

UNIVERSITY OF OKLAHOMA  
CONOCOPHILLIPS SCHOOL OF GEOLOGY AND GEOPHYSICS

# EARTH SCIENTIST

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# ABOUT THIS ISSUE

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**On the cover:** 2017 regional field trip - Geology 4136 in the Tetons

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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 Thus, accounting for the rare exceptions of years unpublished, we are now on volume 41 of the SGG alumni magazine. And, prior to that, we have records of SGG 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 contact the School of Geology and Geophysics at (405) 325-3253.

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Those who contemplate the beauty  
of the

# EARTH

find reserves of strength that will  
endure as long as life lasts

- RACHEL CARSON



# WELCOME TO THE GEOFAMILY

The recent eruptions on Hawaii transported me back to 1983, my freshman year at UCLA. The year started out tremendously; although the early 80s were dominated by Switzer and his Sooners, I attended the 1983 Rose Bowl to watch my Bruins defeat the Michigan Wolverines— the first of a string of Rose Bowl victories, and my introduction to big-time college football. Two days later, on January 3, 1983, Kilauea Volcano began erupting on the Big Island of Hawaii— which would prove to be another defining moment of my freshman year.

As a first-generation college student attending a large public university, I had no idea what I was getting into that first year. I could have easily fallen through the cracks. Instead, I fell into the geology department, and they caught me.

In high school, I didn't even know if I was going to go to college. When my school friends began discussing it during lunch period, they inspired me to complete an application for the nearest UC school.

But upon reaching the box labelled "Major," my fingers stalled. My mind drew a blank. In this pre-Google Dark Age, I opened the UCLA catalog and started thumbing through the majors, beginning with "A." I knew I liked science, and my parents had instilled a love of the outdoors by virtue of summer camping trips to the beach, and day hikes to the mountains and deserts around Los Angeles. My father inadvertently goaded my love of rocks by building a wall of unique pieces— magnetite, obsidian, petrified wood— collected during his trips selling restaurant ware in small towns of the Mojave Desert. All of this made me pause when I turned the page to discover "Earth and Space Sciences." The final selling point was the required summer camp, which sounded so— well, so sophisticated to this west-coaster.

So when my high school counselor impatiently urged me to "Just put it down, the average person changes their major seven times!" I followed his advice. And this is how I found myself sharing the dorms at the Hawaii Volcano Observatory with 49 other UCLA field trippers — geo majors, roommates, spouses — in the fall of 1983. For the cost of the plane ticket, we experienced the historic (near) beginning of what would become the longest continuous volcanic eruption in recorded history.

Our trip to Kilauea was so epic it inspired my roommate and fellow field tripper, a psychology major, to later write her senior thesis on the cultural psyche of the geology department. Beginning with the field trip, and extending through our undergraduate years, she became enamored with the uniqueness of this quirky, artistic, occasionally beer-imbibing group. She explored the question of why it was that the geology department (or Earth Science, or Geoscience, or Earth & Space Science, or whatever is your preference) had a culture like no other on campus. She surmised it had to do with a lot of forced time together under challenging circumstances. Death marches in the field, led by the departmental billy goat (for many of you— Charlie Harper?). Near-death experiences with rattlesnakes, scorpions, bears, and lightning. Boulder rolling and other pranks, until somebody put an eye out. Spending a week in Hawaii, but skipping the beaches to take daily lunch near a new gravel pit or pahoehoe flow. Getting lost in a caldera. Changing a tire while breaking every rule in the auto manual's book (beginning with "Ensure vehicle is on a level surface..."). Hiking the Permian Reef trail in a mental fog the day after OU defeated UT. Exploring, experiencing the beauty of the planet, and the camaraderie of those who share that fascination with the planet. Even when, occasionally, you might fantasize that you could boulder-roll them.

In the end, Geoscience is about these connections. The Earth System comprises interconnected components, wherein — unlike Las Vegas — whatever happens in one place doesn't stay in that place. Geoscientists are social, artistic individuals who appreciate interconnectivity and the ensuing complexity. I think this is what my roommate tapped when she lit upon the uniqueness of the (every) geology department. And it is what saved me and shaped me as a very young, diffident college freshman at a large, potentially impersonal public university.

Geology departments become families. Having completed my first semester as the new director of OU Geology and Geophysics, I'm striving to foster the interconnectivity that defines our home planet, our scientific culture, and our mission as a department. As alumni of this special departmental culture, I invite you to stay involved, and help foster the next generation of scrappy but artistic scientists of the Earth.

-Lynn Soreghan, Director and Eberly Family Chair



# A LETTER 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 ConocoPhillips School of Geology and Geophysics 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 Gallogly assumed his new role on July 2, 2018, bringing a much needed focus on cost and a renewed commitment to research, graduate education and faculty support.

## RESEARCH

President Gallogly has stated his 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 should be well-received.

## 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 Gallogly 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 Gallogly has stated publicly his intent to pay our faculty equitably among our peer institutions. This commitment to pay competitive salaries coupled with a performance-based bonus structure should bode well for 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 Gallogly and look forward to the many benefits his leadership will bring. 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.





# A LETTER FROM THE AAC CHAIR



Dear Alumni, Faculty, and Students,

I am the current chair of the Alumni Advisory Council. Our mission is to advise and assist the school in maintaining and building a world-class earth science program that prepares graduates at all levels for careers in industry, government and/or academia. In my seven years serving on the council, I have witnessed the revitalization of the Geophysics program, expansion of geochemistry and addition of hydrogeology. Each of us should celebrate these achievements. Philanthropy of the alumni and companies have played a vital role in supporting the school's students. That said, daunting challenges ahead must be surmounted. The shameful level of Oklahoma's monetary commitment to education at all levels continues to tear through the School's budget, and enrollment drops have caused cuts in program fees as well. The School needs your active support. That support can come in many forms - big and small; such as individual giving, encouraging your company to contribute, teaching a short course, sponsoring a field trip, helping students attend and present at conferences, and volunteering at events.

Over the prior year, I have enjoyed several long discussions with Dr. Soreghan about the direction of the school and trends in industry relative to the current program. The path from freshman to master's takes six to seven years. I believe industry is at an inflection point of change that is both exciting and troubling. The global economy will continue to de-carbonize, particularly away from oil. This trend will have an impact on the employment needs of energy companies across a spectrum of skills. More importantly, those graduating a decade from now must be prepared for a world in which reservoir and financial modeling, statistical analysis and machine learning will dominate the decision-making process. Those who lack fluency in these areas will be left behind. It is absolutely crucial that such important, yet peripheral, skills be underpinned by a broad and deep understanding of geology, geophysics and geochemistry. Without this core knowledge, one cannot pass common-sense judgment on the complex outputs of those who just push buttons.

Lastly, I encourage each you to join a professional society. They offer networking and education opportunities. Although I do not have firm statistics, I suspect that many of us will change jobs within 10 years. These societies do not function without the commitment of volunteers. Active participation offers a pathway to leadership and professional advancement for a career that is beyond mere employment. As one of my mentors once told me, "Andrew, if Service is beneath you, then Leadership is beyond you." We should all strive to be learners, leaders and helpers.

Sincerely yours,  
Andrew Cullen

## NEW FOR 2019

Note that we will begin a new tradition of holding our annual Student Research Symposium in coordination with the spring AAC meeting; for 2019, we expect this to be in early April. Andrew Cullen (AAC chair) will send a reminder about the date at a later time.





**GERILYN S. SOREGHAN**

DIRECTOR AND EBERLY  
FAMILY CHAIR  
DAVID L. BOREN  
PROFESSOR



**R. DOUGLAS ELMORE**

PROFESSOR AND EDWARD  
MCCOLLOUGH CHAIR



**YOUNANE ABOUSLEIMAN**

PROFESSOR AND LARRY  
W. BRUMMETT / ONEOK  
CHAIR  
DIRECTOR, INTEGRATED  
POROMECHANICS  
INSTITUTE (IPMI)



**ANDREW S. ELWOOD MADDEN**

ASSOCIATE PROFESSOR



**MICHAEL BEHM**

ASSISTANT PROFESSOR



**MEGAN E. ELWOOD MADDEN**

ASSOCIATE PROFESSOR AND  
STUBBEMAN-DRACE  
PRESIDENTIAL PROFESSOR



**BRETT CARPENTER**

ASSISTANT PROFESSOR



**MICHAEL H. ENGEL**

PROFESSOR AND CLYDE  
BECKER CHAIR



**XIAOWEI CHEN**

ASSISTANT PROFESSOR



**XIAOLEI LIU**

ASSISTANT PROFESSOR



**SHANNON DULIN**

ASSISTANT PROFESSOR



**DAVID LONDON**

NORMAN R. GELPHMAN  
PROFESSOR





**RICHARD  
LUPIA**

ASSOCIATE PROFESSOR AND  
ASSOCIATE CURATOR,  
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**JOHN D.  
PIGOTT**

ASSOCIATE PROFESSOR



**MATTHEW J.  
PRANTER**

PROFESSOR AND LEW AND  
MYRA WARD CHAIR

## FACULTY AWARDS

Dr. Nori Nakata received the Young Scientist Award, Seismological Society of Japan 2017.

Dr. Kurt Marfurt is serving as the SEG Distinguished Short Course Instructor for 2018. Dr. Marfurt is giving 29 one day classes in 20 countries!

Dr. Lynn Soreghan was awarded the David L. Boren Professorship in April 2017.



**JUDSON L.  
AHERN**  
PROFESSOR EMERITUS



**G. RANDY  
KELLER**  
PROFESSOR EMERITUS



**M. CHARLES  
GILBERT**  
PROFESSOR EMERITUS



**R. PAUL  
PHILP**  
PROFESSOR EMERITUS



**CHARLES W.  
HARPER, JR.**  
PROFESSOR EMERITUS



**ZE'EV  
RECHES**  
PROFESSOR EMERITUS



# GEORGE B. MORGAN RETIRES AFTER 25 YEARS OF SERVICE

Dr. George Beers Morgan VI retired at the end of 2017 after 25 years of exceptional service to the university as the manager and operator of the university's Electron Microprobe Laboratory. Morgan is an alumnus of the school (M.S. 1986, Ph.D. 1988), and he served as an adjunct professor in the school for most of his career. He is succeeded by Dr. Lindsey E. Hunt, who assumed operational responsibilities in the Microprobe Laboratory in May 2018. Dr. Hunt obtained extensive training in electron beam methods and chemical analysis as an undergraduate at the University of West Georgia (magna cum laude 2011), and through her Ph.D. in geology at Texas A&M (2017). She came to OU after a year as an Assistant Professor of geology at Austin Peay State University in Tennessee. The Electron Microprobe Laboratory is funded through the Office of the Vice President of Research as a core research facility of the University. Dr. David London, Stubbman-Drace Presidential Professor and Norman R. Gelphman Professor of Geology, has directed the facility since its inception in 1988. The U.S. Department of Energy has been the source of two such Cameca microbeam instruments, and the National Science Foundation has provided four grants in support of the laboratory.





**REBECCA  
FAY**

COORDINATOR OF  
ACADEMIC STUDENT  
SERVICES



**LEAH  
MOSER**

MANAGER OF  
OPERATIONS



**GINNY  
GANDY  
GUEDES**

ADMINISTRATIVE  
COORDINATOR



**ASHLEY  
TULLIUS**

SPECIAL EVENTS  
AND DONOR  
RELATIONS  
COORDINATOR



**GAIL  
HOLLOWAY**

INSTRUCTOR AND  
UNDERGRADUATE  
RECRUITER



**ROBERT  
TURNER**

LAB TECHNICIAN



**GINGER  
LEIVAS**

FINANCIAL ASSOCIATE



# AAPG STUDENT CHAPTER

ANDREINA LIBORIUS, PRESIDENT

In 2017-2018, our AAPG chapter organized more events than ever before and cooperated with other student organizations in SGC and in the college. We planned and executed field trips, technical talks and discussions with faculty; events for professional development, discussed branding yourself and leadership; and participated in outreach activities with local schools. Highlights include the first ever “Who Wants to Be a Geo-Millionaire” game, co-hosted with SEG, the annual Blood Drive and presenting awards at the annual Mewbourne College Student and Alumni Awards Banquet. The chapter has a renewed charge: increase the knowledge and interaction of the students with academic entities, society and the oil and gas industry by looking for opportunities for networking, interview training and community activities. All-in-all, this past year has been tremendous.



# SEG STUDENT CHAPTER

LENNON INFANTE, PRESIDENT

The SEG Student Chapter recruited new members, organized workshops, arranged lunch and learns, and conducted fundraising. Throughout the year, SEG partnered with both AAPG and Pick & Hammer on several events. SEG events and workshops included: Effective Branding Techniques with BP, Improve Your Presentation Skills Workshop, Rokdoc Rock Physics Intro Training Course, Seismic Geomorphology and Seismic Stratigraphy Extracting Geologic Insights from 3D Seismic Data Workshop and an Art Gallery Fundraiser. SEG also organized a series of lunch and learns, on Microseismic and Seismic Attributes, Appraising and Developing Your Unconventionals, Application of Neural Networks in Seismic Data, and Amplitude Interpretation of Seismic Reflections.





# PICK & HAMMER CLUB

DANIEL MBAINAYEL AND SARAH SUNDBERG, INCOMING OFFICERS

One of Pick and Hammer’s main activities this year was continued involvement in outreach to K-12 students to provide a glimpse of how amazing geosciences can be. We gave hands-on presentations on rocks and minerals and basic geological principles, and gave tours of Sarkeys Energy Center.

We participated in the Science in Action Day at the Sam Noble Oklahoma Museum of Natural History. Pick and Hammer showcased samples and answered geology questions. Other activities included preparing middle and high school students for the geology section of the Science Olympiad , helping Boy Scouts earn their merit badge for geology and environmental science, teaching elementary school students in the CASP (Community After-School) program and setting up a display case of samples at a local high school.

All told, we reached over 2,000 students in the 2017-2018 academic year, greatly aided by the support of students, faculty and staff of the SGC, as well as a generous donation from Halliburton. We also worked to make the club a community - a place where any student with an interest in geology can make friends, learn and feel at home while pursuing their degree. We scheduled field trips, social events and mineral auctions. Our trips included a fall camping trip to the Wichita Mountains, a fossil-digging trip to the Ordovician Bromide Formation near Ardmore, Oklahoma, and – the biggie – our trip to Tucson, Arizona, for the annual Gem and Mineral Show, where we purchased a variety of rocks, minerals and fossils for our auctions. We also obtained samples to create mineral kits for the outreach program. En route back from Tucson, we visited White Sands National Monument.

Our social events included monthly meetings, bowling at HeyDay, dinosaur bingo with prizes and club dinners to end each semester. The first bowling event was held jointly with SPE to encourage geology students to come along with petroleum engineering students. Our mineral auctions are crucial for raising funds for trips and other activities. It's been a great year!

Camping trip in the Wichita Mountains



Club officers at Science in Action Day



Club members at the White Sands National Monument



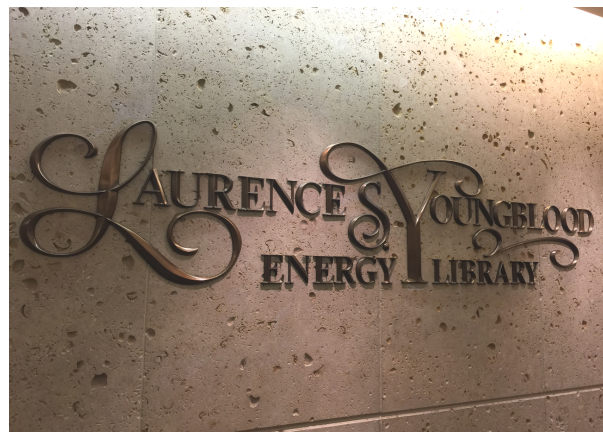
# LAURENCE S. YOUNGBLOOD LIBRARY ANNUAL UPDATE

JAMES BIERMAN

With the temporary renovation closure of the Engineering Branch Library in Felgar Hall, the Laurence S. Youngblood Energy Library in Sarkeys Energy Center will be the sole University Libraries satellite location on the northeast corner of campus for the foreseeable future. James Bierman continues to serve as head librarian for geology and engineering, and now offices full time in Youngblood alongside administrative assistants Larry Austin and Courtney Oliphant.

