# The Outerop

# Block around the rock

The future of astrochronology

Stephen R. Meyers page 14

Department of Geoscience • University of Wisconsin-Madison

# **The Outcrop** 2012-13

Chair's Letter, Brad Singer1
Board of Visitors' Report, Rick Sarg, Doug Connell2
Gifts, 2012
Distinguished Alumni Awards for 20134, 5
Students in the Field-Spring Break 2012, Dave Lovelace6
Students in the Field–Spring Break 2013, Shanan Peters 7
Students in the Field–Geosci 430/431, Shanan Peters8
Degrees Awarded 2012-139
In the News, Honors10
Student Awards and Scholarships11-12
Weeks Lectures and Speakers12
Laguna del Maule Volcanic Field13
The New Mass Spectrometer
Cover: Clock Around the Rock, Stephen R. Meyers 14-15
Alumni News 2012-13
Alumni Death Notices, In Memoriam18
Faculty News for 2012-13 19-22
Emeritus Faculty News for 2012-1323-24
Itokawa in Weeks Hall25
WiscSIMS International Meeting25
Geology Museum
Fundraising Initiatives, Clark Johnson 27
Gifts to the Department, 201328

Photos contributed by:

Brad Sageman, front cover; Neal Lord, pp. 1, 11, 20, 24; Michelle Szabo, pp. 2, 3, 5; Tom Doe, p. 4; Billl Hinze, p. 4; Jean Morrison, p. 5; Dave Lovlace, p. 6; Shanan Peters, pp. 7, 8; University Communications, p. 10; Nathan Anderson, p. 13; Clark Johnson, p. 13; Mary Diman pp. 14, 18, 27; Phil Brown, pp. 19, 27; Eric Roden, p. 21; Hifang Xu, p. 22; Mary Anderson, p. 23; Gordon Medaris, p. 24; John Valley, p. 25; Geology Museum, p. 26; Del Brown, back cover.

*The Outcrop* is produced in the Department of Geoscience and supported entirely by alumni gift funds.

Published November 2013. Printed on 100% recycled paper.

#### **Cover Illustration:**

Rhythmic strata of the Boquillas Formation (Cretaceous) Terlingua Creek, near Big Bend National Park, Texas. Photo by Brad Sageman.



### DEPARTMENT of GEOSCIENCE UNIVERSITY OF WISCONSIN M A D I S O N

#### The Outcrop, 2012-13

John Valley–*Faculty liaison* (valley@geology.wisc.edu) Mary Diman–*Editor, graphics, production* (diman@geology.wisc.edu) Bob Dott–*Department historian* (rdott@geology.wisc.edu)

© 2013 Board of Regents of the University of Wisconsin System

#### Alumni and Friends: Please notify the department if you have a mailing address or email address change. The UW Alumni Association or US Postal service may not share new information with us.

We'd like to hear from you! Send professional and personal updates, feedback, news and photos for *Outcrop 2013-14* (will be published fall 2014) to:

*The Outcrop* c/o Mary Diman Email: diman@geology.wisc.edu Fax: 608-262-0693 1215 W. Dayton St., Room 239 Madison, WI 53706

*The Outcrop* on the web: http://geoscience.wisc.edu/geoscience/about/outcrop

#### Please join us:

Geobadger Alumni Receptions at these national meetings:

- AGU in San Francisco, December 9-13, 2013
- AAPG in Houston, April 6-9, 2014
- GSA in Vancouver, British Columbia, Canada, October 19-22, 2014

Party dates, room location, and time will be announced.

Department of Geoscience University of Wisconsin-Madison Lewis G. Weeks Hall for Geological Sciences 1215 West Dayton Street Madison, Wisconsin 53706-1692

Phone: 608-262-8960 Fax: 608-262-0693 E-mail: geodept@geology.wisc.edu www.geoscience.wisc.edu

#### NEW! We have a quarterly email newsletter.

Send an email to join-geoscience-announcements@lists.wisc.edu to receive our department's e-newsletter.

### From the Chair

Dear Alumni and Friends-

The past 18 months have encompassed many events and some key changes in our Department and on campus. The most important of these are highlighted here in our new fall edition of the Outcrop. Mary Diman and John Valley again deserve thanks for assembling contributions from many students, faculty and staff in Weeks Hall, as well as those from many GeoBadgers across the USA.

Faculty, staff, and students have garnered several awards. I am delighted that Michelle Szabo received an administrative excellence award from the chancellor. As many of you know, Michelle is a major positive force in guiding the Department forward. Our faculty continue to excel in the competition for federal research grants. For example, the Department's recent proposal for a new electron microprobe—led by John Fournelle and John Valley—was the highest-rated in this year's NSF instrumentation competition and we will soon purchase a next generation probe. It was a privilege to meet many of you at national meetings of the Geological Society of America in Charlotte, the American Association of Petroleum Geologists in Pittsburgh, and the American Geophysical Union fall meeting in San Francisco.

The cover article by Steve Meyers (pages 14-15) describes his passion for astrochronology—the science of deciphering orbital rhythms of the Earth from records of paleoenvironmental changes recorded in sedimentary rocks. Steve's research on this topic is quantitative and tackles both the theoretical underpinnings and the measurement of chemical proxy records of astronomical forcing. He recently received a five-year NSF CAREER grant to pursue this research and establish a foundation for teaching astrochronology in the years to come.

Other milestones include the departure of Associate Professor Anders Carlson in December for the Oregon State University. We wish Anders well in his new position. The search by the Department for a new faculty member in the area of surface processes and landform evolution is currently underway. Sadly, we note the passing of several alumni in 2012-13, including Ray Wilcox, Dick Paull, and Jay Nania, each of whom were honored as distinguished alumni by the Department. Obituaries and tributes can be found on page 18. The Department also lost a very close friend with the passing of Professor Emeritus Jim Knox of the geography department in 2012.

The University of Wisconsin has a new chancellor, Rebecca Blank, and the Colleges of Letters and Science and Engineering have new deans in Karl Scholz and Ian Robertson, respectively. The 2013-15 Wisconsin budget once again includes significant cuts in funding to the university, so these new campus leaders and I face unprecedented challenges. We need and value your support more than ever. Despite the dramatic decline in state funding for



the university since I became Chair in 2011, our undergraduate enrollment continues to increase such that we now have more than 120 geoscience majors-these are numbers not seen in Weeks Hall since the early 1980's. Whereas this speaks to the high demand for well-trained geoscientists, it has also placed enormous pressure on our ability to teach courses at the highest level and to fund the cadre of graduate students needed to help teach these courses. This fall, with help from our Board of Visitors (page 2), we have embarked on a new initiative aimed at raising funds to support graduate student research assistantships. The Jay Nania fund is one example of such an opportunity (page 27). Please consider supporting the Department by contributing to our drive for graduate student RA funds. We would like to connect with as many of our alumni as possible and thus began a quarterly e-newsletter last year to keep you up-to-date on the Department's many activities. I urge you to send an email to the address <joingeoscience-announcements@lists.wisc.edu> to receive the e-newsletter.

This is my final year of serving the Department as its Chair. It has been an honor to work with such dedicated staff, students, and faculty colleagues. I have come to realize more clearly than ever what a truly special institution this is. We owe a great deal to all the people who have pursued their degrees and their dreams here. Indeed, our alumni are one of the greatest resources the Department enjoys. Please let us know about your activities, both personal and professional, so that GeoBadgers can stay connected to their friends around the world.

Sincerely,

Jul Jr

Brad Singer



The Board of Visitors Meeting, September 13, 2013: Left to right, Kirt Campion, Bill Morgan, Mark Solien, Carol McCartney, Jamie Robertson, Tom Johnson, Rick Sarg, Steve Johannsen, Jim Davis, Martin Shields, and Brad Singer.

#### **The Board of Visitors**

Thank you from the Board of Visitors for your continued support of the department and its activities this past year. Your financial contributions are especially important given the challenging budgetary times for the department and the university.

During 2012-13, The Board of Visitors assisted the department in several ways. Last spring, with encouragement from the department, we sent letters to the College in support of giving credit for field camp and in support of initiating a search for a replacement for Anders Carlson. The Board, in response to encouragement from the dean and the department, also sent a letter in support of the UW budget to the Joint Committee on Finance of the Wisconsin Legislature.

We recognize the success of the department in capturing research dollars and in teaching, as evidenced by faculty members who have been recognized both within and outside the university. The Board congratulates Chuck DeMets on the Kellett mid-career award from the university; Eric Roden who received a Vilas Associate award; Steve Meyers on receiving an NSF Career award; Cliff Thurber, who received the Jordan-Vilas Distinguished Achievement Professor; Shanan Peters on being selected the Dean L. Morgridge Professor of Geoscience and on receiving an NSF Career award; Clark Johnson who garnered a Vilas Distinguished Professor Award; and Jean Bahr who was named Outstanding Educator by the Association of

Women Geoscientists.

The Board would also like to recognize Rich Slaughter for his leadership of the Geology Museum. During his tenure the museum has increased its research efforts, supporting two museum scientists, increased its outreach activities, updated and improved museum displays, and is in the process of getting an upgrade to its sample preparation laboratory. The Geology Museum has become a destination in Madison, and we encourage all alumni who are in or come to Madison to make a visit to what has become an outstanding part of the department.

The Board has concluded its fund-raising efforts for the Student Field Experience Fund. This fund was started to ensure that field experiences, which have been vital aspects of the UW-Madison Geoscience experience, continue to play a leading role in the education of future Department of Geoscience students. To date this fund-raising effort has received commitments in the form of gifts, pledges, and bequests of \$1,750,000. A new fund has been established in memory of distinguished alumnus Jay C. Nania, a longtime member and leader on the Board of Visitors. The Jay Nania Endowed Fellowship, when fully funded, will be awarded to a graduate student in the department for superior achievement, and will provide a twelve month research fellowship. We encourage donations to both the Student Field Experience and Jay C. Nania funds.

In addition, there are many other ways to contribute to the well being of the department, and students in particular. Please see page 28 for a list of funds and consider a contribution. Chris Glueck of the UW Foundation (chris.glueck@ supportuw.org, 608-265-9952), who assists the Board with its fund-raising activities, will be pleased to provide you with information on donation options that best meet your particular desires and circumstances.

We are always pleased to hear your comments and would welcome your suggestions for nominations to serve on the Board. On behalf of the Board of Visitors, thank you again for your support of the Department of Geoscience.

Rick Sarg, Board Chair jsarg@mines.edu Doug Connell, Board Vice-Chair dconnell@barr.com

#### Board Members / Contact

Rick Sarg, Chair	ncksarg@sbcglobal.net		
Tim Berge	tbberge@hotmail.com		
Donald Cameron	dcameron@bemagold.com		
Kirt Campion	kmcampion@marathonoil.com		
Doug Connell, Vice-Ch	oug Connell, Vice-Chair dconnell@barr.com		
Tom Doe	tdoe@golder.com		
Steven Driese	steven_driese@baylor.edu		
Evan Franseen	evanf@kgs.ku.edu		
Thomas Hoffmann	hoffman.tf@gmail.com		
Steve Johannsen	SJohannsen426@gmail.com		
Claudia Mora	cmora@lanl.gov		
Jeff Pietras	jeff.pietras@uwalumni.com		
Martin Shields	DrMLShields@gmail.com		
Sally Zinke	sallyzinke@yahoo.com		

# Gifts to the department in 2012: Thank you

Kenneth R. Aalto Paul N. Agarwal Daniel A. and Cynthia T. Alexanian Rebecca A. Allen Lance C. Anderson Charles B. Andrews and Elin Quigley Eric L. Aserlind Shashank R. Atre Jack A. and Laurel Babcock Brian C. Ball Michael E Barber Richard L. Beauheim John C. Behrendt Hugh F. Bennett Timothy B. S. Berge Robert O. Beringer Jonathan M. Berkson Karl J. Bethke Marcia G. Bjornerud Robert Blodgett Geoffrey C. Bohling Leo E. Bourcier BP North America Inc. Scott Brandt Michael R. Brauner Deena G. Braunstein Susan C. Broenkow Elwood R. and Della A. Brooks Donald E. and Tammye R. Cameron John S. Campbell Kirt M. and Jean M. Campion Kathleen G. Chambers Rodger H. Chapman Ronald R. Charpentier Chevron Energy Technology Co. Kenneth W. and Linda Ciriacks Robert M. and Suzanne G. Cluff Joan L. Coles Douglas E. Connell ConocoPhillips

Andrew D. Cosner Theodore F. Cota Nancy L. Crossfield William L. Curry William E. Davies James C. Dawson David A. DeVries Barry E. DeZonia Eugene W. Domack Steven G. and Marylaine H. Driese Janet M. Elliott Mark E. Emerson Maitri Erwin Wendy S. Esch Exxon Mobil Corporation Stanley C. Fagerlin Kurt L. Feigl Sarah K. Fortner Frederick A. Frey, Jr. Henry C. Fuller, Jr. Walter V. Green and Martha L. Gerdes Terrence M. Gerlach Steven I. Germiat Gregg M. Gibbs Robert H., Jr. and Linda C. Gillespie Scott D. Giorgis Jackson E. and Barbara E. Goffman Erin L. Gray Douglas B. and Lynn M. Groh Stanley K. Hamilton Robert J. and Barbara M. Hartman Patricia M. Hartshorne David C. and Florence E. Hass Nicholas G. Hayden Fred G. Heivilin Donald R. Hembre Robert G. and Elizabeth W. Hickman Glenn B. Hieshima Julie L. Hill Thomas F. and Karen J. Hoffman

Tom and Nancy Holley Terrance J. Huettl Steven T. Iltis Theodore E. Jacques William J. Johnson David G. and Sallie B. Jones James A. Joy William R. Kaiser Kirk L. and Jo L. Kapfhammer Robert F. Kaufmann Sally W. Kendrick Dennis R. Kerr Joe D. Kington and JoAnn R. Gage John H. Kopmeier, Jr. James G. Kosalos Jeffrey J. Kuglitsch William E. Laing John Larson Robert C. and Linda L. Laudon Thomas S. and Suzanne L. Laudon David R. Lee and Mariory B. Rinaldo-Lee Patrick J. Lehmann Samantha E. Leone David J. and Sheryl L. Lesar Kyle T. and Sherry S. Lewallen Jennifer L. Lewis Lance R. Lindwall Eric M. and Janet N. Luttrell Ruth H. Macdonald Louis J. Maher, Jr. Carol Mankiewicz Randall S. Marquard Stuart D. and Marcella E. Mathias John R. Mathie Charles L. Matsch Karen M. McCurdy David M. Mickelson Patricia D. Moore Claudia I. Mora William A. Morgan John P. and Tashia F. Morgridge

James R. Mulkey and Nancy Diezel Mulkey James A. and Elizabeth D. Munter Ralph H. Nafziger Newmont Mining Corp. Nexen Petroleum Michael P. Niebauer Alan R. and Wendy A. Niem Nyal J. Niemuth Gordon L. Nord, Jr. Jonathan E. Nyquist and Laura E. Toran Teresa M. O'Neill Perry G. Olcott Donald E. and Carol L. Paull Lynn E. Paull Rachel K. Paull Daniel T. Peterson Shaili M. Pfeiffer William W. Pidcoe, Jr. Edward L. Hershberg and Valerie J. Poris Michael L. Porter Sarah M. Principato E. Richard Randolph William R. Reise and Dolores G. Ellis-Reise Alberto Reves James D. and Stella M. Robertson Dennis L. Roder Gary D. Rosenberg Amy S. Ruf Dana C. Ruff Rickie L. Ryan Phillip L. Salstrom Cara M. Santelli J. Frederick Sarg Madeline Schreiber Frederic L. Schwab Janet E. Sempere Kirk W. and Elizabeth Sherwood Martin L. Shields Kent R. Siegel Susan Simpson

Christy H. L. and Kathleen A. Smith George L. Smith Mark A. Solien Donna Staples Philip H. Stark George J. Stathis Michael W. Stephens Thomas E. Stephenson Albert Y. Sun Harold W. Sundelius Michael L. and Lily A. Sweet Daniel L. Szymanski Joyashish Thakurta Jeffrey C. Thompson Scott E. Thornton Roderick W. and Carol H. Tillman Scott A. Troemner Andrew P. Trzaskus Lois J. Vitcenda Andrew F. Walch Maurice A. Warner Scott J. Weber Bruce R. Weertman Warren W. and Judith L. Wegner Walter T. Weinig James L. Welsh J. Michael Widmier Mary M. Wilcox Sarah E. Wilcox Brett M. Wingfield Leonard C. Winters Maryjane Wiseman Michael J. Woldenberg John L. Wray Susan Wustrack Nancy N. Yeend Lynn Yehle William C. York-Feirn Charles T. Young Donald A. Yurewicz and Theresa A. Einhorn Chunmiao Zheng

#### GSA Charlotte in 2012-alumi at the Badger reception



Jean Bahr, Peter Riemersma, and Christine Barsewski.



Chris Gellasch and Charlie Andrews.

