

FACULTY NEWS 2003

RICHARD ALLEN

This year saw the first deployment of our very own broadband seismic network in Oregon, great progress in the research of graduate students in my group, and my unforgettable encounter with the elephants at the San Francisco Zoo.

The Oregon Array for Teleseismic Study (or OATS) was deployed in May thanks to the efforts of geophysical staff members **Neal Lord**, **Lee Powell**, **Rob Pyzalski** and **Bill Unger**, and graduate students **Andrew Lockman** and **Mei Xue**. The instruments are now positioned in a line running from southeast Oregon to the northwest across the Newberry Caldera, the Three Sisters Volcanoes and out to the coast. This is the line of volcanism associated with Newberry that looks just like a hotspot track except that it is oblique to the Yellowstone hotspot track. What this means is that the Newberry hotspot cannot be the product of a mantle plume—the phenomenon long believed by many to be responsible for the volcanic tracks of hotspots. The instruments will record continuously for two years, allowing us to construct an image of the crust and mantle structures in the region. [For maps and photos see <http://www.geology.wisc.edu/~rallen/OATS/>]

Meanwhile, back at home, **Mei Xue** has been continuing her study of the structure beneath Iceland, another hotspot, in an effort to understand mantle flow. The observed flow directions look nothing like the predictions of the various existing models for the region, so we are having great fun interpreting the results. **Andrew Lockman** has completed his

study of the characteristic beginnings of earthquakes in the Pacific Northwest and Japan to demonstrate that we can assess the hazard posed by an earthquake in these regions before significant ground shaking. Both Mei and Drew presented their research at the American Geophysical Union (AGU) meeting in San Francisco. At the same meeting I convened AGU's first ever session on earthquake alerting systems, which brought together seismologists, engineers and public policy specialists from the US, Europe, and the Western Pacific to discuss improving efforts to mitigate seismic hazard. On the same theme, new graduate student **Erik Olson** has started working with me on the characteristics of earthquakes. He will be focusing on large magnitude events around the world in an effort to explain how we can know the magnitude of an earthquake before it is over.

And finally, my encounter with the elephants. It started with the publication in *Science* of our work on earthquake characteristics and its application to earthquake early warning. The idea caught the imagination of the press and the hunt for analogies was on. One such analogy involved animals: small animals such as birds have small voice boxes and thus produce high pitched squawks; large animals such as elephants have large voice boxes and produce very low pitched groans. Similarly, small earthquakes produce high frequency signals and large earthquakes produce low frequency signals. Through rapid recognition of these differences we can determine the magnitude of an earthquake, and the hazard it poses, before there is significant ground shaking. To return to the story, I recorded one interview at the San Francisco Zoo. While waiting for the elephants to groan appropriately, I was coerced by the keepers into giving the elephants their morning bath to the great amusement of the reporter, Molly Bentley—yes, the daughter of **Charles Bentley**—who now works in the BBC's San Francisco bureau.



The triumphant field crew after installing the final OATS station in southeast Oregon. Left to right: Lee Powell, Rob Pyzalski, Mei Xue, and Andrew Lockman. Photo, Neal Lord. [For more photos of the deployment visit <http://www.geology.wisc.edu/~rallen/OATS/>]

MARY ANDERSON

2003 was relatively uneventful, which I am finding is rather a blessing as one gets older. I am happy to report that **Wes Dripps** (now at Univ. Massachusetts-Boston) finished the PhD thesis in summer 2003, although I still await the final delivery of a personal copy of his thesis. **Paul Juckem** also finished (a co-advised MS with **Randy Hunt**, USGS) and continues work with the USGS in Middleton. Two of my newest grad students, **Chris Lowry** and **Raycine Hodo**, have involved me in research on aquifer storage and recovery (ASR). Chris is doing an ASR modeling project based on the hydrogeology representative of a proposed facility in Wisconsin and Raycine is doing geochemical studies of mercury with help and funding from **Dave Krabbenhoft** (USGS, Middleton office). Work on northern Wisconsin lakes in conjunction with **Randy Hunt** (USGS Middleton office) continues, currently involving **Rahul John** (PhD candidate) and **Melissa Masbruch** (MS candidate). (Look for our latest paper on the Trout Lake work in a special CD issue of the journal *Ground Water*, which came out as the last issue of 2003.) Chris and Rahul both presented papers at the MODFLOW2003 conference in September in Golden, Colorado, and Chris presented a second paper at NGWAs EXPO meeting in Orlando in December. I was named the 2003 Farvolden Lecturer by the University of Waterloo, which gave me the chance to travel to Canada in October to give the lecture. My topic was “*Groundwater in a Conveyor Belt of Lakes: Implications for groundwater age, chemistry, and effects of climate change*”. The lecture culminated an all day symposium for alumni as well as faculty and students. UW-Madison hydro alum **Charlie Andrews** came from Virginia to hear my talk, taking the opportunity to visit a branch office of his company in Waterloo. He also took a group of us out to dinner. Professor **Kunihide Miyaoka** from Mie University, Japan, arrived on Nov. 1 for a ten-month stay. I look forward to continued interactions with him in 2004. On the home front, Charles and I enjoy the company of our three cats and our



summer vacations in Stratford, Ontario, for a week of Shakespeare. Also, I continue to work my way (slowly) up the progression of “belts” in aikido, a non-competitive martial art. The founder of aikido, Morihei Ueshiba, tells us: “*Those who are possessed by nothing possess everything.*” Something to think about.

