UNLV Department of Geoscience

18th Annual Geosymposium

April 28th, 2023 Program and Abstracts

THANK YOU TO OUR AWARD SPONSORS

THANK YOU TO OUR GOLD SPONSORS

THANK YOU TO OUR SILVER SPONSORS

THANK YOU TO OUR AWARD AND RESEARCH GRANT SPONSORS

Graduate Academic Achievement Award
Sponsored by: Southern Nevada Water Authority

Undergraduate Academic Achievement Award
Sponsored by: Nevada Gold Mines

Best Poster Presentation Award
Sponsored by:
Jacobs Technology
IDS (International Directional Services)
Kinross Gold

Atomic Testing Museum

Best Oral Presentation
Sponsored by:
Nevada Gold Mines
Universal Engineering Sciences

Research Poster Session
Sponsored by: IDS

Student Research Grants
Sponsored by: Geological Society of Nevada

THANK YOU TO OUR CAREER SHOWCASE SPONSOR

Nevada Gold Mines by Barrick

THANK YOU TO OUR INDIVIDUAL DONORS

Annie Duke
Andrew Miller
Brandon Agcopra
Brandon Scott
Carmen Gilbert
Cory Nelson
Chloe Weeks
Collin Davidson
Deborah Morales
Drew Jackson
James Bristow
Joel Rotert
Katrina Switalski
Kurt Goebel
Laura Dye
Lisa Danielson
Linda Baumert
Lynn Oliver
Malik Milton
Maria Rojas
MaryKay Orgill
Merryn Cole
Monica Milton
Nathan Eck
Pamela Burnley
Robin Grove
REI Robert Klein
Samantha Maciech
Satish Bhatnagar
Sierra Ramsey
Simon Jowitt
Springs Preserve
Susan Lederer
Theresa Hruby-Minden

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,

Welcome you to the 18th 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'd like to thank our sponsors Nevada Gold Mines (NGM), Mission Support and Test Services (MSTS), Southern Nevada Water Authority (SNWA), Kinross Gold, KGHM Robinson Mine, IDS, Jacobs Technology, Geologic Society of Nevada, Universal Engineering Sciences, and the Atomic Testing Museum. Without their support this event would not be possible. We are very appreciative of their continued interest in and commitment to student research.

I'd also like to thank the Springs Preserve, REI, Suzie Lederer, and Debbie Morales for their contributions to the 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. Andrew Martin for leading our Hoover Dam field trip and his willingness to volunteer his time. A special acknowledgement is owed to Maria Rojas, Frank Sinatra, and the Geoscience office staff for playing an invaluable role in the logistics of making this event happen.

GeoSymposium would not be possible without the students and volunteers. I'm incredibly grateful for their contributions. A particular thank you is owed to a few individuals. Dr. Jeremy Koonce, our faculty advisor, for his dedication and efforts year after year. Debbie Morales for being so dedicated to helping and guiding me through organizing this event. Amanda Ostwald and Sierra Ramsey for their organization, consistency, and time putting the program together. Suzie Lederer for her endless generosity and commitment to helping Geoscience students. A final thank you to all the students, faculty, community members, judges, alumni, and presenters participating in GeoSymposium.

Cheers,

Molly E. Pickerel
GeoSymposium Coordinator, 2023

Committee Members

Molly Pickerel
Maria Rojas
Debbie Morales
Suzie Lederer
Sierra Ramsey
Amanda Ostwald

Subcommittee Members

Dexter Lim
MacKenzie Mitchell
Thomas Boes
Giuseppe Lucia
Drew Jackson
Evan Silva
Nick Foresta
Chloe Weeks

Geosymposium Advisor: Dr. Jeremy Koonce
Website: Dr. Arya Udry

SCHEDULE OF EVENTS

Friday, April 28th

Science and Engineering Building (SEB)*

8:00 am	Sign-in
8:30 am	Opening Remarks
8:45 am	Keynote address
9:45 am	Oral Presentation Session I
11:00 am	Poster Presentation Session I
12:30 pm	Lunch
1:30 pm	Oral Presentation Session II
2:30 pm	Break
3:00 pm	Poster Presentation Session II
4:30 pm	Break

Blasco Event Hall, Foundation Building (FND)*

5:00 pm	Awards Ceremony
5:30 pm	Reception and Silent Auction

Saturday, April 29th

Field trip to Hoover Dam:

Depart from Lilly Fong Geoscience (LFG)* Building parking lot at **7:45 am**

*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 at the Blasco Event Hall in the Foundation Building. Bidding will only be accepted online at the following link:

https://e.givesmart.com/events/veJ/

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

ABSTRACTS: TABLE OF CONTENTS

POSTER PRESENTATIONS

MORNING SESSION: GRADUATE STUDENT POSTERS

MORNING SESSION: UNDERGRADUATE STUDENT POSTERS

POSTER PRESENTATIONS

AFTERNOON SESSION: GRADUATE STUDENT POSTERS

AFTERNOON SESSION: UNDERGRADUATE STUDENT POSTERS

AFTERNOON SESSION: HIGH SCHOOL STUDENT POSTERS

KEYNOTE SPEAKER BIOGRAPHIES

Nick Downs and Justin Reppart *(MSTS)*

Nick Downs is a Senior Scientist at the Nevada National Security Site, where he has worked since 2021. Prior to joining the NNSS he worked at Chesapeake Energy as a Geoscience Supervisor and a Development/Exploration Geologist. Nick graduated from Duke University in 2009 and received his Masters in 2011 from the UNLV Geoscience Department.

Justin Reppart has been a Scientist II with the MSTS Geoscience Group at the Nevada National Security Site since 2021. He received his Bachelor's degree and Master's degree in Geology from UNLV in 2015 and 2019. Previously Justin worked as an intern at Johnson Space Center, in the experimental petrology laboratory.

Noe Santos *(Bureau of Reclamation)*

Noe Santos is the River Operations Manager for the Boulder Canyon Operations Office in the Bureau of Reclamation's Lower Colorado Basin Region. Noe manages a group of civil engineers and hydrologists to plan/implement operations at Hoover, Davis, and Parker Dams to ensure the delivery of Colorado River Water to Lower Basin states and Mexico, model basin wide reservoir conditions for the next five years, and to determine shortage/surplus conditions for the states of Arizona, California, Nevada, and the country of Mexico. Together, Noe's group fulfills Reclamation's primary mission and supports the Boulder Canyon Operations Office in implementing the role of Water Master on behalf of the Secretary of the Interior.

Noe received his Bachelor of Science degree in Civil & Environmental Engineering in 2009 and a Master of Science degree in Civil & Environmental Engineering in 2011 from the University of Nevada, Las Vegas. Noe's graduate research focused on the development of artificial intelligence algorithms to model natural systems.

Noe has been recognized for his academic and professional achievements by the American Society of Civil Engineers and received the 2017 Young Government Civil Engineer of the Year Award and the 2019 Edmund Friedman Young Engineer Award for Professional Achievement.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

INCIPIENT OLIVINE DISSOLUTION IN ULTRAMAFIC SOILS RECORDS THE EFFECTS OF CLIMATE, COMPOSITION, AND CRYSTALLOGRAPHIC ORIENTATION

Feldman AD[1,2], Hausrath EM[1], Burnley P[1], Rampe EB[3], Morris RV[3], Munoz J[4], Uyeda GH[4], Seward G[5]

1-University of Nevada Las Vegas, Las Vegas, NV, USA
2-Desert Research Institute, Las Vegas, NV, USA
3-NASA Johnson Space Center, Houston, TX, USA
4-Northern Arizona University, Flagstaff, AZ, USA
5-University of California, Santa Barbara, Santa Barbara, CA, USA
Anthony.feldman@unlv.edu

Widespread olivine presence in aqueously altered Martian sediments and rocks has been proposed as consistent with relatively limited durations of water-rock interaction. To investigate olivine's utility as an indicator of past environmental conditions for in-situ and returned Martian sample studies, polycrystalline forsterite and fayalite disks were buried for 365 days within Mg/Fe-rich and Al-poor ultramafic soils chemically relevant to many settings on Mars. Field locations included the warm (≤12.8 ºC) and wet (~101-118 cm precipitation/year) Mediterranean climate Klamath Mountains, California, the cold (≤3.9 ºC) and wet (~120 cm/year) subarctic climate Tablelands in Newfoundland, Canada, and the warm (~14.1 ºC) and dry (~14.4 cm/year) desert climatic conditions in Pickhandle Gulch, Nevada. Disk surfaces were examined using SEM/EDS, AFM, EBSD, XPS, and VNIR. Dissolution features on forsterite surfaces include lining features and flat-bottomed pits with nearly vertical side walls. Pitting depth follows the order Klamath Mountains > Tablelands >> Pickhandle Gulch, indicating the importance of warm and wet conditions enhancing dissolution over cold and wet conditions, with minimal observed alteration under arid conditions. Depleted Mg/Si ratios on surfaces from the wetter sites are consistent with Mg-leaching proceeding dissolution. EBSD mapping indicates pitting features preferentially form along the b axis, consistent with crystallographic orientation strongly influencing the initiation of dissolution. By contrast, emplaced fayalite disks buried in the Klamath Mountains show minimal etch-pit formation. Elevated Fe/Si ratios from XPS measurements and indications for M-OH bonds in VNIR spectra of the altered fayalite are consistent with formation of a hydroxylated layer limiting dissolution under oxidizing soil conditions. These results demonstrate olivine chemical and morphological characteristics can record environmental conditions during aqueous alteration, but whether olivine is Mg- or Fe-rich is critical in determining the kinds of environmental imprints that would be observed in studies of altered olivine within Martian sediments and rocks.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

