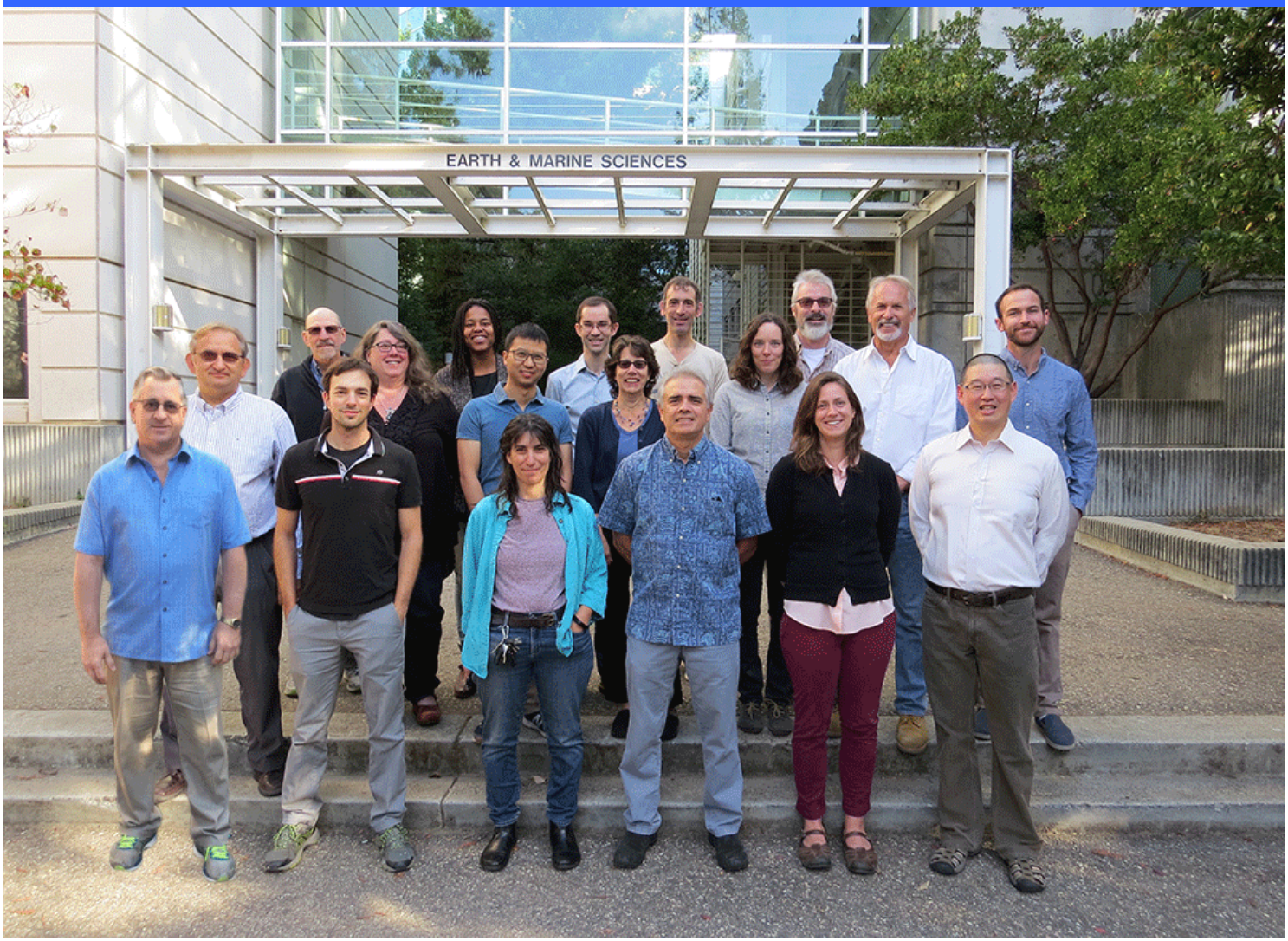
Earth & Planetary Sciences at UC Santa Cruz

Fall 2017



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Chair's Welcome

Dear Alumni and Friends,

I officially assumed position of department chair in July, taking the reins from Prof. Quentin Williams who skillfully guided EPS for 6 years leaving the program in great shape. The department is indebted to him for his service.

We welcome several **recent arrivals** starting with the department manager, Grace Caslavka, hired in Winter 17. EPS is fortunate to have Grace, who came to us from UCSF where she managed the Department of Surgery. We also welcome Assistant Professor Myriam Telus who arrived this summer to begin the process of building her lab. Myriam, a geochemist/planetary scientist, comes to us from the Carnegie Inst. where she was a post-doctoral fellow. Two additional hires will arrive in winter/spring 2018; Dr. Margaret Zimmer, a hydrogeologist coming from Duke University where she is a post-doc; and Dr. Mathis Hain, a theoretical biogeochemist coming from Southampton University where he is a research scientist. The department also welcomes 14 students to the graduate program, one of our largest classes in over a decade. We look forward to their contributions to the program.

Personally, I look forward to the challenges and rewards of chairing EPS. The department is in the process of **undergoing a major transition** with the arrival of a large cohort of new faculty and the retirement of several long-standing members of the department. This transition is in line with the long-term growth plan which targets key areas of opportunity including planetary and climate/environmental sciences, complementing our traditional areas of excellence in geophysics /tectonics and surface processes/paleoenvironments. This transition in the composition (and diversity) of EPS also strengthens interdisciplinary ties to other programs enhancing opportunities for both research and teaching. Indeed, several of the latest hires will be contributing courses to the **new undergraduate major in Environmental Sciences** (scheduled to initiate in Fall 2018). We anticipate that this program along with continued growth in planetary will eventually double the number of EPS undergraduate majors. We also anticipate the number of graduate students to increase. All of this growth is good, but will place additional pressure on department infrastructure.

Fortunately, to accommodate this growth, the EPS department recently acquired additional lab and office space when the Ecology and Evolutionary Biology dept moved from our building to the new coastal campus. As for financial support, to augment campus/divisional funding, the department has been ramping up **development activity**, working

Editors:
Susan Schwartz &
Francis Nimmo

Phone:
831 459 2266

Emails:
syschwar@ucsc.edu
fnimmo@ucsc.edu

Chair's Welcome (continued)

primarily with alumni to increase EPS gifts/endowments. For better or worse, private funding will play a greater role in augmenting the traditional sources of funding for training students and conducting research, as is the case for many other programs nationally. One notable addition to our existing funds is the Eli Silver Fund, organized and launched by some of Eli's students in 2016 (see p. 30).

This spring we hosted an **Alumni event** in Houston, and plan to hold another one in New Mexico in Fall 2018 (see p. 11). A conference in honor of Bob Garrison will be held at UCSC in May 2018 (see p. 5). And this December, many will also be traveling to New Orleans for AGU, the first time the fall meeting has been held outside of San Francisco. Due to the generosity of EPS Alumni Council members Chuck Lawson, Kevin Biddle, Peter Vrolijk and Mike Underwood we will still hold the traditional EPS Alumni event Tuesday evening of the meeting (Dec 12). We look forward to seeing many of you there! Details are below.

Regards,

Jim Zachos, Chair

http://www.facebook.com/UcscEPS

We hope to see you at the Crescent City Brewhouse, New Orleans for our

17th Annual UCSC EPS Alumni Event at Fall AGU!

Tuesday, December 12, 2017

from 6:00pm - 8:30pm

527 Decatur Street

New Orleans, LA 70130

http://www.crescentcitybrewhouse.com/

Department News

Matthew Clapham

Jim Zachos was elected to the National Academy of Sciences, the fifth person in the department to be so honored.

Matthew Clapham was elected a Fellow of the Geological Society of America

Jim Zachos with his celebratory NAS cake

Andy Fisher

Andy Fisher received a campus Excellence in Teaching Award (for the second time!)

Margaret Zimmer

Grace Caslavka

Margaret Zimmer and **Mathis Hain** were appointed as new faculty members in hydrogeology and biogeochemistry, respectively. Mattis will arrive in Spring 2018.

Grace Caslavka was appointed as the new department manager.

Eli Silver

A new fund in honor of **Eli Silver** was organized and launched by some of Eli's former students.

Mathis Hain

Slugs in the News

Conference in Honor of Bob Garrison

Four decades of research on the Monterey Formation and Neogene marine units

Meeting venue: TBD, Santa Cruz, CA

May 8th to 10th 2018 (Pre and post field trip dates TBD)
For more details contact Christina Ravelo, acr@ucsc.edu

Aradhna Tripati (PhD 2002) received the Bromery Award for Minorities from the Geological Society of America

PhD student Carolyn Branecky was interviewed about climate change by the California Academy of Sciences as part of their Flipside Science project (https://www.calacademy.org/educators/flipside-science).

Jim Gill in March 2017 aboard the new German R/V *Sonne* holding lava dredged from the 1700 m-high volcano in the Havre Trough, New Zealand, that was named for him. Erin Todd (PhD 2011) also participated in the 6-week expedition that tested concepts in their respective PhD theses 40 years apart.