# Distinguished Alumni Awards for 2013

#### THOMAS W. DOE

For distinguished contributions in geomechanics and their applications to radioactive waste disposal and hydrocarbon reservoirs; and in providing guidance and advice to students at the University of Wisconsin-Madison and liberal arts colleges.

of flow in rock

fractures, applying

these approaches

disposal efforts in

the US, Canada,

Sweden, Japan,

and France. More

been applying the

recently, he has

lessons learned

to radioactive waste

THOMAS W. DOE (M.S. 1973, Ph.D. 1980)

came to the University of Wisconsin-Madison after earning his BA in geology at Pomona College in 1971. Tom's strong interdisciplinary interests in engineering and geology began with his MS with Bob Dott, where he used soil mechanics principles to explain soft-sediment deformation in eolian sandstones of the Weber formation in Utah. His Ph.D. was jointly with Bezalel Haimson and Cam Craddock on geomechanical aspects of using tunnels for confining superconducting magnets acting as load-leveling for power grids.

Since 1986, Tom Doe has been at Golder Associates in Redmond, Washington, where he is a Principal. He has continued developing methods for integrating geologic fundamentals with geomechanical and petroleum engineering methods to better characterize the complexities



Tom Doe

from radioactive waste research to improving the understanding of fractured oil and gas reservoirs, including hydraulic fracturing applications in unconventional reservoirs.

Tom served as president of the American Rock Mechanics Association from 1998-2000. He also has been a member of the Committee on Geological and Geotechnical Engineering of the National Academy of Sciences and he has served on numerous panels reviewing radioactive waste disposal projects in the U.S. and internationally. The University of Wisconsin-Madison's College of Engineering honored Tom with a Distinguished Achievement Award in 2004.

Tom Doe has supported the development of future generations of earth science professionals through his work on the boards of the Geological Engineering program at Wisconsin and the Keck Geology Consortium of liberal arts colleges. Tom has just joined the Board of the Department of Geoscience. He has held adjunct positions at the University of California-Berkeley, the University of Washington, and the University of Utah. Most recently he spent a semester at Pomona College teaching hydrogeology.

-Herbert F. Wang, Citationist

#### WILLIAM J. HINZE

For distinguished contributions in advancing potential-field methods in geologic studies from the engineering to continental scale, and in providing extraordinary service to society and his profession.

#### WILLIAM J. HINZE (B.S. 1951, Ph.D. 1957)

Emeritus Professor of Geophysics at Purdue University, is a native of Wisconsin who became George Woollard's first undergraduate in geophysics. His Ph.D. thesis was a gravity study of the Baraboo Range, which was the start of a lifelong devotion to the use of potential fields in geologic studies, particularly in the Precambrian basement rocks of the midcontinent. Bill's studies helped identify the Midcontinent Anomaly as a Keweenawan rift and its extension through Lake Superior into the subsurface of the Michigan Basin for which he received the Goldich Award from the Lake Superior Institute.

Bill spent 40 years teaching and doing potential-field research at Michigan State and Purdue Universities where he was major professor to 90 graduate students who are



Bill Hinze

publications and has co-edited or co-authored five books. He is senior author of the Cambridge University textbook; "Gravity and Magnetic Exploration" and coauthor of the text "The Magnetic Field of the Earth's Lithosphere". He has served as Associate Editor of Geophysics,

than 130 journal

recognized leaders Senior H in academia and Researc industry. His research Chair of has involved a range of scales, varying from exceller local engineering Bill I investigations to numero satellite studies of activitie the continents. He geophys has authored or and geo co-authored more fields, a

Senior Editor of The Journal of Geophysical Research – Solid Earth from 1990 to 1996, and Chair of the Board of Journal Editors of the AGU. He received the AGU Kaula Award for editorial excellence and innovation.

Bill has served in an advisory capacity on numerous national and international geoscience activities building on his expertise in exploration geophysics, seismotectonics, the geophysics and geology of continents, gravity and magnetic fields, and digital geoscience data. He has been a member of several NAS/NRC committees and numerous task groups of the Academy and a member or chair of committees of the International Lithospheric Commission and the International Association of Geomagnetism and Aeronomy. —*Herbert F. Wang, Citationist* 

#### JEAN MORRISON

For distinguished contributions in the fields of metamorphic petrology and stable isotope geochemistry, and in providing academic leadership and vision.

emplaced plutons

providing new

insight into the

role of hydrous

fluids. Working

in the Whipple

Mountains, she was

large quantities of

surface water can

the first to show that

#### JEAN MORRISON (Ph.D. 1988) is Professor

of Earth Sciences, University Provost and Chief Academic Officer of Boston University. Jean completed her Ph.D. at the University of Wisconsin-Madison working with John Valley in the Adirondack Mountains. From Madison, Jean moved to the University of Southern California where she was on the faculty 22 years before moving to her present position in 2011. Jean's research is directed at the role of fluids in metamorphic processes. Her studies of metamorphosed Precambrian anorthosite massifs in New York, Ontario, and southern California established that extensive interactions with fluids were important in altering the compositions of magmatic protoliths and wallrocks, but that the meta-igneous rocks themselves were largely pristine. Her research on metamorphic core complexes distinguished magmatic vs. subsolidus epidote in deeply



Jean Morrison

percolate deeply, locally cooling the crust along detachment faults.

Jean has contributed to Earth Science through numerous professional positions. She has held several editorial positions, including eight years as a Senior Editor of the Journal of Metamorphic Geology. She was a member of the Council of the Mineralogical Society of America and of the UW-Madison Department of Geoscience Board of Visitors. In 2000, she was named the Sigma Chi Professor of the Year and received Sigma Gamma Epsilon's Excellence in Teaching Award. In 2002, she received the prestigious USC Associates Award for Excellence in Teaching. Jean is the first woman to be a Full Professor in the Department of Earth Sciences at BU and she is the first woman to be Provost of BU. In 2010, Jean was elected President of AAU/ AGS, the Association of American Universities (UW was a founding member in 1900) and Association of Graduate Schools.

At USC, Jean founded and directed WISE, the Women in Science & Engineering program in 2002, leading to her expanding role as an academic leader. She served as Associate Dean and Associate Provost before moving to BU as University Provost, where she brings the academic experience, skills, and vision needed to help the University's goal of increasing quality and impact. *—John W. Valley, Citationist* 

#### GSA Charlotte in 2012-alumi at the Badger reception



Clockwise from left: Megan Haserodt, Kallina Dunkle, Chris Carlson, Jeff Wilcox, Bill Simpkins, Jim Welsh, Aaron Cavoise, and Steph Maes.

# Land of Enchantment!

Geobadgers made a break for the Mexican Border

#### by Dave Lovelace

Spring Break that is! In 2012 a contingent of 22 GeoBadger undergraduates that was co-led by Shanan Peters and Dave Lovelace, made tracks for New Mexico on the inaugural Rails-to-Rocks Spring Break Fieldtrip. For most of the students this was their first experience riding a train across the country, and what an experience it was. After traveling across the flats of the central plains throughout the night, the students awoke to a sunrise that illuminated the grandeur of the high plains and the distant Rocky Mountains.

The group loaded the vans and stocked up before heading out to the San Ysidro anticline for a stratigraphy and mapping project. The next morning, although a little breezy, was a brilliant New Mexican day. We were only a little concerned when we looked towards our next destination, the Valles Caldera, and saw a decent buildup of dark clouds. Our minor concern turned out to be warranted. We looked at huge volcanic outcrops, hot springs, and an ever increasingly thick layer of freshly fallen snow. Upon reaching Los Alamos (and getting enough cell coverage to look at the weather for the next few days) we decided that there was only one reasonable



The group at the top of Emery Pass (Emery Caldera volcanic sequence).

alternative—drive the remaining length of the Rio Grande Rift all the way to the Mexican border!

Being good geologists we were tempted to deviate from our southern b-line by the evocative sounding City of Rocks State Park. A day of relative warmth, and dry conditions was a welcome treat after nearly 10 hours of non-stop driving through snowstorms. We spent the next day climbing around the remnants of flows from the Emory Caldera before we proceeded to the southern border to collect pyroclastic bombs that contain pieces of mantle (peridotite) from Kilbourne Hole!

Once we had all safely stowed our beautiful specimens the group made the trek north to Albuquerque with several stops along the way. We spent an afternoon playing in the gypsum sands of White Sands National Monument (which included some rather impressive aerial acrobatics by our fearless leader), camping along ancient reef buildups in the Sacramento Mountains, and a stop at the Great Unconformity. Of course no trip to New Mexico would be complete without a lava walk across the basaltic flows of the Rio Grande Rift (Valley of Fires) before heading home.

Our group of GeoBadgers: Shanan Peters, David Lovelace, Nichole Braudy, Evan Owens, Erin Berns, Ariel Goerl, Brigham Heyn, Shelby Kail, Lauren Lande, Benjamin Link, Alexandra Macho, Christian MacLeod, Bridger Mann-Wood, Raymond Nechvatal, Christina Porter, Nicholas Rashid, Thiruchelvi Reddy, Melissa Reusché, Andrew Ruetten, James Senn, Jessica Shen, Marshal Tofte, David Sandvig, Matt Wilson, and Kimberly Johnson made this trip a wonderful success. The Spring Break 2012 undergraduate trip was made possible by the alumni **Student Field Experiences Fund.** 



Jump around: Geobadgers on the gypsum dunes at White Sands National Monument.



After a week of visiting amazing locales the students collaborate on their San Ysidro mapping project on the train ride back to the Badger State.

# GUMO '13

### Spring Break: Geobadgers ride the rails to a UW Classic

#### by Shanan Peters

For many denizens of Weeks Hall, spring break provides the perfect opportunity to prime the summer field pump and get reacquainted with rocks in the field. Spring 2013 was no exception, and this year's undergraduate trip was a real classic in more ways than one. Under the direction of Shanan Peters, grad student T.A. Sharon McMullen, and brand new alumna volunteer instructor Nicole Braudy, a group of 21 undergraduate GeoBadgers ventured to southern New Mexico and West Texas. Their ultimate destination: the world-class Permian Reef complex of the Guadalupe Mountains (GUMO) region.

All four of my previous spring break trips have involved some pre-trip classroom time, but this year's preparation activities could be considered fieldwork in many other geoscience departments! Thanks to the definitive work of **Lloyd Pray, Toni Simo**, and their cadre of fine graduate students, we have a prodigious volume of world-class GUMO samples, all of which are curated in the Geology Museum by **Carolyn Eaton** and **Rich Slaughter**. This resource allowed



Shanan Peters gives a short lecture on bioturbated carbonate mudstones along the Permian Reef Trail.

met at Memorial Union, loaded the Van Galder bus to Chicago's Union Station, and then once again boarded Amtrak's Southwest Chief bound for Albuquerque. About 24 hours later, three vans were loaded and we headed out into the desert, dry camping on Pennsylvanian carbonates near Salinas Pueblo National Monument. After waking up to frozen water bottles, the group spent most of the first chilly day on a mapping exercise in some fantastic structures and carbonates in the Manzano Mountains. From there, it was straight to Walnut Canyon, Carlsbad Caverns, and

then back out to BLM land, where we dry camped on amazing and fun-to-explore cave networks in the evaporites of the Castile Formation. The next day was spent on McKittrick Canyon's Permian Reef trail, a world classic. On the way down from the very top of the Permian Reef Trail, we heard a bellowing "hello UW" from a group on their way up. It was Jody Bourgeois (UW PhD 1980), with a group of geology students from the other UW (Washington, that is)! We all enjoyed our accidental rendezvous, and took the opportunity to snag a collective UW photo.

Our last nights in GUMO were spent at the Pine Spring Campground, and

many in the group took a half day to hike up to the top of the world in Texas: Guadalupe Peak (as it turned out, Professor Peters led the charge up the mountain by a considerable margin). Rader slide outcrops at the foot of the mountain provided the final piece of the geological puzzle we had been assembling over the week, and gave us one last grand overview of GUMO. From there, it was on to the Great Unconformity in El Paso, and then back up the Rio Grande Rift to ABQ and the train home.

our group to examine hand samples and thin sections from nearly all of the major stratigraphic units in GUMO. So, before even setting foot on an outcrop, we had a great overall sense of the fine-scale petrology of the carbonate units we would see. This meant that we could focus field time on stratigraphic relationships and geometries, one of the real draws of GUMO, while not sacrificing the carbonate petrology that only polished slabs and thin sections can provide.

When March 23rd finally arrived, our group



The UW-Madison Geobadger Spring Break '13 crew.

Our group of GeoBadgers: Michael Bahrmasel, Brian Bartell, Jackson Borchardt, Zarek Boutaghou, Eric Chojnowski, Annaka Clement, Ariel Goerl, Carl Holtan, Shelby Kail, Lauren Lande, Matt Ledvina, Ben Link, Will Montz, Ray Nechvatal, Emma Olson, Christina Porter, Nick Rashid, Thiru Reddy, Andrew Ruetten, David Sandvig, and Matt Wilson were all great, as usual.

So, once again, it was another successful Spring Break undergraduate trip, made possible by the alumni **Student Field Experiences Fund.** •

# Beach Berm Bustin' on Lake Michigan

**Students in the Field** 

*Geobadger Sed-Strat explores a siliciclastic shoreface* 

#### by Shanan Peters

Geosci 430/431, Sedimentology and Stratigraphy, was reintroduced to our course catalogue in fall 2010 as part of a revised geoscience undergraduate curriculum. The lab portion of the course, Geosci 431, is field focused and one of the highlights in 2012 was a weekend trip to Warren Dunes State Park, not far from Benton Harbor, Michigan. This unique lakeshore environment features 80 m tall aeolian dunes and an active sandy shoreface. The goal of the field trip is to get hands-on experience with the sedimentology, stratigraphy, and fluid dynamics of a siliciclastic shoreface system. As an additional bonus, the group is also exposed to process sedimentology in fluvial systems, which feed into Lake Michigan, and this is where our field trip gets really interesting!

Sed-Strat takes place in the fall, often during relatively dry weather. As a consequence, the small fluvial systems that feed into Lake Michigan lose power and the wavedominated shoreface takes over, often building up beach berms that





impound the small creeks, creating temporary back-berm lakes. The sed-strat classes in 2010 and 2011 were able to observe these back-berm lakes, and then catastrophically drain them by digging small trenches that quickly turned into raging torrents, complete with standing waves! The 2012 beach berm wasn't big enough to dam the river, so last year's class missed out on that, but there was still plenty to see. The first day was unusually calm, allowing the class to easily wade into the lake and observe offshore sand bars in action.

Like all of our undergraduate major courses, sed-strat continues to swell in numbers. Fall 2011's class had 20 students, fall 2012 grew to 31, and fall 2013 has even more still. Bigger classes make it harder to get in the field, but thanks to the **Alumni Student Field Experiences Fund**, we are able to make it happen.





### DEGREES AWARDED MAY 2012-AUGUST 2013

#### Pb.D. Degrees

#### **MAY 2012**

**Bryn A. Benford**, Tikoff/DeMets, *Faulting and Strain Partitioning in Jamaica from GPS and Structural Data: Implications for Gonave and Hispaniola Microplate Kinematics, Northern Caribbean* 

#### AUGUST 2012

Kallina M. Dunkle, Anderson, Preferential Flow Paths in Heterogeneous Glaciallydeposited Aquitards

**JoAnn R. Gage**, Wang, Scale Dependence of Rock Mass Properties Measured by Fiber-optic Strain Gages

**Christopher A. Gellasch**, Bahr, Vulnerability of Urban Public Supply Wells in Fractured Siliciclastic Aquifer Systems

**Joe D. Kington,** Tobin, *The Structure and Kinematics of the Nankai Trough Accretionary Prism, Japan* 

Alexander C. Teel, Thurber, Seismic Tomography of the Sacramento-San Joaquin River Delta: Joint P-Wave/Gravity and Ambient Noise Methods

#### **DECEMBER 2012**

**Tina R. Hill,** Xu, *TEM Investigation of Nano-scale Precipitates in Ultrahigh-Pressure Clinopyroxenes* 

**David M. Lovelace**, Peters, *Ichnology*, paleoecology, and paleoenvironments of the Chugwater Group (WY), and Triassic macrostratigraphy of the western USA

**Ian J. Orland**, Valley, Climate deterioration in the Eastern Mediterranean as Revealed by Ion Microprobe Analysis of a Spelcothem that grew from 2.2 to 0.9 Ka in Soreq Cave, Israel

#### **MAY 2013**

**Amalia C. Doebbert,** Carroll, *Applications* of Detrital Zircon Geochronology and Isotope Geochemistry in Provenance Study Fangfu Zhang, Xu/Roden, Investigation of the Formation Mechanism of Sedimentary Dolomite

#### AUGUST 2013

**Chloë Bonamici**, Valley, *From grain to terrane: Integrated geochemical and structural studies in granulites* 

**Anthony D. Pollington,** Valley, *Stable isotope signatures of diagenesis: Natural and experimental studies* 

**David Ullman,** Carlson, *Dismantling the Laurentide Ice Sheet: Refining the chronology and mechanisms of deglaciation* 

#### Master's Degrees

#### MAY 2012

Nicolas A. Garibaldi, Tikoff, Constraints on the Geometry and Timing of Neotectonic Deformation within the El Salvador Fault System, El Salvador

**Benjamin J. Linzmeier,** Peters, Depth Migratory Behavior Elucidated by Ion Microprobe Analysis of  $\delta^{18}$ O Within Nautilus Macromphalus Shell Aragonite

Ashley Russell, Valley, Oxygen isotopes in garnet from eclogite: a review, new measurements, and zoning revealed by secondary ion mass spectrometry

**Carolyn Streiff**, Tobin, Fault zone architecture inferred from interpretation and seismic waveform modeling of the megasplay fault zone in 3D seismic reflection data, Nankai Trough Accretionary Prism

