

Faculty News 2008



Geology 929 Seminar (Benchmark Papers in Hydrogeology), fall 2008: Andy Leaf, Scott Johnson, Eric Booth, Mary Anderson, Ron Breitmeyer, Cassidy Miller, Kallina Dunkle, and Meg Dickoff. (Fumi Sugita)

MARY ANDERSON

The year 2008 was a bumper crop for hydro students with four of my MS students and one PhD student completing the degree. **Jonathon Carter** finished the MS (co-advised by **Madeline Gotkowitz**, WGNHS) in early summer and is working for Barr Engineering in Minneapolis. **Chris Muffels** (MS co-advised by **Randy Hunt**, USGS) finished later in the summer and returned to S.S. Papadopoulos in Maryland. **Kallina Dunkle** (MS co-advised by **Dave Mickelson**) finished in early fall and is staying on for the PhD. **Seann McClure** (MS co-advised by **Randy Hunt**) finished late in the fall semester and took a job with a consulting firm in Seattle. Finally, **Chris Lowry** finished the PhD (co-advised by **Randy Hunt**). He is currently working as a post-doc under Professor **Steve Loheide** in Civil and Environmental Engineering at UW-Madison.

In July, through the good graces of **Ken Bradbury** (WGNHS), I was invited to participate in a very interesting workshop with Chinese researchers held in Door County, Wisconsin. In the fall, I finished editing the IAHS volume *Benchmark Papers in Groundwater*, which was published at the end of the year (<http://www.cig.ensmp.fr/~iahs/benchmark.htm>). Students in the fall 2008 hydro seminar read some of these benchmark papers. I continue to enjoy being editor-in-chief of the journal *Ground Water* and will stay with the editorship until December 2010. That continuing "job" will ease my transition into retirement from UW, effective July 1, 2009. I will continue advising two graduate students until they finish: **Scott Johnson**, who joined us in fall 2008 for the MS, and **Kallina Dunkle**, who is beginning the PhD. Scott's research project (co-advised with **Ken Bradbury**) is in Door County and we've already taken one field trip to view the site. After retirement, I also plan to start saying "yes" to national committee work that involves

travel to interesting places. All that together with several home projects that have been on hold for years will keep me busy.

JEAN BAHR

Spring semester of the past year was busy, but much less stressful than the previous fall with new Department Manager **Michelle Szabo** shouldering an increasing share of administrative duties. That allowed some time for field work installing multilevels with **Cassidy Miller** for his thesis research on nitrate and iron cycling in a riparian wetland and testing a new distributed temperature sensing cable system to monitor an aquifer storage recovery well with grad students **Andy Leaf** and **Meg Dickoff**. **Drew Gower** returned from his field work in Burkina Faso with an intriguing set of isotopic and geochemical data that are shedding light on the impacts of seasonal impoundments on groundwater flow and water quality. In April, Professor **Fumi Sugita** from Chiba University of Commerce in Japan joined us to spend her sabbatical working on data she previously collected on nitrate transport and initiating new studies of groundwater chemistry variations in springs. A highlight of the spring semester was the joint hydro-structure field trip to New Mexico (see page 13).

July was the month of transitions as I handed over the department reins to **Cliff Thurber** and at the same time assumed new duties as GSA Vice-President. The GSA position led to several trips to the headquarters in Boulder CO, as well as trips to DC to discuss the importance of geoscience research and education with congressional and Federal agency staff as they prepared for the new administration. It is encouraging to see that the stimulus package that has been proposed includes significant funding to support NSF, the USGS, and a number of other agencies that deal with energy and Earth systems.

While I don't miss the day to day headaches of

the Department Chair's office, I feel fortunate to have had the opportunity to interact more closely with our Board of Visitors and with alumni from a variety of areas and generations over the past three years. I hope to be able to continue to visit with alumni and other friends of the department during future meeting and field trip travels.

PHIL BROWN

2008 was a good year for me both professionally and for my family. In May **Jason Huberty** and I attended a fluid inclusion meeting at the USGS in Reston (where Jason presented his senior thesis work) and then I continued on to Park City to run Field Camp for two weeks before heading to southern Africa for four weeks. I attended a field workshop in South Africa on high-grade iron ore deposits and presented an invited paper on the history of iron ores from the Lake Superior district. I am beginning a research project (with **Steffen Hageman**, University of Western Australia) in northern Minnesota and Michigan applying the ideas that have been developed in the currently mined high-grade iron ore deposits of Brazil, Australia and South Africa to this historic district. Throughout 2008 **Matt Riederer** worked for Teck-Cominco in northern Minnesota drilling and defining a Cu-Ni-PGE property. **John Marma** continues to be successful working for Newmont at the Midas underground gold mine in north central Nevada where we spent three days with all 50 of our Field Camp students in June—a real economic shot in the arm for the two saloons in the metropolis of Midas, Nevada, population <20. **Phil Gopon** has begun as a MS student (after an unexpected year hiatus spent in Iraq) and will be working on a gold-silver prospect in Nevada.

