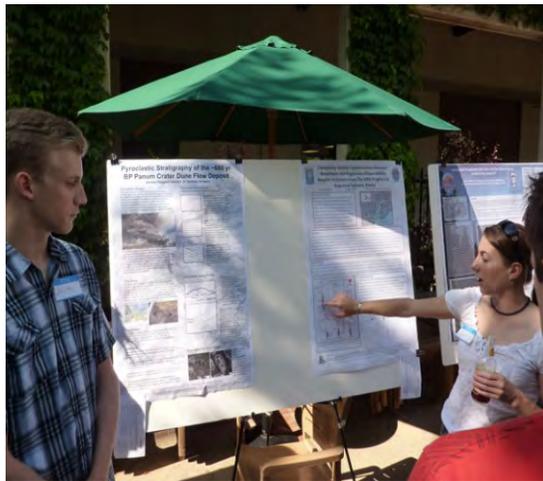
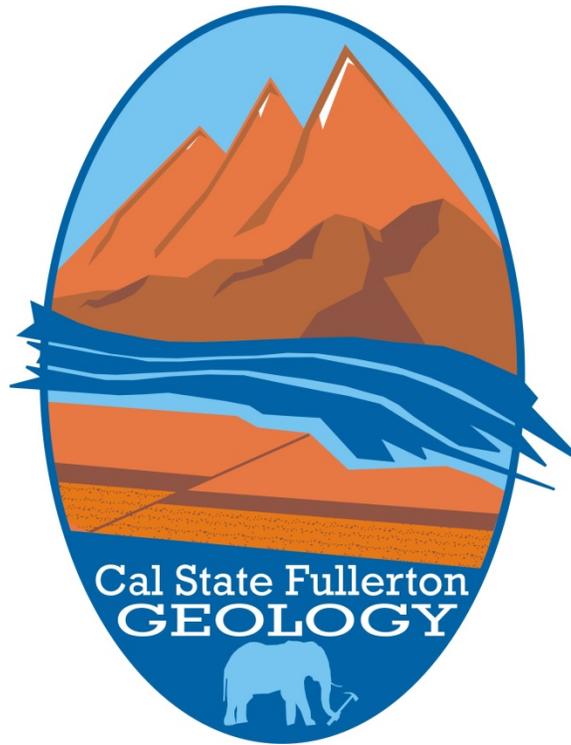




# 2014 Geology Research Day

**Abstract Volume**  
**Department of Geological Sciences**  
**California State University,**  
**Fullerton**  
**Titan Student Union - Garden Café,**  
**April 25, 2014**





*The Department of Geological Sciences at California State University, Fullerton is an interdisciplinary education and research community whose members are active mentors and role-models. Our mission is to provide a student-centered educational and research experience that emphasizes critical thinking, communication, and scientific citizenship.*

*'Research Day' is an extension of this mission, where students are afforded the opportunity to share their research findings and scientific experiences with faculty, student peers, friends, family, and members of the professional geological community in an informal and supportive environment. Thank you for participating in this year's event!*

5<sup>th</sup> Annual Geology Research Day  
~ California State University, Fullerton ~  
Department of Geological Sciences  
*Titan Student Union Garden Café*  
April 25, 2014

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# *Undergraduate Proposal Category*



*Using Ostracods in Silver Lake, California to Reconstruct Past Hydrologic Variability*

Student: Andrea Arevalo

Faculty Advisor: Dr. Matthew E. Kirby

**Abstract**

Within the Holocene, Silver Lake has undergone dramatic hydrologic changes reflecting regional climate variation of the Mojave Desert. (M.E. Kirby et al, 2002). Ostracods, serving as the proxy in this paper, deliver these relationships during this time allowing for paleohydrologic reconstruction. Data suggests a gradual trend of times of colder and wetter climate to warmer and drier climate. Conditions became unfavorable for ostracod growth as Silver Lake transitioned from an ephemeral lake to its present day state, a playa lake. This regions weather is greatly influenced by Pacific Ocean interactions, introducing pluvial events due to atmospheric river storms, which ultimately change the typical conditions at which lakes can be maintained. Such events promote wetter winters, allowing for longer high lake level standings (M.E. Kirby et al, 2002). Ostracod data was plotted comparatively over interglacial and glacial periods of the Holocene. Our data displays synchronized changes, recording events such as the Younger Dryas. Understanding the relationships between climate and hydrologic responses allows for proper accommodating for deficiencies in our water budget of Southern California.

*Drilling Methodology and Field Guide and Its Use for the Drilling Industry*

Student: Nancy Ibarra

Faculty Advisor: Dr. Richard Laton

**Abstract**

Water is an essential part of life and with the increasing population the need for clean potable water is increasing at a greater rate. Drilling is a necessary component in the extraction of water and this makes it an essential element of our society. There are various methods of drilling and their use is dependent on many factors such as geology and cost limits. For experienced and non-experienced drillers alike choosing a method can be time-consuming and difficult. This undergraduate thesis consists of making a website compatible to the needs of the drilling industry. The information gathered will be defined thoroughly and categorized by method within a website and should make an adequate field guide for drillers, geologists, and engineers. The website can be browsed and the guest can evaluate which method is the best choice for their project. The content is being gathered from lectures given in advanced hydrogeology courses, books, drilling company contributions, and Dr. Richard Laton's experience. This data can be easily accessible without the need of a textbook. The website will list drilling methods, their advantages, disadvantages, and the development of well installation as well as other related topics. It will also discuss tools and techniques related with well development such as casing, pipes, bits and well installation. This website can be a tool that contributes to improving the drilling industry, a necessary component of our water industry.

*Correlation of Last Chance Range Basalts in Death Valley, California, by X-ray Fluorescence Spectroscopy (XRF)*

Student: Jacob Kato

Faculty Advisor: Dr. Jeffrey Knott

**Abstract**

The Last Chance Range is located in the Northern part of the Death Valley region. Evidence using basaltic flows has shown that there is a fluvial correlation between Owens Valley and Death Valley. These basaltic flows are found within valleys and on the peaks of the Inyo and Last Chance Ranges. Gravity would dictate in the past, these basaltic flows would have traveled down river channels. To determine the flow, samples of basalt will be taken from the Last Chance Range. Samples will be made into a powder and then analyzed for major trace elements using an X-ray Fluorescence Spectrometer (XRF). Geochemical data will then be compared with other basaltic flow data to analyze the topography of the fluvial environment during the Pliocene in Death Valley and Owens Valley.

# *Undergraduate Thesis Category*



*Assessing a Late Triassic Fossil Sponge Reef Mound to Further Understand the Shift from Paleozoic Fauna to Modern Fauna*

Student: Mihai Agiu

Faculty Advisor: Dr. Nicole Bonuso

**Abstract**

This study will examine a fossil sponge reef mound recently located in New Pass Range, Central Nevada, in order to document reef dynamics for further understanding of how reefs became modernized. The reappearance of reefs in an ecosystem often serves as a marker for the end of recovery. After the end-Permian mass extinction (approximately 252 million years ago), in which about 96 percent of all marine species perished, secondary reef-building organisms, such as sponges, recovered initially as the primary reef-builders. Marine organisms from the past died out and new, more modern organisms took their place. The sponge reefs are intermediate between the "Paleozoic" fauna prior to mass extinction, and "modern" fauna. Understanding past extinctions and recoveries is significant because of current issues with global climate change and marine ecosystem degradation. Such information can be used in comparison with modern crises to help predict possible outcomes, and contribute to conservation initiatives to avoid large-scale changes in modern marine communities. Research methods include both field and laboratory procedures: A ten meter high by ten meter long reef mound comprised of limestone, was documented by using a systematic gridrock sampling scheme. Rock samples were collected from locations where the grid lines intersect: approximately 25 samples. Rock thin-sections will then be produced to examine and document the fossils within the rocks. The efforts of understanding the shift from "Paleozoic" fauna to "modern" fauna will provide insight on marine ecosystem recovery.