In the summer of 2017, University Libraries had the good fortune to partner with Jim Anderson and Brittany Pritchett of the OGS in their effort to preserve and display Oklahoma's first geologic map. The Gould Map, as it has become known, is dated 1904 and was created by Charles N. Gould, the "father of Oklahoma geology" and founder of the OU School of Geology. Jim and Brittany re-discovered the map in 2014 and spearheaded its lengthy conservation process. Following a July unveiling ceremony, the Gould Map was put on loan to University Libraries and mounted at the entrance of the Youngblood Library. The full story behind the Gould Map is available in the April-June 2017 issue of Oklahoma Geology Notes.

Other news from the Youngblood Library include materials transfers that consolidated subject holdings between the Engineering and Youngblood Branch Libraries. The two branches have historically maintained separate petroleum engineering collections, and the logic of those physically divided collections has not always been clear or particularly useful to students or faculty. All library materials relating to petroleum geology, petroleum technology and oil and gas recovery are now consolidated into a single collection housed at the Youngblood Library.







# BABY BOOM

The School of Geology and Geophysics added five little ones between summer 2016 and spring 2018. Above (from left): Shannon Dulin, Assistant Professor, and daughter, Hazel (1). Rebecca Fay, Coordinator of Student Services, and daughters, Jane (2) and Anna (6 months). Xiaowei Chen, Assistant Professor, and son, Lucas (6 months). Ginger Leivas, Financial Associate, and son, Caden (1).





# Meet the New Faculty

## DR. BRETT CARPENTER

Assistant Professor of  
Structural Geology



Brett Carpenter received his bachelor's degree in earth & space science education and physics education from Mansfield University of Pennsylvania. He then received his master's and doctoral degrees in geosciences from the Pennsylvania State University. Following his Ph.D., he completed a 4-year post-doctoral position at the Istituto Nazionale di Geofisica e Vulcanologia (INGV) in Rome, Italy, which was followed by two years of additional post-doctoral research at the University of Oklahoma.

His research uses multidisciplinary techniques, fieldwork, laboratory experiments, geochemistry and seismology to better understand the strength and slip behavior of tectonic faults. His research interests focus on how fault structure and small-scale

processes affect large-scale fault and crustal behavior. He is particularly interested in the behavior of earth materials at shallow to central crustal conditions, where destructive earthquakes originate and propagate. This research has applications to natural hazards forecast and preparation, energy development and carbon sequestration. His primary research method is combining structural observations from boreholes, outcrops, and 3D seismic volumes with laboratory experiments to determine the mechanical, hydrologic, and acoustic properties of different Earth materials, many of them collected from faults worldwide.

He has played an important role in field-based projects, including two major scientific drilling initiatives:

the San Andreas Fault Observatory at Depth (SAFOD), and the Alpine Fault Deep Fault Drilling Project (DFDP). Over the course of the past eight years he has served in several roles for these projects, including on-site as a lead core geologist, sample collector, and as part of the science team. He is now the lead investigator on the Drilling Investigation of Seismogenic Crust in Oklahoma (DISCO) project and co-lead investigator on the Scientific Exploration of Induced Seismicity and Stress (SEISMS) project. His research has been recognized by the National Science Foundation in the Science Nation episode, "Earthquakes to the Core -- Researchers Drill Down at the Epicenter," as well as by Earthscope, GeoPRISMS, and AGU through various awards.





# Meet the New Faculty

## DR. XIAOLEI LIU

Assistant Professor of Organic  
Geochemistry

Xiaolei Liu graduated with a doctorate in organic geochemistry in 2011 from the Department of Geosciences at the University of Bremen, Germany. His Ph.D. program was focused on the natural distribution of a specific group of lipid biomarker molecules, the glycerol ethers, in marine sediments, which is indicative of the conditions of past depositional environments. Dr. Liu then continued with two postdoctoral appointments, first within the MARUM Center for Marine Environmental Sciences at University of Bremen, Germany, and later within the Department of Earth, Atmospheric and Planetary Sciences at the Massachusetts Institute of Technology.

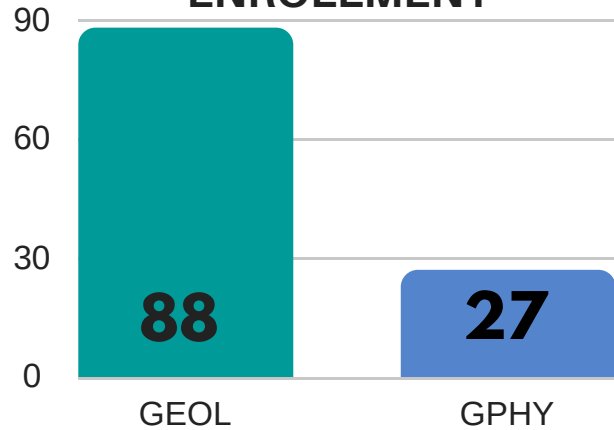
His research experiences in organic geochemistry and environmental microbiology provide him with profound insights, expertise and research interests in the fields of geobiology and biogeochemistry. However, during his postdoctoral research, he conducted a two-year collaborative project with ExxonMobil to study thermal diagenesis of polar lipids in petroleum samples. After working within the industry, Dr. Liu noticed that polar lipids analysis can help explain many questions related to oil and gas, but had not been well applied.

With Dr. Liu's new appointment at OU, he has built a lab equipped with powerful GC-MS (gas chromatography mass spectrometry) and LC-Qtof-MS (liquid chromatography quadrupole time of flight mass spectrometry) for polar lipids analysis on various environmental and petroleum samples. For instance, one project that his lab will work on is to analyze the C86 tetraacids, a group of problematic naphthenic acid molecules causing pipeline blockage during crude oil processing. Dr. Liu is also enthusiastic about the living microbial community in petroleum reservoirs, to understand three basic questions: who is there, what are they doing and how will they influence production?

# SGG BY THE NUMBERS

Earth Science is the highest-ranked graduate program of any science program at OU, and one of the highest ranked programs overall (US News and World Report).

## UNDERGRADUATE ENROLLMENT



SGG is among the highest scholarship totals for students at the University of Oklahoma

# \$5,100

AVERAGE SCHOLARSHIP FOR UNDERGRADUATES PER YEAR

# 73

CLASSES TAUGHT BY SGG FACULTY

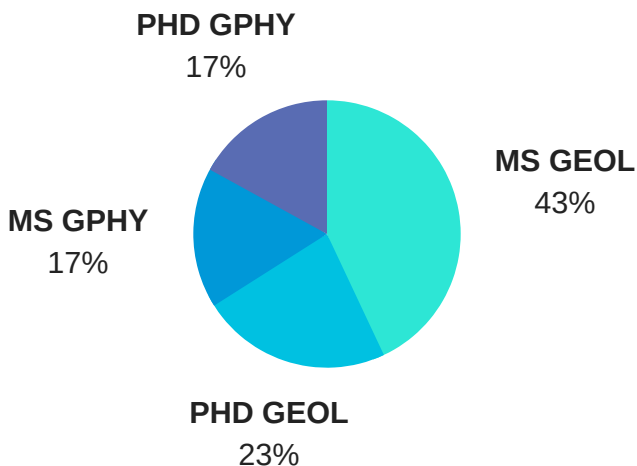
ARTICLES PUBLISHED BY SGG FACULTY

# 66

# 42

FIELD CAMP SCHOLARSHIPS AWARDED

## GRADUATE ENROLLMENT



# 13

COMPANIES RECRUITED DURING FALL 2017

# 2,370

STUDENTS TAUGHT BY SGG FACULTY

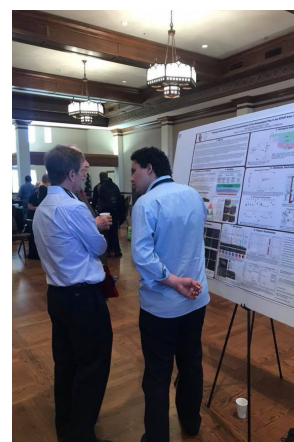
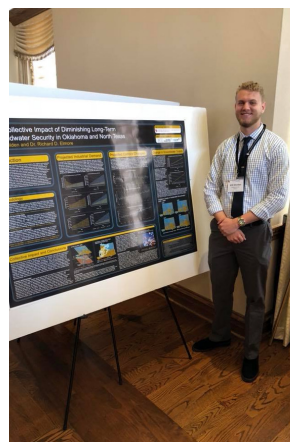
# 16

UNDERGRADS CONDUCTED RESEARCH

# \$2,085,844

IN FACULTY RESEARCH EXPENDITURES





# CONOCOPHILLIPS STUDENT RESEARCH SYMPOSIUM

In March 2018, ConocoPhillips sponsored the annual Student Research Symposium. This year, 57 students participated in three categories. The winners are as follows:

## UNDERGRADUATE

**1st Place: Will Shelden**, The Collective Impact of Diminishing Long-Term Water Security in Oklahoma and North Texas

**2nd Place: Sarah Sundberg**, A Quantitative Analysis of Hydraulic Fracturing Induced Seismicity in Oklahoma

**3rd Place: Nina McCollom**, Phosphate dissolution mysteries. What is actually in my synthetic "Whitlockite" samples?

## MASTER'S

**1st Place: Kelsey Lewis**, Fluvial Architecture of the Burro Canyon Formation using UAV-Based Photogrammetry: Implications for Reservoir Performance, Rattlesnake Canyon, Colorado

**2nd Place: Zhuobo Wang**, Novel 2D Forward Seismic Model of Slope-to-Basin Sedimentation through Integration of LiDAR, Schmidt Hammer, and Density Analysis, McKittrick Canyon, Texas

**3rd Place: Emily Ryan**, Variation in Time Averaging and Taphonomic Character of Shell Beds in Lake Tanganyika, Africa: Paleoenvironmental and Stratigraphic Implications of Shell Beds in Rift Lakes.

## PH.D.

**1st Place: Gerhard Heij**, Quantitative Petrofabric evaluation of the Wolfcamp Shale: Advancing Unconventional Reservoir Characterization

**2nd Place: Lennon Infante**, Seismic Expression of Igneous Intrusive and Extrusive Bodies in North Graben, Taranaki Basin, New Zealand: Implications for Pitfall Interpretations

**3rd Place: Javier Tellez**, Fluvial Architecture of the Burro Canyon Formation using UAV-based Photogrammetry and Digital-Outcrop Models, Piceance Basin, Colorado

## BEST RESEARCH GROUP

**1st Place: Dr. Elmore's** research group

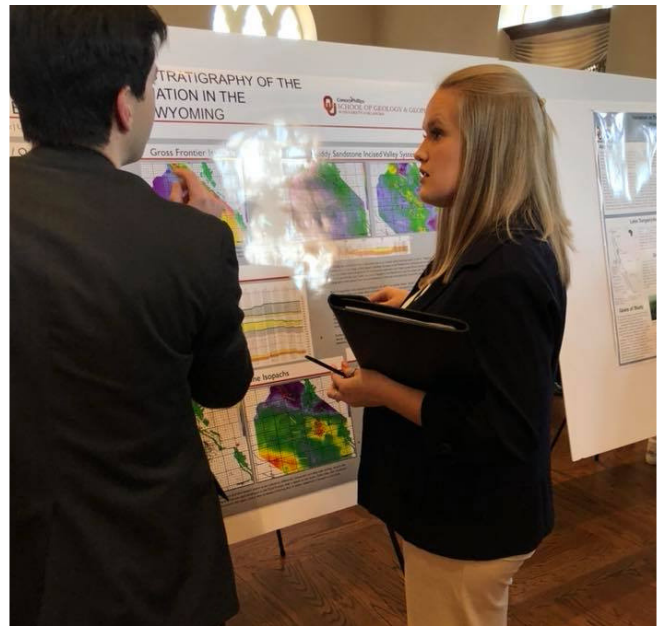
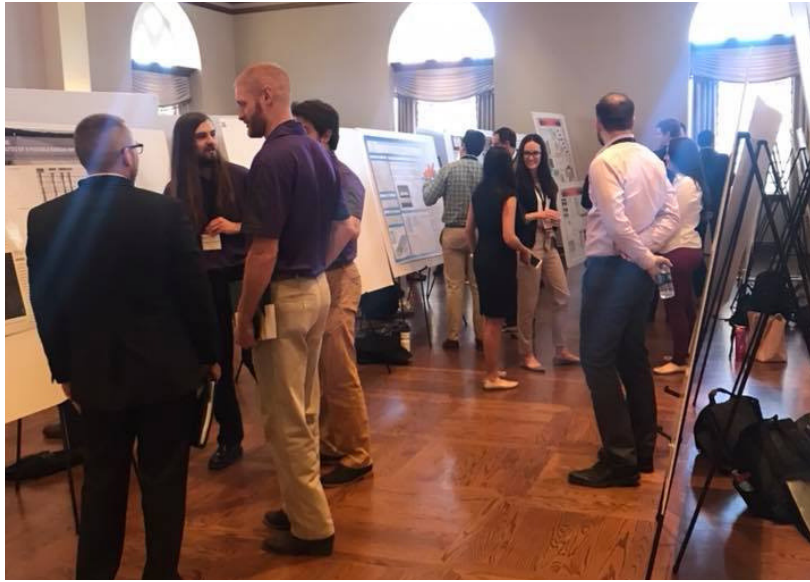
**2nd Place: Dr. Marfurt's** research group

**3rd Place: Dr. Pranter's** research group





# SPRING BREAK STUDENT EXPO



In addition to the ConocoPhillips Student Research Symposium, we also hosted the Spring Break Student Expo in March 2018. The Expo invites students from across the country to compete in a research poster competition, network with company representatives from industry and participate in short courses instructed by SGG faculty, alumni and friends. This year we saw an increase from last year's competition, with 79 students participating in the poster session. SGG students swept the awards in both categories. The winners are as follows:

## GEOLOGY

**1st Place: David Duarte**, Significance of Calcite to Reservoir Quality of Mississippian Strata, in the MERGE Area of Oklahoma

**2nd Place: Javier Tellez**, Fluvial Architecture of the Burro Canyon Formation Using UAV-based Photogrammetry and Digital-Outcrop Models, Piceance Basin, Colorado

**3rd Place: Will Kibikas**, Measurement of Rock Strength and Geophysical Properties of Oklahoma Basement Rocks **AND Emily Ryan**, Variation in Time Averaging and Taphonomic Character of Shell Beds in Lake Tanganyika, Africa: Paleoenvironmental and Stratigraphic Implications of Shell Beds in Rift Lakes

## GEOPHYSICS

**1st Place: Colin Pennington**, Coulomb Stress Interactions During the M5.8 Pawnee Sequence

**2nd Place: Lennon Infante**, Seismic Expression of Igneous Intrusive and Extrusive Bodies in North Graben, Taranaki Basin, New Zealand: Implications for pitfall interpretations

**3rd Place: Folarin Kolawole**, Basement Structures in North-Central Oklahoma



# SGG SPRING AWARDS PICNIC

In addition to the MCEE Student and Alumni Awards Banquet, SGG also hosted our annual Spring Awards Picnic and softball game. Students, faculty and staff enjoyed an afternoon of Geology vs. Geophysics softball, delicious food, and awards recognizing the achievements of our students over the past year. The awards are as follows:

**OUTSTANDING FRESHMAN** KENZI FREEMAN

**OUTSTANDING SOPHOMORE** ZACHARY TOMLINSON

**OUTSTANDING JUNIORS** MAX FIRKINS AND TRAVIS VICK

**EVERETT DEGOLYER AWARD FOR OUTSTANDING ACHIEVEMENT** GERRY HEIJ

**BEN HARE EXCELLENCE IN RESEARCH AWARD** TRAVIS MORELAND AND FOLARIN KOLAWOLE

**STAN CUNNINGHAM EXCELLENCE IN TEACHING AWARD** STEVE ADAMS



Gerry Heij



Travis Moreland



Kenzi Freeman



Max Firkins and Travis Vick



Steve Adams



# STUDENT HONORS AND AWARDS

**Richard Brito** (Fall 2017) and **Charles Duval** (Spring 2018) received the Provost Certificate of Distinction in Teaching Award.

