UNIVERSITY OF OKLAHOMA
SCHOOL OF GEOSCIENCES

EARTH SCIENTIST

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ABOUT THIS ISSUE

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Design: Ashley Tullius
Contributors: Geosciences Faculty, Students and Alumni

On the cover: White Sands National Park
Photo Credit: Lily Pfeifer

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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 Thus, accounting for the rare exceptions of years unpublished, we are now on volume 42 of the alumni magazine.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.

For accommodations, please call the School of Geosciences at (405) 325-3253.

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WELCOMES FROM

PEOPLE

AWARDS

HIGHLIGHTS

ALUMNI

FROM THE DIRECTOR

Dr. Lynn Soreghan

I am writing this about two weeks after the George Floyd killing — the horrific incident that reignited protests on issues of systemic racism and social justice — domestically and globally. But why begin my letter with this event — How does it relate to us — to OU Geosciences? My answer is multifold: this issue relates to us individually, and us societally — because we either stand together or fall together as humanity. But this issue relates to us as geoscientists because the geosciences are the least diverse field amongst all STEM disciplines, and that troubles me: we know that effective teams are diverse teams. Geoscientists will help navigate a sustainable future for humanity; thus we need all hands and voices and we need them now.

Like many other faculty and students, I had planned to be kicking off summer field work about now. Instead, we find ourselves in improvised home offices, muddling along through the COVID-19 pandemic. Uncertainty abounds following the wholesale cancellation of all spring events — the Expo, Research Symposium, colloquia, Spring picnic, MCEE banquet, AAC, First-Year field trip, even field-based field camp. Yet bright spots abound, as we discovered the blessings of Zoom, manifest in common refrains such as "You're muted," "Sorry — that was my cat," and "No, don't worry — your video's off." Yes, we miss seeing people in person — and we really miss being in the field — but it turned out that many events boasted better attendance than previously: thesis defenses, the AAC meeting, and guest-speaker events, to name a few. Plus, Dr. Dulin and her wizardly TAs crafted a virtual field camp that's attracted widespread adoration. And we all witnessed striking images from around the world of cityscapes with remarkably clean skies and guarded emergences of wildlife.

The pages to follow offer a glimpse of both "pre-COVID" and "syn-COVID" activities in Geosciences, as well as some significant shifts in our faculty. Among the latter, we bid farewell to Dr. Shankar Mitra, who retired in December 2019, and to Dr. Roger Slatt, who passed away in February 2020. We regret that the pandemic caused cancellation of the memorial that Roger's family had planned for March. In January we welcomed Dr. Yichuan Wang, who is overseeing the computer lab, and are welcoming the newest addition to our faculty — Dr. Junle Jiang (computational geophysics) in August 2020.

The future is perennially uncertain, and COVID-19 has cast more uncertainty than normal: We are facing pandemic-induced budget cuts, and associated delay before we can mount new faculty searches. But we remain hopeful; at this writing our freshman commits are double those from last year. Many thanks to our alumni for your continued support, and special thanks to Raleigh Blumstein for cheerfully leading the AAC.

I'll close by returning to how I began: words go only so far in helping us evolve our culture. I hope we can begin effecting real change within ourselves and greater society by acts both small and large: by listening and learning to those who have endured systemic racism and all manner of discrimination, by working with our students to cultivate an inclusive and encouraging environment, and by working with the administration and our faculty to create a diverse geoscience program poised to lead us into a better future on planet Earth.

FROM THE DEAN

J. Mike Stice

The University of Oklahoma and the Mewbourne College of Earth and Energy are proud of the many accomplishments of the School of Geosciences throughout the past year. The school has been, and continues to be, a leader in a number of key areas across the industry. In addition to its reputation in the industry, the school is a campus role model for service, teaching, research and delivering a high-quality general education in geology and geophysics. At the university level, I am excited about the new leadership. President Harroz was named to be the 15th president of the University of Oklahoma on May 9, 2020. Joe is my personal friend and favorite as I have served as his colleague for the last five years. His leadership as dean of the College of Law was exemplary. Our new director, Lynn Soreghan, has made amazing progress towards our commitment to increasing our ranking from 54th to a top 25 school of geosciences.

RESEARCH

President Harroz has reinforced past president Gallogly's plans to expand our research efforts at the university. This focus on new ideas and the capturing of additional research funding in specific focus areas such as energy research has been well received. During President Harroz' interim assignment, he recruited a world-class Vice President of Research and Partnerships. Tomas Diaz de la Rubia comes to us with a wealth of experience working with Fortune 500 energy and manufacturing companies to identify emerging technologies. At the college level, we have committed to doubling research expenditures by 2025, and with Tomas' support, I am confident that we will deliver.

GRADUATE EDUCATION

Our focus over the past two decades has been the undergraduate experience. These efforts have paid huge dividends to our undergraduate programs and have differentiated us from our peers. However, our graduate programs are the key to improved rankings and the generation of new ideas, resulting in enhanced research, which will lead to growth. President Harroz has expressed his intent to focus on expanding and enhancing our graduate programs by increasing stipends, a focused recruiting effort and a larger graduate student body.

FACULTY SUPPORT

President Harroz during his interim assignment, recruited five new deans and announced his commitment to pay competitive salaries coupled with a performance-based bonus structure, improving our ability to attract and retain the highest-quality faculty. All of these initiatives will strengthen the university, the college and the school. I personally want to express my full support for President Harroz and Lynn Soreghan as we aggressively pursue our goals. We have a lot to be proud of at the University of Oklahoma, and I would like to thank you for your support and confidence in the Mewbourne College of Earth and Energy.

ADVERSITY, DIVERSITY AND INCLUSION

This year, we have faced some of the most difficult challenges imaginable. The global pandemic forced us out of the classroom and into remote learning, transforming our education methods. Both the faculty and students met this challenge head on, converting our spring semester into a virtual success. Moreover, summer online courses were expanded to offer additional education opportunities to those quarantined at home. Most notable, this country was struck hard by a series of horrific, unjust events highlighting the systemic racial bias that continues to grip our nation. Our college and university stepped up and proactively supported the Black community in peaceful protest. As a college, we have taken specific actions to unlearn the racial biases that underpin the unacceptable discriminatory behavior. Black Lives Do Matter at the University of Oklahoma.

FROM THE AAC CHAIR

Raleigh Blumstein

Dear Alumni, Students, and Faculty:

WOW! So far 2020 has given us a wild ride, however, it is times like these that bring out the best in humankind and create opportunities to throw ourselves into endeavors larger than our personal lives. Many of you have looked to the Alumni Advisory Council to focus some of your time and energy. I can say that the director and I appreciate all the support you continue to show the school and university.

These times have forced us to shift our behavior and typical communication mechanisms a bit. The AAC saw this most recently with our first fully remote digital meeting. It was an amazing success for a first run, and we plan to have that as part of future on-site AAC meetings (when approved by the university). We had much larger participation in general, as well as, a broader range of our alumni base participating (graduation years and demographics). I look forward to seeing each of you either in person or via webcam for our fall meeting. If all goes well, we will host it in conjunction with a home football weekend.

Another positive step coming from the Spring AAC meeting was the decision to have an AAC targeted fundraising effort for 2020. The Gifts and Endowments Committee, led by Tyler Howe, presented this effort to the membership and it was enthusiastically embraced. The membership selected the annual First-Year Field Trip for this fundraising effort. Please be watching your email for communication from the school in conjunction with the AAC for how to participate in the fundraiser.

As always, we are looking to reconnect with alumni who have moved around the globe. If you know of fellow alums who you think would be interested in reengaging with the school and the AAC please direct them to the "OU School of Geosciences AAC" LinkedIn group and Facebook page.

In closing, I would like to encourage all alums to go to the alumni page on the School of Geosciences website (http://www.ou.edu/mcee/geosciences/people/alumni) and provide updated contact information to both the school and the AAC. Alternatively, you can provide your contact information directly to the AAC by emailing me (rdblumstein@gmail.com), Nicole Fritz (nbaylor@gmail.com), or Tiffany Stephens (Tstephens@wdoil.com).

Cheers,

Raleigh Blumstein
AAC Chair,
Fall 2019 - Spring 2021

LYNN SOREGHAN

DIRECTOR AND EBERLY FAMILY CHAIR
DAVID L. BOREN PROFESSOR

XIAOWEI CHEN

ASSOCIATE PROFESSOR

YOUNANE ABOUSLEIMAN

PROFESSOR AND LARRY W. BRUMMETT/ ONEOK CHAIR
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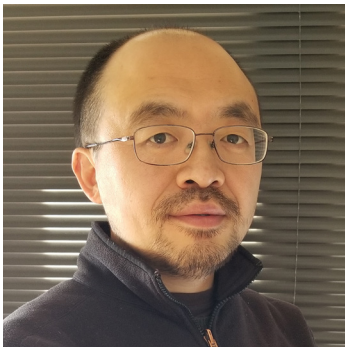
MATTHEW J. PRANTER

PROFESSOR AND VICTOR E. MONNETT CHAIR



XIAOLEI LIU

ASSISTANT PROFESSOR

MICHAEL J. SOREGHAN

ASSOCIATE PROFESSOR

DAVID LONDON

NORMAN R. GELPHMAN PROFESSOR

BARRY L. WEAVER

ASSOCIATE PROFESSOR

RICHARD LUPIA

ASSOCIATE PROFESSOR AND ASSOCIATE CURATOR, SAM NOBLE MUSEUM

STEVE WESTROP

WILLARD L. MILLER PROFESSOR AND CURATOR, SAM NOBLE MUSEUM

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KURT J. MARFURT
RESEARCH PROFESSOR

G. RANDY KELLER
PROFESSOR EMERITUS

JUDSON L. AHERN
PROFESSOR EMERITUS

SHANKAR MITRA
PROFESSOR EMERITUS

M. CHARLES GILBERT
PROFESSOR EMERITUS

R. PAUL PHILP
PROFESSOR EMERITUS

CHARLES W. HARPER, JR.
PROFESSOR EMERITUS

ZE'EV RECHES
PROFESSOR EMERITUS

REBECCA FAY

ACADEMIC PROGRAMS COORDINATOR

LEAH MOSER

MANAGER OF OPERATIONS

GAIL HOLLOWAY

INSTRUCTOR AND UNDERGRADUATE RECRUITER

ASHLEY TULLIUS

COMMUNICATIONS AND EVENTS COORDINATOR

GINGER LEIVAS

FINANCIAL ASSOCIATE

ROBERT TURNER

LAB TECHNICIAN

MEET THE NEW FACULTY

DR. JUNLE JIANG
ASSISTANT PROFESSOR

June Jiang is a geophysicist whose research is driven by his curiosity about the ever-changing, dynamic processes of the Earth, and a keen interest in understanding the societal impacts of natural hazards. He studies the deformation and seismicity in the Earth's crust that are associated with human activities or tectonic processes, which include microseismicity, fault creep, major earthquakes, ground uplift and subsidence, and their potential interactions in geothermal fields, crustal faults, and subduction zones.

Dr. Jiang's research utilizes analyses of high-resolution geodetic data—primarily from the Global Positioning System (GPS) and Interferometric Synthetic Aperture Radar (InSAR)—and seismicity catalogs, along with physics-based computational modeling. He uses the combination of these tools to study geophysical processes over multiple time scales (from seconds to centuries and longer) and their behavior under transient or steady environmental forcing. A unique advantage of this data-driven, computation-intensive approach is the capability to bridge insights from laboratory-scale rock mechanics experiments and field observations from seismology, geodesy, and geology. Through such interdisciplinary efforts, Jiang hopes to better understand the multiscale complexity of crustal dynamics and improve the assessment of natural hazards, as well as the monitoring and mitigation of induced hazards during geo-energy explorations such as hydraulic fracturing and geothermal energy production.

Dr. Jiang received his bachelor of science degree in physics at the Peking University in Beijing, China, and doctoral degree in geophysics and a doctoral minor in computational science and engineering at the California Institute of Technology, followed by postdoctoral work at the University of California San Diego and Cornell University. With a multicultural educational background and as a first-generation college student in the past, and he is appreciative of different experiences and perspectives, as well as committed to teaching and mentoring students of diverse backgrounds and career aspirations and promoting inclusion and equity in Earth Science.

AAPG STUDENT CHAPTER UPDATE

HANNAH MORGAN, PRESIDENT

Our goal this past year was to provide new professional and personal development opportunities, increase participation and membership across the college, and continue hosting successful events from previous years. The organization continued hosting our Mock Interview event with OCGS, our TopGolf Fundraising and Professional Networking event with the SEG Student Chapter, and various Lunch & Learns. Additionally, we held the most successful American Red Cross blood drives to date, with donations exceeding 20 units each semester. This year, we started a successful new Industry Technical Talk Series with Shell, BP, Chevron, Chesapeake Energy, and ExxonMobil, where geoscience professionals lectured on industry insights and technical knowledge. We had the honor of hosting the president of the AAPG Energy Minerals Division, Dr. Edith Newton Wilson, for a talk on the energy transition and an AAPG Distinguished Lecturer in-person, Dr. Irene Arango, as she presented on "Understanding Expulsion Capacity and Organic Porosity in Unconventional Petroleum Systems." To top it all off, we also had the honor of hosting the AAPG president, J. Michael Party, as he presented on "Marketing Yourself." Overall, the OU AAPG Student Chapter had a successful year filled with memorable events and opportunities for our students.

OU SEG STUDENT CHAPTER WINS BEST STUDENT CHAPTER WORLDWIDE

JULIAN CHENIN, PRESIDENT

OU's Society of Exploration Geophysicists Student Chapter was deeply humbled to be awarded the Best Student Chapter at the 89th SEG Annual Meeting in San Antonio last September. The SEG Annual Meeting is an international geoscience exhibition which, brings more than 7,000 professionals from all over the globe.

This award completely transformed our student chapter, as we were able to deliver more academic and professional development opportunities while also giving back to students within our local and global community. At the beginning of the semester, our goal was to focus on more outreach and have a stronger presence within our local and global community. The OU SEG student chapter hosted its second annual Top-Golf Networking Social in Oklahoma City on October 25, 2019 where students were able to network with industry professionals in a relaxed and informal environment. We also hosted our new flagship event focused around the importance of geophysics within the earth sciences: SEG Week.

From November 18-20, 2019, we offered a series of technical talks featuring industry icons such as Dr. Henry Posamentier, Mr. Satinder Chopra and SEG Distinguished Lecturer, Dr. Heloise Lynn. We hosted a live broadcast of these talks for other universities across Latin America. We provided the universities from Venezuela and Colombia with a link where they were able to listen to these live talks while also interacting with the speakers and our SEG student members. Karelia La Marca translated the talks' information in two different languages so that we were able to strengthen the relationship between our student chapters.

The OU SEG student chapter has many great ideas planned for next year and we are looking forward to continue building on our momentum. We recently held our elections and our officers are eager to start turning their ideas into reality to better help our student members.

PICK & HAMMER CLUB

CONNOR MEARS, PRESIDENT

The 2019-2020 academic year was one to remember for the Pick and Hammer Club. This year we continued our tradition of community outreach, as well as planning and organizing social and technical events.

Pick and Hammer on-campus events included Eat and Meets, movie nights, general club meetings, and Pete's Pro Pics. Eat and Meets continued their success of giving students an opportunity to learn more about professors' research while getting to know them in casual environment. We branched out with the guests and had Dean Mike Stice join us for lunch while giving a talk on leadership. Pete's Pro Pics was an event conducted in the fall that allowed students to get professional-level headshots for free, for use on job search platforms. Our Lead Outreach coordinator, Peter Reilly, took and edited all of the pictures. Movie nights were a great way for students to take a break from studying and relax once a month.

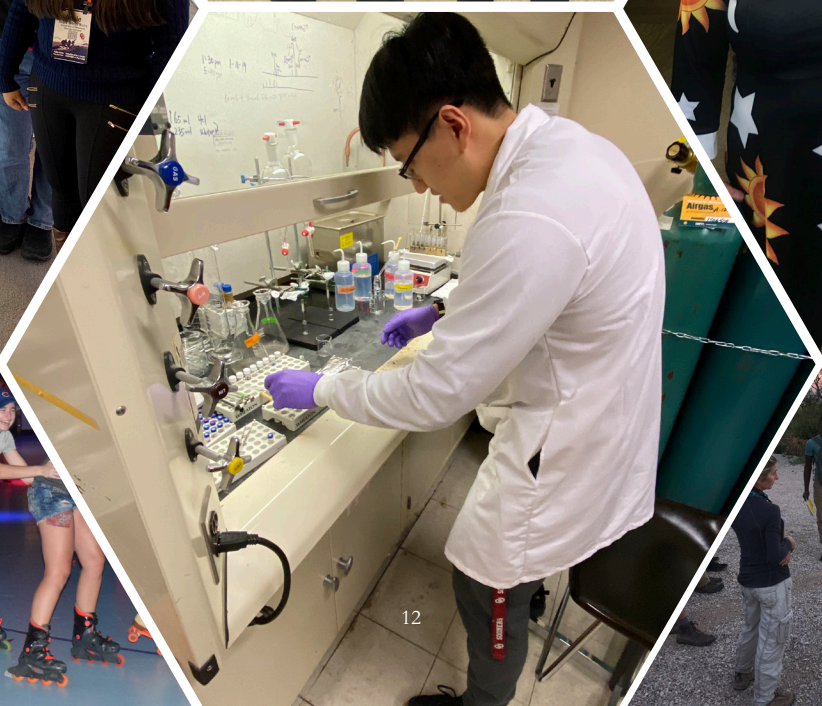
There were several off-campus field trips planned for this school year, but a few of them had to be cancelled due to COVID-19. In the fall semester, we went on a rock-climbing trip to the Wichita Mountains, where we had nearly 20 students attend and learn the basics of rock-climbing real rocks. Some of the events planned for the spring semester that were cancelled include a trip to a quarry in Davis to go mineral hunting, a trip to the Great Salt Plains State Park, and a spring break trip to the Grand Canyon and Meteor Crater in Arizona. The Grand Canyon Trip was aimed at getting new members to join the club, and there were 12 non-majors and six freshman or sophomore School of Geoscience majors that were signed up for the trip.

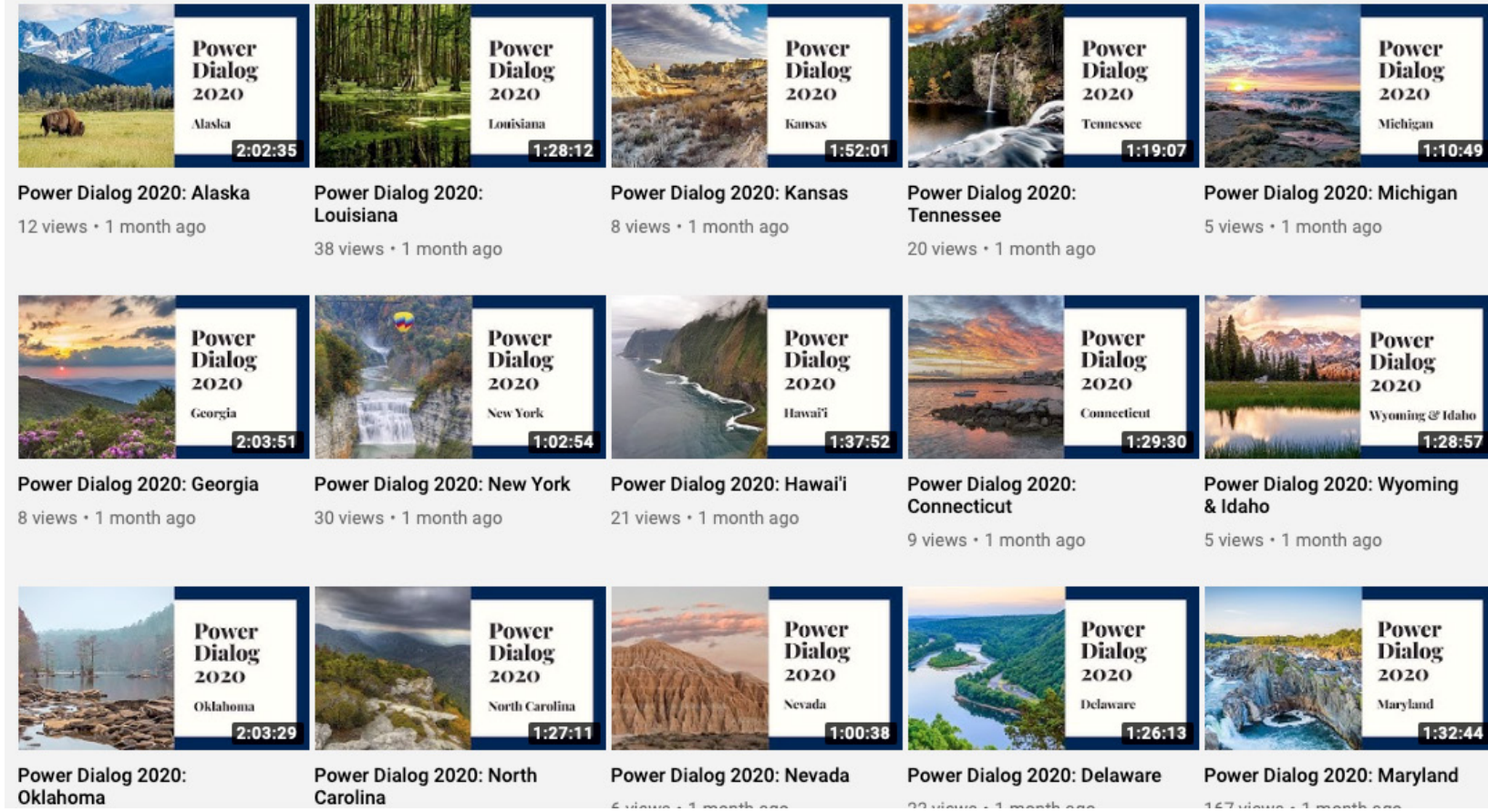
In the eighth year of our Haliburton K-12 Outreach program, Pick and Hammer participated in 15 outreach events until the semester was cut short. These included interactive Sarkeys Energy Center tours, school visits, volunteering with Science Olympiad, the Boy Scouts of America and many more. Our largest outreach event was the OERB STEM Community Night in the fall, where we gave away mineral kits and genius boxes to students and teachers K-12 to give them a more hands- on learning experience. We reached an estimated 1,100 students this year and are exploring ways to continue our outreach efforts amid the COVID-19 pandemic.


SEG SOCIETY OF EXPLORATION GEOPHYSICISTS
DATE 17 Sep 2019
University of Oklahoma
PAY TO Geophysical Society
Five-thousand and 00/100
$5,000.00


Gingerbread Cottage kit


EARTH SCIENTIST
NATIONAL WEATHER CENTER
F EARTH AND ENERGY
GEOSCIENCES
HOMA





OU HOSTS SOLVE CLIMATE BY 2030

DR. LYNN SOREGHAN

"What we do locally will change the future." — Dr. Eban Goodstein, Bard College

April 2020 brought the 50th anniversary of the first Earth Day (April 1970), and with it a nationwide and international effort termed "SolveClimateBy2030." Initiated and organized by Dr. Eban Goodstein, environmental economist at Bard College Center for Environmental Policy, the SolveClimate effort (http://www.solveclimateby2030.org) called for a "Virtual Teach-in on Climate Solutions and Justice," in a spirit of casting hope on what has become humanity's greatest challenge: how to successfully navigate our way into a future that skirts the threat of a destabilized climate system. Eban's vision entailed working with local volunteers to organize a unique webinar in each participating state (and several international locales) that would address a few "ambitious but feasible" solutions to move the needle on the climate change challenge, and address issues of climate justice, such as ensuring jobs for our future workforce.

It turned out that Eban's vision of a series of webinars was well suited for the threats imposed by COVID-19, since it was pitched as a webinar.

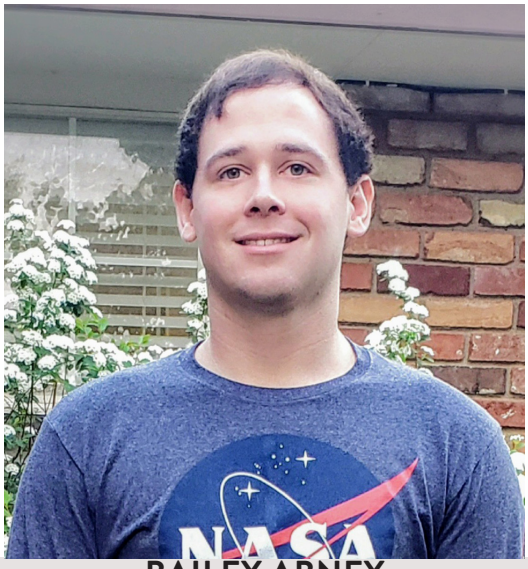
The University of Oklahoma represented the state of Oklahoma in organizing Oklahoma's contribution, which was produced jointly by Dr. Lynn Soreghan (director of Geosciences), Dr. Zev Trachtenberg (director of Environmental Studies, and a professor of Philosophy), and Dr. Mike Stice (dean of the Mewbourne College of Earth and Energy). Oklahoma's webinar featured four speakers who presented on topics relevant to Oklahoma: Dr. Berrien Moore (dean, College of Atmospheric and Geographic Sciences, OU), Kylab McNabb (Principal, Vesta Strategic Solutions), James Collard (director of Planning and Economic Development, Citizen Potawatomi Nation), and Dr. Mike Stice (dean, Mewbourne College of Earth and Energy). Dr. Moore reminded the listeners of the science of climate change, and the need for carbon emissions reductions — including negative carbon emissions. Kylah McNabb focused on the importance of wind energy for Oklahoma, which has abundant, but currently underutilized, wind potential. James Collard addressed the concepts of industrial ecology and a circular economy — creating economic systems that minimize waste, allowing resources to be recycled infinitely. Finally, Mike Stice focused on the expertise Oklahoma has in critical solutions, such as carbon sequestration, and the need to regulate and contain fugitive emissions. dean Stice made the point that, here at OU, we can boast a century's worth of expertise in understanding the subsurface; we should apply that expertise to engineering solutions for global problems, such as engineering carbon sequestration, and working on low-temperature geothermal energy.