*New Specimens of Leatherback Sea Turtles (Dermochelyidae) from the Miocene of Orange County Shed Light on Morphological Trends*

Student: Katrina Awalt

Faculty Advisor: Dr. James Parham

**Abstract**

The Miocene is a key time in the evolutionary history of leatherback sea turtles, because it marks the last appearance of archaic thick-shelled forms (*Psephophorus* spp.). Current knowledge about Miocene dermochelyids is limited, and mainly based on specimens from Europe and the eastern USA. Recent studies have raised questions about the taxonomic diversity and biogeographic distribution of Miocene dermochelyids, and so the description of new specimens from this time, especially from new areas, is key. Although dermochelyid fossils are known from a few Miocene sites in California, the only published record is a single femur that was mentioned over 75 years ago (and misidentified as a cheloniid). Many important specimens from California have been unstudied in museum collections. Over the past decade, paleontological mitigation at three sites in Orange County resulted in the collection of new, relatively complete dermochelyid specimens, in combination with more fragmentary specimens from other California sites, provide new data on the diversity, distribution, and morphology of dermochelyids in the eastern Pacific. We compare the morphology and stratigraphic position of these specimens to other Miocene dermochelyids in order to refine the temporal and geographic patterns associated with this important time in the evolutionary history of leatherbacks. The data show that the transition from archaic thick-shelled forms to the more thin-shelled forms includes intermediate morphotypes that appear sequentially within the Miocene marine formations of California.

*Paleoecology and Shallow Marine Taphonomy of a Late Pleistocene Whale Fall Habitat on the Southern California Coast*

Student: Lorainne Benton

Faculty Advisor: Dr. Nicole Bonuso

**Abstract**

The primary objective of this study is the identification of a boring bivalve species preserved in a Pleistocene period shallow marine whale fall found in Southern California and currently housed at the John D. Cooper Paleontological and Archaeological Curation Center. The broader evaluation of the whale fall serves as a means of reconstructing the paleoecology of the California coast, which assists in reconstructing the geologic history of this area. The analysis of whale falls and the communities that form as a result of whale taphonomy is intricately related to exploring the oceans of the past as a whole. There are three distinct stages of taphonomy for whale falls: a scavenger stage, an enrichment stage, and a sulphophilic stage. The whale jawbone that is the subject of this project bears trace fossils and two specimens of boring bivalves, which suggests that the whale fall was buried during the second stage of taphonomy. Identification of the bivalve species will be based upon the detailed collection of shape, width, depth, and location data. This data will be compared to the morphology of taxa known to have inhabited this region in order to confirm identification. Preliminary analysis suggests that the trace fossils were created by members of the genus *Petricola*. Three potential species are known to have been active during the Pleistocene in Southern California, which may account for the trace fossils: *Petricola californiensis*, *Petricola gracilis parabella*, and *Petricola tellimyalis*. The identification of the invertebrates that inhabited this particular whale fall will assist in the reconstruction of the shallow marine habitat during this period of time. In addition, comparing fossil whale fall communities with modern ones is a significant tool for understanding morphological and population changes in invertebrate species as well as the whales themselves. This can also allow for a clearer representation of the distribution of various species by contrasting the types of whales and invertebrates found at different whale falls throughout the world.

*Geochemical Correlation of Basalts in Northern Deep Springs Valley, California, by X-Ray Fluorescence Spectroscopy (XRF)*

Student: Aaron Justin Case

Faculty Advisor: Dr. Jeffrey Knott

**Abstract**

In northern Deep Springs Valley (DSV), between Owens Valley and Death Valley, California, Miocene-Pliocene-age, olivine basalts lie on the valley floor and atop the adjacent White/Inyo Mountains to the west and the Deep Springs Range to the east. Previous geologic mapping shows the DSV basalt flows and the Last Chance Range (LCR) basalts found to the southeast are the same geologic unit with a source in the White/Inyo Mountains. The basalts in northern DSV are offset ~400 m by the Deep Springs fault and have a K/Ar age of 10.8 Ma.

To determine if the olivine basalts found in the region are all from the same source, four samples were collected in a linear pattern from west to east across northern DSV. The samples were powdered and analyzed for major and trace element composition by X-Ray Fluorescence spectrometer (XRF).

Trace-element plots (e.g., Ba, Nb, Zr, Y, Ce, etc.) show that the DSV basalts are similar and are likely from the same source; however, the composition of the DSV basalts are distinct from the LCR basalts. I interpret this data by presenting the DSV and LCR basalts have different sources and should not be mapped as the same geologic unit. The likely source of the DSV basalts is in the White/Inyo Range. The geochemical correlation shows that the DSV basalts flowed NW to SE in a paleochannel 10.8 Ma and that DSV did not exist at that time.

*Paleotsunami Research with Possible Evidence of Subsidence at the Seal Beach Wetlands, Seal Beach, CA*

Student: D'Lisa O'hara Creager  
Faculty Advisor: Dr. Brady Rhodes

**Abstract**

The Seal Beach Marsh is located inside the Seal Beach Naval Weapons Station in north Orange County, CA. The wetland formed as a result of flooding and infilling of topographic lowlands during early Holocene sea-level rise. The Seal Beach marsh may contain a record of prehistoric tsunami and other paleoseismic data because the marsh is a low-energy depositional environment and historic anthropogenic disturbance is limited. To test if the marsh has a record of tsunami, sixteen reconnaissance gouge cores between 150 and 240 cm in length were collected and described in the field. The reconnaissance cores showed peaty organic layers interbedded with mud and sand. To investigate the stratigraphy at greater depths, a 377-cm vibracore was collected. Preliminary analyses of the vibracore show the top 15 cm is modern marsh. From 15 to 107 cm below land surface (bls), peaty mud and mud of varying thicknesses are interbedded. At 118 cm bls, a 10-cm thick sand layer covers mud at a sharp irregular contact. A 10-cm sand layer with an irregular basal contact at 137-cm bls covers peaty mud that consists of 50% organic matter. Peaty mud transitions to mud at 140 cm bls. Alternating mud and muddy sand layers of varying thickness continue to 246 cm bls. At 250 cm bls, a 2-cm thick mud layer caps a muddy peat layer. Mud at 270 cm bls extends down until a sharp irregular contact is made with a sand layer at 356 cm. A 21-cm thick sand layer marks the base of sediment recovery in the vibracore. The core was analyzed for loss on ignition (LOI) at 550°C (% total organic matter) and 950°C (% total carbonate) as well as magnetic susceptibility (CHI) at 1-cm intervals. These analyses confirm the existence of several organic-rich zones alternating with organic-poor mud. Our working hypothesis is that these peaty layers represent repeated subsidence of the marsh, perhaps related to seismic activity on the Newport-Inglewood Fault zone.

*Possible Shell-Hash Tsunami Deposit at the Los Penasquitos Marsh, San Diego County, CA*

Student: Jeremy Cordova

Faculty Advisor: Dr. Brady Rhodes

**Abstract**

The Los Penasquitos Marsh is one of a series of coastal wetlands between San Diego and Orange County that formed within stream valleys that flooded and filled with sediment during Holocene sea-level rise. In order to test the hypothesis that these wetlands contain prehistoric tsunami deposits, within the normal wetland sediments, 21 reconnaissance cores between 48 and 321cm in length were collected and described in the field. Nearly all the sediment cores contained a peaty layer in the top 5-25cm, underlain by dark brown and black mud, above interbedded fine-medium gray sand and mud. The stratigraphy in the cores is consistent with the complete infilling of a lagoon behind a baymouth bar of sand, a 'drowned river valley'. Five of the cores taken, ranging from 1.0-1.5 km inland from the present day beach, intersect a distinctive 0.5 – 12.0 cm-thick shell-hash and muddy sand layer between 233 and 280cm depth.