Kathy Sullivan (BS 1973) was named as the 2017 Charles A. Lindbergh Chair of Aerospace History. Sullivan has served as Under Secretary of Commerce for Oceans & Atmosphere and National Oceanic and Atmospheric Association Administrator since March 2014 and has a long career as a distinguished scientist, astronaut and oceanographer.

Slugs in the Field

Professor Noah Finnegan talks with his Summer Field Geology students about the geomorphology of transtensional faults near McGee Creek, CA.

Sophia Probasco and friend measuring the Poleta Formation

Last night of Summer Field Geology at Sierra Nevada Aquatic Research Laboratory, CA.

Summer field. John Stapke on a famous trace fossil outcrop (*Taphrhelminthopsis sp.*)

Graduate students Alex Nereson and Colleen Murphy accompany professors Noah Finnegan (left) and Margaret Zimmer (center right) to the site of a large landslide in California's Diablo Range. Smoky skies originated from the October 2017 wildfires in Napa and Sonoma Counties.

Geologic hazards field trip, San Andreas Fault

Slugs in the Field

Grad student Sarah Neuhaus in Antarctica

Geomorphology field trip (1)

Geomorphology field trip (2)

Planetary Sciences field trip to Meteor Crater, led by Ian Garrick-Bethell and Myriam Telus

EART102 (Marine Geology) King Tides class field trip, led by Ana Garcia Garcia

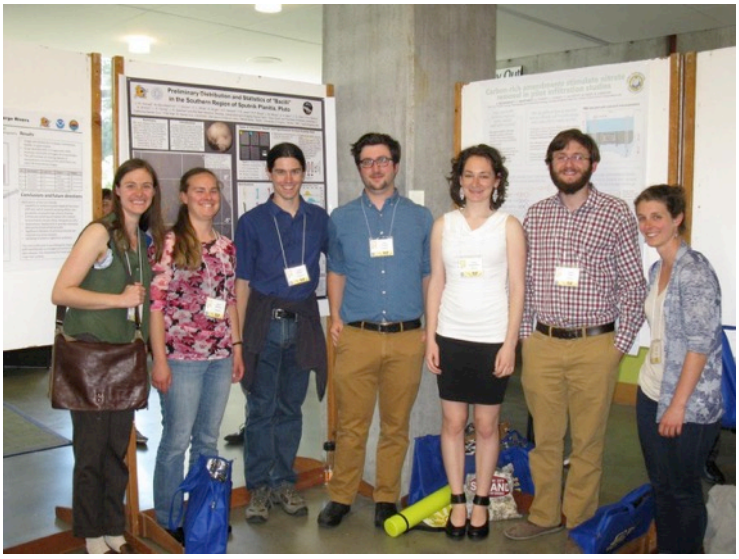
Slugs Around Campus

Undergraduate student Selina Davila Olivera ('17) prepares a soil sample as part of her thesis research into the mechanical and hydrological properties of earthflows.

Undergraduate participants in the inaugural EPS Department Research Symposium

EPS bike parade 2017, theme: rainbow

Graduate student Claire Masteller, with her award-winning subduction cake at the Departmental picnic

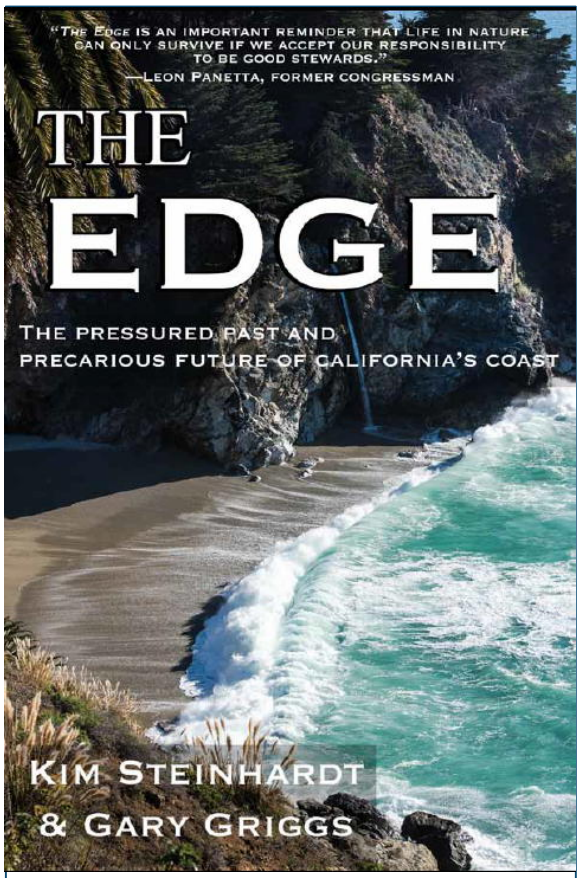


EPS presenters in the UCSC Grad Division Research Symposium (l-r) Carolyn Barnecky, Sarah Neuhaus, Carver Bierson, Jack Conrad, Sarah Beganskas, Dan Killam, Allison Pfeiffer

Slug Science News

Formation of glacial polish explained
Post-doc Shalev Siman-Tov, Professor Emily Brodsky and Slug alum Greg Stock collected samples of glacial polish in Yosemite National Park. Detailed analysis showed that the polish results from glacial abrasion and redeposition in a thin, wear-resistant layer.

(Siman-Tov et al., *Geology* 45, 987-990, 2017)



Gary Griggs' latest book

The Edge came out in September, published by Craven Street Books. It is a personal treatment of the California Coast, combining politics, history, law, culture and science.

Pluto cooled by atmospheric haze
Assistant Professor Xi Zhang proposed that the surprisingly low temperatures in Pluto's atmosphere are a result of cooling caused by small particles (similar to smog) which form in the upper atmosphere and then drift downwards. The model makes predictions which will be tested when the James Webb Space Telescope launches in 2019.

(Zhang et al., *Nature 551,* 352-355, 2017)

GEODES Update by Dan Killam

GEODES is a student-run discussion group that aims to promote communication and diversity within the EPS Department. In 2016 GEODES received the Chancellor's Achievement Award for Diversity.

The student-run group Geoscientists Encouraging Openness and Diversity in the Earth Sciences (GEODES) has entered its fourth year fostering inclusion and participation of underrepresented groups in our department and the broader earth sciences. This year, they have organized events on science outreach techniques, a camping workshop and facilitated departmental networking through a pizza party and a game night. Upcoming events include seminars on universal design, impostor syndrome and environmental justice, as well as a career panel. Other goals include a new "Member" tier to encourage broader participation in event planning throughout the department, particularly among first year graduate students and undergraduates looking for service opportunities. They have expanded collaboration with the Ocean Sciences group CORE (Communicating Ocean Research Effectively), and through new fundraising activities, the officers hope to ensure the growth of GEODES in the future, long after they are Doctors. This year, the officers include Sarah Beganskas, Grace Barcheck, Carolyn Branecky, Rachel Maxwell, Dan Killam and Sarah White.

GEODES Geoscientists Encouraging Openness & Diversity in the Earth Sciences

Contact Us:
ucscgeodes@gmail.com

Casey Moore Fund Report By Dan Killam

The Casey Moore Fund supports graduate student research. The 2016 awardee was Dan Killam.

Last summer, I had the privilege of traveling for two months to live in Eilat, Israel and sample from modern and fossil reefs on the coasts of Israel and Jordan, obtaining shells of the giant clam, *Tridacna*. There are three species in the Red Sea, and I am utilizing growth bands in their shell and stable carbon and oxygen isotopes to determine their relative growth rate. We intend to compare the growth rates of modern and fossil specimens to determine whether these unique organisms grew more quickly in the past, and whether their growth is restricted in the present by human-sourced sewage and industrial pollution. Because the clams are dependent on high water clarity due to their photosynthetic nutrition, they are keenly sensitive monitors of alterations to their fragile reef environment.

With shell samples from over 150 individuals, I have been spending a lot of time in the Stable Isotope Lab these last couple of quarters! And I've been able to do so because of the support of the Casey Moore Fund Award. The support has allowed stable isotope analysis of growth rate in fifteen modern and fossil shells. The award also enabled me to obtain the raw ingredients to mix a dye which can be used to make the growth rings in the clam's shell more visible for counting. Work is ongoing, but so far I am able to report that the fossil population of clams did appear to grow significantly faster in the past, and we have been able to uncover an isotopic offset in the clams' shell carbonate which may represent a unique signal of their symbiotic lifestyle and could possibly be applied to other chapters of my thesis.

Houston Alumni Event

Peter Vrolijk organized an EPS alumni event in Houston in March 2017, with a daytime gathering at a park for food, drinks, reminiscing and updates. Emily Brodsky, Patrick Chuang, and Rob Coe attended to represent the department, and it was an enjoyable and successful afternoon.

Peter Vrolijk with visual aid.