Following the presentations, panelists spent over an hour addressing audience questions emailed during the webinar. We are proud that OU Geosciences, Environmental Sciences and the colleges of Earth and Energy, and Atmospheric and Geographic Sciences were able to represent Oklahoma in this effort. To view any of the webinars, including Oklahoma's, visit: https://www.youtube.com/channel/UCHoKHTESDOZJ9PYTSR8Av2w/videos

SPRING STUDENT AWARDS

JOHN JOSEPH NGYUEN
Charles Gould Award for Outstanding Senior in Geology

PETER REILLY
Alan Witten Award for Outstanding Senior in Geophysics

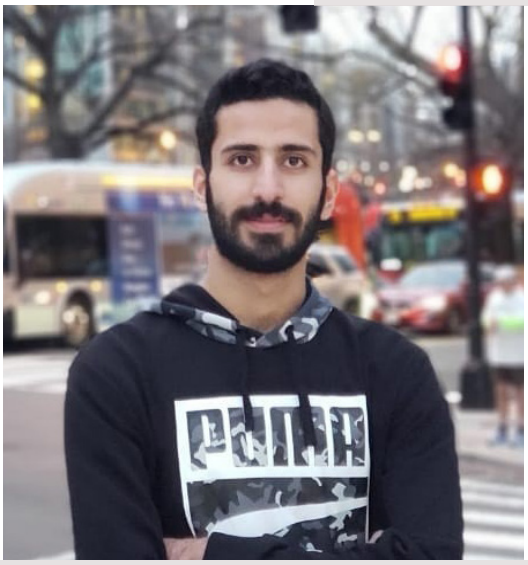


BAILEY ABNEY
David Stearns Award for Outstanding Achievement

CONNOR MEARS
Estwing Hammer Award for Outstanding Work Ethic and Commitment to Academic Excellence

The annual spring MCEE Student and Alumni Awards Banquet and Geosciences spring awards picnic and softball game were, unfortunately, not held due to the COVID-19 pandemic. These events are a time for our students to be recognized for their outstanding accomplishments throughout the year. We'd like to congratulate these students for their acommplishments.

SPRING STUDENT AWARDS



TURKI AL MAMARI
Outstanding Freshman

KADEN DIXON
Outstanding Freshman

BROOKE LEONARD
Outstanding Freshman

LOGAN DICKSON
Outstanding Sophomore

TUCKER MCCOY
Outstanding Junior

RAYMOND NG
Staff Rock

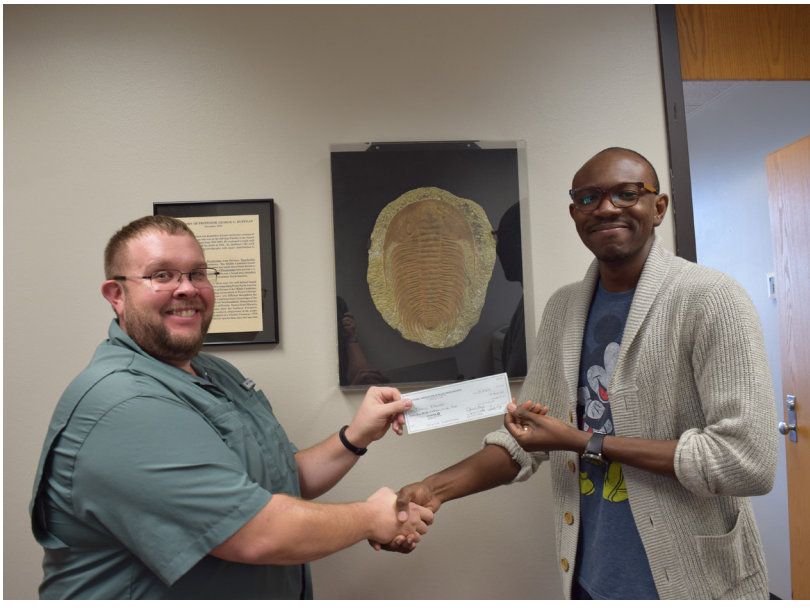
ANDREW RODRIGUEZ
Ben Hare Excellence in Research Award

FOLARIN KOLAWOLE
Ben Hare Excellence in Research Award

ABIDIN CAF
Stan Cunningham Excellence in Teaching Award

STUDENT HONORS AND AWARDS

• Karelia La Marca (fall 2019) received the Provost Certificate of Distinction in Teaching Award
• Colin Pennington received the Mendenhall Postdoctoral Fellowship.
• Dalila Jesus received the Angola Academic Achievement Award for outstanding academic performance and campus involvement.
• The OU SEG Student Chapter was named the Best Chapter Worldwide at the annual SEG meeting.
• The OU AAPG Student Chapter was recognized as an Outstanding Student Chapter at the annual AAPG meeting.
• The OU SEG Evovle Team was honored with several awards during the SEG annual meeting.
• Joy Foluso and Chelsey Gallagher were awarded GSA Graduate Student Research Grants.
• Roberto Clairmont received a grant from the National Association of Black Geoscientists.
• Fola Kolawole was awarded the Superior Academics Scholarship Award from the National Association of Black Geoscientists.
• Jordan Renner received a SIPES Foundation scholarship.
• Marta Anson, Katie Garrett, Hannah Morgan, Jordan Renner and Esra Yalcin received AAPG grants.



CONGRATULATIONS TO OUR 2019-2020 GRADUATES

B.S. GEOLOGY
Bailey Abney
Grace Barber
Tony Bell
Cheyanne Erickson
Francisco Sebastian
Brittney Stroud
Zachary Tomlinson

B.S. GEOPHYSICS
Connor Mears
Peter Reilly
Cameron Wood

M.S. GEOLOGY
Sam Berg
Andy Brown
Laynie Hardisty
Andrew Layden
Daniel Mason
Andrew Rodriguez
Tara Putri
Brittany Tamborello

M.S. GEOPHYSICS
Carl Buist
Karelia La Marca
Angie Ortega Romo
Francis Oyebanji
Hope Williams

PH.D. GEOLOGY
Pierre Karam
Jianjun Li
Carlos Molinares
Dean Richmond
Ming Suriamin
Emilio Torres
Molly Turko
Jing Zhang

PH.D. GEOPHYSICS
Yuji Kim
Folarin Kolawole
Gabriel Machado
Swetal Patel
Colin Pennington
Rafael Pires de Lima

NEW GRADUATE STUDENT FIELD TRIP

CHELSEY GALLAGHER, M.S. STUDENT

Many challenges come along with moving to a new state and starting school in a graduate-level program for the first time, but one of the most challenging parts is the social aspect. Coming to a place where you may not know anyone or know anything about the state can be a significant hurdle to overcome. The School of Geosciences wanted to create something that allowed new graduate students to socialize before the craze of graduate school began, allowing students to meet one another and get to know the geology of the region. Led by Drs. Lynn and Mike Soreghan and Heather Bedle with highlights by Dr. Brett Carpenter, Dr. Andy Elwood Madden and Ph.D. student Fola Kolawole, 15 new graduate students (both master's and Ph.D.) came together to spend several days viewing key geologic features, including stops at Turner Falls, the Wichita Mountains, Lake Elmer Thomas, Vendome Springs and several other locations around Oklahoma.

Not only did we create friendships, but we also got to know several of the geoscience staff and current graduate students who came along to share information about the structure of local quarrys, the geomicrobiology of groundwater, the carbonate sedimentology beneath beautiful waterfalls, advanced petroleum systems in the Woodford Shale, the paleoclimate of Permian redbeds and numerous other fun facts surrounding the surprising geology of Oklahoma. We also stopped to indulge in fried pies, scarfed down some pizza, and had a group dinner in Lawton. After this field trip, we spent the next several months creating new memories through games of trivia, barbecues, lunching between classes, and supporting one another during this new phase of life.

CARBONATE GEOLOGY COURSE ANNUAL FIELD TRIP TO THE FLORIDA KEYS

CARL BUIST, M.S. STUDENT

In October 2019, Dr. John Pigott's carbonate geology class set out on a trip to the Florida Keys to see modern carbonate factories, and reef building organisms. It is difficult to gain a big picture understanding of the past by only looking at fossils and outcrops. Viewing modern environments is essential for understanding how reefs and reef-building organisms potentially lived and how carbonate factories worked in the past. Over the course of nine days, we explored the near shore locations around Florida Keys, the Everglades, the Coffins Patch Reef, Sombrero Barrier Reef, and Dry Tortugas Atoll Reef. Each of these locations presented different areas with unique energy conditions and water depths. More diverse species were present in the deeper calmer areas while less diversity was found in the higher energy, shallow environments.

My favorite day was when we took a boat out to the deeper water and explored the Coffin Patch Reef and the Sombrero Barrier Reef. Seeing all the different corals, sponges and organisms present was amazing. My favorite organisms were the Diploria coral and the rare sea turtle. Learning how these differing environmental conditions affect what types of organisms and species diversity we saw was very enlightening for us. With this information we were able to look at carbonates of the past with a new appreciation and greater understanding, which was very convenient for the next field trip to the Permian Basin.

DEPOSITIONAL SYSTEMS TRIP TO THE SACRAMENTO AND GUADALUPE MOUNTAINS

LILY PFEIFER, PH.D. STUDENT

Dr. Lynn Soreghan's Depositional Systems and Stratigraphy (Geology 4113/5113) class ventured to see world-class outcrops in Texas and New Mexico in a fall fieldtrip to the Sacramento and Guadalupe Mountains. Lead by Dr. Soreghan, 12 upper-level undergraduate geoscience majors and TAs Steve Adams and Lily Pfeifer spent several days stopping to view key outcrops, including the Mississippian Waulsortian mud mounds, Pennsylvanian phylloid algal mounds, and the major facies that compose sub-environments of the Capitan reef system along the Permian Reef Trail. The weather was not ideal in the beginning of the trip, but this did not stop the students from successfully measuring and describing a roadcut section representing transitional marine-terrestrial environments. The trip was not complete, of course, without traditional visits to White Sands National Monument and Carlsbad Caverns!

Top left: Students in the "back reef"; Top right: a photo from White Sands that captures some of the fun weather we experienced!; Above: our students at the top of the Reef Trail.

Students analyzed coal and sedimentary structures associated with inclined heterolithic strata and discussed their impact on heterogeneity and fluid flow within nearby subsurface reservoirs.

Julian Chenin (Geophysics M.S. student) and Juan Acosta (Petroleum Engineering M.S. student) presented a poster at "Amanda's Point Bar".

Students enjoyed lunch at Dillon Reservoir (this is a reservoir characterization course!!).

Geology, geophysics and petroleum engineering graduate students with Dr. Matt Pranter and Dr. Rex Cole. Fluvial deposits of the Cretaceous Mesaverde Group in background.

PICEANCE BASIN FIELD TRIP

DR. MATTHEW PRANTER

Every fall, Dr. Matt Pranter leads a field trip for his graduate-level Reservoir Characterization and Modeling course to the Piceance Basin of northwestern Colorado. Dr. Rex Cole from Colorado Mesa University co-leads the trip. Students learn about the depositional setting, reservoir characteristics, and scale of exceptionally well-exposed Cretaceous fluvial and shallow-marine deposits. The deposits represent shoreface, foreshore, paludal, and meandering- to braided-river environments. The deposits also produce natural gas within 10 miles of the outcrops exposed around the basin margin. Thus, the area is an excellent outdoor laboratory to study these types of depositional systems and reservoirs.

During the field trip, students make observations about the stratigraphic architecture and lithological heterogeneity and discuss concepts previously learned. Students also prepare posters that they present in the field for each of the stops. When the students return to OU, they characterize cores and well logs of the same formations and develop representative 3D reservoir models that they evaluate.


YPF

SEPM'S FIELD EXPERIENCE PROGRAM IN PATAGONIA

DR. LYNN SOREGHAN

Northeastern Patagonia was apparently a party place in the late Miocene, replete with a remarkably diverse fossil record of both marine and continental biota. This, in combination with spectacular outcrops revealing the intermingling of eolian and marine environments, imbued Patagonia as a particularly rich outdoor classroom for the setting of SEPM's (the Society for Sedimentary Geology's) inaugural Field Experience Program.

Former SEPM Council member Dr. Gabriela Mángano (University of Saskatchewan) conceived the FEP as a way of sharing SEPM-based sedimentological and paleontological expertise to students and Young Professionals beyond North America and western Europe. SEPM subsidized many of the expenses, keeping costs for participating students and Young Professionals very low.

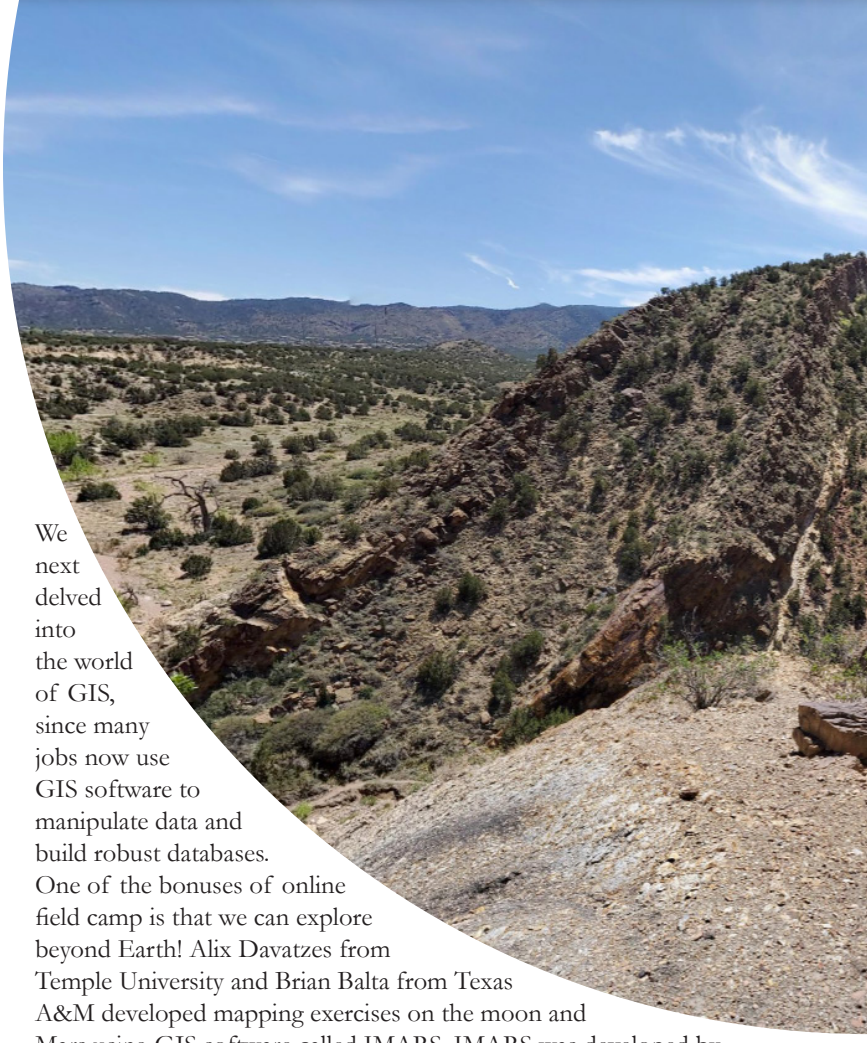
Gabriela, a paleoichnologist (trace-fossil expert), worked with geosciences faculty from the University of Rio Negro (Argentina) — Drs. Noelia Carmona, Juan Ponce and Sylvio Casadio, to develop the outline of the program, and invited two Americans to join the team: Dr. Sally Walker, a paleontologist from the University of Georgia, and me (sedimentology).

Together, we worked with a group of 15 graduate students and Young Professionals from across South America. We spent each field day logging a new section, and mentoring students on sedimentary and paleo attributes, while they patiently mentored us on Spanish. Each evening, students worked on translating their field notes into a coherent story of the Miocene coast, or listened to us give talks.

Across the extent of the preserved Miocene coast, imposing rhea-like creatures ("terror birds") mingled with giant ground sloths, but somehow even the tiny Piglet-esque fairy armadillo found a niche. Clearly, today's world could stand to learn a thing or two from the diversity of the Miocene of Patagonia.

BARTELL FIELD CAMP GOES VIRTUAL

DR. SHANNON DULIN



When the decision was made during spring break to not return to classees, I felt that familiar anxiety creep in. I mean, I always get anxiety as field camp nears, because I want everything to go well. I want everyone to learn and stay safe, I want everyone to learn things, I don't want friendships or relationships to fail during the six weeks living in close quarters in the hot Colorado sun. Most of all, I want everyone to have what I have — the great memories from the camaraderie of hard work, hot days, long nights working on mapping assignments, and vast knowledge I gained during my own field camp in Cañon City.

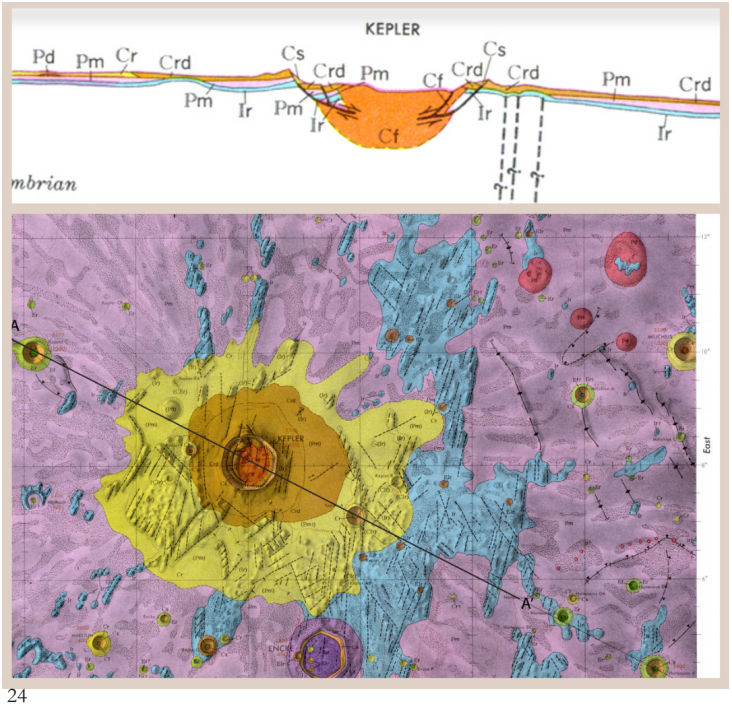
The anxiety this year was different; we had nine OU students and one non-OU student who needed field camp to graduate. And I was going to have to teach field geology…online. Even though I was nervous, I wasn't alone. I'm a member of the National Association of Geoscience Teachers, and through them and field camp directors' group, we organized Zoom meeting after Zoom meeting, starting in March, to develop answers to how we were all going to do the impossible: teach field camp online.

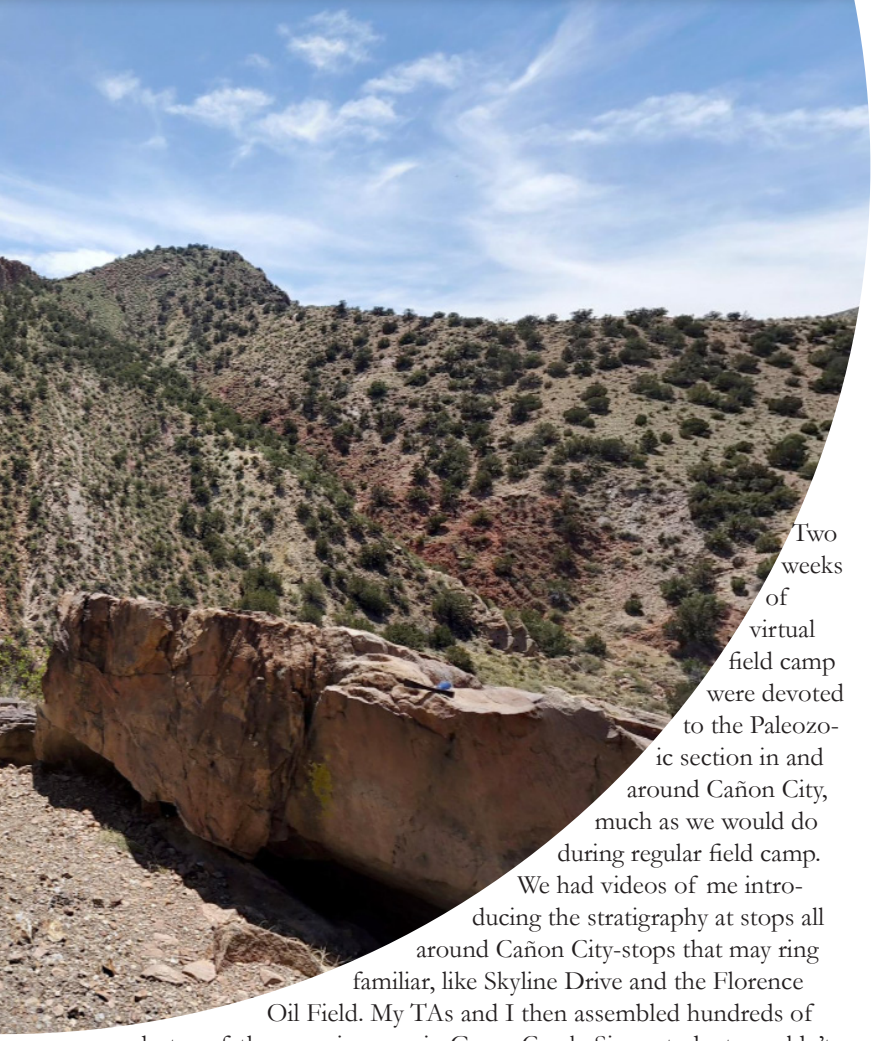
Many schools cancelled their programs for the summer, but students needed the course to graduate. Luckily NAGT has a vast online repository of geoscience teaching materials. Armed with this and our "Tech Thursday" Zoom meetings, we were able to contribute new mapping exercises, revise old exercises to make them work for field camp, and create an extensive menu of field exercises for any and all to use. I've never had a more productive spring semester; working with that dedicated group of individuals made me happy that so many people care about teaching our future geoscientists.

The crash courses in Google Earth Web edition, Google tour builder, and negotiating many virtual geology worlds got my TAs, Alicia Bonar and Steve Adams and I on the right track to build the syllabus. In one NAGT workshop, I worked with 20 others to create nine learning objectives to guide us in creating the curriculum for online field work. Since online work cannot take the place of field work, I decided to focus on the use of different software packages and how they interact with geoscience data. We paired this approach with a stratigraphy and mapping exercise we built using videos and photos of one of our regular mapping areas in Cañon City-Grape Creek. These exercises teach students critical thinking while providing wide exposure to the many ways students might interact with data in future endeavors, whether graduate school or a goverment or private job.

The first project we introduced was a mapping trip through a virtual world. The University of Leeds created virtual worlds in a video game-type atmosphere. You travel through the world, find outcrops, record observations in a virtual field notebook, and navigate the landscape using a virtual compass and a printed topo map.

We next delved into the world of GIS, since many jobs now use GIS software to manipulate data and build robust databases. One of the bonuses of online field camp is that we can explore beyond Earth! Alix Davatzes from Temple University and Brian Balta from Texas A&M developed mapping exercises on the moon and Mars using GIS software called JMARS. JMARS was developed by Arizona State University's Mars Space Flight Facility (jmars.asu.edu), and is used to load satellite and rover pictures from NASA missions onto a GIS platform. The students mapped units on Mars using rover and orbiter data. They also applied the stratigraphic principles of cross-cutting relationships and original horizontality to create a simplified stratigraphic column of units near Kepler Crater on the Moon. They then worked in groups to create cross-sections of the crater. Students learned about impact crater processes (a topic my graduate students have worked on) and the volcanic history of the moon.



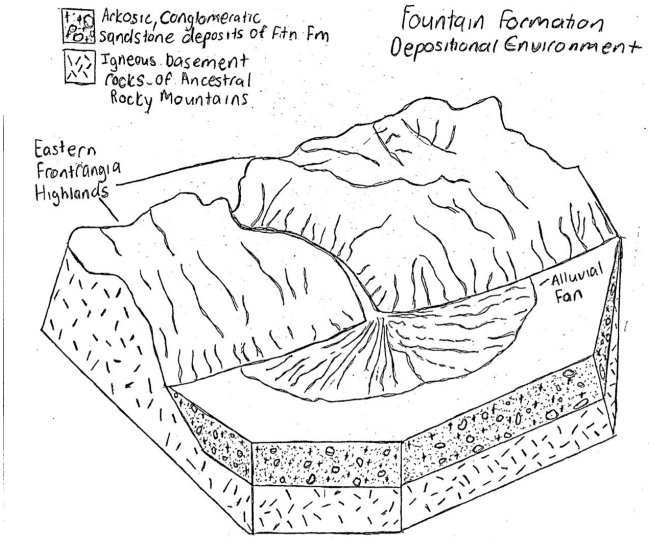


Two weeks of virtual field camp were devoted to the Paleozoic section in and around Cañon City, much as we would do during regular field camp. We had videos of me introducing the stratigraphy at stops all around Cañon City-stops that may ring familiar, like Skyline Drive and the Florence Oil Field. My TAs and I then assembled hundreds of photos of the mapping area in Grape Creek. Since students couldn't take strike and dip measurements, we approximated these observations by taking along-strike oriented photos that displayed the azimuth of the formation. Students then used a digital protractor to record dips of units in their notebooks. We took videos of rocks interacting with hydrochloric acid, so that students could identify rock types. We took close-up photos with grainsize cards and captured hand sample images with a digital microscope. We also were able to create panoramic and 360° images of many outcrops. The students then built a stratigraphic column of exposed units, many of which look like works of art!

The week after we completed the stratigraphy, the students used the Google Earth Web landscape, augmented with hundreds more images, to map unit contacts and create cross sections of Grape Creek. This is a typical mapping exercise that OU and other schools within the Cañon City Embayment conduct every summer. While we couldn't completely recreate the field experience, we provided the students with the data they would need to map the area, which they may have to do in future jobs or during their graduate work. It is one thing to be taken to a field area and led around, but another to have to plan your own exploration of the area (gently guided by myself and the TA) and make your own deadlines to assure you can complete the work. This is an invaluable skill to master before entering the workplace beyond college!

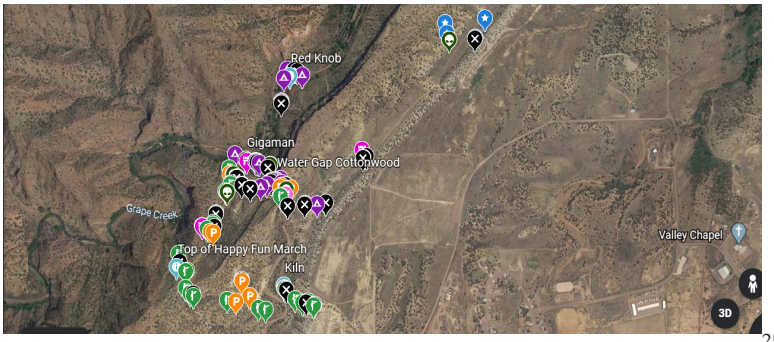
The students still did a regional field trip, albeit a virtual one. Dr. Doug Elmore put together a Google Earth tour of the northern Rockies. Usually this is an in-person field trip to northern Colorado and Wyoming to explore Laramide structures, the Grand Tetons, and the overall tectonics of the area. This year the students virtually visited these places and modern analogs of many of the depositional systems—something we don't get to do in in-person field camp.

We used numerous virutal field trips and mapping exercises, but as of this writing I cannot divulge them - the students are currently working on them!



There were many smaller assignments and field trips that the students took, all from the comfort of home. These virtual experiences gave students the opportunity to see modern environments and geologic processes occurring. The last week, students turned in reports on specific formations, along with figures they had to draft themselves that illustrated how these units formed. Despite not being there in person, the students still saw a lot of rocks, and those observations are what will make them great geologists!