Based on this discovery we collected a 285cm long 5cm diameter piston core to further analyze this possible tsunami deposit. In this larger core the 10 cm-thick shell hash layer consists of angular shell fragments up to 3cm in size, in a muddy sand matrix that includes the following genera: *Mitrella*, *Venus*, *Spirotropis*, *Pecten*, *Nassarius*, *Macoma*, and an unidentified oyster. This fossil assemblage suggests a quiet water marine source for the shell hash debris— from the lagoon and/or offshore, not typical of low energy fine grained comparatively well sorted wetland sediments. The core was analyzed for loss on ignition (LOI) at both 550° and 950°C and magnetic susceptibility (ms). The LOI550 data are unremarkable, and the LOI950 data show an expected spike in mass percent of carbonates within the shell-hash layer. The ms data show low values for the lagoonal muds and sands, but a pronounced spike within the shell hash layer, where the average reading more than doubles from 2.0 to 4.6. We hypothesize that the anomalously high ms value for the shell hash layer indicates a substantial component from an offshore source, where heavier magnetic minerals accumulated seaward of the baymouth bar, but were subsequently swept back upland into the lagoon. If correct this layer represents a large-wave event, either storm or tsunami. Three C-14 dates on shell fragments cluster between 1380-1420 yrs BP, making this the highest energy event along California's coastline in almost 1500 years.

*Wetlands Delineation Using Dendrochronology and Historical Rainfall Data to Crossdate the Climatic Stress Regimes in the Prado Dam Basin Located in Corona, Riverside County, California*

Student: Lucy Cortez

Faculty Advisor: Dr. Richard Laton

**Abstract**

In order to better understand the hydrogeology regimes in the Prado Dam Wetlands Basin located in Corona, California, dendrochronology methods along with historical rainfall data are being used to crossdate climatic stress conditions. Prado Dam consists of a series of wetlands that received inflow from storm water flows and natural run-offs throughout the year. Prado Dam currently feed the Santa Ana watershed and is the key component for the surviving ecosystem that houses endangered species (OCWD, 2013). Dendrochronology is the study of annual-rings-width variations in trees ring to determine past climatic events (Balouet et al. 2009). The black willow (*Salix Nigra*) species is native to Prado Dam and predominantly encompasses the wetland area. For this study the black willow will be the primary species of interest. Black willow tree ring patterns will be cross-dated with local historical rainfall data to recreate hydrogeologic and climatic stress conditions. Because trees respond differently to environmental and climatic conditions, the varying ring patterns in tree cores, narrow and wide, result from growth in varying climatic conditions. Therefore, trees growing in similar environmental conditions will record the similar environmental conditions (Phipps, 1985). Further research is expected to support the varying tree ring width growth patterns with local climatic stressors.

*Dip of the Sierra Nevada Frontal Fault zone in the Vicinity of Lone Pine, California: Steep or Shallow?*

Student: Brian Gadbois

Faculty Advisor: Dr. Phil Armstrong

**Abstract**

The Sierra Nevada Frontal Fault Zone (SNFFZ) includes a series of east-dipping normal faults located at the eastern front of the Sierra Nevada Mountains. According to Byerlee's law, optimal dip for normal faults is  $60^{\circ}$ - $70^{\circ}$ ; therefore, it generally is assumed that SNFFZ normal faults also dip  $\sim 60^{\circ}$ . Estimates of late Pleistocene to Holocene horizontal extension rates are 0.2-0.3 mm/yr, but these estimates are based on a  $60^{\circ}$  dipping fault system. Recent studies near Bishop show that many faults of the SNFFZ dip  $29^{\circ}$ - $46^{\circ}$ . If these shallow dips are correct, then long-term horizontal extension rates based on  $60^{\circ}$  dips should be recalculated because the horizontal component of slip could increase as much as four-fold. This study focuses on faults of the SNFFZ exposed at Tuttle Creek in the vicinity of Lone Pine. Reconnaissance mapping and fault evaluation suggest that exposed bedrock faults, faults cutting Quaternary alluvial surfaces, and fracture systems dip as low as  $29^{\circ}$  E. New data collected using detailed differential GPS measurements across  $\sim 300$  m of elevation change, from which 3-D fault orientations will be evaluated, will help constrain the SNFFZ orientation further.

## *Searching for a Paleotsunami Record at Seal Beach, Southern California*

Student: Dylan Garcia

Faculty Advisor: Dr. Matthew Kirby

### **Abstract**

A 344cm sediment core extracted from the subsurface of the intertidal salt marsh at Seal Beach, Orange County, southern California was examined to determine if there is any evidence for past tsunamis. As many as 20 tsunamis have breached the coast of California within the past two centuries, but none have been reported since 1800 (Eisner et al., 2001). One of the earliest is thought to be the Santa Barbara, southern California tsunami of 1812, which damaged over 60km of Santa Barbara's coast (Topozada et al., 1981; Lander et al., 1993). Today, the coast is heavily developed and populated thus making tsunami research important. High energy material transportation is usually propagated by tsunamis or storms capable of carrying fairly large ( $\leq 0.5$  m diameter) shells, coral, and sand in low energy environments such as swamps, mangroves, and marshes (Nanayama et al., 2000; Goff and McFadgen, 2004; Tuttle et al., 2004; Morton et al., 2007). Multi-proxy methods were used to describe the core including: descriptive analysis, magnetic susceptibility (CHI), and loss on ignition (LOI) at 550°C (% total organic matter) and 950°C (% total carbonate). The stratigraphic record preserved in the subsurface sediments of this coastal wetland does not show definitive evidence of rapid debris transport. We see none of the indicators that characterize a tsunami deposit. Alternating sand and mud layers were identified both visually and through magnetic susceptibility. These sand layers do not necessarily indicate tsunamis, but perhaps a dynamic environment of materials washing into Seal Beach. High CHI values (above  $5 \times 10^{-7}$  m<sup>3</sup>kg<sup>-1</sup>) represent a sandy or muddy magnetite-rich environment from a terrestrial source, such as a beach, stream flow, or flooding. An unusual sand intrusion feature (Unit I) between 202cm-215cm depth was recovered. Unit I is an interface of mud and sand, with softer overlying sediment surrounding a denser sand injection. It closely represents that of a sand or clastic dike intrusion, which are associated with paleoearthquakes, and thus paleoliquefaction features (Obermeier 1987). Seal Beach has a record of past liquefaction as noted by Barrows following the Long Beach earthquake of 1933 (Barrows, 1974). Seal Beach lies above an active right-lateral strike-slip fault known as the Newport-Inglewood fault zone (NIFZ) (Vedder, 1975; Wright, 1991; Grant et al., 1999). This type of soft sediment deformation structure is not uncommon in an active fault zone where liquefaction is prevalent.

*Geochemical analysis of Dome 7403 to determine magma depth and its relationship to the Bishop Tuff and “Early” Rhyolites, Long Valley Caldera, Sierra Nevada, California*