JEAN BAHR

I spent much of 2003 traveling around North America as the GSA Hydrogeology Division Birdsall-Dreiss lecturer. A spring sabbatical and a reduced teaching load in the fall allowed me to visit over 60 different institutions, giving over 80 talks. While my invitations came primarily from universities and colleges, I also spoke at a number of USGS offices, two national labs, the New York Academy of Sciences, and the Cosmos Club in DC. The last of these was as part of a symposium on the history and current status of water management, coinciding with the 125th anniversary of the publication of John Wesley Powell’s treatise on water in the west.

Traveling mostly by car, I had chances to stop at tacky roadside attractions and sites of historical interest. My hosts kept me (too) well fed with everything from elegant dinners in restaurants to informal potlucks. They also entertained me with field trips to springs, wetlands and waterfalls, plus hikes through a variety of terrain. In addition to stimulating discussions of research with faculty and students, the lecture tour provided an opportunity to see a number of former students including **Lucy Meigs** and **Teresa Brown** in Albuquerque, **Elizabeth Keating** in Los Alamos, **Maddy Schreiber** in Blacksburg VA, **Terrence Conlon** and **Gwen Porus (WRM)** in Portland, **Maureen Muldoon** in Oshkosh, and **Diane (Stocks)** and **Jeff Munroe** in Middlebury VT.

The summer break between the spring and fall legs of the lecture tour provided some (much needed) down-time at home. Even my normally hectic three-week field course seemed like a break from the traveling, as most of our exercises

were conducted near Madison. **Ingrid Ekstrom** and **Jeff Wilcox** both defended their MS theses shortly after the end of the field course. Ingrid is now working in Seattle, while Jeff is now working on his PhD with a new grant from the DNR that started in July. July also marked the start of DNR funding for **Hilary Gittings’** study of the Mukwonago River watershed.

In the fall I co-taught Hydrogeology with **Herb Wang** and continued to travel during the weeks that he

Geology 729 students installing a weir in the headwaters of the Mukwonago River. Pictured in the foreground, left to right: Raycine Hodo, Rahul John, Jean Bahr, Hans Hoffman, Hilary Gittings, Jeff Wilcox, Abby McDermott. Photograph, Matthew Ludwig.

lectured. I also began a two-year term as one of the faculty co-directors of the Women in Science and Engineering Residential Learning Community, a program involving about 150 undergraduates who live in Liz Waters Hall. At GSA in Seattle I gave the official concluding lecture of the tour and passed the Birdsall-Dreiss baton (a video of the movie *Groundhog Day*) to next year's lecturer. As an incoming councilor for GSA, I spent much of the meeting in conference rooms, but I did get to oral presentations and posters by graduate students **Jeff Wilcox**, **Abby McDermott**, **Tara Root** and **Hilary Gittings**. And I enjoyed visits with many former students at the UW Alumni Reception.

PHIL BROWN

Hello to all of you from frosty Madison. Last year was a busy and rewarding year for me, my family and my program. Following are a few highlights.

In May I attended and presented at a Short Course on Fluid Inclusions before the GAC-MAC meeting in Vancouver and ran into a wide variety of people I had not seen for many years. It is a good idea to go to different meetings occasionally. In late June, **John Marma** and **Stephanie Maes** (both PhD students) and I returned to South Africa to do field work on projects that had begun in 2002 with the combined Structure-Petrology trip detailed in last year's *Outcrop*. The two weeks that I was there were enjoyable—it was nice to do some honest field work again.

After returning to Madison I immediately went to teach three weeks of Field Camp in Park City. The five school consortium continues to draw 40-50 students each summer but the time remaining at the Chateau may be limited to a couple of years and big changes may be coming for camp. Although total enrollment is still relatively healthy, not many UW-Madison students are taking advantage of the opportunity for a true capstone course in geology—time and money are the usual excuses.

My teaching schedule continues to be full and varied. The combined Earth Materials course continues to be a real challenge to cover the material in one semester—I am thinking about literally “writing the book” so that at least a resource would be available for the way the course has evolved.

A quick update on my family. Jason graduated from Carleton College last June and is employed by Epic computer—amazingly enough in Madison. Peter finished his first year at Grinnell College and is likely to also be a computer science major. Karin is a high school senior and waiting for those college admissions to come round so that she can figure out where she will spend the rest of our money over the next four years. All three children continue to swim successfully (well, Jason is done now) and this keeps them lean and TALL, both the boys are substantially taller than I am. Kris continues to be convinced that she has the best job in the world as the librarian

at our kids' high school a mile from our house.

And speaking of our house, I finally decided that the only way to renovate our kitchen was to destroy the old thus forcing the issue. So almost on a whim I knocked out a wall in August and several months later we have a much improved facility highlighted by 60 square feet of dark green charnockite counter top from coastal Brazil. I certainly learned a lot about choosing “granite” for a kitchen and would be happy to provide advice if you are considering a similar project.

Hope you have a safe and healthy 2004.

