2024 Newsletter

First Dive to Glacier's Edge: Page 19

The University of Texas at Austin
Jackson School of Geosciences

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20 YEARS

Jackson School of Geosciences

Dear Alumni and Friends,

The full majesty of geological settings —their wonder, scope and relevance —can sometimes be hard to capture on the cover of the 9-by-12-inch *Newsletter.* This year's cover is up to the challenge. It captures the natural majesty of Greenland's glaciers, the force of their movement across the landscape, and the dynamic interface of glacier, land and sea. Yet, the details of that interface are still poorly understood, hidden in an ungovernable and dynamic environment that makes scientific investigation challenging—even dangerous!

The cover story follows a mission to Greenland led by Professor Ginny Catania to dive to the underwater face of a glacier to take measurements and images never before collected. The science team is trying to fill in one of the major blind spots in ice sheet modeling, a key component in understanding how much seas will rise in the future, both nearby and as far away as Texas. Indeed, when she's not on a research vessel in icy seas, Catania is part of a research group that works with local communities along the Texas Coast, helping them understand how the melting of glaciers half a world away can affect their lives.

At the Jackson School of Geosciences, we are looking beyond the science we do and seeking to connect our work to real people and communities, and to use our science to help resolve the challenges that they face. Tackling the real-world, relevant problems facing society and our planet is what our students aspire to do, and they demand the education to do it. The modern geoscience student is passionate and wants to make the world a better place. Throughout this magazine, you can read stories of how our work is meeting those aspirations. There's a fascinating story on how our climate modelers are helping the insurance and risk-assessment firm Verisk better understand the risk of a changing world to their business and that of their clients. Another perfect example is the work we are doing with the City of Austin in the UT-City Climate CoLab to help communities right here in Austin become more resilient.

Of course, one of our greatest challenges is to provide all of the energy needed for a modern, healthy and economically sound society. President of The University of Texas at Austin Jay Hartzell has declared 2025 to be the "Year of Energy" on campus, giving us an opportunity to highlight UT's comprehensive energy research portfolio. In addition to evolving ever more sophisticated science and technology for fossil energy exploration and production, there are new energy sources and systems to develop. There's an opportunity to move carbon capture and storage to widespread application, a mounting pressure for new mineral and water resources, and new legal, energy economics, and policy scenarios to evolve. Enjoy our story on "The Energy University," highlighting the ways that the Jackson School is helping spearhead the effort.

I think it's a testament to the job we are doing as a school of geosciences that our enrollment and credit hours are up, bucking national trends. You can read about the changes we are making to curriculum that are opening the geosciences to more students in our Academic Update section. And, there is a great feature on our new Climate System Science major—the first in the state of Texas. The new program will provide students with a technical and scientific understanding of climate systems that can help them succeed in the careers of the future as businesses, industries and communities work to become more resilient.

I hope you sit down, dive in and enjoy your *Newsletter*! None of this incredible science or education would be possible without your continued and amazing support! And don't forget to save the date for the Jackson School's 20th Anniversary Celebration on April 3-5. It's going to be an incredible time to reconnect with the school and old friends, dig into a full plate of Texas barbecue, and enjoy some boot scootin' with Dale Watson & His Lone Stars! I hope to see all y'all there!

Enjoy the *Newsletter*!

Claudia Mora, Dean

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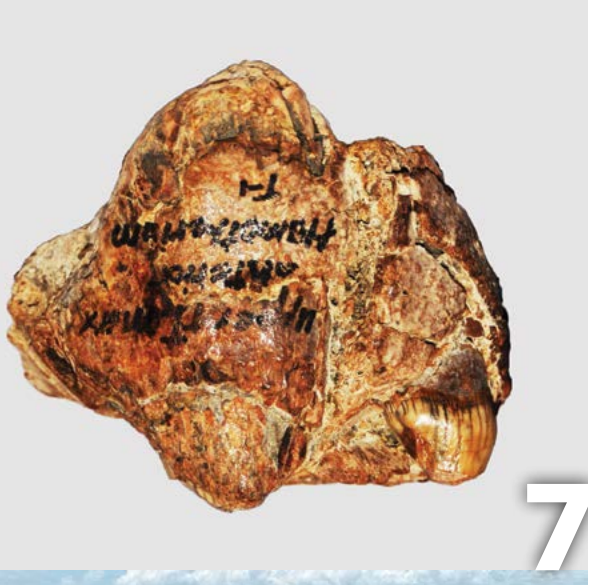
GEO 660 EXPLORES WESTERN U.S.

'UGLY' FOSSIL LEADS TO BIG CAT DISCOVERY ON TEXAS COAST



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Researchers at the Bureau of Economic Geology are studying a suite of catalysts that could release hydrogen gas from rocks without emitting carbon dioxide. This geologic hydrogen could provide a source of carbon-free energy.

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This fall, the Department of Earth and Planetary Sciences rolled out a revised undergraduate curriculum that helps build a common foundation in key geosciences skills and concepts while broadening entry points into the geosciences.

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Professor Emeritus Gary Kocurek passed away in June. He will be missed as a valuable colleague, mentor and friend.

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PHOTO: UNIVERSITY OF TEXAS INSTITUTE FOR GEOPHYSICS.

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The University of Texas at Austin Jackson School of Geosciences is one of the top research institutions in the world, with a depth and breadth of research that sets it apart. This is made possible by the Jackson School's three world-class units: the Bureau of Economic Geology, the Department of Earth and Planetary Sciences and the University of Texas Institute for Geophysics.

Following are some research highlights from the past year.

- *Climate & Environment*
- *Energy Geosciences*
- *Marine Geosciences*
- *Planetary Sciences & Geobiology*
- *Solid Earth & Tectonic Processes*
- *Surface & Hydrologic Processes*

A New Way to Look Inside the Earth

Solid Earth & Tectonic Processes

Surface mapping technology such as GPS, radar and laser scanning have long been used to measure features on the Earth's surface. Now, a new computational technique developed at the Jackson School of Geosciences is allowing scientists to use those technologies to look inside the planet.

Described by researchers as "deformation imaging," the technique provides results comparable to seismic imaging but also offers data about the rigidity of the planet's crust and mantle. This property is essential for understanding how earthquakes and other large-scale geological processes work, said Simone Puel, who developed the method for a research project at the University of Texas Institute for Geophysics while in graduate school.

"When combined with other techniques like seismic, electromagnetic or gravity, it should be possible to actually produce a much more comprehensive mechanical model of an earthquake in a way that has never been done before," Puel said.

Puel, who is now a postdoctoral scholar at the California Institute of Technology, published the research in *Science Advances* in 2024. It used GPS data recorded during Japan's 2011 Tohoku earthquake to image the subsurface down to about 100 kilometers underground.

The image revealed the tectonic plates and volcanic system beneath the Japanese portion of the Pacific Ring of Fire, including an area of low rigidity that's thought to be a deep magma reservoir feeding the system—the first time such a reservoir has been detected using only surface information.

ABOVE: A GPS STATION ATOP THE SIERRA NEVADA MOUNTAINS.
PHOTO: UNAVCO/NATIONAL SCIENCE FOUNDATION.

Jackson School Adds CT Scans to Free Anatomy Archive

Planetary Sciences & Geobiology

For decades, the University of Texas High-Resolution X-ray Computed Tomography Facility (UTCT) at the Jackson School of Geosciences has been helping scientists study specimens from the inside out—creating digital replicas of specimens ranging from Komodo dragons to the bones of "Lucy," the famous early human ancestor.

Now, thousands of UTCT scans are available for anyone to explore thanks to the openVertebrate (oVert) project.

Funded by the National Science Foundation, the oVert project is a free online archive of 3D reconstructions of vertebrate specimens from 18 research institutions. The UTCT contributed about 3,000 scans—including fossils—collected over 26 years from nearly 100 UTCT clients. These clients include more than 60 museums and universities that have agreed to have their data uploaded as part of the effort.

In addition to creating an open archive, the project is also helping the next generation of scientists learn CT skills. As part of the oVert effort, UTCT facility manager and Research Scientist Associate Jessica Maisano has trained six undergraduate students in the lab and organized short courses that taught researchers the best practices for CT data acquisition, visualization and analysis. More information: ***www.floridamuseum.ufl.edu/overt/***

ABOVE: A DIGITAL IMAGE OF A GREEN HERON MADE FROM X-RAY CT DATA. THE SPECIMEN WAS DIGITIZED AS PART OF THE OVERT PROJECT.
IMAGE: ZACH RANDALL/THE UNIVERSITY OF FLORIDA.

UT-City Climate Partnership Thrives

Climate & Environment

The UT-City Climate CoLab made significant strides in its first full year in 2024. The partnership between The University of Texas at Austin and the City of Austin created seasonal climate outlooks for the city, began a project to test whether reflective pavements can reduce temperature and humidity in local neighborhoods, and even helped forecast heat and precipitation for the Paris Olympics.

The City of Austin also approved $350,000 for the program in its fiscal year 2025 budget.

Established in 2023, the CoLab is a collaborative effort between the city's Offices of Sustainability and Resilience and researchers at UT. It is the first city-specific climate collaborative that links city officials and climate scientists to develop city-specific climate data, tools and assessments.

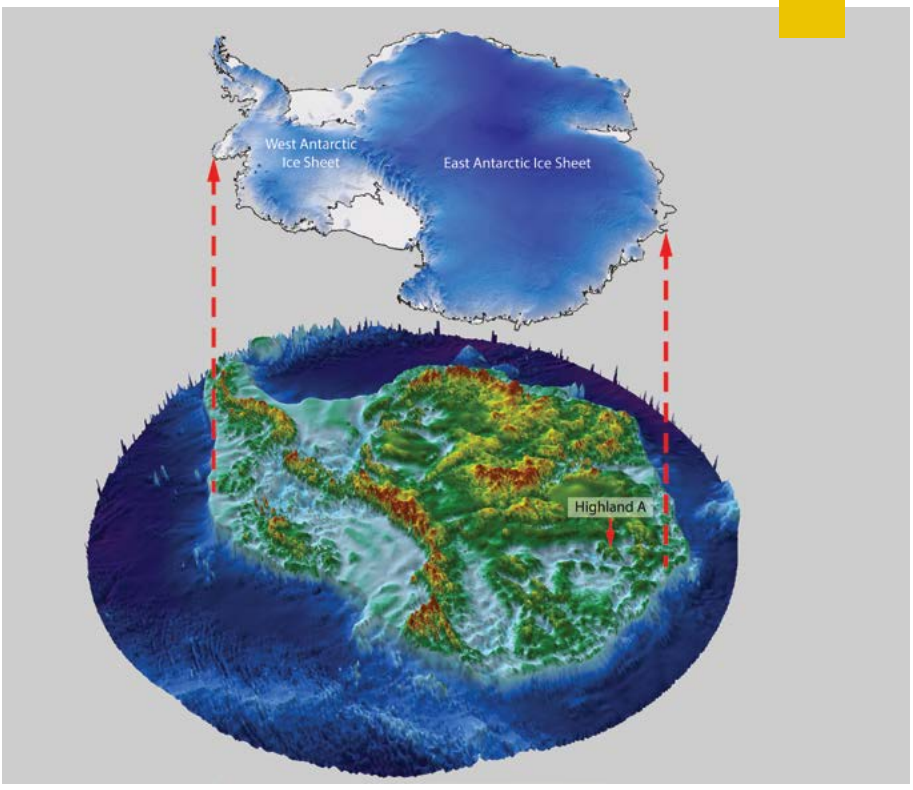
"Austin has experienced a series of weather extremes in recent years, from droughts and heat waves to heavy rain events and deep freezes," said Dev Niyogi, a professor in the Department of Earth and Planetary Sciences. "The UT-City Climate CoLab represents a significant step in linking scientific advances with practical city needs and educational opportunities to develop effective climate solutions and resilience."

Niyogi is leading CoLab research along with Assistant Professor Patrick Bixler of the UT LBJ School of Public Affairs and Associate Professor Junfeng Jiao of the UT School of Architecture.

The science team, which includes multiple Jackson School of Geosciences students, is producing two seasonal outlooks a year to help Austin prepare for extreme weather and heat-related issues. The reflective pavement project will continue throughout the summer of 2025. It involves 6.4 lane miles of reflective pavement installed in a southeast Austin neighborhood. The science team installed air temperature and humidity sensors in the neighborhood and in a neighborhood directly south without reflective pavement. In addition to taking measurements, the team is surveying the residents and bringing in people from outside the neighborhood to walk the area and see if there is a noticeable difference in the perceived heat.

The group also used artificial intelligence methods perfected at the CoLab to help forecast local weather conditions in Paris for the Summer Olympics.

For more information on the CoLab, see ***texuslab.org/colab***



Aerial Surveys Reveal Landscape Beneath Antarctic Ice

Surface & Hydrologic Processes

Long before Antarctica froze over, rivers carved valleys through mountains in the continent's east. Now, millions of years later, researchers have discovered an unexpected remnant of this ancient highland landscape thanks to an aerial survey campaign led by the University of Texas Institute for Geophysics.

The landscape of ancient valleys and ridges formed at least 14 million years ago. The researchers were surprised to find it preserved under the ice rather than ground away by the tremendous weight and motion of the overlying ice sheet.

"This landscape hanging out there in the middle of the basin is a little bit of an odd phenomenon," said co-author Duncan Young, a UTIG research scientist, and co-author of a study on the landscape published in the journal *Nature Communications*. "We're now working to answer why it was preserved and use that knowledge to find others."

Scientists are keen to learn about the land under Antarctica's ice because it plays a vital role in the stability of the ice sheet. Some landscapes let ice flow rapidly to the ocean. Others act to slow or bolster against intruding seawater. The land also records the history of how the ice sheet grew and retreated.

The basin where the ancient landscape was found contains enough ice to raise global sea level by more than 25 feet. But less is known about the land under the ice than about the surface of Mars, said the paper's lead author, Stewart Jamieson, a professor in the department of geography at Durham University.

"And that's a problem because that landscape controls the way that ice in Antarctica flows, and it controls the way it might respond to past, present and future climate change," he said.

More could soon be identified thanks to a long-term effort to map unexplored regions of East Antarctica by Young and his collaborators, who have flown hundreds of flights using a modified, World War II-era DC-3 equipped with UTIG-developed ice-penetrating radar and other instruments.

Fingerprinting Forever Chemicals

Climate & Environment

Research led by scientists at the Jackson School of Geosciences is helping identify the exact chemical composition of forever chemicals, which could help authorities trace them to their source when they end up in aquifers, waterways or soil.

The technique involves passing samples through a strong magnetic field, then reading the burst of radio waves their atoms emit. This reveals the composition of carbon isotopes in the molecule and gives the chemical a "fingerprint," a feat that had not previously been achieved with organofluorine compounds, which make up forever chemicals.

"Ultimately we will be able to trace molecules and see how they move," said Cornelia Rasmussen, a research assistant professor at the University of Texas Institute for Geophysics who co-led development of the technique. "For example, whether they just stay where they got dumped or whether they're moving downstream."

The new technique was described in a paper published in *Environmental Science & Technology*.

The researchers tested their technique on samples that included pharmaceuticals and a common pesticide. They are now conducting a pilot study to see how the technique will fare on pollutants that show up in Austin's creeks and wastewater. If successful, the technique could be useful for state and federal agencies that want to track the spread of water-borne forever chemicals.

ABOVE: THE LANDSCAPE OF ANTARCTICA AS IT WOULD APPEAR IF THE ICE WERE LIFTED AWAY. "HIGHLAND A" IS THE REMNANT OF AN ANCIENT LANDSCAPE CARVED BY RIVERS LONG AGO.
GRAPHIC: STEWART JAMIESON/DURHAM UNIVERSITY.

Researchers Propose New Step in Tectonic Squeeze

Solid Earth & Tectonic Processes

Back arc basins are large-scale geological features that push continents apart and pull them together as they open and close over millions of years. The basins shape mountain ranges, help regulate the planet's climate, and hold extensive geological records of the planet.

However, there's still much to learn about the details of how the opening and closing process works. Research led by Jackson School of Geosciences doctoral student Fernando Rey and published in the journal *Geology* is helping shed light on what might be an overlooked step in the closure process.

While analyzing tiny crystals called zircons from the Andes mountains of Patagonia—which formed by the closing of a back arc basin—Rey found what looked like an anomaly. Zircons that formed when the basin was starting to close had the chemical signature of zircons that formed when the plates were moving apart. The closing signature eventually showed up, but about 200 million years later than expected.

In the study, Rey and his collaborators propose that the delayed signature could be the result of a transitional phase in the closure process. This phase involves the same tectonic forces that squeeze the plates together also underthrusting crust into a magmatic chamber where the zircons are formed—influencing its isotopic signature.

"If you put some oceanic basin below this magma, you have a change in the composition of this magma as it's incorporated," said Rey. "This is something that was not documented before this study."

Researchers think this transitional phase could be a step in the back arc basin closure process around the world. If that's the case, there's a good reason it has not been observed before, said Rey. Most back arc basins close faster than Patagonia did—in a few million years rather than tens of millions. This shorter closure window means there's less of a chance for zircons that formed during this transitional phase to make it into the geologic record.

Rey is currently analyzing zircons from the Sea of Japan—a modern back arc basin that's in the early stages of closure—to see if there are signs of oceanic crust influencing the zircon signature.

ABOVE: FERNANDO REY, A DOCTORAL CANDIDATE AT THE JACKSON SCHOOL, IN THE LOWER ZAPATA FORMATION IN THE TORRES DEL PAINE NATIONAL PARK, CHILE. **PHOTO:** JACQUELINE EPPERSON.

Best Look Yet at Bizarre 'Worm-Lizard' Anatomy

Planetary Sciences & Geobiology

Sporting smooth scales, a large central tooth and sometimes small forearms, amphisbaenians live underground, burrowing tunnels and preying on just about anything they encounter—not unlike a miniature version of the monstrous sandworms from "Dune."

The fact that these "worm lizards" spend their days hunting beneath sand and soil makes them difficult to study. But thanks to two papers published in *The Anatomical Record*, new light is being shed on amphisbaenians and their strange anatomy.

With help from the University of Texas High-Resolution X-ray Computed Tomography Facility at the Jackson School of Geosciences, researchers completed a detailed comparative analysis of 15 amphisbaenians from southern Africa and a bone-by-bone description of every cranial anatomical feature of the species *Zygaspis quadrifrons*. The research is the most detailed look at southern African amphisbaenians to date, according to the research team, which included Christopher Bell, a professor in the Department of Earth and Planetary Sciences.

Some of the most striking imagery to come from CT scans of the reptiles are the large nasal cavities and wavy skull sutures that "grab" on to each other like puzzle pieces. The images also render in exquisite detail the amphisbaenians' strange singular central tooth, which interlocks with two bottom teeth.

"Combined with the powerful jaw muscles in amphisbaenians, it gives them a ferocious bite for an animal of their size," Bell said. "They can bite and tear out pieces of their prey."

With little biological and ecological data available on amphisbaenians, studying their anatomy is the best way for researchers to learn more about these bizarre animals and the hidden lives they lead beneath the surface.

ABOVE: THE SKULL OF THE WORM-LIZARD ZYGASPIS QUADRIFRONS WITH SECTIONS HIGHLIGHTED IN DIFFERENT COLORS. THIS IMAGE HIGHLIGHTS THE SPECIMEN'S LARGE NASAL CAVITIES AND PROMINENT CENTRAL TOOTH.
IMAGE: JACKSON SCHOOL, SAM HOUSTON STATE UNIVERSITY.

Carbon Storage Survey Update

Marine Geosciences

In March 2024, Research Professor Tip Meckel led a marine seismic acquisition project offshore of San Luis Pass on south Galveston Island. The project is part of the ongoing carbon storage surveying research happening at the Gulf Coast Carbon Center at the Bureau of Economic Geology.

The researchers revisited a site where in 2013, Meckel and collaborators found shallow gas anomalies while collecting a high-resolution 3D seismic dataset. These gas anomalies are analogs for potential carbon dioxide (CO_2) leakages from deep storage reservoirs that could be considered for CO_2 emissions storage.

The data from the most recent survey, which was supported by the U.S. Department of Energy, will allow for a 4D time lapse analysis of the gas. Meckel has used this type of analysis in a range of offshore carbon capture and storage projects, including pre-injection site assessment, risk reduction and monitoring.

Other UT participants involved with the seismic acquisition projection include Dallas Dunlap, a research scientist associate at the bureau; Dan Duncan, an engineering scientist at the University of Texas Institute for Geophysics; and graduate student Previna Arumugam.

How Will Air Pollution Affect Climate Change?

Climate & Environment

Once released into the atmosphere, the aerosols that make up air pollution can have a range of climatic effects. They can reflect sunlight or absorb it. They can affect cloud formation and brightness.

A project led by Geeta Persad, an assistant professor in the Department of Earth and Planetary Sciences, is working to understand these effects by projecting climate risks associated with different air pollution scenarios in the coming decades.

"In the next 20 to 30 years, (the aerosols) will either stay the same or grow slightly or disappear completely. That's a huge uncertainty in how rapidly climate change is going to accelerate," said Persad. "What we're really trying to do here is ensure that this aerosol uncertainty is going to be characterized appropriately."

Persad and her team will use SPEAR, one of the leading climate prediction models of the National Oceanic and Atmospheric Administration (NOAA). They will be focusing on how hazards—such as floods, fires and drought—across the United States could be affected by different levels of aerosol emissions.

The research is part of a larger NOAA initiative called "Climate Futures: Projections for Socially-Relevant Problems." The initiative includes 13 research projects seeking to improve climate change projections. The project is funded by a grant from the Modeling, Analysis, Predictions, and Projections program at NOAA's Climate Program Office.

ABOVE: A SMOGGY DAY IN LOS ANGELES. SMOG CONSISTS OF AEROSOLS THAT CAN HAVE WIDE-RANGING IMPACTS ON CLIMATE CHANGE EFFECTS.
PHOTO: FLICKR/CHANG'R.

Lab Experiments Revealing Role of Rock Permeability in Slow Slip Quakes

Solid Earth & Tectonic Processes

Slow slip events occur when pent up tectonic forces are released over the course of a few days or months, unfolding like an earthquake in slow motion. They don't cause destruction. But that does not make slow slip events less scientifically important.

In fact, their role in the earthquake cycle may help lead to a better model to predict when earthquakes happen.

In a paper published in *Geophysical Research Letters*, a Jackson School of Geosciences research group led by Harm Van Avendonk, Nathan Bangs and Nicola Tisato explores how the makeup of rocks, specifically their permeability—or how easily fluids can flow through them—affects the frequency and intensity of slow slip events.

In 2019 and 2022, the group traveled to New Zealand's North Island to collect rocks from several outcrops near the Hikurangi Margin, a subduction zone off New Zealand's coast where slow slip events occur about once a year. The researchers brought back a cache of rocks to the Jackson School, where they tested their permeability and elastic properties.

Tisato and other researchers analyzed rocks from nearby surface outcrops that were once part of the earthquake fault deep underground. Previous permeability studies have been performed only on loose sediments that have been consolidated into solid rock.

Tisato and graduate student Jacob Allen are currently analyzing rock samples from the center of the margin and testing for differences in permeability. The rocks at the northern end of this subduction zone are richer in clays than those at the southern end. Because clays are malleable and can hold a lot of water and other fluids, they are ideally suited to trap, fracture and channel those fluids. That could explain why slow slip events on the northern end of the subduction zone happen frequently, whereas they occur rarely on the southern end, Tisato said.

"We have to go through the exercise of understanding why in the north of the Hikurangi Margin there are slow slips, and why in the south of the Hikurangi Margin we have fewer slow slips," Tisato said. "Because if we understand that, then we have an additional step to go towards the prediction."

Three former graduate students from the Jackson School also contributed to this paper: Carolyn Bland, Kelly Olsen and Andrew Gase.

'Ugly' Fossil Places Extinct Saber-Tooth Cat on Texas Coast

Planetary Sciences & Geobiology

Important scientific finds don't always come in the prettiest packages. Sometimes new discoveries come in little ugly rocks. Such is the case of a 6-centimeter-wide, nondescript mass of bone and teeth that helped a doctoral student at the Jackson School of Geosciences expand the geographic footprint of a large cat that roamed the Earth tens of thousands of years ago.

"You can't even tell what it is, let alone which animal it came from," John Moretti, who led the research, said of the specimen. "It's like a geode. It's ugly on the outside, and the treasure is all inside."

The fossil is lumpy and rounded, with a couple of exposed teeth that are a little worse for wear, having been submerged and tumbled along the floor of the Gulf of Mexico for thousands of years before washing up on McFaddin Beach, just south of Beaumont, Texas.

From there, it entered into the fossil collections of Russel Long, a professor at Lamar University, who found the fossil while beachcombing in the 1960s. After Long passed away, the fossil was passed to his former student, U.S. Rep. Brian Babin—who worked as a dentist for 38 years and immediately recognized the fossil as a jawbone and teeth.

But the identity of the fossil remained a mystery until Moretti entered the picture, working with Jackson School Professor Chris Bell and Will Godwin, a fossil curator at Sam Houston State University, which houses the specimen.

Moretti brought the fossil to be X-rayed at the Jackson School's University of Texas High-Resolution X-ray Computed Tomography Facility. The scan revealed there was more to this mass than met the eye: a hidden canine tooth that had not yet erupted from the jaw bone is embedded within the specimen, out of plain sight.

It was just what Moretti needed to identify the fossil as belonging to a *Homotherium*, a genus of large cat that roamed much of the Earth for millions of years.

The fact that the tooth was nestled in the jawbone indicated that the cat wasn't fully grown when it died. It also helped protect the tooth from the elements.

"Had that saber tooth been all the way erupted and fully in its adult form, and not some awkward teenage in-between stage, it would have just snapped right off," Moretti said. "It wouldn't have been there, and we wouldn't have that to use as evidence."

Homotherium spanned across habitats in Africa, Eurasia and the Americas. It was a large, robust cat about the size of a jaguar, with an elongated face, lanky front legs, and a sloping back that ended in a bobtail. Their serrated canine teeth were covered by large gum flaps, similar to domestic dogs today.

Homotherium fossils have been found in several areas of Texas, but this fossil shows for the first time that the big cat roamed the now-submerged continental shelf that connects Texas and Florida. Scientists hypothesize that this stretch of land was a neotropical corridor, a humid strip of grassland that enabled animals such as capybaras and giant armadillos to move from Mexico to Texas to Florida without venturing farther north.

The discovery that *Homotherium* lived along this corridor gives scientists a small glimpse into the ecology of this landscape during the Late Pleistocene, Moretti said, with big carnivores such as these cats helping to shape the broader animal community by tamping down prey-animal populations and influencing regional biodiversity.

The findings were published in *The Anatomical Record*.

ABOVE: DOCTORAL STUDENT JOHN MORETTI HOLDS A SKULL OF THE SABER-TOOTH CAT HOMOTHERIUM THAT IS PART OF THE JACKSON SCHOOL'S VERTEBRATE PALEONTOLOGY COLLECTIONS.
PHOTO: JACKSON SCHOOL.

INSET: THE "UGLY" FOSSIL SPECIMEN. TWO TEETH ARE VISIBLE BREAKING OUT AT THE BOTTOM: AN INCISOR AND THE TIP OF A PARTIALLY-ERUPTED CANINE.
PHOTO: SAM HOUSTON STATE UNIVERSITY.

Capturing Carbon Across the Country

Climate & Environment

Carbon capture and storage is not a one-size-fits-all solution. There are a range of approaches for keeping carbon dioxide (CO_2) emissions out of the atmosphere—from injecting emissions underground to forest management strategies—and different regions have different strengths.

A first-of-its kind report, "Roads to Removal: Options for Carbon Dioxide Removal in the United States," provides an overview of different types of CO_2 removal techniques, the costs associated with them, and the regions where they could be effectively deployed across the country.

Spearheaded by Lawrence Livermore National Laboratory and funded in part by the U.S. Department of Energy, the report includes 14 academic research institutions as collaborators—including the Jackson School of Geosciences.

Researchers at the school's Gulf Coast Carbon Center, which is part of the Bureau of Economic Geology, were key contributors to the report's chapter on geologic storage. According to the research presented in this chapter, more than half of the land area in the nation has the potential for safe storage of CO_2.

"This report opens more opportunities to explore for storage in deep geologic formations that can accept and store large volumes of captured CO_2," said Sue Hovorka, a research professor at the center and contributor to the report.

The "Roads to Removal" report, along with fact sheets, maps, videos and a complete author list, is available at ***roads2removal.org***

Catalysts Could Make Producing Hydrogen From Rocks a Reality

Energy Geosciences

In a project that could be a game changer for the energy transition, researchers at the Bureau of Economic Geology are exploring a suite of natural catalysts to produce hydrogen gas from iron-rich rocks without emitting carbon dioxide.

If the scientists are successful, the project could jump-start a brand-new type of hydrogen industry: geologic hydrogen.

"We're producing hydrogen from rocks," said Toti Larson, a research associate professor at the bureau and lead researcher on the project. "It's a type of non-fossil fuel production of hydrogen from iron-rich rocks that has never been attempted at an industrial scale."

The research is one of 16 projects funded by a $20 million U.S. Department of Energy initiative focused on geologic hydrogen. The bureau researchers are collaborating with scientists at the University of Wyoming's School of Energy Resources to explore the feasibility of this process on different rock types across the United States.

The natural catalysts that the researchers are studying contain nickel and platinum group elements. They work by stimulating a natural geologic process called "serpentinization," which involves iron-rich rocks releasing hydrogen as a byproduct of chemical reactions. Although serpentinization usually occurs at high temperatures, the catalysts would enable the reaction to occur at lower temperatures and at depths easily accessible to today's technology.

Researchers have already conducted successful tests at the laboratory scale. The next step is to scale up the experiments and test the process on a broad range of iron-rich rock types found across North America. Locations include basalts from the Midcontinent Rift in Iowa, banded iron formations in Wyoming and ultramafic rocks in the Midwest.

ABOVE: ESTI UKAR (LEFT) AND TOTI LARSON ARE LEADING A PROJECT TO PRODUCE GEOLOGIC HYDROGEN FROM ROCKS. THEY ARE BOTH RESEARCHERS AT THE BUREAU OF ECONOMIC GEOLOGY. **PHOTO:** J.EVAN SIVIL.

The Upside to Leaky Pipes: Happy Trees

Climate & Environment

Astute observers of Waller Creek on UT campus may have noticed that it never runs dry. There's a good reason for that. A significant portion of the water in it—anywhere from 25% to 50%—can be traced back to wastewater from leaky municipal pipes.

But there's a silver lining to the less-than-perfect plumbing, according to research from the Department of Earth and Planetary Sciences. The water flowing through the creek sustains trees growing along it, allowing them to thrive during drought conditions that take a toll on trees growing along streams in more rural areas.

The research involved taking small cores from bald cypress trees along Waller Creek and Onion Creek, a rural stream about 12 miles from the UT campus. The cores contained the growth record of the trees, which the researchers then compared with the drought record of the region.

They found that even during the state's most severe drought on record, which spanned from 1950 to 1957, the Waller Creek trees showed only a small decline in growth. In contrast, the trees of Onion Creek faced a steep decline.

Leaky pipes are hardly unique to Austin. That means that around the world, there are probably pockets of trees tapping into wastewater, said Jay Banner, a professor in the department who led the study. Understanding the extent of infrastructure leakage and its ecological influence can help policy makers understand the broader effects of urbanization—the good and the bad—and plan accordingly.

The findings were published in the *Nature Partner Journal Urban Sustainability.*

ABOVE: A VIEW OF WALLER CREEK ON UT CAMPUS. A SIGNIFICANT PORTION OF WATER THAT FLOWS THROUGH IT CAN BE TRACED BACK TO MUNICIPAL SOURCES, WHICH KEEPS THE WATER FLOWING AND THE TREES GROWING.
PHOTO: JACKSON SCHOOL.

Scientists Find Early Warning Sign in Lab-Made Quakes

Solid Earth & Tectonic Processes

Earthquakes happen in irregular cycles, making it difficult to know when or where the next one may strike. Although seismic records show that tremors and other geological movements occur before large earthquakes, earthquake faults produce as many random rumbles as meaningful tremors.

That means a critical part of seismic research is separating what's important from the background noise. Working in the lab, a team of researchers at the University of Texas Institute for Geophysics has made a promising discovery—isolating a pattern of "foreshock" tremors.

The finding, which was described in *Nature Communications*, offers hope that future earthquakes could be forecast by the swarm of smaller tremors that come before them.

"If we're ever going to predict or forecast earthquakes, then we need to be able to measure, characterize, and understand what's happening right before the earthquake," said Chas Bolton, a research assistant professor at UTIG.

Bolton and collaborators measured earthquake cycles on a miniature lab-made fault at Penn State. The fault is only 2 inches long—orders of magnitude smaller than the real thing. But experiments revealed a pattern of tremors that got stronger and occurred more closely together as the lab earthquake approached. No such pattern was found for slower or weaker earthquakes.

This pattern is significant because it means the tremors are connected to the main shock, Bolton said.

"It gives you a physical explanation for what's controlling the foreshocks," he said.

It also gives researchers a telltale pattern to look for in the real world. That's exactly the next step for Bolton, who is beginning that work, starting in Texas, to isolate similar patterns in measurements made by the state's seismological network, TexNet, which is managed by the Bureau of Economic Geology.

ABOVE: A BONY PLATE OF ARMOR CALLED AN OSTEODERM FROM THE TRUNK REGION OF GARZAPELTA MUELLERI. LEFT IMAGE IS THE OSTEODERM AS SEEN FROM ABOVE; RIGHT IMAGE IS THE OSTEODERM SEEN FROM THE SIDE.
PHOTO: WILLIAM REYES.

LEFT: AN ARTIST'S INTERPRETATION OF THE NEWLY IDENTIFIED AETOSAUR GARZAPELTA MUELLERI (SPIKED REPTILE IN MID-GROUND ON RIGHT) AND OTHER PREHISTORIC REPTILES, AMPHIBIANS, AND MAMMAL RELATIVES. THE ARTWORK APPEARS ON THE COVER OF A SPECIAL ISSUE OF THE ANATOMICAL RECORD DEDICATED TO TRIASSIC ANIMALS.
ILLUSTRATION: MARCIO L. CASTRO.

