

# Faculty News—2009

## JEAN BAHR

My duties as GSA Vice President through June and then as President starting in July kept me one the road for much of 2009. In the spring semester I attended GSA Section meetings in St. Petersburg, FL (where I got to visit with hydro alumni **Tara Root** and **Wes Dripps**), Portland, ME, Dallas, TX, and Rockford, IL. Between these trips and others to DC and Boulder for committee meetings, I taught Contaminant Hydrogeology and participated with a colleague from the biological sciences in teaching a course for grad students and faculty on development of instructional materials. In the summer I taught the hydrogeology field methods course and participated again in field trips for the PEOPLE program for high school students.

A sabbatical leave for the 2009-2010 academic year gave me some much needed flexibility in the fall semester. In September I made trips to DC for congressional visits on behalf of GSA and to Colorado for the annual GSA Executive Committee retreat. During the GSA Annual Meeting in Portland, OR in October, I delivered my Presidential Address (see page 7), “presided” over a variety of events, and also went on a field trip led by former student **Terrence Conlon**. I spent much of November and December in California for a final visit with my mother and to help my father adjust to life on his own after her passing. Kind messages of support from students, former students, and colleagues were much appreciated during that difficult time.

I look forward to seeing Geobadgers this spring at GSA Section meetings in Baltimore, Branson, Rapid City and Anaheim.

## PHIL BROWN

2009 was an interesting year for me both professionally and for my family. In February I served on the NSF Graduate Fellowship committee, a humbling look at what it takes to be successful coming out of college these days. Multiple research projects and publications are the norm among the 250+ applicants to the Geoscience panel. My Economic Geology class had 10 students and we finished the spring with a 10-day trip to north central Manitoba in May (see the report elsewhere in the *Outcrop*). I taught the last three weeks of Field Camp in Park City which this year included a three-day trip to the Carlin gold mining area in Nevada. Enrollments continue to be strong in the 40-50

range although this was the last year that Iowa is going to be part of the consortium—not sure what this will mean in 2010.

After camp I spent a couple days with **Phil Gopon** who was doing field work outside Winnemucca, NV for his M.S. thesis studying the geochemistry of the alteration surrounding a gold-silver prospect in Nevada. **John Marma** continues to be successful working for Newmont at the Midas underground gold mine in north central Nevada and spends most of his time in exploration now as opposed to the production end of the business. **Erin Gray** graduated with an undergraduate degree from our department and now also works for Newmont at Midas.

In the fall I began a full-year sabbatical during which I am focusing on continuing my research on high-grade iron ores in the Lake Superior district and rewriting my fluid inclusion data reduction program. I first wrote FLINCOR in 1988-89 and made many additions and changes over the years until it was orphaned by advances in computer operating systems. This has left a couple hundred fluid inclusionists around the world with no easy way to deal with analytical data gathered on heating/freezing stages. Now 20 years later I am re-inventing the program using a new programming environment—this old dog is struggling (successfully I think) to learn new tricks! I will be spending a month in Australia in February-March 2010 working on both the computer program with collaborators and time in the iron mining areas of Western Australia.

My family is well—Jason continues to live in Madison and work for Epic although his role in the company is changing. Peter and his fiancée(!) both survived two years of Teach for America in Washington D.C. (a true life changing experience) and have jobs in Columbus, Ohio. Karin the geo-major graduated from Carleton in 2008 and is following her dream of continuing to be involved with swimming as the assistant coach at Amherst. This fall she has enrolled in a two-year, dual degree program at U.Mass that will give her an MBA and a Masters in Sports Management. Thus she now has two full time jobs as she continues to coach at Amherst. Kris continues to see evolutionary changes in the demographics of the Madison public schools from her vantage as a high school librarian and we continue to keep our fingers crossed that the deepening budget cuts don't close the library.

So with renewed hope for the future I look forward to the rest of 2010.

## ANDERS CARLSON

This past year was quite productive for my research group. **Elizabeth (Libby) Obbink** finished her M.S. in June on the eastern North American freshwater discharge during the last deglaciation and its effects on ocean circulation and climate. Her paper is scheduled for February publication in the journal *Geology*.

**Elizabeth (Lisa) Colville** finished her M.S. in December and is writing her study on Greenland Ice Sheet extent during the last interglacial for submission to the journal *Science*. Libby moved onto an environmental consulting job in Seattle, WA, while Lisa has stayed here to pursue a Ph.D. **Daniel Murray** joined the Quats this fall, working on Patagonian outlet glacier chronologies with **Brad Singer** and me.

This past summer, Lisa Colville, **Kelsey Winsor** and I conducted further fieldwork on Greenland, around Sisimiut, prior to the arrival of the remaining students who attended the summer Greenland field trip (see pages 16, 21). I would like to thank all of the alumni whose donations made this trip possible. **Dave Ullman** and I have been rummaging around the state of Wisconsin, looking for boulders to date the retreat of the Green Bay, Langlade and Chippewa Lobes. Dave also traveled to southern Quebec to collect samples for dating the early Holocene moraines in this region.