CHARLIE BYERS

I had some fired-up students in stratigraphy last spring. **Jon Van Alstine** carried out a research project on the nature of the contact between the Wonewoc Fm. and the Tunnel City Group. The party line is continuous deposition across the boundary, but it looks like an unconformity at some outcrops. Jon was able to demonstrate via thin sections that Wonewoc quartz arenite pebbles are present in a basal conglomerate of the overlying greensand. A group of avid paleophiles from the class (**Clint Boyd**, **Adam Behlke**, and **Dan Hyslop**) declined to write a term paper in favor of plunging into research. They decided to investigate the mysterious Windrow Fm., a gravelly sand of Cretaceous (?) age, reported decades ago from scattered locations in the driftless area. I'm sure they had visions of finding a tyrannosaur skull that Thwaites and Twenhofel had missed, but alas the main thing they collected was experience.

Grad student **Steve Beyer** finished his Master's thesis in the fall. He has put together a composite section of the Ordovician Galena Fm. in its northeastern Iowa outcrop belt. The scattered outcrops are correlated by means of a bentonite bed that Steve fingerprinted via trace element content. **Amy Garbowicz**, new Master's candidate from Lawrence University, plans to work on the Cambrian sandstone formations that make up the scattered outliers in the driftless area and on the Wisconsin dome.

I'm now the Chair for the GSA's History of Geology Division. The chair gets to pick the symposium topic, so the division will be holding a session on layer-cake stratigraphy in Denver next fall. The idea of time-parallel strata had a long run in the 19th century, but it went into severe eclipse by the facies concept for decades; now it is back, in the guise of event and sequence stratigraphy. I hope to see many strat alums at the meeting.

Last spring I had a disconcerting experience; woke up one day and couldn't think of the words for anything (not just igneous rocks, anything!). It turned out to be viral encephalitis and I was out of school for a month. Colleagues and TAs put in heroic efforts to keep my classes running. I got my vocabulary back pretty quickly but my handwriting looked weird all summer.

ALAN CARROLL

The work of my Green River Formation research group continued to enjoy prominence last year, beginning with several presentations given at the third quadrennial meeting of the International Association of Limnogeologists in Tucson in April. **Mike Smith** and **Jeff Pietras** had papers published in *GSA Bulletin* and *Geology* that have drawn a surprising amount of interest, due to their significance in understanding the chronostratigraphic record of lake deposits. Mike's $^{40}\text{Ar}/^{39}\text{Ar}$ paper in collaboration with **Brad Singer** has made the Green River Formation perhaps the best-dated non-marine interval in the world and helped to set new standards for analytical rigor. Jeff has shaken the nearly universal assumption that astronomically-driven climate changes govern lacustrine sedimentation, by showing that supposed 19-23 ky "precession" cycles in the Wilkins Peak Member actually span less than 10,000 years. These papers have thrust our group into the center of several current controversies involving timescale calibration and continental records of climate change.

Among other summer field activities I spent three weeks in the northern foothills of the Brooks Range with **Marwan Wartes**, (photo) who is working on the Cretaceous Fortress Mountain Formation. He is using this interval to help interpret the early history of the range by examining the provenance of conglomerate clasts contained in fan-delta and associated submarine canyon deposits. Most of the time we spent alone in a landscape that bore little or no evidence of the existence of humans, and which is accessible only by air. Mosquitoes have absolutely no problem getting there however, and I don't think I've ever seen so many in one place before! (photo) The bugs did abate for a while just before the July 4 holiday, buried under 6 inches of new snow that also destroyed two of our

three tents. As much as I enjoyed this adventure and the great geology of the region, after three weeks I was quite happy to see the helicopter sent to effect my escape.

I also continued research on the Phosphoria Formation (PhD work of **Colin Walling**) and the east Java Basin (with **Toni Simo** and PhD students **Martin Shields** and **Essam Sharaf**), and began a new collaboration with **Clark Johnson** on the provenance of Cretaceous-Eocene sandstone in the Guala basin in northern California (MS work of **Ben Bymers**). Two members of the Green River group received degrees; **Brooke Swanson** finished her MS on the Luman Tongue (actually in Dec. 2002), and **Jeff Pietras** finished his PhD on the Wilkins Peak Member. Brooke has taken a position in the Geology Museum here, and Jeff began work in December for BP in Anchorage.

CHUCK DEMETS

I spent 2003 engaged in a satisfying mixture of teaching, field work, and modeling. My year began with a bang. Two days into a January field experiment in Jalisco, Mexico, a magnitude 7.6 earthquake ruptured a 20-mile-long segment of the subduction fault beneath the geodetic network we were occupying. The earthquake did more than rattle our nerves—it caused 30 fatalities and destroyed many buildings in our field area, including the hotel where we had completed our training two days earlier. For the next two weeks, we occupied 17 of our existing sites in the region. Graduate student **Stuart Schmitt** is now modeling the data we collected.

My February field experiment in Oaxaca, Mexico also began with a bang, with a magnitude 4 earthquake jolting me awake on my first day in the field. Fortunately, it was not a prelude to larger things to come. Over the next two weeks, we



Marwan Wartes standing on the Fortress Mountain Formation, surveying the Brooks Range to the south. Photo, Alan Carroll.



A pistol for protection against grizzly bears is no help as Marwan Wartes is assaulted by thousands of mosquitoes. Photo, Erin Parcher-Wartes.

successfully occupied our 25-station network, which is designed to study fault locking in this seismically-hazardous region.

