UC Santa Barbara Earth Science

Chair's Letter: Susannah Porter

It is wonderful to be in Webb Hall after eighteen months online. Everything we took for granted before the pandemic—seeing each other in person, sharing conversations in the hallways, and eating delicious Muckers' Bagels—feel like special privileges now, small but important aspects of our lives for which we are grateful. There are other differences as well: people are dutifully masked up; Webb Hall has an outdoor classroom on the roof; and we've incorporated new and creative ways to teach based on our online experiences. Most importantly, there are many new faces around Webb Hall—not only our first year graduate students and new majors, but also the graduate students and majors who joined us last year but only stepped foot on campus recently. We are delighted to welcome them and look forward to a year of new beginnings!

We have an exciting Newsletter for you. You can read about our newest hire, Professor Gen Li, who studies the interactions between tectonics, sediment transport, and carbon cycling, and about Professor Morgan Raven's sparkling new NOISE lab. Our Grad Spotlight features students Katie O'Malley and Han Xiao, who pivoted deftly during the pandemic, developing new skills (Katie) and asking new Covid-related research questions (Han). We report on summer field, which triumphed over anomalously hot and smoky conditions, and we have an update on the important work our Justice, Equity, Diversity, and Inclusion (JEDI) workgroups have accomplished. Finally, we are proud to present our '21 Distinguished Alumni Christine Siddoway and Ed Saade. Wishing them and all of you a great '21-'22, filled with health, happiness, geology, and gratitude.

Muckers' Coterie Bagel Sale. Hannah Shabtian, Zephyr Girard, Jezah Salleva, Noemma Olagaray, Chelsey Assor, Lea Fehringer.

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Photo: Ely, NV by Todd Penniman

Annual Trip to Santa Cruz Island

by Sarah Gerenday

This year's trip to Santa Cruz Island was a little different from what it has been in the past. Since last year's trip was cancelled due to COVID-19, there were two cohorts of "new" students on the trip: the brand new 2021 cohort and the previously remote 2020 cohort. Also unlike in previous years, our party this year contained no faculty. Instead the trip was completely guided by returning students. Our first day began early at Ventura Harbor where we met our new companions and boarded the ferry for a crossing enlivened by conversation and common dolphins. Arriving on the Island at Prisoners Harbor, we were met by helpful UC Reserve staff who took our bags by truck to the field station. We then proceeded to follow on foot. This was another way in which our trip diverged from previous years; virtually all of our travel on the island was by hiking. Once at the field station, we enjoyed games including blackjack (using pebbles for chips) and mafia (set to The Godfather soundtrack). A campfire with s'mores deliciously rounded out the evening.

The next day we set out on a strenuous but rewarding hike to Coches Prietos Anchorage. Along the way, we crossed over the sharply demarcated contact between the Blanca Formation volcaniclastics and the Santa Cruz Island Schist. At the beach, we took the opportunity to explore tide pools, play ultimate Frisbee, admire an osprey, and nap before returning to the field station for an evening filled with scrumptious tacos and camaraderie.

On our third and final day, we prepared to leave and passed the morning making friendship bracelets and playing horseshoes. After making our way back to Prisoners Harbor, we spent more time exploring the beach and keeping an eye out for curious foxes. On the ferry trip back, the waves were as high as our spirits, dampening our clothing but not our enthusiasm as we returned to the mainland with our new friends.

Santa Cruz Island. Photo: Sarah Gerenday

Summer Field Geology (Earth 118): The 2021 Edition

by Alex Simms

Ely, Nevada, 2021. Photo: Alex Simms.

After a year's hiatus, UCSB Earth Science was once again sending students out into the field as part of its annual Summer Field course. Due to high COVID numbers in the winter, and the postponing of Spring Field, it was held a little later than normal in order to accommodate the students doing Spring Field immediately prior to Summer Field. Thus, the students were camping in the field for over 7.5 weeks! Despite the fact that most of the students had little to no prior field experience due to COVID restrictions, they adapted quickly and showed outstanding resilience and enthusiasm throughout their 7.5 weeks—even in the face of some record-breaking heat at the inception of the trip.

