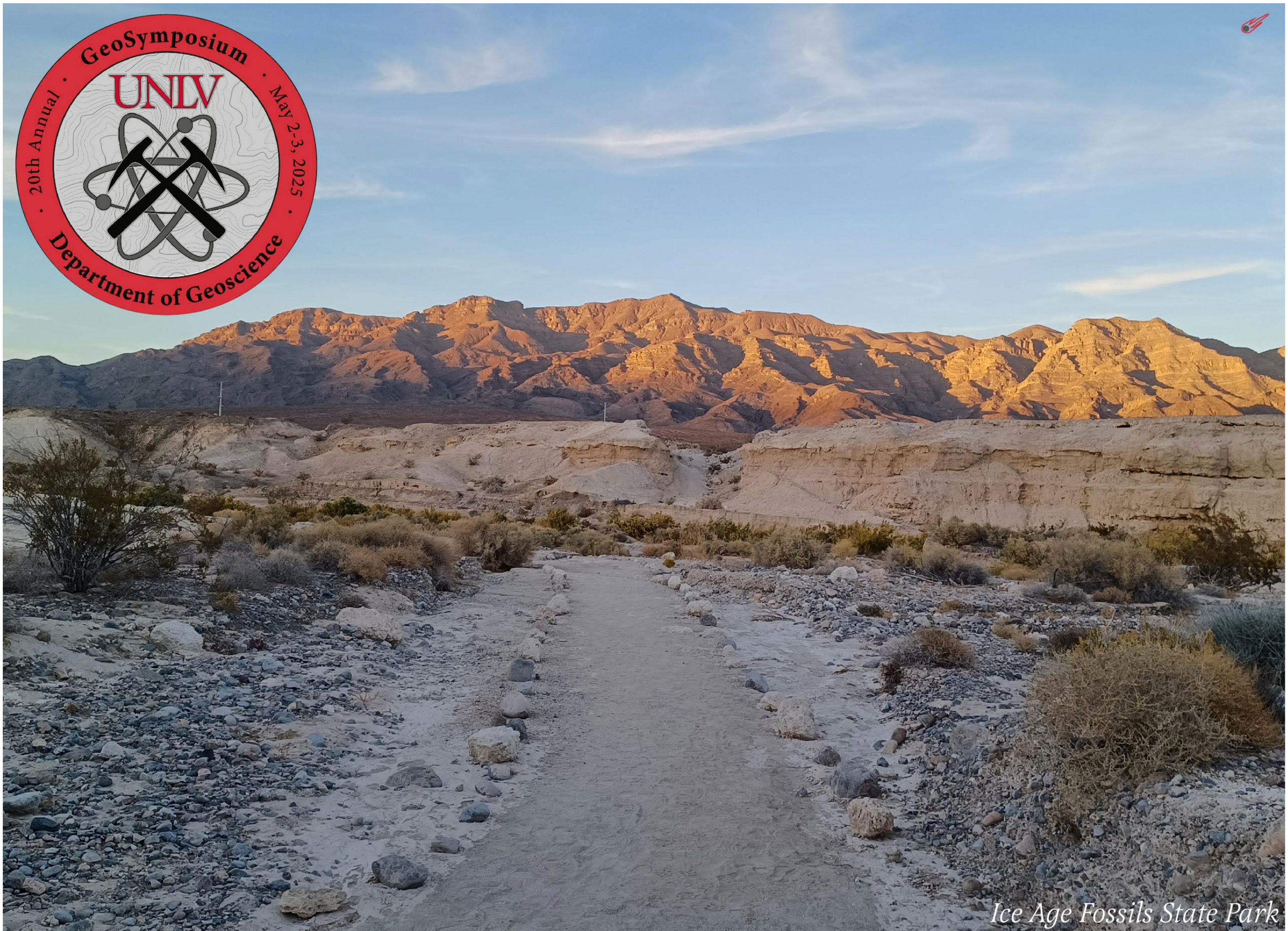


UNLV Department *of* Geoscience

# 20th Annual Geosymposium

May 2nd and 3rd, 2025

# Program and Abstracts

## THANK YOU TO OUR GOLD SPONSORS

NEVADA GOLD MINES
OPERATED BY BARRICK

NEVADA NATIONAL
NNSS
SECURITY SITES

## THANK YOU TO OUR KEYNOTE SPONSORS

SOUTHERN NEVADA
WATER AUTHORITY

KINROSS

## THANK YOU TO OUR SILVER SPONSORS

GEOLOGICAL SOCIETY OF NEVADA

SOUTHERN NEVADA GEM & MINERAL SOCIETY
S N G M S
Rocks "R" Us

COEUR MINING®

amentum

## AWARDS AND RESEARCH GRANTS

**Graduate Academic Achievement Award**
Sponsored by:
Southern Nevada Water Authority

**Undergraduate Academic Achievement Award**
Sponsored by:
Amentum

**Best Poster Presentation Award**
Sponsored by:
Nevada Gold Mines
Nevada National Security Sites
Coeur Mining
Southern Nevada Gem & Mineral Society

**Best Oral Presentation**
Sponsored by:
Nevada Gold Mines
Nevada National Security Sites

**Student Research Grants**
Sponsored by:
Geological Society of Nevada Foundation

## THANK YOU TO OUR CAREER SHOWCASE SPONSOR

## THANK YOU TO OUR INDIVIDUAL DONORS

Pamela Burnley

Michael Nicholl

Samantha Poppenhouse

Sierra Ramsey

Maria Ines Rojas

Laughlin Collection:
Michael Stefflre and Shirley Stefflre

UNLV College of Sciences

*If you are interested in sponsoring future Geosymposium events or student research, please contact:*

**Kara Peterson**
**Director of Development, College of Sciences**
**(702) 895-3488**
kara.peterson@unlv.edu

Geoscience Community,

We welcome you to the 20th Annual UNLV Geosymposium. We are excited to once again give the students an opportunity to present their research to industry sponsors, UNLV faculty, peers, and community members.

I would like to thank our sponsors Nevada Gold Mines by Barrick (NGM), Nevada National Security Sites (NNSS), Southern Nevada Water Authority (SNWA), Kinross, Amentum, Coeur Mining, Geologic Society of Nevada, and Southern Nevada Gem & Mineral Society.

I also would like to thank Pamela Burnley, Michael Nicholl, Maria Rojas, Sierra Ramsey, Samantha Poppenhouse, UNLV College of Sciences, and Michael and Shirly Stefflre, for their contributions to our silent auction.

Thank you to Kara Peterson, from the College of Sciences, for her commitment to making connections with sponsor partnerships and her dedication to hosting a successful Geosymposium. Thank you to Dr. Jeremy Koonce, our faculty advisor, for his continued dedication and guidance year after year to the Geosymposium Committee. Thank you to Park Ranger Dawn Reynoso, for assisting in organizing our field trip to Ice Age Fossils State Park. A special acknowledgement is owed to Maria Rojas, Franki, and the Geosciences office staff for playing an invaluable role in the logistics of making this event possible.

Geosymposium would not be possible without the students and volunteers. I am incredibly grateful for their contributions throughout the past semester. A particular thank you is owed to a few individuals: Brittany Meyers, Fiorella Ramirez-Guasp, Dalton Pell, Mary Clarich, Sierra Ramsey, Ivet Escamilla, and Conner Calloway for dedicating their time and effort to additional responsibilities that made organizing this year’s Geosymposium possible.

And finally, thank you to all the students, faculty, community members, volunteers, judges, alumni, and presenters participating in Geosymposium.

Thank you all,

Samantha A. Maciech

Samantha A. Maciech
Geosymposium 2025 Coordinator

## Committee Members

Conner Calloway

Mary Clarich

Ivet Escamilla

Fiorella Ramirez-Guasp

Brittany Meyers

Dalton Pell

Maria Rojas

Franki Rojas

## Subcommittee Members

Thomas Boes

Ford Gonzales

Katyln Hurley

Giuseppe Lucia

Gabriella Motta

Samantha Poppenhouse

Sierra Ramsey

Geosymposium Advisor: Dr. Jeremy Koonce
Website: Dr. Brenda Buck

# SCHEDULE OF EVENTS

**Friday May 2nd, 2025**

8:00 AM – Check-in

8:30 AM – Opening remarks

8:45 AM – Morning Keynotes Address

9:30 AM – Oral Presentations Session I

11:00 AM – Booth/Networking break

11:15 AM – Poster Presentation Session I

12:30 PM – Break for Lunch

1:30 PM – Afternoon Keynotes Address

2:15 PM – Oral Presentations Session II

3:45 PM – Booth/Networking break

4:00 PM – Poster Presentation Session II

5:00 PM – Awards Ceremony

5:30 PM – Reception/Silent Auction Ends

**Saturday May 3rd, 2025**

Field trip to Ice Age Fossils State Park:

Depart from Lilly Fong Geoscience (LFG) Building parking lot at 8:15 AM and return to campus at 2:00 PM

*Interactive Campus map is available at unlv.edu/maps/campus
Or, open your smartphone camera app and take a picture of this code:

# SILENT AUCTION INFORMATION

This year, the silent auction items will be available for viewing in person during the reception in the Science and Engineering Lobby. Bidding will only be accepted online at the following link:

https://Geosymposium25.givesmart.com

Alternatively, you may use your smartphone camera app to take an image of the following code to access the link:

# ABSTRACTS: TABLE OF CONTENTS

**ORAL PESENTATIONS**

**MORNING SESSION, IN ORDER OF PRESENTATION**



**AFTERNOON SESSION, IN ORDER OF PRESENTATION**

## POSTER PRESENATIONS, MORNING SESSION

## POSTER PRESENTATIONS, AFTERNOON SESSION



## KEYNOTE SPEAKERS

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## POTENTIAL BIOSIGNATURES IN MARS-RELEVANT CLAY MINERALS: A KEY TO UNCOVERING PAST LIFE ON MARS

**Baylee K. Colburn[1], Elisabeth M. Hausrath[1], Leena M. Cycil[1], Aude A. Picard[2], Shichun Huang[3], and Brian Duggan[3]**

*1- Department of Geoscience, University of Nevada, Las Vegas, Las Vegas, NV, USA.*
*2- School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, NV, USA.*
*3- University of Tennessee Knoxville, TN, USA.*
colbub1@unlv.nevada.edu

Magnesium- and iron-rich clay minerals have been detected across numerous locations on the surface of Mars. Studies have shown that clay minerals can preserve elemental enrichments in both field and laboratory settings. This ability, along with their capability of protecting organic molecules, makes clay minerals of high interest to the astrobiology community because the metallome, or the metal content of a cell, may potentially be incorporated into clay minerals. Documenting potential metallome incorporation into clay minerals could further strengthen our potential biosignature assemblage, and having a suite of biosignatures, including morphological, elemental, mineralogical, and isotopic, will support greater confidence in possible detections of past life signature on Mars using returned samples.