Mike McGroder, Richard Gordon, Mike Underwood, Emery Goodman and Patrick Chuang.

Yongzhong Wang, Yaofeng He, Jun Cao and Shengwen Jin.

Emily Brodsky, Mike Underwood and John Idstrom.

Upcoming Events

The annual EPS alum AGU meeting will be in **New Orleans** on Tues Dec 12th from 6:00-8:30PM at the Crescent City Brewhouse, 527 Decatur Street

We are starting to plan an alum event in **New Mexico**, sometime between mid-Sept and end of October 2018. Anyone interested in attending should contact Paul Koch (plkoch@ucsc.edu) for more details.

Grad/Undergrad Degrees & Awards

Graduate Degrees, 2016-17

Mikey Nayak Fall 2016 (PhD)
"Sesquinaries, Magnetics and Atmospheres: Studies of the Terrestrial Moons and Exoplanets"

Delphine Defforey Fall 2016 (PhD)
"Phosphorus cycling in the deep sedimentary subseafloor environment"

Delia Santiago-Materese Fall 2016 (PhD)
"Water Ice Clouds on Mars: Exploring Processes Through Modeling and Laboratory Work"

James Shope Fall 2016 (PhD)
"Modeling Pacific Atoll Island Shorelines' Response to Climate Change"

Alex Steely Fall 2016 (PhD)
"Fault-Controlled Patterns of Uplift in the Central California Coast Range and Laser-Ablation Depth-Profile Analysis of Zircon"

Saffia Hossainzadeh Fall 2016 (PhD)
"Effects of Freshwater Forcing in the Dynamics of the Labrador Sea"

Adrienne Grant Fall 2016 (MS)
"Lower Crustal Xenoliths of the Southern Sierra Nevada: A Major Element and Geochronological Investigation"

Heidi Stauffer Winter 2017 (PhD)
"Regional and Global Implications of Land-Use Change and Climate Change"

Chia-Te Chien Winter 2017 (PhD)
"Impacts of Dry Atmospheric Deposition on Aquatic Systems - Nutrients, Trace Metals and Lead Isotopes"

Erin Todd Winter 2017 (PhD)
"Interplay between modes of strain release along the shallow northern Hikurangi subduction zone, New Zealand"

Tracey Conrad Spring 2017 (PhD)
"Hydrogenetic Ferromanganese Crusts of the California Continental Margin"

Earl O'Bannon Summer 2017 (PhD)
"High-pressure studies of subduction zone related minerals"

Marko Manojlovic Summer 2017 (MS)
"The role of substrate preference in Mesozoic brachiopod decline"

Graduate Awards

J. CASEY MOORE FUND AWARD:
Christina Richardson

ZHEN AND REN WU MEMORIAL FUND AWARD IN GEOPHYSICS:
Joel Edwards

AARON AND ELIZABETH WATERS GRADUATE RESEARCH AWARD: (1 RECIPIENT THIS YEAR)
Cara Vennari

ARCS FOUNDATION AWARD:
Grace Barcheck

HAMMETT ENVIRONMENTAL STUDIES FELLOWSHIP:
Grace Barcheck
Ana Martinez-Fernandez

CHANCELLOR'S ACHIEVEMENT AWARD FOR DIVERSITY:
GEODES – Geologists Encouraging Openness and Diversity in Earth Sciences (Founding Members: Grace Barcheck, Sarah Beganskas, Claire Masteller, Allison Pfeiffer, Danica Roth, and Stephanie Taylor)

PRESIDENT'S DISSERTATION YEAR FELLOWSHIP (1 QUARTER):
Neil Foley

Grad/Undergrad Degrees & Awards

PRESIDENT'S DISSERTATION YEAR FELLOWSHIP (1 YEAR):
Carolyn Branecky

THE EPS DEPARTMENT AWARD FOR THE BEST PRESENTATION AT THE GRADUATE RESEARCH SYMPOSIUM:
Allison Pfeiffer

NATIONAL SCIENCE FOUNDATION (NSF) GRADUATE RESEARCH FELLOWSHIP PROGRAM (GRFP):
Michele Markowitz
Gavin Piccione

NASA EARTH AND SPACE SCIENCE FELLOWSHIP:
Nick Zube

NATIONAL SCIENCE FOUNDATION (NSF) GRADUATE RESEARCH INTERNSHIP PROGRAM:
Christina Richardson

NATIONAL GEOGRAPHIC SOCIETY'S EARLY CAREER AWARD:
Christina Richardson

CENTER FOR DARK ENERGY AND DEEP BIOSPHERE INVESTIGATIONS RESEARCH GRANT:
Esra Mescioglu

MYERS OCEANOGRAPHIC AND MARINE TRUST RESEARCH GRANT:
Christina Richardson
Esra Mescioglu

GEOLOGICAL SOCIETY OF AMERICA HYDROGEOLOGY DIVISION RESEARCH GRANT:
Christina Richardson

GEOLOGICAL SOCIETY OF AMERICA GRADUATE STUDENT RESEARCH GRANT:
Kyle Broach
Ana Martinez-Fernandez

GEOLOGICAL SOCIETY OF AMERICA TRAVEL GRANT:
Christina Richardson

NSF EAR POSTDOCTORAL FELLOWSHIP:
Claire Masteller

NSF SUPPLEMENTAL YEAR FELLOWSHIP:
Kyle Broach

SCHLANGER FELLOWSHIP FROM THE INTEGRATED OCEAN DRILLING PROGRAM:
Sarah White

PHILANTHROPIC EDUCATIONAL ORGANIZATION SCHOLAR AWARD:
Carolyn Branecky

GEOLOGICAL SOCIETY OF AMERICA RESEARCH GRANT:
Karen Lykkebo Petersen

GEOLOGICAL SOCIETY OF AMERICA TRAVEL GRANT:
Claire Masteller

CAMPUS-WIDE OUTSTANDING TA AWARD (FACULTY NOMINATED):
Dustin Harper

EPS DEPARTMENTAL OUTSTANDING TA AWARD (STUDENT VOTED):
Neil Foley – Winner
Ricky Garcia Garzon – Honorable Mention
Dan Killam - Honorable Mention
Claire Masteller - Honorable Mention
Allison Pfeiffer - Honorable Mention

Grad/Undergrad Degrees & Awards

Undergraduate Degrees (BS/BA)

Nadim Abu-Hashmeh**
Monica Noel Appiano
Crystal Arango
James Thor Babbe*
Westley Blais
Drew Bogusz
Ariel Charise Boyer
Jessica Coral
Hannah Dailey
Selina Davila Olivera
Blake Davis
Stephanie Douglas
Domininque Vanden Dries
Alexa Evans
Henry Evans
Casey Fitzgerald
Max Friedman
Sydney Carson Ganem
Sam Gurley
Aaron Hagadorn
Larson Henderson
Zhuoqun Hu**
Weston Nicholas Hustace
Zoe Irish
McKinna Krieghoff
Stephan Loveless*
James McFadden
Tyler Paladino**
Ian Peters
Sophia Catherine Probasco
Ulysses Rodriguez
Alejandra Rojas
Angelica Samson
Susana Santos*
Tyler Stewart
Wayne Strojie*
Megan Tang
Mario Tanzil
Dylan Tasker
Jordi Vasquez
Arianna Weingarten
Ryan Willett
Jackie Williams**
Seth Williams*
Angel Yanes
Christopher Zajic

* Candidate for Honors
** Candidate for Highest Honors

Undergraduate Awards

HOLLY DAY BARNETT MEMORIAL SCHOLARSHIP:
Jackie Williams

HIERARACHICAL RESEARCH SYSTEMS FOUNDATION UNDERGRADUATE RESEARCH AWARD:
Nadim Abu-Hashmeh
Kristina Okamoto

SILVIA MILLER SCHOLARSHIP FOR RE-ENTRY STUDENTS FROM THE OSHER LIFELONG LEARNING INSTITUTE AT UCSC:
Sharon Mulready

ASSOCIATION FOR WOMEN GEOSCIENTISTS (SAN FRANCISCO BAY AREA CHAPTER), OUTSTANDING STUDENT AWARD:
Ruby Wood

SANTA CRUZ GEM AND MINERAL SOCIETY SCHOLARSHIP:
Gita Kushwaha

LATINOS IN TECHNOLOGY SCHOLARSHIP AWARDED BY THE SILICON VALLEY COMMUNITY FOUNDATION:
Flor Vanessa Maciel

FOLEY-MENDELSSOHN SCHOLARSHIP FOR EARTH SCIENCE STUDY ABROAD IN BERLIN:
Filomena Fuchs

STEM DIVERSITY PROGRAM NATIONAL

Grad/Undergrad Degrees & Awards

INSTITUDE OF HEALTH (NIH) AWARD:
Deborah Leopo

ROBERT NOYCE TEACHER SCHOLARSHIP FOR CAL TEACH INTERNS:
Crystal Arango

WEBER-HOLT GRANTS:
McKinna Krieghoff
Sophia Probasco
Alejandra Rojas
Jackie Williams
Seth Williams

CANDIDATE FOR HONORS IN THE MAJOR:
James Babbe
Alexander Kreile
Stephan Loveless
Ellen Mills
Ryan Munnikhuis
John Ohman
Sarah Reuter
Susana Santos
Wayne Strojie
Seth Williams
Dmitri Voytan

CANDIDATE FOR HIGHEST HONORS IN THE MAJOR:
Nadim Abu-Hashmeh
Samuel Anderson
Irita Aylward
Natasha George
Zhuoqun Hu
Tyler Paladino
Brian Stiebel
Jacqueline Williams

OUTSTANDING SENIORS:
Tyler Paladino and Zhuoqun (Arthur) Hu

Not all field trips take place in sunshine.

