debt. Our funding priorities reflect our needs and opportunities to sustain and expand our world-class research and teaching efforts of the Department in the 21st century and beyond.

### **THE UNDERGRADUATE CHALLENGE**

With the increasing urgency to train a new generation of Earth and environmental scientists, who will become the specialists addressing our future natural resource needs and policies, we must attract and retain the brightest and most promising students at the undergraduate level. The Department has seen a steady increase in undergraduate majors, and we seek to enhance their academic experience by increasing scholarship support and research opportunities. Learning is not measured only in the academic classroom experience but also by hands-on research. With your support, scholarships and research support will be awarded on need- and merit-based criteria to support those deserving students that hold our society's future.



### **HOW TO SHOW YOUR SUPPORT**

Gifts to the Undergraduate Scholarship & Activities Fund – #307829 will support scholarships and research opportunities for undergraduate students in the Department of Earth and Environmental Sciences.

Give with the enclosed envelope or go to the Department home page and click on "Give Online".

<http://www.lsa.umich.edu/earth/alumnifriends/victorscampaign>







# Victors for Michigan

## National and International Field Excursions

Field investigations are at the very heart of the Earth and Environmental Sciences. U-M's campus offers an intellectually rich living and learning environment full of cultural diversity, but to enable our students to experience geologic and environmental diversity we must provide opportunities for field learning experiences, both nationally and globally. We depend upon generous gifts to make these experiences accessible to current and future generations of students.

Annually, the Department offers field opportunities for graduate and undergraduate students to directly observe, document and interpret geological features and structures across our country and internationally. National trips range from excursions to the Southwest to examine the sequences and structures of the Colorado Plateau, to field studies of the Permian Reef Complex of west Texas (*see page 16*). While our classroom instruction provides a broad geological base knowledge for students, in the field, hands-on experiences solidify this knowledge so that it can be applied to real-life settings of petroleum and resource exploration and to academic-based research. The saying that "a geologist is only as good as the number of rocks that she/he has seen" remains a truth today even as our technology manifests in the new and digitally-based analysis of the Earth.



VICTORS FOR MICHIGAN - FIELD EXCURSIONS

**HELP US MAKE OUR FUTURE GEOLOGISTS  
WELL-ROUNDED AND WELL-ROCKED.**

### HOW TO SHOW YOUR SUPPORT

Gifts to the Field Excursion Fund - #575039 will be used to defray the cost to our students of field experiences in the U.S. and abroad. Such experiences are vital to developing the geological perspective necessary to support the needs of our society in future.

Give with the enclosed envelope or go to the Department home page and click on "Give Online".

<http://www.lsa.umich.edu/earth/alumnifriends/victorscampaign>

**THE WORLD NEEDS VICTORS  
BE ONE OF THE  
VICTORS FOR MICHIGAN**



# Western Adventures

## Spring Field Trip 2013



A



A. Peter Knoop holding forth with students in Palo Duro Canyon in Triassic Dockum Group Sandstones. Photo by Kacey Lohmann



B

B. THE GROUP: Posing on the outcrop of dolomitic Pisoliths in the Carlsbad Caverns parking lot. Comprising both graduate and undergraduate level students, this was the first time most had seen this classic carbonate sequence.



C

C. Kacey Lohmann speculating about depositional environments on the outcrop.





**D.** *Heading up McKittrick Canyon, the students reconstruct the platform-margin-basin transition.*



**E.** *Chad Gregory (Senior) examining sample of dolomite.*

The annual Spring Field Trip brought along 21 students and 3 faculty (Peter Knoop, Maribel Benito from Madrid, Spain, and Kacey Lohmann) through the Midwest out to West Texas and New Mexico. Great exposures were visited in: the Cambro-Ordovician sequences in Missouri, Pennsylvanian Cyclothems of Kansas, Palo Duro Canyon Triassic/Permian, the Great Permian Reef Complex, Carboniferous and Permian of the Pedrogosa Basin, lower Paleozoic of the Franklin Mts., Cretaceous Edwards Plateau, the Cambrian of the Llano Uplift and ending in Pennsylvanian fluvial-deltaic sequences in Kentucky. It was a long two week trip that provided new experiences, new rocks, and new geology for most of our students.