After the meeting in South Africa, my wife Kris and I spent ten days on safari in Namibia—a spectacular, sparsely populated country that I would recommend to anyone. Our safari in Namibia was a celebratory gift to ourselves as we paid our last month of college tuition in May; three children, 12 years! Jason continues to live in Madison and work for Epic. Peter and his girlfriend both survived two years of Teach for America in Washington D.C. (a true life changing experience) and have jobs in Columbus, Ohio which is great as long as he doesn't become a Buckeye! Karin the geo-major graduated from Carleton in June and is following her dream of continuing to be involved with swimming as the assistant coach at Amherst—a tremendous program and opportunity. 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 2009 which will see me on sabbatical next year; hopefully there will still be some open mines to visit around the world!

ANDERS CARLSON

This year, the Quaternary research group doubled in size with the arrival of **Dave Ullman** (MS AOS UW-Madison) and **Kelsey Winsor** (BA Smith College). Dave will be working on the onset and termination of Laurentide Ice Sheet retreat for his PhD and Kelsey is looking at the deglacial history of the Greenland Ice Sheet.

Libby Obbink and **Lisa Colville** continued their MS work. Libby has reconstructed a very interesting record of Laurentide Ice Sheet runoff to the North Atlantic linking increases in freshwater discharge to fluctuations in ocean circulation and climate. Lisa is close to estimating the extent of the Greenland Ice Sheet during the previous interglacial when this ice sheet was significantly smaller than it is today. Both Lisa and Libby presented their results at AGU in San Francisco. I published six papers during the year. One on the history of the Greenland Ice Sheet received press from the Discovery Channel. Another in *Nature Geoscience* on the Holocene Laurentide Ice Sheet retreat was covered in newspapers, websites and radio around the world. Lisa, Libby and I conducted fieldwork this past summer in Greenland. It was my first time on the island and it was quite an experience. Endless days, very high winds and ten-dollar tomatoes. For Libby's birthday, she walked on the Greenland Ice Sheet and enjoyed a delicious dinner of reindeer stir fry. Overall, it was a good year and I would like to thank the continued support the department receives from the alumni.

CHUCK DEMETS

The graduation of all three of my graduate students **Daniel Alvarado**, **Francisco Correa-Mora**, and **Manuel Rodriguez** was the highlight of my past year. The quality of their research is aptly demonstrated by the fact that all of their research has been published in leading geophysical journals or is under review and will be published in 2009. It was my pleasure as their advisor to see each of them mature greatly during the arduous process of preparing their research for their MS and PhD defenses and for publication. Daniel and Francisco are now toasting down in Houston, where they are seeking oil for Chevron. Manuel returned to a faculty



Lee Powell, walking in the Mid-Atlantic rift, Iceland.
(Kurt Feigl)

position at UNAH in his home country of Honduras and is surely the foremost expert in his country on GPS geodesy, tectonics, and earthquake hazard. It was my pleasure to have advised each of them and will always look fondly back on 2008.

The other professional highlight of my year was the near completion of my decade-long effort to construct a new model for present-day global plate motions. The model quantifies the motions of 25 tectonic plates and is based on my compilation and analysis of original marine geophysical, seismic, and geodetic measurements made during the past four decades by geoscientists from ten countries. The 250-page long description of the new model should be submitted for review in early 2009 and will hopefully be published next year, too.

Over the past year, I also launched several new projects that set the stage for some of my research during the next few years. In particular, I started new collaborations with a group from Michigan Tech and a Spanish group from Barcelona on tectonic and volcanic deformation in El Salvador using differential GPS techniques. I also began collaborations with a French group and a faculty member at Penn State toward a first-ever regional-scale, GPS-based model for active crustal deformation of Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.

KURT FEIGL

This year, my group made progress studying active deformation in Iceland. On the observation side, **Brett Carr** completed his MS using satellite radar interferometry to measure rifting across the mid-Atlantic ridge where it comes ashore in northern Iceland. This work led to an NSF grant with **Tim Masterlark**, (UW PhD 2000). On the modeling side, **Anosua "Chini" Mukhopadhyay** joined our group to apply the finite element method approach advanced by Tim during his PhD thesis with **Herb Wang** (*Ed. note: Chini's father, Biswajit Mukhopadhyay, was a post-doc in our department some years ago and worked with John Valley in Long Valley caldera*).

In October, Chini, Herb and I joined **Lee Powell** in Iceland for his last field trip before retiring at the end of the year (see page 17). Lee is a fine instrumentalist. Watching him install delicate seismometers in "interesting meteorological conditions" is like watching a virtuoso playing scales. Although he has done so thousands of times before, the outcome is still perfect. And he keeps smiling! When the Icelandic currency collapsed and

imported goods became scarce, Lee still managed to find PVC conduit in Reykjavik's version of Menard's. On time and on budget, of course.

Lee may continue to help out part time in Weeks Hall to develop an algorithm called General Inversion of Phase Technique (GIPhT) that **Cliff Thurber** and I invented over lunch one day in 2007. Now that it is patented (by WARF), we don't have to keep this idea "under wraps" (or resist the temptation to pun), any longer.