Prehistoric 'Suit of Armor' Helps Identify New Species of Dinosaur Ancestor

Planetary Sciences & Geobiology

Dinosaurs get all the glory. But aetosaurs, a heavily armored cousin of modern crocodiles, ruled the world before dinosaurs did.

These tanks of the Triassic were covered from head to toe in armor plates, and they came in a variety of shapes and sizes before going extinct about 200 million years ago. Today, their fossils are found on every continent except Antarctica and Australia—but full suits of armor from aetosaurs are rare.

That makes a new species of aetosaur identified by William Reyes, a doctoral student in the Department of Earth and Planetary Sciences, all the more exciting. The research focused on a specimen that has about 70% of its armor, with plates from each major region of the body.

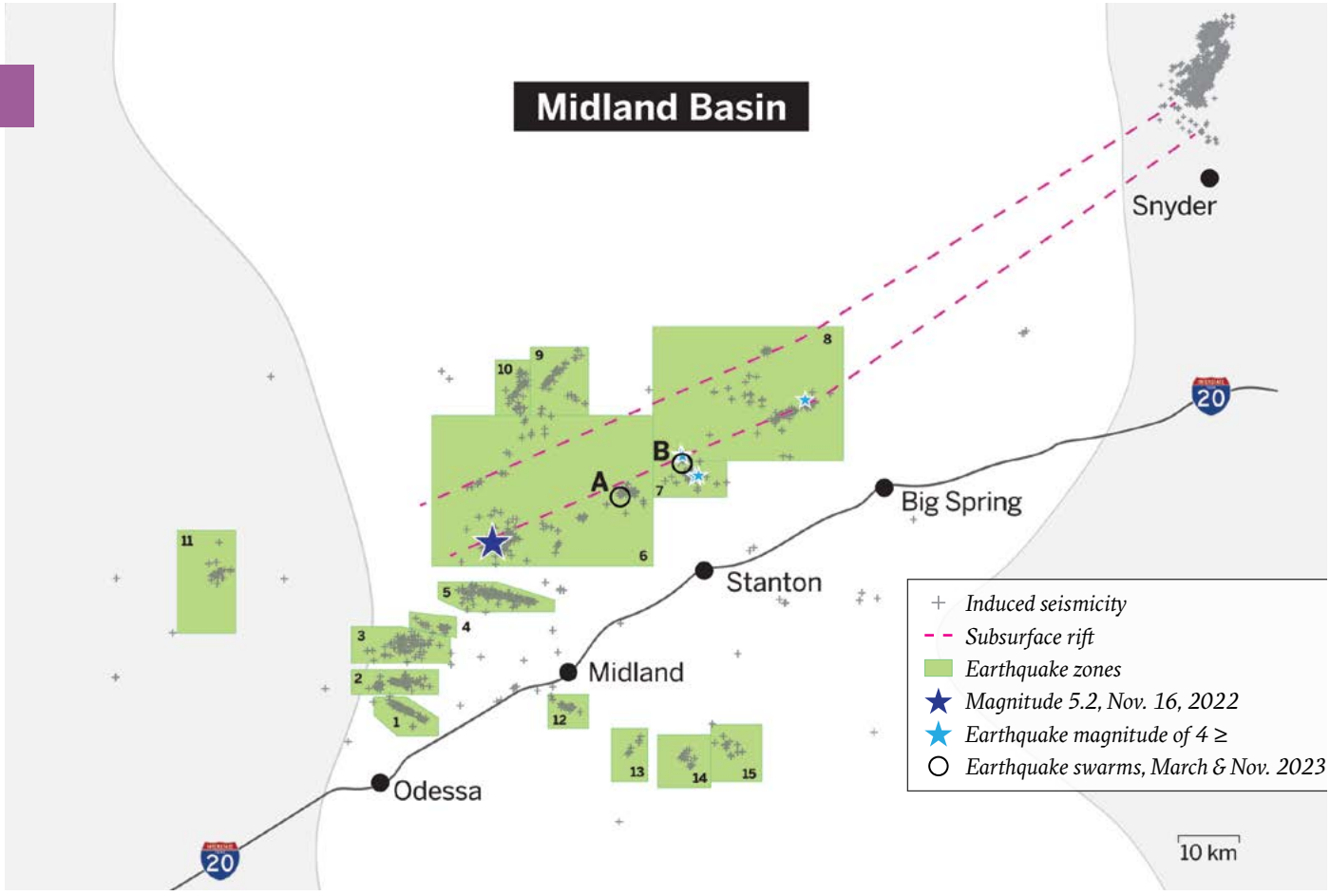
"We have elements from the back of the neck and shoulder region all the way to the tip of the tail," said Reyes. "Usually, you find very limited material."

Reyes named the aetosaur *Garzapelta muelleri*. "Garza" recognizes Garza County in northwest Texas, where the aetosaur was found more than 30 years ago. "*Pelta*" is Latin for shield, a nod to aetosaurs' heavily fortified body. The species name "*muelleri*" honors the paleontologist who discovered the fossil, Bill Mueller.

Reyes said that Garzapelta, which lived about 215 million years ago, would have resembled a modern American crocodile—but with much more armor.

"Take a crocodile from modern day and turn it into an armadillo," he said.

The results were published in *The Anatomical Record*.



Earthquakes on the Move in the Midland Basin

Solid Earth & Tectonic Processes

Since 2017, researchers at the Bureau of Economic Geology have been using TexNet, a statewide seismic monitoring network, to track earthquakes across Texas. Now, they are applying the data to new ends: to forecast where earthquakes could be going next.

In a study published in *Seismological Research Letters*, a team of scientists from the Bureau of Economic Geology described how seismic activity in the Midland Basin appears to be on the move.

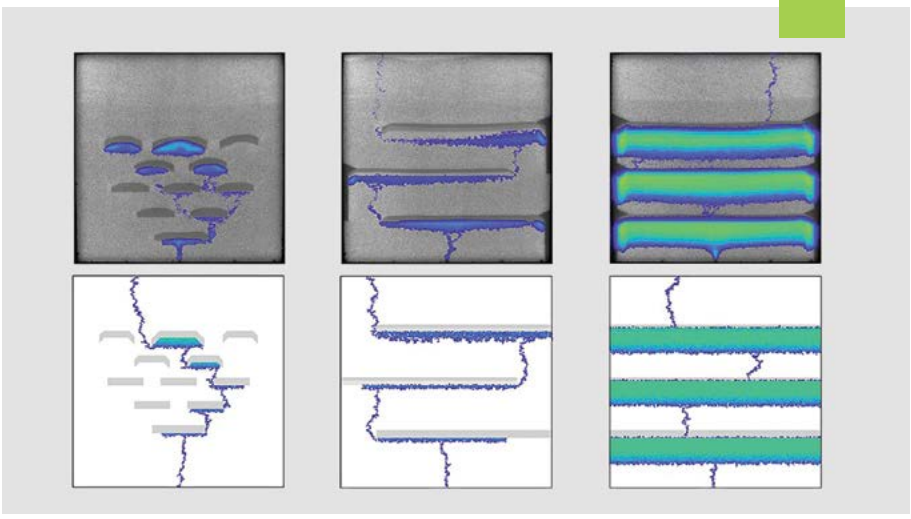
In the past, most quakes happened in the southwest region near Odessa and Midland. The activity is now probably heading northeast toward the community of Big Spring, with the seismicity moving along a newly identified and extensive seismogenic fault zone stretching toward the northeast edge of the basin.

"The fault zone has been activated, and it has the capability to trigger additional earthquakes that can be felt by humans, especially because it's so close to major cities along Interstate 20," said Dino Huang, a research assistant professor at the bureau who led the research.

Huang and collaborators used seismic data from TexNet to calculate the depth, location and orientation of geologic faults—large cracks under the ground where earthquakes can occur—using a technique called passive seismic analysis. This analysis allowed the researchers to find previously unmapped parts of the Midland Basin fault system. Major features of the system include what looks like a rift structure stretching across the middle of the basin in the deep basement rock that is slowly widening over time. This rift structure is surrounded on either side by a complex network of smaller faults.

Within this fault system, the researchers identified 15 distinct earthquake-producing zones—places where earthquakes have already occurred and where the quakes can be traced back to common sources of stress in the subsurface. The researchers then combined the data on earthquake frequency and magnitude from all the zones to determine the future seismic potential of the entire Midland Basin—that is, the potential for future earthquakes to occur.

ABOVE: A COMPOSITE FIGURE SHOWING THE SEISMIC LANDSCAPE OF THE MIDLAND BASIN FROM 2017 TO 2023.
MAP: DINO HUANG, ET AL.



Better Carbon Storage With Stacked Geology

Climate & Environment

The overarching goal of all carbon capture and storage projects is the same: Keep carbon dioxide (CO_2) emissions out of the atmosphere by storing them in the subsurface for good.

One way to do that is to inject the CO_2 into a reservoir space that's covered with a big lid—an impermeable caprock that can keep the gas in place and stop any upward flow in its tracks. That's the model that petroleum exploration has relied on for decades when searching for oil traps, and it works for both oil and CO_2.

But according to research led by the Bureau of Economic Geology and published in the *International Journal of Greenhouse Gas Control*, subsurface reservoirs that are covered by a collection of hundreds of smaller lids—collectively called a "composite confining system"—may be a better option for keeping carbon trapped for the long term.

That's good news for the carbon storage industry. This type of distributed system is common in a range of geological environments, including the Texas Gulf Coast, said study co-author Alex Bump, a research associate professor at the bureau's Gulf Coast Carbon Center.

"Directly under what is the largest concentration of emissions in the U.S., we have incredible reservoirs but few regional seals. What we have instead are lots and lots of discontinuous barriers to vertical flow," said Bump. "There is a very local motivation for this research, but the application is global."

The study describes results from experiments and numerical models that show that the length and frequency of barriers in a composite confining system are the two most influential factors when it comes to keeping carbon in place. They also found that the barriers don't have to be particularly substantial to be effective. Minor reductions in grain size between geologic layers are enough to divert the path of a rising CO_2 plume—helping to spread the gas laterally throughout the reservoir, with little migration toward the surface.

Bump is currently working on developing a best-practices guide for finding and permitting these types of reservoirs for CO_2 storage.

ABOVE: A FIGURE SHOWING THE RESULTS OF THREE EXPERIMENTS SIMULATING THE MOVEMENT OF A PLUME OF CARBON DIOXIDE THROUGH VARIOUS CONFIGURATIONS OF A COMPOSITE CONFINING SYSTEM. THE TOP ROW SHOWS EXPERIMENTAL RESULTS. THE BOTTOM ROW SHOWS THE RESULTS OF A COMPUTER SIMULATION OF THE EXPERIMENT. **FIGURE:** HAILUN NI, ET AL.

Water Quality Risks Linked to Social Factors

Climate & Environment

Many policymakers across the country use median household income to determine which communities are disadvantaged and should be prioritized for certain social programs.

But for water quality violations, social factors—such as low population, high housing vacancy, disability and race—are a better measure than income when it comes to determining who is most at risk, according to a study led by Bridget Scanlon, a research professor at the Bureau of Economic Geology.

Scanlon and her colleagues analyzed how water quality violations from across the contiguous United States reported during 2018-2020 compared with household median income and a social vulnerability index the researchers compiled for the study. The social index is modified from a similar index created by the Centers for Disease Control and Prevention that's used for identifying communities that may need more support during natural disasters and public health emergencies.

The index created by the researchers proved to be a better indicator, capturing about 70% of the population affected by community water-quality violations, about three times the amount captured when median household income was used.

The study was prompted by new federal drinking water infrastructure laws that require states to allocate at least 49% of about $50 billion in federal funding to address water issues in disadvantaged communities.

"The study offers a useful tool that lawmakers can use," Scanlon said. "This can then aid in coming up with lasting solutions that community water systems need to fix these issues."

The findings were published in *Environmental Research Letters*.

Research Aims to Keep Water Flowing in the Southwest

Surface & Hydrologic Processes

The Colorado River is an essential source of water for the southwestern region of the country—with seven states and Mexico depending on it for both municipal and agricultural use.

A 1922 agreement allocates how much water each state is allowed to consume. But that's set to change in 2026, with stakeholders from states, tribes, the U.S. federal government and Mexico negotiating the rules that will govern the future operation of reservoirs along the Colorado River Basin.

Understanding the water supply of the Colorado River Basin over time—and the factors driving its change—can help these stakeholders make plans for sustainable practices for water use, according to Bureau of Economic Geology Research Professor Bridget Scanlon. This is especially important in light of recent water shortages. In May 2024, these shortages led to Lake Powell, the largest water reservoir by surface area in the United States, dropping to a record low of about 35% of capacity.

To that end, Scanlon and collaborators have recently completed research on the water supply of the Colorado River Basin from about the 1940s to the present. The research synthesizes surface water and groundwater supply data from a range of sources—including satellites, ground-based monitoring and regional modeling. It also shows how different laws and water use practices influenced supply levels.

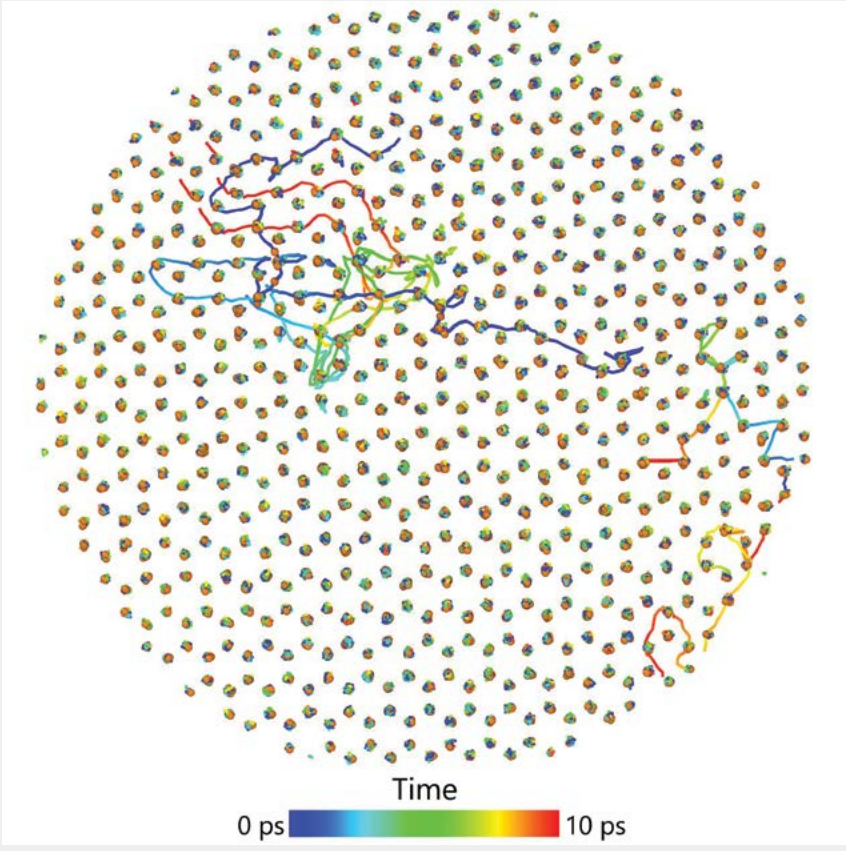
"This gives us the longer-term context," Scanlon said. "And you can see how the system has evolved and how things have been changing over time. And that's important if you're trying to understand controls (on water)—climate variability, variations in irrigation pumpage, all these things."

For example, a combination of wet climate periods, irrigation practices that flooded fields, and water delivery from the Central Arizona Project helped increase water levels in some Arizona aquifers from the late 1970s to the early 2000s after a period of extreme decline starting in the 1940s caused by groundwater pumping for agricultural use.

However, recent water shortages in the Colorado River, largely influenced by a mega drought during the past two decades in the basin, have led the aquifers to decline again.

Scanlon said this historical perspective underscores the importance of wet climate cycles, conjunctive use of surface water and groundwater with managed aquifer recharge, and water conservation.

ABOVE: LAKE POWELL.
PHOTO: MOBILUS IN MOBILI/FLICKR.



Iron Atoms on the Move in Earth's Inner Core

Solid Earth & Tectonic Processes

The Earth's solid inner core is a tightly packed place. But even here, there's space for wiggle room.

Researchers from the Jackson School of Geosciences and Sichuan University in China have found that certain groupings of iron atoms in the Earth's inner core are able to move about rapidly, changing their position in a split second while maintaining the underlying metallic structure of the iron—a type of atomic movement called "collective motion."

Their findings were published in the *Proceedings of the National Academy of Sciences*.

The results, which were informed by laboratory experiments and theoretical models, could help explain numerous intriguing properties of the inner core that have long vexed scientists. They could also help shed light on the role the inner core plays in powering Earth's geodynamo, the elusive process that generates the planet's magnetic field.

"Now, we know about the fundamental mechanism that will help us with understanding the dynamic processes and evolution of the Earth's inner core," said Jung-Fu Lin, a professor in the Department of Earth and Planetary Sciences and one of the study's lead authors.

ABOVE: A MODEL OF IRON ATOMS ON THE MOVE IN EARTH'S INNER CORE. THE MODEL DEMONSTRATES HOW IRON ATOMS ARE EXPECTED TO MOVE ABOUT IN THE EARTH'S INNER CORE OVER 10 PICOSECONDS. ONE PICOSECOND IS ONE TRILLIONTH OF A SECOND. **FIGURE:** ZHANG, ET AL.

Forecasting Earthquakes With AI

Solid Earth & Tectonic Processes

In 2023, researchers at the Bureau of Economic Geology won first place in an international earthquake forecasting competition, with their methods correctly predicting 70% of earthquakes a week before they happened during a seven-month trial in China.

A year later, the *Bulletin of the Seismological Society of America* published their findings as a case study, providing details on the artificial intelligence (AI) algorithm.

Bureau seismologist Yangkang Chen is the AI's lead developer. He and collaborators trained it to detect statistical bumps in real-time seismic data that researchers had paired with previous earthquakes. The outcome was a weekly forecast that successfully predicted 14 earthquakes within about 200 miles of where it estimated they would happen and at almost exactly the calculated strength. It missed one earthquake and gave eight false warnings.

It's not yet known if the approach will work at other locations, but the effort is a milestone in research for AI-driven earthquake forecasting, with the bureau's AI coming in first out of 600 designs.

The researchers plan to test the AI in Texas, since the state experiences a high rate of minor-to-moderate-magnitude earthquakes. The bureau's TexNet hosts 300 seismic stations and more than six years of continuous records, which makes the state an ideal location to verify the method.

The researchers want to integrate the system with physics-based models, which could be important where data is poor, or places where the last major earthquake happened hundreds of years before seismographs were invented.

"Our future goal is to combine both physics and data-driven methods to give us something generalized, like ChatGPT, that we can apply to anywhere in the world," Chen said.

Taming Wildfire With Technology

Climate & Environment

Wildfire risk is a growing concern across the country. That includes here in Texas, where the state's largest recorded wildfire caused devastation across the Panhandle in February.

Although flames may become wild, they're not inscrutable.

They hold data about the fire's potential rate of spread, intensity and emissions. Being able to collect this data as a fire is happening could help with fighting it.

James Thompson, a research assistant professor at the Bureau of Economic Geology, is collaborating with the U.S. Fish and Wildlife Service (FWS) to test spectral imaging technology that can collect data from wildfires in the moment.

Thompson received a NASA grant in fall 2023 to develop this technology, which can attach to an airplane or drone and collects multispectral infrared images of the fire. The device then processes these images for spectral changes that relate to gases, thermal emissions and smoke composition.

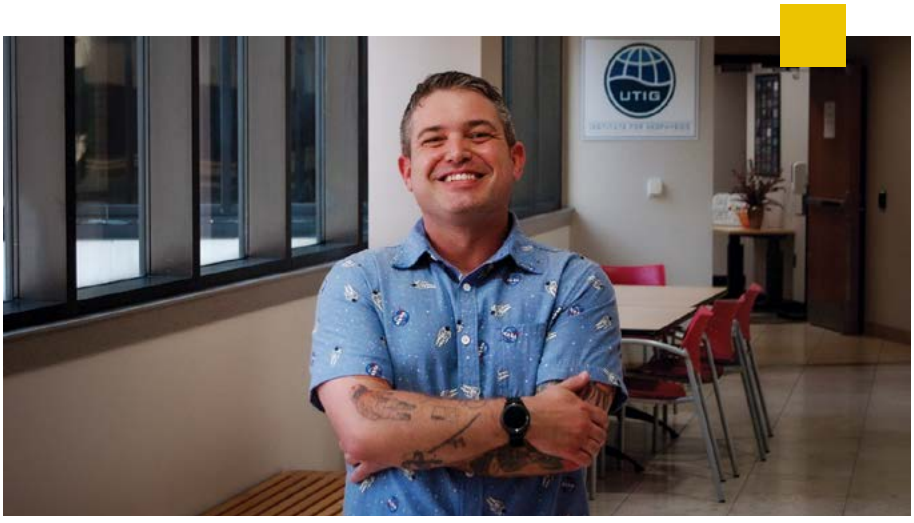
Wildfires are a new application for the technology, which Thompson started developing while he was in graduate school to study active volcanoes as part of his doctoral research.

"I did my Ph.D. on remote sensing of volcanoes," Thompson said. "But fire is something that I've always been interested in pursuing, and the idea for the instrument I'm developing was always planned on being a very versatile tool that can be used widely."

For now, Thompson is working with researchers at the FWS Balcones Canyonlands National Wildlife Refuge near Marble Falls to test the technology on controlled burns, which the FWS is studying as a means to restore the native Texas Hill Country ecology and fight the spread of invasive species.

So far, this year has proved too wet for fires. But when conditions are right, Thompson will be there to study the flames from the air.

ABOVE: FIREFIGHTERS BATTLE FLAMES FROM THE REIGNITED SMOKEHOUSE CREEK FIRE OUTSIDE OF MIAMI, TEXAS. **PHOTO:** TEXAS A&M AGRILIFE MARKETING AND COMMUNICATIONS, SAM CRAFT.



Little Groundwater Recharge in Ancient Mars Aquifer

Surface & Hydrologic Processes

According to the geological record of the red planet, Mars was once a wet world.

But no matter how much rainfall fell on the surface of ancient Mars, very little of it seeped into an aquifer in the planet's southern highlands, according to a study led by Eric Hiatt, a doctoral student in the Department of Earth and Planetary Sciences.

Hiatt made the discovery by modeling groundwater recharge dynamics for the aquifer, using a range of methods—from computer models to simple back-of-the-envelope calculations.

According to Hiatt, the models and calculations converged on the same answer—a miniscule 0.03 millimeters of groundwater recharge per year on average. That means that wherever rain fell in the model, an average of only 0.03 millimeters per year could have entered the aquifer and still produced the landforms remaining on the planet today.

For comparison, the annual rate of groundwater recharge for the Trinity and Edwards-Trinity Plateau aquifers that provide water to San Antonio generally ranges from 2.5 to 50 millimeters per year, or about 80 to 1,600 times the Martian aquifer recharge rate calculated by the researchers.

There are a variety of potential reasons for such low groundwater flow rates, Hiatt said. When it rained, the water may have mostly washed across the Martian landscape as runoff. Or it may have just not rained very much at all.

"The fact that the groundwater isn't as big of a process could mean that other things are," Hiatt said. "It might magnify the importance of runoff, or it could mean that it just didn't rain as much on Mars. But it's just fundamentally different from how we think about (water) on Earth."

The results were published in the journal *Icarus*. The paper's co-authors are Mohammad Afzal Shadab, a doctoral student at the Jackson School, and faculty members Sean Gulick, Timothy Goudge and Marc Hesse.

ABOVE: DOCTORAL STUDENT AND LEAD AUTHOR ERIC HIATT.
PHOTO: JACKSON SCHOOL.

Refining the CO_2 Record

Climate & Environment

Scientists use a range of natural records to measure atmospheric carbon dioxide (CO_2) levels over Earth's history. Examples include air bubbles trapped in ice cores, the chemistry of ancient soils and ocean sediments, and the anatomy of fossil plant leaves.

The methods and techniques can change over time though—which requires studies to be reassessed.

A research consortia led by Columbia University's Lamont-Doherty Earth Observatory that includes Jackson School of Geosciences Professor Dan Breecker did just that, covering geologic records for CO_2 spanning the past 66 million years.

The research, which was published in the journal *Science*, led to some studies being excluded because they were found to be outdated or incomplete in the light of new findings. Others were recalibrated to account for the latest analytical techniques. In the end, the scientists used the data to create a new 66-million-year curve of CO_2 versus temperatures.

In addition to improving the reliability of the scientific record, the research helps put present-day concentrations of atmospheric CO_2 into context with deep time. The research indicates the last time atmospheric CO_2 consistently reached today's human-driven levels was 14 million years ago.

The study was assembled over seven years by more than 80 researchers. Breecker led the evaluation of research on ancient soils, called "paleosols."

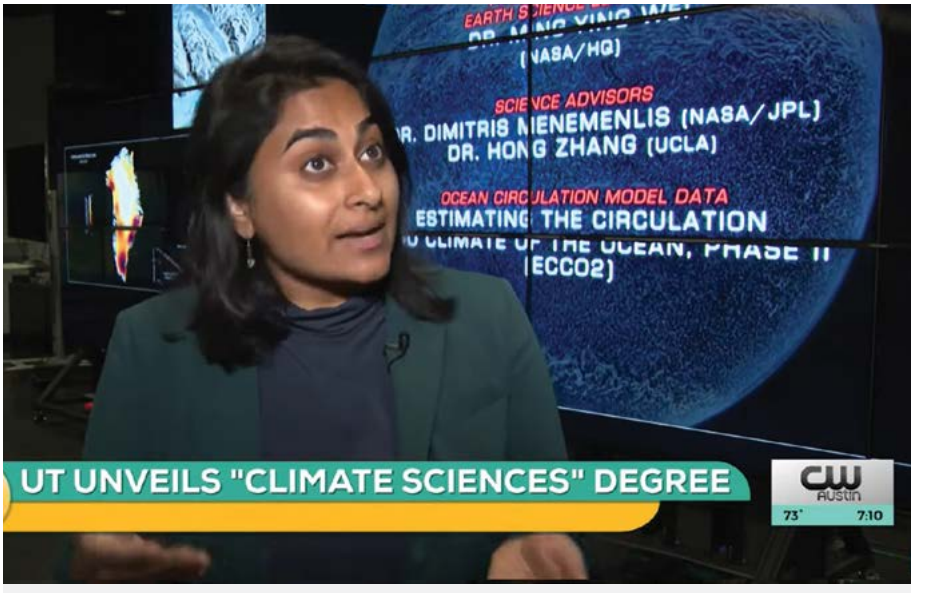
Paleosols record past levels of CO_2 in the environment because they contain calcium carbonate rock, which is made from CO_2 that was available in the surrounding environment as it formed.

Using geochemical techniques, scientists can distinguish atmospheric CO_2 from other sources of CO_2—such as CO_2 produced by microbial respiration—to produce a snapshot of past atmospheric concentrations.

Breecker said that paleosols are an important record of CO_2 because they go back further in time than other records—such as ice—and do not reach a saturation point where they stop recording CO_2 levels. What's more, paleosols can also record data about the surrounding environment, such as changes in rainfall and plant life.

The consortium has now evolved into a larger project, the Phanerozoic CO_2 Proxy Integration Project, that aims to chart how CO_2 and climate have evolved from 540 million years ago to the present.

Jackson School of Geosciences researchers made science news headlines and served as expert sources for news stories across the state and the world. Check out a few of the highlights.



KXAN Covers Climate Major

The local Austin news channel KXAN ran a segment about the new climate major and the opportunities it provides to students. Assistant Professor Geeta Persad was featured in the segment.

For more on the new major, see page 59.

The New York Times

Fossil trove from 74,000 years ago points to remarkably adaptive humans

"This points to how sophisticated people were in this time period."

John Kappleman, Professor
Department of Earth and Planetary Sciences
March 20, 2024

BBC

The worst wildfire in Texas' history has a complex link with climate change

"Megadroughts can set the perfect scene for large wildfires."

Danielle Touma, Research Assistant Professor
University of Texas Institute for Geophysics
March 5, 2024

KUT News

UT researchers help predict local weather during 2024 Paris Olympics

"Olympics is not just about competing. It is, probably to me, also about computing."

Dev Niyogi, Professor
Department of Earth and Planetary Sciences
Aug. 7, 2024

FOX59 News

Significant energy source found under US-Mexico border

"Geothermal has a lot to offer rural communities, underserved communities, something like Presidio checks every block on the very large federal investment in production in tax credits on renewable energy."

Ken Wisian, Associate Director Environmental Division
Bureau of Economic Geology
June 22, 2024

San Antonio Express-News

Why does the Balcones Escarpment matter? It's 'where the West begins.'

"The great Champagne district of France is on the same kind of rock that you see in the zoo in Brackenridge Park, or up in what the city of Austin is built on."

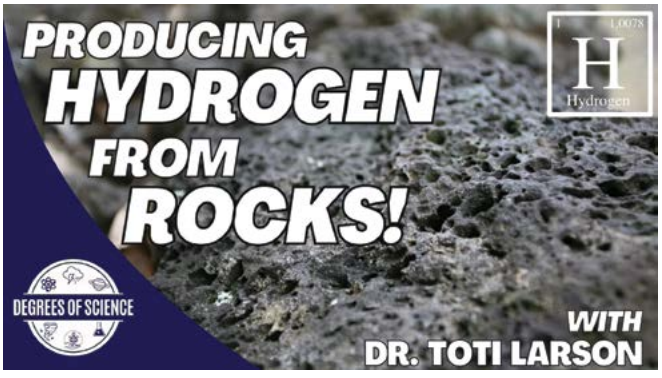
Charles "Chock" Woodruff, Geologist
Bureau of Economic Geology
Feb. 9, 2024

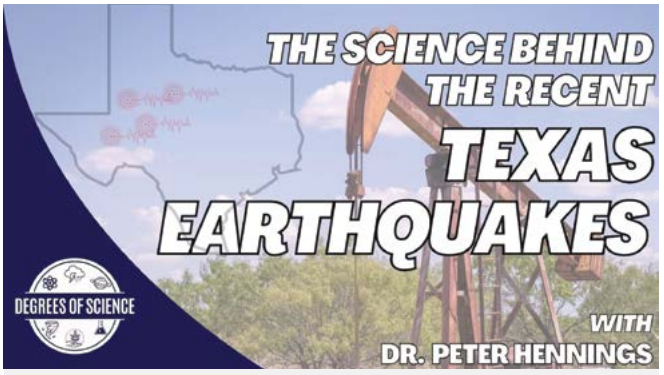
CNN

Earth's moon is shrinking. Here's what scientists say that could mean

"Regardless of what causes those (moon)quakes, it is true that they pose a potential threat to future landing missions, and we need more data about them."

Yosio Nakamura, Professor Emeritus
University of Texas Institute for Geophysics
Jan. 31, 2024





Bureau Researchers Talk Science on Texas TV News

Research Associate Professor Toti Larson and Research Professor Peter Hennings appeared on the science program "Degrees of Science" on KWTX TV. Larson spoke about producing geologic hydrogen from rocks. Hennings described the science behind energy production and recent Texas earthquakes.


THE DAILY TEXAN

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Jackson School of Geosciences unveils climate system science major for fall 2024

New Major Makes News

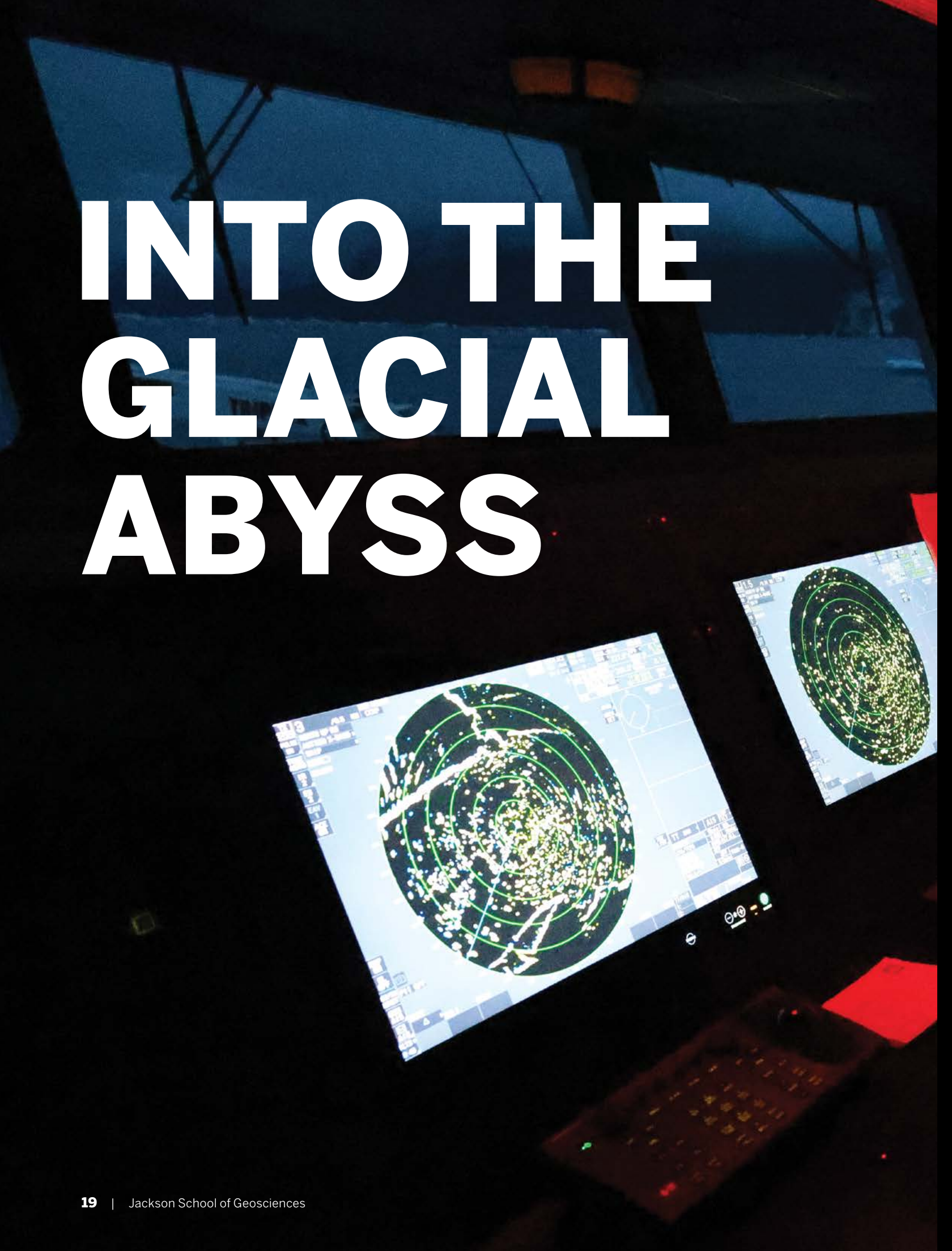
The Daily Texan, the student newspaper of The University of Texas at Austin, announced the new climate system science major on the front page.