To test whether clay minerals can preserve potential mineralogical, elemental, and isotopic biosignatures, we are combining a Mars-relevant clay mineral with microorganisms in multiple experiments. Saponite, the Mg-end member of the 2:1 trioctahedral phyllosilicate group was synthesized using a method based on Criouet et al. (2023). We added two microorganisms to these experiments, *Shewanella oneidensis* and *Geobacter metallireducens.* Both were chosen because of their abilities to grow under anoxic conditions and to use iron for growth, which are relevant for ancient Mars environments.

To examine the biosignature preservation potential of the Mars-relevant clay mineral saponite, we are performing experiments under different durations, temperatures, and biological conditions. These experiments include adding the biological conditions during clay mineral synthesis, in addition to the already synthesized clay mineral. The biological conditions are intact and lysed cells. Samples will be analyzed using SEM, EDS, TEM, ICP-MS, and MC-ICP-MS to characterize their mineralogical, elemental, and isotopic makeups. These data will be assessed to search for potential biosignatures.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## EVALUATING THE OXYGEN ISOTOPE COMPOSITION OF PHOSPHATE AS A POTENTIAL BIOSIGNATURE IN MARS RETURNED SAMPLES THROUGH A SYSTEMS MODELLING APPROACH

**Eduardo Martinez[1], Elisabeth Hausrath[1], Sajjad Ahmad[1], Ruth Blake[2], Jordan Wostbrock[2], and Francis M. McCubbin[3]**

*1-University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2-Yale University, New Haven, CT, USA*
*3- NASA Johnson Space Center, Houston, TX, USA*
martie58@unlv.nevada.edu

The oxygen isotope composition of phosphate is a promising biosignature for detecting past life on Mars. On Earth, the oxygen isotope composition is altered via metabolic processes that enrich the phosphate ions with oxygen-18 isotopes ($\delta^{18}O$) and can exchange with the oxygen isotopes in the presence of biology. Biologically processed phosphate is subsequently released into the environment while retaining the $\delta^{18}O$ signature. Once in the environment, the $\delta^{18}O$ rich phosphate can be found as dissolved ionic species in water, adsorbed onto mineral surfaces such as clay minerals, or precipitated into phosphate minerals. This biological signal can then be compared to the oxygen isotope composition in phosphate produced from abiotic processes (e.g., igneous minerals). Therefore, we focus on two measurable biosignatures: 1) a shift in the $\delta^{18}O$ from the abiotic signature of igneous phosphate to the biologically enriched $\delta^{18}O$, or 2) $\delta^{18}O$ values in phosphate that are in equilibrium with ambient water, a result of biologic processes. Both measurements are distinct from the abiotic baseline found in igneous minerals.

If a biosphere utilizing phosphate once existed on Mars, then either of these measurements could serve as a potential biosignature. Since phosphate is ~8x as abundant on Mars as on Earth, it is necessary to determine whether the $\delta^{18}O$ signal from abiotic phosphate could obscure the biological signature. To explore this, we are using system dynamics modelling STELLA Architect (Systems Thinking, Experimental Learning Laboratory with Animation) to model the transport of phosphate among various pools, including biologic, aqueous, adsorbed, mineralized, and organic phosphorus reservoirs. This model allows us to quantify the phosphate distribution and isotopic differences across various pools to determine where a biological $\delta^{18}O$ is pronounced.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## MECHANISMS OF GOLD ENRICHMENT IN SEAFLOOR MASSIVE SULFIDE DEPOSITS: A STUDY ON THE HIGASHI-AOGASHIMA HYDROTHERMAL FIELD


**Claudia Martinez[1], Andrew Martin[1], Tatsuo Nozaki[2], and John Jamieson[3\]**

*1- University of Nevada Las Vegas, Las Vegas, NV, USA*
*2- Waseda University, Shinjuku City, Japan*
*3- Memorial University of Newfoundland, St. John's, Canada*
martic63@unlv.nevada.edu



Understanding Seafloor Massive Sulfide (SMS) deposit formation is essential for assessing both the economic potential and environmental risks of future deep-sea mining activities. This study investigates the mechanisms controlling gold (Au) and other trace metal enrichments within the Higashi-Aogashima Knoll Caldera (HAKC) hydrothermal system located in the Izu-Ogasawara Arc, Japan. During a research expedition led by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), prior studies identified Au concentrations of up to 275 ppm, exceeding the global average of 1-10 ppm typically observed in SMS deposits. We focus on three vent sites: the Central Cone, Southeast, and East sites – located with the HAKC. The aim of this research is to investigate whether magmatic volatile influx is the dominant mechanism leading to Au enrichment at the HAKC.

Using *in situ* geochemical and isotopic data, results reveal significant differences in Au and Ag concentrations across mineral phases and sites. Pyrite exhibits the highest Au contents, reaching up to 115 ppm at the Central Cone and 33 ppm at the East site. Silver concentrations in pyrite peak at 4245 ppm at the East site, and 2472 ppm at the Central Cone site. Sulfur isotope values vary by mineral and vent site, with $\delta^{34}S$ in chalcopyrite averaging 4.6‰ ± 1.1‰ (1σ, *n=12*) at the Central Cone and 2.8‰ ± 1.0‰ (1σ, *n=16*) in the East site. Pyrite shows lower average values from 0.4‰ ± 2.18‰ (1σ, *n=31*) in the East site and 1.9‰ ± 1.1‰ (1σ, *n=31*) in the Central Cone site. These data show that the deportment of Au varies between the vent sites, but sulfur isotope data does not suggest the presence of a prominent magmatic volatile influx at HAKC.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## UNDERSTANDING THE EFFECTS OF INVASIVE SPECIES ON MARINE FOOD WEB STRUCTURE DURING THE RICHMONDIAN INVASION (LATE ORDOVICIAN)

**Samantha A. Maciech[1], Roxanne M.W. Banker[2,3], Madeline P. Ess[4], Ashley A. Dineen[5], Peter D. Roopnarine[3], and Carrie L. Tyler[1]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Providence College, Providence, RI, USA*
*3- California Academy of Sciences, San Francisco, CA, USA*
*4- Miami University, Oxford, OH, USA*
*5- University of California Museum of Paleontology, Berkeley, CA, USA*
samantha.maciech@unlv.edu

Invasions by non-native taxa can be difficult to study today as ecosystems are typically only monitored after an invasion has already begun. The fossil record is an invaluable tool that can be used to examine an ecosystem before and after the arrival of invaders on time scales not feasible in modern studies. The Richmondian Invasion is a thoroughly documented incursion of invasive marine species that occurred during the Katian Stage of the Late Ordovician approximately 451 to 446 million years ago. Invasions are thought to trigger significant ecosystem restructuring and major changes in energy transfer pathways, such as changes in patterns of interactions and the distribution of taxa among trophic levels in the food web. We evaluated food web structure from across six stratigraphic sequences in the Cincinnatian Series (C2 through C7) from over 79,000 specimens and 1,260 species, and we used these six food webs to answer questions about the Richmondian Invasion: (1) Do the successfully integrated invaders forge new consumer relationships with present functional groups or give rise to novel functional groups? (2) How do the invaders affect the trophic position of functional groups within the food web? Invasive species present in the basin were identified through an extensive literature search, and in this study, we show that invaders influence the trophic position of both predator and prey functional. Proportions of functional groups within each sequence fluctuate throughout the invasion, with cephalopod-dominant functional groups radiating in later sequences, and a large influx of invasive cephalopod species in C7. The presence of invaders results in a shift of network trophic position of functional groups, specifically at the higher levels of the food web ($R^2 = 0.9$, $p << 0.001$). To fully understand food web structure in shallow benthic ecosystems, it may be essential to identify the changes in functions in addition to the species composition, as well as trophic structure. The fossil record of how this marine ecosystem responded to the Richmondian Invasions on evolutionary timescales will allow modern biologists to better predict and respond to future ecosystem changes.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## URBAN TORNADOES AND THEIR IMPACT


