UC Santa Barbara

Earth Science

From the Chair, Andy Wyss

We take pride in having had another stellar year in the Department of Earth Science.

High water marks of the year include the arrival of Robin Matoza (p. 5), our newest faculty member, and the hiring of Roberta Rudnick, who will arrive in January—and will be featured in next year's edition of this newsletter. We congratulate Syee Weldeab on earning tenure, a signal milestone in any young scientist's career, welcoming him to the "old guard."

As always, we are especially proud of the achievements of our graduate students. Our annual Graduate Research Review is highlighted directly below, as are reminiscences about a recent excursion to Santa Cruz Island (p. 3), and profiles of two current students (pp. 8-9).

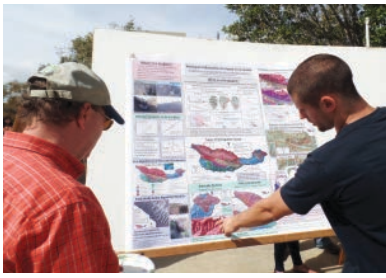
The department welcomed Professor Paul Hoffman as its 2015-16 John Crowell Distinguished Lecturer. He delivered three fascinating talks on "Snowball Earth," one of many topics for which he has achieved world renown. Lamentably, this was the first John Crowell lectureship series that John himself did not attend (p. 5). We mourn John's loss but will forever admire his scientific legacy as well as his foresight and generosity in making this lecture series possible.

Public support allows us to meet the basic continuing demands to keep our undergraduate and graduate programs functioning, but, of course, we strive to deliver more than a "Kirkland"-level of quality (no offense, Costco) in our programs. To provide an exceptional learning environment for our students, we are increasingly dependent upon the philanthropic efforts of our community of supporters. We are tremendously grateful for your generosity, and welcome your input on how such support should be directed.

We wish you a healthy and fulfilling New Year.

IN THIS ISSUE **Fall 2015**

Annual Graduate Research Review



This coming spring our graduate students will display the fruits of their research at the Annual Research Review.

Last year's review was held on the rooftop where our students proudly exhibited 40+ research posters. Most of the research on display came, of course, from our graduate students, but some of our most advanced undergrads made significant contributions to a wonderful display of professional inquisitiveness, as well.

All alumni, friends, and colleagues are heartily invited to attend and learn of the wonderful discoveries being made by our highly talented group of students. The review will be held April 29, 3-6 P.M., on the roof, followed by a departmental barbecue. This event coincides with the campus-wide All Gaucho Reunion – May 1st weekend.

New Field Course:

Intro to Field Hydrology

by Jordan Clark

The Department of Earth Science confers two undergraduate degrees (B.S. and B.A.) and five emphases (Geology, Geophysics, Geohydrology, Paleobiology, and Climate & Environment).

This past summer, Prof. Jordan Clark offered Earth 125-Introduction to Field Hydrology for the first time. The motivation for creating this class was to broaden the field experience for the Geohydrology students, which make up about one-sixth of our majors. Eighteen undergraduates and 1 Ph.D. student (from Geography) attended the camp, held at the Sagehen Creek Field Station in the eastern Sierras about 10 miles north of Truckee. The curriculum was designed to teach basic field techniques and to provide students with experiences relevant for employment as professional hydrologists/environmental consultants. The exercises included mapping a section of Sagehen Creek, collecting cross sectional data, daily gauging of one cross section, and digging a soil pit to characterize the soil layers' hydrologic properties. We also sampled monitoring wells and springs within Sagehen Basin, and a nearby public supply well (thanks to Brian Wright of the Truckee Donner Public Utility Agency). These exercises were developed with the assistance of class TA Menso de Jong, who joined Dr. Clark's research group after receiving a M.S. from Cal State East Bay and working for Padre Associates (in San Luis Obispo). Menso helped plan the class, made sure that students could fill V.O.A. vials, and taught field safety and other environmental geology sampling techniques. After completing the field portion, the class returned to Santa Barbara via the Eastern Sierra, including a tour of Mono Lake and the LA aqueduct. Our last stop was the famous St. Francis Dam site. We hope that this new class fills a need and will be offered annually. One of the nice things about new classes is they can be easily modified. If you have suggestions for additional exercises that your firm finds desirable in new recruits please send them to Prof. Clark (jfclark@geol.ucsb.edu). Also the class is limited by equipment availability (most of it supplied by Prof. Clark's lab group) and donations are welcome to help this class grow in the future.