HYDROCLIMATE REGIMES IN CENTRAL AMERICA DURING THE LAST DEGLACIATION: A PALEO-PERSPECTIVE OF FUTURE CHANGES

Giuseppe Lucia[1], Matthew Lachniet[1], Amos Winter[2], Juan Pablo Bernal[3], Hai Cheng[4]

1- Department of Geoscience, University of Nevada Las Vegas, 4505 Maryland Parkway, Las Vegas, Nevada, USA;
2- Department of Earth and Environmental Systems, Indiana State University, 600 Chestnut St, Terre Haute, Indiana, USA;
3- Centro de Geociencias, Universidad Nacional Autónoma de México, Campus UNAM Juriquilla, Querértaro, Mexico.
4- Institute of Global Environmental Change, Xi'an Jiaotong University, Siyuan Round South Road, Fengxi New City, Xi'an, Shaanxi, China.
Email: luciag1@unlv.nevada.edu

Tropical atmospheric circulation is an essential component of Earth's climate system and regulates atmospheric heat transport and moisture distribution globally. Rainfall patterns in the tropics are linked to the latitudinal position of the intertropical convergence zone (ITCZ) and are modulated by the inter-hemispheric difference of tropical ocean surface temperature. Future projections of the ITCZ shifts and associated rainfall regimes indicate diverse response across the tropics under global climate warming. However, future estimates of precipitation changes are still uncertain for some tropical regions (i.e., Central America) where models lack of fully reproducing the complex dynamics between sea surface temperature variations, ocean circulation and atmospheric processes. Paleo-rainfall records can help testing model discrepancies and shed lights on regional hydroclimate response to global warming during past intervals of rapid climate changes. Here we present a new, multi-speleothem oxygen-isotope record from Guatemala and discuss the processes influencing regional precipitation regimes during the last glacial-interglacial transition (ca. 22-11 thousand years). Our new Central America monsoon data resemble northern hemisphere temperatures records and exhibits two abrupt dry intervals coeval to the North Atlantic cold events, Younger Dryas and Heinrich Stadial 1. We argue that such high-to-low hemispheric links are driven by rapid changes in the Atlantic Ocean circulation and associated ocean-atmosphere interaction. Episodic iceberg discharge in the high latitudes caused a slowdown of the Atlantic thermohaline circulation, and triggered a rapid feedback cascade in the subtropic and tropics via winds intensification and cooling of tropical North Atlantic surface temperatures. As consequence, northward ocean heat transport is reduced and warm surface waters developed south of the Atlantic equator, shifting the ITCZ system toward the southern tropics. In a similar fashion, future ocean circulation slowdowns associated to warming temperatures could cause a rapid ocean-atmosphere response in the northern neotropics and subsequent dry conditions over Central America.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

FRACTURING AND MINERALIZATION: CRUCIAL FACTORS IN GROUNDWATER CONTAMINATION

Susan Lederer[1]

1-UNLV, Las Vegas, Nevada, USA
Leders1@UNLV.Nevada.edu

Uranium (U) mining from breccia pipe structures around the Grand Canyon National Park (GCNP) has occurred since the 1950s. In 2012, the Obama Administration imposed a 20-year moratorium on new U mining and exploration on federal lands surrounding the GCNP. However, one breccia pipe U mine with a valid 1986 mining permit is considering beginning production. The federal mining permit and subsequent Aquifer Protection Permit (APP) issued by the Arizona Department of Environmental Quality (ADEQ) were based on inaccurate information regarding the mineralization, structure of breccia pipes, and the volume of groundwater beneath the mine site. Many of these misconceptions persist today, obscuring the true potential for groundwater contamination.

In this presentation, we will address the following misconceptions and their corrections:

1) Misconception: Perched aquifers are thin and discontinuous, and breccia pipe mines do not require dewatering.
   Correction: These mines do need dewatering, and challenges arose from underestimating groundwater volumes and its proximity to ore bodies.

2) Misconception: Gangue mineralization in breccia pipes is predominantly oxidized, consisting of calcite and hematite.
   Correction: Gangue mineralization is primarily pyrite, with many pipes hosting economically significant concentrations of copper (Cu) and metallic sulfides.

3) Misconception: U and Cu ore are located in the pipes' throats, with minimal fracturing along the breccia pipes' length.
   Correction: U and Cu mineralizations is predominately found in concentric fracture rings surrounding the pipes' throats.

4) Misconception: Uraniferous limonite found near the former Pigeon and Kabab North mines resulted from ore formation fluids.
   Correction: This limonite staining is contamination from acid mine drainage (AMD).

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

NITROGEN ISOTOPES OF THE EDIACARAN STRATA FROM A DEEP-WATER SLOPE SECTION IN SOUTH CHINA

Deborah Morales[1], Ganqing Jiang[1], Shichun Huang[1,2], Audrey Warren[1,3]

1 - University of Nevada, Las Vegas, Las Vegas, NV, USA
2 - University of Tennessee, Knoxville, Knoxville, TN, USA
3 - Utah State University, Logan, UT, USA
morald1@unlv.nevada.edu

The Ediacaran Period experienced fundamental changes in ocean redox conditions that may have triggered biotic innovations including the first appearance and early diversification of metazoans. According to some geochemical data, oxygenation of the Ediacaran ocean occurred ~635 Ma following the Marinoan glaciation. However, other geochemical evidence suggests that oxygenation happened much later during the middle-late Ediacaran or early Cambrian. Hence, the link between diversification of the earliest animals and the redox evolution of the Ediacaran ocean remains debated. Nitrogen isotopes and the cerium anomaly (Ce/Ce*) provide a means of testing the paleoredox evolution and biogeochemical conditions of this important interval in Earth's history. The $\delta^{15}N_{org}$ of a deep-water slope section in South China shows that expansion of the marine nitrate pool and enhanced denitrification may have occurred in several pulses spanning the Ediacaran. Yet, the Ce/Ce*, and available Fe_{PY}/Fe_{HR} data illustrates a more complex stratified system where the location of the chemocline was temporally variable. The lower Doushantuo Formation may have witnessed the redox line near the sediment-water interface where an increasingly oxygenated water column overlaid euxinic porewaters/sediments ($\delta^{15}N \approx 6$ ‰, Ce/Ce* < 0.77, and $Fe_{PY}/Fe_{HR} > 0.7$). Ferruginous conditions may have prevailed during deposition of the middle Doushantuo Formation ($\delta^{15}N \approx 3$–6 ‰, Ce/Ce* ≈ 1.0, and $Fe_{PY}/Fe_{HR} < 0.7$). The upper Doushantuo Formation may have returned back to a stratified Nanhua basin where euxinic bottom water/pore water dominated the seafloor. Comparisons of published data reveal that $\delta^{15}N \leq 2$ ‰ observed from the Wuhe section are not present in many sections of the Doushantuo Formation. Regional heterogeneity could have occurred due to spatial differences in nutrient supply from continental weathering or upwelling, water depth and extent of primary productivity. Similarities in $\delta^{15}N$ pattern among the slope Wuhe section, nearshore E-Shan section, and outer-shelf Wangjiapeng section suggest that during the Ediacaran Period, oxygenated water may have extended (at least locally) to slope environments below the photic zone.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

COMPLEX ZONING IN THE NAKHLITE AND CHASSIGNITE MARTIAN METEORITES AND IMPLICATIONS FOR PETROGENESIS

Amanda Ostwald[1], and Arya Udry[1]

1-University of Nevada, Las Vegas, Las Vegas, NV, United States
ostwald@unlv.nevada.edu

The nakhlite and chassignite martian meteorites are made up of 34 unpaired samples sharing crystallization ages (~1.3 Ga) and ejection ages (~11 Ma), and they therefore comprise the largest single-origin suite of rocks from Mars. There is no spatial constraint on the relative emplacement histories of the nakhlites (cumulates containing olivine and augite) and chassignites (dunites), but they may have been emplaced together or separately as flows or sills. The suite may have been generated by more than one parental magma, and the two cumulus phases of the nakhlites may have originated from one or more magmas. Cumulus phases in the suite do not retain zoning except for that of slowly-diffusing elements such as Cr in pyroxene and P in olivine. In olivine, P is highly incompatible but can be incorporated during disequilibrium crystallization. Chromium is compatible in pyroxene, so it preserves changes in magma composition occurring due to mixing or co-crystallization. We imaged and quantified abundances of these elements and others to help reveal the magmatic and eruptive histories of the nakhlites and chassignites.