## Ella Mayes

*University of Nevada, Las Vegas, Las Vegas, NV, USA.*
mayese1@unlv.nevada.edu



The larger the target, the easier it is to hit. Following this logic, cities will have a larger impact from tornadoes as they grow. Current research does not investigate this relationship in depth, focusing mostly on tornado formation and forecasting, false alarms, and trends, creating a research gap. This research aimed to fill this gap using ArcGIS Pro. Comparing the area of impact and frequency of major tornadoes, those with intensities F or EF 3, 4, and 5, this research found that there is a small correlation between major urban tornadoes and urban expansion. Based on the strength of the correlation, it is more likely that atmospheric variability plays a larger role in the frequency and damage caused by major urban tornadoes. However, it is also possible that the extreme nature of tornadoes and the size of tornadoes relative to the size of urban areas.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## CLIMATE DYNAMICAL CONTROLS ON MODERN RAINFALL ISOTOPE VALUES IN GUATEMALA, CENTRAL AMERICA: IMPLICATIONS FOR SPELEOTHEM-BASED PALEOCLIMATE RECONSTRUCTIONS

**Giuseppe Lucia[1], Matthew S. Lachniet[1], Davide Zanchettin[2], Amos Winter[3], and Osmín J. Vásquez[4]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- University Ca' Foscari of Venice, Mestre, Italy*
*3- State University, Terre Haute, IN, USA*
*4- Carrera de Geología, Centro Universitario del Norte CUNOR, Universidad de San Carlos de Guatemala, Cobán, Alta Verapaz, Guatemala*
luciag1@unlv.nevada.edu

Speleothems (cave calcite deposits) are often referred to as the "ice cores of the tropics" because they provide critical paleoclimatic information of long-term tropical atmospheric dynamics beyond the instrumental record. Notably, the oxygen isotopic composition ($\delta^{18}O$) of speleothems is closely linked to monsoonal rainfall variations at the time of calcite precipitation. However, accurate interpretation of speleothem $\delta^{18}O$ records requires a thorough understanding of the processes that control $\delta^{18}O$ in tropical rainfall. To this end, modern rainfall isotope studies in modern climatic and hydrologic settings are essential for developing robust paleoclimate reconstructions. To support our speleothem-based Central American paleoclimate records, we present a 2-year long, daily rainfall isotopic dataset from the city of Cobán, located on the Caribbean slope of Guatemala. Single-event rainfall $\delta^{18}O$ is poorly correlated with local atmospheric conditions, including rainfall amount. Prominently, a strong correlation between outgoing longwave radiation (OLR), an indicator of convective activity, and daily $\delta^{18}O$ suggests that convective intensity rather than precipitation amount is the dominant control of rainfall $\delta^{18}O$ on daily timescales. Further, prior cumulative rainfall integrated along the moisture trajectories exhibits significant negative correlation with daily $\delta^{18}O$, consistent with upstream moisture rainout. On monthly timescales, rainfall $\delta^{18}O$ shows a pronounced seasonality, with lower $\delta^{18}O$ (-6.9 ± 2.6 ‰) during wet monsoon season (May-November), and more positive $\delta^{18}O$ (-2.4 ± 0.5 ‰) during dry (December-April) period. The lower $\delta^{18}O$ are consistent with enhanced upstream rainfall amount and stronger convective intensity. Our results identify changes in regional atmospheric dynamics associated upstream regional convection as dominant controls of rainfall $\delta^{18}O$ variations. Thus, speleothem-based oxygen isotope reconstructions from Central America provide key paleoclimate records of regionally-integrated monsoonal rainfall and atmospheric convective intensity.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## INSIGHTS INTO NAKHLITE EMPLACEMENT THROUGH 3D CRYSTAL SIZE DISTRIBUTIONS AND PETROFABRIC ANALYSIS OF PYROXENE

**Sierra Ramsey[1], Piper Irvin[1], Arya Udry[1], Scott Eckley[2], Rich Ketcham[3], and Amanda Ostwald[4]**

*1- University of Nevada, Las Vegas, Las Vegas NV, USA*
*2- Amentum, NASA Johnson Space Center, Houston, TX, USA*
*3- University of Texas, Austin, TX, USA*
*4- Smithsonian National Museum of Natural History, Washington, DC, USA*
ramses3@unlv.nevada.edu

Currently, martian meteorites are our only samples from Mars that can be used to investigate igneous processes, including conditions and mechanisms for the formation and emplacement of rocks at or near the martian surface. Despite extensive study, the emplacement of martian meteorites remains enigmatic due to lack of geologic context. However, by quantifying igneous textures (e.g., crystal size distributions—CSD) and petrofabrics, we can better understand how martian rocks are formed and emplaced. X-ray computed tomography (CT) is a non-destructive method to characterize objects in 3D and is ideal for studying rare samples, like martian meteorites, and conducting true 3D analyses. Here, we used X-ray CT and 3D quantitative textural and petrofabric analyses on a suite of nakhlites (n=8), a type of cumulate clinopyroxene-rich rock from Mars, to better constrain the crystallization history and emplacement of these samples.

Nakhlites have similar crystallization histories based on our 3D CSDs. The cumulus phases (i.e., olivine and pyroxene) experienced high nucleation densities related to high degrees of undercooling (=any physiochemical change that promotes crystallization in a magma). Long residence times support a period of magma storage for cumulus phases and CSD profile flattening suggest magma recharge events occurred. These findings are consistent with previous work on nakhlite melt inclusions and preserved incompatible and trace element zoning in cumulus phases. Nakhlite long-axis petrofabrics exhibit foliations of varying strengths, which can develop during crystal accumulation in a variety of environments. The model for how nakhlites solidified has evolved from the single 'cumulate pile' to a more complex model invoking multiple lava flows and sills or lava lake/pond infills. Combining our 3D CSD and petrofabric analysis, we see slow cooling rates, long residence times, a high percentage of crystal content (≥55 vol.%). Our 3D results, taken in tandem with studies using electron backscatter diffraction, suggest nakhlites solidified in a low-to-no flow environment dominated by crystal accumulation, like a shallow intrusion or lava lake/pond.

THE 20th ANNUAL UNLV GEOSYMPOSIUM
MAY 2, 2025

# ANALYSIS OF MARTIAN METEORITES USING X-RAY COMPUTED TOMOGRAPHY FOR 3D VISUALIZATION AND ANALYSIS


## Piper Irvin, Sierra Ramsey, and Arya Udry

*University of Nevada, Las Vegas, NV, USA*
irvinp1@unlv.nevada.edu



Martian meteorites provide valuable information on martian magmatic and volcanic processes. Methods such as quantitative texture analysis and mineral modal abundance can inform us about crystallization histories, magma compositions, and other geologic processes. Most martian meteorite studies have used two-dimensional (2D) methods for quantitative textural analysis and mineral modal abundance of martian meteorites to infer their magmatic history. This study used X-ray computed tomography (XCT), a non-destructive technique that allows samples to be visualized in three dimensions (3D). We used XCT to visualize and analyze two martian meteorites - Miller Range (MIL) 090032 nakhlite and the Northwest Africa (NWA) 14017 olivine-phyric shergottite. The 3D quantitative textural analysis allowed for a more accurate measurement of the pyroxene crystal lengths in MIL 090032, and a machine learning program was trained using the 3D scans to estimate the mineral modal abundances for NWA 14017. These results were compared to previous 2D studies of these meteorites. The use of XCT allowed for the more accurate quantitative textural analysis of MIL 090032 by ensuring the true long axis of each pyroxene crystal was measured without any estimations having to be made. The XCT method also allowed for a more accurate analysis of mineral modal abundance through machine learning training and analysis. This accuracy, as well as the non-destructive nature of the method, makes XCT a valuable tool for future studies.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## THE HIGH-PRESSURE CHARACTERIZATION OF AMMONIA AND IMPLICATIONS FOR THE INTERIORS OF URANUS AND NEPTUNE

**Logan Magad-Weiss[1,3], Ashkan Salamat[2,3] and Oliver Tschauner[1]**

*1- Department of Geoscience, University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Department of Physics & Astronomy, University of Nevada, Las Vegas, Las Vegas, NV, USA*
*3- Nevada Extreme Conditions Laboratory, University of Nevada, Las Vegas, Las Vegas, NV, USA*
magad-we@unlv.nevada.edu

Characterization of material specific systems under extreme conditions has important implications for improving current planetary models for interior dynamics of Ice Giant planets. The prediction of superionic $NH_3$ by Cavazzoni et al. (1999) pointed toward a potentially important, additional parameter in the physical properties of the mantles of Uranus and Neptune. In advance of high pressure–high temperature experiments in the range of this predicted superionic phase, we acquired the Raman spectra of $NH_3$ between 1.6 and 19.2 GPa across the isosymmetric $NH_3$-IV–$NH_3$-V phase transition and reproduced earlier work by Ninet et al., (2006). We also constructed an optical system capable of performing stabilized $CO_2$ laser heating in a diamond anvil cell (DAC) combined with Raman spectroscopy and optical pyrometry in the near-IR for future use in analyzing $NH_3$ under the pressure-temperature (PT) conditions of the predicted superionic phase. This optical setup and stabilized laser heating system will enable us to utilize the integrated intensities of the Stokes/Anti-Stokes Raman shifts to get temperature. These experiments will shed new light on the chemical properties of $NH_3$ under PT conditions deep in the mantles of Uranus and Neptune.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## UNDERSTANDING ORE-DEPOSIT SCALE CONTROLS ON AU ENRICHMENT IN CARLIN-TYPE AU MINERALIZATION: A HIGH-RESOLUTION STUDY OF THE RITA-K DEPOSIT


**Conner Callaway[1], Andrew Martin[1], and Joseph Becker[2]**

*1- University of Nevada Las Vegas, Las Vegas, NV, USA*
*2- Nevada Gold Mines, Elko, NV, USA*
callac3@unlv.nevada.edu



Northern Nevada hosts one of the largest gold (Au) mining complexes in the world, with Nevada Gold Mines extracting ~3 million ounces of Au across ~20 active mines each year. Gold is mined from Carlin-type deposits where it occurs as "invisible Au" bound within the pyrite crystal lattice. Carlin-type deposits are hosted in impure limestones that were deposited on the platform slope during the Devonian. Here we focus on the Rita-K Carlin-type deposit in Nevada, an underground Au mine where deposit-scale enrichment processes that control Au distribution are poorly understood. We investigate the processes responsible for variations in Au content throughout the Rita-K deposit, with the goal of informing future exploration and mining practices for Carlin-type Au deposits. To investigate this, the relationship between structure, fluid flow, Au enrichment, and alteration has been investigated by combining macroscopic descriptions of drill core samples, detailed microscopy, X-ray florescence mapping and bulk-rock and *in situ* geochemical analysis. Two drill holes have been selected for analysis based on the presence of debris flows or vein networks.

