

# Geosciences Program Newsletter

for alumni and friends of the geosciences program.  
Fall, 2021

  
COLORADO MESA  
UNIVERSITY  
Department of Physical and  
Environmental Sciences

## Detrital Sanidine: A new tool for studying sedimentary deposit age and provenance

Some of you know about the detrital zircon (DZ) “revolution” that was championed by Professors George Gehrels and William Dickinson of the U. of Arizona beginning in the 1990s, and which continues today. U-Pb dating of detrital zircon grains from terrestrial sandstones has produced numerous new age estimates (specifically, maximum depositional ages) of poorly dated sedimentary deposits due to the common lack of fossils or volcanic ashes in continental rocks. Successful DZ dating hinges on the presence of “young” zircon grains that accumulated as detrital sand grains were deposited. For example, if a river deposits sand during a period of volcanic activity, there can be a small amount of volcanic ash, including zircon grains, that will be incorporated into the river sands. Dating of the youngest zircon grains in an ancient river deposit produces a maximum depositional age – the river deposit can be no older than the youngest zircon grain that is dated. In addition, DZs provide a powerful means of analyzing sediment provenance versus traditional use of thin sections and estimates of quartz/feldspar/lithic grain proportions. For example, Precambrian-aged ~1.7 and 1.4 Ga zircons in a sample are often a record of fluvial reworking of Laramide basement uplifts that existed in the uplands of ancient river watersheds.

In light of the great interest in detrital zircon U-Pb geochronology, our colleague Dr. Matt Heizler of New Mexico Tech (NMT) wondered aloud in 2015 if similar

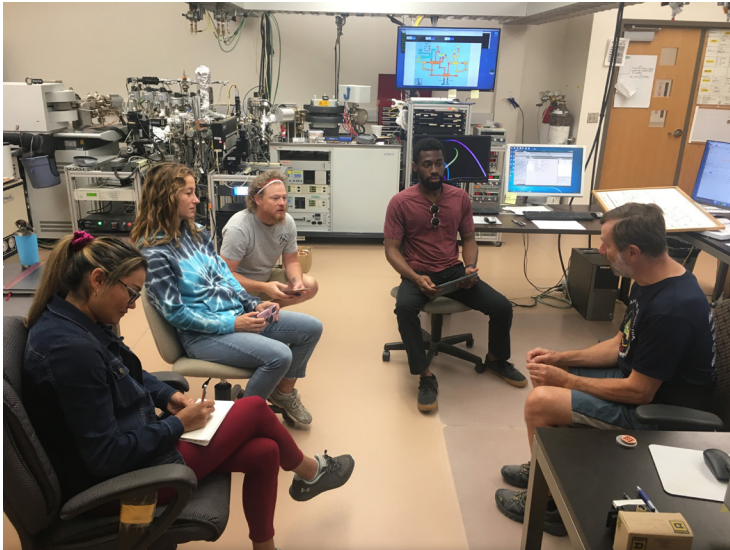
studies of sedimentary rocks could be accomplished using  $40\text{Ar}/39\text{Ar}$  dating of detrital sanidine - sanidine is a high-temperature feldspar produced during explosive volcanic eruptions. The major advantage of detrital sanidine versus zircon dating is the precision of the dates. U-Pb detrital zircon dates are commonly associated with uncertainties of 1-5 million years. In contrast, single-grain  $40\text{Ar}/39\text{Ar}$  sanidine dating has uncertainties of 20,000 to 50,000 years. If you are interested in precise ages of ancient sedimentary deposits, detrital sanidine dating is definitely the way to go!