Earth 125 students and Professor Clark at South Tufa, Mono Lake during the return tour from Sagehen Creek Field Station.

Earth 125 students collecting cross section data above a beaver dam, lower Sagehen Creek.

Santa Cruz Island Trip

by Elizabeth Erickson

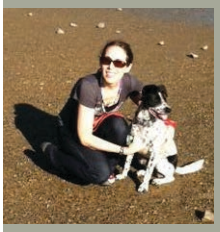
Professor Jim Boles (orange vest) and Mr. Tim Cuellar, (hat over heart) pose with the remainder of the crew near Kiton Point, Santa Cruz Island.

This year began like many before, with a departmental trip to Santa Cruz Island. The timing of this trip made for a great transition from summer into the new academic year. For me, a new graduate, it was a welcoming and engaging adventure for my introduction to the Earth Science cohort and my new home along the California coastline.

The trip began on a pier in Ventura Harbor. It was intimidating as I watched the jovial gathering of old friends and new, knowing this was a defining moment for the start of my next several years. Whatever hesitations I had quickly faded as our journey began. We took a boat across the channel, heading to Prisoner's Harbor on Santa Cruz Island. There we piled ourselves and belongings into the backs of field-hardy jeeps, readying ourselves to head through the island's interior for Christy Ranch, our home base on the island. From there, the adventure continued as our guide to the island, Emeritus Professor Jim Boles, led us on three geology-filled days adventuring across the island to explore the left lateral Santa Cruz Island Fault. The fault divides volcanic materials reminiscent of the Santa Monica Mountains to the northeast and metamorphic and sedimentary materials similar to Santa Barbara units to the south. We worked our way down section along the anticline of the southern units, examining blueschist clasts and erosional sequences. Beyond investigating local geology, we also swam in the ocean, enjoyed beautiful weather during the day with star-filled nights, encountered some mischievous foxes, sang songs to the accompaniment of the ukulele, exchanged stories around a fire, and so much more.

After three action-packed days, we were already speeding back across the channel. A final show of elephant seals, sea lions, a great white shark, and pods of bottlenose and common dolphins, appeared to send us off. The trip ended where it began, but this time I was no longer a stranger looking on, rather a member of the Earth Science community.

STAFF SPOTLIGHT



I grew up in the Northeast and graduated from the University of New Hampshire with a B.S. in Physics. I have spent the last years 10 years working in a lab on various satellite projects. I am glad to be in sunny California and working here at UCSB! I am also excited that there will be no need to break out the shovel this winter!

Outside of work, I love to travel, work on various arts and crafts, & spend time with my 6 year old Australian cattle dog mix, Moby.

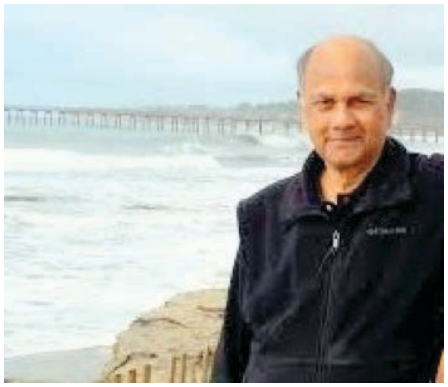
– Katherine Singer
Senior Development Engineer

DISTINGUISHED ALUMNI 2015

Every year, the department honors two of its alumni – one from industry, and one from academia – celebrating their accomplishments and providing our current students with exemplary role models.