#### AUGUST 2012

**Chao Ma**, Meyers, *Testing the Astronomical Time Scale for Oceanic Anoxic Event 2, and its Extension into Cenomanian Strata of the Western Interior Basin* 

Helena M. Menendez, Thurber, Three-Dimensional P-wave Velocity Structure Beneath Long Valley Caldera, California, Using Local-Regional Double Difference Tomography **Jue Wang,** Tikoff, Three-Dimensional Geometry and Structural Analyses of Growth Faults in an Experimental Basin

#### MAY 2013

**Nicole S. Braudy,** Tikoff, *The deformation history of West Mountain, west-central Idaho: implications for the western Idaho shear zone* 

#### AUGUST 2013

**Tyler B. Blum,** Valley, Oxygen isotope evolution of the Lake Owybee volcanic field, Oregon, and implications for the evolution of the Snake River Plain-Yellowstone low $-\delta^{18}$ O large igneous province

Jessica P. Feenstra, Thurber, Microseismicity and 3D tomography of the central Alpine Fault, South Island, New Zealand

**Tim L. Foltz**, Peters, Chemostratigraphy and petrology of the Sauk Sequence in Northwestern Montana: deciphering the causes of stable carbon isotope variability in marine carbonates

**Kyle W. Fredericks**, Tobin/Goodwin, Petrophysical Properties of a Deformation Band Fault Zone in the Entrada Sandstone, Utah

Ashley J. Meulemans, Wang, Tomographic imaging of mine-induced stress changes in North Aurora, Illinois

**Chelsea E. Potier,** Wang, Subsurface Tiltmeter Observations of Solid Earth Tides and Rock Excavation in Northeastern Illinois

Aaron H. Pruitt, Bahr, Potential Impacts of Climate Change on Groundwater/Surface Water Interaction, Chequamegon-Nicolet National Forest, WI

Andrew P. Walters, Meyers, Cyclostratigraphic Evaluation of Repetitive Sedimentary Microfacies from the Green River Formation, Utah

#### Undergraduate Degrees MAY 2012

Andrew J. Eull Elizabeth A. Godlewski Alexander J. Hudy Michael J. Hurth Megan M. Jehring (GLE) Alexandra S. Macho Christian G. MacLeod Stefanie M. Massignan (GLE) Francis J. Newton Stacy L. Oszuscik (GLE) Melissa C. Setz (GLE) Sydney A. Wallner

#### AUGUST 2012

#### Bridger J. Mann-Wood

#### DECEMBER 2012

Jennifer M. Crozier Robert P. Muehlbauer Evan T. Owens Justin C. VanWieringen (GLE) Matthew D. Walker (GLE) Ray Wu (GLE) Faith M. Zangl (GLE)

#### MAY 2013

Muhammad Arif Bin Fazil Matthew L. Bloecher (GLE) Cole M. Christiansen (GLE) David P. Conroy Nicholas B. Garcia Ariel M. Goerl John T. Holcombe (GLE) Cory C. Katzban (GLE) Joseph E. Lane Matthew D. Ledvina Mary R. Matone (GLE) Amara J. Meier (GLE) William J. Montz Angus K. Moore Eric L. Niebler (GLE) Stuart N. Orlowski (GLE) Michael B. Patinkin (GLE) Dana E. Peterson Christina L. Porter Nicholas T. Rashid Melissa M. Reusché Hillary D. Rolf Jessica Shen Ross K. Tipton (GLE) Matthew J. Wilson (GLE) Michael H. Yeager Noor L. Zakaria

#### AUGUST 2013

Myriah M. Borofka Annaka M. Clement Adam R. Johnson Erica N. Larsen Benjamin J. Link Marshal S. Tofte

# In the News: Honors and Acknowlegements

**Richard Alley** (PhD 1987; Distinguished Alumnus 2005)) the Evan Pugh Professor of Geoscience at Penn State received an honorary PhD from UW-Madison at commencement in May 2013. He also gave a special lecture for the department, in Weeks Hall, on May 18.



Richard Alley receives the Honorary PhD from Interim Chancellor David Ward at commencement 2013. Photo, University Communications

- **Clark Johnson** and **Cliff Thurber** were selected by Provost Paul DeLuca to be Vilas Distinguished Professors. This is among the most prestigious awards available to faculty on our great campus.
- **Brad Singer** received a Distinguished Alumnus award from his alma mater, the Department of Earth Science at the University of California, Santa Barbara, on June 7th, 2012.
- Jean Bahr received the 2012 AWG Outstanding Educator Award "honoring wellestablished college or university teachers who have played a significant role in the education and support of women geoscientists both within and outside the classroom" presented at the annual GSA meeting. The nomination was submitted by one of Jean's former PhD students, Maddy Schreiber.
- Jean Bahr was appointed by President Obama to the Nuclear Waste Technical Review Board. The NWTRB is a small independent agency charged with reviewing activities of the Department of Energy associated with management of high level radioactive waste and spent nuclear fuel.
- Mary P. Anderson was honored at the Wisconsin Groundwater Association's, 2012 Annual Meeting technical symposium Friday, April 27, 2012: "A Celebration of Hydrogeology in Wisconsin."

**Clay Kelly** was promoted to Full Professor. **Harold Tobin** has been named a "GastProf" or Visiting Professor for six months at ETH-Zürich for the first half of 2014.

Anders Carlson, Alan Carroll, Shanan Peters, and Kyle Fredericks have received an Honored Instructor Award from students in campus housing.

Graduate students Tim Foltz, Dana Smith, Ad Byerly, Ethan Castongia, and Sarah Lemon, have achieved Honorable Mention at the international finals of the AAPG Imperial Barrel Award at Pittsburgh. AAPG Student Chapter president Kyle Fredericks also contributed substantially to this success, along with Joanne Tudge and Susanna Webb. The Imperial Barrel competition requires that students complete a comprehensive analysis of an actual exploration data set, which includes well logs, seismic, and other information. They have only about six weeks to complete their analysis before presenting their recommendations to a panel of highly experienced industry judges. This year 107 teams world-wide participated in the competition; to get to the finals in Pittsburgh the UW team first had to win a regional competition against four other teams. Particularly noteworthy is the fact that of the 11 finalists, UW was the only team from a state with no oil or gas production, and also the only team from a university with no formal petroleum geology or petroleum engineering programs.

- **Dana Smith** was awarded a Geological Society of America Graduate Student Research Grant and a U.S. Visiting Student Fellowship at the University of Minnesota's Institute for Rock Magnetism.
- Mike Cardiff is the recipient of the Lorenz G. Straub Award, an award for the most meritorious Ph.D. thesis in hydraulic engineering, ecohydraulics, or related fields. The competition for this award is international. The Stanford Department of Civil and Environmental Engineering nominated Mike for his 2010 dissertation.

Mike Cardiff received a 2012 award for excellence in refereeing for AGU's journal Water Resources Research. An official announcement appeared in EOS.

**Phil Brown,** co-instructor **Kurt Burmeister**, and the Wasatch-Uinta Field Camp Program have been honored with the 2013 GSA/ ExxonMobil Field Camp Excellence Award. It was presented by incoming Geological Society of America President Sue Kay at the Denver annual meeting and carries a significant cash award.

**Chunmiao Zheng** (PhD 1988) is the recipient of the 2013 O.E. Meinzer Award given by the Hydrogeology Division of the GSA in recognition of work that has significantly advanced the field of hydrogeology and strongly influenced subsequent research in the field. The award was presented at the GSA annual meeting in Denver. Chunmiao is a professor of hydrogeology at the University of Alabama and also Peking University, where he directs the Center for Water Resources.

He will also receive the 2013 M. King Hubbert Award from the National Ground Water Association.

- **Stephen Guggenheim** (PhD 1976) was given the 2013 Marilyn and Sturges W. Bailey Distinguished Member Award (its highest honor) at the 50th annual meeting of the Clay Minerals Society. Steve gave the Marilyn and Sturges W. Bailey Award Lecture at the meeting. Steve also gave a presentation about S.W. Bailey in a session: *Some Intellectual Genealogies: Honoring Those Who Came before Us.* (photo, page 22).
- **Ian Orland** (PhD 2012) was awarded postdoctoral fellowships by NOAA and NSF. He accepted the prestigious NSF award to work at the University of Minnesota on speleothems from China that record Pleistocene paleoclimate and changes in the Asian monsoon.
- **Ray Nechvatal** and **Melissa Reusché** were accepted into NSF Research Experience for Undergraduates programs for summer 2013. Ray is participating in the DUGG (Dune Undergraduate Geomorphology and Geochronology) project at UW-Platteville and U. Nebraska, and will be working in Nebraska and on south Lake Superior. Mel is attending the Svalbard-REU, and will be working in Kongsfjorden, Svalbard.
- **Steve Sellwood** was honored at the fall 2013 GSA meeting with one of the Hydrogeology Division's Student Research Awards as one of the top applicants to the GSA graduate student grant competition.
- The student research proposal of **Anthony Pollington** was selected for support by the MGPV Division of the the GSA Mineralogy, Geochemistry, Petrology and Volcanology

Division, with an award at the 2013 GSA meeting in Charlotte.

- "Geology student drills into Tohoku quake source: **Tamara Jeppson** in the news", May 22, 2012. Our graduate student was a top news headline on the UW-Madison home page.
- Science June 8, 2012 article on the role and importance of staff scientists at research universities that features UW-Madison and **Noriko Kita**.
- **Brian Jicha** and **Evgenya Shelobolina** promoted to from Assistant to Associate Scientist.
- **Elizabeth Percak-Dennett**, received the 2012 campus-wide Teaching Assistant Award.
- Receiving prestigious grants-in-aid awards from the American Association of Petroleum Geologists are **Richard Becker**, Robert and Lynn Maby Memorial Grant; **Kyle**

**Fredericks**, Gustavus E. Archie Memorial Grant; and **Dana Smith**, Harold J. Funkhouser Memorial Grant. There were only 84 recipients around the entire world this year.

- Jessica Feenstra has been honored in March 12, 2012's Eos with an Outstanding Student Paper award for her poster on her Alpine Fault research that she presented at the fall AGU meeting.
- **Randy Williams** was awarded an AAPG grant (spring, 2013). In addition, he received a GDL grant for research in structural diagenesis.
- Ten of our grad students received GSA research grant awards in 2013: Nathan Anderson (Harold T. Stearns Fellowship), Richard Becker, Erin Birsic, Megan Haserodt, Benjamin Linzmeier, Zachary Michel, Samuel Munoz,

# Deborah Rook, Allen Schaen, and Jody Wycech.

- Megan Haserodt received these grants for her research: Garden Club of America Coastal Wetlands Studies Scholarship, the Anna Grant Birge Memorial Award (UW Madison award for students in freshwater sciences), and the Alaska Geological Society Scholarship.
- In April 2013 undergraduate students **Adam McDaniel** and **Luke Kurey** were awarded The Mineralogical Society of America Undergraduate Prize.
- Travis Tenner, Daisuke Nakashima, and Kouki Kitajima were promoted from Research Associate to Assistant Research Scientist.

Department manager **Michelle Szabo** received one of the university's inaugural 2013 campuswide Administrative Achievement Awards.

# Student Awards and Scholarships for 2013

The Wasatch-Uinta Field Camp Scholarships—Funded by: Herbert & Albert Weeks, Paull Family Undergraduate Scholarship Fund, BP

John Chen Eric Chojnowski Annaka Clement Paul Crossett Kevin Gildea Steven Henning Lauren Lande Brendan McGarity Raymond Nechtaval Christina Porter Thiruchelvi Reddy Brigitta Rongstad Tad Scharnke Erin Thornton Liangquan Wang Matthew Wilson

The Outstanding Sophomore Awards Adam McDaniel Helen A. Tael

The Lowell R. Laudon Outstanding Junior Scholarship Jackson S. Borchardt The Laurence Dexter Environmental Scholarship Jacob R. Wolf

The Mack C. Lake Outstanding Senior Scholarships Cole M. Christiansen Melissa M. Reusché Brigitta L. Rongstad

The Paull Family Undergraduate Scholarship Angus K. Moore The Carl and Val Dutton Scholarship Lindsey V. Shanks

The James J. and Dorothy T. Hanks Undergraduate Award in Geophysics Dana E. Peterson



At the spring awards banquet, left to right: Megan Haserodt, Gabriella March, Deb Rook, Chloë Bonamici, Liz Percak-Dennett, Kelsey Winsor, Shannon Graham, Kyle Fredericks, Ian Orland, and Zach Michels.

The Winchell Scholarships to Foreign Students Muhammad Arif BinFazil Thiruchelvi R. Reddy Noor Liyana Zakaria

#### The Stanley A. Tyler Excellence in Teaching Award Kyle W. Fredericks Gabriella March Deborah L. Rook

The Thomas E. Berg Excellence in Teaching Awards Megan J. Haserodt Zachary D. Michels Kelsey Winsor

The James J. and Dorothy T. Hanks Graduate Student Award in Geophysics Jessica P. Feenstra

The Morgridge Distinguished Graduate Fellowship Deborah L. Rook

> *The Bailey Scholarship* Elizabeth M. Percak-Dennett

The Distinguished Paull Family Undergraduate Student Awards Peter W. Boettcher Erin C. Berns

> The Distinguished Graduate Student Award Chloë E. Bonamici

(Student awards continue on the next page)

#### The C.F. Schiesser Outstanding Research Paper Awards in 2012

#### Wasinee Aswasereelert

W. Aswasereelert, S.R. Meyers, A.R. Carroll, S.E. Peters, M.E. Smith and K.L. Feigl. Basin-scale Cyclostratigraphy of the Green River Formation, Wyoming. Geological Society of America Bulletin

#### Amalia C. Doebbert

A.C. Doebbert, A.R. Carroll, and C. Johnson. (2012) The sandstone-derived provenance record of the Gualala basin, northern California, USA. Journal of Sedimentary Research

#### Christopher A. Gellasch

C.A. Gellasch, K.R. Bradbury, D.J. Hart, and J.M. Bahr. Characterization of fracture connectivity in a siliciclastic bedrock aquifer near a public supply well (Wisconsin, USA). Hydrogeology Journal Shannon E. Graham

GPS and seismic constraints on the  $M = 7.3\ 2009$  Swan Islands earthquake: Implications for stress changes along the Motagua fault and other nearby faults

#### David M. Lovelace

D.M. Lovelace and S.D. Lovelace. (2012) Paleoenvironments and paleoecology of a lower Triassic invertebrate and vertebrate ichnoassemblage from the Red Peak Formation (Chugwater Group), Central Wyoming. Palaios 27:636-657. doi:10.2110/ palo.2012.p12-011r.

#### Ian J. Orland

I.J. Orland, M. Bar-Matthews, A. Ayalon, A. Matthews, R. Kozdon, T. Ushikubo, J.W. Valley. (2012) Seasonal resolution of Eastern Mediterranean climate change since 34 ka from a Soreq cave speleothem. Geochim Cosmochim Acta, 89: 240-255. DOI.10.1016/j.gca.2012.04.035

#### The Bailey Outstanding Research Paper Awards in 2012

#### Melodie E. French

M.E. French, D.F. Boutt, and L.B. Goodwin. (2012) Sample dilation and fracture in response to high pore fluid pressure and strain rate in quartz-rich sandstone and siltstone. J. Geophys. Res. 117: B03215

#### Ashley K. Russell

A.K. Russell, K. Kitajima, A. Strickland, L.G. Medaris Jr., D.J Schulze, and J.W. Valley. (2012) Eclogite-facies Fluid Infiltration: Constraints from  $\delta^{18}$ O Zoning in Garnet. Contr. Min. Pet.165: 103-116. DOI 10.1007/s00410-012-0794-9

#### Fangfu Zhang

F. Zhang, H. Xu, H. Konishi, J.M. Kemp, E.E. Roden, Z. Shen. (2012) Dissolved sulfide-catalyzed precipitation of disordered dolomite: Implications for the formation mechanism of sedimentary dolomite. Geochimica et Cosmochimica Acta 97, 148–165

# SPEAKERS IN 2012

February 3–Dr. Peter Wilf, Paleontological Society Distinguished Lecturer, Penn State University. Fossil Rainforests of Patagonian Fire Lakes and their Australasian Legacy.

February 10–Dr. Gregory P. Waite, Michigan Technological University. Volcanic Conduit Dynamics: A Multidisciplinary Approach to Modeling Low-Frequency Volcanic Seismicity.

February 17–Dr. Anders Carlson, Department of Geoscience, UW-Madison. Southwest Greenland Ice-Sheet Sensitivity to Climate Warming: A Holocene Perspective.

February 24–Dr. Matthew Hurtgen, Northwestern University. The role of ocean chemistry in regulating Earth surface oxygen levels.

March 2– Dr. Reinhard Kozdon, Department of Geoscience, UW-Madison. Ion microprobe analyses of  $\delta^{18}$ O in fossil planktonic foraminiferal shells: Minimizing the effects of diagenesis.

March 9–Dr. Aradhna Tripati, UC, Los Angeles, Departments of Earth and Space Sciences & Atmospheric and Oceanic Sciences, Institute of Geophysics and Planetary Physics. Recent developments in clumped isotope geochemistry and glacial climate.

March 16–Dr. Steve Holbrook, University of Wyoming. The Subduction Sponge: Mantle Serpentinization in the Downgoing Plate. March 23–Dr. Marin Clark, University of Michigan, Earth and Environmental Sciences. Slowing of continental collision: Implications for the forces that resist plate motion.