Student: Matthew Hutchinson

Faculty Advisor: Dr. Brandon Browne

**Abstract**

The cataclysmic eruption of the Bishop Tuff from the Long Valley Caldera 760ka, released ~600 km<sup>3</sup> of rhyolitic magma over one week’s time. This event was followed by a 100,000 year period where ~100 km<sup>3</sup> of fairly uniform, crystal-poor rhyolite erupted from within the caldera, known as the Early Rhyolite (Hildreth, 2004). A sub-circular lava dome located on the NE corner of the Long Valley Caldera floor formed as a result of continued magmatism in the area. The 0.005 km<sup>3</sup> volume dome is unique in that it is the only non-rhyolitic postcaldera eruptive product produced, differing from other volcanic byproducts associated with precaldern, caldera-forming (e.g. Bishop Tuff), and other postcaldera eruptions (e.g. “Early” Rhyolites). Dome 7403 is a small rhyodacite dome with an intermediate composition consisting of euhedral plagioclase and hornblende phenocrysts. The glassy, columnar dome with two lobes suggests that it erupted into and was shaped by an intracaldern lake during the Pleistocene. Whole-rock geochemical analysis of Dome 7403, using x-ray diffraction, shows a lower silica content (66.4% SiO<sub>2</sub>) versus “Early” Rhyolites (75% SiO<sub>2</sub>) and Bishop Tuff (73-78% SiO<sub>2</sub>). Temperature and pressures of storage depths that formed Dome 7403 crystals were calculated using compositional analysis from electron microprobe data and Ridolfi’s calculator to integrate mineral compositions (wt. %) in order to obtain an Al# and specific amphibole type (magnesian-hornblende). Temperatures for sample 13LVMH-3 (north lobe) ranged from 880 – 970°C with pressures ranging from 200 – 400 MPa (~7-16 km). Sample 13LVMH-4 (south lobe) had similar temperature ranges ( $\pm 20^{\circ}\text{C}$ ), but had higher pressures ranging from 250 – 450 MPa. The dome was likely a result of another separate and discrete mafic pulse injected upwards from the upper mantle heating up previous silicic magma. Zoned plagioclase with anorthite rims compared to albitic cores and reaction rims on hornblendes indicate magma mixing before eruptive event. Thin reaction rims on hornblende crystals correspond to a rapid ascent (less than a week). Rates of ascent must be near a maximum rate for the lava Dome 7403 to be present (effusive eruption), otherwise any quicker, the eruption would have been explosive.

*Geology of a Tertiary Intermontane Basin of the Last Chance Range, NW Death Valley National Park, California*

Student: Christopher Johnson

Faculty Advisor: Dr. Jeffrey Knott

**Abstract**

A hypothesized Pliocene fluvial connection between Owens Valley and Death Valley that predates the course of the Pleistocene Owens River would provide a migration pathway for aquatic and other species. The mapped Tertiary sediments and basalt flows hold one key to developing an accurate model of the paleo-river during this time. Previous mapping of the Tertiary sediments and flows was limited to spatial distribution with limited description of the deposits themselves.

In the central Last Chance Range is ~4 km<sup>2</sup> of Tertiary sediments and basalt flows. The Tertiary deposits are along a N-S trending canyon that is underlain primarily by tilted Cambrian-age carbonates of the Bonanza King and Nopah Formations. To better understand the source and nature of these rocks, I constructed a ~1:12,000 geologic map, described the sediments and collected two basalt samples. The basalt was powdered and analyzed by X-Ray fluorescence to determine its geochemical composition.

In the north, the base of the Tertiary sediments consist of coarse, well-cemented landslide debris composed of Bonanza King and Nopah clasts. In the south, the basal unit is debris flow deposits of quartzite boulders. Overlying these coarse deposits are yellow, tan and gray sandstone and breccia with a basalt flow near the top of the section. The Tertiary deposits are capped by a second basalt flow. The beds are folded into a N-S trending syncline. The composition of the basalt is similar to basalts found 3 km to the north in the Last Chance Range.

The quartzite debris flows are enigmatic. Clast imbrications within the debris flows indicate NW-SE flow. The closest outcrop of quartzite to the NW is the Cambrian Zabriskie Quartzite (>2 km) and outside the present drainage basin. No outcrops of quartzite are mapped to the north, east or south. The correlation of basalt flows between basins in the Last Chance Range combined with the exotic quartzite clasts suggest that these now isolated deposits were once part of a larger intermontane basin that extended to the N and NW. The N-S trending fold suggests E-W-oriented compressive stresses post-Pliocene.

The advisor for this undergraduate research project was Dr. Jeffrey Knott (CSUF). Dr. Jade-Star Lackey (Pomona College) provided XRF facilities. Financial support provided by a grant from CSUF Associated Students, Inc. and a CSUF Incentive Grant (to Knott).

*Understanding the Orientation of the Sierra Nevada Frontal Fault System in the Vicinity of Lone Pine and Independence, CA*

Student: Garrett Mottle

Faculty Advisor: Dr. Phil Armstrong

**Abstract**

The Sierra Nevada Frontal Fault System (SNFFS) includes a series of east-dipping normal faults along the eastern front of the Sierra Nevada Mountains in eastern California. Faults there are assumed to dip  $\sim 60^\circ$  east. Late Pleistocene to Holocene horizontal extension rates based on this  $\sim 60^\circ$  dipping fault system are estimated to be 0.2-0.3 mm/yr. Recent studies on the SNFFS near Bishop, CA show that the faults there dip more shallowly at  $29^\circ$ - $46^\circ$  east. Another recent study near Independence, CA shows that faults there dip  $29^\circ$ - $34^\circ$  east. My study was conducted farther south on normal fault exposures near Manzanar National Historic Site, CA. Sixty data points were collected along the bottom cusp of fault exposures in offset Quaternary surfaces. Elevations range from  $\sim 1780$  m to  $\sim 1890$  m over the  $\sim 2000$  m of fault exposure. An Excel program was used to model the fault dip assuming a planar fault, and these data resulted in a  $21^\circ$ - $23^\circ$  east dip. Due to this low-angle normal fault geometry, horizontal extension rates based on a steeply dipping normal fault system need to be re-evaluated, as extension rates could be increased by as much as a factor of four.

*Debris Flow Deposits On Starvation Canyon Alluvial Fan, Death Valley, California*

Student: Kelly Shaw

Faculty Advisor: Dr. Jeffrey Knott

**Abstract**

Three debris fan lobes with volumes of 8-25 million cubic yards were mapped on the Starvation Canyon alluvial fan in western Death Valley, California. These deposits were mapped atop the ~70 ka Qg2 alluvial fan indicating that the debris flows are younger. Starvation Canyon consists of Tertiary volcanic rocks at the mouth with faulted Cambrian and Precambrian metamorphic rocks upstream to the west with the Granite at Hanaupah Canyon is 8.6 km upstream of the piedmont in the headwaters.

Field observations show that the northern lobe of the Qg2 deposits of the Starvation Canyon fan consist of grusified granite boulders at the surface. The debris flow deposits, which generally line a wash channel, are composed of 1-6 m diameter, varnished, but relatively unweathered, granite boulders with rare metamorphic boulders (<2%). The wash channel is incised through the Qg2 deposits with debris flow boulders overtopping the channel margins and resting atop the Qg2 deposits at the distal end. The southern lobe of the Starvation Canyon fan is composed of Qg3 gravels with an intervening active channel (Qg4). Both the younger and active channels are lined with large granite boulders (up to ~9 m diameter) that are unweathered and have very little, if any, varnish.

Based on the field observations, the conclusion that younger, unweathered granite boulders from debris flows are found atop the Qg2 gravel is correct. However, field observations are that the debris flow boulders are limited to the channel and channel margins. This infers that these deposits traveled along the incised channels and did not overtop the Qg2 gravels, aside from the area at the distal end of the fan. Thus, the flow volumes were of significantly lower volume than previously thought and, based on the dominance (>98%) and size (up to ~9 m) of granite boulders these flows would have traveled ~16 km before being deposited on the Starvation Canyon fan, with the origination point >8 km from the apex of the fan. The lack of continuity of these debris flows indicates emplacement by multiple events rather than one large event. This is based on the differences in weathering of the boulders as well as the disconnected nature of the debris flow deposits. The active channel (Qg4) is comprised of similar debris flow deposits as are found in the older channels.