**Carlos Molinares** was awarded Best Graduate Student Oral Presentation at the 2018 South Central Geological Society of America Meeting.

**Jeffrey Hardwick** received the 2018 Outstanding Geoscience Student awarded by the Tulsa Geological Society Foundation

**Will Sheldon** presented his talk, titled "The Future of Water Security in Oklahoma and Texas" at TEDx OU.

**Fola Kolawole** and **Carlos Molinares** were awarded Geological Society of America Research Grants.

**Delico Teixeira** and **Hope Williams** received the Honors College Award for Distinguished Undergraduate Research.

**Javier Tellez** received the Most Dedicated International Teaching Assistant Award from the Graduate College.

**Zachary Tomlinson** was recognized as the Outstanding Student in Mineralogy Award.

**Dalila Jesus** received the Charles Gould Award for the Outstanding Senior in Geology.

**Zainab Alibrahim** received the David Stearns Award for Outstanding Achievement.

**Glicinia Castro** received the Estwing Hammer Award in recognition of her outstanding work ethic and commitment to academic excellence.

**Abraham Wallace** received the Alan Witten Award for the Outstanding Senior in Geophysics.



NO MATTER WHAT  
**ACCOMPLISHMENTS**  
YOU ACHIEVE,  
**SOMEBODY**  
HELPS YOU.

—ALTHEA GIBSON

# CONGRATULATIONS TO OUR 2017-2018 GRADUATES



## **B.S. GEOLOGY**

Zainab Al Ibrahim  
Robin Bias  
Delcio Cardoso  
Glicinia Castro  
Kalila Clemente  
Aristides Costa  
Mason Cullen  
Dalila Jesus  
Shawna Dewald  
Joshua Diehr  
Ryan Forrest  
Sarah Fowler  
Hagan Hunter  
Wenqi Jiang  
Candace Johnston  
Devon Jones  
Kourtney Lewis  
Nicholas Mallozzi  
Brandon Maples  
Kathleen Miller  
Hannah Morgan  
Cullen Norburg  
Jonathon Pelton  
Ricardo Penaloza  
Tara Putri  
Jordan Renner  
Ryan Rosol

Dionicio Salgado  
Will Shelden  
Kenny Sifford  
Cody Totten  
Tony Wiley  
Zachary Wright  
Malia Zinn

Baylee Kushner  
Kelsey Lewis  
Joshua Miller  
Emily Ryan  
Laura Sanchez Flores  
Yagmur Sumer  
Zhuobo Wang  
Chenxi Xu

## **B.S. GEOPHYSICS**

Eyad Fuad Aljishi  
Christopher Browning  
Bailey Hein  
Maggie Martin  
Angie Ortega Romo  
Abraham Wallace  
Madison Williams

## **M.S. GEOPHYSICS**

Murphy Cassel  
Andres Lozano  
David Lubo Robles  
Stephen Marsh  
Oluwatobi Olorunsola  
Kara Rohan  
Jianhang Yin

## **M.S. GEOLOGY**

Steven Adams  
Madison Armstrong  
Brian Castro  
Sarah Clark  
Spencer Clayton  
Ifunanya Ekwunife  
Puntira Henglai  
Ashley Horton  
Lydia Jones

## **PH.D. GEOLOGY**

Sayantana Ghosh  
Ann Ojeda

## **PH.D. GEOPHYSICS**

Jefferson Chang  
Lennon Infante Paez  
Xuan Qi





# GEOLOGY FIELD CAMP

DR. SHANNON DULIN

Thirty-four OU geology students attended the Bartell Field Camp this summer in Cañon City, Colorado. The weather was warm and dry this summer-perfect for field geology! The first two weeks were spent getting to know the stratigraphy of the Cañon City Embayment by measuring section from the Proterozoic Idaho Springs Suite through the last gasp of the Cretaceous interior seaway deposits of the Trinidad and Vermejo Formations. The students mapped the Grape Creek area and the challenging geology underfoot at field camp before heading off on the regional trip with Dr. Elmore to Yellowstone and the Grand Tetons in Wyoming. After coming back, the dreaded Mixing Bowl was the next area to be mapped. This area has vexed many senior geology undergraduates over the decades, and will continue to do so.

The gnats and the heat add to the misery, I mean mystery, of the depositional and structural complexities of the bowl. Many geological arguments over structural orientation, fault contacts and stratigraphic contacts took place this year, as usual, and the students learned the importance of meticulously collected field data. The students took a multi-day trip to Leadville to learn about hydrology and mining practices from Dr. Kato Dee, our newest assistant professor, who joined the department in August. We rounded out field camp with igneous mapping of Cenozoic volcanic complexes at Ruby Mountain, outside of Buena Vista and wrapped up a successful field season for the Bartell Field Camp.





# GEOPHYSICS FIELD CAMP

DR. MICHAEL BEHM

Seven OU students and one student from the University of Utah comprised this year's geophysics field camp group. Supported by faculty, TA Tanner Shadoan, and Dr. Jefferson Chang, they successfully completed a rigorous three-week schedule of geophysical data acquisition, processing and interpretation. Applied methods included reflection and refraction seismic with two types of acquisition systems (cables and nodes), electrical resistivity tomography, ground-penetrating radar, gravimetry and magnetics. High-precision GPS (rover and base station) was used throughout for georeferencing.

The geological target was the depth continuation of a volcanic outcrop. Owing to the multidisciplinary approach and combination of several methods, we confirmed that the intrusion is limited in spatial extent and its potential feeding systems must be located at great depths. This result is of particular interest since these types of volcanic intrusions are widespread in the region, but so far little to nothing is known about their origin and related geodynamic processes.

The three-week course concluded with a group presentation to the geology students and a summary in form of a detailed technical report.



# TRACING ATMOSPHERIC DUSTINESS IN THE PALEO MID- LATITUDES

DR. LYNN SOREGHAN, WITH  
DR. MEHRDAD SARDAR ABADI,  
AND ANDREW OORDT

Atmospheric dust is increasingly recognized as a major actor in Earth's climate system — serving as both an archive and agent of climate and climate change. For several years now, Lynn Soreghan has worked with teams of graduate students to study ancient eolian “dust” (silt and finer sized) deposits, mostly of Pennsylvanian-Permian age, and mostly in the western United States (former equatorial western Pangaea). This time period captures Earth's most recent example of a pre-Cenozoic icehouse (time of large continental glaciation), and Earth's only example of collapse of an icehouse.

After years of characterizing these types of deposits in western equatorial Pangea, we've expanded our scope to capture dust records from regions farther afield, namely the northern and southern paleo mid-latitudes. We identify shallow-marine carbonate systems that formed far from any fluvial-deltaic source of siliciclastic material, and use these ancient reefs as one might use an ice core — as a trap for atmospheric dust.



M.S. student Andrew Oordt and Dr. Lynn Soreghan sporting the OU flag in Andrew's field site of Spitsbergen (Svalbard).



Dr. Mehrdad Sardar Abadi in the Central Alborz Mountains (Iran). Cyclic Permian carbonates above reddish clastics (Carboniferous) contain the dust deposits under study.

Dr. Mehrdad Sardar Abadi, an Iranian post-doctoral scientist working with Dr. Soreghan, collected a sample set from a Pennsylvanian-Permian carbonate setting of Iran, which formed within ~1000 km of the Gondwanan glacial systems, in terranes of the Paleo-Tethys, at a paleolatitude of ~ 35 degrees south. Andrew Oordt, a current M.S. student, traveled to Svalbard for his northern mid-latitude paleo-setting, also from the Pennsylvanian-Permian but at a paleolatitude of ~30 degrees north.

Both Mehrdad and Andrew then spent laborious hours in the lab, extracting and analyzing the silicate mineral fraction from their respective sections, assessing the temporal and spatial distribution of dust in the stratigraphic record.

Ultimately, these records help constrain climate models of the late Paleozoic icehouse, which help us to understand the role of dust in Earth's deep-time climate system.



# GRADUATE STUDENT FINDS 'ALIEN WOOD' IN MONTANA AND OKLAHOMA

DR. RICK LUPIA

SGC graduate student Dean Richmond found the first North American occurrences of a fossil wood taxon, *Xenoxylon meisteri* Palibin et Jarmolenko, 1932, while conducting fieldwork on the Late Jurassic Morrison Formation in central Montana and in western Oklahoma. This taxon was previously known only from China, Eastern Siberia, and Japan but was recovered from six localities — three associated with a carbonate buildup — in Montana and one locality in Oklahoma.

*Xenoxylon* is an enigmatic and entirely extinct genus found in deposits spanning the Carnian (Triassic) through Maastrichtian (Cretaceous). *Xenoxylon* is found widely on the continents of Europe and Asia, and so far only in Alaska, Arctic Canada and Greenland, making this find the southernmost in North America. It is not closely related to any living conifer, but may have affinities to cypresses (Cupressaceae) and podocarps (Podocarpaceae) based on morphology and chemistry.

The absence of *Xenoxylon* throughout most of North America appears to be primarily a sampling bias. There are relatively few paleoecologists working on Jurassic petrified wood so exploration is restricted. In addition, although past researchers have reported occurrences of the genus, their specimens either belong to other genera or are inadequately characterized, missing key characters to support their assignment.

Of particular interest is the potential climate implications of these new *Xenoxylon* occurrences. *Xenoxylon* fossils are limited to the northern hemisphere and their occurrence and global range is hypothesized, based on isotopic and sedimentological data, to be related to the distribution of cool and wet climates. The recovery of *Xenoxylon* from Montana and Oklahoma provides additional evidence that the Morrison Formation, which stretches from New Mexico to Saskatchewan, was not deposited in a uniformly dry habitat with plants restricted to waterways. The Montana occurrences support deposition in a habitat with 'normal' latitudinal variation—warmer/drier in the south and cooler/wetter in the north as has been suggested previously. However, its occurrence in Oklahoma suggests that a markedly cooler/wetter climate extended much farther south than is presently hypothesized during at least brief intervals during the Late Jurassic.

Figure 1: *Xenoxylon* log embedded in tufa in Late Jurassic Morrison Fm., Montana. Scale = 1 m

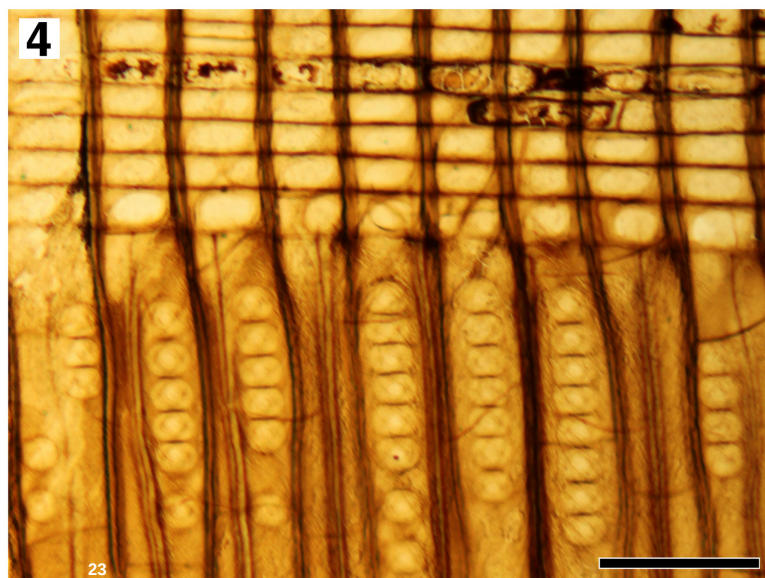
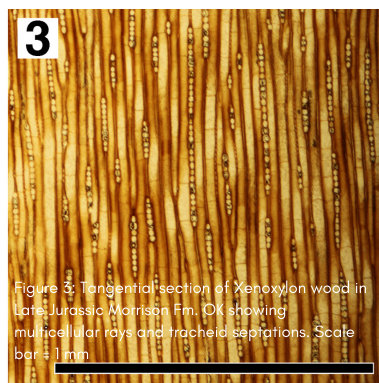
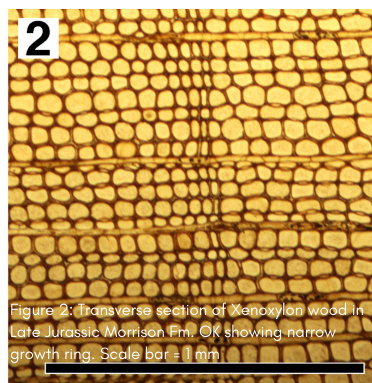


Figure 4: Radial section of *Xenoxylon* wood in Late Jurassic Morrison Fm., OK showing large, simple crossfield pits (top) and mostly contiguous, obround bordered pits with few isolated, round pits (bottom). Scale = 100 microns



# PEGMATITES R US

Dr. David London continued his research on the origins of granitic pegmatites and the various economic commodities that they are mined for: ceramic materials, specialty metals, gems and mineral specimens. His field areas include gem and rare-metal deposits in California and Maine (Fig. 1), and the giant rare-element Tanco pegmatite in Manitoba.

In a recent research article, London and Morgan have now replicated and explained all of the essential attributes of granitic pegmatites (Fig. 2)

London also wrote an invited article for Rocks & Minerals on the occurrence of hydrothermal quartz in southeastern Oklahoma (Figs. 3, 4)

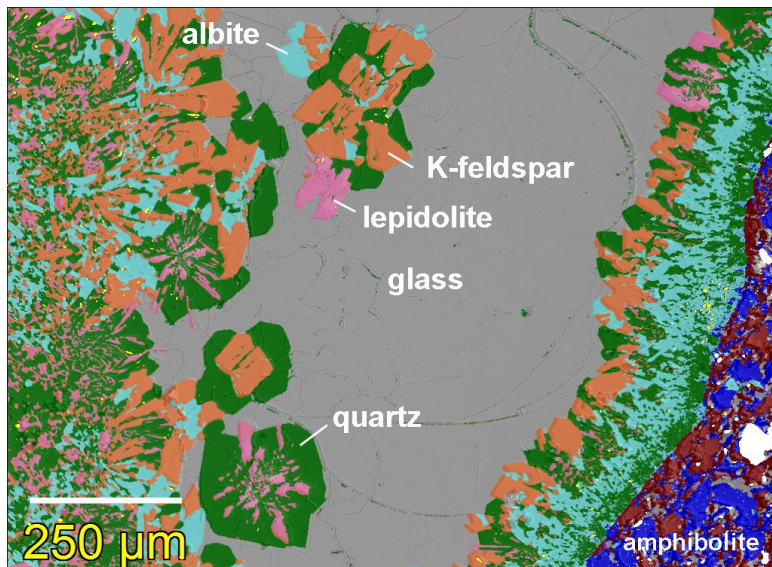


Figure 2. A synthetic pegmatite derived from an experiment conducted at 500 degrees C and 200 MPa, from London & Morgan (2017).