*This field trip was generously sponsored by the Field Excursion Fund established by an anonymous donor and the Department of Earth and Environmental Sciences. Most photos courtesy of Peter Knoop.*

**F.** *Lohmann examining fabric of Wabash Reef, Indiana.*





# Camp Davis Gazette



Five years ago, **Joel Blum (Professor)** wrote in this space about planned renovations for Camp Davis, aimed at providing much needed infrastructure upgrades to the aging facilities to meet both current and future needs, and to accommodate the growing number of students that were enrolling in classes at Camp Davis.

Joel stepped down as director of Camp Davis earlier this year, leaving behind remarkable changes, including the first phase of a renovation project involving 20 new cabins and infrastructure on the east side of camp, annual enrollments tallying close to 150 students in seven courses, and new classes to meet student interests in energy resources (EARTH 344) and introductory level environmental sciences (EARTH 202). We are indebted to Joel for his perseverance and efforts at Camp Davis, and for leaving the facility and the educational program in such an incredibly improved shape .

In the past five years, however, change has continued in our department. On-campus enrollments have continued to grow, and now exceed 120 majors. Changes to our curriculum make a field course at Camp Davis a requirement for all of these students, and enrollments in our upper level courses are reaching capacity. The dedication and ability of the Earth and Environmental Sciences faculty, research associates, and guest faculty who teach at Camp each summer has made our courses highly sought after by students in the Program in the Environment, the Graham Institute for Sustainability, and among students looking to fulfill their science requirements in the College of Literature, Sciences, and the Arts. Demand remains high for our lower level courses, and our upper level courses are being taught at capacity.

To meet the demands placed on the camp facilities with continued high-level enrollment, we have embarked on the planning stages for a second phase of renovation

at Camp Davis. As with the first phase, this project will focus on residential facilities at Camp, with the goal of replacing the cabins in the west wing of Camp with new structures similar to those built in the previous renovation, but modified for higher capacity student occupancy and constructed more robustly for student usage. We envision that these new cabins will allow us to operate more classes, with larger student enrollments, earlier in the season, expanding our Spring term offerings to accommodate student interest in Camp.

It has also become clear through these renovations that Camp Davis needs to develop a strategic initiative fund to be able to move more quickly in the future to meet urgent renovation and repair needs. Developing such a fund will be an integral part of the 'Victors for Michigan' fundraising campaign over the next several years.

Thanks for your past and continuing support that makes Camp Davis such an extraordinary place, and please stop by if you're passing through Wyoming in the summer!

*Nathan Niemi, Camp Davis Director*

## Keeler Grove Established

A generous donation from Phil Deloria and Peggy Burns will fund the planting of a new grove of trees at Camp Davis in memory of Gerry Keeler. Gerry was a professor in the School of Public Health and AOSS at Michigan, and held an appointment in Earth and Environmental Sciences. Gerry was instrumental in the establishment and success of EARTH 341, Ecosystem Science in the Rockies, and co-taught the course for a number of years with faculty from Earth and Environmental Sciences.





# Victors for Michigan

## Camp Davis Renovation and Strategic Fund



**FROM THE OLD TO THE NEW** -- The Camp Davis cabins that most of you recall were built in the late 1920's and early 1930's. Good memories abound on the evenings spent by the old wood stoves, but current safety regulations, increased student enrollments, and demand for longer field seasons (starting in June rather than mid-July), have all created the need for modern facilities. The first phase of renovation replaced cabins on the East side. **It is now time for Phase II.**

*Photos courtesy of Kacey Lohmann.*

Originally constructed by students in the late 1920's as part of the Engineer's surveying camp, the classic tin cabins on what had been called the "student side" remain as the residence for the bulk of our students during their stay at Camp Davis. The old coal and wood stoves have been replaced by electric space heaters; the awning windows (if you can call those metal flaps actual windows) have been replaced with ones that open and close and block the Wyoming winds; the bare tin walls have been covered with panelling to provide a semblance of insulation. Despite all of these incremental improvements to the cabins, the facilities still do not meet safety standards, nor do they provide adequate space to house the increasing numbers of students attending Camp. The facilities at Camp Davis are in dire need of replacement to meet the growing demands of teaching our field experience courses that comprise requirements for degrees in Earth and Environmental Sciences



