14th Annual CSUF Geological Science Research Day

Department of Geological Sciences
California State University, Fullerton

McCarthy Hall—The Black Family Terrace

Friday, May 5, 2023

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McCarthy Hall
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Undergraduate BA/BS Proposal Category

GEOLOGICAL SCIENCES
CSUF

Undergraduate Thesis Proposal

Fire Increase erosion in Chino Hills State Park

By William Robert Bourbois (wrbourbois@csu.fullerton.edu)
Faculty Advisor: Dr. Matthew Kirby

Fire frequency and intensity is becoming more common in the western United States. Areas that occupy the wildland-urban interface are especially susceptible to these changes. One such is the Chino Hills State Park (CHSP), located in southern California. For this study, we collected sediment cores from a small, landslide formed lake in CHSP. Due to the paucity of research from CHSP, it is unclear how past fire activity impacts the landscape. This study will use changes in grain size to examine how the lake's drainage basin has responded to fire activity over the past 80 years. Age control is based on C-14 measurements. Historical fire data from CHSP reveal a complex history of fire in the study region. The largest fires are coeval to higher percent sand between 1940-1970 AD. This increase in sand is inferred to represent an increase in erosion following large fires and their modification of the landscape. As fires become larger and more frequent in the study region, landscape modification may change ecosystems at a faster rate than they can recover naturally

Undergraduate Thesis Proposal

Python Program to Input, Sort, View, and Store Detrital Zircon Geochronological Data in a SQL Database

By Jarrod Burges (jburges@csu.fullerton.edu)
Faculty Advisor: Dr. Kate Metcalf & Dr. Mikhail Gofman (Engineering)

Detrital zircon datasets contain vast amounts of geochronological data, and different labs, researchers, and institutions all have their own standards of formatting. Detrital zircon data are also becoming cheaper and easier to produce which increases the quantity of datasets available to researchers. This increase of data only makes the existing problem of having to organize, sort and filter the data that much more difficult. This program aims to fix this problem of organizing and managing by automatically assuming how data is formatted and storing it into a personalized SQL database. When the program is unsure how to import the data, it prompts the user with a step-by-step wizard to confirm or modify the assumed data values. This is to ensure all data are accurate while still having the bulk of the behind-the-scenes processes automated. The program then remembers the specific formatting that was used and would apply that to future datasets of the same format to be imported. Users can create custom tags for filtering that are not available on existing online databases. The data inside the SQL database can then be used by the built-in filtering and basic plotting to allow users to quickly visualize the data based on current filtering options. Once the user is satisfied with the selected data, it can be outputted in varying formats such as Excel, IsoplotR, DZstats, detritalPy, etc. Users can also split, merge, and share the SQL database for other researchers to merge into their own databases with little user input unless there are conflicting entries. New AI tools such as Chat GPT are intriguing, but we find it is insufficient for our needs as it still unreliable and the results cannot be shared, merged, or stored. The program will use open-source methods of version control which will allow for users to submit their own feedback or help contribute to the program through GitHub. Once the program exits closed alpha development and is published, it will help assist all geochronologists in optimizing their own research methods while seamlessly being able to integrate with already existing tools.

Undergraduate Thesis Proposal

Fire and erosion: A study from Chino Hills State Park, CA.

By Raquel Carmona (raquel5@csu.fullerton.edu)
Faculty Advisor: Dr. Matthew Kirby

Forest fires are becoming more common and more intense in the western United States. Moreover, fire alters the landscape, changing vegetation, exposing soil, and enhancing erosion. This study will use a sediment core collected from a small, landslide-formed lake in Chino Hills State Park to investigate the relationship between fire and landscape modification over the past 80 years in Chino Hills State Park. Age control will be based on C-14 dating. Sediment analyses include magnetic susceptibility, water content, percent total organic matter, percent total carbonate, and percent clastic material. We hypothesize that fire exacerbates hillslope erosion. As fires become more common, landscape recovery will take longer and result in – possibly – permanent shifts in ecosystems.

Undergraduate Thesis Proposal

Distribution of Shear Along the Borrego Springs Shear Zone, Imperial County, California

By Sofia Kabbara (sofi.kab@csu.fullerton.edu)
Faculty Advisor: Dr. Sinan Akçiz

A shear zone is the ductile, deep equivalent of a fault zone. Shear zones are generally wider than faults and typically accommodate large displacements on the order of tens of kilometers. Ductile shear zones may range from the grain scale to the scale of a few to tens of kilometers in width and length. Inactive shear zones, now exhumed to the surface, contain valuable clues that help us understand how rocks deform at depth and how strain is distributed through the lithosphere. The Eastern Peninsular Ranges Mylonitic Zone (EPRMZ), located between the Western and Eastern Peninsular Ranges Batholiths, is one such exhumed structure completely exposed, enabling nearly complete documentation of strain intensity along its entire width. Extending for nearly 100 km from Palm Springs, CA, to the border of Mexico, the inactive EPRMZ consists of three sections cut by the two active San Jacinto Fault and the Elsinore Fault: the Santa Rosa Shear Zone (SRSZ), the Borrego Springs Shear Zone (BSSZ), and the Cuyamaca-Laguna Mountains Shear Zone (CLMSZ). My thesis project will focus on the documentation of shear fabrics within the BSSZ. I will do a geologic transect of the BSSZ along the Montezuma Highway at 1:1000, documenting the occurrence and distribution of non-foliated, foliated (S-tectonite), lineated (L-tectonite), and foliated-and-lineated (LS-tectonite) rocks. Oriented hand samples from outcrops representing each structural section will be collected. Thin sections from these samples will be photographed and structural textures will be described. Foliation and lineation measurements will supplement the macroscopic and microscopic characterization of the BSSZ.

Undergraduate Thesis Proposal

Length scales and degree of mafic and felsic magma mixing and mingling in the Jackass Lakes pluton, Sierra Nevada, CA.

By Julia Real (julia4reals@csu.fullerton.edu)
Faculty Advisor: Dr. Valbone Memeti

This study seeks to examine the interactions of mafic with felsic magmas, the length, scales, and degrees of such interaction in the Jackass Lakes pluton (JLP) of the Sierra Nevada batholith, California. Mafic magmas are often thought to trigger volcanic eruptions, which is why it is important to study magma-magma interactions at the pluton level.

The Jackass Lakes pluton located in the central Sierra Nevada batholith and spans approximately a 13 x 17 km rectangular area. The pluton has been dated as a 98-97 Ma composite intrusion (Pignotta et al., 2010). A large portion of the JLP is composed of medium grained granodiorite, fine to medium-grained quartz diorite, and tonalite (Peck 1980). Previous studies in the area have worked to understand the methods of pluton emplacement, and less so magma mingling, and mixing. McNulty et al. (1996) suggested that episodic magma transport via fractures was the primary mechanism through which the JLP was formed, which likely included diking, lateral expansion of sheets, ductile wall-rock shortening, caldera formation, and possibly roof uplift. Pignotta et al. (2010) concluded that multiple, larger magma chambers might have been active near the final emplacement level, allowing for magma mixing, compositional and textural diversity, diking, and fabric formation over the region. However, a petrologic study examining the length scales of magma mixing and mingling to determine the size of magma chambers and the degree of magma-magma interaction has not yet been done.

This project plans to add onto pervious work by using detailed field mapping, petrography, whole rock major oxide, and trace element geochemistry to examine the compositions and petrologic relationships between exposed granodiorite and diorite magmas along contacts to determine if they are gradational or sharp. The goal is to understand the size and shapes of active magma chambers where mafic magmas intruded into felsic magmas and subsequently mixed or mingled. In addition, element geochemistry will test the importance of fractional crystallization and magma mixing between the different units.

This summer, a 5 km^2 portion will be mapped in the JLP around Lillian Lake at 1:10,000 scale. Documentation of rock types, rock gradations, minerals, abundances, structures, schlieren layers, and stoped blocks will also be included. On collected samples, petrographic analysis will be used to further identify the mineralogy, mineral abundances, and mineral zoning characteristics to determine affinities with different units. X-Ray Fluorescence whole rock element geochemistry will further serve to identify the importance of fractional crystallization and mixing/mingling in forming compositional heterogeneities.

