UNIVERSITY OF OKLAHOMA SCHOOL OF GEOSCIENCES

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ABOUT THIS ISSUE

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Did You Know: The Earth Scientist has showcased departmental news since 1982. Its earlier incarnation was known as the Sooner Geologist, which debuted in 1967. Thus, accounting for the rare exceptions of years unpublished, we are now on volume 46 of the alumni magazine. And, prior to that, we have records of our alumni newsletters dating to 1959.

The Earth Scientist welcomes short letters from readers, and will print them as space allows. Letters should address some item from a previous issue. Please include your name, city and state, as well as an email address, for purposes of correspondence. We may edit your letter for space, style and civility, without distorting the substance or spirit of your piece. We reserve the right to decide whether a letter is acceptable for publication.

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DEAN'S LETTER

John Antonio, Ph.D.

As interim dean of the Mewbourne College of Earth and Energy, it is my privilege to introduce myself to the readers of Earth Scientist. Having joined the Mewbourne College in January of 2023, I am constantly amazed by the exciting and impactful contributions being made by our students, faculty and staff. The college is making tremendous strides in executing our strategic plan in many areas – of recent note is the impressive diversification taking place in the realm of research capabilities and growth, as measured in terms of publications, extramural research expenditures and graduate student enrollment. The faculty and staff have also responded in amazing fashion to the goal of recruiting outstanding students to our academic programs – we are on track to have significant increases in new enrollments for the coming academic year.

As you may know by now, Dr. Lynn Soreghan is stepping down as director of the School of Geosciences after remarkable service in the role for six years. Lynn has demonstrated an unparalleled commitment to research and has earned reputations in both sedimentary geology and deep-time paleoclimate. Under Lynn's leadership and direction, 11 new faculty were hired, broadening the reach of OU Geosciences beyond traditional strengths by developing outstanding programs in many important subdisciplines. Lynn also worked alongside the staff to reinvigorate the Earth Scientist magazine and brainstorm new ways to expand undergraduate recruiting. I cannot say enough about her unique passion, competence and commitment, and I wish her well in this next phase of her career. Regarding next steps for Lynn, it is my privilege to share with you that she has been selected to receive a Fulbright U.S. Scholar fellowship to Serbia for the 2023–2024 academic year. The fellowship is awarded by the U.S. Department of State and the Fulbright Foreign Scholarship Board in recognition of Lynn's academic merit and leadership potential. The Fulbright fellowship is an extremely competitive national award, and we couldn't be prouder that Lynn was selected for this very prestigious award. We look forward to hearing about the exciting discoveries that will come from Dr. Soreghan's time abroad.

It is also my great pleasure to welcome Dr. Matthew Pranter as the new incoming director of the School of Geosciences, effective July 1, 2023. In this role he will hold the Eberly Chair and remain on the faculty as professor of Geosciences. Matt has earned the respect and admiration of his colleagues and peers during his 10 years of service at the University of Oklahoma and 12 years of service at the University of Colorado Boulder. In addition to Matt's academic background in both geology and geological engineering, he has experience as a geoscientist in industry in both research and operations. His current research is focused on petroleum geosciences, energy resources, reservoir characterization and modeling, and sedimentary geology. Matt greatly enjoys working with and advising students and teaches courses at both the undergraduate and graduate levels. Matt has been an active member of the American Association of Petroleum Geologists since 1986, is a member of the AAPG Executive Committee and serves as editor. Matt looks forward to representing the School of Geosciences and engaging with faculty, staff, students, and alumni. Please join me in congratulating Dr. Pranter on his new role. I am excited to begin working with Matt as he leads the School of Geosciences in achieving its aspirations and realizing its mission.

DIRECTOR'S LETTER

Lynn Soreghan, Ph.D.

With this letter, I am signing off as director of OU Geosciences. The past six years encompassed tremendous change both within the school, and globally, as we endured many faculty retirements (and, sadly, two deaths), a collapse of geoscience enrollments nationally and internationally, and a pandemic. Yet I enjoyed my nearly six-year stint, because I was fortunate to work with an incredibly gifted, energetic and collegial group of faculty and staff who all desire the best for our school, and were willing to invest the considerable time it took to affect change. I worked together with these folks to hire 11 new faculty, broadening the reach of OU Geosciences beyond traditional strengths in petroleum geosciences to now offer outstanding programs in, e.g., Paleobiology, Environmental Geosciences, Critical Zone science, Structure and Tectonics, Paleoclimate, Geochemistry, and Geophysics. We've adopted more rigorous standards for our graduate program, increasing the Ph.D.:M.S. ratio, starting a B.S.-to-Ph.D. pathway, emphasizing research leading to publication and initiating a new onboarding seminar and field trip for incoming graduate students, all of which provide a strong foundation for future research growth and visibility. Pending approval from the upper administration, we're inaugurating new certificate options in Earth Science Writing (with the Department of English) and in Secondary Earth Science Teaching (with Science Education) to serve undergraduates who may wish to apply their geosciences education to science communication and/or teaching.

But academic rigor alone fails to change lives. Thankfully, our staff have worked tirelessly to inculcate a strong sense of camaraderie in the school. In addition to annual social events such as our August welcoming party, holiday get-togethers and April awards picnic, we initiated the tradition of "Tuesday Schmoozeday" — a brief, weekly time for students to mingle with faculty and staff in a low-stress manner. As simple as this may sound, small gestures help to maintain a welcoming atmosphere and ensure that all students feel both embraced and empowered.

Our future prospects are tremendous: After plummeting from 2016-2019 and bumping along through the pandemic, undergraduate freshman commits have exhibited exponential growth since 2021; we are looking forward to welcoming a bumper class of geology majors in the fall, and we hosted the largest cohort in our first-year field trip in nearly a decade. Many thanks to staff (and faculty) for an array of efforts to introduce OU Geosciences to prospective students, including Geosciences Day, which will enter its third year in 2024. Similarly, our graduate student commits for fall 2023 increased by nearly 40% relative to 2022. I'm very excited by these trends, which — working in tandem with our extraordinarily talented faculty and staff — promise tremendous success for the future of OU Geosciences.

Please join me in welcoming Dr. Matt Pranter as the new director of the school.

WELCOME FROM THE INCOMING DIRECTOR

Matt Pranter, Ph.D.

I will begin by thanking Dr. Lynn Soreghan for her service as director during the past five and a half years (2018–23).

As we move forward, I am excited to serve as director and Eberly Family Chair for the School of Geosciences and will enthusiastically represent the school and engage with faculty, staff, students and alumni. Fostering a broad, inclusive, and collaborative geosciences environment is one of my primary objectives – a program where everyone in the school is welcome and able to pursue their interests.

The School of Geosciences has benefited greatly from our alumni in terms of substantial financial support and their time. Through the generosity of our alumni, friends and industry donors, we continue to offer generous scholarships. Recently, 75% of our undergraduate majors and 100% of our graduate students received departmental scholarships. Given the declining funding to the school in certain areas, we are especially in need of financial support to run our field trips. Many of our alumni have expressed interest in increasing their involvement with the school in various ways. We look forward to coordinating mentorship opportunities and other activities for our students whereby they can benefit from the guidance and expertise of our alumni.

Our students have continued on to work in a wide range of fields and organizations from the USGS and state geological surveys to academia and national laboratories, and the petroleum industry and environmental consulting. I am optimistic about job opportunities for our students in a range of different fields. Society needs us – geoscientists in a variety of fields are critical as we work to provide natural resources for society, to address fundamental Earth sciences questions, and to solve some of the world's most important challenges. I am cautiously optimistic about the petroleum industry – jobs appear to be steady or even somewhat on the rise again. Many of our students recently received offers for internships or full-time positions both through campus recruiting and other venues from approximately 15 companies. I am encouraged by the increase in campus recruiting the last couple of years and hope this trend continues.

I am also encouraged to see an increase in our graduate applications, and both graduate and undergraduate enrollments are increasing. With 22 new graduate students starting in fall 2023 (20 M.S. and 2 Ph.D.), the number of graduate students will rise from 58 (in Fall 2022) to the mid-60s. Our undergraduate enrollment will likely increase from 79 in fall 2022 to approximately 100 majors.

Over the last several years, we have unfortunately lost several key faculty in petroleum geosciences and also in geophysics (and the associated curricula). The school is down to three geophysics faculty and two fully appointed petroleum geosciences faculty. However, we recently received approval to pursue a search for a new geophysics professor. Addressing our undergraduate geophysics enrollment is a priority. Importantly, securing our petroleum legacy is an important component of the MCEE Strategic Plan. There are also exciting opportunities to expand our current energy research and teaching collaborations among our units and with other departments across campus, especially in areas of geothermal energy, subsurface storage (carbon, thermal, hydrogen), critical energy minerals, and other sustainable energy systems.

The 2022–2023 academic year was one of several changes for the Mewbourne College of Earth and Energy and the School of Geosciences. Our new Interim Dean, Dr. John Antonio, began his position on Jan. 1, 2023. Dr. Barry Weaver retired after 39 years with OU and is now professor emeritus. Robert Turner also retired in February after 22 years with OU. And sadly, earlier this year we lost our good friend and colleague, Dr. John Pigott.

We had several new tenure-track assistant professors begin recently. In the School of Geosciences and with the Sam Noble Museum of Natural History, we now have four paleontology faculty and are developing a new B.S. degree in paleobiology that will make OU and the School of Geosciences unique in this field. Of the new paleontology professors, Drs. Lena Cole and Davey Wright are both assistant curators of invertebrate paleontology, and Dr. Jacqueline Lungmus is assistant curator of vertebrate paleontology. Dr. Sarah George focuses on tectonics and sedimentation, and Dr. Gilby Jepson focuses on structural geology and tectonics. Dr. Hector Lamadrid will join the faculty soon and focuses on igneous and metamorphic processes and critical minerals.

A few notable events in the last year include the following. You will find more detailed information about the School of Geosciences people, events and awards throughout this publication.

- Professor Emeritus Dr. Kurt Marfurt received the Maurice Ewing Award from SEG (their highest honor) and will be presented the award at the 2023 IMAGE Conference in Houston.
- We are excited that Drs. Brett Carpenter and Xiaolei Liu, received tenure and were promoted to associate professors. Congratulations to Dr. Carpenter and Dr. Liu!
- Dr. Megan Elwood Madden was elected a Fellow of the Geological Society of America.
- Dr. Lynn Soreghan received the Fulbright U.S. Scholar Fellowship.
- Dr. Brett Carpenter was elected chair of the Geological Society of America's Continental Scientific Drilling Division.
- Dr. Matthew Pranter completed the first year of his three-year term as AAPG Editor and member of the AAPG Executive Committee.

In April, we celebrated the 100-year anniversary of the invention of the seismic reflection method, which was invented by an OU alum, Clarence Karcher. Dr. Heather Bedle served as co-chair (with Dr. Jim Knapp at OSU) for the three-day SEG workshop and conference at the Hamm Institute for American Energy in Oklahoma City. Oklahoma Gov. Kevin Stitt proclaimed it "Seismic Reflection Day" in Oklahoma.

The OU Society of Exploration Geophysicists EVOLVE Team was recognized for outstanding performance and project management of their multidisciplinary subsurface petroleum integration project, and Dr. Heather Bedle received a special award for her leadership and engagement as the team faculty advisor.

I hope you enjoy this issue of Earth Scientist!

AAC CHAIR'S LETTER

Tiffany Stephens

We are in an interesting time with great inflation, the threat of a recession looming, and still not enough willing workers to go around (on the bright side that might mean more career opportunities for graduates). Natural gas prices have dropped lower than expected due to a miraculously mild winter in Europe and the return to production of the formerly delayed Freeport LNG plant. Oil prices have been a bit steadier. However, with the war in Ukraine and renewable energies proving to be intermittent, Europe still faces an energy crisis. More U.S. LNG facilities are set to be brought online in late 2024 to 2026, which will help with Europe's crisis and hopefully sustain a consistent (or increased) supply of natural gas. However, we, as geoscientists and as a nation, should consider if we could do more. For example, additional support could be gained by building more pipelines. Allowing natural gas to be transported to wanting places in the safety of a pipeline could mean even more opportunity for LNG exports to Europe and it would provide economic relief not only to the people of Europe, but also those states currently having to import theirs. We have so many reserves here in the U.S., that we should be able to help supply the world with energy for generations to come. The century-old threat of running out in the near future seems false. New technologies and new discoveries are proving that time and time again. Not to mention new possibilities of energy through geothermal and other new technologies, many of which are being studied and innovated right here at the university.

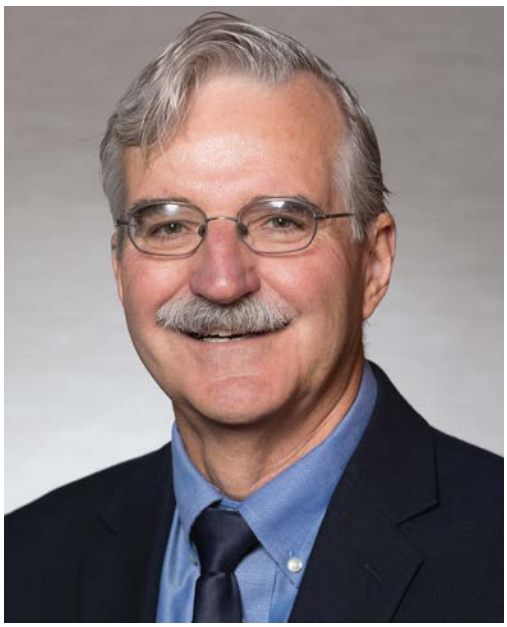
I encourage all of our alumni to stay involved as we work together to form creative solutions for today's energy needs. We have the resources. Let's use them in a responsible, appropriate way to save people's lives and the earth. The answers to saving what's on the earth lies in the earth and geoscientists are perfectly suited to accomplish this.

LYNN SOREGHAN NAMED FULBRIGHT U.S. SCHOLAR FELLOW

Gerilyn Soreghan, Ph.D., has been selected to receive a Fulbright U.S. Scholar fellowship to Serbia for the 2023–2024 academic year. The fellowship is awarded by the U.S. Department of State and the Fulbright Foreign Scholarship Board in recognition of Soreghan's academic merit and leadership potential. This prestigious and competitive fellowship provides unique opportunities for scholars to teach and conduct research abroad.

MEGAN ELWOOD MADDEN ELECTED GSA FELLOW

Megan Elwood Madden, Ph.D., has been elected a Fellow of the Geological Society of America. This honor recognizes her exceptional contributions to the field of geosciences and higher education. Elwood Madden's expertise is in planetary geochemistry. She is highly regarded for her research and teaching in various disciplines, including scientific communication, physical geology, geochemistry, and gender and identity in STEM.



KURT J. MARFURT HONORED WITH 2023 MAURICE EWING MEDAL BY SEG

Dr. Kurt J. Marfurt, geophysics professor emeritus, has been honored with the esteemed 2023 Maurice Ewing Medal by the Society of Exploration Geophysicists. Recognized for his outstanding contributions to geoscience research, education and industry, Marfurt has dedicated his career to advancing the field of geophysics. Serving as the Frank and Henrietta Schultz Professor of Geophysics at the School of Geosciences from 2007 to 2021, he played a pivotal role in shaping seismic imaging, interpretation and data simulation, particularly through the work of his AASPI research consortium. With an extensive portfolio of over 800 papers, his research has revolutionized seismic interpretation through groundbreaking visualization techniques. This well-deserved award acknowledges Marfurt's exceptional achievements and his significant impact on the field of geophysics.

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SINA SANEIYAN
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JAMES ROY MAXEY CHAIR

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DAVID F. "DAVEY" WRIGHT

ASSISTANT PROFESSOR

ASSISTANT CURATOR OF INVERTEBRATE PALEONTOLOGY, SAM NOBLE MUSEUM

BARRY L. WEAVER

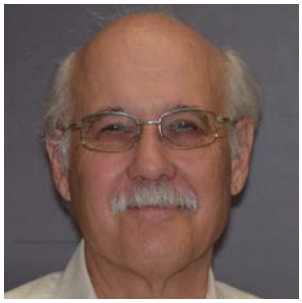
ASSOCIATE PROFESSOR

From left, front row: Xiaolei Liu, Brett Carpenter, Sina Saneiyan, Lynn Soreghan, Caitlin Hodges, Sarah George, Mike Soreghan
Back row: Matthew Pranter, Barry Weaver, Gilby Jepson, Davey Wright, Shannon Dulin, Lena Cole, Heather Bedle

EMERITUS FACULTY

JUDSON L. AHERN

KURT J. MARFURT



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SHANKAR MITRA

M. CHARLES GILBERT

R. PAUL PHILP

CHARLES W. HARPER, JR.

ZE'EV RECHES

G. RANDY KELLER

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LEAH MOSER
MANAGER OF OPERATIONS

GAIL HOLLOWAY
INSTRUCTOR AND UNDERGRADUATE RECRUITER

ASHLEY TULLIUS
SENIOR STUDENT PROGRAM COORDINATOR

GINGER LEIVAS
FINANCIAL ANALYST

ROBERT TURNER
LAB TECHNICIAN

STAFF UPDATES

After 22 years of service to the School of Geosciences, **Robert Turner** retired in March 2023.

Stephen Holloway joined the School of Geosciences staff in April 2023 as a lab technician.

MEET THE NEW FACULTY

Hector Lamadrid, Assistant Professor

Hector Lamadrid's research interests span a wide range of geologic problems that focus on the role and properties of fluids in Earth's interior, how fluids interact with the surrounding rocks, and how these interactions evolve through time and space. Main interests focus in process-driven studies that focus on understanding the hydrothermal and magmatic processes, the associated alteration and enrichment of critical minerals, the fluids and melts trapped during these processes, and the equilibrium and disequilibrium reactions (and their kinetic and thermodynamic mechanisms) to reconstruct the sequences of events and understand the evolution of the Earth's system. Lamadrid's main tools are fluid and melt inclusions, Raman Spectroscopy, EMPA, LA-ICPMS and TOF-SIMS.

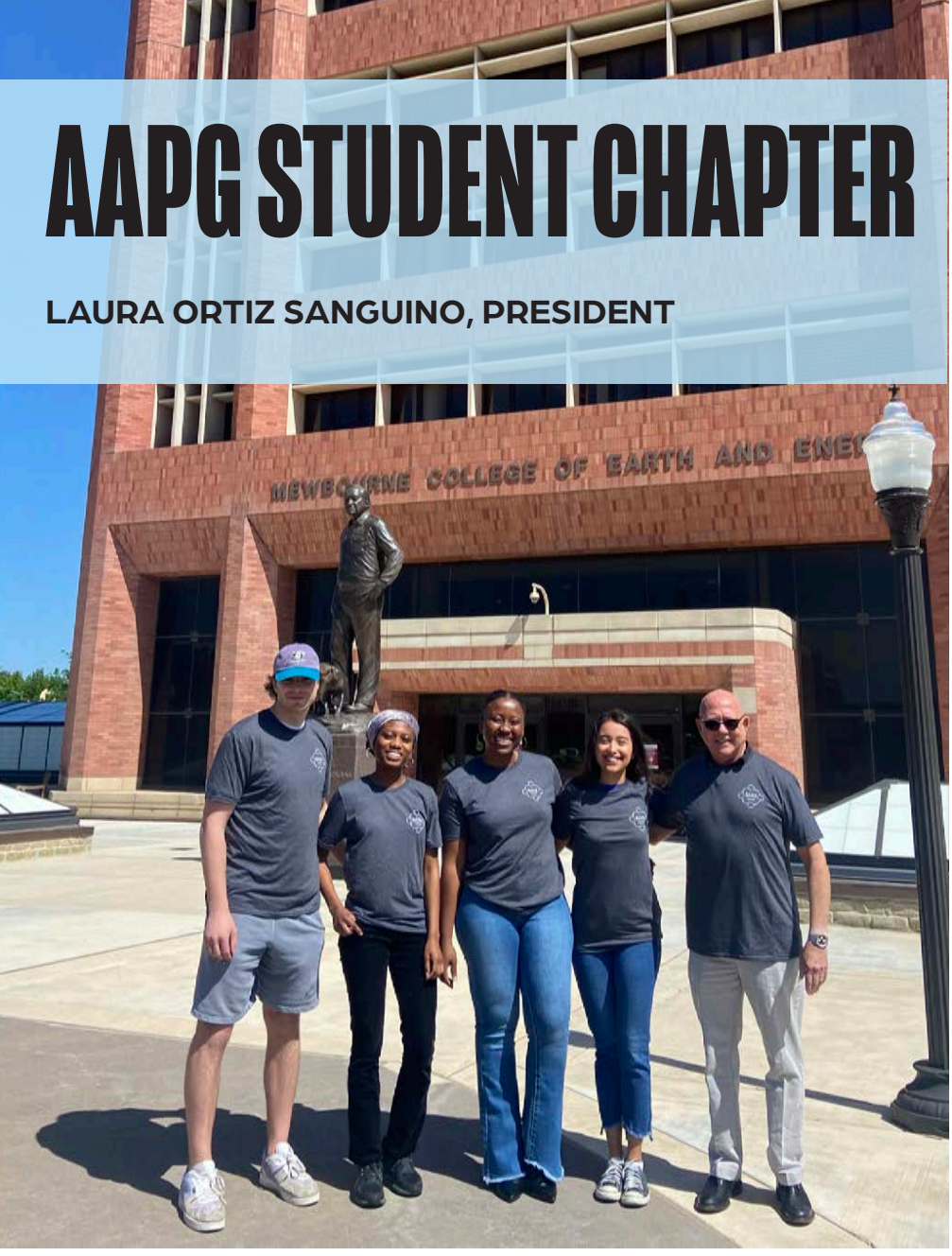
Lamadrid started his career at the National Autonomous University of Mexico, working on the hydrothermal alteration of carbonate basins, focusing on understanding the formation of Mississippi Valley Type deposits in the northeast of Mexico and the migration of hydrocarbon and other fluids in the southeast of Mexico. Lamadrid obtained his Ph.D. from Virginia Tech (2011-2016), working with Professor Robert Bodnar on high-temperature geochemistry and experimental petrology. During that time, Lamadrid studied fluid-rock interactions in natural systems (hydrothermal alteration of mantle rocks, arc volcanism, lower crust metamorphism) and analytical techniques to study the thermodynamic properties of fluids.