*Reconstruction of Hydrologic Changes During the Last 96,000 Years Using Sediments from Baldwin Lake, San Bernardino County, California*

Student: Emily Silveira

Faculty Advisor: Dr. Matthew Kirby

**Abstract**

A multi-proxy analysis of a new sediment core from Baldwin Lake, an alpine-playa lake in the San Bernardino Mountains, has allowed study of the hydrologic changes within the lake during the last 96,000 years. Water resources in southern California are an exceptionally important area of study, as the highly populated region consistently experiences droughts and water shortages. Glacial-age terrestrial paleoclimatology records are sparse in the coastal southwestern United States, and records extending into the Last Interglacial were essentially nonexistent. In order to properly address possible changes in future water availability, it is essential to understand the natural climatic variability of southern California. The reconstruction of hydrologic variability was conducted using the following analyses: magnetic susceptibility, LOI 550°C, LOI 950°C, and grain size analysis. This study pays special attention to the results of grain size analysis. Radiocarbon and OSL dating (provided by UCLA) serve as the age control. The results unveiled changes in the hydrologic system of Baldwin Lake which can be related to climate, as well as lake ontogeny.

*Petrographic and geochemical analysis of the Summit Gabbro and associated granitoids of the Kern Plateau, Southern Sierra Nevada, California*

Student: Elizabeth White

Advisor: Dr. Diane Clemens-Knott

**Abstract**

The Sierra Nevada Batholith (SNB) formed from multiple arc magmatism events that occurred as a result of the collision between the North American and Farallon plates during the Mesozoic Era, 251-65 million years ago. Arc batholiths, such as the SNB, are important to understand because they record episodes of continental crustal growth. Calculating the amount of material, in this case magma, transferred from the mantle to the crust is dependent on the composition of the mantle wedge located beneath the continent. The amount of chemical evolution that was experienced by a magma can be quantified using the magnesium number (Mg#), which includes mafic, plutonic rocks called gabbros. Geochemical characterization of the Summit Gabbro suite from the Kern Plateau provides valuable evidence supporting that this suite may be used for future studies. Using x-ray fluorescence (XRF) samples Fr-119A, Fr-119B, and Fr-120C were identified with high Mg#'s of 76.32, 74.33, and 69.32 respectively. These numbers usually indicate that these magmas have not experienced much differentiation. Petrographic analysis, however, revealed that Fr-119A and Fr-119B have undergone secondary alteration after crystallization, making them unsuitable for mantle composition studies. Samples Fr-121B and Fr-123A had Mg#'s of 63.14 and 64.02 respectively, and while they are not mafic enough to be utilized as proxies for the mantle composition they may be associated with unidentified rocks that are appropriate. Sample Fr-120C has experienced a minimal amount of chemical-evolution and represents a proxy for the composition of the mantle source below the batholith. Data analysis of the sodium concentration versus Mg# also seems to suggest that two distinct magma populations were identified. Sodium concentration may be affected by amphibole crystallization. This new data set from the Summit Gabbro suite provides insight about the type of mantle underlying the eastern Sierra Nevada arc and is one of the first steps to determining how the western margin of the North American continent was modified and expanded by Mesozoic arc magmatism.

## *Graduate Proposal Category*



*A Paleocological Study of the Middle and Late Triassic within Favret Canyon, West-Central Nevada*

Student: Edween Hernandez

Faculty Advisor: Dr. Nicole Bonuso

**Abstract**

Paleozoic shallow marine communities hardly resemble present shallow marine communities. Modern animals such as gastropods and bivalves replaced Paleozoic organisms such as brachiopods and crinoids. Researchers suggest the end-Permian mass extinction reset the stage by removing past communities, thus allowing new communities to take over. However, this transition did not occur immediately after the mass extinction. Once ocean conditions returned to normal in the Middle Triassic, communities stabilized and took on their new shape. Bivalves increased in diversity and abundance by growing thicker shells and some began burrowing deep into sediment. Gastropods also increased in diversity and abundance and grew thicker shells, while some developed new drilling adaptations and became carnivorous. Researchers suggest that changes in shell thickness and deeper burrowing adaptation occurred as a competitive arms race between newly evolved predators (eg: marine reptiles and crabs). Scientists describe these changes in life habit as the Mesozoic Marine Revolution while suggesting that the initiation of this revolution took place in the Middle and Late Triassic. However, we lack data from the Eastern Panthalassa region (ie. present day Western North America). My research will provide new paleoecological data to help piece together the story of how shallow marine communities modernized. The main goal of this project is to track and document taxonomic and ecologic patterns within an environmental context through time. Once I document faunal and environmental patterns, I plan on comparing them to determine causal mechanisms for the observed pattern.

## *X-Ray Diffraction Analysis on Phayao Lake Sediments*

Student: Christine Hiner

Faculty Advisor: Dr. Brady Rhodes

### **Abstract**

The Indochina region, consisting of Myanmar, Thailand, Laos, Cambodia, and Vietnam, currently lacks high-resolution, continuous paleoclimate records. A continuous record from mainland Southeast Asia is essential in order to better understand past climate variability within this region and predict future changes. Therefore, a new sediment core was extracted from Phayao Lake in northern Thailand, approximately 695 km north of Bangkok. A multi-proxy methodology was utilized including loss on ignition and X-ray Diffraction (XRD). For XRD, a series of four samples were dried, powdered, and analyzed to assess variations in clay content throughout the core. The results indicate all four samples contained kaolinite, illite, and chlorite. The presence of these three clays serves as a useful proxy for different climate regimes. While the presence of illite and chlorite suggest a cold, dry climate, the presence of kaolinite indicates a wet, humid climate. The conflicting results highlight the need for quantitative measurements of each type of clay. A comparison of the different clay percentages in a future project would grant the opportunity to better infer the dominant climate signal at Phayao Lake. Furthermore, an undergraduate student from Chiang Mai University completed the loss on ignition component of the project. However, the loss on ignition data is used to reconstruct regional paleoclimate variability in a separate project.

*Ten Million Years of Bird History: a Specimen-Based Approach to Reconstructing the Late Neogene Avifauna of California*

Student: Peter Kloess

Faculty Advisor: Dr. James Parham

**Abstract**

California boasts a rich fossil record of Miocene seabirds. Previous studies, based entirely on data from the literature, have correlated the appearance and disappearance of species to tectonism and climate change. We are using a specimen-based approach to test and refine diversity patterns derived from the literature, and describe patterns of relative abundance and occurrence of seabirds through time. The foundation of our research is a previously unstudied collection of >300 bird specimens from the John D. Cooper Center for Archaeology and Paleontology. These specimens are from a relatively complete sequence of strata ("Topanga," Monterey, and Capistrano Formations) that spans 10 million years of the Middle Miocene to Early Pliocene. We compare this collection with bird specimens from other institutions across California in order to provide a more complete and detailed view of avian communities during this period. For example, our study has found earlier records of gulls (Laridae), grebes (Podicipedidae), and herons (Ardeidae) in California than were previously known. Our data also show that, in addition to the previously noted speciation of alcids, the relative abundance of specimens indicates they dominated the avifauna from the Late Miocene to Early Pliocene. Furthermore, the occurrence of loons (Gaviidae) is also found to increase during this time. These faunal changes are coincident with global temperature decrease following the Middle Miocene Climatic Optimum and changing circulation patterns in the North Pacific resulting from the development of the Isthmus of Panama and movement of Australia. Previous studies of contemporaneous faunal groups (marine mammals and fish) linked observed changes in diversity and morphology to nutrient upwelling and the increased abundance of phytoplankton that results from shifting circulation patterns. The abundance and diversity changes that we find in the Late Miocene avifauna may also be the result of changing circulation and upwelling in the region. Built upon the existing literature reviews, this specimen-based approach can develop a more faithful depiction of the fossil record. Continued study of these collections will yield greater insight into the complex history of birds during the Late Miocene of California, help us define broader patterns of faunal change, and correlate these changes to climate and tectonism.

