



UNIVERSITY OF  
ARKANSAS

FALL 2018

# GeoHog Times

Newsletter of the Department of Geosciences



From the Chair

Dr. Christopher Liner

Welcome to the fall 2018 Geosciences Department (GEOS) newsletter!

One of the changes this year is the retirement of Teresa Center after 20 years as Admin Supervisor for GEOS. Teresa was a friend to all and had the unenviable job of serving under 5 different department Chairs. But we all found her energetic, capable and ready to jump into any problem. Teresa will be missed by all. Jackie Shearman has been Admin Supervisor since July 1 and is getting a good handle on the job. Also in staff news, Fulbright College accepted our request for a halftime position to deal primarily with management of research funds in the department and Ashley Chua has been in the job since late July. JoAnn Kvamme continues to spend two half-days at in the department to coordinate with ENDY students and give general support. Lisa Milligan celebrated her 10<sup>th</sup> year as the department’s public information and communications specialist.

Faculty changes include the retirement of Dr. John Hehr who will hold the title of Emeritus. He has admirably carried a heavy teaching load in the last few years and earned respect among our undergraduate students as instructor for *Sustaining Earth, Meteorology, Earth Science and Climatology*. The department deeply thanks John for many decades of dedicated and meritorious service. Dr. Xuan Shi resigned from the University in August and we wish him well as he moves to the next phase of his career.

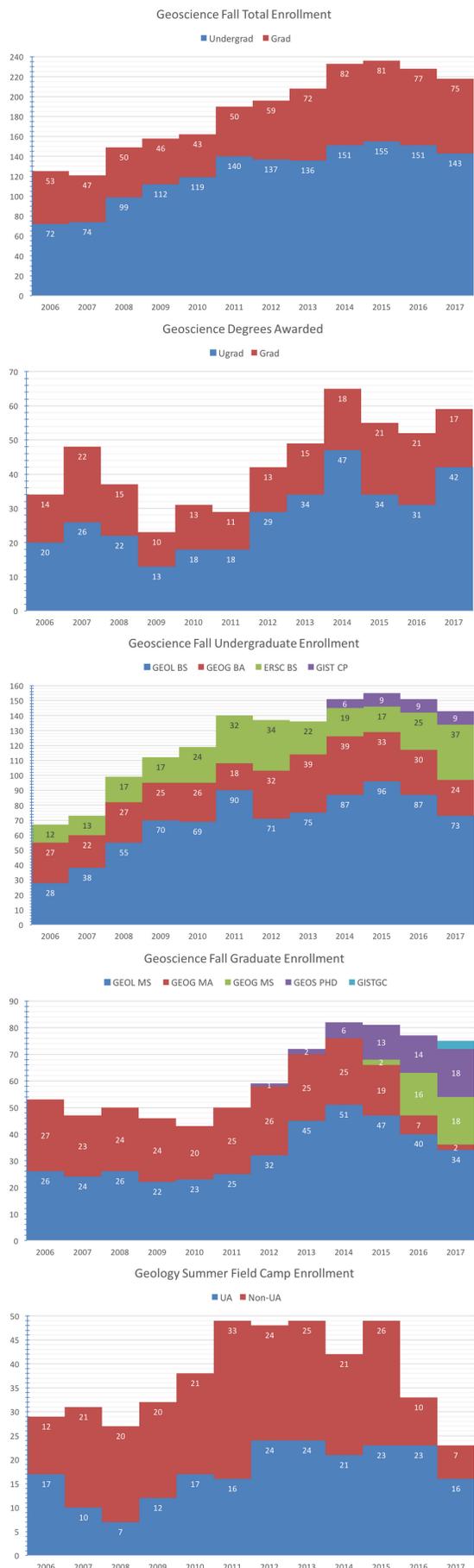
Dr. Yinlin Cheng is a new addition to the faculty (story on page 5) and we are delighted to welcome her to the University of Arkansas! The final bit of faculty news is the hiring of Dr. Dan Sui as Distinguished Professor and Vice Provost for Research, innovation, and Economic Development. Dan works on the social dimensions of geographic information systems. As a geographer, he lines up with our department and tenured into GEOS. Dan comes with a stellar resume and background, most recently at Ohio State and NSF. He will maintain lab and postdoc space in Gearhart Hall and we look forward to having him as part of our GEOS faculty.

In Fall 2018 we taught a Geoscience Careers course for the first time, open to anyone from freshman to PhD students. The format was borrowed from a similar Biology course and the guest list included geologists and geographers in diverse fields. We hope to make this a regular offering.

Our amazing alumni base continues to support programs in the department with donations and direct involvement. The External Advisory Board plans a new capital campaign, called GEOVision, aimed at unrestricted student support. This important effort will allow GEOS in future years to offer scholarships or other support to students that do not line up with existing opportunities. Please consider giving to this worthy campaign if you are able.

I offer a deeply felt thank you to everyone that helps the Geosciences Department work for the benefit of the students of the University of Arkansas.

## GEOSCIENCES BY THE NUMBERS



**Department of Geosciences  
Fall Alumni Event  
4th UARC  
UNIVERSITY OF ARKANSAS  
RESEARCH CONFERENCE  
November 17, 2018**

**SAVE THE DATE!  
Department of Geosciences  
Spring Awards Banquet  
May 2, 2019**

**ON THE COVER:**  
*Students hike on jointed sheet sandstones of the Jurassic Morrison Formation at Cleveland Lloyd Dinosaur Quarry National Natural Heritage Landmark during the 2018 spring break field trip to Utah. Photo courtesy of Andrew Lamb.*

**FACULTY****MOHAMED ALY**

*InSAR, GPS, GIS, Crustal Deformation Modeling, and Geohazard Assessment*

**STEPHEN BOSS**

*Geophysics, Marine Geology, Lacustrine Geology, Earth Systems, Sustainability Studies*

**LINYIN CHENG**

*Hydrologic and Climatic Studies*

**JACKSON COTHREN**

*Director CAST/Super Comp. Center Geospatial Methodologies*

**MATT COVINGTON**

*Hydrogeology, Geomorphology, Karst and Glacial Hydrology*

**FIONA DAVIDSON**

*Department Vice Chair Political Geography, European Studies, Urban Morphology and Planning*

**RALPH DAVIS**

*Vice Provost Research Hydrogeology, Contaminant Transport, Water Resources Management*

**GREG DUMOND**

*Structural Geology and Tectonics*

**SONG FENG**

*Climate Change and Paleoclimates*

**EDWARD HOLLAND**

*Political, Cultural, Religion Geography, International Studies, Conflict and Political Violence, Europe and Asia*

**ANDREW LAMB**

*Geophysics*

**FRED LIMP**

*Leica Endowed Chair Computer Applications, Economic Anthropology, Midwestern Archeology*

**CHRISTOPHER LINER**

*Department Chair Maurice F. Storm Endowed Chair Geophysics and Petroleum Geology*

**JILL MARSHALL**

*Geomorphology*

**THOMAS PARADISE**

*University Professor Hazards, Historic Preservation, Cartography, Middle East and Mediterranean Geography*

**ADRIANA POTRA**

*Ore Geology and Radiogenic Isotope Geochemistry*

**GLENN SHARMAN**

*Stratigraphy*

**JOHN B. SHAW**

*Sedimentology*

**DAVID STAHL**

*Distinguished Professor Global Change, Dendrochronology, Paleoclimatology*

**CELINA SUAREZ**

*Stable Isotope, Low-temperature geochemistry, Paleontology*

**DANIEL SUI**

*Distinguished Professor Vice Chancellor of Research Geography and GIS*

**JASON TULLIS**

*Remote Sensing, GIS, Ecosystem Services*

**RESEARCH FACULTY****PHILLIP HAYS, USGS**

*Isotope Geochemistry*

**ERIK POLLOCK**

*Stable Isotopes*

**BARRY SHAULIS**

*Stable Isotopes*

**SETH WARN**

*Geographic Information Systems*

**INSTRUCTORS****PAULA ANDERSON**

*General Geology, Sustaining Earth*

**RASHAUNA HINTZ**

*Human Geography*

**HENRY TURNER III**

*General Geology*

**EMERITUS****J. VAN BRAHANA**

*Hydrogeology*

**MALCOLM CLEAVELAND**

*Dendrochronology*

**JOHN DIXON**

*Geomorphology, Weathering and Soils, Geoarcheology, Alpine Geography*

**THOMAS GRAFF**

*Political Geography*

**MARGARET GUCCIONE**

*Geomorphology*

**JOHN G. HEHR**

*Meteorology, Climatology, Paleoclimatology, Global Change*

**RON KONIG**

*Structural Geology*

**WALTER MANGER**

*Stratigraphy*

**RICHARD SMITH**

*Geography*

**KENNETH STEELE**

*Geochemistry*

**DOY ZACHRY**

*Stratigraphy*

**ADJUNCT INSTRUCTORS****MAC MCGILVER**

*Petroleum Geology*

**STEVE MILLIGAN**

*Petroleum Geophysics*

**JAMIE WOOLSEY**

*Petroleum Geology*

**STAFF****JACKIE SHEARMAN**

*Administrative Support Supervisor*

**ASHLEY CHUA**

*Fiscal Analyst*

**LISA MILLIGAN**

*Administrative Specialist II*

**Fall 2018****GEOS Colloquium Schedule**

Colloquium meets each Friday during the fall semester at 3:05 pm in GEAR 26, the auditorium.

- Aug 24 Department Introductions
- Sept 7 [Adriana Potra, UA Geosciences, Legacy lead from past mining activity and gasoline additives: evidence from lead isotopes and trace element geochemical studies in the Arkansas River and White River basins, southern Ozark Region](#)
- Sept 14 [Elizabeth Chamberlain, Vanderbilt Earth & Environmental Sciences, The history of a delta and its inhabitants](#)
- Sept 21 [Sean Young, UA Medical School, An introduction to using GIS and medical geography in public health](#)
- Sept 28 [Rick Fritz, Council Oak Resources, Tulsa, OK, Many faces \(or facies\) of the "Osage" STACK Play](#)
- Oct 5 **Josh Blackstock**, UA GEOS PhD candidate
- Oct 12 **Chris Craig**, Montana State University Department of Management
- Oct 19 **Ben Vining**, UA Anthropology
- Oct 26 **John Shaw**, UA Geosciences
- Nov 2 [Hank Theiss, National Geospatial Intelligence Agency, A medley of recent NGA geopositioning research activities](#)
- Nov 9 [Ted Holland, UA Geosciences, The decline of political violence in Russia's North Caucasus, 2010-2016](#)
- Nov 16 **Dawn Warrick**, City of Tulsa Director of Planning and Development
- Nov 30 [John Tipton, UA Mathematical Sciences, Don't let your statistics ruin the science that you love](#)

**Software Donations**

**Schlumberger**

**Petrel** Shared earth—critical insight  
**Techlog** Because every well counts

**GeoTomo**  
 Earth Modeling and Imaging Solutions

**CGG** Passion for Geoscience  
**HAMPSONRUSSELL**  
**INTERPEX** IXRefrax

**Rose & Associates**  
 Oil & Gas Exploration Risk Assessment  
 Prospect Risk Analysis Suite

**PARALLEL GEOSCIENCE**

**IHS**  
 Petra Kingdom

**MJ SYSTEMS**

**dGB Earth Sciences**

**drillinginfo**  
 better, faster decisions

**Data Donations**

**devon**  
**fairfield** nodal  
**swn** Southwestern Energy®  
**OSAGE MINERALS COUNCIL**  
**CEJA CORPORATION**

**Worldwide Map of U of A Geosciences Projects**



**UA Geosciences Grants—One Year**

# Submitted Grants	# Awarded Grants
<b>36</b>	<b>8</b>

Grant Dollars Awarded  
**\$493K**

**UA Geosciences Publications—One Year**

# Refereed Publications	# Other Publications/ Presentations
<b>54</b>	<b>75</b>
# Authored Books	# Edited Books
<b>0</b>	<b>1</b>

## Welcome Dr. Linyin Cheng!



Dr. Cheng received two Bachelor of Science degrees in Civil Engineering and Law from Sichuan University in 2009. She earned her Master of Science in Civil Environmental Engineering in 2011. Her Ph.D. is from the University of California, Irvine, 2014. Her research interests are hydrologic and climatic extremes, (conditional) extreme value analysis, stationary and non-stationary processes, risk analysis, uncertainty analysis, multivariate analysis, (Vine) Copula, Bayesian modeling, empirical Bayes, spatial and temporal stochastic modeling

and detection and attribution.