In September, **Brian Beard** and I received a large NSF grant to continue work on Greenland ice extent during earlier interglacials warmer than present, which will be the focus of Lisa Colville's Ph.D. Kelsey Winsor and I also were successful in a National Geographic grant to work on directly dating west Greenland ice margin retreat. Dave Ullman and I are continuing our NSF-funded work with collaborators at NASA Goddard Institute for Space Studies, combining global climate models with ice sheet mass balance models to examine the mechanisms of ice decay. In 2009, my grad students and I presented results at Fall AGU and North Central GSA, with a total of 15 abstracts and presentations for the year. I also published six papers including two in *Science*.

## CHUCK DEMETS

The year 2009 was a transitional year for my graduate program. After having sent all three of my former graduate students onward to positions in industry or academia after completing their degrees, I welcomed a new graduate student **Shannon Graham**

to my tectonics program and also enjoyed accommodating **Professors Jim Evans** and **Susanne Janecke** of Utah State University, who gave Shannon some company in my tectonics lab during their 2008/2009 sabbaticals. I also hosted **Dr. Sergei Merkouriev**, my collaborator from St. Petersburg, Russia, during his fall 2009 research visit to Madison.

My major research accomplishment in 2009 was the completion of my decade-long effort to construct a new model for present-day global plate motions. The 200+ page manuscript describing this work was submitted for review in mid-2009 and after minor revisions was accepted for publication in late 2009. The manuscript is accompanied by a more than 100 page electronic supplement as well as a Web site that I constructed to present the new model along with more than 1800 pages of documentation of the raw data that form the basis for the new model. Hopefully, this work will be useful and well cited for years to come.

I'm looking forward to fresh initiatives in 2010, including a new initiative with Sergei Merkouriev to reconstruct in unprecedented detail the motions of most tectonic plates over the past 20 Ma. Continuations of my long-term GPS studies of active crustal deformation in Central America, Mexico, and Jamaica will give me an excuse to work in warm, sunny places during the cold Wisconsin winters and engage students in challenging deformation modeling projects driven by field work in exotic places.

### **KURT FEIGL**

As the renaissance in geophysics continued in Madison, I was glad to welcome **Dr. Tabrez Ali** as a postdoctoral associate this fall. After finishing his Ph.D. at Purdue, Tabrez brings his considerable modeling expertise using the finite element method to a study of rifting across the mid-Atlantic ridge where it comes ashore in northern Iceland. Together with **Professors Herb Wang** and **Chuck DeMets**, we are building a group of modelers, including graduate students **Shannon Graham**, **Aaron Masters**, **Anosua "Chini" Mukhopadhyay**, and **Joshua S. Roberts**.

We just learned that NSF will provide funding to work on Okmok volcano in Alaska. It appears to erupt every decade or so, most recently in 1997 and again in 2008. This sequence of events provides a rare opportunity to conduct a rheological experiment to unravel the complex processes associated with magma migration, storage, and eruption in an active volcano. In this experiment, the magma flux during the eruption provides the "impulse" and the subsequent, transient deformation,

the "response." By simulating the impulse, measuring the response, and interpreting the constitutive relations between the two, one can infer the rheology. Okmok is an excellent natural laboratory for such an experiment because a complete cycle of deformation has been monitored using geodetic and seismic means. This project promises to be interesting because I will be working with fellow geobadgers **Professor Cliff Thurber**, **Tim Masterlark**, (UW Ph.D. 2000), and second-year graduate student **Summer J. Ohlendorf**.

### **DANA GEARY**

2009 was a big year for evolution, marking the 200th anniversary of Darwin's birth and the 150th anniversary of the publication of *The Origin of Species*. **Brooke Norsted** (Geology Museum) and I began 2009 immersed in preparations for Darwin Day 2009. The day of talks and family-friendly interactive displays was a big success, bringing in over 600 people.

**Matt Kuchta** completed his PhD thesis in May. Matt studied previously unknown land snails in Pleistocene deposits from the driftless area of Wisconsin. He used radiocarbon and amino acid racemization methods to date the deposits and better understand their sedimentologic and taphonomic history. This information, in combination with paleoecologic data from the fossil assemblages, has proved important in reconstructing the paleoclimate and paleoenvironmental history of the Upper Mississippi Valley during the late Pleistocene.

**Erin Fenlon** (co-supervised with **Shanan Peters**) is investigating bivalve evolution on both macro and micro scales. She is looking at the relationship of environmental perturbations (as recorded in sea-level fluctuations) to rates of evolutionary change (as measured by extinction and origination rates, and as recorded in the tempo of morphologic change within marine lineages from the Eocene).

**MaryRuth Kotelnicki** continues her work on trilobite ecology and evolution, focused now on Ordovician assemblages from the upper Midwest and their relation to contemporaneous assemblages from other parts of the country. **Jim Freiheit's** monograph on Dominican strombid gastropods was finally published in the *Bulletins of American Paleontology*. **Erik Hoffmann** will soon begin a job with BP in Houston.