Climbing a hoodoo.

2017 EPS Commencement Speech By Mary Bannister

Mary Bannister (BS Earth Science 1972) was the General Manager of the Pajaro Valley Water Management Agency for 17 years until stepping down in 2016. She was recognized as Outstanding Community Volunteer by the Pajaro Valley Chamber of Commerce.

It dawned on me that more science is the one possible cure to today's ills when I considered the invitation to speak at the 2017 EPS commencement ceremonies. It's crazy town out there right now – unlike anything I've seen since I was in school at UCSC in the 70's! What is not crazy is that there is a new class of scientists who will make a change – UCSC produces change-makers.

I came here from Antioch, CA of all places, in 1972, very insecure and from a troubled home. And 4 years later I left with a confidence and curiosity that really guided my entire life and career at UCSC. I learned to trust my gut, yet take risks with serendipity. Trust serendipity – it guided me to exciting and unexpected achievements and I know it will serve you well also!

Serendipity

I was unclear on my path forward upon graduation in 1976. After mentioning an interest in going to Alaska to my good friend Alison Till, Ph.D., (just retired from an esteemed career with the USGS), she serendipitously replied, "you should go – here's the number of a friend I have up there, Travis Hudson," who also worked at the USGS at that time. I spent 10 years working in engineering geology in Alaska.

I did engineering geology for several firms in Alaska, including a coastal engineering firm so viewed much of the state, often from the muddy end of a drilling rig. I learned that resources could be managed sustainably and of the importance of environmental considerations even when oil production was involved.

Spirit of Change

When I started at UCSC, there was no Coastal Commission, there wasn't free access to beaches, and there was no Monterey Bay National Marine Sanctuary – and we weren't yet called Banana Slugs, tragically. There was a slaughterhouse above Natural Bridges that dumped offal (cow guts) into the Bay - legally! It was our own Gary Griggs, among others, that fought to stop using our bay as a dumping grounds – he was a surfer – can you imagine surfing and having beef offal float by? Imagine a young Gary Griggs that took on that fight, and won! That's the spirit of change that you now can carry forward.

In the mid-80's Dan Haifley, another Banana Slug, drove his Pinto around the state with an old-fashioned slide show – not PowerPoint (carousel style – you may find one in an antique store) encouraging cities to pass ordinances to ban offshore drilling. He was a hippy then but he wore a suit and tie – appearances mattered even then! Sant Cruz was the model – stopping the oil

Mary Bannister (cont'd)

companies' ability to drill by not allowing the support services to be built in town, a clever device originated, I think, by Gary Patton. It was serendipitous that in 1992 George H.W. Bush needed to carry California to win the presidential election. He was pressured by Leon Panetta and Dan Haifley and a tribe of others to do something important for our state. Out of this and associated efforts, the National Marine Sanctuary was created, protecting 6,000 square miles of our coast! I hope you find this kind of passion to create change, and start with small steps – momentous change can result.

Mentor the Youth

We just lost our local treasure Jack O'Neill. Dan now runs the O'Neill Sea Odyssey program, Jack's brainchild, which has exposed nearly 100,000 kids to marine sciences. Young scientists in the making - Jack's impact is profound.

Another Slug who I revere, Jerry Weber, a legend produced by this department, (he put the "fun" in fundamental field studies back in the day) told me to get licensed as a geologist when I got back from Alaska. I listened, I did get licensed, and it gave me cred over the years, that I otherwise would have lacked. It was serendipitous that I listened to him and I'm forever indebted to Jerry. Bob Garrison was another professor who changed my life - I could feel that he saw talents in me that weren't strictly academic. It gave me confidence.

Eye on the Prize - Science

I spent nearly 20 years fighting California water wars at the Pajaro Valley Water Management Agency. A focus on science over or in spite of politics was key to our survival. When I started, the Agency was in court facing several lawsuits, the results of which set precedent in California water law. Prior to the 2014 groundwater legislation, which Natural Resources Secretary (and Slug) John Laird helped enact, well pumpers around the state could take as much water as they liked. I've heard it 1,000 times, including my last day on the job, that "it's my land and I own the water under it." ***No, you don't.***

Having a groundwater well impacted by seawater intrusion is ruinous. The Pajaro Valley is one of the richest growing regions in the nation if not the world. The Central Coast produces much of the country's strawberries, lettuce, artichokes, brussels sprouts, and you can't irrigate with salt water, end of story. We built a plant with the City of Watsonville, recycling waste water for use as irrigation supply, stopping discharge of effluent into the Sanctuary. It was novel and edgy at the time, a mere 10 years ago, and is becoming commonplace now. All the water that ever was, is. There is no new water, we're using the same water

Mary Bannister (cont'd)

as the dinosaurs and it's all reclaimed.

Communicate – and Communicate Well
Working in water tested my ability, every single day, to effectively communicate with a wide range of people with conflicting interests and find a common way forward. The PR effort to get acceptance of recycled water by the farmers was another story of science being communicated effectively. There is a huge need for good communicators right now – you know who you are. This might be the best way to serve science for some. With your science background now, a career in law could be very rewarding as management groundwater in the state will be litigated for decades and good science and effective communication skills will be key to good policy.

My success at PV Water, was due to two goals I started with – one I think I did well, the other not so much. I decided from the beginning to keep the science front and center. I also said that I wasn't going to get involved in the politics-very naïve. But we never moved from the position of keeping science front and center. When the nay-sayers questioned the science that identified severe overdraft in the Pajaro groundwater basin, we engaged the USGS and UCSC scientists (Dr. Andy Fisher in the lead) to do our groundwater modeling and other technical work. These institutions are trusted by most of the public and their ability to communicate with the public is exemplary.

All but the most combative opponent then at least came to agree with the science behind our findings, the underpinning of our water supply projects which translated into added costs to our public. The science will stand if we tell the story well and in a way that can be understood – back to how important communicating the message is. I recently heard a quote "stop asking if one believes in climate science, instead ask if one ***understands*** climate science." Isn't that timely?

So, go out there and do good science – please. And whether you get a Ph.D., and do research, become a writer and help make science understandable, or take the most noble and urgent of tasks – teaching science to the next generations, do consider public service at some time during your journey. Run for office, get on a board, work for a public agency. You are needed and perfectly set to make great and good change in the world. Heaven knows we've tried, but it is up to you now to carry the torch. I have great confidence that you will do this so well, and that you will be rewarded for taking this rewarding path!

Now I want to wish you all the best and great good luck in the future you chose!

Your flight plan has been filed, you're cleared for take-off!

Thank you!

Below the Ice
By Carolyn Branecky Begeman

When I was an undergraduate, I heard that a group of scientists were preparing to drill through the West Antarctic Ice Sheet to a lake beneath the half-mile-thick ice. I had just finished an undergraduate research project looking at sediment that was transported during floods from similar under-ice lakes ~8,000 years ago. I thought, "how cool would it be to see what these lakes look like today," and contacted a lead scientist on the project, UCSC professor, Slawek Tulaczyk.

Alas, I was born a year too late to participate in the lake drilling, which happened in January 2013 while I was still finishing my undergraduate degree. But Slawek encouraged me to come work with him on the second stage of the project, which was drilling into the deep interior of Antarctica's largest ice shelf, the Ross Ice Shelf. That sounded equally exciting to me, so I secured a graduate fellowship from the National Science Foundation and moved out to Santa Cruz.

Drill camp from the air. Grid in the upper right is comprised of 8'x8' tents.

When the ice shelf drilling project happened in January 2015 (delayed a year by the 2013 government shut-down), it was worth the wait. About a week before I arrived on site, my colleagues and the U.S. Antarctic Program set up a remote camp: 500 miles from the nearest Antarctic station, surrounded by flat, white terrain with the Transantarctic Mountains visible on a clear day to the south. The coastline was out of sight but there was ocean a half-mile beneath our feet. Since our objective was to learn about this sub-ice-shelf ocean

Carolyn is a PhD candidate in the EPS department

setting, our drilling team melted a 3-ft-wide hole in the ice by lowering a hose spewing hot water that they melted from snow on site.