For the past several years, a substantial number of current and former Geology majors (***Rachael Lohse, Kathleen Dykstra, Alejandro Jaquez-Caro, Josh Schlag, Nicole Mejia-Mendoza, Jordan Walker, Stacy Neel, Dana Berg, Sherri Randall, Leyna Weller, Daniel Arinze, Aaron Orelup***) have been part of “Team Sanidine”



*The 2021 Team Sanidine members (from l to r: Andres Aslan, Leyna Weller, Aaron Orelup, Sherri Randall, Daniel Arinze)*

Students collected detrital sanidine samples in the field, visited Dr. Heizler's argon geochronology lab at New Mexico Tech, processed samples at both CMU and NMT, and presented their results at national meetings as well as the traditional April meeting of the GJGS. Specific Team Sanidine projects have produced new age estimates of sedimentary units including ancient river gravels found at Columbine Pass on the



*Team Sanidine members with Dr. Matt Heizler in the New Mexico Tech argon mass spectrometer lab.*

Uncompahgre Plateau (***Sherri Randall***), beneath the lava flows of Grand Mesa (Aslan et al., 2019), Rex Cole's Goodenough formation on the flanks of Grand Mesa (***Josh Schlag*** ('20)), the Ohio Creek Conglomerate and overlying basal Wasatch Fm. (***Stacy Neel***), and the Lower Williams Fork Fm. (***Jordan Walker*** ('20)). Jordan's senior thesis was published in the Mountain Geologist; Walker et al., 2021). Other projects have involved the use of detrital sanidine to interpret sediment provenance and paleogeography (***Kathleen Dykstra*** ('18), ***Alejandro Jaquez-Caro*** ('19), ***Sherri Randall***). The latest phase of detrital sanidine student-faculty research involving a summary of Miocene rivers and the paleogeography of Western Colorado was presented by ***Sherri Randall, Aaron Orelup, Leyna***

***Weller*** and ***Daniel Arinze*** at the 2021 GSA meeting in Portland. This ongoing work suggests that the oldest evidence of the ancient Colorado River is preserved beneath the basalt flows of Grand Mesa and that integration of the upper Colorado River in western Colorado probably occurred in the Late Miocene (ca. 11 Ma), long before integration of the Colorado River through Grand Canyon! Our visits to NMT have allowed us to set up a sample processing lab at CMU that includes sieving, magnetic separations, and the use of lithium metatungstate (a safe alternative to traditional heavy liquids) to produce mineral separates. Following sample processing and separation of potassium feldspar grains, a binocular microscope with a polarizer is used to hand pick sanidine grains in wintergreen oil. Unfortunately, this last step has to be completed at NMT because we lack a suitable microscope (hint, hint - if anyone has a binocular microscope with a polarizer that we can use for this purpose it would be greatly appreciated!). To date, our research has been supported by the CMU Unconventional Energy Center.

***Stay tuned for future studies by Team Sanidine!***

## Coordinator's Corner - Andres Aslan

*Program and Faculty News*

Welcome back to our first newsletter of the COVID era! While the 2020 partial shutdown of in-person teaching and the rise of COVID cases in the Fall of 2020 certainly disrupted the Geosciences Program, we have achieved a level of normalcy on campus that we hope will continue.

Fall 2021 is beginning with significant changes to the Geosciences faculty. As many of you know, Prof. Rex Cole, as well as Larry Jones, retired in Spring 2020. Rex, now a CMU Professor Emeritus, along

with Bill Hood, continues to be active within the Geology program. Rex is also the self-proclaimed "pinch hitter" for classes in need of a guest lecture! With Rex's departure from the full-time teaching ranks, we are very pleased to welcome Dr. Javier Tellez as our new Sedimentology faculty member. Originally from

Colombia where he received his early geologic training and worked in the oil industry, Javier comes to us from the U. of Oklahoma where he completed his graduate studies. Javier's Ph.D. involved a range of studies including carbonate rocks, numerical modeling of petroleum reservoirs, and field studies of the Cretaceous Burro Canyon Fm. in the Grand



*Prof. Rex Cole at the Spring program picnic where he and Larry Jones' long-standing contributions to the Geology program were celebrated.*

Junction area. Javier is hitting the ground running and has already agreed to be the co-advisor, along with Kerry Riley, of the CMU student chapter of



*Dr. Javier Tellez our new Sedimentology faculty member in Geosciences.*

AAPG. In addition, the Geosciences welcomes back two former CMU geology graduates as adjunct faculty. Marisa Connors ('14) is teaching a section of Geology of Colorado and Eric Farmer ('01) teaches a lab section of Physical Geology. Marisa currently works for Yeh and Associates in

Grand Junction and completed her M.S. degree at Colorado State Univ. Eric currently teaches Earth Science at Grand Junction HS (including Physical Geology & Lab). Eric completed his M.S. degree at Purdue University and worked for Exxon-Mobil for 10 years before turning to the Grand Valley to embark on his teaching career. Welcome Javier, and welcome back Marisa and Eric!!