Dr. Cheng's research experience last year was as research scientist for CIRES, NOAA, and ESRL/PSD, where she focused on diagnosing human-induced thermodynamic and dynamic drivers of weather and climate extreme events, the interrelationship between drought and heatwaves, and she developed conditional frameworks and concepts for diagnosing combinations of extreme events. She is a proposal reviewer for the National Science Foundation and a reviewer for many journals. She won the 2017 Best Paper Award from the International Association of Hydrological Sciences. She was published in four journals last year, and has 2 more in review at this time. Cheng has made many presentations at meetings including the Fifth International Workshop on Climate Informatics, the CIRES Review, AOGS, the International Detection and Attribution Group, AGU, the International Conference on Advances in Extreme Value Analysis and Application on Natural Hazards, ESRL Physical Sciences Division.

Dr. Cheng joined us in August, 2018!

## Jill Marshall Receives the AGU 2018 Leopold Young Scientist Award



Jill Marshall was honored with the American Geophysical Union's (AGU) Earth and Planetary Surface Process Group's 2018 Luna B. Leopold Young Scientist Award. She is one of 75 distinguished scientists receiving a prestigious award from AGU this year. The award is given annually to an early career scientist (no more than 5 years post-degree) in recognition of significant and outstanding contributions that advance the field of earth and planetary processes. The award honors Luna B. Leopold, a pioneering and world-renowned geomorphologist and hydrologist who engaged and nurtured young (early) scientists throughout his career.

Dr. Marshall is especially honored to be named for this award, as she benefitted, like so many others, from Dr. Leopold's enthusiasm and unsparing advice at a critical point early in her science career.

This is **the** top early career award in geomorphology in the United States and both highly prestigious and competitive. Jill was nominated for her pioneering work in understanding how rock is converted into soil in both cold, unglaciated and temperate terrains, 'forcing us to rethink how climate, lithology and life interact to create landscapes that humanity depend on today'. Nominators praised her poly-disciplinary and Renaissance approach to answering grand challenges in geomorphology and Critical Zone science, listing the 'astonishingly diverse set of techniques ... she brings to problems including remotely sensed topographic data, geochemical data, petrography, and numerical modeling, all with foundations in extensive fieldwork to understand landscape change holistically'.

Jill will be giving the Sharp Lecture at AGU in Washington D.C. this December. The named lecture will be both webcast and archived for future viewing.

More information on the award can be found [here](#) and [here](#). More information on Jill's research can be found on her [webpage](#).

## Thomas Paradise Inducted into the Explorer's Club in NYC!



Paradise stands in front of the Explorer's Club with Mike Wyrick, UA BA, Business 1994.

At the recent Board of Directors meeting of the international [Explorers Club](#) based in New York City, Tom Paradise professor in the [Department of Geosciences](#) in the [J. William Fulbright College of Arts and Sciences](#), was inducted into the prominent 114-year-old organization, and awarded the status of [Explorers Club Fellow](#).

Founded in 1904 in New York City, the club promotes and supports the scientific exploration of land, sea, air and space by sponsoring research and education in the natural, geographic and biological sciences, cultural documentation, and humanitarian support and outreach.

Founded by President Theodore Roosevelt in association with Great Britain's Royal Geographic Society (est. 1830), and the Sierra Club (est. 1892), the Explorers Club includes a worldwide membership of men and women who were "first to the North Pole, first to the South Pole, first to the summit of Mount Everest, first to the deepest point in the ocean, and first to the surface of the moon."

Paradise was nominated and endorsed by two Explorers Club fellows who wrote, "Paradise is regarded as a renowned international authority on the ancient city of Petra in southern Jordan," and "has received research awards and international accolades for his field work in Petra."

The criteria for Fellow status are stringent and recognize awardees "who have distinguished themselves by directly contributing to scientific knowledge in the field of geographic scholarship, exploration, the sciences or allied fields. Such accomplishments are evidenced by scientific publications documenting fieldwork and/or explorations."

Paradise has been a professor in the Department of Geosciences since 2000, in addition to having previously served as director of the [King Fahd Center for Middle East Studies](#) from 2005-2010 and again from 2015-2017. He has conducted research in the Middle East and North Africa since 1990, however, it is his work on Petra's architecture, geography, geology and history that has been most recognized, having been published in more than 50 papers, reports, chapters, and books.

In addition, Paradise's work has been showcased on television including PBS' NOVA, Smithsonian, Discovery, NatGeo and Travel Channel specials. Paradise continues to conduct research in Petra with students, and to act as a consultant for a number of film and TV show creators, producers and writers on the topic of "Petra, the rose-red city half as old as time."

## Updates from the GEOS External Advisory Board

### Greetings from the Board Chair

My name is Bill Coffey and I'm in the second year of my 2-year term as Chair. I received an MS in Geology in 1981, and since then have been employed in the oil industry, serving in a variety of roles and companies. I am currently with Warwick Energy Group, having retired from Devon Energy last April.

Heath Wallis is the Vice Chair of the Advisory Board, and will take over as Chair in 2019. Heath is a Geography grad and his input and experience has added much to our board activities.

### Spring 2018 Board Meeting Highlights

Added 3 new members: Dawn Warrick, GIS and city planner of Tulsa, Randy Lawson of Lawco Energy in Bentonville, and Dan Wagner, hydrologist with the USGS.

Tenure Promotions for Associate Professors: Celina Suarez, Song Feng, and Matt Covington.

New FTE Geography hire Linyin Cheng, starting August, 2018.

Other Spring Board meeting updates included: retirements of John Hehr and Teresa Center, with Teresa's replacement Jackie Shearman assuming her role.

Our Board will continue identifying areas of support, and has initiated a fund for Unrestricted Student Support. This fund, kicked off by Dr. Chris Liner, will be part of 4-year commitment known as GeoVision.

To date, the Board has raised the remaining Walton Match of \$90,000, adding to the total of almost \$3 million dollars over the past ten years.

### Important Dates:

The Board is resuming a 2 meeting per school year schedule, with **the next Board Meeting on campus, set for Friday, November 16 from 11am to 2 pm.** This is also the weekend of the Geosciences Research Conference. This event highlights GEOS student research in an informal poster session format, allowing great interaction with Board members, faculty and students. There will be cash prizes for top finishers.

The board will host fall and spring colloquium speakers, with dates set for Friday, October 5, 2018, and April 5, 2019.

We also look for dates to host alumni Meet and Greets in regional areas (Houston, Tulsa, OKC) during our Ad Hoc Teleconference Committee Meetings, so stay tuned.

Our board is very active and engaged in all aspects of Geoscience. Come out and support our Department by attending alumni events and send suggestions to me: [billcoff@yahoo.com](mailto:billcoff@yahoo.com).

Sincerely,

Bill Coffey  
Advisory Board Chair  
on behalf of the Board

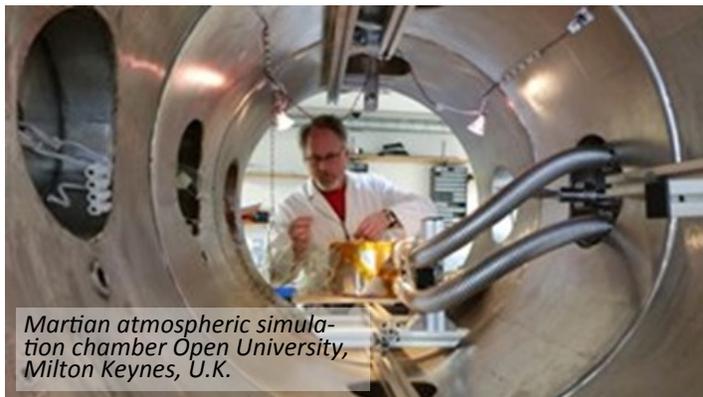
## Origin of Martian Gullies



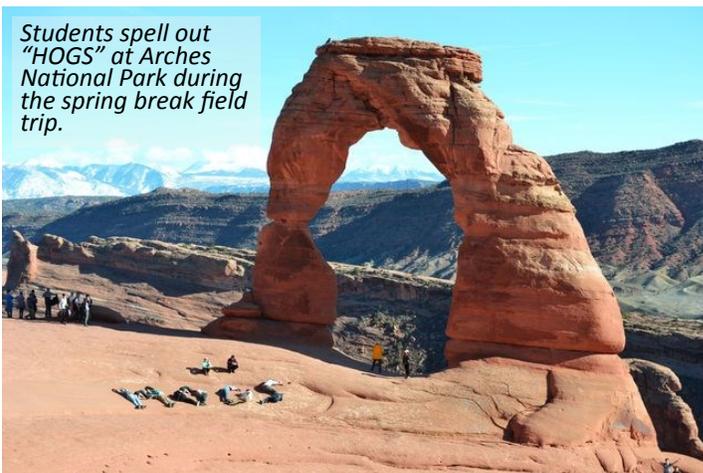
Over the past 5 years Emeritus Professor **John Dixon** and his doctoral students in Space and Planetary Sciences have been studying the origin of gullies on Mars using a combination of experimental simulations and photogrammetric techniques. Much of the more recent work of Dixon's research group has been conducted in collaboration with colleagues in the School of Physical Sciences at the Open University in the United Kingdom. The results of this research

have recently been published in both scientific journals as well as in a monograph resulting from a workshop entitled "Martian Gullies and their Earth Analogs" published by the Geological Society of London.

Two of the recent papers have been published in collaboration with Department of Geosciences Alumnus Kate Auld (Coleman) and report on her development of a classification of Martian gullies using photogrammetric techniques and gully morphology. The second paper reports on her doctoral investigations of gullies as slushflow phenomenon using experimental simulation techniques. The collaborative research with the colleagues in the U.K has focused on CO2 sublimation as a trigger for gully and other hillslope movements on Mars using the Open University's Mars atmospheric simulation chamber.



Martian atmospheric simulation chamber Open University, Milton Keynes, U.K.



Students spell out "HOGS" at Arches National Park during the spring break field trip.