JOHN FERNELLE

During 2008 I helped organize the Microbeam Analysis Society's successful EBSD (electron backscatter diffraction) conference in Weeks Hall in April. Over 100 geological and material scientists from the North America, Africa and Europe attended. My term as a director of the MAS ended and I became the society's archivist. Two major trips occurred: 25th anniversary with wife Judi Munaker was celebrated with a three-week train excursion through Europe, starting with Barcelona (warm end of February) and ending with snow in Amsterdam in mid March. Researching the Fournelle genealogy (meeting many cousins) was a high point. In June daughter Marta and I visited Colombia, for a reunion with my junior high school friends from 47 years before, and Marta returned to her birth country for the first time.



John Fournelle in Fornells de la Selva near Girona, Spain. Several Spanish towns named “Fornells” go back at least to the 10th century.

DANA GEARY

2008 began as did each of the past few: with intense preparations for UW-Madison’s Darwin Day. With **Brooke Norsted** of the Geology Museum, I organize this outreach event every year. A huge effort from many undergrad and graduate paleo students plus others from all across campus helps to make this a success.

In June, several paleo students (graduate and undergraduate) took a wonderful field trip to New York State (see page 14). We visited some truly historic quarries, collected a lot of nice Paleozoic fossils, got to see the fabulous Paleontological Research Institute in Ithaca, and generally had a great time.

July activities with Sarah and Molly (now in 9th and 7th grades) included a couple of fabulous backpacking trips in Colorado, as well as a visit with family in California.

Matt Kuchta moved from Duluth to Menomonie, where he is finishing up his PhD on Pleistocene land snails from the driftless area of Wisconsin. Matt has discovered a wealth of previously unknown gastropod fossils that make extremely useful paleoenvironmental indicators. **MaryRuth Kotelnicki** completed her MS thesis on trilobite trace fossils. MaryRuth is staying in Madison for her PhD and will continue to investigate her beloved trilobites. **Erik Hoffmann** continues to plug away on his PhD project, using stable isotopes to study the interaction of life history and environment in zebra mussels and their ancestors. Erik had an incredibly tumultuous year health-wise, but seems to be back on his feet now. The fact that his Pittsburgh Steelers won the Superbowl will certainly help him usher in a new year. We were all very pleased to welcome **Dave Lovelace** and **Erin Fenlon** this fall as new paleo grad students.

LAUREL GOODWIN

Never a dull moment. That’s what I was thinking—or at least the part of what I was thinking that I can print—when Casper, Wyoming airport security refused to let new MS student **John Schneider** (co-supervised with **Harold Tobin**) board the plane with a bag full of sandstone. In Mr. Security’s mind, those variably cemented samples we had carefully selected from the Cretaceous Mesaverde Formation looked like weapons, so they weren’t going on, and since they didn’t check us through security until they had closed the belly of the plane, neither was John. (The story has a happy ending—John and the samples returned intact a day late). Meanwhile, back in Madison, PhD

student **Jennie Cook** and MS student **Melodie French** had visited numerous local outcrops of St. Peter sandstone, returning with great quantities of massive samples in what Melodie termed a “St. Peter domestication project.” They also cataloged small reverse faults in many of these outcrops, which Jennie is now studying further.

So what are we doing with all this sandstone? Jennie, Melodie, John, Harold, and I are engaged in a variety of efforts, along with U Mass collaborator David Boutt, to quantify the mechanical and hydrologic effects of variable cement content in sandstone. We are relating these variations to processes of hydraulic fracturing and fault-zone development. We also visited faults in sediment when **Jean Bahr** and I hauled a bunch of graduate students off to New Mexico to consider the structure and hydrology of the Rio Grande rift (a description on page 13). And new PhD student **Erin Stoesz** arrived in fall, 2008 to work with me and Harold Tobin on length scales of deformation and velocity signatures of fault zone structures. Our research efforts are not confined to the upper crust, however. **Basil Tikoff** and I continue to co-supervise students focused on mid- to lower crustal deformation. PhD student **Chloë Bonamici** and I braved the worst drought I’ve ever seen in central Australia to make progress in our effort to better understand the mechanical behavior of deep crustal granulites. Chloë, a gifted field geologist, is working on the anatomy of a kilometer-scale sheath fold. Basil launched **JoAnn Gage** on her PhD work in the Inyo Mountains of California. JoAnn is working to quantify rheologic variations in the wall rocks of the Papoose Flat pluton. She came home with spectacular samples of mineralogically zoned boudins. **Evan Earnest-Heckler**, who arrived in January 2008 to start an MS, traveled to Mt. Isa, Australia, where he did

research with the support network of the James Cook University field camp, led by collaborator **Tom Blenkinsop**. Tom subsequently joined us in Madison for a sabbatical leave in fall 2008. Other sabbatical visitors to the structure group also arrived in fall 2008: **Steve Wojtal** came from Oberlin for a single semester, but **Jim Evans** and **Susanne Janecke** are here from Utah State University for the entire 2008-2009 academic year. And UCLA emeritus professor **Gerhard Oertel** continues to grace us with his presence with weekly visits.