Figure 4: Doubly-terminated quartz crystals (largest is 19 cm long) from an unnamed location ~ 1 km west of Hochatown, OK. David London specimen and photo.



Figure 3. "The Castle", a perfect skeletal quartz floaters (19 cm tall) from west of Broken Bow, Oklahoma. David London specimen and photo.



Figure 1. A 38' crystal of spodumene at Plumbago Mountain, Maine. Photo courtesy of Gary Freeman.



# LANDSCAPES OF DEEP TIME IN THE RED EARTH OF FRANCE: RESEARCH TRAINING IN PALEOCLIMATE

LILY PFEIFER AND DR. LYNN SOREGHAN

Drs. Lynn and Mike Soreghan, together with Ph.D. student Lily Pfeifer, are leading an International Research Experiences for Students summer program funded by the National Science Foundation involving undergraduates from underrepresented groups - especially Native Americans and first-generation college students. This summer's research focuses on detecting tropical climate conditions in eastern equatorial Pangea in the Late Paleozoic (300 Ma) and entails study of red bed and associated sediments from this time. The red beds are remarkably similar to the ubiquitous Permian red mudstone of western Oklahoma, and indeed, France forms the paleoequatorial antipode to Oklahoma, representing eastern and western equatorial Pangea, respectively.



Lily Pfeifer and Lynn Soreghan searching for exposure of mudstone



Riding in a red mudstone saddle



Participants spelling out the topic of their study



Logging and sampling in the Salagou Formation

A panoramic view of Lake Salagou, showing the redbeds of the eponymous Salagou Formation





# GEOPHYSICAL INVESTIGATION OF THE MEERS FAULT

DR. MICHAEL BEHM

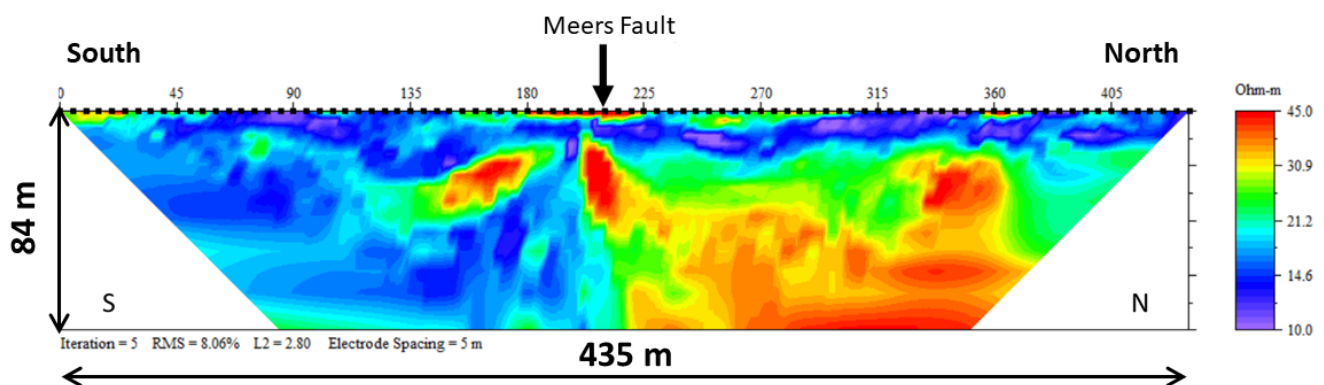
The Meers fault in southwest Oklahoma is part of a SE-NW-trending fault system that forms the boundary between the Wichita Mountains and the Anadarko basin. It shows evidence of movement in the Holocene and is potentially capable of generating large earthquakes. The investigations so far focused on trenching and surface observations (e.g. Luza et al. 1987; Streig and Chang 2018), revealing relatively little about the structure at depth.

In spring 2018, the School of Geology and Geophysics conducted seismic and electrical resistivity measurements at two locations in the exposed central part of the Meers fault. Data were acquired along two 400 m long profiles, allowing imaging of the subsurface down to ca. 80 m depth.

Electrical resistivity tomography (ERT) utilized a multichannel system with 88 electrodes at 5 m spacing. Seismic acquisition combined a 72-channel Geode system and 60 autonomous three-component receivers, providing a total of 132 receivers at 3 m spacing. A sledge hammer was used as a seismic source. Processing and interpretation of the data are at initial stages, and indicate a near-vertical and very well defined fault (e.g. no broad fault zone).

Kimbell ranch is acknowledged for allowing access to its property. A large group of very motivated students ensured smooth and successful data acquisition.

Preliminary vertical electrical resistivity section across the Meers fault (indicated at the surface by the black arrow). The profile is located in the Hennessey Shale of Permian age. The Meers fault seems to separate two shale units of different resistivity and does not appear as a wide transition zone.

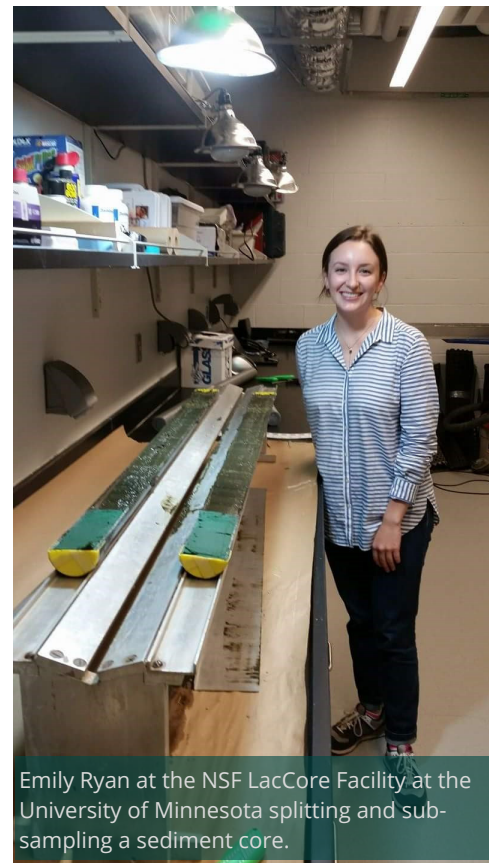


Luza, K., Madole, R., and Crone, A., 1987: Investigation of the Meers fault, Southwestern Oklahoma. Oklahoma Geologic Survey Special Publication 87-1, ISSN 025-0929  
Streig, A. and Chang, J., 2018: Paleoseismic & Geophysical Evaluations to Improve Seismogenic Source Characterization of the Meers Fault, OK: Collaborative Research between Geological Sciences, Portland State University and the Oklahoma Geological Survey, University of Oklahoma.  
USGS Technical report, available at [https://earthquake.usgs.gov/cfusion/external\\_grants/reports/G16AP00141.pdf](https://earthquake.usgs.gov/cfusion/external_grants/reports/G16AP00141.pdf)





Lake Tanganyika, looking west across to the Democratic Republic of Congo.



Emily Ryan at the NSF LacCore Facility at the University of Minnesota splitting and subsampling a sediment core.

# EXPLORING THE SHELL BEDS OF LAKE TANGANYIKA

DR. MICHAEL SOREGHAN

Lake Tanganyika, within the East African Rift System, forms an important analog for understanding continental rifting, and its sediments record climate change history. But the lake, which is the largest tropical lake on Earth, is also a biodiversity hotspot and a critical natural resource, as its fisheries supply as much as 40 percent of the protein to the surrounding population.

Dr. Michael Soreghan and student Emily Ryan, (MS 2018) have been studying a unique shallow-water environment of the lake, vast carpets of snail shells that cover tectonically controlled platforms in the lake. These shell beds host a number of endemic creatures: other snail species, crabs, sponges and Cichlid

fish that use the shells for brooding. These shell beds represent accumulation of many generations of snails and so represent a time-averaged horizon. The physical and biologic factors that lead to the creation of these time-averaged, or condensed horizons, are poorly understood, but likely represent periods of environmental change. A better understanding of shell bed formation not only helps interpret Lake Tanganyika's past, but provides a means to better interpret the sequence stratigraphic importance of other lacustrine coquinas, which are prevalent in petroliferous rift basins of West Africa and Brazil.



Example of the shell beds within Lake Tanganyika. Note the male Cichlid guarding his nest and the freshwater sponges near the ruler.

Ryan joined colleagues from the University of Kentucky on a 14-day research cruise on the lake to collect short sediment cores that record historic climate change events, as well as recent changes in sedimentation induced by deforestation and land use change. The increased sedimentation is impacting the shell beds by decreasing the abundance and diversity of organisms that live on the shell beds. This increased sedimentation may also be mimicking a climatic change event, and thus ties into the stratigraphic significance of lacustrine shell beds within the geologic record.





# 2017-2018 SMS SHALE CONSORTIUM

COMPILED BY JING ZHANG AND DR. ROGER SLATT

OU SMS (STACK-MERGE-SCOOP) consortium (formerly named the Woodford Shale Consortium), directed by Dr. Roger Slatt, is maturing after six years. We recently started a Phase IV component. The project is funded through a consortium of oil and gas companies, many that have participated in this program since its inception in 2012. SMC phase IV aims to finalize the 26 theses/dissertations completed. Twenty-nine companies have participated in various stages and there are 20 active companies. The Phase IV is designed to compile all Woodford data into a solid, rock-based study while transitioning to Meramec-Sycamore research. We are well into Sycamore with an M.S. student completing reservoir characterization from cores of Meramec, and one Ph.D. student describing the recently popular Sycamore I35 outcrop, which has been analyzed by another group using our same sampling sites! We are documenting a new outcrop that we believe has never been documented before. We also completed several county-wide isopach, structure and oil-gas prone maps.

A key to our success has been leading field trips and core workshops for individual companies. During 2017, SMS held several Woodford-Sycamore field trips and associated core workshops for our consortium members. The field trips are always big hits.

Students in Slatt's Shale course (to be expanded into a two-semester course), attend these trips and actively participate. The participating students are: Richard Brito, Jing Zhang, Sayantan Ghosh (now Ph.D.), Benmadi Milad, Carlos Molinares, David Duarte, Naya Ekwunife (now M.S.), Emilio Torres, Daniella Beccara (now M.S.) and Henry Galvis (now M.S.). They are a first-class group. The core workshop displayed one Hunton-Woodford transition core, two Woodford cores and three Meramec cores.

SMS has done comprehensive research on selected unconventional reservoirs, including organic (TOC; RockEval) inorganic geochemistry analysis (XRD, XRF, thin section), seismic inversion, subsurface reservoir modeling, isotope analysis for paleoenvironmental interpretation rock hardness/brittleness, etc. SMS is devoted to correlating reservoir characteristics obtained from the field and tied to the subsurface to construct application analogs, and locate preferred frac zones and other subsurface features amenable to preferred landing zones. Most of the SMS students publish in technical journals; 11 technical presentations and six theses were completed for the year of 2017. We are forever indebted to our sponsors to trust in our abilities. For further details on our shale program, see the February 2018 AAPG Explorer.



# RESERVOIR CHARACTERIZATION

DR. MATTHEW PRANTER

The Reservoir Characterization and Modeling Laboratory has been busy with research on Mississippian reservoirs of north-central and central Oklahoma.

Activity in the carbonate and chert-rich reservoirs of the “Mississippi Lime” of north-central Oklahoma has shifted south with a focus on the Mississippian-age Meramec and Osage Series (and underlying Woodford Shale) of the STACK play (Sooner Trend in the

Anadarko Basin of Canadian and Kingfisher counties), as well as the Merge/SCOOP trends. A small army of students from the RCML (Fnu Suriamin, Katie Drummond, Joshua Miller, Garrett Hickman, Mike Miller, Laynie Hardisty, Cody Totten, and others) have been working on these reservoirs and equivalent outcrops in collaboration with students and faculty from petroleum engineering. Dr. Andrew Cullen (Warwick Energy) provided a robust data set in the STACK area, technical advice and serves on student committees. We are also working on a large integrated reservoir characterization study (with geophysics and engineering faculty/students) funded by Marathon to improve understanding of the stratigraphic and structural framework and how facies, mineralogy, petrophysical properties, fluid characteristics and operational practices relate to production and recovery. An improved understanding of these parameters aids in well-placement and spacing optimization in selected landing zones.

Dr. Rex Cole (Colorado Mesa University) and I have conducted on fluvial deposits and reservoirs. Three-dimensional architectural-element models of fluvial deposits constrained to outcrop data show how static and dynamic connectivity are sensitive to internal heterogeneity of architectural elements, sandstone-body width, net-to-gross ratio and well spacing. All three students have submitted manuscripts on this research.

The RCML has also been well represented at various conferences including five posters at the 2018 AAPG in Salt Lake City. We have also published articles on the Mississippian reservoirs of the Midcontinent in AAPG Memoir 116.

The Integrated Reservoir Modeling and Simulation class had a great time on the fall field trip to Colorado (Figure 2) as Dr. Rex Cole and I led students to numerous localities to analyze world-class fluvial and shallow-marine outcrops.

In addition, the RCML has used conventional and drone technology on outcrop-reservoir analogs to unravel stratigraphic and facies architecture of fluvial deposits and implications for reservoir performance (Figure 1). Javier Tellez, Sarah Clark and Kelsey Lewis have been key players. This research expands on the 16 years of collaborative research Dr. Rex Cole (Colorado Mesa University) and I have conducted on fluvial deposits and reservoirs. Three-dimensional architectural-element models of fluvial deposits constrained to outcrop data show how static and dynamic connectivity are sensitive to internal heterogeneity of architectural elements, sandstone-body width, net-to-gross ratio and well spacing. All three students have submitted manuscripts on this research.

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Figure 2 A) Drone-based photogrammetry models require flight paths at two or more distances from the outcrop face to obtain different levels of detail. (B) Outcrop reconstruction of Escalante Canyon, Colorado. (Models generated using Pix4DMapper Pro.)