This year the 22 students traveled to northwestern Nevada and established their camp in the foothills of the Schell Creek Range, located about 30 miles north of Ely, Nevada. After a short excursion to the Miocene extensional basin fill at Horse Camp, they measured section and mapped across the area including the neighboring Egan Range. They were introduced to the spectacular structural geology of the Basin and Range as well as the plentiful Paleozoic and older carbonates of the region. They will likely curse dolomites for the rest of their careers. The unusually high temperatures were alleviated this year by plentiful trips to the McGill pool after hard days in the field. Nevertheless, they outlasted their professors (they had 3 different instructors over the course of the 7.5 weeks) and ended up doing some incredible work—two of the groups even presented their maps at the annual meeting of the Geological Society of America this fall in Portland.

LinkedIn

Seeking to strengthen and enliven our department network, we encourage you to follow our new "UCSB Department of Earth Science" page on LinkedIn. Former students, please follow instructions on the page that will identify you as a department alum. bitly.com/EarthScienceLinkedIn

Update from the Justice, Equity, Diversity and Inclusion (JEDI) Faculty Committee

by Zach Eilon and Andy Wyss, JEDI Faculty Committee Chairs

Our department's Justice, Equity, Diversity, and Inclusion (JEDI) faculty committee has worked hard this past year to increase the diversity and accessibility of all our academic programs. To review our five-year Strategic Action Plan, look under the JEDI tab on our website.

Recognizing the uneven exposure to the geosciences that highschoolers receive, we have begun proactively soliciting first-year undergraduates and transfer students with a welcome email and detailed flyers about each emphasis in the major. Through one-to-one faculty outreach, we are strengthening our links to neighboring Cal State campuses to establish pipelines for promising students to flow to graduate programs in both directions, and establish new research collaborations. We have overhauled our graduate admissions, with a more comprehensive application review process that better assesses the range and diversity of educational and professional experiences of our richly varied applicant pool. We are in the midst of reconstructing our departmental website to more effectively present ourselves to the outside world. We even have a new LinkedIn page—do please follow us and add us to your education history!

We are also focused on making our undergraduate experience the best it can be. Our expanded undergraduate advising program, in its second year, offers new tools for helping our majors navigate their undergraduate studies. With bold initiative from the student-led Geoscience Enrichment and Mentoring for Students by Students (GEMSS) program, we have supported skills and career development workshops during the past year to help undergraduates translate a passion for the geosciences into post-graduation vocations. We are indebted to the alums who participated in these efforts—your contributions were indispensable. We have new pathways into undergraduate research within the department, and a revamped senior thesis program that provides greater support for mentors and mentees alike in structuring and completing compelling thesis projects. In the coming year, we plan to further harness our students' energy and our alumni's experience to enhance our program so it is welcoming to students from all backgrounds, especially those that have been historically excluded from the geosciences. We welcome your ideas and your help!

Back in The Field

Earth 18 students near the San Andreas fault, taught by Dr. Paul Alessio. Photo: Andy Wyss.

New NOISE Lab

by Morgan Raven

After great suspense, the Raven NOISE Lab (Natural Organics Interacting with Sulfur in the Environment) has officially fully moved into their new, custom-built facilities in the Preston Cloud Building. Researchers in the NOISE Lab primarily investigate marine and coastal sediments, particles, and the organisms that inhabit them, and this new lab space is ideally arranged to prepare samples of mud, water, or cells for analysis. Equipment in the wet chemistry space includes hoods for working with chemicals, an anaerobic chamber for handling oxygen-sensitive samples, and equipment for processing, extracting, and purifying many different materials from the environment.

The new biogeochemistry lab is unique because it is equipped for methods that are traditionally segregated into separate 'flavors' of biogeochemistry labs: Organic geochemistry labs generally study things that dissolve in oils, so dishes and tools are generally made out of glass and metal. Aqueous geochemistry labs study things that that dissolve in acids, so everything is made out of plastic. NOISE Lab does both! The dishwashing system may be complicated, but NOISE Lab's integrated organic-aqueous approach also makes it possible to learn a ton about how organic carbon can be transformed in the environment.

Immediately adjacent to the new wet chemistry space is a new analytical lab, supporting two mass spectrometers. The smaller instrument, an Elemental Analyzer-Isotope Ratio Mass Spectrometer (EA-IRMS) known as Janeway, measures the amounts and isotope compositions of carbon and sulfur in sediments and many other types of samples. The larger instrument, just installed in September 2021, is a Nu Plasma 3 Inductively Coupled Plasma Mass Spectrometer (ICPMS) known as Picard. The ICPMS is also used to measure isotope ratios, but for much smaller samples and a much wider range of elements—from Boron to Plutonium. In NOISE Lab, however, Picard will be used primarily to measure sulfur isotopes. This new technique for sulfur isotopes by ICPMS, a NOISE Lab specialty, makes it possible to measure isotope ratios on as little as 15 nanomoles of sulfate—10 to 100 times smaller samples than can be measured by standard EA-IRMS methods.