In October, I went to Honduras to initiate a new five-year, NSF-funded study of active deformation in northern Central America. Over the next few weeks, our team installed a 30-station geodetic network spanning the tectonically active western half of the country. Along with my active GPS networks in Mexico, Jamaica, and El Salvador, I am now engaged in five long-term, on-the-ground field projects in four foreign countries, as well as a sixth project along the creeping segment of the San Andreas fault in central California (with **Basil Tikoff** and his student **Sarah Titus**).

Back at home, the constant stream of data flowing from these field projects is keeping my graduate students **Stuart Schmitt** and **Francisco Correa** busy with modeling efforts to extract useful information about the seismic cycles of active faults in these regions. Both students are employing 3-dimensional finite element meshes that simulate actively deforming lithosphere with embedded faults. The meshes allow for lateral and depth variations in material behavior and thus are meant to provide more realistic representations of crustal behavior in response to stress.

DANA GEARY

The spring of 2003 went by in a blur, as I taught Evolution and Extinction, and Geobiology (after **Clay Kelly** went to sea), and chaired the search for a new museum director. The search was both arduous and interesting, as all searches seem to be. I am very pleased that **Rich Slaughter** will be the new director of our museum.

In the summer, Sarah (9), Molly (7), and Rob accompanied me into the field. We drove out to SW Utah to work on Cretaceous brackish gastropods. MS student **Erik Hoffmann** and Utah State Paleontologist Jim Kirkland joined us for an interesting and fun time in the field. On the way home, we enjoyed family time in Zion and Yellowstone.

The fall brought a most welcome sabbatical for me. My primary project in early fall was preparing a review of punctuated equilibrium for a GSA symposium on the scientific legacy of Stephen J. Gould. In December, **Imre Magyar** was in Madison, as we continue our fruitful collaboration on Lake Pannon in Hungary.

DAVE MICKELSON

Last spring was hectic, as usual, although it was nice to no longer be Chair of Geological Engineering (after a three-year term) and to spend more time on classes and research. **Brad Singer**, **Danny Douglass**, **Mike Kaplan**, and I left before Christmas (2002) for Argentina and were

there for several weeks. We had Christmas dinner (consisting of frozen pizza and a soda!) at a gas station in Patagonia (see photo below). Our research program in the Uintas continues to flourish. **Eric Carson** finished his PhD that was jointly advised by **Jim Knox** and me on Holocene stream behavior there. **Ben Laabs** is doing his PhD work on the south side of the Uintas, where he is doing cosmogenic dating of boulders on moraines as well as mapping for the U.S. Forest Service. **Prof. Zhou Shangzhe**, with whom I am working in China spent about a week in the field with us before we all attended the INQUA meeting in Reno. After the meeting Vin and I had a wonderful two weeks in Glacier N.P. and the Canadian Rockies. It was our first time in that area, and except for the forest fires and occasional smoke problems it was wonderful. Our Scandinavian Ice Sheet project enters its 3rd year. **Jessica Darter** and **Carrie Moeller** have both spent time in Norway collecting field data to support the ice sheet modeling being done by **Cornelia Winguth**. I am also still active in research in Wisconsin. We are mapping St. Croix County over a two-year period. **Hans Hinke** finished his thesis last spring and **Steve Kostka** is working there now. This year also saw completion of our Lake Superior shoreline erosion project, on which **Lindsay Anderson's** MS thesis and **Leslie Pearson's** senior thesis focused.

Sabbatical began in September. As much as I like undergrad teaching, it has been wonderful to have more time to work on projects with grad students and with catch up on my own writing. Vin and I attended the geomorphology symposium in Binghamton, NY in October and then spent a few days seeing peak autumn foliage in southern Maine, New Hampshire and Vermont. It's been many years since I have seen fall color in New England, and it was great. It was also very nice to see so many former students at GSA in Seattle. Our Quat dinner was a great success, with 25 participants this year (photos elsewhere in the Outcrop). Let's make this an annual event!



Christmas dinner on the road in Argentina. Photo, Dave Mickelson.

NITA SAHAI

The most gratifying part of the past year is news related to my students. Our research group has grown with the addition of two graduate students, **Tim Oleson** and **Drew Mangham**, and we also had two undergraduates working in our laboratory on independent research projects. **Sonja Rauum**, the undergraduate research scholar is working on an exciting project looking at the effect of organic compounds on enhancing kaolinite precipitation rates in conditions similar to soil pore fluids. Our first master's student, **Katie Thornburg**, graduated at the end of last summer. Katie did a neat study on identifying the reasons for local and temporal fluctuations in arsenic contamination levels in the groundwaters of Eastern Wisconsin. Meanwhile, **Katya Delak** continues her challenging work on understanding the role of organic molecules in catalyzing silica biomineralization by diatoms.

We are also starting out in a new research direction, understanding the role of crystal-chemistry and interfacial solvation in determining the adhesion strength of biological cells (both prokaryotes and eukaryotes) on mineral surfaces. Tim and Drew will be involved in this work, to be done in collaboration with colleagues in the Departments of Biochemistry, Chemistry and Soil Science. I was also honored and pleased to receive joint appointments in the Analytical Chemistry Division of the Department of Chemistry, and in the interdisciplinary Environmental Chemistry and Technology program. This allows for much easier collaborations and for advising students with interdisciplinary interests. I am also excited by the faculty searches in Mineralogy and Geomicrobiology currently underway in the department. These additions should be an excellent complement to our own research group, to the other geochemists, and to the department as a whole. I look forward keenly to the synergy with the research groups of these anticipated faculty hires.