April 27–Dr. Tim Masterlark, University of Alabama. Probing the magma chamber of an active volcano with numerical models.

May 4–Dr. Carl Jacobson, Iowa State University. Subduction and unroofing of the Late Cretaceous-Paleogene Pelona-Orocopia-Rand schists of southern California and southwestern Arizona.

May 11–Dr. Brad Singer, Department of Geoscience, UW-Madison. Geological, geochemical and geophysical evidence for rhyolitic caldera inception in the Laguna del Maule volcanic field, southern Chilean Andes.

September 14– Dr. Peter Huybers. The bright side of the tree ring divergence problem.

September 19–Professor S. Majid Hassanizadeh, Utrecht University, Henry Darcy Distinguished Lecture. Sponsored by a grant from the National Ground Water Association. Transport of Viruses in Partially Saturated Soil and Groundwater

September 28–Dr. I-Ming Chou, U.S. Geological Survey. Quantitative Raman Spectroscopic Analyses of Geological Fluids. Also, New Developments on Optical Cells for the Study of Geologic Fluids at Moho and Sedimentary Basins.

October 5–Dr. Thomas Olszewski, Texas A&M University. The Permian Reef of West Texas: How Do Complex Ecological Communities Respond to Environmental Change?

October 12–Professor Emile Okal, Northwestern University. Eleven tsunamis from Sumatra (2004) to Tohoku (2011): Are we getting wiser?

October 19–Dr. Paul Hsieh, USGS-Menlo Park. The Science Behind the Taming of the Deepwater Horizon Oil Spill. Also, Fifty years of research and development to understand fluid flow in fractured rocks.

November 9–Professor Demian Saffer, Department of Geosciences, Pennsylvania State University. Pore Pressure in Subduction Zones: Where, Why, and How High?

November 1–ProfessorJulie Bowles, UW-Milwaukee. Ignimbrite (Post-)Emplacement Thermal History Derived from Titanomagnetite Curie Temperatures: Effects of Nonconvergent Cation Ordering and Exsolution.

November 30–Professor Steven Holland, Department of Geology, University of Georgia. Sea level, habitat area, and marine biodiversity.

Dec 14–Professor William Johnson, University of Utah. Pathogens in the subsurface: Predicting Darcy-scale transport from nanoscale processes.

# Campaign at the Laguna del Maule Volcanic Field



In May, a top story in the university's *The Why Files: The Science Behind the News* 2013 featured the 3-week field campaign at the Laguna del Maule volcanic field, Chile by Brad Singer, Basil Tikoff, Cliff Thurber, and graduate students Nathan Andersen, Erin Birsic, Hélène Le Mével (pictured, above), and Tor Stetson-Lee, as they try to understand better what is driving the astonishing uplift of this large volcanic system in the Andes. Journalist Dave Tenenbaum accompanied the GeoBadger team for the 1st week of the 3-week campaign. Go here: http://whyfiles.org/2013/exploring-a-volcano/

#### Isotope Geochemistry Laboratory Renovation and Installation of New Mass Spectrometer



The new MC-ICP-MS instrument, showing the detector/ collector system in the foreground. Samples are introduced at the opposite end of the instrument, via solutions or laser ablation.



The existing MC-ICP-MS instrument (right) and femtosecond laser ablation system (left), and new MC-ICP-MS instrument in center-rear.

In 2013, the Department's Radiogenic Isotope Lab, directed by **Clark Johnson** and **Brian Beard**, underwent an expansion and installation of a new Multi-Collector Inductively Coupled Mass Spectrometer (MC-ICP-MS). The new mass spec, a Nu Instruments Nu Plasma II, joins existing instrumentation in the lab, a Thermal Ionization Mass Spec (TIMS) that was installed in 1987, and another MC-ICP-MS, a Micromass IsoProbe, which was installed in 2000. A Photon Machines femtosecond laser ablation system (developed between 2010 and 2012) sits adjacent to the two MC-ICP-MS instruments so that either can be used for in situ isotopic measurements on micron-size spots.

The research program of the Radiogenic Isotope Lab spans a range of topics from evolution of volcanic systems to early Earth metabolisms and surface conditions. The new MC-ICP-MS has some clear advantages over the existing MC-ICP-MS for lighter elements, as well as a more robust lowlevel detection system to aid in analysis of very small samples. The \$700K instrument was funded by NASA and NSF, as well as the Graduate School at UW-Madison. The lab remodeling costs, significant for these specialized instruments (\$120K), were covered through gift funds. Gift funds are essential to the Department in its effort to provide state-of-the-art facilities to students, staff, and faculty, as remodeling cannot be covered from Federal grant funds.

# Clock around the rock

Deciphering the beat of a timeless rhythm— The future of astrochronology

#### by Stephen R. Meyers

The geologic record is the only available documentation of long-term environmental change, providing an opportunity to evaluate the causes and consequences of climate variability, and the evolving linkages between Earth System components, including the biosphere. In order to accurately interpret this record and assess rates of biologic, chemical, and physical change on our planet, we require a means to tell time as accurately as possible, often to a precision higher than that attainable by traditional geochronologic methods. My research program contributes to a frontier area of Earth Science known as Astrochronology, which utilizes the geologic record of climate oscillations - those ascribed to periodic changes in the Earth's orbit and rotation - to measure the passage of time directly from repetitive sedimentary layers in rock. The basic concept is akin to a tree's annual growth rings, used to reconstruct the chronology of its life. The 'fastest' of these astronomical rhythms occurs with a period of 20,000 years, and when such oscillations are reliably preserved in the stratigraphic record, they provide the most finely resolved time scale available for most deep time (> 1 million vear old) strata. UW-Madison has substantial roots in this field, as one of the key scientific figures that recognized the potential of Astrochronology and helped to spur along its 'modern' renaissance is distinguished alumnus Alfred G. Fischer (B.A., 1939; M.S., 1940; see Outcrop 2008).

The impact of Astrochronology on the quantification of deep time, and the evaluation of past perturbations to the Earth System (e.g., extinction events and climate change), has been truly revolutionary; the approach is now even employed to calibrate radioisotopic dating methods and test their veracity. But reading the periodic astronomical rhythm



Steve Meyers in his Weeks Hall lab.

from the stratigraphic record is often challenging, as climate change is influenced by other factors, including random ('stochastic') processes. Further, climate is only one of numerous controls on the formation of the sedimentary rock record. Perhaps most troubling, the rate of formation of the rock record can be highly variable, and strata are often riddled with long and short pauses and omissions – gaps in the recording that can be difficult to quantify, or even identify. The result is a patchy amalgam of astronomical signal and noise, which requires a careful and sophisticated quantitative approach: part stratigraphy, part geophysics, part geochemistry, and part paleoclimatology. This intersection of fields is where I have focused much of my scientific effort, in developing a theoretical and computational framework for Astrochronology that extracts the signal from the noise, while using both components to constrain the dynamics of surface Earth processes.

In 2008, I introduced a conceptual framework termed the 'pathway of the orbital signal' (Figure 1), which provides a broader context for the challenges outlined above, but also illustrates the potential prospects of Astrochronology (Meyers et al., 2008). This pathway recognizes the preserved climate signal as one that has been sequentially filtered through a wide array of processes, each of which serves to distort - and may even render unrecognizable - the climate response that we seek to quantify. Alternatively, if each step in this pathway is quantitatively constrained, the resulting 'transfer functions' yield information about a wide range of Earth surface processes, including paleoenvironmental change, but also the dynamics within depositional systems (ice sheets,

continental margins, etc.) and their feedbacks with climate change. My first contribution on the specific topic of transfer functions was the introduction of a quantitative approach for evaluating the linkage between climate and deposition, using a statistical time-series analysis approach (Evolutive Harmonic Analysis) in



**Reconstructed Climate Variables** 

Figure 1. Theoretical pathway of the orbital signal, from insolation changes to proxy data series employed for time-series analysis (Meyers et al., 2008).

tandem with stratigraphic modeling (Meyers et al., 2001). A follow-up paper (Meyers and Sageman, 2004) more thoroughly developed a new approach for identifying cryptic gaps in stratigraphy – the missing part of the recording – a fundamental problem that has served as a major challenge to the field of Astrochronology.

In these studies and subsequent publications, an underlying philosophy is that much of what has commonly been regarded as noise in the stratigraphic record is in fact untapped signal. Thus, the approach I've pursued is to develop and apply appropriate quantitative statistical methodologies and modeling techniques, which when combined with sound stratigraphic reasoning and high quality data, can accurately and precisely extract the signal from the noise. Subsequently, the integration of recovered astronomical signals with a wide array of geochemical, paleobiologic, and sedimentologic data, to assess rates of environmental and biologic change, provides a major advance in quantification of the surficial Earth System. It is important to stress that our goal is to understand rates, a time derivative, and traditional geochronologic precisions are not sufficient to provide rate information over short timescales  $(10^4 \text{ years})$ ; this is a major advantage of astrochronologic approaches to time.

Although the potential power of Astrochronology is clear, a challenge that still hinders many studies is the inability to unambiguously assign observed stratigraphic rhythms (measured in meters) to astronomical cycles (measured in years) using available radioisotopic age data; in such circumstances the presence of specific astronomical cycles must be assumed. This results in a potential circularity in derived geologic timescales, and has led some to question the veracity of particular astrochronologies. To help resolve this issue, a new computational method for astrochronologic testing termed average spectral misfit (ASM), has been developed (Meyers and Sageman, 2007; Meyers et al., 2012a). The technique comprehensively evaluates all plausible astronomical interpretations (time scales) while also providing

a formal statistical test of the null hypothesis of 'no astronomical signal' via Monte Carlo simulation. The method has now been applied to address long-standing cyclostratigraphic controversies, from the Triassic, Cretaceous and Eocene (Figure 2; Meyers and Sageman, 2007; Meyers, 2008; Meyers et al., 2012a).

Over the coming years, the direction of my research program will be guided by a recently funded NSF CAREER award, "Deciphering the Beat of a Timeless Rhythm: The Future of Astrochronology". This project builds upon the theoretical and computational advances outlined above, to address fundamental challenges to the development of accurate and precise deep time astrochronologies. Its major topics include (1) statistical astrochronologic testing (e.g., further development of ASM), (2) integration with radioisotopic data (including Bayesian statistical approaches; Meyers et al., 2012b), (3) refining orbital and rotational models for the Earth, and (4) transfer function assessment for evaluation of Earth surface processes. One objective is to provide a standard quantitative methodology for Astrochronology - which is presently lacking - and its dissemination through software (such as 'R'), professional workshops, and graduate student training.

An ultimate goal is to bring attention to Astrochronology as an important and evolving



Figure 2. Upper graph: Average Spectral Misfit results for oil yield data from the Currant Creek Ridge No. 1 core (Wyoming, USA), Eocene Green River Formation. The astronomical interpretation of Fischer and Roberts (1991) is confirmed. Lower graph: A segment of the analyzed oil yield data from the Currant Creek Ridge No. 1 core illustrating the identified short eccentricity (~100 ka) and long eccentricity (~400 ka) cycles. Results from Meyers (2008).

approach for investigating Earth history as a whole. In addition to this work, I have established an x-ray fluorescence scanning laboratory that provides much of the geochemical data for ongoing projects (see Outcrop 2010), and I maintain a broader involvement in sedimentary geology and paleoclimatology/ paleoceanography research. A common theme in all this work is the integration of data with modeling and statistical techniques, to unravel the history of the climate system, oceans and geosphere.

#### CITATIONS

Fischer, A.G., and Roberts, L.T., 1991, Cyclicity in the Green River Formation (lacustrine Eocene) of Wyoming: Journal of Sedimentary Petrology, v. 61, p. 1146–1154.

Meyers, S.R., Sageman, B., and Hinnov, L., 2001, Integrated quantitative stratigraphy of the Cenomanian-Turonian Bridge Creek Limestone Member using Evolutive Harmonic Analysis and stratigraphic modeling: Journal of Sedimentary Research, v. 71, p. 627-643. (JSR Outstanding Paper of 2001)

Meyers, S.R., and Sageman, B.B., 2004, Detection, quantification, and significance of hiatuses in pelagic and hemipelagic strata: Earth and Planetary Science Letters, v. 224, p. 55-72.

Meyers, S.R., and Sageman, B.B., 2007, Quantification of Deep-Time Orbital Forcing by Average Spectral Misfit: American Journal of Science, v. 307, p. 773-792.

> Meyers, S.R., 2008, Resolving Milankovitchian Controversies: The Triassic Latemar Limestone and Eocene Green River Formation: Geology, v. 36, p. 319-322.

Meyers, S.R., Sageman, B.B., and Pagani, M., 2008, Resolving Milankovitch: Consideration of Signal and Noise: American Journal of Science, v. 308, p. 770-786.

Meyers, S.R., Sageman, B.B. and Arthur, M.A., 2012a, Obliquity forcing of organic matter accumulation during Oceanic Anoxic Event 2, Paleoceanography, 27, PA3212, doi:10.1029/2012PA002286.

Meyers, S.R., and Siewert, S.E., Singer, B.S., Sageman, B.B., Condon, D.J., Obradovich, J.D., Jicha, B.R., and Sawyer, D.A., 2012b, Intercalibration of radioisotopic and astrochonologic time scales for the Cenomanian-Turonian boundary interval, Western Interior Basin, USA, Geology, v. 40, p. 7-10.

# Alumni News—2012-13

### 1950s

#### Gwen M. Schultz, MA Geography, 1950

My book Wisconsin's Foundations, published by the University of Wisconsin Press, has been selling well for several years. I have arranged to have all royalties past and future to go to the C.K. Leith Library of Geology and Geophysics in Weeks Hall. (Please see the inside back cover of this Outcrop.)

#### Ron Tank, BS 1951, MS 1955, MS Water Resources Management, 1980

ronald.w.tank@lawrence.edu I taught intro geology at Lawrence University in Appleton, WI.

#### Lynn A. Yehle, BS 1952, MS 1954

I am continuing as a geologist emeritus with the USGS.

#### Joan L. Coles, BS 1954

joancoles@smission.com

We took a trip to Antarctica in January 2012, and to Santa Fe for a week of opera in August 2012.

#### Rachel Krebs Paull, BS 1954, PhD 1980

rocdox@comcasst.net

It was a quiet, sad, close-to-home year. Not a happy one for RAP or me—the downward slide for my brave man was hard for us both. He left us on Oct 13, 2012, seeking fabulous geology over the ridge, with trout fishing to match...I've lost (despite the 11 years post-stroke) the love of my life, as well as my encyclopedia! I'm so grateful for our time together. (See the obituary for Richard A. Paull on page 18).

#### Gaither M. Randall, MS 1954

I worked for 32 years in the oil industry and retired in 1986. My wife Kathleen and I live in Sun City West, AZ. (Editor's note: Mr Randall's poem, Man of Geology, is too lengthy to publish here, but we will place it in our alumni archives files.)

#### Ray Murray, PhD 1955

rcm@bresnan.net

The second edition of "Evidence from the Earth—Forensic Geology and Criminal Investigation" has been published. I received the "Forensic Geoscience Group award for contribution to the field" from the Geological Society of London.

I am on the Scientific Working Group for Geology developing standards for Forensic Geology sponsored by the Army Criminal Investigation Laboratory. Lots of talks around the world on solving crimes with rocks and minerals.

#### Walter Wornardt, BS 1956, MS 1958

I developed and applied the well log seismic sequence stratigraphic, analysis to shale trends in Eagle Ford-Austin and Bossier-Haynesville, originally developed in 1990.

#### Marvin L. Schroeder, BS 1958

linmarschroeder@msn.com

My book Geologic Odyssey, A Journey through Earth Science, is now being distributed nationwide. The book details aspects of my geologic life with the intention of furthering understanding about the earth sciences within a general audience. It may also be of interest to students. The book is currently on the Kindle and Nook ebook websites and Amazon. com.

#### Jose Fonseca, BS 1959

I am retired as director of exploration of Petrobras International (Braspetro) participated in the exploratory group that discovered the super giant Majnoon Oil Field in Iraq (1976) with over eight billion barrels of oil reserves.

#### Richard L. Mertins, BS 1959

I am retired (National Utilities Co.) and living an active life in Oconomowoc, WI and Naples, FL.

#### John Weihaupt, BS, MS, PhD

#### John.Weihaupt@ucdenver.edu

A new publication, Impossible Journey: The Story of the Victoria Land Traverse 1959-1960, Antarctica by the emeritus professor, University of Colorado, Denver, traces the trail of a four-month, 2,400-km journey into the unexplored hinterland of East Antarctica in 1959-60. According to the publisher, Geological Society of America, the trek by the Victoria Land Traverse team is a critical link in the International Geophysical Year/U.S. Antarctic Research Program.

#### 1960s

#### Pete Stark, MS 1960, PhD 1963 pete.stark@ihs.com

Another year of fulfilling professional activities: I managed a handful of publications, presented papers at seven industry meetings, and I especially enjoyed speaking at one of Alan Carroll's classes. I am the co-author of an analysis of 27 tight oil plays in North America. This project culminated with workshops in Saudi Arabia, Paris, and Milan.

#### Richard A. "Skip" Davis, post-doc, 1964-65

madradrpt@gmail.com

I published two books, one sole-authored, one coedited. I received an Honorary Membership from SEPM. My book on Gulf Coast beaches is in press.