Krishna Sinha

Before arriving at UCSB in 1965, Krishna Sinha received his BS and MS degrees at Patna University in India. While in England exploring opportunities for advanced studies, and after opting against a career in mining geology, he received a handwritten letter from Professor Aaron Waters inviting him to consider attending UCSB. Krishna accepted that offer, and through the exceptional mentoring of Aaron, George Tilton, Cliff Hopson, Dick Fisher,



Bill Wise, and Robert Garrison, he received his PhD in 1969. This was followed by a two-year post-doctoral fellowship at the Department of Terrestrial Magnetism (Carnegie Institute of Washington), where he worked developing new mass spectrometry techniques. While there, Krishna developed joint research programs with the U.S. Geological Survey, enabling him to start coupling isotopic systems to regional geologic histories. In 1971 he was hired by Virginia Tech to set up a mass spectrometer and geochemistry facility. He spent 37 years there mentoring students in melding geochemical and field data to unravel the geological history of much of coastal North America. An invitation to serve on the Tectonics Review panel at NSF

(Continued on page 8)

Mary Stallard

After completing her master's in 1986 under the incomparable Dr. Jim Boles, Mary Stallard spent two years with the USGS assessing geothermal resources in Honduras, Mexico, and Lassen National Park. Thereafter she moved to the environmental industry, spending 17 years at Weiss Associates where she managed its Environmental Investigations Group. After the birth of her daughter in 1998, Mary struggled to balance a demanding job with the time she wanted to spend time with her little girl. Ultimately she decided the best way to accomplish this would be to start her own firm, Montclair Environmental Management, Inc. ("MEMI"), with her husband, Rob Marinai. Rob, also a 1986 Boles master's student, worked in the oil and environmental industries before earning an MBA. He runs the financial side of the business and also directs habitat restoration projects that generate credits for parties needing to settle environmental liabilities. In its 10 year existence, MEMI has turned into exactly what Mary had envisioned, a small consulting practice that tackles a wide range of complex environmental problems involving hydrogeology and geochemistry (on a flexible

schedule). MEMI is often brought in to provide specific expertise on large projects with other consulting firms, collaborations that Mary especially enjoys. A particularly interesting ongoing project involves hexavalent chromium in groundwater in the Davis, California area. Understanding what's going on

(Continued on page 9)

Robin Matoza

Robin Matoza, our newest faculty hire, uses seismic and infrasonic waves to investigate the working of volcanoes. Infrasound has frequencies below 20 Hz, below the limit of human hearing. Using seismology he studies magmatic, hydrothermal, and faulting processes occurring within and around volcanoes. With infrasound he studies the mechanisms and dynamics of explosive eruptions and shallow volcanic degassing. This work is focused on understanding geophysical signatures of volcanic unrest and eruption, with application in monitoring and mitigating volcanic hazards.

Matoza grew up in Liverpool, England. In 2004, he completed an undergraduate masters in Geophysics at the University of Leeds. During 2002–2003, he was an undergraduate exchange student here at UCSB where he met his future wife, Emily.

He was a graduate student at the Institute of Geophysics and Planetary Physics (IGPP), Scripps Institution of Oceanography, UC San Diego from 2004-09. His Ph.D. dissertation concerned the 2004–2008 eruption of Mount St. Helens as well as volcanoes Kilauea, Hawaii and Tungurahua, Ecuador. Thereafter, he was a postdoctoral researcher at the French Commission for Atomic and Alternative Energies (CEA), a major center for infrasound research just outside Paris. There he studied the long-range atmospheric propagation of infrasound from explosive eruptions, demonstrating the feasibility of acoustic early warning systems of remote explosive volcanism for aviation safety.

In 2011 he returned to IGPP, Scripps as a Cecil H. and Ida M. Green postdoctoral scholar, later becoming a Project Scientist. His recent work has included systematic analyses and high-precision earthquake relocation at volcanoes and continued development of volcano-acoustic source theory based on field experiments.

In Memoriam

With great sadness we said goodbye to our beloved colleague and friend, Professor Emeritus John Crowell. John passed away May 13, 2015, an hour after his 98th birthday. He was a world-renowned scholar; during World War II, while working for the Allied Forces, he and others successfully forecast favorable conditions for the invasion of Normandy. This marked the beginning of a remarkable career.

John C. Crowell was born on May 12, 1917. He was a loving son, husband, father, grandfather, and friend. His two great legacies include his family, and his myriad contributions to the field of Geology. He will be remembered for his ground-breaking contributions to the tectonics of the San Andreas fault system and to the record of Paleozoic glaciation across the Gondwanan continents. Ridge Basin, California – the subject of his 1947 PhD dissertation at UCLA and decades of subsequent research – remains the definitive study of sedimentation along a strike-slip fault.