PhD student Lena Capece changes the "ash catcher" on the elemental analyzer (EA).

In order to prepare such tiny samples, it is also critically important to keep everything very, very clean. Potential contamination lurks everywhere, from sea salt in the air, to drywall dust, to shampoos and soaps. So, especially for small samples, members of the group will complete the final steps of their methods in the separate clean room. To minimize the amount of contamination that can get on samples, the room has enhanced air filtration, and researchers wear highly fashionable shoes and coats to enter the room.

Research in the new NOISE Lab is off and running, with five undergraduate researchers, three graduate students, and a post-doc working hard to understand how organic carbon can be preserved in sediments and rocks. The new facilities will be the home of NOISE Lab research for many years to come—who knows what discoveries these walls will see!

Undergraduate Spotlight

Sneha Bhetanabhotla

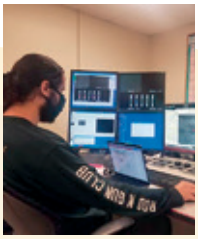
The goal of Sneha's project was to compare two different methods for processing volcanic infrasound data: the Progressive Multi-Channel Correlation (PMCC) algorithm and the least squares method. With help from Dr. Iezzi and Prof. Matoza, Sneha developed and wrote a Python program to analyze data outputted by WinPMCC, a program that uses the PMCC method. They then combined this algorithm with the least squares processing method, and conceptualized and wrote a Python program to analyze volcanic data based on narrow frequency intervals, which provides a more rigorous method of infrasound data analysis.

Ranpeng Li

Ranpeng wrote her senior thesis in 2020 on the seismic velocity structure beneath Alaska using an unprecedentedly dense set of data collected from the US Transportable Array deployment. Ranpeng showed beautifully how the subducting slab descends through the mantle in close alignment with the Wadati-Benioff zone of earthquakes, and found unexplained regions of high temperatures beneath the Queen Charlotte fault system. Ranpeng has just begun her PhD in geodynamics at the University of Florida.

Odalys Callejas

Odalys is a McNair scholar undertaking research and a senior thesis with PhD student Francisco Apen and Prof. Roberta Rudnick. Odalys is investigating the age and origin of deep crustal rocks that were transported to Earth's surface in a kimberlite within the Siberian Craton. She is particularly interested in determining whether there is lateral variation in the lower crust as a function of distance from the craton center. She spent the past summer as a WAVE Fellow at CalTech where she worked with Dr. Claire Bucholz.



Jack Rager

Under the supervision of Dr. Rudnick and Grad Francisco Apen, Jack's thesis project focused on the geochronology and petrology of high-grade metamorphic rocks from Tanzania to understand how and when the rocks were buried and subsequently exhumed to the surface. This work entailed using the laser ablation facilities in Cloud and the electron microprobe in Woodhouse.

We Wish For

We Wish For...

Continued support of the Alex Johnson Memorial Fund, which honors the memory of our beloved graduate student Alex Johnson, sustaining and promoting the mentorship of undergraduates in Earth Science.

Unrestricted funds, which support revitalization of department space; field equipment, vital to our field classes; and microscopes, vital to our lab classes.

Your Ideas Welcome

We truly welcome your thoughts. What lessons did you take away from here? What would benefit the most from improvements? We solicit in your input, and greatly value your perspective.

Your Donation Dollars at Work

Summerfield camp at Ely, NV

We are deeply grateful to our many alums, colleagues, and friends of the department who have helped us financially this past year!