What garnered the most press attention while we were in the field was the spotting of a malnourished fish. However, as an Earth scientist I was interested in processes that affect the ice sheet's dynamics, with the goal of improving sea level rise projections. Specifically, I wanted to measure the sources of heat below the ice sheet and their contribution to ice melting. This sector of the ice sheet is not experiencing much surface melting because air temperatures are still quite cold, -20 °C on average. Thus, melting from the bottom of the ice sheet is more important to sea level projections: on land, meltwater at the contact between the ice sheet and the ground makes the ice flow faster toward the coast; over sea, melting of ice shelves can also make ice flow faster as the ice shelf shrinks in size.

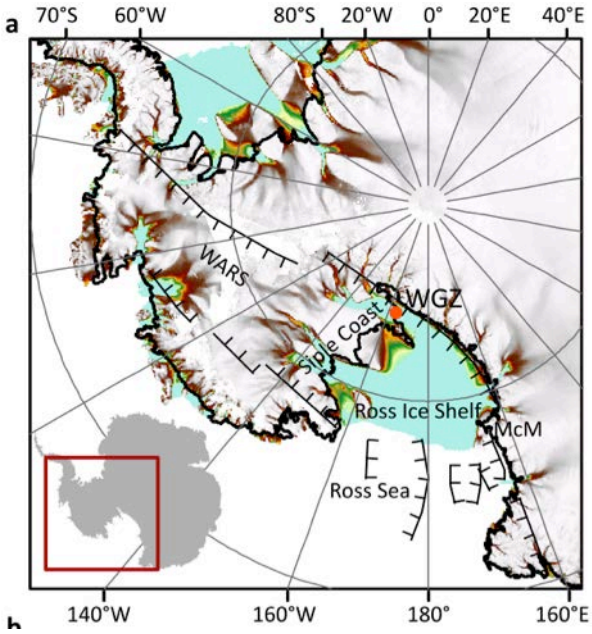
Elevated geothermal heat flux

Professors Andy Fisher and Slawek Tulaczyk and UCSC's Machine Shop worked together to design and build a geothermal instrument that was small enough to be lowered down an ice sheet borehole. Thus, this instrument was used to collect the first direct measurements of geothermal heat flux below the ice sheet, the second of which Slawek and I collected.

The West Antarctic Ice Sheet is located on top of a broad rift system, similar in scale and degree of extension to the Basin and Range. This new

Below the Ice (cont'd)

measurement is revealing a geothermal heat flux field that is elevated and spatially variable, perhaps not unlike geothermal heat flux in the Basin and Range. However, this could make creating a geothermal heat flux map for ice sheet modelers a complicated endeavor, given the lack of direct measurements and limited knowledge of the



Our drill site is located at the edge of the Ross Ice Shelf (orange dot, WGZ). This site lies within the extensive West Antarctic Rift System (WARS). The largest U.S. Antarctic Station is located at the opposite end of the ice shelf on McMurdo Island (McM).

geology that is buried beneath the ice sheet. I'm planning to contribute another measurement of geothermal heat flux with a New Zealand Antarctic team this year to help fill in these gaps.

Suppressed oceanic heat flux

Typically, ice shelves melt fastest at their landward extent, where they first go afloat. Since the ice-water interface is deepest there and the melting point of water decreases with pressure, the heat content of the ocean water relative to the melting point is greatest there. Our drill site was located at this deep sub-ice-shelf ocean cavity, where we would expect ice-shelf melting to be fast. However, my colleague Dr. Oliver Marsh (Canterbury) found

On deck above a half-mile-deep hole through the West Antarctic Ice Sheet. Carolyn Begeman on right

that melt rates there were no greater than average for the ice shelf.

When I analyzed the oceanographic data we collected at that site, I found that the water derived from ice-shelf melting was forming a cold, fresh layer sitting buoyantly along the ice-shelf base. This water layer that insulated the ice-shelf base from the warmer (but still very cold, -2°C!) seawater. From these observations, I'm learning what conditions keep ice shelves stable, and also what might make them vulnerable to breaking up in the future. We've seen major ice shelf collapses in the Antarctic Peninsula in the last several decades and in the geologic record since the Last Glacial Maximum. These events, which trigger ice loss and sea level rise, motivate me to assess ice-shelf vulnerability to changes in ocean conditions.
This is now the last year of my Ph.D. and I'm investigating the prospect that glacial retreat on volcanoes will trigger volcanic eruptions. Stay tuned!

I'd love to hear your thoughts! Get in touch with me at cbranecky@ucsc.edu.

Flipping the classroom: innovative teaching methods at use in EPS

By Susan Schwartz and Matthew Clapham

For centuries university students have been listening to professors lecture, but that is starting to change. This shift is driven largely by cognitive science research that shows how learners must actively engage with the material to gain a deep understanding, build connections among ideas, and acquire the skills to successfully apply their knowledge in varied situations. Active learning itself is not a new idea – the lab and field trip activities in our courses are examples – but its use in the classroom is a new innovation.

One approach to increase the amount of active learning in the classroom, while recognizing the continuing need to deliver content, is the "flipped classroom" model. The flipped classroom gets its name because it inverts the traditional lecture approach, delivering content outside of the classroom and allocating in-class time to active learning exercises. The overarching concept of a flipped classroom can incorporate many different strategies for pre-class and in-class work, and we have experimented with those possibilities over the past five years while flipping several of our upper-division courses, including Invertebrate Paleobiology, Geologic Hazards, and Sedimentology and Stratigraphy. We have structured these classes to deliver important content through pre-class readings or recorded video lectures, providing the foundation for active learning in class. In-class work, which is the key step for deeper learning, can then take the form of worksheets with conceptual exercises, hands-on experiments, collecting and analyzing data, classroom debates or discussions, and peer review of writing assignments.

Professor Susan Schwartz engaging with the students in a flipped classroom.

Matthew and Susan are both EPS Professors.

The most important benefit of the flipped classroom is the improvement in student learning. Students are able to engage more deeply with material, thinking and reasoning like a geoscientist rather than relying on more superficial memorization. As an example, the final sed/strat field exercise visits Montara State Beach, where the students are faced with the task of interpreting a rather unusual suite of depositional environments. The shift in student performance after flipping the class has been remarkable; students employ more sophisticated reasoning and have more confidence in their problem-solving skills. Some groups have even correctly interpreted the depositional environments while in the field! In Geologic Hazards, students are asked to map fault related features along a section of the San Andreas Fault in Watsonville. Although prior to flipping the classroom, students examined

the same aerial photos, LiDAR, topographic maps and Google Earth images in lab section to produce their maps, moving these activities into the classroom resulted in vastly improved maps. Taking class time to work on this activity elevated its importance in student's minds so they were far more focused. This heightened attention along with the presence of both the professor and the TA to provide individualized instruction were responsible for the improved performance.

Active learning, rather than lecturing, also provides greater opportunities for personal interactions that are not only valued by students but also rewarding for the instructors. We greatly appreciate the opportunities to get to know our students, along with the ability to assess what and how students are learning as we work directly with them in the classroom. Students work in small groups during class time and get to know and learn from each other as well as from the instructor. Most become quite skilled at group interactions and learn how to be effective team players, assets that employers value highly.

The flipped classroom isn't without its challenges. We in the Earth sciences are fortunate to have small class sizes for most of our upper-division elective courses, which makes this kind of instruction feasible. Still, the active learning portion of a flipped class requires a small student-to-instructor ratio to provide support and answer questions. So far, the department has received sufficient TA allocations to support these flipped classes, but we work in a time of continually tightening budgets and our department lacks the resources of some others that can supplement TA budgets from internal sources. We are hoping to develop a departmental fund to be used to supplement TAships for instructional support, including flipped classes. If you support our efforts to flip the classroom, we encourage you to make a contribution to the EPS department specifically targeted for this use.

Although active learning can be frustrating at times for students, because they are continually pushed to grapple with the unknown, many students appreciate rising to the challenge. The video lectures have been unexpectedly popular, in part because it's easy to pause and replay a video. Student response has also been largely positive with the following quotes taken directly from student evaluations in some of our flipped classrooms:

"I liked the style of lectures online before class, then using class time to complete activities. The activities forced you to learn so I felt like I got a lot out of the class".

"I enjoyed having the opportunity to have the coursework flipped where we watch the lectures at home and then complete the assignments in class with immediate attention from the professor".

TA Esteban Chaves helping a student.

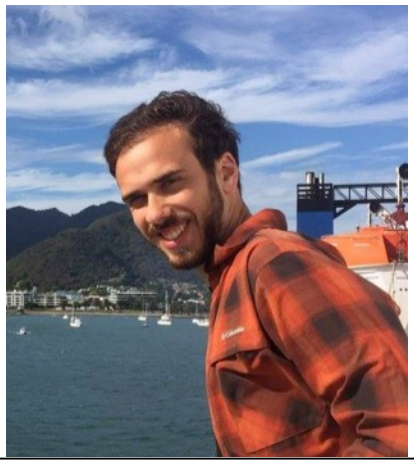
The innovation of flipped classrooms is one example of how EPS faculty are staying on the cutting edge of teaching practices, helping to provide a rich learning environment for our students that will prepare them for success in grad school and the workforce.