John was a member of the University of California faculty for 40 years (1947-1967 at UCLA, and 1967-1987 at UCSB). He led a distinguished and remarkable life.

Your Donation Dollars at Work

We are deeply grateful to you, our many alums, colleagues, and friends of the department who have helped us financially this past year! You have helped another group of students travel to New Mexico, Santa Cruz Island, and Iceland for an unforgettable Summer Field experience. You have underwritten awards to our many accomplished students, supporting their lab research, and field work, providing them the resources needed to reach their full academic potential. You have helped us host internationally-renowned scholars, bringing the freshest fruits of their scholarship through our doors. And your generosity has helped us recruit exceptional faculty and graduate students, raising the already enviable stature of our department globally.

Funds Still Needed in Specific Areas

We are most appreciative of your astonishing generosity, particularly with student support funds, but the department continues to face challenges in the area of field operations.

Our department would greatly benefit from a 12-passenger van for field trips. This vehicle would save the department much of the cost of renting vehicles, and gives us ready access to mobility when the need arises. In addition, much of our field equipment is decades old; your support would allow the purchase of new camp stoves, the replacement of aging Bruntons, and the adoption of new field-oriented technologies.

Much of our department's space would benefit from revitalization, especially our main office, tectonic work room, computer lab, and seminar rooms.

Request for Your Ideas

As friends of the department, you likely have ideas on what we need to better serve the students, faculty, researchers and staff. We truly welcome your thoughts. What do you remember as a student here that needed the most help or support? We are very interested in your input, as we greatly value the perspective you provide.

Thank you all so much!
Andy Wyss, Chair

With Appreciation

Earth Science Fund Drive

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Graduate Student Spotlight

Shelby Fredrickson

I am thankful to have studied in what are arguably two of the most beautiful places in California: Bodie Hills near Owens Valley and the Santa Barbara-Ventura coast. Born and raised in Fresno, California, I earned a BS in Geology from Fresno State in 2014. During my undergraduate studies, I worked with Christopher Pluhar, using paleomagnetism to calculate tectonic rotations of fault-bounded crustal blocks in Walker Lane. It was this research that piqued my interest in landscape evolution and tectonic geomorphology.

Now I study the Santa Barbara-Ventura fold belt transition at Rincon Creek with Edward Keller. The Santa Barbara and Ventura Fold Belts have very different uplift rates: ~1-2 m/ky and ~6-8 m/ky, respectively. The onshore transition between these fold belts occurs at Rincon Creek, near Carpinteria, but it is unclear whether this transition is a tectonic boundary or just a convention. I use a combination of geomorphology and geochronology to describe patterns and rates of crustal deformation near Rincon Creek and test whether the known change in uplift rate is spatially discrete or distributed across the transition zone. If verified by pending geochronology, a discrete change in uplift at Rincon Creek supports the presence of a cross-fault, which has implications for the segmentation of east-west fault systems that intersect Rincon Creek. I am looking forward to presenting my results at the American Geophysical Union fall meeting this December.

I have developed quite an appreciation for geomorphology as a multidisciplinary subject, incorporating GIS, MATLAB, field studies, and laboratory work. This project has introduced me to methods including geomorphic mapping, stream profile analysis, optically stimulated luminescence (OSL) dating of deformed landforms, and the examination of bucket auger core logs. I am very grateful for the EarthScope grant to process my OSL samples at the Utah State University Luminescence Lab, the Earth Research Institute grant for summer work, and the Carolyn Edwards Murphy and Christina Edwards Field Studies Fellowship. Most of all, I am glad to be a part of this spirited department, and I am proud to be a Gaucho!

Krishna Sinha

(Continued from Page 4)

provided him the opportunity to promote and support the increasing role of tectonics in geosciences through on-demand access to data and models. Through his efforts, and the support of hundreds of his colleagues, the Geoinformatics Division within the Geological Society of America was established. The Division, of which Krishna was the founding Chair, continues to thrive, providing significant benefits to the community at large.