#### Jack Halberg, BS 1964

msg4jh@hotmail.com

With a partner I continued to pick up and evaluate gold mining tenements in Western Australia. Forty years worth of 1:25,000 scale mapping in the Yilgarn Block of Western Australia and associated petrographic/geochemical data bases will shortly be offered on-line. Mary Jo and I thoroughly enjoyed the **Brown/Bowser**-led White Lake reunion field trip. In Boulder NV we caught up with Fred Bachhuber, my White Lake mapping partner in 1963.

#### Charles W. Barnes, PhD 1965

chuck.barnes@nau.edu

I am retired after 40 years at Northern Arizona University. Research activities include the structural geology of eastern Grand Canyon and adjacent complex monoclines, which interfinger. Also geology of Venus, Mars, and Ganymede (Jupiter's largest moon).

#### Stan Hamilton, MS 1965, PhD 1967

I worked for many years with Amax Exploration and Amax Gold in the metallic mineral exploration and mining business and am currently a consultant and senior associate with Behre Dolbehr and Company.

#### Nancy Neal Yeend, BS 1965

I volunteered to help with research on endangered South African penguins, but after one week the research turned into penguin rescue, because of yet another oil leak near Robben Island.

#### Gary Rosenberg, BS 1966

The History and Philosophy of Geology Division, GSA, gave me their highest honor, the Mary C. Rabbitt Award this year for my publications on art history of history of geology. I retired from IUPUI this year and moved to Milwaukee to continue my research, an exploration in art history and history of geology.

#### David R. Schwimmer, BS 1967

schwimmer\_david@columbusstate.edu I am in the Department of Earth and Space Sciences at Columbus State University (GS). I am working on both Cambrian trilobites and Late Cretaceous vertebrates. Recent papers are in PLOS ONE, and Southeastern Geology.

#### Lee Trotta, BA 1969

lctrotta53072@yahoo.com

In May 2012 I participated in a three-week scientifuc expedition to the Galapagos. I continue as Editor of the Wisconsin Ground Water Association Newsletter.

#### 1970s

#### James C. Dawson, PhD 1970

dawsonjc@plattsburg.edu

I am now in my 43rd year of teaching geology to undergraduates at SUNY Plattsburgh and I was recently elected Chair of the History and Philosophy of Geology Division of GSA for 2012-13.

#### Mike Peters, MA 1970

mlpeters@sharontelephone.com My wife Lana and I met at UW in the fall of 1969. We are farming in southern WI. We grow organically certified grain crops, corn wheat, soybeans, etc. From our farm I can see a prominent glacial ridge, or terminal moraine six miles to the east. Doc Laudon once told us, that if you get interested in this, you will stop at every "pile of rocks you see on a trip". And you know, we still do.

#### Paul LaPointe, MS 1976, PhD 1980

I spent a busy year constructing full-field fractured reservoir models for fields in Iraq, Utah, Kuwait, and Abu Dhabi. I also completed a data "mining" project for a longwall coal mining company in New Mexico. I was invited to give the keynote address in June at the annual meeting of the American Rock Mechanics Association, and Memoir 96, Uncertainty Analysis and Reservoir Modeling: Managing Assets in an Uncertain World, which I co-edited with a colleague from Schlumberger, was finally published; in December I became a Charles H. Taylor Fellow of the AAPG. One of my favorite times this year was participating in the First Geological Engineering Conference held in Madison in September and getting back to campus. It was good to see some old friends from the department: Jean Bahr, Mary Anderson and Ken Bradbury.

#### Bob and Suzanne Cluff, MS 1978 (both)

bobcluff@discovery-group.com; suecluff@discovery-group.com Discovery Group celebrated its 25-year anniversary. Who would have thought it possible?

#### Eugene Domack, BS 1978

edomack@hamilton.edu

I was elected a fellow of AAAS in 2012. I continue to teach glacial geology, geology of the southern hemisphere, and to take undergrads to Antarctica under NSF support.

#### **Robert Freymuller, BS 1978**

robert.freymuller@gmail.com

After many years of chasing oil and gas plays around Texas I have settled down with my family in Austin, where I am a state employee with the railroad commission. We enjoy staying in our little apartment in Paris, France any chance we get, and rent it to vacationers when we are not there.

#### Jim Stark, MS 1978

I am the Water Science Center Director, US Geological Survey, Minnesota.

#### Dave Moecher, BS 1979, MS 1984 moker@uky.edu

was promoted to Professor, named Chair of the Department of Earth and Environmental Sciences, and received the University of Kentucky Kenneth Freedman Outstanding Faculty Advisor Award for undergraduate advising, which allowed him to compete for and be awarded the National Academic Advising Association Region III Outstanding Faculty Advising Award. **Ryan Quinn**, a recent UK MS student who worked with me, is now in the Department of Geoscience at UW working with John Valley (who was on my PhD dissertation committee at the University of Michigan).

#### Dale C. Vodak, BS 1979

dcvodak@gmail.com;

dale.vodak@tceq.texas.gov

I helped arrange then participated in a field trip to the gorge at Canyon Lake outside New Braunfels, TX, as part of my annual Professional Geoscientist Continuing Education hours.

#### 1980s

#### Jack Murosko, MS 1981

I am a senior program manager for environmental services at Exelon Power, and a subject matter expert for site investigations, site remediation, groundwater issues, and coal combustion byproducts.

#### Keith Winfree, MS 1983

keith.e.winfree.@conocophillips.com I had the great pleasure of mentoring a summer intern who had previously earned his MS at Tulsa under the direction of my classmate, Dr. Dennis Kerr. I am enthusiastic about the "new" upstreamonly Conoco Phillips.

#### 1990s

# Shashank R. Atre, MS 1990 (Geophysics), 1993 (Geology)

satre@robertmorris.edu I became Chair of the Natural Sciences at Robert Morris University of Illinois in January 2012. A paper was accepted for publication by EEGS.

#### Gary Gianniny, MS 1990, PhD 1995

gianniny-g@fortlewis.edu

I received the "Scholar of the Year" Award for 2011-12. My work with undergraduate research currently focuses on Paleozoic carbonate sequences stratigraphy, and microbial carbonates. In the last three years I have also collaborated with my wife, Dr. Cynthia Dott (also at fort Lewis College) on integrated riparian hydrology and plant community ecology along rivers of the southwest.

#### Wendy Esch, BS 1992

wendye@shawanoschools.com I am a physical sciences teacher (astronomy, geology, in Shawano, WI) and a NASA Heliophysics Educator Ambassador, NASA Themis Mission-GEONS.

#### Terrance Huettl, BS 1992

thuettl@comcasgt.net I am the VP of development at the Whitesell Construction Company, Delran, NJ.

#### Ann Fritz, MS 1996

AFritz@nd.gov

I have been an Environmental Scientist III in the North Dakota Department of Health–Division of Water Quality since 2000. Our division is the water quality regulatory authority for North Dakota. My responsibilities are in the GIS program and also a number of GIS users in the Health Department. Increasing oil activity in North Dakota's Bakken Play has made our work interesting and busy! I recently became a Certified GIS Professional. I am the North Dakota data steward for the National Watershed Boundary Dataset and active in stewardship activities for improving that dataset for the nation.

#### 2000s

#### Craig N. Reid, GLE 2001, Geology 2001 Craig@C2Earth.com

I founded C2Earth, Inc. an engineering geology and geotechnical engineering firm servicing the greater San Francisco and Monterey Bay Areas. In January 2012 C2Earth, Inc. acquired Upp Geotechnology, a corporation that provided engineering and geologic services in the Bay Areas since the early 1980's. Our lovely daughter, Soraya L. Reid was born on August 30, 2011.

#### Yu-Feng Lin, PLE PhD 2002

yflin@illinois.edu

I took a new hydrogeologist position at the Illinois State Geological Survey after working ten years at the Illinois State Water Survey.

#### Jennifer (Neilsen) Lewis, MS 2006

I teach full time at Madison (WI) Area Technical College: general geology, earth science, and oceanography. I also serve as an on-line teaching fellow for my college. Ian and our two sons explore the East Coast while he finishes his post-doc at Princeton.

#### Penelope Lancaster, MS 2007

I moved to the University of Portsmouth (UK) as a senior research associate in March 2013.

#### Kuwanna Dyer Pietras, MS 2005

dyerpiet@binghamton.edu Jeff and I just moved the family to New York and we've accepted teaching positions at SUNY Binghamton. I'm an adjunct lecturer and I'll be teaching geomorphology and environmental geology, and likely pursuing my PhD in geomorphology in the next year or so. I am really enjoying being back in academia and spending more time in the field. We are enjoying our new lives and house on the hill, and our girls are adjusting well. Abby is now 4 years old and Erin will be 2 years old in December. Can't believe how fast the time is flying. . . Jeff and I will celebrated 10 years together in September!

# In Memoriam

**Ray Everett Wilcox,** PhB 1933; PhM 1936, PhD. 1941 passed away in Lakewood, Colorado, at age 99 on March 12, 2012, just weeks away from his 100th birthday. He was born in Janesville, WI.

Ray made groundbreaking contributions to two disciplines, volcanology igneous petrology and optical mineralogy. He was a distinguished Research Geologist at the U.S. Geological Survey (USGS) in Denver for 40 years.

At the UW he studied with the outstanding scientists of that era. Under R.C. Emmons and A.N. Winchell he gained a solid foundation of the principles and utility of optical mineralogy. He married Mary Marks in 1942, a geology major (and in a mapping class Ray was teaching).

During World War II he was an officer in the Aleutian Islands and later did fieldwork for the U.S. Geological Survey. Ray conducted long-term observations of Parícutin Volcano in Mexico, where he spent two years near the remote village of Angahuan. A volcano on Seguam Island now bears his name. In 1969 Ray was one of two mineralogists in the Survey chosen for the Lunar Sample Preliminary Examination Team to analyze lunar samples from the Apollo 11 and Apollo 12 missions.

Ray received many career honors: the UW-Madison Distinguished Alumni Award in 2001, the U.S. Geological Survey Department of Interior Meritorious Service Award in 1983, the U.S. Geological Survey Scroll of Honor, and the Geological Society of America 50-Year Fellow Award. He was also a Life Fellow of the Mineralogical Society of America.

Mary Marks Wilcox (UW-Madison Geology, BA 1942), his wife of 69 years, four children, nine grandchildren, and ten great-grandchildren, survive him.

**Raymond C. Robeck**, BPh 1941, died December 14, 2012. After preparing bomb target charts for the US Air Corps, he joined the USGS Fuels Branch (1943-45) studying the coal resources of Mexico and Korea. After studying the uranium of the San Rafael Swell, Utah, he resigned and became a consulting geologist. In 1985 he retired to Maui.

**Elliott A. Riggs**, BS 1951, MS 1953. Died August 12, 2012 in Farmington, NM. He worked for Texaco until 1965, after serving in the military, when he left to start well site work based on his experience in the Paradox and San Juan Basins.

**William Blake Fox,** BS 1952, MS 1957, died May 5, 2011. He and his wife Donna lived in Casper, Wyoming for the last 40 years of his life. **Richard A. Paull**, BS 1952, MS 1953, PhD 1957, died on October 13, 2012, in Littleton, CO. He was born May 20, 1930, in Madison.

RAP did two graduate theses under Lowell Laudon, with field areas in the Canadian Rockies and Big Horn Basin of Wyoming. He served two years as a lieutenant with the U.S. Air Force doing missile site surveys in the Caribbean and South America and in Europe. After five years as a clastic sedimentologist in Tulsa, OK, he left petroleum research, to develop the geology program at the UW-Milwaukee, and served as the first departmental chair. He worked tirelessly for 34 years before retirement to establish a strong departmental reputation in the petroleum industry and to acquire student support. He created and led a seven week summer field camp for geology students in the Rocky Mountains for 31 years, and he and his graduate students produced pioneering geologic maps and stratigraphic reports for southern Idaho. He co-authored books and roadguides on the geology of Wisconsin and Upper Michigan.

Along with his wife Rachel Krebs Paull (BS 1954, MS 1970, UW-Milwaukee, PhD 1980), he was honored as a Distinguished Alumnus of our department 2002. He was married to Rachel for 58 wonderful years, and has three daughters, and five grandchildren, who survive him.

John J. Prucha died October 22, 2012 at the age of 88 in Syracuse, NY. A former senior geologist of New York State, he served as dean of the College of Arts and Sciences and twice as chair of Earth Sciences at Syracuse University. He was a specialist in structural geology. His bachelor's and master's degrees were from our department (UW) in the early 1960s.

James C. Knox passed away in Madison at the age of 71 on October 6, 2012. He was born in Platteville, Wisconsin. Jim taught Geography at UW-Madison since 1968, retiring in 2011 as Evjue-Bascom Professor. His specialty area was geomorphology.

Jim supervised the completion of 30 Ph.D. dissertations and 55 M.S. theses in Geography. He also supervised MS students in the UW Water Resources Management Program and was a member of PhD dissertation committees in Geosciences, Civil & Environmental Engineering, and Soils. Professional Honors given to Jim Knox include Fellowship in the Geological Society of America, Fellowship in the American Association for the Advancement of Science, a research Honors Award from the Association of American Geographers, the G.K. Gilbert Award for Excellence in Geomorphological, the M.G. Marcus Distinguished Career Award. The Association of American Geographers' Presidential Achievement Award for Long-Standing and Distinguished Contributions to the Discipline, and The Geological Society of America's Quaternary Geology and Geomorphology Division's D. J. Easterbrook Distinguished Scientist Award for Unusual Excellence in Published Research. He authored or co-authored 90 research publications. He is survived by Kathleen (McCabe) Knox, two daughters, and two grandsons.



Jay C. Nania, BS 1984, MS 1987, was born on November 8, 1961 in Madison. He died on March 18, 2013 in Houston, Texas at the age of 51, following a valiant fight against brain cancer. Jay was an explorer who

found adventure in all aspects of life. He was a dedicated Wisconsin Badger, an enthusiastic Green Bay Packers fan, a loyal BP employee, and a committed friend to our department.

Under the guidance of his beloved advisor, Dr. Cam Craddock, "Indiana Jay" experienced his most extreme adventure while pursuing his master's thesis in the harsh arctic climate of Spitsbergen. His experiences at the UW left him with a strong desire to give back to the university and its students. Jay felt privileged to serve on our Board of Visitors for more than a decade. The department named a lab in his honor in our structure wing and he was named a UW-Madison Geoscience Distinguished Alumnus in 2004. Jay worked for BP America for 25 years managing an array of bright and hardworking geologists, geophysicists, and engineers to bring energy from the deep waters in the Gulf of Mexico. One of the roles he enjoyed most at BP was recruiting and mentoring the new generation of geoscientists.

Jay married the girl next door, Silvia Orengo, an Italian doctor, and theirs was a true partnership—together, they built a life greater than their dreams. Jay is survived by his wife Silvia, and their three children Christina, Jason, and Julia, the ultimate source of his happiness, joy, and pride. He will be remembered fondly as a man of integrity and honesty who laughed often with spirit, and loved his family and friends.

Memorials to Jay may be made to the Department of Geoscience through the link: www.supportuw.org/giveto/geoscience in memory of Jay Nania. Checks can also be made to the UW Foundation, US Bank Lockbox, Box 78807, Milwaukee WI 53278-0807 with Jay Nania Geoscience in the memo line

# Faculty News—2012-13

#### JEAN BAHR

It has been a busy year and a half since my last submission to the Outcrop. One highlight of this time has been Mike Cardiff's arrival in the summer of 2012, bringing lots of great new directions (and youthful energy) to the research and educational aspects of our hydrogeology program. A second highlight was my nomination and appointment by President Obama to the Nuclear Waste Technical Review Board. The NWTRB is a small independent agency charged with reviewing activities of the Department of Energy associated with management of high level radioactive waste and spent nuclear fuel. As part of those duties, I had the opportunity to attend several interesting technical meetings last spring in New Mexico as well as board meetings in Washington DC, Hanford, Washington and Ann Arbor Michigan. During one of the New Mexico meetings I got to visit with alumnus Bill Arnold, whose work at Sandia includes evaluating deep boreholes as a possible disposal option. Yet another trip to New Mexico (this one just for fun) allowed for a mini-reunion in Santa Fe (along with Mary and Charles Anderson) with hydrobadgers Bill Arnold, Erik Webb and Teresa Brown. As part of the NWTRB's attempts to learn from international efforts to manage radioactive waste, I spent a week in France last summer visiting fuel reprocessing processing facilities and the underground laboratory in Bure that provides a testing ground for repository construction and operations in clayrich rocks. The third highlight for me was receiving the Association for Women Geoscientists Outstanding Educator Award during the 2012 GSA annual meeting. I was overwhelmed by the kind citations by former students

Maddy Schreiber, Sue Swanson, and Tara Root, all of whom are now outstanding educators in their own right.