We conducted qualitative and quantitative major and minor element analyses using the electron probe microanalyzers at Rutgers University and the University of Nevada, Las Vegas (UNLV). We conducted trace element analyses using the laser ablation inductively coupled plasma mass spectrometer at UNLV.

Nakhlite olivine frequently contain P-rich inner cores mantled by oscillatory P zoning to a P-enriched rim. Chassignite pyroxene is homogenous in terms of Ca, but Cr is variable through the core and occurs in oscillatory enrichments toward a Cr-depleted rim. Chassignite olivine contains skeletal cores mantled by thin P oscillations. These findings indicate that the nakhlite and chassignite magmatic system underwent significant thermal and chemical changes possibly due to magma mixing and storage.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

TRACE ELEMENT ANALYSIS OF OLIVINE AND PYROXENE-HOSTED MELT INCLUSIONS IN THE NORTHWEST AFRICA 13669 NAKHLITE

Sierra Ramsey[1], Amanda Ostwald[1], Arya Udry[1], and James M.D. Day[2]

1-Universtiy of Nevada Las Vegas, Las Vegas, NV, USA.
2- Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA, USA.
ramses3@unlv.nevada.edu

Nakhlites make up ~8% of the total number of martian meteorites and are clinopyroxene-rich cumulate rocks linked by shared crystallization and ejection ages. Given their shared ages, and similar chemistry and mineralogy, the nakhlites represent the largest single-origin suit of igneous rocks from any planetary body besides the Moon and Earth. As such, nakhlites are important for understanding magmatic and volcanic processes on Mars. One method of interrogating the relationship between cumulate rocks, which has been used for both terrestrial and extraterrestrial rocks, is studying the parental melt compositions by melt inclusions (MI), or small pockets of melt entrapped while a crystal is growing. Here we present trace element compositions derived from olivine and pyroxene-hosted MI to assess the petrogenesis of Northwest Africa (NWA) 13669, a recently found nakhlite.

Trace element abundances in MI are more enriched (>10 × CI) in rare earth elements (REE) than the whole rock but broadly parallel the whole rock REE pattern of NWA 13669 and the whole rock REE patterns of other nakhlites. Pyroxene-hosted MI in NWA 13669 also have varying degrees of REE enrichment. Whole rock and MI trace element compositions suggest NWA 13669 sampled a single depleted mantle source common to all nakhlites. Ratios of trace elements (e.g., Zr/Y, Nb/Y) are variable between different MI, and scatter likely indicates post-entrapment processes have occurred between the host phase and MI. Trace element scatter also indicates that the NWA 13669 parental melt underwent storage/ponding before entrainment and emplacement, likely within a crystal mush. Magma storage/ponding within a crystal mush would have allowed post-entrapment diffusive reequilibration to occur, which is also consistent with our current understanding of terrestrial magma chamber dynamics. Reequilibration in a crystal mush can also account for the homogeneity of major elements in NWA 13669 pyroxene and olivine.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

ASSESSING THE PETROGENESIS AND MAGMATIC SULFIDE PROSPECTIVITY OF THE SOUTHWESTERN LAURENTIA LARGE IGNEOUS PROVINCE (SWLLIP)

Boes, Thomas J.[1], and Jowitt, Simon J.[1]

1-University of Las Vegas, Las Vegas, Nevada, USA
boes@unlv.nevada.edu

The ~1.1 Ga magmatism of the Southwestern Laurentia Large Igneous Province (SWLLIP) generated a series of mafic-ultramafic dikes and sills emplaced within Mesoproterozoic sedimentary units and older crystalline basement rock throughout the southwest United States and northern Mexico. This LIP event remains enigmatic in terms of identifying the processes that generated this magmatism and any potential links to the contemporaneous magmatism of North America's mineralized Mid-Continent Rift LIP to the northwest of the SWLLIP. The contemporaneous 1.1 Ga Mid-Continent Rift LIP event hosts economically viable magmatic sulfide deposits in the Duluth Complex in Minnesota and elsewhere. This study aims to further our knowledge of the petrogenesis of the SWLLIP and the magmatic sulfide potential of this magmatic event.

Whole-rock lithogeochemical and Pt, Pd, and Au data have been obtained for 52 SWLLIP samples from California, Arizona, and New Mexico, allowing an initial assessment of the petrogenesis, magmatic sulfide fertility, sulfide saturation status, and crustal contamination of magmas of the SWLLIP. All these factors are critical aspects of assessing the potential for this LIP to host magmatic Ni-Cu-platinum group element (PGE) sulfide mineralization. Two suites have been identified within the SWLLIP, a potentially prospective mainly tholeiitic suite, and a seemingly unprospective alkaline suite, with the petrogenesis and magmatic sulfide potential currently being assessed in more detail.

The ongoing interpretation of these data will not only enable the determination of the petrogenesis and magmatic sulfide potential of this event but will place this LIP into the tectonic and global LIP record, potentially aiding in paleocontinental reconstruction. These data will also allow the further testing of the hypothesis that magmatism may be derived from a mantle plume that formed the magmatism of the Mid-Continent Rift of North America, as mentioned above.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

INVESTIGATING THE GENESIS OF THE GEOLOGIST SEAMOUNTS

Brandon Scott[1], and Kevin Konrad[1]

1- UNLV, Las Vegas, Nevada, U.S.A
brandon.scott@unlv.edu

The seafloor is dotted with tens of thousands of ancient seamount structures, whose formation processes are not well understood. Even one of the most extensively studied seafloor features—the Northwest Hawaiian Ridge and Hawaiian Islands—are surrounded by seamounts with potentially diverse geodynamic origins. However, these diverse seamounts have limited age constraints and petrological studies or lack them altogether. Understanding the genesis of these seamount structures can provide insights into a potentially diverse range of oceanic lithospheric processes that can source submarine volcanism. The Geologist Seamounts, also known as the South Hawaiian Seamounts (19.15°N, 157.15°W), are one such poorly understood seamount province located ~200 km south of Maui, HI. The Geologist Seamounts consist of ten interconnected volcanic structures (ridges, seamounts, guyots) that form an inverted V-shape. Previous research on a few of the seamounts inferred late-Cretaceous (~80–85 Ma) formation ages based on a few paleomagnetic inclinations and total fusion $^{40}Ar/^{39}Ar$ age determinations (Sager and Pringle, 1987), but extensive modern high-resolution age constraints as well as geochemical modeling of depth of melting, degree of melting and the potential mantle source reservoirs sourcing these features are still lacking.

Since the publication of the previous research in 1987, new igneous rock samples have been recovered from the Geologist Seamounts by the National Oceanic and Atmospheric Administration (NOAA) during expedition EX1504L3 in 2015. For geochronologic and petrologic work, this study utilizes five igneous and one sedimentary rock samples recovered from expedition EX1504L3, and two igneous rock samples previously collected by the School of Ocean and Earth Science Technology, University of Hawaii (SOEST) in 1984 during expedition KK840824-02. Here we combine new $^{40}Ar/^{39}Ar$ age determinations, new igneous rock compositional analysis, multibeam bathymetry, ROV dive footage, and paleo-plate reconstructions to procure compelling insights about the timing and genesis of the Geologist Seamounts.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

STRATIGRAPHIC RESPONSE TO TECTONIC MODE SWITCH IN CORDILLERAN HINTERLAND: A CASE STUDY IN THE NORTHERN BASIN AND RANGE, UTAH-IDAHO-WYOMING

Ian Gillette[1], Tomas Capaldi[1], Ryan Anderson[2], and Russell DiFiori[3]

1-University of Nevada Las Vegas, Department of Geoscience, Las Vegas, NV, USA
2-Idaho State University, Department of Geosciences, Pocatello, ID, USA
3-Idaho Geological Survey, Moscow, ID, USA
gillei1@unlv.nevada.edu