I especially enjoyed teaching in fall 2003. Fluids and Sedimentary Processes, which is co-taught with Prof. **Charlie Byers** was in its third year, and both Charlie and I felt that it was our best experience with that course. I also thoroughly enjoyed co-teaching a graduate research seminar, Minerals and Macromolecules, with Prof. **Joel Pedersen** of the Soil Science department, and I learned a lot myself. The fun continues in spring 2004, as I finally get my first opportunity to teach a full graduate course in the field of my expertise, Interfacial Biogeochemistry. Last but by no means the least, the graduate student seminar series is in its second year, and is doing extremely well. The credit goes to the students who have attended the seminar regularly and presented high quality talks that are accessible to non-specialists.

If there's one word to sum up the past year, it's *travel*. I was fortunate to be invited in June to a research workshop in Telluride, Colorado, on the "Chemical

Reactivity of Aqueous Species at Mineral Surfaces". The small nature of the group, only 20 members, allowed for some stimulating exchanges amid breath-taking scenery in the Rockies. I was also an invited speaker in the Second Annual Conference at Hamilton College, NY, in July 2003. This NSF-funded conference is organized by a consortium of seven 4-year colleges in the Northeast. The main goals of the conference are to encourage undergraduate participation in research following the "learning-through-doing" idea, and to show undergraduates how different aspects of chemistry are applied in other fields. In addition, I presented talks at a couple of universities, and at the fall AGU meeting. I also made two trips to India in the winter of 2003 for family reasons. The support from the department during this period is deeply appreciated.

TONI SIMO

When the time of the year arrives to write for *The Outcrop* I always get puzzled by the idea of describing what has happened; I am so used to looking ahead that the action of stopping and looking back is both welcoming and perplexing. I continue my teaching and research part-time at UW-Madison and UPC in Barcelona. I still find this interaction between two worlds stimulating and challenging, but the traveling is getting old.

Wasinee Aswasereelert has started her work in the Eau Clair Shale in Wisconsin. It is a project in collaboration with Dave LePein, a new hire in Sedimentary Geology at the Wisconsin Geological Survey. It is interesting as it ties sedimentology and hydrogeology and has important environmental implications; an aquitard, the Eau Clair, is protecting the main aquifer in southern Wisconsin. The



*Prof. Nita Sabai (far right) and Katie Thornburg (second from the left) were joined by, Jeff Brownson (far left), and (next to Katie), left to right, Katya Delak, Miriam Barquero-Molina, Hilary Gittings, and Tara Root, after the defense of Katie's master's thesis on Aug. 4.
Photo, Mary Diman.*

Ordovician work is finally getting published and we are getting new results. Thanks to **Liz Leslie** and **Lauren Chetel**, who are working with **Brad Singer**, we have Ar/Ar age dates for K-bentonites of the Galena group. Lauren has also shown that some of the previously published K-bentonites are actually clay-rich seams with grains similar in composition to K-bentonites, however the K-feldspars are Precambrian in age, not Ordovician. Permian rocks are still full of surprises. Work by **Leonardo Piccoli** in the Wolfcampian and collaboration with Dave Hunt in the backreef Capitan strata is yielding great sedimentological and ground penetrating radar (GPR) results. The GPR project is giving us plenty of satisfaction as we are improving both penetration and resolution, and we are exploring the connection of density logs to bridge the gap between GPR (electromagnetic waves) and seismic (acoustic waves).

The GPR project is giving new input to research in my old PhD field grounds, the Pyrenees. After leading several field trips for oil companies, I felt once more the attraction to work in the area, but with a geophysical twist. Imaging of some of the Pyrenean outcrops will be the thesis of **Preeya Jirutthitjaroen**. The Cretaceous research does not end in the Pyrenees; **Chris Gordon** will start a new project in the mechanical stratigraphy of Cretaceous outcrops in central Tunisia. In collaboration with **Basil Tikoff**, we have made a preliminary trip to define the area and make contact with professors in Tunisia and leaders of the Tunisian oil company ETAP. We have found wonderful outcrops and hope to have a short article in the next *Outcrop*. **Essam Sharaf** has made good progress in his work in the Oligocene-Miocene of the East Java Basin. His work has established a credible paleontological and stratigraphic framework and is extending field work into a subsurface data set. Essam's thesis provides a connection between tectonics and sedimentation in an area that has plenty of both!

At the introductory level, I taught Introduction to Geologic Structures, Geologic Evolution of the Earth (both with **Basil Tikoff**) and Environmental Geology (with **Chuck DeMets**). The Florida field trip was, as always, my favorite. A seminar/field trip with Alan Carroll and a large group of ExxonMobil people was really interesting.



Prof. Brad Singer, with students Brian Jicha and Miriam Barquero-Molina on a rare clear day at volcanically active Pyre Peak (1054 masl) on Seguam Island, central Aleutian Island arc. Photo, Brad Singer.