Needless to say, things have been hopping in the Structure Wing. It has been a lot of fun to cram Basil’s, Harold’s, and my students into a room with whatever visiting faculty are around to discuss everything from fundamental structural concepts to any one of the range of aspects and scales of crustal deformation we are collectively addressing. Tom, Steve, Jim, Susanne, and Gerhard have broadened our horizons, and given our current group of students a wider view of the world of structure and tectonics.

SHANAN PETERS

The 2007-2008 academic year was my first in this department, and I’m pleased to report that things are off to a great start. I continue to make progress in quantifying the rock record of North America (yes, all of it!) for the purpose of testing hypotheses about evolution, climate, and tectonics. NSF, PRF and the USGS are supporting this work and I’m feverishly trying to complete an interactive web application that will allow you to explore rocks and fossils in a Google Earth/Maps interface. Other macrostratigraphy projects are also rolling along. Undergraduate major **Neal Auchter** has been tackling the Late Cretaceous-Pleistocene record of New Zealand while **Clay Kelly** and I have taken on the Atlantic basin. Adjunct Assistant Professor **Patrick McLaughlin** at the state survey and UW-Madison graduate **Norlene Emerson** and I have also been working to build tools for compiling geological data on a large scale, both for research and teaching purposes. It’s hard not to be excited by the convergence of all of these efforts in macrostratigraphy.

Of course I continue to stay active in the field, and the Eocene sequence stratigraphy of Wadi Al-Hitan in Egypt has become the focus of my recent work. This past November, I took **Eric Williams** with me on a return trip to measure sections and expand geographic coverage. Despite very disappointing performance from a brand-new Magellan GPS mobile mapping device, we were able to get some great new data that will (we hope!) provide an unprecedented look at sequence architecture in a wave pro-

tected shelf embayment and that will also help to constrain the frequency and amplitude of sea level changes during the buildup of the Antarctic ice sheet.

My new graduate student, **Dave Lovelace**, is also making sure that I keep at least one foot in the field by tackling an ambitious field project in the Chugwater Group of Wyoming. His aim is to provide a modern sedimentologic and stratigraphic understanding of the oft-neglected Chugwater and to incorporate that understanding into a regional quantitative analysis of Triassic sedimentation in western North America. It'll be interesting to see what he makes of all that.

Outside of the department, I'm definitely starting to feel like Madison is my home, though I still have a lot to learn about the city and its surrounding countryside. A canoe will help with some of that.

ERIC RODEN

A major highlight of 2008 was **George Tangalos's** MS on microbial iron oxide metabolism and iron isotope fractionation in chemically

precipitated sediments that we believe are analogs to the earliest stages of Banded Iron Formation genesis in Archean and Neoproterozoic marine environments. George's results provide a direct demonstration of how microbial activity could have generated large quantities of mobile, isotopically-light iron in ancient BIFs, and support the idea that microbial iron oxide

reduction played a major role in biogeochemical cycling on the early Earth. Another key discovery this year (led by postdocs **Marco Blöthe** and **Evgenya Shelobolina**) was the recovery in pure culture of a chemolithoautotrophic iron-oxidizing bacterium from acidic, iron rich groundwater and sediment in Lake Tyrell, Australia. This was significant because the organism recovered in culture corresponds directly to an organism which we know from high-throughput ribosomal RNA gene sequencing (collaboration with molecular biologists at Woods Hole Marine Biological laboratory) is a dominant component of the microbial community in Lake Tyrell sediments. We are collaborating with **Jill Banfield** at UC Berkeley and Jochen Brocks at the Australian National University to determine whether cell membrane lipids from this

organism are preserved (i.e. as "molecular fossils") in iron oxide concretions which are abundant in the lake sediment. If so, we will have obtained what is arguably one of the best demonstrations to date of how iron-bearing minerals can serve as long-term repositories for the organic record of microbial life, which has important implications toward the potential for recovery of signatures of past life in iron-rich rocks on Mars. Other research led by Evgenya revealed a new and important twist in the low-temperature geochemical cycle of iron, namely the capacity for neutral-pH

chemolithotrophic bacteria to oxidize reduced iron in phyllosilicates such as smectite and biotite. The potential for microbially-catalyzed biotite oxidation has major implications for the kinetics of weathering of this important primary mineral phase, which supplies much of the reactive iron to sedimentary environments. Although it has been known for a long time that microorganisms can promote weathering of biotite and other iron-bearing primary minerals through production of carbon dioxide and organic ligands that help to dissolve the mineral surface once it has been oxidized, our results are the first to suggest that microorganisms can promote weathering by vastly accelerating the initial (oxidation) step in the process. In addition, these findings provide one of only very few examples of how microorganisms can conserve energy for cell growth from the oxidation of ferrous iron in highly-insoluble primary minerals, a process which has long been suggested as a basis for microbial life in basalt-rich rocks on Earth as well as Mars. Evgenya has developed a novel enumeration/isolation technique that has demonstrated the presence of biotite-oxidizing microorganisms in a variety of soil and sediment samples, and we plan to utilize this technique to look for such organisms in more exotic locales (e.g. hydrothermal vents in Iceland) that could serve as more direct analogs for possible life-supporting environments on Mars. All of the above results are illustrative of how the geomicrobiology group employs a combination of field and laboratory work to elucidate the contribution of microbes to geochemical cycling in modern and ancient environments.