*Does Evidence of Abrupt Coseismic Subsidence Exist in Seal Beach Wetlands Stratigraphy?*

Student: Robert Leeper

Faculty Advisor: Dr. Brady Rhodes

**Abstract**

The Seal Beach wetlands (SBW) are located along strike of the Newport-Inglewood fault zone (NIFZ) in northern Orange County, CA. This site is significant due to the wetlands being situated where fault geometry produces a releasing bend. In wetland environments, abrupt coseismic subsidence may cause an immediate rise in relative sea level. This change is recorded in the stratigraphy and characterized by abrupt changes from organic-rich sediment to mud or sand and microfossil assemblages that change suddenly from brackish to marine. Forty-eight reconnaissance cores collected in the SBW commonly revealed an upper and lower section of organic-rich sediment interbedded with mud or sandy mud. In vibracore SB002VC, a 12-cm thick shell-hash layer exists and preliminary microfossil data show that abrupt changes in diatom assemblages are coincident with abrupt changes in sediment type. A 30-cm long sand dike injected into overlying organic-rich sediment is present in vibracore SB018VC. To quantitatively characterize the stratigraphy, multi-proxy analyses have been performed through loss on ignition at 550°C (% total organic matter) and 950°C (% total carbonate), and magnetic susceptibility (CHI). Based on field observations and preliminary data, it is hypothesized that the lower section of organic-rich sediment is the relic marsh surface that subsided during a major prehistoric earthquake on the NIFZ. Future goals include analyses such as grain size distribution, palynology and Cesium-137 geochronology, while expanding on the micropaleontology work and radiocarbon dating already completed.

*A 3,000 year history of precipitation variability in Southern California using sediments from Crystal Lake*

Student: Jennifer Palermo

Faculty Advisory: Dr. Matthew Kirby

**Abstract**

In Southern California the amount of seasonal precipitation is controlled by the winter season, making it of particular importance to the densely populated region to understand past precipitation variability. As a result of the seasonal distribution of precipitation, any change in the amount of winter season precipitation has a significant impact on Southern California's annual hydrologic budget. Because measured precipitation records for Southern California are scarce, not well resolved, and extend back only 200 years, this study aims to reconstruct a high resolution history of past precipitation variability, including droughts and floods, for the past 3000 years in Crystal Lake, CA. Crystal Lake is one of the few, natural lakes in Southern California. The lake is relatively small in size, 0.1 kilometers across the widest dimension and 0.23 kilometers across the longest dimension, and only 6.4 meters deep, as of 2003. Located 1650 meters above sea level in the Angeles National Forest of the San Gabriel Mountains, the lake is hydrologically closed, fed only by groundwater springs, snowmelt, and direct precipitation run-off; evaporation is the only source of water loss. This study will utilize the chemical and physical characteristics of lake sediments from Crystal Lake – sediments from natural lakes provide excellent records of past precipitation variability. Two Livingston piston cores will be obtained from the basin, one from the depocenter and one from the littoral zone, and correlated using mass magnetic susceptibility (MS) and loss on ignition (LOI) for spatial continuity. LOI 550° and 950° will measure total organic matter and total carbonate, respectively. The sediment cores will also be sampled for grain size analysis and carbon:nitrogen ratios. Radiocarbon-14 dates will provide a temporal scale for the study. After determining episodes of wet and dry climates in Crystal Lake, our record will be compared to other regional records to better understand the mechanisms that are driving climatic changes in Southern California, such as ocean-atmosphere interactions like El Niño Southern Oscillation or Pacific Decadal Oscillation.

# *Graduate Thesis Category*



*Complex ichnofabrics in the Lower Member of the Union Wash Formation, California: Limited recovery from the Permian – Triassic mass extinction*

Student: Paul Alms

Faculty Advisor: Dr. Adam Woods

**Abstract**

Signs of biological recovery typically appeared quickly after most of the mass extinctions in Earth's history. Delayed recovery following the Permian-Triassic mass extinction is thought to be due to unusual oceanic conditions, including anoxia and hypercapnic stresses, which persisted from the Permian-Triassic boundary until the end of the Early Triassic. In areas where oceanic conditions returned to normal, however, organisms recovered at normal Phanerozoic rates. The thin-bedded limestones and silty limestones of the Dienerian-Smithian Lower Member and Middle Member of the Union Wash Formation near Darwin, California are characteristic of shallow shelf and middle to outer shelf environments, respectively, and were examined in order to better establish the relationship between biotic recovery and environmental conditions. The Lower Member of the Union Wash Formation shows extensive biologic activity in the form of abundant *Thalassinoides* trace fossils. The upper portion of the Lower Member and the Middle Member of the Union wash Formation show a return to stressful oceanic conditions, reflected in the rock record by the presence of finely laminated facies, seafloor precipitates, and a lack of metazoan fossils. The bioturbated beds of the Lower Member of the Union Wash Formation were examined to determine the extent of the biologic recovery during the Early Triassic, using the ichnofabric index of the tops and sides of bedding planes and burrow diameter as recovery proxies. Despite the presence of complex ichnofabrics, the small burrow diameters and monotypic trace fossil type of the Lower Member of the Union Wash Formation indicate that only limited recovery occurred in the shallow shelf environment, and was ultimately squelched when anoxic waters flooded the area. The results of this study suggest that the presence or absence of harsh environmental conditions was a strong control for determining the timing of biotic recovery, and limited recoveries were limited to "false starts" if environmental conditions deteriorated.

*Late Holocene Hydrologic Reconstruction Using Lake Sediments from Abbott Lake, California*

Student: Christine Hiner

Faculty Advisor: Dr. Matthew Kirby

**Abstract**

A multi-proxy study on a new sediment core collected from Abbott Lake, California is used to reconstruct hydrologic variability during the Medieval Climate Anomaly (MCA) and Little Ice Age (LIA) (2,000 cy BP to the present). Since Abbott Lake is one of only a few natural, permanent lakes between coastal southern and central California, it serves as an important location for extending the knowledge of past hydrologic variability along the coast of western United States as well as constraining the spatiotemporal variation of the hydroclimatic dipole characterizing this region. A series of analyses were used to infer past climate conditions within the lake and its drainage basin including magnetic susceptibility, loss on ignition, grain size, and  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  isotopic analysis of *Gyraulus parvus* shells. The results reveal central coastal California was characterized by a relatively warm, dry climate regime during the MCA and a cool, wet climate during the peak of the LIA. Hydrologic variability in this region is driven by northern Pacific Ocean-atmosphere dynamics, specifically Pacific Decadal Oscillation (PDO), rather than tropical Pacific Ocean forcings such as El Niño Southern Oscillation (ENSO). Furthermore, a comparison to the Castor-Lime Lake record in eastern Washington reveals the position of the dipole has shifted relative to Abbott Lake multiple times over the past 1,500 cy BP. However, the dipole has maintained its modern position north of Abbott Lake since 220 cy BP.

*Deciphering Biotic Responses to Rapid Climate Change at the Plio-Pleistocene Boundary*

Student: Bethany Malenick

Faculty Advisor: Dr. Nicole Bonuso

**Abstract**

The Pliocene-Pleistocene transition is a dynamic period for taxonomic loss and origination resulting from the closing of the Panama Isthmus. Evidence from the Atlantic and Pacific Oceans indicates that this tectonic change altered ocean circulation patterns redistributing sea surface temperature (SST) and nutrient availability globally. It is unknown how eastern Pacific marine invertebrate taxa responded to those oceanic changes. This study aimed to document changes in marine invertebrate community diversity and abundance in response to a hypothesized decrease in SST and increase in nutrient availability at the Plio-Pleistocene boundary. Samples were collected from 9 fossil beds within the San Diego Formation, Tourmaline Surf Park, San Diego County, CA. Foraminifera biostratigraphy confirmed the location of the Pliocene-Pleistocene at the project site. The collected samples were identified and diversity and abundance were calculated. While diversity declined into the Pleistocene, abundance levels varied sporadically. To determine the variables controlling changes in diversity and abundance SST was tracked via Stable Isotope Analysis and nutrient availability was recorded via Ba/Ca ratios calculated through Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). Results indicated that SST decreased during this interval, while nutrient availability increased. NMDS, Clustering Analysis, and ANOSIM were used to statistically determine differences between the San Diego Formation Plio-Pleistocene fossil beds and known Pleistocene fossil sites in Orange and Los Angeles Counties. The statistical results confirm that there are significant differences between the Pliocene and Pleistocene horizons. The Plio-Pleistocene boundary provides a unique laboratory to examine how environmental change affects life on Earth and can provide direct insights into our present-day biodiversity crisis for two reasons: 1) many Plio-Pleistocene taxa are extant thus providing a direct prediction of how modern taxa might respond to rapid climate change; and 2) the proposed environmental analyses provides a more rigorous and detailed analysis than previous studies thus providing a more direct comparison with modern climate patterns.