Krishna and Barbara met while attending UCSB. They were married in 1970, under a pepper tree at Barbara's parents' home in Samarkand. They agreed to return to Santa Barbara after retirement, moving here in 2013. Together with their dog Max, they enjoy the climate and beauty of this area. With Krishna's appointment as an Adjunct Professor, it seems their travels are complete. Krishna works uninterruptedly on research papers about geologic topics that have always intrigued him.

Graduate Student Spotlight

Ryan Neilson

This is my fourth year as a graduate student working with Professor Frank Spera. I graduated from Colorado School of Mines (2012) with a B.S. in Geological Engineering. I am married and have two children.

I investigate thermodynamic and transport properties of liquid aluminosilicates at high temperature and pressure using molecular dynamics (MD) simulations—a numerical method that models inter-atomic forces between ions. Integrating over short (~1 femtosecond) time steps, the MD method calculates acceleration, velocity, and positions of all atoms, thereby simulating the dynamics of the system at the atomic level. MD simulations are powerful tools for investigating thermodynamic and other material properties at conditions unattainable in the laboratory.

The MD method is extremely useful for analyzing atomic-structure information such as coordination numbers. Comparing coordination statistics directly to thermodynamic properties highlights the connection between microscopic structure and macroscopic properties of liquid silicates. For example, the self-diffusivity of atoms through the liquid structure is directly calculated in MD simulations, and hence, these two properties (diffusion and structure) can be analyzed simultaneously.

Currently, I am investigating the thermodynamics of cooling liquid $NaAlSi_3O_8$ below the fusion temperature and the associated glass transition. I am attempting to predict the glass transition temperature of this feldspar composition as a function of pressure at high cooling rates. Geologic glasses and glass-forming processes have important implications for seawater geochemistry, industrial ceramics, and meteorite impacts.

In addition to the graduate research reviews every spring, I have presented aspects of my work at AGU, in a petrology seminar, and as part of the Graduate Simulation Seminar Series from Chemical Engineering. I have a manuscript in revision for American Mineralogist on an equation of state for liquid $NaAlSi_3O_8$. Also, I am writing a paper on glass transition phenomena, expecting to submit that work by the end of 2015.

Mary Stallard

(Continued from Page 4)

there remains elusive, so she is happy to brainstorm with anyone interested!

When not working, Mary loves to be outdoors: backpacking, hiking, cycling, volunteering in Oakland parks and gardens and shoreline cleanups, or just sitting in the sun doing a crossword puzzle. She and Rob are gratified that their 16-year old daughter, Amelia, also loves the outdoors and backpacking, is active in environmental causes, and may even pursue an "Earth" related career.

STAFF SPOTLIGHT

I'm a Southern California native and a Gaucho. I stumbled into working in Student Services by accident when I tutored my way through college and I have been at it ever since! I love working with students and being an organizational mastermind and I am so excited to join Earth Science! Outside of work I am an active performer in dance and aerial (circus skills hanging from stuff), a nerd, and a cat lover; I like to keep it eclectic!

– Shannon Dalton
Undergraduate Program Coordinator

Arthur Sylvester

Awarded Dickson Emeriti Professorship

We are pleased to announce that Arthur Sylvester was awarded the prestigious Dickson Emeriti Professorship at UCSB for 2015-16.

Art remains incredibly active in the department, despite "retiring" more than a decade ago. He continues to regularly contribute to the teaching of our field courses. He has taught or co-taught Earth 118, Summer Field Geology, our physically and intellectually demanding "capstone" course seven times. He regularly leads, without salary, our large GE course, Earth 18, shepherding dozens of undergraduates on four-day field trips in Southern California, generously sharing his extensive knowledge of the area.

Art has given to the students and the department in a myriad of ways, making his receipt of the Dickson Award richly deserved. Its associated stipend will help Art, along with his illustrator and co-author Libby Gans (B.S., 1994), put the finishing touches on the *Roadside Geology of Southern California*, a book aimed at a broad public audience. The popular and respected *Roadside Geology* series, currently numbering some two dozen titles, has been glaring for its lack of coverage of Southern California. Given the tens of millions of people inhabiting this region (some large fraction of which, doubtlessly, are geologically curious), we are confident that this volume will quickly become the most widely read title in the series.