The kinematics of the tectonic regimes which governed North American's Cordillera following the cessation of Sevier and Laramide deformation and the surficial response remain poorly constrained. The present study provides insights into surface responses to changes in tectonic regime from compression to extension recorded in a series of Paleocene to Pliocene basin deposits in the Northern Basin and Range of Utah, Idaho, and Wyoming. We conducted field sedimentology that involves measuring stratigraphic sections at the decimeter scale, paleoflow analysis, conglomerate clast composition measurements, and sampling for detrital zircon U-Pb geochronology and geochemistry. We integrate these new sedimentary datasets to track changes in depositional environment and sediment source areas during this phase of tectonic mode shift. Data collected from detrital zircon fission track analysis from Wasatch Fm shows significant sedimentary recycling from Paleozoic and Mesozoic strata derived from the Sevier thrust belts. Cenozoic aged zircons show enriched sources associated with underthrusting of the magmatic arc between 160-55 Ma, whereas zircons dated between 55-50 Ma record a transition to depleted magmatic sources, which is interpreted at the onset of extension. The period between 30-15 Ma showed a prolonged period of magmatic inactivity. Youngest phase of magmatism younger than 20Ma shows strong signals that are associated with the onset of Yellowstone hotspot related magmatism. Stratigraphic results show an evolution in sedimentation within the Wasatch Fm (55-50Ma) show evidence of a compressional tectonic setting with structures and lithofacies indicative of formatting within hinterland basins. These include diamictite debris flows deposits, Conglomeratic braided stream deposits, Sand and mud dominated fluvial, and lacustrine carbonate deposits which were interpreted as having formed in alluvial fans system, braided stream systems, and floodplain systems respectively. The Salt Lake Fm (16-4Ma) shows characteristics of having formed within an extensional tectonic setting, namely debris flows with sediments derived from proximal footwalls.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

A NEW APPROACH FOR DIFFERENTIATED LAYERING USING THE FINITE ELEMENT METHOD AND SPATIAL STATISTICS

Joshua Myers[1]

1- UNLV, Las Vegas, Nevada, USA
Myersj25@unlv.nevada.edu

Metamorphic structures such as foliation, cleavage, and differentiated layering develop in varying conditions geographically and metamorphic. Most of these structures accrue overtime with processes that are not easily identifiable. These processes, however, reflect a structure's deformation history from stress and strain, cleavage planes, and graded bedding. The rheology and chemical makeup of the Johnnie formation from the green-schist facies leaves traces of history that are incomprehensible. Metamorphic structures, micro and macro, are unique in nature regarding their orientation. These structures develop stress patterns oriented to their environment. These patterns form from local stresses on areas affected by regional metamorphism, allowing the unaltered parent rock to be distinct. Samples from the green-schist facies were made into thin sections and examined using the Energy-dispersive detector to track the segregated phases of the altered rock. The finite element method further tracked the stress patterns through force chains, further analyzing why these structures occurred in relation to their surrounding conditions. In (Williams 1990), the presence of water allows the flow of other materials to invade the parent rock during deformation. By analyzing the force chain within the rock, a model was proposed to explain the formation of these patterns. Force chains can be applied to polycrystalline materials, however further research suggests that force chains can be modeled to fit the spectrum from granular to poly-rocks. The force chains can lead to where the stress is mostly localized and also determine the magnitude. By identifying these force chains, more theories can be applied regarding how differential layering exists and why.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

THE ACOUSTOELASTIC EFFECT IN POLYCRYSTALLINE QUARTZ AT HIGH PRESSURE AND TEMPERATURE

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

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

This study investigates the effect of a material's stress state on P- and S-waves velocities, known as the acoustoelastic effect. This material property is well known in metals and has been measured at ambient to low pressure conditions in geologic materials. The acoustoelastic effect was recently evaluated in olivine at high pressure conditions relevant to Earth's interior (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. The current study seeks to expand the study of the acoustoelastic effect by investigating polycrystalline α-quartz from 1.4-2.6 GPa and 450-660°C.

Our method employs the DIASCoPE ultrasonic system, incorporated into the D-DIA multi-anvil apparatus, at the APS 6-BM-B beamline 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 acoustoelastic effect is then derived from the relationship between the relative elastic wave velocity change (ΔV/V) and macroscopic stress. This study will aid in our understanding of the acoustoelastic effect and provide a new experimental technique to measure the stress state in elastically deformed geologic materials at high pressure conditions.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

MEASURING THE PERIODICITY OF STRESS IN POLYCRYSTAL MODELS

Richard Panduro-Allanson[1], and Pamela Burnley[1]

1-University of Nevada, Las Vegas, Department of Geoscience, Las Vegas, NV, USA
panduroa@unlv.nevada.edu

Shear strain localization is typical in deforming rocks and is vital for developing faults and tectonic boundaries. Shear localization is generally thought to be caused by temperature, fluid, and/or microstructure. We will explore how elastic heterogeneity (a microstructural influence) produces stress amplifications, which can lead to shear localization in polycrystal models. Previous finite element simulations of elastically heterogeneous polycrystal models have shown that the stress distribution can be described as forming an anastomosing pattern of high-stress streams parallel to the compression direction. This anastomosing patterning resembles force chains; linear, high-stress features that form parallel to compression in granular materials. The literature suggests that buckling force chains govern shear band formation in granular materials; thus, viewing polycrystalline materials through a force chain lens may bring new insights. In previous simulation work, the initiation of plastic deformation produced shear bands with a spacing proportional to the density of patterning in the stress distribution and with displacements that are inversely proportional to the number of shear bands forming. We continue this work by attempting to quantify the spacing of force chains in the stress distribution in 2D simulation of polycrystals using the autocorrelation and Fourier transform. These mathematical techniques are used to determine the periodic nature of a signal and may help quantify the stress patterns in polycrystalline models. This quantification may allow us to make testable predictions for real materials' stress distribution and shear localization.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

PRELIMINARY RESULTS FROM TESTING DESTRUCTION OF CLAY MINERALS BY SILICA-POOR BRINES IN GALE CRATER, MARS USING LABORATORY AND FIELD EXPERIMENTS

J. E. Valdueza[1], E. M. Hausrath[1], T. F. Bristow[2], E. B. Rampe[3]

1- Department of Geoscience, University of Nevada Las Vegas, Las Vegas, NV
2- NASA AMES Research Center, CA
3- NASA Johnson Space Center, Houston, TX
valdueza@unlv.nevada.edu
elisabeth.hausrath@unlv.edu

The Mars Science Laboratory (MSL) *Curiosity* rover landed in Gale crater to investigate the spectral signatures of secondary phases seen from orbit in Mount Sharp. The lower strata show spectral signatures of clay minerals, hematite, and hydrated Mg sulfates, and the upper strata are dominated by hydrated Mg sulfate signatures. This significant mineral transition has been observed in other locations on Mars, and therefore processes related to the orbitally identified clay mineral-sulfate transition are likely important broadly across Mars. Sedimentary analyses of the smectite clay minerals observed in the Glen Torridon (GT) region of Mount Sharp suggest formation in a lacustrine aqueous environment, whereas the hematite-bearing unit Vera Rubin ridge (VRR) indicate that it was formed at the same time as GT and altered by extensive diagenesis. Recent work suggests that the observed mineral transition from smectites and talc-serpentine in GT to iron (III) oxides and oxyhydroxides in VRR may have resulted from extensive diagenetic alteration by density-driven, silica-poor brines sourced from the overlying Mg-sulfate bearing unit on Mount Sharp. Although this alteration process by silica-poor brines is observed in limited locations on Earth, the hypothesis has not been tested in laboratory and field experiments. Therefore, we are working to demonstrate the impacts of silica-poor brines on clay mineral alteration in laboratory column dissolution and terrestrial analog burial experiments. In preparation for these longer-term experiments, we performed preliminary batch dissolution experiments on materials relevant to Glen Torridon (e.g., nontronite and serpentinite) and used magnesium sulfate brine solutions. The analysis involved the separation of solids and solutions by centrifuging, characterization of solids by SEM, and evaporation of solutions at different temperatures. Initial observations of the reacted solid materials from SEM analyses showed minimal alteration of the solid materials, although secondary precipitates such as amorphous silica may be present. Additional insight will be provided by mineralogical and chemical analyses of the solutions and solids. As a result, this work will provide important constraints on the diagenetic fluid conditions that formed the observed minerals, leading to a better understanding of the role of brines in the aqueous history on Mars.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

MONITORING THE EFFECTS OF CARPENTER–1 FIRE THROUGH REMOTE SENSING

Ibtihaj Ahmad[1]

1-Department of Civil, Environmental and Construction Engineering, University of Nevada Las Vegas, Las Vegas, Nevada, USA
ahmadi1@unlv.nevada.edu

Wildfires possess a significant threat to the environment and people due to their negative impacts on ecosystem. With their frequency and intensity expected to increase studying wildfires and their behavior is crucial for effective land management for future. The carpenter 1 fire is one the largest fires in the history of Nevada, it costed the stated around $20 Million. The fire started on 1st July 2023 and was completely extinguished on 18th August 2023, it kept blazing for almost 8 weeks straight. The fire was ignited on Mount Charleston which is a National Recreational Area on Spring Mountains, approximately 17 miles north of Las Vegas. Despite the magnitude of the fire, no qualitative or quantitative studies had been conducted using remote sensing to study the post fire effects. The study aimed to quantify the fire severity and the loss of vegetation to bare soil through vegetation indices of remote sensing (RS). The utilization of RS provides a quick and efficient method to study wildfires. The study will utilize Landsat 8 spectral bands imagery, to calculate Normalized Difference Vegetation Index (NDVI) and Normalized Burn Ration (NBR) for inferring burn severity and vegetation loss. The study provided valuable insights into the after effects of fire, post fire vegetation recovery and for future land management.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