### AS YOU PONDER YOUR ANNUAL GIVING CONSIDER DESIGNATING YOUR GIFT TO THE CAMP DAVIS STRATEGIC FUND

#### Your contribution will:

1. Renew the student housing facilities to modern and safe accommodations.
2. Build a sustainable fund to maintain and continue to upgrade all of the improvements that have been and will be made in the future.
3. Keep Camp Davis "Michigan Strong" for the 21st century.

A Phase II Renovation Fund has been created to meet this need, and is an integral part of the **Victors for Michigan** Capital Campaign which officially began this November. In addition to new cabins that can house larger number of students, these facilities will include modern bathrooms, upgraded and safe electrical systems, and integrated heating that will enable the Camp to be used over the course of the Spring months. This will allow greater utilization of Camp Davis, with more courses and higher enrollments. Your support is needed to make this transition and ensure the future of our beloved Camp Davis.

Give with the enclosed envelope or go to the Department home page and click on "Give Online".

<http://www.lsa.umich.edu/earth/alumnifriends/victorscampaign>

VICTORS FOR MICHIGAN -- CAMP DAVIS

# ALUMNI NEWS

**Antonio Arribas (PhD '92)** has retired from BHP Minerals, where he was last in charge of greenfields exploration geoscience based in Singapore, and has moved to Ann Arbor with his wife Rocio. Aside from the Department and the town, the other attraction of Ann Arbor for them was two sons, one at UM Medical School and another in high school. The Department is taking advantage of his extensive experience in the mineral industry by having him join our Alumni Advisory Board. We are certain that his insights will be both a benefit to the long range planning of the Department as well as to students interested in the mining and ore industry.



**Carrie Glauner (BS '13)** recently got a job doing environmental assessments and remediation with AECOM, an "earth solutions" firm. She says she is receiving lots of additional training and loves using her Geology degree in a real, exciting and profitable job. She did note that changing her hair color from a wild fluorescent pink to its normal tones was helpful in securing the final interview.



Photo: Selfie by Carrie Glauner



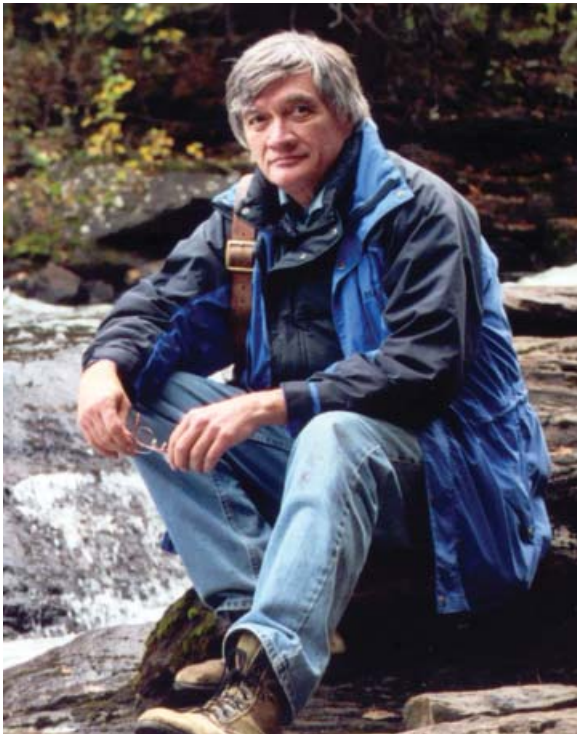
**Dan Wiitala (BS '86)** provided a guest lecture entitled "Anatomy of a Mine" for Adam Simon's EARTH 380 class on mining, economics, and the environment on March 22 2013. Dan and his firm, North Jackson Company, have been consulting on hydrology and data management for the Eagle Mine copper-nickel project. This project is in northern Marquette County in Michigan's upper peninsula and is the first mining project developed under Michigan's Part 632 non-ferrous metallic mining rules. Eagle Mine is scheduled to begin operations in 2014 and is expected to produce 360 million pounds of nickel, 295 million pounds of copper and small amounts of other metals over its eight year productive life. Dan provided an overview of the mine permitting process and environmental assessment and controls, the economics of the project, and its expected impact in the UP. In addition, he related an entertaining perspective of Upper Michigan's mining and film history (see *Anatomy of a Murder*, which was filmed on location in Marquette and released in 1959). Dan will return to guest lecture in Adam Simon's course in Fall 2014, and he will host a graduate field trip to the Eagle Mine and its environs in Summer 2014.