Lamadrid continued his research at the University of Toronto (2016-2018), where he obtained the Roger E. Deane Postdoctoral Fellowship. During his postdoctoral years, he developed new experimental and analytical methodologies to constrain the properties of fluids (volatiles and melts) and the environmental factors (physical, chemical, and biological) that affect the hydration (serpentinization), carbonation and dehydration reactions that occur in low to high-temperature hydrothermal systems.

From 2018 to 2020 Lamadrid joined the Preparing Future Faculty Diversity Program at the University of Missouri and, in 2020, transitioned to an assistant professor position, where he continued his research on fluid-melt-rock interactions.

AAPG STUDENT CHAPTER

LAURA ORTIZ SANGUINO, PRESIDENT



In the 2022–2023 academic year, our goal was to provide the community with technical and soft skills through multiple technical and social activities for our Mewbourne College of Earth and Energy. A great highlight from this year was the partnership with fellow student chapters Pick & Hammer, Society of Exploration Geophysicists, Soil and Water Conservation Society, Geothermal Rising, and Society of Petroleum Engineers, which was key in the success of the events.

This year, we organized the second edition of the AAPG Energy Week, which hosted various technical talks on energy transition as well as fun events such as a "Happy Hour" and AAPG/SEG officer elections. These events are intended to provide our community with technical information about new energies, specifically, hydrogen, geothermal and wind. Speakers also shared their insights on the job market in the energy industry and recommended networking resources. During this week, Matthew Pranter also gave a talk about the publication process from his perspective as AAPG Bulletin editor; this talk was very beneficial for the student body as publishing is highly recommended (for undergraduate and master's) or required (for Ph.D. students).

We strived to provide our students with practical experience in the application of geoscience knowledge to the energy industry. Joe Batir, Petrolern LLC, provided a one-day hands-on course on geothermal exploration. Petroleum engineering and geoscience students enjoyed the experience and expressed the intention of having part II of this course. We also hosted Matt Corbett and Chris Walker, from bp, who presented a talk on "The Role of Geoscientists: An Example From CCS Well Planning".

Perpetuating the tradition of doing outreach at elementary schools, we visited Lincoln Elementary and delivered third- and fourth-grade students a gift bag sponsored by the OGS that contained minerals, rocks and fossils. The activity consisted of teaching them about the differences between rocks and minerals and hearing about their current knowledge of geosciences. This was by far the most rewarding experience of the year as we planted a seed of love for geology in these young children.

Other community/social activities were the two blood drives coordinated in partnership with the rest of the geosciences student chapters and the Oklahoma Blood Institute, successfully reaching the donation goal. We also hosted, in partnership with SPE, the Women's Coalition 2023, to commemorate and celebrate the importance of the female faculty, students, and staff in our school. Professors Caitlin Hodges and Megan Elwood-Madden shared their life stories and advised on how to navigate through their careers while being women in STEM. Other volunteering activities included the Little Event, Big Event, a gift donation drive and Habitat for Humanity.

We also faced a difficult challenge as we mourned the passing of our dear faculty advisor, John Pigott, who unexpectedly passed on Feb. 14, 2023. He was a great guide for our student chapter for many years and his advice will be sorely missed. Matthew Pranter will take over his role starting in fall 2023.

Overall, we are delighted with the great experience and activities we hosted during 2022-2023 and trust that the 2023-2024 AAPG SC will continue such work. Giving back to the community through technical and social activities was extremely rewarding. We are also thankful to our student members, faculty, staff, fellow student chapters, and the Oklahoma Geological Survey for their contribution to the success of our events.


SEG
SOCIETY OF EXPLORATION GEOPHYSICISTS
image
EMILY
SPEAKER
STUDENT
image
image
MARIO
STUDENT
image
JOHN
STUDENT
image
VANESSA
STUDENT


TERRA VERDE
TBE
2022


SEG
The University of Oklahoma
Student Chapter


SEG
EVOLVE

SEG STUDENT CHAPTER

KARELIA LA MARCA, PRESIDENT

The SEG student chapter empowers students to participate and spearhead projects that address issues, challenges and opportunities related to SEG's mission of promoting the science of geophysics.

Last year, we started expanding our frontiers to the energy transition, as climate change is pivoting science's focus. Understanding how we can transfer our technical skills (gained mainly from oil and gas exploration and production) to new energies is necessary. Therefore, in the 2022-2023 academic year, the SEG student organization aimed not only to create awareness about a world that needs more conscious and well-rounded professionals but also to foster empathy inclusion, and diversity by hosting technical talks and events (Friendsgiving event and the DEI social hours) that were more inclusive in collaboration with other associations. Teamwork and collaboration were critical to our success, and I appreciate the great work every single officer put in to make it possible: President Karelia La Marca, V.P. Diana Salazar, Treasurer Emily Jackson, Secretary John McKnight, Social Media Coordinator Vanessa Rios, and Special Events Coordinator Mario Ballinas.

We increased our student involvement, and now we have around 50 students (from geology, geophysics, and petroleum engineering) actively participating in our wide range of events. Some members attended the IMAGE in Houston, thanks to the joint efforts of both student chapters to offer accommodation, transportation and registration. At IMAGE, our student chapter was awarded the Summit level of excellence, the only U.S. student chapter to receive it worldwide in 2022. This award speaks highly of the accomplishments of SEG OU, which we aim to continue in the upcoming years. Our students are highly involved in SEG activities like the EVOLVE program, Challenge Bowl, and Leadership Symposium and have volunteered for the organization in different ways, including hosting talks and reviewing articles in journals. We provided feedback on our methods of communication and our own Slack channel to the current president of SEG, Ken Tubman, which he implemented for the worldwide organization as "Slack Community."

Volunteering events such as The Big and Little events, Shell Fest, Camp Crimson, Habitat for Humanity, a blood drive, a food drive, and outreach events that help keep the organization present outside of the university. Our flagship event, "SEG week," had excellent attendance and students learned from renowned professionals in the seismic interpretation field, such as Kurt Marfurt and Satinder Chopra. Chopra traveled from Canada to share his knowledge and even spent one-on-one time with students. Other talks were focused on new energies such as CCUS and geothermal. We even co-hosted a talk with the AAPG on the "Geology of Coffee". This, along with the "Who wants to be a Geomillionaire" events ,are some of the fun experiences we provided last year.

We are saddened to have lost one of our advisors, John Pigott, but he would have liked us to keep fostering both personal and professional development for the geology and geophysics students at OU, and that's what we focused on.

Overall, it was a fun and fulfilling year for the SEG OU student chapter and the geoscience community. We thank our student members, faculty and staff for their continuous support throughout the year.

PICK & HAMMER CLUB

LOGAN CRAWFORD, PRESIDENT

The 2022–2023 academic year was a great springboard for the Pick and Hammer Club. While we were still feeling some of the lingering effects of COVID, the club was able to make steps back toward our historic "normal" and return to the outreach events we are known for.

Pick and Hammer Club is known for its outreach events, and this year marked a step forward in returning to our roots. With schools welcoming us back again after COVID restrictions were lifted, we were able to visit students across Oklahoma, and even visited a few schools in Kansas, thanks to our Lead Outreach officer, Xander Margheim. Once again, the Oklahoma Science Olympiad invited us back to create and proctor tests in two categories; Rocks & Minerals and Dynamic Earth: Water Systems & Pollution. We were able to attend every SciOly event in Oklahoma this year!

One of the staples of Pick and Hammer outreach is our Genius Box donation. Every student present at a guided outreach event is given a geology-themed activity box. The boxes were acquired with outreach funding from Halliburton. Unfortunately, the company that produced these boxes rebranded, and we were not able to purchase them anymore. Thanks to some brainstorming and an additional donation from RKI Energy Resources, the club was able to produce our own version of the activity box in-house. The students and teachers love the activity kits, and we are proud to be able to begin passing them out to students again.

Our officers and club members were quite busy this year. We participated in numerous tabling events, such as: the Mewbourne College Welcome Back, Shell Fest, OERB STEM nights, Oklahoma's Oil and Natural Gas Expo, Norman Earth Day Festival, the Oklahoma City Geological Society's Gem & Mineral Show and Space Night at the Science Museum. For the first time in Pick and Hammer history, the club was invited to have a display table at the Plaza District's annual Plaza Fest. This event drew in a crowd of roughly 20,000 attendees, providing us an amazing opportunity to visit with the Oklahoma City community.

Pick and Hammer held a mineral auction at the Trailblazer Gala – an event that the club looks forward to each year. Trailblazer allows us to network with industry leaders while also raising money for the club's expenses and outreach events. Thanks to a generous donation from the Trailblazer recipient, Ronnie K. Irani, the club raised the largest amount yet! Mr. Irani provided the club with a gorgeous Green River mass mortality fish plate as the main auction item, which brought in an amazing $4,000.

Overall, Pick and Hammer had an excellent year in regard to outreach and building connections in the community. We have a great group of officers for the upcoming school year, and we look forward to getting back into classrooms and spreading our love of geosciences. Rock and Stone!

SOIL AND WATER CONVERSATION SOCIETY

JACOB CLEMENTS, PRESIDENT

"What possibilities!" President David Ross Boyd's first words upon seeing the new University of Oklahoma campus perfectly express the future of OU Geosciences and its newest student organization, the Soil and Water Conservation Society.

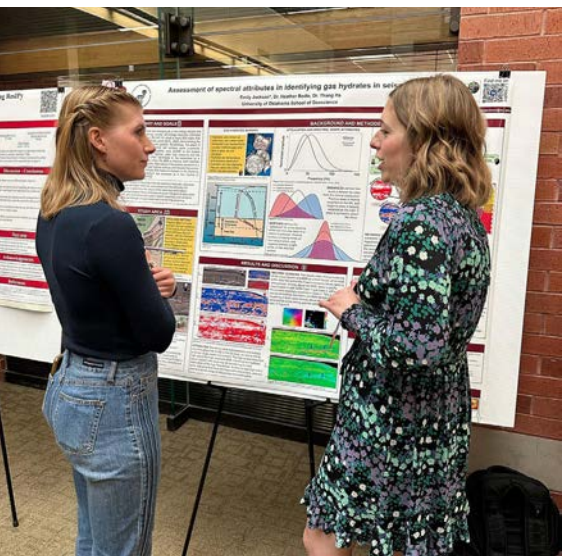
Earth is at a crossroads. Anthropogenic climate change continues to worsen. This is not a problem that exclusively affects developing nations or anywhere outside of North America, but it is one of the truly global problems we face. Perhaps no place is affected as much as the Critical Zone, where all terrestrial life occurs. Continued agricultural production and protecting our water quality are essential to our survival. Geoscientists are critical in researching and providing solutions to solve these problems. As OU Geosciences continues to diversify and research the Critical Zone, we decided there is no better time to build a grassroots organization for students interested in environmental geosciences. Much like the Critical Zone, which brings scientists from multiple fields, SWCS has generated significant student interest not only in OU Geosciences but also in the School of Meteorology, the School of Civil Engineering and Environmental Science and students who are undecided in their major.

Our executive team is thrilled with our progress over the past year. We are fortunate to have had multiple excellent guest speakers throughout the year. We brought in Zack Sanders, a research technologist with the Penn State Extension, for our first event. Zack discussed his research on Agroecosystem Models, which are critical to protecting our global food supply.

We also brought Kim Shaw with Blue Thumb, a division of the Oklahoma Conservation Commission, to talk to us about watershed management and nonpoint source pollution. For the final event of our inaugural year, we brought in Matt Bostick, a Level 3 Sommelier with Llano Estacado Winery in Lubbock, Texas, to guide us through the "Soil Science behind Viticulture," which was incredibly popular. We also partnered with the other student organizations in the Geosciences Fall Food Drive, which reduced food waste and supported the OU Food Pantry, another critical campus resource.

We are genuinely excited about the possibilities the 2023–2024 academic year will bring for SWCS! We look to build on the success of our inaugural year by offering private watershed management training in fall 2023 with Kim Shaw while the weather is still great. We also look forward to bringing in more guest speakers over the next year. As the student chapter of a national professional organization, we want to leverage the national SWCS network to expand networking and professional development opportunities for undergraduate and graduate students. We hope to enable connections so students can enter one of the numerous environmental industries or pursue research. We hope you are as excited about what possibilities lie ahead for SWCS and the School of Geosciences as we are.

From left, front row: Molly Yunker, Segun Bodunde, Ellie Callahan, Lynn Soreghan and Vanessa Rios Perez. Back row: Logan Crawford, Dodger Stankewitz, Declan Martin, Laura Ortiz Sanguino, Gabe Jandebeur, Austin McGlannan and Karelia La Marca.



SPRING BREAK STUDENT EXPO

The Spring Break Student Expo was held on March 10 in Sarkeys Energy Center. Four short courses were taught by OU Geosciences, faculty, alumni and friends. In additon, four companies exhibited at the Expo: BP, Continental Resources, Devon Energy and Ovintiv.

26 students presented their research in the poster competition. The Oklahoma Geological Survey served as judges and awarded the top three posters in each category $500 prizes for their outstanding research. Prize money was generously sponosored by the Oklahoma Geological Foundation.

The winners are as follows:

Undergraduate:
Logan Crawford
Gabe Jandebeur
Declan Martin
Dodger Stankewitz

Master's:
Ellie Callahan
Laura Ortiz Sanguino
Vanessa Rios Perez

Ph.D.:
Segun Bodunde
Karelia La Marca
Austin McGlannan

From left, front row: Ellie Callahan, Diana Salazar Florez, Logan Crawford, Katie Murphy. Back row: Carlos Russian (ConocoPhillips), Declan Martin, Tiffany Legg, Austin McGlannan, Karelia La Marca, Faith Thompson, Brady Fox, John McKnight, Lynn Soreghan.

GEOSCIENCES STUDENT REASEARCH SYMPOSIUM

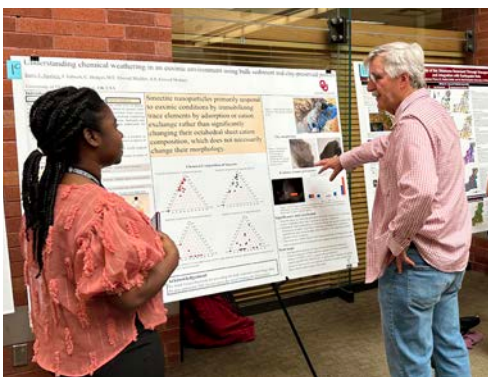
With the generous support of Oklahoma Oil and Natural Gas and ConocoPhillips, the School of Geosciences held the Geosciences Student Research Symposium on March 31. Students, faculty and staff gathered to discuss research projects happening in the school and to celebrate the winners with a reception afterward. The Oklahoma Geological Survey served as judges and awarded the top posters in each category $500 prizes for their outstanding research. Congratulations to our students!

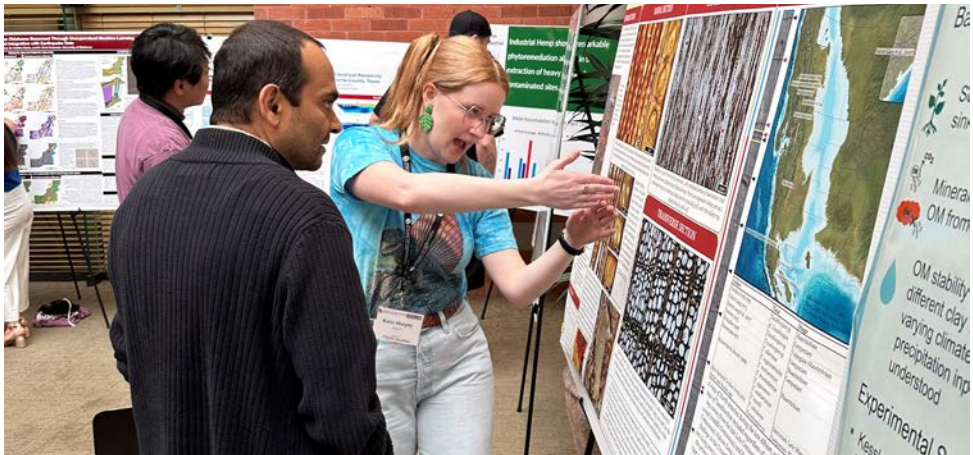
The winners are as follows:

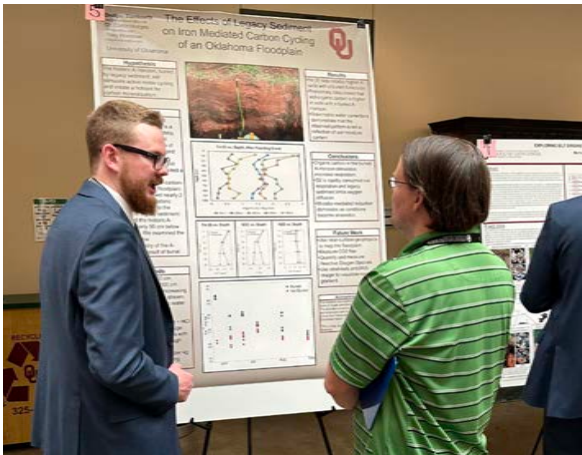
Undergraduate:
Logan Crawford
Brady Fox
Declan Martin
Faith Thompson

Master's:
Ellie Callahan
John McKnight
Katie Murphy
Diana Salazar Florez

Ph.D.:
Karelia La Marca
Tiffany Legg
Austin McGlannan







GEOSCIENCES STUDENT AWARDS AND HONORS

• Steve Adams was selected as a recipient of the National Association of Geoscience Teachers Outstanding TA Award.

• Jarah Burdette was awarded the Outstanding Senior for the Mewbourne College of Earth and Energy.

• Faith Thompson placed in the top three undergraduate research posters at the Oklahoma Clean Lakes and Watersheds conference.

• Karelia La Marca was awarded the 2023 Outstanding Student Award from the Geoscience Foundation of Tulsa.

• Itunu Apalara was awarded third place in the poster session at the Clay Minerals Society conference.

• Itunu Apalara was awarded a grant from the Lewis and Clark Fund for Exploration and Field Research in Astrobiology.

• Daniel Mansourian was awarded the Oklahoma Geological Foundation Graduate Fellowship.

• Aaron Walker was selected as the recipient of the Dave Campbell Award from the Oklahoma Geological Foundation.

• Riley Woodrow was awarded the Black Field Camp Grant from the Oklahoma Geological Foundation.

The following students were awarded field camp grants from the Oklahoma Geological Foundation:

- Christian Davila
- Colby Higdon
- Dawoud Al-Hashemi
- Dodger Stankewitz
- Brady Fox
- William McCraine
- Turki Al Mamari
- Declan Martin
- Logan Crawford
- William Glathar
- Sultan Al Balushi




OUTSTANDING FRESHMAN:
EMILY ELDER, KENDALL BIRNEY AND SILAS SNEAD

OUTSTANDING SOPHOMORE:
BRAEDEN MORELAND AND BRYSON FETTERS

OUTSTANDING JUNIOR:
WILL MCCRAINE AND CHRISTIAN DAVILA

CHARLES GOULD AWARD FOR OUTSTANDING SENIOR IN GEOLOGY:
BRADY FOX

ALAN WITTEN AWARD FOR OUTSTANDING SENIOR IN GEOPHYSICS:
TURKI AL MAMARI

DAVID STERNS AWARD FOR OUTSTANDING ACHIEVEMENT:
SULTAN AL BALUSHI AND DAWOUD AL HASHEMI

ESTWING HAMMER AWARD FOR EXCELLENCE:
FAITH THOMPSON AND DODGER STANKEWITZ


STAN CUNNINGHAM EXCELLENCE IN TEACHING AWARD
JACOB CLEMENTS

BEN HARE EXCELLENCE IN RESEARCH AWARD
KATHERINE SLUDER (M.S.) AND STEVE ADAMS (PH.D.)

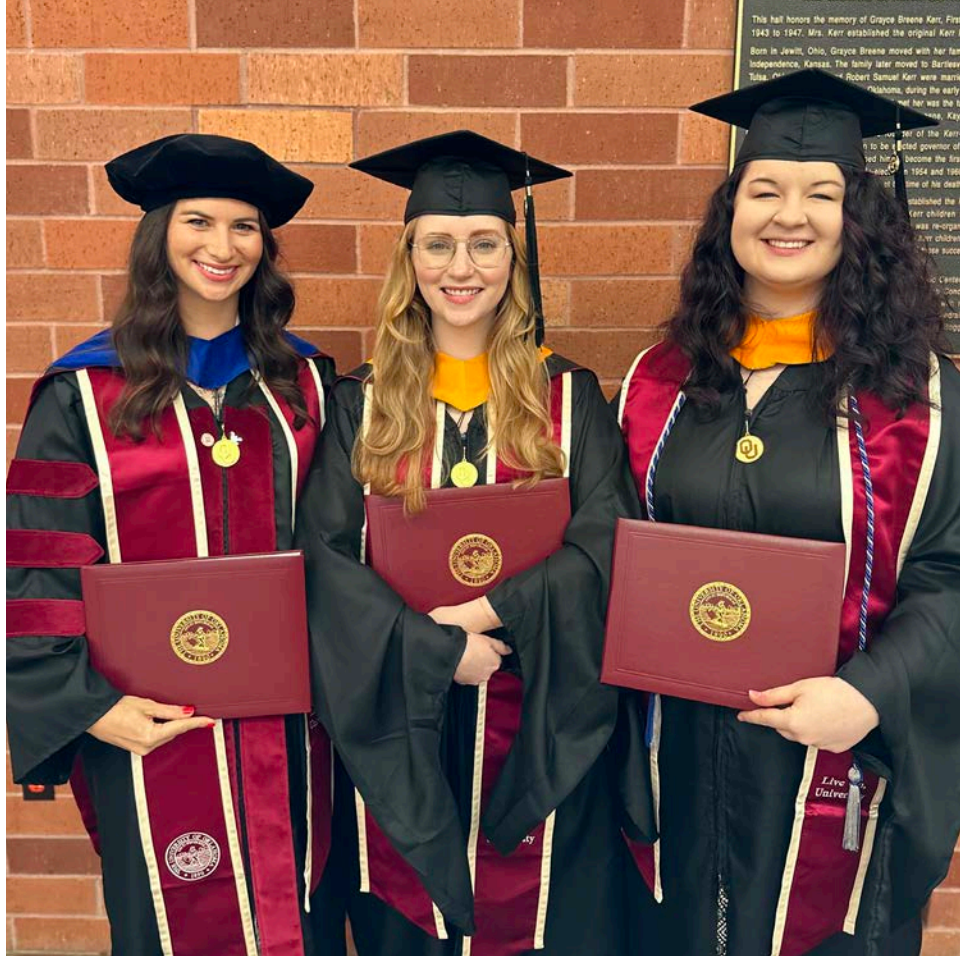
FRANK A. MELTON MEMORIAL RESEARCH AWARD
LAURA ORTIZ (M.S.) AND STEVE ADAMS (PH.D.)