Eric Williams inspects a sequence boundary in Wadi Al-Hitan Egypt that record a 45+ m fall in eustatic sea level. **Shanan Peters** and **Eric** traveled to Egypt in November to resume work on sequence stratigraphy. (*Shanan Peters*)



While on a field trip to sample the acidic, hypersaline, Fe-rich sediments in Lake Tyrell (Victoria, Australia), **Eric Roden** (front) and **Evgenya Shelobolina** excavate a massive iron concretion from the lake bed.



View north from rim of the Collapse caldera on Fogo, Cape Verde. The caldera wall (left) exposes 1000 m of Pleistocene lava flows and dikes. The active Fogo stratovolcano (right) rises to 2829 masl and is among the steepest volcanoes in the world. The last eruption in 1995 produced the dark basaltic lava flow in the middle of the caldera floor, which nearly destroyed the island's nascent vineyards and wine industry. (Brad Singer)

NITA SAHAI

The best part of 2008 has been the degree of interaction among the students, post-doctoral scientists and faculty of NASA Astrobiology Institute (NAI) lead by PI **Clark Johnson** and co-PIs including **Brian Beard**, **Eric Roden**, **John Valley**, **Huifang Xu** and myself. We have even enthused other members of our department, not directly involved in NAI to participate in our activities, including seminars and field trips on the biogeochemistry of early earth history. These topics have included the preservation and identification of biosignatures in the rock record on Mars and on Earth in the early co-evolution of the atmosphere, hydrosphere, geosphere and biosphere.

The past year was also great for getting grants funded after a long drought and we had a publication in the prestigious journal, *Science*, on the role of nanoparticulate minerals and naturally-occurring inorganic solid phases in biogeochemical interactions and processes. My graduate students (**Tim Oleson**, **Nianli Zhang**, **Jie Xu**) and post-doctoral associate (**Donald Mkhonto**) continue to work hard and I am impressed by their ability to work independently and to take ownership of their research projects. Tim had his first paper published in the prestigious journal, *Langmuir*. The study was on membrane phospholipid-oxide mineral surface interactions. We have found that oxide surface chemistry affects phospholipid vesicle adsorption and bilayer self-assembly even at several nanometers from the surface. These studies have implications for cell membrane stability during early stages of evolution of life, and biomineralization, biomedical, and industrial implications. Nianli and Jie are pioneering studies probing the effects of silicate and oxide mineral structure-surface chemistry, respectively, on the viability of human stem cells that differentiate into bone-forming cells and on the viability of bacteria. After two years of very careful molecular modeling studies, Dr. Mkhonto has uncovered unprecedented detail on the role of organic acids and amino-acids in affecting crystal growth/dissolution of calcite, with potential implications for a wide

range of biogeochemical and biomedical applications. Also, continuing in our lab's tradition of always having at least one undergraduate researcher in our group, we are also lucky to have working with us, Senior **Tony Giuffre**, who is double-majoring in chemistry and geology.

Meanwhile, I continue to enjoy teaching at the 100-, 300- and 700- levels, and serve on the Departmental Council, Graduate Studies Committee, Undergraduate Curriculum Committee, and am Chairing the Computer Committee. Internationally, I serve as Associate Editor for *American Mineralogist*, the journal of the Mineralogical Society of America (MSA), serve on MSA short-course selection committee, and am an Organizer and Chair of two sessions in the Human Health and Geology Thematic Session at the Goldschmidt Conference to be held in Davos in 2009, planning for which started in early 2008. A final thought, in closing, is to realize how lucky we are to be able to pursue professionally what truly excites and engages us on so many levels.

BRAD SINGER

The publication of 15 peer-reviewed papers in 2008 make it the most productive year yet for my research group. Rare Gas Geochronology Lab manager **Brian Jicha** and I learned in January that the NSF would support 75% of the cost of a next generation, five-collector, mass spectrometer and CO₂ laser for argon geochronology. Importantly, the balance of support came from a mix of Departmental gift funds and an award of Graduate School WARF funds. The sensitivity of this new instrument, coupled with its multi-collection capability, will enable us to determine ages of very young volcanic rocks at a much greater pace than is possible with our current single-collector spectrometer. The year's highlight was giving an invited talk in June to a group of about 100 international geophysicists at the Institute for Rock Magnetism conference in Cargese, Corsica on the Shallow-Core magnetic field (SCOR) hypothesis. The SCOR model—a result of collaboration between myself