**Suzanne Hurter (PhD '92)** recently moved to down under with a job at Arrow Energy Pty Ltd in Brisbane, Australia. We'll see how long it takes for her to pick up the dialect and start drinking Foster's Beer. Good Luck!!!!



# TRANSITIONS

## ROD EWING RETIRES 2013



**Rod Ewing (Professor)** will retire from the University of Michigan at the end of 2013. He is the Edward H. Kraus University Professor in the Departments of Earth & Environmental Sciences, Materials Science & Engineering, and Nuclear Engineering & Radiological Sciences. During his time at Michigan, he led a multi-disciplinary research group that focused on the properties of nuclear materials and the materials science of the nuclear fuel cycle. In January, 2014, he will begin an appointment as a Professor in the Department of Geological and Environmental Sciences at Stanford University. He will also be the first Frank Stanton Professor of Nuclear Security in the Center for International Security and Cooperation at Stanford. Frank Stanton, who had a long-standing interest in matters of nuclear security, was the president of CBS from 1946 to 1971 and is considered a visionary of the broadcast industry. Among many broadcast firsts, he organized the first presidential debate in 1960 between John F. Kennedy and Richard Nixon.

**Bob Owen (Professor)** retired from the Department this last year following his furlough semesters. Bob was a Professor of Marine Geochemistry in the Department of Earth and Environmental Sciences and a Professor of the Environment in the *Program in the Environment*. During his career he participated in more than 20 oceanographic research cruises, including deep sea several drilling legs in the Pacific and Indian Oceans, and non-drilling legs in the Atlantic Ocean, Mediterranean Sea, and Gulf of Mexico. His experiences were not limited to ocean explorations; he also participated in submersible operations in the Great Lakes. Bob is known and respected for his geochemical analysis of deep sea sediment cores to determine the causes of past climate change and to assess the role that seafloor hydrothermal activity has played in the evolution of ocean chemistry and climate history. While at Michigan has held various administrative posts, including Director of UM's Rocky Mountain field station in Jackson, WY, Director of the *Program in the Environment*, and Associate Dean in the College of Literature Science, and the Arts. In 2004 he was awarded an Arthur F. Thurnau Professorship. He has served as President of the International Marine Minerals Society, and he is currently UM's representative to the Consortium for Ocean Leadership, where he serves on the Board of Trustees. Having joined our Emeritus "Penthouse" Professors, you will be hearing from him in our future postings of the GeoScience Newsletter. *Modified from the UM Retirement Memoir.*

**Christopher Stefano (PhD '2010)** recently joined the A.E. Seaman Mineral Museum in Houghton as Associate Curator of the mineral collections. He has kept busy, both with museum tasks and public presentations. He recently presented a lecture entitled: "Minerals with Stories: Working with Historical Mineral Specimens". As part of his work, he recognizes both the geological and human historical background of many of the museums specimens. As an example, each specimen has a card which shows where and by whom it was collected. His fascination has led to archival searches of the people behind the minerals, including Douglass Houghton who started the Geology Department at U-M. Keep up the good work Chris.

---

## IN MEMORIAM

**Eleanor Cochrane (BS'50)** passed away on September 13, 2012. She remained a loyal football fan and supporter of the University of Michigan and the Department of Earth and Environmental Sciences. She was also involved for many years with the Alpha Xi Delta Sorority. She was preceded in death by her husband,

Curtis, and her sister, Corinne Reding. She is survived by her children, Cathy (Phil) Harrison and Bruce (Monique) Cochrane, four grandchildren - Jennifer (Trey) Cook, Rebecca Harrison, Ian and Nicolas Cochrane - a niece, and two nephews.