In light of the turmoil in the United States, and the world, I'm glad I had the opportunity to work with my colleagues, my wonderful TAs, and everyone who banded together to make online field camp a reality. I know the students were disappointed to not visit Bartell Field Camp this year, but they did come away with a head full of knowledge about geologic processes, software usage, and a series of job talks from colleagues who were able to visit the class via Zoom. The exercises that we've developed will be used in my field methods class in the coming years. My anxiety about students getting injured in the field was alleviated this year…although my back now realizes that my office chair could sure use an upgrade!



BARTELL FIELD CAMP GOES VIRTUAL

My experience at the OU 'Virtual' Field Camp of 2020 was an interesting one. Though there is a somber realization that there were many missed opportunities to see extraordinary geologic features and experience being out in the field with colleagues who share a similar interest with me, I found the virtual experience to be much more enriching to my college career than expected. This field camp gave me insight into how a workspace environment that is distant from each other can be greatly challenging and frustrating. Yet even with this setback we have all experienced, I found that I learned a multitude more skills and tricks than I had anticipated. Because of this, I feel confident that I have acquired what was intended from a non-virtual field camp. This I must attribute to the amazing teacher Shannon Dulin, and TA Steven Adams. I am sure there were many long nights and waking hours trying to put this together in such a rush. Thank you.

-Branson Harris

Online field camp surpassed my expectations. I will admit that I did not expect much going into this, as I was just disappointed we couldn't do it for real. However, Dr. Dulin and Steven Adams created a workload that I can only imagine would rival what we would have done in Colorado. One skill I improved on a lot this summer is spatial reasoning. Digital camp presents some obvious advantages but also disadvantages as well. It is very nice to be able to hop from site to site which may be miles away in the field but we often only got glimpses of what this looks like on foot. As a result of this, I was forced to think in three dimensions to realize what may be happening in the subsurface. This was my greatest take-away from field. Overall it was a really fun experience and I gained a lot of confidence in my field savvy and geologic interpretations.

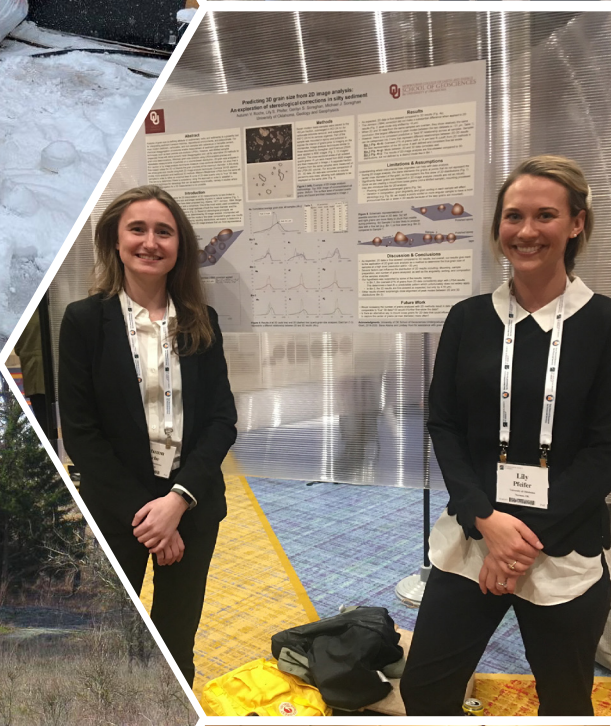
-David Sanger

My experience at virtual field camp went better than I expected and was run very smoothly. I personally liked the JMARs program a lot and I did not expect to get to do mapping projects on mars and the moon. Since I'm doing planetary geology for my master's, this was a great experience for me. I learned a lot about mapping and cross sections even tho it was on the computer and I would argue that certain things were easier to do on the computer. I also got much better at interpreting the geologic history of an area by looking at all the clues and coming up with a deformation hypothesis. Overall even though we were not in the field I feel like my field techniques improved greatly and I got much better at mapping in general. I also learned alot about environment of deposition and got better at using that to interpret where certain rock units should be without even looking close up at the rocks. While I would have liked to be in the field I still feel like this class did a great job at teaching us the necessary skills we will need for our future.

-Bailey Abney



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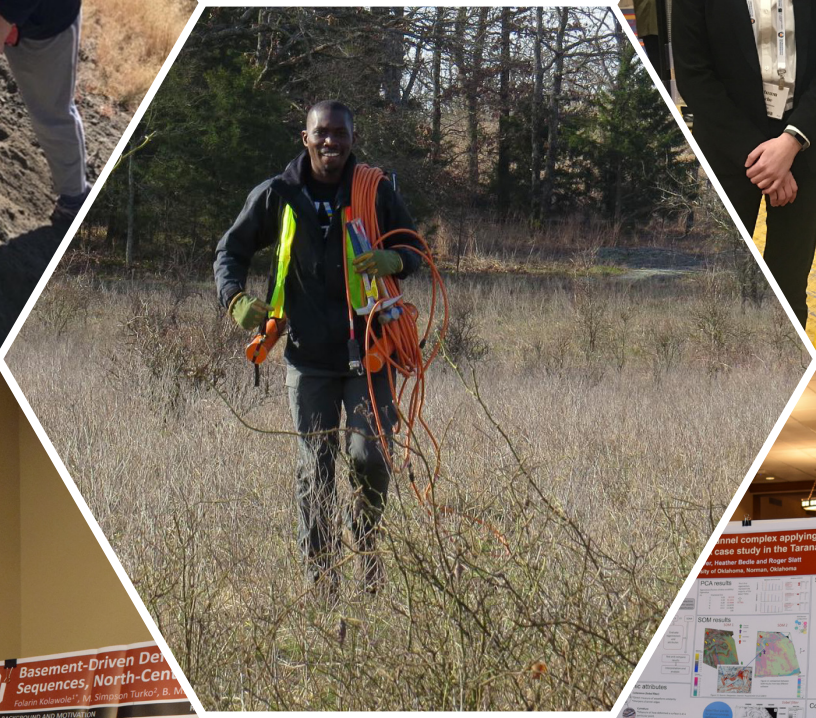
An exploration of stereological corrections in silty sediment


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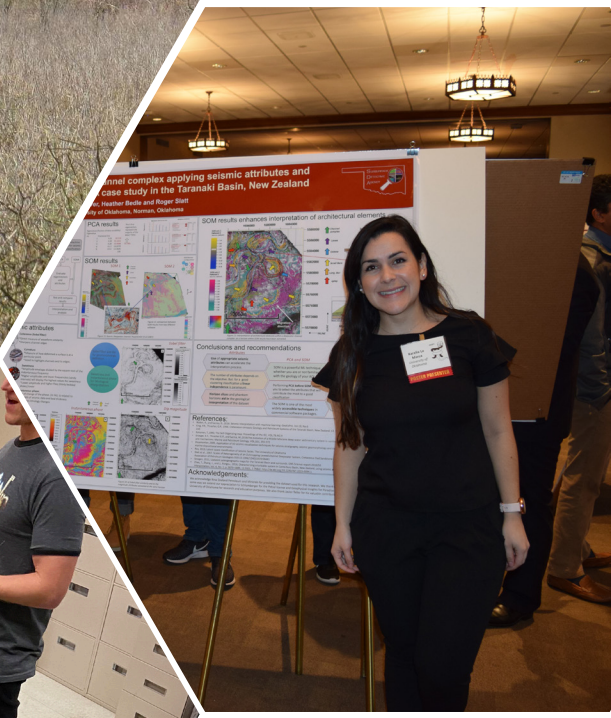
nnel complex applying seismic attributes and
case study in the Taranaki Basin, New Zealand
Heather Bedle and Roger Slatt
PCA results
SOM results enhances interpretation of architectural elements
SOM results
Conclusions and recommendations
References:
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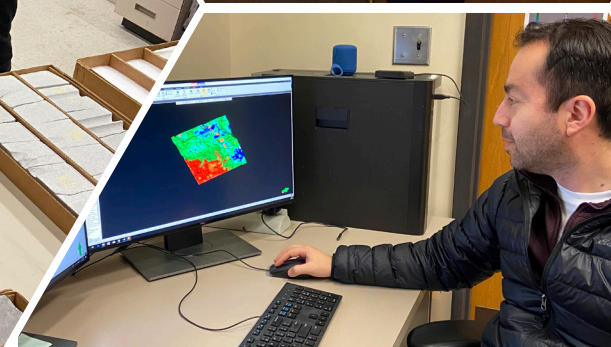


OLD LOESS IN THE OLD WORLD

LILY PFEIFER, PH.D. STUDENT

Ph.D. student Lily Pfeifer and Dr. Lynn Soreghan (together with their French colleagues Stéphane Pochat and Jean Van Den Driessche) have published new work in the Geological Society of America Bulletin documenting loess deposits of early Permian age (~300-285 million years old) in France, preserved as a record of exceptionally thick redbeds. These rocks — similar to the Permian redbeds of Oklahoma — archive evidence of a dusty atmosphere in early Permian time in eastern Pangea. Together with previous work lead by Drs. Lynn and Mike Soreghan (and their students) on loess deposits in the western U.S. (western side of Pangea), this work implies a global distribution of windblown dust in low-latitude Pangea that might be linked to alpine glaciation. This is collaborative work, involving undergraduate students that are a part of Drs. Lynn and Mike Soreghan's NSF-funded France IRES (International Research Experiences for Students) program. We are looking forward to being back in France next summer to learn more!

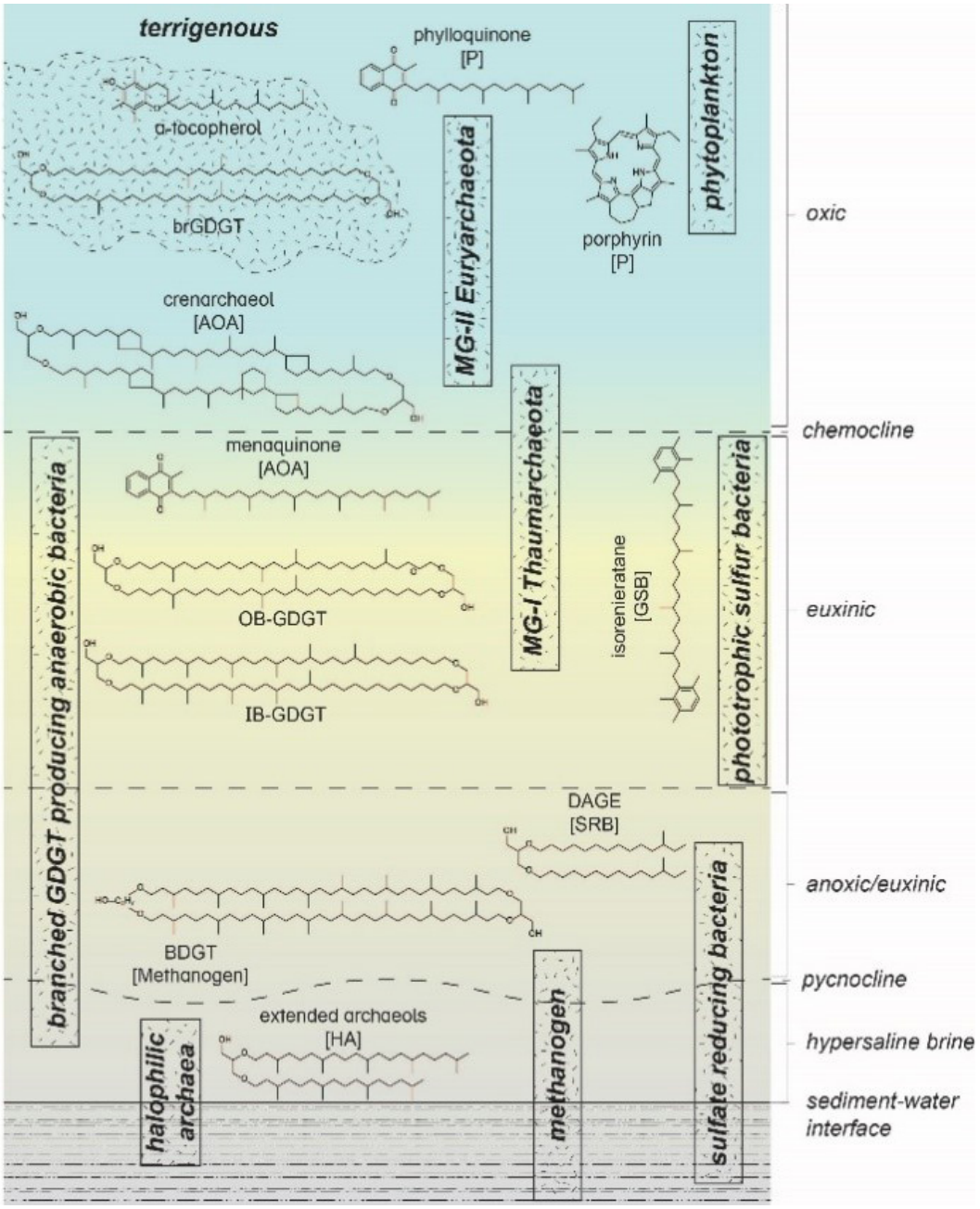
Can you guess what we're spelling here?

Answer: DUST!

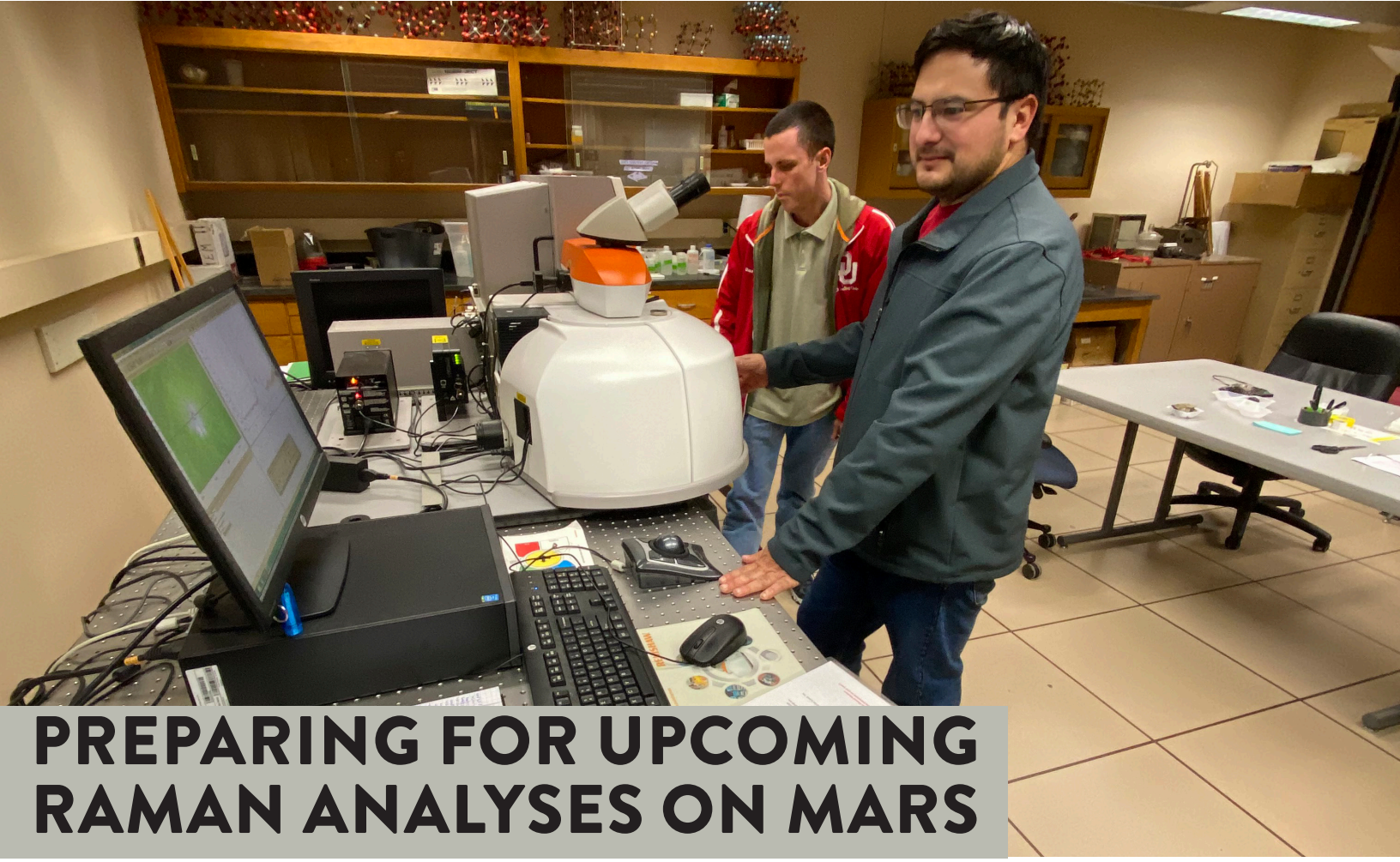
HOLISTIC LIPID BIOMARKER INVENTORY FOR PAST MARINE MICROBIAL ECOLOGY

DR. XIAOLEI LIU AND GREGORY CONNOCK, PH.D. STUDENT

Since last summer, Dr. Liu and students, Gregory Connock, Chenxi Xu and Derek Park, have developed robust liquid chromatography quadrupole time-of-flight mass spectrometry (LC-qTOF-MS) protocol capable of generating a comprehensive lipid biomarker inventory reflective of microbial communities spanning the entire water column. Major lipid biomarker groups characterized by a single injection include intact and fossil derivatives of 1) tetrapyrrole and carotenoid pigments, 2) archaeal and bacterial glycerol alkyl ether lipids, 3) tocopherols and quinones, 4) long chain alkenones and diols, and 5) hopanoids and steroids. Remarkably, this method can also analyze the concentration and isotopic composition of chelated trace metals, such as vanadium, nickel and iron in the form of metalloporphyrins. Integration of the holistic lipid biomarker inventory and chelated trace metals analysis grants unparalleled insight into the response of planktonic microbial communities, residing at different yet specific depths, to vacillating water column chemistry and structure of past ocean.



Recent investigation of oceanic anoxic event 2 (93.9Ma), arguably the most pervasive Mesozoic OAE, revealed undocumented microbial ecological changes coeval with a major perturbation to the biogeochemical cycling of C and N based on isotopic studies. Application of the LC-qTOF-MS method uncovered a diverse molecular fossil record enabling unparalleled insight into the microbial response to widespread marine deoxygenation. These results substantially build on previous biomarker-based efforts traditionally limited to the surface ocean, and constrain interpretations of the C and N isotopic record by providing much needed, site-specific biogeochemical context. Refinement of OAE interpretations is of considerable interest given the increasing similarities between modern Earth and past marine hypoxia. Continued study will focus on improved characterization of the primary producers, with particular emphasis centered on disentangling the spatiotemporal evolution of community composition.



PREPARING FOR UPCOMING RAMAN ANALYSES ON MARS

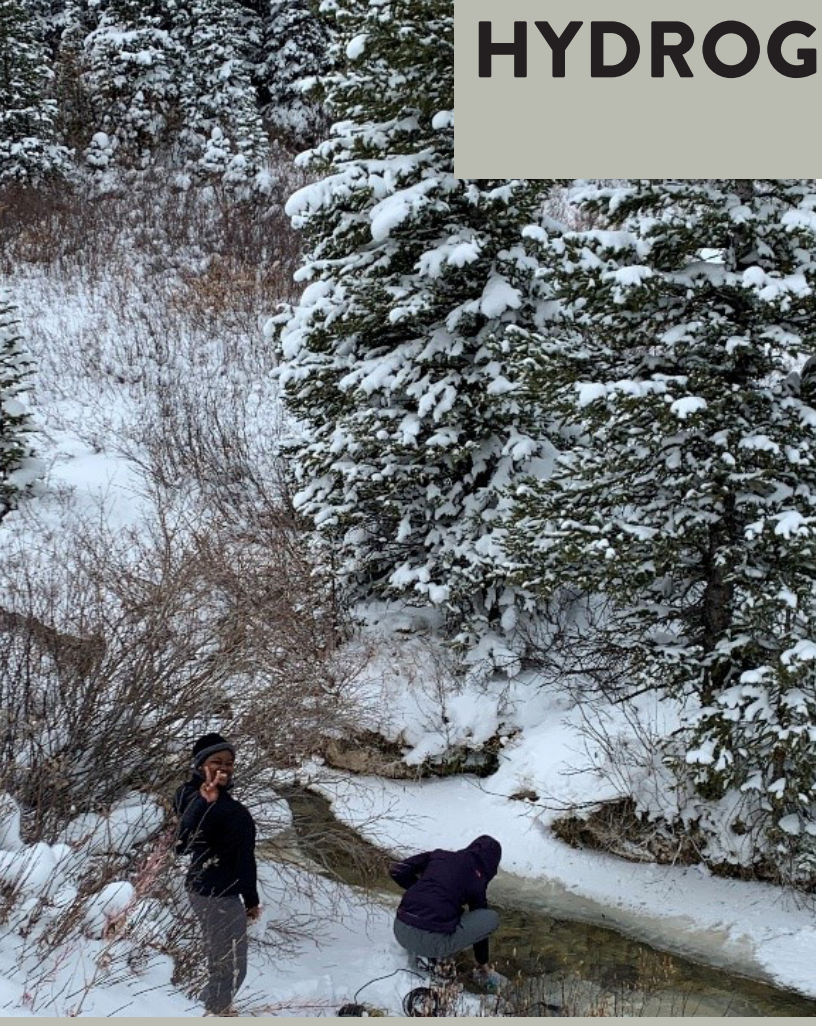
DR. MEGAN ELWOOD MADDEN, DAN MASON AND ANDREW RODRIGUEZ

Master's students Andrew Rodriguez and Dan Mason have been working diligently to shoot lasers at rocks, brines, sediments and ices in preparation for two upcoming missions to Mars. Both NASA's Mars 2020 Rover (a.k.a. Perseverance) and the European Space Agency's ExoMars Rover (a.k.a. Rosalind Franklin) will be carrying Raman spectrometers as part of their instrument toolset designed to characterize the minerals, salts and potential ices and organic molecules found in the "soils" and sediments on Mars. Andrew and Dan have been collecting spectra of brines, rocks, sediments and ices to create a Raman spectral library that mission scientists can use to interpret the spectra they collect from rocks and sediments on the surface of Mars. Raman spectroscopy uses a laser to excite covalent bonds within a sample, causing them to vibrate and release light at a slightly different wavelength. Since different molecules vibrate in different ways and these vibrations change when molecules change phases between liquid, solid and gas, we can use Raman spectroscopy to identify minerals and solutes, as well as detect melting/freezing/evaporation/condensation processes in brines and other solutions.

Andrew Rodriguez's project focuses on identifying and characterizing basalt-brine alteration assemblages using Raman. He reacted basalt chips with different brines for a year, and sampled them at shorter intervals, then analyzed them with Raman and Scanning Electron Microscopy (SEM) to look for evidence of basalt-brine alteration and characterize any new minerals formed during the experiments. He found that iron oxides form relatively quickly as the basalt reacts with the brine. Andrew also identified sulfate and carbonate minerals that formed as the basalts altered, similar to alteration assemblages observed in orbiter data collected from the region draining into Jezero Crater, the Mars 2020 Rover's designated landing site. Jezero Crater contains an ancient delta that drains a region which appears to contain altered mafic rocks, carbonates and clays. Since deltas on Earth are excellent at trapping and preserving organic material, scientists hope that if life was present on Mars before or during the period when the fluvial system was active ~3.5-4 billion years ago, evidence will be preserved within the deltaic sediments. However, if brines were present in the crater or buried sediments, they may have altered the organic matter. Andrew's study provides data needed to identify brine alteration signatures in the mafic sediments.

Dan Mason collected spectra from several planetary-analog brines over a range of temperatures, from 200K -295K (-100°F to 70°F) to investigate how the spectra of brines change as they freeze and thaw. Planetary scientists can use these data to investigate how recurring slope lineae (RSL's) form on Mars. These dark streaks appear on the walls of craters in the low-to-mid latitudes on Mars during the spring and summer months. There are several different models for how they form — perhaps from melting of ice leading to the release of groundwater through seeps or springs in the crater wall, or streaks of salts from much older seeps may deliquesce water vapor from the atmosphere, forming wet patches. A third hypothesis suggests that water or brine may not be involved at all; instead, thermal expansion of dry sediment may lead to grain flows, exposing darker material below that is gradually re-covered by lighter dust. If brine, salts or ice are involved, Dan's experiments will help Mars scientists test these hypotheses if or when a Raman spectrometer gets close enough to zap a streak with its laser!

HYDROGEOLOGY RESEARCH GROUP UPDATES



Joy and Chelsey sampling in a winter wonderland near Montezuma, Colorado after a snowstorm.

DR. KATO DEE

Greetings from the Hydrogeology Research Group and what a busy and exciting year it has been! The first two graduate students joined the group in fall 2019. Chelsey Gallagher completed her B.S. in geology degree from Northern Arizona University. Chelsey will be researching the significance of mountainous watershed DOM during baseflow conditions as related to molecular composition and metal binding properties. Joy Foluso received her B.S. in geology degree from the University of Ibadan in Ibadan, Nigeria. Joy's research will be investigating the hydrology and geochemistry of groundwater and streams in Unaweep Canyon, Mesa County, Colorado. Although the COVID-19 has presented some challenges to our research, mainly a shut-down of the lab, we anticipate that field and lab work will still go on for this summer. Look out for research presentations from our group at TBD conference either this fall or early next spring!

After spending most of my first year at OU setting up the Aqueous Geochemistry Lab, we now have the capability to complete spectroscopic (absorbance and fluorescence) measurements and TOC analysis of dissolved organic matter (DOM). Last year, we sampled three times during snow-melt, summer, and baseflow (fall) conditions to account for seasonal influences on DOM composition (see 2019 Earth Scientist). To say the least, we were successful considering the challenging conditions of a deep spring snow-pack in late-May and a strong winter storm in the fall. Fortunately, Geology undergraduate (Mark Masterson) and Environmental Science graduate (Harper Stanfield) students were able to provide field. You gotta love field work in the mountains of Colorado! Results from these efforts are a continuation of ongoing research related to seasonal effects on DOM plus some slight modifications to our methods to provide more insight into DOM fractionation with metal oxides. Furthermore, several wells and springs were added to begin investigating groundwater DOM composition in the Upper Arkansas River watershed.

In fall 2019, I offered a new course (Field Methods in Hydrogeology) that focuses on field methods in geohydrology. Students conducted in-situ groundwater testing that included slug and pump tests and evalutated data was evaluated in AQTESOLV. Later, we covered various methods used to sample groundwater. Dr. Behm was a guest instructor and covered concepts of hydrogeophysics and supervised a resistivity survey at the Norman Landfill site to delineated the water table. The sudden transition to online delivery during the middle of spring 2020 semester imposed challenges yet a silver lining with a better appreciation on how Canvas can be leveraged to improve even in-class courses.

Dr. Behm providing instructions prior to conducting a resistivity test at the Norman Landfill.

Field Methods class recording in-situ water quality results as part of a groundwater sampling lab exercise.