Debris flow samples are highly silicified, with an average of 86 wt.% ($n=25$, ±1σ, 1.34 wt.%) $SiO_2$ when compared to vein network samples that average 39 wt.% ($n=17$, ±1σ, 10.0 wt.%) $SiO_2$. The distribution of Si in micro-X-ray fluorescence element maps indicates that while vein networks facilitate fluid flow, debris flows promote intergranular flow enhancing wall-rock interaction, sulfidation and Au deposition. Moreover, element mapping of pyrite grains challenges the well-established model that all pyrite rims that grow on preexisting pyrite grains have a high Au content. Bulk rock geochemical data shows no correlation between Au and As in both debris flow samples ($r^2=0.002$) and vein network samples ($r^2=0.12$). The lack of correlation between Au and As suggests that intergranular fluid flow enhances fluid-rock interaction leading to the formation of arsenian pyrite rims both with and without Au, and that pyrite rims are not necessarily required for the formation of Carlin-type Au.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## EVIDENCE FROM HP/UHP METASEDIMENTS FOR RECYCLING OF ISOTOPICALLY HETEROGENEOUS RUBIDIUM INTO THE MANTLE

**Mary Clarich[1], Baoliang Wang[2], Vincent Busigny[2], Frédéric Moynier[2], and Yan Hu[1]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Université Paris Cité, Institut de Physique du Globe de Paris, Paris, France*
clarich@unlv.nevada.edu

The Rb-Sr radioactive decay system has long been used to constrain mantle heterogeneity caused by crustal recycling. However, variations in $^{87}Sr/^{86}Sr$ reflect both source composition and time-integrated accumulation of $^{87}Sr$, causing ambiguity in interpretations. In contrast, the Rb isotope ratio ($^{87}Rb/^{85}Rb$, expressed as $\delta^{87}Rb$) provides a tracer for sediment recycling and its interaction with the mantle that is unaffected by radiogenic ingrowth. This application relies critically on the knowledge of the extent of mass-dependent Rb isotope fractionation during the subduction of oceanic plates, which remains largely unconstrained. This study analyzes the Rb isotope composition of metasediments from the Schistes Lustrés nappe, located in the western Alps, and their associated protoliths from the Lavagna nappe, northern Appennies, Italy. The 12 metasediment samples are calc-schist to siliceous metapelites that have subducted to 90 km depth along a cold (~8°C/km) subduction zone and undergone high- to ultrahigh-pressure metamorphism. Their $\delta^{87}Rb$ values range from -0.17 ± 0.08‰ to 0.04 ± 0.03‰ and show no correlation with metamorphic grades. In addition, these $\delta^{87}Rb$ values are indistinguishable from those of the four non-metamorphosed protolith samples (-0.12 ± 0.02‰ to -0.01 ± 0.04‰) composed of marls and pelites. These findings indicate that the majority of Rb is retained within subducting sediments during prograde metamorphism. This conclusion is further supported by the lack of correlation between Rb loss indicators (e.g., $K_2O/Rb$ and $K_2O/Cs$) and the $\delta^{87}Rb$ values in these metasediments. Therefore, the variation in their δ87Rb values primarily reflects varying levels of chemical weathering that occurred to metasediment protoliths. Our results show that subducting sediments maintain pre-subduction Rb isotopic signatures, which suggests that the $\delta^{87}Rb$ variability measured in mantle-derived magmas can track the presence and distribution of recycled sediments in the mantle.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## INSIGHTS INTO THE LARAMIDE: CRETACEOUS SHORTENING RECORDED IN THE LITTLE PIUTE MOUNTAINS, EASTERN MOJAVE DESERT


## Cole B. Jacobs and Michael L. Wells

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
jacobc12@unlv.nevada.edu



The Little Piute Mountains of the eastern Mojave Desert host the NE terminus of two undated ductile structures–the Scanlon thrust and Meteor normal fault–which extend for >45 km to the SW to comprise the largest continuous deformation zone in the Mojave. Between these structures are ~600 meters of deformed and extremely attenuated (≤90%) Paleozoic strata forming a reclined, southeast-verging syncline. Recently, the youngest deformed unit (presumed Triassic Moenkopi) unit has proven to yield a U-Pb detrital zircon maximum depositional age (MDA) of ~120 Ma (Kwiatkowski, 2021), requiring Cretaceous shortening despite speculated Jurassic deformation (Foster et al., 1992). This, along with recent $^{40}Ar/^{39}Ar$ muscovite ages from the Winters Pass thrust (Wells et al., 2024) suggesting Laramide-aged shortening in the eastern Mojave provide the impetus for resolving the age of these enigmatic structures.

Uncovering the deformation story of the Little Piute Mountains is essential to elucidate geodynamic models of the Laramide orogeny (~90–50 Ma) and influences of hypothesized flat-slab subduction or terrane collision, especially considering inconsistencies and increasing skepticism of currently accepted Cordilleran orogenesis. The eastern Mojave Desert is regionally situated at a critical position for testing Laramide tectonic models, positioned within Saleeby's (2003) proposed flat-slab deformation corridor, and adjacent to the proposed Tikoff et al. (2023) Insular Terrane collision. The lack of Laramide contraction in the region has led to the dismissal of end-loading as a shortening mechanism in the Rocky Mountain foreland province (Jones et al., 2011). We present new LASS U-Th-Pb monazite petrochronology, and a robust ~120 Ma U-Pb detrital zircon MDA from four samples which prove the youngest deformed strata is not Triassic Moenkopi, but rather a new formation deposited in an unrecognized Cretaceous basin, suggesting Laramide-aged shortening is recorded in the Little Piute Mountains.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## IMPACT OF UNDERLYING GEOLOGY ON CALIFORNIA SPRINGS AND CARBON SEQUESTRATION POTENTIAL

**Lilah Blake and Elisabeth Hausrath**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
lilah.blake@unlv.edu

This project aimed to examine the effects of underlying geology on California spring chemistry and location, as well as examining the carbon sequestration potential of rock types. Using ArcGIS Pro and Excel, analysis was conducted to determine proximity and relationships between various geospatial elements. Datasets were used from various sources, including those provided by government agencies and some from previous studies. The findings reveal a correlation between spring location, fault lines, and rock type. Ultramafic rocks have carbon sequestration potential and could capture $CO_2$ that issues from springs. The impact of geology on spring chemistry could have implications for exploratory missions on other planets.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## STABLE POTASSIUM ISOTOPIC COMPOSITION OF THE EARTH'S MANTLE AS A REFERENCE FOR THE MOON'S FORMATION

**Mary Clarich and Yan Hu**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
clarich@unlv.nevada.edu

Terrestrial planets grew through successive accretion of gradually larger rocky bodies, and Earth's main-stage accretion ended with a cataclysmic impact that presumably formed the Moon. Potassium (K) is a moderately volatile element during planetary accretion, and the K isotopic composition ($\delta^{41}K$) of the Bulk Silicate Earth (BSE) provides an essential baseline for constraining the Giant Impact origin for the Moon. The Moon has a small (0.4‰) but significantly higher $\delta^{41}K$ value relative to the BSE, which could be indicative of evaporative volatile loss during the Giant Impact. However, this previous finding is based on limited numbers of crustal rocks from Earth and the Moon. Potassium distribution remains poorly understood within the mantle, where 75% of terrestrial K resides, yet in much lower abundances than Earth's crust. A recent study of mantle peridotites, which are direct samples of Earth's mantle, revealed highly variable and, on average, a lower $\delta^{41}K$ value than oceanic basalts formed by partial melting of the mantle. This discrepancy between mantle peridotites and oceanic basalts warrants further investigation into the K isotopic composition of the mantle, which is the aim of this proposal.

Recent advancements in analytical techniques and instrumentation have made it possible to precisely measure the K isotopic composition of samples with low K abundances. **Here, we propose a study on mantle peridotites to further constrain the K isotopic heterogeneity and the composition of the BSE.** The purified K fraction of the samples will be measured using the Nu Sapphire Multi-Collector Inductively Coupled Plasma Mass Spectrometer (MC-ICP-MS), which is equipped with a state-of-the-art collision-reaction cell to effectively remove the massive isobaric interferences produced from the argon plasma. The new data will be used to establish a more representative $\delta^{41}K$ value for the BSE, which will be used to test various impact models for the Moon-forming Giant Impact.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## MODELING BIOLOGICAL SOIL CRUST EVAPORATION FLUXES IN ARID LANDS

**Ivet Escamilla Franco[1], Katlyn Hurley[1], Nicole Pietrasiak[2], Michael J. Nicholl[1], and Hannes H. Bauser[1]**

*1- Department of Geoscience, University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, NV, USA*
escami1@unlv.nevada.edu

Biological soil crust— or biocrust—consists of a complex assemblage of autotrophic organisms that are found at the land surface and may be the dominant living ground cover in arid environments. More than 40% of the Earth's terrestrial surface are considered as arid, where low precipitation and high evaporation are key factors in water depletion. Biocrusts influence a wide range of soil surface features, including roughness, porosity, water retention, and aggregation. For these reasons, the presence of biocrust modifies the hydrologic response of soils, including evaporative processes, which are the focus of this study. Previous field studies suggest that biocrust can either increase or decrease evaporation with respect to bare soil. Here, we aim to develop an improved understanding of how biocrusts influence evaporation. We will replicate a bench-scale laboratory evaporation experiment using a 2-layered HYDRUS-1D model. We hypothesize that proper choice of soil hydraulic properties for a thin surface layer will result in model outcomes that mimic experimentally measured evaporation fluxes for sand columns both with and without a biocrust.