Undergraduate Thesis Proposal

Belonging in the field: Measuring factors influenced by a required geologic field techniques class

By Adrian Remigio (remigioadrian@csu.fullerton.edu)
Faculty Advisor: Dr. Ginny Isava

Fieldwork components in courses offer several benefits to students, including solidifying higher-order thinking, transferable skills, and analytical reasoning. Despite the apparent benefits to this alternative to classroom learning, students may still have reservations or choose not to participate. A set of interview questions and a questionnaire were administered both at the start and at the end of the Spring 2023 geologic field techniques class at Cal State Fullerton in order to analyze how perceptions of self-efficacy, identity as a geologist, and sense of belonging change over the course of the class. Results from these surveys and interviews will be analyzed for this thesis. Research will benefit not only future renditions of the geologic field techniques course at CSUF, but also other courses that include fieldwork, not limited to earth history, hydrology/surface processes, and field camp. Themes and conclusions made from this study will be used to make suggestions for field-based learning, in hopes of mitigating the reasons behind why a student may be hesitant or choose not to participate in field experiences.

Undergraduate Thesis Proposal

Evidence of Biotic Recovery following the Permian-Triassic Extinction in the Union Wash Formation of Owens Valley, CA

By David Rogoff (DRogoff@csu.fullerton.edu)
Faculty Advisor: Dr. Adam Woods

The Lower Triassic (Smithian to Spathian) Union Wash Formation, located in east-central California, was deposited along the outer continental shelf edge of western Pangaea, near the equator. The deposition of this formation took place concurrently with the biotic recovery following the end-Permian mass extinction, and allows us to examine the interaction between biotic recovery and environmental conditions. The recovery was slow in the region, taking place throughout the entire Early Triassic, and demonstrating at least three distinct recovery events. These recovery events were interspaced with periods of harsh environmental conditions including increased temperatures and anoxic and/or hypercapnic waters leading to setbacks in biotic recovery. Even during these periods of recovery, anoxic waters from below and un-survivable sea surface temperatures from above forced remaining life forms into narrow windows within the water column in which marine life could still exist and continue to recover. The Union Wash Formation is divided into three informal members, the uppermost member being the focus of the research proposed in this paper. This member consists of a lower micritic limestone and shale subunit and an upper subunit comprised of laminated siltstone. The aim of this research will be to determine if there was another incursion of stress during deposition of the upper member, or if the recovery continued unabated in the upper part of the unit. Research will take place both in the field at the Union Wash locality of the Union Wash Formation and at California State University Fullerton. The upper member is exposed at the Union Wash locality, over a 94.5m stratigraphic interval. Field observations will consist of measurement of the upper member, breaking the unit down into smaller subunits based on lithologic changes, detailed rock descriptions, and the determination of ichnofabric indices. Hand samples will be collected from each subunit or every five meters, and brought back to CSUF to be cut, polished, and areas of interest will be made into thin sections. The findings of this research will serve to further our understanding of the post-extinction recovery along the western margin of Pangaea near the end of the recovery interval from the Permian-Triassic mass extinction.

Undergraduate Thesis Proposal

Shouldn't the Borrego Springs and Santa Rosa Shear zones, separated by the San Jacinto Fault, share similar structural histories?

By Cory Stratton (corystratton2002@csu.fullerton.edu)
Faculty Advisor: Dr. Sinan Akçiz

Plutonic rocks of the Peninsular Ranges batholith in southern California were mylonitized in the large shear zone known as the eastern Peninsular Ranges mylonite zone (EPRMZ). Extending for nearly 100 km from Palm Springs, CA, to the border of Mexico, the EPRMZ consists of three sections cut by the San Jacinto Fault and the Elsinore Fault: the Santa Rosa Shear Zone (SRSZ), the Borrego Springs Shear Zone (BSSZ), and the Cuyamaca-Laguna Mountains Shear Zone. Since the recognition of the shear zone in the early 1960s, most recent research projects have focused on determining the timing of the formation of the mylonitic rocks and rock cooling history. Structural investigations have revealed conflicting tectonic histories: While the BSSZ is interpreted to have formed only due to westerly ductile thrusting, its northern continuation, the SRSZ, contains microscopic and macroscopic evidence for west-directed thrusting followed by east-dipping ductile extensional structures. My investigation aims to add new data to this discourse and clarify our understanding of the processes that formed these mylonites. Field activities will include mapping rock structure, type, distribution, and orientation along both BSSZ and SRSZ. Field investigations will also include collecting mylonitic rock samples for microscopic structural analyses. Laboratory work will consist of examining and documenting oriented rock slices and selecting and producing oriented rock thin sections. Thin sections will be examined under a microscope to discern ductile and brittle motion within the rock fabric by detecting deformed microscopic structural features. These field and laboratory investigation results will reveal whether BSSZ and SRSZ share similar structural histories.

Undergraduate BA/BS Thesis Category

GEOLOGICAL SCIENCES
CSUF

Undergraduate Thesis

Causes of Magma Compositions and Extent of Magma-Magma Interaction in the Jackass Lakes pluton, central Sierra Nevada, CA

By Sadie Durning (sdurning@csu.fullerton.edu)
Faculty Advisor: Dr. Vali Memeti

The 98-97 Ma Jackass Lakes Pluton (JLP) is a 13 km by 17 km rectangular pluton that offers a record of the growth and magma evolution of the upper magma plumbing of the Sierra Nevada batholith. It formed 2 myrs before the 95-85 Ma, 1,100 km2 Tuolumne intrusive complex (TIC) to the north, which produced large magma mush bodies after a short, initial time of magmatic sheeting. While McNulty et al. (1996) proposed extensive diking for the growth of the JLP, Pignotta et al. (2010) described an early diking stage followed by the assembly of magmas into irregular bodies via magma mixing/mingling. To test these hypotheses and define the extent of magma-magma interaction and thus magma body sizes, the granodiorites of the west central part of the JLP were mapped at 1:10,000 scale and petrologically and geochemically examined.

The main phase of the JLP (Kj) is a K-feldspar porphyritic biotite granodiorite. It is intruded by the Anne Lake hornblende biotite granodiorite (Kja) via sharp contacts. Two hornblende-bearing biotite granodiorite units have gradational contacts with each other and the Kja. The finer grained, more mafic Kja grades into the coarser grained, plagioclase porphyritic Rutherford phase (Kjr) to the west. Further west, the Kjr grades into the Fernandez Pass phase (Kjf), which contains coarser grained, more euhedral hornblende and potassium feldspar phenocrysts. Whole rock XRF major oxide and trace element analyses reveal that at least some JLP plutonic units have fractionation relationships. Kja and Kjr are very similar in geochemical composition, and Kjf is a more-evolved magma fractionated from Kja based on trace elemental analysis. The Jackass Lakes granodiorites are contemporaneous units aged between 98.79 +/- 0.65 Ma to 97.77 +/- 0.50 Ma determined by LA-ICPMS U-Pb zircon geochronology, although field observations of Kj stoped blocks in Kja, Kjr, and Kjf show that Kj is older than the others. The compositions and gradational contacts between Kja, Kjr, and Kjf indicate that they likely formed an interconnected magma chamber over ≥4 km east to west.

As opposed to the eastern part of the pluton, which previous researchers have determined is a sheeted dike complex with smaller intrusions, the northwest-central part of the Jackass Lakes Pluton formed map-scale granodioritic and granitic bodies that were able to mix and fractionate. Some of these fractionates likely fed the porphyry and/or volcanic units. This work supports the idea that pluton bodies may start as smaller, less-focused intrusions but may eventually mature to form larger magma chambers and feed eruptions at the surface.