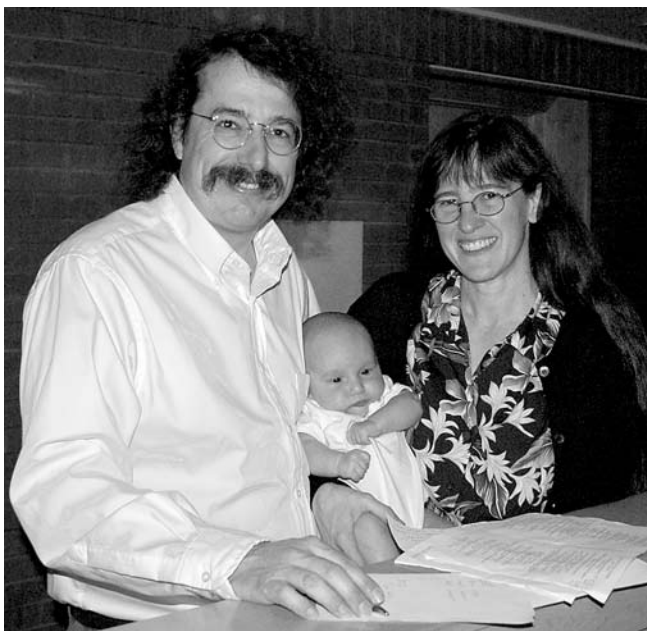
UW-Madison senior research scientist

Ken Hoffman—was published in *Science* in September, leading to several interviews and widespread internet news media coverage (see cover story on page 24). I traveled from Corsica directly to the Cape Verde islands of Santo Antao and Fogo for a month long field campaign aimed at sampling records of geomagnetic field excursions captured in extensive lava flow sections exposed on these very dry hotspot volcanoes. Indeed, the km-high collapse caldera and recent growth of the active stratovolcano on Fogo are among the most impressive volcanic features on Earth (see photo). Cape Verde was followed by a road trip across the Rockies with my wife Teri and daughter Zoe to collect a few Cretaceous ash fall deposits for a new time scale initiative in my lab that involves senior honors student **Sarah Siewert**, to present a talk at the Goldschmidt conference in Vancouver, British Columbia, and to take in parts of Glacier, Olympic, and Yellowstone National Parks. A pretty good way to spend the summer! I also managed to get in enough tennis instruction with Zoe in August that she was able to make the JV team at Kettle Moraine high school as a freshman. Next year I am sure that she will be whipping me on the courts.

CLIFFORD THURBER

For the most part, 2008 was a wonderful year for my research group. A major highlight was the successful installation of a seismic array surrounding Katmai Pass and Trident Volcano in Katmai National Park, Alaska. **Lee Powell** worked with AVO staff members Stephanie Prejean and John Paskievitch to do the installation under extremely challenging conditions. The instruments will be retrieved in summer 2009 and should provide a fabulous dataset for new grad students **Rachel Murphy** and **Summer Ohlendorf** to study. Katmai has been much more active seismically than normal these past few months, hinting at a possible reawakening. Meanwhile, grad students **Jeremy Pesicek** and **Ninfa Bennington** are working hard on their PhD theses on Sumatra and the San Andreas fault, respectively, and **Alex Teel** is completing his M.S thesis on aftershocks of great megathrust earthquakes. Undergrad **Laura Sumiejski** had a very successful summer doing research on earthquakes leading up to the January 2006 eruption of Augustine volcano. Her work will be published in *Geophysical Journal International* early in 2009.

Post-doc **Guoqing Lin** completed her work analyzing double seismic zones and the 3D seismic structure of all of California, and has now moved on to start a faculty position at Miami University. New post-doc **Ellen Syracuse** joined the group in the fall and will be working on the



Basil Tikoff, Oliver Hotchkiss Tikoff, and Sara Hotchkiss at the 2008 Spring Awards Banquet in April. (Neal Lord)

3D seismic velocity and attenuation structure of the Alaskan subduction zone and will take part in our continuing Alaskan volcano research.

As for me, I finally completed a major study of the 3D seismic structure of northern California, unveiling some surprising features deep beneath the surface, and had the thrill of getting a patent with **Kurt Feigl** approved on a new method of InSAR data analysis. The second half of the year was dominated by learning the ropes of being department chair and writing a decadal department self-study. I won't claim to be enjoying my new role, but it's an important job at a very challenging time, and I will do my best to keep the department moving forward.

The year came to a bittersweet end with the retirement of **Lee Powell**. Lee has worked tirelessly for decades developing instrumentation, deploying instruments in the field, and keeping virtually anything and everything in Weeks Hall functioning. His wizardry will be sorely missed.

BASIL TIKOFF

So, 2008 started off great with the birth of Oliver Hotchkiss Tikoff on January 2. I have learned an enormous amount about my own limitations (it is amazing how stupid you can be when you are seriously sleep deprived), how great some of my faculty colleagues are (an especially big thank you to **Laurel Goodwin** and **Phil Brown**), and just how much fun it is to have an ankle biter around.