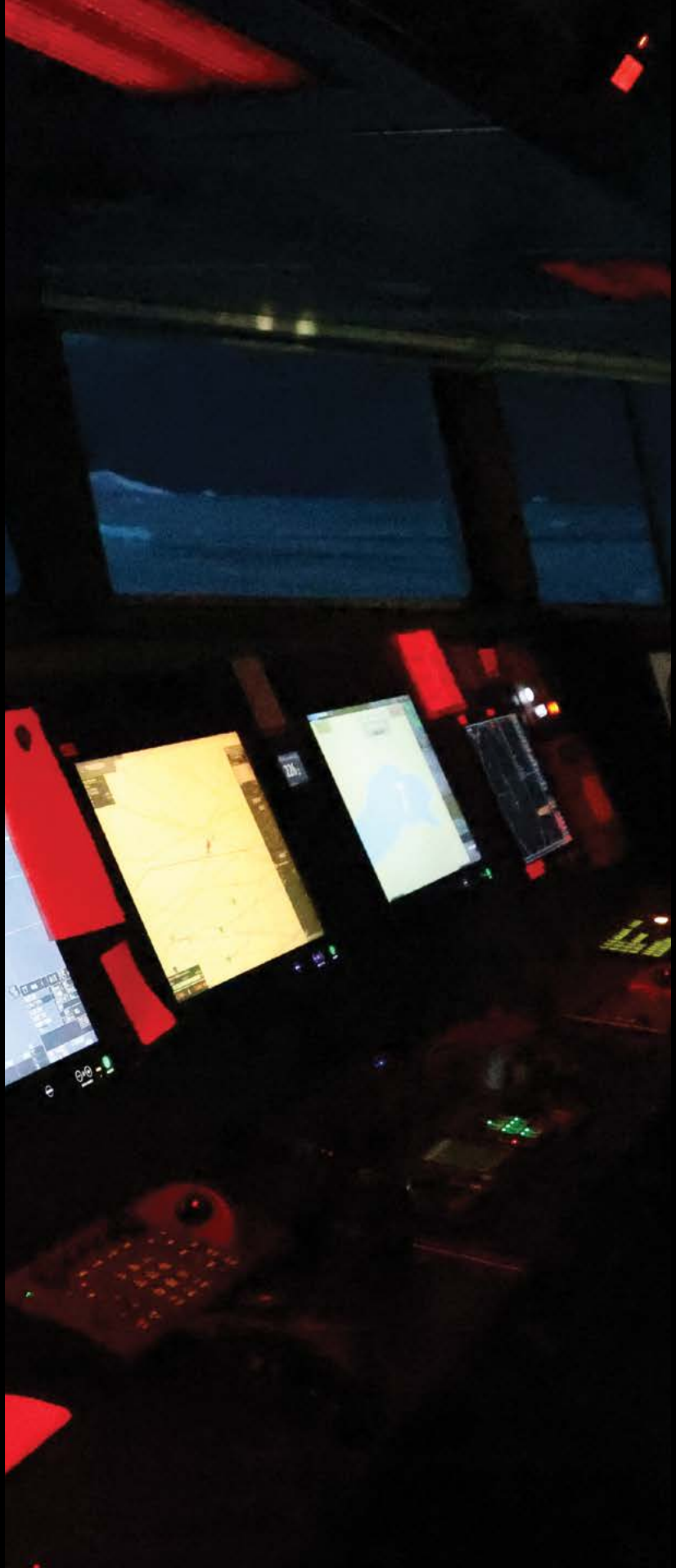
UTCT on 'Every Rock Has a Story!'

Science YouTuber Ethan Baxter stopped by the University of Texas High-Resolution X-ray Computed Tomography Facility (UTCT) to see whether a spherical rock was a dinosaur egg. Facility manager and Research Scientist Associate Jessica Maisano explained the science of CT-scanning and shared the story of her journey to the geosciences.

For more, visit ***www.jsg.utexas.edu/news***

INTO THE GLACIAL ABYSS





NIGHTTIME ON THE BRIDGE OF THE RESEARCH VESSEL CELTIC EXPLORER DURING A UT-LED MISSION TO EXPLORE GREENLAND'S GLACIERS FROM THE SEA.
PHOTO: UNIVERSITY OF TEXAS INSTITUTE FOR GEOPHYSICS.

In summer 2024, a Greenland expedition led by The University of Texas at Austin dove into an undiscovered frontier in search of answers about future sea level rise

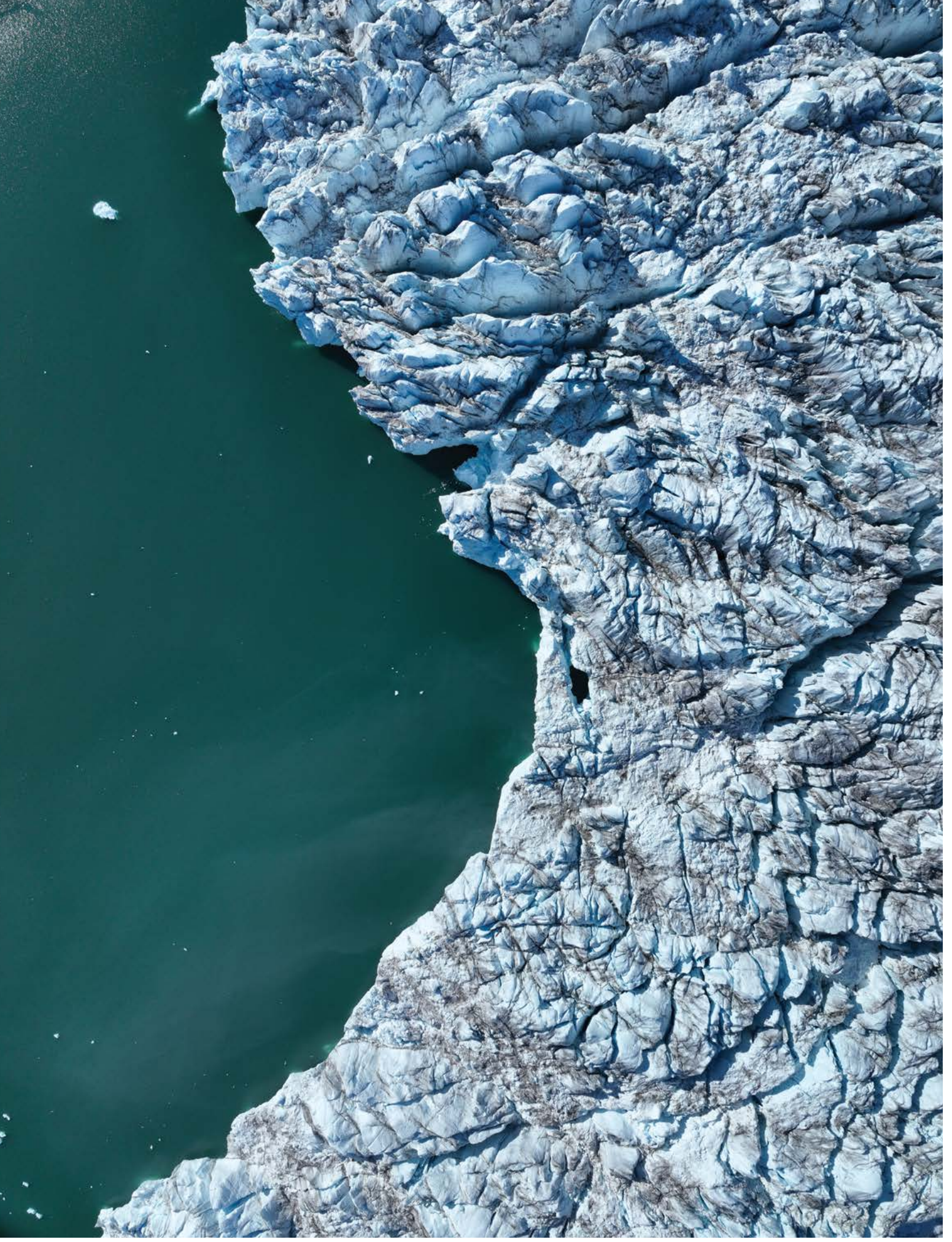
BY CONSTANTINO PANAGOPULOS

On the far western edge of Greenland's ice sheet, a large glacier leads to the sea, where it breaks against the water like a frozen wave 5 miles across. Here, dark with mud, the sea seethes with the force of subglacial rivers rushing in from beneath grinding ice.

In the middle of the fjord, surrounded by mile-high mountains, a green and white research vessel, the Celtic Explorer, watches over the drama unfolding below. Its many cranes are in motion. Cables and poles hang over the side. A crowd of engineers and technicians hurries about the deck.

Suspended beneath the ship's octopus arms is a car-size contraption. The large white lettering on the red and orange body reads Nereid Under Ice. This is NUI, a unique robot submersible that's about to embark on the last of seven historic dives to survey the glacier underwater. For the first time ever, scientists are getting an up-close look at the underwater face of the glacier.

The dive is part of a scientific expedition led by the University of Texas Institute for Geophysics (UTIG) to study the turbid, treacherous waters where glaciers fall into the sea and learn why some of Greenland's glaciers are retreating quickly under climate change while others are not.



"The biggest uncertainty in predicting sea level rise is how ice sheets will behave in the future and the biggest uncertainty in predicting ice sheet behavior is how the ocean, atmosphere and bedrock interact with the ice."

That's chief scientist Ginny Catania, a professor at UTIG at the Jackson School of Geosciences, and a veteran of polar fieldwork. Headed by Catania, the expedition's primary mission is to survey naturally forming underwater sandbanks — called moraines — and see whether they might be slowing the ice sheet's retreat.

Catania has assembled a team of 23 scientists, students and engineers from seven institutions, including the Woods Hole Oceanographic Institution (WHOI), University of Florida, Rutgers University, Oregon State University, Tufts University and Aarhus University in Denmark. They're supported around the clock by the 15-strong crew of the Celtic Explorer, a research vessel of Ireland's Marine Institute.

In such a dynamic and unexplored environment, every measurement made could be new to science. That's why the Celtic Explorer and NUI are bristling with sensors ready to measure everything, from the geology of the muddy seafloor to the size of microparticles in the swirling water.

Ships rarely come this close to large active glaciers and no submersible has ever gotten as close to one in Greenland as NUI has. There's good reason. Aside from strong subglacial currents, icebergs the size of skyscrapers topple from the glacier's edge or emerge from the depths without warning, filling the fjord with ice.

Into this maelstrom NUI must dive for up to 12 hours at a time. High-risk, high-reward research is the scientists' oft-repeated phrase, and it's one that NUI expedition leader Molly Curran fully embraces.

"It's a hard and challenging environment, but I think what makes me feel comfortable putting NUI over the side every time is having the trust in my team, the scientists and the work that they've done," she said.

Cables and cranes retracted, NUI's thrusters spurt to life, and the plucky submersible disappears into the turbid depths.

From Greenland Moraines to Sea Rise in Texas

Greenland's ice sheet is vast. It's nearly three times the size of Texas and holds enough water to raise sea levels 23 feet. At the edges where it spills into the ocean, its glaciers carve wide valleys in bedrock. The way that happens is important to what comes next.

As glaciers slide downhill, loose rocks get frozen onto the bottom of the ice. The rough underside scrapes the bedrock to a fine powder. This gets washed into the sea via meltwater channels, visible from above as muddy sediment plumes.

Over time, the sediments pile up in front of the glacier and form underwater moraines.

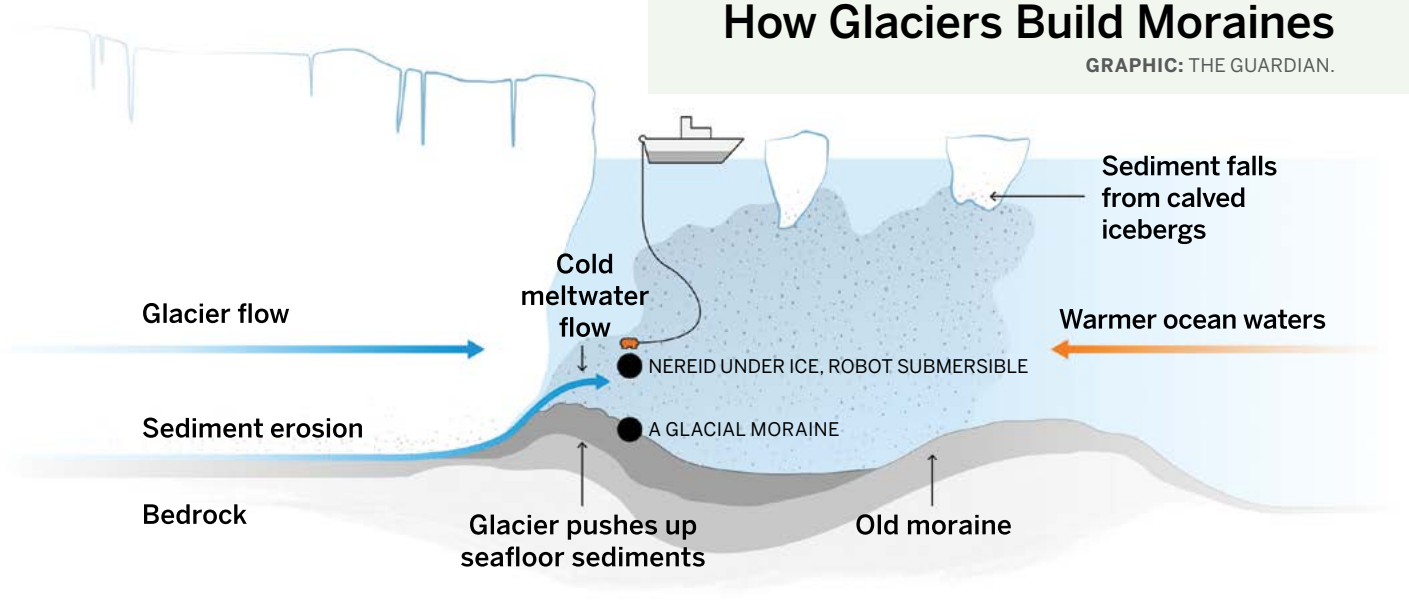
OPPOSITE PAGE: A DRONE-EYE VIEW OF THE SEAWARD FACE OF KANGERLUSSUUP SERMIA, A GLACIER IN WESTERN GREENLAND. THE ICE PICTURED HERE MEASURES ROUGHLY A THIRD OF A MILE FROM TOP TO BOTTOM.

ABOVE: PROFESSOR GINNY CATANIA IN FRONT OF NUI ON THE DECK OF THE CELTIC EXPLORER.

PHOTOS: UNIVERSITY OF TEXAS INSTITUTE FOR GEOPHYSICS.

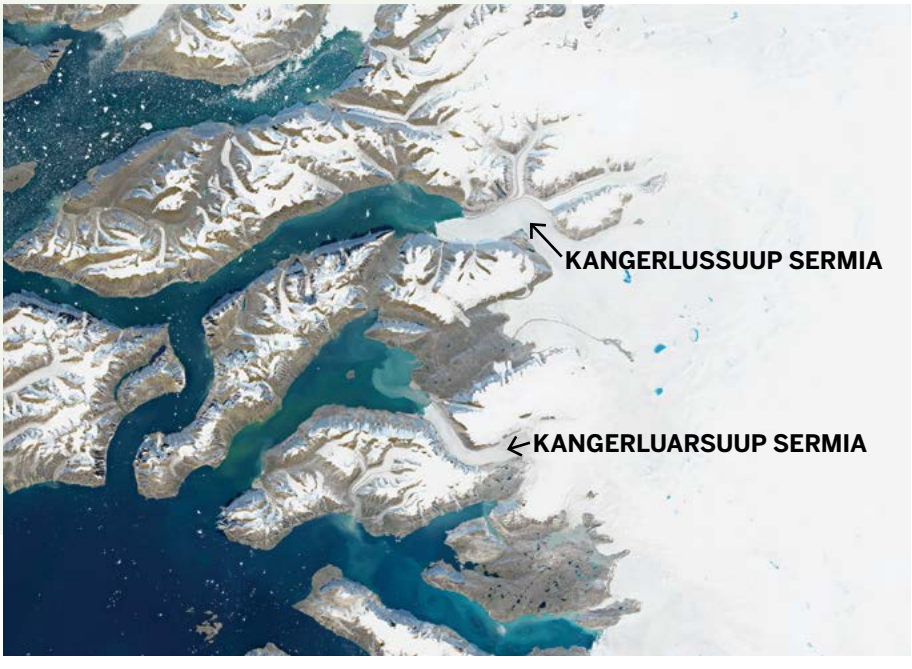
How Glaciers Build Moraines

GRAPHIC: THE GUARDIAN.



LEFT: GREENLAND. THE YELLOW BOX SHOWS THE SITE OF THE RESEARCH MISSION.

BELOW: THE GLACIERS STUDIED BY THE RESEARCH TEAM. UNLIKE MOST OF GREENLAND'S 300 SEA-FACING GLACIERS, THESE TWO HAVE NOT RETREATED IN RECENT YEARS.
IMAGE: JACKSON SCHOOL OF GEOSCIENCES/COPERNICUS SENTINEL-2.



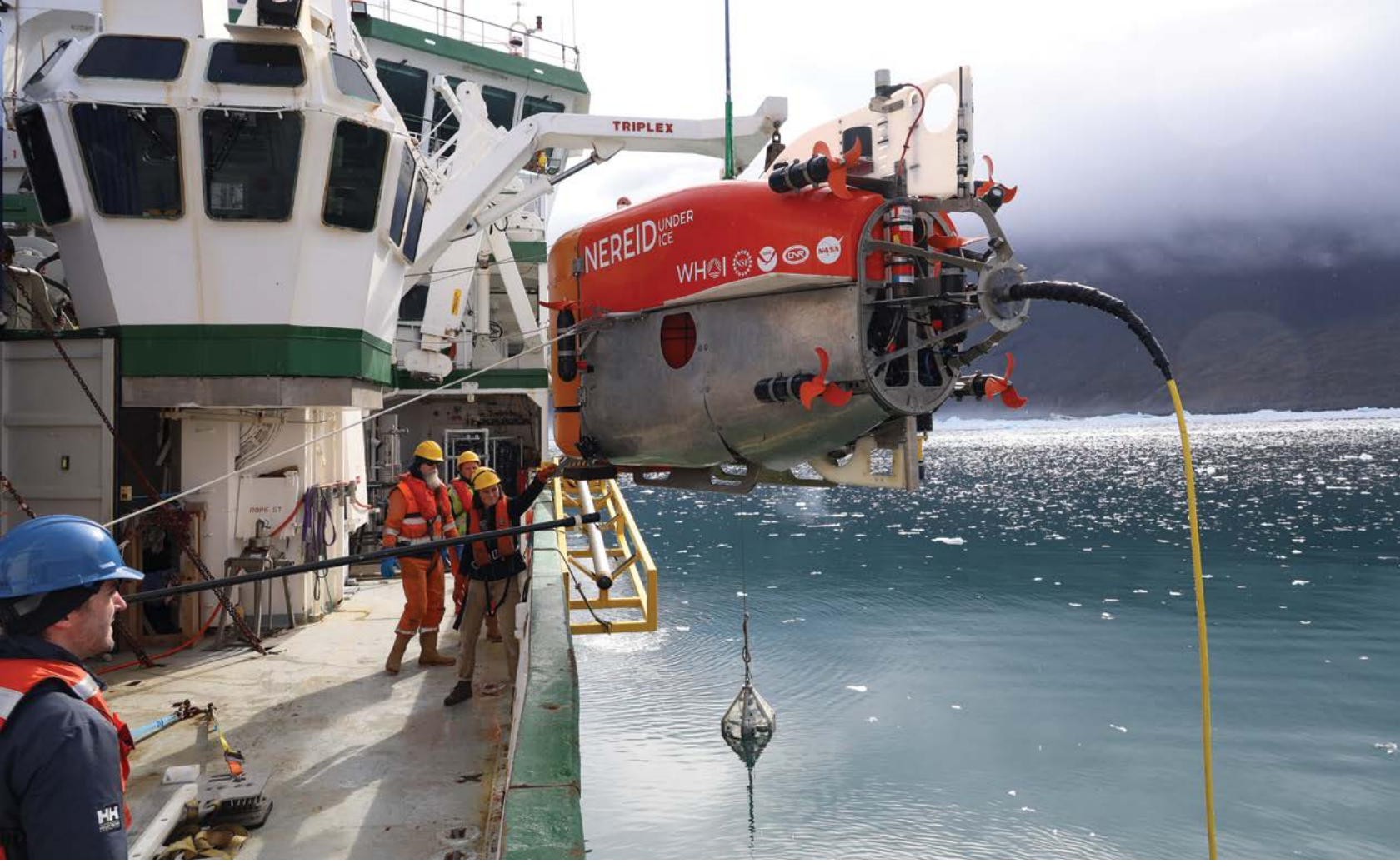
Most of Greenland's 300 sea-facing glaciers have retreated in recent years. The expedition scientists think that these moraines could explain why some 30 have held fast or even advanced.

One idea is that glaciers get wedged on their moraines, giving them a grounding point and keeping the ice from retreating deeper into the fjord. A large-enough moraine may also block warm ocean currents from reaching the ice.

But the waters near Greenland's active glaciers are so treacherous that no one has ever gotten close enough to say which scenario is accurate, or whether something else is at play. Until now, that is.

Getting here has been far from smooth sailing. A mission like this was long considered too big a risk for most funding agencies. But the W.M. Keck Foundation supports high-risk, high-impact research and saw the potential in Catania's ideas to open new fields of science. With the Keck Foundation on board and additional funding from the National Science Foundation, the expedition set sail from Galway, Ireland, in July 2024.

On arrival in Greenland, the expedition targeted two glaciers. The largest, Kangerlussuup Sermia, is about 5 miles wide. It sheds many icebergs during the summer, but despite that, its terminus, or edge, has stayed at about the same place since satellite



observations began 30 years ago. The second glacier, Kangerluarsuup Sermia, is about half the size. Since 1998, its terminus has retreated about half a mile but stopped in 2016, where it has remained. Today it shows little activity and sheds few icebergs.

All this is important because Greenland is losing ice and raising sea levels fast—270 billion tons of annual meltwater, or about 2 millimeters of sea level rise a year, twice that of Antarctica, and increasing.

"Understanding how much ice Greenland will lose by the end of the century is really important for coastal communities all over the world," said Mikayla Pascual, one of the Jackson School students on the expedition. "Is it going to be a meter or 3 meters of sea level rise? Ultimately, that's what we want to answer."

Pascual has devoted her research to creating an ice sheet model that will include the Greenland data and perhaps answer that question.

Eventually, though, action to mitigate the effects of sea level rise will have to happen in the places where they are already being felt. These are place like Texas, where Pascual and much of the expedition team live and where rising sea level already threatens the Gulf Coast with storm surges and flooding.

On the Celtic Explorer, Pascual and the other scientists watch as NUI's pilots and engineers run through checklists and key up waypoints. Hundreds of feet below the surface, NUI signals that its systems are healthy. All is well. A hair-thin communications line connects it to an instrument box suspended from the Celtic Explorer. Curran gives the word: The mission is a go.

Rotors spinning, the submersible turns from the vessel and begins its transit to the glacier.

Ice From Above

The drone shoots up from the Celtic Explorer and disappears into the brilliant blue sky.

On the bow, a portable speaker is playing mid-'90s hits. UTIG glaciologist Benjamin Keisling is monitoring Tern, one of two aerial drones the researchers have named after local seabirds: the other is Kittiwake. With him is Marcy Davis, a UTIG engineering scientist whose technical duties include planning, flying and processing data from the drone flights.

Keisling points at the glacier about a mile distant.

"Oh my God. What is that?" he says.

"Looks like ice," replies Davis. The pair burst out laughing.

Like any job, scientists sometimes deal with monotony. They crack jokes, often bad ones. Spontaneous dancing is not uncommon.

Flights typically last 30 minutes before the battery runs low, but this one's short. Davis and Keisling have programmed Tern to scout the glacier's southern face for the NUI team while the submersible is in transit.

ABOVE: THE ROBOT SUBMERSIBLE, NEREID UNDER ICE, RETURNING TO THE DECK OF THE RV CELTIC EXPLORER.
PHOTO: UNIVERSITY OF TEXAS INSTITUTE FOR GEOPHYSICS.

The drone flights have not been without drama. The previous day, while Kittiwake was still 2 miles from the ship, a massive iceberg announced itself with a thunderous roar. Throttle open all the way, Kittiwake fought fierce headwinds to beat an ice wave barreling toward the Celtic Explorer. The drone landed hot and hard as the ship's engines roared to life.

Aside from reconnaissance missions, the drones have hovered over the glacier's turbulent plumes, videoed the vigor and speed of the water, and caught playful seals on camera. But their main scientific mission is to survey the glacier and map daily changes that connect the glacier with what's happening elsewhere.

"Ultimately the processes that we're trying to better understand here at the terminus impact how the whole ice sheet responds to changes in its environment and, in turn, how sea level might change in the future," Keisling said.

Robot Bumblebee Goes Diving

A bank of screens shows a live feed from inside NUI's bay doors. The submersible's outstretched robot arm is all that's visible in the muddy water. All of a sudden, the screen turns milky white. NUI has hit the seafloor, kicking up clouds of powdery fine sediments. It's all very intentional.

With zero visibility at the base of the ice, the NUI team came up with an unorthodox way of collecting seafloor samples.

"We call it the bumblebee. It's worked surprisingly well," Curran said.

The technique involves rising to a depth with better visibility, directing the submersible to grab a coring tube from its basket, then diving to the seafloor with the tube held out in front. It takes immense coordinated skill from the NUI team, but especially pilot Victor Naklicki of the Woods Hole Oceanographic Institution.

A screen confirms the foot-long core is secure. For the briefest moment, Naklicki's trademark scowl breaks into a smile.

"Piloting is the fun part of the job," he said.

NUI is designed to operate in unique environments. Its chief advantage is that it is directly controlled with a single length of hair-thin fiber-optic tether nearly 25 miles long, much longer and lighter than the cable used by a conventional remotely operated vehicle (ROV). It can also operate as an autonomous underwater vehicle (AUV) if the fiber breaks.

"A conventional ROV couldn't get up close to the terminus without endangering the ship it's tethered to, and a conventional AUV can't take samples or navigate a dynamic environment like this. Only a hybrid vehicle like NUI allows us to get to these hard-to-reach places and come back safely," Curran said.

In terms of scientific exploration, NUI is probing glaciology's event horizon. Nearly everything it's done has been a scientific first: It has returned seafloor cores from the shadow of the glacier, surveyed the glacier's underwater face, mapped moraines in real time, and measured swirling ocean currents inside ice caves.

On the face of it, what NUI encountered—sediments raining from above and holes in the ice—was unremarkable. But the size of almost everything at Kangerlussuup Sermia has been off the charts.

It's led to some close calls. Curran remembered the first time NUI stopped beneath one of the glacier's sediment plumes. When the submersible went to take off, it was as if something kept pulling it back down.

"Did we flood a housing? Did we lose some part of our (buoyancy) foam?" she said.

Curran gave the order to drop NUI's emergency ballast, and the submersible rose free to continue its mission. When it got home, the engineers found its instrument bay was filled with glacial sediments—a nerve-wracking experience for the NUI team but a 50-pound serendipitous win for the expedition's sediment scientists.

A display shows a real-time rendering of the ice-face as seen by NUI's multibeam sonar. In some places, the ice is cliff-like, rising 1,000 feet from seafloor to surface. In other places there are vast ice caves hundreds of feet across. It's these that draw the most gasps from the watching scientists.

The caves drew one or two gasps from the team operating NUI too, but for different reasons. The first time NUI came to a large ice cave, they felt it being pulled inside by currents no one has ever measured before. They were more careful around the ice caves after that.

Catania said the ice caves probably are hollowed out by under-ice rivers carrying surface melt. But she thinks the cliff-like portions are being smoothed down by meltwater leaking from the bottom of the glacier. If that's true, the volume of

meltwater would be enormous, but it would support an idea put forward by one of the expedition members, Rutgers University researcher Becca Jackson, that glaciers lose as much ice through contact with the ocean as they lose by contact with warm air.

"This could be evidence that that's true because we see so much leakage of water from this distributed system. It's coming out everywhere and causing melt everywhere," Catania said.

Until the data are fully processed and analyzed, they can only speculate about what these features mean.

Whirling, Swirling Ocean

After passing west of Ireland, the North Atlantic Current, which begins as the Gulf Stream in the tropics, heads north until it hits the southern tip of Greenland.

Here, the current's warm, salty seawater plunges beneath Greenland's cold, fresh coastal waters. But it still reaches many glaciers and erodes them at their deepest points. With global warming heating up the Atlantic, that means even more heat could be reaching the glaciers, said Rutgers University oceanographer Bridget Ovall.

That's where the shield-like moraines come in. For instance, under the surface at the second, smaller glacier, Kangerluarsuup Sermia, the expedition found a secret defense against the warm Atlantic seawater: a large, old moraine.

"What we saw was that all that warm Atlantic water can't get to the glacier because it can't get up over that sill (the moraine). The only water reaching the glacier is cold polar water," Ovall said.

Surveys found that this old moraine probably was dumped into the fjord during the Little Ice Age, a period in the Middle Ages when the Northern Hemisphere cooled, glaciers advanced and Kangerluarsuup Sermia reached further into the fjord.

Back at the main glacier, Kangerlussuup Sermia, the picture is muddier, and not just from sediments pouring into the fjord. Here, the ocean currents are much more complex, and until data from NUI and the Celtic Explorer are analyzed, it won't be clear how much warm water makes it to the glacier.

What the scientists do know is that the sea near the glacier is being churned up by meltwater jetting out of the glacier. Some of it comes out from underneath in sheets of flowing water. In other places it shoots out of the face of the glacier in vigorous spouts.

Ovall said that each stream makes its own little circulating layer in the ocean. That could mean one of two things. By stirring up seawater, the curtain of circulating currents is stopping warmer Atlantic water from reaching every part of the ice.

"Or it might mean that you're creating more lateral circulation cells in front of the glacier, potentially bringing more heat to the glacier. It could go either way," she said.

OPPOSITE PAGE: ONE OF THE UTIG DRONES RETURNS FROM AN AERIAL RECONNAISSANCE MISSION AT KANGERLUSSUUP SERMIA.

ABOVE: A PRE-DIVE MISSION BRIEFING. L-R: MIKE JAKUBA, MOLLY CURRAN (BOTH WOODS HOLE OCEANOGRAPHIC INSTITUTION), GINNY CATANIA (UT) AND BRIDGET OVALL (RUTGERS UNIVERSITY).

PHOTOS: UNIVERSITY OF TEXAS INSTITUTE FOR GEOPHYSICS.

Reading the Ice's Future in the Mud

After nearly 12 hours in the water and dwindling battery power, NUI is hauled gently back on deck. Beneath a twilight Arctic midnight sky, the Celtic Explorer transitions to nighttime research operations. The researchers head below to wind down and rest.

The nightshift scientists emerge, steaming coffee in hand. It's Sean Gulick, a research professor at UTIG, and John Jaeger, a professor at University of Florida, accompanied by graduate students Pascual and Emily An of Oregon State University. For the next 12 hours, the ship will sail up and down the fjord, trailing a mile-long seismic antenna and stopping periodically to recover cores from the seafloor.

These operations are all about peering into the glacier's muddy past.

A thousand years ago, a brief climate anomaly known as the medieval warm period forced glaciers to retreat and coincidentally allowed Vikings to settle where once there had been ice. Then followed a period of global cooling starting around 1215, during which glaciers advanced (and Vikings left) three times. After each surge, the glaciers retreated again.

Understanding this back and forth tells us what to expect as the planet warms, said geophysicist Gulick.

"The retreat from the Little Ice Age is an interesting analog to retreat today. How did it actually retreat? What did it leave behind? Does it have a stuttery start where it seems to retreat and then holds?" Gulick said.

The answers are buried in the seafloor that Gulick and the subsurface geophysics team have imaged using seismic waves. The X-ray-like pictures of layered sediments will tell them a story of glacial advance and retreat going back centuries.

A long metal cylinder hits the deck with a clang. It holds 20 feet of sediments cored from the seafloor when the cylinder, weighed down by metal weights, slammed nose-first into the bottom. It's called a gravity core, and it works as you'd imagine.

This is the mud that Jaeger, a sedimentologist, has been waiting to get his hands on. Along with NUI's haul from the foot of the glacier, samples like these can tell scientists much more about how the moraines are physically built and how stable they may prove to be.

And when paired with seismic imaging, the cores will give the scientists an accurate history of the glacier's behavior during past climate changes, Jaeger said.

Farewell to Ice

It's the morning after NUI's last dive at the glacier. The science deck is busy. At mid-starboard, deck crew are deploying an ocean measuring sensor to eke out some last-minute science. Nearby, NUI engineers are busy packing up instruments and securing their gear for the voyage home. On the other side of the deck, Jaeger and a bleary-eyed coring team are stacking the sediment cores that they pulled from the seafloor overnight.

Over the course of seven dives, NUI delivered astonishing surveys of the glacier's underwater ice-face, retrieved

pristine glacial sediments, and even measured ocean currents inside a submerged glacial ice cavern.

"Giving scientists the tool to access that environment and seeing the excitement on their faces the first time we did that was just super rewarding," Curran said. "It's why I love my job."