Jiewen (left in orange vest) and Pranshu (right in green vest) look at a node site, feeling accomplished. (Photo courtesy to Dr. Christine Ruhl from UofTulsa).

CHASING OKLAHOMA EARTHQUAKES

DR. XIAOWEI CHEN

2019 was another great year for the earthquake seismology group I lead.

Former postdoc Qimin Wu published on source complexity of a Mw4.0 earthquake in central Oklahoma, sponsored by the USGS and NSF. The study demonstrated that small earthquakes can be complex, and involve cascading failure of multiple small patches that grow into a bigger earthquake. Student Colin Pennington is continuing this research with more detailed finite-slip inversion, and will submit his work for publication. The complexity in small induced earthquakes motivated Colin to write a proposal to the highly prestigious USGS Mendenhall postdoctoral fellowship program, and he was successful!. We will be waving goodbye to Colin, who will move to the Bay area. Qimin also moved to the Bay area in early 2020. Hopefully the OU team (Qimin and Colin) will continue to excel in California.

At the SSA meeting, student Zach Rosson, co-mentored by Dr. Jacob Walter at OGS, received the best student presentation award based on his study on Oklahoma aftershock statistics, later published in *Geophysical Research Letters*. This study developed a new empirical space-time window for Oklahoma earthquakes, and can be used to make more accurate forecasts in the future.

I collaborated on a project led by Dr. Shirzaei at ASU on forecasting Oklahoma seismicity based on pore pressure and poroelastic modeling. The study demonstrated that better understanding of the physical processes of earthquake occurrence can lead to better predictions, and was published in *Proceedings of the National Academy of Science*, with many news reports.

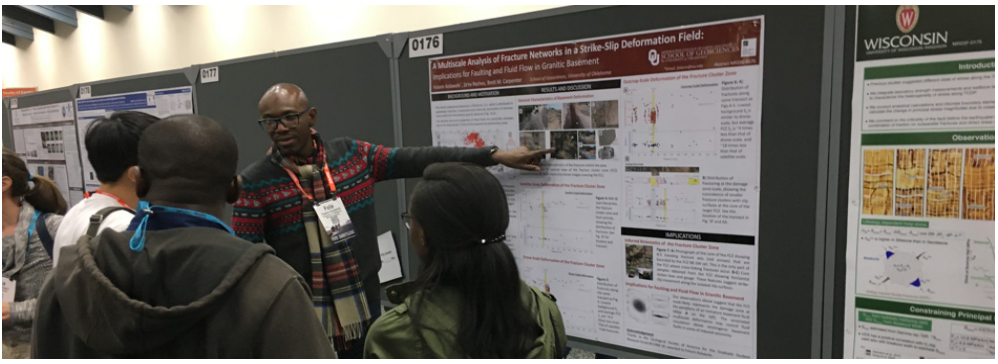
Ph.D. student Yan Qin, went to Los Alamos National Laboratory for an internship. She learned to use machine learning to forecast induced seismicity, and she published a study that summarized Oklahoma stress fields by combining earthquakes and structural geology. The study benefited from collaboration with Dr. Carpenter's group on structural interpretation of mapped fractures, and datasets from Dr. Jacob Walter and Dr. Daniel Trugman at LANL.

I am pursuing permission for road access for a dense nodal array in Cushing. Cushing is the oil hub of the United States, but few people know that the Cushing Fault is extending towards the tanks in the subsurface. In 2016, the fault hosted a M5 earthquake, which caused structural damage to buildings, but fortunately not much damage to the storage tanks. The goal of this nodal array is to understand the anatomy of the Cushing Fault, to better predict future earthquake risk associated with national strategic infrastructures. The deployment benefited from collaboration with Dr. Behm's group and Dr. Christine Ruhl's from University of Tulsa (Figure 1). We collected beautiful, high-quality data!

In December, my group had a record year of attendance at the American Geophysical Union with 9 abstracts, and several happy attendees.

I started another project to collaborate with Oklahoma fiber network providers (OneNet) to turn redundant fiber cables ("dark" fiber) into thousands of seismic channels using distributed acoustic sensing technology. The project has received seed funding from the OU VPR FIP (Faculty Investment Program) as of May 2020.

Left to right: (Dr. Chen's group) Qimin Wu, Colin Pennington, Angie Ortega, Jiewen Zhang, Yan Qin, (Dr. Behm's group) Pranshu Ratre, Zhuobo Wang at AGU fall 2019 meeting. (Photo courtesy of Dr. Carpenter)



DR. CARPENTER'S RESEARCH GROUP UPDATE

DR. BRETT CARPENTER

My research group has continued their work at pace. Numerous themes of research continue and group members have presented their research at numerous conferences:

2019 AAAS National Meeting: Dr. Carpenter
2019 GSA Joint Regional: Dr. Carpenter, Max Firkins
2019 AAPG ACE: Fola Kolawole
2019 ARMA: Will Kibikas
2019 AGU: Dr. Carpenter, Will Kibikas, Fola Kolawole

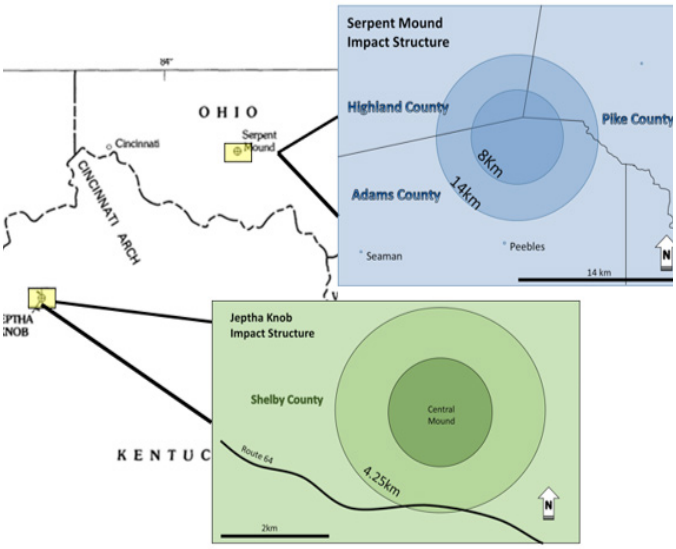
As upgrades to the lab facilities continued, the group focused on field work, 3D seismic interpretation, and lab work with colleagues at Chesapeake Energy. The group continues interest in the structure, behavior and properties of Oklahoma's igneous basement, with applications to sedimentary deformation, induced seismicity, seismic hazard, and the tectonic history of the mid-continent. Group members authored or were involved in journal articles published in *Nature Geoscience*, *Scientific Reports, Journal of Geophysical Research-Solid Earth, AAPG Bulletin, Pure and Applied Geophysics, Tectonophysics, and Basin Research*.

My group, collaborating with Dr. Michael Behm, completed a series of geological and geophysical measurements at their Mill Creek field location, now one of the most extensively studied outcrops of Precambrian basement in the central United States. Undergraduate students Connor Mears and Brittany Stroud helped organize and direct the scientific investigations. Undergraduate Jean-Joel Legre aided as he continued his project on data from the same area. The group has identified a structure that may be a strike-slip fault .

Dr. Carpenter co-convened a session, "Fault deformation during the seismic cycle: from the field to the laboratory," at the 2019 American Geophysical Union Fall Meeting. He also gave colloquium talks at KSU, University of Tulsa, OSU and UT Austin. He was interviewed *The Tulsa World,* AAPG Foundation, NPR Tulsa, Third Pod from the Sun, and the Associated Press.

In 2019, Dr. Carpenter welcomed Jean-Joel Legre (UG), Paul Gilbert (M.S.), Pierre Karam (Ph.D.) and Sai Sandeep Chitta (Postdoc) to the research team. For 2020, Dr. Carpenter would like to congratulate Connor Mears and Brittany Stroud for finishing their undergraduate degrees.

Delcio Teixeira (M.S.) is investigating the Sycamore Formation in the Arbuckle Mountains. Here Delcio is collecting cores.



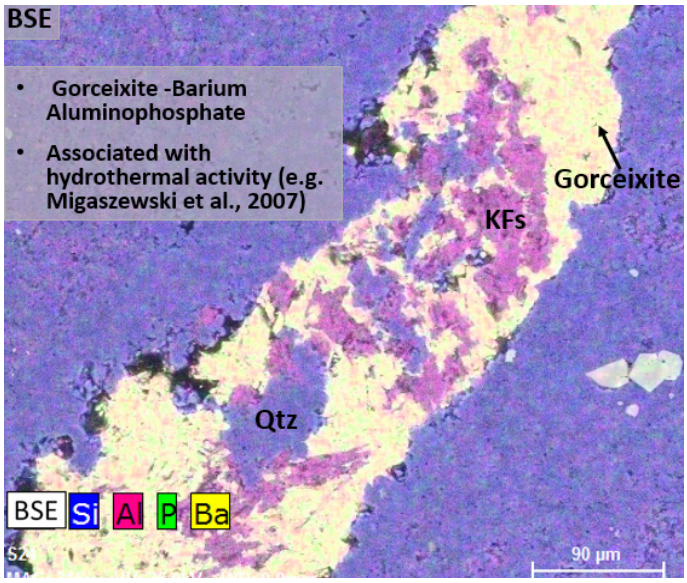
Emily Simpson (M.S.) is testing if she can date the timing of impact at the Serpent Mound and Jeptha Knob impact craters in Ohio and Kentucky (see picture for locations).

Elizabeth Smith (M.S.) is currently conducting an integrated study of Womble Shale in Oklahoma and Arkansas. Picture of Liz and Katie Garrett examining a Womble outcrop in Arkansas.

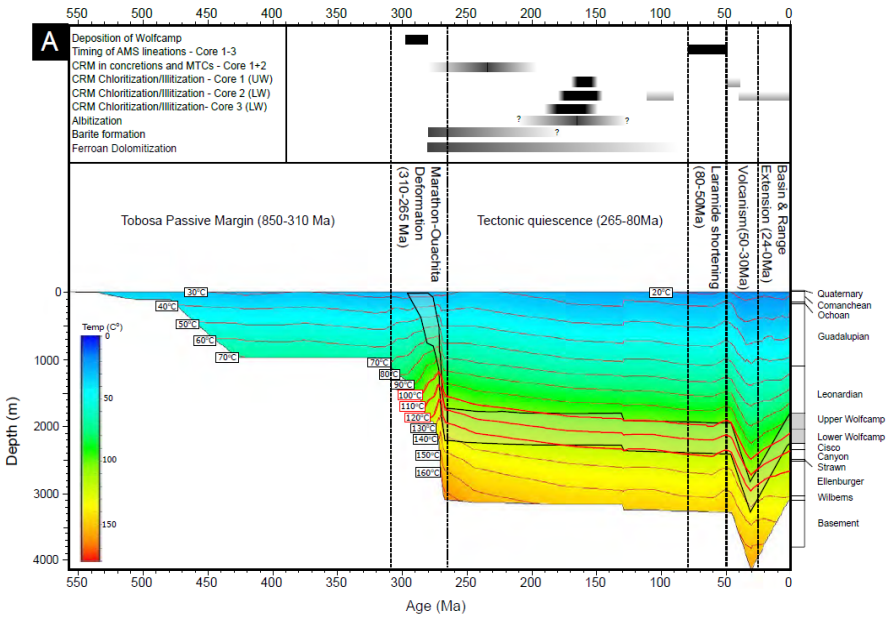
DR. ELMORE'S RESEARCH GROUP

Doug Elmore's research interests include establishing the timing and origin of fluid flow and burial diagenetic events in sedimentary rocks. His students are using an integrated paleomagnetic, magnetic fabric and geochemical approach to date diagenetic events and to investigate the nature of diagenetic alteration. They have completed integrated diagenetic studies of the Wolfcamp Shale and Barnett Shale in Texas, Marcellus Shale in Pennsylvania, as well as the Mississippian formations in Oklahoma.

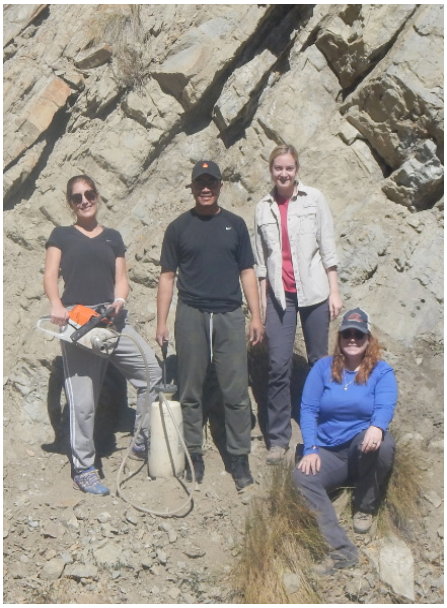
Jennifer Roberts (M.S.) recently published on dating hydrothermal alteration in the Woodford Shale in Oklahoma (Roberts et al., 2019, Geological Magazine, v. 156, 2042-2052.



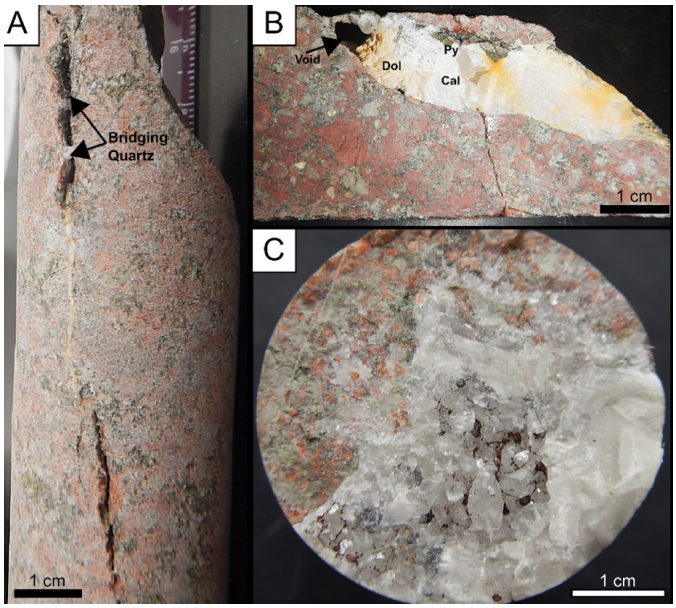
Backscattered electron (BSE) image with elements based on an energy dispersive spectroscopy (EDS) overlay displaying a fracture filled with hydrothermal minerals including gorceixite (yellow-green-pink), potassium feldspar (pink-blue) and quartz (blue). The Woodford contains a Late Permian chemical magnetization indicating alteration by hydrothermal fluids at that time.



Gerry Heij completed his Ph.D., and recently published on the Wolfcamp in Texas (Heij and Elmore, AAPG Bull., 2019; Heij & Elmore, JGR, 2020). The figure above is a 1D basin model with isotherms for Irion County, Texas. The absolute and relative timing of burial events are depicted as a paragenetic sequence and based on AMS, paleomagnetic and textural relationships using SEM.



Marta Anson (Ph.D.) is conducting a paleomagnetic/diagenetic study of the New Albany Shale in Kentucky/ Indiana and a cyclostratigraphic study of the Late Cretaceous Pierre Shale in Colorado. Picture of Marta and drilling helpers (minus Matt).



Matt Hamilton (Ph.D.) is conducting diagenetic and paleomagnetic studies of Precambrian rocks in Oklahoma focusing on developing a better understanding of induced seismicity in Oklahoma (see pictures of porosity in basement fractures) and to determine pole positons to test models for true polar wander. He is also helping Branson Harris, an undergraduate, on dating alteration in a fault zone in the Honey Creek Limestone in the Northern Arbuckle Mountains and working with Stacey Evans (OGS) on a study of Arbuckle dolomites.

Katie Garrett (Ph.D.) is conducting diagenetic studies of the Nonesuch Shale and stromatolites in the Copper Harbor Formation in Michigan, and conducting an integrated diagenetic/paleomagnetic study of tectonic dolomite veins in Ordovician limestones in Kentucky. Here Katie is climbing up the dolomitized fault zone.

Several other students recently finished their M.S. degrees: **Jeff Hardwick** and **Cory Terrell** recently completed studies of the Meramec in Oklahoma, **Calvin Layman** finished his study of the Wolfcamp in the Delaware Basin in Texas, and **Sheridan Mullen** completed her thesis on the Frontier Formation in Wyoming.

Students measure the longshore drift with oranges.

SEDPET FIELD TRIP

Dr. Elmore still takes the SedPet class to examine deltaic deposits west of Ft. Worth and to Galveston Island. Because of COVID-19, the trip in 2020 was virtual.

From the 2019 trip: students are still burying each other in the sand, although they seem to be gettting more creative.

PICK & HAMMER OUTREACH

Dr. Elmore has acquired five years of funding from Halliburton to support outreach by Pick & Hammer Club to K-12 students. The P&H students are good recruiters.

P&H students (back right) after demonstrating to a high school class.

Christina Hamilton (M.S.) recently completed a paleomagnetic and diagenetic study of the Kentland Impact crater in Indiana. In the picture she is pointing to shatter cones in the quarry. Based on her paleomagnetic and diagenetic study, she found that the impact occurred in the Jurassic.

RESERVOIR CHARACTERIZATION AND MODELING LABORATORY (RCML)

DR. MATTHEW PRANTER

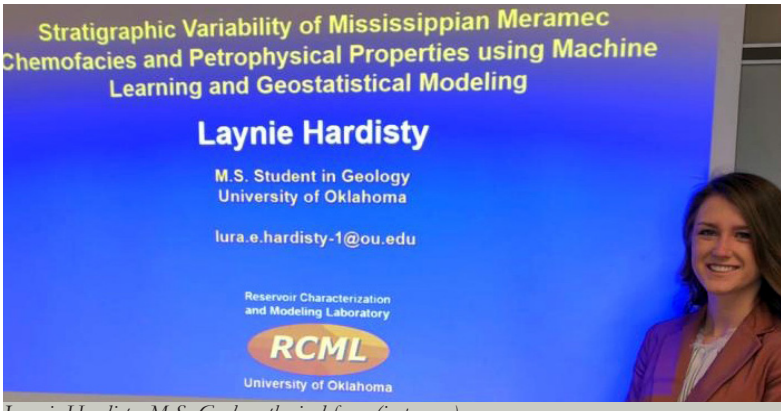
Matt Pranter (Professor and Victor E. Monnett Chair in Energy Resources) and his students conduct research on the sedimentology, stratigraphy, chemostratigraphy, structure and reservoir quality of petroleum reservoirs. During the last year, Fnu "Ming" Suriamin, Javier Tellez, David Duarte, Laynie Hardisty and Hope Williams focused on Mississippian deposits and reservoirs of Oklahoma. Several were sponsored through a grant from Marathon Oil. David Lubo is developing machine learning techniques for petroleum applications (with Dr. Kurt Marfurt). Lindy Dingmore is exploring the Permian Wolfcamp Formation in the Delaware Basin (in collaboration with Drs. John Pigott and Zulfiquar Reza). Javier Tellez, Hannah Morgan, and Spencer Corbett are investigating Cretaceous formations in the Piceance Basin (with Dr. Rex Cole of Colorado Mesa University). Ryan Rosol is studying the Pennsylvanian Marchand Sandstone in south-central Oklahoma (with Dr. Abbas Seyedolali, OGS).

Students continue to use a range of data and methods from outcrops, cores, thin sections, and XRF analyses, to machine learning with well-log and seismic data, to seismic inversion and 3-D reservoir modeling.

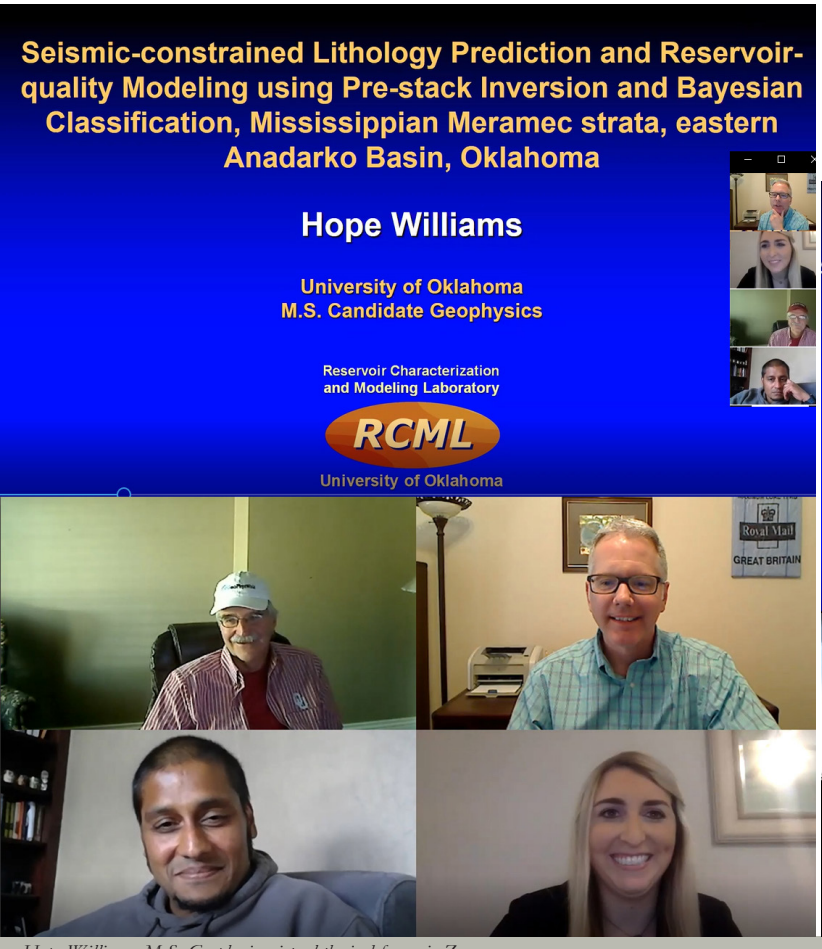
Javier Tellez and Hannah Morgan presented results of their research at the 2019 AAPG ICE in Buenos Aires, Argentina, and 2019 Rocky Mountain Section-AAPG in Cheyenne, Wyoming, respectively.

Several RCML students recently graduated (see images), including Laynie Hardisty (M.S. Geology), Hope Williams (M.S. Geophysics), and Dr. Fnu "Ming" Suriamin (Ph.D. Geology). Given the COVID-19 pandemic, Hope and Ming were my first graduate students to have virtual defenses via Zoom! The RCML welcomes two new M.S. Geology students for fall 2020, Grace Barber and Brittany Stroud; both graduated this May from OU with bachelor of science degrees in geology.

Ph.D. Geology student Javier Tellez presenting at Rocky Mountain Section-AAPG, Wyoming



Laynie Hardisty: M.S. Geology thesis defense (in person)



Hope Williams: M.S. Geophysics virtual thesis defense via Zoom

Fnu "Ming" Suriamin: Ph.D. Geology dissertation virtual defense via Zoom

OU PERMIAN BASIN RESEARCH GROUP

DR. JOHN D. PIGOTT

The OU Permian Basin Research Group focuses on integrating the outcrop with the subsurface in order to understand aspects of the petroleum system evolution of one of the world's most prolific Super Basins: the Permian of West Texas-New Mexico. Supervision of graduate students in their thesis and dissertation investigations in geological-geophysical-petroleum engineering studies are conducted by myself with collaborations with Drs. Heather Bedle, R. Douglas Elmore, Kulwadee Pigott, Matt Pranter, and Zulfiquar Reza. Data for analyses range from public and proprietary domains of acquisition and without exception are state-of-the-art. Topics and students leading the investigations are:

1. LiDar XRF of Yates High Res Seq Strat – Aimee Plowman
2. LiDar of fractures in Bone Canyon and Schmidt Hammer Ductility – Travis Plemmons
3. LiDar integrated with XRF/spectral gamma ray of Bone Canyon Seq Strat – Andy Brown
4. LiDar 3D Seis Strat of sediment gravity flow chutes in Shummard Canyon – Matt Lynch
5. LiDar Schmidt hammer XRF for ductility in Shummard Canyon – Andrew Layden
6. LiDar XRF Hi Res Seq Strat of the Bone Spring Fm at Rest Stop Canyon – Jordan Renner
7. LiDar Schmidt hammer XRF for ductility at Rest Stop Canyon – Ryan Forrest
8. High Res 3D Seis Strat of Leonardian Shelf to Basin SL Response – Cy Frazier
9. Petrophysical High Res Seq Strat of Bone 2 in Northern Delaware – Tyler Bickley
10. Quantitative 3D Seis Strat of the Bone Springs in Northern Delaware Basin – Ru Zhai
11. LiDar XRF analysis of Guadalupian Tsunamiites – Travis Moreland
12. 3D Quantitative Seismic Stratigraphy of the Midland and Delaware Basins – Abidin Caf
13. XRF High Res Chemo-Stratigraphy of McKittrick Canyon – Chenxi Xu
14. LiDar- Schmidt Hammer Forward Seis Model of McKittrick Canyon – Zhuabo Wang
15. Reservoir Modeling of the Bone Spring Fm– Tien Phan
16. Integrated petrophysical-geological-geophysical analysis of resource play production histories – Joseph Snyder

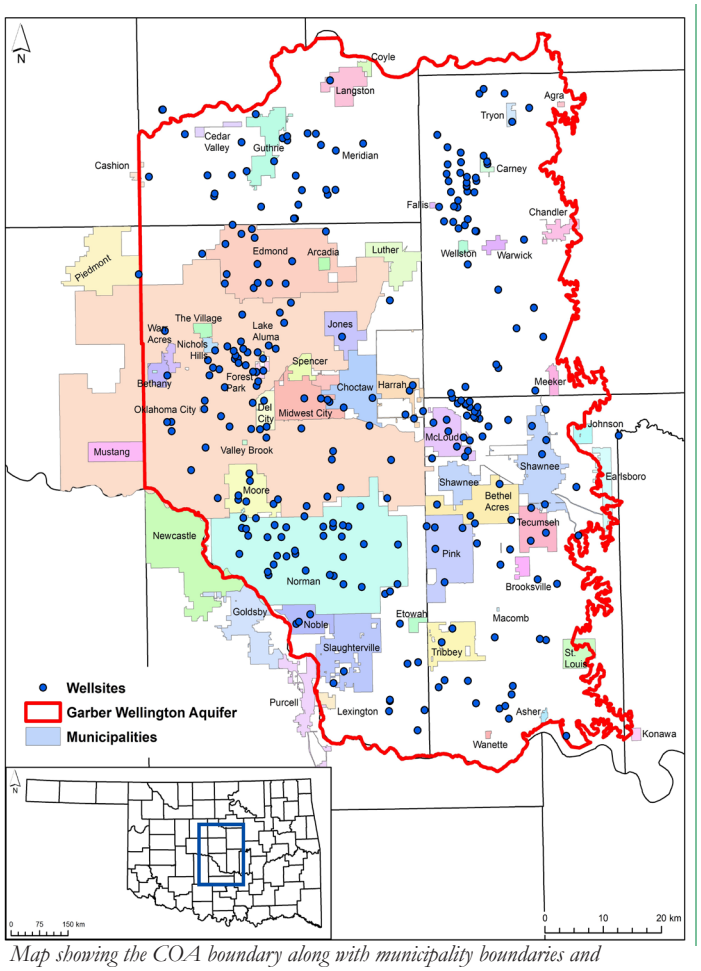
WE'RE #1 - HEXAVALENT CHROMIUM IN THE CENTRAL OKLAHOMA AQUIFER AND THE SECRET INGREDIENT

DR. ANDREW ELWOOD MADDEN

Health effects related to hexavalent chromium in drinking water rose to national attention through the Hollywood film *Erin Brokovich* starring Julia Roberts and based on actual events taking place in the area of Hinkley, California. Chromium occurs naturally in rocks, commonly substituting for ferric iron (Fe(III)) or present in elevated concentrations in certain mafic minerals. Chromium occurs in the non-toxic trivalent Cr(III) form and the hexavalent Cr(VI) form that is toxic at sufficient concentrations. Two national surveys by the nonprofit organization Environmental Working Group in 2009 and 2011 elevated Norman, Oklahoma to attention as having the highest levels of tap water Cr(VI) of any U.S. city included in their network. According to current EPA standards, which set total chromium at 100 parts per billion, Norman's tap waters are in full compliance. Meanwhile, advocacy groups such as EWG advocate for a lower standard. The EPA is currently reviewing the evidence regarding such a change.