In June I attended the North American Paleontology Convention (NAPC) in Cincinnati, and gave a paper on growth rates, longevity, and the evolution of large body size in Lake Pannon melanopsid gastropods (as determined by stable

isotope analyses). These and other isotopic analyses are proving useful in understanding both the evolution of large body size in Lake Pannon mollusks, and the development of seasonality and climate in the Late Miocene-Pliocene of the region.

### **LAUREL GOODWIN**

The Structure Wing continued to be a dynamic place in 2009, thanks to both residents and visitors. Professors Jim Evans and Susanne Janecke remained in Madison on sabbatical from their home institution of Utah State University into July. Their presence and interests further strengthened growing ties between the geophysics and structural geology groups. We were sorry to see them leave.

**Melodie French** received the Outstanding Student Paper Award from the Mineral and Rock Physics Focus Group for her 2008 Fall AGU poster describing the results of poroelastic modeling of deformation experiments she planned on the St. Peter sandstone. She completed the experiments at Sandia National Labs in the summer, exploring petrophysical controls on natural hydraulic fracture for the first time (previous experiments focused on induced hydraulic fracture). Melodie completed her MS in December and is working in Brian Evans' lab at MIT while deciding where to do a PhD.

**Evan Earnest-Heckler**, co-supervised by **Basil Tikoff**, successfully defended his MS thesis in December, also. He is fitting in final corrections while completing his first year as a PhD student at the University of Massachusetts-Amherst. MS student **John Schneider** and undergraduate field assistant **Sam Harms** completed a successful field season in Utah, exploring the effect of varying clay content on the character of faults in sandstone. Co-supervisor **Harold Tobin** and I helped John and Sam launch the expedition, with lively discussions in the summer heat and extraordinary scenery. John subsequently got married, spent the fall semester enjoying an internship with Chevron, and returned with a job offer from BP. Whew!

Sam Harms subsequently assisted PhD student **Erin Stoesz** with her fieldwork. I joined them for a few sunny days on the Punchbowl fault in southern California, where Erin is working with co-supervisor Harold Tobin and me to better understand the impact of fault-zone deformation on seismic velocity. In contrast, **Jennie Cook's** attention was focused on finishing her PhD, with innovative approaches to addressing the influence of diagenesis on deformation. She ventured into the field only briefly, to catch a look at parts of

the San Gregorio fault zone that were exposed by particularly vigorous winter storms. We happened on the exposures during a particularly memorable, alumni-supported (thank you!), field trip that I led with **Alan Carroll**, **Shanan Peters**, and Basil Tikoff (see pictures and note on page 20). I wish you all at least one adventure as pleasant in the coming year!

### SHANAN PETERS

More than two quick years have passed since I first arrived in Madison, and I'm pleased to report that things are moving along quite well. My research group is growing and becoming quite diverse. **Dave Lovelace** continues to make progress on the Triassic of Wyoming and will have been subjected to the rigors of preliminary examination by the time you read this (good luck Dave!). **Erin Fenlon** also continues to work with **Dana Geary** and me on the morphology and evolution of Gulf coast marine molluscs during the late Eocene climate transition.

A few new graduate students have come into the fold this year, including **Ben Linzmeier**, who is working with **John Valley** and me to better understand fine-scale growth increments in Paleozoic and recent corals, **Deb Weinstein**, who is tackling the record of continental sedimentation and mammalian evolution in North America, and **Caitlin Keating-Bitonti**, who is working with **Clay Kelly** and me to better understand paleoceanography and macrostratigraphy during the late Miocene. I look forward to watching this new group of students grow.

I'm also happy to be working with two of our undergraduate majors. Senior **Angeline Catena**

has been working with Dave Lovelace on a thesis that focuses on detrital zircon provenance analyses in the Permian-Triassic of Wyoming, which has been great for both of them. I'm also lucky to have ensnared (or was I ensnared by?) Junior **Dylan Loss** early in his career. We are working on two great projects together. One involves the stratigraphy and sedimentology of the Sauk Sequence in northwestern Montana, which will form the bulk of Dylan's thesis. The other involves a quantitative evaluation of the concept of "storm wave base" in sedimentology. **Bob Dott** has been fun to talk to about both of these projects.

As for my own research, I continue to focus on macrostratigraphy, and with the help of my postdoc **Noel Heim**, we've developed some new research and teaching tools (<http://macrostrat.geology.wisc.edu>). State survey geologist **Pat McLaughlin** and I are also conspiring to take North American stratigraphy in new directions by combining the largest scale syntheses of macrostratigraphy with the high resolution basin-scale analyses. Stay tuned!