Undergraduate Thesis

A Paleoenvironmental Analysis of Oncoids from the Lower Cambrian Chambless Limestone of the Marble Mountains, CA

By Candice Galindo (cgalindo7@csu.fullerton.edu)
Faculty Advisor: Dr. Adam Woods

The Lower Cambrian Chambless Limestone is located in the Marble Mountains of the Mojave Desert in eastern California, and is well known for containing, large, well-developed oncoids, which are spherical to oblate microbial allochems that form from the precipitation of calcium carbonate during algal photosynthesis. Previous research conducted on the oncoids from the Chambless Limestone by Foster (2011) and Unal and Zinsmeister (2007) have noted that the oncoids are porostromate and contain the filamentous microfossil Girvanella. Foster (2011) and Unal and Zinsmeister (2007) proposed that the oncoids found within the Chambless Limestone formed under quiet conditions based on: 1) the large size of the oncoids, which average 2-4 cm in diameter, including the largest examples found near the base of the Chambless Limestone that were likely disturbed only during storm events; 2) the micritic nature of the matix; and, 3) the presence of archaeocyaths, which indicate water depths of 20 m to 50 m (Hill, 1964; Foster, 2011). Closer analysis of the oncoids and surrounding sedimentary rocks of the Chambless Limestone provide an opportunity to test the hypothesis of Foster (2011) and Unal and Zinsmeister (2007) that the oncoids indeed formed under quiet conditions. A detailed stratigraphic section of the Chambless Limestone was measured, and the unit was broken up into smaller subunits based on lithological changes. Samples were removed from each subunit that were slabbed and examined in thin section. Results reveal that the oncoids within the Chambless Limestone fall into 2 main size categories: 1) smaller oncoids, 0.25 – 2cm in diameter, which have concentric internal laminae; and, 2) larger oncoids, 3 – 5 cm in diameter, with asymmetric internal laminae. Trilobites are the dominant fauna throughout the Chambless Limestone, with hyoliths, echinoderms, and archaeocyaths, common to rare depending on the subunit. Field and hand sample observations show the rocks from each subunit are massive or heavily bioturbated, while thin section reveal common peloids throughout much of the formation. Further study of the collected samples suggests the oncoids formed in a normal marine environment, while changes in fossil hash content and the varying size of the oncoids provide evidence of longer-term sea level changes. The occurrence of shale subunits higher in the study section suggest an increase in detrital matter input, which is possibly due to delta lobe switching coming from a landmass to the east. Overall, this study further supports the hypothesis of Unal and Zinsmeister (2007) that the oncoids of the Chambless Limestone formed under quiet conditions, with longer-term changes in sea level leading to changes in oncoid size and morphology.

Undergraduate Thesis

Landscape Modification by Fire in Chino Hills State Park

By Ashley Hansen (ashleyhansen@csu.fullerton.edu)
Faculty Advisor: Dr. Matthew Kirby

The wildland-urban interface is term used to describe developments near open flammable space (Stewart et al., 2007). As humans continually encroach upon this space, the threat to human lives and structures rises (Mell et al., 2010). Chino Hills State Park (CHSP) is one area impacted by fires at the wildland-urban interface. This project aims to establish a wildfire history in CHSP using a sediment core extracted from Chino Hills Lake, located within the park, approximately 600 m from the nearest residence. This project investigates past fire frequencies to better understand what to expect from future wildfire activity and how it will impact those at the wildland-urban interface.

Carbon-14 dating indicates the sediments to be modern – less than 1940 AD. Magnetic susceptibility, loss on ignition (LOI), and charcoal counts were used to characterize the sediment and reconstruct the fire history. LOI remained relatively constant throughout the core; whereas, magnetic susceptibility, a proxy for run-off, was positively correlated with charcoal counts and reveal more runoff in the early 20th century when CHSP experienced larger-acreage fire burns. Our interpretation is that higher runoff (i.e., higher MS values) in the mid 20th century (1940-1970 AD) reflects fire-related preconditioning of the substrate rather than a wetter climate. This preconditioning removed vegetation making the soil more susceptible to erosion. These findings suggest that future burns will expose the region to greater erosion including landslide risk.

Undergraduate Thesis

Investigation of the Kuna Crest and Sentinel Granodiorite contacts in the Tuolumne Intrusive Suite in The Sierra Nevada Batholith, California

By Youssef Hijazi (yhijazi4@csu.fullerton.edu)
Faculty Advisor: Dr. Vali Memeti

It is crucial to understand how the process of magmatic intrusion works and its effects on the surrounding rock units to understand how Earth's crust forms and evolves through time. One well preserved model for these processes comes in the form of Tuolumne Intrusive Complex located in the Sierra Nevada, California, USA. The Tuolumne Intrusive Complex preserves evidence of a variety of magmatic processes that have shaped the area including crystal fractionization, magma mixing, assimilation, and magmatic differentiation. This study focuses on the western part of the Tuolumne Intrusive Complex to reconstruct the contact relations between the Sentinel Granodiorite and the Kuna Crest. The Kuna Crest and Sentinel Granodiorite formations, as part of the incremental plutonic complex history (95-85 m.y. development), have been part of ongoing research by geologists and has been a topic of debate as to how the area was formed. Some of the earlier research suggests that the Kuna Crest was a smaller rock unit surrounded by the Sentinel Granodiorite that may have intruded into the Kuna Crest. Subsequent studies suggest that the Kuna Crest acted as an older separate intrusion that was later invaded by the Sentinel. The objective of this study is to interpret whether the two units are contemporaneous and/or if the Sentinel Granodiorite is grading into the Kuna Crest. Methods used in this study include field mapping and observations for overall geology of the area, petrographic analysis for mineralogy, mineral assemblages, and characteristics of enclaves and their host rocks, and XRF analysis of geochemistry for accurate ageing of units. The collection of this data assumes the nature of the Kuna Crest and Sentinel granodiorite contact. Results from this study suggests the Sentinel Granodiorite is in fact grading into the Kuna Crest and the two units are contemporaneous. This contact relationship surely will continue to be studied by geologists and will continue to be argued on its nature and formation. Further investigation and study are required to better understand the complex geology of the Tuolumne Intrusive Complex and ultimately the greater area of Yosemite National Park. Only then will we grasp the full understanding of the complex evolution and formation of our earth's crust throughout its history.

Undergraduate Thesis

Was California Wetter During the Little Ice Age? A Comprehensive Analysis on Floods in Carrizo Lake, Southern California

By Samuel Hippard (hippardsam@csu.fullerton.edu)
Faculty Advisor: Dr. Matthew Kirby

California suffers from prolonged droughts which threaten to permanently change the sourcing and availability of freshwater in the state. Conversely, extreme precipitation events – associated with atmospheric rivers – cause a surplus of water and, at times, catastrophic flooding. For example, the 1861-1862 CE megastorm event produced state-wide flooding and severe socioeconomic impacts. To better understand the history of these megastorm events in California, we collected and analyzed 5 sediment cores from a sag pond from the southern end of the Carrizo Plain National Monument, California (CA). Radiocarbon dating and the occurrence of exotic pollen (Erodium) constrain the sediment core's timing. Using a variety of physical sedimentological analyses, we identify at least nine flood event layers. The three thickest event layers (1525 CE, 1760 CE, and 1861-1862 CE), and the presumed most severe flooding, occur during the Little Ice Age – a period of wetter climate in CA (Hiner et al., 2016; Kirby et al., 2010, 2014, 2023). The 1525 CE events consists of two distinct event layers and correlates to flood events in Zaca Lake (Kirby et al., 2014) and Santa Barbara Basin (SBB) (Du et al., 2018; Sarno et al., 2020). We also find correlations to the SBB flood record for the 1760 CE and 1861-1862 CE events.

Undergraduate Thesis

How do geoscience faculty organize introductory earth science/geoscience topics and why in that order?