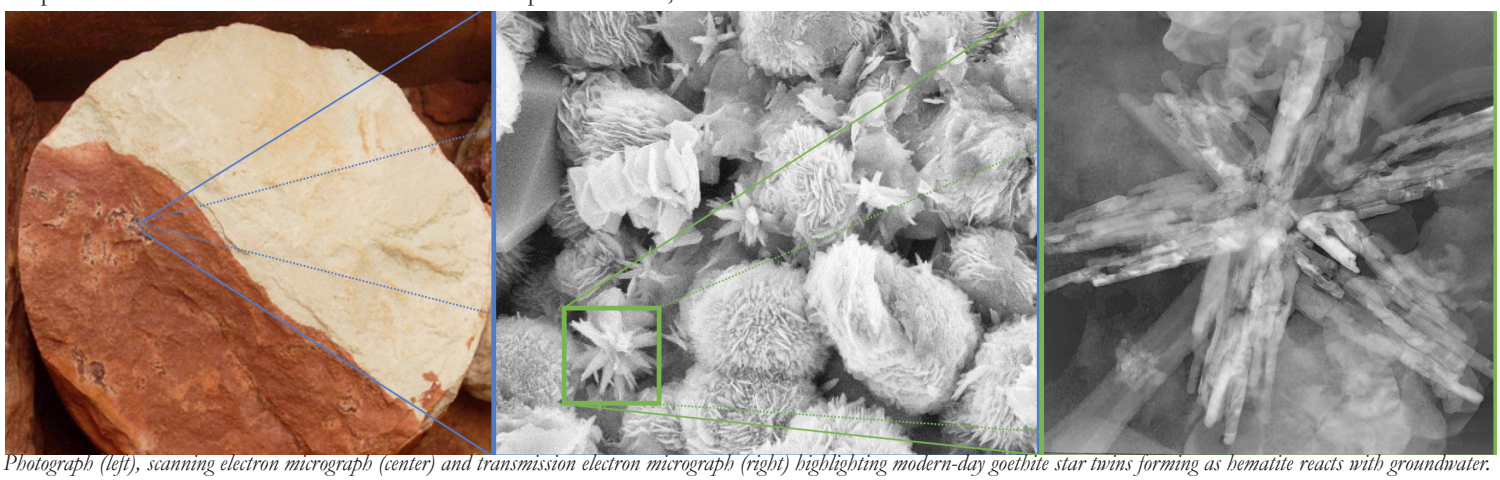
Groundwater from the Central Oklahoma Aquifer supplies approximately a quarter of municipal use in Norman. In the 1980s, the U.S. Geological Survey identified naturally occurring toxic trace elements, such as arsenic, chromium, and uranium. Municipal supply wells are more likely to access deeper, older waters with generally higher trace element concentrations than shallower waters accessed by individual property owners However, not all older deeper waters have higher trace elements.

In the 2000s the USGS, and the EPA, identified the source of arsenic as desorption from iron oxide minerals due to elevated pH. However, the same explanation cannot explain the distribution of chromium in COA groundwaters, indicating other processes are at work.



Map showing the COA boundary along with municipality boundaries and wells used in our recent studies (Brandon Maples).

To understand the aquifer system and uncover the reasons behind the distribution of naturally occurring elevated Cr(VI), researchers working with Dr. Andy Elwood Madden have studied core, outcrop, and groundwater analyses via a range of methods. Students who have worked on the COA include: Jeff Westrop (MS), Andrew Swindle (PhD, now Associate Professor at Wichita State U.), Emma Bachman (UG), Molly Sexton (MS), Brent Weeks (UG), Virginia Priegnitz (UG), Shelbie Bartlett (UG), Sarah van Deventer (UG), Elizabeth Sullivan (UG), and most recently Brandon Maples (MS) and Zach Tomlinson (MS). Additionally, we have collaborated with Dr. Kato Dee, Dr. Megan Elwood Madden, Dr. Qinhong (Max) Hu (UT-Arlington), and Dr. Tingying Xu (UMN) as well as folks at the City of Norman, including Ken Komiske, Chris Mattingly, and Geri Wellborn.



Photograph (left), scanning electron micrograph (center) and transmission electron micrograph (right) highlighting modern-day goethite star twins forming as hematite reacts with groundwater. The nanoscale minerals in the right-hand TEM image were collected directly from groundwater.

Student projects tested several hypotheses to explain Cr(VI), including (1) desorption of chromate ions similar to the story for arsenic, (2) dissolution or equilibrium control by chromate incorporated in barite (hashemite), (3) mixing of Cr-bearing deep brine into aquifer waters, (4) transport of Cr-bearing colloids (tiny minerals that remain in suspension as groundwater moves), (5) release of trace amounts of chromate substituted into dolomite, etc.

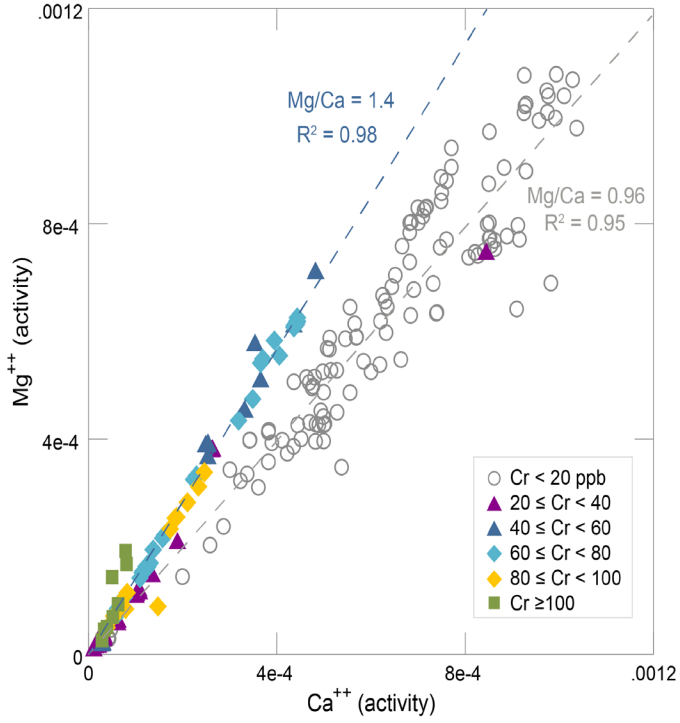
Jeff Westrop demonstrated that the majority of the Cr in the aquifer rock is in the HCl-extractable fraction, which is dominated by hematite nano-microcrystals that give it the red color. The chromium in this fraction exists as Cr(III) substituted for Fe(III). In addition, chromium is also found in smaller amounts in clays and other trace minerals and adsorbed on minerals. His work, supported by other student projects, demonstrated that anytime you see red rocks in outcrop or core they most likely will have Cr as well, but in the non-toxic Cr(III) form. So what causes the widely distributed Cr(III) to change to Cr(VI)?

Our work studying USGS groundwater data for the COA resulted in an interesting observation: groundwaters with elevated chromium almost entirely fell on a trend of excess Mg over Ca. But why would Mg be linked to Cr?

MANGANESE: MISSING INGREDIENT?

Most COA groundwaters are in equilibrium with dolomite - rainwater percolating through the aquifer dissolves dolomite, releasing nearly 1:1 proportions of Ca and Mg. Interestingly, COA dolomite also contains an abnormally high (~1%) concentration of Mn as Mn(II). However, Mn(II) has not been detected in the groundwater. This is not too surprising, as under groundwater conditions we expect Mn(II) to be oxidized to form Mn(III)/(IV) oxide minerals. The formation of Mn oxide minerals in the aquifer is critical to the Cr story: previous lab and field studies demonstrated that manganese oxide minerals are the primary reactant in natural systems, causing Cr(III) to convert to Cr(VI). Thus a likely scenario might be that dolomite dissolution releases Mn(II), which forms Mn oxides and then produces Cr(VI) from Cr(III). However, there are two problems with this. Firstly, a small amount of dolomite dissolution brought groundwaters quickly to equilibrium, shutting down further dolomite dissolution. Also, why then do Cr-bearing waters have elevated Mg/Ca ratios?

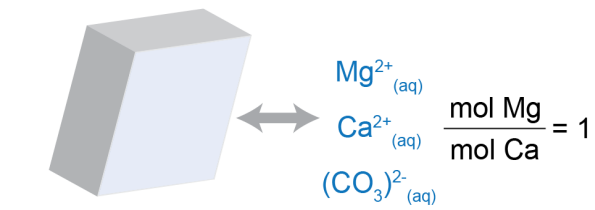
Groundwater Ca and Mg concentrations illustrating Cr-bearing waters have higher Mg/Ca ratios.



CATION EXCHANGE AS AN ENGINE TO DRIVE DOLOMITE DISSOLUTION

Dissolution of Mn(II)-bearing dolomite releases Ca(II), Mg(II), and Mn(II). Clay minerals such as smectite in the aquifer can exchange cations with those in groundwater. In the– COA, some Ca and Mg from dolomite dissolution exchange with sodium in the clay. The clay prefers Ca over Mg, enriching Mg in groundwater as exchange proceeds. Brandon Maples and Zach Tomlinson are using a combination of experiments, GIS, geochemical modeling, and statistical analyses to test the hypothesis that cation exchange can drive further dolomite dissolution. If correct, cation exchange would produce more Mn oxides and convert Cr(III) to Cr(VI). More to come!

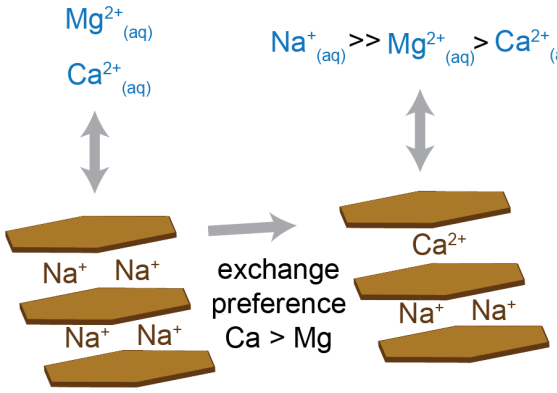
<u>Shallow groundwater; low Na-clay content</u>
dolomite in equilibrium with pore water



dolomite
$(Ca_{0.495}Mg_{0.495}Mn_{0.01})_2(CO_3)_2$

limited Mn(II) release and Mn(III/IV) oxide production

<u>Deep groundwater; high Na-clay content</u>
ion exchange drives dolomite dissolution along flowpath



dolomite temporarily undersaturated due to ion exchange

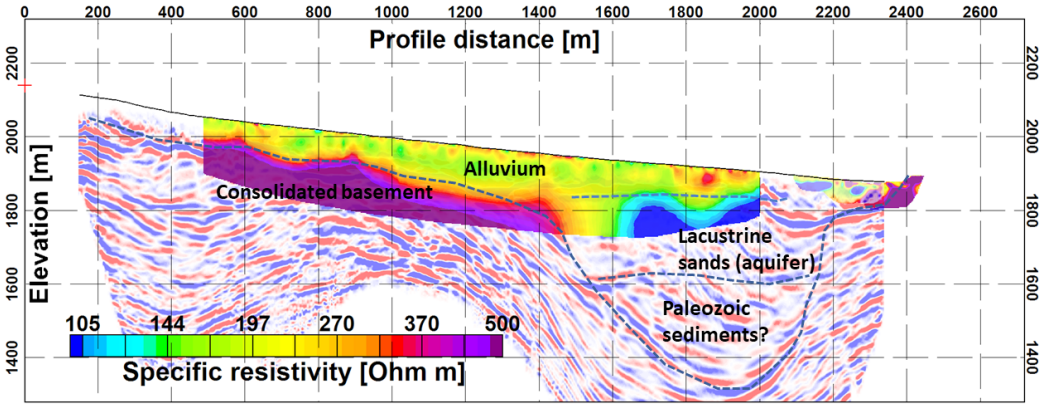
dolomite dissolution
Mn(II) release
Mn(III/IV) oxide production
groundwater Mg/Ca > 1

A DEEP ELECTRICAL RESISTIVITY SURVEY IN COLORADO: THE HUNT FOR UNTAPPED WATER RESERVOIRS USING GEOPHYSICS

DR. MICHAEL BEHM

Unaweep Canyon in westernmost Colorado hosts a spectacular landscape and represents a fascinating geologic history. It is posited to be over-deepened by glacial carving in the Paleozoic which, if confirmed, hints at cooler global temperatures in that time. Recent acquisition and analysis of seismic data provided very strong evidence for glacial over-deepening, and helped secure funding for a drilling campaign through an NSF project led by Dr. Lynn Soreghan. Part of this new project is additional geophysical data acquisition and analysis. The shallow subsurface (<200 m depth) is thought to comprise the record of a catastrophic landslide event in the Upper Pleistocene, leading to damming of the ancestral Gunnison River and deposition of lacustrine sediments. These sands represent a potential aquifer, which would be of significance in this arid region of the United States.

Electrical resistivity tomography (ERT) maps specific electrical resistivity in the subsurface with high resolution. The inverse of resistivity, electrical conductivity, is proportional to the water content of a medium. Consequently, low electrical resistivity can indicate an aquifer. In October 2019, the Applied Geophysics research group set up an ERT survey in Unaweep Canyon along the previous seismic profile. Geophysics graduate students Pranshu Ratre, Deepankar Dangwal, Zhuobo Wang and Dr. Soreghan's PhD student Steve Adams worked three hard days in the field. The exploration target (100 – 200 m depths) required a 1.5 km long profile, realized with two overlapping survey lines. Each survey line comprised 915 m of multi-channel cables and 184 electrode locations to be deployed in an alpine environment. Thanks to detailed planning, the dedicated team of graduate students, and perfect weather, the logistical nightmare was overcome and high-quality data obtained (Figure 3).



Preliminary results support the interpretation of glacial over-deepening by a sudden termination of the high-resistivity basement rocks in the center of the profile. The lacustrine sands in the valley fill exhibit low resistivity, indicating water saturation. Ongoing research aims at a quantitative estimate of the water content through joint inversion and interpretation of seismic velocities and electrical resistivity.

The ERT campaign was accompanied by an outreach component in form of a public lecture and discussion with the community of Gateway, Colorado. This event was very well received on both ends, and we will remember the local beef stew cuisine!

Acknowledgements: This experiment would not have been possible without the support of the entire Gateway community, in particular Nancy Smith, Ray Moores, and Leon Moores, as well as Scott Lissoy for providing property access. This project was funded through NSF. Kate McKinley and THG Geophysics are thanked for renting of additional equipment.

Deployment in the field

A small subset out of 915 m ERT multi-channel cables

JUST ADD A LITTLE LIFE, AND STIR

DRS. LYNN SOREGHAN AND MEGAN ELWOOD MADDEN

Ph.D. student Cansu Demirel-Floyd documents the vast impacts of microbes on silicate weathering.

In Introductory geology, we learn about two types of weathering: mechanical, and chemical, and are told that the former predominates in, e.g. glacial environments, whereas the latter predominates in, e.g. tropical environments. Glaciers crush rocks, but water and heat break chemical bonds.

But it turns out that meltwater streams are veritable soups of cations — exhibiting surprisingly high solute fluxes that belie the extremely low temperatures of these settings. Ph.D. student Cansu Demirel-Floyd, working with us, is probing the reasons for the unexpectedly high rates of chemical weathering in glacial systems by targeting the role of life.

Cansu brings a background in geomicrobiology to her work, which informs both her deep expertise in experimental culture growth, and her healthy respect for her tiny charges — and perhaps explains her penchant for wearing a "Mostly Microbes" T-shirt around the school.

Cansu's research focuses on the role of polyextremophilic cyanobacterial mats on silicate weathering in periglacial settings. "Polyextremophiles" are life forms that can endure multiple extremely harsh environmental conditions, such as cold, nutrient limitation, and intense UV exposure, the types of conditions found in polar glacial settings such as Antarctica's McMurdo Dry Valleys, and mid-high-latitude glaciated regions such as Iceland— the two sampling sites studied to date— as well as the surface of Mars.

Polyextremophiles marshal a host of survival strategies to battle the elements, such as production of pigmentation, extracellular polymeric substances (EPS— a kind of microbial mucous), and cold-active enzymes. But in doing so, they alter their microenvironment by activities such as photosynthesis, which raises pH, and production of organic acids via their EPS. These microenvironmental alterations in turn induce chemical havoc at the molecular level, effectively accelerating chemical weathering.

Cansu's experiments include abiotic controls, and her initial results are demonstrating the significant impact of life on chemical weathering, and on releasing nutrients to fuel further life. It is yet another demonstration of the interconnectedness of the Earth system. Silicate weathering —vastly accelerated by life's effects— represents the primary means by which Earth naturally scrubs excess CO2 from its atmosphere. Cansu's research thus impacts our understanding of Earth's carbon cycle, but also informs the possible effects of life on other planets.

Demirel-Floyd's research is funded by a National Science Foundation Polar Programs grant awarded to Soreghan and Elwood Madden.

SPRING GEOSCIENCES ADVISORY COUNCIL MEETING MOVES ONLINE DUE TO COVID-19

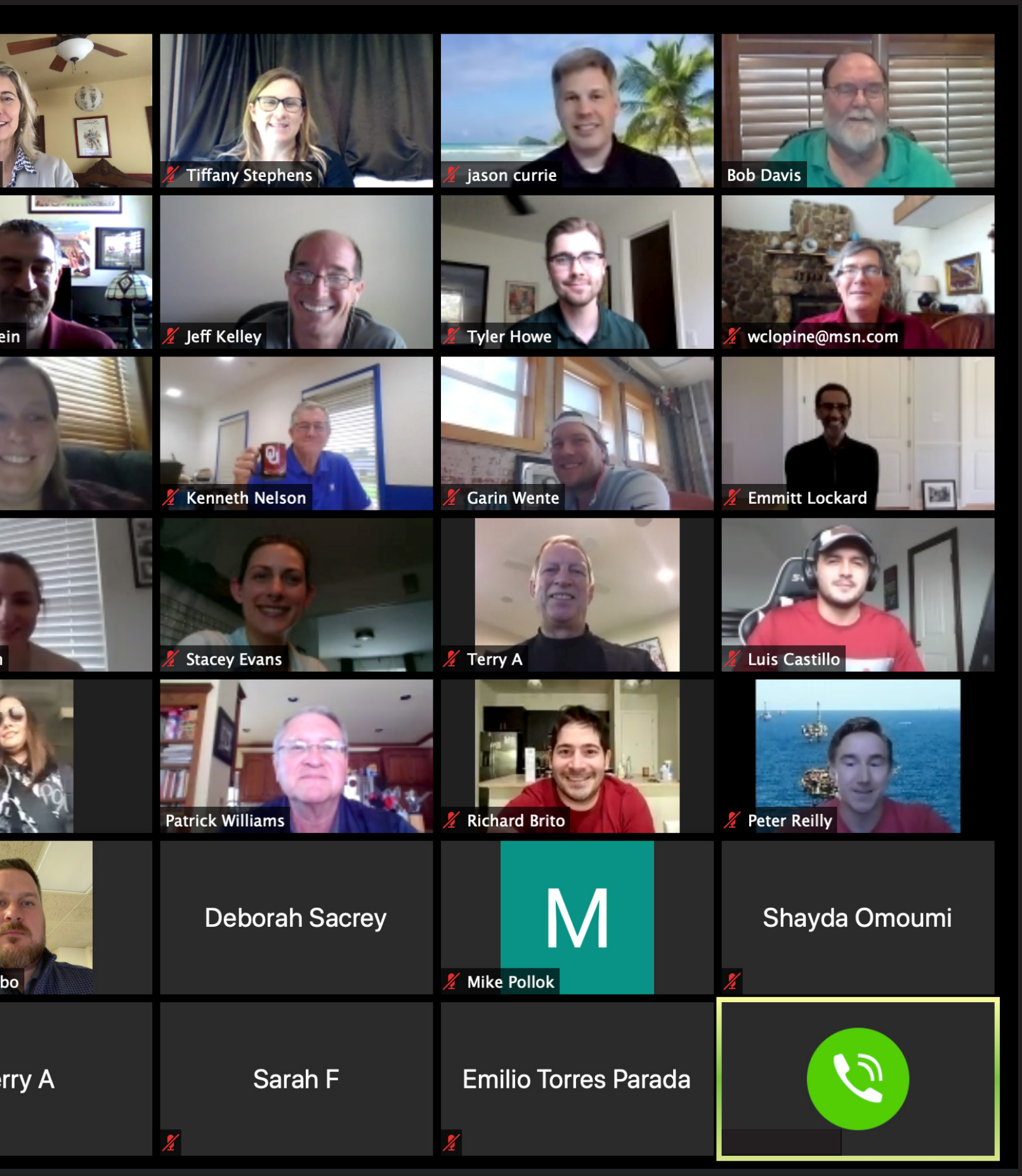
BILL CLOPINE, PAST AAC PRESIDENT

Following social distancing guidance from the university, the April 24, 2020, Spring School of Geosciences Alumni Advisory Council Meeting was moved online. The platform was a Zoom Meeting hosted by the school's director, Lynn Soreghan, and AAC President Raleigh Blumstein. The meeting was well attended with over 50 participants. Dr. Soreghan presented an overview of the school, while Raleigh and other AAC officers covered AAC business and proposed changes to the AAC bylaws.

Looking for silver linings where we can find them, the Zoom Meeting platform allowed for much wider participation than likely would have occurred with an onsite-only meeting. There was active and productive discussion among meeting leaders and participants. Dr. Soreghan, Raleigh and other AAC officers fielded numerous questions and did an outstanding job with their presentations. Several meeting participants commented on how successful the meeting format was, and encouraged making the same online format available in the future.

Making some sort of online meeting option available for AAC members unable to travel to Norman has been discussed for years, but for whatever reason this previously never came to pass. With the uncertainty we now face for future travel and onsite meetings, the online meeting option is an excellent alternative. The AAC president and Dr. Soreghan are to be congratulated for making this option available and for being so well prepared for our first online AAC meeting. Hopefully in the future an online option will remain available as an additional way for AAC members to participate even after we return to having onsite meetings.

To participate in future AAC online meetings on Zoom, AAC members need only to open an account at Zoom.com. It is simple and free for a basic membership. Please consider opening an account and joining us if social distancing guidelines remain in effect or if you are unable to travel to Norman for the Fall AAC Meeting.


Tiffany Stephens
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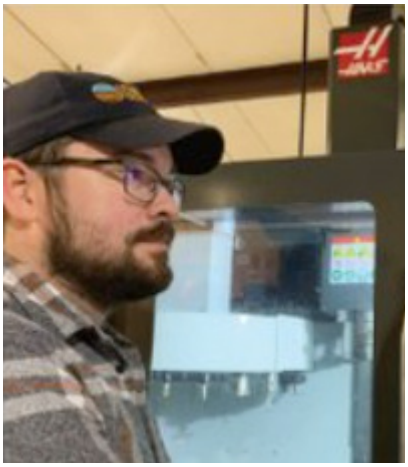
Emmitt Lockard
Stacey Evans
Terry A
Luis Castillo
Patrick Williams
Richard Brito
Peter Reilly
Deborah Sacrey
M
Mike Pollok
Shayda Omoumi
Sarah F
Emilio Torres Parada

ALUMNI NEWS

Andrew Cullen (B.S. '78, Ph.D. '90) says, "I am now only working part time on the executive team for Warwick Investment Group. The extra free time has allowed me to expand some of my research interests in Oklahoma (field-based, socially distant). I am presently awaiting Hg analyses from the Woodford Shale and Arkansas Novaculite; testing these units for a probable volcanic signature that has been documented in similar age rocks in Algeria, Germany, Siberia, and Viet Nam. Over the previous year, I have published several articles in the Shale Shaker and maintained my expertise in the geology of SE Asia by serving as a peer reviewer for several journals."



John Leeman (B.S. '12) says, "I'm operating a successful scientific instrument and prototype compa ny, Leeman Geophysi cal LLC, based in Northwest Arkansas. We're growing rapidly and supplying instru ments, training, and design services to research and commer cial interests"

Aaron Liesch (M.S. '88) says, "I recently retired from ExxonMobil after 31 years working various assignments around the world. I'm currently hiding at home and looking forward to possibly doing some teaching next year."

Robert C. Lewellyn ('56) says, "I'm a retired consulting geologist in Wichita, Kansas."

Fangyu Li (Ph.D. '17) says, "This year I am honored to receive the J. Charence Karcher award from SEG. The prestigious award is the highest award for young geophysicists. This award is given in recognition of significant contributions to the science and technology of exploration geophysics by a young geophysicist of outstanding abilities."

Diane Brownlee Ginther (M.S. '81) says, "Diane is enjoying retirement in the mountains of North Carolina. Fresh mountain air, great views, and room to roam make this the perfect retreat during this crazy time! She and Paul are expecting their first two grandchildren this year, so blessing abound!"

Tiffany Stephens (B.S. '02, M.S. '05) says, "I had a baby girl on April 28th. Edyth Faye was 9 lbs 3.5 oz and 21.5 in long at birth. She is welcomed by me and my husband, Scott, and siblings: Jocelyn, Elijah, and Toviyah."

Photo courtesy of Diane Brownlee Ginther

MEMORIALS

IN MEMORY OF OUR ALUMNI GONE TOO SOON

Albert Allen
Al Basinger
Charles Blackwood
Morris Blumenthal
John Brackett
Paul Crawford
Misak Ekizian
John Ely
James Fambrough
Emma Giddens
John Goffe
A. Hafer
Verlan Harrell
A.V. Jones
Russell Long
Charles Mahaffey
Fred McConnell
Daniel Melton
Betty Moore
Dwight Mundell
George Reid
Russell Roberts
Robert Self
Patrick Shannon
Harold Smith
Elvis Snodgrass
Roger Stephens
Robert "Bob" Stephenson
Frederic Summers
Ronald Thompson
Kenneth Townsend
Billy Ward
R. Warren

"And if this isn't a day when your universe has tilted and something precious you take for granted has not been suddenly irrevocably lost, bow before the mystery and let gratitude wash over you for the miracle of life, health, and this brief walk on our fragile planet."