**THE 20th ANNUAL UNLV GEOSYMPOSIUM**
**MAY 2, 2025**

## MAPPING HYDROLOGY OF SISTEMA HUAUTLA


## Timothy Heming

*University of Nevada Las Vegas, Las Vegas, NV, USA*
timothy.heming@unlv.edu



Sistema Huautla is one of the deepest caves in the world making it invaluable for everything from archaeology to zoology. The surface conditions are essential for understanding the in-cave conditions over time since rain percolates through the surface into the karst interior, sealing rainfall information over time. In this project, a collection of geologic, hydrologic, and chemistry information is combined to congregate knowledge on Sistema Huautla's surface conditions. The collection was created in ArcGIS using a number of in-built tools and prefabricated maps from both INEGI, USGS and PESH 2019 (a mapping expedition within Sistema Huautla). The origin for most of the maps was Orizaba, Mexico northwest of the caves. The combined maps identified three watershed-associated water chemistries that all feed into the landscape of Sistema Huautla. Furthermore, evidence for consistent temperature and rainfall across the cave system informs our understanding that the cave is under consistent exogenic (external) conditions across its ~10 $km^2$ surface. The combined climatic information from Sistema Huautla defines an annual precipitation of 30 mm with a range in annual temperature from 15 to 27 °C. The next steps are to collect a long-term set of data within the caves to confirm their suitability for use in modern climate analyses.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## MEASURING THE IMPACT OF BIOLOGICAL SOIL CRUSTS ON EVAPORATION


**Katlyn Hurley[1], Nicole Pietrasiak[2], Raul Roman[2], Michael Nicholl[1], and Hannes Bauser[1]**

*1- Department of Geoscience, University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- School of Life Sciences, University of Nevada, Las Vegas, Las Vegas, NV, USA*
hurlek1@unlv.nevada.edu



In arid and semi-arid regions such as the Southwestern United States, the soil between vascular plants (grasses, shrubs) is commonly occupied by biological soil crusts (biocrusts). These surficial structures form when organisms, such as bacteria, lichen, mosses, and fungi, bind with soil particles to create a living aggregate. Biocrusts are important because they are estimated to occupy 12% of the terrestrial Earth's surface and are known to impact the hydrologic cycle. However, the manner and degree to which biocrusts affect the hydrologic cycle is poorly understood and previous studies have yielded conflicting results, especially for processes related to evaporation. Here, we focus on characterizing the effects of biocrusts on water transfer to the atmosphere. Controlled laboratory experiments will be used to isolate the effects of biocrusts from the multitude of competing factors inherent in field studies. Utilizing an engineered sand as a soil surrogate, we will pack columns and grow biocrust microbes on the soil surface. As cyanobacteria are often the primary organism and first colonizer, two cyanobacteria species (*Microcoleus* sp. and *Scytonema hyalinum*) have been selected to develop our laboratory-grown biocrust. These biocrust columns will be weighed over time to gauge evaporative loss, and the results will be compared to results from a sterile, but otherwise identical, control column. Results of this investigation will serve as a basis for future experiments and to assist in evaluation of measurements from larger-scale experiments (e.g., lysimeters).

THE 20th ANNUAL UNLV GEOSYMPOSIUM
MAY 2, 2025

# LINKING GROUNDWATER RESPONSE TO FLOOD INUNDATION USING REMOTE SENSING AND IN SITU MONITORING DATA


## Chanel Koh[1] and Zach Perzan[2]

*1- University of Nevada, Reno, Reno, NV, USA*
*2- University of Nevada, Las Vegas, Las Vegas, NV, USA*
chanelk@unr.edu



Changes in climate have led to an increased frequency of extreme hydrologic events such as floods and droughts. One mitigation strategy is flood managed aquifer recharge (flood-MAR), where water is directed towards specific pieces of land to infiltrate into the subsurface. Using flood-MAR can have benefits such as absorbing excess water and storing groundwater that can be used in drought years. However, the efficiency of flood-MAR remains poorly understood. This project aims to calculate the recharge efficiency of prospective flood-MAR sites in the Central Valley of California, using historical floods as natural analogues for flood-MAR. This is done by analyzing satellite-derived inundation maps to produce graphs of max flood extent depiction (MFED) values and groundwater levels over time. Then, the lag time between inundation and an increase in groundwater levels will be used as a representation of recharge efficiency. The results of this project can then be used to derive components of high-efficiency flood-MAR sites to guide future decisions about site locations.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## APPLYING BACKCASTING TO IDENTIFY DRIVERS OF POTENTIAL FUTURE WATER QUALITY CHALLENGES IN LAKE MEAD


### Eunice Ledres[1], Hannes Bauser[1], Deena Hannoun[2], and Brooke Stemple[2]

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Southern Nevada Water Authority, Las Vegas, NV, USA*
ledres@unlv.nevada.edu



Lake Mead is a multipurpose reservoir on the Lower Colorado River Basin that supplies drinking and irrigation water to over 40 million people. At full capacity (over 31 million acre-ft), Lake Mead would be the largest reservoir in the United States. Since 2000, a prolonged drought in the source regions of Lake Mead has led to a 71% decline in lake volume. The Southern Nevada Water Authority developed the Lake Mead Model to support the management and delivery of high-quality water to the Las Vegas Valley and downstream users. The Lake Mead Model has become an important tool in supporting water quality management through forwards projection. **This study aims to enhance modeling efforts for Lake Mead by applying a backcasting and classification method to identify potential solutions for future water quality problems.** The backcasting method predicts different drivers of challenges that water managers and water supplies may face, starting with high water temperature discharge at the Hoover Dam. Rather than predicting the future, backcasting predicts drivers (such as air temperature, lake elevation, inflow volume, and others) of the future. Once backcasting is applied, a classification method is developed that quantifies the significance of each driver–and the correlation between the drivers–for each challenge scenario. The combination of the current method of predicting future outcomes, and the new method in backcasting and classification aims to help enhance the current use of the Lake Mead Model, and the planning, management, and maintenance of water quality in Lake Mead.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## HETEROGENEOUS EVAPORATION FLUXES DUE TO BIOLOGICAL SOIL CRUSTS IN ARID LANDS THROUGH HIGH-RESOLUTION THERMAL IMAGING

**Rebekah C. Magness, Hannes Bauser, Markus Berli, and Nicole Pietrasiak**

*University of Nevada, Las Vegas, Las Vegas, NV USA*
magness@unlv.nevada.edu

Biological soil crusts are a unique colony of living organisms incorporated in the topmost millimeters of the soil surface. Biological soil crusts are often found in dry regions of Earth and play an important role in arid ecosystems. The extent to which biological soil crusts influence evaporation in arid lands remains unknown. There is an overarching consensus that biological soil crusts play a critical role in the hydrologic processes in arid settings, however, there is uncertainty whether biological soil crusts increase or decrease evaporation. To gain a better understanding of the impact of biological soil crust on evaporation compared to bare soil, we analyze a biological soil crust patch atop a lysimeter with bare soil through high-resolution thermal imaging. **This study consists of two objectives: 1) determine the heterogeneous evaporation patterns due to the presence or absence of biological soil crusts, and 2) evaluate changes of these evaporation patterns over time.** Using surface temperature data from a high-resolution thermal camera and evaporation data from a lysimeter, we can infer the evaporation using the three-temperatures model, which is based on the energy balance equation. With this model, we will calculate and compare the evaporation fluxes of biological soil crusts and surrounding bare soil. By identifying variations in evaporation within a surface with varying biological soil crust cover, we aim to better characterize the role biological soil crusts play in the hydrology of arid lands.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## CONTROLS ON SPELEOTHEM CARBON ISOTOPES SISTEMA HUAUTLA, MEXICO


**Paloma M. Marcos and Matthew Lachniet**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
marcop1@unlv.nevada.edu



Similar to $\delta^{18}O$ isotopic values, speleothem carbon isotope values can reveal key aspects about past climatic and environmental conditions. However, in addition to climate, various local processes influence speleothem $\delta^{13}C$ values, which is why confident and detailed interpretations of this proxy are often a challenge to determine. The Sistema Huautla cave system is the deepest known in the Americas at 1560m. This extensive cave site has been an area of interest among cavers and scientific researchers from 1965 to the present day, with over 400 project participants and 200 published articles. Samples from this cave have been found to be over 433,000 years old and are considered to be in pristine condition compared to most other tropical stalagmites when used for U-Th dating. After the completion of an independent study with the LVIS laboratory in the Fall 2024 Semester, I was able to work first hand with several of the Sistema Huautla (SH) speleothem samples to assess and discover the controls on the speleothem $\delta^{13}C$ isotopes over time. Samples of calcite were drilled out of the speleothem samples at 1 mm intervals to increase the resolution of the data as these samples had previously only been analyzed to a 4 mm resolution. All of the samples were processed using a shoreline 5410 deluxe mill attached to a tachometer to ensure accuracy. The drill head and speleothem are cleaned between collections to prevent contamination. Carbonate $\delta^{13}C$ and $\delta^{18}O$ were measured using isotope ratio mass spectrometry (IRMS) to produce the dataset for my Senior Thesis. The main known sources of carbon isotopes in speleothems are summarized as the following; Vegetation (C3, C4, and CAM) ranging from -25‰ to -12‰ $\delta^{13}C$, Bedrock ranging from ~0 ∓ 4‰, Eolian silt, and Atmospheric CO2 ranging from -6.5‰ to -8.5‰ $\delta^{13}C$. Using Pandas and Matplotlib within the Python Coding Language, I have been able to constrain the likely relevant sources of carbon isotopes in the speleothems by plotting and applying basic statistical analysis for each sample. The preliminary results suggest that bedrock and atmospheric $CO_2$ may have a stronger influence on the $\delta^{13}C$ isotope signal than I had previously hypothesized. Previously I thought to use the dataset to understand if C3 or C4 Vegetation had a stronger contribution to the carbon isotopes within the sample, however from the initial results of the figures I have completed coding in Python indicate the average $\delta^{13}C$ absolute values lying in -3‰ to -7‰ which are more consistent with bedrock and atmospheric $CO_2$ influence. Some of the samples have multiple growth axes and require more detailed analysis where I plan to present my final results at the 2025 Geosymposium poster sessions next month.