By Javier Uravasquez (juravasquez@csu.fullerton.edu)
Faculty Advisor: Dr. Ginny Isava

This research paper will explore how geoscience faculty organize their courses. Compared to experts, students typically tend to have a more linear approach to knowledge organization, which will lead them to having to use memorization rather than understanding the main concepts and making underlying connections between topics. However, through the proper organization of knowledge, and constructivism, students have the capacity to think like experts, solve more complex problems, and become more successful in their introductory geoscience courses. This study will help determine how a professor can help a student become more successful, when organizing the way they teach topics in an introductory geology course. Syllabi were compiled for introductory geoscience courses from 53 professors at 40 different universities. Topics taught in each course were analyzed and categorized into 31 different groupings, such as plate tectonics, volcanoes, metamorphic rocks, etc.. The data was organized to show how many times each topic came immediately before or after each other topic. Interviews were conducted with a subset of instructors who provide their syllabus to the study, in order to better understand how and why topics were arranged in specific orders. It was found that there are certain topics that are generally given at the beginning of the course, during the middle of the course, and toward the end of the course. Initially, courses with a high percentage of instances start with topics like chemistry, earth history, earth science, and planetary science. Toward the middle of the semester/course, are the topics that could be considered the most important topics. These topics include plate tectonics, mineralogy, volcanoes, igneous rocks, sedimentary rocks, and metamorphic rocks. lastly, the semester typically ends with the topics like glaciation/glaciers, hydrology, climate and climate change. We found that there are certain topics that are focused on more and take up more course time during the semester. The top 5 are as follows, plate tectonics (n=129) had a frequency of 8%, hydrology (n=107, 6.7%), earth history (n=99, 6.2%), mineralogy (n=89, 5.6%), and volcanoes (n=86, 5.4%). “n” is the number of instances of a topic and n divided by the total number of topics (n=1,603) is the frequency percent. There were topics that typically came immediately before or after other specific topics, and although several of the topics can be interchangeable, most of the geological processes are interconnected and build on each other. You cannot understand volcanoes without understanding plate tectonics. Through the proper organization of knowledge, students can think like experts, solve more complex problems, and become more successful in their introductory geoscience courses, which will then allow them to become more successful in their future geoscience academic careers.

Undergraduate Thesis

Analyzing Mafic Rocks And Their Interactions With Granodioritic Host Magma In The Jackass Lakes Pluton Of The Central Sierra Nevada Batholith

By Edgar Villasano (eemilio@csu.fullerton.edu)
Faculty Advisor: Dr. Valbone Memeti

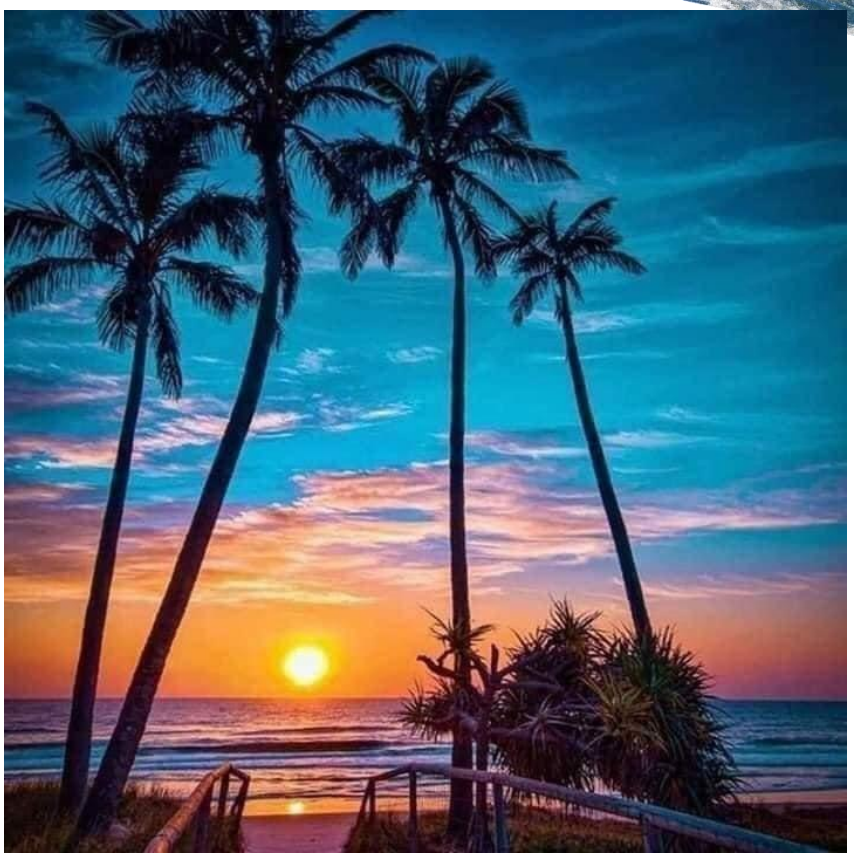
The intrusion of mafic magmas has often been interpreted to trigger volcanic eruptions. Thus, understanding interactions between mafic and felsic magmas in plutons is important. The 175 km2, 98-97 Ma Jackass Lakes pluton (JLP) in the central Sierra Nevada batholith, a slightly older pluton just south of the 1,100 km2, 95-85 Ma Tuolumne intrusive complex, is compositionally more heterogeneous at map to outcrop scale. It is largely composed of compositionally varying and mappable equigranular to porphyritic granodiorites. In addition, cm- to several km-long quartz diorite bodies are found across the JLP. McNulty et al. (1996) suggested that these mafic magmas represent dikes or sheets, while Pignotta et al. (2010) proposed that they occur in irregular shapes and mixed/mingled with host magmas.

This study analyzed seventeen mafic rock samples from map-scale bodies to cm-scale enclaves from the NW- central JLP with petrography, Cathodoluminescence (CL) imaging, plagioclase extinction angle analysis to determine anorthite content, and XRF whole rock major and trace element analyses to examine 1) if these mafic magmas are compositionally homogeneous and likely derived from the same source, and 2) to what degree they interacted with host granodiorites.

Most mafic rock outcrops observed in the study area occur in cm- to m-scale irregular bodies made of quartz diorite. Of the four observed granodioritic host phases, only the Jackass Lakes granodiorite phase (Kj) and the Jackass Lakes Rutherford Lake phase (Kjr) showcase the occurrence of mafic enclaves. Petrography has revealed that of the five most prominent minerals typical in intermediate granitoids, quartz varies the most with a range of 3-30%, with hornblende and plagioclase feldspar being tied as the second most varied mineral with their respective ranges of 14-40% and 29-55%. Most samples are porphyritic, with plagioclase, quartz, and alkali feldspar making up most phenocrysts (the latter two likely deriving from the granodioritic host). Plagioclase varies most in grain size (0.20-20 mm) and forms sizeable clusters. Sericitized plagioclase cores indicate higher An-content derived from earlier, more mafic magmas. Five samples were selected for plagioclase extinction angle analysis due to their varied occurrences across the JLP, with two associated granodioritic host phase samples undergoing the same analysis for comparison. The plagioclase grains of the five mafic samples showcase an average anorthite content range of 43-45% whereas the two host samples showcase values of 13.5 and 25.5% respectively, meaning the plagioclase grains of the mafic bodies are closer in composition to one another than those of the granodioritic host phases. This apparent homogeneity across plagioclase compositions alludes to the mafic samples all potentially sharing a magmatic source.

In CL, the mafic samples appear homogeneous in regard to zoning, along with the mineral distribution of the three observed samples reflecting the modal abundances calculated via petrographic analysis. An observable contact between two units in one thin section is relatively clean, with minimal transfer of plagioclase grains occurring between the units. While said observation suggests minimal mixing/mingling with the surrounding host granodiorite units, the irregular plagioclase zoning observed in a third sample indicates magma (crystal and melt) mixing with the host granodiorite. Magma mixing as part of the mingling process between the mafic bodies/enclaves and the host granodiorites is further supported by XRF whole rock major and trace element analysis. While the mineral abundances point towards compositionally relatively homogenous mafic rocks, the varied distribution of some major and trace elements such as CaO, FeOt, MgO, Ba, Zr, and Sr point towards heterogeneity among the mafic magmas. Such heterogeneity can be explained by minor mineral abundance variations caused by fractional crystallization, magma mixing at the emplacement level and during magma ascent, and some heterogeneities likely present in the source.