BRAD SINGER

2003 was filled with a variety of activities that began with a Weeks Field Trip to Chile during which seven graduate students and I explored volcanic geology in both the high and dry Atacama region of the central volcanic zone and the lower more temperate volcanoes of Villarica and Puyehue in the southern volcanic zone. Images of this trip from a colloquium I presented are located on the department's web site at: http://www.geology.wisc.edu/field_work/chile_singer. In October we welcomed the new lab manager Dr. Xifan Zhang who comes to us via The Ohio State University and MIT. See more about Xifan's background on page 26 and his web page <<http://www.geology.wisc.edu/people/display.html?id=396>>.

My research in geochronology continues along four broad fronts, thanks to generous new support from the NSF:

(1) Glacial history of Southern South America

Dave Mickelson, **Jim Bockheim** (Professor in Soils Dept.), PhD student **Danny Douglass**, former post-doc **Mike Kaplan** and I have constrained the timing of glacial advances out of the Patagonian ice cap at 46° S latitude that occurred during marine oxygen isotope stage 6 (135 ka) and during the Holocene using cosmogenic ¹⁰Be dating of moraine boulder surfaces. This unique direct age for a stage 6 ice margin in South America demonstrates for the first time a close synchronicity of terrestrial climate during the past two major ice ages in the northern and southern hemispheres. Because cosmogenic surface exposure dating of deposits in the 10-12 ka age range is extremely demanding, we are still trying to determine whether the prominent Holocene advance corresponds with the Younger Dryas cold period of the northern hemisphere or the Antarctic cold reversal in the South. This project is expanding to include dating of similar deposits at 50° S latitude that will comprise the MS thesis **Richard Becker** and PhD dissertation of **Brad Sleeth** who recently joined our department.

(2) Timescales of arc magmatic processes

I spent a rainy, windy month last Summer on the uninhabited central Aleutian Island of Seguam with PhD student **Brian Jicha** and MS student **Miriam Barquero-Molina** completing a geologic map of this active volcano and collecting samples for

Brian's dissertation work. Thanks to a new grant from the NSF, we will be undertaking $^{40}\text{Ar}/^{39}\text{Ar}$ and U-Th isotope disequilibrium studies of Seguam, as well as similar studies at Parinacota volcano and Puyehue volcano in the central and southern volcanic zones of the Chilean Andes, respectively. PhD student **John Hora** is leading the work on Parinacota—which we visited together in October—and MS student **Melissa Harper** continued her thesis work on Puyehue. The aim is to determine whether crustal thickness plays a role in retarding magma ascent rates thereby influencing the longevity of crustal magma chambers and timing of eruptive episodes. The U-Th isotope work of these students is underway in collaboration with **Clark Johnson** and **Brian Beard**.

(3) *Geodynamo behavior of the last 5 m.y.*

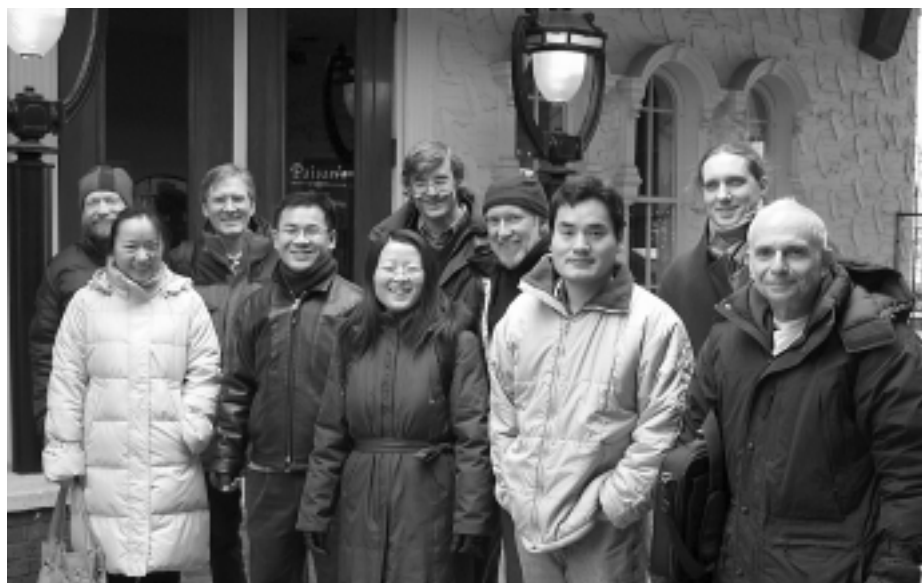
I have continued to refine the Geomagnetic Instability Time Scale (GITS) through $^{40}\text{Ar}/^{39}\text{Ar}$ dating of lavas worldwide that record brief periods of unusual geodynamo behavior during the past few m.y. I was invited to present some of these results at a Chapman Conference on "Timescales of the Earth's Internal Magnetic Field" in March at the University of Florida. Look for two chapters in the upcoming AGU Monograph on this subject that contain the newest findings from the UW-Madison Rare Gas Geochronology Lab. **Miriam Barquero-Molina** completed her MS thesis on paleosecular variation of lavas and tuffs in the Atacama region of Chile over the past 4 m.y. This is one of several studies of paleosecular field behavior in the southern Hemisphere that we have completed with Laurie Brown at the University of Massachusetts.