**Chris Gellasch** successfully defended his PhD in August of 2012, just in time to move to the DC area where his is now a faculty member at the Uniformed Services University of Health Sciences in Bethesda MD. Chris' interesting findings related to fractures and poroelastic effects that may promote migration of viruses to deep municipal wells have now appeared in papers published by Hydrogeology Journal and Ground Water. **Aaron Pruitt** completed his thesis looking at potential climate change

impacts on baseflow in the Chequamegon National Forest and has now joined GeoBadgers Steve Germiat, Joe Morrice, and Seann Mc-**Clure** at Aspect Consulting in the Seattle area. PhD student Steve Sellwood is expanding on the work that Andy Leaf initiated using down hole heat pulse experiments with fiber optic distributed temperature sensing to identify preferential flow zones in siliciclastic aquifers. Meg Haserodt, who joined my group in fall of 2012, is investigating impacts of road development on the hydrogeology of peatlands and associated salmon streams on the Kenai Peninsula of Alaska (where she had spent a year prior to starting graduate school). I was able to join her there for a week of field work in July and enjoyed the dramatic vistas as well as close (but not too close) encounters with a mother and baby moose ..

#### **CHUCK DEMETS**

My research in 2013 began with a trip to Guatemala with my graduate advisee **Andria Ellis**, where we spent two weeks with collaborators installing a new geodetic network to study the earthquake cycle of the Motagua and Polochi fault system and Middle America subduction zone. In late February, I spent another week in El Salvador with my Salvadoran collaborators to install geodetic sites that will complement our now-10-yr-old network in that country.

Together with my ongoing studies of the tectonics of nearby Mexico and Honduras, where we operate an additional ~60 geodetic sites, our decade-long, NSF-sponsored international study of the active tectonics of northern Central America is providing valuable new information about earthquake hazard and long-term deformation in the region. In April/May of 2013, my long-time



Phil Brown, left, prepares students for the day's mapping transect at White Lake 2012.

Russian collaborator **Dr. Sergey Merkouriev** spent a month working in my lab on a detailed chronology of global plate motions over the past 20 million years.

After nearly a decade of hard work processing large amounts of data from the global midocean ridge system, our research is beginning to yield exciting results, including evidence for several previously unknown, significant changes in plate movements at 8 Mybp with important implications for the tectonics of wide parts of the globe, including the Himalayas and western North America. Ultimately, we will submit a series of 8-10 papers that document all of this work. During the summer of 2013, my graduate advisee Shannon Graham completed two papers about a fascinating ultra-slow, deep slip event on the subduction zone fault beneath western Mexico that appears to have migrated laterally beneath the continent and then triggered a M=7.4 shallow earthquake in March of 2012. Given everything in the pipeline, the next year holds a lot of promise!

#### KURT FEIGL

At the Spring Banquet, graduate students **Hélène Le Mével** and **Nathan Andersen** nominated me for the OOPPS award in a hilarious presentation. Apparently, their field work in Chile did not go exactly according to the (theoretical) plan developed by this professor. In accepting the award (photo, next page), I could only claim (lamely) that the plan "seemed like a good idea at the time". It and I were recognized for "stupefying stupidity and unabashedness" by the Gerrymandering Guiltless Sorcerer's Association (GGSA). The handsome certificate (which seems to have lost a corner in a fire)

adorns the wall in the geophysics lab, along with several other (irreproducible) results. It is now securely anchored to the wall, thanks to the craftsmanship of **Brian Hess** 

Why was I laying plans for field work in Chile? The Laguna del Maule volcanic field on the crest of the southern Andes continues to deform at exceptionally rapid rates, as measured using GPS and radar images acquired by satellite. The rate of uplift is more than 200 millimeters per year. It is among the highest ever observed geodetically for a volcano that is not actively erupting. A similar style of deformation, albeit at much lower rates, occurred during the recent inflation episodes at three other large,



Kurt Feigl accepts the Oopps Award for 2013.

silicic volcanic systems, including Yellowstone in the United States, Santorini in Greece, and Lazufre in the central Andes. Stay tuned for more exciting results from this fascinating project that also involves **Herb Wang**, **Chuck DeMets**, **Cliff Thurber** and **Brad Singer** (photo page 13).

With **Herb Wang** and post-doc **S. Tabrez Ali** (now promoted to Associate Scientist), I have been studying an approach to increase the power production of a geothermal field. We are performing a hydro-mechanical experiment to analyze the (constitutive) relationship between impulse and response.

During the past year, I benefited from the wonderful privilege of sabbatical. With support from the Lewis G. Weeks Trust Fund and UW-Madison, I was able to recharge my intellectual reservoir. I pursued a tripartite program focused on observing Earth by satellite imagery. The three parts of the program included: (1) exploring graphical approaches for thinking, learning and teaching; (2) developing methods and missions for monitoring earth by satellite; and (3) applying satellite surveying to anthropogenic subsidence.

#### LAUREL GOODWIN

I've been thinking a lot about earthquakes lately. More specifically, I've been thinking about everything from (1) the mechanics of earthquakes and faulting, to (2) which of the structures we see in fault zones record seismic failure, to (3) how sandstone petrophysical characteristics control the type and distribution of structures in fault damage zones, and even (4) how we can better quantify the rheology of the lower crust in order to better understand the seismic cycle.

It's a lot to think about. Luckily, I've had a great team of students to think with. An NSF EAGER grant (for high risk but potentially transformative research) supports **Dana Smith's** MS study of pseudotachylyte ('fossil earthquakes') in low-angle normal faults of Arizona metamorphic core complexes. With UW collaborators **Brian Jicha** and **Brad Singer** and University of Minnesota collaborator Josh Feinberg, Dana's been integrating structural, paleomagnetic, and <sup>40</sup>Ar/<sup>59</sup>Ar analyses to constrain the orientation of these enigmatic faults at the time of seismic failure.

Kyle Fredericks, co-supervised with Harold Tobin, completed his MS thesis and started a 'dream job' with Conoco-Phillips this summer. Among other things, Kyle showed that both the density of deformation bands in damage zones of faults in sandstone, and the magnitude of distributed cataclasis between deformation bands, varies with the porosity and mineralogy of different sandstone facies. PhD student Randy Williams is also studying faults in sandstone; however, he is evaluating basin-scale and individual fault controls on fluid flow resulting in carbonate cementation over time in the Rio Grande rift. His work will help us understand how cement contributes to progressive fault seal in extensional tectonic settings.

Undergraduate **Ben Link** has studied slickenfibers recording bedding-parallel slip in the last stages of formation of the Baraboo Syncline. His senior thesis tells a tale of fluctuating pore fluid pressure causing deformation to alternate between brittle (seismic) and ductile failure at the brittle-ductile transition.

Finally, PhD student **Christy Barsziewski** is focusing on strain localization in the lower crust, integrating microstructural and finite strain analyses with the goal of quantifying the viscosities of the weakest common rocks we know: those with mica. Her work will help us understand how increasing mica content or organization facilitates deformation at high strain rates, and potentially explains the component of post-seismic deformation shown to be caused by lower crustal flow beneath major crustal fault zones.

Hope you are all well. You are always welcome to visit (Weeks 179).

#### **SHANAN PETERS**

The UW Board of Regents approved my promotion to Associate Professor with tenure in summer '12, but despite the jokes I make with friends and family, it sure doesn't feel like I'm deadwood! The past year has been very eventful. Thanks to a generous gift from John and Tashia Morgridge, and the confidence of our faculty, I'm now the Dean L. Morgridge Chair of Geoscience. Holding an endowed chair named for an alumnus is an honor, but the tangible benefits to our department and university are many. There are few better ways to ensure the long-term success of a program than endowing a faculty position.

In keeping with living up to the votes of confidence I've received from colleagues, my research program continues to grow. A number of important new results have appeared in press since my last report. Notably, research highlighted in the 2011 Outcrop snagged the cover of Nature (http://www.nature.com/nature/ journal/v484/n7394), a study on Phanerozoic sulfur cycling appeared in Science, and Clay Kelly, Andy Fraass and I published a Nature paper on deep sea macrostratigraphy and planktic foraminifera (http://www.nature.com/ nature/journal/v493/n7432/full/nature11815. html). Thanks to NSF EarthCube activity at UW, I also started a collaboration with computer scientists Miron Livny and Christopher Ré. Our work involves machine learning and geological data mining. The first results of GeoDeepDive were published at SIGMOD '13, with coauthors Jackson Borchardt and Tim Foltz.

The team continues to make progress. **Dave Lovelace** became a Research Scientist in the Geology Museum. **Tim Foltz** finished a fine MS thesis and accepted an industry job in Colorado. **Sharon McMullen** joined our team in fall '12, **Ben Linzmeier** continues to make progress towards his PhD, **Deb Rook** is finishing up her PhD as the Morgridge Distinguished Graduate Student, and **Marshall Tofte** and **Scott Hartman** joined us in fall '13.

I'm also lucky to have a talented IT team. **Puneet Kishor**, Senior Programmer Analyst, is attached to our group, but he is now Science and Data Coordinator at Creative Commons. **Michael McClennen**, Senior Programmer Analyst and Chief Software Engineer for the Paleobiology Database (based in our department), is the backend specialist and **John Czaplewski**, Programmer Analyst, is the frontend specialist. We work well together and are creating some cool tools for exploring Earth science data. You can check out some of our work here: http:// paleobiodb.org/navigator and http://earth-base. org/geomaps.

#### **ERIC RODEN**

After completing my seventh year of teaching and research since moving to the University of Wisconsin in 2005, I had the opportunity to go on sabbatical for the 2012-2013 academic year. Rather than spending an extended period of time at another institution, I took advantage of my flexible schedule to make numerous shorter trips (seven total) to give invited talks and promote research collaborations at other academic institutions and scientific conferences. A few



Eric Roden and Jim McKinley from PNNL with a multilevel sampler retrieved after five months of in situ incubation in a groundwater well. The white cylindrical chambers were packed with a mixture of sand and specimen biotite, which were subsequently colonized by native groundwater microorganisms. The inset is photo of Eric Roden and his mother Alene L. Roden taken a month before her death.

highlights of these trips include a visit to Montana State University (MSU) in September 2013 to give a talk and collect samples from two ironrich hot springs in Yellowstone National Park (YNP), kicking off the new NASA Astrobiology Institute project (led by Clark Johnson) that includes a collaboration with Eric Boyd at MSU, an extremely bright young scientist who managed to lure our group into the mysterious and diverse world of YNP microbial geochemistry. Another highlight was a visit to Pacific Northwest National Laboratory (PNNL) in January 2013 to visit with colleagues and retrieve materials from an in situ groundwater mineral incubation experiment (see photo) designed to explore changes in microbial communities across an oxidation-reduction boundary at the top of the Pliocene-age Ringold Formation in eastern Washington. Materials from this and several other recent microbiological studies (including one in YNP) are being subjected to so-called "metagenomic" analysis, which seeks to not only identify (through DNA sequencing) microorganisms in natural materials, but also to catalog their entire metabolic capacity. Taking systematic steps in this direction was the main focus of my sabbatical leave, and with the world-class support of the UW Biotechnology Center, the Geomicrobiology Laboratory is now tasting the fruits of the "genomics revolution".

I will close by noting the passing of my mother in January 2013. I mention this because my mom (as well as my father, who died in 2010) was always a great supporter of my studies and work in academia. Although it hurts to realize that she's gone, I take solace in reflecting on how we stuck together through all the ups and downs that came to pass through the years, with her patiently listening to my stories of elation over new opportunities and experiences, as well as those of the struggles that inevitably arise as one moves through a challenging career. With this in mind, it seems natural to dedicate this brief piece to my mother, Alene L. Roden, without whom none of the good fortunes of the past year or any years prior would have been possible.

#### **BRAD SINGER**

2012-13 were exciting years for my program. The most significant change was my home address: Teri, Zoe and I moved into Madison, only about six blocks from Weeks Hall, in September, 2012. I do not miss the 230,000 miles

of driving I racked up on I-94 over the previous 13 years! In 2012: MS student Daniel Murray, Anders Carlson, and I published a paper in Geology on the late-glacial to Holocene climate transition in Patagonia showing that it occurred in sync with changes in the Northern Hemisphere; Brian Jicha and I published a paper in the Journal of Geophysical Research documenting the growth rate of the submarine portion of Mauna Loa volcano, the largest volcano on Earth; and Steve Meyers, graduate student Sarah Siewert and I published a paper in Geology that for the first time uses astrochronology (see Steve's Outcrop cover article on pages 14-15), <sup>40</sup>Ar/<sup>59</sup>Ar and U-Pb isototopic dating to define the Cenomanian-Turonian stage boundary. The location of the latter study, in Pueblo State Park, CO, is the site of the Global Stratotype, Section, and Point (GSSP) for this stage boundary. A pair of large bronze signs describing this GSSP will be dedicated on October 25, 2013 prior to the GSA meeting in Denver. These signs are part of the outreach supported by an NSF grant to refine the Cretaceous time scale that I share with Steve and Brad Sageman at Northwestern University. In 2012 and 2013 PhD students Nathan Andersen and Hélène Le Mével joined me for field work in the Laguna del Maule volcanic field in the southern Andes of Chile where an impressive quantity of rhyolitc magma has leaked to the surface in the last 20,000 years. In 2013 our field party included Basil Tikoff, and graduate students Tor Stetson-Lee and Erin Birsic. I continue to lead the effort to secure funding to investigate the cause of unrest and astonishing surface uplift of

20-30 cm a year that has been occurring since 2007 in this volcanic field. This focus on caldera inception is forging exciting new collaborations with Cliff Thurber, Chuck DeMets, Kurt Feigl, Basil Tikoff, Ninfa Bennington, Clark Johnson, Brian Beard, and Brian Jicha, as well as investigators at universities in the US, Canada, and Chile. UW-Madison journalist David Tennenbaum joined us during the 2013 field campaign and produced an on-line article about our work for the whyfiles: http://whyfiles.org/2013/exploringa-volcano/. Graduate student Allen Schaen and Brian Jicha recently undertook field work in the Aleutian Island arc via the US Fish and Wildlife Survey vessel, the Tiglax. With support from the NSF, we are investigating along with Sue Kay of Cornell University the earliest evolution of magmatism in this subduction zone. I am serving my last year as Department Chair, and am looking forward to a sabbatical year beginning in July, 2014.

#### **BASIL TIKOFF**

The academic year 2012-13 was a pretty great year for research. It saw the successful completion of the active seismic component a major NSF EarthScope project that I have been working on. It turns out that geophysicists typically name projects, and our project is somewhat unoriginally called IDOR (for the IDaho-ORegon transect project). We thought of calling it OREIDA, but we figured we would get sued for copywrite infringement or something; it had the additional disadvantage of making me think of tater-tots, which makes me hungry. We also thought of calling the project EIEIO (EarthScope Investigation Exploring Idaho and Oregon) that name did not work for somewhat obvious reasons. If you have ever been part of a large seismic crew, you know that it is basically an exercise in barely managed chaos. To be someone who was nominally responsible - as the lead PI – it is a bit nerve wracking: There was 1 accident, ~30 flat tires, a crazy fieldtrip, and late-night student antics (involving a cemetery - don't ask). There were  $\sim$ 60 students from all over (including four UW students: Nicole Braudy, Will Montz, Tina Porter, Joey Lane).

Anyway, we are just now getting the results, and they are going to be great. Stay posted for some very nice results from that study. In other Idaho news, Nicole Braudy graduated with a Masters in December 2012. She did a very nice job working on geological mapping in West Mountain, Idaho, where the seismic line crosses the Western Idaho shear zone. Graduate students **Ad Byerly and Tor Stetson-Lee** are going to continue the work in Idaho going forward.

I continue to work on deformation of the

lithospheric mantle with students, post-docs, and colleagues. Zach Michels has been doing a great job working on the mantle microstructures, and has become our resident EBSD (Electron BackScatter Diffraction) expert. Seth Kruckenberg left his postdoctoral position at UW-Madison, and is now a faculty member at Boston College. Seth was working in the Twin Sisters and on the Dun Mountain belt, New Zealand, on mantle microstructures. However, we also have some new people in Madison working on these projects. Eric Stewart, working on the same Dun Mountain project, is finishing his PhD with my collaborator Dr. Julie Newman at Texas A&M University but is working for the year in Madison on strain modeling. We were also joined in March by Vasilis Chatzaras, who received a Marie Curie postdoctoral fellowship from the European Union. He will work in Madison for a few years before heading to the University of Utrecht in the Netherlands.

**Richard Becker** has recently started as the Head TA for the department. He is doing well on his PhD and was awarded a NSF doctoral dissertation improvement award for his work on bedrock controls on glacial erosion. It is nice to keep a scientific "foot" in the Sierra Nevada mountains (where I did my PhD – they say you can never finish your PhD and I have recently decided that is a good thing). **Andria Ellis** is working with **Chuck DeMets** and myself, on neotectonic deformation in central America (specifically, Guatemala). She is doing well, retrofitting her engineering background to become more geological (I think that is the correct metaphor to use for an ex-engineer).

I also got sucked into the Laguna de Maule project, after trying not to for several years. I really enjoyed working with **Brad Singer** (the lead instigator), collaborator Glyn-Williams Jones, and UW-Madison students (**Tor Stetson-Lee**, **Hélène Le Mével, Nathan Anderson, Eric Birsic**). Now that we have the gravity baseline set up, I guess I will have to go back to Chile every year during our winter (summer in the southern hemisphere and the only time of year that you can get to the field area). It is a hard life being a geologist.