## GEOSPATIAL ANALYSIS OF FIRE TEMPERATURE THRESHOLDS IN RELATION TO BUILDING MATERIAL RESILIENCE WITHIN LOS ANGELES COUNTY


**Mauricio Morteo, Gabrielle Fernando, Lauren Frixione, and David Contreras**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
mmorteo@unlv.nevada.edu



Wildfires in Los Angeles County since 2018 have caused extensive structural damage with varying impacts on different building material types. This poster examines the relationships between estimated fire temperature zones and structural damage outcomes to determine critical temperature thresholds for various exterior building materials. Identifying the point at which the materials transition from minimal, moderate to catastrophic failure could inform more resilient building practices in fire-prone regions in LA County. While previous research may have examined general wildfire damage patterns, the specific temperature thresholds may pose a greater understanding of structural damage. This project's methodology persists through data sets that are to be found in the ArcGIS database on California fires, the burn severity on certain structures and its building materials to therefore determine our results. Raster analysis correlates the temperature thresholds throughout LA county along with tables indicating which building materials best survived the fires and what their temperature thresholds were throughout past and current fires in the region. Results will show how resistant certain materials are based off their maximum fire temperature threshold. Based on the information given we want to show which materials are better fire resistant than others to help better the structural integrity of buildings in surrounding affected fire areas.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## PROTECTING NATIVE SAGEBRUSH IN THE GREAT BASIN: A GIS-BASED APPROACH TO INVASIVE SPECIES MANAGEMENT

**Kimberly Sorreda, Jenna Slack, Colin Weeks, Eric Ling, and Johnnathan Vanderhoof**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
sorrek1@unlv.nevada.edu

As North America's largest desert and known for its unique biodiversity, the Great Basin houses more than 800 different species of plants like sagebrush which covers at least 400,000 square miles of the area. Sagebrush's dominance plays a significant role in the Great Basin's ancient ecosystems. However, throughout the decades, it has faced an alarming decline due to competition from invasive grasses such as cheatgrass and is a major contributor to the status of the Great Basin as one of the most endangered ecosystems. To mitigate the alarming decline of sagebrush habitats, proactive management for its conservation must be prioritized. Using Geographic Information Systems (GIS) Technology, we model the spread and impact of invasive grasses in the Great Basin to predict areas at high risk of fires and identify vulnerable sagebrush areas based on slope and aspect. to prevent the decline of the sagebrush habitat. Preliminary results from GIS analysis indicates vulnerable areas of the Great Basin and allows for motivated conservation efforts. This study illustrates the ability of GIS as an empowering tool for the management and protection of the Great Basin's native sagebrush species from invasive grasses.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## ABANDONED ARIZONA: THE EFFECT OF WATER CONTAMINATION BY ABANDONED URANIUM MINES ON THE ARIZONA POPULATION.

**Emily Surber, Maryn Ferguson, Portia Nead, Haritha Ramalingam, and Sophie Seeds**

*University of Nevada Las Vegas, Las Vegas, NV, USA*
surbee1@unlv.nevada.edu

Water contamination from industrial sites continues to be a health hazard for the surrounding environment and the ever-expanding human population. Abandoned infrastructure can leach harmful materials into groundwater systems that span for miles, reaching populations thought to be safe from contamination. This study analyzes the impacts of abandoned uranium mines, based out of Arizona, specifically Navajo Nation, over the past thirty years on water resources in the surrounding communities. This study assesses the risk of contamination using data gathered from recent clean-up efforts and risk assessment scores. Our research is emphasized by our map of Arizona's water resources in relation to sources of uranium contamination. We conducted an overlay analysis as well as buffering to determine and measure potentially affected areas. We hypothesize that populations exposed to uranium, specifically from abandoned mine contaminated water, will show a quantified impact. By analyzing potential contaminated areas, we can show the significant impacts the uranium mines have on the environment and the people living in the surrounding areas.

THE 20th ANNUAL UNLV GEOSYMPOSIUM
MAY 2, 2025

# THE ACOUSTOELASTIC EFFECT IN POLYCRYSTALLINE QUARTZ AT HIGH PRESSURE AND TEMPERATURE


**Taryn K. Traylor[1], Pamela C. Burnley[1], and Matthew L. Whitaker[2]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Mineral Physics Institute, Stony Brook University, Stony Brook, NY, USA*
traylt1@unlv.nevada.edu



The measurement of mineral elastic properties through experimental studies is crucial for seismic data interpretation and can aid in our understanding of the deformation processes that shape the Earth. This study investigates the effect of a material's stress state on P- and S-wave velocities, known as the acoustoelastic effect. This material property is well known in metals and has been measured at ambient to low confining pressure conditions in geologic materials. The acoustoelastic effect was previously evaluated in olivine at high-pressure-temperature conditions relevant to the Earth's lithospheric mantle (Traylor et al., 2021). A measurable acoustoelastic effect was observed in olivine that was nearly insensitive to changes in temperature and showed a minor pressure dependence. This research seeks to expand the study of the acoustoelastic effect by investigating polycrystalline α-quartz through a series of uniaxial deformation experiments at 1.4–2.8 GPa and 200–900°C.

Our method employs the DIASCoPE ultrasonic system, incorporated into the D-DIA multi-anvil apparatus, at the APS 6-BM-B beamline at Argonne National Laboratory to obtain in situ longitudinal (P) and shear (S) wave velocities at high pressure and high temperature. We use elastic-plastic self-consistent (EPSC) numerical modeling to forward model X-ray diffraction data collected in D-DIA experiments to obtain the macroscopic stress on our sample. The relationship between the relative elastic wave velocity change ($\Delta V/V$) and macroscopic stress is then evaluated using the linearized first-order equation based on the model proposed by Hughes and Kelly (1953) to determine the acoustoelastic constants and interpret our observations.

# THE DEMISE OF FOSSIL CYCAD NATIONAL MONUMENT AS A CONSEQUENCE OF PALEONTOLOGICAL RESOURCE MISMANAGEMENT

**Nathaniel Valentine[1], Vincent Santucci[2], Justin Tweet[2], and Aubrey Bonde[2]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- National Park Service*
nv29@unlv.nevada.edu

Fossil Cycad National Monument, established in 1922 under the authority of the Antiquities Act of 1906 serves as a reminder of the consequences of paleontological resource mismanagement due to poor collection practices by paleontologists. The site was scientifically valuable as it preserved numerous specimens of flowering cycadeoid fossils from the Cretaceous, the time period corresponding to the evolution of flowering plants. With the assistance of paleontologists from the National Park Service, I conducted a literature review and examined primary sources to determine the number of fossils removed from the site between 1890-1957. Excessive collection of in-situ fossils by paleontologists was the main contributor to fossil depletion. To maintain the status of the site as a national monument, plans to create a visitor center were proposed but never built. With no compelling reason to keep the site for scientific or cultural value, it was decommissioned as a national monument by Congress in 1957. Further research on the site could examine the rate of fossil depletion before 1920 and between 1920-1957 by tracking and cataloging specimens stored in collections within the United States and internationally.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## THE EFFECTS OF ANOXIA AND OCEAN ACIDIFICATION ON THE FUNCTIONAL DIVERSITY OF SHALLOW MARINE ECOSYSTEMS IN THE LATE TRIASSIC

**Fiorella Ramirez-Guasp[1], Lydia Tackett[2], Roxanne M.W. Banker[3], Ashley A. Dineen[4], Peter D. Roopnarine[5], and Carrie L. Tyler[1]**

*1- University of Nevada, Las Vegas, NV, USA*
*2- University of Missouri, Columbia, MO, USA*
*3- Providence College, Providence, RI, United States*
*4- University of California, Berkeley, CA, USA*
*5- California Academy of Sciences, San Francisco, CA, USA*
ramirezg@unlv.nevada.edu