One indicator that Geology at CMU is getting closer to normal is the success of Field Camp this past summer. Sixteen students attended Field Camp this summer with a big "assist" from the Grand Junction Geological Society.



*Field Camp students (from l to r) Anja Riedel, Sherri Randall and Amanda Hicks having some fun in a Salt Wash adit in the Henry Mts.*

## Faculty Spotlight - Dr. Greg Baker

Dr. Baker arrived pre-COVID at CMU in the Fall of 2019 as the new Hydrology professor in Geosciences, and—with everyone else—has striven to meet the personal and professional challenges of the times. His roundabout route to the Western Slope has included faculty positions at SUNY Buffalo (6 years), the University of Tennessee (10 years), Illinois Wesleyan (3 years), and the University of Kansas (4 years).

A proud father of his sons (Nick and Archer) and his daughter (Camryn), he—along with his geologist wife Dr. Jennifer Roberts—have made a living from teaching out-of-doors and there is no better place than the Western Slope!

Greg considers himself an applied geologist—meaning field work



*Dr. Greg Baker, our Hydrology faculty member in Geosciences, and field companion.*

and hypothesis testing in real world situations are paramount—and his principal tools fall into the “remote sensing” category including techniques such as shallow seismic imaging, ground penetrating radar, and sUAS (drone) photogrammetry.

Greg brings over two decades of research at the R-1 level (with his work cited over 1400 times and an h-index of 21), but his passion has always been teaching; thus, the Geology Program at Colorado Mesa University is exactly the right fit with CMU’s teacher-scholar model. He has been a participant in large-scale projects including: superfund sites (e.g., identifying uranium groundwater contamination at Oak Ridge National Laboratory, Tennessee USA); large mining sites (e.g., protecting water resources near the Los Azules copper mine, San Juan Argentina); and glaciers (e.g., mapping ice/water transport at Matanuska Glacier, Alaska USA).

Since arriving in 2019, Dr. Baker has led or co-led CMU student projects on topics as diverse as drone-based time-lapse monitoring of the West Salt Creek landslide, magnetic modelling of potential buried igneous intrusions near Colorado National Monument, crustal tomography beneath the Grand Valley, and post-fire slope stability monitoring at the Pine Gulch Fire. In addition, two larger ongoing projects involve collaborations outside of CMU including study of modern dolomite precipitation via extremophiles in relic saltcrusts on the southern coast of Puerto Rico, and developing a post-Oligocene climate-driven record of erosion and dune development in the White River Badlands of South Dakota.

The focus on field-based teaching in the Geology Program at CMU fits well with Greg's teaching goals and philosophy. Greg currently teaches Field-based Physical Geology, Ground Water, Field Camp, and topic courses that use drone photogrammetry. In addition, the continued support of alumni & friends of the Program through generous donations provide critical resources for continued student-centered research in Colorado and around the world.



Greg "leading the charge" during a field trip to Colorado National Monument.

## Links to Dr. Baker's Work

- **Videos:** <https://vimeo.com/geoavatar>
- **3-D Digital Models:** <https://sketchfab.com/GeoAvatar>
- **Faculty Web Page:** <https://www.coloradomesa.edu/directory/physical-environmental-sciences/gregory-baker.html>
- **Research Publications:** <https://scholar.google.com/citations?hl=en&user=3gPjucUAAAAJ>

## Student Activities and Research

The past year saw enormous activity among the Geosciences students, despite COVID. Here is a snapshot of the senior projects completed last Spring and presented to the GJGS at the April meeting:

**Caden Anderson,** Formation and propagation of polygonal fractures in the Jurassic-aged eolian sandstones of the Grand Valley Area