(4) *Sedimentary basin chronostratigraphy*

I continue to enjoy rewarding collaborations with **Alan Carroll** and **Toni Simo** as we work to quantify the history and environments of Eocene Lake Gosiute in Wyoming and Utah and the Ordovician epicritic sea via $^{40}\text{Ar}/^{39}\text{Ar}$ and U-Pb zircon dating of ash beds. This work includes the PhD dissertation of **Mike Smith** and recent graduate **Jeff Pietras**, as well as the MS thesis of **Lauren Chetel**. As a result of these projects, I was invited to the NSF-sponsored "Earthtime" workshop at the Smithsonian Institution in October where novel approaches and new collaborations needed to solve these problems were debated. I can tell you that we are well situated here at UW-Madison to lead the way in the next generation of dating these important sedimentary archives.

CLIFF THURBER

2003 was a productive and exciting year for me. I did a fair bit of traveling again this year (Fairbanks in January, Albuquerque in February, a family vacation to the Four Corners region in June, Japan in July, Albuquerque again in August, Tucson in September, Long Valley in October, Parkfield in November, and San Francisco in December), but my wife Judy out-did me by traveling to Australia and Italy. The trip to Long Valley was probably my favorite, as it combined a trip to an incredible place I had always wanted to visit with a thought-provoking workshop that brought together many professional acquaintances of mine. My research group remains strong, although sadly this has been **Bill Lutter's** last year of working with us—he is switching to full-time employment in Medical Physics. Bill has worked in Weeks Hall for over a decade, and he will be sorely missed. On a brighter note, **Haijiang Zhang** successfully defended his PhD thesis in October, and has now joined **Wayne Du**, **Jean Battaglia**, and **Mike Brudzinski** as post-docs in my group—Jean joined us in January 2003. As for my current graduate students, **Xiaowei Yan** (second year) has been working on subduction zone seismicity in Japan, including a study of a recent magnitude 7 earthquake, and **Erik Olson** (first year) has been working on the analysis of earthquake data from Parkfield, CA. To help support all these people, I was fortunate to have three new research projects all approved for funding beginning in early 2004. One will support the continuation of our work on three-dimensional fault zone structure and high-precision earthquake locations at the San Andreas Observatory at Depth (SAFOD) site, part of the EarthScope project. Another will continue our work on subduction zones, but combining the study of local and global network data. The third will start a new effort to model the



Left to right, rear: Neal Lord, Cliff Thurber, Bill Lutter, Lee Powell, and Jean Battaglia. Front: Xiaowei Yan, Wayne Du, Mei Xue, Haijiang Zhang, and Bill Unger. Photo, Neal Lord.

regional-scale three-dimensional crustal structure of northern California. One of the major highlights of my year was the completion of a textbook on inverse theory, co-authored with **Rick Aster** (UW-Madison M.S., 1986) and Brian Borchers of New Mexico Tech. The book, *Parameter Estimation and Inverse Theory*, has been submitted to Academic Press for review and publication. I expect 2004 to be another exciting year, as SAFOD drilling begins at Parkfield in the summer.

BASIL TIKOFF

There were lots of happenings in 2003 in structural geology. The department successfully hired **Laurel Goodwin**, as a second structural geologist in the department (see page 40). Laurel works on a broad range of topics, but has lately been interested in brittle faults, fluid flow in fault zones, and microstructures. She arrived in January 2004. **Cam Craddock** has been very accommodating about Laurel's arrival, and has even agreed to move his office from the isolation ward (which he told me, when I first arrived, was the best part of the building—and he was right).

There were more successful defenses. **Scott Giorgis** successfully defended his PhD thesis, the first in structural geology in about a decade, when Cam Craddock's last PhD student completed his thesis. Scott did a great job working in the western Idaho shear zone, documenting both neotectonics and Mesozoic structures. Scott is staying on for the spring semester as a postdoctoral fellow. **Karoun Charkoudian** and **Selena Mederos** (co-advised with **Alan Carroll**) both successfully defended their Master's thesis. Both Karoun and Selena worked on a combination of geological and geophysical methods, in the Canadian Shield and the Rocky Mountains, respectively. Additionally, both look to be headed to Houston for jobs in the oil industry. Otherwise, the rest of the structure group is going along strong. There are currently four PhD students: **Cheryl Waters**, **Eric Horsman**, **Sarah Titus**, and **Stephanie Maes** (co-advised by **Phil Brown**). In addition, we were joined by **Skylar Primm** and **Caroline Webber**, who both started Masters projects. Skylar will be working in the Sierra Nevada Mountains on self-organization of shear zones, and Caroline will investigate fabrics in the Dun Mountain ophiolites in New Zealand. So, both scored on scenic field areas. Undergraduate students **Carrie Larson** and **Jon Van Alstine** are both doing senior honors projects in structural geology, and both doing an excellent job. Undergraduates **Simon Masters**, **Angela Hull**, and **Martha Gilbert** have helped out around the lab, keeping the science going.



John Valley, center; Andrew Davis, Cameca-USA, right, and Michel Schumacher, Cameca-Paris, left, analyzing data on the Cameca 1270 Ion Probe in Edinburgh, Scotland. Photo, Neal Lord.