Masters MS Proposal Category



GEOLOGICAL SCIENCES
CSUF

Masters Thesis Proposal

Can low-volume magmatism generate large-scale eruptions? Petrologic investigations of the Jurassic Standard and King Creek plutons, CA

By Caitlin Bates (cbates9@csu.fullerton.edu)
Faculty Advisor: Dr. Vali Memeti

A source for volcanic eruptions, plutons serve as valuable tools for studying volcanic processes in the absence of volcanic materials. In the Sierra Nevada batholith (SNB) in California, the voluminous Cretaceous magmatic flare-up event overprinted much of the Jurassic plutonic and volcanic rocks produced during the relatively lower-volume Jurassic flare-up event. As such, finding a connection between the currently existing Jurassic plutonic and volcanic rocks in the SNB has proven challenging. Furthermore, field relationships and isotopic dating on Sierran Jurassic plutons and small occurrences of volcanic rocks have not provided strong support that the plutons fed the volcanic eruptions. The main question is whether this is the case because 1) a large Jurassic record of volcanism that was fed by plutons is missing due to the overprinting by the younger and more voluminous Cretaceous magmatic flare-up and later erosional events, or 2) whether the Jurassic low-volume magmatism never allowed for plutons to grow large enough magma chambers to feed volcanic eruptions and instead they were fed directly from the mantle without storage in a plutonic magma plumbing system. Detailed study of Sierran Jurassic plutons will provide invaluable clues as to the ability of the lower-volume Jurassic plutonic magma plumbing to produce small and large-scale eruptions.

This study is conducting detailed petrologic and geochemical analyses of the Jurassic King Creek and Standard plutons in the SNB to determine if they could have produced small and/or large-scale eruptions. Evidence that these plutons are crystal cumulates permits the conclusion that they have lost melt, most likely in a volcanic eruption, or a hypabyssal intrusion. The existence of crystal cumulates is examined with petrography and geochemistry analyses of the plutons. In particular, since individual minerals are great recorders of the history of magma processes that they witness, LA-ICP-MS trace element and electron microprobe mineral-scale analyses will be used to determine compositional changes over the growth histories of crystals in the magma chamber. In comparison with XRF whole-rock geochemical analyses, they will allow to determine if the crystals grew in an environment that is different than what the whole-rock chemistry suggests, which may be an indication of melt loss. Chemical modeling using whole-rock and mineral-scale compositions will assess the percentage of crystals in the magma chamber vs melt and estimate the magma temperatures and compositions when melt loss occurred, either via a rapid eruption of the magma chamber, if it erupted at all, or a low-volume upward percolation of melt in a network of crystals. Evidence of cumulate properties of the plutons combined with evidence of sufficient loss of melt will provide strong support for the hypothesis that even low-volume magmatism in the Jurassic allowed the plutonic magma plumbing to produce volcanic eruptions, small or large, whether they are preserved or not. Such findings will provide valuable insight into the behavior of continental magmatic arcs and can offer a better framework for studying modern arcs and understanding the risk of volcanic eruptions they may pose.

Masters Thesis Proposal

Investigating Pluton Emplacement Mechanisms in the Jackass Lakes Pluton, Sierra Nevada Batholith, California

By Brandon Cugini (bcugini@csu.fullerton.edu)
Faculty Advisor: Dr. Valbone Memeti

The Jackass Lakes pluton (JLP) is a 98-97 Ma, 175 km2 pluton in the central Sierra Nevada batholith. It is ideal for evaluating pluton emplacement histories as it contains coeval volcanic and porphyry units as roof host rocks, older (Illilouette) pluton wall rocks, and internal "pulsing" usually not found together in other plutons. McNulty et al. (1996) interpreted the JLP to have grown largely via sheeted dike intrusions, while Pignotta et al. (2010) argued for complex irregular intrusions with mixing and mingling of internal pulses, stoping, and host rock downward return flow. A combination of map and outcrop level observations looks at contact relations between metavolcanic, porphyry, and plutonic units, including internal contacts, mineral fabrics, and presence and distribution of host rock xenoliths. This is coupled with microstructure and Electron Backscatter Diffraction (EBSD) analysis to quantify differences in preferred orientations of different minerals to test if they record emplacement related flow. Preliminary observations include: 1) microscale ductile strain in the Illilouette pluton only right at the straight western contact due to minor? JLP induced downward return flow, 2) metavolcanic pendants with shallow JLP contacts constricted to higher elevations with extensive stoped block fields indicating stoping along roof contacts, 3) mapped JLP phases are not sheet-like but separated by wide gradational contacts indicating large-scale mixing and mingling, 4) JLP-scale NNW striking mineral fabrics overprinting internal contacts indicating regional strain, and 5) local meso- and microscale solid state deformation with kinematic indicators showing magmatic fabric parallel [MV2] dextral shearing. It is not clear if the shear indicating solid state deformation is related to a local regional shear zone (Krueger and Yoshinobu, 2018), or emplacement; or if shearing started operating during syn-emplacement of the JLP. EBSD analysis in progress will determine strain intensity and orientations of especially higher temperature magmatic minerals (e.g. plagioclase) to test for contact-parallel, emplacement-related internal magma flow. Our current conclusion is that the JLP followed a rather complicated growth history by a variety of emplacement processes as proposed by Pignotta et al. (2010).

Masters Thesis Proposal

Investigating the petrologic links of the Jackass Lakes volcanic-porphyry-plutonic complex, Sierra Nevada batholith

By Samantha Dunn (samariedunn@csu.fullerton.edu)
Faculty Advisor: Dr. Vali Memeti

The 98-97 Ma Jackass Lakes pluton (JLP) in the central Sierra Nevada batholith is a well-exposed 175 km2 resurgent pluton of largely granodiorite (Kj) and minor diorite that intruded into contemporaneous dacitic and rhyolitic volcanic ejecta (Km) and the Post Peak subvolcanic porphyries (Kpp) of the ca. 101-97 Ma Merced Peak Caldera sequence (McNulty et al., 1996; Pignotta et al., 2010). U-Pb zircon ages by Pignotta et al. (2016) and ages now attained at the Arizona LaserChron lab show that all three units are coeval within uncertainty (Km: 97.97±0.50, Kpp: 99.02±0.56 – 97.86±0.56, Kj: 98.09±0.56 -97.55±0.54). This timing relationship is essential to determine the petrologic connection of the volcanic-porphyry-plutonic units.

We are testing the following hypotheses: 1) the JLP granodiorites are compositionally complementary to the more felsic Kpp leucogranite and Km meta-rhyolites that formed from melt-extraction from the magma reservoir leaving behind crystal cumulates. Alternatively, 2) all three units are compositionally the same (equivalent).

Mapping of ~25 km2 of the north- and west-central JLP at 1:10,000 scale included the main porphyritic hornblende-bearing biotite granodiorite (Kj), the equigranular hornblende biotite granodiorite (Kja, Anne Lake phase), the Kpp biotite leucogranite, and the dacitic to rhyolitic, lithic-bearing crystal tuff (Km). The mapping redrew some contact lines mapped by Peck (1980) and revealed new granodiorite phases of the JLP: Kja2 (type of Anne Lake phase granodiorite), Kjr (Rutherford Lake granodiorite), and Kjf (Fernandez Pass granodiorite). The characteristic differences include variations in volume % mafic minerals, grain size, and texture. Stoped blocks of Kj are found in the minor, younger granodiorite phases. Mafic enclave swarms are found exclusively in the Kj, along with stoped blocks of Km and Kpp. The nature of contacts between JLP phases varies. While Kj-Kja, Kj-Kja2, and Kj-Kjr contacts are sharp, Kja-Kja2, Kja-Kjr, and Kjr-Kjf are gradational over ~30 ft. Contacts between all phases of the JLP, Kpp, and Km are sharp. Magmatic foliations in the JLP strike N-NW (McNulty et al., 1996; Pignotta et al., 2010).

Petrographic and XRF bulk rock element analyses show support for the complementary hypothesis for the Kj with the Kpp units. Crystal accumulation in thin sections of the plutonic units is seen by the clustering of plagioclase crystals. Further evidence of crystal accumulation and melt extraction is supported by the complementary compositions of Kj with Kpp on the SiO2 vs Ba and Zr plots. Km shows both complementary and equivalent relationships with Kj and Kpp. Km plots both along trend lines and away. The Km samples showing equivalent relations with Kj have abundant plagioclase phenocrysts, seen in thin sections. Kja plots along a fractionation trend and shows no direct relationship with the Kpp or Km. Further trace element chemistry on plagioclase by LA-ICPMS will provide further information on the direct relationships between the units. These results indicate that the Jackass Lakes pluton was capable and did erupt and form near-surface hypabyssal intrusions.