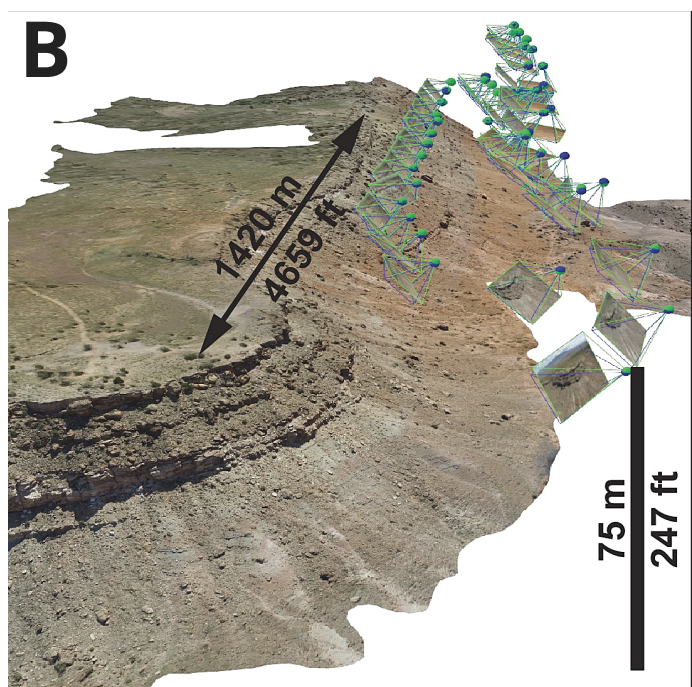
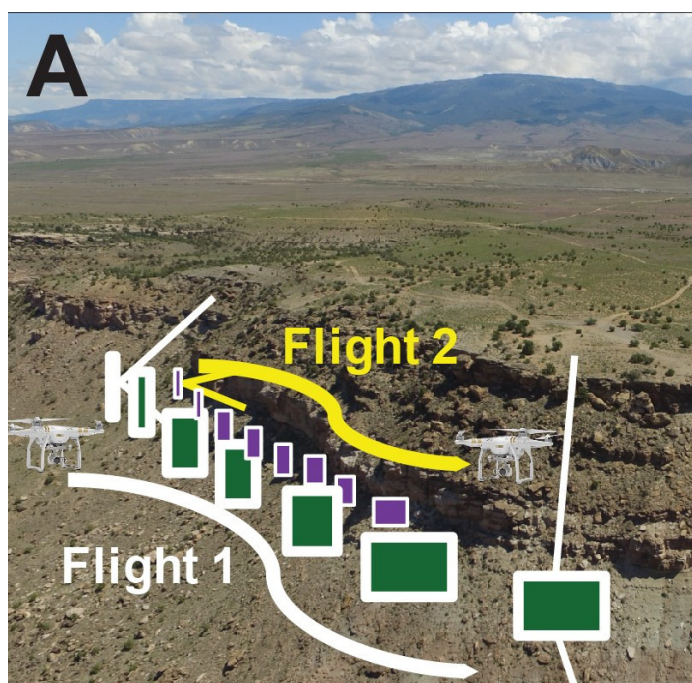
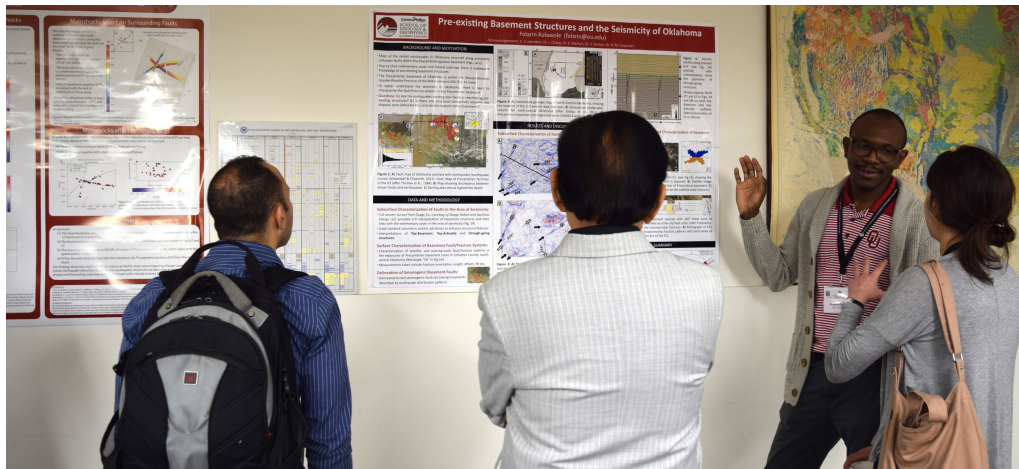


Figure 1) IRMS field trip. Students with Dr. Matt Pranter and Dr. Rex Cole (field trip leaders, far left) and Javier Tellez (TA, far right) with fluvial deposits of the Cretaceous Mesaverde Group.





# DRILLING INVESTIGATION OF SEISMOGENIC CRUST IN OKLAHOMA

The drastic, unexpected surge of earthquake activity in the central United States since 2009 has alarmed the public and resulted in raising the earthquake hazard estimate for Oklahoma based on its induced seismicity. Induced earthquakes also have been observed throughout other portions of North America (Colorado, Arkansas, Texas, Ohio, Kansas, Illinois, western Canada) and worldwide (Switzerland, southern Italy, Germany, Netherlands, India, China). Most recent earthquakes occurring in Oklahoma nucleated at depths well within the igneous basement. Although much is known about the shallow sedimentary sequences in Oklahoma, where oil and gas are produced, little is known about the structure and in-situ properties of the underlying igneous basement, where the largest and most damaging earthquakes originate.

In order to address these issues, members of the international scientific community attended a workshop held over May 3-5 in Norman, Oklahoma. The workshop was funded jointly by the International Continental Scientific Drilling Program, the Mewbourne College of Earth and Energy, the Southern California Earthquake Center, and the School of Geology and Geophysics. It was convened by Brett Carpenter, Ze'ev Reches, Cristiano Collettini, Francois Cornet, Heather DeShon, Stephen Hickman, Kuo-Fong Ma, Xiaowei Chen, Ahmad Ghassemi, Nori Nakata and Jake Walter. Approximately 95 participants from about 10 different countries attended the meeting, with representation from the following groups: scientific drilling (ICDP, CSDCO), government agencies (OCC, NGRI-India), geological surveys (USGS, OGS, Ark.GS, KGS, Tx BEG, GFZ-Germany), and industry (Chevron, Whitestar, Natural Resources-Canada, Hawk Energy, UNAM-Mexico, CTFOK).





# IMAGING A PALEOVALLEY TO IMAGINE PALEOCLIMATE

Dr. Lynn Soreghan and Dr. Michael Behm

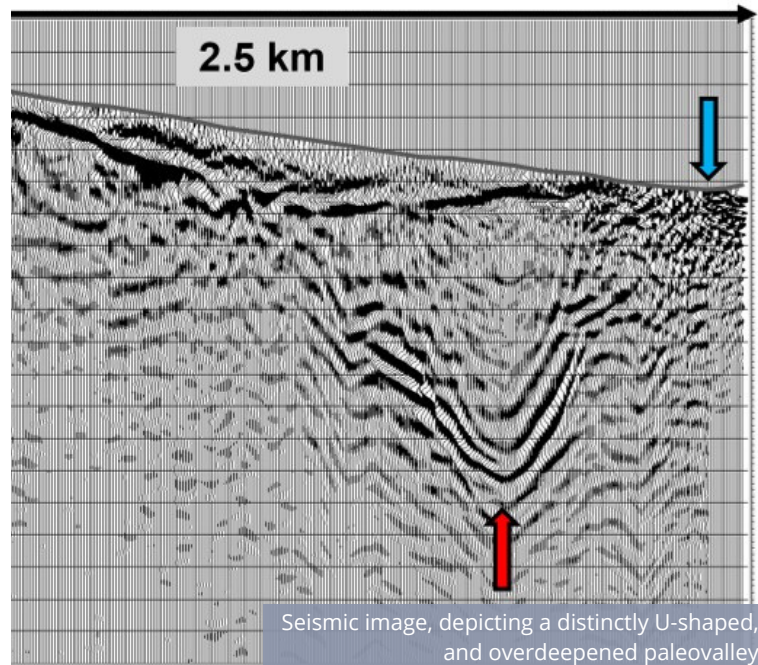
Unaweep Canyon (western Colorado) has been the subject of ongoing research by our group. We are continuing to explore the hypothesis that this odd landform — a large, Precambrian basement-cored canyon that hosts two streams flowing in opposite directions, is a paleo-landform, and was carved glacially. In fall 2017, we made additional progress by acquiring reflection seismic data in the western canyon, to image the basement surface and to characterize the sediment fill here. If we can demonstrate that the true bedrock form is U-shaped, and deep, the case for a glacial origin will be strengthened.

We teamed with researchers from the University of Texas El Paso, Drs. Steve Harder and Galen Kaip, to acquire a 2.5 km line extending in a transverse orientation across the western canyon. An accelerated weight drop was used as source, and the receiver side comprised 520 nodal instruments at a spacing of 5 m. This project forms the thesis project for M.S. student Anna Patterson.

The data are of excellent quality and allow imaging of the bedrock surface up to 500 m of depth. Refraction and reflection processing confirm a U shape for the bedrock surface, and a sediment depth that, when combined with knowledge of the bedrock surface downstream (west), suggest the valley is “overdeepened” — that is, excavated to a depth below fluvial base level. Such a longitudinal profile is impossible for a river, but typical of glacial valleys. If confirmed, then Unaweep Canyon may indeed be the remnants of an ancient glacial valley.



Dr. Jefferson Chang taking meticulous notes during acquisition (using an accelerated weight drop)



Seismic image, depicting a distinctly U-shaped, and overdeepened paleovalley



Anna Patterson and Pranshu Ratre survey the line



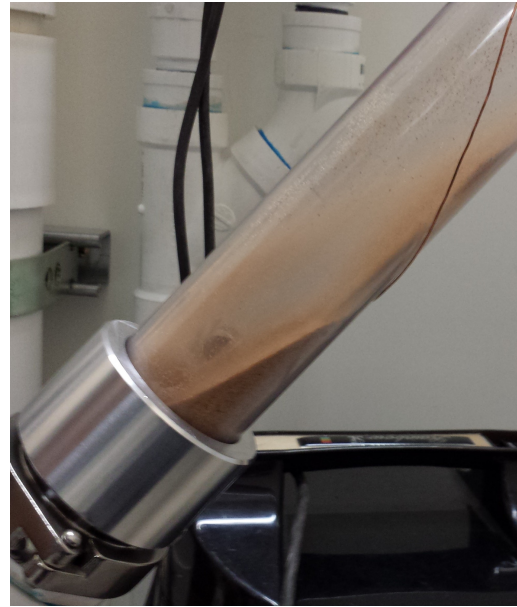
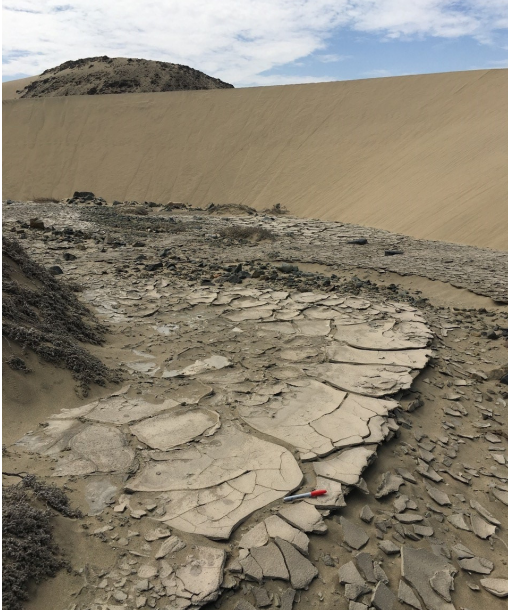
Dr. Michael Behm and Feng Cheng deploying nodes





Dunes at the Algodones field site in southern California (pictured left)

Dunes in the desert of equatorial Peru



Sand from the Little Sahara dune field saltating in the abrasion chamber

# DO DESERT DUNES PRODUCE ABUNDANT SILT? WHY DOES IT MATTER?

Steve Adams, M.S. Geology Student

I am working with Dr. Lynn Soreghan to investigate the potential of aeolian dune fields to produce silt-sized particles ( $4 - 63 \mu\text{m}$ ). Modern aeolian silt deposits, known as loess, are commonly associated with glacial processes of the Quaternary icehouse. If restricted to glacial intervals of Earth history, then loess deposits would serve as a key paleoclimate indicator in the rock record. Past experiments using a variety of starting material, from crushed vein quartz to river sand returned conflicting results — some successfully produced abundant fines, whereas other experiments failed to do so.

Dune sand collected from the Algodones dune field in California and the Little Sahara dune field in Oklahoma was used in a custom-built apparatus designed to simulate saltation and associated wind abrasion of sand under windstorm conditions. The produced fines were collected and measured (mass, grain size).

Results were then scaled up to the dimensions of a large sand sea. Scaled results indicate dune fields are unlikely to produce sufficient silt to form large loess deposits. Results of our experiments will assist paleoclimate interpretations of loess deposits found in the rock record.

Future work will investigate silt deposits in Peru and their potential sources. Western Peru is an ideal paleoclimate analog for the study of silt production, with the presence of alpine glaciers at low latitude as well as warm-desert dune fields in close proximity to possible loess deposits. Samples from glacial lakes, rivers and aeolian dunes were collected on a recent field trip to Peru. Studying the grain morphology and sediment geochemistry may enable us to distinguish the source of the silt and the associated mechanisms of production, to help inform interpretations of past Earth conditions.





My name is Will Sheldon, and I'm a recent graduate of OU's School of Geology and Geophysics. During my time in SGG I had the chance to study geosciences under outstanding faculty and among a group of talented and diverse classmates. The courses provided in our college gave us a variety of opportunities to venture into the field and work with the science hands-on, something I really appreciated given our field's close relationship to the natural world. One such opportunity was a trip we took to New Mexico as part of our GEOL 4113 Class, Depositional Systems and Stratigraphy, taught by current director of the school, Dr. Lynn Soreghan. The trip was an amazing chance to see many of the topics covered in the course out in the real world. We got to hike the Permian Reef in Guadalupe Mountains National Park in order to see the different facies of marine depositional systems. We visited White Sands National Monument at sunset to learn about eolian processes. We even hiked into Carlsbad Caverns to see one of the largest natural cave systems in the United States.

# SEE WHAT SGG HAS TO OFFER

OU's geology program also provided me with a variety of different academic opportunities to really explore what I was interested in. One of these was my academic research project which I worked on under Dr. Richard Elmore. I decided I wanted to focus on groundwater security issues in Oklahoma and North Texas and their potential social, economic and environmental impacts. The project ended up turning into a passion of mine and inspired me to go on to study natural resource law at the University of Tulsa, where I'll be starting this fall. Under Dr. Elmore's mentorship and the resources the college provided me I was able to present my research at the Geological Society of America's South Central Conference and at the ConocoPhillips Research Symposium hosted at OU. An additional opportunity I had over the course of conducting my undergraduate research in the SGG was the chance to work with OU's Center for the Creation of Economic Wealth's TEDx team to give a TED talk on my research at OU's annual TEDxOU conference. Giving a TED talk on



something I'm so passionate about was an amazing experience. It was also an awesome platform to talk about the geosciences field, the issues it covers and my own research in an accessible way that people can understand and relate to. I hope to have more chances like this in the future to educate people about the issues our field deals with and appreciate all the amazing opportunities I've had to do it over the past four years in the SGG.