*A Paleooceanographic Analysis of the Ely Springs Dolomite,  
East-Central California: Constraining the Duration of the Hirnantian Glaciation*

Student: William Pilesky  
Faculty Advisor: Dr. Adam Woods

**Abstract**

In order to better understand the mechanics behind modern climatic change, other periods in Earth history when rapid temperature shifts had a substantial effect on Earth's biota need to be examined. The End-Ordovician mass extinction likely resulted from climatic cooling associated with Hirnantian (latest Ordovician) glaciation, which invigorated ocean circulation and altered ocean chemistry far from the ice sheet. Examination of the Ely Springs Dolomite (east-central California) provides a means to study the effects of shifts in ocean circulation on Earth's tropical biota during an interglacial period and constrain the duration of the Hirnantian glaciation by determining how long changes in ocean circulation persisted. The Ely Springs Dolomite was examined at two localities; Willow Spring Canyon (Mazourka Canyon), CA and Talc City Hills, CA. At Talc City Hills, the Ely Springs Dolomite contains abundant crinoid columnals scattered throughout the unit, rugose corals near the base, and storm deposits consisting of crinoid hash beds near the Ordovician-Silurian boundary. The change in fauna is indicative of a shift from warm, tropical waters to cool waters that were introduced to the shelf via upwelling. At Willow Spring Canyon, the formation is divided into three informal members: an Upper Ordovician member consisting of chert-rich dolostone; a middle, lowermost Silurian member consisting of massive dolostone; and an upper, Lower Silurian member consisting of interbedded cherty dolostone and thick chert beds. This sequence records a drop in sea level followed by a relative rise in sea level caused by the glaciation and deglaciation of Gondwana, while the chert-rich nature of the unit is indicative of vigorous ocean circulation, upwelling, and high primary productivity. Initial trace element geochemistry and lithologic analysis of the Ely Springs Dolomite suggest that upwelling and high primary productivity were present during deposition of much of the formation, demonstrating that vigorous ocean circulation was persistent and driven by a long-lived Gondwanan glaciation.

# *Environmental Science Research in Thailand Category*



*The Presence of Fluoride in the San Kamphaeng Water System in Chiang Mai, Thailand*

Presenters: D'lisa O. Creager, Fongsaward S. Singharajwarapan, and Brady P. Rhodes

**Abstract**

The San Kamphaeng hot springs are located near Chiang Mai, a major city in northern Thailand. The area is filled with extensive north-south oriented fault zones. When these fault zones occur over a heat source, groundwater fluid and surface water travel downwards where they are sequentially heated up and allowed to interact with other fluids. The new heated fluid journeys back upward towards the surface via fractures in the rock and expelled through a hot spring. Fluids within this system can interact with the surrounding groundwater and surface water. The San Kamphaeng hot spring fluids have a history of exhibiting high fluoride levels. The high fluoride content could potentially be seen in the surrounding groundwater and surface water, allowing us to determine if the hot spring fluid is interacting with these systems. Water samples were taken from the hot spring, up stream and down stream from two creeks surrounding the hot spring, and also from ground water wells. The pH, temperature and GPS coordinates were recorded for each sample. The samples were then chemically analyzed for their fluoride content and total dissolved solids. A simple groundwater map was constructed using three groundwater elevations in order to discern the direction of groundwater flow. The fluoride content of the hot spring fluids was then compared to that of the ground water and creek water. This coupled with the direction of surface water and ground water flow revealed the nature of the interaction between the systems.

*Debris Flow Hazards in the Pai Valley, Northern Thailand*

Presenters: Garcia, D.J., Shaw, K., Rhodes, B.P., Chantraprasert, S.

**Abstract**

In this study we look at past mass wasting events in the Pai Valley of Northern Thailand to better understand the size and scope of previous slide events. Thailand is located in southeast Asia, sharing borders with Burma, Laos, Cambodia, Malaysia, The Andaman Sea and The Gulf of Thailand. Pai Valley is in the northernmost region of Thailand, close to the Burmese border. Research on past slides in this area is significant because of the population living on these slides. The inhabitants of Pai had an estimated population of about 2,284 as of 2006 ([www.geonames.org](http://www.geonames.org)). Residents built their homes on the suspected slide area and are dependent on the agriculture grown on the slides. A future slide event could be catastrophic for the valley, including major loss of life. It is hypothesized that in the past there was a massive debris flow that originated west of the valley. Our research shows the suspected slides are “Torrent Slides,” or “Long Slides.” These are channelized type slides discharging water and debris composed of bedrock, unconsolidated sediment or organic material and can be triggered by changes in ground water conditions or the geometry of the slope. Given the tropical setting of the area, it is presumed these slides were triggered by excessive rains or unseasonably wet periods. Through satellite imagery and on the ground mapping we determined at least two slide events and possibly a third. The mapping process involved driving and looking for locations with boulders versus bedded areas. When we determined the end of the boulder section and beginning of bedding, we plotted the location on our map. We continued until we had the boundaries of the slide determined. Clast counts were performed at a number of locations within the slide area. At each location an average of 50 clasts were counted, classified and measured. Sizes ranged from sand grain to 16 meters. The main lithologies of the clasts were granite and sandstone, this is expected if the slides originated west of the valley. There was no clear difference in weathering from one location to the next which leads us to believe these events occurred in a relatively short time frame. Future research could determine the precise origins of the slides and cosmogenic dating could be helpful in determining how old the slides are.

## *Gravity Mapping the Ban Pong Basin*

Presenter: Billy Pilesky

### **Abstract**

The Ban Pong Basin is located in Northern Thailand, approximately 9km southwest of Chiang Mai in the Nam Phare area. The basin is part of the Northern Thailand basin and range province and is one of many north-south elongated rift basins in this area that formed due to regional extension during the Oligocene through the Pleistocene (Rhodes, *et al.* 2005). Sandstones and conglomerates of the Tertiary Mae Rim Formation are unconformably overlain by poorly consolidated gravels within the basin and are bound by a low grade metamorphic basement that consists of the Paleozoic Shan Thai terrain (Rhodes, *et al.* 2005). The goal of this study was to conduct a geophysical survey on the Ban Pong basin to determine 1) the depth of the basin, and 2) the overall structure of the basin. A gravity survey was completed during the Summer of 2013, using a gravimeter to collect gravity data at ~1km intervals. Gravity corrections were made to correct for changes in altitude, latitude, density of subsurface rocks, and possible drift, in order to create a Bouger gravity anomaly map of the basin. This study determined that the Ban Pong basin is a relatively shallow basin and only reaches a maximum depth of 0.46km compared to the much larger Chiang Mai basin which reaches depths greater than 2km. The shape of the basin is a half-graben with a high angle detachment fault to the east that separates the Neogene sedimentary deposits from the Paleozoic basement. Sedimentary basin deposits thin out to the northwest, away from the border fault, which suggests that the border fault is a growth fault with normal displacement that formed syn-sedimentary during regional extension.