## Broadening Geosciences Disciplines at the National Association of Black Geoscientists Annual Technical Conference: Houston, TX, September 5-8, 2018

**Steve Boss** has been awarded \$38,000 from NSF. This project provides partial support for about 10 faculty from historically black colleges and universities (HBCUs) and for about 50 students-of-color from across the nation to participate in the Annual Technical Conference of the National Association of Black Geoscientists (NABG), 5-8 September 2018 in Houston, TX. Engaging HBCU faculty in professional development opportunities such as the NABG will help maintaining their scholarship and social capital among prospective employers of their graduates. Furthermore, most HBCU degree programs of relevance to the geosciences are environmental and atmospheric sciences programs. Students in these programs are historically under-represented at the NABG annual conference. The objective is to expand the disciplinary representation of NABG to include more people-of-color interested in broader disciplines of Geosciences. A primary aim of this project is to engage faculty and students in HBCU environmental sciences programs and aid their participation in a national conference of importance to placing them in the 21st Century geosciences workforce.

Despite the efforts of professional organizations like NABG, underrepresentation of African Americans in geosciences remains. Recent assessments found that degree awards in geosciences to persons from underrepresented groups remain very low; <10% of geoscience degrees at every academic level are awarded to those with minority status, and African Americans earn fewer than 3% of geoscience baccalaureate degrees. Earlier participants in NABG meetings have continued in their academic preparation in geosciences or entered the national geosciences workforce; including 100% career advancement for students who attended at least four NABG conferences. Thus, participation of students-of-color in NABG appears to be strongly correlated with career success.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

### Faculty and Staff Awarded

**Steve Boss**, Department of Geosciences, and **Jo Ann Kvamme**, Environmental Dynamics Program, University of Arkansas, received the Cooperative Developmental Energy Program (CDEP) Service Award for 2018 at its Nineteenth Annual Industry Awards Banquet on Sunday, February 25, 2018 from Isaac J. Crumbly, Associate Vice President for Career & Collaborative Programs and Director/Founder of CDEP. Fort Valley State University. This recognizes those who for over a period of five or more years have served as CDEP's liaison with their institutions, companies, or agencies.

They also attended CDEP's Thirty Fifth Annual Energy Career Day Scholarship Awards Luncheon. During the luncheon, CDEP awarded approximately eight to ten 5-year dual degree scholarships (estimated value of \$60,000 each). The scholarships were awarded to academically talented students to pursue dual-degrees in energy and environmentally-related disciplines such as biology, chemistry, engineering, geology, geophysics, health physics, and mathematics offered by FVSU and partnering universities.



### National Association of Black Geoscientists

GEOS PhD student **Timmera Whaley** earned 2nd place prize for her presentation, "Assessing Environmental Justice in Alabama Using GIS" at the National Association for Black Geoscientists (NABG) meeting in Atlanta, Georgia. Also presenting were GEOS PhD Candidate **Laurre Aboaba**, MS Candidate **Christain Falzone**, and **Mark Agana**, ENDY PhD Candidate and GEOS instructor. Our department received funding from the National Science Foundation (NSF) to send 61 students from around the country to this conference.

**Steve Boss** and **Jo Ann Kvamme** facilitate and help organize this conference every year. They have been involved in funding students and organizing this conference since 2009 when it was hosted here. This year Dr. Boss has received another award from NSF and will be sending 55 more students, 8 from the UA, to the meeting in September in Houston.



## First Year Musings

There have been many highlights during my first year at the U of A. These include the start of new and exciting research, such as a Devon Energy-sponsored project to conduct 3D outcrop modeling and reservoir characterization on local Mississippian units. Asher Boudreaux (M.S. student), myself, and Celina Suarez have been working on detrital zircon geochronology of the Triassic-Jurassic boundary succession in Utah and Arizona (see photo from Zion National Park). This project was recently funded by the National Science Foundation (NSF) and represents the first NSF Sedimentary Geology & Paleontology grant to ever be awarded to researchers from the state of Arkansas. Tagging along with the Spring Break field trip and doing field work afterwards in red rock country was definitely a highlight of the year. Another highlight was completing construction of a mineral separation laboratory that has the capability of extracting heavy minerals (e.g., zircon) from rock or sediment samples. Along those lines, myself and Barry Shaulis conducted the first ever detrital zircon U-Pb age analyses at the Trace Element and Stable Isotope Laboratory. Teaching Petroleum Geology was a highlight of the spring; eight students got to work on some new lab materials including a core donated this year by a small independent oil & gas company from Tyler, Texas.

Glenn Sharman, Petroleum Geology.



## John Burnham Shaw featured speaker at the Tulsa Geological Society



**Dr. John Shaw** presented Processes and Stratigraphic Products of River Delta Channel Networks on January 23, 2018 at the Tulsa Geological Society's monthly luncheon at the Summit Club in Tulsa.

Channel networks on river deltas form important architectural elements in deltaic reservoirs, and control growth patterns in modern systems. He showed recent progress in understanding the formative processes of distributary channels and how the network geometry can be predicted. In particular, he showed that the distance to the first island on a delta is predictable and that the mean angle of bifurcation between channels is 72 degrees, consistent with theoretical prediction. Theory, experiments, measurements from modern systems and stratigraphic implications were discussed.

## Fulbright College 2018 Connor Faculty Fellows



**Edward C. Holland** is one of eighteen outstanding faculty members that have been selected as the 2018 class of Connor Faculty Fellows at the [J. William Fulbright College of Arts and Sciences](#). Their expertise spans the natural sciences, humanities, fine arts and social sciences and the funds from the Connor fellowship are intended to help each rising academic further their career development.

"Each of these fellows is a true rising star who has already accomplished so much in their career," said Todd Shields, dean of Fulbright College. "They make us so proud and we cannot wait to see what they will accomplish in the years ahead."

Robert and Sandra Connor of Little Rock established the Connor Endowed Faculty Fellowship in 2004 to provide essential faculty development opportunities to rising academic experts in the college. Annually, a college committee including the dean recognizes faculty who have made excellent contributions to the college and their departments. The award is used to facilitate travel, expand research initiatives and support classroom activities.

The Connors' original gift of \$1.5 million formerly allowed the college to designate up to 10 fellows each year. An additional gift has now allowed the college to expand the number of fellowships. Since its inception, the endowment has enabled Fulbright College to recognize 158 Connor Fellows, many of whom are now leaders in their departments, serving in administrative capacities or in prominent teaching and research positions with impressive publication records.



*Congratulations to Ted and McKenzie Holland on the births of Benjamin and Greta on June 25!*

## The Cephalopod is back!

When Ozark Hall underwent a multi-million dollar renovation funded by the Honors College (thank you very much), a valued and historic item was moved to the university museum collections. 'The Cephalopod' was known to geoscience students for decades and it's return to the halls of what is now Gearhart Hall was a priority for former Chair Davis and the effort continued under current Chair Liner. The winding path and Byzantine politics that consumed nearly four years need not concern us here. The display case and the specimen are now in place (see photo). As part of the project, Prof. Manger was asked to compose text for the display. In his inimitable style, here is the text:



### Giant Cephalopod

## *Rayonnoceras solidiforme*

Phylum Mollusca - Linnaeus, 1758

Class Cephalopoda - Cuvier, 1798

Subclass Nautiloidea - Agassiz, 1847

Order Pseudorthoceratidae - Flower and Caster, 1935

Family Carbactinoceratidae - Schindewolf, 1943

This conch of the pseudorthoceratid, carbactinoceratid nautiloid *Rayonnoceras solidiforme* Croneis, 1926, was collected from the Upper Chesterian Fayetteville Shale along Town Branch in 1964 by Dr. Royal Mapes, who at the time was a geology student at the University of Arkansas, where he completed his BS and MS degrees. He later received his Ph.D. from the University of Iowa after service in the US Army. Dr. Mapes spent his entire professional career at Ohio University, retiring as Professor of Geology in 2012.

At least 20 valid species of *Rayonnoceras* Croneis, 1926, have been described from the North American midcontinent, the western states, and Alaska, recovered from rocks of Late Mississippian (Chesterian) age, with a single reported occurrence in Early Pennsylvanian strata from Texas, and also from western European strata of Upper Viséan to Lower Namurian age in Great Britain, Ireland, Belgium and Germany.

This 7 feet 2 inch (2.18m) specimen was the largest post-Ordovician orthoconic nautiloid on record, but was missing its distal end of about 12 inches (304mm). The white plaster addition is of another specimen. In 2003, three University of Arkansas Geology students—Kevin Morgan, Jonathan, Gillip, and Sarah Kee—discovered a *Rayonnoceras solidiforme* in the Fayetteville Shale of southwestern Fayetteville that measured exactly 8 feet (2.44m), a new world record. Interestingly, it was also missing its distal end.



Thank you to the UA Museum Collections and Marilyn Suter for storing, cleaning, and bringing this back to us!



Installation begins!

## Economic Geology Donation



**Adriana Potra** is grateful for the donation of ore samples from Jon Thorson of Denver Colorado. These will give our students a much

better understanding of economic deposits by having actual ore samples to analyze.

Potra has dedicated space in her office for their storage. She will mainly use them for teaching purposes, not yet for research. Perhaps, down the line, she will be using them to do some Pb isotope and trace element geochemical studies. They are extremely useful for teaching, and she does not want to destroy them.

12/20/17

Dear Dr. Potra,

*This letter will accompany suites of samples that I am donating to the economic geology program you have started at the University of Arkansas. I am continuing the donations that I began in 2014, and this year I am again trimming my collections of sediment-hosted copper materials.*

*Please use any of this material that you can; if you can't use it please pass it along to one of the other courses. I wish you the best of luck in reviving the study of economic geology at your university. Hopefully these samples will be useful.*

Regards,

Jon P. Thorson  
Consulting Geologist  
Denver, CO

### Sediment-hosted copper from Montana and Idaho

SSCu-17-1, Snowstorm Mine, Wallace, Idaho - open pit, malachite on Revett Quartzite; 1-2x3

SSCu-17-2, Snowstorm Mine, Wallace, Idaho - open pit, malachite and other unidentified oxide copper minerals - 1-3x1/2

SSCu-17-3, Snowstorm Mine, Wallace, Idaho - open pit, malachite and neotocite or tenorite on Revett Quartzite - 1-2x3

SSCu-17-4, Snowstorm Mine, Wallace, Idaho - Snowstorm #1 level, malachite and disseminated bornite in Revett

Quartzite - 1-2x3

SSCu-17-5, Snowstorm Mine, Wallace, Idaho - Snowstorm #2, malachite and azurite on Revett Quartzite - 1-2x4

SSCu-17-6, Snowstorm Mine, Wallace, Idaho - Snowstorm #3 level, disseminated bornite and chalcocite in Revett Quartzite - 1-3x4

SSCu-17-7, Snowstorm Mine, Wallace, Idaho - Snowstorm #3 level, disseminated bornite and chalcocite in Revett Quartzite, with spots of ankerite - 1-2x3

SSCu-17-8, Missoula Tunnel, Wallace, Idaho - disseminated and fracture controlled chalcocopyrite and pyrite in Revett Quartzite - 1-2x3

SSCu-17-9, Missoula Tunnel, Wallace, Idaho - disseminated bornite and chalcocite in Revett Quartzite - 1-2x2

SSCu-17-10, Lucky Friday Mine, Wallace, Idaho - disseminated galena and sphalerite in Revett Quartzite - 1-2x6. Not strictly SSCu, but similar mineralization to the disseminated copper. People are still struggling to relate the two, however, the copper occurrences do have peripheral Pb-Zn zones.