### ERIC RODEN

Two long-awaited papers related to microbially-mediated redox cycling of iron came out in 2009, one describing the activity and composition of neutral-pH iron redox cycling communities in a groundwater iron seep, and one analyzing the composition and activity of a chemolithoautotrophic iron-oxidizing, nitrate-reducing enrichment culture that is being used for studies of solid-phase iron oxidation and anaerobic iron cycling. We are currently closing in on a paper that describes the ability of this

culture to oxidize reduced (ferrous) iron in phyllosilicate minerals such as smectite and biotite. In addition, the work of a new graduate student in the NASA Astrobiology Institute (NAI) program is examining the ability of the culture to gain energy for growth from the oxidation of ferrous iron in fresh basalt glass. The latter studies are soon to be complemented by a hunt for novel organisms (e.g. in weathered Hawaiian volcanic glass) capable of this metabolism utilizing either oxygen or nitrate as the oxidant. All of the above microbial pathways have key implications toward the potential for iron-based microbial life on extraterrestrial rocky planets (most notably, Mars). Other ongoing iron-related geomicrobiological research includes collaborations with **Clark Johnson** and **Brian Beard** that led to two new papers which examined the fractionation of iron isotopes during the interaction of ferrous iron with iron oxides in the presence and absence of dissolved silica; the work of another NAI-supported graduate student on iron mineralization and isotope fractionation coupled to microbial reduction of a novel iron oxide/silica coprecipitate that mimics iron oxide phases likely to have been present in Archean and Neoproterozoic marine sediments that were the progenitors of Banded Iron Formations; DOE-funded studies of iron-oxidizing and -reducing organisms from a redox transition zone in groundwater aquifers in eastern Washington state, where iron-bearing minerals have a key impact on metal-radionuclide contaminant speciation and transport; NSF-supported studies on microbial communities associated with cyclic oxidation and reduction of iron and nitrogen by microorganisms in near-surface aquifer and riverine floodplain sediments in southern Wisconsin; microbiological and mineralogical analysis of clay-rich subsoils in nearby Shovelers Sink (located in the Cross Plains Unit of the Ice Age National Preserve; (see photo, next page) where we suspect sustained seasonal cycles of phyllosilicate-associated iron oxidation and reduction are taking place; and studies of the ability of iron-reducing microorganisms to respire with solid-phase (insoluble) substances in organic-rich soils and sediment. The latter studies included collaboration with a geochemist at Humboldt University Berlin on electron spin resonance analysis of the redox state of solid-phase humics, and with **Huifang Xu** in our department on the physical association of organics with iron oxides that seems lie at the heart of the ability of solid-phase humics to accelerate (via "solid-state electron shuttling") microbially-driven



Photo: Shanan Peters

Undergraduate major Dylan Loss at Switchback Pass, Montana. The unconformity at the top of the Sauk is visible in the background. July 2009.

reduction of iron oxides. Finally, we completed a line of inquiry on the potential for the stable capture of uranium in nanophase hydroxyapatite formed through microbial metabolism of organophosphate compounds in calcium-rich, uranium-contaminated groundwater at Oak Ridge National Laboratory in Tennessee.

### NITA SAHAI

This was a very busy year academically, with a lot of student and post-doctoral training and project completions, publishing papers, teaching at the 100-, 300- and graduate levels, and outreach activities both locally and internationally. It was also a very successful year for recruiting graduate students through the Wisconsin Astrobiology Research Consortium (WARC), for grant funding and for winning awards!

**Donald Mkhonto** completed his 2.5 year post-doctoral stint in our laboratory. We are currently writing up his Molecular Dynamics simulations results of amino-acid interactions at calcite surfaces, with implications for biomineral crystal morphology control. New post-doc, **Yang Yang**, is conducting cutting-edge Molecular Dynamics simulations to investigate the role of Bone Sialoprotein in hydroxyapatite nucleation during bone biomineralization.

**Tim Oleson**, defended his Ph.D. in August. His work shows that the stability of lipid membranes (which constitute all biological cells) in contact with mineral surfaces depends on critical mineral properties, which are ultimately related to crystal structure. Research from previous student, **Mark Stevens'** M.S. thesis, on the adhesion of immune system cells to oxide- and silicate-based biomedical implants, was published in *Langmuir*, the top journal of surface chemistry. Another publication, first-authored by graduate student, **Jie Xu**, was invited for a special issue of the *Journal of Physical Chemistry C*.

We have had enormous success with funding this year from NSF's Division of Materials Research (DMR); NSF EAR's Research Experience for Undergraduates Program (REU), and NASA Astrobiology Institute's Director's Discretionary Funds (NAI DDF). The aim of the NSF DMR grant is to investigate the role of calcium silicate bioceramic implants in promoting the differentiation of human mesenchymal stem cells



**Eric Roden examines clay subsoil in Shovelers Sink in the Cross Plains Unit of the Ice Age National Preserve.**

into osteoblasts (bone-forming cells) for bone tissue regeneration. Graduate student, **Nianli Zhang**, is making significant progress on this project, supported this year by a departmental S.W. Bailey Fellowship. In the NAI DDF and NSF projects, current graduate student, Jie Xu, and three new graduate students, **Chunxiao Zhu**, **Edward Greiner**, and **Heather Jordan**, are investigating the potential role of minerals in the pre-biotic self-assembly of life and the early evolution of bacterial cell surfaces in contact with minerals. Chunxiao and Ed are Weeks Fellows and Heather is an Advanced Opportunities Fellow.