# Supporters of the Department of Earth and Environmental Sciences 2010-2013

*The Department would like to acknowledge the generous corporate, foundation, and individual gifts it has received over the last three fiscal years (July 1, 2010 – June 30, 2013). These gifts are invaluable in supporting our graduate and undergraduate programs, our education and outreach efforts, and for attracting and retaining the highest quality faculty and staff. To all those that have given -- **Victors for Michigan --GO BLUE!***

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## **THANK YOU ALL!!!**

It is through your continuing and generous contributions that the Department maintains its ability to support the needs of our students and faculty. Such support ensures a bright and sustainable future for the Department and University.

# **GO BLUE**

# Recent Bachelors Degree Candidates

## Majors

<b>Amanda Collins</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Kevin Garrett</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Carrie Glauner</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Chad Gregory</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Gabriel Grinstein</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Dominic Haywood</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Gretchen Klank</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Grace Lieb</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Taryn O'Connell</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Rachel Palmer</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Alexander Piskin</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Clayton Smith</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Carla Valdes</b>	<i>Earth &amp; Environmental Sciences BS</i>
<b>Andrew Biebuyck</b>	<i>Geological Sciences BS</i>
<b>Aaron Brewer</b>	<i>Geological Sciences BS</i>
<b>Jane Cooper</b>	<i>Geological Sciences BS</i>
<b>Helen DeMarsh</b>	<i>Geological Sciences BS</i>
<b>Paul Den Uyl II</b>	<i>Geological Sciences BS</i>
<b>Izyan Nadirah Dzulkipli</b>	<i>Geological Sciences BS</i>
<b>Marissa Gunnarsson</b>	<i>Geological Sciences BS</i>
<b>Gen Ito</b>	<i>Geological Sciences BS</i>
<b>Kylie Joki</b>	<i>Geological Sciences BS</i>
<b>Brigid Lynch</b>	<i>Geological Sciences BS</i>
<b>Zachary Menzo</b>	<i>Geological Sciences BS</i>
<b>Syamil Mohd Razak</b>	<i>Geological Sciences BS</i>
<b>Megan Mueller</b>	<i>Geological Sciences BS</i>
<b>Matthew St Clair</b>	<i>Geological Sciences BS</i>
<b>Clinton Sweet</b>	<i>Geological Sciences BS</i>
<b>Matthew St Clair</b>	<i>Geological Sciences BS</i>

## Minors

<b>Issac Anderson</b>	<b>Lauren Beriont</b>
<b>Matthew Buch</b>	<b>Stephanie Chen</b>
<b>Kendall Effinger</b>	<b>Lindsey Eldredge-Fox</b>
<b>Raye Evrard</b>	<b>Lindsay Isenhardt</b>
<b>Veronica Kincaid</b>	<b>Sharon Oser</b>
<b>Dana Rollison</b>	<b>Nicholas Schiavo</b>
<b>Emily Seeley</b>	<b>Anna Snoeyink</b>
<b>Brett Sosnik</b>	<b>Brian Stark</b>
<b>Sarah Anne Terry</b>	<b>Jamie Vaughan</b>



## Recent Masters Theses

<b>Sarah Aarons</b>	<i>Variable Hf-Sr-Nd Radiogenic Isotopic Compositions in a Saharan Dust Storm over the Atlantic: Implications for Dust Flux to Oceans, Ice Sheets and the Terrestrial Biosphere</i>
<b>Rich Fiorella</b>	<i>Dehumidification over Tropical Continents Reduces Climate Sensitivity and Inhibits Snowball Earth Initiation</i>
<b>Joseph Friedmann</b>	<i>Fracking: Formulation of Appropriate State Regulation Of Waste Disposal</i>
<b>Timothy Gallagher</b>	<i>A New Paleothermometer for Forest Paleosols and its Implications for Cenozoic Climate</i>
<b>Timothy O'Brien</b>	<i>Timing of Iapetus Ocean Rifting in the St. Lawrence Rift System of Southern Quebec, and Fault and Cleavage Dating along the Champlain Thrust of Vermont, Northern Appalachians</i>
<b>Zhangyi Hu</b>	<i>The Effects of Differentiated Heat Production and Transition Zone on the Stability of Deep Dense Pools at the Core-Mantle Boundary</i>
<b>Kathleen Presley</b>	<i>Characterization of the Interactions between Shale Cementation and Fracture Pump Resistance, and the Subsequent Contributions to Air Emissions from Eagleford Shale Hydraulic Fracturing Operations</i>
<b>Allyson Tessin</b>	<i>Isotopically Depleted Carbon in the Mid-Depth South Atlantic During the Last Deglaciation</i>