Late Triassic marine ecosystems experienced global oceanic disturbances that were catastrophic for fauna residing on the seafloor. Widespread volcanic eruptions likely raised atmospheric $CO_2$ levels, triggering chemical weathering and global nutrient enrichment, which led to ocean acidification and oxygen depletion. Maintaining functional diversity has recently become a focus for conservation especially after disturbances, as functional diversity is crucial for ecosystem stability and resilience, and loss of species does not necessarily equate to loss of functions. Functional diversity refers to the variety of biological traits the species within an ecosystem possess and how these traits influence their response to disturbances or their ability to modify the environment. Thus, understanding changes in ecosystem functioning across the Norian-Rhaetian boundary (205 Ma) in the Late Triassic can help us better understand the resilience of modern marine ecosystems in the face of anthropogenic disturbances. The Late Triassic marine fauna of the Panthalassic ocean, now exposed in New York Canyon, Nevada, provides a well-documented, high-resolution stratigraphic framework to study these shallow marine ecosystems. Here, we compare the functional diversity of the Norian assemblage from New York Canyon, Nevada, to a global Rhaetian assemblage using biological traits (tiering, feeding, and motility). Norian species produced 14 functional entities, or unique groupings of traits, while the Rhaetian assemblage produced only 12. The loss of two functional entities is notable, as the global assemblage should represent a larger range of organisms and functions. A Spearman's rank correlation indicates that the distribution of taxa among functional entities differs between the two assemblages ($\rho = -0.41$, $p = 0.045$), likely as a result of ecosystem disturbance. The fossil record provides the most obvious and widely accessible archive of past ecosystems that can be used to determine the effects of anoxia and ocean acidification on ecosystem functioning.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## PALEOCLIMATE FORCING OF MEXICAN DEGLACIATION


**Timothy Heming and Matt Lachniet**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
timothy.heming@unlv.edu


Mexico and the surrounding region are home to karst (cave) environments. Speleothems are cave calcite deposits, which are robust paleoclimate (past weather) proxies that record past rainfall variations in their stable isotopic composition and can be radiometrically dated with U-series dating methods (Dorale et al., 2004; Fairchild et al., 2006; Fairchild & Baker, 2012; Fohlmeister et al., 2020; Lachniet, 2009; Wong & Breecker, 2015). Few sites have well-dated speleothem records from within and near Mexico, which can be compared to other paleoclimate proxies like lake sediments (Bernal et al., 2011; Lachniet et al., 2013; Wright et al., 2022, 2023; Lucia et al., 2024). The existing data provide diverging representations of the Holocene climate across Mexico. For example, a stalagmite from Cueva Bonita in the north of Mexico was nearing dry conditions by 20,000 years ago while Juxtlahuaca Cave in southwest Mexico appears to have instead rapidly dried around 18,000 years ago (Lachniet et al., 2013; Lucia et al., 2024). T*he goal of this project is not only to identify these inconsistencies of climate variability, but also to add a well-dated stalagmite from approximately the same latitude as Juxtlahuaca to test regional forcings and identify the cause of the regional incoherencies.* While few ideal sites have been identified, here I identify a potentially ideal site with strong dating. The site I propose to generate a new paleoclimate reconstruction from is Sistema Huautla, Oaxaca, Mexico. Sistema Huautla is on the Caribbean slope of Mexico at approximately ~18°, the same latitude as Juxtlahuaca. New understandings drawn from Sistema Huautla have implications for past climate, subsequently increasing understandings of the development of Mexican agriculture which arose since the Last Glacial Maximum, and projections for future climates of the region which rely on paleoclimate records as an accuracy test.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## SPATIAL AND KRIEGING ANALYSIS OF RECURRING PHYTOPLANKTON BLOOMS IN LAKE HAVASU


**Eunice Ledres**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
ledres@unlv.nevada.edu



Phytoplankton blooms can disrupt water quality by modifying nutrient dynamics, producing harmful toxins, and reducing dissolved oxygen levels. In the summer of 2015, Lake Havasu experienced a substantial phytoplankton bloom, and in recent years, high phytoplankton densities have become an annual occurrence. Lake Havasu consistently shows higher phytoplankton densities than upstream reservoirs like Lake Mead, indicating it has crossed an ecological threshold and experiences recurring summer cyanobacteria blooms, some of which produce toxins. Given the role of Lake Havasu as a key water source for Arizona’s largest renewable water supply, the persistent blooms merit closer investigation. **This study utilizes phytoplankton data curated by the Southern Nevada Water Authority to conduct a spatial analysis of phytoplankton distribution in Lake Havasu**. **Using interpolation techniques and the kriging method in ArcGIS Pro, phytoplankton genus and density will be estimated across the lake**. By enhancing the understanding of phytoplankton community dynamics in Lake Havasu, **this research aims to contribute to the ongoing efforts to improve and maintain water quality in this vital reservoir**.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## MAPPING BIOLOGICAL SOIL CRUSTS: A SUPERVISED CLASSIFICATION APPROACH


**Rebekah C. Magness**

*University of Nevada, Las Vegas, NV, USA*
magness@unlv.nevada.edu



Biological soil crusts are a unique ecosystem of living microorganisms and macroorganisms incorporated in the uppermost millimeters of the surface. Covering an estimated 12% of the Earth's surface, biocrusts play a critical role in arid land hydrology. However, despite their prevalence, the influence of biological soil crusts on hydrologic processes, like evaporation, remains poorly understood. **This study addresses this knowledge gap by mapping biological soil crust atop a lysimeter in Boulder City, Nevada. This mapping will enable future research to analyze how biological soil crust affects evaporation in arid climates. Understanding this relationship will directly inform us about the hydrologic cycle of arid environments.** A high-resolution map was produced using a supervised classification model, distinguishing biological soil crust and non-biological soil crust. Four training classes- biological soil crust, rock, bare soil, and man-made objects were used for classification. A supervised classification model was selected due to close collaboration with the Biology department. I have an in-depth knowledge of the image and what pixels are and are not biological soil crust to be used for training sites. By accurately characterizing the biological soil crust atop of a lysimeter, this study lays the groundwork for future biological soil crust evaporation research by providing a known percent cover and specific spatial distribution.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## UNIQUE SHOCK TEXTURES IN THE NEW DEPLETED BASALTIC MARTIAN METEORITE NORTHWEST AFRICA 15917

**Gabriela Motta[1], Amanda Ostwald[2], Sierra Ramsey[1], Arya Udry[1], Gordon Osinski[3], James Day[4], Megan Ferrell[4], Alan Zukowski[5], and Valerie Payre[5]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Smithsonian National Museum of Natural History, Washington, DC, USA*
*3- University of Western Ontario, Ontario, CA*
*4- Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, USA*
*5- University of Iowa, Iowa City, IA, USA*
mottag1@unlv.nevada.edu

Martian meteorites are rocks from the surface of Mars that have been impacted, ejected, and transported to Earth, and are the only samples we currently have of the Red Planet. Throughout the planet's history, Mars has consistently been impacted by rocks from outer space (e.g., meteoroids, asteroids), which have formed craters that displace and eject material from the martian surface. As a result, high-pressure minerals (e.g., ringwoodite, coesite) may form and record the intensity, duration, and temperature of these impact events, which can later be analyzed on Earth using high-precision analytical techniques. As martian meteorites do not have geologic context, quantitatively analyzing these high-pressure minerals can help us better spatially correlate these samples to similar ejection sites on Mars and can possibly help with determining the burial depth of these rocks. Northwest Africa (NWA) 15917 is a new incompatible trace element depleted basaltic martian meteorite, which contains unique shock textures such as amorphous shock melt pockets, dissociated reaction rims, and heterogeneous mineral intergrowths. Using qualitative imaging, we observe that these shock melt pockets are chemically heterogeneous and may host high-pressure mineral phases, which will be quantitatively analyzed in the near future. Identifying distinct high-pressure mineral phases within heterogenous and amorphous shock melt pockets will provide insight into the breakdown of minerals as a result of impact events. We have also conducted bulk rock geochemistry, *in situ* mineral major, minor, and trace elemental analyses, and X-ray computed tomography in order to compare the geochemistry, mineralogy, and texture to other similar martian meteorite samples (e.g., Queen Alexandria Range 94201, NWA 12522). Here we present a preliminary investigation on the petrogenesis and unique shock textures of NWA 15917 to better understand constraints on shock pressure, deformation, and impact events on the martian surface.

# INCOME-BASED DISPARITIES IN ACCESS TO PUBLIC PARKS IN LAS VEGAS, NEVADA


**Christopher Nelson, Rylee Infuso, Adryan Lujan, and Nicholas Mendez**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
nelsonc9@unlv.nevada.edu



This project uses ArcGIS to analyze the spatial relationship between public parks and lower-income neighborhoods in Las Vegas, Nevada. The purpose is to identify disparities between neighborhood income level and park accessibility targeting only parks that are accessible to the public. The analysis omits heavily restricted parks such as those found in private, gated communities or public-school greenspaces. Data sources primarily stem from local and federal government including the Clark County GIS Data Management Office, City of Las Vegas GeoCommons, and the U.S. Census Bureau. Graduated colors highlight which neighborhoods contain the most parks within their boundaries for effective analysis and visualization of park accessibility relative to income. Statistical methods such as buffer analysis and spatial statistics help identify any potential disparities. Our findings indicate that higher-income neighborhoods have better access to parks than lower-income neighborhoods.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## INDIUM DEPORTMENT AS A COMPONENT OF HYDROTHERMAL MINERALIZATION — THE WEST DESERT SKARN DEPOSIT, UT

**Dalton Pell[1], Andrew Martin[1], Stephanie Mills[2], Simon Jowitt[3], and Max Frenzel[4]**

*1- University of Nevada, Las Vegas, Las Vegas, NV, USA*
*2- Utah Geological Survey, Salt Lake City, UT, USA*
*3- University of Nevada, Reno, Reno, NV, USA*
*4- Helmholtz Institute Freiberg for Resource Technology, Freiberg, Germany*
pell@unlv.nevada.edu