**Rhett Dacuag,** Joint and fault patterns in the Devil's and Kodel's Canyon areas and their relationship to the Redlands Fault

**Anastasia Daniel,** Geometric characteristics of Coal Gulch arroyo in the eastern Book Cliffs near Loma, Colorado

**Alex Fenske,** Pebble Compositions in the Cretaceous(?) Ohio Creek Conglomerate and Paleocene basal Wasatch Formation, Mesa, Colorado

**Roan Hall,** Mega-tsunamis in Prince William Sound, Alaska

**Karlie Hadden,** Preliminary investigation of crustal and upper mantle tomography of the Devil's Canyon area of Western Colorado

**Devin Horvat,** Identifying shallow unexposed features in basement rock through ground-based magnetic surveying in the vicinity of Devils Canyon, Grand Valley, western Colorado

**Pedro Terres Illescas,** Chemical analysis of volcanic rocks of the Timber Mountain, Painted Brush, and Belted Groups, Timber Mountain – Oasis Valley Caldera Complex, Nevada

**Jarad Lavelle,** Using structure from motion to detect movement of the 2014 West Salt Creek landslide headwall

**Frank Martinez,** Carbon sequestration as a method of decarbonization

**Brycen Meyer,** Detrital zircon study of the provenance of the Ohio Creek and the Dark Canyon formations

**Anja Riedel**, Remote sensing of the 2020 Pine Gulch fire burn scar

**Zakary Saint**, Determining if trilobites are a reliable stratigraphic tool

**Lisa van Kirk**, Alkali-silica reaction potential of aggregates of Western Colorado: application to concrete

**Myah Baker & Abby Winkler\***, Analyzing stable isotopes of natural waters to detect trends on the Western Slope, \*presented at the CMU Student Showcase but not at the GJGS meeting

## Student Awards

*The Geosciences faculty nominated the following student award winners in Spring 2021:*

RMAG Neal J. Harr Award (awarded to the top senior in the program): **Jarad Lavelle**

William C. Hood Student Research Award: **Devin Horvat**

Verner C. Johnson Geology/GIS Award: **Caden Anderson**



*Prof. Verner Johnson (l) and Caden Anderson (r) receiving the Verner C. Johnson Outstanding Student in Geology & GIS award.*

Richard Dayvault Memorial Endowed Scholarship: **Karlie Hadden**

Forrest Nelson Fund Scholarships: **Sherri Randall, Destiny Duarte, Anja Riedel, Karlie Hadden, MJ Winey, Amanda Hicks, Hailey Peters, Daniel Arinze, Aaron Orelup, Leyna Weller, Roan Hall, Rhett Dacuag, Kyle Karren, Faith Urbin, Jackson Weber**

Mark Garman Field Camp Scholarship: **Sherri Randall, Myah Baker**

Geosciences Tuition Scholarships: **Sherri Randall, Amanda Hicks, Destiny Duarte, Anja Riedel**

Association for Women Geoscientists: **Sherri Randall, Destiny Duarte**

American Institute of Professional Geologists:

**Sherri Randall**

Colorado Energy Scholar - in association with the West Slope Colorado Oil & Gas Association: **Anja Riedel.**

This annual scholarship is awarded to Colorado's most outstanding student pursuing a future career in Western Colorado's diverse energy industries.



*Sherri Randall is only the 2nd CMU Geology student to ever receive an American Institute of Professional Geologists award.*



Forrest Nelson scholarship awardees (from l to r) Anja Riedel, Destiny Duarte, Karlie Hadden, Amanda Hicks, Rhett Dacuag along with Andres Aslan. Not pictured: Sherri Randall, MJ Winey, Hailey Peters, Daniel Arinze, Aaron Orelup, Leyna Weller, Roan Hall, Kyle Karren, Faith Urbin, and Jackson Weber.