— Carolyn Moore

Reported as of June 2020 to OU Development

REFLECTING ON MEMORIES OF DR. ROGER SLATT

COMPILED BY PAUL WEIMER, NEIL HURLEY AND ROBERT DAVIS

Roger Slatt, a well-known and influential Honorary AAPG member, died on February 22, 2020, in Norman, OK after treatment for cancer. Slatt had a distinguished career, both in academia and industry, and he was an important leader in the broad field of reservoir geosciences. Born and raised in San Francisco, he received his Ph.D. from the University of Alaska. His first foray into academia was teaching for six years at Memorial University and Arizona State. He then spent 14 years working at Cities Service and at Arco Research and Arco International. Slatt returned to academia in 1992 as the department chair at the Colorado School of Mines. He departed in 2000, when he joined the faculty at University of Oklahoma. At OU, he held the Gungoll Family Endowed Chair; he continued to supervise students until the time of his death.

In industry and academia, Slatt was an early advocate and practitioner of integrated reservoir teams, which combined geology, geophysics and reservoir engineering. Although this approach is commonplace today, it was not always the case. His work helped establish the emerging field of reservoir characterization, with a special and extensive focus on deep-water sandstone reservoirs. He was an early researcher in the study of shales in that he published a book on argillaceous rocks in 1992. Years later, he made important contributions in the development and understanding of tight-rock reservoirs. Slatt did extensive service for many professional groups, and received many honors and distinctions from many different groups and societies.
A longer obituary will appear in the AAPG Bulletin. In the meantime, we would like to illustrate Slatt's influence through testimonials from individuals who worked with him during his career.

While working in industry, Slatt was viewed as an inspiring and supportive manager. As an academic, Slatt worked closely with colleagues to develop research and teaching programs, and he mentored professors, researchers and students. He developed many close working relationships with industry. Slatt felt a strong obligation to students and their careers, especially after universities. He exhibited many ways, but most prominently in his work on student job expos.

"I will miss Roger and I owe him a lot. He was one of my strongest mentors in the early days of the 1980s). He hired me at both Cities Service and at ARCO. He provided me with many opportunities. One of my best managers ever."
-Bob Loucks

"Roger was my first and best boss. I was not his best subordinate. He was both a leader and a mentor to us. Roger had the rare gift of being able to get the absolute best out of the people he managed, and he inspired their fierce loyalty. The lessons Roger taught me about leadership have stayed with me throughout my entire career and helped me greatly in my own."
-Jory Pacht

"I worked with/for Roger the entire time he was at ARCO. He *always* stood up for his people, even during the many 'dark days' when heads were rolling. He saw my potential and did everything he could to support me. I remember after one of the very brutal "reorganizations," I was placed into Roger's group. In our first meeting with Roger's new boss, that boss turned to me and said, 'I don't know who you are or what you do, but Roger said we really need you - we will see.' As it turned out, I was the last research geologist turning out the lights after the BP merger. The Roger quote, which he loved to use at the end of his presentations: 'More work is needed...' I still use it."
-Chuck Vavra

"Roger hired me into his reservoir group at Arco in 1987, and he set up projects that I worked on with some amazing Arcoids in Alaska, California, Gulf Coast, North Sea and Indonesia. Roger instilled in me the benefits of working in multidisciplinary teams, a concept I used as a template in academia when setting up the Australian School of Petroleum. Roger and I co-taught several courses, including Reservoir Characterization, and my students still use his textbook. Another memorable contribution he made to my life was to introduce me to Sushi (via Nakamoto restaurant in Plano, Texas)! Many a fine lunch consuming 'raw bits' with Roger and Linda! Vale Roger Slatt!"
-John Kaldi

"Roger was a mentor to me. Years ago, he wrote an article in AAPG Explorer in which he encouraged professionals to consider leaving industry to pursue academic careers. His main interest was the transfer of acquired knowledge and wisdom to help the students. Roger's article had a big impact on me. Ultimately, I left industry to teach at the Colorado School of Mines, where Roger became my mentor and boss. We had great collaborations together.
I will always fondly remember Roger for his friendship, and his strong focus on field geology. He was a doer, more than a talker. Sadly, the geologic community has lost a great one."
-Neil Hurley

"Roger was a close collaborator for 16 years, in co-teaching courses (both university and external), organizing research conferences and technical sessions, and ultimately co-authoring two books. More than anyone I have ever worked with, Roger was a tremendous, stimulating, creative sounding board for generating ideas, and then transforming them into action. His decision style was one of presenting facts, discussing possible solutions, finding the best one, and then moving on. No drama, histrionics, or excessive chatter. He also placed a high value on investing into his students' careers and future. His passing has created a large void in the geo-community."
-Paul Weimer

"Dr. Slatt has been an inspiring force for hundreds of Geoscience students over decades, not only through his academic teachings and achievements but also through his intellectual curiosity and humble character. His passion for science and forward-thinking consistently pushed his work beyond the edge of knowledge."
-Gabriel Borges

"Ironically despite all the rewarding professional collaborations I enjoyed with Roger over 30 years – from integrated reservoir geoscience to teaching to recruiting many of his students – my fondest and most vivid memories are of gastronomy. During the seminal 1998 AAPG-EAGE Research conference on deepwater reservoirs in Almeria, Spain that he and Paul Weimer co-organized, I introduced Roger to Tapas Bars and he was instantly hooked; his favorite was Iberian Ham ('pata negra'), or as Roger subsequently would say, "bring me some of that blackfoot ham." Later, the dining was in the field in Arkansas, after a morning looking at the turbidites, where he insisted we take the group to the 'world famous' Pig Pit Barbecue. And finally, enjoying dinners with him in Norman, most memorably at his son's restaurant. The pleasure he got from good geoscience was equaled or surpassed by his enjoyment of people and how he was able to interact with us."
-Henry Pettingill

"Roger was one the founders of the various 'Student Expo's' held annually around the country by the AAPG and its AAPG Sections. In 1997, he worked with Mary Beth Hattiburg and Susan Morrice in sponsoring a gathering in Susan's office. The event was attended by 20 students and 3 companies, where the students presented their geologic work and were interviewed for jobs. All in attendance thought this get-together was a good idea, so another such meeting was held the next year. This idea was then seized upon by Mary Broussard in Houston and the first AAPG Student Expo was held at Rice University in 1999.

When he arrived at Oklahoma, he organized the first AAPG Spring Expo at OU in 2001, initially sponsored financially initially by the AAPG, SEG, and numerous companies. He expanded on the Gulf Coast Expo by adding short courses and field trips along with prizes for best student presentations. This 'OU Spring Expo' was the first one annually outside of the Houston area and is now known as The 'Mid-Continent AAPG Student Expo'."
-Dub Peace

A EULOGY

DR. JOHN PIGOTT

Although we know the number of years this little planet which geologically we call Earth exceeds four and half billion, the number of years and days we have on this little planet are not known to us. So the sun rises, and it sets, for each of us.

Well, once upon a time, the day after Independence Day, July 5, 1941, five months before the U.S. entered World War II, the sun rose in Nova Scotia, then Oklahoma, then Colorado, then Arizona, and finally in San Francisco. And that morning a little boy born to Helen and Earl Slatt greeted the world for the first time. His name: Roger Malcom Slatt.

Well, the years began to accumulate and the sun in his life rose a little higher. It was early morning in this little boy's life and in San Francisco one could not ignore the fresh moist sea breezes from the ocean, one could not help but be aware of the international makeup of the peoples and cuisine of the city, and the history of earthquakes in the city, and just perhaps this began to affect his interest in geology.

Then in Roger's life it was the middle of the morning, with the sun at about 10 o'clock. Roger had questions about life, and about science. So he attended San Francisco City College and then California State in San Jose. Now San Jose is an incredibly beautiful place to go to school. He saw the Pacific every day, and here geology really began to tug at his heart. Later in the morning, with the sun higher, Roger continued his education and went on to the University of Alaska where it was a little bit chillier, and where he earned his master's and Ph.D. and, incidentally, began to hone his fishing skills while studying glaciology and river, not exactly sure which he loved most, fishing or the rivers.

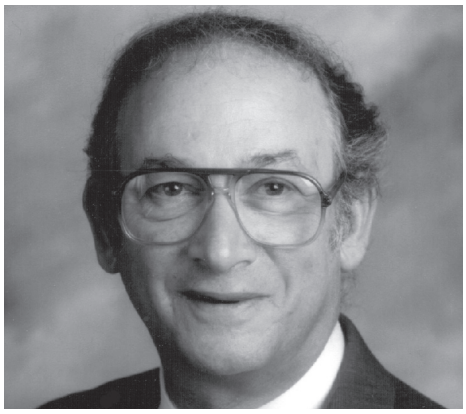
Anyway, it was late morning, and after graduation Roger became an assistant professor at Memorial in Saint John's Nova Scotia. Roger and I spoke about Saint John's several times, and if you have ever visited Saint John's you would be struck by three things: the challenging weather, and the incredible beauty of the seascape, and the tenacity of its people. Roger began work in the ocean by studying the Great Banks.

Well, the sun rose higher that day, and with it his interests in all things sedimentologic, and suddenly Roger's field boots were itching, and he felt he had to travel. He left Nova Scotia to become a professor at Arizona State. Quite a climatic change compared to Nova Scotia, perhaps a bit of global warming. But something deep down in him missed the ocean and he wanted more data that what academia could provide him in sedimentology and stratigraphy, and it must be said, the price of oil began to climb, consequently, just about noon, he joined Atlantic Richfield as a research geologist, and then Cities Service, then back to Arco as their manager of Reservoir Evaluation, which would have been back in California, but Arco had moved to Houston, but oh well, he could still fish.

It was now afternoon. Roger marries Linda, whose wit, charm, and energy was infective to all who met her, and especially Roger, and whose energy helped in no small way propel Roger in his continually growing academic and professional career. With her dance shoes, Linda joined Roger's itchy boots in going out to see the world, its people, its cultures, and its geology. This couple loved to travel internationally.

It is now mid-afternoon. Roger does something really crazy. He leaves Arco to return to Academia, but to become a professor and head of the Department of Geology and Geological Engineering at Colorado School of Mines. He enhances greatly their program in Petroleum Geology by hiring new faculty, and initiating the Student Expo. But after eight years, he and Linda must have become very bored with those mountains and both were thinking about something really flat, where they could finally see where the Sun goes in the evening, and for it not to be hidden behind a mountain; wonder where what could that be?

So as the sun begins to descend in Roger's day, it is now late afternoon. Once again Roger Linda move, this time on May 3, 1999, he flies into Oklahoma to interview for the directorship of the School of Geology & Geophysics. That very day the Bridge Creek-Moore F5 tornado strikes…could this be a message? Apparently not, as Roger takes the position, he both listens and has the ear of the school's alumni, and adds to OU's petroleum geology status and program, in no small way. For example, he brings the Student Expo from School of Mines to OU, and establishes more than one Industry Consortia. Roger's research continues with sedimentation of deepwater deposits and he pioneers research in the Unconventional, laying the groundwork for Woodford Exploration



For Roger, now the afternoon becomes evening, and Linda's day ends, and she departs his life, tearing a part of him away, leaving him alone, with only science and his students. Roger leaves the directorship, but ramps up his research founding the Reservoir Characterization Institute and is appointed as the Gungoll Family Chair. His honors are many, international, and well-deserved for his pioneering work in shales, he publishes more than 150 abstracts and papers, and authors or co-authors half a dozen books, but one should not forget the human aspect. Roger graduates more than 100 students, and helps them find jobs, often in times when the price of oil is not at its highest.

The sun gets even lower in the sky, twilight advances. Roger continues to teach and advise his students, never wanting to quit, though his body suffers and his failing health begin to take its toll. He still plans for the future: planning as he does each year to go fishing in Montana or Colorado, continues being on student committees, but the night is almost here.

Just this last week, he was visited in his hospice at RiverMont by his students, and Yoana brings him the book with the kind words of many of his former students whom he unselfishly continues to help mentally, morally, and financially. Roger never gives up.

These are some of the words they wrote: more than a mentor; proud of you; opportunity; deeply thankful; infectious enthusiasm; guidance; patience; constant support; family; welcomed; kindess; big heart; forever grateful; friendship; wisdom; excellent supervisor; leadership; impressive legacy; work ethic; generosity; you changed my life; profound gratitude; my advisor, my friend, my father; encouragement; passion; great memories; amazing attitude; greatness; sense of humor; inspiration; perfect role model; legacy; compassion; cosmopolitan by heart; wealth of knowledge accessible to everyone; life-changer; committed to education; positive influence; humble character; true explorer; empowering style; selfless person; unique; best example; legend of geology.

The final rays of the sun begin to fade and finally even they are extinguished. Last week the day ended for Roger on this planet, but a day spent well, with a human being utilizing every second to his best ability. Roger smiles. He lets go. The Petroleum legend leaves us as he joins his beloved Linda in the night.

Now, Roger was not known to be particularly religious…but I have learned that he was a closet Protestant. So, if I may be so forward, I would like to quote from St.Paul in the twilight of his life as he wrote to the Corinthians:

O death, where is thy sting? O grave, where is thy victory? … But thanks be to God, which gives us the victory through our Lord Jesus Christ…. Therefore, my beloved brethren, be ye steadfast, unmoveable, always abounding in the work(s) of the Lord, for… your labour, is not in vain...

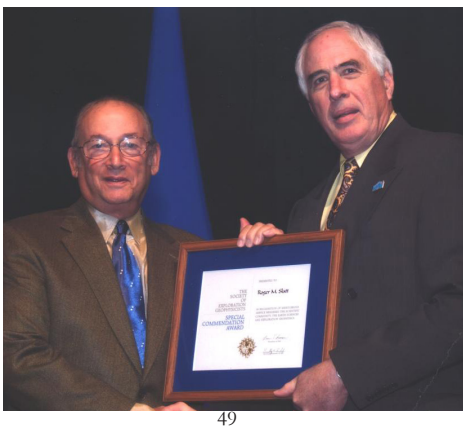
So what is the work of the Lord? It is to care for others.

And Roger Slatt did care for others, his loving Linda, his sons Andrew and Tom, his grandchildren, his students, and his friends, and the University of Oklahoma. Roger cared for them very, very much. One could say that in many cases his love for them was unconditional, indeed, the way we should treat each other.

Each of us are given a day on this planet, but really, we do not know how long that day is. But what is important is not how long that day is, but how we spend that day, for we do have a choice. And Roger made his.

So, let us pause for a moment of personal silence for this man, his life, and what he has meant to us, and the University of Oklahoma.

Well, the sun has set for you Roger. But, some of us believe the sun also rises. Godspeed Roger!



MEMORIES OF BOB STEPHENSON

RECOUNTED BY RAY POTTS

Bob's life was made up of 3-4 areas: Sports, the Baptist Church, OU and Geology.

In sports, he played shortstop at OU and subsequently played AAA baseball for several organizations, including as shortstop for the St. Louis Cardinals. "I asked him once why he didn't stay and he said a curve ball got me." Bob remained involved in OU sports even as he pursued his M.S. in geology. He started a wrestling tournament during Thanksgiving break at OU (which may still be happening), and was a timekeeper for the OU football team at home games.

Bob was very active at First Baptist Church, helping to build a recreational area for the church, and serving as a deacon. He emphasized growing the church and serving the community.

I met Bob working for the Pure Oil Company, where we were both geologists. In 1967, Bob and I formed Potts-Stephenson Exploration together, and we rotated serving as president, flipping a coin to decide who would go first. During a trip to Amarillo, Bob had reserved a room for us at the Holiday Inn. Upon arrival, we were told that the reservation wasn't on file. After sorting things out, they were able to get a room to share with a rollaway bed. As always, we flipped a coin to see who would have to sleep in the rollaway. Bob lost and the bed collapsed in the middle of the night. Bob made a joke about being a president of an oil company and sleeping on a broken rollaway.
"He truly was the most honest man that I've ever been around. Bob was a rarity."

He loved to play practical jokes. He was always playing jokes on people. But one time, the tables were turned, because one thing he did not want was a birthday party! He did not like being the recipient of the Happy Birthday song, but he tolerated it. A staff member made him a cake that was a sponge disguised with icing. Bob had a knife and continually tried to cut the cake, but gave up and ripped the cake in half with his bare hands to reveal that it was indeed a joke.

Bob was an active alumnus, serving on several OU committees. His blood ran Sooner Red— he was always committed to OU.

IN MEMORY OF AL BASINGER

AS PUBLISHED IN THE EXAMINER-ENTERPRISE

Al was born Nov. 5, 1931, in Joplin, MO, the son of A.E. Basinger Sr. and Mildred MacDonald Basinger. From his early years it was clear Al loved his gift of life and thoroughly enjoyed the people in it. In his senior year, his family moved to Bartlesville where Al worked for his dad, an early day waterflooder in Nowata County, while attending high school.

Once he discovered the University of Oklahoma, Al knew he had found the right place. Al received his degree in geology from OU and served in the Air Force for three years. Upon returning to Bartlesville, he realized there were few job opportunities, so he got a truck and an oil lease in Osage County where he drilled his first well. Fortunately, it was successful.

Al married the former Ann Brewer in 1963 and they began 56 years of marriage. They had two sons, Joe and John. During those years Al concentrated on learning new oil production techniques while enjoying his family and surviving economically. He joined Rotary Club and served on several local boards, including the hospital and bank, and continued his friendships in the oil patch and in town. He especially relished his long involvement with the Geology Council at his alma mater, and reunions with Alpha Tau Omega, his college fraternity. The family traveled to Norman, OK, for almost every OU Sooner home game, all becoming and remaining big fans.

During this time, he also modified and received a patent on a downhole drilling tool, which was manufactured in Bartlesville and often used in Al's wells. These ventures increased his business and personal experience. He emphasized that meeting people of widely differing interests and opinions was fascinating, because he loved to tell good stories and hear them in return.

For his part, Al didn't mind admitting he loved boats and planes, fast cars, fine clothes and fancy dining. His taste ran to unpretentious men, witty women, single malt whiskey and mild cigars. He possessed a deep and appreciative laugh which could not be duplicated.

While his lifestyle would not suggest an active religious life, Al believed deeply and never doubted his faith would steer him in the right direction.

REMEMBERING EMMA GIDDENS

DR. JOHN PIGOTT

Memory is a funny thing; it can persist even when the reality that it is founded upon departs. Such is one reality, Emma Lyn Giddens, who departed this world on 25 March 2020. 28 years earlier she began her life in Pasadena California on 6 September 1991, born to Brent Giddens and Kara Salmonson and thus began to etch memories on her parents, her younger sisters Kate and Olivia and indeed all those she touched. Emma was an accomplished athlete, a four-year varsity starter for the Palos Verdes High School lacrosse team which went to the CIF Finals twice during her tenure and doubling as a varsity cheerleader for three years — an unusual combination to say the least. She was a runner, getting her mileage in at the university almost every day, through rain, shine, and challenges. Emma was a remarkable combination of elegance, toughness, grace and grit...qualities that would eventually mold her into a remarkably devoted daughter as well as propel her to elite scientific excellence and accomplishment.

Following high school, she attended Southern Methodist University, earning dual degrees in Math and Geology in four years while doing undergraduate geological research in Jamaica (where I first noticed her). Her passion for geology was first ignited under the guidance of Dr. Matt Hornbach, and further developed through an internship with Hunt Oil Company, which convinced her to pursue a career in petroleum geology. Immediately thereafter, Emma applied and was admitted to the University of Oklahoma's elite ConocoPhillips School of Geology and Geophysics, under my guidance. She eagerly became one of his pioneers in integrating the LiDar to extract lithologic information with the portable XRF in order to determine outcrop mineralogy coupled with photographic image analysis to determine spatial percentages. Emma was such a wizard at integrating these tools that her fellow graduate students at OU often came to for guidance and calibration. Her candle always burned bright from both ends, so it is not a surprise that during her study she was selected as only one of five OU students on my AAPG Imperial Barrel Award Team of 2014, an incredibly intensive international petroleum exploration contest. Emma's presentation skills as well as the others on her team held the judges spellbound in the competition. The team tied for first place out of more than 120 universities worldwide was a incredible accomplishment and Emma cemented her interest in Petroleum then and there. That summer, she joined the IBA team with me on a fieldtrip to England to visit William Smith's geological back yard so-to-speak, and on the way the team could not miss stopping by the IBA namesake: the Imperial College of London. That summer Emma spent a rewarding and valued internship at Devon Energy in Oklahoma City.

Her master's thesis, titled "Pleistocene Coral Reef Destruction in the Florida Keys: Paleotempestite Evidence from a High Resolution LiDar XRF Analysis of Windley Key Quarry, FL." Writing this thesis, and in so doing, she fell in love with carbonate rocks and the Florida Keys. Graduating with an M.S. in Geology in 2016, she asked me where should she go for the Ph.D. and I suggested the University of Miami.

That year, Emma was accepted into the University of Miami's Rosenstiel School of Marine and Atmospheric Science, where she this was her fourth and final year of a Ph.D. program furthering her cutting-edge research in carbonates under the guidance of Dr. Gregor Eberli. Her dissertation was on the "Petrophysical Properties of Carbonate Drift Deposits."

Once again, it should be said that Emma was a woman pioneer in geology. When she presented some of her initial work on the petrophysics of drift deposits at the annual AAPG Convention in San Antonio, it attracted the attention of many, and one in particular: Saudi Aramco. Indeed, they invited her to visit their research laboratory to use their equipment, the first woman to so be awarded. But perhaps the pinnacle of her many accomplishments in such a young life was that she was recently awarded the Gustavus E. Archie Memorial Grant, tragically just days after she passed away. This high honor named after an early pioneer of the exploration of the giant Elk City Field of Oklahoma is only awarded to only two recipients each year. In no small way, her awarding of the Archie grant substantiates Emma's geological intellectual abilities, and, not coincidentally, her Oklahoma connection. This connection was not trivial. Something about Oklahoma stuck. While she loved her undergraduate years at SMU and was driven to be her best by Dr. Eberli in her pursuit of her Ph.D. at "The U" in Miami, there is no question that her academic and professional heart was and will always be in Norman, Oklahoma. For even when Emma was at the University of Miami, she would enthusiastically assist me in lecturing my OU carbonate classes on their fieldtrips to the Keys, would often return to Norman to see the mighty Sooners play, and if Emma were reading this now, she would likely exclaim "Boomer!"and await your response.

But these accomplishments pale with respect to describing Emma as a real human being, one who lived passionately, loved being around people, squeezed the most out of life in delving into good foods, wines, and enjoying a wide variety of music, including since childhood, Tom Petty. One trait that must be stated, one that sometimes ruffled people's feathers is that when Emma encountered something that was not right, she spoke her mind directly and bluntly. When she met a barrier or a force that she felt was wrongly placed in front of her, she was resilient. And as Tom Petty famously said: "Well, I won't back down... No, I'll stand my ground." The well-known phrase "Well behaved women rarely make history" certainly applied to her. Strong, confident and determined, yes, but sensitive beyond reproach. Her family, her friends, those in need, she was there. And her caring was not limited to humans, while in Norman, Emma adopted a special needs cat, named Marci, whom she loved dearly.

Emma is survived by her parents, Kara Salmonson and Brent Giddens, as well as her sisters Kate and Olivia, and her brother in law Andreas Lang. She is also survived by her grandparents Karen Bates, Gerald and Lois Giddens, Barry and Cecilia Evans and many aunts, uncles, cousins and friends, and, of course, her beloved Marci.

Her family has set up with the Foundation a memorial to Emma, a grant which will be awarded annually to "the student who best exemplifies Emma's passion for geology, brilliant scientific mind, kind heart and relentless drive for perfection." Those who wish to post pictures, a testimonial and/or make a tax-deductible contribution, can do so at https://giving.oufoundation.org/OnlineGivingWeb/Giving/OnlineGiving/GiddensMem

Yes, it can be said that memory is a funny thing, but it is often a poignant reality for those left behind. All touched by the memory of Emma Giddens continue to see and hear her in their mind, and many of us with the hope that someday we will see her again. The human mind is and always will be just like that: sadness balanced by hope. Perhaps this is why we treasure Memorials.

IN MEMORY OF A.V. JONES, JR.

AS PUBLISHED IN THE ABILENE REPORTER

A.V. Jones, Jr., a pillar of the Albany, Texas, community and the independent oil and gas industry, died peacefully at home on July 12, following a brief illness. He was 88 years old.

The son of a West Texas wildcatter, A.V. Jones, Jr. started working in the oil patch as a young teenager. Over the course of his long life, he saw the ups and downs of the oil business from every vantage point—from the immediate experience of a gusher or a dry hole, from the excitement of running a thriving company in boom times and the challenges of making it through a bust, from the inside of U.S. politics and the outside of global markets. "I've worked two lifetimes," said A.V., who could still be found working in his office until just recently. "Most people have a career for thirty or thirty-five years, but I've been in the business now more than sixty."

Born on June 30, 1932, in Wichita Falls, Texas, A.V. was ten weeks old when his parents, Alva Vance Jones Sr. and Nellie Ruby Jones, moved with their newborn to Albany. Except for his college years, A.V. Jr. lived in Albany the rest of his life.

He was a member of the First Christian Church of Albany, where he first served on the church board at age 12 when most of the adult men of the community were away in World War II.

As a fullback for the 1948 Albany Lions in his senior year of high school, A.V. was a significant factor in that team's one-loss record. He earned the nickname "Goat" for the way he put his head down like a billy goat and charged forward. "A.V. was known throughout the area as Goat Jones, not just in Albany," says his younger brother and lifelong business partner, Jon Rex Jones. "People knew him as a fine athlete and tougher than a boot." A.V. also played football for Cisco Junior College.

A.V. met his future wife, Pat Lidia, on the football field where she was a cheerleader. He was 14 and she was 13 when they went to a school party together, and they were inseparable from then on. They were married September 12, 1950, and celebrated 69 years of marriage last fall.

While still in high school, A.V. worked in his father's oil business, Jones & Stasney, digging ditches and sitting on wells. After he graduated in 1953 from the University of Oklahoma, A.V. and his father created their own company; they were soon joined by Jon Rex. A.V. Jones & Sons would become one of the most successful and notable independent oil and gas companies in Texas.

When their father died suddenly in 1965, A.V. Jr. and Jon Rex took over the company. A.V. brought to their endeavor a keen understanding of geology and an incisive mind for evaluating deals. The "Jones boys" made their mark as developers of the oil fields in northeast Shackelford County and eventually expanded their oil exploration to the Gulf Coast, Colorado, Oklahoma, Michigan, and internationally. A.V. was always proud of a 1973 front-page feature about the family business in the Wall Street Journal.

He was an early member of the All-American Wildcatters and a leader in the oil industry, serving as president of the West Central Texas Oil and Gas Association, the National Stripper Well Association, and the Independent Petroleum Association of America. In those roles, he testified before the U.S. Congress several times, helped gain approval of the pivotal "Stripper Well Amendment," and advocated for independent oil producers on national television shows, including two appearances on Good Morning America. A.V. remembered, "They wouldn't attack me, because I was a nice, friendly, smiling guy from little Albany, Texas. Part of my charm was that I wasn't quite as smooth as a lot of people expect an oil executive to be."