Critical metals are becoming increasingly important to the United States and the world because of their integral role in national security, energy and technology applications. Indium (In) is one such metal that has a continuously growing demand due to its use in liquid crystal display (LCD) screens, semiconductors, and the manufacturing of photovoltaic solar cells. The West Desert Skarn Deposit (WDSD) is a polymetallic skarn deposit in Utah that has been identified to contain high amounts of In. Initial observations have concluded that the In is present in significant amounts within sphalerite (≤11.3 wt.% In), chalcopyrite (≤0.3 wt.%), and In-sulfides (roquesite and sakuraiite) and the In-oxide dzhalindite, which is common among other In-bearing deposits. This study analysed a suite of minerals and their In concentrations to construct a deportment model to better understand the controls on the mineral-scale distribution of In. The mineral assemblage was determined using microscopic descriptions and scanning electron microscopy (SEM) with mineral liberation analysis (MLA). Mineral compositions were determined using an electron probe microanalyzer (EPMA). Element maps were created to understand semi-quantitative distributions of In. The analytical data acquired will be integrated into a deportment estimation. The initial data collected proves In is recoverable from the WDSD as a by-product, potentially making the WDSD a future producer of domestic In.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## WATER FLOW CHANGES IN LARGE HETEROGENEOUS VADOSE ZONES OVER TIME


**Samantha Poppenhouse and Zach Perzan**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
poppenho@unlv.nevada.edu



The Central Valley of California, one of the most agriculturally productive regions in the United States, suffers from overextraction of groundwater. Shifting precipitation patterns and an increase in high-intensity flood events have further diminished opportunities for natural groundwater recharge. In response, water managers have begun diverting flood waters applied as managed aquifer recharge (Flood-MAR) to increase water infiltration to the groundwater system. The extended infiltration time would allow for the banking of water for future use. Promising results have been seen with the implementation of Flood-MAR in short-term studies, but more information is needed on how the flow of water changes over time in the large unsaturated zones observed in the Central Valley. The movement of water in large heterogeneous vadose zones is not well understood due to the difficulties in characterizing the subsurface, limited ability to monitor infiltration due to cost, and the depth of the unsaturated zone. Future water management decisions in the Central Valley will be informed from the results of modeling the area. ParFlow-CLM, the 3D computational software, will use a previously characterized agricultural site to simulate water infiltration and percolation from the surface through to the saturated zone. ParFlow-CLM will help provide a better understanding of the movement of water through the large heterogeneous unsaturated zone.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## CONSTRAINING DEFORMATION HISTORY OF THE KILBECK HILLS: A KINEMATIC ANALYSIS OF THE KILBECK FAULT AND SCANLON THRUST


## Henry Schatz and Michael Wells

*University of Nevada Las Vegas, Las Vegas, NV, USA*
schatz@unlv.nevada.edu



The Laramide orogeny was a large-scale mountain-building event during the Late Cretaceous to Mid-Eocene in which a NE-directed compression applied to the North American Plate led to uplift of the Rocky Mountains. The driving mechanisms for the Laramide remain controversial and the principal proposed models include shear coupling between a low-angle Farallon plate subducting beneath North America and the collision of terranes at the western plate margin. This study will focus on the Kilbeck Fault and Scanlon Thrust, which are exposed in the Kilbeck Hills of San Bernardino County, California. The goal of this study is to provide new data on the timing and kinematics of deformation in a little-studied region between the Clark Mountain Thrust Complex to the north and the Maria Fold and Thrust Belt to the south to address the proposed models.

The study will involve a combined effort of sample collection, geologic mapping, and geochronological and kinematic analyses. Geochronological analyses will be accomplished by the combination of accessory-phase (monazite, titanite, rutile, apatite, and zircon, depending on their presence) dating of deformed rocks in the fault zones and detrital zircon dating of deformed Mesozoic(?) metasediments using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Kinematic analyses will be conducted by field and microstructural observations supported by lattice-preferred orientation (LPO) analysis of deformed quartz grains using electron backscatter diffraction (EBSD) on a field emission scanning electron microscope (FESEM). It is hypothesized that determining the age and kinematics of the Kilbeck Fault and Scanlon Thrust will provide new insights to discriminate between alternative models for Laramide mountain-building and help to link the two different belts of shortening to the north and south.

THE 20th ANNUAL UNLV GEOSYMPOSIUM
MAY 2, 2025

# INVERTEBRATE FUNCTIONAL DIVERSITY OF FOSSILS FROM ARROW CANYON, NEVADA


## Nathaniel Valentine, Samantha A. Maciech, and Carrie L. Tyler

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
nv29@unlv.nevada.edu



Paleontology can be used to study how ecosystems evolve and respond to changes in the environment. Here we examine invertebrate fossils from the Pennsylvanian, a time period that ranged from 323.2 to 298.9 million years ago, which are preserved along the walls of Arrow Canyon (Nevada) in the Bird Spring Formation. We surveyed three sites within the canyon and used data from the Paleobiology Database to create a list of taxa found on the canyon from this time interval. Although ecosystems have traditionally been studied using the composition of the ecosystem (the number of species), recent work has shown that functional structure may be more important to the health of an ecosystem. Therefore, here we examine functional diversity (the types of functions performed by all of the organisms in an ecosystem). Three functional traits were assigned to each taxon: tiering, feeding, and motility, using the Paleobiology Database and the scientific literature. We examined both how much of the functional space was filled, and how species were distributed within functional space using Functional Entities, unique combinations of functional traits. Brachiopods dominated the fossil samples, as the geologic setting favored the preservation of their shells. Other invertebrate phyla are represented, though their sample sizes are low. Further study on the functional diversity of the Bird Spring Formation may incorporate fossil data from other fossil localities to expand sample sizes at the genus level.

# THE 20th ANNUAL UNLV GEOSYMPOSIUM
# MAY 2, 2025

## URBAN HEAT ISLAND EFFECT IN LOW INCOME NEIGHBORHOODS

**Isabelle Walter, Corey Ruschmann, Ruth Ogunbiyi, and Katie Vidal**

*University of Nevada Las Vegas, Las Vegas, Nevada, United States of America*
waltei1@unlv.nevada.edu

Heat islands are areas with higher temperatures than those around them, caused by urban materials such as roads that absorb heat, restricted airflow, and heat generated from human activities. Areas of vegetation called green spaces relieve the heat island effect by providing shade, reflecting radiation from the sun, and emitting moisture. Green space isn't distributed equally concerning socioeconomic standing, resulting in temperature disparities. Specifically, lower-income neighborhoods are more likely to experience elevated temperatures than higher-income neighborhoods. To evaluate this disparity, we measured the spatial autocorrelation between income, green space, and temperature in Las Vegas using Esri ArcGIS Pro and public data. To identify the areas most affected, we mapped temperature, green space, and income in Las Vegas. We calculated the variance statistic to quantify the difference in temperature and green space between neighborhoods of different socioeconomic standing.

# MEASURING THE OXIDATION STATE OF IRON IN FERROUS CLAY MINERALS AS THEY OXIDIZE TO FERRIC CLAY MINERALS TO BETTER UNDERSTAND THE ROLE OF CLAY MINERALS IN POTENTIAL BIOSIGNATURE PRESERVATION ON MARS

**Ian Zambrano, Eduardo Martinez, and Elisabeth Hausrath**

*University of Nevada, Las Vegas, Las Vegas, NV, USA*
zambri1@unlv.nevada.edu

Mars is an iron-rich planet that contains a variety of iron-bearing clay minerals. Evidence shows clay minerals are a promising tool for biosignature preservation. This is because clay minerals are able to adsorb and concentrate nutrients (e.g., phosphate, sulfate, nitrate, etc.) and organic compounds of astrobiological relevance. Ferrous saponite, an $Fe^{2+}$ bearing smectite, is speculated to have been present on Mars and could have played a critical role in nutrient cycling in early Mars history. Nontronite, an $Fe^{3+}$-bearing smectite, has been detected on Mars in the same environments as phosphate (a nutrient with biosignature potential). Additionally, ferrous saponite can oxidize into nontronite under certain conditions, and therefore influence the preservation and mobility of phosphate and other nutrients. The oxidation state of clay minerals is known to influence the binding and stability of phosphate in Mars-like conditions. In this study, we monitor the oxidation state of Fe in laboratory-synthesized ferrous saponite as it oxidizes into nontronite with and without the presence of phosphate. We measure oxidation of $Fe^{2+}$ to $Fe^{3+}$ over time to understand the effect of phosphate mobility and the stability of our clay mineral phases by using iron colorimetry. The results of this study can be used to understand the characteristics of the clay minerals as iron oxidation state changes over time and help understand the conditions of potential past life on Mars.

# KEYNOTE SPEAKERS' BIOGRAPHIES

**Colby Pellegrino** (*Southern Nevada Water Authority*)

Colby Pellegrino is the Deputy General Manager of Resources for the Southern Nevada Water Authority and the Las Vegas Valley Water District. After joining the agency in 2003, Pellegrino served as an instrumental part of the Water Resources division, supporting Colorado River modeling efforts to anticipate changes caused by climate change, reduced flows, and other inputs. In her current capacity, she is responsible for the management of the Water Authority's water resource portfolio, which includes protecting Nevada's interests and rights to Colorado River water through interstate negotiations, developing regional water conservation programs, managing groundwater resources, and water resource planning. A native of Las Vegas, she earned her Bachelor of Science degree in civil engineering from the University of Nevada, Las Vegas, and her Master of Business Administration from Mississippi State University.

**David Todaro** *(Kinross)*

Dave Todaro is the Geology Manager for Kinross Nevada, where he oversees Round Mountain and Bald Mountain operations. He has been with Kinross for 2 years, and before that has over a decade of experience with Aurcana Silver and Barrick Gold. His experience in mining geology has been focused on underground mining operations being involved with many different mining techniques. Dave graduated from Fort Lewis College in Durango Colorado in 2010 with a bachelor's degree in Geology and Minor in GIS.