*The Department of Geological Sciences  
at  
Cal State Fullerton  
cordially invites you to*

**SAVE THE DATE**

**COMING  
UP**

*for our*

**2nd Annual Fall Alumni Dinner**

*Friday, October 17*

*6:00pm*

*Location: TBD*

*(wherever we can find a place for this rowdy bunch!)*

Additional Party information to follow

RSVP to [geology@fullerton.edu](mailto:geology@fullerton.edu)



## Alumni of the Year Page



### About Mark Zeko

Mark graduated from CSUF with a Bachelor of Science in Geology in 1987 and a Master of Science in Environmental Science / Hydrogeology in 1994. Since then, Mark has built a career as a renowned professional in the environmental industry specializing in the remediation of groundwater, soil, and soil vapor impacted by industrial and commercial land uses. He is the vice president and chief financial officer of Environmental Engineering & Contracting, Inc. (EEC), an environmental consulting firm based locally in Santa Ana. Mark and his business partner John Shaffer have established EEC as a top-tier consulting firm throughout the United States. Currently, EEC provides sought-after consulting and technical services in soil, soil vapor, and groundwater assessment and remediation; environmental due diligence; wastewater treatment and compliance; sewer system and storm water management; environmental compliance; litigation support; construction; and technology and geographic information systems in environmental applications.

Mark is a registered professional geologist/hydrogeologist in 14 states whose distinguished career in geology has led him throughout the United States and abroad. During his career, he has presented numerous lectures at both scientific and trade association conferences. He is currently pursuing expansion opportunities in California's emerging and hotly debated hydraulic fracturing, or *fracking*, industry where he seeks to help devise regulations and guidelines for the safe and environmentally responsible extraction of natural resources using this method. The issue is now at the forefront of policymaking efforts, especially in California, which is expected to set the precedent for regulation of the American energy

industry. Mark currently speaks throughout the country on the emerging policies, risks, and opportunities that will give shape to the fracking industry in the coming years.

Mark has employed many CSUF alumni at EEC and generously volunteers his knowledge and time to mentor CSUF undergraduates in developing successful careers. Through his and his wife, Janet's (also a CSUF alum), donations the CSUF Department of Geological Sciences was able to hold its first annual alumni event this past fall 2013.

For his professional accomplishments and personal commitment to the CSUF Department of Geological Sciences, Mark is a prime example to the CSUF community, and the professional community at large, of the value of a CSUF education and therefore deserves to be named the Geological Sciences Alumni of the Year in 2014.

## **GEOLOGY STUDENT AWARDS/SCHOLARSHIPS**

### **May 2014**

#### **Marilyn A. Brown Award**

*William "Billy" Pilesky*

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*

#### **Prem K. Saint Hydrology Award**

*Emily Vavricka*

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: \$200 and a copy of "Cadillac Desert" or equivalent*

#### **John D. Cooper Field Camp Award**

*Sara Baldwin*

Annual award to a declared Geological Sciences Major with outstanding performance in GEOL 481A-Geology Field Camp. *Award: a leather belt embossed with Cooper Award/year, holster and a rock hammer*

#### **Dr. Margaret Skillman Woyski Field Camp Scholarship**

*Elizabeth White*

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 fieldwork and will be enrolling in summer field camp. *Award: \$550*

#### **David L. Willoughby Scholarship**

*Mihai Agiu*

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 fieldwork. Minimum GPA of 2.5 or higher in Geological Sciences at the time the scholarship is awarded. *Award: \$400*

#### **Candice L. Jones Outstanding Service Award**

*Kelly Shaw*

Given to the student who has made a significant contribution to the mission, operation and/or well being 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 each (Funded by Titan Textbook Rewards Program)*

#### **Outstanding Academic Achievement Award**

*Kalie Duccini*

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 (Funded by Titan Textbook Rewards Program)*

#### **Outstanding Major Award – B.S. in Geology**

*Daniel Philo*

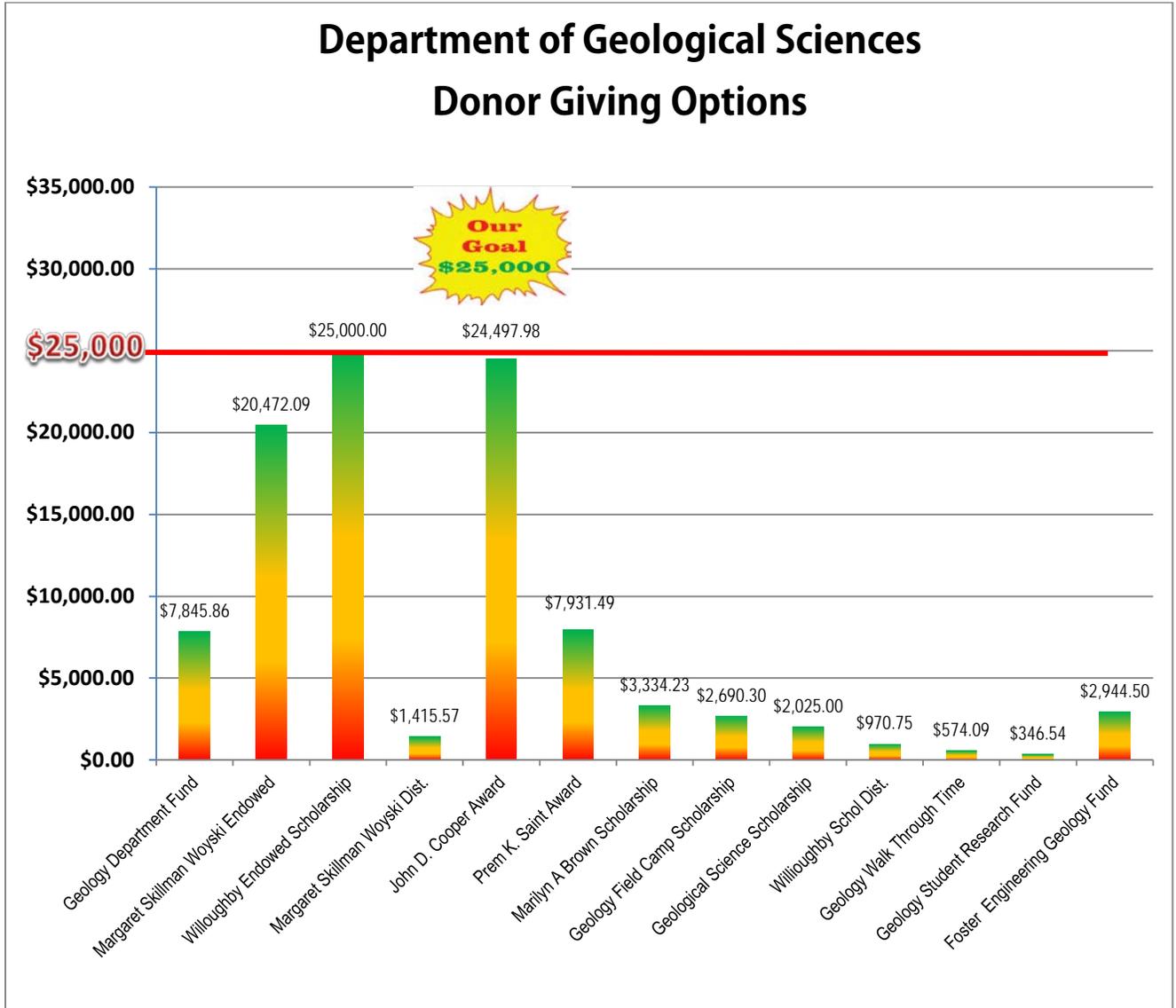
Awarded to an upper-division Bachelor of Science Geology major who demonstrates high quality performance in classes, their undergraduate research project, and some type of service to the department, University or community. *Award: \$250 plus engraved glass (Funded by Titan Textbook Rewards Program)*

#### **Outstanding Major Award – B.A. in Earth Science**

*Priyanka Cid*

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 (Funded by Titan Textbook Rewards Program)*

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**Thanks to All of Our Geology  
Students, Faculty and Staff for  
another successful year within the  
Geology Family!!!**

**Dear Past,  
Thanks for all the lessons.**

**Dear Future,  
I'm Ready!!!**

**....CSUF Geology Student**

# Geology Research Day 2014