As always, we also had active undergraduate research students in our group. **Tony Giuffre**, who double-majored in geology and chemistry, measured the adsorption of amino-acids on minerals. Tony received several awards from the Department and UW. This summer, I was privileged to be actively involved in the Khorana Program at UW, named for Nobel Laureate, Prof. Har Gobind Khorana, formerly a UW faculty member. The Khorana Program is an initiative funded by the Indian Government to bring top-caliber Science/Engineering undergraduates from India to the UW, to provide hands-on research experience. Nineteen Khorana scholars were chosen from more than 23,000 applicants. I hosted sophomore, Madhuresh Sumit. The students and faculty hosts were honored to meet Prof. Khorana and co-Nobel Laureate, Dr. Marshall Nirenberg, at a reception.

As one of the WARC co-PIs, I was involved in the outreach activities at a Madison Mallards game (minor league baseball team), in May 2009. I also participated in the Diverse Scientists Panel-Member, "How I Became a Scientist", at

the Sennett Middle School, Madison. I answered questions from the students on what a geologist does, why I chose to become one, my experiences as an immigrant in the USA, and my experiences as a female, racial-minority, scientist in the physical sciences.

This was also a wonderful year for awards. I was delighted to hear, in January 2009, that I had won the prestigious Romnes Faculty award from the University of Wisconsin and in October, that I have been elected a Fellow of the Mineralogical Society of America.

In summary, it is rewarding to know that our research group continues to draw the best quality of post-doctoral researchers and students at all levels and, that our hard work and innovative, multi-disciplinary research is being recognized by the UW and the international community of academicians and geoscientists.

### BRADLEY SINGER

My research group evolved considerably during a very busy 2009. **Sarah Greene** completed her MS thesis on the petrology of historic dacitic lava domes and ash falls at Santa Maria Volcano, Guatemala, and took a position with Exxon in Houston. **John Hora** completed his PhD on the evolution of magmas beneath Volcan Parinacota, Chile and is currently a post-doc at Gottingen University, Germany working with my long-time collaborator Gerhard Worner (Gerhard is the Victor Goldschmidt Chair in Geochemistry at Gottingen). My proposal to the NSF with new faculty member **Steve Meyers** and collaborator Brad Sageman (Northwestern University) to revise the Cretaceous Time Scale was successful. **Sarah Siewert** has joined this effort to pursue her MS thesis on  $^{40}\text{Ar}/^{39}\text{Ar}$  and U-Pb dating volcanic ash beds in Coniacian-Santonian strata of Montana, Wyoming, and Utah. In July, I gave a talk at the Goldschmidt meeting in Davos, Switzerland, followed by some time with Teri and Zoe near Sisteron, France. A late Summer Rocky Mountain road trip with Sarah Siewert, lab manager **Brian Jicha**, and I taking turns at the wheel, brought us to sample several classic Cretaceous ash bed localities. **Kate Smith** joined the group in January to undertake geochemical and isotopic studies of Santa Maria Volcano for her MS thesis. Kate, Sarah, Brian, and I travelled

to Santa Maria Volcano in March to collect samples for Kate's thesis work as well as to learn more about the geology of Atitlan Caldera. **Heather Cunningham**, who recently earned her PhD at Macquarie University, Australia, wrote a successful proposal to the NSF Post-doctoral program, and has joined my group for the next 2 years to study the long-term evolution of the Atitlan Caldera complex using the argon and thorium isotope systems. Portions of the projects at Santa Maria and Atitlan involve demanding measurement of the isotopic composition of thorium – work that is done in close collaboration with **Brian Beard** and **Clark Johnson** in the Radiogenic Isotope Laboratory. In December, Brian Jicha and I took delivery of a new 5-collector mass spectrometer for the Rare Gas Geochronology Laboratory. Purchase of this instrument was made possible mainly via an NSF grant, but Departmental gift funds played an essential role in securing the instrument, and building a new gas handling system for it. The Department's new Instrument Innovator, **Peter Sobol**, has, along with Brian Jicha, played a critical role in installing, testing, and automating this new mass spectrometer. This has truly been a team effort! Finally, the last days of the year saw me off to Argentina with new student Dan Murray. Dan's MS thesis focuses on the glacial history of the southern Patagonia Ice Cap during the last 25 ka, which he will determine via <sup>10</sup>Be dating of glacial deposits east of the southern Andes.

### **CLIFFORD THURBER**

2009 was a wonderful year for my research group. My year started with a trip to South Africa to attend the January IASPEI meeting in Cape Town, to which I added six incredible days on safari in the Sabi Sands Game Reserve—an unforgettable experience. In March, I flew to New Zealand to give an invited presentation at an international workshop on a proposed fault-zone drilling project on the South Island's Alpine Fault. In April, I attended the SSA meeting in Monterey to give an invited talk on the structure and seismicity of Alaskan volcanoes. In May, **Alex Teel** successfully defended his M.S. thesis on the analysis of seismicity associated with large megathrust earthquakes. Alex is working on a USGS-funded study related to the earthquake hazard in the Sacramento River Delta area while he develops his plans for a Ph.D. thesis. The USGS project emerged from a comprehensive study of the three-dimensional crustal structure of northern California that I published in the *Journal of Geophysical Research* in January. The manuscript documenting the patented