SSCu-17-11, Spar Lake Mine, Troy, Montana - disseminated and clots of chalcocopyrite in Revett Quartzite - 1-2x3

SSCu-17-12, Spar Lake Mine, Troy, Montana - disseminated and clots of bornite and chalcocite in Revett Quartzite - 1-2x3, 1-4x7

SSCu-17-13, Spar Lake Mine, Troy, Montana - large nodules of chalcocite and bornite in green-gray argillite, interbeds between quartzite ore horizons - 1-4x6

Sediment-hosted copper, China

SSCu-17-14, Tangdan Mine, Dongchuan, Yunan Province, China - bornite and chalcocite replacing stromatolitic dolomite - 1-4x4, 1-1x3

SSCu 17-15, Sanjiachang Mine, Yimen, Yunan Province, China - chalcocopyrite in quartzite, 1-4x5

SSCu 17-16, Sanjiachang Mine, Yimen, Yunan Province, China - chalcocopyrite and bornite in quartzite, 1-3x3

SSCu 17-17, Guantingchan Mine, Wuding, Yunan Province, China - chalcocopyrite in quartzite, 1-3x4

SSCu 17-17, Guantingchan Mine, Wuding, Yunan Province, China - brecciated pink quartzite with disseminated chalcocopyrite, cemented with quartz, 1-3x4

SSCu-17-18, Dameichan Mine, Wuding, Yunan Province, China - Kupferschiefer-style copper mineralization in black shaly dolomite, 1-3x4

SSCu-17-19, Dameichan Mine, Wuding, Yunan Province, China - post mineral breccia

SSCu-17-20, Sanjiachang Mine, Yimen District, Yunan Province, China - gossanous supergene breccia, 1-5x5

SSCu-17-21, Prospect 67, Yimen District, Yunan Province, China - pink dolomite with disseminated chalcocopyrite and bornite - 1-3x6

Sediment-hosted copper, Namibia

SSCu-17-22, Koperberg prospect, Kalahari Copperbelt, south central Namibia, malachite and cuprite in sheared argillite, 1-3x4

Donations to University of Arkansas

SSCu-17-23, Malachite Pan prospect, Kalahari Copperbelt, eastern Namibia, malachite in greenish-gray argillite, 1-3x6

SSCu-17-24, Sib prospect, Kalahari Copperbelt, central Namibia, fracture controlled chrysacolla in green siltstone, 1-3x4, 1-1x2

SSCu-17-25, Sib prospect, Kalahari Copperbelt, central Namibia, disseminated malachite in sandstone, 1-3x4, 1-1x2

SSCu-17-26, Noams prospect, Kalahari copperbelt, central Namibia about 20 km south of Klein Aub, disseminated malachite in quartzite, 1-1x2

SSCu-17-27, Kopermyn Mine, central Namibia, disseminated chalcocite and malachite in sandstone, 1-1x2, 1-3x4

SSCu-17-28, Kopermyn Mine, central Namibia, disseminated chalcocite and malachite in breccia of mostly rhyolite fragments, 1-3x4

SSCu-17-29, Okohongo prospect, NW Namibia, malachite and chrysacolla in green argillite, 1-3x6

SSCu-17-30, Epunguwe prospect, NW Namibia, diopside, cuprite and chrysacolla on quartz vein, 1-2x3

SSCu-17-31, Omatapati prospect, NW Namibia, malachite, azurite and cuprite after chalcocopyrite in pink dolomite, 1-3x4

### Miscellaneous

Zebra dolomite, Eureka, Nevada, 1-4x6, 1-2x4

Leadville, Colorado - rhodochrosite on pyrite, Julia Fisk Mine - 1-2x3

## Theropod Tracks in Arkansas



University of Arkansas scientists, including **Celina Suarez**, using laser-imaging technology documented and digitally preserved the first known set of theropod dinosaur tracks in the state of Arkansas, discovered in 2011 in a working gypsum quarry near Nashville. “From a technical standpoint, it’s important that the ability to rapidly scan such a large area is available to paleontologists.

It was invaluable for this project since we had such little time to work,” said Celina Suarez, an assistant professor in the Department of Geosciences who was part of the team that documented and studied the tracks. This location “actually confirms that the main genus of large theropods in North America was *Acrocanthosaurus*,” said Suarez. “It now has been found in Wyoming, Utah, Oklahoma, Arkansas and Maryland, a huge range.”

This technology, called LiDAR, which stands for light detection and ranging, uses a pulsed laser to measure distances to the earth in tiny increments, generating a

data “point cloud” that is used to digitally recreate a physical space. In this case, the equipment was mounted on a lift over the site. By analyzing carbon and oxygen isotopes of the rock at the track surface, researchers determined that the track surface was indeed the surface that the animals stepped on, rather than an underlying layer that remained when the original surface eroded. Researchers from the University of Arkansas Center for Advanced Spatial Technology (CAST) provided the scanning equipment and expertise.

The site had two different sized *Acrocanthosaurus* tracks, suggesting both adult and younger animals walked the ancient tidal flat about 100 million years ago, during the Cretaceous Period. It also contained tracks made by sauropods, long-necked plant-eating dinosaurs.

The mining company moved its operations to allow researchers a short window of time to document the find. Researchers used LiDAR because traditional methods would have taken too long. After the tracks were discovered, researchers received a \$10,000 Rapid Grant from the National Science Foundation to quickly document the site. The U of A’s vice provost for research and economic development and the J. William Fulbright College of Arts and Sciences provided matching grants, for a total of \$30,000. The tracks, have since been lost to ongoing quarry operations.



*LiDAR in action at the dinosaur track site.*

## GP-IMPACT: Professional Development Pathways to Diversifying the Geosciences Workforce

**Steve Boss** has been awarded \$349,801.00 from NSF. Professional Development Pathways to Diversifying the Geosciences Workforce is a partnership between the University of Arkansas and the Geological Society of America (GSA) with assistance from UNAVCO and the University of Texas-Austin to broaden participation and increase inclusion in the global geosciences workforce. A primary objective is aiding progress of underrepresented minority students (URMs) toward employment in the national geosciences workforce, an area of critical national need. The project proposes to design professional development workshops intended to increase the quantity and quality of applications from URMs for internships or other professional opportunities (e.g. GeoCorps; Geoscientist-In-the-Parks, GIP; Research Experiences in Solid Earth Science for Students, RESESS, etc.). The objective is to aid URMs who are advanced undergraduate or beginning graduate students to improve written and oral communication skills as expressed in written applications and/or interviews for internships/fellowships.

The project is an extension of programs to broaden participation and increase inclusion of underrepresented minorities (URMs) in geosciences developed at the Department of Geosciences, University of Arkansas and the Geological Society of America (GSA) with assistance from UNAVCO. The proposed effort will target URMs in GSA's On to the Future (OTF) initiative and offer financial support to participants to attend professional development workshops focused on acquiring soft skills (written and oral communication skills related to internship/fellowship applications) at multiple GSA conference venues (annual and geographic section meetings) annually. The primary goal of the proposed program is to provide URMs in the geosciences academic/career pipeline supplemental professional training to enhance the quantity and quality of internship/fellowship applications such that greater numbers of URMs are selected for these educational and professional experiences, ultimately aiding their transition to the geosciences workforce through acquisition of both technical and non-technical skills coveted by employers. A critical aspect of this experiment will be to track progress of URM participants and their success rate being selected for internships/fellowships as a consequence of participation in the proposed workshops. Project personnel are uniquely positioned to monitor this population over the next three years to determine how well they perform at this task and how they progress through the pathways to the national geoscience workforce. It is anticipated the project will support at least 40 participants annually (minimum of 120 over 3 years). Participants will be supported for 2nd and 3rd year experiences in an effort to greatly increase their retention and persistence in GSA and, by extension, the geosciences profession. Recurrent counseling, mentoring, education, training, and engagement with this cohort will help them establish a sense of community and belonging within the geosciences. This strategy is a well-documented best practice for promoting URM progress and ultimate success in STEM disciplines.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the

Foundation's intellectual merit and broader impacts review criteria. Professional Development Pathways to Diversifying the Geosciences Workforce is a partnership between the University of Arkansas and the Geological Society of America (GSA) with assistance from UNAVCO and the University of Texas-Austin to broaden participation and increase inclusion in the global geosciences workforce. A primary objective is aiding progress of underrepresented minority students (URMs) toward employment in the national geosciences workforce, an area of critical national need. The project proposes to design professional development workshops intended to increase the quantity and quality of applications from URMs for internships or other professional opportunities (e.g. GeoCorps; Geoscientist-In-the-Parks, GIP; Research Experiences in Solid Earth Science for Students, RESESS, etc.). The objective is to aid URMs who are advanced undergraduate or beginning graduate students to improve written and oral communication skills as expressed in written applications and/or interviews for internships/fellowships.

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**Fall 2018****Geosciences Courses**

General Geology  
 General Geology Lab  
 General Geology Honors  
 General Geology Honors Lab  
 Human Geography  
 Earth Science  
 Earth Science Lab  
 World Regional Geography  
 World Regional Geog. Honors  
 Mineralogy and Petrology  
 Digital Earth  
 Found. Geospatial Data Analysis  
 Intro to Cartography  
 Sustaining Earth  
 Sustaining Earth Honors  
 Geospatial Comp. Toolkit  
 Oceanography  
 Geospatial Applications & IS  
 Spatial Analysis Using ArcGIS  
 Geospatial Data Mining  
 Intro to Geodatabases  
 Geography Middle East  
 Geography Middle East Honors  
 Economic Geology  
 Stratigraphy and Sed.  
 Geography of Religion  
 Petroleum Geology  
 Meteorology  
 Principles Remote Sensing  
 Applied Climatology  
 Applied Climatology Honors  
 Geography of Political Violence  
 Intro to GIS Programming  
 Petroleum Geophysics  
 Intro to Raster GIS  
 Intro to GPS and GNSS  
 Low-T Geochem of Nat Water  
 Geography of Europe  
 Geospatial UAS  
 Geospatial UAS Honors  
 Geoscience Colloquium  
 Geography of Fictional Worlds  
 Subsurface Geological Mapping  
 Quaternary Environments  
 Stratigraphic Principles  
 Environmental Site Assessment  
 GIS Programming  
 Tectonics  
 Research Methods in Geosciences  
 Special Problems:  
 Geography of Fictional Worlds  
 Subsurface Geological Mapping

*OLLI  
 students with  
 professor  
 Tom  
 Paradise at  
 the Spanish  
 Steps in  
 Rome*

**OLLI Students Tour Rome**

**Tom Paradise**, University Professor took seventeen Osher Life Long Learning Institute (OLLI) students on an eight-day class and educational tour of Rome in May, 2018. He designed the extensive itinerary, and guided the group members throughout their visit to the Eternal City. *"Having lived, worked, and conducted research in Rome over the years, this was a rare and fun opportunity to share my experiences of the city with our unique OLLI students from Arkansas,"* Paradise said. *"This tour focused on strolling tours of famous and unusual architecture and art, Rome's cuisines, and secret spots."*

OLLI students visited many of the city's historically significant sites, such as the Roman Forum, Pantheon, Colosseum, and the Vatican. Consuelo Lollobrigida, University of Arkansas Rome Center faculty member and adjunct professor for the Fulbright College, presented a lecture for the students on the history, artistry and architectural details of the Vatican's Sistine Chapel. It gave the OLLI trip participants an expert frame of reference before

their visit to Vatican City.