For NUI, it's home and a well-earned rest. The submersible has been incredibly successful. That bodes well for another WHOI-led, Keck Foundation-funded project: an autonomous underwater observatory that will use NUI's technology to explore and monitor Antarctica's floating ice shelves.

But for Catania and the other researchers, the science has only just begun. In among the terabytes of information and stacks of glacial sediment samples are possible clues to the ice sheet's future. It's difficult to know which of those clues will be most valuable.

"We've never seen anything at the glacier terminus with this much resolution before," Catania said. "The measurements that we got were just so novel that the analysis has to be novel, and that requires rewriting a lot of the book on how we'll do that."

The wind whips up white caps on the fjord. On the Celtic Explorer's bow, the drone team wraps up their last aerial survey. The two uncomplaining drones have surveyed nearly 1,000 miles of ice. With the last drone on deck, the sun breaks over the buttressing mountain and sets the glacier alight.

The scientists came into this project with a hypothesis that glacial sediments are protecting some glaciers from retreating too fast. To test that, they crossed an undiscovered frontier where for now at least, they've found more questions than answers.

There's much work ahead of them, but it's clear that historic science has taken place. During the years to come careers will be written from the findings.

"I cried when NUI first saw the ice, just a little," Catania said. "It's so much effort putting all this together that finally seeing it working in the way that we expected was really moving."

At the mouth of the fjord, the Celtic Explorer turns for open seas. An armada of icebergs trails in its wake.

More Underwater Glacial Exploration

Mission Blog
ig.utexas.edu/greenland-blog

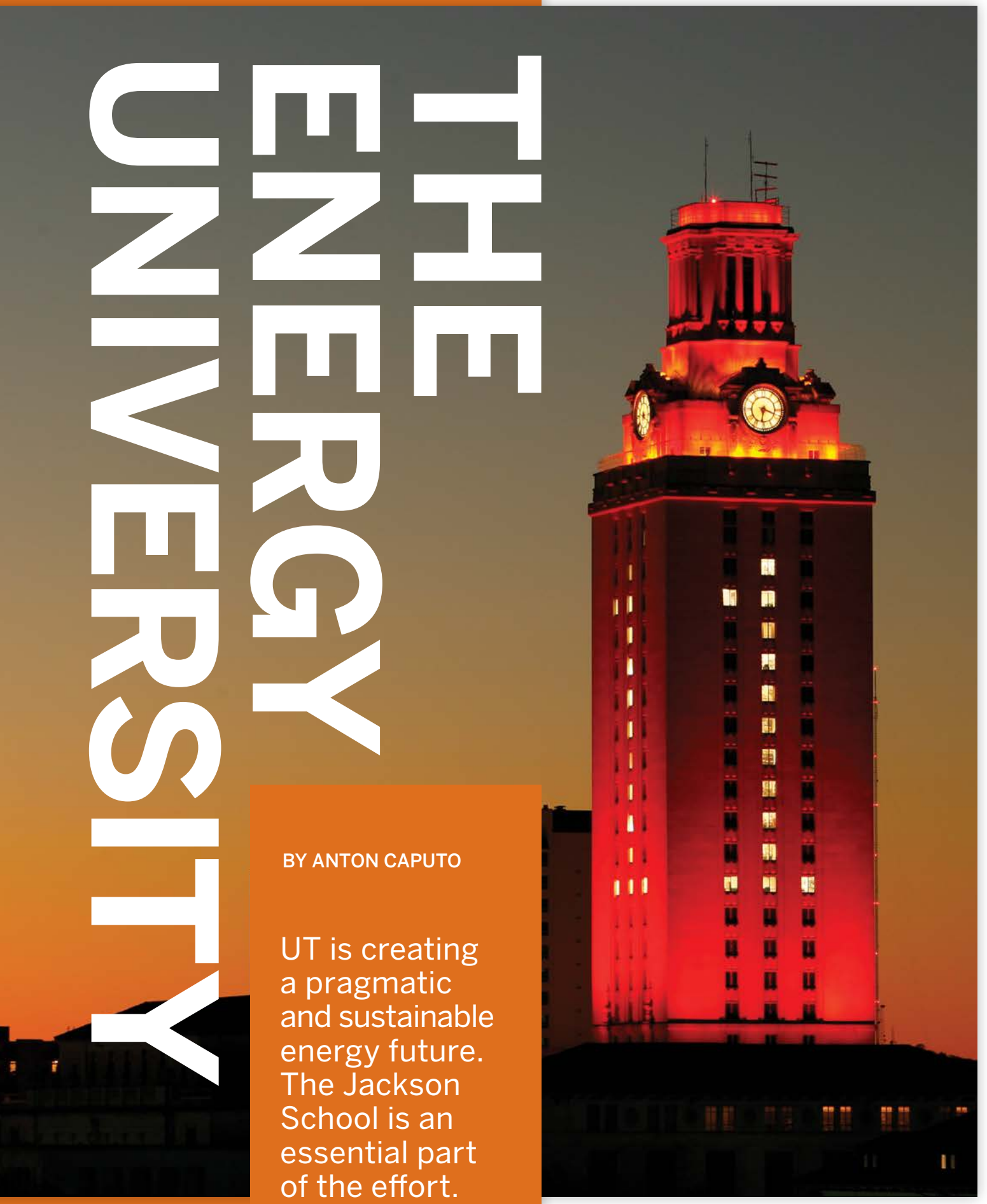
Mission Website
ig.utexas.edu/greenland-terminus

OPPOSITE PAGE, ABOVE: BENJAMIN KEISLING (LEFT) AT THE CONTROLS OF ONE OF THE DRONES WHILE DAN DUNCAN (BOTH UTIG) ACTS AS SPOTTER. THE SHIP'S BOW WAS THE PERFECT LAUNCH PAD FOR THE UTIG DRONES.
OPPOSITE PAGE, BELOW: GRADUATE STUDENT MIKAYLA PASCUAL.

ABOVE: SHALLOW ICE CAVES RISE ON KANGERLUSSUUP SERMIA. THE ICE-FACE HERE HAS BROKEN FROM THE MAIN GLACIER, RAISING THE PREVIOUSLY SUBMERGED CAVES ABOVE SEA LEVEL.

PHOTOS: UNIVERSITY OF TEXAS INSTITUTE FOR GEOPHYSICS.

THE ENERGY UNIVERSITY



BY ANTON CAPUTO

UT is creating a pragmatic and sustainable energy future. The Jackson School is an essential part of the effort.

At the most recent State of the University address, President Jay Hartzell boldly claimed that The University of Texas at Austin is "THE Energy University."

It's no secret that UT has been a leader in energy research and education for years. But Hartzell's announcement touted a vision and reality far beyond the traditional picture of Texas energy.

UT, and Texas as a whole, is not just a place that specializes in one aspect of the energy industry—be it traditional oil and gas, or alternatives like hydrogen, wind, geothermal, carbon storage or any of the other aspects of producing low-carbon energy.

It specializes in them all.

And it's not just engineering and geosciences. From law, policy, business and economics—the schools and institutes that make up UT have the collective brain power and industry partnerships that make it a power player.

"I don't think anybody can match the breadth of our expertise. I don't think anybody can match what we have to offer in this place," said Hartzell as he announced that 2025 would be the "Year of Energy" at UT. "I also think we have a pragmatic approach to the problem. We realize that it's going to take multiple sources of energy to address the world's needs."

Nowhere is that drive to tackle the challenge of providing sustainable, affordable, clean energy more active than at the Jackson School of Geosciences.

"We do it all," said Dean Claudia Mora. "From our historic roots in the exploration and production of hydrocarbons to leading the way into new energy sources and technologies like geological production and storage of hydrogen, geothermal, and carbon capture and storage. The challenge of sustainably providing energy, mineral and water resources is fundamental to being a geoscientist."

Long a leader in energy-related geosciences, the Jackson School is bucking national trends, with growing student enrollment when other geoscience and earth science programs are shrinking.

Mora said the school's ability to lead in all the issues that surround modern energy and the energy transition is playing a large part in the school's growth. That comes from not just embracing all forms of producing energy, but also the associated economic and environmental issues, including mitigating climate change impacts.

The Jackson School has top-rated programs in geology, geophysics, seismology, paleontology and geochemistry. Beyond the traditional foundational disciplines, Mora points to the school's multidisciplinary Energy and Earth Resources master's program, and undergraduate majors in environmental science and climate system science as examples of how the school is preparing students for all aspects of modern energy challenges.

And just this fall, the Jackson School officially joined the UT Kay Bailey Hutchison Energy Center, linking it to the university's premiere forum for energy issues. The center brings together expertise from UT's school of business, law, policy, engineering and now the geosciences.

"I don't think anybody can match the breadth of our expertise."

Jay Hartzell,
UT President

"It's the perfect environment for our students to gain a holistic understanding of the energy industry and to learn, connect, and grow into the energy leaders of the future," Mora said. "When you look at energy and all the issues that surround it, the business and legal parts are not independent of the science and technology parts. Our students need to understand how business works. Even a great scientific idea can fail the business test, and the other way around."

UT geologists and geoscientists have been using their knowledge of the subsurface for oil and gas development for more than a century, with much of that research happening at the Bureau of Economic Geology, which was founded in 1909 as the State Geological Survey—a function it still serves today. Its director serves as the State Geologist of Texas, a role that includes the important duty of providing information about geological resources to the public and the Texas Legislature.

In recent years, the Jackson School has used the expertise at the bureau to build large and active programs in hydrogen and geothermal. And for decades now, its scientists have been leading the way in realizing the promise of carbon capture and storage with work at the Gulf Coast Carbon Center.

The school also expanded its critical mineral expertise with new faculty hires who conduct research on both the exploration and recovery of critical materials from rocks and water. This is an area that Mora said is key for the ongoing energy transition, as the drive to rapidly expand wind, solar and battery technologies will demand a massive increase in critical mineral production.

"Natural resources are necessary for every energy source, and geoscientists are needed to find and sustainably develop those resources," she said. "There are no easy solutions to the challenges ahead when it comes to providing affordable, sustainable energy to the world while safeguarding the climate and environment. The Jackson School is proud to be part of UT's efforts to educate and inspire students to meet the energy challenges of the future. There is no place working harder, across so many energy domains, and no institution better positioned to find these solutions than UT Austin."

OPPOSITE PAGE: UT TOWER. **PHOTO:** THE UNIVERSITY OF TEXAS AT AUSTIN.

SPANNING THE ENERGY LANDSCAPE

70+

Energy-related company partnerships

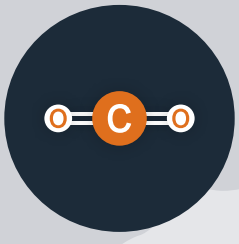
$118M

Generated by STARR Program for State of Texas

The Jackson School of Geosciences has cutting-edge research projects and programs in nearly all energy and energy-related resources. Highlights include:

STARR of Texas

- **The State of Texas Advanced Resource Recovery** program conducts geoscience and engineering research to increase the production and profitability of the state's earth resources.
- To date, the program has returned over $118 million to the state on an investment of less than $10 million.
- Working to better understand emerging energy opportunities on **Permanent University Fund (PUF)** lands, which support higher education in Texas.



Carbon Capture and Storage

- Conducting leading-edge scientific and technical research for decades at the **Gulf Coast Carbon Center**.
- Leading the U.S. Department of Energy's **GUMBO** project to jump-start Gulf Coast carbon capture economy.
- Ongoing carbon storage surveys in the Gulf of Mexico to facilitate carbon capture and storage projects.

Critical Minerals

- Pioneering a new mining technology to reduce the energy needed to access critical minerals.
- Researching methods to produce rare earth elements from coal ash.
- Researching the possibility of extracting lithium from brines that are created as a byproduct of energy production.
- Expanding new critical mineral expertise with key new hires.

Hydrogen

- Working to develop a hydrogen economy at scale in the **GeoH$_2$ Industrial Affiliates Program**.
- Investigating naturally occurring hydrogen in Texas.
- Researching in situ subsurface hydrogen generation.
- Planning a hydrogen injection project at Devine Test Site.

$117M

U.S. Department of Energy funding during the past decade

196

TexNet seismic stations

5

AAPG Berg Award Winners

16

Energy-related Industrial Affiliates Programs

Geothermal

- Spurring new paradigm of "geothermal anywhere" in **HotRock Geothermal Research Consortium.**
- Studying feasibility of closed-loop geothermal energy systems on military bases.
- Finding a significant source of geothermal energy in Presidio County.
- Contributing to the multidisciplinary, cross-collaborative effort to produce "The Future of Geothermal in Texas: The Coming Century of Growth & Prosperity in the Lone Star State."

Induced Seismicity

- Managing the **TexNET** seismic network to collect data on earthquakes in Texas and research their cause and associated risks.
- Studying the impacts of large-scale injection on the subsurface and surface environment to mitigate potential hazards at the **Center for Injection and Seismicity Research (CISR).**
- Developing AI earthquake forecast tools in Texas and other areas.

Policy and Economics

- Joining the **UT Kay Bailey Hutchison Energy Center**, which focuses on energy issues at the intersection of business, law, policy, engineering and geosciences.
- Conducting a global supply chain study of the environmental and economic costs of electricity generation methods.
- Researching the relationships among energy resources and generation, economics, and the environment at the **Center for Energy Economics**.

Oil and Gas

- Leading the way for decades in the study of the Permian Basin's hydrocarbon-producing formations.
- Producing the comprehensive public studies and maps of the nation's major oil and gas shale plays in the **Tight Oil Resource Assessment (TORA) consortium**.
- Characterizing all aspects of subsurface reservoirs in multiple research consortiums.

THE SCIENCE OF BIRDSONG

BY MONICA KORTSHA

Research is revealing new details about the origin and structure of the syrinx — the unique vocal organ of birds

Humans have been long fascinated by birdsong and the symphony of other avaian sounds—from coos and honks to quacks and peeps. But little is known about how the unique vocal organ of birds—the syrinx—varies from species to species or its deeper evolutionary origins.

A trio of recent studies led by researchers at The University of Texas at Austin is changing that.

The studies include high-resolution anatomical scans of syrinxes from hummingbirds and ostriches—the world's smallest and largest bird species—and the discovery that the syrinx and larynx, the vocal organ of reptiles and mammals, including humans, share the same developmental programming.

According to Julia Clarke, a professor at the Jackson School of Geosciences, this genetic connection between the vocal organs is an exciting new example of "deep homology," a term that describes how different tissues or organs can share a common genetic link.

"To me, this is as big as the flippers-to-limbs transition," said Clarke, who co-led or co-authored the studies. "In some ways, it's even bigger because the syrinx is not a modified organ with a new function but a completely new one with an ancient and common function."

The three studies are built on a foundation of collaborative and interdisciplinary syrinx research with physiologists and developmental biologists that Clarke has been leading for over a decade. The research got its start in 2013 when Clarke, a paleontologist, discovered a syrinx in a fossil of a duck-like bird that lived in what is now Antarctica during the Late Cretaceous. The specimen is the oldest syrinx to be discovered. But when she tried to compare the fossil syrinx to the syrinxes of modern birds, she found the scientific literature lacking. Many of the studies dated back to the 19th century, before the advent of modern scientific imaging, or cited claims from those older studies without double-checking them.

This set Clarke on a mission to modernize—and maximize—syrinx data collection.

"We had this new three-dimensional structure, but we had nothing to compare it to," said Clarke, describing CT imaging data of the fossil syrinx. "So, we started generating data that did not previously exist on syrinx structure across many different groups of birds."

Over the years, Clarke and members of her lab have developed new methods for dissecting, preserving and CT-scanning syrinxes that have helped reveal the syrinx in more detail. These enhanced views of the ostrich and hummingbird vocal organ have shown that bird behavior may be just as important as the syrinx when it comes to the repertoire of sounds these birds produce.

For example, in the study of the ostrich syrinx, the researchers found no significant differences in syrinx anatomy between adult male and female birds. (Previous studies focused only on male ostriches.) However, even though both sexes have the same vocal equipment, male ostriches tended to make a wider variety of sounds than female ostriches do, with the sounds often associated with aggressive behaviors between rowdy males. On a visit to a Texas ostrich farm, the researchers recorded 11 types of calls, ranging from high-frequency peeps and gurgles in baby ostriches to low-frequency boos and booms in adult males. These included a few call types that had never been recorded. But the only sounds definitively recorded from adult female ostriches were hisses. What the females lacked in range, they made up for in attitude, said Michael Chiappone, who became involved with the ostrich research as an undergraduate student at the Jackson School and is the lead author of the study, which was published in the *Journal of Anatomy*.

"They were quite prolific hissers," said Chiappone, who is now a doctoral student at the University of Minnesota.

For the hummingbird study, which was published in the *Zoological Journal of the Linnean Society*, the researchers compared the hummingbird syrinx with the syrinx of swifts and nightjars, two close relatives, and found that all three birds have similar vocal folds in their syrinx despite having different ways of learning their calls. Swifts and nightjars work with a limited repertoire of instinctive calls while hummingbirds can elaborate on calls by learning complex songs from one another, a trait called vocal learning.

OPPOSITE PAGE: BIRDS COME IN A SPLENDID ARRAY OF SHAPES AND SIZES. BUT THEY ALL HAVE THE SYRINX — THE UNIQUE VOCAL ORGAN OF BIRDS — IN COMMON. **ILLUSTRATION:** KOUZOU SAKAI.

According to Lucas Legendre, a Jackson School research associate who led the hummingbird research, the findings suggest that the common ancestor of all three birds also had a similar vocal fold structure—and that it may have helped lay the groundwork for the evolution of vocal learning in hummingbirds.

"Having all of the (vocal fold) structures already present before vocal learning was acquired by hummingbirds probably made it easier for them to acquire vocal production learning," he said.

Before the study, it was uncertain if swifts even had vocal folds. As part of the research, Legendre created a 3D digital model of the swift vocal tract that takes viewers down the windpipe to the syrinx and to the vocal folds that rest near the top of each branch of the syrinx. The model—dubbed the "magical mystery voyage" by Clarke—shows the advances in anatomical knowledge of the syrinx that her lab is leading.

"This is a structure that wasn't known to exist outside of hummingbirds, but our CT scans revealed that swifts have these vocal folds in the same position," Clarke said. "This is the kind of voyage we needed to go on to get these answers."

At the same time Clarke and her team were developing methods to preserve and capture syrinx anatomy across bird species, they were working with Clifford Tabin, a developmental biologist at Harvard University, on investigating the evolutionary origins of the syrinx by tracking the gene expression that accompanied vocal organ development in the embryos of birds, mammals and reptiles.

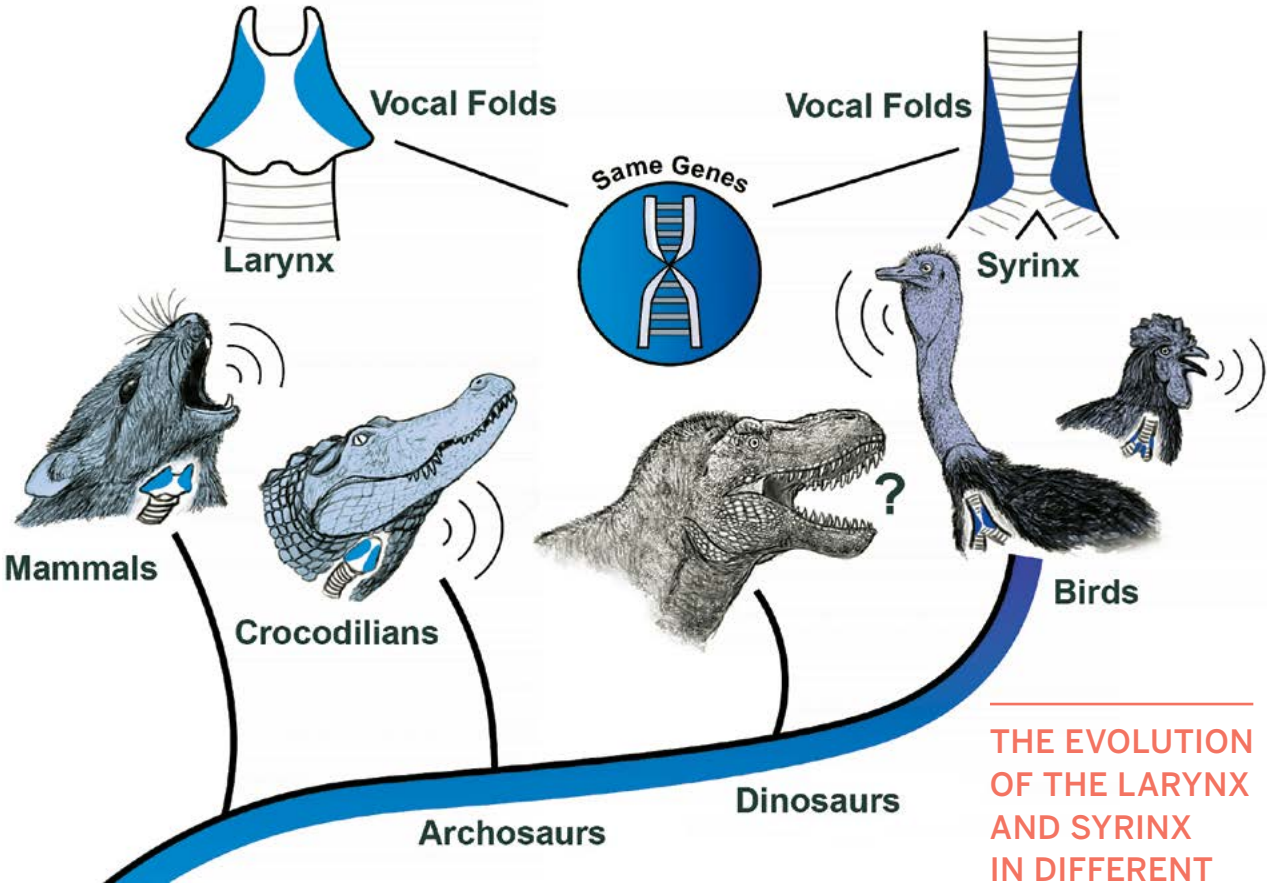
The research published in *Current Biology* is a culmination of that collaboration. The study details how scientists discovered the deep connection between the larynx and the syrinx tissues by observing that the same genes were controlling the development of the vocal organs in mice and chicken embryos, respectively, even though the organs arose from different embryological layers.

"They form under the influence of the same genetic pathways, ultimately giving the vocal tissue similar cellular structure and vibratory properties in birds and mammals," said Tabin, a co-lead author on the study.

The study also analyzed syrinx development across bird species—which involved observing gene expression in embryos from 14 different species, from penguins to budgies—and found that the common ancestor of modern birds probably had a syrinx with two sound sources, or two independently functioning vocal folds. This trait is found in songbirds today, allowing many to create two

ABOVE, LEFT: JULIA CLARKE, A PROFESSOR AT THE JACKSON SCHOOL OF GEOSCIENCES, ON VEGA ISLAND IN ANTARCTICA. **PHOTO:** JULIA CLARKE.
ABOVE, RIGHT: RUBY-THROATED HUMMINGBIRD. **PHOTO:** SHENANDOAH NATIONAL PARK.

BELOW: RESEARCHERS FROM THE CLARKE LAB RECORD OSTRICH SOUNDS ON A FARM IN TEXAS. CARLOS ANTONIO RODRIGUEZ-SALTOS (LEFT) HOLDS RECORDING EQUIPMENT WHILE MICHAEL CHIAPPONE TAKES PHOTOS. **PHOTO:** MICHAEL CHIAPPONE.



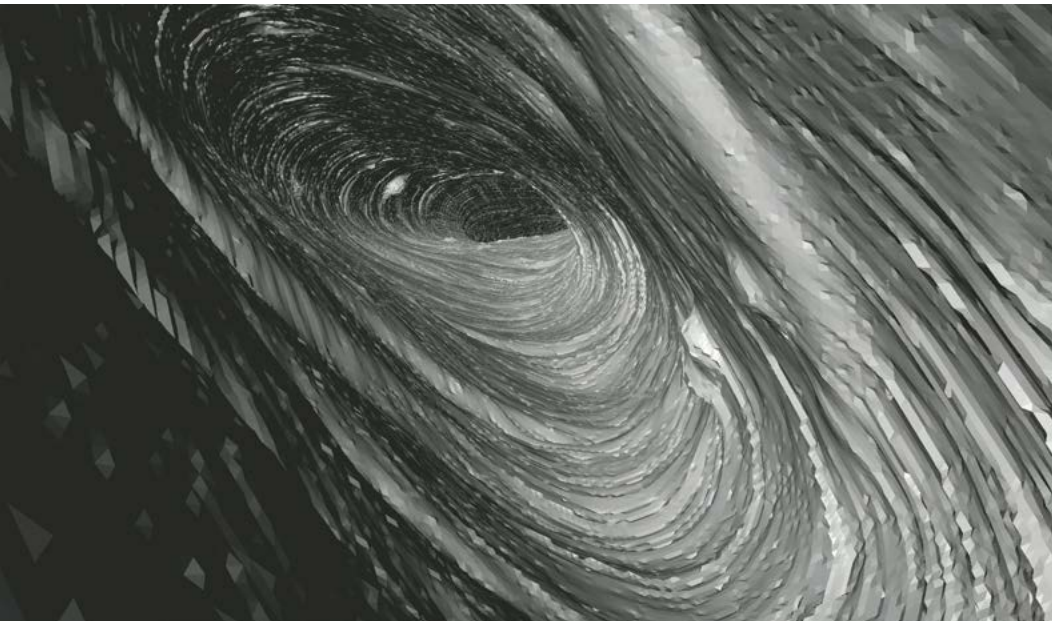
THE EVOLUTION OF THE LARYNX AND SYRINX IN DIFFERENT ANIMAL LINEAGES

Although birds are direct descendants of non-avian dinosaurs and have both a larynx and a syrinx, it's unknown if non-avian dinosaurs had either organ.

GRAPHIC: MICHAEL CHIAPPONE.

distinct sounds at the same time. The research suggests that the common ancestor of birds may have been making similarly diverse calls.

These results may shed light on the syrinx's origins, but it's still unknown when the syrinx first developed and whether nonavian dinosaurs—the ancestors of today's birds—had the vocal organ, said Clarke. No one has yet found a fossil syrinx from a nonavian dinosaur.



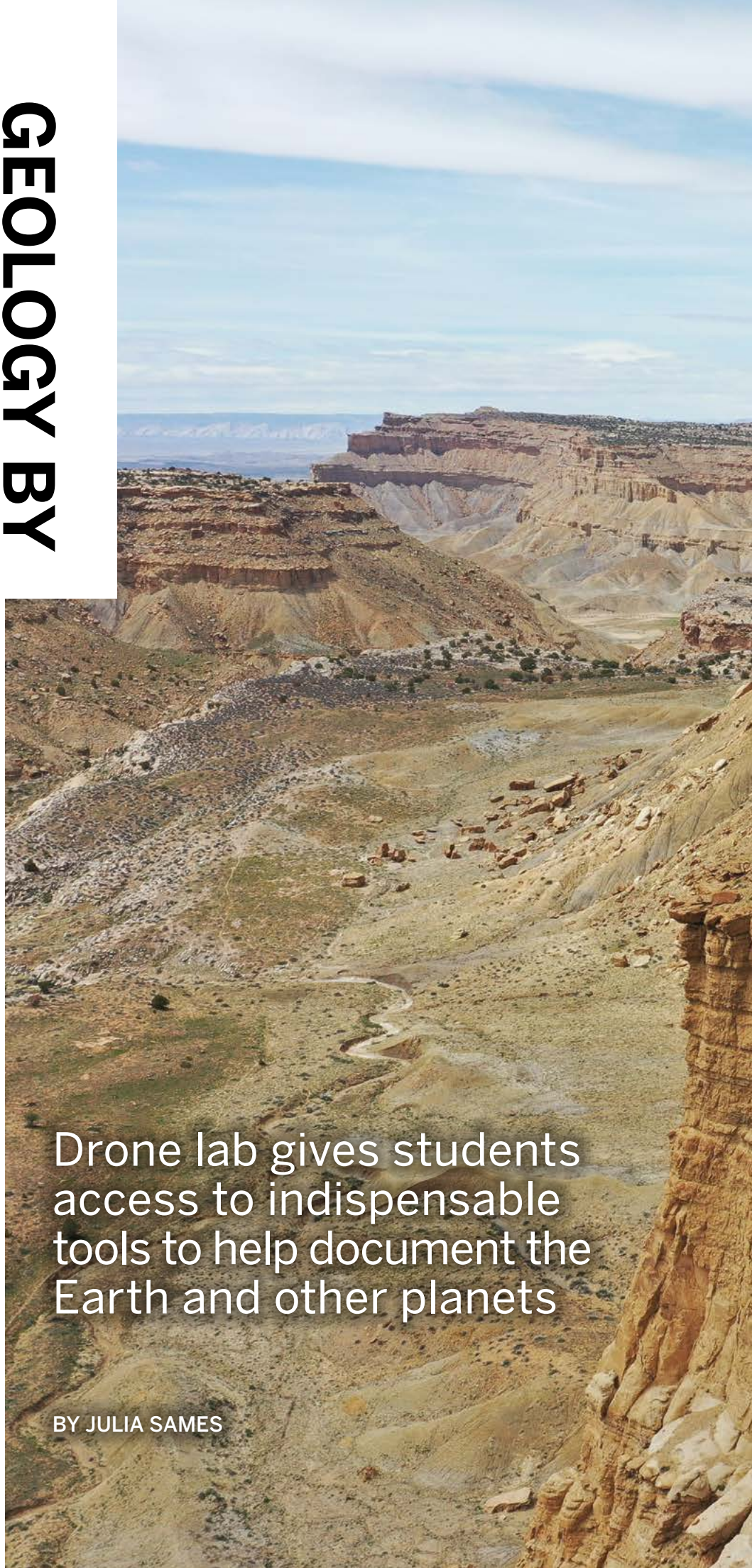
BELOW: A CT IMAGE FROM A SWIFT SYRINX.
IMAGE: LUCAS LEGENDRE.

According to Clarke, the best way to understand the possibilities for ancient dinosaur sounds is to continue studying vocalization as it exists today in birds, the dinosaurs that are still with us, and other reptile cousins.

"We can't start talking about sound production in dinosaurs until we truly understand the system in living species," she said.

These research projects were supported by the Gordon and Betty Moore Foundation, Howard Hughes Medical Institute Professors Program and the Jackson School. Chad Eliason, a senior research scientist at the Field Museum of Natural History and former postdoctoral scholar at the Jackson School, was also a major contributor to these syrinx projects and others.

GEOLOGY BY DRONE



Drone lab gives students access to indispensable tools to help document the Earth and other planets

BY JULIA SAMES

One hundred and twenty million years ago, when much of Texas was a shallow ocean, some unexpected places hundreds of miles from our current coastline made up its beach. As eras passed, the Earth crashed into itself, the water receded, and Texas became land. But the limestone deposits that had been shaped by the water's movement remain as a living record of this oceanic period in the form of ancient fossilized beaches.

While surfing Google Earth one day, Jackson School of Geosciences Professor Charlie Kerans happened upon a pristine example of this kind of fossil beach, just an hour's drive northwest of Austin along Cow Creek. As he zoomed into the satellite photos, he could see the telltale signs: prograding, shallow, wavy steps of limestone descending like a sandy beach as it travels under the ocean.

THE BOOK CLIFFS NEAR GREEN RIVER, UTAH, SHOW THE COASTLINE OF WHAT ONCE WAS THE WESTERN INTERIOR SEAWAY. RESEARCHERS STANDING ATOP CLIFFS ARE (L–R) CORNEL OLARIU, MARIEL NELSON, MICHELLE TEBOLT AND TIM GOUDGE. **PHOTO**: MICHELLE TEBOLT VIA DRONE.

ABOVE AND OPPOSITE: PROFESSOR CHARLIE KERANS GUIDES STUDENTS IN HIS GEO 383N DEPOSITIONAL SYSTEMS: CARBONATES AND EVAPORATES COURSE ACROSS COW CREEK, NEAR LAGO VISTA, TEXAS. THIS IS A PRISTINE EXAMPLE OF A FOSSIL BEACH, KERANS SAID. **PHOTOS:** JACKSON SCHOOL.

The sandstone layers had been stripped away over the years, making this exceedingly well-preserved beach plain as day.

"They were never modified by mountain building events or deformed. So, the present-day structural setting of the rocks is pretty much the way they were deposited 120 million years ago," Kerans said. "It takes almost no imagination to see how they were formed."

Kerans set out on his kayak toward the property and met its owner, who turned out to be a University of Texas alumnus. He was happy to give Kerans access to the outcrop to teach his GEO 383N Depositional Systems: Carbonates and Evaporates course.

On a mild Wednesday morning in January, Kerans and a dozen of his graduate students explored the outcrop, documenting its features at the micro and macro scales—by hand lens and by drone.

Along with GPS and the field notebook, in recent years drones have become standard issue for Jackson School students heading into the field. These tools have been made more accessible through the Department of Earth and Planetary Sciences' new drone lab, where students can easily use drones and virtual reality headsets to enhance their coursework and research. By sheer virtue of its availability and the enthusiasm of instructors such as Kerans, students are increasingly incorporating drone imagery and data into their studies.

Kerans has brought these students and their tools to "tell the story" of this perfect stretch of fossil beach. Because it's private property, this special outcrop is inaccessible to most people. There's also no guarantee of its continued preservation. Condos could be here in 10 years, Kerans noted.

"Do not assume this is always going to be here," he told the students. "The more we can document it, the better."

Student Nick Regier was on the team tasked with imaging the scene by drone. He directed the device back and forth over the banks of Cow Creek, stopping methodically to take photos and talk about the process as he went. Regier said he enjoyed flying the drone because it creates amazing vantage points of outcrops such as this. Plus, it's fun.

The drone team took 1,200 photos that day to capture the outcrop. The next day, Kerans showed the students how to merge them to create a three-dimensional model of the space in the drone lab.

In 2022, Danny Stockli, chair of the Department of Earth and Planetary Sciences, allocated $150,000 to build out this lab space. His goal was to make drone technology as accessible as possible for students of all levels, with the hope that they could carry these in-demand skills into their careers after graduation.