InSAR modeling technique I developed with **Kurt Feigl** was also published in January. In August, **Jeremy Pesicek** defended his Ph.D. thesis on the structure and seismicity of the Sumatra region. Jeremy is staying on at UW as a post-doc funded by a NASA subcontract (the Sumatra project) and a new USGS volcano hazards project to study two Alaskan volcanoes, Augustine and Okmok. The latter project will provide some support for second-year graduate students **Rachel Murphy** and **Summer Ohlendorf**, who will also be working on a new NSF-funded project to analyze the structure, stress state, and earthquake source mechanisms of the Katmai area in Alaska. Grad student **Ninfa Bennington** is working toward the completion of her Ph.D. thesis involving joint inversions of geophysical data in the Parkfield area, supported by an NSF grant and a Morgridge fellowship. Ninfa gave birth to daughter Lea over the summer. Post-doc **Ellen Syracuse** is completing a detailed study of the decollement fault beneath Kilauea volcano, Hawaii, as part of a new NSF-funded project, and she will participate in the USGS volcano hazards study. I will also be collaborating with Jackie Caplan-Auerbach of Western Washington University on an ocean-bottom seismometer study of Loihi seamount, Hawaii, and with former UW post-doc **Guoqing Lin**, now on the faculty at Miami University, on a study of spatio-temporal variations in Poisson's ratio within volcanoes and fault zones. Former undergraduate students **Patrick Statz-Boyer** and **Laura Sumiejski** both had first-author papers published this year, and Laura was given a Hanks Outstanding Geophysics Student Award at the spring 2009 banquet. Laura is now a graduate student at Scripps, and Patrick began graduate work at Berkeley after working at a geothermal company for a year. I was recently appointed as a member of the Steering Committee of the NSF MARGINS program, which is engaged in developing its next five-year science plan. Finally, I am now half-way through my term as chair, and after writing our department's decadal self-study report in 2008 and pushing through the department name change and major (but temporary) department budget-cutting measures in 2009, I have my fingers crossed for a successful curriculum revision and university review of our department in early 2010.

### **BASIL TIKOFF**

2009 was a blur. My son Oliver survived the year. I'm pretty sure that I did some teaching. I think I did some research. Ok, I'll try to think this

through in a more linear way.

Spring semester 2009 was a bit of a bummer of a semester, including too much going on too quickly. I'm pretty sure that I taught an Integrated Liberal Studies (ILS) class on "Ways of Knowing in Science" with **Nancy Ruggeri**, who is working on her PhD in the School of Education for work associated with this class. The ILS class is an overview of science to non-science majors that I very much enjoy teaching. I also taught structural geology, which is always fun particularly with the requisite field trip to Baraboo. Over spring break, I also managed to do some fieldwork in Jamaica, working with **Bryn Benford** on her PhD project (an effort with **Chuck DeMets** to understand the neotectonics there—an effort made more relevant by the recent Haiti earthquake).

**Bridget Diem** also did a great job finishing her undergraduate senior thesis investigating growth faults formed during experimental basin formation, and imaging these features in three-dimensions using the Halliburton Geoscience Visualization Center.

At the end of the semester, I went to Boise, Idaho, for the biannual EarthScope national meeting. In addition to co-chairing the meeting, **Bryn Benford** and I led a professional fieldtrip for the meeting to her Master's thesis field area in the Owyhee Mountains (if you are wondering, "Owyhee" is the old spelling for "Hawaii", and there are many stories about how the mountains got their name—I subscribe to the observation that there are a lot of basalts in both places). Bryn did a superb job of leading the fieldtrip. I also went on a great fieldtrip at the end of the semester to central California (see report on page 20).

Summer 2009: Summer is always great. I spent about a month in Hawaii, watching Oliver while Sara attempted to get some research done. I was asked, along with four other scientists, to put together the EarthScope science plan and its associated fall meeting. So, I spent a lot of that summer on the phone and on email related to that effort. However, I also managed to get some field research done with a new NSF-supported post-doctoral fellow, **Seth Kruckenberg**, while in Australia. Seth was willing and able to help finish up field work in one of the last sections of exposed granulites that we've spent the last (gulp) decade working on near Alice Springs. It was also great to have Steve Wojtal, from Oberlin College, join us while looking at very deformed rocks and camping in the Australian outback. I also spent some time in the Sierra Nevada Mountains with **Paul Riley** and **Richard Becker**. Paul is working on a PhD investigating a newly recognized fracture system;

Richard is just starting his PhD, investigating how fracturing in the bedrock controls glacial erosion.

Fall semester 2009:

**Evan Earnest Heckler** finished his Masters project in the Mt. Isa region in Australia (co-advised by **Laurel Goodwin** and myself), even after starting his PhD project at the University of Massachusetts in hydrogeology. There are two undergraduate students doing senior projects this year:

**Matt Francis and Kelly Hoehn.** **Seth**

**Kruckenber** continues to be immensely helpful around the lab, keeping the structure group operational. As always, I enjoyed teaching Geology 202 with **Anders Carlson** and the ILS—Ways of Knowing in Science class.