The itinerary also included a trip east of Rome to Villa d'Este and the celebrated Renaissance Gardens of Tivoli - one of the wonders of the landscaping and engineering world. Tivoli's gardens are renowned for their fantastic fountains including the magnificent Tivoli Water Organ that plays musical tones as water is forced through the stone pipes of an organ. The Garden's fountains are a unique engineering masterpiece since no mechanisms or assistance are used, only the power of gravity drives the numerous fountains. This tour was led by Emilio del Gesso, a professor of art and architecture at the University of Arkansas' Rome Center.

The trip, which was organized by the University of Arkansas Rome Center and the Office for Study Abroad & International Exchange, was the first of its kind for OLLI and marked the institute's 10th anniversary.

**Paradise Honored as Outstanding Faculty**

Sponsored Student programs has honored **Tom Paradise** as the 2018 Outstanding Faculty Member at their event on April 5, 2018. Chancellor Steinmetz, along with the Dean of the Graduate School and International Education, Dr. Kim Needy, were in attendance along with their graduating students, visiting students, faculty advisors, special guests from several non-government organizations, and the Cultural Attaché from Turkey.

## Song Feng awarded OMNI Center for Peace, Justice and Ecology Climate Science Award



This award promotes “successful climate science research conducted by Fulbright College faculty and students in developing knowledge of the causes and impacts of global climate change, and in developing tangible solutions to mitigate global climate change and its deleterious effects on humanity and global ecosystems.” Feng’s internationally-recognized research on past, present and future climate changes and impacts uses global and regional climate models and advanced statistical methods.

Feng’s research specifically focuses on climate change and physical mechanisms on regional and continental scales; climate change and its impacts on water sustainability and agriculture; and paleoclimate change and variability.

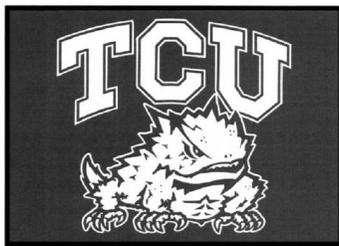
“Dr. Feng exemplifies all that this award stands for,” said Peter Ungar, distinguished professor in the [Department of Anthropology](#) and director of the [Environmental Dynamics Program](#). “Dr. Feng’s work on climate modelling is world-renowned. He is a leader in the field, and is committed to climate change teaching and pre-professional training at the University of Arkansas.”

Feng plans to use the stipend from this award to travel to the American Geophysical Union (AGU) fall meeting, which is the largest worldwide conference in the geophysical sciences, attracting more than 20,000 earth and space scientists, educators, students and policy makers annually. He will also use the funds to travel to the American Meteorological Society (AMS) annual meeting, which is the world’s largest yearly gathering for the weather, water and climate community.

## New Petra Research and Findings—2016-2018

Tom Paradise’s latest research provides evidence that Petra was inundated by catastrophic floods in the 4-5th centuries; one of the strongest indications of paleo-flooding can be demonstrated through the distinct patterns of sediment distribution. As floodwater rises above its channel, high energy water mobilizes larger particles (boulders, pebbles, gravel) while slower energy can only move finer sediments (sand, silt, clay). In Petra, a sampling scheme was designed to analyze grain size distribution above the wadi bank where catastrophic flooding has been speculated. Samples of surface sediments were collected downstream from the confluence that caused the city center flooding. Six (6) one-kilogram samples were collected during the fall 2016 and winter 2017 across the south side of the terrace that flanks Wadi Musa above Petra’s *downtown*. The samples were collected at roughly five meter spacing, orthogonal from the terrace ridge above the wadi toward the Garden-Pool Complex and Great Temple. Sediment samples were sieved and separated into ten particles classifications from gravel, sand, silt, and clay. These were converted to percentages of grain size for the total mass at each collection site.

The findings revealed decreasing large grain components away from Wadi Musa, Petra’s main water source. Analysis revealed that gravel and coarse sand comprised 70% of the samples collected *nearest* the wadi, while only 30% of the largest grain sizes were found *farthest* from the wadi. This indicates a distal mega-floodplain in Petra much higher than previously thought. Distal areas of floodplains are characterized by larger components of *fine-grained* particles (clay, silt), the case along the wadi channel terraces in Petra. This analysis confirmed prior research indicating that Petra’s city center may have been razed by massive flooding -- which would have dramatically altered the dynamics of its commerce, culture, society, and trade. A pattern of fine particles increasing *away* from the wadi indicates a low-energy distal floodplain where lateral flooding (during a rare mega-flood) deposited the finest silt and clay particles high above the wadi and road, on the terrace of the Great Temple and the Garden-Pool Complex. This distal floodplain indicates that the 4-5th century floodwaters reached much higher than previously considered, further strengthening the argument for the devastation of Petra’s city center.



**Dr. Xiangyang (Cheyenne) Xie**

School of Geology, Energy, and the Environment  
Texas Christian University  
Ft. Worth, Texas

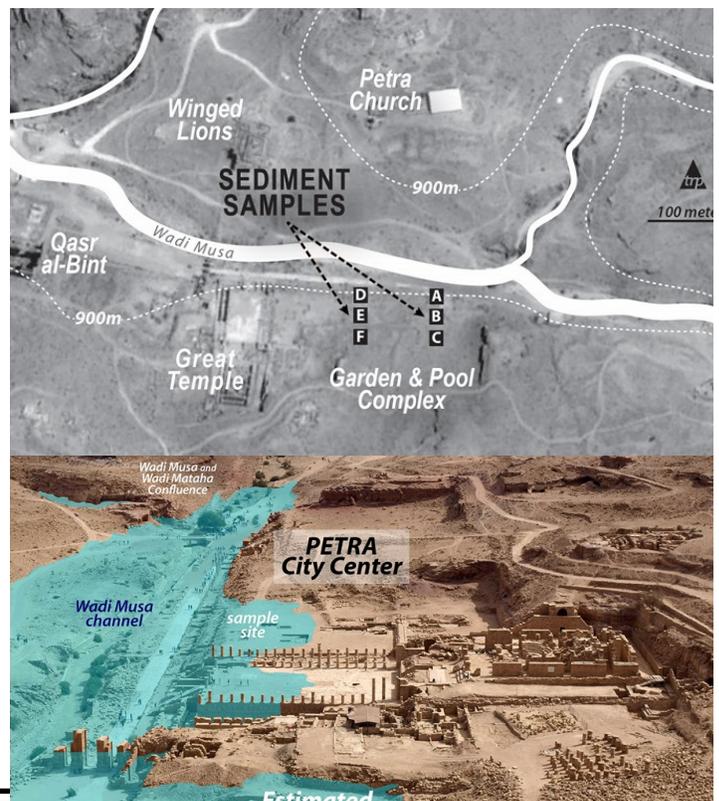
**GEOLOGY OF THE  
SOUTHWESTERN OZARK REGION  
FROGS AND HOGS  
Spring Geology Field Trip  
April 13-15, 2018**

**Dr. Walt Manger**

Department of Geosciences  
University of Arkansas  
Fayetteville, Arkansas



“THE BEST GEOLOGIST IS THE ONE WHO’S SEEN THE MOST”



## Crenshaw Archeological Site Studied



Crenshaw has long been known to be an American Indian historical site here in Arkansas. The university in Fayetteville is one of the few places that has a Nu Plasma multicollector inductively coupled plasma mass spectrometer, which measures how much of each isotope is present in lead or strontium, said John Samuelsen, a PhD Candidate in the Department of Anthropology. Samuelsen will work closely with **Adriana Potra** of the UA's Department of Geosciences because some of the isotopic work from the Crenshaw site will be done at that department's metal-free radiogenic isotope laboratory. It's a "room inside a room" with HEPA-filtered air. Other UA researchers who will be involved in the project include **Erik Pollock** and **Barry Shaulis**.



Samuelsen has developed a method of examining lead isotopes in tooth enamel that he believes will determine whether the remains in the skull-and-mandible burial ground belonged to locals. It will be employed in conjunction with a method that he has previously used to examine strontium isotopes in tooth enamel. Lead has six isotope ratios, compared with one for strontium, making it a better marker for the research.

Samuelsen has received a \$14,750 grant from the National Science Foundation to do the research, which he estimates will take a year and a half. He did a pilot study involving five samples from the skull-and-mandible burial site, 13 burials at Crenshaw of entire bodies and samples of tooth enamel from 56 animals in southwest Arkansas.



Samuelsen said the pilot study verified that his method of analyzing biologically available lead works, but the full study will include 60 additional samples from the skull-and-mandible burial site and 80 more animals from Arkansas and primarily other states. The skull-and-mandible burial ground at Crenshaw is the largest site of its kind in the United States. There are a few smaller skull burial sites in the U.S. and Mesoamerica. He said researchers have generally believed the remains in those sites to be the victims of warfare.

Since its discovery in the 1960s, researchers have debated the meaning of the skull-and-mandible cemetery, as it has come to be known. Many of them believe that it contains trophies of war -- heads and jawbones of enemies from far-away battlefields. But in 2016, Samuelsen, a doctoral candidate at the University of Arkansas, Fayetteville, argued strongly for a different hypothesis. He published a paper in the *Journal of Archaeological Science* saying the burial ground could contain the remains of people, or their relatives, who lived around Crenshaw, possibly farming

the more rural areas. After they died, their skulls and jawbones could have been returned to the village for ceremonial burial, similar to the custom today of the deceased being returned to family plots or church cemeteries for burial. Transporting only skulls and jawbones would have been easier than carrying back bodies or full skeletons, especially at a time before the Caddo had horses. Crenshaw was a large ceremonial center from about A.D. 700 to 1400 along the Red River in Miller County. It also was a large village for most but not all of that time, Samuelsen said.

The remains in the burial site date from about A.D. 1253-1399. The remains of the skull-and-mandible burial ground were uncovered due to farming practices in the 1960s. Then looters dug in the area for some time. Samuelsen said there appear to be at least seven burial grounds at Crenshaw, but the others contain full skeletons. The Caddo prehistoric territory included western Arkansas, eastern Oklahoma, northeastern Texas, northwestern Louisiana and the southwestern corner of Missouri. The Crenshaw site is on private property, and researchers try to keep its location a secret. It's not open to the public, but the Caddo Nation has given UA researchers permission to study the site.