The lab itself is not much to look at. It's a narrow room with desktop computers, chairs, and a tall window. But it's a treasure trove for a techy geoscientist. Here, students are outfitted with high-

end computers that can process drone software and build interactive models from their footage, virtual reality (VR) headsets to dive into the 3D space, and drones of various sizes and capabilities that students can borrow for their research projects.

Along with Kerans, Assistant Professor Tim Goudge is arguably the biggest remote imaging enthusiast among the Jackson School's faculty. He has introduced drones to students ranging from GeoFORCE high school seniors—he leads a trip to Lake Jackson every year where they research coastal erosion—to doctoral students working on their dissertations. He believes the draws are innumerable. Drones allow geoscientists to expand the scope of their work, to take field data home with them, and to use artificial intelligence to parse extra data that has been collected but gone unused.

Pedagogically, it is often most effective for students to hear the same thing several times in order for it to be cemented in their learning, Goudge noted. With VR, professors can show students what they will see when they go out into the field and prepare them beforehand. This generally makes their time spent in the field more efficient and meaningful. Plus, drones open a new realm of accessibility for students with physical limitations that might preclude them from getting to hard-to-reach outcrops.

Not to mention, this is the kind of cutting-edge technology that graduates will be expected to have proficiency in as they enter the workforce.

"(Drone experience) has become the norm in the same way that we expect our students to know how to identify how big a sand grain is versus gravel grain," Goudge said. "We will expect them to maybe not know how to fly and acquire these data, but at least how to think about them and analyze this type of 3D geospatial data."

Liesel Papenhausen, a junior environmental science-geology major, is putting remote sensing at the center of her senior thesis project. During the next two years, Papenhausen will repeatedly travel to Sargent Beach and Bryan Beach, both on the Texas coast southeast of Houston, to measure the two extremes of coastal migration and shoreline change. Sargent Beach is one of the fastest-eroding beaches in Texas, while Bryan Beach is amassing sand at a rate faster than almost any beach in Texas. To collect this data, she plans on using lidar drones, which emit light pulses to collect more precise and detailed elevation data than a standard drone would.

By assessing the data through 3D models, it's much easier to piece together the story and the spatial understanding of a place, Papenhausen said.

"It's a perspective you can't get otherwise," she said.

Morgan Carrington, a current doctoral student, and Michelle Tebolt, who graduated in the spring with a Ph.D., have both worked with Goudge to capture drone footage in Utah as an analog for Mars.

Carrington is researching how the interplay of surface water and groundwater form canyons on Earth, and what that could tell us about how the canyons on Mars were formed. Canyon alcoves in particular are of great interest to Carrington, because groundwater influences that shape in

DRONE LAB FLEET

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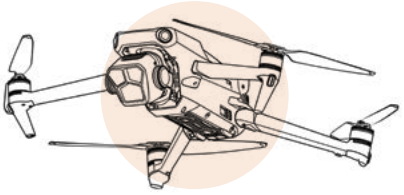
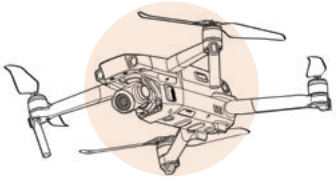
Drone Type	 <249 g 	 958 g 	 1100 g (max) 
Number Available	8	8	2
Approx. Cost	$400	$1,500	$4,000
Uses	Collecting moderate-quality images that can be made into 3D models. This drone is used to teach students how to fly and acquire data.	Collecting high-quality images that can be used to create 3D models or study landscape changes. This drone is used for teaching and research.	Collecting high-quality images and thermal data. The images can be used to create 3D models and study landscape changes, while the thermal data can be used to understand spatial changes in surface temperature. This drone is used for research.

NOTE: THIS TABLE DOES NOT INCLUDE DRONES THAT BELONG TO INDIVIDUAL RESEARCHERS OR RESEARCH GROUPS.

three dimensions. If this formation translates to Mars, then maybe there was groundwater involved in the formation of the canyons there too.

Being able to see these Utah alcoves in 3D, both in person and through drone models, is indispensable to Carrington's research.

"I had just been looking at (these alcoves) from the top down, aerially, for a year and a half. Those alcoves, just how deep they are, the magnitude of them, was completely lost on me without having gone out there," she said.

Tebolt placed drone technology squarely at the center of her research: She studied the gap in sedimentary data on Mars that comes about by relying solely on satellite imagery to study its surface. The findings were eye opening.

She started her work by looking at ancient sedimentary coastal features in Utah that are similar to the features she looked into on Mars, and taking drone images at varying altitudes and resolutions.

Tebolt processed these images and turned them into both 3D outcrop models and plain top-down elevation models, the kind of data that satellites provide. She then dialed back the resolution on these top-down models to 25 centimeters per pixel, the clarity available via satellite, and discovered that the sedimentary cross-bedding was no longer visible. Cross-bedding can be an indication that water was moving through an environment during its development.

"So, if this feature was on the surface of Mars right now, there's no way we would be able to know unless we got better images than we currently have of the surface," Tebolt said.

This cross-bedding was, however, as visible in the drone photos as it is up close in the field. Tebolt concluded that drone footage would provide a useful scale between satellite imagery and NASA's Mars rover imagery, which can capture the surface of Mars in very fine detail.

Drone use, while incredibly useful in the advancement of the geosciences, is just as useful as an introduction to the field for new students.

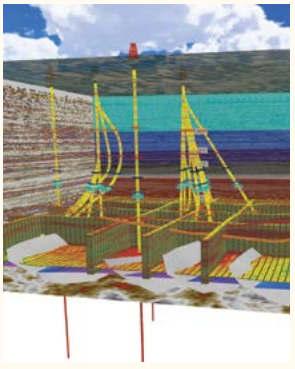
"It's one of those rare things that both gets students excited and is important," Goudge said. "Often things that we think are important to teach our students are not always the things that students find the most exciting."

The geosciences are a field where students are compelled to think in three-dimensional space, perhaps more than any other science, Goudge noted. But it is not solely a study that can occur at the macro scale. The observation of grains less than a millimeter in diameter are an equally essential data point, and these details cannot be adequately captured by drone, at least as the technology currently stands.

To examine these small-scale details, students must go into the field. This, Goudge said, is what makes drones and VR visualization a complement technology, rather than a replacement technology.

Back at Cow Creek, while Nick Regier flew a drone over the fossil beach, he noted the importance of being there in person to learn the full story of the outcrop.

MEET ME IN THE SUBSURFACE



Drones are a great tool when visiting field sites — such as outcrops, rivers or ice sheets. But things get a bit trickier for geoscientists studying the subsurface. There's no way to travel thousands of meters underground to measure faults or size up oil deposits.

However, if they aren't opposed to donning a pair of funky goggles, this can suddenly become very real in virtual reality (VR).

Robin Dommisse, a senior 3D geomodeling adviser at the Bureau of Economic Geology, is an impassioned advocate for experiencing data in this immersive way.

There's something about being able to walk around, view and manipulate a 3D model that is inherently appealing to the human brain, Dommisse said. It allows viewers to jump right into field mode and take in information just by looking around.

"With VR, you immediately go beyond visualization to analysis, and all of a sudden you start to see things completely differently," he said.

Visualizations that might look inviting enough in a PowerPoint presentation become immersive, interactive experiences in the world of virtual reality. This, according to Dommisse, can help highlight the connections between surface outcrops and subsurface reservoir models.

For example, one of Dommisse's projects takes place in a 3D cross section of an oil reservoir in the Delaware Basin in West Texas. When in the VR world, if you look up, you'll see oil rigs above, sitting on a transparent layer of earth. Turn from side to side, and you'll see wells like octopus tentacles curving thousands of feet underground. Glance down, and you'll see some of the deeper wells extending for miles below the cross section. This isn't just a representation of what the subsurface could look like; it's an accurate, scientific model of the Delaware Basin, based on seismic data, well log information, and scans of cores that have been taken from these wells.

It's like being able to see underground, with the added ability to zoom in, zoom out, and click on anything for more detailed information.

Dommisse has seen the way that VR encourages people to explore their environment independently, while also making it a shared space for collaboration.

"There's something very interesting I've noticed. When I go to a (Zoom or Teams) session showing 3D interpretation and modeling tools, I can give control of the mouse over to anyone, but few people ever grab it," he said. "But when I meet with multiple people (in VR) right now, I see that especially younger generations are much more inclined to interact with the objects in the 3D environments."

Dommisse has understood the connection between 3D visualization, enhanced comprehension and engagement for decades. Hanging in his office is a 26-year-old photo of children crowded around Dommisse and his computer at Apache Oil Company on a "bring your kid to work" day. They're all grinning and wearing 3D glasses.

The difference now, aside from the obvious technological advancement, is the relative affordability and accessibility of VR software and hardware. Meta offers VR headsets for $200. And BaselineZ, the software Dommisse uses to visualize outcrop and seismic data, donated an enterprise license to The University of Texas at Austin to use for free.

That means a field trip to the subsurface is more accessible than ever before.

"Forget about all the theory. Just put on the headset, make up your own mind," Dommisse said.

"It gives you the context you need to understand what is actually happening in the geology, in the rocks," he said. "If you don't actually put your nose on the rock, you don't really know what's happening. There's so many things in this fine scale of the hand lens — or even just the eye — that you just can't make out, say, with outcrop images."

Kerans, who often uses VR goggles to explore the Earth from the comfort of his office, notes that there's still a ways to go before virtual reality can eclipse real-world exploration. There are still quirks in the technology that can make it difficult (or nauseating) to use. The goal for now is just to show students how cool the geosciences are.

"There's a lot of cool science in geosciences, and it's quite impressive technologically and scientifically. (Drones and VR) are a good way to get people jazzed about it," he said.

ABOVE: BASELINEZ 3D VIRTUAL REALITY VIEW SHOWING AN INTERACTIVE SUBSURFACE OIL RESERVOIR SCENE. **IMAGE:** ROBIN DOMMISSE.

QUANTIFYING CHAOS

Extreme weather is becoming more costly. The University of Texas Institute for Geophysics and insurance services company Verisk have teamed up to better understand where, when and why extreme weather happens, and its future in a warming climate.

BY CONSTANTINO PANAGOPULOS

WAVES FROM STORM CIARÁN HIT NEWHAVEN LIGHTHOUSE IN THE SOUTH OF ENGLAND ON NOV. 2, 2023. **PHOTO:** HOWARD STANBURY/FLICKR.

When Storm Ciarán slammed into Europe in November 2023, it battered the continent with wind, hail and torrential rain. The deadly storm set off wildfires, spawned tornadoes and swept away roads and buildings, leaving 21 dead and causing over 2 billion euros ($2.14 billion USD) in damage.

Intense cyclones like Ciarán are rarely seen in Europe. But the storm was part of a global trend in damaging weather events —including thunderstorms, tornadoes and wildfires—whose impacts are getting worse as the climate warms and populations grow.

This new reality has thrust climate science to the forefront of the insurance industry. Insurance companies were among the first to wake up to the idea that understanding climate change is vital for the future of their business.

That's true for insurance services company Verisk, which recently warned that insured losses from extreme weather have risen sharply in recent years, and the trend is expected to continue. But exactly how and where it will have the greatest impact is a multibillion-dollar unknown.

What makes extreme weather particularly hard to predict is that reliable storm records go back only a few hundred years. Modern weather observations, barely a few decades. This means scientists just don't have enough data about freak events such as Ciarán or other kinds of extreme weather events.

"It's very hard to make estimates about a one-in-1,000 years event based on observational data," said Yuko Okumura, a research professor at the University of Texas Institute for Geophysics (UTIG).

Verisk is partnering with UTIG to solve the problem. Okumura and her team are running a climate simulation on a supercomputer at the Texas Advanced Computing Center that will give them 100,000 years' worth of weather data. Verisk scientists, meanwhile, have developed an artificial intelligence algorithm to improve the simulation's accuracy and resolution.

"It's important to understand how those (extremes) will change in the future so that we can adapt."
Danielle Touma

The simulation will deliver a huge cache of data that will let Verisk model the full range of weather possibilities in any region. The same data will help UT researchers investigate what drives extreme weather and how it might change in the future.

For Verisk, the project will allow the company to make a technological leap from statistical approximations to a sophisticated physics-derived simulation of every kind of weather the planet can produce.

The three-year project's goal is to better understand and prepare for what lies around the corner in an era when extreme weather is becoming increasingly destructive and unpredictable. Global warming isn't the only culprit. Weather impacts are being felt in places that have neither the infrastructure nor resources to defend against them, making deadly events with multibillion-dollar price tags much more common.

"They've gone through the roof," said Charles Jackson, a former UTIG climate scientist who now leads Verisk's global atmospheric perils unit. "There are several reasons why that's happened, including stronger extremes and a greater fraction of coastal developments becoming exposed to hazardous weather."

With the stakes so high, it never has been more important to understand the hazards of extreme weather. And with experts on everything from mathematical uncertainty to cascading weather hazards and access to the world's most powerful academic supercomputers, that's exactly what UTIG is uniquely poised to do, Okumura said.

"These are current and urgent problems, but UTIG has the expertise and computational resources to help our partners come up with real solutions for the communities they serve," she said.

Modeling Extremes

Before joining Verisk, Jackson was tackling the mathematics of uncertainty at UTIG. These equations and formulas help manage the chaos of real-world physics in modern climate models. Today, he leads a research team at Verisk that develops similar models to calculate the risk of extreme weather.

These models typically incorporate weather predictions, climate records and other data about a particular place.

The UTIG project offers something different. It uses a global model—which is important because extreme weather in one area can have knock-on effects elsewhere—and it will supply data about very rare weather events that have an outsized impact on potential losses. The information could be very significant for the industry.

"You can have many, many storms in a year that add up to a billion dollars, but then one year you have one big event that's $100 billion on its own," Jackson said.

The fear with global warming is that these heavyweight events may begin occurring more frequently or in vulnerable places. But because they don't happen often enough to show up in shorter climate simulations, they are in effect flying under the radar, Jackson said.

The UTIG project is a major effort to cover that data blind spot. By gathering 100,000 years of simulated climate data, the Verisk researchers will gain information about where the future extreme weather hot spots are likely to be and adjust their risk assessments accordingly.

More precisely, the project isn't just one simulation. It's a set of 2,500, each spanning the 44 years from 1979 to 2023. For context, the climate models that inform the reports of the U.N.'s Intergovernmental Panel on Climate Change use sets of about 10 concurrent simulations.

"Being Texas, we've naturally gone super large," Jackson quipped.

There's one more trick up Jackson's sleeve: Verisk's proprietary machine learning algorithm effectively smooths out flaws in the climate model, making the results more lifelike. That's because weather is inherently chaotic, and even the tiniest flaw in the model can skew things in ways that only get worse as the simulation progresses.

This kind of artificial intelligence is new to the climate community, but it represents an exciting new set of tools with which to do better science, Jackson said.

For Verisk that means a better understanding of weather risks. For the UTIG researchers it's a way to learn what drives extreme weather and its connection to climate change.

Cascading Calamity

In 2023, unusually strong winds fanned fires that destroyed Lahaina, Hawaii, and killed 101 people. A similar firestorm killed 104 people in a seaside village outside Athens in 2018.

In both instances, environmental conditions converged to turn a dangerous event into a catastrophe, said Danielle Touma, a research assistant professor at UTIG and a member of Okumura's team.

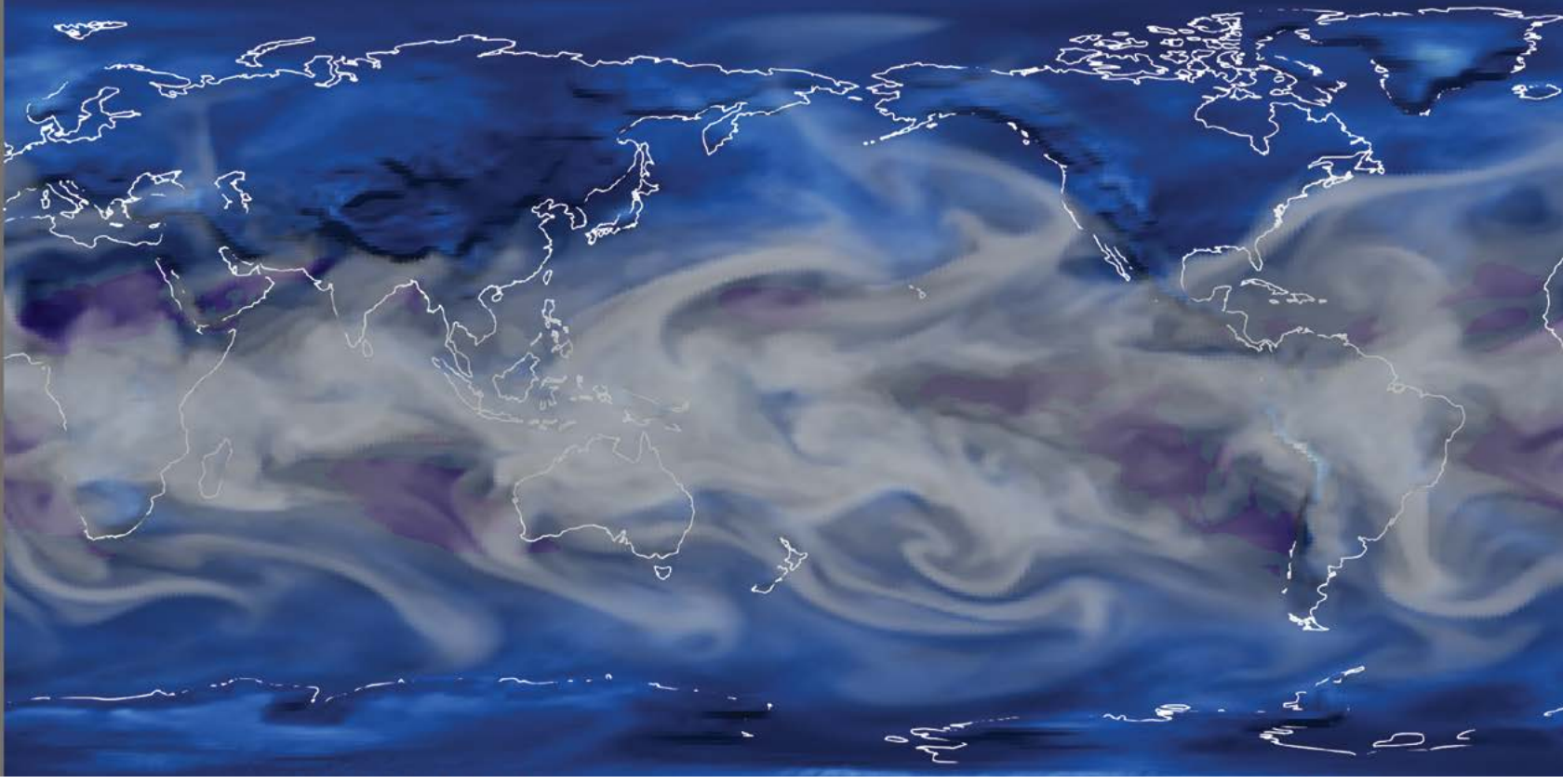
"It was only with that combination of very dry weather, lightning strikes and high winds that a spark became an inferno that engulfed (Lahaina) within a few hours," she said.

Touma is an expert on extreme weather. She studies the causes of extremes and how one catastrophe can build on another, such as heavy rain setting off landslides after a wildfire.

One of her roles on the project is to decide what defines an extreme event. That includes storms, wildfires and flashfloods, but also less obvious conditions that can still have severe impacts on people and the environment.

For example, prolonged heat waves can destroy crops, dry up reservoirs, overload energy grids and harm the most vulnerable. But heat waves are especially deadly when paired with a blast of humidity, Touma said.

"If humidity is above a certain amount, sweat can't evaporate as quickly, and so, our bodies just can't cool," she said. "That's why we've included humidity in the data we're collecting from the simulations."



For Touma, the simulations are an opportunity to understand the part played by climate change. For each run of the simulation, the researchers tweak the atmosphere less than a trillionth of a degree. It's a tiny change, but the chaotic nature of weather means that each variation lets the simulation play out in a unique way without altering global warming's overall influence. That lets them separate statistical anomalies (like rolling 100 sixes in a row) from longer-term warming trends (a loaded dice).

"It's important to understand how those (extremes) will change in the future so that we can adapt, and to understand the consequences of not mitigating greenhouse gas emissions," Touma said.

Variable Climate

Global warming isn't the only driver of extreme weather. Natural climate swings were setting the stage for extreme weather long before people came on the scene. The hot and cold seesaw between El Niño and La Niña is such a strong driver of global weather that for decades, it obscured the impact of human-driven global warming.

The new simulations will help UTIG researchers separate trends in extreme weather that are caused by natural climate variability and those ultimately linked to greenhouse gas emissions.

The opportunity to decipher climate variability and extreme weather is what makes the new simulations so important, Okumura said. Picking apart these patterns to get at the underlying climate hazard is what drives the UTIG research.

"We might look at El Niño and say we'll have 1 millimeter more rainfall per day in Texas over the course of a season," she said. "But what does that mean? If it is spread evenly, it is great for agriculture, but if it all falls at once, then you could have flash floods."

When the simulations are complete, the UTIG researchers hope to have enough data showing how El Niño is changing and how that will affect extreme weather.

They'll also tackle other climate swings such as El Niño's fickle northern cousin, the North Atlantic Oscillation, which sets the baseline for winter weather in North America and Europe.

That's of particular interest to Jackson and the Verisk team because their initial focus is to develop atmospheric peril models—winter storm, summer storm and flood models—for the European market. After that, they'll move on to other regions.

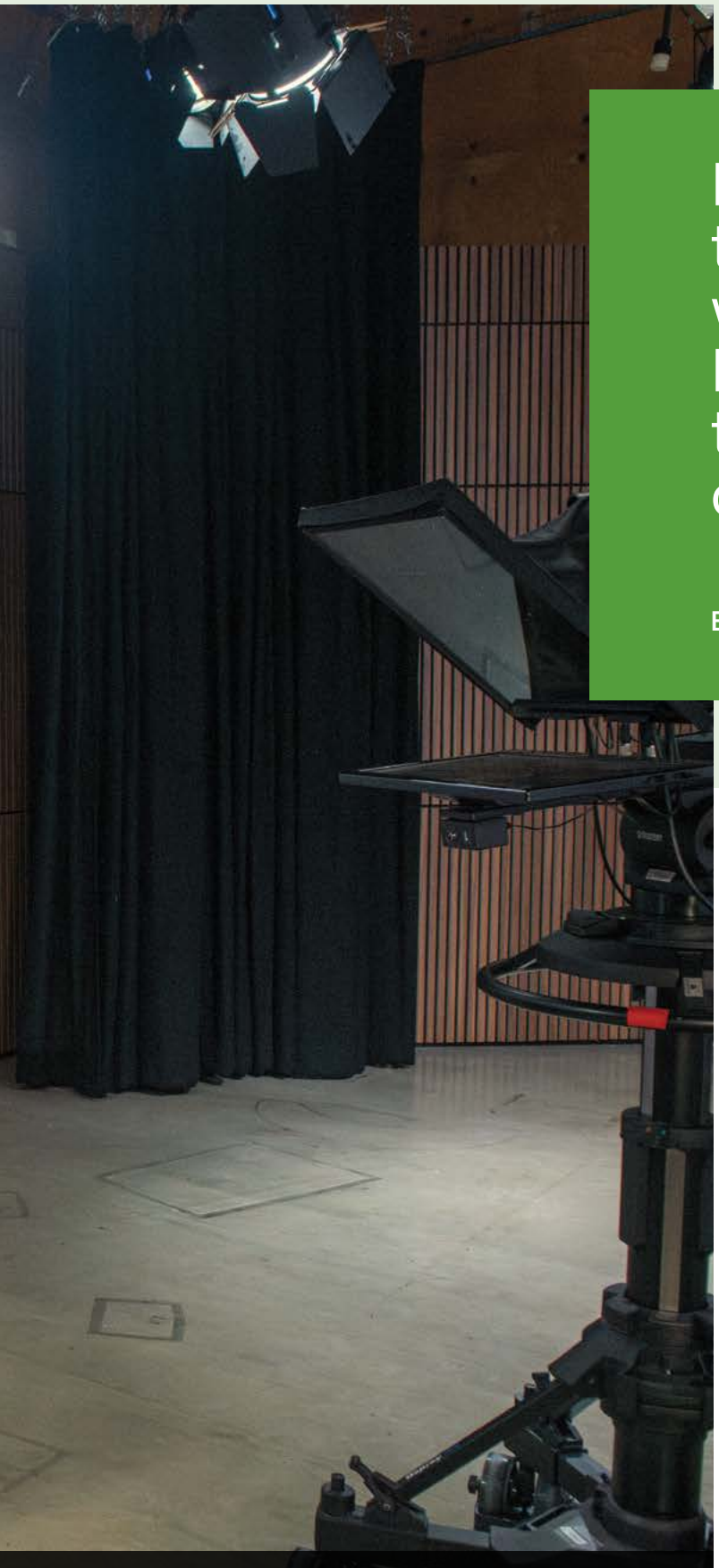
"The combination of expertise in climate modeling, plus the high-performance computing resources and the knowhow to get the most out of them, is very rare to find in one place, but it's all right there at the University of Texas," Jackson said.

The simulations are still running, but when complete, the huge cache of data will let Verisk prepare for climate disasters and help UT researchers answer questions about the future of extreme weather.

OPPOSITE PAGE: UTIG CLIMATE RESEARCHERS YUKO OKUMURA (LEFT) AND DANIELLE TOUMA ARE RUNNING THOUSANDS OF SIMULATIONS TO SHED LIGHT ON LINKS BETWEEN WEATHER EXTREMES AND CLIMATE CHANGE.
PHOTO: JACKSON SCHOOL.

ABOVE: A SNAPSHOT FROM A CLIMATE SIMULATION SHOWING GLOBAL CLOUD COVER AND SURFACE HUMIDITY. THE RESEARCHERS LOOK FOR PEAKS IN THESE AND OTHER WEATHER CONDITIONS THAT MIGHT GIVE RISE TO EXTREME WEATHER EVENTS.
GRAPHIC: GREGORY ABRAM AND FRANCESCA SAMSEL/TEXAS ADVANCED COMPUTING CENTER.

star teacher



PROFESSOR JAY BANNER (LEFT) AND ASSOCIATE PROFESSOR AND FILMMAKER SCOTT RICE IN A STUDIO AT THE UT MOODY COLLEGE OF COMMUNICATION. **PHOTO:** SANDY CARSON.

How an innovative teacher, an Emmy Award-winning director and a Hollywood celebrity came together to make science cool (or hot)

BY MONICA KORTSHA

There's no shortage of fun things to do on a Friday night in Austin, Texas. For many locals, attending the monthly "Hot Science–Cool Talks" event at The University of Texas at Austin is at the top of the list.

On a warm March evening, that's where hundreds of Austinites have gathered, packing into Welch Hall to hear UT associate professor and astronomer Caitlin Casey talk about how pictures of deep space from the James Webb Space Telescope are "breaking the universe"—or at least challenging scientists' long-held theories about how it works.

Attendees are as diverse as couples on a date night, retirees and wriggling kindergartners. Collectively, they fill almost all of the auditorium's 483 seats. Five minutes before the start of the event, and there are still about a dozen people waiting outside the auditorium doors, ready to fill any open spots that ushers can find among the crowd.

"Hot Science" has been going strong for 25 years, with the free lecture series bringing the science on campus to a public audience. Most speakers are UT faculty members and researchers from across all scientific realms, from robotics to dinosaurs.

But according to Jay Banner—the founder of "Hot Science," the master of ceremonies at each talk and a professor at the UT Jackson School of Geosciences—there's something about astronomy that gets people excited, especially kids. After Casey's talk concludes, a gaggle of grade schoolers lines up at the microphone to ask about white dwarf stars, black holes and what existed before the Big Bang.

"He became my favorite professor."

Isha Bhasin

ABOVE: A PACKED HOUSE AT THE FIRST "HOT SCIENCE–COOL TALKS" LECTURE IN 1999. **PHOTO:** JACKSON SCHOOL.

BELOW: THE MARCH 2024 "HOT SCIENCE–COOL TALKS" LECTURE BY ASSOCIATE PROFESSOR CAITLIN CASEY. **PHOTO:** JACKSON SCHOOL.

"I feel like this is my Ph.D. exam all over again!" replies Casey before delving into a response.

Banner created "Hot Science" to help people forge connections with the science and scientists around them. The series has been a hit since its beginning. So many people showed up to the first talk in 1999, which was about birds as modern dinosaurs and was delivered by Jackson School Professor Timothy Rowe, that they lined the back of what is now the school's Boyd Auditorium and overflowed into the stairwells.

"We turned away over 100 people who couldn't fit in the room," Banner said. "Then we knew there was an appetite for this, and it's really just grown and grown from there."

While filling up auditoriums on the UT campus for over two decades is an achievement on its own, Banner thinks "Hot Science" has the potential to reach even more people. He is working to boil down the essence of the "Hot Science" experience—the scientific wonder and the personal connection—into a new television series called "Hot Science TV."

The series is still in its early stages. There are currently six episodes, each one about seven minutes long, available for free online. Each episode showcases a "Hot Science" topic and speaker, who, first and foremost, must be a great teacher.

This is something Banner knows all about. This year, he received the Robert Foster Cherry Award for Great Teaching, one of the highest honors for teaching at the college and university level. The award is presented by Baylor University every two years and comes with a $250,000 prize for the winner and $25,000 for the winner's home department.

The Cherry Award is agnostic about subject. Recipients include English literature instructors, mathematicians, choral directors, and now with Banner as a winner, geoscientists. The award is open to all university or college instructors in the world, as long as they teach in English.

With such a wide variety of teachers entering the contest each cycle, a large part of choosing a winner comes down to evaluating who has had a transformational effect on students, said Kevin Dougherty, chair of the Cherry Award committee.

"This is beyond being an engaging person in the classroom," he said. "Recipients are people that students can look back and say, 'Having Dr. Banner in my first year athe University of Texas changed the trajectory of my life.'"

According to undergraduate student Isha Bhasin, Banner's engaging teaching style is why she is a geosciences student today. She became an environmental science major at the Jackson School after taking Banner's course, "Sustaining a Planet," as a first-year student. It's a class she now recommends to all first-years she meets.

"He became my favorite professor," she said. "He opened my eyes not only to what sustainability means but how it's applicable in every part of our lives."

MaryLynn Musgrove, a research scientist with the U.S. Geological Survey and Banner's first graduate student, said that Banner's mentorship,

motivation and enthusiasm have been a guiding light through her own career.

"He has a way of motivating people by being interested in what they're interested in," said Musgrove. "It's motivation through mutual respect and support."

The Cherry Award is the cherry on top, so to speak, of a long list of Jackson School and UT teaching honors that Banner has received. This includes being part of UT's Academy of Distinguished Teachers, a select group of the university's top faculty members recognized for their pedagogical prowess.

But the award is also a reminder of how far he has come. That's because, according to Banner, he started out as a terrible teacher.

When he first joined the UT geosciences faculty in 1990, his teaching style could be politely summed up as maximalist. Banner said he tried his hardest to pack everything he learned in his own 16 years of post-high school education into the five months of a school semester.

He recalls completely misjudging his students' reaction to this "more is more" approach.

"I can remember coming into the room one day with two of those full slide trays, swinging open the door, and the students turned and looked at me and their eyes were really wide with, what I thought at the time was wonderment," Banner said. "But as I learned once I saw the reviews at the end of the semester, they were wide with either terror or hatred."

Banner credits a pointed critique from an anonymous student in a course evaluation with helping him realize that he needed a new approach to teaching. It simply read: "Banner should be giving these lectures to the other faculty."

"That just jumped off the page at me," Banner said. "I'm not very good at this, and I want to do better. And I became better over the next several years."

According to Banner, this process involved learning how to break down big concepts into smaller, memorable building blocks and finding opportunities for students to experience the excitement of discovery for themselves.

On a recent trip to Barton Springs Pool and the surrounding greenbelt, these teaching tactics were clear, with Banner engaging the class in a discussion about aquifer recharge next to a looming limestone cliff eroded with holes. Far from packing every minute, Banner gave students the time to engage with their surroundings. The class spent a few quiet minutes to watch a blue heron stalk its prey along the water's edge.

Now, as Banner works to get "Hot Science TV" to bigger audiences, there are some parallels between the development of the show and his own teaching journey. "Hot Science TV" isn't the first attempt to expand the reach of the "Hot Science" speakers through video. The current iteration of the program grew out of some constructive criticism. This time, it wasn't from an anonymous review, but from someone with a bit of a higher profile—the actor Adrian Grenier, a celebrity who has starred in numerous Hollywood movies and played the lead on the early 2000s HBO series "Entourage."

Nowadays, in addition to acting, advocating for environmental causes, and working the land on his Bastrop farm, Grenier is a member of the Advisory Council of the UT Environmental Science Institute, which Banner directs.

During a council meeting about five years ago, Grenier said that if "Hot Science" was going to go big, simply taping the talks and uploading them online, as the institute had been doing for years, wasn't going to cut it.

"Hot Science" needed to be transformed from a long lecture into, as he put it, "a little show."

ABOVE: ACTOR ADRIAN GRENIER HELPED MAKE "HOT SCIENCE TV" INTO A SHOW. **PHOTO:** SHUTTERSTOCK.

LEFT: JAY BANNER AND STUDENTS IN HIS ENVIRONMENTAL JUSTICE CLASS COLLECT WATER SAMPLES FRESH FROM THE AQUIFER THAT FEEDS BARTON SPRINGS POOL. **PHOTO:** JACKSON SCHOOL.

"They have all these great speakers, and they all have this amazing content on stage for people who are there, but what about all the people who can't be there in person?" Grenier said, recounting the conversation at the meeting. "Why not make a show that people can access from afar?"

Banner agreed whole-heartedly. But this time, he would need some help.

That's where Scott Rice and his team of students majoring in radio-television-film at the UT Moody College of Communication come in.

Rice is an Emmy Award-winning filmmaker and an associate professor of practice at the Moody College, where he teaches the film production class "Script to Screen" with Matthew McConaughey.

The class is all about giving students a first-person look into how films are produced from beginning to end. This often involves Rice inviting students to take part in his own film, TV and commercial productions. When Rice found out about Banner's interest in turning the "Hot Science" lectures into a show, he said he was excited to work with his students to make it happen.