STAFF ROCK
MARIO BALLINAS






CLASS OF '23
Live On, University




ΒΘΠ

CONGRATULATIONS TO OUR 2022-2023 GRADUATES

B.S. GEOLOGY

ROBERT BAKER
JARAH BURDETTE
CHLOE CODNER
WILLIAM GLATHAR
ETHAN KIRBY
JOSEPH MORRELL
RYAN PEPLINSKI
DODGER STANKEWITZ
FAITH THOMPSON
AARON WALKER

B.S. GEOPHYSICS

TURKI AL MAMARI
JOSHUA MCGLOTHLIN

M.S. GEOLOGY

KAYDRA BARBRE
ELISE CALLAHAN
BRANSON HARRIS
KYLE MATTINGLY
KATIE MURPHY
VANESSA RIOS PEREZ
DAVID SANGER
BRITTANY STROUD
IAN TAYLOR

M.S. GEOPHYSICS

MARIO BALLINAS
EMILY JACKSON
HAOYU LI
LAURA ORTIZ SANGUINO

PH.D. GEOLOGY

STEVE ADAMS
ALICIA BONAR
CANSU FLOYD

PH.D. GEOPHYSICS

ABIDIN CAF
DEEPANKAR DANGWAL
RAYMOND NG
ZHUOBO WANG

GEOSCIENCES DAY

GAIL HOLLOWAY, RECRUITER

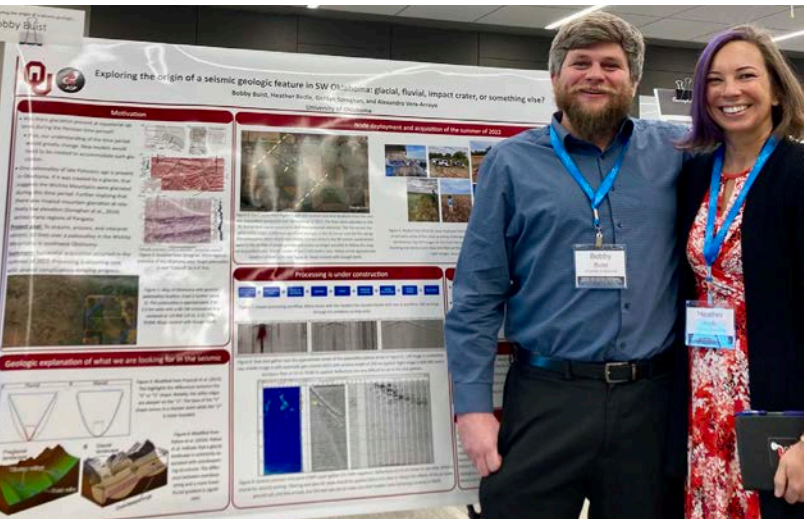
Our second annual Geosciences Day was a resounding success! On March 3, 2023, the school hosted 19 students and their guests to highlight our programs, meet our professors and current students and learn about our research opportunities. High school and community college students were invited to attend from all over Oklahoma and the surrounding states, and attendees represented a variety of majors and grade levels.

Thanks in part to a generous grant from the Oklahoma Geological Foundation, we expanded our event for this year. Feedback from last year indicated that time with current students and faculty was a highlight. The amount of time given to the student panel was extended, allowing our current students to talk about their experiences in the program and answer questions from the participants. We made some larger changes to the informal lunch as participants from last year loved getting to talk one-on-one to students and faculty at the lunch. In addition to increasing the time allocated, all four of the school's clubs had tables at the lunch, allowing them to showcase their events, interests and activities. At least 12 faculty, eight club officer, and numerous current students attended to talk to participants and partake in lunch.

The lab tours were also expanded for this year. With the wide variety of professors participating and disciplines represented, we had something for all aspects of the geosciences. All students started with the Geophysics lab on the 14th floor, rotating through stations with Heather Bedle, Junle Jiang and Sina Saneiyan and their graduate students. For the remaining labs, we had students rotate through in small groups. For the first time block, Rick Lupia, Lena Cole and Davey Wright showed fossils in the Paleontology lab, Megan Elwood Madden ran samples on the Raman spectrometer, Brett Carpenter demonstrated stress relationships, and Andy Elwood Madden and Shannon Dulin magnified samples in the SEM. For the second time block, Lynn and Mike Soreghan discussed climate and sedimentation, Kato Dee ran water samples and Caitlin Hodges worked with soil samples.

We had great feedback from the attendees. The lab tours were a definite favorite of the day. "The touring of the labs was amazing" and "the paleontology lab was the highlight" were two of the responses given related to the labs. However, feedback was great on all aspects of the day. "It was very eye opening and if it were 30 years earlier, I would change my major. Thanks to all who participated in putting on this event!! I love OU!!!" "For me, it was seeing all of the rocks and fossils." "Getting to meet some of the professors he will be learning from and hearing their journey and passion for what they do." "I love it, and it convinced me to apply." However, my favorite comment had to be that the highlight was "the entire day."

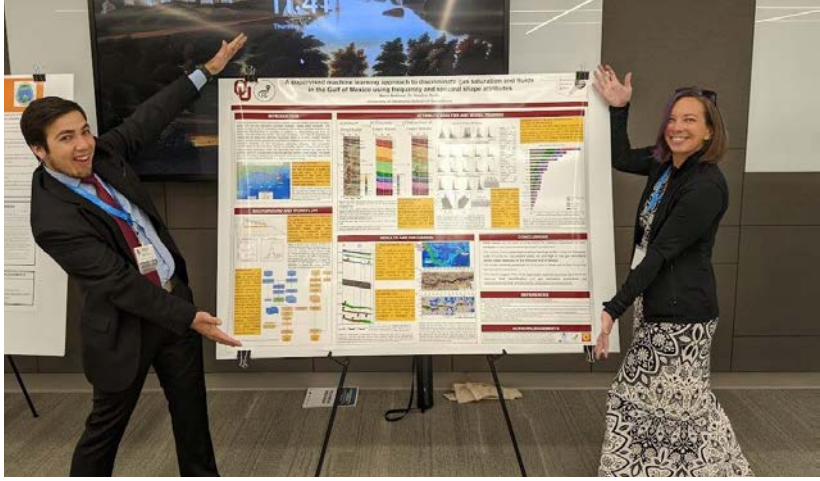
We definitely will be continuing the event in future years, adding in everything we can to show off our amazing program!

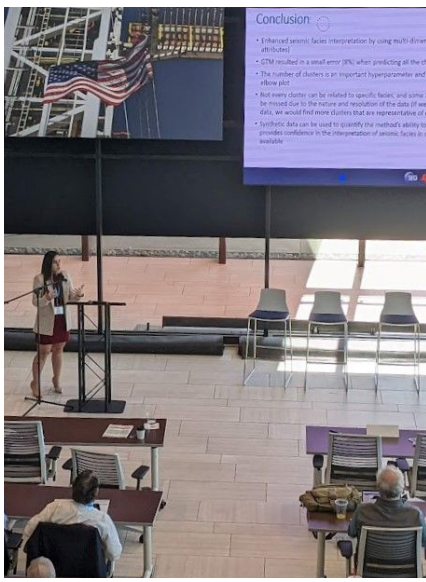


CELEBRATING 100 YEARS OF SEISMIC REFLECTION DATA

HEATHER BEDLE, PH.D.

The Society of Exploration Geophysicists recently held a workshop titled "Seismic Reflection Centennial: Mapping the Earth Beneath our Feet." Held from April 12–14, 2023, at the prestigious Hamm Institute for American Energy in Oklahoma City, this workshop commemorated the 100th anniversary of the seismic reflection method. The event was co-chaired by Assistant Professor Heather Bedle from the University of Oklahoma and Professor Jim Knapp from Oklahoma State University





The workshop featured a range of activities and discussions that showcased the rich history, recent advancements and future prospects of seismic acquisition, processing and interpretation. One of the highlights was the presence of Clarence Karcher's relatives, honoring his and his team's groundbreaking contributions to the field. In recognition of this milestone, the Oklahoma Governor proclaimed April 12, 2023, as "Seismic Reflection Day" in the state.

The workshop included presentations shedding light on the early events and pioneers who shaped seismic reflection. It served as a reminder of the seismic reflection experiment conducted by John Clarence Karcher and his colleagues on June 4, 1921, in Belle Isle, Oklahoma City. Their groundbreaking work demonstrated the ability to image subsurface geologic boundaries using seismic waves. Over the past century, seismic reflection has played a pivotal role in exploring and exploiting petroleum reservoirs worldwide, and more recently, in geothermal and other resource exploration. Moreover, this method has revolutionized our understanding of the Earth's history, structure and tectonic processes while aiding geohazard assessment and engineering endeavors.

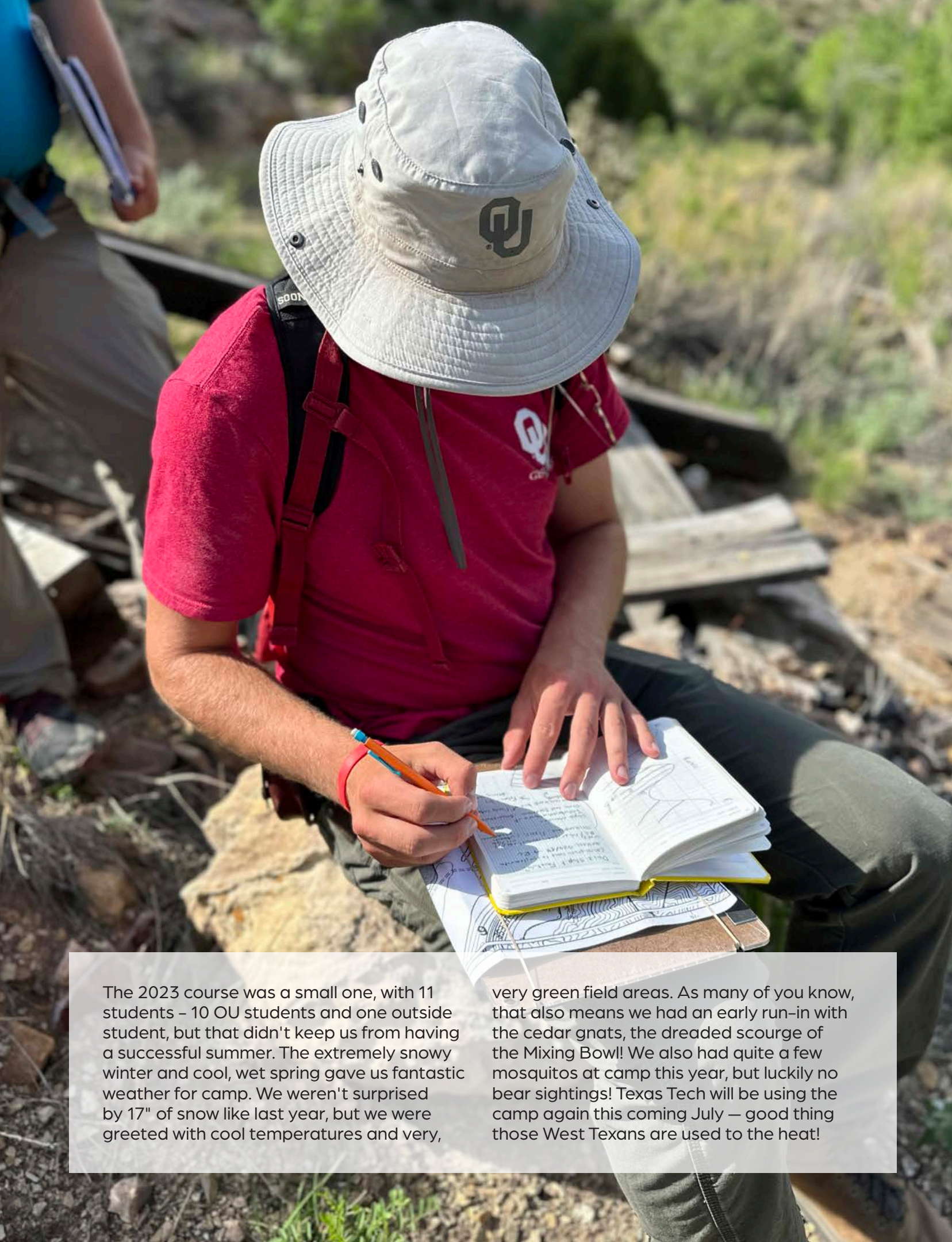
The three-day event included engaging activities such as a tour of the History of Science Collections at the University of Oklahoma Libraries, followed by a tour and reception at the Sam Noble Museum in Norman, OK. Day two was dedicated to student outreach activities, providing a platform for the next generation of geoscientists to learn from and connect with seasoned professionals – almost 100 local high school students attended! Finally, the field trip on April 14, led by OU Alumni Molly Turko and Brandon Spencer and OU assistant professor Brett Carpenter, allowed participants to explore the seismic scale structural geology and stratigraphy of the Arbuckle Mountains in southern Oklahoma, with stops at historical monuments dedicated to the illustrious history of geophysics.

Among two days of technical presentation, almost a dozen were led by current students and alumni from the OU School of Geosciences. They showcased their research, ranging from innovative techniques for analyzing old data to cutting-edge approaches using seismic attributes and machine learning for subsurface interpretation.

BARTELL FIELD CAMP

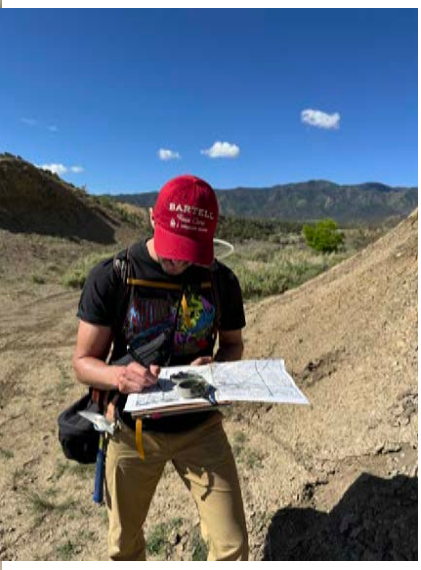
This year's Bartell Field Camp began with a first — Alumni Field Camp! Since Bartell Field Camp's 10th anniversary occurred during pandemic restrictions (summer 2021), we were unable to celebrate. We made up for it this year by hosting our first Alumni Field Camp event. Alumni, students and emeritus professor, Doug Elmore, came together for the opening weekend of camp with great food, a few field trips and facilitiy tours. Stephanie Buettner and Ashley Tullius put together a wonderful weekend for us all! Our loyal chefs, Bob and Carolyn Likens, once again treated us with their fantastic fare! We certainly could not get by without this duo, who has been dedicated to feeding all of our students for several years.


WELCOME
to
Alumni Field
Camp



The 2023 course was a small one, with 11 students – 10 OU students and one outside student, but that didn't keep us from having a successful summer. The extremely snowy winter and cool, wet spring gave us fantastic weather for camp. We weren't surprised by 17" of snow like last year, but we were greeted with cool temperatures and very, very green field areas. As many of you know, that also means we had an early run-in with the cedar gnats, the dreaded scourge of the Mixing Bowl! We also had quite a few mosquitos at camp this year, but luckily no bear sightings! Texas Tech will be using the camp again this coming July — good thing those West Texans are used to the heat!

Now that we have another field camp year in the books, I want to thank the students and the alumni for their patronage of such a special place. Denny Bartell and Doug Elmore, along with numerous alumni, took their vision of a world-class field facility and made it happen over 10 years ago. We are still going strong in Cañon City, the best place in the country to experience field camp, with a great set of staff, caretakers, meal-makers and wonderful neighbors. A great time was had by all this summer, and I hope to see many more of you at future alumni events at camp!



The students mapped their usual places — Grape Creek, the Mixing Bowl, Blue Ridge — and were treated to an extended regional field trip with new stops. Our newest assistant professors, Sarah George and Gilby Jepson, joined the Bartell Field Camp staff. Part of their tenure involved taking the students to Utah to look at Sevier-style deformation. This, combined with mineralization and extensional tectonic in Leadville, led by Kato Dee, gave the students a very well-rounded tectonic experience. They were able to see the contrasts in Laramide-style thick-skinned deformation, extensional Cenozoic tectonics and associated volcanism and mineralization, and thin-skinned thrust faults as they traveled west. Camping along the way through Colorado and Utah is always a bonus and was also a first for many in this year's cohort.

GEOPHYSICS FIELD CAMP

SINA SANEIYAN, PH.D.
LYNN SOREGHAN, PH.D.

This year, the geophysics field camp was focused on tackling real research challenges with multiple near-surface geophysical methods including electrical resistivity imaging and magnetometry. Five students (Sultan Al Balushi, Dawoud Al Hashemi, Turki Al Mamari, Christian Davila and Joshua McGlothlin) joined the three-week field camp program from May 21 to June 9 and worked at two different sites in Colorado.

Geologic mapping of the subsurface with geophysical methods

The first project was mapping the mafic dikes around the Bartell Field Camp site with magnetometry and electrical resistivity imaging. The students started their work by finding several dikes with obvious outcrops. Then, they selected several mafic dikes nested inside felsic hosts at different locations. This was to ensure the observation of a good geophysical signal contrast. For the first geophysical survey a Geometrics G826 magnetometer was used. This professional proton magnetometer is sensitive to 1 nanoTesla variations in the Earth's magnetic field; however, it is very slow (6 sec/reading) due to its old technology. Therefore, a low-resolution survey grid was designed to save time and ensure large land coverage. Unfortunately, the results were not satisfying—likely owing to the low survey resolution. Thus, the students opted for a lower-sensitivity magnetometer with the ability to collect data at a much higher frequency: their smartphones. Nowadays, most smartphones have a 3-component magnetometer embedded for navigation (i.e., the compass). The smartphone magnetometer can record variations in Earth's magnetic field as low as 10 nanoTeslas at frequency of 1 Hz or higher. This enables faster data collection and hence closer and denser data points yielding higher data density and resolution. The students re-performed the surveys done using the professional magnetometer with their smartphones and were able to sense the magnetic signal from several large dikes in the area (Figure 1).

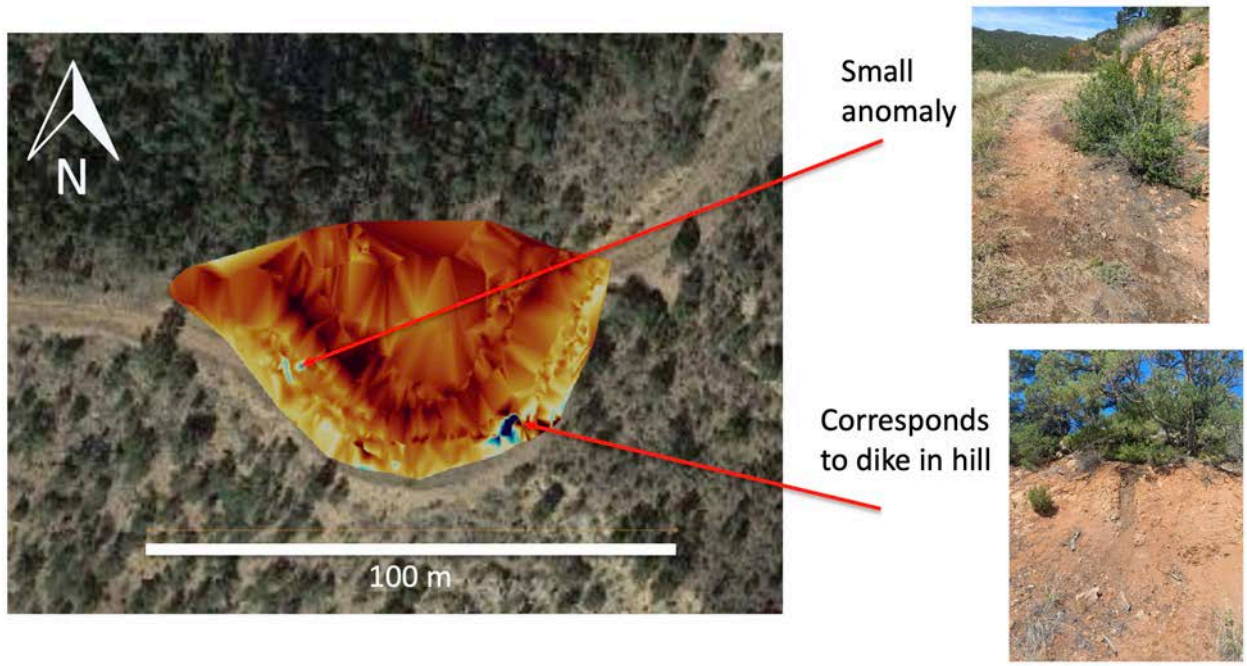


Figure 1 - Smartphone magnetic survey results. Two anomalies, correspontding to mafic dikes, are observed by showing a dipolar pattern

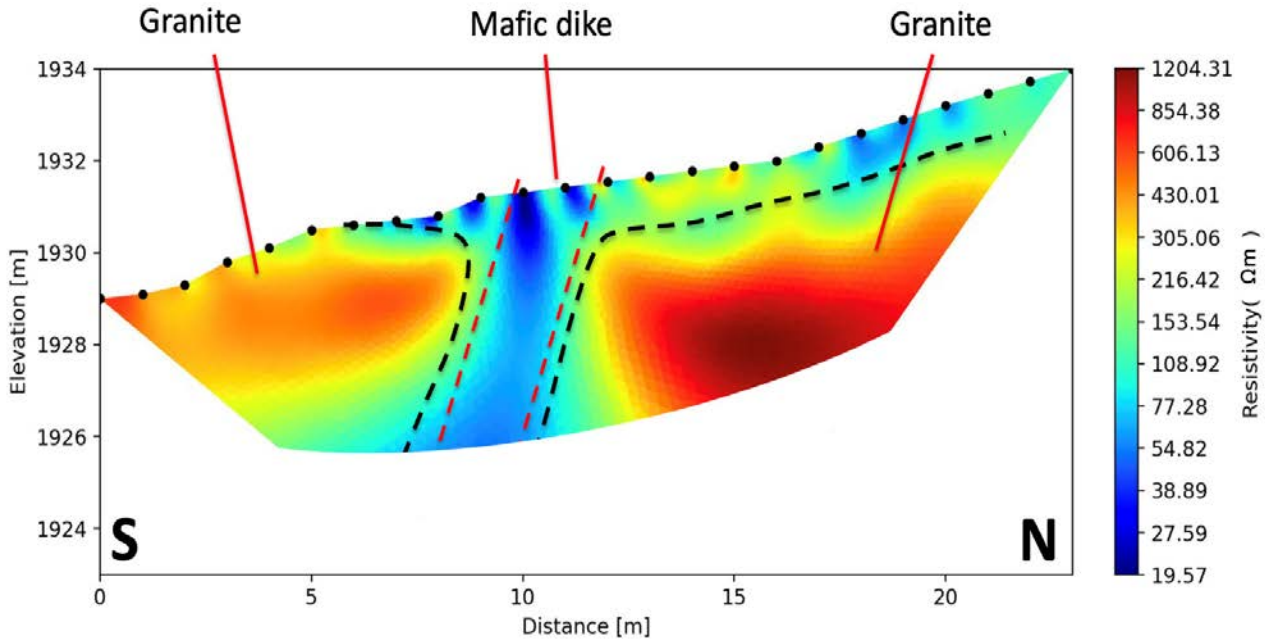


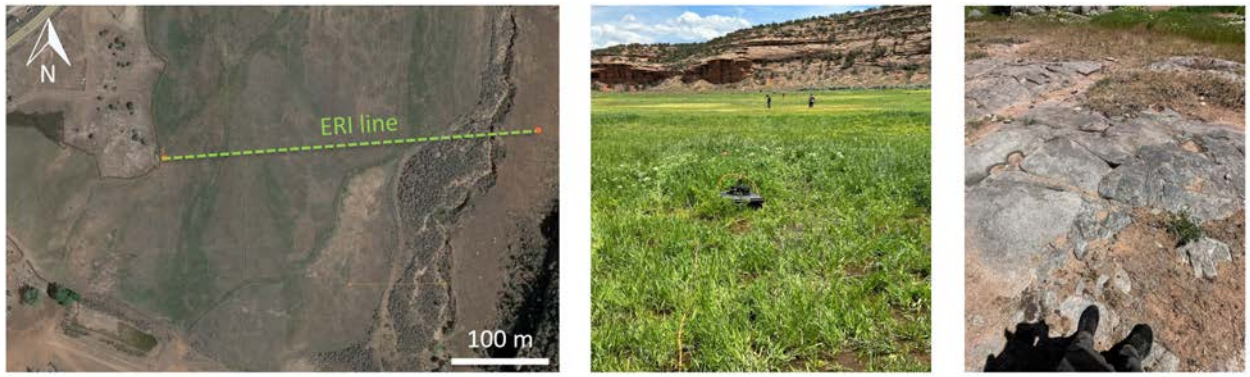
Figure 2 -Example of ERI survey over one of the dikes. The low resistivity feature corresponds to the dike outcrop at the surface.