An undergraduate perspective on EPS
By Tyler Paladino

My years in the Earth and Planetary Sciences department at UC Santa Cruz were some of the most enjoyable and important of my life. As far back as I can remember, I've been fascinated with not only rocks of all sorts, but outer space as well. When I was young, out hiking with my family, I would constantly fill my pockets with rocks, and when my pockets were full, I'd fill my parent's pockets too. The night skies were also mine to explore. I set about identifying planets and constellations; Mars and the Big Dipper were always the easiest to pick out for me. My childhood was full of exploration of this world and others, so when it came time to figure out what I wanted to do with my life, planetary science was the obvious choice.

As a high school senior, I researched several universities, eventually deciding on UCSC. It had the one of the best planetary science programs in the nation and also one of the most unique campuses on the planet. As soon I began my first quarter in 2013, I was already head over heels in love with the school. My first quarter I was enrolled in Elise's Earth 5/L, which was my first exposure to a real geology class. Needless to say, I enjoyed every minute of it (minus the fact that it was at 8 AM). It was a great introduction to the diverse field of Earth sciences and got me excited for what was to come.

Unfortunately, I wasn't able to take another Earth science class until Spring quarter of my sophomore year, as I was busy slogging through prerequisites (calculus, physics, chemistry, etc.). When the time came for enrollment of Spring quarter, I was more than ready for studies that were actually in my field. So I decided to enroll in my very first upper division class: Earth 110C! Yeah, it probably wasn't the best idea…But I loved it! Emily was away that quarter, so Doug Hemingway taught the course. It was during this class that I began to see what an incredible and unique department we have here at UCSC. I distinctly remember during the first week of the



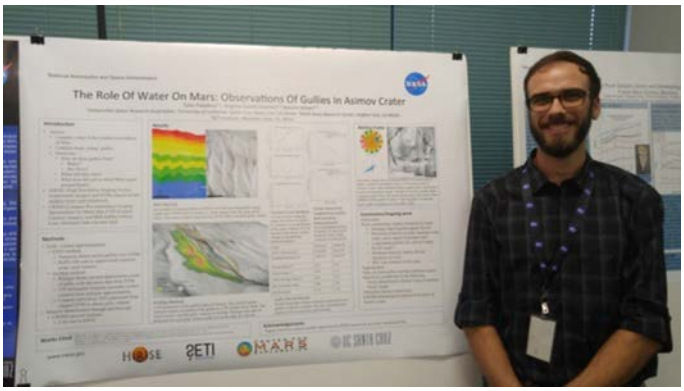
Tyler Paladino graduated this year as outstanding student in the major.

quarter, sitting alone in S&E working on a 110C assignment and feeling very lost, when out of nowhere, Kellen Martin (now pursuing a Masters at UCSC) showed up and said something akin to, "Hey fellow Earthie, mind if I join you?" Before I knew what was happening, I was working on this assignment with about 6 or 7 other Earth Science majors who were excited to meet new people and work together. I didn't know these people at all, yet they all seemed like my best friends. This, I think, is a common sentiment shared by everyone who's passed through our department. You'll never meet a more wholesome, collaborative, and friendly group of people than in the UCSC EPS department.

Building upon this experience, my mind began to turn to research. I decided I wanted to continue my education onto graduate school and learned I would need a mentor with whom I could complete a senior thesis. At this point in time, I knew I wanted to do something with planetary science, but I was not sure what. Luckily, the EPS department hosts a huge, diverse group of professors all doing incredibly interesting research, so there were plenty of choices. At the end of my junior year, I eventually settled on Susan Schwartz, a brilliant seismologist working on strange and interesting projects all over the

planet. I didn't have much of a seismological background (seismology is a bit hard to do on other planets when you don't have seismometers on them), but the project she had for me was too interesting to pass up.

For the next year, under the tutelage of Susan and one of her graduate students, Grace Barcheck, I began researching the Whillans Ice Stream, which is one of the many ice streams found on Antarctica that drain ice from the South Pole to the greater hydrologic system. Where the Whillans Ice Stream meets the Ross Ice Shelf is a region known as the grounding zone, or where the ice sheet transitions from sitting on earth to floating on water. As the tides move up and down, the ice sheet flexes in this area, causing seismic events to occur in the ice. I was able to show that these seismic events are tidally modulated, and are seismically (as well as spatially and temporally) distinct from other seismic events that occur on the WIS. I was also able to postulate, with some certainty, the seismic source mechanism behind the events.



Poster presentation of work carried out at NASA Ames research center on Asimov crater, Mars.

This project was perfect for me for a variety of reasons. One,I still didn't have much of an idea of what I wanted to do in Planetary Science. Planetary Science, at its core, is simply Earth Science on other planets. I needed to experience every different aspect of Earth Science before I began to think about an area of focus. Second, even though I didn't have the greatest interest in seismology, this project was still very fun and enjoyable to research as it was so strange and unheard of. Third, the experience of doing independent research is quite valuable. This research taught me a huge amount about not only seismology, but also glaciology, how to code in MATLAB, as well as how to write scientifically. All of these skills have helped me immeasurably in my studies, and will likely continue to serve me for years to come. To Susan and Grace, you already know how big of a help you both were/are to me, but thank you again for the constant support and the opportunity to be a part of the seismology research group.

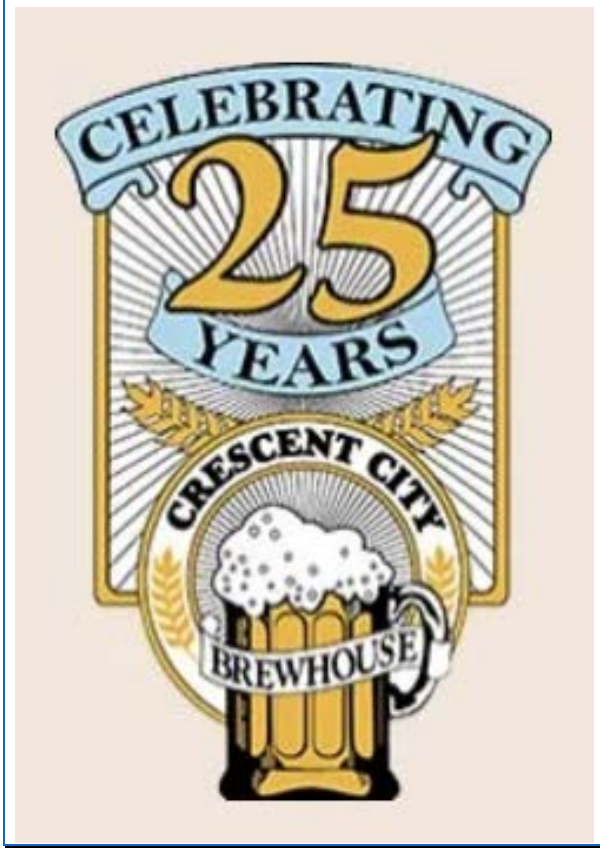
Currently, I am an intern at NASA Ames research center, just over the hill in Mountain View. My research here focuses on the origin and formation of gullies on Mars. My research group attempts to prove that these gullies were formed by liquid water sometime in the recent geologic past. We characterize their morphologies as well as estimate the volume of the gullies using ENVI, ArcGIS and MATLAB. By understanding the morphologies and volumes of these gullies, we can learn not only about their origins and formation, but we can also begin to postulate as to whether the red planet as a whole was warm and wet or cold and dry in the past, an argument currently being fiercely debated among Martian Planetary Scientists. For this project, I get to use several datasets of current Martian orbiters

Collecting award rocks for graduation with now graduated fellow alums Nadim Abu-Hashmeh and Christopher Zajic

(namely the Mars Reconnaissance Orbiter) that are snapping very high resolution images (HiRISE imagery @ .25 m/pixel) and taking spectral mineralogy measurements (CRISM instrument) at this very moment. At its core, it's a geomorphology project, but it also contains facets of several other fields, such as astronomy, volcanology, hydrology, and biology.

My time at UCSC prepared me for this internship generously. I can tell that If I didn't already have writing experience, or coding experience, or research experience, I would have gotten far less out of this internship. I have to thank not only my thesis advisor Susan, but also the many professors who taught me to write scientifically, to code efficiently, and to research intelligently: Francis, Ian, Noah, and Andy, thank you all.