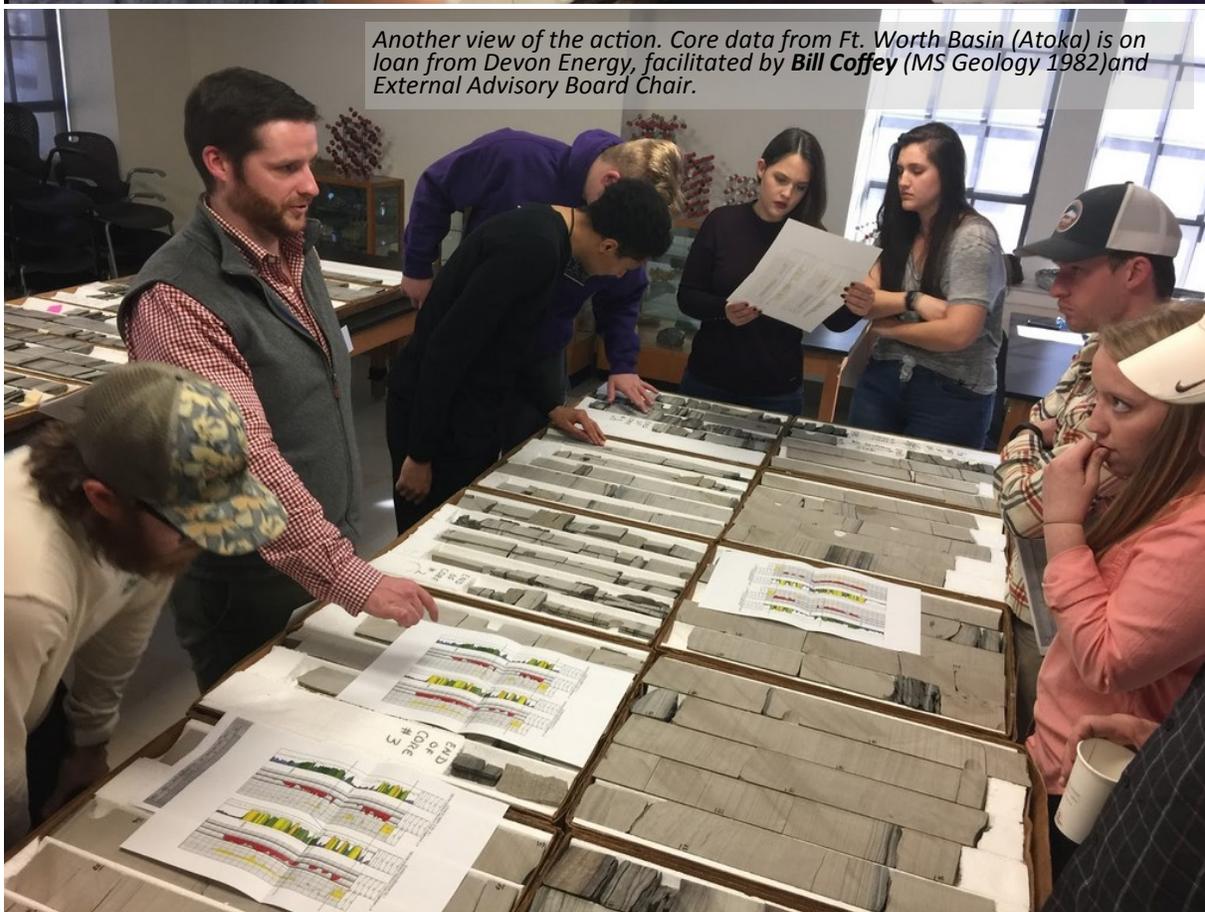
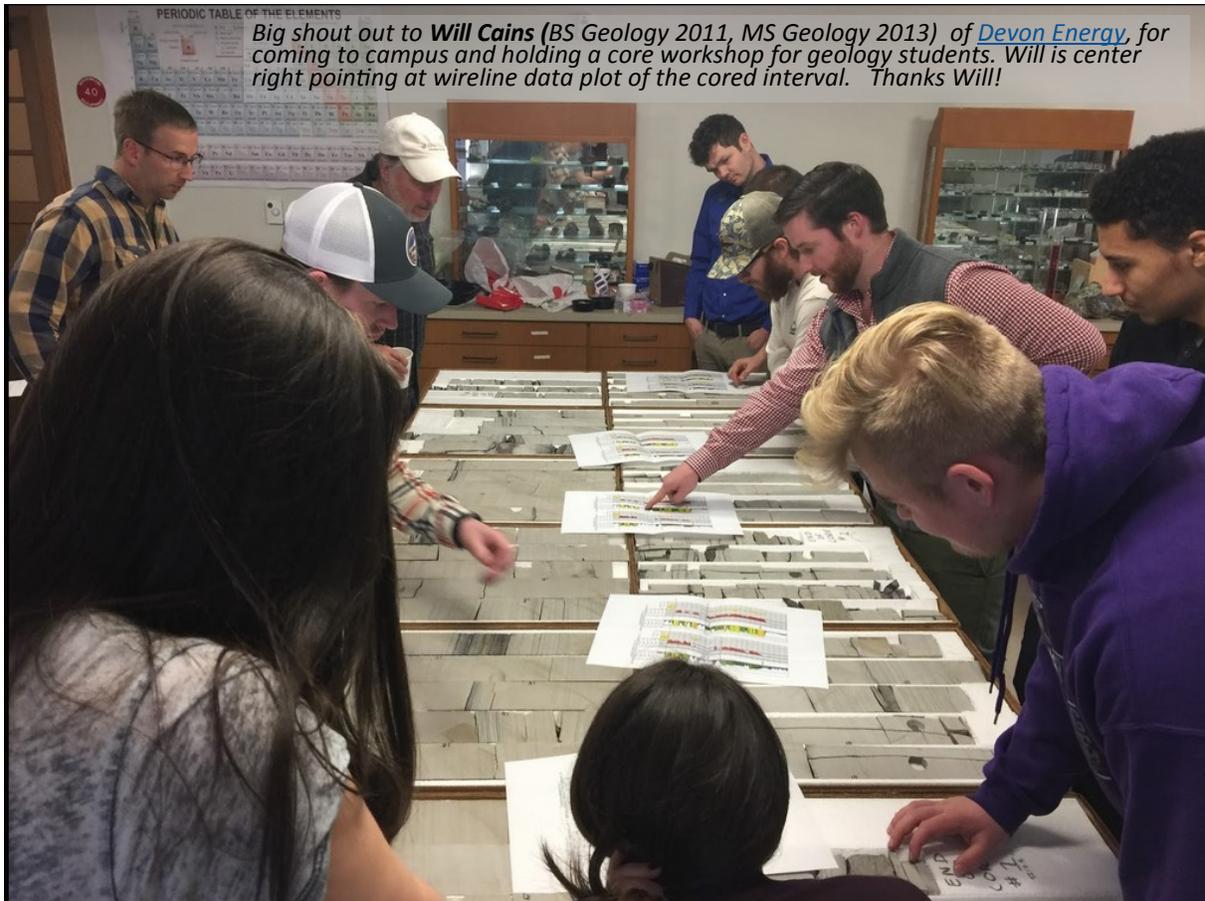
If the remains of local people are buried in the burial site, the lead and strontium isotopes in their tooth enamel should correspond with those of non-migratory animals that lived in the same area at about the same time, Samuelsen said.

Lead and strontium are elements that occur naturally and would have been in the soil and plants. Humans and animals were both eating plants in the same areas, so it doesn't matter if they weren't eating the same plants, Samuelsen said. "You're assessing the human's location based on the ratio of lead in animal teeth." The research will include tooth enamel from deer, rabbits, possums, raccoons and squirrels. Some of the enamel samples will come from as far away as Illinois.

Whether those buried at the skull-and-mandible burial ground are Caddo ancestors is important to the tribe, Sabo said. "They need to know where the people buried at Crenshaw came from. If they came from within the region the Caddo inhabited in the past, it's very likely those are the remains of their own ancestors. ... That information is crucial to modern Caddo decisions about how and where to re-bury them."

Arkansas archaeologists conducted official excavations of the Crenshaw site during much of the last half of the 20th century.

## CORE WORKSHOP IN GEARHART HALL—May 3, 2018



## GEOS Alumna Confirms that State Dinosaur is a New Species

*Arkansaurus fridayi* has been the state's official dinosaur for about a year. But it wasn't until very recently that scientists confirmed how unique our ornithomimosaur (ostrich-like dinosaur) really is.

**Rebecca Hunt** (BS Geology 2003), a paleontologist with the U.S. Bureau of Land Management in Moab, Utah, published a paper March 19 in the *Journal of Vertebrate Paleontology* identifying *Arkansaurus fridayi* as a new species unique to Arkansas. It lived here during the Early Cretaceous period, about 113 million years ago, when much of what's now Texas was underwater and the shoreline was within 100 miles of southern Arkansas.

*Arkansaurus* is the second-oldest ornithomimosaur of its kind discovered in North America, the oldest being *Nedcolbertia justinhofmanni*, found in Utah in 1993. Like other ornithomimosaur, it was bipedal, with long forearms, a long neck and feathers instead of scales. Its strong back legs and ostrich-like build would have made it a fast runner and a fearsome predator.

Landowner Joe Friday discovered the fossilized remains of *Arkansaurus*, consisting of a nearly complete right foot, in a road construction pit dug on his Locksburg farm in 1972; hence the name "fridayi." The fossils were the first found in Arkansas.

Evidence of dinosaurs is rare in Arkansas because the rocks fossils are found in are not well preserved here, Hunt said. They are also covered with thick layers of vegetation and soil.

Hunt began studying the fossils in 2001 when she was a U of A undergraduate. "It's been a long, ongoing project," she said. When she finally did publish the findings, she honored the late James H. Quinn, former chair of what was then the U of A Geology Department, by naming him the second author on her *Journal of Vertebrate Anthropology* paper. Quinn, who died in a fall while collecting fossils in 1977, did the initial work to identify the fossils.



## AAPG Certificate of Meritorious Service

The Mid-Continent Section Certificate of Meritorious Service Award is given to those individuals who have contributed their time, dedication, and volunteer services to the AAPG Mid-Continent Section. The 2017 recipients are:

- ◆ Shane Matson (BS Geology 2001, MS Geology 2007) as General Chair for the 2015 AAPG Mid-Continent Section Convention, Tulsa, Oklahoma
- ◆ Jamie Woolsey (BS Geology 2004, MS Geology 2007) as General Chair for the 2016 Ft. Smith, Arkansas Field Conference as hosted by the Fort Smith Geological Society
- ◆ Eric Gross (BS Geology 2005, MS Geology 2007) as Editor of the Second Biennial AAPG Mid-Continent Section Field Conference Guidebook.

## Alums on the Move!

- ◆ Lacie Knight has begun working for Alta Resources in Houston, Texas.
- ◆ Yarri Davis has moved to Fayetteville
- ◆ Mac McGilvery will be teaching Petroleum Geology in Fall 2018
- ◆ Jamie Woolsey will be teaching Subsurface Geological Mapping in Fall 2018
- ◆ Rebecca Hunt is now the Park Paleontologist at Dinosaur National Monument.



Jane Spellman (MS Geology 1987) has just returned from a National Geographic polar bear-counting expedition that circumnavigated the Svalbard archipelago.

## Imperial Barrel Award

The Department of Geosciences is proud to recognize five of our Master of Science geology students who represented UA at last weekend's **Imperial Barrel Award** (IBA) competition in Oklahoma City. **Asher Boudreaux, Christain Falzone, David Kilcoyne, Josh Stevens** and **Griffin Warner** formed the 2018 UA Imperial Barrel Award (IBA) team that competed on Saturday, March 17, 2018. The faculty advisor to the 2018 IBA team was **Steve Milligan** (BS Geology 1980) and industry advisor was **Jamie Woolsey** (BS Geology 2004, MS Geology 2007) of PQ Geoconsulting.

The IBA program is offered every year by the **American Association of Petroleum Geologists** (AAPG). It is a prospective basin evaluation competition for geoscience graduate students from universities around the world. Regional competitions send their first place winners to an international contest. The University of Arkansas Department of Geosciences competes in the Mid-Continent division, which this year also included Wichita State University, Oklahoma State University, the University of Oklahoma, and Kansas State University.