# DR. ELMORE'S SEDIMENTOLOGY FIELD TRIP TO INVESTIGATE PENNSYLVANIAN DELTAIC DEPOSITS NEAR MINERAL WELLS, TEXAS AND BARRIER ISLAND/BEACH PROCESSES/DEPOSITS ON GALVESTON ISLAND

THANK YOU BHPBILLITON



Group at Fish Tales thanks BHP for supporting their field trip



Describing Pennsylvanian deltaic sequence



Trough cross bedding in sandstone at top of sequence



Measuring the longshore current with oranges



Digging a trench to see beach stratification



Plant roots on the beach indicating the island is eroding and migrating landward





Polymict Breccia in steeply inclined dolomite beds



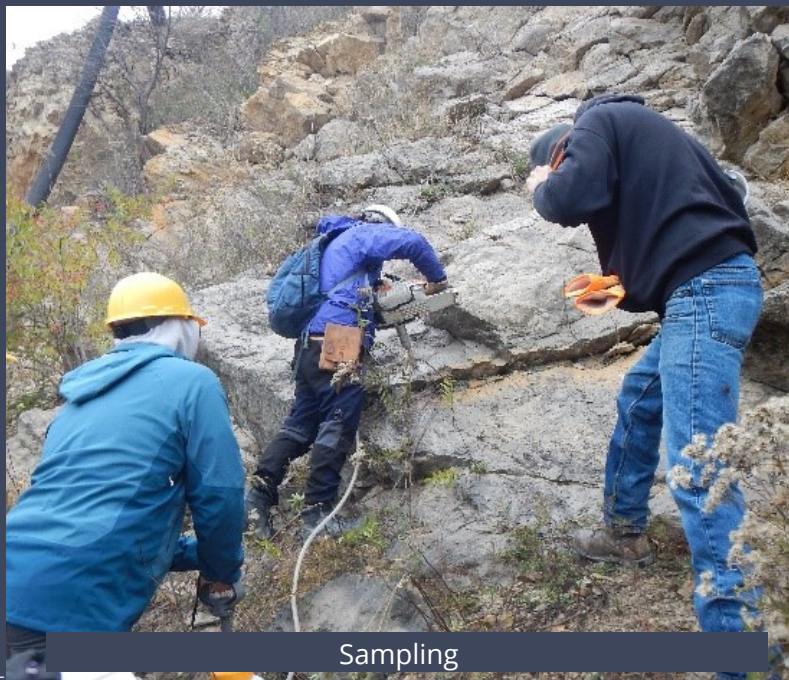
Close up of polymict breccia

# RESEARCH ON THE KENTLAND, INDIANA IMPACT CRATER WITH CHRISTINA HAMILTON AND DR. DOUG ELMORE

The age of the Kentland impact is not well constrained and Christina is conducting a paleomagnetic study to date the impact and to test if there is evidence for hydrothermal alteration associated with the impact.



Christina Hamilton pointing out shatter cones



Sampling



# ALUMNI NEWS

We welcome submissions of news and updates from our alumni. To submit your news, please use the included form on page 48 or email your news to [geology@ou.edu](mailto:geology@ou.edu).

**Don Walker** (B.S. Petroleum Geology '04) shares, "My wife, Jennifer (BBA Energy Management and BBA Economics, Class of 2004) and I adopted our daughter, Genevieve Marie, in Guangzhou, China, in December 2017. She is making a great transition to her new family and life in Houston and doing very well. I was also promoted to Senior Staff Geologist at EP Energy in January 2018."



"I think the success of any school can be measured by the contribution the alumni make to our national life." - John F. Kennedy



**Vance Hall** says, "Marilyn and I recently visited Sedona for the first time. The surrounding trails and vistas exceeded our expectations. I want to return, better prepared to appreciate the geology. The names of the formations exposed in the area drew my attention. In our undergraduate geology courses, we were introduced to the stratigraphy of the Grand Canyon. Names such as the Coconino Sandstone and the Redwall Limestone were familiar, and I was able to examine some rocks without rappelling down a canyon wall or riding the rapids down the Colorado."

**Andrew Cullen** shares, "I was an invited speaker at AAPG's SCOOP-STACK Playmaker Forum (available through Search Discovery) and published series of nine of "My Favorite Outcrop" descriptions in the Oklahoma City Geological Society's Shale Shaker (available through AAPG Datapages and OCGS). I served on two MSc thesis committee chaired by Dr. Pranter and am currently working with Dr. Behm on shallow geophysics of the Meers fault, primarily as a field laborer. Lastly, my most recent peer-reviewed work has over 100 reads on Research Gate: Gozzard, S., Kusznir, N., Franke, D., Cullen, A., Reemst, P., and Henstra, G., 2018. South China Sea crustal thickness and oceanic lithosphere distribution from satellite gravity inversion, *Petroleum Geoscience*, 2016-162. "





**Allen Crockett** (B.S. Geology '67) is in his 12th year with the Bureau of Land Management as supervisor of a staff of environmental scientists in planning, permitting and administering development of federal oil and gas resources in western Colorado. This "second career" follows more than 30 years as a consultant in the private sector for mining and federal facilities remediation. Allen received a Ph.D. in geology and ecology from the University of Colorado in 1975 and a law degree from the University of Denver in 1981. In 2016, he self-published a book on the ecology of Colorado and is currently working on a second edition. Allen's wife of 36 years, Linda, recently completed a Ph.D. in psychology and is Dean of the Aspen campus of Colorado Mountain College. They enjoy traveling around the country to visit the highest points of the 48 states. Allen reports that he will always have warm feelings for OU and a deep appreciation for the solid academic footing it provided.

**Lura Joseph** (M.S. Geology '81) shares, "I retired from the University of Illinois, Urbana-Champaign, on May 1, 2018, with the designation of Associate Professor Emerita, University Library, after 17 years of service. I was previously a petroleum geologist for 15 years in Oklahoma."

**Ken Ruzyla** (class of '69) shares, "After first setting foot in Gould Hall in Sept. of 1965, and 40 years working in the oil & gas industry, I have retired as of March of 2015. It has certainly been an up and down experience, and the industry has changed completely during that time, but I am very fortunate to have had the opportunity to work in exploration, research, and the service sector, so it has been interesting. My wife, Carol Ann, retired in January after an equally long career as an RN. We have one grandson, Richard, who will turn 6 this month. Our son, Eric, has BA and MA degrees from Stephen F. Austin State University and works in TV production. Our daughter, Nancy, also an SFA grad, lives in Webster, TX with husband Dennis, a mathematician working at NASA.

"I am now a full-time investor as well as a "student" of golf. Investing in Wall Street may not be as interesting as studying the interstices of an oil & gas reservoir, but the pay is a whole lot better. I am also working on my first novel. Any "spare" time is spent on my two great passions, model railroading and restoring some old motorcycles, which take up most of the space in my garage. OOPS! I left out my other passion: OU football! Go Sooners! That "squib" kick at the close of the first half of the Georgia game cost us both that game and the National Championship."

**John Watson** (B.S. '54, M.S. Geology '59) was honored with the Snowsport Builder award June 9 by the Far West Ski Association for long term contributions to the sport that have made an indelible imprint upon it. The award recognizes over 50 years of leadership and innovation in the fields of ski area development (remember the Mineral King dispute and all the other conflicts raised by the Sierra Club and others the on environmental issues?), original publications, ski history programs, and recognition systems. This is the 22nd such award since 2008.

Service started at the club level on committees and went forward at the council and divisional presidencies (and as a national committee chair and then VP). Watson authored in 1973 the first Rules for Governance of the National Ski Hall of Fame.

Watson remains the History Chair of FWSA and is the President of the Far West Ski Foundation founded in 1964. He reanimated this foundation in 2009. It makes 10- 20 grants per year for Alpine ski-racing scholarships, services enabling adaptive skiing for the disabled and wounded veterans, educational support to snowsport museums and since 2009 support for women's ski jumping. The USA now has the ninth-ranked lady jumper in the world - Sarah Hendrickson.

Watson never earned a dime from snowsport; all his half century of activity was as a volunteer.



# MEMORIALS

in memory of our alumni gone too soon

Reported as of August 2018 to OU Development

Thomas J. Alexander  
J. O. Ambrose  
Robert W. Amis  
Bill Oren Andress  
Marshall Lee Austin  
Alan Baharlou  
Joe G. Blair  
Charles Richard Brammell  
Janis Martin Calmes  
John G. Cameron  
Charles Burnham Chase  
Mertie Ann Chilton  
Leo Richard Chisholm  
Paul Eugene Clark  
Henry Franklin Coffeen  
Albert L. Crabtree  
Stanley L. Cunningham  
Dale Vernon Dalton  
Dorothea L. Dougherty  
James H. Edwards  
Nelson B. Escue  
Jimmie Jack Fielder  
Phillip A. Fitter  
Richard A. Garden  
Harry Lee Gearhart  
James Miller Goodger  
Patrick L. Gore  
Harold Herndon Haralson  
Reginald Wilson Harris  
Thomas W. Henry  
Samuel L. Hessa  
Charles L. Hughes  
Richard Floyd Johnson  
Earl Verner Jones  
Arno Richard Kassander  
Charles R. Kellett  
Gene Marshall Kennard

Guy B. Kiker  
Myrl Stuart Kirk  
Robert Ray Lam  
Clayton E. Lee  
Daniel Coleman McClung  
Laddie B. McDade  
Thomas M. Meason  
Bill E. Morgan  
William James Moyer  
Harry Ellsworth Nicholls  
George Clark Pendleton  
Virgil R. Pyatt  
M. Glenn Robb  
William Donald Rogers  
Thomas David Rowell  
Charles N. Scott  
Allen G. Siemens  
Joe M. Sloan  
John David Slover  
Edward Barrett Smith  
John Thomas Spears  
Albert M. Stall  
James L. Steidley  
Daniel M. Strong  
James Hugh Trexler  
B. C. Tucker  
Jan C. Tupper  
Doris Yvonne Turney  
Bernard Eric Waghorne  
Keith F. Walker  
Robert F. Walker  
Floyd Sherald Waters  
Alvin E. West  
Frank Kenneth Williams  
Wilfred Joseph Wilson



# Rodger "Tim" Denison

By Andrew Cullen

Rodger "Tim" Denison passed away on 8 July 2016 after a rich life of 83 years. Tim was born 11 November 1932, in Fort Worth, Texas, but raised in Tulsa. Tim graduated from the Wentworth Military Academy in Missouri. Despite growing up in an oil town, Tim's real interest was in studying history. Tim had a deep interest in history and decided to study geology because he regarded it as a historical science given its focus on studying the evolution of things through time. He obtained a B.Sc. in geology from the University of Oklahoma. During the Korean War he completed Ranger training and served two years as a platoon leader. In Korea Tim developed his love of classical music. Following his service, Tim returned to OU for his M.Sc where he met Caroline Holmes on a blind date. They married three months later and enjoyed 58 years together.

After graduating from OU, Tim worked for the Oklahoma Geological Survey on the basement rocks of southern Oklahoma with Bill Ham. In the early 1960s, Bill Muehlberger at the University of Texas at Austin began an AAPG- and Air Force-supported project on the basement rocks of North America, which became Tim's doctoral thesis at UT. He was one of the youngest people ever named to the UT Geology Advisory Council, and missed only three of the advisory committee meetings in his more than four decades.

In 1964, Tim took a job as a researcher with Mobil Oil and the family moved to Dallas, where Tim joined Mobil Research and Development and became known as one of the pioneers of strontium isotope stratigraphy.

Except for 14 years as a consultant, Tim worked for Mobil until he retired and became a research scientist at the University of Texas at Dallas. In 2009, the Geological Society of America South-Central Section held a special session in Tim's honor titled "A View of the Craton Southward into the Gulf of Mexico" at its meeting in Dallas. In 2014, the Oklahoma Geological Survey dedicated their monumental volume *Igneous and Tectonic History of the Southern Oklahoma Aulacogen* to Tim. Tim published over 70 papers in the peer-reviewed geoscientific literature and was active in both GSA and AAPG, providing a rare and much-needed bridge between academia and industry.

When Tim wasn't geologizing, he attended to his family and many interests. He rebuilt Alfa Romeos, played tennis, and read widely, especially history. He loved classical music and collected Bullwinkle memorabilia. His family will remember him as a superb team member to have in a game of Trivial Pursuit; a weekend cook whose specialties were nachos, and grilled cheese made in the waffle iron; a connoisseur of both good and cheap beer; and an avid Simpsons fan. He was also very fond of cats. Survivors include his wife, Caroline Holmes Denison; daughter and son-in-law Kelly and Tim Harrell; daughter and son-in-law Cambria and Brian Reinsborough; grandchildren Calder, Reeve and Kellen Reinsborough.

## A remembrance by M. Charles Gilbert

Rodger E. Denison was one of our alums whose sterling science reputation, and influence in the larger oil and gas industry, will be felt for a long time to come. He was born in Tulsa, but had relatives in Hobart, near the Wichitas, which gave him a lasting interest in, and love of, that area. His dad, A. Rodger Denison, was a President of AAPG, and I can remember Rodger Denison speaking to the School in 1958-60 when I was a hardrock graduate student with Hugh Hunter. Tim had just finished his M.S. in 1958, "The Basement Complex of Comanche, Stephens, Cotton, and Jefferson Counties, Oklahoma" directed by Cliff Merritt, Phillip Chenoweth, and Hugh Hunter. Tim then worked for the Oklahoma Geological Survey with Bill Hamm. Because the area of Tim's study included the Wichita Mountains, and Hunter was doing a new, and for the time, a more modern study of the gabbroic rocks, Hunter's hard rock group of Bill Hiss, myself and Burke Spencer, plus Tim at the Survey had a lot of interactions. In later years, he generously shared with me some of his unpublished notes and data on the Wichitas.

The work Tim did with Hamm and Merritt on the structural and geological evolution of what came to be known as the Southern Oklahoma Aulacogen became a landmark study on the basement and orogenic setting of the southern Midcontinent. This monumental study was published by the OGS as Bulletin 96 in 1964, and is still widely cited.

I was finishing my M.S. in 1960 on the gabbroic rocks of the Glen Mountains near Roosevelt, and planning to go to UCLA for Ph.D. work, while Tim was planning on going to UCB for a Ph.D. to work with F. J. Turner, a famous metamorphic petrographer.

Subsequently, after being at UCLA for a year, I found out that Tim changed his mind and found the project the W.R. Muehlberger at the

University of Texas, Austin had developed on the basement of the mid-US was more aligned with his interests, and he transferred to UT. His Ph.D. was on the basement of NE Oklahoma and was published in the OGS Circular 84 in 1981.

At TU, Tim developed long-lasting ties with Ed Lidiac also in that basement group. This background led to Tim's lifelong interest in what makes the crust of the middle U.S. so provocative and enlightening. It also gave him deep interests in two otherwise competing schools—OU and TU. Tim's 2 daughters went to UT, and Cambria, the younger, got a Ph.D. there in mineralogy/geology.

Before 1990, Tim and his sister established a fund in honor of their dad at the School. He also established accounts at UT as well, so he strongly supported both schools, although he probably got more recognition from UT than from us.

Tim worked for many years with the Mobil Research Lab in Dallas.

During that time the lab developed the first Sr isotope variation curves for the Phanerozoic. This was a major big science innovation that had direct applications on petroleum occurrences, as well as how to put together the basic geologic history and development of the last 500 million years of Earth history.

Tim served on the Alumni Advisory Committee, and on its board in the 1990s and early 2000s. He provided a voice for the long-term growth of the School and importance of basic science in education of students, no matter what their shorter-term interests might be. Through the years he interacted with Ken Johnson on the nature of the Oklahoma-Texas Permian. He was a dear friend of many in the OGS and kept his ties with many in the Oklahoma geologic community.



# Marlan W. Downey

By Andrew Cullen

Marlan W. Downey passed away peacefully on May 29, 2017, Memorial Day. He will be deservedly remembered an exploration trailblazer and a true gentlemen. Marlan graduated from Fall City High School (Nebraska) at 16 and received his BA in chemistry from Peru State in 1952. He served honorably in the US Army as artilleryman in the Korean War before returning home to earn his Bachelor of Science and Master of Science in Geology from the University of Nebraska and a PhD in Science from Peru State. His first work as a geologist was in hard rock geology – gold mining in South Dakota, but switched to oil and gas upon taking a job with Shell. Marlan had a thirty-year career with Shell Oil in management and research, retiring in 1987 as President of Pecten (US Shell’s international company).

At Pecten Marlan directed team responsible for major discoveries in Cameroon, Syria, Canada, Malaysia, and Brazil; President Biya of Cameroon knighted Marlan in 1987 for his services to that country. After a brief retirement during which he founded Roxanna Oil Company, he joined ARCO, serving as President of ARCO International for seven years. After retiring from ARCO, he became the Bartell Professor of Geoscience at the University of Oklahoma, and Chief Scientist at the Sarkey’s Energy Center. He is an honorary alumnus of the University of Oklahoma.