The EPS department at UCSC is unique for too many reasons to mention here, but I'll name a couple that are especially important to me. First is simply the close-knit community of people-- The colleagues, friends, mentors, professors, graduate students, etc. They all want to help you succeed at whatever career path you're hoping to follow. They are always willing to sit down and talk, whether that be about how to get into graduate school, deciphering a new piece of literature, or simply having intelligent and fun discussions. Second is the opportunity to do research. The sheer variety of interesting research done in the department is amazing, and allows students to truly find their passion and acquire important research experience with a professor who wants to see you succeed. Not many other majors can provide these things, nor can they better prepare you for the world to come.
I will complete my internship at Ames this December. I'll be applying to graduate schools all over the country, utilizing the skills and knowledge I gained at UCSC to hopefully begin pursuing an interesting Planetary Science PhD project. I can't thank this department enough for what it's given me: a strong sense of community, professional skills to last me a lifetime, and an overwhelming sense of pride for my alma mater. To all my friends and colleagues who have yet to graduate, enjoy your time here and appreciate the individuals around you and the many experiences available to you. I can say with absolute certainty that this department is one of the greatest in the solar system.



We hope to see you at the Crescent City Brewhouse, New Orleans for our

17th Annual UCSC EPS Alumni Event at Fall AGU!

Tuesday, December 12, 2017

from 6:00pm - 8:30pm

527 Decatur Street

New Orleans, LA 70130

http://www.crescentcitybrewhouse.com/

Alumni Notes

1977

Larry Smith, BS: I have been working on the stratigraphic record of glacial Lake Missoula for a number of years. I was able to represent the Montana portion of the Channeled Scabland - glacial Lake Missoula story on a recent Nova show on PBS. It was a bit dramatically named "Killer Floods" - something none of the scientists had a word in! I'm still teaching Geological Engineering at Montana Tech in Butte. I have many fond memories of working hard and learning a boatload of geology in the labs and field at UCSC. Field camp was memorable, even though my energy level petered out greatly when we came back to campus to finish the paper. That's something that got changed, thankfully!

1978

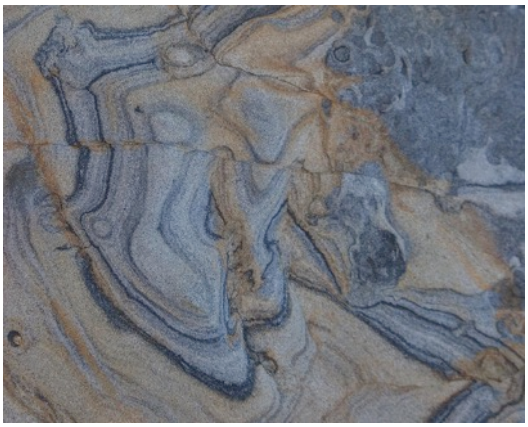
Patrick Vaughan, BS: I spent the last 20 years mostly working on landscape restoration projects for California State Parks in Northwestern California. Most projects are related to improving the degraded salmonid fishery, complicated by historical logging and now marijuana cultivation in the vicinity of the Mendocino Triple Junction. I also have had the opportunity to map and decipher landforms and deposits influenced by tsunamis on some of our coastal beaches. In September 2017 we completed removal of the Benbow Dam on the South Fork of the Eel River, the second largest concrete dam removed in California to date (just in time to avoid post-Oroville regulation).

1979

Jane Ellis-McNaboe, BS: I retired in 2016 from a career in the environmental side of the oil business. We are the proud grandparents of two boys. Their Mom (our daughter) is also a Geoslug! My husband (also a geologist, retired from Chevron) and I divide our time between Lake Tahoe and cruising on our sailboat. Our boat travels have taken us from Canada to Mexico, next on the itinerary is the Inside Passage to Alaska.

1984

Dallilah Sabba, BS (MS 1988): Born in the Middle East, Dallilah's early education was initially in Baghdad but later carried out in England where one of her teachers urged her to take an A level (high school) course in geology. An extraordinary teacher who solidified her love of geology taught this course. Subsequently she and her mother moved to the U.S., eventually settling in Santa Cruz, where she enrolled initially at Cabrillo College, transferring later to UCSC. Her senior thesis was a petrologic study of the Miocene Santa Cruz Mudstone, research that remains the only detailed analysis of this formation that dominates the coastline in and north of Santa Cruz. Her Master's thesis was a detailed depositional environment and petrologic investigation of lower Tertiary limestones, known as the Burns Sand and associated with basalts in the Santa Cruz Mountains. Her initial professional work experiences focused on environmental projects in the Bay Area with Dames & Moore and The Ellington Group. This work set the stage for her being hired by SLAC National Accelerator Laboratory, Menlo Park in 1997 as an Environmental Engineer (Geologist). SLAC is a Department of Energy (DOE) physics laboratory managed by Stanford University for DOE. Founded in 1962, it is one of the world's leading linear particle accelerators and the site of numerous groundbreaking scientific discoveries. It includes research in Astrophysics and the Linac Coherent Light Source where researches can study matter on the femtosecond scale. Dallilah's earlier work in the private sector on environmental problems, particularly her field investigations, enabled her to contribute significantly at SLAC from the start of her appointment there. She deals with a variety of environmental issues, particularly those dealing with soil and groundwater remediation projects. In her spare time, Dallilah focuses on her love of minerals (she is a member of the Bay Area Mineralogists) and on outdoor photography, interests that allow her to continually enjoy the geologic wonders of California and Nevada.



Trace fossils on an eroded bedding surface of turbidite layers in the Carmelo Formation at Weston Beach, Point Lobos Natural Reserve, the site of many UCSC field trips. Photo by Tom Clifton.

Shorebird (Semipalmated Plover) on turbidite deposits of the Carmelo Formation at Weston Beach, Point Lobos State Natural Reserve. Photo by Tom Clifton

1987

Ken Manatt, BS: Still employable! Rocks always seem to be too far away. My offspring moved to Kresge this Fall. My favorite Geoslug memory is melting rock powder in platinum crucibles for XRF major element analysis.

1990

Tom Clifton, PhD: Following undergraduate studies at UC Santa Barbara where he won the Woodhouse Award for scholarship, Tom's thesis work at UCSC was on the fluid dynamics that produce antidune bedforms in clastic sediments. This research employed field observations, experiments and modeling to uncover the intricacies of antidune genesis, providing new insights on sediment transport and stratification. In addition, he took courses in marine ecology, and this combination of interests in sediment processes and marine biology provided the skills that would be key in his subsequent professional life. Initially he worked as a Project Geologist in San Francisco with Dames & Moore on a variety of environmental endeavors including designs of remedial processes for contaminated groundwater and development of computer tools for generating core logs and analyzing field data. These computer skills provided the basis of his next work at ES Designs in San Jose, where he developed web designs and services for a variety of educational institutions. More recently Tom has combined his scientific and computer proficiencies as a Physical Sciences Lab Manager at the Monterey Peninsula College, working with UCSC ESP alum Fred Hochstaedler (Ph.D., 1991) and providing instrumental and field support for all the sciences. He is also responsible for maintaining MPC's seismometer and weather station, and assists in the development and teaching of course labs. For the past five years he has volunteered as a Docent at the Point Lobos State Natural Reserve near Carmel. There he performs a variety of duties that include leading geological and birding walks, curating the museum, producing a newsletter, coordinating efforts to deal with invasive plants, and performing bird and sea otter counts. Working and living in the natural grandeur of the Monterey Peninsula, Tom was naturally drawn to outdoor photography, as illustrated by a couple of his photos included in this Newsletter.

1994

Marino Protti, PhD: I have been working as a seismologist for 33 years at the Costa Rica Volcanological and Seismological Observatory at the National University (OVSICORI-UNA) from where I took a leave of absence for 6 years to study at UCSC (1988-1994). All my work in Costa Rica has been in cooperation with a very nice friend and Faculty at UCSC, who happen to be also my PhD. advisor, Susan Schwartz. I have also enjoyed the friendship and academic partnership of Karen McNally (RIP), Eli Silver and Dan Sampson. Most of my work is on subduction zone processes and I have been involved in several international monitoring projects to anticipate future large earthquakes. My new challenge is to promote interest in the possibility of drilling, on land, the seismogenic zone of large subduction earthquakes, and build a 100-200 year (4-5 earthquake cycles) international tectonic

observatory on Osa peninsula, in southern Costa Rica. My wife, Anne Marie McCaffrey, is also a GeoSlug (MSc. 1994). We have two lovely girls and a very happy life in Costa Rica. Maintaining my connections with UCSC and having the unconditional help of Susan Schwartz has been fundamental in my career. Her trust in me, took me all the way down to Antarctica where I became a strong supporter of the Antarctic Treaty System (ATS). I am now finishing a masters degree program in Foreign Affairs and Diplomacy and I´m completing my thesis on the political and scientific reasons on why Costa Rica adheres to the Antarctic Treaty. I´ll write a draft of the bill to be submitted by the Costa Rica Ministry of Foreign Affairs to our Congress to joint the ATS. My favorite Geoslug memory was the Loma Prieta Earthquake. Earth Sciences was then at the Applied Sciences building and the first two people who evacuated the building (the fastest runners!) were two seismologists: Aaron Velazco and me.