Electrical resistivity imaging was performed in two locations where strong magnetic anomalies corresponding to the mafic dikes were observed to map the dip angle of these dikes in the subsurface. Figure 2 shows that one of these dikes dips at 70°.

The first part of the field camp incorporating magnetometry and ERI showed how a combination of field observations and geophysical surveys can help in identifying and characterizing mafic dikes in the subsurface. Additionally, the students learned how to design surveys and interpret geophysical signals to explain geological features in the subsurface.

Unaweep Canyon field trip

The second week of the field camp was designated to survey parts of Unaweep Canyon in western Colorado. We began with a one-day field trip to orient the students to the field area and the geological enigmas associated with this field site. We visited both Black Canyon of the Gunnison and Unaweep Canyon, to compare the geomorphology visible at the surface and discuss different hypotheses for how Unaweep Canyon—an enigmatic canyon with two small streams that flow from a central divide—may have formed. Part of the answer lies in being able to determine the depth to basement at various sites through the canyon. We decided to attempt to measure depth to basement at the two ends of the canyon. We designed a few electrical resistivity lines extending >200 m in an effort to image as deep as possible. The 400 m long ERI line at the first site at the northeastern part of the canyon (Figure 3) revealed a depth of investigation (depth at which the data is reliable) of > 80 m and could clearly map the basement (high resistivity features at depth in Figure 4). Additionally, we observed evidence of clay deposits in the middle of the ERI transect that were likely saturated. This was evident by the muddy regions in that area.



a) Map of the survey area

b) Survey area

c) Basement outcrop at the eastern part of the ERI line

Figure 3 - ERI at site 1.

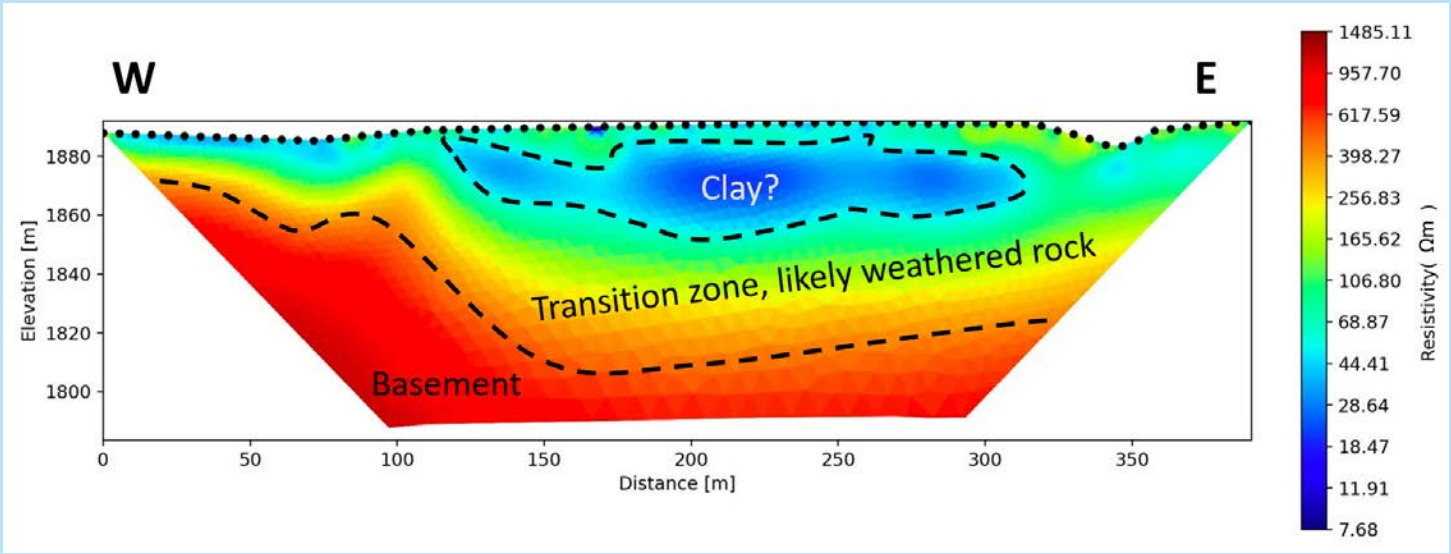
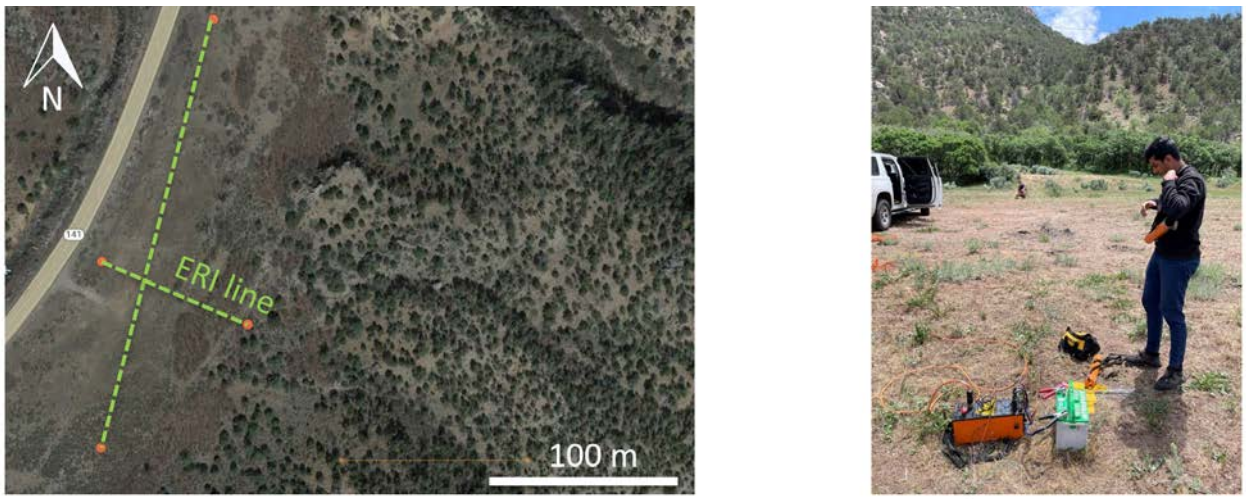


Figure 4 - ERI results of site 1 survey. The basement is shallow in the west but deepens toward the east.

The second site at the southwestern part of the canyon was more challenging owing its rough topography (Figure 5). We performed two perpendicular 2D ERI surveys in a small meadow. We were not able to reach the same depth as the first site's ERI survey due to the shorter line lengths here. All in all, we were not able to image the basement in the results (i.e., no evidence of high resistivity features at depth were observed – Figure 6).



a) Map of the meadow

b) The meadow

Figure 5 - ERI at site 2.

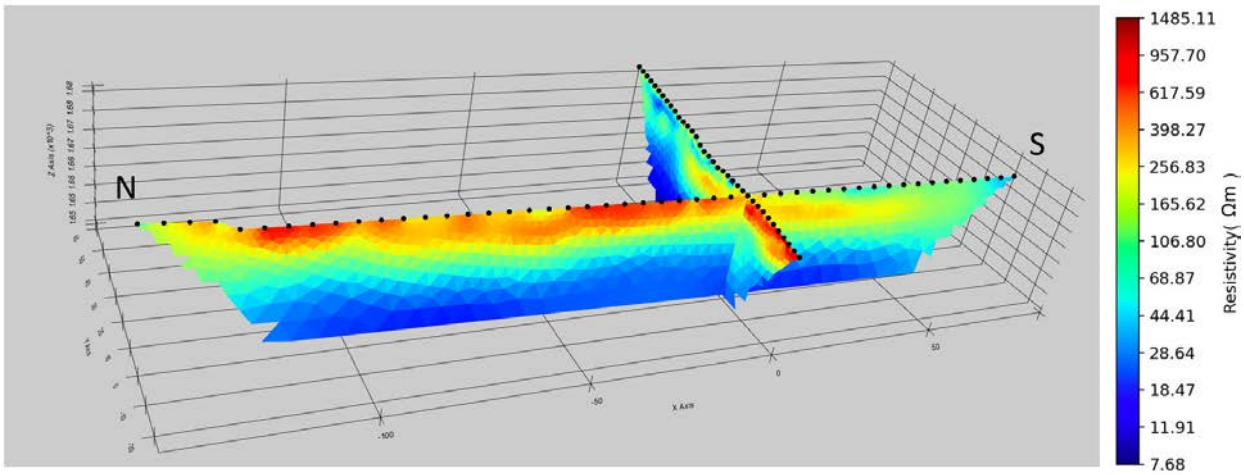


Figure 6 - ERI results of site 2 survey. No evidence of the basement is seen here. Note the high resistivity values associated with bedrock are not present at depth.

Characterizing the Unaweep Seep

The last part of this field trip was to characterize the depth and extent of the Unaweep Seep. We designed two lines in here to cover two angles of the seep in the subsurface (Figure 7). The results show that the seep is relatively shallow and seemingly flowing over an impermeable barrier at depth (Figure 8). This might be the reason that the seep area is broad and muddy at all times.

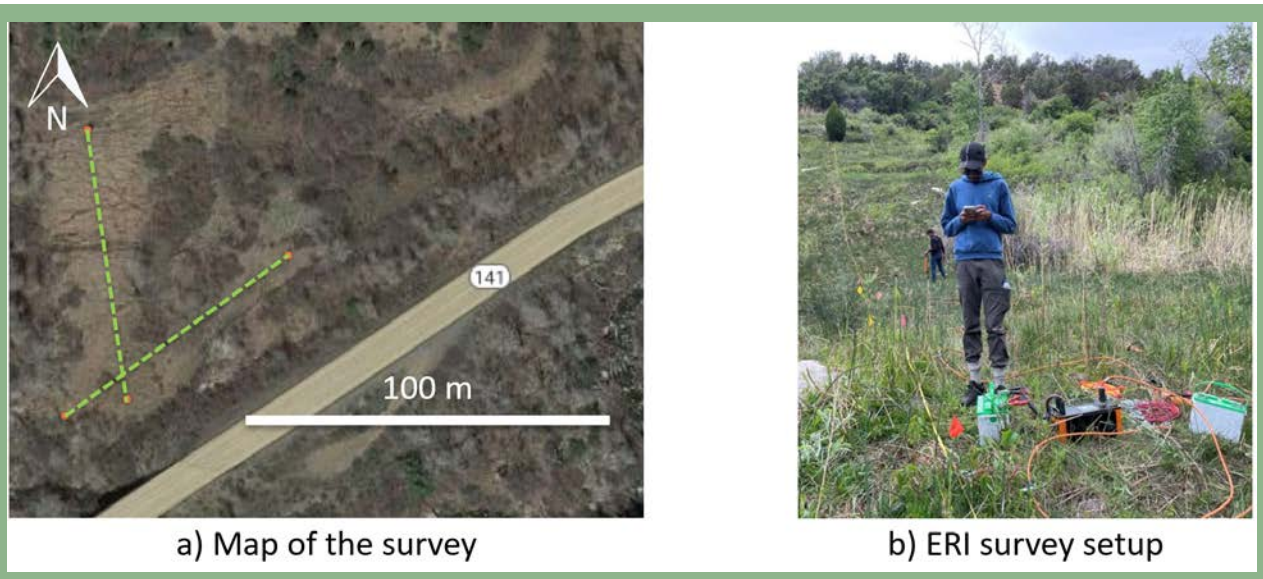


Figure 7 - ERI at the Unaweep Seep

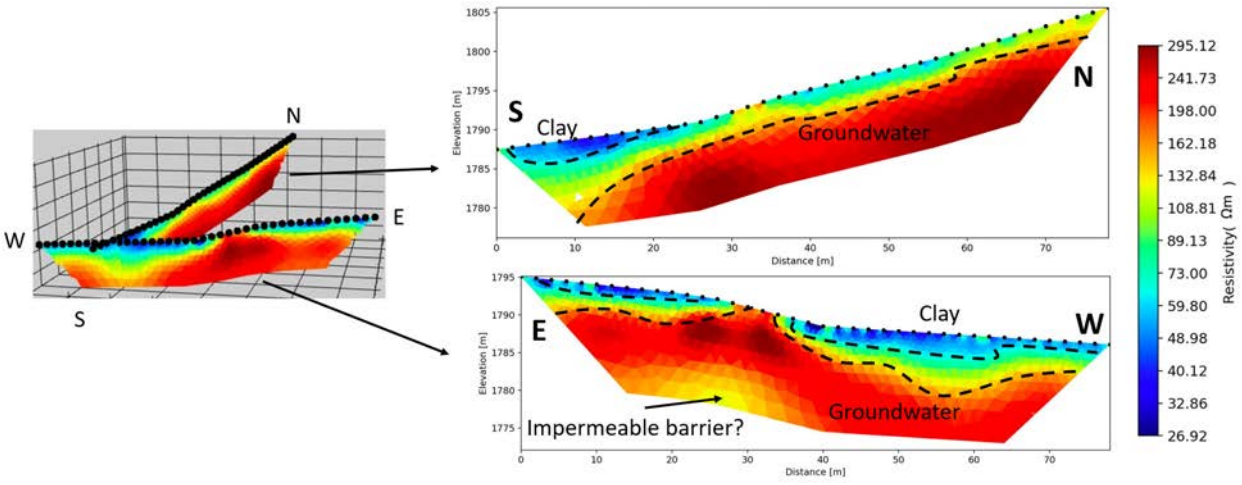


Figure 8 - ERI results at the Unaweep Seep

NEW GRADUATE STUDENT FIELD TRIP

BRETT CARPENTER, PH.D.

New graduate students to the School of Geosciences took part in the New Graduate Student Field Trip as part of GEOL 5001: Topic in Geosciences. The course itself is "intended to provide new graduate students with an overview of selected concepts in the geosciences, through reading and discussing the literature, a field trip and short writing assignments." Additionally, a variety of graduate school "survival skills" are covered including those related to the scientific method, science communication and time management.

As part of the course, students go on a three-day field trip that acts as an introduction to the geology of Oklahoma. The field trip is led by Drs. Lynn and Mike Soreghan and Dr. Brett Carpenter. Recently hired faculty are also invited on the trip. This year, the trip was joined by Drs. Lena Cole and Davey Wright, new paleontologists in the School of Geosciences. The field trip is designed to introduce some of the beautiful geology of the state to graduate students who may be researching and/or teaching about it. The first stops are near Mill Creek, where students visit an active quarry and outcrops of some of the oldest rocks in the state, the Troy Granite. At these stops students are able to see that rocks are highly deformed, they are riddled with faults and igneous intrusions. The group then stops at Vendome Well in Sulphur before enjoying dinner nearby.

On day two of the trip, students visit several stops in the vicinity of the Arbuckle Mountains. Students learn about the Woodford Shale near Ardmore, The Cool Creek Formation at Turner Falls and the overall tectonic history of the Arbuckle Mountains while looking at the Collings Ranch. Before heading off to the Wichita Mountains, students are treated to Arbuckle Fried Pies. After arriving in the Wichita Mountains, students get a view of the area from the top of Mount Scott and then learn about the history of the area, the Wichita Mountains and Southern Oklahoma Aulocogen, in a stop at Quetone Point and while hiking to the top of Little Baldy.

On the final day of the trip, the students are asked to ponder the depositional environment of the Post Oak Conglomerate before heading off to the Slick Hills to learn about the depths of the Anadarko Basin from Dr. Heather Bedle. Students then examine the El Reno Group, while enjoying lunch at Red Rock Canyon Adventure Park before heading to the final stop of the trip in the Blaine and Flowerpot Formations.

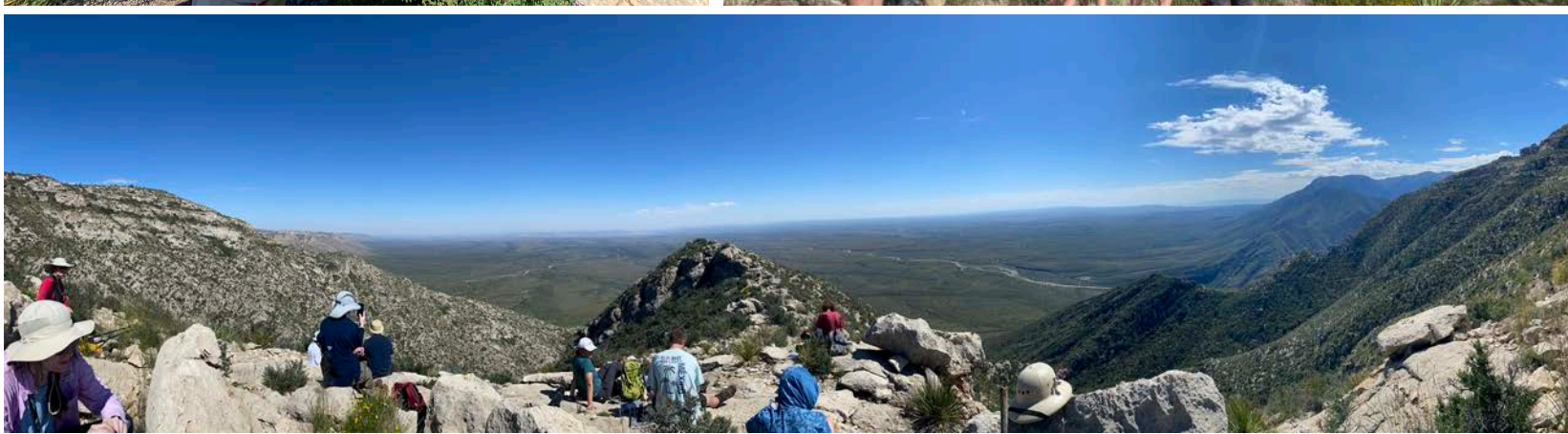
All in all, students get to experience the beauty of the state while learning about some of the most important rock formations that impact Oklahoma in various ways. Students also form bonds with each other that will help them throughout their graduate studies in the School of Geosciences.

"As a new international grad student, I knew few things about the geology and landscapes of Oklahoma, so I really enjoyed all of the stops and the trip. As a geophysicist that worked for the industry, I particularly enjoyed the stops where I could relate the outcrop with what I did at my job. The Woodford Shale was also amazing because I could visualize and materialize concepts that I only saw in books. I was fascinated by seeing the bitumen coming out of the little cracks of the most productive shale of Oklahoma. This textbook outcrop not only amazed me with its rich organic content, but also helped me to better understand the importance of cracks and fractures on reservoir rocks."
–Pamela Blanco Dufau, M.S. geophysics student

"Growing up an Okie who spent most of my time outdoors, it is always enjoyable to find new interesting places in your backyard that have gone unexplored to this point. I enjoyed seeing the redox features and potential paleosols in the Blaine and Flowerpot Formations, as that was a new location I hadn't seen before. Now geared with the geologic knowledge to understand my surroundings more intimately, finding these new locations and revisiting old ones becomes that much more exciting."
– Brock Dumont, M.S. geology student

DEPOSITIONAL SYSTEMS AND STRATIGRAPHY FIELD TRIP

This fall the Depositional Systems and Stratigraphy (GEOL 4113) class took their annual field trip to the Sacramento and Guadalupe Mountains of New Mexico and Texas. Lynn Soreghan led the four-day field trip that exposes students to many different rocks and environments of this part of paleo-equatorial Pangaea from the Mississippian through the Permian. Some highlights of the trip were visiting White Sands National Monument, measuring a stratigraphic section in La Luz Canyon, seeing giant marine algal-microbial mud mounds, hiking the Permian Reef trail and visiting Carlsbad Caverns. This is an important trip that exposes students to rocks deposited through a dynamic interval of Earth history. They discover how changes in tectonics, sea level, and climate influenced environments and the biosphere through time.