Masters MS Thesis Category

GEOLOGICAL SCIENCES
CSUF

Masters Thesis

Assessing formation conditions of turbidite-hosted carbonate concretions of Ridge Basin, CA using 87Sr/86Sr, d13C, and CIW

By Tracy Donelli (tdonelli@fullerton.edu)
Faculty Advisor: Dr. Sean Loyd

Carbonate concretions are zones of preferentially cementation in sedimentary rocks. Concretion formation is driven by different biotic or abiotic diagenetic reactions that lead to localized carbonate mineral saturation. Large (up to ~5 m across), ellipsoidal carbonate concretions occur within late Miocene (~10 Ma) sandstone turbidites of Ridge Basin, CA. These concretions are absent from interbedded shales, suggesting that the host lithology plays a role in concretion authigenesis. This study uses integrated total inorganic carbon (TIC) contents, carbonate carbon isotope compositions (d13Ccarb), carbonate cement strontium isotope compositions (87Sr/86Srcarb), and Chemical Index of Weathering (CIW) analyses to determine concretion formation mechanisms. d13Ccarb values range from -1.7 to -12.57‰ VPDB indicating significant carbon contribution from organic sources. Petrographic and TIC content analyses indicate that concretions are calcareous feldspathic litharenites with 8.3 to 23.2% carbonate cement. Low minus-cement porosity and microscopic compaction features indicate deep concretion formation in an environment lacking active microbial metabolism (precluded by high temperatures). Preliminary cement 87Sr/86Srcarb data average 0.711544, which is higher than the 87Sr/86Srseawater composition of contemporaneous (~10 Ma) seawater. These comparatively radiogenic strontium isotope compositions suggest partial Sr incorporation from reactive silicates (feldspars primarily) in the host turbidite. These preliminary findings indicate deep concretion formation likely driven by reaction of organic-derived CO2 with turbidite silicates, providing sources of calcium and alkalinity for carbonate authigenesis. Future CIW and 87Sr/86Srcarb analyses will provide additional insight into this hypothesized formation mechanism and specifically help address why cementation is localized rather than pervasive.

Masters Thesis

Assessing carbonate concretion formation mechanisms within the lower Miocene Rincon Shale, CA

By Melonie D. Nguyen (melonguyen@fullerton.edu)
Faculty Advisor: Dr. Sean Loyd

Carbonate concretions often result from the microbial degradation of organic matter and/or cycling of methane in marine sediments. These concretions provide a unique window into the biogeochemistry of past marine diagenetic environments, but there is still much to be explored in terms of detailed formation pathways. This study explores concretion precipitation mechanisms within the Early Miocene Rincon Shale by using carbonate-associated sulfate (CAS) proxies in conjunction with traditional δ13C analyses. The Rincon Shale is organic-rich and hosts abundant dolomite concretions, making it ideal for this study. Concretion carbonate δ13C values range from –20.2 to +6.7‰, potentially the result of variable mineralization pathways, including methanogenesis. CAS concentrations range from 0 to 646 μmol CAS/mol CO3, and δ34SCAS values range from –11.9 to +28.8‰. The highest δ34SCAS values likely reflect concretion precipitation within sediments experiencing sulfate reduction, whereas the lower values may have resulted from either aqueous sulfide oxidization in the sediments or the unintended oxidation of pyrite during CAS extraction. Acidification experiments indicate significant release of Fe3+ upon the addition of HCl to Rincon samples, which is a known driver of pyrite oxidation. To limit δ34SCAS contamination as a result of pyrite oxidation by Fe3+ during CAS extraction, stannous chloride was added during the acidification step. Extractions with and without stannous chloride did not yield appreciably different □34SCAS compositions, potentially reflective of in situ sulfide oxidation contemporaneous with concretion formation. Significant negative correlation between δ13C and □34SCAS ($P < 0.001$) and positive correlation between TIC contents and □34SCAS ($P < 0.001$) indicate preferential cementation during sulfate reduction that is diminished with increased influence of sulfide oxidation, providing another line of evidence supporting in situ processes. Thus we propose that Rincon concretions formed within sediments exhibiting sulfate reduction, methanogenesis and/or sulfide oxidation. These findings offer additional evidence for the importance of anaerobic biogeochemical processes in promoting carbonate concretion formation in marine sediments.

Masters Thesis

Composing a tectonic history of a mélange, Rattlesnake Creek Terrane, Klamath Mountains, Northern California

By Diana Urda (diurda@fullerton.edu)
Faculty Advisor: Dr. Kathryn Metcalf

The Klamath Mountains region in Northern California contains multiple terranes that have mixed geologic records creating a large-scale story. The Rattlesnake Creek Terrane (RCt) in particular is a mélange of different metamorphosed sedimentary, mafic volcanic-plutonic, and ultramafic rocks with an extensive geologic history that includes tectonism, volcanism, and accretion. The geologic setting in which the RCt initially formed is speculated to be either an endemic or exotic model. An endemic model will show evidence of continental factors playing a part in the formation of the RCt, while an exotic model will display evidence of foreign mafic samples. Field work, sedimentary point counting, and detrital zircon geochronology is explored to explain this speculation of the history of the RCt.

We present new geochronologic and sediment provenance data from metasedimentary and metaigneous blocks in the RCt. Some blocks have significant age populations at approximately 1500 Ma, 1750 Ma, and 2750 Ma, consistent with North American provenance. Other blocks have a single Early or Middle Jurassic age population with a few older ages similar to the first group. These patterns suggest that the RCt incorporated North American-derived material prior to deposition of the overlying Middle Jurassic cover sequence. Maximum depositional ages will provide constraints on the accretion history. Although the blocks are metamorphosed, petrographic point counting can help us understand the protoliths and even their tectonic settings. The ultimate goal of this study is to determine the setting in which the RCT formed to provide more accurate information about the geologic history of the Klamath Mountain Region.

Masters Thesis

A 21,000 Year Hydroclimatic Reconstruction from Big Lake, California.

By Daisy Quiroz (daquiroz@fullerton.edu)
Faculty Advisor: Dr. Matthew Kirby

Understanding the history of California's water is critical to preparing for, and mitigating, future drought, floods, and other climate-related issues. Here, we infer changes in hydroclimate at Big Lake, California, using a multi-proxy approach on near shore to mid lake sediment cores (BigLRC 19-05, 2.03 m length. BigLRC 19-04, 2.62 m length. BigLRC 19-01, 6.6 m length.) Located in the Northern Coast Range of California, Big Lake represents a key site for understanding CA's water history due to its position along the north-south CA precipitation dipole. Analyses in this study include visual description, magnetic susceptibility (MagS), percent water content, total organic matter (%TOM, loss-on-ignition at 500°C), and percent clastics (%Clastics, i.e., residual content), and grain size. Radiocarbon dates (n=16) on discrete organic materials have been run to constrain the timing of hydroclimatic changes. High values of MagS and %clay are interpreted to reflect relative deep water conditions; whereas, high values of %TOM, Msilt, Csilt, VFsand, and Fsand are interpreted to reflect relative shallow water conditions. This inverse relationship between %clay and Msilt, Csilt, VFsand, and Fsand likely reflect changes in sediment-energy dynamics as the lake base level expands (deep lake) and contracts (shallow lake). Initial results indicate a deep, low productivity lake during the Last Glacial Maximum and Heinrich Stadial 1. The lake shoaled (although still deep with low producitivity) at the start of Bolling-Allerod (ca. 14.7 ka) and through the Younger Dryas (YD). By the end of the YD (11.7 ka), the lake started to regress, and productivity increased significantly reaching a lake lowstand between 11.0 and 5.2 ka. A notable highstand interrupts this regression between 10.4-9.4 ka. Lake levels rise slightly beginning at 5.2 through to the modern concomitant with a slight decrease in productivity. Future work will compare our results to various climatic forcings, such as insolation, the Atlantic Meridional Overturning Circulation, North Pacific sea surface temperatures, and El Niño-Southern Oscillation proxies, with the intention to explain, not simply describe, past hydroclimatic change.