The year did see the first “Structural Geology–Paleontology” field trip, with **Clay Kelly** and a variety of graduate students, to Dinosaur National Park. That was great fun: Where else can you go rafting down the core of an anticline? I easily doubled my paleontological knowledge (which started at about zero—this is sort of embarrassing, but because I did an undergraduate degree in physics, I've never taken a paleontology class). Anytime Clay wants to do another fieldtrip, I'm ready to go.

Teaching continues, as always. I very much enjoy co-teaching with Toni Simo for two of the core undergraduate classes, which has the additional advantage of making the undergraduate curriculum fairly coherent. Also, several graduate students (Eric Horsman, Sarah Titus, and Scott Giorgis) and myself are signed up for an educational class for this spring, to learn how we can more effectively teach three-dimensional visualization.

But, I must admit, I am looking forward to a desperately needed sabbatical during the 2004-2005 academic year.

JOHN VALLEY

This year was full of pleasant surprises and unexpected travel. At the beginning of the year, I budgeted my time and thought I had things under control with four planned trips: to present a review paper on UW zircon research in Freiburg, Germany; to aid **Beth Valaas** with fieldwork on metamorphism of Biwabic iron formation in Minnesota; to present a plenary lecture at a Symposium in Salvador, Brazil, and to look at granites in Pernambuco with **Val Ferreira** and **A.N. Sial** (sabbatical at UW 2002); and to attend GSA in Seattle.

My schedule began to fall apart in late April when I went to China on seven days notice to cover for an Australian colleague who couldn't travel because of the SARS scare. **Aaron Cavosie**

had 10 days of beam time reserved on the Beijing ion microprobe. This was too precious to lose, but it required two of us to be efficient. We bought two boxes of surgical face-masks and ran the instrument for 220 hours non-stop. The data are great, but unlike other trips, Beijing seemed under siege and left much to be desired.

In June, the Major Research Instrumentation Program at NSF funded us to purchase an ion microprobe of our own (see the 2002 *Outcrop*). We received \$2,000,000, the largest award of over 600 made by this program over the past two years. This created the need for unplanned trips #2 and #3 to test the two competing models. **Neal Lord** and I went to Edinburgh, Scotland (photo, previous page) to test the Cameca 1270 in June and to Canberra, Australia to test the SHRIMP-II in July. We selected Cameca and expect delivery of the 11 ton instrument to a new first floor lab in Weeks Hall in December 2004.

The final unplanned trip was to AGU in San Francisco. Four weeks before the meeting, I learned that I would receive the N.L. Bowen Award from AGU. I am delighted by this honor, named for the most important petrologist of the 20th century, and that **Andree** could come. After the ceremony, we had dinner with old friends, **Eric Essene**, **Jim O'Neil**, and **Assoc. Dean Jean Morrison**. Earlier in the meeting, we got together with **Mike DeAngelis**, **Ilya Bindeman**, **William Peck**, **Carrie Moeller**, **Jake Eaton**, **Pupa DeStasio**, and **Ben Gilbert**.

HERB WANG

A highlight of my year was teaching a three-week, summer field course in environmental justice (www.geology.wisc.edu/~wang/SummerEJ). The course won a second place award from the North American Association of Summer Sessions. Three high school teachers were in the course so that they could bring the subject back to their students. Five days were devoted to field trips to Altgeld Gardens in southeast Chicago (photo), the Sixteenth Street Community Health Center in Milwaukee, the Menominee Reservation, the mouth of the Fox River in Green Bay, a paper mill in Wisconsin Rapids, and Madison's landfill, sewage treatment plant, recycling center, and Charter Street power plant. The paper mill visit was to experience a state-of-the-art mill in conjunction with reading a new book by Lis Harris called *Tilting at Mills*, which describes a project to try and build a mill in the South Bronx using recycled paper.



Cheryl Johnson (center), executive director of the People for Community Recovery (PCR) in southeastern Chicago, talks about her community to Environmental Justice students. Left to right, Ashley Gehrke, Brooke Mantbe, Cheryl Johnson, Lindsey Verbunker, and Emily Eggebrecht. Photo, Jeff Miller.

I taught an honors seminar on Environmental Justice in the fall. About a dozen students organized a Saturday afternoon teach-in on campus as their term project. Other students made a video or developed a web site or wrote a grant proposal for the People for Community Recovery (PCR). Environmental studies graduate student **Martha Boyd** and I collaborated with PCR and other partners on an EPA proposal to PCR to add to their capacity to improve their health, environment, and economic well being.

In August my student **Tyson Strand** completed his PhD thesis on percolation modeling of two-phase fluid flow. I incorporated Tyson's results for evaporative drying into predictions of elastic properties of partially saturated rock, which I presented at an engineering mechanics conference in Seattle in July and at a workshop in Puerto Vallarta, Mexico in November.

I was part of a group that drafted the earth science component for an underground science laboratory. The report can be found at www.earthlab.org. The neutrino physicists keep pressing for an underground facility whether at the Homestake mine or at some other location. The Homestake mine is filling with water as the pumps have been shut off. In October I visited Cashmere Mountain in the eastern Cascades as another potential site. The nearby Sleeping Lady Mountain Retreat provided very comfortable accommodations for the meeting.

KLAUS WESTPHAL

I kept watch over the museum and its many programs. At the end of the year, I handed over the reigns to my successor Richard Slaughter. For more information see the Museum's Annual Report elsewhere in *The Outcrop*. I also taught the popular course "Life of the Past."