Otherwise, all is going well in the structural geology lab. We were joined in 2008 by **Evan Earnest Heckler**, who is doing a masters project in the Mt. Isa region in Australia. Evan is doing good work on an interesting project, and

is generally great to have around. Otherwise, the rest of the students are plugging along: **Paul Riley** is still working on fracture systems in the Sierra Nevada and is now a dissertator; **Bryn Benford** is working on the neotectonics of Jamaica (co-advised by **Chuck DeMets**); **JoAnn Gage** has successfully passed the Tikoff-school-of-four-wheel-driving (including how to fix a flat tire on a very steep incline with a very sharp drop-off) and is crafting a very nice project on the Papoose Flat pluton aureole in the Inyo Mountains, California; **Chloe Bonamici** has become one with the large sheath fold

that is Mt. Hay in central Australia. I would like to thank all of them for their understanding for the past year, when perhaps I've been a bit behind on getting things to them. **Sander Hunter** and **Laura Young** both finished senior projects in the Henry Mountains (UT) and Twin Sisters Mountains (WA), respectively.

The fall 2008 semester was particularly busy, with multiple semester-long structural geology visitors. These included **Tom Blenkinsop** (James Cook University), **Jim Evans** (Utah State University), **Susanne Janecke** (Utah State University), and **Steve Wojtal** (Oberlin College). Susanne and Jim are around for the ongoing spring semester 2009 semester as well. These geologists contributed to making a very vibrant intellectual atmosphere around Weeks Hall; it is great to have them all visiting.

I am looking forward to 2009 but I will also miss all the great things about 2008.

JOHN VALLEY

This has been a wonderful year with many fun discoveries. The NASA Astrobiology Institute is now going full swing. In April many of us gave talks at the Astrobiology Science Conference in San Jose. Immediately afterwards, I presented a second talk at the Mars Sample Return workshop in Albuquerque. In May, we ran a fieldtrip to examine banded iron formations of the Lake Superior region (see article by **Jason Huberty**, page 14). The trip fit well with SIMS studies by Jason and **Philipp Heck** of BIFs from Australia, S. Africa and Greenland and follows **Beth Valaas Hyslop's** (MS 2004) paper on O and Fe isotopes in the metamorphosed Biwabik BIF. In another

NAI project, **Taka Ushikubo**, **Noriko Kita**, **Aaron Cavoie** (PhD 2005), and I published the first study of Li isotopes in zircons, showing that 4.3 to 4.0 Ga zircons are highly enriched in [Li] and fractionated in $\delta^7\text{Li}$, suggesting that Earth's earliest crust was intensely weathered by a CO_2 -rich atmosphere. **Dayi Ortiz** and **Craig Grimes** are also studying zircons with interest in igneous petrology and Early Earth. It was an active year for the Wisc-SIMS lab. In June, with assistance from **Jim Kern**, Noriko and I hosted 75 scientists to the 5th international Geo-SIMS Workshop at UW: live music in the Weeks Hall Courtyard at night and two days of excellent talks. In the fall, Tomoki Nakamura, Noriko, Taka, and I reported oxygen isotope analyses in *Science* for samples returned by the NASA Stardust Mission from Comet Wild2. The crystals are smaller than had ever been analyzed before and we needed to use an electron microscope after analysis to see if we hit our targets. The analyses were perfect and to our surprise showed that samples formed near the Sun and were ejected past Pluto to the Kuiper belt, in contrast with earlier theories about the formation of the Solar System. We are also developing a new program in paleoclimate proxies. **Reinhard Kozdon** has succeeded to analyze zoning of $\delta^{18}\text{O}$ within single forams, which provides a new insight to interpret the most important marine proxy for climate change. **Ian Orland** (MS 2008) published his study of seasonality from stalagmites in Soreq cave, Israel, which shows the first sub-annual data from before the instrumental record and suggests that rainfall in the eastern Mediterranean dropped from 100 cm to 50 cm per year between ca. 100 AD and 700 AD. Ian does not claim that climate change caused the fall of the Roman Empire, but we find the correlation interesting and worthy of further investigation. On the home front, Andrée and I went to Pasadena in November for the wedding of David Valley and Vivian Ferry, who met in freshman chemistry lab at the University of Chicago and now are both graduate students in Chemistry/ Materials Science.

HERB WANG

I am writing this year's note from the Earthquake Research Institute at the University of Tokyo. I completed ten years as associate dean in the college and am on a year's research leave. Before heading out on research trips, Rosemary and I spent a month from mid-June to mid-July in New Orleans where I continue to serve as faculty advisor to a multidisciplinary group of graduate students studying the feasibility of restoring a former cypress forest just north of the Lower Ninth Ward (for details see **Maitri Venkat-Ramani's** 2007 *Outcrop* article).

My interest in fiber-optic and tiltmeter techniques for measuring ground motions at the former Homestake Mine in Lead SD led me to visit fiber-optic companies in Switzerland in September as well as underground rock laboratories at Mont Terri and Grimsel.

In October I visited the Reykjanes Peninsula with **Kurt Feigl, Lee Powell, and Anosua (Chini) Mukhopadhyay** as part of Kurt's project on earthquake triggering associated with a magnitude 6.6 event on June 17, 2000. We arrived in Iceland the day their banking system collapsed, which was the economic equivalent of a triggered failure event.