"There's a lot of hard-core learning that happens on the production side," Rice said. "The students are not doing some little small task or activity. They're actually running the show."

Each episode of "Hot Science TV" is shot in a single day, with students managing the scheduling, the set staging and videography. All the footage is pieced together into a program where the speaker is talking directly to the camera, taking the audience on a journey through their research.

"In this show, the scientist is the host. They speak directly to the viewer and express their particular passion for what they do, why they do it, and the heart behind it," Rice said. "The heart element is very important. It's the human element."

So far, "Hot Science TV" has been funded by small grants and fundraising campaigns. Banner and Rice are currently looking for a long-term funder or larger platform to invest in the show. Although film is a tough business, Rice said he is confident that the show has what it takes to be a success, with the program receiving positive reviews — particularly from K-12 teachers, whose students have always been a staple at the "Hot Science" lectures and critical to the success of the series.

But Banner said that schoolteachers and their students aren't the only audiences who can benefit from tuning in to "Hot Science TV," or spending a Friday night out at a "Hot Science" talk.

"I think another audience is university professors," Banner said. "Each one of those speakers has nudged me toward being a better teacher because I sit there and I analyze, 'OK, this a great talk. What is it about it that's making it so great, and how can I use that in my teaching?'"

That's the thing about great teachers: They always keep learning.

OPPOSITE PAGE:
TOP: MORIBA JAH, A PROFESSOR AT THE UT COCKRELL SCHOOL OF ENGINEERING, AS SEEN IN THE SPACE POLLUTION EPISODE OF "HOT SCIENCE TV."
CREDIT: "HOT SCIENCE TV."
MIDDLE: SCOTT RICE WITH STUDENTS DURING FILMING OF A "HOT SCIENCE TV" EPISODE.
PHOTO: SCOTT RICE.
BOTTOM: JAY BANNER HOLDS THE MIC SO A MEMBER OF THE AUDIENCE CAN ASK A QUESTION DURING THE MARCH 2024 "HOT SCIENCE–COOL TALKS" LECTURE.
PHOTO: JACKSON SCHOOL.

THE CHERRY ON TOP

The Robert Foster Cherry Award for Great Teaching from Baylor University is one of the top honors for teachers at the university and college level in the world — and this year, Professor Jay Banner was its recipient.

The Cherry Award crowns a list of distinguished teaching awards and accolades that Banner has earned over the years.

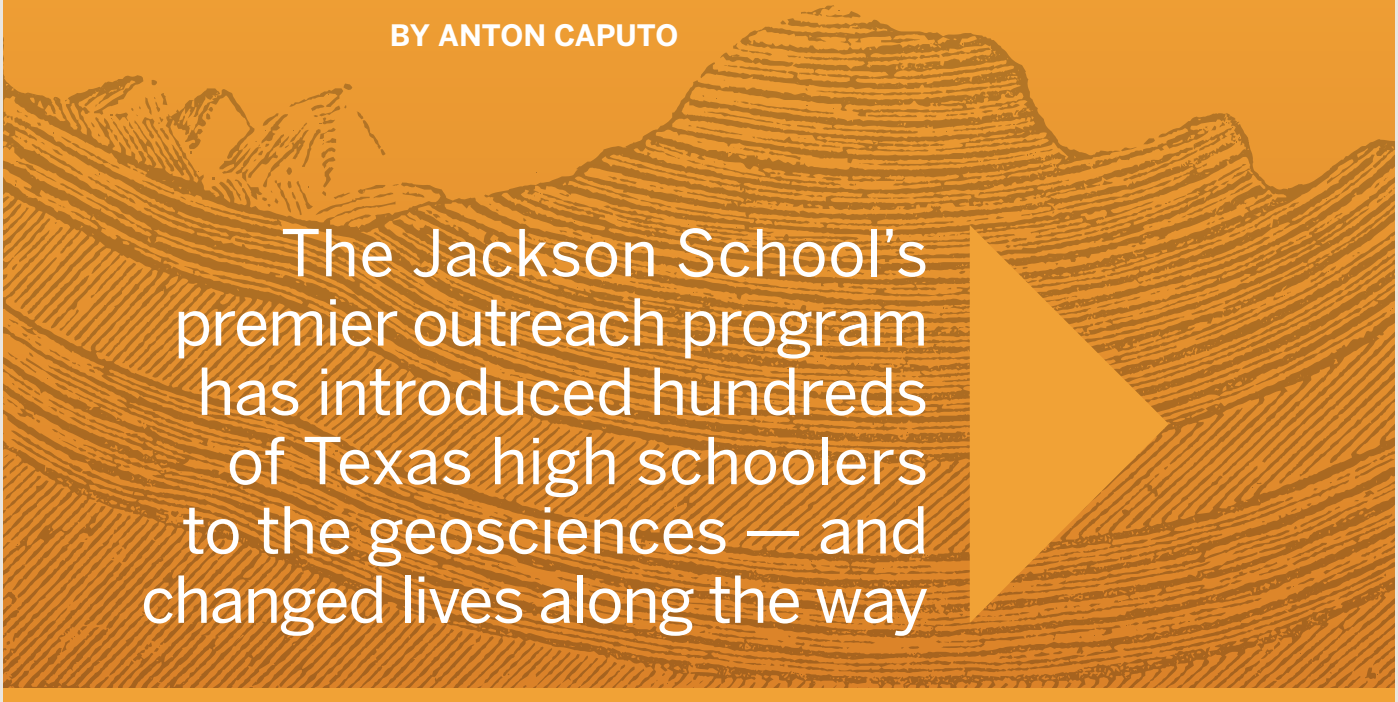
- President's Associates Teaching Excellence Award, 2016-17
- University of Texas System Regents Outstanding Teaching Award, 2013
- Texas Exes Teaching Award, 2012
- Friar Centennial Teaching Fellowship Award, Friar's Society of the University of Texas, 2011
- Inducted into the University of Texas at Austin Academy of Distinguished Teachers, 2011
- Outstanding Educator Award, Jackson School of Geosciences, 2010
- Evelyn and Moses E. Knebel Distinguished Teaching Award, Department of Geological Sciences, 1996, 2006, 2007

Watch "Hot Science TV" Episodes:

hotscience.tv

GeoFORCE TURNS 20

BY ANTON CAPUTO



The Jackson School's premier outreach program has introduced hundreds of Texas high schoolers to the geosciences — and changed lives along the way

Twenty years ago, a group of young students, flanked by their parents, nervously waited for a bus at Southwest Texas Junior College. All were incoming high school freshmen from rural towns in South Texas. In most cases, they were about to enter a series of firsts: first time out of the state, first time on an airplane, and first time away from home without family.

The group of 40 was the inaugural GeoFORCE class. The innovative new program started by the Jackson School of Geosciences was an effort to tackle key issues facing the field: A massive shortage of geologists and geoscientists loomed, and exposure to Earth sciences was becoming ever more rare at the high school level.

The idea was to help reverse the trends by finding bright students in the eighth grade and educating them in the geosciences every summer through high school. The program has since expanded to Houston, Austin and the Rio Grande Valley, but the underserved rural communities of Southwest Texas were the first target.

These students were GeoFORCE's self-described "guinea pigs," a moniker many of them still bear with pride. Over the next four years, for two weeks their first summer and a week during the following three, they would learn geology from some of the best educators in the world on trips to Washington, D.C., Virginia, New Mexico, Arizona, the Pacific Northwest, Florida and the Jackson School.

Looking back over the past two decades, it's obvious from program statistics and growth that GeoFORCE has thrived. But sometimes, the impacts on young lives are best relayed through their stories.

Five of those original students, now in their early 30s and entering midcareer, have shared their thoughts and memories of the program and how it has helped shape the professionals and people they have become.

Carlos De La Torre

Hometown:
Sabinal

Education:
Texas A&M University,
B.S. in Wildlife Ecology
Conservation with minor
in Earth Sciences

Profession:
U.S. Forest Service
Partnership Coordinator

Carlos De La Torre has spent much of his adult life seeking new places and experiences. He worked two internships for the National Park Service in Grand Teton National Park and Puerto Rico's San Juan National Historic Site. He spent 27 months in the Peace Corps in Peru. And now—after stops in Washington, D.C. and Maryland—he lives in Alaska, where he is a partnership coordinator for the U.S. Forest Service.

That's far afield for a kid from Sabinal, Texas.

Yet, when Carlos looks back to his first trip on that GeoFORCE bus 20 years ago, he remembers feeling anything but secure.

"It was scary," he said. "There were so many strangers. There were so many other students. I think I cried for a little bit at the beginning."

Carlos describes himself as an introverted kid at that time in his life, intimidated by the high-energy students around him and anxious about the whole situation. After a few days, though, as he made friends and got into the groove of the academic work, Carlos' anxiety eased and his excitement grew. It was a lesson he would take along with him in life.

"That was the first time on my journey to get comfortable with large groups and being on my own," he said. "You have to explore the world to understand it better."

GeoFORCE offered Carlos many firsts in life. Given his financial situation, costly travel was not likely. Neither was ready access to higher education. GeoFORCE helped change that.

"I was exposed to what a university looks like," he said. "It definitely normalized that this is the path we all can take and that you are invited to join."

That path took Carlos to Texas A&M University where he would major in wildlife ecology and conservation and minor in Earth sciences. College was where Carlos really bloomed, taking active leadership roles in university clubs, joining study abroad programs, and jumping at opportunities to travel for internships and join other outreach programs such as the National Park Service Academy program.

Given his college and professional experiences, Carlos chuckles when thinking back to his days in GeoFORCE, pointing out that most of the young students have no concept of the logistical feats and hard work that go into providing them with world-class educational opportunities.

"When you're a student, there is zero understanding of all the behind-the-scenes work," he said. "All of these efforts that everybody puts into this, from the drivers of the buses, to all the administrative tasks, to the teachers—I think everyone should appreciate that they all took part in the bigger picture of having a positive impact on youth.

12%
of GeoFORCE students have earned a bachelor's in geoscience,
30x
times the national rate

60%
of GeoFORCE alumni declare a STEM major in college,
3x
times the national rate

Debbie Duran, PG

Hometown:
Eagle Pass

Education:
University of Texas
at San Antonio,
B.S. in Geology

Profession:
Booz Allen Hamilton,
Senior Consultant

Looking back at herself as a 13-year-old, Debbie Duran can only shake her head and smile. As an Eagle Pass middle schooler, Debbie had never really heard of geology or the notion that you could study it in college. And like most of her classmates, she had never been on a plane or traveled outside the state of Texas.

Then came GeoFORCE.

"It opened a whole new world. We were being spoken to in a different language—shown a different lens to view the world (through)," she said. "I wouldn't be where I am right now had they not planted that seed in 2005."

That seed grew into a love for and career in geology. Like many students, Debbie went on the GeoFORCE trips because they sounded like a great adventure and an opportunity to explore new places. But after the outings to the Pacific Northwest between her junior and senior years of high school, it all clicked, and she never looked back.

After high school, Debbie went to The University of Texas at San Antonio, where she majored in geology. During the summers, she would return to GeoFORCE as a counselor for the Southwest and Houston cohorts and the Alaskan offshoot.

She considered graduate school after completing her undergraduate degree in 2013 but landed a job as a staff geologist at Talon/LPE, an environmental consulting firm. From there, she moved on to SWCA Environmental Consultants, where she worked as a geologist in training under a professional geoscientist. Debbie's career would eventually take her to the San Antonio Water System, where she worked in the resource protection department as an environmental specialist. And in 2022, she reached a milestone and obtained her professional geoscientist license from the State of Texas.

This was one of the proudest moments in her professional career. And in a fitting tribute to GeoFORCE, she reached out to then-Associate Director Eleanour Snow to thank her and the program for their role in shaping her future. Debbie is now at management and technology consulting firm Booz Allen Hamilton, where she focuses on environmental work as a senior consultant.

Two decades later, the memories of her experiences with GeoFORCE as a teenager still burn brightly. She said she can vividly remember "that distinct Jester smell," referring to her time on the Forty Acres in the aging Jester Center dorms that have served generations of Longhorns and visitors. And she will still occasionally during her work refer to a textbook by Professor Leon Long, who led some of her first field outings in GeoFORCE and introduced her to a future of hard and rewarding work in geology. That work has paid off both professionally and personally, she said.

"You have to have patience. You have to have tenacity. You have to have rigor. You have to want it. But it'll pay off," Debbie said. "I think the most satisfying part for me is being able to help my family. That's priceless. All of the hard work has paid off. And it all started with GeoFORCE.

1,708
students have completed the GeoFORCE program since 2005

GeoFORCE is active in
24
counties across Texas

Felipe Villanueva

Hometown:
Uvalde

Education:
Texas A&M-Corpus Christi, B.S. in Environmental Sciences: Marine and Coastal Resources; University of Texas at San Antonio, M.S. in Environmental Science

Profession:
University of Texas at San Antonio, Chemical Safety Specialist

Among the clutter on Felipe Villanueva's desk is a square piece of stone about the size of a Rubik's Cube. It looks like a paperweight, but it has a much stronger meaning to Felipe, who has carried it around since his high school days.

"It's a piece of limestone from Florida," he said of his prized keepsake from his time in GeoFORCE. "The final year, we had the final test. I think I had the highest score. It was like, 'Do well and you get a rock.'"

Sounds about right for a program that introduces teenagers to geological wonders and geology as a science.

These days, 20 years removed from his introduction to GeoFORCE, Felipe is a chemical safety specialist at The University of Texas at San Antonio. After finishing Uvalde High School, he attended Texas A&M-Corpus Christi, where he received a bachelor's in environmental science. From there, he took a job as an academic lab technician at San Antonio College and eventually pursued and completed a master's degree at UTSA while working full time.

Felipe grew up as a Longhorn fan, so when his eighth grade science teacher first mentioned GeoFORCE, the association with UT immediately caught his interest. But when he first brought the opportunity home, his mother balked. She didn't like the idea of her 13-year-old son being away from home. His dad, also an avid Longhorn fan who spent a lifetime pushing education on his children, had a different reaction.

"My dad said, 'Go do it because these opportunities don't come by that often,'" Felipe said. "Being involved with UT was the biggest thing. For my family, being asked by a university of that caliber was a big deal—a family honor."

Two decades later, Felipe remembers the adventure and exacting nature of the program. Early mornings, long bus rides, many lectures and enough granola bars to turn a person off them for a lifetime.

"We hit the ground running. It was a crash course in geology, and I don't think any of us expected that," he said. "We were just mentally and physically drained by the end of it."

But he loved it. He still has his original GeoFORCE lanyard in addition to the limestone prize, and said he still checks the program's website to keep up with its accomplishments. And he still, occasionally, thinks about the geology lessons. They came flooding back to him when doing fieldwork for a master's in environmental science.

"It was a lot of getting hit in the face with tree branches and stuff like that. And then I was like, 'Oh, look, columnar joints,'" he said.

Felipe has simple advice for any young person thinking about applying.

"Just do it," he said. "Go see the rest of the country and just have those experiences. It's kind of a once-in-a-lifetime opportunity."

In 2015

GeoFORCE received the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring from

President Barack Obama

Isaac Jimenez

Hometown:
Eagle Pass

Education:
UT Jackson School of Geosciences, B.S. in Geology

Profession:
Environmental Scientist

Going from a small Texas border town to a mammoth university like The University of Texas at Austin is a potentially daunting adjustment for any young person. But Isaac Jimenez had an ace in the hole when he left Eagle Pass for the Jackson School of Geosciences in 2009.

Like several of his classmates, Isaac had spent four years in the GeoFORCE program, traveling the country and learning the geosciences from some of the best in the field.

GeoFORCE unquestionably sparked his decision to enter the Jackson School and pursue a career in geology and environmental sciences. But beyond that, it created a ready-made support group to help him succeed when he showed up on the Forty Acres.

"A lot of people that were in GeoFORCE went to UT, and we all kind of stuck together," he said.

The support was a big deal. He leaned heavily on his friends and then-GeoFORCE Associate Director Eleanour Snow. She helped him land a job as a lab technician at the University of Texas Institute for Geophysics, where he got to work alongside graduate students. Snow also mentored him all through college and even afterward, helping with professional contacts and offering career advice.

"College is hard, and it's not just the school stuff," he said. "She would help out with anything."

Two decades after first entering GeoFORCE, Isaac is an environmental scientist with Versar, where he has been for nearly nine years. He envisioned himself entering the oil and gas industry when he came out of college, particularly after a summer internship with Lewis Energy in San Antonio that he landed with the help of some GeoFORCE contacts. But the market was in a downturn and jobs were scarce. So he did a short stint at the Texas Commission on Environmental Quality and then moved on to Versar, a construction project management company.

The career path is quite a transition for a teenager who had no idea what the geosciences were before GeoFORCE. Like most, Isaac was nervous when first stepping on that bus. But he said that the counselors made everyone comfortable and, most importantly, kept them busy with studying, tests and games.

And then there were the trips.

"They took us to the Grand Canyon," Isaac said. "It's like, yeah, I've seen this in a photo, but it's right there!"

Isaac remembers the program as rigorous, but he said it paid off in both knowledge and—just as importantly—confidence.

"You just really had to pay attention. For a lot of kids that was the hard part," he said. "But when I got to geology, I was like, 'I've been studying this stuff for four years now.'"

GeoFORCE students have earned a total of

782 bachelor's degrees

116 master's degrees

203 associate degrees

16 doctoral and law degrees

Marissa Vara

Hometown:
Uvalde

Education:
UT Jackson School of Geosciences, B.S. in Geology; Louisiana State University, M.S. in Geography-Paleoclimatology

Profession:
The University Corporation for Atmospheric Research (UCAR), Higher Education Specialist

Marissa Vara remembers well the day in eighth grade that her pre-AP science teacher introduced the class to a new program that would take kids all over the country, teaching them geoscience by using some of the world's most amazing natural wonders as living labs.

She went home and excitedly told her parents about the GeoFORCE program. Her dad had an immediate answer: "No."

Though terribly disappointed, Marissa understood her father's reaction.

"That's the way it is with small-town Mexican American families," she said. "That first summer, it was two weeks going away without a family member, and we don't like to leave our children with strangers."

Her mom had a different view. The program was free and offered tremendous opportunity for Marissa to grow and learn. Family conversations ensued. Dad relented, and Marissa was introduced to The University of Texas at Austin and the geosciences.

That first summer was a dizzying array of exhausting bus rides, hikes and lessons—and lots of fun. Marissa said she remembers Professor Leon Long lecturing on outcrops.

"It was very much like a freshman class at the Jackson School," she said, laughing. "None of us knew what the heck we were doing."

After the first year, the program evolved to provide students with more guidance, and the lessons began to take shape in her mind. Then, in her third-year summer trip to Oregon, it all came into focus.

"Suddenly, I was like 'I can do this. I can be a geologist and actually connect the way the world works,'" she said.

Thanks to scholarships she obtained through GeoFORCE, Marissa was able to attend UT. The transition was difficult, as it was for most of the five GeoFORCE students who entered the Jackson School that year. But the now-bonded group, with the help of GeoFORCE mentors, pushed through.

"We depended on each other a lot to help each other study, to help motivate each other to move forward," she said.

GeoFORCE would shape every aspect of Marissa's professional life from then on. She worked there every summer and was able to leverage contacts, such as mentor Eleanour Snow, to attend graduate school. It was during that time she realized academia was not the right professional fit, but that educational outreach might be. She sought the advice of then-GeoFORCE Director Samuel Moore, who welcomed her back as an educational observer to see how the program really worked.

From there, her path was set. She has since forged a successful career with the National Science Foundation, working for programs to broaden participation and help inspire kids much like herself. And this past summer back in Uvalde, in a "full circle moment for her family," her nephew started his third year with GeoFORCE, the Oregon trip.

"I think it's crucial for the rural communities to have something like this," Marissa said. "They feel seen and heard from something big like the University of Texas, and that's huge."

Since its start in 2005, GeoFORCE students have earned

91

bachelor's degrees in Geosciences

21

master's degrees in Geosciences

NEW CLIMATE DEGREE

The Jackson School of Geosciences is offering the first climate system science undergraduate major in the state of Texas

BY JULIA SAMES

OPPOSITE PAGE: PROFESSOR KERRY COOK (LEFT) AND ASSISTANT PROFESSOR GEETA PERSAD, THE ARCHITECTS OF THE NEW CLIMATE SYSTEM SCIENCE MAJOR. **PHOTO:** JACKSON SCHOOL.

A couple of years ago, when news first got around that the Jackson School of Geosciences would be creating a new climate system science major, some of the undergraduate students were pretty upset. Not because they disagreed with its creation, but because by the time it was finalized, they would be too far into their studies to be able to make it their major. The envy was rampant, said senior hydrology and water resources major Ben Kern.

"A lot of my classmates and a lot of people in my cohort are into geology and Earth science because they want to understand climate change," he said. "They want to be fighting that battle and better understanding the systems that are going to govern our future."

Perhaps no one can appreciate the far-reaching effects of climate change better than those who will be tasked to live through it longest: young people. As temperatures continue to creep up, the coming generations of university graduates will be entering adult life facing the unknowns that come with the ongoing changes in Earth's climate. This is the challenge of their generation, and the Jackson School intends to equip them with the knowledge and experience they'll need to make an impact.

This fall for the first time, Jackson School students were able to declare a major in climate system science, the first degree of its kind in the state of Texas. Not environmental science. Not sustainability. Not meteorology. True climate science: the quantitative study of all the complex ways that the atmosphere, biosphere, cryosphere, and hydrosphere interact to control the Earth's climate.

Taylor Roberts, a junior at the Jackson School, has always been interested in extreme weather and the ways that climate change can affect major weather events. She transferred to a climate system science major during this fall semester, as soon as she was able to. Based on her experience, she foresees that this will be a popular track.

"Especially at the Jackson School, it feels like everyone has their own need to make a positive impact, especially when it comes to climate," Roberts said.

It's been years since the Department of Earth and Planetary Sciences last added a major. Professor Emeritus Mark Cloos, who served as department chair from 1996 to 2000, remembers that the environmental science, teaching, and geosystems engineering degrees were all established in the late '90s. Since then, the Jackson School has had the same list of majors and essentially the same overall curriculum.

The decision to create an undergraduate major dedicated to the study of the climate system resulted from a combination of internal and external forces, including student involvement and employment opportunities. During the pandemic, Department Chair Danny Stockli began the process of a sweeping department-wide curriculum revision. The idea of a climate system science major came up organically in the process, bolstered by the sheer number of climate experts already in house. The department has 15 faculty members who specialize in either water, climate, or the environment. And along with researchers at the Bureau of Economic Geology and the University of Texas Institute for Geophysics, the Jackson School has expertise in every sphere of the climate system.

"We were talking about what skills and opportunities we want our students to have, and how do we best deploy faculty," Stockli said.

A new major that focused on climate science was the clear path.

As soon as this news broke, Professor Kerry Cook and Assistant Professor Geeta Persad volunteered to spearhead the development of the major. Cook had the very experience this task required; years ago, she helped establish the climate science major at Cornell University. And Persad, who at the time was new to the department, had already recognized a need for more climate-centric educational opportunities.

ABOVE: BEN KERN (LEFT) AND TAYLOR ROBERTS, UNDERGRADUATE STUDENTS AT THE JACKSON SCHOOL OF GEOSCIENCES. KERN IS A SENIOR HYDROLOGY AND WATER RESOURCES MAJOR. ROBERTS IS A JUNIOR WHO RECENTLY TRANSFERRED TO THE CLIMATE SYSTEM SCIENCE MAJOR THIS FALL. BOTH STUDENTS SAID THAT UNDERSTANDING CLIMATE CHANGE HELPED ATTRACT THEM TO THE GEOSCIENCES. **PHOTO:** JACKSON SCHOOL.

"It seemed very obvious to me that our geoscience school should be where the scientific basis for all the climate work on campus was happening," Persad said.

The curriculum they designed is comprehensive, emphasizing the basic science and mathematical tools needed for the rigorous scientific study of the climate system. The major is underpinned by foundational courses in physics, math, data science and computer science, along with an abundance of geoscience courses that cover the breadth of climate science.

One emphasis of the curriculum involves developing computational skills.

"The climate data being collected now is pushing the envelope for what we even call a big data set," Cook said. "Huge amounts of data are being collected. The challenge is in extracting knowledge from it. Our students will have the computer skills to do that."

Cook knows students are up for the challenge. Course enrollment data from previous semesters shows that students are already interested in climate-focused courses. Plus, climate system science is an inherently interdisciplinary area of study, and that appeals to the sensibilities of incoming students, Cook said.

"Climate science is a very natural way to become interdisciplinary because the atmosphere and the ocean are strongly interactive with each other. You can't understand one without understanding the other, let alone interactions with

ABOVE: RESEARCHERS FROM THE JACKSON SCHOOL OF GEOSCIENCES EXAMINE AN AEROSOLS MAP AT THE TEXAS ADVANCED COMPUTING CENTER VISUALIZATION LAB. FROM LEFT TO RIGHT: GRADUATE STUDENT SEBASTIAN UTAMA, POSTDOCTORAL FELLOW IFEANYICHUKWU NDUKA, AND GRADUATE STUDENT CAMERON CUMMINS.
PHOTO: JACKSON SCHOOL.

the biosphere, the cryosphere and the land surface. So it's very attractive to students for that reason," Cook said.

In addition to employment opportunities in the public and private sectors upon graduation, climate system science graduates will be qualified for admission to graduate programs in climate science, atmospheric science, oceanography and other related disciplines.

Every facet of human life, ecosystems and the physical Earth itself have already been affected by climate change. As climate change progresses, so will humanity's need for better data, broader understanding and creative problem-solving. Climate system science is a relatively young field, and climate change is a problem that has been emerging more quickly than society can train itself to deal with.

Persad said that in order to adequately address these needs, a sea change is needed in the way organizations set goals and operate: Climate science will need to be baked into the foundation of their policies and infrastructure. For this to happen, more people need to be entering the workforce with a technical understanding of the climate system.

"You need people who understand the dynamics of what is happening to work with everyone else to design the policies, solutions and infrastructure. Right now, neither the workforce nor the protocols exist," she said.

That's changing bit by bit. The insurance, finance, agriculture, manufacturing, supply chain, and logistics industries are just a few examples of where climate science is being considered in decision making and policies. And in Austin, as in other cities globally, the city government is taking a proactive approach in tackling infrastructure planning.

Last year, The University of Texas at Austin and City of Austin created the UT-City Climate CoLab, a unique project in which researchers at the Jackson School and UT's Planet Texas 2050 initiative provide hyper-localized climate data to city leaders, staffers and the Austin community. As climate change continues to put its imprint on communities, the city understood that local climate projections must be built into their infrastructure planning.

This kind of localized data isn't something city planners can find on their own; researchers must generate the data based on larger climate models and combine the information with localized concerns. During the spring, the CoLab released its first technical report, which includes temperature, precipitation and wind projections up to the year 2100. This ushers in a new era for city planning documents, which are

often designed to be used for decades and usually rely on historical data.

But Zach Baumer, chief sustainability officer for the City of Austin, noted that historical data isn't going to cut it for future planning anymore.

The City of Austin is currently working on updating its 100-year water plan to include this new climate data. This is another project where UT researchers, particularly Jackson School climate scientists, are playing a leading role. Projections of higher temperatures, volatile rain levels, and a growing population are all being incorporated into this revision, Baumer said.

"When you're looking at how the climate's changing, you need to understand scientifically what's going to happen," he said. "UT has people who can get that knowledge, but it's only useful if you can convert it into language that water and utilities people can understand, and make it useful for them to incorporate that science into the planning, the engineering, and the money that they're going to spend."

In the private sector, climate science has become integral to the business model of insurance and risk analysis companies. In 2017, Josh Hacker co-founded the climate risk analysis firm Jupiter Intelligence, sensing a nascent demand for improved, specific climate data that companies can plan around. Jupiter's current clients include three of the top five U.S. banks, energy and utilities companies, private equity firms, and a wide range of corporations including, for example, the pharmaceutical company AstraZeneca.

AstraZeneca has production facilities all over the world and relies on the security of its supply chain. So, the company wants to be aware of its risk exposure to physical hazards as they change over time, Hacker said.

Another emerging need is in government-mandated climate risk assessments. Many larger companies are already compelled to share financial risks with their shareholders, but in Europe regulators are now requiring that they also disclose climate risk. This will affect an additional 50,000 companies during the next two to three years, Hacker noted.

However, Jupiter and other risk analysis firms can only be part of the equation. Organizations are going to need climate translators in house.

"I've had companies ask me, where do we find these people?" Hacker said. "There's no doubt in my mind that there will be growth in this field."

That growth could include people such as Taylor Roberts. She doesn't know yet where her climate science degree will lead her, but she hopes to continue studying the relationship between climate and weather in a master's or doctoral program. She feels a sense of duty and urgency to continue to help mitigate the effects of climate change, even if it's on a small scale.

"I couldn't imagine studying anything else. This gives me a sense of purpose," Roberts said.

Climate System Science Faculty

Jay L. Banner
Geochemistry, paleoclimate reconstruction, karst hydrology

Daniel O. Breecker
Stable isotopes, soils, carbon cycle

M. Bayani Cardenas
Hydrology, water resources, water quality

Ginny Catania
Ice sheet dynamics, ice-ocean interactions, ice-bed interactions

Kerry Cook
Climate dynamics, atmospheric dynamics, climate modeling

Anna Ruth Halberstadt
Ice sheet dynamics, paleoclimate, Antarctica

Patrick Heimbach
Global ocean circulation, ice sheet dynamics, climate change

Marc A. Hesse
Groundwater, geological carbon storage, firn hydrology

Ashley M. Matheny
Ecohydrology, biometeorology, land-atmosphere exchange

Dev Niyogi
Extreme weather and tropical systems, urban meteorology, land-atmosphere interaction

Geeta Persad
Aerosol pollution, global climate modeling, climate risk

Daniella Rempe
Hydrology, geomorphology, ecohydrology

Timothy M. Shanahan
Climate variability, climate change, paleoclimatology

Zong-Liang Yang
Hydrometeorology, climate resilience, land-atmosphere interaction

New Curriculum Opens Doors to the Geosciences

The path that Jackson School of Geosciences students take to complete their bachelor's degree became more welcoming, unified, and holistic this fall as the Department of Earth and Planetary Sciences rolled out its revised undergraduate curriculum.

"It's three things," said Department Chair Danny Stockli. "We have a much bigger aperture of taking students in. We want to give them more fundamental basic skills. And then we want to expose them to the breadth of geosciences before they decide on their major."

For decades, undergraduate students would enter the Jackson School as general geology majors, and from there decide if they wanted to switch to a different major within the school.

Now, students start their education in the geosciences by choosing an introductory course that piques their interest. It could be Dinosaurs, National Parks, Earth in 2100, or Physical Geology, for example. This is meant to cast a much wider net to attract students with a diverse range of interests to the geosciences.

From there, students will take courses that strengthen their skills in computational literacy, geospatial tools, data analysis, and machine learning.

Importantly, all students will take the same three required foundational courses from all three programmatic subject areas of the geosciences: lithosphere and deep earth; subsurface, surface, and life; and water, climate, and the environment. This means that all students will graduate with an understanding of key geoscientific concepts, from the rock cycle to climate change.

"This is structured as a holistic educational experience," Stockli said. "Students are going to be better prepared for whatever (geosciences) major they choose down the road."

Machine Learning for Geoscientists

There's a trove of potential discoveries about the Earth hidden among large data sets—from improved climate models to forecasting quakes. But uncovering them will take data science skills.

A new machine learning certificate program launched by the Jackson School of Geosciences is helping equip students with the skills needed to process and analyze the huge data sets that increasingly define many areas of geosciences research.

Students enrolled in the program will learn the programming language Python, how to code AI models and AI-driven visualizations. They will also complete a research project where they can apply their skills to a geosciences question.

While developed with the geoscientist in mind, the certificate is open to all degree-seeking graduate students at The University of Texas at Austin.

To learn more visit:
www.jsg.utexas.edu/ai-certificate

Undergraduate Course Enrollment on the Rise

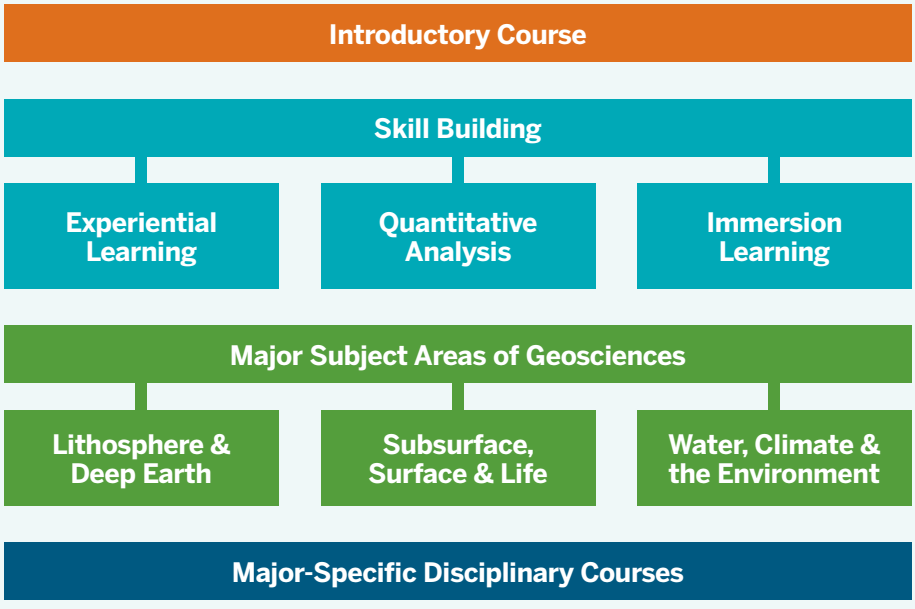
The number of total credit hours that students are taking at the Jackson School of Geosciences grew by 19% from the 2022–2023 academic year to the 2023–2024 year. The huge uptick—from 14,233 credit hours to 16,950 credit hours—bucks the downward trend most geoscience schools are experiencing, both nationally and internationally.

The Department of Earth and Planetary Sciences' introductory courses are a big driver of this growth. Even if students do not go on to major at the Jackson School, undergraduates are increasingly choosing to fulfill their natural sciences requirement here.