The gift endowment was established in 1955 by Edward Dickson, who served as a University of California Regent from 1913 to 1946, the longest tenure of any Regent to date.

Faculty Awards

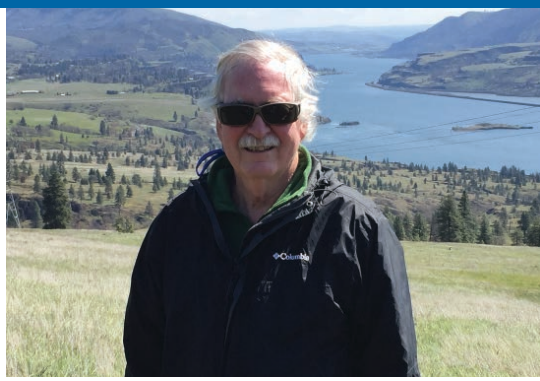
Tanya Atwater Receives GSA Honors – August 2015

Annually the GSA honors individuals who have made significant and sustained contributions during their careers, advancing the science of structural geology or tectonics. This year, our Professor Emerita Tanya Atwater was awarded GSA's coveted Structural Geology & Tectonics Division Career Contribution Award.

Matthew G. Jackson Awarded the James B. Macelwane Medal – July 2015

Professor Matthew Jackson has been awarded the prestigious Macelwane Medal from the American Geophysical Union. The James B. Macelwane Medal is given annually to three to five honorees in recognition for "significant contributions to the geophysical sciences by an outstanding early career scientist."

Bill Prothero



Bill came to the department in 1976, from the Institute for Geophysics and Planetary Physics at UCSD, where he did pioneering work in the field of Ocean Bottom Seismology. During his Ph.D. studies in Physics, he developed a superconducting gravimeter that is commercially available to this day, and is deployed world-wide. During his UCSB career, he and his team continued to perfect ocean bottom seismometers used in the California borderlands. This technology was later exported to land instruments, where high quality earthquake recordings were made in Long Valley, Hawaii, and Anza Borrego desert.

During the later part of his career Bill worked to build scientific literacy. The microcomputer revolution of the 90s and the availability of powerful low cost computers, enabled him to apply technology to improve student learning in his large general education oceanography class, with hopes that his innovations would spread. Supported by numerous NSF grants and collaboration with colleagues in the Graduate School of Education and the Department of Psychology, he developed software that made it easy for students to acquire real Earth data, use it to support theories such as plate tectonics, and write papers reviewed by their peers. Many of these innovations are incorporated in today's class management systems.

Summer Field Research 2015

This year's Summer Field students traveled to three stunning areas with three different professors: New Mexico with Alex Simms; Iceland with Phil Gans; and, Santa Cruz Island with John Cottle. The 6 weeks were grueling, and, at the same time, awe-inspiring and unforgettable.

Photos top to bottom:
Students atop an unnamed 8435' peak of Cretaceous Dakota Sandstone as they map on the eastern fringes of the San Juan Basin in northern New Mexico; Looking east over the Jökulsá á Fjöllum river in Vatnajökull National Park, northeast Iceland; Students investigate paleo-transport direction using asymmetrical ripple marks in the Beechers Bay member of the Blanca Formation, Santa Cruz Island.

STAFF SPOTLIGHT

After a happy butter and gluten laden childhood in France, a UCSB BA and MA in Marine Biology, and a decade as a software entrepreneur, Yann found his true calling in the 90's when he joined what was then the Geology Department as an IT guy. He foolishly left us at the turn of the century to go raise a family and an antiquities museum, and returned last spring to a department he had been missing for far too long.

– Yann Ricard
Graduate Program Coordinator

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❑ Making a gift using securities

❑ Including Earth Science at UCSB in my will or living trust

❑ I wish to establish a pledge: $ _____

▶ MATCHING GIFTS

I (or my spouse) work for a company that will match my gift.

Company name _____

❑ Form Enclosed ❑ Form Forthcoming

❑ I wish to remain Anonymous

Thank you for your generous gift!