Masters Thesis

Characterizing sub-decadal sedimentation within a Southern California coastal wetland over the past century

By Carlos Barron (carlosbarron@csu.fullerton.edu)
Faculty Advisor: Dr. Joe Carlin

Estuaries and coastal wetlands are ecosystems that have increasingly been at risk in recent history due to natural and anthropogenic impacts. These impacts can be made directly to the coastal zone or occur within the watershed. Regardless of where the alterations occur, the impacts are recorded within the sediment records of these coastal environments. Therefore, estuarine sediments can be a valuable archive for natural and anthropogenic alterations within coastal systems. The Tijuana River Estuary (TRE) is a wetland system in Southern California located proximal to the US-Mexico border. Urbanization within the watershed, the majority of which is in Mexico, has increased exponentially over the past several decades resulting in a system that can experience massive, pulsed sedimentation events during wet periods. In this study we looked to characterize changes in sedimentation within the TRE over the past several decades with an emphasis on the impacts of human alterations and natural events. Here we present data from various cores acquired in areas proximal to the active river mouth and areas located adjacent to tidal creeks distal from the river mouth. The data shows an overall peak in sediment accumulation rates in the late 1990s/early 2000s followed by a general decrease in sedimentation rates in the following decades. These peaks in sedimentation coincides with the intense, and relatively frequent El Nino events during the 1980s and 1990, while the decline in rates is consistent with a more quiescent period post-2000. While the amount sediment delivered to the TRE has varied over decadal timescales, changes in sediment characteristics have been more consistent through time, Over the past ~100 years the sediment in the TRE has become consistently finer, and sedimentary organic carbon analyses suggest an increasing input from marine sources (although pulses of higher terrestrial sources are observed during wetter climate periods). Collectively, these data suggest that the TRE has experienced changes in sediment inputs, both in quantity and type, over the past several decades that is likely related to both climate and human alterations to the system. Understanding these changes will be critical to managing these important habitats in the future.

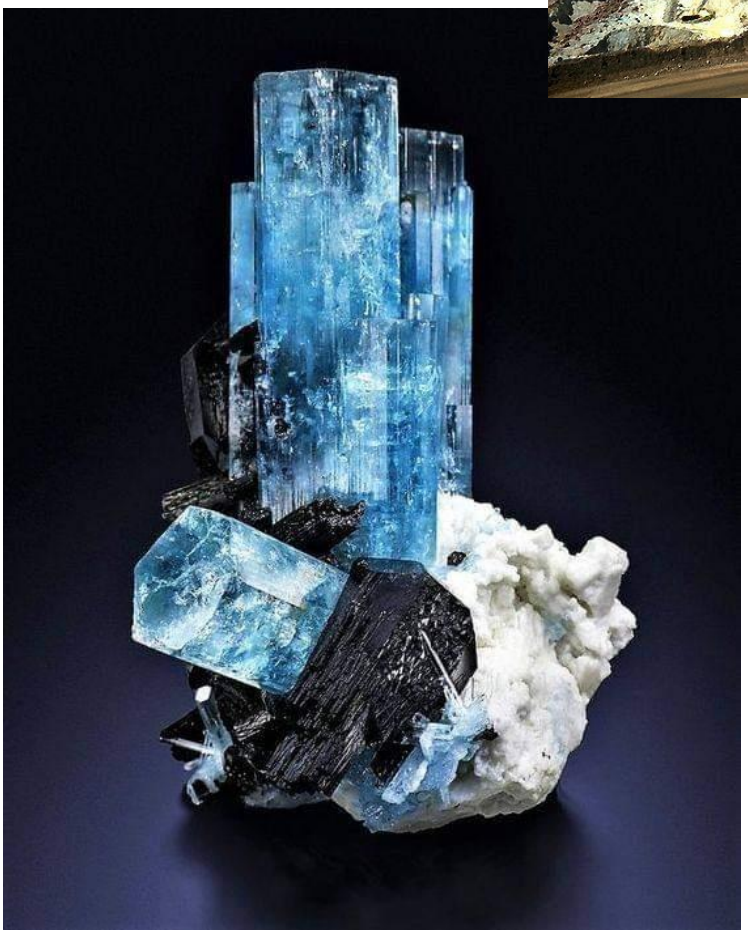
Masters Thesis

Preliminary Data on Seasonal Sedimentation Associated With a Living Shoreline Restoration Project in an Urban Southern California Estuary

By Katya Beener (katyabeener@csu.fullerton.edu)
Faculty Advisor: Dr. Joe Carlin

Estuaries in Southern California are particularly vulnerable to sea level rise as they are constrained by urbanization and/or steep topography which limits upland habitat migration. Therefore, estuarine habitat resilience and sustainability in Southern California are primarily dependent on building elevation capital through increases in sedimentation. To address this issue, resource managers in California are increasingly pursuing living shorelines restoration projects as means to minimize shoreline erosion and promote sediment deposition. In this project, we will present preliminary data characterizing seasonal sedimentation associated with a living shorelines restoration project in Newport Bay, Newport Beach, California. Living shorelines were installed in 2016-2017 at four different locations in the estuary, with three different configurations (oysters only, eelgrass only, and oysters and eelgrass combined) and a control site with no modifications at each location. These preliminary data reflect comprehensive sedimentation monitoring that includes quantifying bimonthly sediment deposition using sediment tiles and characterizing newly deposited sediment properties including sediment texture and composition. Initial results reveal that the combination oyster/eelgrass living shoreline configuration promoted the highest sediment deposition on average. These preliminary results also reveal that sedimentation was higher in the spring months (March-June) than the winter months (January- March). This is unexpected, as the majority of Southern California's precipitation (and runoff) occurs during winter months, although precipitation was negligible (max monthly precipitation was 2.5 cm) and increases in streamflow minimal throughout the study period. This may indicate that sediment supplied to this section of the bay comes from marine sources driven by marine processes rather than fluvial sources. Further characterization of the sediment deposited may help to distinguish these sediment sources. Our goal through this project is to determine whether living shorelines are effective at promoting sedimentation up shore within the estuary and therefore may be a useful management tool to address the potential for intertidal habitat loss due to sea level rise in the region.

Student Research Category



GEOLOGICAL SCIENCES
CSUF

ENST Masters Thesis

Monitoring Water Quality of a Wetland A Case Study in Norco, CA

By Andrew Williams (Awilli6@csu.fullerton.edu)
Faculty Advisor: Dr. W. Richard Laton

Historically, wetlands have been a natural filter for pollutants. Studies from 2001 and the academicyear 2013 show that the project site, a wetland located in Norco Hills, California, has the potentialto successfully remove pollutants. This project aims to identify if the project site has maintained its ability to remove pollutants. Furthermore, this paper will analyze the data collected from 2001to present to see if external factors such as drought and weather events affect a wetland's ability tonaturally filter pollutants. Testing done at the site will include soil samples taken at the water tableas well as hydrologic samples measuring total dissolved soluble (TDS), conductivity (EC), and pH. Modeling GIS will be used to predict the potential runoff vectors. Beyond modeling, drone data and public sourcing were used to analyze vegetation growth over the last decade in addition to potential increased points of urban runoff for the site.