#### JOHN VALLEY

Five students in my group finished their theses last year. **Ben Linzmeier** (MS 2012) was coadvised by **Shanan Peters** in studies of the vertical migration of modern chambered nautilus, which are recorded by regular variations of  $\delta^{18}$ O in daily growth bands. **Tyler Blum** (MS 2013) formulated a new model for the genesis of low  $\delta^{18}$ O rhyolites in the Snake River Plain showing that it is the largest low  $\delta^{18}$ O magmatic province known. Ben and Tyler are continuing for PhDs. Ian Orland (PhD 2012) completed studies of Soreq cave, Israel and paleoclimate in the eastern Mediterranean. Ian was awarded prestigious post-docs by both NOAA and NSF. Chloë Bonamici (PhD 2013) used oxygen diffusion profiles in titanite to demonstrate rapid cooling of the

Carthage-Colton



GeoBadgers at the 50th meeting of Clay Mineral Society in Champaign, Illinois. Left to right: Huifang Xu, Robert J. Pruett (BS 1985), Fred G. Heivilin (BS 1963), and Stephen Guggenheim (PhD 1976). Steve was given the 2013 Marilyn and Sturges W. Bailey Distinguished Member Award at the meeting. Please see page 10.

mylonite zone during gravitational collapse of the Grenville Mountain belt (ca 1 Ga). Anthony Pollington (PhD 2013) showed that silicate diagenesis in the Mt. Simon sandstone from the Illinois basin was driven by burial and heating rather than fluid flow and may have taken far longer than previously believed. Both Chloe and Anthony have accepted post-docs at Los Alamos National Lab. Other departures are Taka Ushikubo who moved to JAMSTEC in Cochi, Japan, where he has purchased a new ion microprobe and Ken Williford who is a staff scientist working on astrobiology and Mars-sample return at the Caltech Jet Propulsion Lab. This summer, we welcomed new students, Adam Denny and Jake Cammack and new post-docs, Navot Morag and Maciej Sliwinski. We also heard that a proposal written by John Fournelle and myself to buy a new electron microprobe for the Eugene N. Cameron Lab. received a perfect score from NSF and is the only one funded. It seems like I just did this, but in fact we bought the present probe over 20 years ago. Last June, the WiscSIMS Lab. organized a Workshop on High Resolution Proxies of Paleoclimate (see description elsewhere in this issue of the Outcrop). This was a great success and a lot of fun.

#### HUIFANG XU

Graduate students **Tina Hill** and **Fangfu Zhang** (co-advised by **Eric Roden**) defended their PhD dissertations. Tina studied the formation mechanism of precipitates of low-pressure silica polymorphs in pyroxenes from ultra-high pressure metamorphic rocks with **Gordon Medaris**. She reported the first natural occurrence of the silica polymorph, keatite. Fangfu's thesis is about natural catalysts of dissolved hydrogen sulfide and polysaccharides (major components in microbial exopolymeric substances) that can catalyze dolomite nucleation and growth at room temperature. Fangfu's discoveries will shed new light on solving the "dolomite problem" that has puzzled geologists for decades. Graduate student Zhizhang Shen solved the crystal structure of "delta-dolomite" using the Z-contrast imaging method and density function theory. Delta-dolomite occurs as nano-precipitates in sedimentary dolomite with composition between calcite and dolomite. Graduate student Gabriella March (co-advised by John Valley) continued on protodolomite and Ca-Mg-carbonate precipitated from alkali springs associated with Del Puerto serpentinite, California Coast Range. Graduate student Minglu Liu investigated the effect of halophilic microorganisms from Deep Spring Lake on dolomite precipitation. Graduate student Xintong Jiang investigated the role of polysaccharides on growth rate of Ca-Mg-carbonates using an in-situ fluid cell. Graduate student Xin Deng studied adsorption of sugars on calcite in order to understand effect of polysaccharides on dolomite precipitation. New graduate students Nick Levitt (co-advised by Clark Johnson) and Seungyoel Lee just joined my research group. Visiting graduate student **Yang Lu** worked on the relationship between mineralogy of carbonates and carbon isotope composition in carbonate precipitates associated with modern deep sea methane seeps from South China Sea. Visiting graduate student Chengxiang Li investigated interaction of single graphitic layers within sedimentary black talc nano-crystals. Undergraduate student Yihang Fang is investigating the relationship between bio-mats and dolomite distribution in ancient stromatolites in order to understand roles of anaerobic bacteria in dolomite precipitation. Hiromi Konishi (Lab Manager of S.W. Bailey X-ray Diffraction) accepted a faculty position at Niigata University in Japan. Dr. Rie Fredrickson joined my research group as the new XRD Lab manager. Rie's expertise is X-ray diffraction of crystals with commensurate and incommensurate modulations. I have been investigating structures and defects of nano-minerals using TEM, Z-contrast imaging and density function theory.

# Emeritus Faculty News—2012-13

#### MARY ANDERSON

A highlight of 2012 was an AWRA Conference in Milwaukee in honor of Professor Emeritus Doug Cherkauer (UW-Milwaukee) and me. The conference was organized by Daniel Feinstein and drew several other hydrobadgers both as speakers, Jean Bahr, Ken Bradbury, Dave Hart, Randy Hunt, and Maureen Muldoon, and participants including my first graduate student, Bob Karnauskas, and my last, Kallina Dunkle (see picture). Other hydrobadgers in attendance included Craig Eisen and Rich Manser. Another event of note was recognition at a banquet at the 1st International Conference and Reunion of UW-Madison's Geological Engineering Program in September 2012. Speakers included hydrobadgers Yu-Feng Lin and Kirk Heatwole.

I continue busy with various national committees, including as an officer of my section of the National Academy of Engineering, which took me to London in March 2013 for a global grand challenges summit. **Bill Woessner** and new co-author **Randy Hunt** and I are well into the preparation of a 2nd edition of our modeling textbook; expect publication in late 2014 or early 2015. Husband Charles and I enjoyed much vacation travel, including to Door County (Wisconsin), Stratford (Ontario), Florida, California (for our 40th wedding anniversary), and Santa Fe (NM) in summers 2012 and 2013 where, with **Jean Bahr**, we reconnected with **Erik Webb**, **Theresa Brown**, and **Bill Arnold**.

#### **CARL BOWSER**

It's hard to believe we've been in Arizona for two and a half years, but the end of last August marked that milestone. The move has rekindled my interests in western geology, living at the foot of a peak that was instrumental in Bill Dick-

inson's pioneering work on metamorphic core complexes. I regularly attend the weekly geology department talks, and have come to know a number of faculty, many of whom the Madison faculty know through their own work. George Davis, Jay Quade, Karl Flessa, Bill Dickinson, Andy Cohen, and Mark Barton all have links to various UW researchers, and I enjoy conversations with them from time to time. Vance Holliday (joint Geosciences/Anthropology) was in the UW geography department before moving here, and through him I've made acquaintances with people at the tree-ring lab. I've had conversations with the Dean of the College of Sciences, Joaquin Ruiz, and we're talking about potential involvement of the Biosphere II and the LTER program. I've joined the Arizona Geological Society, and enjoy monthly dinner meetings. The nearby USGS office has among it's staff UW's own Mark Bultman. The electron probe on campus is managed by Ken Domanic.

The annual Tucson Gem and Mineral Show is a big deal around here, and I'm now helping to staff the Mineralogical Society of America booth at the Convention Center. Our house had several guests during the show, and if you're in town give a call or stop by the MSA booth. Last year, **Bob Jenkins** stopped by, and I find that his office is but a couple of miles from our house.

Judy and I joined USGS colleagues from the Denver area (Larry Benson, Bob Rye, and Gary Landis) on a six day tour of Anasazi sites in New Mexico and Colorado (Bandelier, Chaco, Salmon, Aztec, and Mesa Verde). Larry tied the story together stressing using his collaborative work with isotopes and tree rings to chronicle the drought driven migrations out of the San Juan Basin. My camera got a workout.



Mary Anderson (center) with first graduate student Bob Karnauskas and last graduate student Kallina Dunkle, April 2012.

We're enjoying our new digs, and have had several Madison visitors since the move. Regular trips to see family in Tempe and joining them for Thanksgiving in Puerto Peñasco, Sonora, Mexico fill our plate. A visit from Madison's former mayor, Joel Skornika, former Madison neighbors, L&S Associate

Dean, **Bill Barker**, were welcome. A growing list of acquaintances from the U of A, our local neighborhood, and Madison and Colorado snowbirds keep us busy, and when the skies fill with monsoon clouds or cacti are in bloom I ply the nearby hills with my camera to capture what I can. Hot? Sure, but "it's a dry heat."

Some recent activities to help prove that retirees keep active around here: I attended five day photo workshop in the badlands of South Dakota ("The Model in the Landscape") under the tutelage of Doug Beasley. I'm exploring graphic visions of Native American stories, and this was an excellent opportunity to explore the work, and to get used to working with models. (photo links on request). I'm working with the Western National Parks Association, and I'm scheduled to give talks in January on the general subject of photographing national parks. Finally, I've been elected to serve on the Board of Trustees of the Tucson Symphony, pretty exciting.

#### DAVID L. CLARK

One of my good friends maintains that old age is nothing more than a son-of-a bitch, and over the past few years I have grown to agree with that judgement. Nonetheless, the Clarks are hanging in there and after eight delightful years in northern California have found new pleasure in interacting with kids (who also are growing older) and grandkids (who are certain they will never be old) in the mountains of Utah. While Arctic studies are only a memory, I am comforted to know that our 1980 GSA Special Paper on Arctic Ocean sediment cores continues to be cited as the original contribution for Arctic paleoceanography. However, because conodonts are now believed to be early marine vertebrates, my past contributions are now as a vertebrate paleontologist, and they continue with a forthcoming publication concerned with conodonts and the major Paleozoic unconformity in the Central Wasatch Mountains. It is to be released this fall in the Utah Geological Association's new digital publication, "Geology of the Intermountain West." I have limited contact with former grads, but they are getting older too!

#### ROBERT H. DOTT, JR.

My years are not so eventful as they used to be. Wait, that is not quite correct, for I have a lot of events but of a different sort, which would be of little interest to alumni. Nancy's stroke in 2011 changed everything for us, but we are in very good circumstances in the Oakwood Retirement Center. I brought along a few favorite large specimens that now adorn the edge of a rose garden in front of our apartment and we have some favorite smaller minerals and fossils in our comfortable new home. They hardly substitute for the rock wall in our former back yard, however.

I keep getting invitations to talk to lay groups mostly about "frac" sands, most of which are mined in Wisconsin at more than 100 sites. I also gave a rock walk around Oakwood to discuss the many different kinds of glacial erratic boulders used for landscaping. I manage to get to most of the Board of Visitors meetings for the free lunch. I also attend as many guest speaker occasions as possible. It provides a small, painless way to keep up a little bit with the great, new developments in our science. Many of these are breathtaking, but some are sleep inducing as well for an old pensioner.

In June, an alumnus alerted me to a quotation in the Smithsonian Magazine for June 2012 from something I wrote about **T.C. Chamberlin**. It was in an article about Alfred Wegener and Continental Drift. You will have to look it up in the unlikely event that you are really curious (http://www.smithsonianmag.com/ science-nature/When-Continental-Drift-Was-Considered-Pseudoscience.html?c=y&page=2). I lunch occasionally with fellow emeriti **Dave Mickelson, Lou Maher, John Attig,** and **Lee Clayton**. We miss our former fellow luncher, fluvial geomorphology colleague **Jim Knox**, who died so suddenly last year (Please see p. 18.).

#### LLOYD PRAY

Lloyd and Carrel both turned 94 this year. They are happy and comfortable in a three-room apartment at Sebring Assisted Care Residence at Coventry Village in Madison. Their address is: Lloyd and Carrel Pray, 7710 N. Brookline Drive, Madison, WI 53719.

Both Lloyd and Carrel are now in wheelchairs, both the result of falls. Lloyd broke his hip four years ago, and Carrel broke her foot a year ago. In spite of corrective surgeries, it is not possible for them to walk, however, they are both able to stand, which allows them to be able to do some things, like getting into a car. His family was able to get Lloyd up to his cottage on Lake Superior twice last year. He was delighted to be there.

Both Lloyd and Carrel's memory continue to slip, and it has become



Dana Geary, left, Clay Kelly, and Bob Dott are identifying fossils in the lobby floor tiles at the Wisconsin Institutes for Discovery. The Institute's adjoining banquet hall was the venue for our spring awards event on April 19, 2013.

increasingly difficult for them to express thoughts. They recognize close family, but are often unable to remember old friends, so if you are able to visit, you will likely find that they cannot remember the earlier connections. Having said that, they would be delighted to receive any visitors, and this is easily arranged. If you are in the area and would like to visit, contact their son John who lives in Madison (email: japray@wisc.edu; phone (cell) 608-334-6058, he can arrange it.

Their other sons and families are scattered around the country: Larry is in Minneapolis, Ken lives in Cincinnati, and Doug lives in Los Angeles.

#### **GORDON MEDARIS**

Retirement continued to be filled with research and travel in 2012-13. I published a paper on a Czech garnet pyroxenite in the Journal of



Zach Michels and Basil Tikoff in the Klamath Mountains of California/Oregon.

Geosciences (2013) with **Emil** Jelínek, Brian Beard, John Valley, Mike Spicuzza, and Ladislav Strnad, and another paper on pseudorutile in the Baraboo Range in the Canadian Mineralogist (2012) with John Fournelle.

In 2012 I presented an overview of granitic saprolites in the Lake Superior Region at the 58th Institute on Lake Superior Geology with Steve Driese, Terry Boerboom, and Mark Jirsa, which was followed in 2013 by a presentation on a metasaprolite in the McGrath Gneiss at the 59th ILSG with Terry Boerboom, Brian Jicha, and Brad Singer. Returning to my interest in the mantle, I gave a paper in May, 2013, on the chemical and physical properties of central European lithospheric

mantle with Zach Michels, Bryn Benford, Basil Tikoff, Virginia Toy, Lukáš Ackerman, and Emil Jelínek at "Basalt 2013" (a specialized conference on volcanism and mantle xenoliths, convened in Görlitz, Germany,), followed in September by a presentation on another Czech garnet peridotite at the 10th International Eclogite Conference in Courmayeur, Italy, with Zach Michels and Czech colleagues.

Nancy and I continue to enjoy our elderly pursuits of biking, paddling, and snorkeling, which in the past two years have included biking along the Spree River in Germany, biking halfway across Wisconsin from Trempealeau to Madison (mostly on rail trails), and introducing my eightand ten-year old grandsons to bike touring via a five-day trip along the Root River in Minnesota. We returned to central Florida in December/ January for our yearly fix of river paddling, swim-

> ming with manatees, and biking, and in August we traveled to the Sylvania Wilderness for a week of paddling. February, 2012, found us in the Caribbean snorkeling in Little Cayman, followed in 2013 by snorkeling and sea kayaking in Belize.

A highlight of the summer was meeting Zach Michels, Basil Tikoff, and Vasilis Chatzaras, in the Klamath Mountains of California/Oregon to examine the Seiad metaophiolite (the subject of my PhD dissertation almost 50 years ago), where they educated me regarding sheath folds and a deep crustal detachment (photo, left).

(Continued, next page)

#### (Emeritus faculty news, continued)

#### **DAVE MICKELSON**

Vin and I continue to enjoy retirement, although things never seem to slow down! I'm doing a fair bit of consulting, particularly for projects along the Great Lakes shorelines. We are now using LIDAR to do slope profiles for stability analysis. A research aspect of the coastal projects is to understand why many L. Michigan shoreline bluffs have stabilized since high levels of the 1970s and 1980s, but others are still failing. I was pleased to see the Surficial Geology Map of Glacier Bay National Park published by NPS. It was co-authored with Richard Becker and Greg Streveler, a longtime Glacier Bay friend. The Geology of the Ice Age Trail book published in 2011 has been successful, and I give quite a few talks around the state on that topic. It received the Best Guidebook Award from the Geoscience Information Society.

Vin, Maisy, and I spent several weeks at the family cottage in Massachusetts this summer. In June, we were joined in Madison and at the cottage by my cousin from Sweden and his wife. Daughter Amy is now a registered Gemologist living in Cleveland, so we are able to visit with her en route to the east coast. Our daughter Susan had her first child in December, so we are enjoying seeing him grow on visits to Knoxville and via Skype. Also, we had the most productive garden this summer that I can remember. This has resulted in a full freezer and many jars of pickles and relish!

# Itokawa in Weeks Hall



WiscSIMS scientists **Noriko Kita**, and **Daisuke Nakashima** (photo) examined samples of the near-Earth asteroid Itokawa in July 2012. These tiny grains,  $< 100 \,\mu$ m in diameter, were returned to Earth by the Japanese Aerospace Exploration Agency (JAXA) Hayabusa mission in 2010. They are the only samples of an asteroid collected by spacecraft. Preliminary studies by laboratories in Japan suggested that Itokawa samples resemble equilibrated LL chondrite meteorites, but it was difficult to measure oxygen isotope ratios accurately. WiscSIMS was selected to make these measurements and is the first laboratory outside of Japan to receive Hayabusa material. Special sample preparation and analysis procedures were developed for these precious materials. All three stable isotopes of oxygen were measured in seven particles showing that pyroxenes are not equilibrated with olivine. The new data support the designation LL4-6 chondrite, strengthening the often-hypothesized link between asteroids and meteorites (Nakashima et al. 2013 Ear. Planet. Sci. Lett. 379: 127-136).

## WiscSIMS hosts international meeting



High Resolution Proxies of Paleoclimate University of Wisconsin-Madison June 23-26, 2013



WiscSIMS organized the first Workshop on High Resolution Proxies of Paleoclimate, which was held in Weeks Hall on June 23-26, 2013. Sixty-two scientists attended from around the world. Invited keynote lectures and contributed research talks covered the marine and continental records of past climate throughout the Cenozoic and in the Archean. UW scientists delivered tutorial lectures describing the theory and applications of ion microprobe analysis to proxy samples of paleoclimate.