UCSB ES-FRIENDS

A special mailing list for our alumni and other friends of the department that delivers special news and announcements about our department and its faculty, alumni, and student accomplishments. To sign up, please send a request to grad@geol.ucsb.edu

With Appreciation

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Understanding Earth's Continents

by Roberta Rudnick

Roberta Rudnick joined the Earth Science Department in January of 2016 after having served 16 years as a professor at the University of Maryland, where she was department chair from 2011 onwards. Roberta works on broad questions related to the continents: What are they made of? How did they form? When did they form? Did they change over Earth's history? She also works on more esoteric topics such as understanding the geochemical behavior of sulfur-loving (chalcophile) elements, lithium and its isotopes, and halogens during igneous differentiation, metamorphism and chemical weathering. To do this, she and her students analyze samples that provide insights into the nature of the upper and lower continental crust, as well as the lithospheric mantle underlying the crust. Recent cool discoveries include:

molybdenum and its isotopes in glacial diamictites track the onset of oxidative weathering following the Great Oxidation Event at ~2.4 Ga (work of former PhD student Allison Greaney and former post-doc Rich Gaschnig); accessory phase thermochronology of lower crustal xenoliths can be used to bracket the Moho temperature and, combined with surface heat flow, place constraints on crustal radioactivity (work of PhD student Franciso Apen); high-grade metasediments were transported into the lower crust of southern New Mexico by continent-continent collision during the Picuris Orogeny, thereby elucidating the nature of that still mysterious orogeny (work of PhD student Mary Ringwood); and fluorine is depleted in Archean upper continental crust relative to post-Archean crust, suggesting that halogen recycling to the mantle became active near the end of the Archean (work of PhD student Pengyuan Han).

Reader's Corner

Favorite books recommended by Earth Science Faculty

What Stars Are Made Of. The Life of Cecilia Payne-Gaposchkin by Donovan Moore

The Map that Changed the World by Simon Winchester

Timefulness: How Thinking Like a Geologist Can Help Save the World by Marcia Bjornerud

A New History of Life by Peter Ward and Joe Kirschvink

The Story of Earth: The First 4.5 Billion Years, from Stardust to Living Planet by Robert Hazen

Roadside Geology of Southern California by Art Sylvester and Libby Gans

Han Xiao

Han Xiao is a fourth-year Ph.D. candidate in Geophysics, working with Professor Toshiro Tanimoto. He received his BS in Geophysics from Ocean University of China and MS from Tongji University in Shanghai.

His research is focused on seismic noise, especially S-wave microseisms. Microseisms are a kind of seismic noise generated by ocean activities, which can be used to monitor deep sea activities and long-term climate change, as well as study underground structures.

During the COVID-19 period, Han worked with Prof. Zach Eilon, Chen Ji, and Toshiro Tanimoto to use seismic noise to monitor people's activities. Seismic records provide unique signals that can elucidate human activities on a large scale. They examined variations in seismic noise between 1 and 40 Hz, which provide proxy information on cultural behavior in real time. To further the research, Han uses the latest Distributed Acoustic Sensing (DAS) data to help understand seismic noise. DAS is a new technology that uses the optical phase changes in Rayleigh backscattered light in a long optical fiber as thousands of seismic sensors. At the end of the fiber, an instrument called the interrogator unit (IU) sends laser pulses down the cable that reflects off the fiber flaws and bounces back to the IU. When the fiber is disturbed by changes in strain, vibrations, and temperature,

there are changes in size, frequency, and phase of light scattered backed to the IU to measure and record seismic waves—in the ocean or, recently, in a sea of people.

Katie O'Malley

Katie joined the department in Fall 2020 moving from her hometown of Chicago to Santa Barbara with a single suitcase and her not-excited-for-air-travel cat named Yang. As an undergraduate she attended Purdue University where she balanced her time with undergraduate research in hydrology and performing with the Purdue Contemporary Dance Company. She graduated in May 2020 with a B.S. in Chemistry and minors in Dance *and* Earth, Atmospheric, and Planetary Science (EAPS).

Lately, you can find Katie spending a majority of her time in Cloud Research Lab working with Dr. Morgan Raven to develop a novel stable minor isotope tracer, 33S-SO4. This new tracer will provide never before recovered details for the chemical mechanisms behind the ocean's ability to preserve carbon.

Outside of research, Katie has become increasingly passionate about science communication. Over the pandemic she taught herself how to animate using Procreate software and has become enthralled with making easy to digest animated visualizations about her research methodology and other complex science concepts. Starting this fall she will be stepping into leadership for GEMSS, a department organization which helps to connect undergraduates with Earth Science graduate students to receive support and mentorship throughout the academic year. She will also be joining the JEDI student committee

this Fall. After graduation, she hopes to continue onto her Ph.D. in the marine sciences.

DISTINGUISHED ALUMNI 2021

Annually, the Department honors two of its alumni—one from academia, and one from elsewhere—celebrating their accomplishments and providing our current students exemplary role models.