IGNEOUS AND METAMORPHIC SPRING BREAK FIELD TRIP

JAYLAH SPENCE, UNDERGRADUATE STUDENT

This semester I enrolled in GEOL 3223 – Igneous and Metamorphic Petrology. As a part of this course, we learn the systems, geochemistry and structure of igneous and metamorphic rocks. In the lab, we have the opportunity to use our microscopes to develop a deeper understanding of the systems from which these rocks are generated. This year my class and I were fortunate enough to travel to New Mexico, down through the Rio Grande Rift in order to get a one-on-one experience with the rocks that we had spent the last nine weeks discussing and learning about in our class.

On this trip, we looked at the Albuquerque volcanoes, Bandelier National Monument, Zuni Bandera Crater and numerous outcrops and overlooks. The trip to New Mexico allowed me for the first time to use my rock hammer and collect my own samples as well as learn to do physical hand sample classifications in the field. Having the experience of being a "field geologist" for a week helped me learn to critically think about the rocks that I was looking at and develop the potential petrogenesis and geochemical processes that the rock underwent. I am extremely grateful for the time and memories I collected from this trip and will forever remember the sites, mountains and knowledge that I gained. For me, this trip was monumental, not only because I got to spend a week with some of my closest friends, but because this trip helped me to decide what I want to focus my studies in geology on – Igneous petrology.

A BRIEF HISTORY OF (GEOLOGIC) TIME

BEN MATSUMARA, UNDERGRADUATE STUDENT

A distinct iridium layer divides the Cretaceous and Tertiary periods at Colorado's Raton Basin. The bright line, gleaming amidst the coal and mudstone, represents an impact that rivals 10 million atomic bombs. While this boundary marks the end for our prehistoric dino friends, it is only the beginning stop on the University of Oklahoma's Geosciences Field Trip.

Students scramble over and around the rocks at Raton Basin, few having seen these features anywhere other than textbooks. As they look around at the scenery their three trip leads, Barry Weaver, Michael Soreghan, and Gail Holloway begin to ask questions. "How did this form?", "What rocks and minerals are found in this area?" and "Why is this significant?" These are the types of questions that will be asked at each stop along the seven-day trip. As students shuffle back to their vehicles, they do so with a new outlook on the landscape ahead.

The morning sun shines brightly as everyone smiles for a customary group photo. Standing tall at roughly 9,000 feet elevation, OU's "High Camp" offers beautiful views of Cañon City below. However, impressive scenery is not the only reason students have made the early trek up. As they descend down the mountain road, Gail describes the purchase of OU's field camp area and points out many of the geologic features that make it perfect for hands-on study. Within less than a mile the group encounters multiple rock types and geologic structures, all of which they will map out during junior year field camp. This week-long introductory trip provides just a small sample of what's to come.

Later on this same day the group makes its way up the narrow Skyline Drive trail. While other tourists take photos of Cañon City below, OU's students are busy inspecting the rocky outcrop nearby. Caleb Simmons, a paleontology major and student assistant on the trip, asks questions from atop a small natural ledge. Behind him is a set of large fossilized dinosaur tracks along with other preserved features from an ancient landscape. Students below make educated guesses as to the landscape and environment that allowed these remnants to form. This is something the group has done often in class, but seeing things in person offers a whole new perspective.

Over the next few days our budding scientists visit weathered igneous intrusions, ancient fossil beds, massive sand dunes, mountain glaciers, and beautiful rocky canyons. At each stop they take time to learn the geologic history of the area and examine distinctive features they have read so much about. While the focus of this trip is helping students learn through firsthand experience, there are more than just educational benefits. As freshman student Kaitlyn Hahn mentions, the trip "taught me to be more curious." Along these same lines, Skylar Thurman describes how the trip made her take more time to admire the earth and "realize how much I take it for granted." It is the additional benefits that aided students on previous trips in attaining higher grades and encouraged their participation in extracurricular geoscience activities.

As the trip winds down and students load up for the 11-hour drive home, there is the usual quietness that comes with early morning travel. However, small pockets of laughter can be heard as new friends share stories and crack jokes between each other. This is the final, and possibly most important benefit gained from the trip. As fellow geology major Matthew Ryne explains, "My favorite part was getting to become friends with 20-plus other students who share the same passions and interests as I do." It is because of these newfound friendships that students are more likely to succeed in school and work endeavors. Although the drive back to Norman signifies the end of the field trip, this is only the beginning for many a successful geology career.

RCML RESEARCH GROUP UPDATE

MATTHEW PRANTER, PH.D.

This has been a very busy and productive year. I completed my first year of the three-year term on the American Association of Petroleum Geologists (AAPG) Executive Committee and as AAPG editor. I also started as the director of the School of Geosciences on July 1.

Students in my Reservoir Characterization course enjoyed the fall 2022 field trip to the Piceance Basin near Grand Junction, Colorado. We visited several localities to analyze world-class fluvial and shallow-marine outcrops. Later in the semester, the students analyzed subsurface data from the Piceance for these same formations. Javier Tellez, Rex Cole and I co-lead the trip. Javier and Rex are both with Colorado Mesa University in Grand Junction.

I recently expanded the courses I teach by offering two additional general education courses. I instructed Earth, Energy, Environment (GEOL 1033) in fall 2022 and

spring 2023 semesters and plan to teach it every spring semester moving forward. This energy-related course is very timely, especially given the global energy-related issues and the long-term energy demand. There were approximately 25 students (a range of majors) enrolled each semester. I provide a balanced and realistic approach to each type of energy source. Most of the students are enlightened as they begin to understand that every energy source has advantages and disadvantages, that so-called "green" energy also has major environmental impacts, and that our future energy needs will require a diverse energy mix.

I am excited to offer a new general education course in fall 2023 called Geology of National Parks (GEOL 1023). I subdivided the course based on geological processes. I will cover a range of parks from Yellowstone and Hawaii Volcanoes to Grand Canyon and Zion, to Rocky Mountain, Yosemite, Kenai Fjords, and Carlsbad Caverns.

Students in the Reservoir Characterization and Modeling Laboratory (RCML) have been very productive in their research and made presentations at several conferences. Abidin Caf graduated (Ph.D. Geophysics, 2022) and was recently hooded during the May 2023 graduation commencement and convocation. Brittany Stroud (M.S. Geology, 2022) also graduated and presented the results of her regional study of the Caney Shale at the 2022 IMAGE Conference in Houston. The work explores the variability of elemental composition, mineralogy, and petrophysical properties of the Caney Shale within the Ardmore Basin, Oklahoma. Caf presented his work on seismic-constrained reservoir modeling and simulation for CO2 sequestration potential of the Arbuckle Group at several conferences including IMAGE and the Seismic Reflection Centennial. Both Caf and Brittany are now working with Devon Energy in Oklahoma City as an exploration geophysicist and petroleum geologist, respectively. My other graduate students are also working hard on various aspects of research in petroleum geosciences and energy resources. Anna Turnini and Rui Zhai will both present at the 2023 IMAGE Conference in Houston.

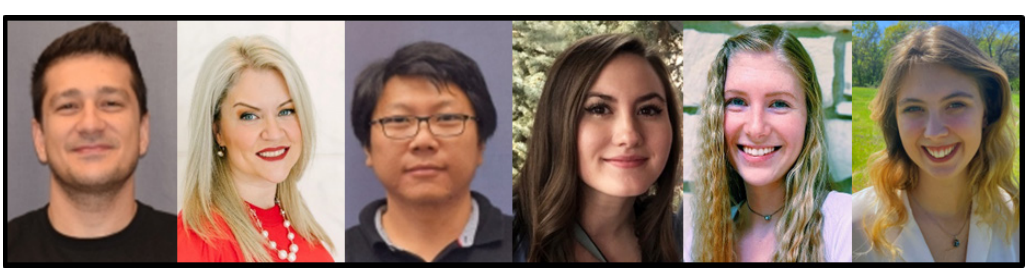


Figure 2: RCML graduate students. (left to right) Ph.D. students: Abidin Caf, Anna Turnini, Rui Zhai, M.S. students: Brittany Stroud, Grace Barber, Faith Grayson

AASPI RESEARCH GROUP UPDATE

HEATHER BEDLE, PH.D.

The Attribute Assisted Seismic Processing and Integration Research group has been extremely prolific over the last year. In the 2022–2023 academic year, we have graduated three M.S. students, Mario Ballinas, Emily Jackson and Laura Ortiz and welcomed one new Ph.D. student, April Moreno-Ward, and four new M.S. students, Pamela Blanco, Evan Jowers, Jacob Maag and Patience Ojoboh. With post-docs David Lubo Robles and Thang Ha, working hard on the AASPI software platform, in addition to new seismic attribute and machine learning algorithms, we are debuting new 3D visualization and well log capabilities this year! Kurt Marfurt continues to enjoy his "retirement", while working diligently with the group on his research, writing a book and algorithm development for AASPI. Coming from different academic and cultural backgrounds, our students and researchers make AASPI a robust group for creating new ideas and workflows.

Using a mixture of seismic reflection attributes in combination with a variety of machine learning methods to illuminate the geology hidden beneath our feet, AASPI has published over a dozen peer-reviewed manuscripts this academic year in a variety of scientific journals, as well as several newsletter articles with AAPG, all available on the AASPI website. Taking advantage of the virtual capabilities, we continue to record our student presentations, as well as tutorials for AASPI workflows, and these, and our publications are available on the AASPI website (http://mcee.ou.edu/aaspi/). Presentations in other languages such as Spanish are available, as well, to make AASPI more accessible and inclusive to all.

Karelia La Marca recently published the first portion of her Ph.D. on her work on the "Sensitivity analysis of seismic attributes parametrization to reduce misinterpretations: applications on multi-story deepwater channel complexes," which improves our understanding of common pitfalls in deepwater channel architecture interpretation using seismic data. This work has been expanded upon using a variety of machine learning methods for unsupervised seismic facies algorithms.

Alex Vera-Arroyo has continued his Ph.D. research working on an evaluation of unsupervised learning accuracy in classifying seismic amplitudes associated with hydrocarbon responses, and to classify hydrocarbon responses using synthetic seismic data and partial angle stacks of well-known oil fields.

During the third year of his Ph.D., Bobby Buist has worked on a couple of projects using geophysical subsurface imaging techniques to help further our understanding of the distant, and not so distant, past. His first project revolved around exploring an anomalous, paleo-valley type, feature located in southwest Oklahoma. 2D seismic lines were designed, deployed and seismic data was acquired over the summer of 2022 to help image the paleo-valley. His second project delves into the world of ground penetrating radar (GPR), and its uses in cemeteries to help find burials that are either unmarked or

have multiple individuals in the same grave. By calculating traditionally seismic attributes on GPR data, new insights into the data are being revealed.

Ph.D. student Marcus Maas created a new reservoir productivity prediction tool based on supervised machine learning. We use seismic multi-attributes and well test parameters (mainly flow capacity) to train different supervised regression algorithms (Random Forest, K-nearest neighbours and Support Vector Machine) and then predict flow capacity values in the whole 3D seismic cube. Our blind test (development wells) validation accuracy is 79% using random forest regression for a subsalt reservoir in the Santos Basin.

Ph.D. student April Moreno-Ward has begun to undertake research to bridge the gap between ML and seismic interpretation by implementing best practices and enhancing classification methods using unsupervised clustering algorithms (including K-means, DBSCAN, ICA, PCA, K-PCA, and t-SNE) focusing initially on deepwater channel facies. Her second project, research starting in summer 2023, will utilize image classification on lacustrine core in the Newark Basin.

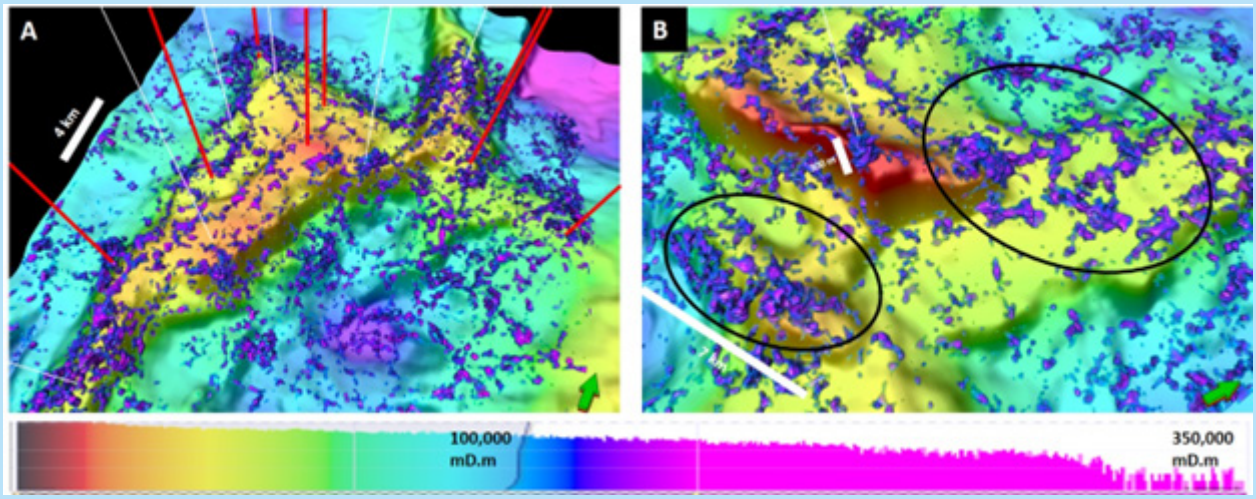
Mario Ballinas (M.S.) focused on using a series of frequency-related seismic attributes as training inputs for a supervised machine learning classification. Various reservoirs composed of water, oil and varying gas saturations were used to create the model, and the final trained model was capable of predicting those fluids in a different dataset, thereby becoming a risking tool during the hydrocarbon exploration phase in the Gulf of Mexico.

Emily Jackson (M.S.) employed two relatively untested seismic attributes to measure attenuation from gas hydrates in the Pegasus Basin, offshore New Zealand. Her work included seismic interpretation, understanding the theoretical zone where hydrates occur in the shallow subsurface offshore, mechanisms that give the complex an unexpected attenuation within hydrates, and unsupervised machine learning. This project demonstrated that seismic attributes are useful tools to measure zones of attenuation with gas hydrates, and opens up new opportunity for future research in applying statistical attributes for gas hydrate identification.

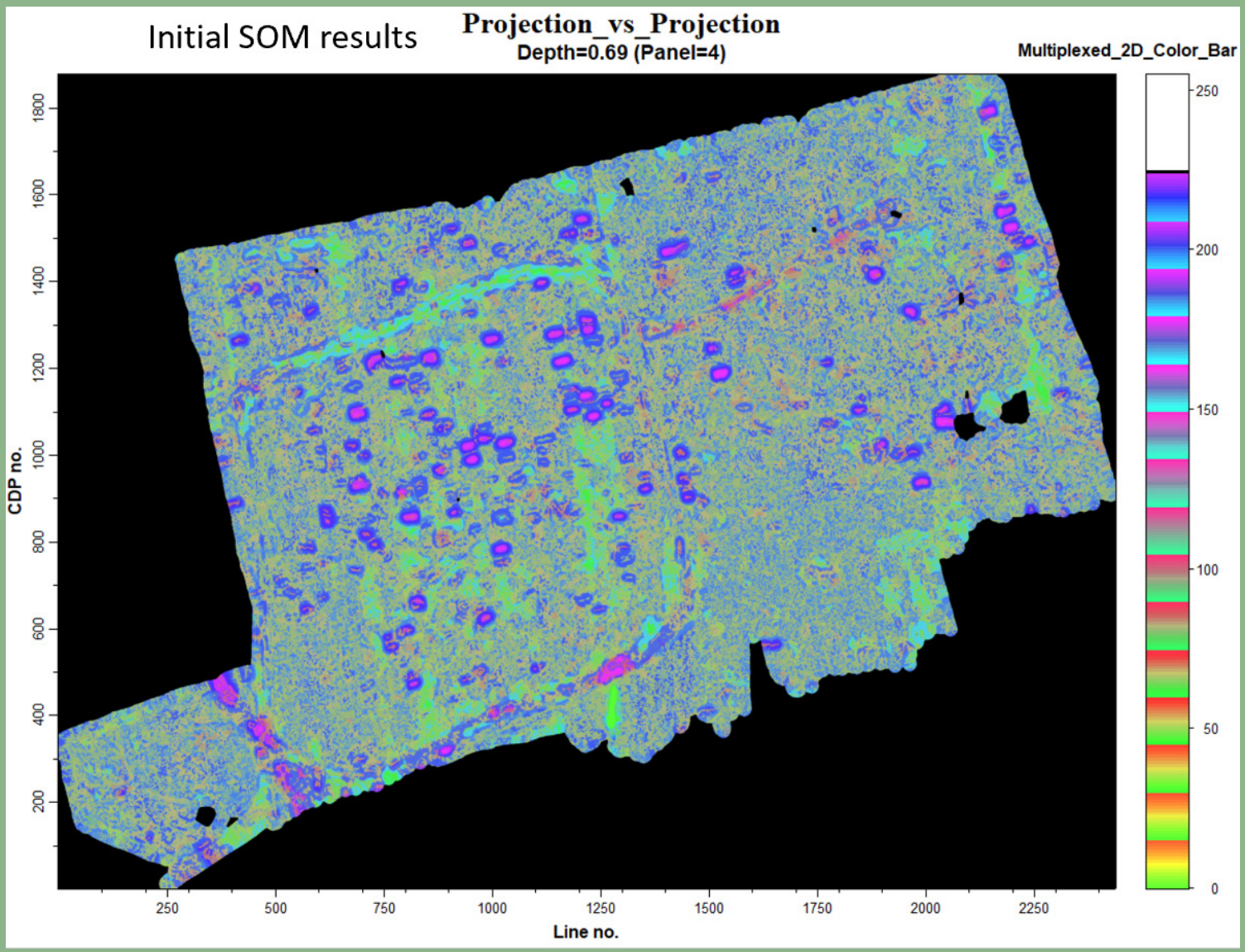
Laura Ortiz recently graduated with a M.S. in geophysics. Her research consisted of investigating the geomorphological and stratigraphic evolution of the Grayburg and San Andres Formations in the Midland Basin, Texas. This project integrated data from core, well logs and seismic into a geological model, which granted her the Frank Melton Memorial Award for Geologic Research!

Diana Salazar (M.S.) is working on the application of novel geometric seismic attributes for the identification of seismogenic faults in the Oklahoma basement and areas with potential CO2 storage. Through her research at OU, she has also explored different machine learning methods, such as convolutional neural networks, self-organizing maps, generative topographic mapping and probabilistic neural networks for fault mapping and seismic facies classification.

Pamela Blanco (M.S.) is using a seismic cube located in the Matagorda Island block in the Gulf of Mexico to give a geological insight and describe the structural framework of the area, which is characterized by a large growth fault system developed from the Middle to late Miocene epochs. In addition, the seismic cube presents processing issues due to merging cubes with different characteristics, so another objective of her research is to understand the capabilities and limitations of seismic facies clustering using unsupervised learning in a problematic dataset.



Geobodies 3D view of the predicted flow capacity model seismic volume at Mero Field (A) and Central Libra block (B), where the prediction model was built using Random Forest.



Using AASPI software on GPR data in a Civil War -age graveyard in Kentucky to identify buried bodies

M.S. students Patience Ojoboh, Jake Maag, and Evan Jowers recently joined the AASPI research group and are working at identifying their research projects – stay tuned for more to come from these students!

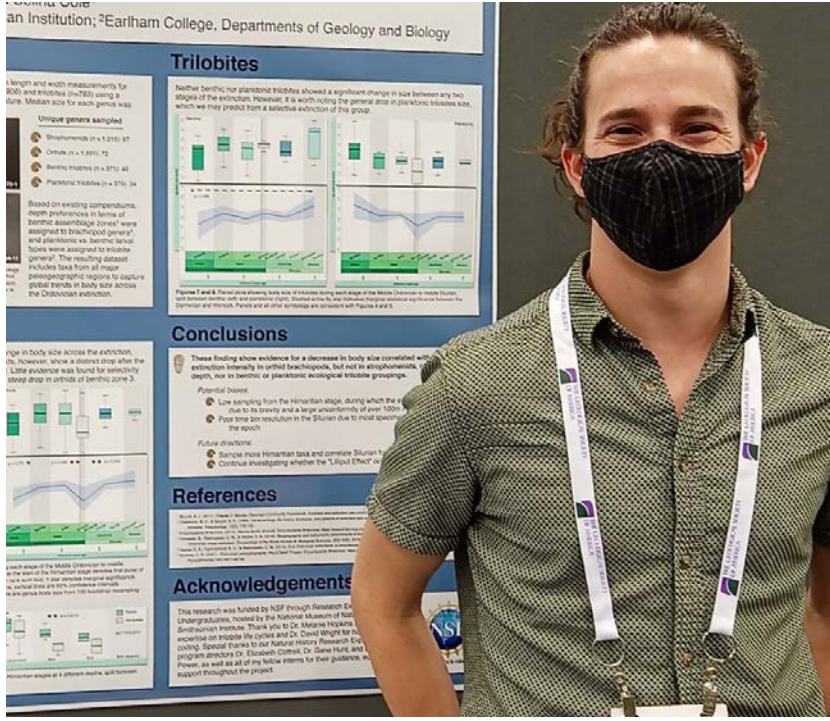
Post-doc Dr. Thang Ha continues his work maintaining and developing new applications for the AASPI consortium. He has also designed a modular machine learning workflow for facies classification, allowing users to test different algorithms on the same training data and reuse generated models. Additionally, he has been optimizing the 3D CNN fault detection workflow and providing a more user-controlled fault labeling process.

Post-doc Dr. David Lubo-Robles has been researching the development and application of machine learning techniques, quantitative seismic interpretation, and seismic attribute analysis for oil and gas, geothermal reservoir characterization, hydrogen storage, and carbon capture, utilization and storage (CCUS).