## JOHN VALLEY

This was a busy, productive year. Meetings ranged near and far, from Davos, Switzerland to Rockford, Illinois. Highlights include delivering the keynote address at NC-GSA on “Paleoclimate-Hadean to Recent” and organizing a special symposium at Goldschmidt on *in situ* isotope analysis. At the symposium, I spoke on new developments at WiscSIMS that have greatly improved accuracy of oxygen isotope analysis; **Jason Huberty** (first year UW grad. student) described a new theory for interpreting and improving SIMS data from magnetite; and **John Eiler** (UW PhD 1994) presented exciting nanoSIMS results from his lab at Caltech. In December, **Dayi Ortiz** defended her MS thesis on mineral inclusions in detrital zircons as a tool for sedimentary provenance studies. Three post-docs completed their projects this year. **Philipp Heck** studied meteorites from mid-Ordovician limestones in Sweden and China and has moved to the University of Chicago. His paper is in press showing that these wide-ranging samples are derived from break-up of a single asteroid, thought to be the parent of all L-chondrite meteorites. **Craig Grimes** finished his work on zircons from modern ocean crust, submitted a paper suggesting that the Hadean pre-4 Ga zircons formed in felsic crust, and moved to Mississippi State.



**Fiber-optic sensor installation party.** Left to right: **Steve Gabriel (Spearfish High School)**, **Mary MacLaughlin (Montana Tech)**, **Mary's husband Steve, Alan Turner (Micron Optics)**, **Herb, JoAnn Gage (standing)**, **Noni (kneeling, Montana Tech)**, **Matthew Kogle.**

**Anne-Sophie Bouvier** completed her year at WiscSIMS working on Li isotopes and moved to Bristol University. Two new students joined my group this year, **Chloë Bonamici** is combining geospeedometry, geothermometry, and geochronology during ductile deformation of major mylonite zones in the Grenville Province, and **Raiza Quintero** is studying the genesis of peraluminous granites from the Sierra Nevada batholith. **Yaron Katzir** is back in Madison this year, working in the Stable Isotope Lab, on sabbatical from Ben Gurion University, Israel. Some of you will remember Yaron as a post-doc in our department from 1999-2002. Last summer, **Aaron Cavosie** (PhD 2005) returned (from Univ. Puerto Rico) as a NASA Astrobiology Fellow to study shocked detrital minerals from the Vredefort Dome, and **Jade Star Lackey** (PhD 2005, now at Pomona College) visited to analyze zircons. As this is written in early 2010, I am happy to welcome two new post-docs, **Kouki Kitajima** (from Tokyo University) and **Ken Williford** (Curtin University, Perth, Australia) who are interested in Precambrian geology and Astrobiology. Other WiscSIMS news last year includes **Ian Orland's** paper on seasonality and drying of climate in the Eastern Mediterranean during the first millennium (see article page 23); **Reinhard Kozdon's** paper showing that foraminifera, the main climate proxy before 800 ka, can be zoned in oxygen isotope ratio; and a paper by **Jen Macalady's** (UW post-doc 2001-02 with **Jill Banfield**) post-doc at Penn. State who used the WiscSIMS lab to analyze carbon isotope ratios in single bacteria from Frasassi Cave in

Italy, establishing the first known example of non-marine chemoautotrophic symbiosis. I have never had more fun, working with all of these people and others who space does not permit me to mention.

## HERB WANG

My year's research was focused around a couple of fiber-optic sensor installations—one in an underground vault at Aburatsubo, which houses quartz-tube extensometers operated by the University of Tokyo's Earthquake Research Institute, and the other in the former Homestake gold mine in Lead, South Dakota. These meter-long tubes record strain and/or temperature changes. While in Japan between January and March, I also visited

underground research laboratories in Horonobe and Mizunami. Since I left, Tomo (Tokunaga) and his Japanese colleagues have improved the sensitivity of the Aburatsubo sensors to the point where the variation of tides in Aburatsubo bay is being seen in the data. The Homestake sensors were installed in late July (photo above) at a depth of 4100 feet and we began continuous recording in early October. These measurements are sensitive to the small changes in temperature associated with ventilation. Between June and October I made five trips to Lead for the field work, hosting my Japanese collaborators, committee meetings, and workshops.

I spent June in New Orleans for the third summer with another great group of students. The big event was the launching of synthetic “floating islands” in the former cypress forest adjacent to the Lower Ninth Ward ([www.youtube.com/uwnola](http://www.youtube.com/uwnola)).

I taught hydrogeology and coordinated a seminar on geological carbon sequestration in the fall semester. I went to Berlin as a reviewer for the Intercontinental Scientific Drilling Program and visited Brugg Cable, one of our fiber-optic sensor suppliers, near Zurich. In December two of my Japanese collaborators and I visited Micron Optics in Atlanta. Micron Optics is our primary fiber-optics sensor supplier and their optical sensing specialist, Alan Turner, is a key member of our fiber-optics team. December also meant the AGU meeting in San Francisco where it was nice to connect with geophysics Geobadgers at the reception.