1996

Bryce Hoppie, PhD: Following a bachelor's degree in geological engineering from the South Dakota School of Mining and Technology, Bryce came to UCSC to pursue studies in sedimentary geology. His Ph.D. thesis centered on Miocene phosphatic deposits in California's Cuyama Basin. a proximal facies of the ubiquitous Monterey Formation. Utilizing his engineer's talent for deconstructing the parts of complex entities, he succeeded in correlating the numerous sub-facies in the Cuyama formations with the components of sequence stratigraphy. This allowed reconstruction of sea level variations and tectonic subsidence within this basin. After leaving UCSC, he received an appointment to the faculty of the Minnesota State University, Mankato where he has advanced from Assistant to Full Professor. Among his accomplishments was the pioneering development of a certified B.S. degree program in the Dept. of Chemistry and Geology, which he promoted through the addition of new Earth Science faculty and Adjuncts, new facilities and equipment including a state of the art science building, and substantial external grant funding. Along with teaching courses in engineering geology, environmental geology and hydrogeology, Bryce has continued research in surficial and groundwater, agricultural drainage systems, and deep sea & continental margin sedimentation as a participant in ODP Leg 150 & IODP Leg 329. Along the way in his busy life, Bryce compares his pioneering years at MSU-Mankato to what he imagines were the formative years for Earth Sciences at UCSC – building from scratch! In a recent communication from wintery Minnesota, he states: "I was just thinking about Santa Cruz recently. The first time was about week ago when my older daughter, Sierra, mentioned UCSC as a possible option for her graduate studies. And just this morning, I was remembering the warm, bright morning sunrises in Santa Cruz as I was standing in the dark, on my driveway, in freezing first-dawn temperatures, scraping a 1/4 inch thick layer of ice off my younger daughter's windshield."

2000

Marjan Rotting, MS: I worked as a consultant in the Environmental Geology and Engineering Geology fields. My favorite work was working as a mathematical modeler with sub surface fluid models using ModFlow. I took a ModFlow course at Princeton to hone up my skills. Currently I am working the Portland Community College in Portland, Oregon. I teach Field Geology of the Gorge, Tillamook and Mt. St. Helens; Geology; Volcanoes and Earthquakes; Oceanography; Astronomy and Meteorology. My favorite Geoslug memories are from Field Camp. I learned so much about the practical aspects of geology from Gerald Weber.

2001

Louis Arighi, BS: This fall I started a new position as a Project Manager/Geologist at RPS in Mountain View, CA. My favorite Geoslug memory is a weekend field trip to Big Creek for the Intro to Field Methods class, watching Ken Cameron leave all the 20-year olds in the dust hiking uphill.

2002

Dean Ledgerwood, BS: Registered Geologist and Certified Engineering Geologist, working for 15

years in Geotechnical Engineering. My projects include small and large scale commercial developments, identifying both geologic hazards and geotechnical concerns relative to the proposed site development. I've also worked on a large number of solar installation projects, including the largest solar installation project in the world (as of 2015). A 4,600 acre solar site in Antelope Valley, with a capacity of 579 megawatts! Outside of work I pour all my remaining energy as a volunteer for our local Little League. I work as Head Umpire for the Little League Board and Manager for one of the Majors team.

2006

Erica Howat (Schneider), MS 2005 & Ian Howat, PhD : Erica and Ian Howat reside in Worthington, Ohio with their two children, Anna (6) and Galen (4). In 2017, Ian was promoted to full professor in the Department of Earth Sciences at the Ohio State University. Erica was promoted to Market Manager at Battelle Memorial Institute where she supports the Infrastructure and Environment Business Unit and NEON (the National Ecological Observatory Network). They celebrated their 10 year anniversary in September.

2010

Kristen Whitney, BS: My master's thesis work was recently published in Ecohydrology: http://onlinelibrary.wiley.com/doi/10.1002/eco.1875/full
I earned my M.S. in Geological Science from Arizona State University (ASU) in 2015. I am now working on my PhD in Geological Science at ASU and am in my 2nd year.

2013

Jessica Johnston, BS: For the past year I have worked as a Natural Resource Specialist with Triangle Properties, a forprofit company that designs and implements mine reclamation and habitat restoration projects throughout California. We are responsible for reclaiming all of the aggregate mine sites of our parent company, Teichert, as well as natural resource (e.g., endangered species, protected wetlands) mitigation for Teichert and outside developers and government agencies. I recently adopted a new dog, Phoebe, a 4 year old terrier mix who loves squirrels and belly rubs. My favorite Geoslug memory is learning all the mineral names - I wish I could remember them! If any current or recently graduated GeoSlugs are interested in learning about mine reclamation or habitat restoration first-hand please contact me. We are always looking for more labor help. JJohnston@teichert.com

2014

Marcel Peliks, BS: After graduation in 2014 I have been staying busy with geology and non-geology related jobs. I worked in Tahoe as a snowboard instructor for a season and a half, did an internship with the USGS in Washington for half a year, and now I am back in Santa Cruz and working for a geotechnical firm in Los Gatos. It has been a fun 3 years and I am grateful to all the faculty and friends in the Earth Science Department who have helped me get on this path. If any students or recent graduates have any questions about working in the geology field I would be happy to share my experiences. Hope everyone is doing well.

2015

Alexandra "Sasha" Belinsky, BS: After graduating and completing Summer Field, I was hired at the Monterey Bay Aquarium Research Institute (MBARI) to create an archive for the Smithsonian Institute of rare igneous seafloor samples collected by David Clague over his 50+ year career. That led to me becoming his Research Assistant within the Submarine Volcanology group here at MBARI. We go on research expeditions in the East Pacific Ocean and I get to play with cool rocks every day!

2017

Jordi Vasquez, BS: After working on long-term water supply planning with the SFPUC in San Francisco, I'm now moving to Los Angeles to join the Southern Region Office of the state Department of Water Resources. There I'll be able to get out into the field a bit more while continuing to work on water issues. I'm excited to continue my career in the water sector and my plan is to eventually get my Master's in Hydrology. Go Slugs!

Earth and Planetary Sciences Department
University of California, Santa Cruz
1156 High Street
E&MS Building, Room A232
Santa Cruz, CA 95064
http://eps.ucsc.edu

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Your contribution can help build an endowment that will have lasting benefit for future generations of EPS students, or you can support ongoing needs in teaching, research and service.

On the next page we describe current high-priority EPS development goals.

(1) Please Give Online
Please visit the EPS web site for information on current funds/endowments and EPS Department priorities: http://eps.ucsc.edu/support-us/index.html

We recently updated this part of the EPS website. You can read about current development priorities, and after choosing the fund/endowment of your interest, you will be transferred directly to a page where you can enter the amount of your gift and credit card information.

This is the easiest way to support the EPS Department!

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Please use the form on the next page to prepare your donation. We list the four highest EPS development priorities: more information for each of these can be found at the website noted above.

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We are glad to discuss your interest in supporting EPS at UCSC, and to provide information that may be helpful in directing your contribution to be consistent with your goals.

Please contact:
Jim Zachos (Department Chair): 831-459-4644, jzachos@ucsc.edu
Francis Nimmo (EPS Development Coordinator): 831-459-1783, fnimmo@ucsc.edu
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Four highest EPS Development Priorities (Fall 2017):

NEW! Eli Silver Earth and Planetary Science Opportunities Fund

This fund supports undergraduate majors and graduate students in the UCSC Earth and Planetary Sciences Department, contributing to costs for professional development, education, and living expenses.

Casey Moore Fund

The Casey Moore Fund supports current EPS graduate students as they conduct thesis-related research. *Match alert!* Contributions up to $5000 for the current calendar year will be matched 1:1 by a generous alumnus.

Double the impact of your contribution by donating before the end of 2017

Gerald Weber and Suzanne Holt Fund

The Weber-Holt Fund supports EPS majors while they participate in summer field camp, an iconic experience that satisfies the "capstone course" requirement applied to all undergraduates at the University of California.

Zhen and Ren Wu Memorial Award Fund

The Wu Fund supports EPS graduate students in geophysics as they conduct thesis-related research, with an emphasis on students seeking careers in exploration industries.

The above funds are endowments that will assure benefit for years to come. You may also donate to the Earth and Planetary Sciences Fund which supports alumni events, research, field trips and equipment with funds that can be readily accessed (unlike endowments, which are scholarship funds based on market payout percentages):

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This fund supports immediate EPS research, education, and development needs.

Please see http://eps.ucsc.edu/support-us/index.html for more development options

Earth and Planetary Sciences Department
University of California, Santa Cruz
1156 High Street
E&MS Building, Room A232
Santa Cruz, CA 95064
http://eps.ucsc.edu

☐ **Please update my contact information**

Name(s): _____

Address: _____

Email: _____ Telephone: _____

Degree: _____ Year: _____ ☐ New address

News about myself and other classmates

Please use space below to let us know where you are and what you are up to!

May we publish your comments on the Earth and Planetary Sciences website under Alumni? ☐ yes ☐ no

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Earth and Planetary Sciences Dept.

University of California Santa Cruz

1156 High St

Santa Cruz CA 95064

831-459-4089

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