Geology Student Awards

April 2023

Outstanding Graduate Student Award in Geology - Diana Urda

Awarded to a Geology graduate student who demonstrates excellent performance in classes and in their research as evidenced by, but not limited to, publications, presentations, collegiality, and/or leadership in the department. ***Award: $250 plus engraved glass***

Outstanding Graduate Teaching Associate in Geology - Tracy Donelli

Awarded to Geology graduate student teaching associate (TA) who demonstrates outstanding performance based on, but not limited to, Student Opinion Questionnaires, in-class visitations by faculty, teaching, collegiality, and/or mentoring other TAs. ***Award: $250 plus framed award certificate***

Outstanding Major Award – B.S. in Geology - Sadie Durning

Awarded to an upper-division Bachelor of Science Geology major who demonstrates high quality performance in classes, their undergraduate research project, and some type of service to the department, University or community. ***Award: $250 plus engraved glass***

Outstanding Major Award – B.A. in Earth Science Samuel Hippard

Awarded to an upper-division Bachelor of Arts in Earth Science major who demonstrates high quality performance in classes and some type of service to the department, University or community. ***Award: $250 plus engraved glass***

Outstanding Academic Achievement Awards– B.S. in Geology – Edgar Villasano

Awarded to a junior or senior major with an exceptional CSUF GPA. The number of units completed in Geology and the related fields will be factored into the decision. ***Award: $250***

Outstanding Academic Achievement Awards– B.A. in Earth Science – Kristin Shearer

Awarded to a junior or senior major with an exceptional CSUF GPA. The number of units completed in Geology and the related fields will be factored into the decision. ***Award: $250***

Candice L. Jones Outstanding Service Award – Ashleigh Quiroz

Given to the student who has made a significant contribution to the mission, operation and/or wellbeing of the Department community. Examples of service include, but are not limited to, taking a leadership role in Geology Club activities; serving as a TA, tutor, or volunteer in GEOL classes; selflessly assisting others in meeting their educational, research or outreach objectives. Efforts above and beyond any employment or course credit obligations are given greater weight, and a positive attitude is required. ***Award: $250***

Prem K. Saint Hydrology Award - Andrew Williams

Award for Geological Sciences or Environmental Studies (with Environmental Sciences emphasis) major with a GPA of 3.0 or better for the previous academic year. Recipient must show an outstanding academic performance in course work and/or research in Hydrology, Hydrogeology or Water Quality. Award based on the recommendation of the geology full-time faculty. ***Award: $200 and a copy of "Cadillac Desert"***

Searchers Gem and Mineral Society Award – Cory Stratton & Sofia Kabbara (Split)

Established by The Searchers Gem and Mineral Society and awarded to an undergraduate or graduate student who has demonstrated an interest in mineralogy, petrology or science education, with 2.5 or better G.P.A. during the previous academic year, and the recommendation of the faculty. ***Award: $1000***

John D. Cooper Field Camp Award – Caitlin Bates

Annual award to a declared Geological Sciences Major with outstanding performance in GEOL 481A-Geology Field Camp. Selected by field camp instructor with approval of all full-time geology faculty. ***Award: backpack embroidered with Cooper Award/year***

Marilyn A. Brown Award – Maren Jorgensen

Awarded to a graduate student conducting research in the general areas of paleontology or stratigraphy, and having an expressed or demonstrated interest in teaching or educational outreach. ***Award: $200***

Geology Student Scholarship

April 2023

David L. Willoughby Scholarship – Sadie Durning

Given in memory of the late David Willoughby, an alumnus of the department. His family established the award in recognition of David's passion for sedimentary geology and paleontology. This scholarship is open to undergraduate students who are studying geology or paleontology, or who are participating in course-related field- work. Minimum GPA of 2.5 or higher in Geological Sciences at the time the scholarship is awarded. Recipient to be selected by faculty. ***Award: $550***

Dr. Margaret Skillman Woyski Scholarship – Ashleigh Quiroz

Open to a declared geology major with 2.5 GPA or better for the previous academic year. Awarded in even years to a student who has demonstrated excellence in field- work and will be enrolling in summer field camp. The award will be made on the recommendation of the entire full-time faculty of the department. ***Award: $550***

Department of Geological Sciences Alumni Field Camp Scholarship – William Bourbois & Ashleigh Quiroz

Open to declared Geology and Earth Science majors that will be enrolled in GEOL 481A – Field Camp, in the upcoming summer. Awarded to a student who shows financial need, outstanding academic achievement (2.5 GPA or better for the previous academic year), and quality of written statements. This scholarship is given through the generosity the alumni and friends of the Department of Geological Sciences. Recipient to be selected by faculty of the Department of Geological Sciences. ***Amount: $550***

Clemens-Knotts² Scholarship – Ashley Hansen

This scholarship was established by faculty members Diane Clemens-Knott and Jefferey R. Knott. This scholarship is open to undergraduates who will attending the C.S.U. Fullerton field camp or a similar geologic-mapping-focused field camp in the upcoming Summer. Women are encouraged to apply. ***Award: $550***

John D. Cooper Field Camp Scholarship – Sadie Durning

Awarded to a student who shows financial need, outstanding academic achievement (2.5 GPA or better for the previous academic year), and capacity to excel at field camp. Recipient to be selected by faculty of the Department of Geological Sciences. ***Award: $550***

Armstrong Travel Award – Vincent Mugica

This award is established by emeriti faculty members Tish Armstrong and Phillip Armstrong and recognizes their desire to promote undergraduate student attendance at professional meetings. This scholarship is open to undergraduates who wish to attend a professional meeting. Preference will be given to students who are attending a meeting for the first time. Presentation of research at the meeting is not a requirement for this award. ***Award: $500***

Coppel Graduate Award – Caitlin Bates

This scholarship was established by Lynn and Claude Coppel in Fall 1995. Prior to her retirement in 1992, Mrs. Coppel worked for 24 years as the science reference librarian at CSUF. Her husband Claude, was a research supervisor with Chevron Oil Field Research in the production department. Mr. Coppel served in this position for 27 years prior to his retirement in 1992. Chevron Oil Field Research is a matching donor for this scholarship. ***Award: $3000***

Department of Geological Sciences
2023 Alumni of the Year
Sally Bilodeau

About Sally

Sally Bilodeau is a California Professional Geologist (PG). She formerly held additional California licenses for Certified Engineering Geologist (CEG) and Certified Hydrogeologist (CHG), as well as for Certified Environmental Manager in Nevada. She has over 45 years of experience in consulting in the environmental field and specializes in RCRA permitting, assessment, and corrective action. She received her BA in Earth Science from California State College (in those days)-Fullerton and obtained her MS in Applied Earth Science from Stanford University. She has been with AECOM (and ENSR) since 2000 and is presently semi-retired. She originally worked as an engineering geologist assessing geologic hazards associated with land development and later became involved in cleaning up hazardous waste sites as an environmental geologist. She has publications ranging from fault studies in Guatemala to Groundwater Monitoring of US Landfills. For the Cities of the World Series that the Association of Engineering Geologists (AEG) started in 1980, she has co-authored three papers: Geology of Denver, Geology of Boulder, and Geology of Los Angles. She is a past recipient of the AEG best paper of the year awards in 1983 and 1988 for the Denver and Boulder papers. For the Geology of Los Angeles paper she and the co-authors were awarded the 2010 E.B. Burwell, Jr. Award for outstanding contributions to geology by the Geological Society of America (GSA). She is also a Fellow with the GSA.

2022-2023 Geology Donor Wall

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Thank you!
Your generosity will provide aid to CSUF students for decades to come and additionally providing the department with the resources to produce well rounded future geologists.

GEOLOGICAL SCIENCES
CSUFULLERTON

Save the Date

CALIFORNIA STATE UNIVERSITY, FULLERTON

DEPARTMENT OF GEOLOGICAL SCIENCES

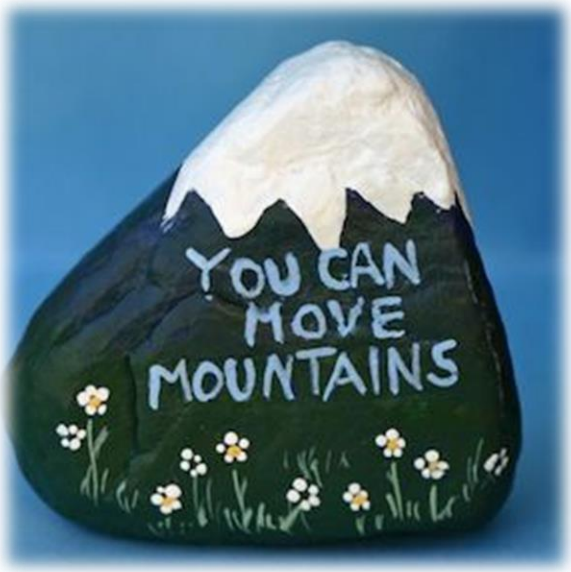
11th Annual Alumni Night Event

Where: Dave & Buster's - Orange, CA

When: October 6, 2023

Time: 6:00 pm

Thanks to all of our Geoscience Students, Faculty, Staff, and Alumni for another successful year!



Special thanks to

the South Coast Geological Society for their support of CSUF students,

and to

the Department Staff and Dr. Richard Laton for making Research Day such a special event!