HUMAN PRESSURE ON BIGHORN SHEEP ACCESS TO WATER IN JOSHUA TREE NATIONAL PARK, CA

Riley Jones[1]

1- University of Nevada, Las Vegas, Las Vegas, NV, USA
riley.jones@unlv.edu

Joshua Tree National Park received over 3 million visitors in 2022 and is characterized by dramatic rocky mountains, roaming herds of bighorn sheep (Ovis canadensis nelsoni), and the eponymous Joshua trees (Yucca brevifolia). Unfortunately, the presence of humans often causes wildlife to avoid heavily-trafficked areas. Several of the most popular trails in Joshua Tree National Park are located near or around major water sources; thus, the wildlife population may be pressured away from these important water sources due to human use. To investigate how human pressure affects bighorn sheep access to water sources, 31 bighorn sheep were fitted with GPS-tracking collars, trail counters were installed at 4 hiking trails near water sources, and 8 motion-activated cameras installed at critical water sources. This project identifies the areas most used by the bighorn sheep, describes the seasonal movements of these herds, and analyzes the human pressure of the trails near to important water sources. During the summer, the park service closes the 49 Palms trail to allow wildlife access to the oasis located at the end of the trail. This has a demonstrable effect on the bighorn sheep's willingness to access the oasis; when the trail is open, the bighorn sheep only access a smaller, ephemeral pool farther up the canyon. The most popular water source is the Cow Camp reservoir; this permanent water source has the least human pressure as there is no official trail to this location. These use density maps confirm that closing trails during the summer allows wildlife to access critical water sources during the hottest months.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

RECORD OF THE TERMINATION OF THE PENULTIMATE GLACIATION FROM A MEXICAN SPELEOTHEM

Aaron English[1], Matthew Lachniet[1], and Giuseppe Lucia[1]

1- UNLV, Las Vegas, NV, USA
englis20@unlv.nevada.edu

Speleothems are an ideal paleoclimate proxy as they can be sampled for isotopic signatures and directly dated using U/Th dating. Here we present the stable isotope record of a speleothem from the Sistema Huatla cave system in Oaxaca, Southern Mexico, with focus on Termination II of the penultimate glaciation into the following Eemian interglacial period.

This speleothem showed near continuous growth over the time period of interest. Samples were drilled at 1.0-mm intervals along the speleothem growth axis and analyzed for $\delta^{18}O$ and $\delta^{13}C$ isotopes in the Las Vegas Isotope Science Laboratory. Seven U/Th dates were drilled, of which three have already been analyzed at the University of New Mexico radiogenic isotope laboratory and are used to provide the preliminary chronology.

The $\delta^{18}O$ data show a rapid trend toward more negative $\delta^{18}O$ starting at the base of the at the base of the sample, dated to ~ 132,000, and ending ~124,000 years ago. The transition is followed by a plateau, and then another brief spike towards even more negative $\delta^{18}O$ ~116,000 years ago. The decrease in $\delta^{18}O$ is associated with a strengthening of the Mesoamerican monsoon which cannot be explained by an increase in insolation, but rather an increase in the Atlantic Meridional Overturning Circulation (AMOC). The timing of Termination II in our sample matches the timing found in the marine ice volume record.

With climate change presenting an overwhelming threat, developing a more thorough understanding of regional implications to global changes in climate throughout time is increasingly important.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

Reconstructing Magmatic History of Iceland Using Detrital Ar-Ar Dating of River Sediments

Odinaka Okwueze[1], Tomas Capaldi[1], Kevin Konrad[1]

1-University of Nevada Las Vegas, Department of Geoscience, Las Vegas, Nevada, USA
Okwueo1@unlv.nevada.edu

The interaction between mantle, Earth surface processes, climate, and ocean evolution is a fascinating ongoing area of study where Iceland could potentially play a major role. Iceland is a key region where deep mantle upwelling in the form of the Iceland plume for at least 70 Ma has generated large pulses of volcanic activity across Greenland, the British Isles, The Northern Atlantic, and Iceland. Understanding the Iceland mantle plume could provide a better insight into late Cenozoic climate variation, mantle plume tempo, and the interaction between mantle plumes and mid-ocean ridges. Measuring the mantle plume tempo could show when there were major Cenozoic volcanic CO_2 outgassing and associated climatic warming as well as indicate how and when major portions of Iceland's lithosphere were formed. Understanding the timescales of plume volcanic activity requires high-precision dating of basaltic magmatism. Here we seek to establish a detrital geochronological history by sampling and dating basaltic modern river sediment across numerous Iceland river catchments. We will assess the quality and viability of grains from Iceland's river catchments for 40Ar/39Ar incremental heating geochronology. We propose sand grains that are less altered with a greater abundance of volcanic glass will yield more accurate age data. Ultimately, we aim to develop a geochronometer capable to record the temporal history of mafic magmatism, which we can then use to gain novel insight into Iceland's mantle plume tempo, and potential climatic response. In the future, more work needs to be done sampling grains across Iceland's river catchments, as well as collecting off-shore sediment cores from both the Greenland and Iceland shelves to better understand mantle plume activity and the potential climatic impacts associated with it.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

GEOSPATIAL SLOPE STABILITY ANALYSIS AND DRAFTED RESEEDING PROGRAM FOR THE LAKE TAHOE BASIN, SOUTH LAKE TAHOE, CALIFORNIA

Morgan Adamson[1], Taryn Alves[1], Steven Butler[1], Alexandra Middleton[1], Grecia Sanchez[1]

1-University of Nevada Las Vegas, Las Vegas, Nevada, United States of America
adamsm12@unlv.nevada.edu

The risk of slope failure and soil erosion of hillslopes in the greater South Lake Tahoe, California, the area is elevated and requires the implementation of reseeding programs to mitigate events of mass wasting. Overlapping relationships between soil types, fire-scarred areas, slope grades, drainage pathways, and proximity to municipal zones highlight numerous areas with a low factor of safety that poses a threat to natural and urban environments if left untreated. Available public soil, wildfire, and regional spatial datasets have been cross-referenced using ESRI's ArcGIS software to conduct this spatial analysis. The soil and slope analyses were conducted in three phases scaling from a broad to a regional scale. In the first phase, the analysis was set to isolate a specific region of study in the Lake Tahoe region using soil, fire scar, and municipal areas. In the second phase, the reduced area was further analyzed to outline specific hillslopes that need stabilization using previous classification as well as slope and the intersection of drainage paths. In the third phase, an economic analysis was conducted to identify the most critical areas using a 1000 ft buffer from the drainage pathways and identify zones of urgent reseeding. This analysis proposes a spatial and financial assessment for a regional reseeding program in the selected areas to increase drainage, reduce soil entrainment, and mitigate mass wasting. The resulting slopes suggested for the proposed reseeding program are displayed as drafted maps, and the associated costs of the most critical and hazardous areas are displayed through table calculations. A reseeding program should begin on the outlined areas of high hazard. If budget permits, the implementation should expand to the entire identified hazardous areas.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

QUANTIFYING EVAPOTRANSPORATION RATES AT BONANZA SPRING USING ARCGIS

Tyler Andreas[1], Mina Graham[1], Claudia Martinez[1], Arely Ochoa[1], Kristi Sexton-Rodriguez[1]

1-University of Las Vegas, Nevada, Las Vegas, Nevada, United States of America
Andreas@unlv.nevada.edu

Arid climates are greatly susceptible to the effects of climate change, which makes it important to understand the breakdown of the water budget at Bonanza Spring in the Mohave Desert. Recent studies on evapotranspiration in arid regions focus on partitioning the process into evaporation and transpiration when quantifying the impact of shrub spatial patterns on dissipation rates. Here, we use ArcGIS to map the watershed and surrounding vegetation of Bonanza Spring, where we measure fluxes in regional evapotranspiration via NAIP aerial photography. The digital elevation model generated by ArcGIS serves as an interpretative tool that allows us to define the drivers behind Bonanza Spring evapotranspiration rates. We predict that this study will provide a measurement of the hydrological stability and overall health of this desert ecosystem. Ultimately, the results of this study could contribute to a better understanding of the effects of climate change on water budgets in arid regions.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

DISTRIBUTION OF PARKING SPACE UNIVERSITY OF NEVADA LAS VEGAS

Conner Callaway[1], Sandra Joesph[1], Brandon Agcopra[1] and Henry Schatz[1]
1-University of Nevada Las Vegas, Department of Geoscience, Las Vegas, NV, USA
callac3@unlv.nevada.edu