Two pilot studies were conducted on the ion microprobe during the workshop: oxygen isotope ratios in foraminifera from DSDP site 277, Campbell Plateau, to identify and quantify diagenetic overprints biasing published 'whole-shell' records, and in an annually banded Chinese stalagmite. In the Chinese stalagmite, the ion microprobe improved the resolution of an oxygen isotope proxy record of Asian monsoon strength to a monthly resolution across an abrupt paleoclimatic event in the Northern Hemisphere. This proxy record is the first to provide a year-by-year account of monsoon dynamics during a rapid paleoclimate change. Attendees toured the WiscSIMS Lab during analysis and discussed results in real time as they were acquired.

The conference web site includes the abstract volume and keynote lectures: http://www.geology.wisc.edu/~wiscsims/ Paleoclimate\_Workshop/Abstract%20Volume. pdf •

### UNIVERSITY OF WISCONSIN-MADISON

# Geology Sel

# **Exhibiting Signs of Life**

In September, 300-square feet of our museum was transformed into Biosignatures: What Does Life Leave **Bebind?** Under the direction of Assistant Museum Director **Brooke Norsted**, this exhibit was made possible with funding from the NASA Astrobiology Institute and lots of support from departmental researchers namely Clark Johnson, John Valley, Eric Roden, Huifang Xu, as well as former post-doc Ken Williford and current PhD candidate Liz Percak-Dennett. Highlights of the exhibit include Earth's oldest rocks, fossils and, a very special addition to the museum's collection (and on display for the first time in Wisconsin!)-a piece of Mars. As part of this exhibit (and with additional financial support from NASA and a private meteorite collector) we acquired a 27.1 gram piece of the Tissint Martian Meteorite that landed in Morocco in 2011.

## A Paleontological Smorgasbord

This summer the museum field crew, led by Museum Scientist Dave Lovelace, discovered a variety of fascinating fossils during our expedition the Late Triassic (~230 mya) Popo Agie Formation of west-central Wyoming.

> Very little work has been done on this

unit, since it was last prospected over 100 years ago. Our crew consisting of one graduate student and six undergraduate students found numerous pieces of giant amphibians, archosaur teeth and bone fragments, and a complete one meter skull of a phytosaur (the largest land predator at the time and ancestor of crocodiles). These important discoveries help us understand an area that has been overlooked for far too long

### Down to the Studs

After 25 years of operation, the museum's fossil preparation lab is receiving a complete renovation. From a new dust collection system and fume hood to high efficiency LED lights and a new floor - the updated lab will usher in a new generation of student projects, outreach opportunities, and educational displays. We thank the College of Letters and Science UW's Instructional Laboratory Modernization Committee and the UW's ILM program for making this possible.

## Cool!

To commemorate our 165th year of being a museum (that's right, we were founded in October of 1848-the same year Wisconsin became a state) we have partnered with UW's Babcock Dairy to produce a custom ice cream flavor that will be available in April and May of 2014. Help us come up with a name and recipe for our anniversary. Submissions must be emailed to museum@geology. wisc.edu by December 6th.

The new astrobiology exhibit occupies the space where many large stromatolites once resided. One of our large stromatolites remains and has new graphics to accompany it.

# SCUM **OFTENDE** It you could explore Earth three billion years ago, you'd be hard pressed to recognize it as the planet we call home today. First off, all life was microscopic. Secondly, you wouldn't be able to breather the air. To cap it all off, the oceans were green since they were loaded with dissolved iro Although tiny, the microbreather EARTH

We've got slimy microbes to thank for kickstarting our oxygen-rich atmosphere!

the Earth. Before 2.4 billion years ago, Earth's atmosphere had very little oxygen in it. Through photosynthesis, these microbes made oxygen, which built up over time, causing a mass extinction of other microbes that needed an oxygen-free planet.



While they were once the most abundant form of life on Earth. While they were shown incrobial communities are rare today. C stromatolite-forming microbial communities are rare today. C place they still thrive is in the super salty Hamelin Pool of Sh Bay on the western coast of Australia.

THE STROMATOLITE AT YOUR FEET This stromatolite was found in Wisconsin and hails from a tim when our state was covered by a warm, shallow sea. While this specimen is a mere 450 million years old, scientists have found 3.4 billion year old stromatolites which, to date, are the oldest feasible heaven.



excavating a phytosaur skull from Wyoming's Triassic Popo Agie Forma-

tion. Clockwise from top left, Garrett Johnson, a local student, Deborah

Rook, Emily Wilson, Kim Johnson,

Melissa Reusché, and James Nassif.

# DEPARTMENT TARGETS FUNDRAISING NEEDS

#### by Clark Johnson

If you have been receiving the new quarterly e-newsletter via email, you may have noticed that we have been highlighting several fundraising needs. We greatly appreciate any donation to specific funds that alumni feel are important to them, but we wanted to note some specific needs and goals for those of you considering a general gift to the department. The three initiatives below are all aimed at student support.

# SUMMER FIELD CAMP

Summer 2013 marked the 42nd year of UW-Madison's participation in the Wasatch-Uinta field camp based in Park City. The remarkably diverse geology available in the Park City region provides our students with a very special place for this capstone course, rounding out all the lectures and labs they had in Weeks Hall (and Science Hall before that).

It is a major financial challenge, however, to keep Summer Field Camp affordable for our students. In the past we have offered a limited number of Field Camp scholarships for our undergraduate students from our unrestricted gift funds, but with the large increase in the number of our majors, and simultaneous increases in Field Camp costs, we cannot help all of our students in need. We therefore solicit your help in creating a Field Camp Scholarship fund. We hope to achieve a sustained giving level of \$30K annually for Field Camp scholarships.



#### Sharon Meinholz Graduate Student Fund

Geobadgers may remember that nine years ago we created the

Sharon Meinholz Graduate Student Fund to remember Sharon, who passed away unexpectedly in 2004, and the main purpose of this fund was to support student travel to professional meetings. Numerous Geobadgers knew Sharon, who served as our department Student Records Secretary from 1990 to 2004. To many students, she was like a second mother, keeping track of them from the application stage to final thesis completion. We chose to honor Sharon by creating a fund to help student professional development, in recognition of Sharon's great love of all of the students she worked with.

Sharon's family, as well as many alumni, have regularly given to the fund. But the fund has become depleted as the need has grown. Our goal is to build up the fund to the \$50K level so that it may provide partial annual meeting support for several students. We hope those of you who knew Sharon, and even those who did not, will consider a special gift to this fund so we may continue to support professional development for students in the coming years.



Field Camp, day one: Getting organized at Bonanza Ridge.

#### JAY C. NANIA ENDOWED GRADUATE SUPPORT FUND

As many Geobadgers are aware, Geoscience alumnus Jay C. Nania (B.S. 1984, M.S. 1987) lost his battle with cancer earlier this year. (Please see page 18.) Jay grew up in Madison, attending school on the near west side. Upon graduating from Madison West High School in 1980, he enrolled at the University of Wisconsin-Madison, and graduated with a B.S. in Geology in 1984. He continued on as an M.S. student, working with Professor Cam Craddock in structural geology. Jay has been a strong supporter of the Department for many years, serving in various roles as a BP recruiter and Board of Visitors member and Chair.



Jay Nania, center, with Dottie and Cam Craddock in 2004.

To honor Jay's love of geology and his desire to help future Geobadgers, Jay's wife Silvia has established the "Jay C. Nania Endowed Graduate Support Fund" at the UW Foundation. Our goal is to grow this fund to the \$200K level over the next year so that it is sufficient to regularly provide research support for a student. Ultimately, we hope funds will grow beyond this initial target to fully support a graduate fellowship each year, but our initial target will allow the fund to support research activities of graduate students, including field work and summer support.

Our focus on graduate support is important, as this has been one of the most challenging shortfalls for us to cover as the TA budget continues to decline. We hope you will consider joining the alumni, faculty, and staff who have already contributed to the fund by considering a gift in Jay's memory.

For more information, please contact Chris Glueck at Chris.Glueck@supportuw.org or 608-265-9952, or give online at http://geoscience. wisc.edu/geoscience/giving/

### In 2012 and '13 we awarded 33 Field **Camp Scholarships to Geoscience** majors to attend the Wasatch-Uinta Summer Field Camp in Park City.



**DEPARTMENT** of

MADISON

Please consider making a gift to the Department of Geoscience Field Camp Scholarships fund or to your other favorite fund.

http://geoscience.wisc.edu/geoscience/giving/

**UW FOUNDATION FUNDS** *Give online or make checks payable to the UW Foundation.* 

amount							
	Geoscience Annual Fund						
	Geoscience Community Fund						
	Student Field Experience Fund	ink you for remembering us!					
	Lectures Fund						
	Field Camp Scholarships						
	Sharon Meinholz Graduate Student Fund – suppor	ts travel to professional meetings					
	James J. and Dorothy T. Hanks Fund – supports an	annual "Best Geophysics Student" award					
	C.K. Leith Fund for Structural Geology						
	Lloyd C. Pray and J. Campbell Craddock Fund - sup	ports graduate students in sed or structural geology					
	Hydrogeology Research Fund						
	L. Cline/L. Pray/R. Dott Sedimentary Geology Field	Fund					
	Paleontology Research Fund						
	Eugene N. Cameron Scholarship Fund (Economic G	eology, Mineralogy, Petrology, Geochemistry)					
Sturges W. Bailey Scholarship Fund (Mineralogy and Petrology)							
	George P. Woollard/Sigmund I. Hammer Memoria	l Fund (Geophysics)					
	Robert and Ramona Sneider Museum Fund – enhancing museum exhibits						
	L.R. Laudon Scholarship Fund - used for award to the Outstanding Junior major						
	S. Tyler -T. Berg Scholarship Fund – support awards to outstanding TAs						
	Geology Museum Fund						
	Museum Student Field Experience Fund						
	JNDS & DEPARIMENT GIFT FUNDS Pleas	e make checks payable to the Dept of Geoscience.					
umount	Charles R. Van Hise Fellowship	Library Fund					
	Mack C. Lake Scholarship	Petrology Fund					
	McClintock Geophysical Research Fund	Ouaternary Fund					
Your name							
A d d u a a a							
Address							
Phone	one Email						

# Thanks to their authors, these book purchases will benefit both the reader and the department

#### GEOLOGY OF THE ICE AGE NATIONAL SCENIC TRAIL

by David M. Mickelson, Louis J. Maher Jr., and Susan L. Simpson. 2011. This 305-page overview of Wisconsin's geology helps readers understand what Ice Age Wisconsin was like, explaining key geological concepts, geological processes, materials, and landforms. The authors detail geological features along each segment of the trail and at each of the nine National Ice Age Scientific Reserve sites. Paper \$34.95 t, ISBN 978-0-299-28484-8, University of Wisconsin Press, http://uwpress.wisc.edu/books/4650.htm

The authors have donated their royalties to the Department of Geoscience.

#### ROADSIDE GEOLOGY OF WISCONSIN (Roadside Geology Series)

**by Robert H. Dott Jr. and John W. Attig.** 2004. The general geology of each region of the state with 35 road guides to fill in the details of the geologic processes that are chronicled in the rock, sediment, and landforms along the roadside. The 346-page book is heavily illustrated with more than 200 maps, figures, and photographs. \$20.00. The State Geological and Natural History Survey, http://wisconsingeologicalsurvey.org/roadside.htm

The authors have assigned their royalties to the UW Foundation for the benefit of the Department of Geoscience, the Geology Museum, and the C.K. Leith Library of Geology and Geophysics.

#### WISCONSIN'S FOUNDATIONS

**by Gwen M. Schultz.** 2004. A Review of the State's Geology and Its Influence on Geography and Human Activity. Second

edition, with a foreword by James M. Robertson. A book for a broad audience about the origins, evolution, and geological underpinnings of the Wisconsin landscape. This book has received awards from the Wisconsin Historical Society and the Council for Wisconsin Writers. Paper \$24.95 t, ISBN 978-0-299-19874-9, University of Wisconsin Press, http://uwpress.wisc.edu/books/2969.htm

The author has arranged to have all royalties, past and future, to go to the C.K. Leith Library of Geology and Geophysics.

#### Faculty and Staff in the Department of Geoscience

#### Faculty

Jean Bahr Philip Brown Michael Cardiff Alan Carroll Chuck DeMets Kurt Feigl Dana Geary Laurel Goodwin Clark Johnson D. Clay Kelly Stephen Meyers Shanan Peters Eric Roden Bradley Singer, Chair Clifford Thurber Basil Tikoff Harold Tobin John Valley Herbert Wang Huifang Xu

*Emeritus Faculty* Mary Anderson Charles Bentley Carl Bowser Charles Byers Nikolas Christensen David Clark Robert Dott Louis Maher Gordon Medaris David Mickelson Lloyd Pray Klaus Westphal

John Attig Kenneth Bradbury Eric Carson Lee Clayton Michael Fienen Dante Fratta Madeline Gotkowitz Bezalel Haimson David Hart Randy Hunt David Krabbenhoft Patrick McLaughlin James Robertson Jay Zambito Research Staff Tabrez Ali Brian Beard Ninfa Bennington John Fournelle Shaomei He Brian Jicha Noriko Kita Kouki Kitajima Reinhard Kozdon Weiqiang Li Daisuke Nakashima Travis Tenner Staff

Ben Abernathy

Brandon Converse

Jane Fox-Anderson

John Czaplewski

Shirley Baxa

Mary Diman

Judy Gosse

Brian Hess

Patrick Kuhl

Neal Lord

Peter Sobol

Bill Unger

Mike McClennan

Jansi Prabakaran

Mary Schumann

Michael Spicuzza

Michelle Szabo

Jim Kern

#### Post Doctoral

Vasilieios Chatzaras FX D'Abzac Rie Takagi Fredrickson Andrew Frierdich Navot Morag Ian Orland Carol Ormand Aaron Satkoski Maciej Sliwinsk Xiangfang Zeng

#### **Geology Museum**

Carolyn Eaton Dave Lovelace Brooke Norsted Richard Slaughter

*Geology Library* Marie Dvorzak Toby Lathrop







GEOLOGY ICE AGE NATIONAL SCENIC TRAIL

A and Staff in the Departs Associated Faculty John Attig Tabres

### lty

SIDE EOLOGY

WISCONSIN

RT H. DOTT, JR. IN W. ATTIG



1. E	Brad Singer	21. Randolph Williams	41. Breana Hashman	61. Dave Lovelace	81. Megan Haserodt
2. N	/lichelle Szabo	22. Michael Cardiff	42. Alex Baldwin	62. Chris Erlandson	82. Chris Rawles
3. H	lerb Wang	23. Kurt Feigl	43. Austin Cary	63. Brian Jicha	83. Cliff Thurber
4. L	aurel Goodwin	24. Gordon Medaris	44. Mike Schiltz	64. Malia Lehrer	84. Bin Guo
5. J	lohn Valley	25. Patrick Kuhl	45. Alia Schroeder	65. Daisuke Nakashima	85. Marshal Tofte
6. 0	Chuck DeMets	26. Jody Wycech	46. Lilly Quetschke	66. Travis Tenner	86. Michael McClennen
7. J	lean Bahr	27. Lindsey Shanks	47. Brian Beard	67. Dana Geary	87. Tor Stetson-Lee
8. A	ndi Ellis	28. Neal Lord	48. Clark Johnson	68. Adam Denny	88. John Czaplewski
9. E	Ethan Castongia	29. Reinhard Kozdon	49. Peter Sobol	69. Jacob Cammack	89. Shanan Peters
10. 0	Gabriella March	30. Jim Kern	50. Phil Brown	70. John Fournelle	90. Aaron Satkoski
11. J	udy Gosse	<ol> <li>Kouki Kitajima</li> </ol>	51. Yihang Fang	71. Chengxiang Li	91. Vasileios Chatzaras
12. J	lansi Prabakaran	32. Nathaniel Fortney	52. Nathan Anderson	72. Erin Birsic	92. Mitchell Turino
13. E	Deb Rook	33. Navot Morag	53. Susanna Webb	73. Yang Lu	93. Nathan Kainz
14. L	iz Percak-Dennett	34. Shannon Graham	54. Tamara Jeppson	74. Tyler Blum	94. Tabrez Ali
15. 5	Sharon McMullen	35. Nick Levitt	55. Hélène Le Mével	75. Zhizhang Shen	95. Nathan Hagar
16. N	/lary Diman	36. Rie Fredrickson	56. Yaoquan Zhou	76. Maciej Sliwinski	96. Clay Kelly
17. F	Ryan Quinn	37. Minglu Liu	57. Sarah Lemon	77. Xintong Jiang	97. Michael Johnson
18. E	Ben Linzmeier	38. Mary Schumann	58. Summer Ohlendorf	78. Phil Gopon	
19. F	Robert Muehlbauer	39. Allen Schaen	59. David Lim	79. Zach Michels	
20.0	Christine Barszewski	40. FX D'Abzac	60. Scott Hartman	80. Michael Miller	

Department of Geoscience University of Wisconsin-Madison 1215 W. Dayton St. Madison, WI 53706-1692

Nonprofit Organization U.S. Postage Paid Madison, Wisconsin Permit No. 658