Marlan was a former President of the AAPG, an elected Fellow of the American Association for the Advancement of Science, a Senior Fellow of the Institute for the study of Earth and Man at SMU, and a Fellow of the Geological Society of the United Kingdom.

In 2000, he organized and chaired the Presidential Energy Policy Symposium in Washington, DC. In 2002, he received the R.H. Dott award for best geologic publication, and in 2003 he received the Hedberg Medal for outstanding scientific achievements. In 2005, he was honored as a “Legendary Oil Finder” by the Petroleum History Foundation. In 2008, Marlan received the Sidney Powers Memorial Award, the highest honor bestowed by the AAPG, for his outstanding contributions to oil and gas exploration.

Marlan led exploration teams in 62 countries, with an extraordinary record of consistent successes in his sixty-year career. Even when the stakes were large and tensions high, Marlan had a sanguine demeanor and deft touch with his staff. Hearing him say, “My tummy just doesn’t quite feel right about this.” was his gentle way of telling you to recheck your work. A favorite saying often attributed to Marlan is one that we must always keep in mind: “Geology is a science. Exploration is a business.”

Marlan leaves behind his wife Marea Downey and six children, Donald, Julie, Karen, Justin, Alex, and Nick. He will be truly missed, but fondly remembered by all of those whose lives he touched. If any of his friends would like to make a charitable donation to a memorial fund set up on behalf of Marlan, to be used for scholarships in the field of geology, please contact Marea Downey at [marea@roxannaoil.com](mailto:marea@roxannaoil.com) and she will be pleased to give further details.

## A remembrance by M. Charles Gilbert

We were extremely fortunate to recruit Marlan to serve the School and OU as Bartell Chair in 1996. During the time I was Director, the Bartell Chair (created by our loyal alum, D. Bartell) became available. As it happened, Marlan had just retired from this second “Presidency” of a major company: Shell’s Pecten International Company in 1987; and ARCO International in 1995. Thus, we were able to move appropriately to see if Marlan would come to OU’s School of Geology & Geophysics as the Bartell Chair. And he accepted.

We worked out an arrangement whereby Marlan came to Norman during the middle of the week, staying at the nearby Holmberg House, while being at the School, and interacting with students, faculty, and alums. Marea, his lovely wife, kept the main residence in Dallas. Marlan lectured in a variety of courses. The larger Earth science community, involving the engineers, geophysicists, geologists, and foreign-service contacts of the Sarkeys Energy Center, then named Marlan, Chief Scientist of Sarkeys.

Marlan was called on for his knowledge of the world petroleum business, and its myriad relations, to give advice and consultations on how OU should be relating to this vast diverse economy....and, what serious exploration is all about. He was so popular with our alumni that he was made a member of the School’s AAC, and an honorary OU alum. He found this fascinating considering the long intense sports competition between OU and University of Nebraska, his alma mater. He served as Bartell Chair and SEC Chief Scientist for about 3 years. I believe he really enjoyed his time here. He acknowledged his connections with OU for all the years afterward. As a Director I was always so appreciative of his willingness to let the School use some of his Chair funds to support students.

Marlan had founded Roxanna Oil Company as a family oil and gas business when retiring from Shell Pecten and was involved in its operations till his passing. He was an active member of AAPG, and its President in 2012. He had various associations with other universities including SMU. He was one of the most distinguished faculty members we have had in the last 20 years. Marea and his six children survive him.



# Stanley L. Cunningham

By Andrew Cullen

Stanley Lloyd Cunningham passed away on November 29, 2017 at the age of 79. Stan graduated from Tishomingo High School in 1956. He attended East Central University on a football scholarship, but after his freshman year transferred to the University of Oklahoma. Stan played trumpet in the Pride of Oklahoma Marching Band and professionally in several musical organizations. During summer breaks in college he worked on geophysical crews for Western Geophysical, Amerada Petroleum, and Cities Service Oil Company. He graduated from OU in 1960 with a Bachelor of Science in Geology and earned his Doctor of Jurisprudence the College of Law at the University of Oklahoma in 1963.

Stan practiced law for nearly 40 years. He started at Phillips Petroleum Company working on international ventures in Europe, Africa, the Middle East, the Far East, South America and the Caribbean. In 1971 he joined the McAfee & Taft law firm, which is now the largest law firm in Oklahoma. Stan always maintained his interest in the technology of geophysics and returned to the University of Oklahoma to earn his Master of Science in Geophysics in 2004 at the age of 66. He thereafter engaged in the oil business as a geophysicist and lawyer, with partners who were experts in drilling, operations, leasing and geology. He also taught petroleum geology at OU as an adjunct professor. He was active in the Alumni Advisory Council of the ConocoPhillips School of Geology and Geophysics and served as chairman for a term.

Stan also served his country for nine years in the Air Force Reserve and Air National Guard. While he was on active duty for training, he was the student commander of a squadron of 2,500 men, and received an outstanding student award. He commanded an Aerial Port Flight. His last assignment was that of a Judge Advocate General officer.

Stan married Suzanne Yerger on September 18, 1960, at St. Mark's Episcopal Church in Shreveport, Louisiana. They met as undergraduate students at OU and their love lasted a lifetime,

Stan was interested in sports, especially the fortunes of the football team at OU, and in music, especially jazz. He owned an extensive collection of jazz. He was a member of the 75 Dance Club of Oklahoma City. He and Suzanne also loved to dance in Santa Fe, New Mexico. Their favorites were the tango and western dancing at La Fonda Hotel with the Bill Hearn Trio.

Stan graduated from OU with honors, including the Order of the Coif (law), the Board of Editors, Oklahoma Law Review, Phi Kappa Phi (multidisciplinary), and Sigma Gamma Epsilon (geoscience). As an undergraduate student, he was a Harry J. Brown scholar. As a law student, he received the Rocky Mountain Mineral Law Foundation award in oil and gas law, and the American Jurisprudence award in the law of evidence.

He was also a member of the American, and Oklahoma Bar Associations, and a member of the bar of the Supreme Court of Oklahoma, the United States District Court for the Western District of Oklahoma, the United States Court of Appeals for the Tenth Circuit and the Supreme Court of the United States. During his legal career, he appeared before each of these courts at various times as lead counsel. In 1979 he presented oral argument to the Supreme Court of the United States. He was listed in Best Lawyers in America, Who's Who in American Law, and Who's Who in the World. He was a member of the American Society of International Law, the Federal Energy Bar Association, Phi Alpha Delta law fraternity, and the Oklahoma City Mineral Lawyers Society. He was also a member of the Society of Exploration Geophysicists, the American Association of Petroleum Geologists, and the Society of Independent Professional Earth Scientists, as well as industry and scientific organizations.

## A remembrance written by M. Charles Gilbert

Stan was an unusual individual with two careers: geology and law. He graduated in Geology in 1960, two years after I did ... maybe I even taught him in a lab as a GTA. Just after graduating he married Suzanne Yerger. She is an artist and has been involved with Stan and his associations with the School throughout their lives. They have two sons.

Stan graduated with a law degree in 1963 and went on to practice law for almost 40 years, most of it related to oil and gas. He was with Philips Petroleum for about 8 years, before joining McAfee and Taft in Oklahoma City. So, throughout his career, geology was always a big part of his life.

I became the School Director in 1990 while Stan was actively involved in alumni activities. He served on the AAC as Chair and Board member. He was energetic in thinking about ways to involve more alums and in ways to raise funds for the School for its long term growth. Stan was one who could give constructive criticism and take feedback easily. He was a pleasure to work with

He attended all AAC meetings that I can remember, until the time of his death.

He had an abiding interest in technological-related geology and geophysical approaches to Earth processes and history. He decided to become a geophysics graduate student in 2002 and graduated with a M.S. in Geophysics in 2004. His thesis "Instantaneous Spectral Analysis of a High Impedance Atokan Sandstone in the Northern Arkoma Basin" was chaired by Roger Slatt, John Castagna (former OU faculty, now U of Houston), and Roger Young. Stan had the intelligence and drive to expand his skills and approaches in geosciences. He was a special editor of the Journal of Geophysics, and a Certified Earth Scientist.

Doug Elmore, School Director at that time, called on Stan to aid in teaching petroleum geology in various courses for business, engineering, and geology students. His passing represents a real loss to those carrying the School's torch of past great deeds toward an even grander future.



# FACULTY PUBLICATIONS AND GRANTS 2017

## **Younane Abousleiman**

### Journal Articles

Chen, S. L., Abousleiman, Y. (2017). Wellbore stability analysis using strain hardening and/or softening plasticity models. *International Journal of Rock Mechanics and Mining Sciences*, 93, 260–268.

Han, Y., Abousleiman, Y., Hull, K. L., Al-Muntasheri, G. A. (2017). Numerical Modeling of Elastic Spherical Contact for Mohr-Coulomb Type Failures in Micro-Geomaterials. *Experimental Mechanics*, 57(7), 1091–1105.

Liu, C., Abousleiman, Y. (2017). Shale Dual-Porosity Dual-Permeability Poromechanical and Chemical Properties Extracted from Experimental Pressure Transmission Tests. *Journal of Engineering Mechanics*, 143(9).

Hull, K. L., Abousleiman, Y., Han, Y., Al-Muntasheri, G. A., Hosemann, P., Parker, S. S., Howard, C. B. (2017). Nanomechanical Characterization of the Tensile Modulus of Rupture for Kerogen-Rich Shale. *SPE Journal*, 22(04), 1024–1033.

Mehrabian, A., Abousleiman, Y. (2017). Wellbore Geomechanics of Extended Drilling Margin and Engineered Lost-Circulation Solutions. *SPE Journal*, 22(04), 1178–1188.

Liu, C., Hoang, S. K., Tran, M. H., Abousleiman, Y. N., Ewy, R. T. (2017). Poroelastic Dual-Porosity Dual-Permeability Simulation of Pressure Transmission Test on Chemically Active Shale. *Journal of Engineering Mechanics*, 143(6).

Liu, C., Mehrabian, A., Abousleiman, Y. (2017). Poroelastic Dual-Porosity/Dual-Permeability After-Closure Pressure-Curves Analysis in Hydraulic Fracturing. *SPE Journal*, 22(01), 198–218.

### Grants

Abousleiman, Y., "Geomechanics Gas Shale Consortium," Various Oil Companies.

## **Michael Behm**

### Journal Articles

Behm, M. (2017). Feasibility of borehole ambient noise interferometry for permanent reservoir monitoring. *Geophysical Prospecting*, 65(2), 563–580. 10.1111/1365-2478.12424.

## **Brett M. Carpenter**

### Journal Articles

Townend, J., al., E., Carpenter, B. M., al., E. (2017). Petrophysical, geochemical, and hydrological evidence for extensive fracture-mediated fluid and heat transport in the Alpine Fault's hanging-wall damage zone. *Geochemistry, Geophysics, Geosystems*. 10.1002/2017GC007202.

Savage, H. M., Kirkpatrick, J. D., Mori, J. J., Brodsky, E. E., Ellsworth, W. L., Carpenter, B. M., Chen, X., Cappa, F., Kano, Y. (2017). Scientific Exploration of Induced Seismicity and Stress (SEISMS). *Scientific Drilling*, 23, 57–63.

## **Brett M. Carpenter cont.**

Trippetta, F., Carpenter, B. M., Mollo, S., Scuderi, M., Scarlato, P., Collettini, C. (2017). Physical and transport property variations within carbonate-bearing fault zones: Insights from the Monte Maggio Fault (Central Italy). *Geochemistry, Geophysics, Geosystems*, 18, 4027–4042.

Kirilova, M., al., E., Carpenter, B. M., al., E. (2017). Textural changes of graphitic carbon by tectonic and hydrothermal processes in an active plate boundary fault zone, Alpine Fault, New Zealand. *Geological Society, London, Special Publications*, 453.

Toy, V., al., E., Carpenter, B. M., al., E. (2017). Bedrock geology of DFDP-2B, central Alpine Fault, New Zealand. *New Zealand Journal of Geology and Geophysics*, 60, 497–518.

Sutherland, R., al., E., Carpenter, B. M., al., E. (2017). Extreme hydrothermal conditions at an active plate-bounding fault. *Nature*, 546, 137–140.

Tesei, T., Carpenter, B. M., al., E. (2017). Friction and scale-dependent deformation processes of large experimental carbonate faults. *Journal of Structural Geology*, 100, 12–23.

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### Grants

Carpenter, B. M., Chang, J. C., Reches, Z., "RAPID: Collaborative Research: GPS observations of post-seismic deformation from the 3 Sep 2016, Mw 5.8, Pawnee, Oklahoma," National Science Foundation.

## **Xiaowei Chen**

### Journal Articles

Savage, H. M., Kirkpatrick, J. D., Mori, J. J., Brodsky, E. E., Ellsworth, W. L., Carpenter, B. M., Chen, X., Cappa, F., Kano, Y. (2017). Scientific Exploration of Induced Seismicity and Stress (SEISMS). *Scientific Drilling*, 23, 57–63.

Goebel, T., Weingarten, M., Chen, X., Haffener, J., Brodsky, E. (2017). The 2016 Mw5.1 Fairview, Oklahoma earthquakes: evidence for long-range poroelastic triggering at >40 km from fluid disposal wells. *Earth and Planetary Science Letters*, 472, 50–61.

Chen, X., Nakata, N., Pennington, C. N., Haffener, J., Chang, J. C., He, X., Zhan, Z., Ni, S., Walter, J. I. (2017). the Pawnee earthquake as a result of the interplay among injection, faults, and foreshocks. *scientific report*, 7(4945).

Chen, X., Nakata, N. (2017). Preface to the Focus Section on the 3 September 2016 Pawnee, Oklahoma, Earthquake. *Seismological Research Letters*, 88(4), 953–955.

Pennington, C., Chen, X. (2017). Coulomb Stress Interactions during the Mw 5.8 Pawnee Sequence. *Seismological Research Letters*, 88(4), 1024–1031.



**Xiaowei Chen cont.**

Zhang, Q., Lin, G., Zhan, Z., Chen, X., Qin, Y., Wdowski, S. (2017). Absence of remote earthquake triggering within the Coso and Salton Sea geothermal production fields. *Geophysical Research Letters*, 44(2), 726–733.

**Grants**

Chen, X., "Collaborative Research: Multi-scale validation of earthquake source parameters to resolve any spatial, temporal or magnitude-dependent variability at Parkfield, CA," National Science Foundation.

Nakata, N., Chang, J. C., Chen, X., "NSF RAPID: Monitoring aftershocks for the Mw5.8 Pawnee earthquake," National Science Foundation.

Chen, X., "NSF-RAPID: Rapid Response for the M5.1 Fairview Earthquake – Detailed Understanding of the Fault Systems in Western Oklahoma," National Science Foundation.

Chen, X., "Effect of geothermal operations on earthquake source processes in the Salton Sea geothermal field," University of Southern California, University.

Chen, X., Murray, K., "Modeling fault slip induced by fluid disposal on pre-existing faults," Oklahoma Geological Survey, State.

**R. Douglas Elmore****Journal Articles**

Elmore, R. D., Haynes, J., Farzaneh, S., Anzaldúa, S. (2017). Integrated paleomagnetic and diagenetic study of the Mississippian Limestone, North Central Oklahoma. *AAPG Memoir* 116, 116.

Roberts, J., Elmore, R. D. (2018). A diagenetic study of the Woodford Shale in the southeastern Anadarko Basin, Oklahoma, USA: Evidence for hydrothermal alteration in mineralized fractures. *Interpretation*, 6(1), SC1–SC13.