The accessibility of parking in relation to building distance and occupancy on the property of University of Nevada Las Vegas (UNLV) is a fundamental question for the function, accessibility, and safety of students. The area of study for this project focuses on the designated parking spaces and buildings that house classrooms based on information provided by the UNLV Department of Transportation and UNLV OIT. One of the major questions to ask is how the number and type of parking spaces relates to distance and building occupancy. This study undertakes a spatial analysis using ESRI's ArcGIS and a combination of mapping techniques. Using this study, the data can be plotted and choropleth maps used to portray the relationship between classroom size and parking spot distribution. Using this study we intend to identify areas furthest from all parking structures, creating a map that highlights accessibility. This map demonstrates that there are areas on campus that are inaccessible and the spatial distribution of spaces is heavily biased to the Southwest side of campus.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

MOUNT MERAPI VOLCANIC HAZARD MAP (JAVA, INDONESIA)

Mary Clarich[1], Stephanie Acevedo[1], Alexandra Diaz[1] , Sapphire Arana-Ramos[1]

1-UNLV, Las Vegas, Nevada, USA
clarich@unlv.nevada.edu

The tectonically complex area of Indonesia is home to many volcanoes in some state of eruption or dormancy which pose risks to the surrounding populations. Mount Merapi, located on the boarder of the province Central Java and special region of Yogyakarta, is in an active state of eruption. We are using ArcGIS software to build a hazard map by utilizing population density, mapping of previous lava flow radius, and infrastructure of nearby cities. We used ESRI database to gather relevant data. Processes such as overlaying and merging were applied to generate our map with the given data. Our output shows a map rank of areas that pose the most risk of hazard based on Mount Merapi volcanic eruptions. The creation of the hazard map for Central Java and Yogyakarta can then be used by local officials to evaluate population safety, implement safety procedures, and to understand the immediate danger radius of Mount Merapi.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

LIMITS TO SOUTHERN NEVADA ECONOMIC DEVELOPMENT AND CONSERVATION ACT EXPANSION

Dexter Lim[1], Joseph Kolibar[1], Samantha Maciech[1], and Kimberly Terry[1]

1-University of Nevada Las Vegas, Las Vegas, Nevada, USA
limd10@unlv.nevada.edu

The growth of the Las Vegas Metropolitan Area has always been predicated on compromises between the ideals of growth and the realities of a sensitive arid environment. Nevada's current political delegation has proposed a significant tract of urban expansion to this region through the introduction of the Southern Nevada Economic Development and Conservation Act (SNEDCA). Questions of equity and logistical process must be addressed. This study has been constructed to assess the largest contiguous corridor of the proposed development area set forth by the most recent version of SNEDCA based on its espoused principles of providing affordable housing and environmental conservation. Key factors that influence the process of land development that will be analyzed in this research include the slope of the territory, soil type, wash and drainage patterns within the area, and the proximity to both currently established infrastructure as well as natural conservation areas. This project demonstrates through mapping and indexing where new development would not be impacted by these aforecited criteria - and where development may be hindered or a harm to the social or environmental justice mentioned as a goal in the text of the legislation.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

NEW INSIGHTS ON THE ORIGIN OF THE CENTRAL LINE ISLANDS FROM REMOTELY OPERATED VEHICLE EXPEDITIONS

Amber Ciravolo[1], and Kevin Konrad[1]

1-University of Nevada, Las Vegas, Las Vegas, NV, US
ciravolo@unlv.nevada.edu

Unraveling the origins of submarine intraplate volcanism is important in understanding plate and plume dynamics and refining absolute plate motion models. One region of submarine intraplate volcanism that has long fascinated researchers is the Line Islands Volcanic Lineament (LIVL). The LIVL extends more than 4000 km from the Mid-Pacific Mountains to the Tuamotos and consists of a linear array of volcanic features that lack an apparent age progression. Most of the lineament's most enigmatic features are in the Central Line Islands Province: between the Clarion Fracture Zone and Jarvis Island, south of the Clipperton Fracture Zone. This province contains cross-trending ridges and seamount clusters as well as the Line Islands Ridge (LIR), a large bathymetric rise representing a large output of volcanic material. Due to the diverse suite of volcanic features in the Central Line Islands Province, numerous formation processes have proposed ranging from a single mantle plume, multiple plumes, interaction between a plume and spreading center, or shallow tectonic processes such as leaky transform faults. These potential drivers can be narrowed down with in-depth geochemical and geochronological analyses.

In recent years, several expeditions by the National Oceanic and Atmospheric Administration (NOAA) and Ocean Exploration Trust (OET) have explored and retrieved samples from the Central Line Islands Province using telepresence remotely operated vehicles (ROVs) with the purpose of elucidating the origin of volcanic features in the region. This project presents petrological and geochronological data from three ROV expeditions to the Central Line Islands Province (EX1705, NA110, NA137), including late-Cretaceous age-determinations for seamounts surrounding Jarvis Island that exclude the possibility of interaction with the ancient Pacific-Phoenix spreading center.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

MAPPING THE CRETACEOUS TO CENOZOIC HISTORY OF THE MACDONALD HOTSPOT

Nicholas Foresta[1], Dr. Kevin Konrad[1]

1-University of Nevada, Las Vegas
Foresn2@unlv.nevada.edu

The South Pacific contains an extensive arrangement of linear chains produced most commonly by hotspot activity. The Macdonald hotspot currently underlies the Macdonald seamount, which resides at the eastern end of the age progressive Cook-Austral lineament. Growing isotopic and geochronological evidence suggest that volcanism associated with the Macdonald hotspot extends for at least 70 Ma, progressing near eastern Samoa and connecting with the Tokelau island chain. These observations are supported in part by current absolute plate motion (APM) models for the Pacific, which indicate that the Macdonald hotspot may have generated seamounts in the Tokelau region. Previous lava flow sampling within the Tokelau Chain and eastern/northern Samoa region is sparse and has been hampered by pervasive basalt alteration and a lack of potassium-bearing phenocryst phases appropriate for $^{40}Ar/^{39}Ar$ age determinations. Therefore, previous work on the Tokelau chain and Samoa region lacks sufficient data supporting a long-lived Macdonald plume hypothesis. Here we present our plans to obtain new $^{40}Ar/^{39}Ar$ age determinations, whole rock and trace element geochemistry and Sr-Nd-Pb isotopic ratios on lava flow samples recovered via submersibles on research expeditions NA112 and FK210605 from seamounts within the Howland and Baker Island unit of the Pacific Remote Island National Monument and the Swains Island Marine Wildlife Preserve, respectively. Through age determinations and isotopic fingerprinting we aim to refine the history of the Macdonald hotspot. With improved age progressions and hotspot track geometry we will be able to improve models on independent plume and plate reconstructions.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

QUARTZ FLOW STRENGTH INVESTIGATION VIA X-RAY DIFFRACTION EXPERIMENTS AND ELASTIC PLASTIC SELF-CONSISTENT MODELS

Denali Jivanjee Medina[1], and Pamela Burnley[1]

1-Department of geoscience, University of Nevada Las Vegas, USA
Jivanjee@unlv.nevada.edu

Our understanding of the rheology of Earth's interior can be advanced by investigating the results of deformation DIA (D-DIA) experiments on polycrystalline samples using elastic plastic self-consistent (EPSC) modeling, which improves the resolution of stress measurements. Quartz has been the focus of many past studies due to its abundance in the continental crust and its relative rheologic weakness, which renders it a reasonable proxy for the flow strength of the ductile middle crust. We present a suite of 13+ uniaxial x-ray diffraction deformation experiments on novaculite; temperatures range from 25 °C to 1316 °C with pressures between 1.39 GPa and 2.83 GPa, and strain rates between $-1x10^{-5}s^{-1}$ and$-6x10^{-6}s^{-1}$. High energy white light was used to gather diffraction data every ~10 to 12 minutes during deformation. d-spacings from the (101), (110), (200), (201), and (112) lattice planes were measured, producing lattice strain up to ~7%. Maximum sample strain is measured at ~ 30%. Elastic plastic self-consistent models of strain will allow us to identify the relative differential stress and the critical resolve shear stress (CRSS) of individual slip systems as a function of pressure. We will compare our data set to those from past experiments to corroborate our finding and investigate the pressure dependence of quartz flow strength using the flow law expressed as $\dot{\varepsilon} = Af_{H_2O}^{r} exp(-Q + PV/RT)\sigma^{n}$.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

GIS USE FOR TRANSITIONAL HOMELESS ENCAMPMENT SITE SELECTION IN PORTLAND, OR

Denali Jivanjee Medina[1]

1-Department of geoscience, University of Nevada Las Vegas, USA
Jivanjee@unlv.nevada.edu