AASPI Principal Investiagator Heather Bedle continues to lead the group toward the future of seismic reflection research, with new efforts pivoting to use and test our unique and successful imaging and analysis methods, previously developed by AASPI for frontier energy applications, including carbon capture and underground storage, geothermal reservoirs, and hydrogen storage. In addition to over a dozen AASPI industry sponsors, Bedle has received grants from the National Science Foundation, Department of Energy and American Chemical Society, and she is collaborating with international scientists in research for future energies and the energy transition. We continue to look toward our alumni and industry colleagues for guidance, ideas, data and support. Also, if any alumni would like a three-month evaluation license to explore and see what AASPI is up to, just contact me!

COLE RESEARCH UPDATE

LENA COLE, PH.D.

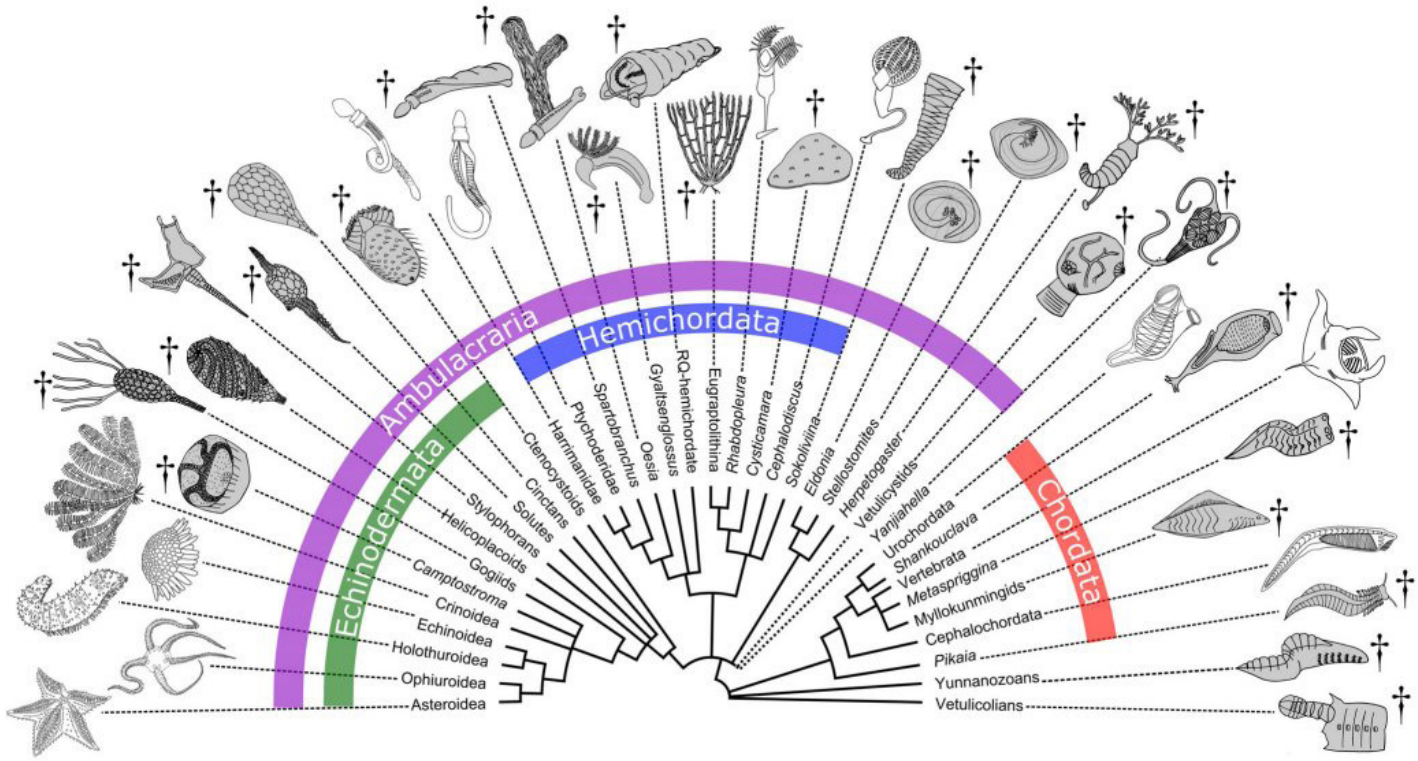


In my first year as faculty at OU, my work has focused on building a lab group and continuing research within the major themes of extinction and paleoecology in the invertebrate fossil record. Ongoing field research on the Ordovician mass extinction continued with a month-long expedition to Quebec, Canada, that produced an exciting collection of fossils, including the discovery of several new species of fossil crinoids. Related to this work, undergraduate Caleb Simmons joined my lab in the spring to study how body size changed in trilobites across the Ordovician mass extinction. Former undergraduate advisee Cade Orchard, who worked on the role of ecological factors in driving patterns of body size change over the Ordovician extinction, presented their work at a regional GSA meeting and was also accepted into the master's program at the University of Georgia to study terrestrial sequence stratigraphy and paleontology.

On the paleoecological side, notable progress includes a perspective piece I published in *Nature Ecology & Evolution* that discusses the relationship between morphological form and ecological function during the Cambrian–Ordovician radiation of echinoderms. In addition, a study of ecological niche partitioning among crinoids from the Bromide Formation of southern Oklahoma was published in *Elements of Paleontology* with co-author Davey Wright. Undergraduate Colby Higdon also joined the lab in the spring of 2022 to begin developing a model for characterizing feeding ecology of bizarre, stalked echinoderms such as paracrinoids and rhombiferans that lived alongside a diverse crinoid fauna. Colby's research leverages the spectacular collections at the

Sam Noble Museum and will help to inform ecological dynamics such as competition and competitive exclusion between Ordovician filter feeders.

Finally, I look forward to welcoming a new graduate student to my lab in the fall, who plans to investigate patterns of extinction selectivity across multiple fossil groups.



PALEOBIOLOGY RESEARCH GROUP

DAVID F. WRIGHT, PH.D.

In his highly influential book *Tempo and Mode in Evolution*, the 20th-century paleontologist G.G. Simpson once remarked that research questions in the study of evolution are too vast and too difficult to be solved from the standpoint of any single scientific discipline, and that synthesis between disciplines was the only way to understand the major features of evolution. Today, the science of paleontology is far more than just staring at old fossils in dusty collections. It's that, too, but it often involves diverse skill sets, including geologic fieldwork, knowledge of genetics and animal development and a broad analytical toolkit of statistical and computational techniques.

As an example, consider a recent collaborative effort between myself, OU paleontologist Lena Cole, and colleagues at Harvard and the Smithsonian, which focused on the origin and evolution of the Deuterostomia. Deuterostomes are a group of animals that include the Chordata (i.e., humans and all other vertebrates), Hemichordata (i.e., worm-like animals, including fossil graptolites) and the Echinodermata (starfish, sea urchins, and their kin). The diversity of species and the disparity of body plans across these groups are absolutely immense, which makes reconstructing their most recent common ancestor an extremely challenging problem to solve. This work, published in *Biological Reviews,* combined fossils, genes and patterns of animal development to map changes in both fossil morphology and gene-regulatory networks across the evolutionary tree of life. This cross-disciplinary approach is significant, as it enabled us to reconstruct the anatomical features of the ancestral deuterostome and provide crucial information for understanding the timing and mechanisms underlying the evolutionary history of this diverse and important group of animals.

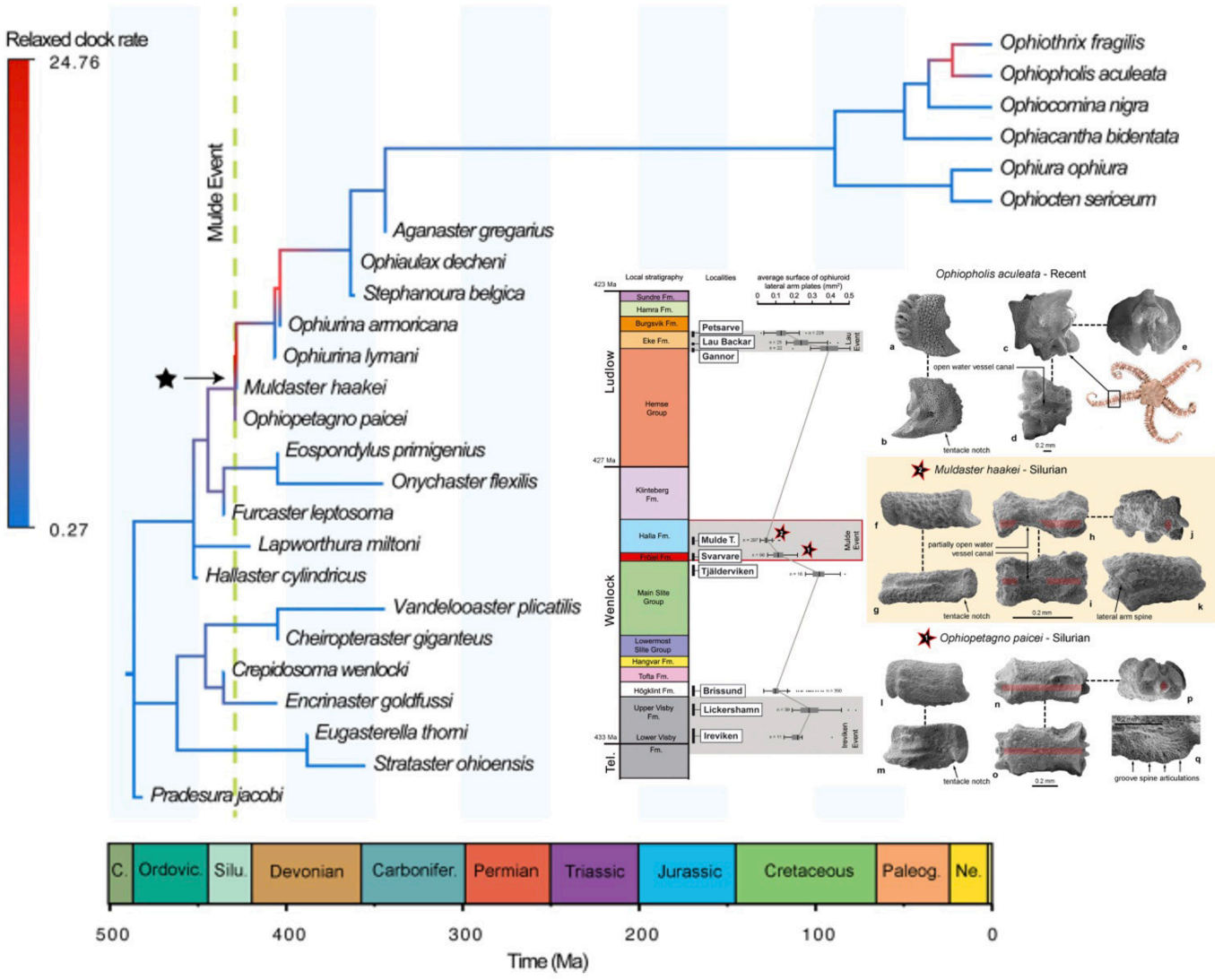
Another example comes from a study in *Communications Biology* describing two new species of fossil brittle stars from the Silurian of Gotland. In addition to "just" describing new species, I applied Bayesian statistical methods and Monte Carlo simulations to determine ancestor-descendant relationships and calculate rates of evolutionary change. When combined with high-resolution

stratigraphic and geochemical data, these results show how the origin of modern-day brittle stars can be traced to environmental crises and carbon cycle perturbations that took place more than 400 million years ago.

The interdisciplinary and collaborative themes of the Paleobiology Research Group also have a local flavor. Did you know the Ordovician-aged Bromide Formation of Oklahoma (Arbuckle Mountains) contains the most diverse fossil echinoderm fauna known in the entire history of life? Last year, Lena Cole and I published a paleoecological investigation of crinoids from the Ordovician-aged Bromide Formation of Oklahoma. This study is one of the first to integrate quantitative phylogenetic methods with multivariate analysis of feeding ecology on a fauna this geologically ancient. A fascinating result of this work is how it's able to capture small-scale ecological dynamics usually not resolved in the fossil record, and suggests that major transitions in Paleozoic faunas may have been influenced by the cumulative effects of ecological turnover instead of mass extinction events alone.

Those who know me know I strongly believe science is a social activity and public good. Scientists work together with colleagues, exchange ideas and are shaped by cultural forces, even within our own subdisciplines. Last year, I was involved in several projects aiming to improve the culture of *how* science is done by asking questions about *who* gets to participate in science and *how* we can improve recognition, support and accessibility of taxonomic research, especially for researchers belonging to marginalized and/or historically excluded communities. This work resulted in several articles published in the *Bulletin of the Society of Systematic Biologists* and was funded by the National Science Foundation.

Moving forward, I am happy to announce my lab will be welcoming a new Ph.D. student in fall 2023, and I will be looking to recruit undergraduates interested in specimen-based projects and/or learning computational skills in paleobiology.



CLIMATE, LITHOSPHERE AND SEDIMENTARY TECTONICS RESEARCH GROUP UPDATE

SARAH GEORGE, PH.D.

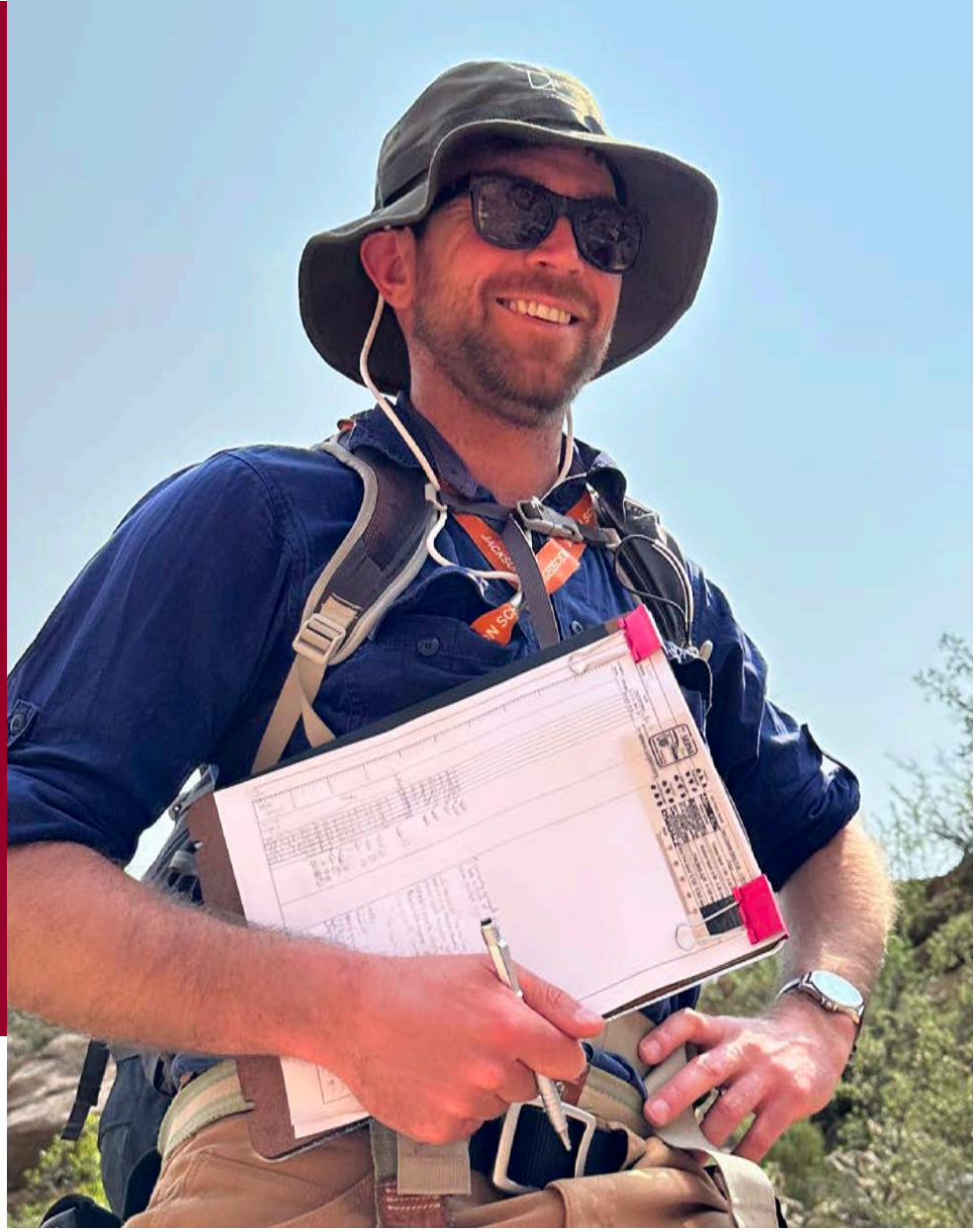
Since arriving at OU in January 2023, I have kept busy teaching, developing research proposals and working with undergraduate student Will McCraine on the elusive origins of the Ogallala Formation (pictured). The Miocene–Pliocene Ogallala Formation extends from Texas to South Dakota and hosts the Ogallala Aquifer, an important aquifer for the central USA. Deposition of the Ogallala Formation may be tied to a rapid phase of basin evacuation in the Laramide basins, potentially related to rapid climatic shifts, but this hypothesis has not been tested using modern methods. Will received an Undergraduate Research Opportunities grant through OU and conducted field work in western Oklahoma and Kansas over spring break to collect samples for sedimentary provenance. Given that so little provenance work has been conducted on the Ogallala, and we hoped for a broader initial sample set, we shamelessly recruited friends in Wyoming, Nebraska and Colorado to do some citizen science and collect additional samples for us. Will plans to present his results at GSA 2023.

Being at OU has fostered new outreach and collaboration opportunities. During Spring Expo, Dr. Gilby Jepson and I cotaught a Geochronology and Thermochronology Applied to Basin Systems short course. We had ~10 students and had a great time doing a crash course into some of the methods we regularly employ. Members of the Sam Noble Microscopy Center and I developed and received a grant through OU's Strategic Equipment Investment Proposal to purchase a new large area chemical mapping software. The software update is useful in identifying what materials (or minerals) are present, in what abundance and in what configuration — all of which provide valuable information to material scientists and geoscientists alike.

Summer and next fall are also ramping up quickly. Three M.S. students (pictured at the Post Oak Conglomerate) will be joining the CLAST group in the fall. They will conduct their first field seasons this summer in Colombia and Canada. Both field seasons are funded through active NSF grants. Finally, I'm writing this update from OU's Bartell Field Station, where I get to learn the ropes of OU's field camp for a few weeks, prior to co-leading five days of the regional trip to the Book Cliffs, San Rafael Swell and Canyon Range in Utah — should be some great geology!

JEPSON RESEARCH UPDATE

GILBY JEPSON, PH.D.



I joined the School of Geosciences in January 2023. Since joining, OU Geosciences has been collegial and welcoming; it has been delightful to be a part of such a talented and motivated department. I have received a teaching release for spring, as such, it has been possible to spend more time improving laboratory capacity at OU. Together Drs. George, Elwood-Madden, Frickenstein, students Dumont, McGlannan, McCraine, and staff Turner, Holloway, Moser, Tullius and Leivas, we have established a functioning geochronology and thermochronology laboratory. To do this, we have augmented existing systems such as the jaw-crusher, disk-mill, and roller mill with a water density separation table, Franz magnetic separator and heavy liquids. Using existing microscopy capacity at OU Geosciences and LA-ICP-MS facilities at the Mass Spectrometry, Proteomics & Metabolomics core facility, myself, George and Frickenstein have accurately determined fission-track and U-Th-Pb ages for monazites from the Himalaya, Nepal and apatites from the Cutler formation, Colorado. Work continues achieving suitable zircon fission-track U-Th-Pb dates and we hope to have this up and running shortly. Together, our goal is for accurate and precise geo-thermochronology to be available for students, faculty, and external users.

In the spring semester, I co-led a geochronology-thermochronology seminar on basins with George as part of the Energy Symposium. It was exciting to introduce students from Oklahoma and Arkansas to radiometric techniques, which are fundamental to understanding the Earth. At the time of this writing, I am with Shannon Dulin, Sarah George and Steve Adams leading OU undergraduates through their Field Geology course.

Two master's students will be joining my research group in the fall. One will work in collaboration with George to document the timing of thrusts in the Canadian Cordillera, whereas the other will be focusing on documenting the timing of thrusting/river incision in the Nepalese Himalaya. Finally, Dr. Malyshev from Saint Petersburg University will be joining the department on a Fulbright scholarship in the fall. Dr. Malyshev is an expert in tectonics and thermochronology with a focus on the Verkhoyansk fold thrust belt. We are excited to host Malyshev as his expertise in structural geology and tectonics will be a great benefit for the growing research focus of OU on orogenic systems.

FOSSILS IN THE FIELD: INVESTIGATING THE FIRST MASS EXTINCTION EVENT ON ANTICOSTI ISLAND

LENA COLE AND DAVID F. WRIGHT, PH.D.

In August of 2022, excitement ran high as we returned to a remote island in Quebec, Canada, to continue our study of one the first major disasters in the history of life: the Late Ordovician mass extinction (also known as the "LOME"). Mass extinctions are catastrophic events characterized by the loss of over 75% of Earth's species and have occurred only five times in the history of life. The first of these "big five" mass extinctions occurred around 445–443 million years ago during the Late Ordovician ,when rapid, global cooling resulted in extensive sea level fall of 150 meters or more that destroyed marine shelf habitats where Ordovician life was most diverse. Subsequent warming and ocean anoxia is thought to have further exacerbated species loss. We know from measures of biodiversity before and after the LOME that around 85% of all species died out during this ~2 million-year crisis, making it the second most severe extinction in Earth's history. Unfortunately, the fall in sea level also produced a near-global unconformity across the LOME, so much of what happened during the extinction event has remained a mystery.

There are, however, rare sites that preserve the LOME interval, and Anticosti Island is arguably the best of these elusive locations. Located in the Gulf of Saint Lawrence off the northeastern coast of Quebec, the Anticosti preserves a near-continuous succession of Late Ordovician and early Silurian rocks spanning the LOME, and a rich fossil biota that includes trilobites, crinoids, brachiopods, bryozoans, sponges, cephalopods, gastropods and more. As a result, the rocks of Anticosti provide an incredibly high-resolution framework for investigating faunal turnover, ecosystem restructuring, extinction selectivity and evolutionary change within species that survived the extinction. Further, Anticosti strata were deposited along a shallow-deep transect, creating an incredible setting that allows us to study species' responses to the LOME across a paleobathymetric gradient.