Veronica Vasquez, the Jackson School's assistant dean of academics and student affairs, foresees that with the introduction of the department's new Climate System Science major this fall, the student credit hour numbers will only continue to increase.

Geosciences Curriculum

No matter their major, undergraduate students at the Jackson School of Geosciences now share a common foundation in knowledge and skills.



GEO660

ABOVE: UNDERGRADUATE STUDENT RALEIGH BURTON USES A GEOLOGICAL MAP AND THE SURROUNDING OUTCROP TO DRAFT A GEOLOGICAL CROSS SECTION THROUGH THE SAN RAFAEL SWELL IN CENTRAL UTAH DURING THE GEO 660A (GROUP 1) TRIP. **BELOW LEFT:** A GROUP SHOT OF GEO 660A (GROUP 1) WHILE WALKING UP GENTILE WASH IN THE BOOK CLIFFS OF UTAH. **BELOW RIGHT:** STUDENTS MADDOX HIGBEE, CAMILA VAN DER MAAL AND JANET CAÑAMAR DRAFTING AND CORRELATING THEIR MEASURED SECTIONS THROUGH THE KENILWORTH MEMBER OF THE BLACKHAWK FORMATION OF THE BOOK CLIFFS.

PHOTOS: MATT MALKOWSKI.

This year, the Jackson School of Geosciences capstone field camp began a new split structure. The course is now divided into GEO 660A and GEO 660B, with each course running for three weeks during the May term.

Due to high enrollment, GEO 660A was divided into two groups with the same learning objectives but different field areas. Group 1 explored West Texas and New Mexico with Charlie Kerans and David Mohrig. They then headed to Utah with Matt Malkowski and Peter Flemings.

Group 2 explored Utah with Cornel Olariu and Brian Horton before heading to New Mexico with Jim Gardner and Kenny Befus.

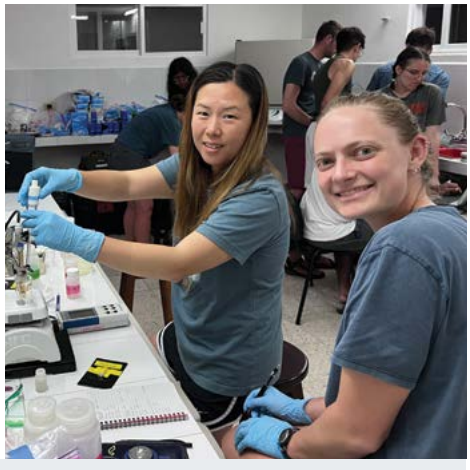
GEO 660B focused on structural geology, tectonics and landforms. This group, led by Peter Hennings, Danny Stockli, Craig Martin and Miriam Barquero-Molina, visited Utah, southern Montana, and western Wyoming.

ABOVE: INSTRUCTOR KENNY BEFUS TEACHES STUDENTS FROM GEO 660A (GROUP 2) HOW TO PAN FOR HEAVY MINERAL SEPERATES IN THE RIO GRANDE IN NEW MEXICO.
RIGHT: STUDENTS IN GEO 660A (GROUP 2) FINISHING THEIR MEASURED SECTION TO DOCUMENT THE FINAL SEA LEVEL TRANSGRESSION OF THE KENILWORTH MEMBER IN UTAH.
BELOW: STUDENTS AND INSTRUCTORS FROM GEO 660B LOOKING AT AN EXPOSURE OF THE MOAB FAULT RIGHT OUTSIDE ARCHES NATIONAL PARK IN MOAB, UTAH.

PHOTOS: WADE AUBIN, MATT MALKOWSKI, MIRIAM BARQUERO-MOLINA.

BELOW: GROUP PHOTO OF THE GEO 660B CLASS BENEATH THE DELICATE ARCH IN ARCHES NATIONAL PARK IN MOAB, UTAH.

PHOTO: MIRIAM BARQUERO-MOLINA.



hydro

This year's hydrology field camp spanned from the banks of the Lower Colorado River, to the Texas Hill Country, to the Yucatán Peninsula. In Mexico, the camp studied groundwater-seawater interactions in the fishing village of Celestún before traveling inland to study (and cool off) in the cenotes that ring the city of Mérida.

TOP LEFT: MARIA HERRERA, ARUSHI BISWAS, PARKER ANDERSON AND BEN KERN TAKING A BREAK AT THE BEACH IN CELESTÚN, MEXICO. **TOP RIGHT:** INSTRUCTOR MARCUS GARY TEACHING STUDENTS HOW TO MEASURE STREAMFLOW OF CYPRESS CREEK. **MIDDLE LEFT:** ESHA KRISHNAN, MATAN LEBOVITS AND CLEO CHIU SURVEYING WELL LOCATIONS WITH A TOTAL STATION. **MIDDLE RIGHT:** MIELLE LEE AND RILEY GARRETT TITRATING WATER SAMPLES TO MEASURE ALKALINITY.

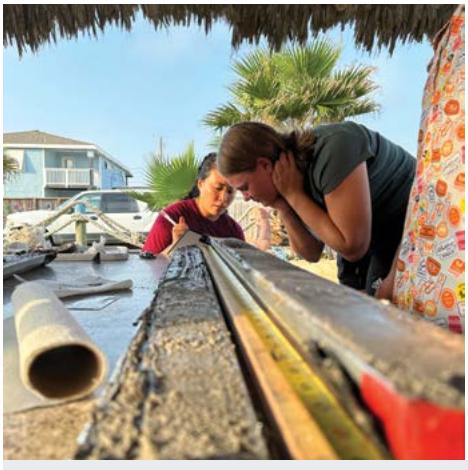
PHOTOS: BAYANI CARDENAS.

LEFT: STUDENTS MEASURING WATER QUALITY WITH A SPECTROPHOTOMETER (LEO DIMAURO, CALEB GARCIA QUIBALLO, ZOE CLARK, SYDNEY COLE, WITH PROFESSOR TIM SHANAHAN IN THE FOREGROUND).

PHOTO: BAYANI CARDENAS.

MG&G

The Marine Geology and Geophysics Field Course returned to Port Aransas this year to study the geologic history of Corpus Christi Bay, Aransas Bay, and surrounding waters. Students traveled from Laguna Madre in the south to the mouth of the Mission River in the north to collect geophysical, sedimentological and aerial data.



ABOVE LEFT: INSTRUCTOR DAN DUNCAN SUPERVISES AS EMA PARKER, ENRIQUE MORALES AND EMILY HUGO PREPARE TO TAKE GRAIN SIZE MEASUREMENTS IN THE SEDIMENTOLOGY LAB AT THE J.J. PICKLE RESEARCH CAMPUS. **ABOVE RIGHT:** INSTRUCTOR DALLAS SHERMAN SUPERVISES ENRIQUE MORALES, EMA PARKER AND EMILY HUGO AS THEY DIG A TRENCH ON MUSTANG ISLAND. **MIDDLE LEFT:** MIKAYLA PASCUAL AND EMILY HUGO EXAMINE A CORE FROM THE MISSION RIVER DELTA. **MIDDLE RIGHT:** STUDENTS UNLOAD GEOPHYSICAL EQUIPMENT FROM THE TRUCK IN ARANSAS PASS, TEXAS.

PHOTOS: CHRIS LOWERY, JINGXUAN WEI.

RIGHT: STUDENTS SET UP MULTIBEAM EQUIPMENT ON THE R/V SCOTT PETTY AT THE UT MARINE SCIENCE INSTITUTE IN PORT ARANSAS, TEXAS.

PHOTO: CHRIS LOWERY.

SCOTT PETTY JR (CENTER-LEFT) WITH DAUGHTERS JOAN PETTY (LEFT) AND SUSAN PETTY AND SON SCOTT JAMES PETTY. **INSET:** SCOTT PETTY JR. AND WIFE ELEANOR.

Petty Enters Hall of Distinction

The Jackson School of Geosciences inducted longtime supporter Scott Petty Jr. into its Hall of Distinction in Spring 2024.

Petty and his family are champions of geophysics at The University of Texas at Austin. They have generously supported the school in a number of ways, most recently establishing a new endowment, the Scott Petty Jr. Endowed Chair, to support the director of the University of Texas Institute for Geophysics.

Previously Petty established the Scott Petty Marine Geology and Geophysics Fund and donated a research boat, the Scott and Eleanor Petty Coastal Research Vessel, to be used for the Marine Geology and Geophysics field camp and the Rapid Response program. Petty also established a maintenance fund for the boat and continues to actively participate in the field camp program by attending student presentations and providing advice and support. He also continues to contribute to the O. Scott Petty Geophysical Fund, which was established by his father.

Although not an alumnus of the Jackson School, Petty received bachelor's and master's degrees in petroleum engineering from UT, and his family has long ties to it. His father served on the advisory council from 1955 to 1969, and was then elected an honorary life member. Scott Petty Jr. joined the council and served from 1969 to 1990. He has also served as a leader of many professional organizations, including the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, the Society of Petroleum Engineers, the Association of Professional Engineers, the Geologists and Geophysicists of Alberta, the Geophysical Society of Houston, the South Texas Geological Society, and the Texas Land & Mineral Owners Association.

Petty joins his father, who was inducted into the Hall of Distinction in 2016, the first father-and-son members.

"Every day as I walk into the dean's office, I see the name plaques for each member of our Hall of Distinction and I silently acknowledge the important ways that this special group has demonstrated, through their distinguished careers and commitment to the school, the best qualities of what we hope for in the future leaders we teach," said Dean Claudia Mora. "With all of Scott's active support for geophysics across the school — and most importantly for the Institute for Geophysics — he is highly deserving of being a member of the Hall of Distinction."

UT Advances in XPRIZE Competition To Fight Fire With UAVs

Researchers from UT have advanced to the next stage of the XPRIZE Wildfire challenge — a four-year global competition to use uncrewed aerial vehicles (UAVs) to find and fight wildfires in minutes flat.

The researchers are part of team Texas-Soton, a multidisciplinary group of geoscientists and engineers from institutions in Texas and Europe. The team was one of 29 selected to advance to the next stage and to equally share a $750,000 milestone prize.

The Jackson School of Geosciences has two team members: Associate Professor Ashley Matheny and Research Assistant Professor James Thompson.

The State of Texas Advanced Resource Recovery (STARR) program at the Bureau of Economic Geology is also supporting the team.

EER Student Earns Outstanding Student Award From Carbon Storage Summer School

PREVINA ARUMUGAM (SECOND FROM LEFT)

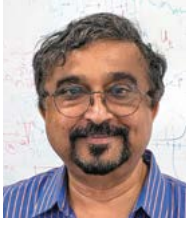
Previna Arumugam, a graduate student in the Energy and Earth Resources master's program, received an Outstanding Student Award from the 2024 International CCS Summer School.

The summer school is a prestigious week-long course run by the International Energy Agency that delves into various aspects of the carbon capture and storage industry.

Over 200 people, both professionals and students, applied to the program, which took place in Darwin, Australia. Previna was one of 45 participants from 28 countries. Katherine Romanak, a research professor at the Bureau of Economic Geology's Gulf Coast Carbon Center, was an instructor for the program.

Previna is a graduate research assistant at the Gulf Coast Carbon Center and is advised by Research Associate Professor Alex Bump. Her research focuses on the lateral migration of subsurface carbon dioxide and efficient detection of unintended plume migration to ensure safe and secure containment.

Sen Named Global Lecturer for AI-Driven Seismic Imaging Course



Mrinal Sen, a professor and a pioneer in machine learning for seismic imaging, has been selected by the Society of Exploration Geophysicists (SEG) as the speaker for its 2024 Distinguished Lecture Short Course.

Sen will set off on a global tour to present his research to the SEG's worldwide members and non-members. Sen was announced as the 2024 instructor at SEG's International Meeting for Applied Geoscience & Energy (IMAGE) conference in Houston in August, where he presented the first course.

In preparation for the tour, Sen has written a short book about machine learning in seismic imaging that participants will receive as part of the course.

"I was both happy and honored that they asked me to present the course," Sen said. "It's obviously a lot of work, but it's very close with my current research, so I think I can offer something that companies, researchers and students will find valuable."

Sen is a professor in the Department of Earth and Planetary Sciences and conducts research at the University of Texas Institute for Geophysics.

In the 1990s Sen was among the first to use an early form of artificial intelligence called neural networking to fill gaps in patchy seismic data. Since then, his research group has developed numerous methods combining mathematics with the latest computational technology. These accomplishments have led to academic and industry accolades for Sen, his research colleagues and students. This includes Sen earning SEG's prestigious Virgil Kauffman Gold Medal in 2018.

In addition to speaking to global audiences, Sen has played a key role in advancing machine learning for seismic imaging at the Jackson School. This year, the school launched a new certificate program in machine learning and data analytics for geosciences, developed and taught by Sen.

Sen's short course, "Physics and Data Driven Seismic Data Analysis: A Narrative of Two Approaches," is open to members and non-members of SEG. Learn more or register at ***seg.org/education/courses/mrinal-sen-disc***

Rempe Recognized for Early Career Contributions

Daniella Rempe, an associate professor in the Department of Earth and Planetary Sciences, has received the American Geophysical Union's Early Career Award in Hydrologic Sciences.

The award recognizes outstanding contributions to hydrology through research, education and societal impacts.

Rempe studies groundwater and soil moisture and its relationship to drought and climate change. She said that the award was validation for her work and the work of those with whom she has collaborated.

"An award like this is not just about me. It represents a lot of people and a lot of effort, and that's what we're all celebrating," she said.

Jackson School Professor Bayani Cardenas, who nominated Rempe, said that she is a highly sought-after researcher with a knack for getting field measurements in difficult places.

"She's also a dedicated teacher who has instituted changes to our teaching that are impressive for anyone, let alone someone at such an early career stage," he said.

Rempe has developed novel research techniques to measure moisture and gases in deep bedrock. Her work is especially relevant to studying the critical zone — the part of the natural world where life flourishes, and usually defined as the bottom of groundwater to the top of tree canopies.

Notable findings from Rempe include the discovery that trees widely use bedrock moisture as a water reserve, which can help sustain them during drought, and taking some of the first carbon dioxide measurements from within forest bedrock. This research found that nearly a third of CO_2 released by forests comes from microbes in rock fractures far beneath the soil.

Dean Mora Named President-Elect of AGI

During the summer, the American Geosciences Institute (AGI) board of directors elected Claudia Mora, the dean of the Jackson School of Geosciences, to serve as the institute's next president.

Mora will serve as president-elect during the next year and then begin her term as president in 2026.

AGI is one of the leading professional organizations for geoscientists. The president serves as its ambassador and chief spokesperson, representing more than 40 scientific and professional organizations and a worldwide AGI membership of over a quarter-million earth, atmospheric and ocean scientists.

Faculty Fellows

Six faculty members at the Jackson School of Geosciences were elected fellows of professional scientific societies, an honor that recognizes scientific achievement and service.

Bridget Scanlon, Fellow of the American Association for the Advancement of Science (AAAS)

Research Professor Bridget Scanlon was among 11 faculty members at The University of Texas at Austin who were elected fellows of the AAAS. Eligible nominees are members whose efforts for the advancement of science or its applications are scientifically or socially distinguished. Scanlon is a leading authority on water resources, including its usage, storage and conservation.

Demian Saffer, Fellow of the American Geophysical Union (AGU)

The University of Texas Institute for Geophysics Director Demian Saffer has been named an AGU fellow, the organization's highest honor. Only a tiny fraction (0.1%) of its 40,000 members achieves this status. According to AGU, Saffer was selected for "leadership in unifying the hydrological, mechanical and geological study of earthquakes and subduction dynamics."

Zong-Liang Yang, Fellow of the American Meteorological Society (AMS)

Professor Zong-Liang Yang was elected a 2025 fellow of the AMS, an honor that recognizes outstanding contributions to the atmospheric or related oceanic or hydrologic sciences or their applications during a substantial

Mora joins a roster of AGI presidents from The University of Texas at Austin. They include Jackson School deans emeriti Sharon Mosher (2012-2013), William Fisher (1990-1991) and Peter Flawn (1987-1988), and Scott Tinker, the former director of the school's Bureau of Economic Geology (2015-2016).

Olariu Awarded Dickinson Medal

During the 19 years Cornel Olariu has spent as a researcher at the Jackson School of Geosciences, he has written 85 peer-reviewed papers published around the globe, received $6 million in funding as a principal investigator or co-PI for research projects, and has supervised 23 master's and doctoral students through to their graduation. Olariu, a research associate professor in the Department of Earth and Planetary Sciences, is known in particular for his field work, which provides new insights on how surface rivers, waves and tides shape marine and lake deltas.

For his many innovative contributions to the field of sedimentology, the Society for Sedimentary Geology awarded Olariu the William R. Dickinson Medal in 2023. While most awards tend to be bestowed at the culmination of a researcher's long career, this is an award given to recognize excellent mid-career scientists on the path to great discoveries.

Former Department Chair Ron Steel worked closely with Olariu for years at the Jackson School of Geosciences and wrote the announcement that came with his award.

"Over his career so far, Cornel Olariu and his students have made very significant advances into new emergent themes in sedimentology and basin analysis," Steel wrote. "Cornel's work illustrates well that careful outcrop documentation (extended greatly with drone-collected data) and extended even further with the use of subsurface datasets lead to influential innovative results in sedimentology and basin analysis."

Olariu made a name for himself with his research on Utah's Book Cliffs, a popular destination for geology student trips and industry geoscientists to explore. These groups often refer to his papers in their studies of the outcrops. Olariu came to The University of Texas at Austin in 2005 as a post-doctoral scholar.

period of years. Yang's research focuses on understanding and modeling interactions between the land and atmosphere, with his models used at centers around the globe.

Michael Young, Fellow of the American Society of Agronomy (ASA)
Associate Dean for Research Michael Young was named a fellow of the ASA, the highest recognition bestowed by the organization. It is based on professional achievements and meritorious service. Young has over 35 years of professional experience in academic research, federal regulatory oversight and private industry. His research spans the general areas of environmental geosciences, hydrology, and soil sciences and physics.

Daniel Breecker, Fellow of the Geological Society of America (GSA)
Professor Daniel Breecker is among two faculty members at the Jackson School of Geosciences to be named a GSA Fellow in 2024. Breecker's nomination highlighted sustained achievements in research, mentoring and training geoscientists. Breecker began teaching at the Jackson School in 2009 and studies biogeochemical processes occurring at or near the land surface.

Mark Helper, Fellow of the Geological Society of America (GSA)
Distinguished Senior Lecturer Emeritus Mark Helper also has been named a GSA Fellow. Helper taught at the Jackson School of Geosciences for 32 years and was field camp director until his retirement in 2022. The fellowship nomination cited Helper's impact on the nation's geoscience education and especially his contributions to NASA's astronaut training in geology.

Cardenas Named 2025 BDL Lecturer

Next year, Jackson School of Geosciences Professor Bayani Cardenas will be going on a world tour — giving talks at institutions around the world as the 2025 Birdsall-Dreiss and LaMoreaux International Distinguished Lecturer (BDL).

The Hydrogeology Division of the Geological Society of America (GSA) announced Cardenas as the upcoming BDL lecturer in September. He already has 50 talks scheduled in nine countries, which he plans to deliver in person.

"It's pretty surreal," Cardenas said. "It's going to be a once-in-a-lifetime experience."

The international talks presented as part of the BDL lectureship are funded by GSA's LaMoreaux fund and are referred to as LaMoreaux Lectures.

Founded in 1978, the BDL Lectureship provides funding for outstanding scientists working in the field of hydrogeology to visit other institutions and give talks about their research. There are no applications for the position. Instead, each year a panel of former BDL lecturers reviews nominations and makes their choice solely on the reputation of prospective candidates for their research excellence and ability to communicate.

Cardenas holds the J. Nalle Gregory Regents Professorship in Geological Sciences in the Jackson School's Department of Earth and Planetary Sciences. His research examines hydrologic flow and transport processes in a variety of scales and settings, from Arctic permafrost to tropical reefs.

Cardenas is the third BDL lecturer from The University of Texas at Austin. Previous UT lecturers are Charles Kreitler (1985) and Bridget Scanlon (2007).

The lectureship runs from January to December of 2025.

AAPG Honors Flemings With Berg Award

Jackson School of Geosciences Professor Peter Flemings is the recipient of the 2024 Robert R. Berg Outstanding Research Award, a top honor bestowed by the American Association of Petroleum Geologists, a worldwide professional association.

During his career, Flemings has worked to apply his academic research to bring about real-world breakthroughs. His work analyzing how pressure within Earth's crust is controlled by geology and fluid flow, for example, shaped how oil companies now safely search for hydrocarbons.

His research was fundamental in understanding the geologic conditions that contributed to the 2010 Deepwater Horizon blowout in the Gulf of Mexico. For two months after the oil spill, Flemings served as a member of Energy Secretary Steven Chu's BP Macondo Well Integrity Team in Houston.

PETER FLEMINGS (CENTER WITH GLASSES)

Flemings' most recent project involves retrieving samples of methane hydrates from deep beneath the Gulf of Mexico's seafloor. He is leading the Department of Energy-funded project to study the energy-rich substance that makes up as much as 20% of the world's mobile carbon.

The Berg Award recognizes a singular achievement in petroleum geoscience research. Flemings is the fifth scientist affiliated with the Jackson School to receive it.

Demian Saffer, the director of the University of Texas Institute for Geophysics, said that Flemings had earned his place in the hall of fame of petroleum geophysicists.

"Peter has made foundational contributions to the science of fluid flow in the subsurface, and pioneered methods that have profoundly changed our understanding of forces shaping sedimentary basins and continental margins. On a practical level, his work has modernized how we explore petroleum systems," Saffer said. "In many ways, this award is about more than any one achievement. It's about Peter's ability to straddle between the fundamental and the practical."

Milliken Wins Pettijohn Medal

Research Professor Kitty Milliken has been awarded the Francis J. Pettijohn Medal in recognition of "excellence in sedimentology" by the Society for Sedimentary Geology (SEPM).

The Pettijohn Medal is awarded to those who have a significant record of outstanding contributions in sedimentary geology, including all aspects of sedimentology and stratigraphy. Its recipients are eligible to be later nominated for the Twenhofel Medal, SEPM's highest award. All nominees must have at least 20 years of experience since earning their doctoral or equivalent degree.

Milliken joined the Bureau of Economic Geology in 2008. She earned a bachelor's degree in geology from Vanderbilt University in 1975 and master's and doctoral degrees in geology from The University of Texas at Austin in 1977 and 1985.

Banner Named Top Teacher

Jay Banner, a professor in the Department of Earth and Planetary Sciences and the director of the Environmental Science Institute, is the 2024 recipient of the Robert Foster Cherry Award for Great Teaching, one of the highest honors for teaching in the world. The award is conferred by Baylor University. See story on page 47.

TRAVIS STONE

SINJINI SINHA

ERIC HIATT

TREVOR BROOKS

Jackson School Students Win Top TA Awards

The Jackson School of Geosciences was the best represented school among the January 2024 winners of the Outstanding TA Award from the National Association of Geoscience Teachers (NAGT).

Three Jackson School students — Eric Hiatt, Sinjini Sinha and Travis Stone — were among the 14 teaching assistants to be honored in January. The Jackson School winners are all doctoral students in the school's Department of Earth and Planetary Sciences. Fellow doctoral student Trevor Brooks also won an Outstanding TA Award later in 2024.

Department Chair Danny Stockli noted that talented teaching assistants are critical to the success of the department's teaching mission.

"These four students are wonderful examples of what it means to go beyond expectations in contributing to our goal of educational excellence. A well-deserved recognition," he said.

Winners receive a one-year membership in the NAGT, which includes an online subscription to the *Journal of Geoscience Education* and the organization's quarterly magazine, *In The Trenches*.

Undergraduate and graduate students are eligible for the award. Students are selected based on nominations from people familiar with their instruction and outcomes in the classroom.

Professor Sean Gulick nominated Hiatt, who taught the fall semester of Gulick's GEO 416E course, "Solid Earth Processes." Professor Rowan Martindale nominated Sinha and Stone, who taught lab and lecture sections for Martindale's GEO 405 course, "Life Through Time." Stone also developed virtual field trips used by the new GEO 416S course, Earth and Planetary Processes Through Time. Professor Dev Niyogi nominated Brooks, who taught the GEO 303E, "Earth in 2100" course; and EJC 311, "Introduction to GeoHealth & Climate."

Awards

Common Abbreviations:

AAAS ..... American Association for the Advancement of Science
AAPG ..... American Association of Petroleum Geologists
AGU ..... American Geophysical Union
AMS.... American Meteorological Society
BEG ..... Bureau of Economic Geology
CPSH ..... Center for Planetary Systems Habitability
EPS..... Department of Earth and Planetary Sciences
GSA .....Geological Society of America
GSEC..... Graduate Student Executive Committee
JSG..... Jackson School of Geosciences
SEG.. Society of Exploration Geophysicists
SEPM.... Society for Sedimentary Geology
UTIG..... Institute for Geophysics

FACULTY & RESEARCHERS

SAHAR BAKHSHIAN
Tinker Family Publication Award, BEG

JAY BANNER
Robert Foster Cherry Award for Great Teaching, Baylor University

SHUVAJIT BHATTACHARYA
A.I. Levorsen Memorial Award — Best Oral Presentation, AAPG Gulf Coast Section

DANIEL BREECKER
Fellow, GSA

ALEX BUMP
Tinker Family Publication Award, BEG

BAYANI CARDENAS
Knebel Teaching Award: Field/ Experiential Education, EPS
Birdsall-Dreiss and LaMoreaux International Distinguished Lecturer, GSA

ALEJANDRO CARDONA
Director's Circle of Excellence, UTIG

GINNY CATANIA
Director's Circle of Excellence, UTIG

YANGKANG CHEN
AETA Earthquake Prediction AI Algorithm Competition, 1st Place, AETA & Peking University
Top Cited Article Award, JGR: Solid Earth, AGU

DANIEL DUNCAN
Eleanor Picard Excellence Award, UTIG

DALLAS DUNLAP
Tinker Family Publication Award, BEG

PETER FLEMINGS
Robert R. Berg Outstanding Research Award, AAPG
Director's Circle of Excellence, UTIG

SERGEY FOMEL
Best Paper, Interpretation, SEG

CYRIL GRIMA
Director's Circle of Excellence, UTIG

MARK HELPER
Fellow, GSA

BRIAN HORTON
Director's Circle of Excellence, UTIG

SEYYED HOSSEINI
Tinker Family Publication Award, BEG

SUSAN HOVORKA
Tinker Family Publication Award, BEG

STEPHEN LAUBACH
Honorary Member, AAPG
Fellow, Albert W. & Alice M. Weeks Centennial Professorship in Geological Sciences, JSG

BOB LOUCKS
President's Award for Outstanding Paper, AAPG Gulf Coast Section

MATT MALKOWSKI
Knebel Teaching Award: Intro Course, EPS

ROWAN MARTINDALE
Knebel Teaching Award: Undergraduate Upper Division, EPS

ASHLEY MATHENY
Demonstration State, XPRIZE Wildfire Challenge, XPRIZE Foundation

TIP MECKEL
Tinker Family Publication Award, BEG

KITTY MILLIKEN
Francis J. Pettijohn Medal, SEPM

CLAUDIA MORA
President-Elect, American Geosciences Institute

HAILUN NI
Tinker Family Publication Award, BEG

DEV NIYOGI
Future Horizons in Climate Science-Turco Lectureship, AGU

CORNEL OLARIU
William R. Dickinson Medal, SEPM

IULIA OLARIU
Tinker Family Publication Award, BEG

GEETA PERSAD
Knebel Teaching Award: Teaching Innovation, EPS

ROB REED
President's Award for Outstanding Paper, AAPG Gulf Coast Section

DANIELLA REMPE
Early Career Award in Hydrologic Sciences, AGU

DEMIAN SAFFER
Fellow, AGU

BRIDGET SCANLON
Fellow, AAAS

MRINAL SEN
Distinguished Instructor Short Course, SEG

KRISTA SODERLUND
Outstanding Researcher Award, UTIG

KYLE SPIKES
Knebel Teaching Award: Intro Course, EPS

DANNY STOCKLI
Knebel Teaching Award: Graduate, EPS

JAMES THOMPSON
Demonstration State, XPRIZE Wildfire Challenge, XPRIZE Foundation

ALICE TURNER
Outstanding Postdoc Award, UTIG

LEAH TURNER
Women in Energy Pinnacle Award, Hart Energy

ZONG-LIANG YANG
Fellow, AMS

QIQI WANG
Jackson School Best Graduate Paper, Runner-up, EPS

KEHUA YOU
Outstanding Young Researcher Award, UTIG

MICHAEL YOUNG
Fellow, American Society of Agronomy

STUDENTS

LEENA ABDULQADER
Al-Masri Fellowship, JSG

TAUFIK AL AMIN
Charles A. Caughey Graduate Fellowship, JSG

RAWAN ALASAD
Best Ph.D. Talk, Spring 2024, EPS

ABDULKARIM AL-HUSSAINI
Robert K. Goldhammer Memorial Grant, AAPG Foundation

PREVINA ARUMUGAM
Outstanding Student, 16th International CCS Summer School, International Energy Agency Green House Gas
Go Further Fund Award, JSG
Energy & Earth Resources Fellowship Award, JSG
TEX-E Fellow, Texas Exchange for Energy & Climate Entrepreneurship

SOPHIA BAUTISTA
Outstanding Student Presentation Award, AGU
Travel Grant, National Association of Geoscience Teachers

SARAH BROOKER
Lipman Student Research Grant, GSA
Ronald K. DeFord Field Scholarship, JSG

TREVOR BROOKS
Outstanding Teaching Assistant Awards, National Association of Geoscience Teachers

GRACIELA LOPEZ CAMPOS
Endowed Graduate Fellowship, UTIG

EDWARD CLENNETT
Dorothy Ogden Carsey Fellowship, JSG
William R. Muehlberger Graduate Fellowship in Structural Geology/ Tectonics, JSG
Endowed Graduate Fellowship, UTIG
Outstanding Graduate Student Award, UTIG

ETHAN CONRAD
Endowed Graduate Fellowship, UTIG

SUSAN COOK
Estwing Hammer Award, Runner-up, EPS

ROBERT DOMEYKO
Outstanding Student Presentation Award, AGU

WILLIAM EAGLE
Udall Undergraduate Scholarship, Udall Foundation

SHUANG GAO
Best Paper, Interpretation, SEG
Chevron Energy Graduate Fellow, UT Austin Energy Institute

ERIC HIATT
Outstanding Teaching Assistant Awards, National Association of Geoscience Teachers

COLLIN HOFFMAN
Undergraduate Petrography Contest, 2nd Place, EPS

SHUHUA HU
Student Scholarship, Geophysical Society of Oklahoma City
75th Anniversary Scholarship, SEG
David R. Lammlein Scholarship, SEG
ExxonMobil Upstream Research Co. Scholarship, SEG

QUINN JOHNSON
Graduate Petrography Contest, 3rd Place, EPS

XANDER KELLY
Undergraduate Groundwater Field Methods Award, EPS

NATTHAKORN KONGUTHAITHIP
William Dow Hamm Memorial Grant, AAPG Foundation

RODRIGO LEAL
Graduate Fellowship, AMS

LANDON LOCKHART
Jackson School Best Graduate Paper, Runner-up, EPS
Student Paper Contest, 1st Place, UT Austin Student Chapter, Society of Petrophysicists and Well Log Analysts
Endowed Graduate Fellowship, UTIG

JOSHUA MALONE
Outstanding Student Poster, Sedimentary Geology Division, SEPM

CARSON MILLER
GSEC Student Service Award, EPS
Scholarship, The Hydrographic Society of America Houston Chapter
Endowed Presidential Scholarship, UT Austin
Endowed Graduate Fellowship, UTIG
Outstanding Graduate Student Award, UTIG

RUSSELL MILLER
Jackson School Best Graduate Paper, Runner-up, EPS

SUMMER MONTOYA
Undergraduate Groundwater Field Methods Award, EPS

EMILY MOORE
James and Ruth Harrison Scholarship, SEG

JOHN A MORETTI
Honorary Award Winner, American Federation of Mineralogical Societies

PAUL MORRIS
Jackson School Best Graduate Paper, EPS

NEELARUN MUKHERJEE
Off Campus Research Grant, JSG
Workshop Travel Grant, Pacific Northwest National Laboratories/ Consortium of Universities for the Advancement of Hydrologic Science
Travel Grant, Environmental System Science, U.S. Department of Energy

IZZY MULLER
Graduate Petrography Contest, 2nd Place, EPS

JOSHUA MUNRO
Lipman Student Research Grant, GSA

CLAUDIU NISTOR
Graduate Petrography Contest, 1st Place, EPS

LIAM NORRIS
Graduate Student Research Grant, GSA
Graduate Student Research Grant, Jurassic Foundation
Steven Cohen Award for Student Research, Society of Vertebrate Paleontology

SAWYER PARKER
Undergraduate Petrography Contest, 3rd Place, EPS

MEDHA PRAKASH
Planetary Habitability Student Award, CPSH
John C. Bianchi Jr. and John L. Boone Endowed Presidential Fellowship, JSG
NASA Planetary Sciences Division Travel Grant, Meteoritical Society

MADISON PREECE
Outstanding Graduate Teaching Assistant, Fall, EPS

BERIT HUDSON-RASMUSSEN
Graduate Groundwater Field Methods Award, EPS

NICHOLAS REGIER
Master's Friday Best Speaker, 1st Place, EPS
Outstanding Graduate Teaching Assistant, Spring, EPS
Endowed Presidential Scholarship, JSG

ANGELICA REYES
Undergraduate Petrography Contest, 1st Place, EPS

KAITLIN SCHAIBLE
Schlanger Ocean Drilling Fellowship, U.S. Science Support Program
Endowed Graduate Fellowship, UTIG

ASHLEE SIDDALL
Meckel Family Named Grant, AAPG Foundation

ADAN SILVA
Eastern Section Paul Potter Memorial Field Geology Grant, AAPG Foundation

SINJINI SINHA
Outstanding Teaching Assistant Awards, National Association of Geoscience Teachers
Positive Mental Health in the Geosciences Workshop Award, Science Education Resource Centre/GSA
Endowed Presidential Fellowship, UT Austin
Graduate Teaching Showcase Presenter, UT Austin Center for Teaching and Learning

DAPHNE SMITH
Master's Friday Best Speaker, 2nd Place, EPS

TRAVIS STONE
Outstanding Teaching Assistant Awards, National Association of Geoscience Teachers

SAGE TUREK
Outstanding Graduate Teaching Assistant, Fall, EPS

VANESSA WEBER
Estwing Hammer Award, EPS

EBONY WILLIAMS
Outstanding Graduate Teaching Assistant, Spring, EPS

STAFF

TODD BEAUDREAU
Consider it Done Award, EPS

JJ DUPONT
Chief Happiness Officer Award, UTIG

PHILIP GUERRERO
Lifetime Service Award, Texas Association of Graduate Admissions Professionals

EMMA HARDIN
Chief Happiness Officer Award, Dean's Staff

ELIZABETH KELTON
Consider it Done Award, UTIG

ADAM KIRK
Shining Star Award, BEG

DIDEY MONTOYA
Outstanding Staff Award, UT Austin

CONSTANTINO PANAGOPULOS
Shining Star Award, UTIG

JENN RAYMOND
Staff Excellence Award, EPS

ANGELA REYES
Outstanding Support Staff Award, UTIG

GEORGIA SANDERS
Shining Star Award, Dean's Staff

RICK SIERRA
Chief Happiness Officer Award, BEG

LEE SPARKS
Chief Happiness Officer Award, EPS

NINA STAEBEN
Consider it Done Award, Dean's Staff

MICHAEL WANG
Consider it Done Award, BEG

JESSICA WOOLLARD-ADAIR
Shining Star Award, EPS

SERVICE AWARDS

VICKIE AMIDON
20 Years

MELISSA ARMSTRONG
10 Years

MATTHEW BROWN
15 Years

ANTON CAPUTO
10 Years

DAVID CHAPMAN
15 Years

ROXANA DARVARI
10 Years

ROBIN DOMMISSE
10 Years

DALLAS DUNLAP
25 Years

DAVID EDEY
10 Years

KENNETH EDWARDS
15 Years

ROSALIND GAMBLE
20 Years

LAURA HERNANDEZ
10 Years

ADRIAN HUH
15 Years

NATHAN IVICIC
20 Years

JAY KIPPER
20 Years

STACI LOEWY
15 Years

ADAM MENA
10 Years

RONALD O'NEILL
20 Years

VINCENT O'SULLIVAN
10 Years

DESMOND PATTERSON
10 Years

FRAN PEÑA
15 Years

ROBERT REED
25 Years

YI JIN SHI
20 Years

SARA SIEBERATH
15 Years

CHRISTOPHER STELLA
15 Years

TIMOTHY URBAN
25 Years

EDWARD VIZY
15 Years

BRIAN ZAVALA
20 Years

13TH ANNUAL STUDENT SYMPOSIUM WINNERS

On Friday, Feb. 16, 2024, dozens of participants ranging from high school students to doctoral students presented their research at the 13th Annual Jackson School of Geosciences Student Research Symposium.