Supported homeless camps designed to facilitate community self-sufficiency may provide a pathway into permanent housing for those struggling in Oregon. The Department of Justice has concluded the law supports allowing the homeless to sleep on the streets, rendering it difficult to remove unsanctioned camps. In Portland, a state of emergency has been declared as socioeconomic issues boil over but sanctioned encampments could reduce health and safety concerns. In November 2022, the Portland City Council voted in favor of Mayor Ted Wheeler's plan to ban camping outside of designated areas over an 18-month period while supporting the community with six sanctioned camps. As of February 2023, the city has secured $27 million to establish the camps. Identifying ideal locations has proved challenging, however, GIS provides an ideal tool for planning Mayor Wheeler's goals. Using satellite imagery and parcel ownership data, three potential pilot locations will be selected based on the proximity to public transportation, WorkSource OR resources, food pantries, and rehabilitation/mental health support. The buffer and intersect tool within ArcMap will be used to find an area of 4-5 acres within 2 miles of the aforementioned features and outside of neighborhoods. The dissolve tool will then be utilized to output areas of interest. The results of this study are a preliminary selection, further discussion and negotiation with land owners and on-site surveying will be the next steps.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

PREDICTING MAUNA LOA LAVA FLOW PATHS WITH ESRI'S ARCGIS

Robert A. Jackson[1]

1-University of Nevada Las Vegas, Las Vegas, Nevada, USA
Jacksr25@unlv.nevada.edu

Lava flows can extend tens of kilometers from a source vent, destroying everything in their path; and while predicting the timing of such hazards is impossible, we can predict probable paths of descent to better mitigate the damages incurred by such events. Mauna Loa, being the largest volcano on Earth and having hosted 33 eruptions since 1843, poses a reoccurring threat to the local communities and natural resources of the island of Hawai'i. Hazard mapping is crucial to better mitigate future risks and quantify resources of concern. Basaltic lava flows will flow downslope under influence of gravity, similar to water, along paths of least resistance from the source vent. The resistance to flow is determined by underlying topography and the slope gradient of the volcano, the viscosity of the lava(SiO_2 wt. %) of the lava, and the supply of material from the vent. Through use of hydrology analysis tools and digital elevation models deployed through the use of ESRI's ArcGIS software, we model probable flow paths from known eruptive centers using steepest descent paths to identify potential targets for destruction for future eruption scenarios. Additionally, using these flow paths paired with geologic mapping of historic lava flows, we delineate zones of risk and quantify targets of potential impacts to such areas affecting the population, infrastructure, and natural resources of high-risk areas such as coral reef systems and critical habitat areas. Using this model and geologic mapping, we present a map illustrating likely descent paths and targets of concern for future eruption scenarios.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

CHICAGO'S COMMUNITY DEVELOPMENT PROJECT

Joshua Myers[1]

1- UNLV, Las Vegas, Nevada, USA
Myersj25@unlv.nevada.edu

Chicago's community redevelopment project has created a plan aimed at revitalizing and reinvesting back into low income neighborhoods. This process involves creating affordable housing and remodeling old communities to allow opportunities for new residents to rent or own. The problem arises as the majority of these communities are renters and predominantly minorities. Chicago historically remained having segregated communities for decades, with the North side and downtown being predominantly white. As new residents with higher income will increase property value for homeowners, renters will be negatively affected as their monthly payments will suffer an increase.

Socioeconomic factors, demographics, and geo-spatial data were taken into account when analyzing the projected rate of gentrification in the future. As Gentrification has positive and negative factors involved, the type of community that will be affected the most would identify as a minority. Geo-spatial analysis has increased different perspectives regarding gentrification and its aspects toward the community. For future projects related to Chicago's development plan, a geo-spatial discussion will be conducted to further measure the relationships involving gentrification which doesn't deteriorate the community's culture and minority populations.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

THE AGE AND KINEMATICS OF THE SADDLE ISLAND DETACHMENT, SOUTHERN NEVADA

Morgan Adamson[1], Margo Odlum, and Megan Ferrell

1- University of Nevada Las Vegas, Las Vegas, Nevada, United States of America
adamsm12@unlv.nevada.edu

The age and kinematics of the ductile deformation and detachment faulting at Saddle Island are complex and debated in previous work. Saddle Island is a metamorphic core complex within the U.S. Cordillera, and it hosts two main deformational features of interest in this study: a low angle detachment and a lower plate mylonitic fabric. The relationship between these features and the timing of deformation are not well understood, and previous studies have directly conflicting interpretations of timing and geodynamic drivers of deformation. This study will determine the sense of shear as well as the absolute ages of the structural features by way of: field and microtextural analysis and apatite petro- and thermochronology. Analysis of this area will support a structural model for metamorphic core complexes in between proposed models of (1) a single stage of deformation where the mylonites represent the down dip continuation of normal faults at the brittle ductile transition or (2) a two stage reactivation where the low angle normal fault exhumed an older mylonitic fabric. The study will also relate the local deformational features to regional deformational events through the dating and kinematic analysis of each structural component. Saddle Island is potentially a structurally controlling feature in southern Nevada, especially to the region of Lake Mead and Las Vegas. Through this analysis of Saddle Island's brittle and ductile deformation, we can better understand the dominant tectonic drivers of the faulting and its relationship to regional tectonics.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

NEW INSIGHTS INTO THE AGE AND COMPOSITION OF SUBMARINE VOLCANIC FEATURES NEAR THE MARIANA TRENCH

Claudia Martinez[1], Kevin Konrad[2]

[1]*University of Nevada, Las Vegas, Department of Geoscience*
Martic63@unlv.nevada.edu

The Western Pacific Plate holds an extensive coverage of seamounts, guyots, ridges and small volcanic cones with formation ages ranging from the Early Cretaceous to Miocene. Collectively, the volcanic structures in the region are referred to as the Western Pacific Seamount Province (WPSP). Given the range of ages, detailed sampling of the WPSP is essential to better understand the diverse drivers of regional intraplate volcanism. Thus far, volcanism in the region appears to be related to mantle plume volcanism in the Cretaceous as well as reactivation of volcanism from plate deformation in the Miocene to recent (e.g. petite spot volcanism).

Here we present new $^{40}Ar/^{39}Ar$ age determinations for lava flow samples that were recovered via submersible in the Marianna Trench region on the Pacific Plate and one sample from the Marianna forearc. The subset of sampled submarine volcanic features include: Pigafetta Guyot (15.90°N, 148.89°E), Vogt Guyot (19.80°N, 148.44°E), an unnamed subducting guyot (18.45°N, 146.83°E), an unnamed "petite-spot" volcano on the flank of Fryer Guyot (20.62°N, 147.32°E) and an enigmatic structure called Hadal Wall (16.56°N, 147.59°E). These new age determinations are integrated with multibeam bathymetry and ROV dive footage to provide new insights into the long-persisting hotspots currently underlying the South Pacific isotopic and thermal anomaly and the scale of forearc volcanism during the initiation of Mariana Arc.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

TECTONIC SIGNIFICANCE OF BASAL CONGLOMERATES OF THE NORTHERN COLORADO RIVER EXTENSIONAL CORRIDOR, NV

Conner Callaway[1], Tomas Capaldi[1], Michael Wells[1] and Eugene Smith[1]

1-University of Nevada Las Vegas, Department of Geoscience, Las Vegas, NV, USA
callac3@unlv.nevada.edu

A basal conglomerate overlies a significant unconformity over Paleoproterozic and Mesozoic crystalline basement rocks across the Colorado River Extensional Corridor south of Las Vegas. This study utilizes field sedimentology and detrital zircon U-Pb geochronology to determine the age and tectonic significance of this conglomerate facies. We seek to determine if this conglomerate unit is associated with either (1) Cretaceous-Paleogene contractional event during uplift of the Kingman Arch along basement-involved reverse faults, or (2) Miocene topographic growth during initial Basin and Range extensional deformation. Field samples from a E-W transect across the McCullough Range, Eldorado Valley, and Eldorado Mountains were collected for sediment provenance characterization and age dating using detrital zircon U-Pb geochronology in the Nevada Plasma Facility Laboratory. New detrital zircon results will be compared with similar conglomerate facies of the Cretaceous Lavina Wash sequence and Miocene Jean Conglomerate found in the Spring Mountains to the west, and Oligocene-Miocene Rainbow Gardens Formation in the Frenchman Mountains to the north. Our data will provide new constraints on the regional paleogeography before the main phase of Miocene Basin and Range extension.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

MONITORING DROUGHT LEVELS WITHIN LAKE MEAD USING ARCGIS

Abigail Smith[1], Alissa Suarez[1], Jade Poole[1], Robert Cooper[1], and Victoria Knight[1]

1-University of Nevada, Las Vegas, Las Vegas Nevada, USA
smith128@unlv.nevada.edu

The size of the lake and its user population poses an array of challenges in the management of the resource. However, monitoring the drought and water levels is a step in the process of reclamation and ArcGIS is a tool sufficient enough to evaluate the lake's complexities over a range of time. To accurately determine the full scope of changes caused by the water drought, we will compile several different geodatabases concerning Lake Mead water levels over a period of 30-40 years. Using the geographic imaging information, we can approximate the amount of water that Lake Mead loses every year as well as every decade. To further improve our understanding of the drought, we will also analyze the impacts it has on surrounding streams and pathways.