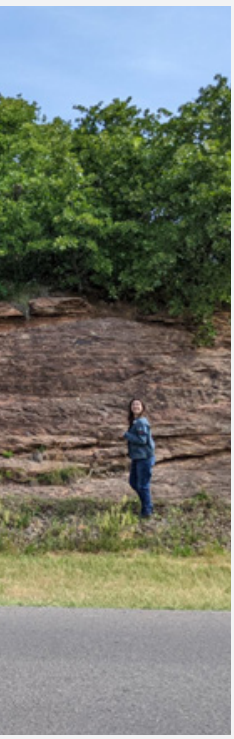
The 2022 field season marked our third expedition to Anticosti Island after a two-year hiatus due to the COVID-19 pandemic. As in previous years, we were accompanied by our longtime collaborator, Melanie Hopkins, a trilobite expert who is the division chair of paleontology and curator-in-charge of invertebrate paleontology at the American Museum of Natural History. We also brought along field assistant extraordinaire Jake Spicer, a postdoctoral researcher studying cephalopods, two graduate students learning paleontological field methods for the first time and even a videographer from the AMNH who documented part of the expedition. Together, we worked at sites across the island to measure stratigraphic sections and collect and document fossil invertebrates within a stratigraphic context to pinpoint when, why and how harsh environmental conditions during the LOME impacted the biosphere.

As always, we camped at primitive sites across the island throughout the month-long trip due to Anticosti's remote nature and minimal infrastructure. Some new challenges in 2022 included heavy rains that made river exposures inaccessible, as well as painfully abundant biting flies. However, spirits remained high throughout (most of) the trip as we made some very exciting fossil finds across the island. Most notably, several of the fossil specimens we collected represent new species, including several undescribed crinoids and an edrioasteroid—the first ever discovered from the Ordovician of Anticosti!

Our 2022 expedition to Anticosti Island was generously supported by the Stavros Niarchos Foundation, and a short summary video of our research was produced (https://youtu.be/8xxWH15rVBg). The hundreds of specimens we have collected thus far are reposited at the AMNH by special agreement with the Canadian government. During the summer of 2023, we will be visiting the AMNH to begin describing these new species, in addition to continuing our work to evaluate patterns of faunal turnover and morphological change over the extinction. We look forward to returning to Anticosti in August of this year, and hopefully future years, to continue disentangling the mysteries of the first mass extinction event!

READING OKLAHOMA'S PERMIAN RED BEDS - THE GARBER SANDSTONE

ELLIE CALLAHAN, M.S. STUDENT



The sedimentary rocks that define much of Oklahoma's uniquely red-orange landscape have long been misunderstood. These Permian-aged "red beds" record a transitional time in Earth history characterized by profound climatic and tectonic events across the North American Midcontinent. Over the years, students advised by Michael and Lynn Soreghan have studied these enigmatic beds to better understand their depositional environments and potential sediment sources. These studies found that Early to Middle Permian red beds likely reflect arid terrestrial environments dominated by deposition of windblown dust and ephemeral lakes, mudflats and rivers. These findings contrast early studies suggesting the red beds are largely marine in origin. In particular, the Garber Sandstone stands out amongst these massive silty units as a predominantly cross-bedded and coarser-grained sandy unit. I was able to develop a clearer hypothesis for the depositional environment and source of sediment for the roughly 280-million-year-old unit after roaming through the Oklahoma countryside for almost two years in search of outcrops of the Garber Sandstone (and turning every pair of white socks I own red in the process).

To unravel the Garber's complex history, we used a combination of detrital zircon geochronology, sandstone petrography, grain size analysis and core and outcrop observations to supplement sediment provenance and paleoenvironment interpretations. Conducting the detrital zircon geochronology analyses was particularly exciting as in the summer of 2022 I flew to the University of Arizona LaserChron Center and utilized the Thermo Element 2 Laser Ablation-Single Collector-Inductively Coupled Plasma-Mass Spectrometer to record ratios of U-Pb radiometric isotopes for six samples. This dataset proves to be essential in understanding where the sediment comprising the Garber Sandstone came from across Pangea. Detrital zircon geochronology is particularly powerful when combined with sandstone petrography and paleocurrent datasets, which were also assessed from many outcrops.

This research expands upon our growing understanding of Permian red beds of the North American Midcontinent. Early Permian paleoclimate, paleogeography and sediment transport trends have been further refined during a particularly complicated time period that reflects similar paleoclimatic changes occurring in the modern. Additionally, the Garber Sandstone is part of the Central Oklahoma Aquifer, which is a vital groundwater source for much of the Oklahoma City metropolitan area. Understanding its depositional history will aid in providing necessary background for future hydrogeologic studies of the aquifer.

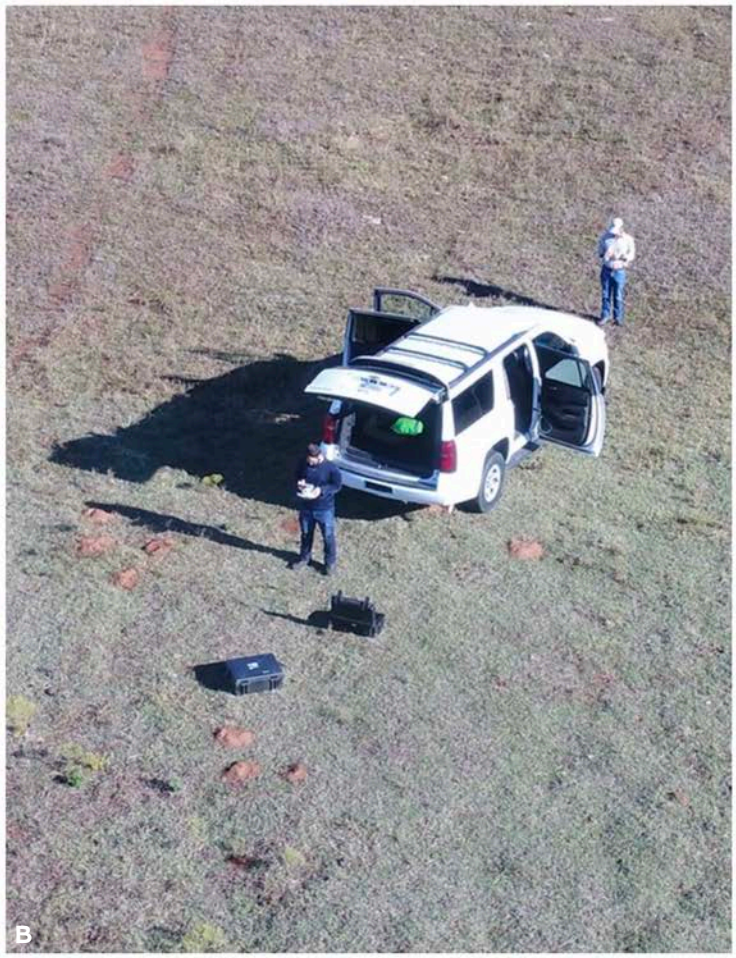


Figure 1 – A: The complete setup of the magnetic survey installed on a small drone (The non-metallic sleeve carries the smartphone which is mounted below the drone with a 1.5 m non-magnetic cable). B and C: Operating the drone. D: the exposed wellhead.

LOCATING UNDOCUMENTED ORPHANED OIL AND GAS WELLS USING AIRBORNE SMARTPHONE SURVEYS

DANIAL MANSOURIAN AND SINA SANEIYAN, PH.D.

The near-surface geophysics group at the School of Geosciences at OU is studying the application of finding undocumented abandoned oil and gas wells using everyday devices such as smartphones. The abandoned wells are scattered across the U.S. by the millions and pose environmental threats to soil, water and air. Unfortunately, only a fraction of these wells have been identified, and Oklahoma is one of the most critical states which suffers from a large number of abandoned wells. Considering the abundance of these wells, our near-surface geophysics group realized the need to develop a cost-effective and efficient geophysical method to locate these wells. The team (PI: Sina Saneiyan and the Ph.D. student: Danial Mansourian) realized that most of these wells still have their metallic well casing or pipe in the ground. The metallic casing usually is made of ferromagnetic material (such as cast iron and steel); thus, the team decided to utilize the magnetic sensors of the smartphones (the compass), which are sensitive to the ferromagnetic material, to locate abandoned wells by aerial magnetic surveying.

The magnetic surveying method is a well-established technique that is used to identify the ferromagnetic anomalies in the subsurface such as unexploded

ordnance (UXO) and iron ore minerals. The method relies on the measurement of changes in the Earth's magnetic field caused by ferromagnetic material. Since most modern smartphones come with a built-in high frequency (10 – 100 Hz) three-axis magnetometer sensor, they have the capability to locate a variety of ferromagnetic materials including the metallic casing of abandoned oil and gas wells. The casings of orphaned wells are mostly vertical and have strong magnetic anomalies that appear as pronounced monopoles on a magnetic map. For their research, the near-surface team used an Apple iPhone 12 Mini and mounted it onto a drone with a non-metallic sleeve to test its sensitivity at different elevations for locating an abandoned well (Figure 1A).

The team surveyed a site in Oklahoma with an exposed steel wellhead on the surface. This site was chosen as a reference point to evaluate the efficiency of the innovative and cost-effective airborne magnetic surveying setup in identifying obscured orphan wells. As many abandoned wells in the U.S. are covered by tree canopy, the data acquisition was designed and implemented at three flight altitudes at 10, 15 and 20 meters above ground level (magl). Using a small recreational drone, magnetic data and their coordinates were collected using the internal sensors of the smartphone and a map of subsurface magnetic intensity distribution was created (Figure 2). Based on the results, it is evident that the smartphone sensors are capable of finding undocumented abandoned wells. At an altitude of 10 magl the iPhone 12 Mini magnetometer could pick the magnetic anomaly of the well at high intensities, more than 52 micro-Tesla (µT); sufficient to accurately locate the well. At an altitude of 15 magl the iPhone 12 Mini struggled to accurately locate the well but was able to locate some anomalies very close to the location of the well, and it was unable to detect any magnetic anomalies at 20 magl (probably more signal processing is required to extract the well anomaly at this altitude).

The findings of this research can shape a new cost-effective approach to addressing the very important environmental hazard of undocumented orphan wells. The abandoned oil and gas wells, which are one of the largest greenhouse gas emitters to the atmosphere, can now be located more easily and efficiently. The team has plans to improve their study by using supplementary techniques that can amplify the magnetic signals and also detect methane emissions of orphan wells. Furthermore, the near-surface team intends to find the wells from higher elevations and more challenging terrains and help citizen scientists to find these wells more easily in urban environments.

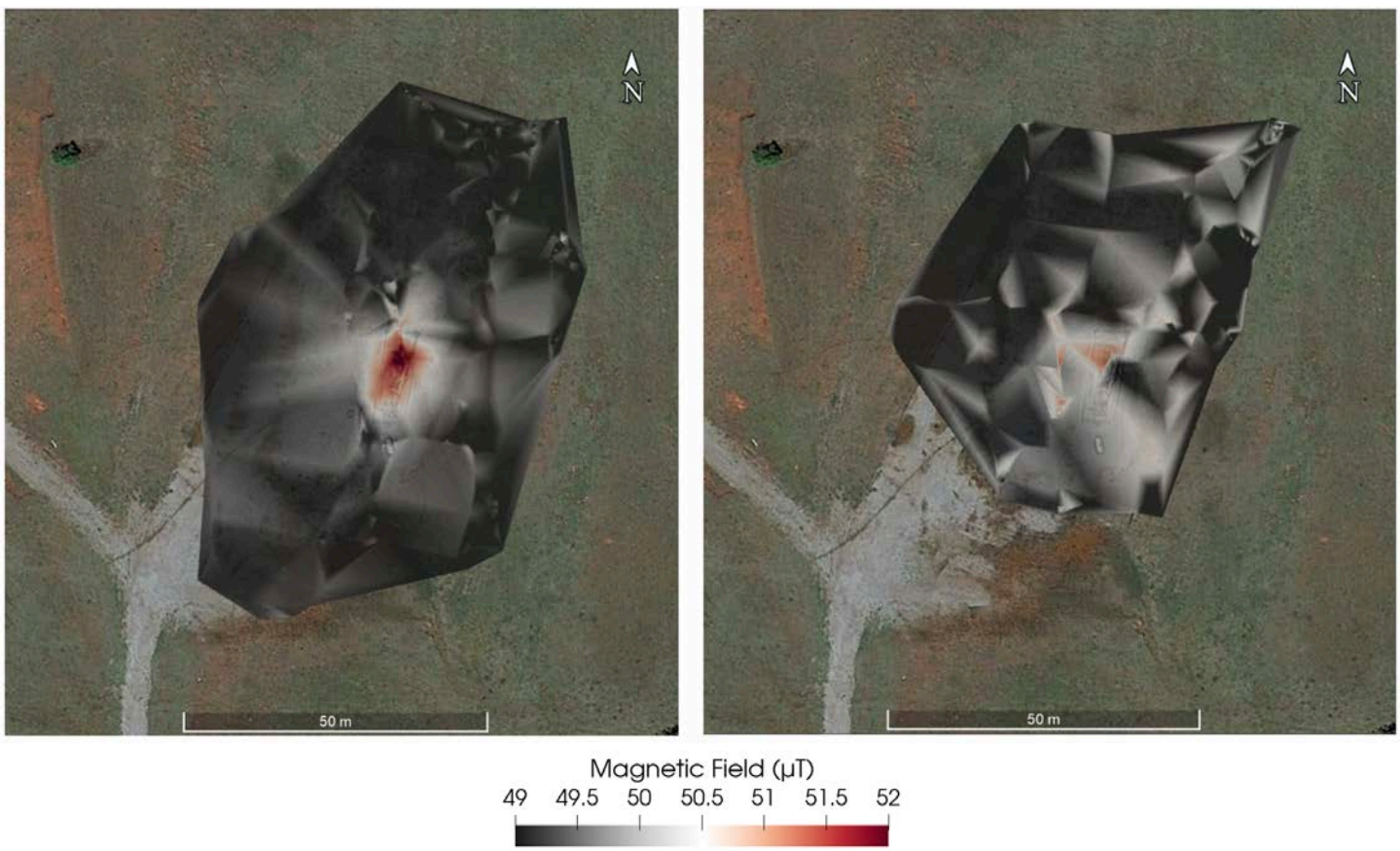


Figure 2 – Survey results A: drone altitude ≈ 10 magl. B: drone altitude ≈ 15 magl

FROM GEOTHERMAL FIELDS TO MEGATHRUST FAULTS: USING DIVERSE DATA AND COMPUTATION TO STUDY SOLID EARTH SYSTEMS

JUNLE JIANG, PH.D.

What is Solid Earth Geophysics nowadays? To me, it involves sharpening our abilities to sense our present Earth at all scales and connect with its past and future in a coherent, systematic way. Many research fields of geophysics are witnessing revolutions at multiple fronts, with novel instrumentation and technologies, exploding data volume and computing power and more sophisticated analytical tools. These technical advances, paired with geoscientists' ingenuity and rigor, are crucial to addressing many problems that are scientifically and societally important. In the Crustal Dynamics and Computational Geophysics Group, we bring observational and computational approaches to understand the dynamic processes and properties of the Earth's crust. We primarily use satellite-based geodetic techniques, seismological observations and multi-physics geomechanical modeling, which lay the foundation for our pursuits in various problems of the solid Earth system.

Currently our group fully supports two Ph.D. students and one M.S. student, along with co-advised students. Four group members presented their research (four posters and one invited oral presentation) at the American Geophysical Union Annual Meeting in Chicago in December 2022. This is the first national conference for many students, all of whom received the OU Robberson Travel Grant and departmental travel support. Together, we cover the topics about fault zones, geothermal fields, subduction zones, seismicity, fluids, time-lapse monitoring, computational modeling, community science and so on. We also helped with the AGU exhibit booth to promote our school and connect with prospective undergraduate and graduate students.

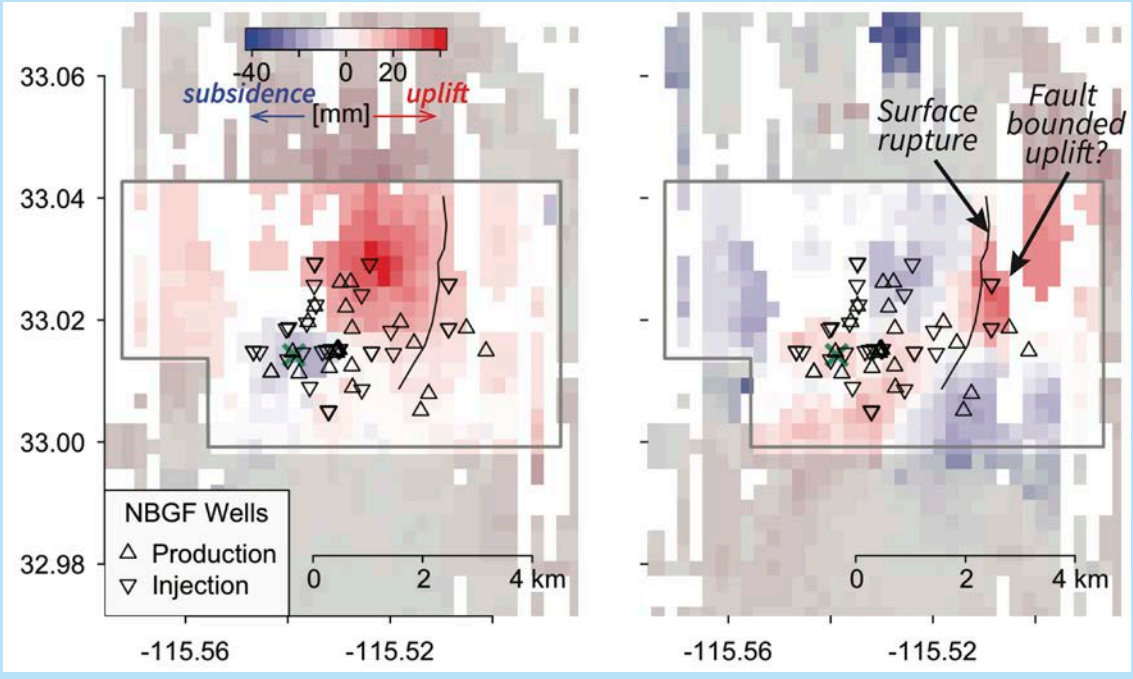


Figure 1. Ground subsidence and uplift at the North Brawley geothermal field (NBGF) in Imperial Valley, California.