**Devon Energy** and **Chesapeake Energy**, both Fortune 500 companies, hosted and ran this regional event in Oklahoma City. Housing and meals were provided to the teams and their coaches; presentations were done in front of four judges in a meeting room on the Chesapeake campus. Participants made connections, meeting many professionals in the oil and gas industry. **Carolyn Brown** (BS Geology 2013, MS Geology 2015), a participant in our 2014 team, now works for Chesapeake and facilitated the mid-continent regional competition.

The goal of the project is to assess provided data as if the team were sent to an industry data room with the task of reporting back to senior management with a specific

recommendation regarding the opportunity. From Griffin Warner: "The given dataset area was ~90,000 square miles (huge!) with only 4 wells, that were all dry holes. We worked this project from scratch, and got to see some of the brightest minds in our department come together to create something that we will all remember for the rest of our lives." All regional teams receive the same data set that is evaluated for its petroleum potential. The team must assess each petroleum systems element: source, generation, reservoir, trap, and seal. Prospects were defined by potential hydrocarbons in place and prospect risk was determined. Our team defined two prospects in the Bight Basin offshore area of South Australia. Team members divided duties to evaluate this data and prepare a prospect that has the greatest potential for producing oil or gas. The judges AAPG members and experienced prospectors from this exploration industry. The presentations are limited to 25 minutes and the teams must answer all questions.

Kingdom and Petra software donated by IHS was heavily used by the team. "One of the hardest things was getting familiar with software that is common among oil companies," said team member Christain Falzone. But "the easiest part had to have been doing background research on our study area." Maps, well logs and seismic lines were uploaded into the Kingdom and Petra programs, so that cross sections and spatial analysis could be used to create the geologic history of the area.

Team member Asher Boudreaux said, "Although it's stressful, the end result is rewarding. There is no better way to gain knowledge and experience toward the oil industry than competing in IBA. I am very proud of our team and how we represented the University of Arkansas."



UA 2108 IBA: Coach Jamie Woolsey, Josh Stevens, Asher Boudreaux, Griffin Warner, David Kilcoyne, Christain Falzone, and coach Steve Milligan

## PhD Student Research



GEOS Ph.D. candidate **Josh Blackstock** is using the proceeds from his ARSC Dissertation Award to focus on the role of shallow groundwater and its influence on the occurrence and chemical evolution of deeper circulating groundwater which can contain high total dissolved solids and gases discharging at Earth's surface. Research investigating the variability of chemistry in these more chemically extreme natural waters have critical importance with regard to the

practical application of water chemistry data in examining water quality for human health, water availability for resource evaluation, and monitoring of water chemistry for forecasting of geologic hazards. His research localities have been located primarily within the caldera-hosted geothermal systems of the Taupo Volcanic Zone, New Zealand and the Valles Caldera, New Mexico.

Josh was also the winner of the best poster at the Arkansas Water Resources meeting in Fayetteville in July, 2018.

Many of the tools that used in the Geosciences for investigating shallow and deep groundwater interactions require portable instrumentation can be cost prohibitive particular when operation is within extreme environments (e.g. low pH, high-temperatures soils and natural waters). To overcome this cost barrier, two low-cost methods have been developed as part of his dissertation research to measure dissolved CO<sub>2</sub>, in-situ, and CO<sub>2</sub> fluxes emitting from high-CO<sub>2</sub> soil and surface water environments. Funds from the ARSC Dissertation Award will be used for execution of experiments associated with travel to Michigan Technical University in Houghton, Michigan and the Valles Caldera National Preserve in northern New Mexico. At Michigan Technical University, he will compare CO<sub>2</sub> flux measurements between a state-of-the-art commercial system operated by Assistant Professor Chad Deering and our low-cost platform. Experimental tests will consist of laboratory and field components and will provide a comparative assessment of the systems' accuracy. At the Valles Caldera National Preserve, high geologically-derived CO<sub>2</sub> is present within groundwater, surface waters, and soil environments. The distribution and geochemical evolution of high-CO<sub>2</sub> waters in extreme environments, such as the Valles, however, are poorly constrained. Here, the ARSC Dissertation award has presented a unique opportunity for travel and collaboration to leverage expert-knowledge with staff of the U.S. Geological Survey, National Park Service, and U.S. Forest Service and will build directly upon knowledge gained from the MTU experiments to accurately quantify high-CO<sub>2</sub> discharge within the Sulphur Creek and Jemez River watersheds that are proximal to the National Preserve.

## Fort Smith Geological Society Award



Dr. Adriana Potra presented MS GEOL student Stephen Denham with the **Fort Smith Geological Society (FSGS) Scholarship** at that society's final meeting, on April 24, 2018.

Our department had students who received awards from the Tulsa Geophysical Society, the Tulsa Geological Society and the Shreveport Geological Society.

## Geological Society of America



Congratulations to undergrad **Mason Frucci**, undergrad geology student, who won [\*Best Undergraduate Oral Presentation\*](#) at the 2018 South-Central GSA Meeting in Little Rock last March. His paper was titled: [\*Oxygen Isotopic Composition of Semi-Aquatic Turtle Phosphates From the Early Cretaceous Holly Creek Formation, Southern Arkansas.\*](#)

## Treitel Library Donation



Dr. Sven Treitel is a German born Argentinian American geophysicist who earned BS, MS and PhD degrees from the Massachusetts Institute of Technology in the 1950s and was instrumental in the transition of exploration geophysics from analog to digital recording and data processing. His working career was with Amoco Research in Tulsa. As an Honorary Member of the Society of Exploration Geophysicists and former Editor of the journal *Geophysics*, Sven had a close volunteer relationship with Geoscience Chair Chris Liner, including Liner serving as Assistant Editor of *Geophysics* under Treitel as Editor (1997-1999). Since retirement, Sven kept a consulting practice which was winding down in January 2017. At that time, he contacted Liner about the possibility of donating his library of books and manuscript material to the University of Arkansas. Some material had gone in an earlier donation to the University of Calgary. Over the next few months a plan was developed through meetings with Dean of Libraries Carolyn Allen and Head of Special Collections Lori Birrell culminating in a signed agreement on 17 October 2017. Over 1000 books and other items were collected in spring 2018 and brought to the Mullins Library. Seven boxes of manuscript materials comprised of Dr. Treitel's research notes were also included in the collection. The U of A is very lucky to have the Treitel Collection, which could easily have gone to the U of Tulsa or MIT.

## GEOS 4686—Geology Field Course in Montana

The 2018 summer field camp was yet another epic adventure for all participants involved. Enrollment grew over the previous year with ~25 students (a number of which were from other universities across the country), 4 teaching assistants, and 5 professors participating. The department's annual summer field camp has been in operation for 36 consecutive years since it was first started by Professor Robert Morris back in 1982. Students experienced field mapping and hydrogeology fieldwork in the spectacularly exposed Permian to Tertiary rocks of southwestern Montana. **Greg Dumond** served as the field camp coordinator, a newly designated position with responsibilities that include logistics and planning. **Glenn Sharman** (a first-time field camp instructor) and **John Shaw** (a second timer), along with Greg (a field camp veteran), taught the first three weeks of camp that were based in Dillon, Montana. Students first cut their teeth on a 3 mi<sup>2</sup> mapping project along Frying Pan Gulch and then graduated to a more geologically complex, 5 mi<sup>2</sup> mapping project at Big Hole (field mapping area shown in the background of the photo). Besides learning how to measure bedding orientation with a Brunton compass and how to draw geologic contacts on a topographic map, students also learned how to recognize the sound that a rattlesnake makes, how to drive through deep water on the way to the mapping area, and how to have a good time in downtown Dillon. Glenn Sharman and John Shaw pioneered a new project involving measuring paleoflow from cross-bedding and performing a moderately complex structural restoration using stereonet; fortunately, the students rose to meet the challenge.

**Jill Marshall** (another field camp first timer) and veteran **Matt Covington** led the second half of field camp. The

students got a break from field projects with a trip to Yellowstone and Teton National Parks to kick off the second half of the field camp. From there the group migrated to Elkhorn Springs, Montana where they used field observations of temperature, water chemistry, and discharge to study the Elkhorn Hot Spring system. This helped them to prepare for a larger project studying water contamination and remediation effectiveness at the Elkhorn Mine. Students also got to experience snow in June on the last day of the Elkhorn Mine project. This was a nice lead in to the glacier mapping project at Kelly Reservoir where students mapped relict glacial landforms. After finishing up the projects, the group moved on to Glacier National Park and had a few rainy but enjoyable days hiking and observing the glacially carved landscape. The camp ended with a bang in Sun River Canyon, where we camped after leaving Glacier. We were awakened up early in the morning by a man from the dam on Gibson Reservoir (above our camp). He "suggested" we pack up, because they weren't sure how much longer they were going to be able to control the flood water. In what turned out to be the 3rd largest flood on record for Sun River, we narrowly escaped through rising water as more and more roads closed. While the flood cut short our geological observations in Sun River Canyon, it surely provided a memorable experience for students as well as the instructors.

Besides the fun of teaching students field geology, Glenn enjoyed fly fishing for the first time and photographing western birds, including many species he'd never seen before. He finished out the year with field work in Wyoming on a spectacular sedimentary sequence in the Hanna Basin that preserves a record of the most pronounced climatic warming event to have occurred since the Mesozoic.





*Photo of faculty and grad students from the Introductions Orientation meeting, Friday, August 17, 2018.*

## **Commencement**

May 11, 2018 - Among the hundreds of students at the University of Arkansas Fulbright College Honors Program, our department was well represented by **Sarah Williams**, BS GEOL, Cum Laude, **Mason Frucci**, BS GEOL, Cum Laude, **Seth Gilchrist**, BS GEOL, Cum Laude, and **Regan Hime**, BE GEOL, Summa Cum Laude, as well as by psychology major **Tia Francis**, Summa Cum Laude, who will be joining our department as a masters student in Geography in the fall.



*Geosciences undergraduates at the Spring 2018 commencement!*



## Department of Geosciences Promotes Math-Science-Engineering Academy

For the eighth year in a row, 26 rising high school juniors visited the University of Arkansas to take part in the Math, Science and Engineering Academy (M-SEA) pre-college outreach program in partnership with Fort Valley State University in Georgia. This year the participants were from Georgia, Oregon, and Alaska.

The students were welcomed to campus by Yvette Murphy-Erby, vice provost for [Diversity and Inclusion](#); Todd Shields, Dean of the [J. William Fulbright College of Arts and Sciences](#); Pat Koski, Associate Dean of the [Graduate School and International Education](#); Chancellor Joe Steinmetz, and [Department of Geosciences](#) professor emeritus **Van Brahana** and professor **Steve Boss**; "I believe the willingness of our upper administration to participate in this welcome event demonstrates their sincere commitment to increasing diversity and inclusion on our campus," said **Jo Ann Kvamme**, assistant director of the of [Environmental Dynamics Program](#) and co-coordinator of the M-SEA program.

Students then learned about the admission process, visited the U of A's Center for Multicultural and Diversity Education, visited the Honors College, and attended classes in geosciences taught by **Van Brahana** and **Steve Boss**, and electrical engineering classes taught by Robert Saunders. The students also participated in field trips to

Savoy Research to learn about geology and hydrology, to the Harry D. Mattison Power Plant to study electrical engineering and power generation, and to Walmart Corporate Headquarters in Bentonville to see 'big data', marketing, cyber security and new innovations.