## Recent Doctoral Dissertations

<b>Jennifer Cotton</b>	<i>Using Soils to Constrain Past and Future Climate Change</i>
<b>Xuan Guo</b>	<i>Density and Compressibility of FeO-bearing Silicate Melt: Relevance to Magma Behavior on the Earth</i>
<b>M. Louise Jeffery</b>	<i>A Climate Perspective on Paleoelevation and Erosion Processes in the Central Andes</i>
<b>Meghan Wagner</b>	<i>Silver as a Novel Tracer for Late Quaternary Southern Ocean Biological and Geophysical Processes</i>
<b>Rohit Warrier</b>	<i>New Applications of Atmospheric Noble Gases in Hydrogeology, Atmospheric Sciences, Paleoclimate and Tectonics</i>
<b>Laura Waters</b>	<i>The Effect of Degassing of H<sub>2</sub>O on Crystallization and Oxidation in Highly-Evolved Magmas: Implications for the Origin of Rhyolites</i>

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### Scholarships/Fellowships Fall 2011 through Fall 2013

#### Camp Davis Scholarships

**Shell Camp Davis Scholarship:** Carli Balogh, Evan Everson, Emerson Hendry, David Hunt, Juston Jaco, Kristen Kiluk, Kaitlin Ma, Michael Perles, Anna Sedlar, Chari Singleton, Anlexandra Skrivaneck, Patrick Temple, and Christopher Whalen

**Kornfield Family Camp Davis Fund:** Andrea Davilla, Elise Huber, Rebekah Kreckman, Rebecca Campbell, Dominic Haywood, Jordan Hood, Ethan Manilow, Srishti Pillutla, Rhiannon Rush

**Graham Institute Scholars:** Raymond Mahaffy, Alyssa Mandilk, Avery McIntyre, Mary Milford, Elizabeth Nakamura

**Judith H. Turneure Memorial Student Aid:** Zachery Gizicki, Karen Hawley, Jessica Hicks, Amelia Runco.

#### Graduate Fellowships

**Joseph and Anna Drobeck Trust:** Michael Cherney

**W.H. Hobbs Fellowship in Geology:** Yi-Wei Lui

**Susan M. Kruger Scholarship Fund:** Michael Broersma

**Russell C. Hussey Scholarship:** Joseph El Adli

**Earnest A. Novak Scholarship Fund:** Yi Nui, Meghan Wagner

**Henry N. Pollack Graduate Fellowship in Geological Sciences:** Michael Cherney, Sandra Fernando, Xiaofei Pu and Katlyn Turner

**Chester B. Slawson Memorial Fund:** Xiaofei Pu

**F. S. Turneure Fund In Geology:** Lydia Staisch

**Stewart R. Wallace Fellowship:** Emile Moacdieh, and Alex Voorhies

**Violeta Pena y Lillo Scholarship:** Lydia Staisch

# C o r p o r a t e C o n n e c t i o n s



*Drilling for the good stuff on the Mississippi Delta circa 1970. Photo from the archival collection of Kacey Lohmann when he worked with Texaco in New Orleans.*

This year the Department was grateful to Shell Oil Company (**Katy Keller, PhD'06**), and Conoco-Phillips (**Jason Mailloux, BS '06**) for coming to campus to interview our students for internships and permanent jobs the petroleum industry. We are seeing an increasing number of our students, both at the undergraduate and graduate levels, guiding their academic training with a goal of undertaking oil exploration for careers. This year **Ran Feng (PhD Cand)** and **Kris Rhodes (PhD Cand)** joined Shell as summer interns. In addition, **Liz Tanis (PhD Cand)** is joining Shell as a full-time exploration geologist. **Tiffany Napier (PhD Cand)** was also fortunate to take on a USGS summer internship. We treasure these ties with industry and will continue to provide the educational background and encouragement to our students to pursue such lifetime careers.