With a smile that could rival the Texas sun, A.V.'s small-town charm was authentic. He loved his neighbors and took pride in creating jobs and opportunities for the people of his hometown. A.V. and Jon Rex built the Jones family office building on Hill Street in Albany. Over the years, they also helped develop Albany's downtown, the First National Bank of Albany / Breckenridge, and the Old Jail Art Center. Devoted to maintaining Albany's tight-knit and supportive community, A.V. could always be seen at local celebrations. He performed many times in the Fandangle and the Albany Nativity.

In 1962, he became the Albany representative to the West Central Texas Municipal Water District board, helping to develop and manage the Hubbard Creek Reservoir. He would serve many years as board president, and he only retired from the board in 2008, after 46 years of service.

Known as "Grandsir" to his grandchildren, A.V. loved seeing his grandkids grow up in Albany and Abilene, whether cheering on his only granddaughter as a Lady Lion or mentoring his three grandsons in the business of deal-making. He delighted in watching his great-grandchildren experience a Lions football game or their first Fandangle.

In his later years, he focused on investing in other people's ventures and developing portfolios of investment funds for oil and gas deals. "When we tell about some of these deals," A.V. explained not long ago, "people sometimes ask, 'How did you figure that out?' And I would try to explain that it's just about being here, day after day, reading a lot, and having experiences, and then having enough going on that you can act when you see an opportunity. We don't have any special gift or instinct to see what's coming. A lot of people can see it. But doing it takes moxie. You can teach a ten-year-old to do the mechanics of what I do. The part you can't teach is the business insight—'I want that deal, I don't want that one.' Now, there are things we can't do because we don't have enough money. We sure don't have the kind of capital that Exxon has. But those Exxon guys don't get to live in Albany. They don't get to go to a Lions football game on Friday night or quail hunting after work."

A.V. loved quail hunting and his bird dogs. It was always a good day when he could take friends and family out for a hunt on nearby ranchland. As a leader in quail habitat conservation, A.V. received the 2010 Quail Conservation Lifetime Achievement Award from the Texas Wildlife Association Foundation. And in 2013, he received the T. Boone Pickens Lifetime Sportsman Award from Park Cities Quail.

A.V. and Pat's philanthropy also extended to the University of Oklahoma's School of Geology and Mewbourne College of Earth and Energy. Most important to A.V. was supporting Albany institutions, including the public schools, Ben Richey Boys Ranch, Lions football, and the First Christian Church.

A.V. is survived by his beloved wife; two younger siblings, Jon Rex Jones and Jean Jones Tucker; brother-in-law William Tucker; daughter Patti Jones (Gerald Cockrell); son K.C. Jones (Pati); grandchildren Jay Hardaway (Lindsay), Jacob Jones (Barrell), Zach Jones (Sarah Kate), and Madison Jones; nine great-grandchildren; and numerous nieces and nephews. He is predeceased by his sister-in-law, Ann McArron Jones, and by his oldest child, Van Jones.

GEOSCIENCES FACULTY YEAR IN REVIEW 2019

**This document lists, for each faculty member, publications and grants active in CY 2019, classes taught in CY 2019, and graduate students completed during spring 2019, summer, 2019 and fall 2019. Please note that faculty have varied effort distributions, listed as proportions devoted to Teaching (T), Research (R), and Service (S).*

YOUNANE ABOUSLEIMAN
Effort Distribution: T20, R60, S20
Book Chapters
Mehrabian, A., Nguyen, V. X., Abousleiman, Y. N. (2019). "Wellbore Mechanics and Stability in Shale." Shale: Subsurface Science and Engineering Geophysical Monograph Series, Vol. Chapter 11, 197-212. Geophysical Monograph Series. https://doi.org/10.1002/9781119066699.ch11.

Journal Articles
Hull, K. L., Jacobi, D., Abousleiman, Y. (2019). "Oxidative Kerogen Degradation: A Potential Approach to Hydraulic Fracturing in Unconventionals." Energy & Fuels, DOI: https://doi.org/10.1021/acs.energyfuels.9b00104.

Liu, C., Han, Y., Liu, H.-H., Abousleiman, Y. (2019). "Wellbore-Stability Analysis by Integrating a Modified Hoek-Brown Failure Criterion With Dual-Porochemo-electroelastic Theory." SPE Journal, DOI: https://doi.org/10.2118/195685-PA.

Guo, J., Liu, C., Abousleiman, Y. (2019). "Transversely isotropic poroviscoelastic bending beam solutions for low-permeability porous medium." Mechanics Research Communications, Vol. 95, 1-7. https://doi.org/10.1016/j.mechrescom.2018.11.001.

Teaching
PE 2153 Mechanics of Materials

HEATHER BEDLE
Effort Distribution: T40, R40, S20
Manuscripts
Bedle, H. (2019) Seismic attribute enhancement of weak and discontinuous gas hydrate bottom-simulating reflectors in the Pegasus Basin, New Zealand. Interpretations, Vol 7, Iss. 3.

Amonpantang, P., H. Bedle, J. Wu (2019) Multi-attribute analysis for channel element discrimination in the Taranki Basin, New Zealand. Interpretations, Vol.7, Iss. 2.

Grants
Marfurt, Kurt J., Bedle, Heather, "Attribute-Assisted Seismic Processing and Interpretation Consortium," Sponsored by Various Oil Companies, Industry. (January 2008 - December 2020).

Teaching
GPHY 3423 Intro to Petroleum Geology/Geophysics
GPHY 4874 Seismic Exploration
GPHY 5970 Advanced Seismic Exploration
GPHY 6970 Work Flows in 3D Seismic

MICHAEL BEHM
Effort Distribution: T45, R45, S10
Journal Articles
Cheng, F., Xia, J., Behm, M., Hu, Y., Pang, J. (2019). "Automated Data Selection in the Tau–p Domain: Application to Passive Surface Wave Imaging." Surveys in Geophysics, Vol. 40, No. 5, 1211–1228.

Behm, M., Cheng, F., Patterson, A., Soreghan, G. S. (2019). "Passive processing of active nodal seismic data: estimation of VP/VS ratios to characterize structure and hydrology of an alpine valley infill." Solid Earth, Vol. 10, No. 4, 1337-1354.

Behm, M., Walter, J., Binder, D., Cheng, F., Citterio, M., Kulessa, B., Langley, K., Limpach, P., Mertl, S., Schöner, W., Tamstorf, M., Weyss, G. (2019). "Seismic Characterization of a Rapidly-Rising Jökulhlaup Cycle at the A.P. Olsen Ice Cap, NE-Greenland." Journal of Glaciology.

Grants
Soreghan, Gerilyn S., Behm, Michael, Dulin, Shannon A., "COLLABORATIVE RESEARCH: Equatorial Glaciation and Landscape Burial in the Late Paleozoic: Implications for Pangaean Climate and Tectonics," Sponsored by National Science Foundation, Federal, $449,032.00. (September 1, 2019 - August 31, 2022).

Teaching
GPHY 5864 Gravimetric and Magnetic Exploration
GPHY 5970 Geophysics Near-Surface Imaging

Students Completed (Spring 2019 – Fall 2019)
Patterson, Anna, M.S., "Reflection seismic investigation of an alpine valley in Unaweep Canyon, Western Colorado: Evidence of Paleozoic glaciation of the Uncompahgre Plateau."

BRETT M. CARPENTER
Effort Distribution: T40, R40, S20
Journal Articles
Qin, Y., Chen, X., Walter, J., Haffener, J., Trugman, D., Carpenter, B. M., Weingarten, M., Kolawole, F. (2019). "Deciphering the stress state of seismogenic faults in Oklahoma and southern Kansas based on an improved stress map." Journal of Geophysical Research – Solid Earth, 124, DOI: 10.1029/2019JB018377.

Kolawole, F., Johnston, C., Chang, J. C., Marfurt, K. J., Lockner, D., Reches, Z., Carpenter, B. M. (2019). "The susceptibility of Oklahoma's basement to seismic reactivation." Nature Geoscience, 12, DOI: 10.1038/s41561-019-044-S.

Liao, Z., Liu, H., Carpenter, B. M., Marfurt, K. J., Reches, Z. (2019). "Analysis of fault damage-zones using 3D seismic coherence in the Anadarko Basin, Oklahoma." AAPG Bulletin, 103, DOI: 10.1306/1219181413417207.

Reches, Z., Zu, X., Carpenter, B. M. (2019). "Energy-flux control of the steady-state, creep, and dynamic slip modes of faults." Scientific Reports, 9, DOI: 10.1038/s41598-019-46922-1.

Chen, X., Morgan, C., Carpenter, B. M., Reches, Z. (2019). "Weakening mechanisms of Alpine Fault gouge in high-velocity shear experiments." Journal of Geophysical Research - Solid Earth, 124, DOI: 10.1029/ 2019JB017383.

Collettini, C., Tesei, T., Scuderi, M., Carpenter, B. M., Viti, C. (2019). "Beyond Byerlee friction; Weak faults and implications for slip behavior." Earth and Planetary Science Letters, 519, DOI: 10.1016/j.epsl.2019.05.011.

Grants
Walter, Jacob, Ghassemi, Ahmad, Carpenter, Brett M., "Refining principal stress measurements in reservoir underburden in regions of induced seismicity through seismological tools, laboratory experiments, and theory," Sponsored by Electric Power Research Institute, Inc., Non Profit, $495,423.00. (October 1, 2018 - September 30, 2022).

Carpenter, Brett M., "Laboratory Constraints on Slip Evolution in Sedimentary Lithologies," Sponsored by Chevron, U.S.A., Industry, $210,000.00. (September 1, 2019 - August 31, 2022).

Carpenter, Brett M., Chang, Jefferson C., Reches, Zeev, "RAPID: Collaborative Research: GPS observations of post-seismic deformation from the 3 Sep 2016, Mw 5.8, Pawnee, Oklahoma," Sponsored by National Science Foundation, Federal, $16,187.00. (November 1, 2016 - October 31, 2019).

Teaching
GEOL 1104 Dynamic Earth
GEOL 1114 Physical Geology
GEOL 3114 Structural Geology
GEOL/GPHY 4970/5970 Fractures, Faults and Earthquakes

Students Completed (Spring 2019 – Fall 2019)
Shadoan, Tanner, M.S., "Seismic Radiation During Slip Along Bi-material Faults: An Experimental Investigation."

Vera, Alex, M.S., "The Mechanical Characterization of Subsurface Lithologies Using An Integrating Approach; Combining Laboratory Studies, Borehole and Drilling Data and Seismic Information to Explain Hydrocarbon Production in Mature Fields."

XIAOWEI CHEN
Effort Distribution: T40, R40, S20
Journal Articles
Qin, Y., Chen, X., Walter, J., Haffener, J., Trugman, D., Carpenter, B. M., Weingarten, M., Kolawole, F. (2019). "Deciphering the stress state of seismogenic faults in Oklahoma and southern Kansas based on an improved stress map." Journal of Geophysical Research – Solid Earth, DOI: 10.1029/2019JB018377.

Rosson, Z., Walter, J. I., Goebel, T., Chen, X. (2019). "Narrow Spatial Aftershock Zones for Induced Earthquake Sequences in Oklahoma." Geophysical Research Letters, DOI: https://doi.org/10.1029/2019GL083562.

Zhai, G., Shirzaei, M., Manga, M., Chen, X. (2019). "Pore-pressure diffusion, enhanced by poroelastic stresses, controls induced seismicity in Oklahoma." PNAS, Vol. 116, No. 33, 16228-16233, DOI: https://doi.org/10.1073/pnas.1819225116.

Wu, Q., Chen, X., Abercrombie, R. E. (2019). "Source Complexity of the 2015 Mw 4.0 Guthrie, Oklahoma Earthquake." Geophy. Res. Letters, Vol. 46, DOI: 2019GL082690. https://doi.org/10.1029/2019GL082690.

Grants
Neeman, H.J., and 30 others, "Acquisition of a Regional Resource for Long-term Archiving of Large Scale Research Data Collections," National Science Foundation, $967,755.00. (September 1, 2018 - August 31, 2021).

Chen, Xiaowei, "Understanding the triggering process of the foreshock sequence of the 2010 M7.2 El-Mayor-Cucapah earthquake," Sponsored by University of California-Southern California Earthquake Center, University. $25,000. (February 1, 2019 - January 30, 2020).

Chen, Xiaowei, "Collaborative Research: Multi-scale validation of earthquake source parameters to resolve any spatial, temporal or magnitude-dependent variability at Parkfield, CA," Sponsored by National Science Foundation, Federal, $224,262.00. (March 15, 2016 - February 28, 2019, no cost extension to 2021).

Chen, Xiaowei, "Probing the characteristics of earthquake source complexity in areas of structural complexity," Sponsored by University of California-Southern California Earthquake Center, University, $15,000. (February 1, 2018 - January 31, 2019).

Chen, Xiaowei, Jacob Walter, "Roles of stress heterogeneity and stress interaction in induced seismicity: example from the Fairview/Woodward area in Oklahoma", Sponsored by USGS NEHRP program, $52,705. (May 16, 2018 - May 15, 2020).

Chen, Xiaowei, "Improving fracture monitoring of hydraulic fracturing to enhance production," Sponsored by McCoy fund from MCEE, $100,000. (January 1, 2019 - August 31, 2019).

Teaching
GPHY 1103 Adventures in Geophysics
GPHY 4413/5413 Global Geophysics
GPHY 4970/5970 Induced Seismicity

Students Completed (Spring 2019 – Fall 2019)
ROSSON, ZACH, M.S., "AFTERSHOCK DECAY IN SPACE AND TIME OF INDUCED SEISMICITY IN OKLAHOMA."

KATO DEE
Effort Distribution: T40, R40, S20
Grants
Dee, Kato T., "Lower Sullivan Climax Mine PA/SI and Lancaster/Tip-Top Mine Post Removal Action Sampling," Sponsored by U.S. Department of Agriculture, Forestry Service, Federal. (May 10, 2019 - May 1, 2020).

Teaching
GEOL 4633 Hydrogeology
GEOL 5970 Field Methods In Hydrogeology

SHANNON A. DULIN
Effort Distribution: T70, R15, S15
Grants
Soreghan, Gerilyn S., Behm, Michael, Dulin, Shannon A., "COLLABORATIVE RESEARCH: Equatorial Glaciation and Landscape Burial in the Late Paleozoic: Implications for Pangaean Climate and Tectonics," Sponsored by National Science Foundation, Federal, $449,032.00. (September 1, 2019 - August 31, 2022).

Teaching
GEOL 1034 Native Science and Earth Systems
GEOL 1114 Physical Geology
GEOL 1124 Earth History
GEOL 3123 Introductory Field Geology
GEOL 4136 Field Geology
GEOL 4533/5533 Earth's Past Climate

Students Completed (Spring 2019 – Fall 2019)
Rohleder, Nicholas, M.S., "Paleomagnetic Analysis of The Flynn Creek and Wells Creek Impact Structures, Tennessee, U.S.A."

Schwing, Jonathan, M.S., "Magnetostratigraphy of the Pre-Colorado River Integration Lost Cabin Beds, Cottonwood Valley, Arizona."

R. DOUGLAS ELMORE
Effort Distribution: T40, R40, S20
Book Chapter
Wickard, A., Heij, G., Elmore, R. D. (2019). "A diagenetic study of the Wolfcamp Shale in the southeast Midland Basin, West Texas: A petrographic and SEM study of two cores." *Mudstone diagenesis: Research perspectives for shale hydrocarbon reservoirs, seals, and source rocks*: AAPG Memoir 120, Tulsa, OK: AAPG, Vol. Memoir 120, 225–240. AAPG.org.

Journal Articles
Gerhard, H., Elmore, R. D. (2019). "The magnetic fabric of the Wolfcamp shale, Midland Basin, west Texas: Understanding petrofabric variability, hydrocarbon associations, and iron enrichment." AAPG Bulletin, Vol. 103, No. 11, 2785–2806, DOI: https://doi.org/10.1306/04101918140. AAPG.org.

Steullet, A. K., Elmore, R. D., Hamilton, M., Heij, G. (2019). "Remagnetization of Marcellus Formation in the Plateau Province of the Appalachian Basin." Frontiers in Earth Science, Vol. v. 7, No. Article 185, 16, DOI: https://doi.org/10.3389/feart.2019.00185. 810 Sarkeys Energy Ctr.

Roberts, J., Heij, G., Elmore, R. D. (2019). "Paleomagnetic dating of hydrothermal alteration in the Woodford Shale, Oklahoma, USA." Geological Magazine, Vol. 156, 2043–2052, DOI: doi:10.1017/S0016756819000360. www.cambridge.org/geo.

Grants
Elmore, Richard D., "Diagenetic study of Meramec, Major and Garvin counties, Oklahoma," Sponsored by Devon Energy Corporation, Industry, $97,093.00. (January 30, 2017 - June 30, 2019).

Teaching
GEOL 3233 Sedimentary/Petrology
GEOL 5003 Diagenesis
GPHY 5364 Paleomagnetism

Students Completed (Spring 2019 – Fall 2019)
Hamilton, Christina, M.S., "A Paleomagnetic and Diagenetic Student of the Kentland Impact Crater."

Layman, Calvin, M.S., "Core Based Depositional, Chemostratigraphic, and Diagenetic Analysis of the Upper Wolfcam, Southern Delaware Basin, Texas."

Mullen, Sheridan, M.S., "Deltaic Sedimentation of the Late Cretaceous Frontier Formation in the Southeast Bighorn Basin, Wyoming."

ANDREW S. ELWOOD MADDEN
Effort Distribution: T35, R40, S25
Grants
Krumholz, Lee R., Callaghan, Amy V., Madden, Andrew S., Sankaranarayanan, Krithivasan, "RII Track-2 FEC: Building Genome-to-Phenome Infrastructure for Regulating Methane in Deep and Extreme Environments (BuG ReMeDEE)," Sponsored by South Dakota School of Mines and Technology, $1,414,387.00. (August 1, 2017 - July 31, 2021).

Teaching
GEOL 1033 Earth, Energy, Environment
GEOL 1114 Physical Geology
GEOL 6970 Clay Mineralogy

Students Completed (Spring 2019 – Fall 2019)
Hullaster, Desiree, M.S., "Redox interfaces in the proximal Permian Cutler Formation, Mesa County, Western Colorado."

MEGAN E. ELWOOD MADDEN
Effort Distribution: T25, R40, S35
Grants
Elwood Madden, Megan E., "Characterizing the geochemical formation conditions of jarosite and alunite outcrops on Mars in the context of lab experiments and field observations," Sponsored by SETI Institute, Non Profit. (November 1, 2019 - April 30, 2022).

Elwood Madden, Megan E.,"PDART Step-2: Raman Spectral Database of Aqueous Solutions for Planetary Science," Sponsored by NASA - Headquarters, Federal. (February 13, 2018 - February 12, 2021).

Soreghan, Gerilyn S., Elwood Madden, Megan E., "Quantifying Surface Area in Muds from the Antarctic Dry Valleys: Implications for Weathering in Glacial Systems," Sponsored by National Science Foundation, Federal, $351,785.00. (June 1, 2016 - May 31, 2019).

Teaching
GEOL 3063 Exploring Planetary Worlds
GEOL 4223/5223 Principles of Geochemistry
GEOL 6970 History of Water on Mars

MICHAEL H. ENGEL
Effort Distribution: T50, R30, S20
Teaching
GEOL 1104 Dynamic Earth
GEOL 3633 Introduction to Oceanography
GEOL 5343 Stable Isotope Geochemistry

XIAOLEI LIU
Effort Distribution: T40, R40, S20
Journal Articles
Lü, X., Liu, X., Xu, C., Song, J., Li, X., Yuan, H., Li, N., Wang, D., Yuan, H., Ye, S. (2019). "The origins and implications of glycerol ether lipids in China coastal wetland sediments." Scientific Reports, Vol. 9, No. 1, DOI: 10.1038/s41598-019-55104-y. http://dx.doi.org/10.1038/s41598-019-55104-y.

Zeng, Z., Liu, X., Farley, K. R., Wei, J. H., Metcalf, W. W., Summons, R. E., Welander, P. V. (2019). "GDGT cyclization proteins identify the dominant archaeal sources of tetraether lipids in the ocean." Proceedings of the National Academy of Sciences (PNAS) Vol. 116, No. 45, 22505-22511, DOI: 10.1073/pnas.1909306116.

Liu, X., Russell, D. A., Bonfio, C., Summons, R. E. (2019). "Glycerol configurations of environmental GDGTs investigated using a selective sn2 ether cleavage protocol." Organic Geochemistry, Vol. 128, 57-62, DOI: 10.1016/j.orggeochem.2018.12.003.

Grants
Liu, Xiaolei, "The isotope composition of complete archaeal tetraethers analyzed separately in parallel and antiparallel glycerol configurations: a potential approach to disentangle signals of heterogeneous sources," Sponsored by American Chemical Society, Petroleum Research Fund, Non Profit, $110,000.00. (January 1, 2020 - August 31, 2022).

Nanny, M., and 14 others, "NSF-MRI: Acquisition of an Inductively Coupled Plasma Mass Spectrometer (ICP-MS) System to Enable Elemental Analysis in Research, Training and Education," National Science Foundation, $396,778.00. (August 15, 2018 - July 31, 2021).

Teaching
GEOL 1114 Physical Geology
GEOL 6103 Petroleum Geochemistry
GEOL 6970 Geochemistry Seminar

DAVID LONDON
Effort Distribution: T35, R,30, S25
Journal Articles
London, D., Hunt, L. e., Schwing, C. R., Guttery, B. M. (2019). "Feldspar thermometry in pegmatites: truth and consequences." Contributions to Mineralogy and Petrology, Vol. 175, DOI: https://doi.org/10.1007/s00410-019-1617-z.

Maner, J. L., London, D. (2019). "Enrichment of manganese to spessartine saturation in granite-pegmatite systems." American Mineralogist, Vol. 104, 1625–1637.

Teaching
GEOL 1114 Physical Geology
GEOL 2224 Intro to Mineral Sciences
GEOL 4923/5923 Pegmatites

Students Completed (Spring 2019 – Fall 2019)
Duval, Charles, M.S., "Evolution of the Hydrothermal Stage within Miarolitic Cavities in Granitic Pegmatites of California and Maine, USA."

RICHARD A. LUPIA
Effort Distribution: T40, R40, S20 (split appointment w/museum)
Journal Articles
Richmond, D., Lupia, R., Philippe, M., Klimek, J. (2019). "First occurrence of the boreal fossil wood Xenoxylon meisteri from the Jurassic of North America: Morrison Formation of central Montana, US." Review of Palaeobotany and Palynology, Vol. 267, 39-53.

Grants
Lupia, Richard A., Cifelli, Richard L., "Collaborative Research: Time of Transformation: integrating the dynamic biotic, geologic, and climate systems of North America during the Early to Late Cretaceous transition," Sponsored by National Science Foundation, Federal. (August 15, 2019 - July 31, 2024). $406,609

Landis, Margaret, Lupia, Richard A., "Digitization TCN: Collaborative Research: The Pteridological Collections Consortium: An integrative approach to pteridophyte diversity over the last 420 million," Sponsored by Yale University, University. (August 1, 2018 - July 31, 2021). $38,937

Teaching
GEOL 1104 Dynamic Earth
GEOL 5413 Paleobotany

KURT J. MARFURT
Research Professor
Journal Articles
Machado, G. L., Hickman, G. J., Gogri, M. P., Marfurt, K. J., Pranter, M. J., Reza, Z. A. (2019). "Characterization of Arbuckle-basement waste-water disposal system, Payne County, Northern Oklahoma." Interpretation, 7, SL19-SL26. DCI 10.1190/INT-2019-0025

Kolawole, F., Johnston, C., Chang, J. C., Marfurt, K. J., Lockner, D., Reches, Z., Carpenter, B. M. (2019). "The susceptibility of Oklahoma's basement to seismic reactivation." Nature Geoscience. 12, DOI: 10.1038/s41561-019-044-S.

Liao, Z., Liu, H., Carpenter, B. M., Marfurt, K. J., Reches, Z. (2019). "Analysis of fault damage-zones using 3D seismic coherence in the Anadarko Basin, Oklahoma." AAPG Bulletin, DOI: 10.1306/1219181413417207.

Pires de Lima, R., Bonar, A., Duarte, D., Marfurt, K. J., Nicholson, C. (2019). "Deep convolutional neural networks as a geological image classification tool." The Sedimentary Record, Vol. 17, No. 2, 4-9.

Pires de Lima, R. A., Suriamin, F., Marfurt, K. J., Pranter, M. J. (2019). "Convolutional neural networks as aid in core lithofacies classification." Interpretation, 7, SF27-SF40.

Qi, J., B. Lyu, A. Alali, G. Machado, Y. Hu, and K. J. Marfurt, 2019, Image processing of seismic attributes for automatic fault extraction: Geophysics, 84, O25-O37. DCI 10.1190/GEO2018-0369.1

Chopra, S., and K. J. Marfurt, 2019, Multispectral, multiazimuth, and multioffset coherence attribute applications: Interpretation, 7, SC21-SC32.

Ha, T. N., K. J. Marfurt, B. C. Wallet, and B. Hutchinson, 2019, Pitfalls and implementation of data conditioning, attribute analysis, and self-organizing maps to 2D data: Application to the Exmouth Plateau, North Carnarvon Basin, Australia: Interpretation, 7, SG23-SG42. DCI /10.1190/INT-2018-024.

Infante-Paez, L., and K. J. Marfurt, 2019, Using machine learning as an aid to seismic geomorphology, which attributes are the best input?. Interpretation, 7, SE1-SE18. http://dx.doi.org/10.1190/INT-2018-009.

Kim, Y., R. Hardisty, and K. J. Marfurt, 2019, Attribute selection in seismic facies classification: Application to a Gulf of Mexico 3D seismic survey and the Barnett Shale: Interpretation, 7, SE291-SE297.

Lubo-Robles, D., and K. J. Marfurt, 2019, Independent component analysis for reservoir geomorphology and unsupervised seismic facies classification in the Taranaki Basin, New Zealand: Interpretation, 7, SE19–SE42.

Pires de Lima, R., and Kurt J. Marfurt, 2019, Convolutional Neural Network for Remote-Sensing Scene Classification: Transfer Learning Analysis: Remote Sensing, 12, article no. 86.

Grants
Sondergeld, Carl H., Rai, Chandra S., Devegowda, Deepak, Ousseini Tinni, Ali, Marfurt, Kurt J., Pranter, Matthew J., "Reservoir Characterization in Unconventional Oil & Gas Reservoirs," Sponsored by Marathon Oil Company, Industry. (September 1, 2017 - December 31, 2020).

Marfurt, Kurt J., Bedle, Heather, "Attribute-Assisted Seismic Processing and Interpretation Consortium," Sponsored by Various Oil Companies, Industry, $5,893,915.00. (January 2008 - December 2020).