THE 18TH ANNUAL UNLV GEOSYMPOSIUM

APRIL 28th, 2023

MAPPING FLOODS IN VENICE, ITALY

Mitchell, Mackenzie[1]; Carter, Skyler[1]; Santiago, Daniel[1]; Torres, Eddey[1]; Cohen, Caroline[1]

1- Geoscience Department at University of Nevada Las Vegas, Las Vegas, Nevada, United States of America
mitchm14@unlv.nevada.edu

While Venice, Italy has been “sinking” into the ocean for centuries, the impacts that anthropological activities has had in the past few decades has no doubt had a massive impact on the natural ecosystem. While there are various hypotheses as to why this phenomenon exists, the main question remains: What does the future hold for Venice? A vulnerable coastal lagoon made up of several islands connected by canals and bridges, the city of Venice is significant to Italy due to its history, culture, and conduct of both local and international trade. Venice flooding is due to a coalescence of natural anad human factors, such as sea-level rise via melting ice sheets, thermal expansion, and anthropogenic carbon dioxide production, which is caused by climate change and plate tectonics. While the rate of subsidence is still highly debated, some research shows that the average rate of subsidence is incredibly high in some areas, while some areas remain fairly intact. Implementation of geographic information systems (GIS) will be crucial in conducting comparative studies for the rate of relative sea level rise and subsidence, and comparing how certain regions may be more affected by it than others. Using GIS data, we can help to identify the most vulnerable regions and provide crucial information for policymakers to develop strategies to mitigate the impact of flooding on the city's infrastructure and economy.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

AIR POLLUTION IN AND AROUND LAS VEGAS, NEVADA

Robyn Gregrich[1], Anabella Figueroa[1], Madelyn Jacobson[1], Gabriella Perrotto[1], Cassey Pacris[1]

1-University of Nevada, Las Vegas
gregrr1@unlv.nevada.edu

It is well-documented that large gaps in life expectancy exist between differing communities in the United States. There are many variables that play a role in determining life expectancy, including socioeconomic status, education level, genetic factors, overall health, and environmental factors. Current research suggests there is a correlation between proximity to sources of air pollution and reduction in lifespan. Our project aims to review average life expectancy by zip code in the Las Vegas, Nevada metropolitan area against proximity to potential sources of air pollution such as power plants, airports, highways, and plumes in order to create awareness of the presence of these hazards in the Las Vegas Valley. Using information published by the EPA, we were able to determine a radius of within 500 feet from major highways and airports and within 3 miles of a fossil-fuel power plant puts residents at greatest risk of adverse effects from air pollution from those sources. Using GIS software, we produced a map displaying the locations of major roadways, the boundaries of airports, and circles representing the respective three-mile radii around power plants throughout the valley, along with a selection of life expectancy data from the U.S. Small-area Life Expectancy Estimates Project for areas at highest and lowest risk of exposure to air pollution. It is outside of the scope of this project to adjust for all applicable variables regarding lifespan; however, residents should make informed decisions regarding the dangers of air pollution when making decisions regarding where to live or build homes, and it is perhaps even more imperative that urban planners, energy companies, and other stakeholders consider the impact on local residents when considering where to locate important but polluting infrastructure such as power plants and highways.

THE 18th ANNUAL UNLV GEOSYMPOSIUM
APRIL 28th, 2023

ANTHROPOGENIC CO_2 RELEASE AND EXTINCTION RATES ARE MUCH FASTER THAN THOSE OF THE END-PERMIAN MASS EXTINCTION

Tiyonna (Jia) Phung[1], Morgan Aittama[2], and Ganqing Jiang[2]

1-Durango High School, 7100 W. Dewey Drive, Las Vegas, NV 89113
2-Department of Geoscience, University of Nevada, Las Vegas, NV 89154-4010
Tiyonna.310562@nv.ccsd.net

Since the industrialization, atmospheric CO_2 has increased from ~280 ppm in year 1750 to ~421 ppm in year 2023[1]. Among these, the majority (101 ppm) of CO_2 increase happened in the last 60 years (from 320 ppm in 1960 to 421 ppm in 2023) by fossil fuel combustion, with an average annual emission of 13.1 gigatons (Gt; 1 Gt = 10^{15} g) of CO_2 or 3.6 Gt of carbon[1,2]. During the same time period, about 900 IUCN (International Union for Conservation of Nature)-documented species went extinct, which amount to 180 extinctions per century or 0.5% of the known species[3]. To illustrate the severity of global warming and extinction induced by anthropogenic CO_2 emission, emission and extinction rates are compared with those of the end-Permian mass extinction (~250 Ma) – the largest mass extinction event in Earth's history that eliminated more than 90% of marine species. We use the carbon isotope ($\delta^{13}C$) data obtained from the best-preserved P-T boundary sections[4, 5] to calculate the amount of volcanic CO_2 emission needed to generate a negative $\delta^{13}C$ excursion from +2‰ to –3‰ within 35,000 years. Annual loss of species during the extinction event is calculated from the latest paleontological database[5]. The results show that during the end-Permian mass extinction, an annual emission of 1.08 Gt C (or 3.96 Gt CO_2) is needed for an up to 5‰ negative shift in $\delta^{13}C$ and the extinction rate of marine fauna is 16 species per century. The comparison demonstrates that the anthropogenic CO_2 release is 3.6–8.4 times faster than that of the end-Permian mass extinction and the biodiversity loss since the industrialization is more than 10 times faster than that of P-T boundary mass extinction.

1. Scripps Institution of Oceanography, UC-San Diego: https://keelingcurve.ucsd.edu/
2. USGS: https://www.usgs.gov/faqs/how-much-carbon-dioxide-does-united-states-and-world-emit-each-year-energy-sources
3. Rull, V., 2022. Biodiversity crisis or sixth mass extinction? EMBO reports 23, e54193.
4. Liu, S.-A., Wu, H., Shen, S.-z., Jiang, G., Zhang, S., Lv, Y., Zhang, H., Li, S., 2017. Zinc isotope evidence for intensive magmatism immediately before the end-Permian mass extinction. Geology 45, 343-346.
5. Fan, J.-x., Shen, S.-z., Erwin, D.H., Sadler, P.M., MacLeod, N., Cheng, Q.-m., Hou, X.-d., Yang, J., Wang, X.-d., Wang, Y., Zhang, H., Chen, X., Li, G.-x., Zhang, Y.-c., Shi, Y.-k., Yuan, D.-x., Chen, Q., Zhang, L.-n., Li, C., Zhao, Y.-y., 2020. A high-resolution summary of Cambrian to Early Triassic marine invertebrate biodiversity. Science 367, 272-277.
6. Avise, J.C., Hubbell, S.P., Ayala, F.J., 2008. In the light of evolution II: Biodiversity and extinction. Proceedings of the National Academy of Sciences 105, 11453-11457.

s

ADDITIONAL HIGH SCHOOL POSTERS
GEOPATHS PROGRAM

Project 1 (Dr. Jiang):
ANTHROPOGENIC CO2 RELEASE AND EXTINCTION RATES ARE MUCH FASTER THAN THOSE OF THE END-PERMIAN MASS EXTINCTION

Tiyonna (Jia) Phung[1], Durango High School; Morgan Aittama[2], UNLV; Ganqing Jiang[2], UNLV

1- *Durango High School, 7100 W. Dewey Drive, Las Vegas, NV 89113*
2- *Department of Geoscience, University of Nevada, Las Vegas, NV 89154*

Tiyonna.310562@nv.ccsd.net

(See page 44 for abstract)

Project 2 (Dr. Burnley):
THE VOLCANO THAT TIME FORGOT

Cezar Alvarenga[1]; Christian Fikre[2]; Erica Mann[3]; Danielle Nochera[4]; Pamela Burnley[5]; Mary Clarich[5]; Racheal Johnsen[5]; Gene Smith[5]; Monique Somma[5]

1- *Western High School*
2- *Durango High School*
3- *West Career and Technical Academy*
4- *Basic High School*
5- *University of Nevada, Las Vegas*

Project 3 (Dr. Nicholl):
VANISHING H_2O: ARID SOIL EVAPORATION RATES

Authors: Jeremiah Naoum[1]; Jade Perez Pascual[1]; Kenyonna Johns[1]; Michael Nicholl[2]; Dexter Lim[2]

1- *Western High School*
2- *University of Nevada, Las Vegas*