In November I went to Berlin as a reviewer for the DFG's Intercontinental Continental Drilling Program (ICDP) panel and I also visited the ICDP office in Potsdam to inquire about proposing the Homestake site as an ICDP project.

December brought the AGU and a month in Palo Alto with our daughter and her family. It was nice catching up with **Jon Nyquist**, whom I have not seen in many years, at the geophysics alumni event. December also included a day trip to Irvine to give a briefing on the Homestake project to the National Research Council's Committee on Geological and Geotechnical Engineering (COGGE) on which alum **Tom Doe** serves.

With the New Year Rosemary and I left for Tokyo, where we are living right next to Yushima Shrine and three blocks from Ueno Park. It is about a 30-minute walk to ERI, which is on the northwest corner of campus. Google maps pro-

vide quite an excellent image. My hosts are Tokunaga-san (Tomo), who spent a year as a post-doc in my lab about 12 years ago, and Sano-san (Osam). We want to try out fiber-optic monitoring at an underground facility in Japan and so we visited ERI's Aburat-subo research station where they have monitored strain for over fifty years. It is on the tip of the Miura Peninsula, about 60-kilometers south of Tokyo near the epicenter of the Great Kanto earthquake of 1923. Rosemary was the one to first feel a magnitude 5.8 earthquake when we were in our apartment on the morning of February 1, 2009.

HUIFANG XU

We have ordered a Rigaku Rapid (II) XRD system (funded by NSF). The new XRD system with 2-D image plate detector will be capable of texture analyses, powder crystals, single crystal, and spatially resolved micro-diffraction. It will be installed in the **S.W. Bailey** X-ray Diffraction Laboratory in early summer.

Graduate student **Kuang-Sheng Hong** has worked on splitting (decomposing) water by using piezoelectric crystals and fibers, a newly discovered *Piezoelectrochemical* effect. His new discovery can be applied for scavenging waste mechanical energy to generate hydrogen. Graduate student **Fangfu Zhang** (co-advised by **Eric Roden**) has been working on roles of dissolved sulfide and other low dielectric organic solvents on formation high magnesian calcite and disordered dolomite. Fangfu has discovered a mechanism to break the strong bond between Mg^{2+} and its bonded water dipoles. Graduate student **Tina Hill** has been studying nano-phases of native copper associated with Fe-bearing enstatite and proto-enstatite in the Oregon sunstones using atomic resolution TEM. Her discovery has important implications in understanding its host rock and developing colored / transparent materials that are extremely resistant to thermal shock. New graduate student **Jason Huberty** (co-advised by **John Valley**) has been working on micro-structures and isotopes in magnetite from Hamersley basin of Western Australia. Visiting graduate students **Mei Zhang** and **Yubing Sun** joined my research group last summer. Mei has been working on natural carbon nanotubes associated with pyrite framboids that are closely related to modern deep sea methane seeps. Mei's discovery has potential implications in recognizing a new biosignature and exploring hydrocarbon gas reservoirs. Yubing has been working on roles



At GSA 2008 in Houston: UW-Madison's Huifang Xu and NC State's Mike Vepraskas. (Mary Diman)

of oxide-based nano-porous environment in geochemical reactions, especially on uranium (VI) sorption / desorption in polluted groundwater aquifer environments, a challenging problem that our nation faces today. High school senior, **Gabriela Farfan** has been selected as a finalist of 2009 Intel Science Talent Search. She will present her research results that were done in my lab at the talk in Washington D.C. (*Ed. note: As we go to press, we have learned that Gabriela placed 10th, won a \$20,000 scholarship, and shook hands with President Obama at the Award Ceremony*).

Postdoc **Hiromi Konishi** has studied nano-phase minerals in ultra-high pressure metamorphic omphacite from Sulu area of East China in order to understand evolution history of the host rock. Hiromi also studied both modern dolomite and synthetic disordered dolomite in order to understand roles of bio-organics on sedimentary dolomite crystallization.

I have studied size-dependent stability of titania nano-phases as function of temperature, pressure, and their surrounding environments (such as solution acidity). We have published the first environment-sensitive phase diagram for the nano-crystalline anatase-rutile. Through collaboration with Dr. Yifeng Wang of Sandia National Laboratories, we have proposed a new self-organization model for the oscillation between silica-rich and Fe-mineral-rich bands in the banded-iron-formations. I also systematically investigated manganese dendrites. The commonly believed pyrolusite (MnO_2) does not occur in all the studied dendrites. However, hollandite, todorokite, and birmesite are the main Mn-minerals in the dendrites. Through collaboration with Professor Larry Barton of University of New Mexico, we studied the role of sulfate-reducing bacteria (SRB) on aqueous MoO_4^{2-} reduction and formation of curved molybdenite (MoS_2) mono-layers. The findings will help us to understand the real formation mechanism of Mo-bearing layers in late Archean and late Proterozoic black shale. ●



Herb decked out for a ride on top of the cage into the Homestake mine down to 4550-ft depth. (Herb Wang)