Ed Saade

Having grown up on the coast of California, Edward (Ed) Saade knew going into college at UCSB (1977) that he wanted to make a career on the ocean. He picked Geology as a freshman and has made a successful and meaningful career of it for more than 45 years.

Ed spent nearly 20 years on research vessels mapping the seafloor and analyzing sub-surface sediments in the US and abroad. This work ranged from geohazards to support offshore infrastructure projects, to search and recovery efforts, including those following the Challenger Space Shuttle disaster in 1986 and the TWA flight 800 crash a decade later.

By the late-1990s, Ed ultimately landed with leading geo-data specialist company Fugro, overseeing offices in San Diego, Washington DC and Houston. Today, he serves as President of Fugro-USA and Group Director of the entire Americas region.

He has overseen multiple technology innovations that are improving the quality, coverage, and accessibility of geodata to clients globally. He has also championed innovative partnerships and collaboration to address resilient coastlines and a sustainable ocean economy, including direct support for the UN Ocean Decade and Seabed 2030 initiatives.

UC Santa Barbara Department of Geology
Distinguished Alumnus of 2021

Christine Siddoway

Christine Smith Siddoway '95 entered the PhD program at UCSB with a single objective in mind: to conduct field work in West Antarctica. She soon discovered that Professor Bruce Luyendyk and Dave Kimbrough '82 had polar research plans. Their work led to recognition of Antarctica's only substantiated metamorphic core complex, developed during broad extension across West Antarctica and Zealandia, within Gondwana. Siddoway continues to work in Antarctica and by now has traveled to the Ice 14 times, supported by 10 NSF awards. Most recently, Siddoway joined IODP379 to the Amundsen Sea, an ocean expedition that offered plenty for a "land geologist" to do: she identified IRD (iceberg-rafted detritus) recovered from the deep sea surrounding Antarctica. Some clasts match bedrock sources as far inland as the Ellsworth Mountains… which suggests that Antarctica has an open interior seaway, at times! BBC science covered this finding last year (bit.ly/Siddoway). Siddoway is employed at Colorado College, in the Rocky Mountains, with plenty of good local geology to investigate in the Pikes Peak region. One unusual problem involves granite-hosted sedimentary injectites that are Cryogenian in age (a "Snowball Earth" interval), and this recently brought Prof. Frances Macdonald to Colorado! (see bit.ly/UCSBMacdonald).

Gen Li

Gen Li is a geochemist and geomorphologist who studies the dynamic processes that cycle elements and materials in the Earth system. He is interested in the interplay between tectonics, sediment transport, and carbon cycling. Those processes regulate Earth's climate, shape landforms, and steer global biogeochemical cycles, making Earth a habitable planet. Studying those processes also help us to better understand and mitigate natural hazards, such as landslides. Gen combines field studies, laboratory work, theory development, remote sensing, and numerical modeling for his research, and enjoys working with researchers from diverse backgrounds.

His recent research topics include sediment and carbon transport in large rivers, sediment production and transport from landslides, mountain building and erosion over earthquake cycles, development of new techniques to measure and characterize organic carbon, and uplift-erosion-weathering-carbon cycling interactions. Gen does field work in the Nepalese Himalayas, eastern Tibetan mountains, permafrost floodplains in the Arctic, and the Mississippi river deltas.

Gen Li grew up in eastern China where the Huai River joins the Chang Jiang (Yangtze River). He holds a BS in Geology from Nanjing University, China, and a PhD in Earth Sciences (2017) from the University of Southern

California. Before joining UCSB, Gen worked at Caltech and UCLA as postdoctoral scholar. He is looking forward to joining the department and to continuing his studies of mountains, rivers, landslides, and carbon in beautiful Santa Barbara.

STUDENT THANK YOUS

Heartfelt thanks to our donors

My Earth Science classes have kept me excited to learn each day, even from my laptop at home, this award really validated my love for Earth Science and made me feel like my hard work has paid off. Thank you!

I am humbled to receive this award and it inspires me to work hard in the future! This award will allow for me to pursue my future goal of going to graduate school.

I felt enormously honored to be the recipient of this award. Being a member of the Earth Science community has been one of the best experiences of my life.

Your generosity is deeply appreciated and I cannot stress enough how grateful us grad students are for the support, especially during such trying times.

This award helps fuel motivation to continue pursuing my passion for research and the monetary award will help drive my work forward during these uncertain times.

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Santa Cruz Island, 2021. Photo: Michael Montgomery