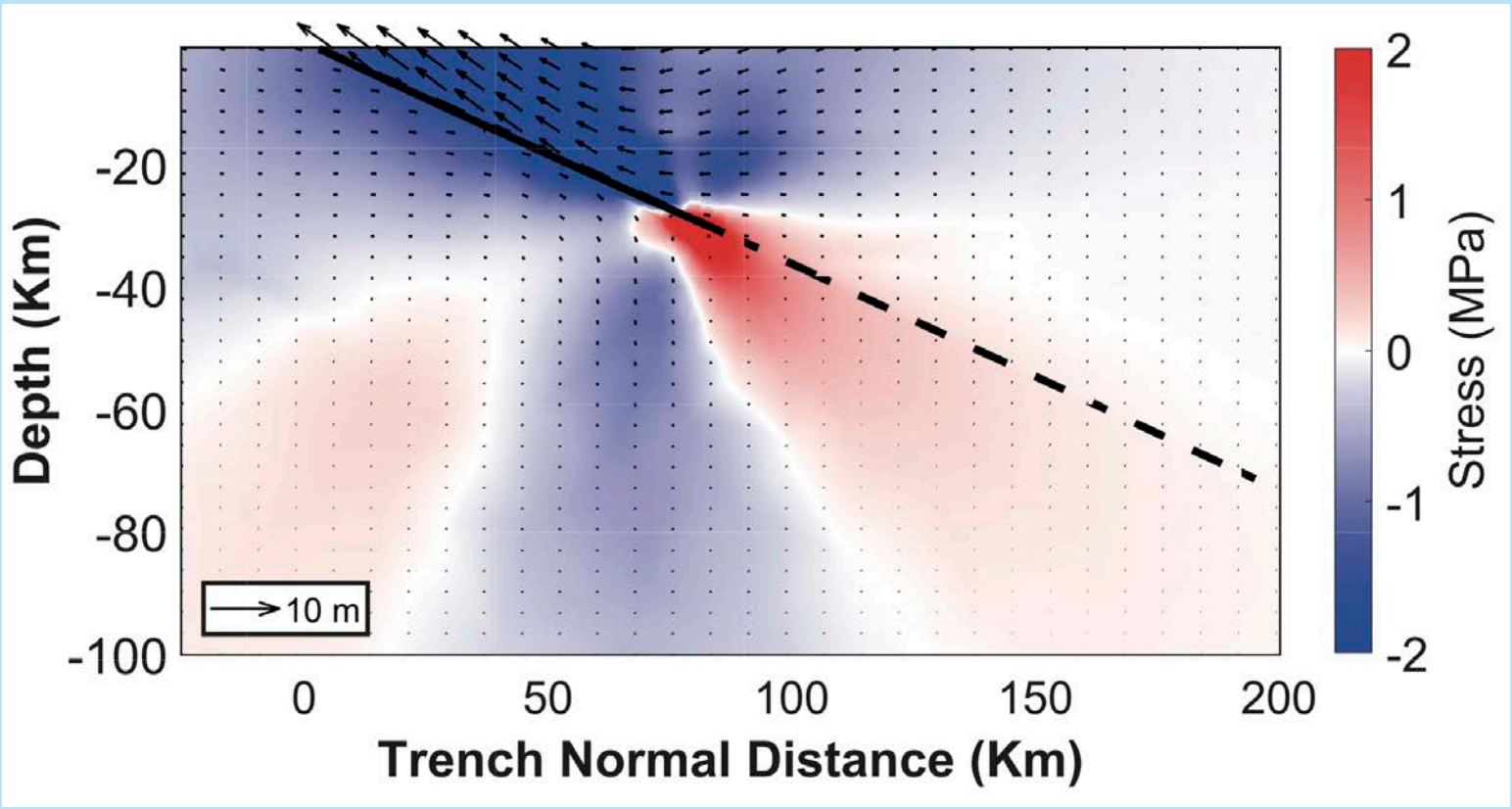
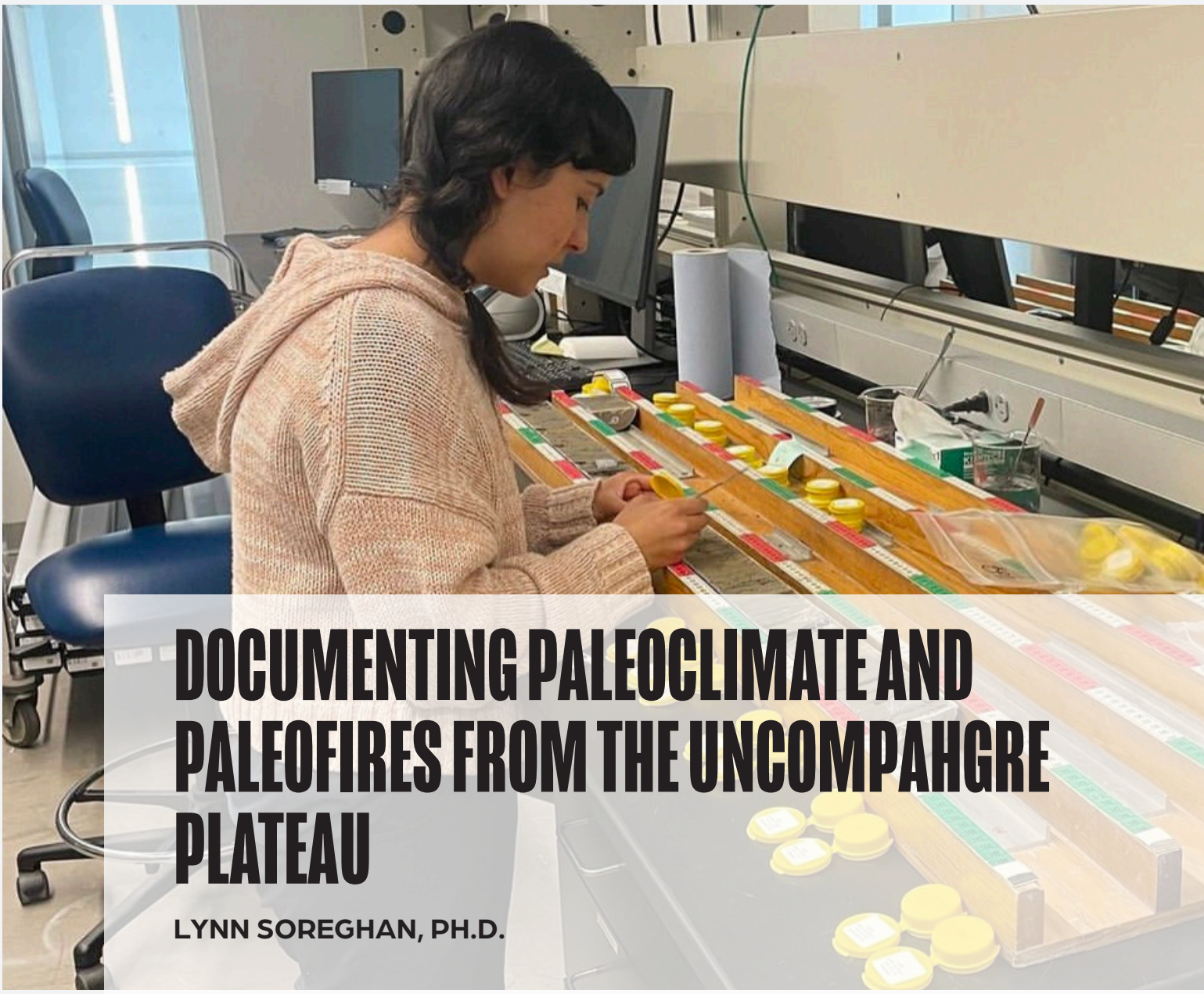


Figure 2. Subduction zone deformation (vectors) and stress changes (in color) due to a megathrust earthquake.

The Ph.D. students in our group have successfully presented their dissertation proposals and passed the General Exam in spring 2023. Ph.D. student Ganiyat Shodunke studies the evolving ground deformation and fluid pressure within a geothermal reservoir in response to fluid injection and production (Figure 1). She proposes to apply these methodologies to carbon sequestration and storage problems later for her dissertation. Ph.D. student Segun Steven Bodunde focuses on understanding the relation between lithospheric deformation and seismicity in subduction zones (Figure 2). He proposes to use the insight and tools from large-scale problems to improve the forecast of induced seismicity in Oklahoma. Both students simulate poroelastic behavior of fluid-saturated rocks in three-dimensional heterogeneous crustal structures, with unique constraints from space-geodetic measurements of ground deformation.

Besides student-led projects, we have ongoing collaborations within the department and with the Oklahoma Geological Survey, as well as other institutions (e.g., TAMU, U Oregon, and UC Berkeley), which will help expand our research group in the future. These projects tackle problems ranging from earthquake swarms in California and Hawaii to landslides in Oklahoma and Arkansas. We greatly appreciate the current funding support from the NSF (National Science Foundation), NASA (National Aeronautics and Space Administration), and SCEC (Southern California Earthquake Center, an NSF- and USGS-funded multi-institution consortium) and look forward to exciting new opportunities.

Despite the disparate scales and settings of our research projects, students and collaborators of our group often use similar research tools for computation and observations. A common thread of these projects is to deepen our understanding of the interplay between the structure, strain, stress, seismicity and/or fluids of the Earth's crust. These are fundamental and challenging problems in geosciences — we will strive to make our contributions in our capacity while enjoying the process. Importantly, I believe our students and mentees will obtain excellent training in open-minded exploration, critical and creative thinking, quantitative analysis, and problem solving, which would prepare them for rewarding career paths with wide possibilities.

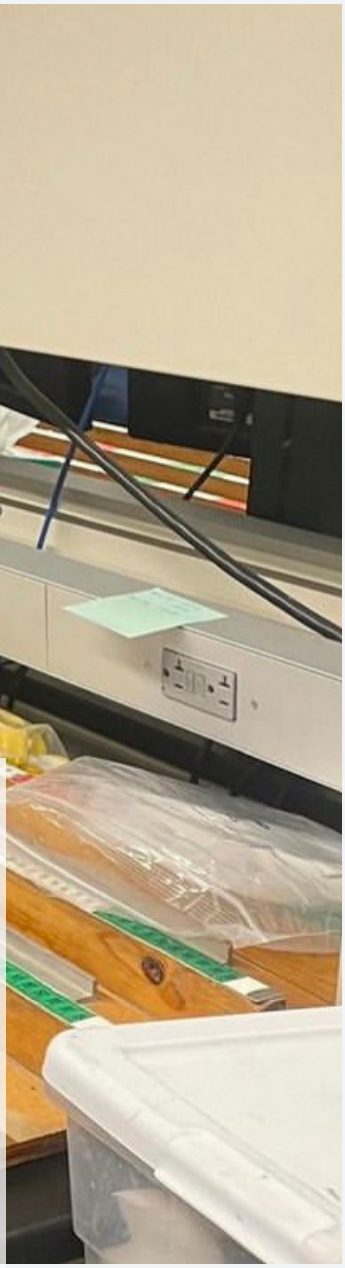


DOCUMENTING PALEOCLIMATE AND PALEOFIRES FROM THE UNCOMPAHGRE PLATEAU

LYNN SOREGHAN, PH.D.

In June, M.S. students Mackenzie Flynn and Karen Valles had the opportunity to visit the Continental Scientific Drilling Facility at the University of Minnesota. The CSDF is the centralized facility in the U.S. for core analysis and storage for NSF-supported research drilling. The students meticulously sampled, at high resolution, 94 sediment cores (spanning ~160 m!) collected from Unaweep Canyon, Colorado, in February 2022. The core penetrated lake deposits hypothesized to have resulted from catastrophic mass wasting that dammed the ancestral Gunnison River when it flowed through Unaweep Canyon during the early Pleistocene. Remarkably, this lake now represents a nearly unique record of early Pleistocene paleoclimate from the Rocky Mountains, as most other records date from the late Pleistocene. Preliminary pollen analysis from the Unaweep paleolake (conducted by collaborator Gonzalo Jímenez), suggests that the study area experienced several glacial-interglacial cycles dating from the time prior to the mid-Pleistocene transition, when such cycles shifted from an approximately 40ky periodicity to a 100 ky periodicity.

The students worked tirelessly to collect a total of 2,564 sediment samples destined for different analyses, including carbon-nitrogen-sulfur analysis, organic geochemistry biomarkers, palynology and charcoal particle concentration. These analyses will be integrated with other core data to document early Pleistocene paleoclimate — including the relationship among glacial-interglacial cycles, paleodroughts and paleofires in this region of the Uncompahgre Plateau.



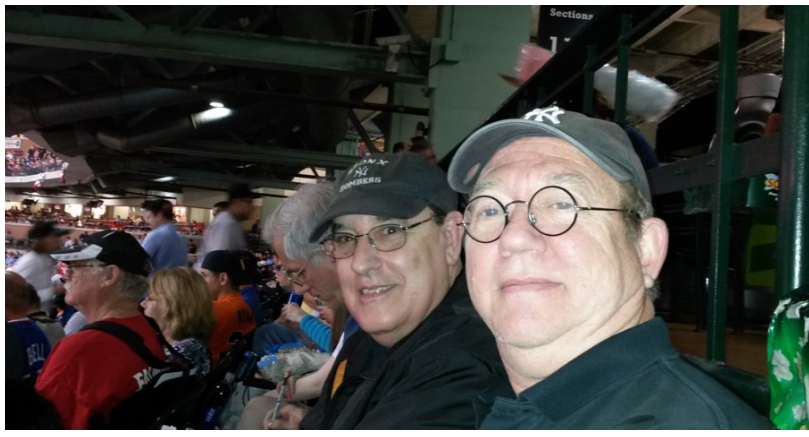
REMEMBERING DR. JOHN PIGOTT

ANDREW CULLEN, PH.D.

These reflections on the life and times of John Pigott, or Dr. P as he was affectionately known by many of his students, are sure to fall short. John was a partially opaque multi-faceted crystal refracting and reflecting light and life in many directions and hues. Perhaps only his wife, Kulwadee, could see and appreciate the full spectrum of his nature.

John's childhood and adolescent years were spent in Stephenville, Texas. His dad passed early and he and his brother, Charles, were raised by their mother. With his smarts and a streak of prankish mischief, John must have been a bit to handle. Among other pranks he shared with me was the time he super-glued his brother to the bedsheets. Stephenville is a quaint town with a small university. It was never going to contain John. He went off to the hippie stronghold of Austin to attend the University of Texas where he double majored in geology and zoology. His zoology degree was earned with distinction. John was also on the UT saber team for several years; I always imagine John thinking of pirates as he competed. John stayed on at UT to earn his master's in geology under Bob Luigi Folk, who is renowned as much for his brilliance as his eccentricity; spinning around stick-throwing blindfolded students on a beach to get random cobble samples to etching quartz in boiling hydrofluoric acid to test for provenance (metamorphic, volcanic and plutonic quartz did etch differently). It was under Folk that John picked up a few eccentricities, such as the snake and eagle grading system, much better than A-F. Folk tried to learn a new language every few years, which influenced John's linguistic interests, principally French. During his master's field work diving on the Cayman Islands escarpment to sample reef cements, John met the legendary explorer Jacques Cousteau. Dr. P became a certified dive master almost five decades later. He loved the sea and was rarely found outside the carbonate optimum zone, +/- 30° of the equator. I always think of the Jimmy Buffet lines, "Some of them go for the sailing, caught by the lure of the sea."


Los Hidalgo




AEROPOSTALE

John studied under Fred Mackenzie at Northwestern University for his doctorate. John's research on Tectonic Controls of Phanerozoic Rock Cycling presaged much of the current focus on paleoclimates in the rock record. With a sterling academic pedigree, John could have continued his cutting-edge research, but instead went to work for Amoco International assessing carbonates of southeast Asia and gaining exposure to global-scale oil and gas exploration.

Despite what might have been a promising industry career, John left Amoco for the University of Oklahoma around 1982 — recruited by John Wickham. At OU, John's journey becomes even more interesting. While he continued his work on carbonates, he also began to delve deeply into reflection geophysics and signal processing as a tool to better understand carbonates in the subsurface. His exposure to global geology at Amoco also drove his quest toward basin analysis and petroleum systems.

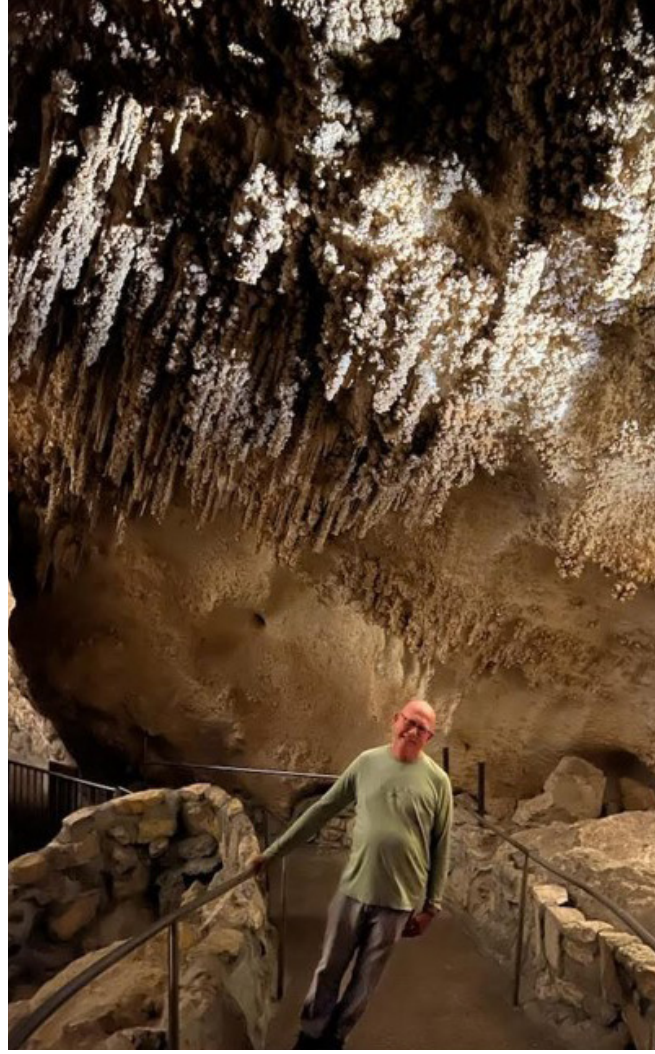
John's classes had strong applied components and students benefited from exposure to skillsets and problem-solving relative to recruiting company's needs.

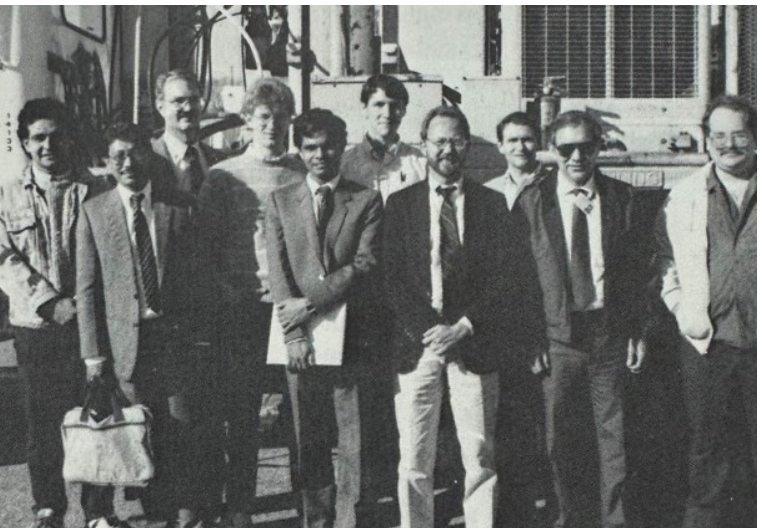
John was in his scientific broadening phase when we first met. After I had given a colloquium on the Galapagos Islands, he took me out for a nice dinner with excellent French wine. We hit it off well. I was working part time at the OGS evaluating sand and gravel deposits. With five years prior minerals and oil and gas experience, I was underemployed. Over dinner, John told me he was looking for a Ph.D. student to work in southeast Asia. The next day I went by his office. He gave me a copy of Warren Hamilton's visionary USGS Professional Paper "Tectonics of the Indonesian Region" and said, "Read this and let me know what you want to do." A year later we spent a summer field season in northern Papua New Guinea and completed a trip around the world in 87 days — stopping in Tahiti to "decompress and look for ooids" on our last leg. John used the money and our airfare from teaching a class in Abu Dabi and I pitched in my savings. No grant, we just did it! John was like that. Always finding a way to get things done. Around this time, as John was going through the stress of the tenure process, we developed bonds deeper than the typical professor-student relationship. The next fall after getting tenure, John took sabbatical at the Museum of Natural History in Paris. I joined him for a month to do my sandstone petrography. We shared several different hotel rooms, including one with only one bed, and often dined on roasted chicken, baguettes, wine and cheese. That month passed quickly, and then John led a few well-heeled alumni on a weeklong

gastronomic extravaganza through the Burgundy region along the Rhone River. I drove the second van carrying our luggage and a smoking spouse. It was a fantastic experience and I learned so much about wine as John introduced me to some expensive lifelong pleasures.

It was also during this period John began a profound personal transition, away from what I call his Stingray Johnny phase (red Corvette and gold chain — seriously) to a spiritual journey of Buddhism and Catholicism that would mold the introspective spiritual man he became. His journey of self-discovery led him to his beloved wife, Kulwadee, and reinvigorated the Catholic faith of his youth. John became a deacon and a dedicated member of the St. Thomas More University Parish. Through all this, John continued to teach at OU, turn-out graduate students and consult globally. John saw no color or race among the different people from the many countries of his students. He embraced their individuality in the spirit of the Grace of God.

Dr. Pigott was a great teacher with a Socratic method that emphasized lateral thinking and applied science. His academic offspring of loyal students and Imperial Barrel teams continue to support the School of Geosciences. John's sudden departure from this physical world stunned all of us. He had just turned an energetic 72 and still had much ahead in his life. John will be dearly missed and fondly remembered for years to come.





MEMORIALS

In memory of our alumni gone too soon

Charles Acker
Richard Alexander
James Atkinson
Barth Bracken
Nancy Brown
William Brown
David Brummett
Paul Buckthal
Gerald Burkett
Richard Cohoon
George Conant
Barry Critedes
James Duffield
William Gilmore
Harold Hanke
Carolyn Hayes
Richard Hedlund
David Kisling
Robert Lewellyn
John Lollar
Glen Luff
Philip Marsh
Jack Plitt
Thomas Ray
Colonel Richardson
Barry Robbins
John Sartin
Thomas Stapleton
Michael Stewart
Kneelon Teague
Bill Tilley
William 'Bill' Walton
William Weaver
Billy Wolfe

**as reported to OU Advancement through July 2023*

FACULTY YEAR IN REVIEW

This document lists publications and grants for faculty in CY 2022.

PUBLICATIONS

Abousleiman, Y., Dung, P., Liu, C. (2023). "Dual-porosity dual-permeability rate transient analysis for horizontal wells with nonuniform and asymmetric hydraulic fractures."

Liu, C., Phan, D., Han, Y., Abousleiman, Y. (2022). "Stress solutions for short- and long-term wellbore stability analysis." *Journal of Natural Gas Science and Engineering*, Vol. 105, 104693.

Hull, K. L., Abousleiman, Y. (2022). "Chemomechanical effects of oxidizer-CO2 systems upon hydraulically fractured unconventional source rock." *The Canadian Journal of Chemical Engineering*, Vol. 100, No. 6, 1417-1426.

Chen, S., Abousleiman, Y., Muraleetharan, K. (2022). "Computational implementation of bounding surface model and its verification through cavity benchmark problems." *International Journal for Numerical and Analytical Methods in Geomechanics*, Vol. 46, No. 3, 553-569.

Shengli, C., Muraleetharan, K. K., Abousleiman, Y. (2022). "Computational implementation of bounding surface model and its verification through cavity benchmark problems." *International Journal of Numerical and Analytical Methods in Geomechanics*, Vol. 46, No. 3, 553-569,

Chen, S. L., Abousleiman, Y. (2022). "A graphical analysis-based method for undrained cylindrical cavity expansion in modified Cam Clay soil." *Géotechnique*, Vol. 72, No. 1, 1-11,

Liu, C., Dung, P., Abousleiman, Y. (2022). "Dual-porosity dual-permeability rate transient analysis for horizontal wells with nonuniform and asymmetric hydraulic fractures." *Rock Mechanics and Rock Engineering,* Vol. 55, 541–563 (2022), No. 55, 541-563.

Bedle, H., Salazar Florez, D., Garneau, C. (2022). "Recognizing Societal Influences in Earthquake Geohazard Risk Perception with Explainable AI While Mitigating Risks Through Improved Seismic Interpretation." *The Leading Edge*, Vol. 41, No. 11, 756-767.

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Salazar Florez, D., Bedle, H. (2022). "Study on the parameterization response of probabilistic neural networks for seismic facies classification in the Gulf of Mexico." *Interpretation*, Vol. 10, No. 1, T1-T23, DOI: 10.1190/int-2020-0218.1.

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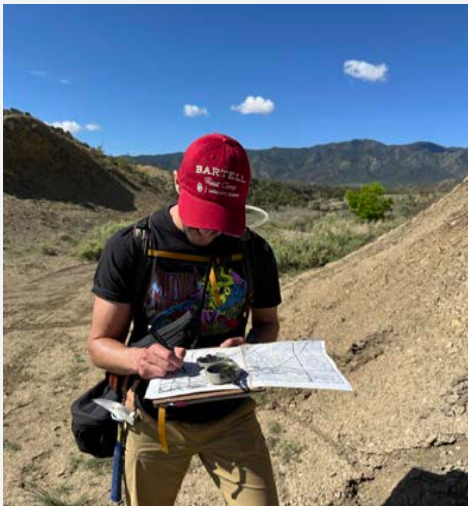

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