## Museums of Western Colorado/ CMU Geosciences Paleo Activities

Dr. Julia McHugh

The partnership between the Geosciences Program and the Museums of Western Colorado (MWC) continues to give numerous opportunities to CMU students to participate in paleontology research, field work, and museum collections. Geosciences students **Will Vrooman, Jackson Weber, and Leyna Weller** participated in Museum internships over the 2020 & 2021 summer sessions, which gave them hands-on experience working in the Mygatt-Moore quarry digging dinosaur bones, and learning mechanical preparation skills in the Paleo Lab at Dinosaur Journey. Geosciences major



Leyna Weller holding a tail vertebra of an Allosaurus that she was cleaning and repairing in the MWC paleo lab.

**Brandi Maher** also worked at the quarry during 2020 & 2021 summer sessions as the MWC Paleontology Field Coordinator, where she was responsible for quarry mapping, excavations, and helping oversee volunteers and public dig participants. Additionally, Brandi assisted in museum exhibits in the summer of 2020 project updating the Utahraptor exhibit. The



Brandi Maher working on the update of the Dinosaur Journey Utahraptor exhibit.

update took about three weeks to complete, using over 12 yards of novelty mohair, 500+ feathers, and a whole lot of glue and X-acto blades! The result is a much more scientifically accurate Utahraptor exhibit. **Miriam Kane** ('20) also helped with the MWC paleontology collections inventory project, helping to digitize collections and log locations for thousands of fossil specimens. The summer of 2020 also saw the publication of two peer-reviewed research articles co-authored by Geology students Miriam Kane and Anja Riedel with Dr. Julia McHugh (MWC Curator of Paleontology, CMU Geology faculty) and Dr. Stephanie Drumheller (University of Tennessee, Knoxville). These articles were the culmination of two years of research, during which time Miriam and Anja surveyed hundreds of fossils for taphonomic traces on bone surfaces and used bone characteristics to assess the ecology and mechanics of death and decay in the Late Jurassic Period.



GJGS President Jerry Daub (far left) and Field Camp scholarship awardees (from l to r) Amanda Hicks, Caden Anderson, Karlie Hadden, Devin Horvat, Pedro Terres Illescas. Not pictured: Sherri Randall, Anja Riedel.

## Grand Junction Geological Society Support

While the Grand Junction Geological Society (GJGS) has always supported the Geosciences program in many ways, this year the society's support was especially noteworthy. Bill Hood continued his continued efforts to work with and employ students on a variety of research projects using the program's XRD and XRF. Brann Johnson generously helped lead the Henry Mountains week of Field Camp and took students on a tour of key sites including one that was sketched by G.K. Gilbert himself! Jerry Daub and the GJGS Council worked diligently to provide support for our students' participation in Field Camp and provided seven \$750



Brann Johnson instructing Field Camp students near the Henry Mountains in July.

Field Camp scholarships as well as field equipment. In addition, the GJGS provided cash awards to six of the outstanding Geology student presentations at the April meeting. Lastly, two former CMU geology graduates, **Ian Shafer** ('17) and **Ben Haveman** ('13) joined the GJGS council.

## New Computers in the GIS Lab

Verner Johnson

We finally got 18 new desktop computers in WS147 (the GIS Lab)! Thanks goes out to the IT department for purchasing new HP-Z2 professional workstation computers. These new computers are very powerful and fast! And we no longer have to worry about bumping into the computers, which formerly hung down from the bottoms of the desks! The new computers will be handy as we transition to ArcGIS PRO.

## New Seismic Equipment

Verner Johnson & Greg Baker

I am very pleased and excited to announce that we received a new Refraction/Reflection 24-Channel seismometer by Geometrics, thanks to a \$25,000 CMU Unconventional Energy Center grant. Reflection/refraction seismic data are a fundamental tool used in petroleum exploration, the mining industry, and in environmental studies dealing with soil, pipelines, and ground water studies. The new seismometer can generate refraction, reflection, and tomographic data, and will be used in both classes as well as for student-faculty research.

Next, we plan to prepare grant proposals to purchase ground penetrating radar (GPR) and



electrical resistivity units, as well as a stronger energy source for the refraction/reflection seismometer.