**Grants**

Elmore, R. D., "Diagenetic study of Meramec, Major and Garvin counties, Oklahoma," Devon Energy Corporation.

Elmore, R. D., "Diagenetic study of Wolfcampian cores, Texas," Devon Energy Corporation,.

Elmore, R. D., "Characterization of the Basement and Fluid conduits in Arbuckle Group," Oklahoma Geological Survey Governor's office Oklahoma, State.

Outreach by the OU School of Geology and Geophysics to local K12 Schools, Halliburton.

**Andrew S. Elwood Madden****Journal Articles**

Phillips-Lander, C. M., Legett, C., Madden, A. S., Elwood Madden, M. E. (2017). Can we use pyroxene weathering textures to interpret aqueous alteration conditions? Yes and No. *American Mineralogist*, 102(9), 1915–1921.

Chen, X., Madden, A. S., Reches, Z. (2017). Friction Evolution of Granitic Faults: Heating Controlled Transition From Powder Lubrication to Frictional Melt. *J Geophys Res Solid Earth*.

Chen, X., Madden, A. S., Reches, Z. (2017). The frictional strength of talc gouge in high-velocity shear experiments. *J Geophys Res Solid Earth*, 122(5), 3661–3676.

**Andrew S. Elwood Madden cont.**

Sexton, M. R., Elwood Madden, M. E., Swindle, A. L., Hamilton, V. E., Bickmore, B. R., Madden, A. S. (2017). Considering the formation of hematite spherules on Mars by freezing aqueous hematite nanoparticle suspensions. *Icarus*, 286, 202–211.

**Book Chapter**

Chen, X., Elwood Madden, A. S., Reches, Z. (2017). Powder rolling as a mechanism for dynamic fault weakening. *Fault Zone Properties and Processes during Dynamic Rupture*. AGU Geophysical Monograph Series.

**Grants**

Krumholz, L. R., Callaghan, A. V., Madden, A. S., Sankaranarayanan, K., "R11 Track-2 FEC: Building Genome-to-Phenome Infrastructure for Regulating Methane in Deep and Extreme Environments (BuG ReMeDEE)," National Science Foundation.

Elwood Madden, M. E., Pritchett, B. N., Madden, A. S., "Mars Brine Attacks: Investigating Mineral Weathering Reactions in Near-eutectic Brines," NASA – Headquarters.

**Megan E. Elwood Madden****Journal Articles**

Phillips-Lander, C. M., Legett, C., Madden, A. S., Elwood Madden, M. E. (2017). Can we use pyroxene weathering textures to interpret aqueous alteration conditions? Yes and No. *American Mineralogist*, 102(9), 1915–1921.

Marra, K., Elwood Madden, M. E., Soreghan, G. S., Hall, B. (2017). Chemical weathering trends in fine-grained ephemeral stream sediments of the McMurdo Dry Valleys, Antarctica. *Geomorphology*, 281, 13–30.

Sexton, M. R., Elwood Madden, M. E., Swindle, A. L., Hamilton, V. E., Bickmore, B. R., Madden, A. S. (2017). Considering the formation of hematite spherules on Mars by freezing aqueous hematite nanoparticle suspensions. *Icarus*, 286, 202–211.

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Soreghan, G. S., Elwood Madden, M. E., "Quantifying Surface Area in Muds from the Antarctic Dry Valleys: Implications for Weathering in Glacial Systems," National Science Foundation.

Elwood Madden, M. E., Pritchett, B. N., Madden, A. S., "Mars Brine Attacks: Investigating Mineral Weathering Reactions in Near-eutectic Brines," NASA – Headquarters.

**Michael H. Engel****Journal Articles**

Connan, J., Kavak, O., Saglamtimur, H., Engel, M. H., Zumberge, A., Zumberge, J. E. (2017). A geochemical study of bitumen residues on ceramics excavated from Early Bronze age graves (3000–2900 BCE) at Basur Höyük in SE Turkey. *Organic Geochemistry* (115), 1–11.

**Xiaolei Liu****Journal Articles**

Liu, X. (2018). Predominance of the parallel glycerol arrangement in archaeal tetraethers from marine subsurface sediments: structural features revealed by degradation products. *Organic Geochemistry*, 115.

**David London****Journal Articles**

London, D. (2017). Hydrothermal quartz from McCurtain County, Oklahoma. *Rocks & Minerals*, 92, 30–35.



## **David London cont.**

Acosta-Vigil, A., London, D., Morgan, G. B., Cesare, B., Hermann, G., Bartoli, O. (2017). Primary crustal melt compositions: Insights into the controls, mechanisms and timing of generation from kinetics experiments and melt inclusions. *Lithos*, 286, 454–479.

London, D. (2017). Reading pegmatites: what lithium minerals say. *Rocks & Minerals*, 92, 144–156.

Maner, J. L., London, D. (2017). The boron isotopic evolution of the Little Three pegmatites, Ramona, California. *Chemical Geology*, 460, 70–83. (Published)

London, D., Morgan VI, G. B. (2017). Experimental crystallization of the Macusani obsidian, with applications to lithium-rich granitic pegmatites. *Journal of Petrology*, 58, 1005–1030.

## **Grants**

London, D., "An Experimental Calibration of the Fractionation of Boron Isotopes among Granitic Melt, Aqueous Fluid, and Tourmaline," National Science Foundation.

## **Kurt J. Marfurt**

### **Book Chapters**

Qi, X., Snyder, J., Zhao, T., Marfurt, K. J., Pranter, M. J. (2017). Correlation of seismic attributes and geo-mechanical properties to the rate of penetration in the Mississippian Limestone, Oklahoma. *Mississippian Reservoirs of the Midcontinent: AAPG Memoir 116* (vol. 116). AAPG.

Lindzey, K., Pranter, M. J., Marfurt, K. J. (2017). Lithological and petrophysical controls on production of the Mississippian Limestone, northeastern Woods County, Oklahoma. *Mississippian Reservoirs of the Midcontinent: AAPG Memoir 116* (vol. 116). AAPG.

Turnini, A., Pranter, M. J., Marfurt, K. J. (2017). Mississippian limestone and chert reservoirs, Tonkawa Field, north-central Oklahoma. *Mississippian Reservoirs of the Midcontinent: AAPG Memoir 116* (vol. 116). AAPG.

### **Journal Articles**

Qi, J., Machado, G., Marfurt, K. J. (2017). A workflow to skeletonize faults and stratigraphic features. *Geophysics*, 82(4), O57–O70.

Zhao, T., Li, F., Marfurt, K. J. (2017). Constraining self-organizing map facies analysis with stratigraphy: An approach to increase the credibility in automatic seismic facies classification. *Interpretation- A Journal of Subsurface Characterization*, 5(2), T163–T171.

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Sarkar, S., Marfurt, K. J. (2017). Effect of volcanic bodies on hydrocarbon reservoirs in the northeastern part of the Chicotepec Foredeep, Mexico. *Interpretation- A Journal of Subsurface Characterization*, 5(3), SK1–SK10.

Liao, Z., Liu, H., Jiang, Z., Marfurt, K. J., Reches, Z. (2017). Fault damage zone at subsurface: A case study using 3D seismic attributes and a clay model analog for the Anadarko Basin, Oklahoma. *Interpretation- A Journal of Subsurface Characterization*, N, 5(2), T143–T150.

## **Kurt J. Marfurt Cont.**

Qi, J., Li, F., Marfurt, K. J. (2017). Multiazimuth coherence. *GEOPHYSICS*, 82(6), O83–O89.

Infante-Paez, L., Marfurt, K. J. (2017). Seismic expression and geomorphology of igneous bodies: A Taranaki Basin, New Zealand, case study. *Interpretation- A Journal of Subsurface Characterization*, 5(3), SK121–SK140.

Ha, T., Marfurt, K. J. (2017). Seismic reprocessing and interpretation of a fractured-basement play: Texas Panhandle. *Interpretation- A Journal of Subsurface Characterization*, 5(3), SK179–SK187.

Ha, T., Marfurt, K. J. (2017). The value of constrained conjugate-gradient least-squares migration in seismic inversion: Application to a fractured-basement play, Texas Panhandle. *Interpretation- A Journal of Subsurface Characterization*, 5(3), SN13–SN23.

Chopra, S., Marfurt, K. J. (2017). Volumetric fault image enhancement – Some applications. *Interpretation- A Journal of Subsurface Characterization*, 5(2), T151–T161.

## **Grants**

Sondergeld, C. H., Rai, C. S., Devegowda, D., Ousseini Tinni, A., Marfurt, K. J., Pranter, M. J., "Reservoir Characterization in Unconventional oil & Gas Reservoirs," Marathon Oil Company.

Marfurt, K. J., "Attribute-Assisted Seismic Processing and Interpretation Consortium," Various Oil Companies.

## **Shankar Mitra**

### **Journal Articles**

Li, J., Mitra, S. (2017). Geometry and evolution of fold-thrust structures at the boundaries between frictional and ductile detachments. *Marine and Petroleum Geology*, 85, 16–34.

## **Norimitsu Nakata**

### **Journal Articles**

Sleep, N. H., Nakata, N. (2017). Nonlinear attenuation S-waves by frictional failure at shallow depths. *Bull. Seismol. Soc. Am.*, 107(4), 1828–1848.

Chen, X., Nakata, N., Pennington, C. N., Haffener, J., Chang, J. C., He, X., Zhan, Z., Ni, S., Walter, J. I. (2017). the Pawnee earthquake as a result of the interplay among injection, faults, and foreshocks. *scientific report*, 7(4945).

Chen, X., Nakata, N. (2017). Preface to the Focus Section on the 3 September 2016 Pawnee, Oklahoma, Earthquake. *Seismological Research Letters*, 88(4), 953–955.

Kalkan, E., Ulusoy, H., Wen, W., Fletcher, J.P.B., Wang, F., Nakata, N. (2017). Site properties inferred at Delaney Park downhole array in Anchorage Alaska. *Bull. Seismol. Soc. Am.*

## **Grants**

Nakata, N., "Ambient Field Analysis of Earthquake Ground Motion at Groningen Gas Field," Stanford University.

Nakata, N., Chang, J. C., Chen, X., "NSF RAPID: Monitoring aftershocks for the Mw5.8 Pawnee earthquake," National Science Foundation.



**Nori Nakata cont.**

Nakata, N., "Research Council Faculty Investment Program (FIP)," The University of Oklahoma.

Nakata, N., "Imaging 3D subsurface structure at Diablo Canyon, California, using ambient field recorded by a very dense array for high-frequency ground motion prediction," University of California-Southern California Earthquake Center.

**John D. Pigott**

## Journal Articles

Harouna, M., Pigott, J. D., Philp, R. P. (2017). Burial History and Thermal Maturity Evolution of the Termit Basin, Niger. *Journal of Petroleum Geology*, 40(3), 277-297.

Abdel-Fattah, M. I., Pigott, J. D., Abd-Allah, Z. M. (2017). Integrative 1D-2D Basin Modeling of the Cretaceous Beni Suef Basin, Western Desert, Egypt. *Journal of Petroleum Science and Engineering*, 153, 297.

**Matthew J. Pranter**

## Book Chapters

Qi, X., Snyder, J., Zhao, T., Marfurt, K. J., Pranter, M. J. (2017). Correlation of seismic attributes and geo-mechanical properties to the rate of penetration in the Mississippian Limestone, Oklahoma. *Mississippian Reservoirs of the Midcontinent: AAPG Memoir 116* (vol. 116). AAPG.

Lindzey, K., Pranter, M. J., Marfurt, K. J. (2017). Lithological and petrophysical controls on production of the Mississippian Limestone, northeastern Woods County, Oklahoma. *Mississippian Reservoirs of the Midcontinent: AAPG Memoir 116* (vol. 116). AAPG.

Turnini, A., Pranter, M. J., Marfurt, K. J. (2017). Mississippian limestone and chert reservoirs, Tonkawa Field, north-central Oklahoma. *Mississippian Reservoirs of the Midcontinent: AAPG Memoir 116* (vol. 116). AAPG.

## Grants

Sondergeld, C. H., (Rai, C. S., Devegowda, D., Ousseini Tinni, A., Marfurt, K. J., Pranter, M. J., "Reservoir Characterization in Unconventional Oil & Gas Reservoirs," Marathon Oil Company.

Reza, Z. A., Pranter, M. J., Marfurt, K. J., "Geological Characteristics, Reservoir Properties, and Geomechanical and Flow Behavior of the Coupled Arbuckle-Basement System in Northern Oklahoma," State of Oklahoma - Oklahoma Geological Survey.

**Roger M. Slatt**

## Grants

Slatt, R. M., "Consortium: Regional Woodford Shale stratigraphy, Oklahoma," Various Oil Companies.

**Gerilyn S. Soreghan**

## Journal Articles

Trachtenberg, Z., Castro, A. J., Gates, K. K., Randall, A. R., Schlupp, I. B., Soreghan, G. S., Theriault, N. W., Wieters, K. M. (2017). (Inter)facing the Anthropocene: How to Represent an Interdisciplinary Interaction. *Resilience: A Journal of the Environmental Humanities*, 5(1), 18-38.

Marra, K., Elwood Madden, M. E., Soreghan, G. S., Hall, B. (2017). Chemical weathering trends in fine-grained ephemeral stream sediments of the McMurdo Dry Valleys, Antarctica. *Geomorphology*, 281, 13-30.

**Gerilyn S. Soreghan cont.**

Trachtenberg, Z. M., Burns, T. J., de Beurs, K. M., Ellis, S. E., Gates, K. K., Hoagland, B. W., Kelly, J. F., Neeson, T. M., Randall, A. R., Schlupp, I. B., Soppelsa, P. S., Soreghan, G. S., Zeigler, J. J. (2017). The Anthropocene Biosphere: Supporting 'Open Interdisciplinarity' through Blogging. *Trends in Ecology & Evolution*, 32(1), 1-3.

## Grants

Soreghan, G. S., Soreghan, M. J., "IRES: Landscapes of Deep Time in the Red Earth of France: Research Training in Paleoclimate," National Science Foundation.

Soreghan, G. S., Elwood Madden, M. E., "Quantifying Surface Area in Muds from the Antarctic Dry Valleys: Implications for Weathering in Glacial Systems," National Science Foundation.

Soreghan, G. S., "ELT COLLABORATIVE RESEARCH: Investigating the Biotic and Paleoclimatic Consequences of Dust in the Late Paleozoic," National Science Foundation.

Soreghan, M. J., Soreghan, G. S., "Collaborative Research: Records of Permian environments and climate from mid-continent redbeds and evaporites," National Science Foundation.

**Michael J. Soreghan**

## Grants

Soreghan, G. S., Soreghan, M. J., "IRES: Landscapes of Deep Time in the Red Earth of France: Research Training in Paleoclimate," Sponsored by National Science Foundation.

Soreghan, M. J., "The origin and time averaging of Lake Tanganyika shell beds: Implications for conservation and paleoecology of large tropical lakes," National Science Foundation.

Soreghan, M. J., Soreghan, G. S., "Collaborative Research: Records of Permian environments and climate from mid-continent redbeds and evaporites," National Science Foundation.

**Stephen R. Westrop**

## Journal Article

Westrop, S. R., Dengler, A. A. (2017). The mid-Cambrian (Series 3, Drumian-Guzhangian; Marjuman) trilobite *Holmdalia Robison*, 1988 in western Newfoundland and its biostratigraphic significance. *Canadian Journal of Earth Sciences*, 54, 113-118.

## Grants

Westrop, S. R., "Digitization PEN: Expanding and enhancing a TCN digitizing fossils to reconstruct evolving ecosystems the Cretaceous Western Interior Seaway," National Science Foundation



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