*View West from the field Spring Field Trip campsite in Franklin Mountains State Park, TX. Photo courtesy of Sang Chen.*

**Back Cover Caption:** Students on the Spring Field Trip to the Southwest examine an outcrop of the Dockum Group in Palo Duro Canyon, TX. See more photos and story on page 16. *Photo courtesy of Kacey Lohmann*





*With the grand west side of the Guadalupe Mountains framing the background, the Michigan Spirit rises with students rallying for MICHIGAN. While examining the Permian sequence up McKittrick Canyon and in the Basin, the trip detoured to a short visit to the Salt Flats to the southwest of the Permian Reef, where we trenched the recent sediments that contain layers of early-formed dolomite. Samples of this dolomite will be part of the dissertation of Ian Winkelstern (PhD cand), whose research examining the utility of clumped isotope paleothermometry of dolomite to reconstruct Earth surface temperatures in the Paeleozoic. (Photo courtesy of Peter Knoop)*

**Chair:** Rebecca A. Lange

**Faculty:** S. Aciego, B. Arbic, J. Bassis, T. Baumiller, U. Becker, J. Blum, R. Burnham, G. Burton, M. Carroll, C. Castro, L. Cathles, M. Clark, R. Cory, G. Dick, R. Ewing, D. Fisher, M. Flanner, P. Gingerich, I. Hendy, E. Hetland, R. Lange, J. Li, K. Lohmann, N. Niemi, C. Poulsen, J. Ritsema, L. Ruff, N. Sheldon, A. Simon, A. Steiner, B. van der Pluijm, R. Van der Voo, P. van Keken, J. Wilson, Y. Zhang.

**Visiting Faculty, Research Faculty and Postdoctoral Fellows:** J. Alt, J. Ansong, K. Aramugam, C. Badgley, J. Demers, M. Duhaime, A. Fiege, S. Gallen, J. Geissman, J. Gleason, C. Hall, S. Huang, B. Kennedy, L. Kinsman, J. Knipping, B. Lacroix, M. Li, W. Li, S. Miller, G. Moore, A. Nelson, Z. Rak, D. Reed, S. Saumitra, A. Schleicher, C. Sheik, L. Sherman, S. Smith, E. Stevenson, R. Styron, D. Trossman, R. Warriar, A. Wolf, Y. Xiong, I. Zalmout, J. Zhang.

**Lecturers and Adjunct Faculty:** M. Arnaboldi.

**Emeritus Faculty:** C.W. Beck, W. C. Kelly, S. E. Kesler, P. A. Meyers, T. C. Moore, S. B. Mukasa, J. R. O'Neil, S. I. Outcalt, R. M. Owen, D. R. Peacor, H. N. Pollack, D. K. Rea, G. R. Smith, J. C. G. Walker, L. M. Walter, B. H. Wilkinson.

**Support and Laboratory Staff:** B. Apsitis, D. Austin, B. Berg, A. Corey, D. Dewasurendra, A. Ferot, J. Haggerty, K. Harrold, A. Hudon, T. Huston, S. Jain, M. Johnson, N. Kingsbury, J. Magiera, C. Malvica, D. Marcus, M. Messina, B. Sell, W. Wilcox, S. Wilkin, L. Wingate, Z. Xu.

**Alumni Advisory Board:** Paul Koch (Chair), Aboud Afifi, Antonio Arribas, Matt Cabell, Larry Davis, Tracy Frank, Robert Garwood, John Geissman, Steve Glass, Steve Henry, George Ireland, Bob Klein, Eva Moldovanyi, Cary Mrozowski, Chris Palenik, Dexter Perkins, Grigore Simon, Scott Tinker, William Zempolich.

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