## Adam Trumbo Memorial Spring Field Trip

April 16, 2022

The Geosciences Program plans to hold the annual Adam Trumbo Memorial Spring Field Trip on Saturday April 16th 2022 (date is tentative). We would greatly appreciate it if an alum or friend of the program would volunteer to plan or lead the trip. If you are interested, please email **Andres Aslan** - ([aaslan@coloradomesa.edu](mailto:aaslan@coloradomesa.edu)).



2019 Trumbo Field Trip at Onion Creek, Utah

## Maverick Alumni

**Jarad Lavelle** ('21) is working with Ivanhoe Electric, which is part of Global Mining Services, as a contract geologist/geotech logging core in Eureka, UT. Jarad hopes that future projects will involve soil/stream/

rock sampling and mapping in nearby areas. **Miriam Kane** ('20) just started a new job at Gaston Design, LLC in Fruita, CO. Miriam will be doing photogrammetry, 3D modeling, and helping creating cast skeletons of fossils for museum exhibits around the world.

**Donald (DJ) Jarrin** ('16) is currently in the U.S. Army and was promoted to Sergeant and is now a Geospatial Intelligence Imagery Sergeant. DJ gets to play manager, trainer, and analyst. DJ is the GEOINT cell NCOIC (Non-Commissioned Officer In Charge) of both the Geospatial Imagery Analysts (35G) and Geospatial Engineers (12Y), which consists of about 10 soldiers. In January he returned home to Fort Drum, NY, from deployment after being in Afghanistan to assist with base security during the U.S. withdrawal. Several CMU grads (**Mike Feil** ('14), **Jordan Drake** ('18), **Luke Davenport** ('13)) continue to work for Field GeoServices. **Ben Haveman** ('13) and **Ian Shafer** ('17) are currently Council members of the Grand Junction Geological Society, which helps advise the Society on issues such as student scholarships, field trips, and other society business. **Rob Rice** ('14) currently works as an environmental scientist for RSI EnTech (formerly Navarro) – the DOE contractor for the Uranium Legacy program. Rob works primarily in environmental monitoring, which includes surveying abandoned uranium mines, conducting hazard assessments, and environmental sampling. While working, Rob also received his Professional Geologist certificate in Wyoming and completed a MS degree through Emporia State Univ. in Kansas. Rob is joined at RSI by several other former CMU geology grads including **Darby Spence** ('18), **Mickey Guziak** ('16), **Trey Nusbaum-Davis** ('16), **Michelle Davis** ('13), **Garrett Mitchell** ('07), **Erinn Fought** ('14), **Jennifer Graham** ('14), **Jaron Ragsdale** ('16), and **Kathleen Dykstra** ('18).

Sadly, we lost **Aaron Tofsrud** ('13) on May 28, 2021. In addition to graduating with a B.S. degree in Geology, Aaron served in the 82nd Airborne Division in Operation Enduring Freedom in Afghanistan and was honorably discharged in 2004. After graduation, Aaron worked in the oil and gas industry. Aaron was a diligent and conscientious and well-respected student while at Mesa. You are missed Aaron!

## 2021 Maverick Geo Graduates

The following students have or will (May/Dec) graduate with BS degrees in Geosciences this year. Congratulations to each of you!

<b>Caden Anderson</b>	<b>Jarad Lavelle</b>
<b>Rhett Dacuag</b>	<b>Pedro Terres Illescas</b>
<b>Anastasia Daniel</b>	<b>Frank Martinez</b>
<b>Alexander Fenske</b>	<b>Brycen Meyer</b>
<b>Roan Hall</b>	<b>Anja Riedel</b>
<b>Devin Horvat</b>	<b>Zakary Saint</b>
	<b>Brianna Trump</b>

## Geosciences Program Support

We are trying something new this year. If you are interested in donating to the Geosciences Program, the CMU Foundation has established a website with a list and description of our current program funds and scholarships. No more checks in the mail!

### **To donate, simply visit:**

<https://www.supportingcmu.com/geosciences>

If you are interested in learning more about establishing a named fund to support the Geosciences program at CMU, please contact **Rick Adleman** at 970.248.1871.



2021 Henry Mts Field Camp students drawing sill contact with Entrada Sandstone at Trachytet Mesa which was originally documented by G.K. Gilbert