## HUIFANG XU

A state-of-the-art X-ray diffraction system (Rigaku Rapid II) was installed in the S.W. Bailey X-ray Diffraction Laboratory in the summer. A new aberration-corrected field-emission-gun transmission electron microscope and scanning transmission microscope (FEI Titan-80-200) was also installed in the summer. The new instruments have been benefitting both teaching and research in our department and other research groups across the campus.

Graduate student **Kuang-Sheng Hong** has applied his newly discovered Piezoelectrochemical effect to environmental clean-ups using mechanical energy wastes. His paper about piezoelectrochemical effect has been published in *The Journal of Physical Chemistry Letters*. This study provides a simple and cost-effective technology for direct water splitting that may generate hydrogen fuels by scavenging energy wastes such as noise or stray vibrations from the environment. Graduate student **Fangfu Zhang** (co-advised by **Eric Roden**) has been working on the roles of bio-organics on dolomite formation. Graduate

student **Tina Hill** is studying nano-phases and nano-precipitates in pyroxene minerals from ultra-high pressure metamorphic rocks in order to understand evolution history of their host rocks during subduction and exhumation. Graduate student **Jason Huberty** (co-advised by **John Valley**) has studied the effect of magnetite crystal orientations on oxygen isotope analysis, and micro-structures in magnetite from Hamersley basin of Western Australia. New graduate students **Mo Zhou** and **Zhizhang Shen** (co-advised by **Phil Brown**) have started research projects on epitaxial growth of Ca-carbonate minerals and dolomitization of limestone respectively. Visiting graduate student **Yubing Sun** has been working on the role of nano-pores in governing uranium (VI) sorption/desorption in polluted groundwater aquifers, a challenging problem that our nation faces today. High school senior of Madison West High School, **Gabriela Farfan** won the 10th place of Intel Talent Search based on her Oregon sunstone research carried out in the department. She was one of the Michelle

Obama's guests at the President's State of the Union Address this year.

Postdoc **Hiromi Konishi** has studied modern dolomite, synthetic disordered dolomite, and dolomite in carbonaceous meteorite in order to understand roles of organics in dolomite crystallization at low temperature. Postdoc **Hun-Bok Jung** joined the research group in fall, and has investigated uranium behavior in U-polluted sediments, and effect of nanopores on U(VI) reduction.

I continue studying size-dependent stability of nano-phases as function of temperature and pressure. We have published an environment-sensitive phase diagram for gold nano-crystals. I also study early earth environments based on minerals and microstructures in banded iron formations (BIF). Our new results show that BIFs are related to a very old rock called komatiite. The lithosphere affects the hydrosphere, the hydrosphere affects the atmosphere, and all those eventually affect the biosphere on the early Earth. ●

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## Mary Anderson Retires

On May 8, 2009, the last day of classes, Mary P. Anderson retired after 34 years at UW-Madison. Mary was honored at GSA in October and at the department banquet in April where she was toasted and roasted by friends and former students (photo, right). Mary discusses retirement and future plans under Emeritus Faculty News, below. The following is a brief account of her career at UW.

Mary joined the department in 1975. Her field of expertise is hydrogeology with emphasis on numerical simulation of groundwater flow. Research interests include groundwater/lake systems, recharge processes, geological heterogeneity, and heat as a groundwater tracer. Other interests include the history of hydrology and groundwater ethics. Mary co-authored two textbooks on groundwater modeling and over 100 technical publications. She is the editor of the recently (2008) published book *Benchmark Papers: Groundwater*. She was the major advisor for 18 PhD and 33 MS students and taught courses in environmental geology and hydrogeology, including numerical modeling. Mary served on the Physical Sciences Divisional Committee and the University Committee; chaired the Academic Program of the Nelson Institute for Environmental Studies (1992-1995) and served as chair of the Department



**Current and former hydros surprised Mary (center, front) at the spring banquet. Standing: Tom Johnson, Andy Leaf, Bob Nauta, Jean Bahr, Ken Bradbury, Charlie Andrews, Marjory Rinaldo-Lee, Chunmiao Zheng, and Bill Woessner. Seated: Scott Johnson, Kallina Dunkle, Mary Anderson, Barb Bickford, and Meg Dickoff. Not pictured: Carol McCartney.**

of Geology and Geophysics (1999-2002). Nationally, she served on the Board of Directors of the Technical Division of the National Ground Water Association (1980-82), as president of the Hydrology Section of the American Geophysical Union (1996-1998), as a member of the Council of the Geological Society of America (2000-2002), and on numerous national committees. Currently she is Editor-in-Chief of the international journal *Ground Water* (2002-2010). Mary is a recipient of four major professional awards (the M.K. Hubbert Award from the

National Ground Water Association, 1992; the O.E. Meinzer Award from GSA, 1998; the C.V. Theis Award from the American Institute of Hydrology, 2000; the Langbein Lecturer of AGU, 2007). She also received an alumni award from the University at Buffalo (1993), and the Kellett Mid-Career Award from UW-Madison (1995). In 1999, she was elected to Fellowship in both AGU and GSA. In 2006, she was elected to membership in the National Academy of Engineering. As of 1 July 2007 she is the C.S. Slichter Professor at UW-Madison. ●