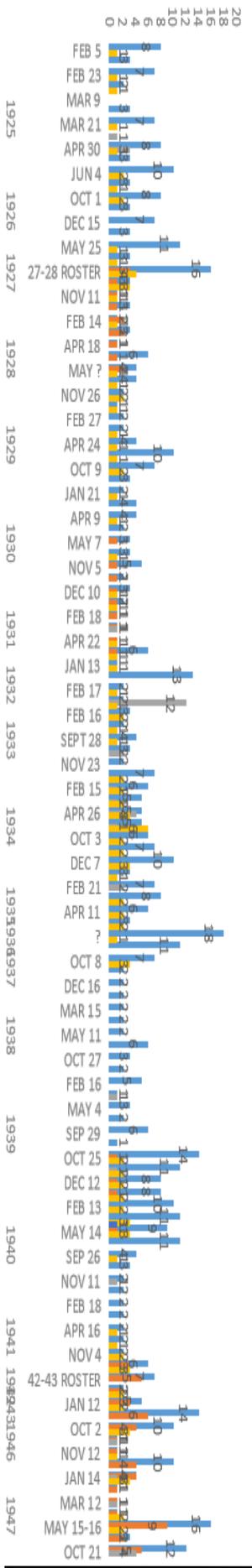
M-SEA is part of the Cooperative Development Energy Program at Fort Valley State University (CDEP) initiated more than 30 years ago to aid in the introduction of academically talented minority and female students to the fields of energy, mathematics, earth science, biology, engineering and computer science. The mission of both programs is to work together to create a pipeline focused on the recruitment and placement of these scholars for professional careers in the energy industry.

The University of Arkansas became a partner in 2010, and 154 students have participated in this program on campus. Twenty-seven participants have matriculated to our campus, with 20 graduates so far. Additionally, six students chose to attend graduate school at the University of Arkansas — five in geosciences and one studying mathematics.

For more information on the Cooperative Developmental Energy Program or M-SEA programs, please visit [www.fvsu.edu/academics/cdep](http://www.fvsu.edu/academics/cdep) and [The Cooperative Developmental Energy Program](#).



**WOMEN IN GEOSCIENCES AT THE UNIVERSITY OF ARKANSAS: 1925-1947** By Lisa Milligan



**Lesli Wood** (MS 1988) donated the book, "Anomalies. Pioneering Women in Petroleum Geology: 1917-2017" to our department. This book reveals the courage, tenacity, and professionalism of individual women when they were often excluded from and minimized in the energy exploration industry.

The history of women in the Department of Geosciences at the University of Arkansas, as housed in the department's historical records, is incomplete but compelling. The university's J.C. Branner Geology Club was named after John Casper Branner (July 4, 1850 – March 1, 1922) who was an American geologist and academic who discovered bauxite in Arkansas in 1887 as State Geologist for the Geological Survey of Arkansas. He served as President of the Geological Society of America in 1904.

The organizational meeting of the J.C. Branner Geology Club was February 5, 1925.

*"Membership in this organization shall be extended to major and minor students in the department of Geology and to such other interested persons as the club may see fit. There shall be two classes of membership, namely: active and honorary. The privileges of active membership shall be restricted to such persons as may take an active part in the work of the club. In accordance with the expressed desire of the Club any person may be invited to accept honorary membership in the Branner Geology Club."*

It was not until May 25, 1927 that discussion on the "advisability of taking women as members" was discussed, and "the majority expressed themselves as favoring the admittance of women as members upon the same basis as men." But five months later, on October 11, 1927, discussion was opened on "reviving the interest in the club which led to the question of the advisability, advantages, high points, and dangers of admitting women to the hitherto masculine club."

*"... after a lengthy discussion, a motion was made and seconded that women be voted into the club. The motion passed with no discussion. The question of membership was brought before the meeting by Dr. Giles."*

On October 19, 1927 Marguerite (sic) Keller became secretary. At this meeting it was suggested that "this be more of a scientific than a social organization." Was there a worry that the admission of women was detrimental to the purpose of the organization?

In December, 1927, Marguerite Keller made the presentation, "Tornadoes in Arkansas." In February, 1928 Miss Minette Ries presented a talk called, "Damn Diamonds;" the minutes-taker chose to add the designation "Miss" to her name.

At the November 26, 1928 meeting it was suggested to invite Dr. Margaret Boos to give the December 18, 1928 talk on Estes Park.

No mention is made of female names or membership until May 7, 1930 when the meeting had a presentation by Eunice Arnaud called "Tornadoes in Arkansas." The following fall semester shows that Ruth Oliver was put on the program committee.

Beginning on November 19, 1930, Ruth Oliver submitted the minutes of the Branner Geology Club, but on May 27, 1931, a member named Tom Milland (sic) proposed that membership be confined to men. The minutes state that this was retracted after discussion.

The list of members for the 1932-33 school year includes thirteen men and no women. At the

October 11, 1932 meeting the minutes include a motion that "girls (due to the scarcity of them that were eligible for membership) would only be admitted to the club on special occasions."

The next list of "regular" members is for the 1937-1938 school year, and includes no obviously female names. It is not until October 17, 1939 that a list of invitees includes at least two women. Two months later the minutes state, "the feminine member of the club" volunteered to give a talk on the next series of the advancement of man. This talk was presented on January 16, 1940 and was titled, "The Neanderthal and Cro-magnon man." This speaker is not on the list of members for the 1940-1941 school year.

The November 4, 1941 minutes include "invitations to potential members," of which at least two are female names. The membership list for the 1942-43 school year includes 7 women. At the October 28, 1942 meeting one of them became the Vice President of the Branner Geology Club.

Then there are no records until this news article, probably from a University newspaper, dated October 2, 1946: **BRANNER GEOLOGY CLUB REORGANIZED AFTER THREE YEARS.**

*After being inactive since 1943, the Branner Geology Club was reorganized last week under the direction of the faculty members of the geology department.*

*The Branner club was first formed in 1925, and was named in honor of John C. Branner, former state geologist for Arkansas.*

*For a long time the membership was limited to men, but gradually the feminine element was added. Since it is a selective organization with an educational as well as social side, only geology majors and minors are eligible for membership.*

*The club officers are: president, Damon Wingfield, vice-president Sheridan Conley; secretary-treasurer, Jane Ann Cole.*

The list of the 1946-1947 members includes at least nine women, two of which are officers, and thirteen "associate" members, including two women. One meeting in October, 1946, had five women out of a total of 17 present.

The minutes of December 10, 1946 show a total of seventeen present, three of which were women. And the January 14, 1947 meeting had only twelve present, but four were women. A field trip on May 16 and 17, 1947 took twenty-seven students to Diamond Cave and included nine women. By the following fall, the minutes included that "visitors are welcome," and out of twenty-three in attendance at the October 21 meeting, seven were women.

A department newsletter for the spring of 1950 announced that SGE had come to campus in 1949:

*"Alpha Psi chapter of Sigma Gamma Epsilon, national honorary and professional fraternity for male students majoring in earth sciences was organized on the campus of the University of Arkansas in 1949. Fourteen charter members were initiated when the charter was granted May 12, 1949.*

*The Kansas chapter and the Oklahoma chapter of Sigma Gamma Epsilon installed the chapter at Arkansas. The purpose of the fraternity is furthering the interest and research of the earth sciences. Members of the staff of the department have been elected honorary members. There are now about 40 chapters ... The mother chapter was organized in Kansas in 1915.*

This is where our documents end. Hopefully more records will soon be found!

## ORGANIZATIONS HIRING UA GEOSCIENCE GRADUATES

AECOM  
 Arkansas Department of Environmental Quality  
 Arkansas Geological Survey  
 Arkansas Department of Transportation  
 Arkansas Natural Resources Commission  
 Arkansas Parks and Tourism  
 Anadarko Petroleum Corporation  
 Beaver Water District  
 Bureau of Land Management  
 Burns and McDonnell  
 Chesapeake Energy  
 City of Springdale  
 Conoco Phillips  
 Core Laboratories  
 Denbury Resources  
 Devon Energy  
 ExxonMobil  
 EnSafe  
 Environmental Defense Fund  
 Environmental Services Associates  
 ESRI  
 Fayetteville Public Schools  
 FTN Associates  
 Garver Engineering Planning and Environmental Services  
 Haas Hall Academy  
 Halliburton  
 Hunt Oil Company  
 Kinder Morgan  
 Marathon Oil Company  
 Bureau of Ocean Energy Management  
 Newfield Exploration Company  
 Noble Energy  
 NOAA National Weather Service  
 North Plains Groundwater Conservation District  
 NWA Community College  
 NWA Regional Planning Commission  
 PGS  
 Pure Earth Resources  
 Rogers Public Schools Schlumberger  
 SCS Engineers  
 Shell  
 Sierra Club  
 Stephens Production Company  
 SWN  
 UNESCO  
 US Army Corps of Engineers  
 US Bureau of Reclamation  
 US Census Bureau  
 USDA Natural Resources Conservation Service  
 US Environmental Protection Agency  
 US Fish and Wildlife  
 US Forest Service  
 US Geological Survey  
 US National Park Service

The links to all of the above can be found at: <http://geoschaircorner.blogspot.com/2017/07/geos-jobs.html>

## STUDENT ORGANIZATIONS

Association of American Petroleum Geologists (AAPG)



Society of Exploration Geophysicists (SEG)



Sigma Gamma Epsilon (SGE)



Gamma Theta Upsilon (GTU)



National Association of Black Geoscientists (NABG)



Association of Women Geoscientists (AWG)



## Spring 2018 Banquet Awards

W.A. Tarr Award  
**Julie Cains**

SGE Volunteer of the Year  
**Josh Blackstock**

SGE Faculty of the Year  
**John Shaw**

SGE Outstanding Teaching Assistant  
**Tanner Corbin**

GTU Excellence in Cartography, Undergrad  
**Meagan Mosier**

GTU Excellence in Cartography, Grad  
**Casey Goodman**

GTU Geographer of the Year  
**Korab Vranovci**

GTU Sir Richard Burton Award  
**Jake Rowlett**



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### Available from SGE:

\$5 Bottle Coozie  
 \$6 Coffee Mug  
 \$6 Pint Glass  
 \$1 Sticker  
 \$16 T-shirt

Prices are a suggested donation. For how-to-order information contact the department by calling 479-575-3355 or emailing [lmilliga@uark.edu](mailto:lmilliga@uark.edu)



**The Spring Awards Banquet  
was held May 3, 2017 at the  
UARK Bowl  
on Dickson Street.  
Photos courtesy of  
Holly Young.  
See all the pictures [here!](#)  
Plan to join us on May 2, 2019!**





UNIVERSITY OF  
ARKANSAS

Department of Geosciences  
340 N. Campus Drive/216 Gearhart Hall  
University of Arkansas  
Fayetteville, AR 72701

**To be good stewards of the taxpayer's money, we have sent an abbreviated hard-copy version of this newsletter to our alums who have not supplied us with an email address.**

Visit our website: [GEOSCIENCES@uark.edu](mailto:GEOSCIENCES@uark.edu)

**Geosciences Facebook pages:**

DEPARTMENT NEWS: <https://www.facebook.com/uageosciences/>  
ALUMNI FORUM: <https://www.facebook.com/groups/90439940396/>