Students Completed (Spring 2019 – Fall 2019)
Machado, Gabriel, Ph.D., "Characterization of Arbuckle-Basement System with a Focus on Seismic Attribute Image of Igneous Intrusions and Seismic Resolution, Payne County, North-Central Oklahoma."

Pires de Lima, Rafael, Ph.D., "Machine Learning Applications for Geoscience Problems."

SHANKAR MITRA
Effort Distribution: T40, R40, S20
Teaching
GEOL 3003 Structural Geology/Stratigraphy
GEOL 6970 Structural Geology/Petroleum Exploration and Production

Students Completed (Spring 2019 – Fall 2019)
Li, Jianjun, Ph.D., "Seismic Methods Applied to Structural Interpretation."

Turko, Molly, Ph.D., "Structural Analysis of the Wichita Uplift and Structures in the Southeast Anadarko Basin, Southern Oklahoma."

JOHN D. PIGOTT
Effort Distribution: T40, R40, S20
Journal Articles
Phan, T. N., Zapata, Y. M., Kabir, S., Pigott, J. D., Pranter, M. J., Reza, Z. (2019). "Probing hydraulically-fractured wells in unconventional shale reservoirs under cyclic CO2 injection: Variation of thermophysical properties." Journal of Petroleum Science and Engineering, Vol. 181, 1-14.

Metawalli, F., Pigott, J. D., Ramada, F. S., El-Khadragy, A. A., Alfify, W. A. (2019). "Reservoir Characterization, Tut oil field, North Western Desert, Egypt." Environmental Earth Sciences, Vol. 77, 77-143.

Grants
McCoy Grant for Research, Bone Spring Sweet Spot Prediction through Basin Reservoir Modeling, Dr. John D. Pigott with Drs. Matthew Pranter and Zulfiquar Reza, $90,000 , Jan-Aug 2019. Sponsored by MCEE.

CML Foundation Grant, Midland Basin Geology and Geophysics, Dr. John D. Pigott, $25,000, Aug 2018-Aug 2019.

Teaching
GEOL 5363 Carbonate Geology
GEOL 5613 Intro to Seismic Stratigraphy
GEOL/GPHY 6970 IBA (2nd Place Internationally)
GPHY 6970 Permian Basin 3D Seismic for Development

Students Completed (Spring 2019 – Fall 2019)
Berg, Samuel, M.S., "High Resolution Sequence Stratigraphy of the NPRA, North Slope, Alaska."

Bickley, Tyler, M.S., "High Resolution Sequence Stratigraphy and Seismic Stratigraphy of the Leonardian Bone Spring Formation Delaware Basin, Southeast New Mexico."

Brown, Andrew, M.S.,"High Resolution Sequence Stratigraphy of the Leonardian Bone Spring Formation Outcrop of Bone Canyon, Guadalupe Mountains, West Texas and its Correlation to the Subsurface"

Frazier, Cyril, M.S., "High Resolution Integrated Vail-Galloway Sequence Stratigraphy of the Bone Spring Formation, N. Delaware Basin, Southeast New Mexico."

Layden, Andrew, M.S. "High Resolution XRF-Schmidt Hammer Based Sequence and Geomechanical Stratigraphy of the Leonardian Bone Spring Formation, Shumard Canyon, Guadalupe Mountain National Park"

Plemons, Travis, M.S., "An Integrated LiDAR-XRF Study and Geomechanical Lithofacies Analysis of the Leonardian Upper Bone Spring Formation, Bone Canyon, Texas."

MATTHEW J. PRANTER
Effort Distribution: T40, R40, S20
Journal Articles
Phan, T. N., Zapata, Y. M., Kabir, S., Pigott, J. D., Pranter, M. J., Reza, Z. (2019). "Probing hydraulically-fractured wells in unconventional shale reservoirs under cyclic CO2 injection: Variation of thermophysical properties." Journal of Petroleum Science and Engineering, Vol. 181, 1-14.

Machado, G. L., Hickman, G. J., Gogri, M. P., Marfurt, K. J., Pranter, M. J., Reza, Z. A. (2019). "Characterization of Arbuckle-basement waste-water disposal system, Payne County, Northern Oklahoma." Interpretation, vol. 7, no. 4, p. 1-18.

Pires de Lima, R., F. Suriamin, K. J. Marfurt, and M. J. Pranter (2019). Convolutional neural networks as aid in core lithofacies classification, Interpretation, vol. 7, no. 3, p. SF27–SF40.

Miller, J. C., M. J. Pranter, and A. B. Cullen (2019). Regional stratigraphy and organic richness of the Mississippian Meramec and associated strata, Anadarko Basin, central Oklahoma, Shale Shaker, vol. 70, no. 2, p. 50-79.

Grants
Sondergeld, Carl H., Rai, Chandra S., Devegowda, Deepak, Ousseini Tinni, Ali, Marfurt, Kurt J., Pranter, Matthew J., "Reservoir Characterization in Unconventional oil & Gas Reservoirs," Sponsored by Marathon Oil Company, Industry. $2,000,000 (September 1, 2017 - December 31, 2020).

Teaching
GPHY 3423 Intro to Petroleum Geology/Geophysics
GEOL 4133 Petroleum Geology
GEOL 6970 Reservoir Characterization and Modeling

Students Completed (Spring 2019 – Fall 2019)
Hardisty, Lura, M.S., "Stratigraphic Variability of Mississippian Meramec Chemofacies and Petrophysical Properties Using Machine Learning and Geostatistical Modeling, Stack Trend, Anadarko Basin, Oklahoma."

Miller, Michael, M.S., "Mississippian Meramec Lithologies and Petrophysical Property Variability, STACK Trend, Anadarko Basin, Oklahoma."

ZEEV RECHES
Journal Articles
Kolawole, F., Johnston, C., Chang, J. C., Marfurt, K. J., Lockner, D., Reches, Z., Carpenter, B. M. (2019). "The susceptibility of Oklahoma's basement to seismic reactivation." Nature Geoscience. 12, DOI: 10.1038/s41561-019-044-S.

Liao, Z., Liu, H., Carpenter, B. M., Marfurt, K. J., Reches, Z. (2019). "Analysis of fault damage-zones using 3D seismic coherence in the Anadarko Basin, Oklahoma." AAPG Bulletin, DOI: 10.1306/1219181413417207.

Reches, Z., Zu, X., Carpenter, B. M. (2019). "Energy-flux control of the steady-state, creep, and dynamic slip modes of faults." Scientific Reports, DOI: 10.1038/s41598-019-46922-1.

Chen, X., Morgan, C., Carpenter, B. M., Reches, Z. (2019). "Weakening mechanisms of Alpine Fault gouge in high-velocity shear experiments." Journal of Geophysical Research - Solid Earth, DOI: 10.1029/ 2019JB017383.

ROGER M. SLATT
Effort Distribution: T40, R40, S20
Journal Articles
Zhang, J., Slatt, R. M. "The significance of karst unconformities on overlying resource shales: Lessons learned from the Devonian Woodford Formation applied to the Permian Wolfcamp Shale." Interpretation 7 (4), SK33-SK43 2019.

Slatt, R. M., Zhang, J. (2019). "XRF (X-ray fluorescence) applied to characterization of unconventional Woodford Shale (Devonian, USA) lateral well heterogeneity." Fuel 254, 115565 2019.

Grants
Slatt, Roger M., "Consortium: Regional Woodford Shale stratigraphy, Oklahoma," Sponsored by Various Oil Companies, Industry. (January 1, 2013 - January 31, 2020).

Teaching
GEOL 5970 Turbidite Petroleum Geology
GEOL 5970 Advanced Unconventional Resource Shale

Students Completed (Spring 2019 – Fall 2019)
Brito, Richard, Ph.D., "The Woodford Shale in the Marietta Basin (Oklahoma and Texas)."

Caylor, Sophia, M.S., "Characterization of the Sycamore Formation, Velma Field, Ardmore Basin Oklahoma."

Cervantes, Antonio, Ph.D., "Structural and Petrophysical Characterization of an Upper Cretaceous Triple-Porosity Carbonate Reservoir: Contribution of Pore Types on Hydrocarbon Pore Volume and Production, Campeche Sound, Mexico."

Liborius Parada, Andreina, Ph.D., "Applied Petroleum Source Rock Evaluation and High-Resolution Sequence
Stratigraphy for Unconventional Reservoirs in La Luna Formation (Cenomanian-Santonian) Northwest Maracaibo Basin, Venezuela."

Milad, Benmadi, Ph.D., "Integrated Reservoir Characterization and Geological Upscaling for Reservoir Flow Simulations of the Sycamore/Meramec and Hunton Plays in Oklahoma."

Molinares, Carlos, Ph.D., "Paleoenvironments and Sediments Around the Frasnian/Famennian (F/F) Transition in the Woodford Shale, South Central Oklahoma – A Multiproxy Approach."

Oyebanji, Francis, M.S., "Unconventional Woodford Shales Resource Characterization using Seismic Anisotropy."

Zhang, Jing, Ph.D., "Multiscale Natural Fracture Characterization Workflow for Unconventional Shale, Woodford and Barnett Shale as Examples."

LYNN SOREGHAN
Effort Distribution: T20, R30, S50
Journal Articles
Soreghan, G. S., Soreghan, M. J., Heavens, N. (2019). "Explosive volcanism as a key driver of the late Paleozoic ice age." Geology, Vol. 47, 600-604.

Behm, M., Cheng, F., Patterson, A., Soreghan, G. S. (2019). "Passive processing of active nodal seismic data: estimation of VP/VS ratios to characterize structure and hydrology of an alpine valley infill." Solid Earth, Vol. 10, No. 4, 1337-1354.

Sardar Abadi, M., Soreghan, G. S., Heavens, N. G., Voeten, D. F.A.E., Ivanova, R. M. (2019). "Warm-water carbonates in proximity to Gondwanan ice–sheets: A record from the Upper Paleozoic of Iran." Palaeogeography, Palaeoclimatology, Palaeoecology, Vol. 531. doi.org/10.1016/j.palaeo.2018.09.008.

Grants
Soreghan, Gerilyn S., Behm, Michael, Dulin, Shannon A., "COLLABORATIVE RESEARCH: Equatorial Glaciation and Landscape Burial in the Late Paleozoic: Implications for Pangaean Climate and Tectonics," Sponsored by National Science Foundation, Federal, $449,032.00. (September 1, 2019 - August 31, 2022).

Soreghan, Gerilyn S., Soreghan, Michael J., "IRES: Landscapes of Deep Time in the Red Earth of France: Research Training in Paleoclimate," Sponsored by National Science Foundation, Federal, $249,953.00. (September 1, 2017 - August 31, 2020).

Soreghan, Gerilyn S., "Deep Dust: Probing Continental Climate of the Late Paleozoic Icehouse-Greenhouse Transition," Sponsored by International Continental Drilling Program, Industry, $77,810.00. (October 1, 2018 - September 30, 2019).

Soreghan, Gerilyn S., "ELT COLLABORATIVE RESEARCH: Investigating the Biotic and Paleoclimatic Consequences of Dust in the Late Paleozoic," Sponsored by National Science Foundation, Federal, $473,116.00. (September 1, 2013 - August 31, 2019).

Soreghan, Gerilyn S., Elwood Madden, Megan E., "Quantifying Surface Area in Muds from the Antarctic Dry Valleys: Implications for Weathering in Glacial Systems," Sponsored by National Science Foundation, Federal, $351,785.00. (June 1, 2016 - May 31, 2019).

Teaching
GEOL 6970 Devono-Mississippi Mudrocks
GEOL 4113/5113 Depositional Systems and Stratigraphy
GEOL 4533/5533 Earth's Past Climate

MICHAEL J. SOREGHAN
Effort Distribution: T40, R40, S20
Journal Articles
Soreghan, G. S., Soreghan, M. J., Heavens, N. (2019). "Explosive volcanism as a key driver of the late Paleozoic ice age." Geology, Vol. 47, 600-604.

Grants
Soreghan, Gerilyn S., Soreghan, Michael J., "IRES: Landscapes of Deep Time in the Red Earth of France: Research Training in Paleoclimate," Sponsored by National Science Foundation, Federal, $249,953.00. (September 1, 2017 - August 31, 2020).

Soreghan, Michael J., "The origin and time averaging of Lake Tanganyika shell beds: Implications for conservation and paleoecology of large tropical lakes," Sponsored by National Science Foundation, Federal, $314,000.00. (September 1, 2014 - August 31, 2019).

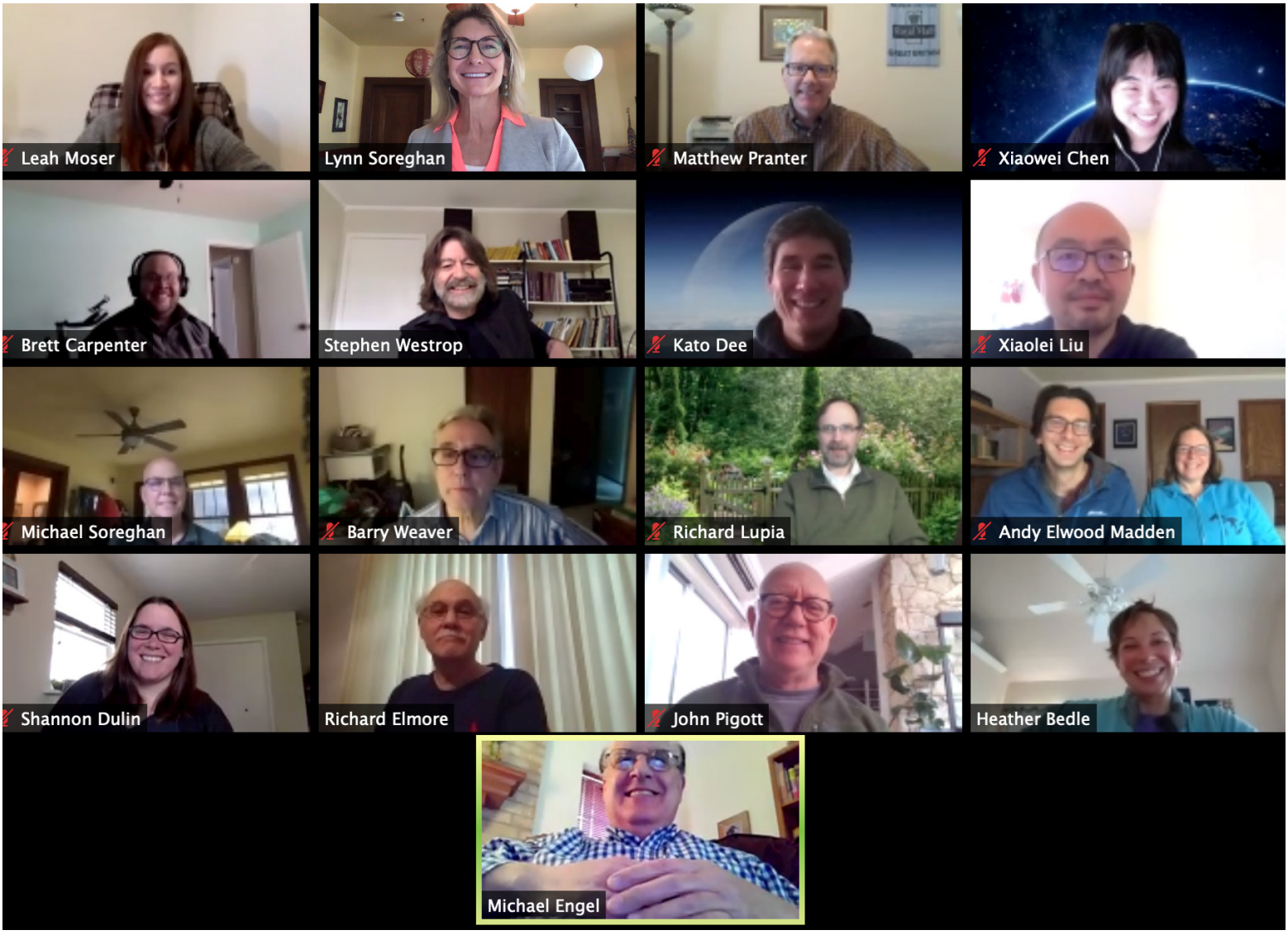
Teaching
GEOL 1104 Dynamic Earth
GEOL 3013 Geology of Oklahoma
GEOL 3023 Resources of Sub-Saharan Africa
GEOL 5733 Tectonics and Sediments in Rift Basins

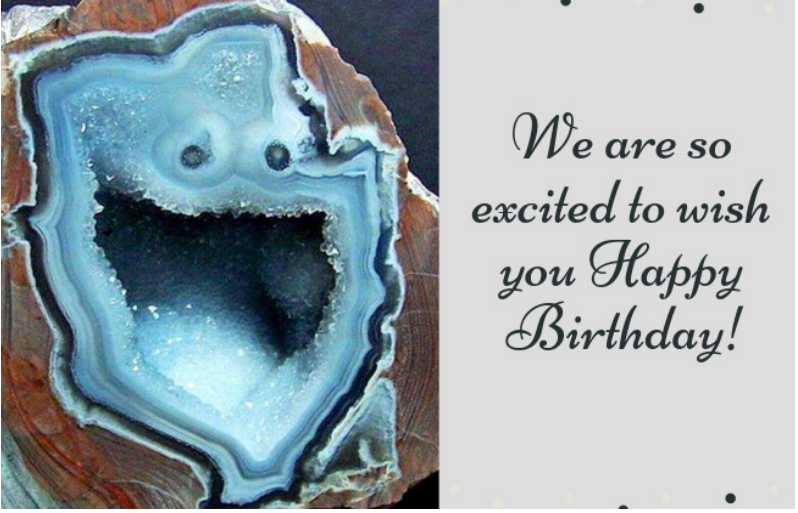
STEPHEN R. WESTROP
Effort Distribution: T40, R30, S30 (split appointment w/museum)
Grants
Westrop, Stephen R., "Digitization PEN: Expanding and enhancing a TCN digitizing fossils to reconstruct evolving ecosystems the Cretaceous Western Interior Seaway," Sponsored by National Science Foundation, Federal, $102,369.00. (September 1, 2017 - August 31, 2020).

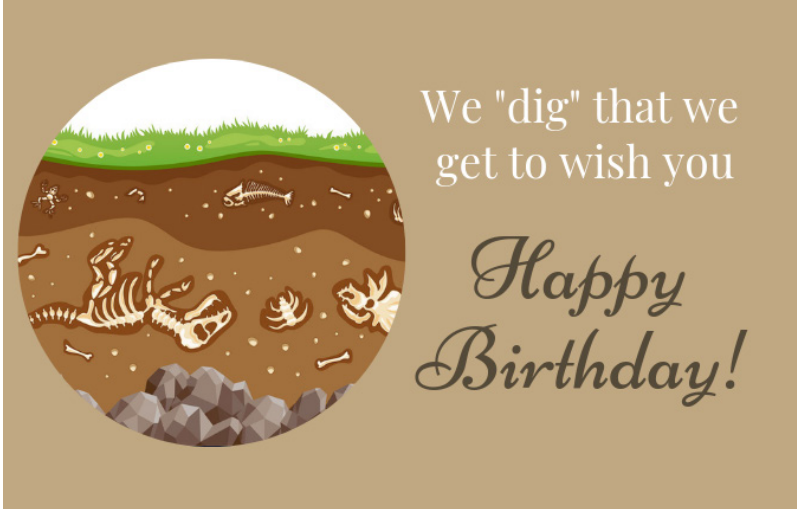
Teaching
GEOL 1024 History of Earth and Life
GEOL 3513 Invertebrate Paleontology
GEOL4513/5513 Evolutionary Paleobiology

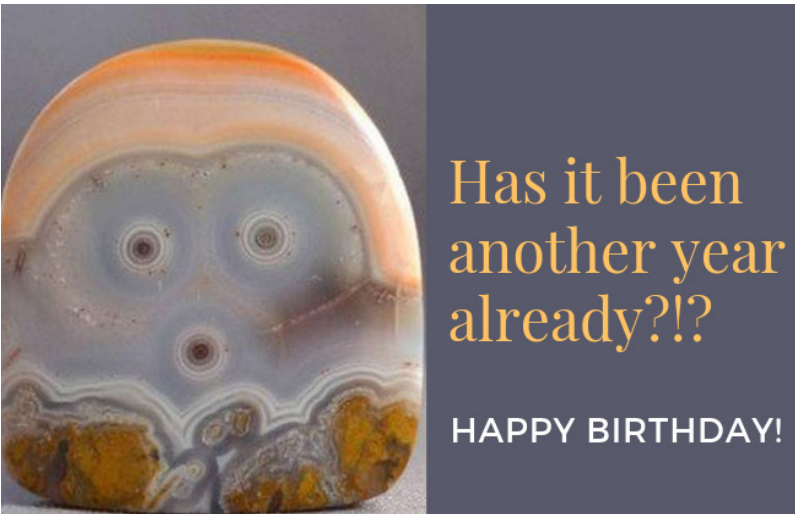
Students Completed (Spring 2019 – Fall 2019)
Blackwell, Sean M.S., "Cambrian (Jiangshanian; Sunwaptan) trilobites from the upper Honey Creek Formation, Wichita Mountains."

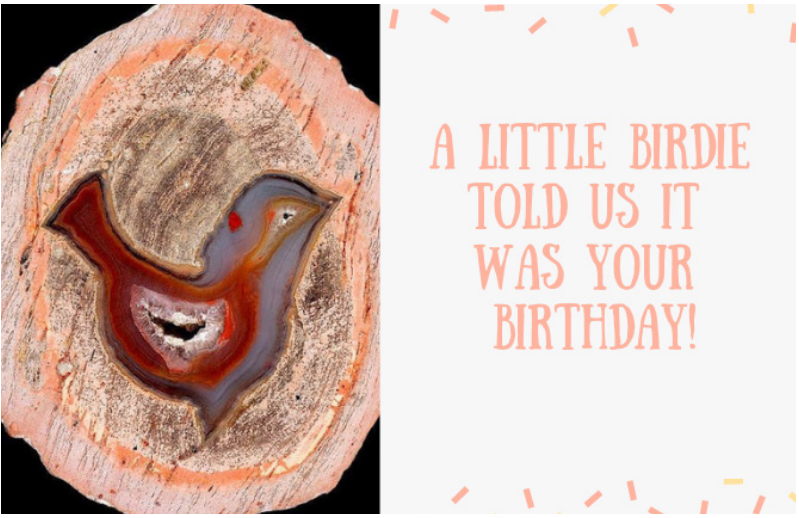
BARRY L. WEAVER
T60, R20, S20
Teaching
GEOL 1003 Volcanoes and Earthquakes
GEOL 3223 Igneous/Metamorphic Petrology

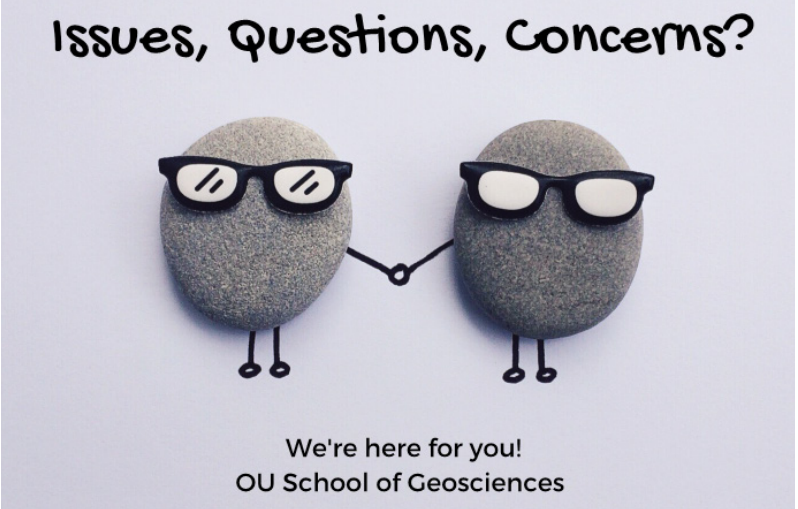












UNDERGRADUATE RECRUITING UPDATE

GAIL HOLLOWAY, UNDERGRADUATE RECRUITER

In the last few years, the recruiting of prospective undergraduate students has focused more and more on personalization. At the same time, students reported that they really did not want phone calls. So, the question became how to personalize without calling, while still reflecting the fun nature of our department.

I reached out to our current students for ideas. One stated that a handwritten birthday card was the most memorable thing she received. Around the same time, I saw the "happy" agate on a geology website. The two were a perfect match and the start of a new recruiting initiative! A year later, I have about eight different cards to send to prospective students with a handwritten message and my contact information. Most have a photo of a natural agate that resembles something, dictating the theme of the card – faces, birds, etc. I had great fun creating these and am always on the lookout for more options. Definitely feel free to send any along – the punnier, the better!

This Spring, I added an additional card. Each Geosciences student accepted to the university received a congratulations follow up card, asking if there are any questions I can answer or information I can supply to make their college decision easier. The card shows two rock "people" and includes one of the department's new stickers. Two more ways the be a little more memorable and provide prospective students a little more fun in the mail!

SUPPORT GEOSCIENCES

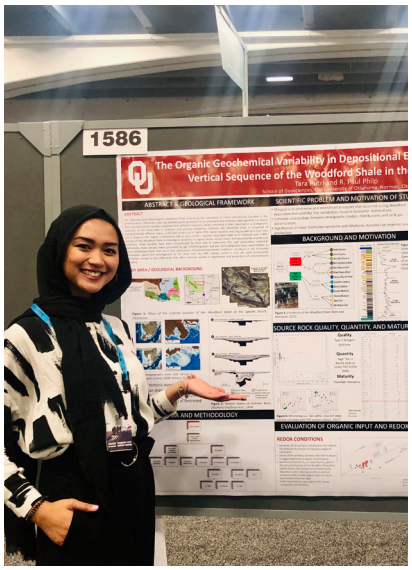
OU.EDU/MCEE/GEOSCIENCES/GIVE

FIELD TRIPS

Enrichment field trips provide our students the opportunity to gain hands-on training in the field throughout their educational experience.

TA SUPPORT

TAs are instrumental in prodiving experiential learning to our students. Your support provides crucial assistance needed to fund our TAs and help us elevate the status and impact of our program.



CONFERENCE TRAVEL

Our students are highly encouraged to present their research at national and international conferneces throughout their academic careers.

OUTDOOR CLASSROOM

Repairs of the Sarkeys plaza have left us with a "clean slate" to convert to an outdoor geo-educational classroom. We hope to incorporate mapping exercises, specimens, and other features suitable for students of all ages.

KEEP IN TOUCH WITH THE SCHOOL OF GEOSCIENCES

VISIT **GEOSCIENCES.OU.EDU** TO LEARN ABOUT UPCOMING EVENTS AND WAYS TO GET INVOLVED

FOLLOW US ON SOCIAL MEDIA

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Twitter: @ougeosciences
Instagram: @ougeosciences

MEWBOURNE COLLEGE OF EARTH AND ENERGY

SCHOOL OF GEOSCIENCES

The UNIVERSITY *of* OKLAHOMA