Each poster was reviewed by a team of judges, who awarded the following students for their excellent work.

HIGH SCHOOL AWARDS

First Place: Benjamin Blume, Lilly Moore, Elizabeth Kvale, Liam Sweeney: "Onion Creek Water Table Soundings"

Second Place: Harsha Samavedam: "Networked Electrochemical Impedance Spectroscopy and a Random Forest Model for Enhanced Water Contaminant Detection"

Third Place: Hoang Thach: "The Stresses on The Colorado River"

UNDERGRADUATE AWARDS

First Place: Madison Fail, Danielle Zaleski, and Mariana Rivas: "Analysis of Microplastics in Sediment: The Effects of Urban Development on Lady Bird Lake, Austin, Texas"

Second Place: Jacob Margoshes: "Rapid Incision and Filling of the Mississippi Canyon During the Late Pleistocene in the Northern Gulf of Mexico"

Third Place: Madison Callan: "Geochemical study of the Karst Aquifers and Cave Systems of the Eastern Yucatan Peninsula: Implications for Carbonate Weathering"

EARLY CAREER AWARDS

First Place: Berit Hudson Rasmussen: "The Role of Root Zone Storage Dynamics in Mediating Runoff Following Disturbance"

Second Place: Sasanka Talukdar: "The Effect of Soil Moisture Feedback on the Intensity of the Heat Dome over Texas"

Third Place: Lucia Bellino: "Magmatic Controls on the Climate of Early Mars"

LATE CAREER AWARDS

First Place: Matthew Goldberg: "Ocean State Estimation and Observing System Experiments using Subsea Cable Data"

Second Place: Sarah Brooker: "Copper isotope composition of Paraíba tourmaline gemstone"

Third Place: Travis Stone: "Extinction-Induced Changes to Moroccan Reef Ecology on the Early Jurassic"

Surveying Hurricane Beryl's Impacts on Barrier Islands

A group of geoscientists from the Jackson School of Geosciences—David Mohrig, Emily Hugo, Cole Speed, and myself—spent a couple of days assessing and surveying the impacts of Hurricane Beryl on Matagorda Beach. This is a location where a barrier island has been exposed to several large storms during the last few years, including Hurricane Nicholas (2021), Tropical Storm Alberto (June 2024) and Hurricane Beryl (July 2024).

As storm surge pushes seawater up the beach and across the barrier island, sand is scoured from the beach and is redeposited on the top of the barrier and in the lagoon, in this case East Matagorda Bay. These sand-rich, lobe-shaped deposits are called washover fans; they are important components of some barrier islands.

Towards the eastern end of Matagorda Beach, a number of small washover fans started forming a few years ago that grew larger as large storms hit the Texas coast. Looking at recent satellite images acquired by Planet Labs, we realized that significant changes took place during Hurricane Beryl; so we headed out to the beach to see these changes up close.

We have found an impressive amount of erosion and deposition: at two locations, the beach and the barrier were completely breached by Hurricane Beryl, forming a 200-meter-wide deep channel at the larger site. Sand lobes up to 250 meters long were deposited on top of the barrier and in the lagoon to form washover fans. In places, these sand lobes are covered by large dunes that seem to be related to the seaward-directed flow of water after the storm surge receded. We dug small trenches to see the nature and structure of the newly deposited sediment and flew drones to map the new features using photogrammetry.

In the long term, as enhanced storm activity in the Gulf of Mexico is likely with rising sea-surface temperatures, it remains to be seen whether and how these newly formed large washover fans continue to grow and whether they develop into full-blown tidal inlets. We hope to be able to monitor their evolution during the next few years.

Zoltán Sylvester
Research Professor,
Bureau of Economic Geology

ABOVE: A BREACH IN A BARRIER ISLAND CAUSED BY STORM SURGE DURING HURRICANE BERYL.
BELOW: WASHOVER FANS ON MATAGORDA BEACH.

PHOTOS: ZOLTÁN SYLVESTER.

Spring Break in Fairbanks, Alaska

During spring break of my senior year as an undergraduate at UT, March 2023, I had the opportunity to travel to Fairbanks, Alaska, to work with a team of researchers from UT Austin, Sandia National Labs, and the University of Fairbanks, Alaska.

At the time, I was majoring in chemistry and had recently been introduced to my current advisor, Peter Flemings. Peter was looking for a graduate student to focus on the geochemical processes in thawing permafrost—fitting my research interests perfectly. Peter invited me to join him on a field expedition to Alaska to recover permafrost and excitedly I agreed. The goal was to collect material for each researcher's permafrost experiments, and mine would focus on simulating a warmer climate and measuring the emitted carbon dioxide and methane. So, on the first day of spring break I packed my bags full of cold weather gear and flew to Alaska.

We set out for our first day in the field, bundled head-to-toe and ready to face the freezing temperatures. Near our first site, we packed our drilling equipment onto snowmobiles and headed down a small trail, our boots crunching on the crisp snow as we walked behind the snowmobiles. At the site, we quickly set up our warming tent, processing tables and drill rig. The drill was well equipped to cut through and collect the frozen soil below our feet, but it would still be a slow, tedious task. We steadily inched through the frozen ground, collecting half a meter of soil at a time. Once the section was collected, we reversed the pipes out of the ground for the material to be extruded and packed while the drilling resumed. After a full day of labor, we were rewarded with three meters of core and clothes that reeked of WD-40. This drilling process was repeated each day during our expedition, and at the end of the week we shipped our newly recovered prizes back to UT.

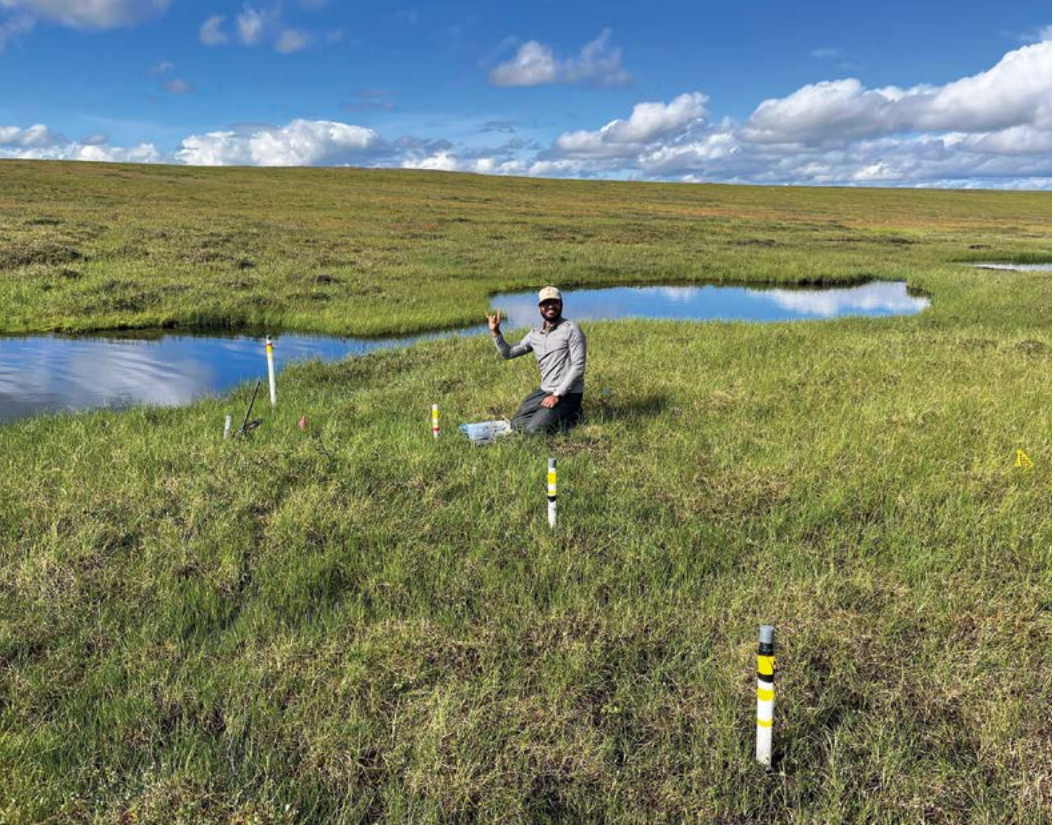
I had no idea what to expect on this trip, but it turned out to be one of the most amazing experiences. Each day tromping through the snow, breathing the cold, fresh air, and drilling for our treasure was thrilling. It was a feeling I knew I needed more of. This trip also gave me the unique opportunity to evaluate my potential advisor as I was not yet officially committed to UT for graduate school. Fortunately, Peter was incredible and I knew I would learn much from him.

A semester before this trip I felt lost as I faced my upcoming graduation. Now, a year into my master's program, I feel incredibly lucky to be where I am. The research this team is doing fills me with excitement and hope, as we have so many intelligent minds working together to understand how the Arctic, and our planet, will change as we continue to face global warming.

Riley Garrett
Master's student

ABOVE, LEFT: RILEY GARRETT (MIDDLE) AND PROFESSOR PETER FLEMINGS (RIGHT) DRILL INTO THE PERMAFROST FOR CORE SAMPLES. **ABOVE, RIGHT:** A GROUP SHOT OF THE RESEARCH TEAM WITH THE PERMAFROST DRILL RIG.

PHOTOS: RILEY GARRETT.



Hydrology in the Tundra

Permafrost thawing is one of the major threats yet lesser-discussed impacts of climate change. Permafrost covers 24% of the surface of the landmasses in the Northern Hemisphere and accounts for almost half of all the organic carbon stored within the planet's soil. If this organic carbon remains frozen, it is trapped in the permafrost. However, once thawing accelerates, microbial activity in the soil will increase, resulting in the decay of organic carbon and the release of carbon dioxide and methane into the atmosphere. The Arctic is warming almost four times faster than the rest of the world, exacerbating the thawing and increasing the risk of permafrost becoming a huge carbon source. However, scientists do not know how the concurrent thawing of permafrost soils and changes in watershed hydrology will affect greenhouse gas emissions. There is a clear need to improve models of cold-region watershed hydrology with extensive field observations to predict how warming and permafrost thaw will affect greenhouse gas releases in the future.

This study is part of a Department of Energy funded project with collaborations from hydrologists and biogeochemists from the University of Michigan, Utah State University, and Oak Ridge National Laboratory. Dr. Bayani Cardenas from The University of Texas at Austin is the principal investigator of this project, and I am the graduate student whose Ph.D. dissertation encapsulates the field and modeling efforts.

Conducting fieldwork in the Arctic is extremely challenging owing to the remote locations and accessibility of the field sites. However, our field efforts are eased with support from the Toolik Field Station (TFS), Institute of Arctic Biology and University of Alaska-Fairbanks.

TFS is located at mile point 284.5 of the Dalton Highway, 370 miles north of Fairbanks (68° 38' N, 149° 36' W). During our field trips, we take a 9–12 hour drive from Fairbanks to TFS along the unpaved Dalton Highway. The Dalton Highway was constructed to serve operations at Prudhoe Bay and regular service of the Trans-Alaska pipeline. There is no cell reception on the Dalton Highway, so we always have an InReach and Satellite phone in the truck. CB radios are commonly used by truckers to communicate hazards and other safety information, and it is recommended that all vehicles along the Dalton Highway have a CB radio with them. The trucks are NSF-owned and TFS-operated, running on a set schedule from Fairbanks to TFS every week. However, there are other options, like the Dalton Highway Express, to travel to TFS. TFS covers transportation, housing, food, and lab space for research and field preparation for all researchers.

We prefer planning fieldwork during the summers as the hydrology is dynamic during that time due to the continuous thawing. Our field site is at the Imnavait Creek Watershed. This watershed is a first-order tundra watershed 2.2 sq. km in area and underlain by continuous permafrost. From TFS, our field site is a short 10–15 minute drive north and a ~1-mile picturesque hike along the Imnavait Creek.

My dissertation focuses on subsurface flow above the permafrost (organic carbon rich supra-permafrost aquifer or active layer). For the last few summers, we have installed fully screened groundwater wells along a 2D transect perpendicular to the Imnavait Creek. The motivation behind this installation is to capture groundwater table elevation within the active layer above the permafrost. We have instrumented this transect to get precise and continuous observations of groundwater level, ice table depth, and temperature profiles.

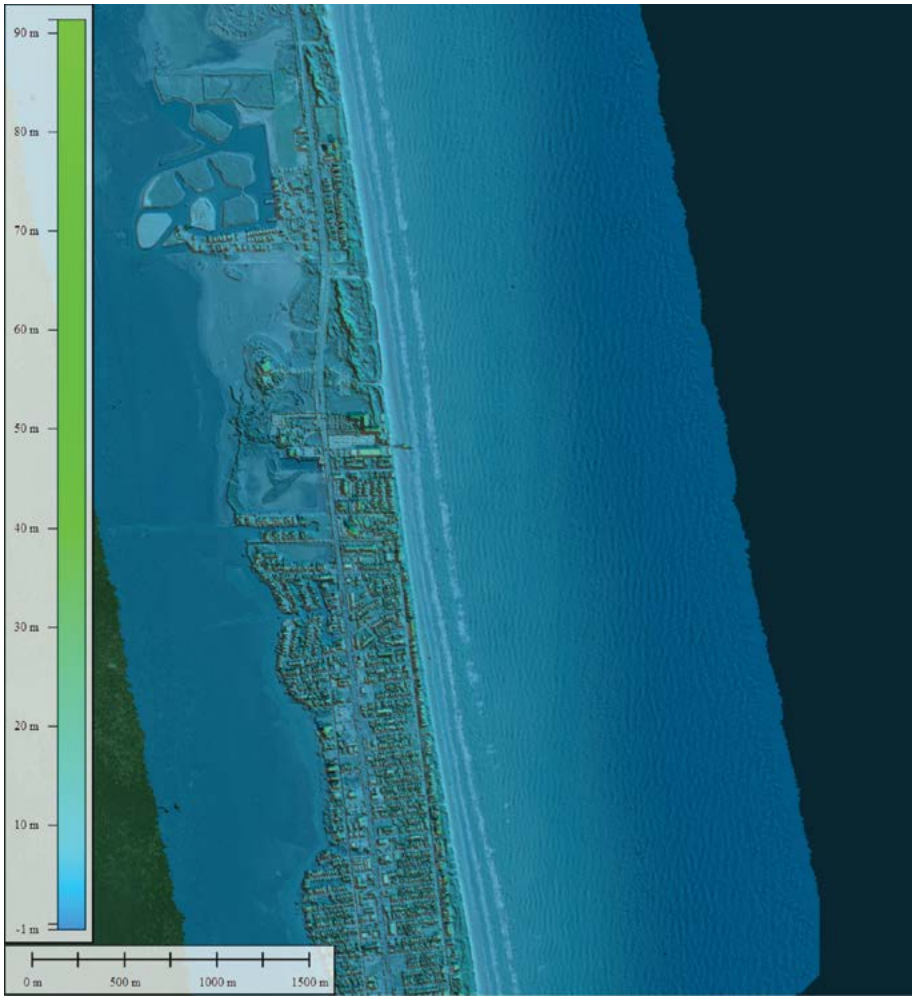
OPPOSITE PAGE, LEFT:
NEELARUN MUKHERJEE GIVES A "HOOK 'EM" FROM THE IMNAVAIT CREEK WATERSHED.
OPPOSITE PAGE, RIGHT:
MUKHERJEE AND GEORGE W. KLING, A PROFESSOR AT THE UNIVERSITY OF MICHIGAN, INSTALL A PIEZOMETER INTO THE PERMAFROST.

PHOTOS: NEELARUN MUKHERJEE

We also measure biogeochemical observations such as dissolved organic carbon, dissolved oxygen, iron, and pH along the transect with depth. We had to take great precautions during field measurements as the tundra landscape is very sensitive, and footprints on the tundra change the topography, thus changing the hydrology. Therefore, in the field, we need to be efficient to ensure minimal disturbance on the tundra, taking as many observations as possible in one go.

These observations will eventually help in numerical model parameterization and validation. We use the multiphysics model Advanced Terrestrial Simulator (ATS) for coupled surface-subsurface thermal hydrology with freezing and thawing, along with PFLOTRAN for reactive transport of DOC (Dissolved Organic Carbon) as water travels through the active layer. This study will help understand how climate variability and warming affect the strong terrestrial-aquatic connection and the hydrologic and biogeochemical processes in terrestrial and aquatic domains.

Neelarun Mukherjee
Doctoral student



RIGHT: SOUTHERN PADRE ISLAND TOPOGRAPHY AND NEARSHORE BATHYMETRY DERIVED FROM NEAR-INFRARED AND GREEN (UNDERWATER) LIDAR.
IMAGE: KUTALMIS SAYLAM.

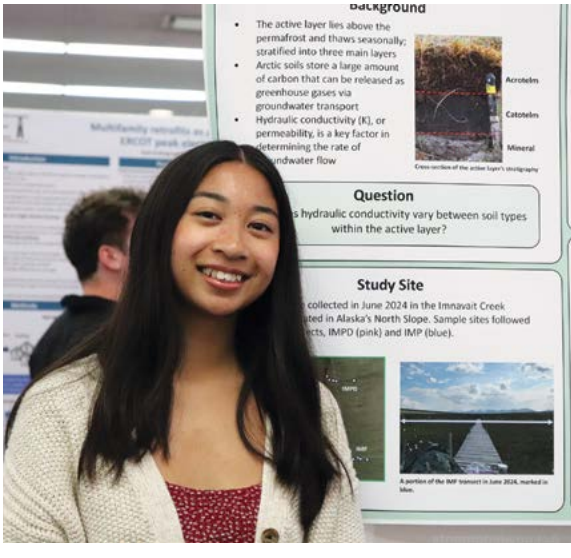
Surveying the Texas Coast from the Sky

In February and March 2024, researchers from the Bureau of Economic Geology at The University of Texas at Austin conducted an airborne lidar survey campaign covering the beaches, barrier islands, and shallow offshore along the entire Texas Gulf shoreline. This project, funded by the Texas General Land Office, was the first major data acquisition project using the bureau's new Leica Chiroptera Mark 5 airborne system. Preliminary results indicated higher spatial resolution of topography and deeper water bottom mapping in the nearshore environment than could be achieved with the previous system.

In addition to the coastal survey, researchers completed lidar data collection for other research groups. The Jackson School of Geosciences requested the elevation map of the Trinity rivershed in eastern Texas to examine ongoing flood effects, and the UT Integrated Biology department inquired about detailed elevation mapping of UT Austin-managed environmental monitoring and biology sites to establish baseline mapping. Researchers also acquired detailed near-infrared lidar data of downtown Austin to compare city infrastructure with that shown by data acquired with the bureau's first lidar system in 2002.

Kutalmis Saylam
Research Science Associate,
Bureau of Economic Geology

A Summer in the Arctic Soil



The Research Traineeship Experience (RTX) at the Jackson School of Geosciences is a nine-week summer program that provides students with research and technical skills. Each participant conducted an independent research project under supervision from mentors in the Jackson School.

For my project, I had the opportunity to travel to northern Alaska to do fieldwork with my mentors, Dr. Bayani Cardenas and Neel Mukherjee. We stayed at Toolik Field Station, a research station dedicated to Arctic sciences. I spent four days exploring the Imnavait Creek watershed, surveying wells and collecting soil samples. Since we were visiting in the summer, our field clothes consisted of mosquito jackets and muck boots to navigate the muddy Arctic tundra. Back at the research station, I'd analyze my samples for hydrologic properties that are relevant for groundwater flow and transport estimates. My work is just a small part of a bigger effort to better understand groundwater and carbon flux in the Arctic, where soils are rich in carbon. I am continuing this research into the 2024-2025 school year for my EVS Capstone project and Jackson Honors thesis.

Overall, the RTX program helped me establish myself as a researcher and find my place in the geosciences. I am grateful for my time in Alaska, where I was surrounded by such knowledgeable scientists that made me feel included and answered my many questions. I would also like to extend a huge thank you to Scarlette Hsia, Lisa Pausback, Jessica Rowling, and Veronica Vasquez for putting together the RTX program this summer.

Sydney Villaruel
Undergraduate student

ABOVE LEFT AND BELOW RIGHT: THE FIELD SITE IN IMNAVAIT CREEK WATERSHED, WITH A VIEW OF THE BROOKS RANGE IN THE BACKGROUND. **PHOTO:** SYDNEY VILLARUEL.
ABOVE RIGHT: THE MIDNIGHT SUN REFLECTING OVER TOOLIK LAKE AT TOOLIK FIELD STATION. **PHOTO:** SYDNEY VILLARUEL.
MIDDLE RIGHT: SYDNEY VILLARUEL PRESENTING HER RESEARCH AT THE RTX STUDENT SYMPOSIUM. **PHOTO:** JACKSON SCHOOL.

Texas High School Coastal Monitoring Program Going Strong

For over two decades, coastal geologist Tiffany Caudle has been leading groups of students to Texas beaches to collect data on coastal geology as part of the Texas High School Coastal Monitoring Program at the Bureau of Economic Geology.

No two trips are ever alike, said Caudle, who has been the program director since 2000. She and the students have faced scorching sun and pouring rain. They have aided in seagull rescues and green sea turtle releases at UT's Marine Science Institute.

But their primary mission has remained consistent: to take on-the-ground measurements that will help inform coastal research at the bureau and coastal management decisions at the state's General Land Office.

"We use their data as checks against our remote sensing data that we collect for shoreline change analysis," Caudle said. "The data the kids are collecting on the ground is helping us ground-truth the shoreline position."

Last year, the program celebrated its 25th year of operation and recently completed its 413th field trip. Just like the shifting Texas shoreline, the program has undergone changes over the years.

The number of participating schools has increased from three to eight, with each school responsible for a field site or sites along the Texas coast. Caudle leads students from each school to their sites about three times a year, where the students collect three types of measurements: a beach profile, shoreline and vegetation line mapping, and observations about weather and wave conditions.

The program has also grown its digital presence. The program website now shares insights—all based on student data—about how hurricanes have shaped dunes, how beach restoration projects are faring, and the state of shoreline vegetation. The site also shares educational materials for students about coastal geology and ecosystems.

Opportunities for citizen science have increased over the years, said Caudle, with scientists enlisting members of the community to collect data on a range of research projects. Still, she said that the longevity of the bureau's program and the influence of its data put it in a class all its own.

"It's pretty unique," she said. "I haven't found anything this long term or where their data is out there for other researchers, scientists and decision makers to use."

Of course, it's not just coastal researchers who benefit. Caudle said the students take pride in being part of a research project that's been happening for generations—and having an exciting research experience to share on college applications.

The project is funded by a Texas Coastal Management Program grant awarded by the National Oceanic and Atmospheric Administration Office for Coastal Management.

ABOVE: STUDENTS CONDUCT A COASTAL SURVEY AT PORT ISABEL.
PHOTO: TIFFANY CAUDLE.

Texas Space Grant Update: Eclipse Science, Designing Moon Tools, Virtual Space Missions

To experience a solar eclipse is a rare occurrence, but to experience two in six months is a once-in-a-lifetime event. But that is exactly what happened over Central Texas, with an annular solar eclipse in October 2023 and a total solar eclipse in April 2024. For both, the Texas Space Grant Consortium hosted overnight camping at local scout camps provided by the Capitol Area Council for over 1,500 Texas youths, who learned how eclipses occur and how to safely observe them.

At the April total eclipse event, Doug Hemingway, an assistant research professor at the University of Texas Institute for Geophysics, spoke to campers about the science behind eclipses, safety, and exoplanet transits. The campers witnessed two launches of scientific balloons by undergraduate students from universities in Puerto Rico, who were sponsored by the Puerto Rico Space Grant. The campers were also joined by a special guest: former astronaut Mike Fossum, who is now the chief operating officer of Texas A&M University at Galveston.

For more than 20 years, Texas Space Grant has hosted a design challenge workforce development program that has connected undergraduate teams of Texas STEM students with mentors from NASA. This year, 24 teams from 16 Texas institutions were selected to participate in a challenge related to NASA's Artemis mission to the moon. The topics were as diverse as developing lunar camera and lighting systems, lunar vehicle design, and dust mitigation. Team projects are reviewed by NASA and other experts, and the top design teams earn Texas Space Grant scholarships.

This year, Texas Space Grant also supported two Space Teams programs that provide middle and high school students from across Texas, Louisiana and New Mexico the opportunity to engage in a series of space mission design and simulation modules. The program is supported by the NASA-funded Space Grant KIDS project and is conducted in partnership with Texas A&M University and two other state space grants.

For the first time, Texas college students had the chance to use virtual reality to design their own Martian buildings in Space Team University's Mars City Design Competition, a new addition to the Texas Space Grant/ Texas A&M University Space Teams partnership program.

The Texas Space Grant Consortium is the Texas branch of NASA's National Space Grant College and Fellowship Program, an outreach initiative to ensure that space research benefits are available to all Texans. Texas Space Grant is hosted at UTIG. Its director is Tim Urban.

ABOVE RIGHT: YOUNG TEXANS WATCH THE TOTAL SOLAR ECLIPSE AT AN EVENT HOSTED BY TEXAS SPACE GRANT.
ABOVE LEFT: THE TOTAL SOLAR ECLIPSE ABOVE CENTRAL TEXAS ON APRIL 8, 2024.

PHOTOS: TEXAS SPACE GRANT.

OPPOSITE ABOVE: A GROUP OF STUDENTS LOOKS SKYWARD.
OPPOSITE BELOW: PROFESSOR PETER FLEMINGS WATCHES THE ECLIPSE.

PHOTOS: JACKSON SCHOOL.

Eclipse on Campus

On April 8, students, faculty members and staffers from the Jackson School of Geosciences donned their protective glasses and headed outdoors to watch the total solar eclipse together.

Scientific Meetings

Scientists at the Jackson School of Geosciences helped organize and host a number of scientific events this 2024. Here are a few of the highlights.

Gordon Research Conference: Porous Media in the Energy and Climate Transition

Professor Marc Hesse served as chair of the 2024 Gordon Research Conference on Flow and Transport in Permeable Media. This year's conference emphasized research with relevance to climate change and the energy transition, and included talks on geothermal energy production, hydrogen storage and ice sheet hydrology. Gordon Research Conferences are known for bringing scientists together to discuss frontier science in small, community-oriented settings. About 120 people attended the conference, which took place in Newry, Maine, on July 14–19, 2024.

First Joint International Earthquake Science Symposium

Earthquake scientists from the United States, Chile, Germany and Japan gathered at The University of Texas at Austin for the First International Earthquake Science Symposium in February 2024. Hosted by the University of Texas Institute for Geophysics, the symposium helped share advances in earthquake science from around the world, as well as lay the groundwork for future projects. Speakers and participants included researchers from the Japan Agency for Marine-Earth Science and Technology and Germany's GEOMAR Helmholtz Centre for Ocean Research Kiel, the leading national marine geophysics research centers for each country.

Bureau Hosts Scientists from Japan's National Hazards Lab

On July 17, 2024, the Bureau of Economic Geology welcomed a delegation of scientists from Japan's National Research Institute for Earth Science and Disaster Resilience (NIED), including the institute's president, Kaoru Takara. The visit included presentations from bureau researchers and NIED scientists about respective research activities on natural hazards and discussions about opportunities for collaboration.

Rising Sea Level's Effects Explored at Workshop

The Texas coastline is thousands of miles from the ice sheets of Greenland and Antarctica, but it's on the front line of rising sea levels caused by the retreating ice. Jackson School professors Ginny Catania and David Mohrig organized a workshop at the University of Houston in April 2024 to discuss how data on sea level rise can be leveraged by communities that stand to be the most affected by it. The workshop brought together polar and coastal scientists and stakeholders from the Texas coast and included a free and public talk about the threats posed by sea level rise and how coastal cities can prepare.

Field Trip to Jamaica Shows Pathways into the Geosciences

During the summer, scientists at the Jackson School of Geosciences helped lead a cohort of six undergraduate students and four graduate students from across the U.S. and Caribbean on a nearly four-week research trip to Jamaica as part of the National Science Foundation's GEOPAths GO program.

The students all had backgrounds in the sciences—but for many, the geosciences were a new field.

One of the goals of the trip was to show students how their backgrounds in computer science, chemistry and other STEM subjects could be applied to a range of geoscience questions, said Rowan Martindale, an associate professor in the Department of Earth and Planetary Sciences and one of the trip mentors. Students contributed to ongoing Earth science research in reef paleoecology, paleoherpetology, hydrology, geochemistry and mangrove ecology.

"Basically, the idea is to find different ways to bring people to the geosciences," said Martindale. "We want to provide pathways for undergrads from environmental sciences, biology, chemistry, physics and marine sciences to enter a geoscience graduate program."

Martindale studies modern and ancient coral reefs. Many of the research projects involved collecting and analyzing samples from modern reef and beach environments and fossil outcrops. For example, to understand how the water quality of a reef environment changed during a day, students took part in a 36-hour sampling trip—where water conditions (light levels, temperature, acidity and oxygen levels) were logged every 15 minutes and water samples taken every two hours to assess how nutrient levels and carbonate chemistry changed. During another project on a rocky and crumbling Pleistocene-aged reef, the students braved a massive deluge to get the photographic and physical samples of a 130,000-year-old coral reef.

"I was absolutely blown away by how these students came together to do the science," Martindale said.

The students also collected water samples and set up sensors in the trees for mangrove research led by Associate

Professor Ashley Matheny, who is part of the GEOPAths team but was unable to go on the trip. They also practiced catching (and releasing) local anoles (a type of lizard) and analyzed cave fossils for biodiversity research led by Jackson School Assistant Professor Melissa Kemp, who is also part of the UT College of Natural Sciences.

Leah Turner, the program director for the Jackson School's outreach programs GeoFORCE and GeoSTEM, also served as a mentor on the trip. Turner is leading the social science research component of the GEOPAths GO Jamaica program to evaluate how well the team is meeting its goals.

Joining the Jackson School team were Isaiah Bolden, an assistant professor from the School of Earth & Atmospheric Sciences at the Georgia Institute of Technology, along with researchers from The Ohio State University, Arizona State University, and institutions in Jamacia. Jamaican collaborators included researchers Denise Henry from the Alligator Head Foundation and Debbie-Ann Gordon-Smith and Camilo Trench from the University of the West Indies-Mona.

The trip was sponsored by a grant from the National Science Foundation's GEOPAths program, which seeks to increase students studying the geosciences at the undergraduate and graduate levels through career-relevant experiences and community building.

Thanks to the grant, the researchers will share the geosciences with a new cohort of students next year and in 2026. Visit the Jackson School's GEOPAth website for application details: ***www.jsg.utexas.edu/geopathsgojamaica***

OPPOSITE PAGE, LEFT: ALLIGATOR HEAD FOUNDATION WARDENS LAY OUT A TAPE MEASURE FOR COLLECTING CORAL REEF ECOLOGICAL DATA IN THE EAST PORTLAND SPECIAL FISHERY CONSERVATION AREA IN JAMAICA.
OPPOSITE PAGE, INSET: A GROUP SELFIE WITH STUDENTS AND INSTRUCTORS.

PHOTOS: ROWAN MARTINDALE, GABRIEL SALTER.

STARR Sharing Knowledge of Earth Resources Across Texas

The STARR group at the Bureau of Economic Geology is focused on geoscience and engineering research that advances the production and profitability of Earth resources in Texas — from oil and gas to hydrogen to mineral exploration.

During the past two years, researchers from STARR — which stands for State of Texas Advanced Resource Recovery — gave presentations on a range of hot topics in Earth resources across the state.

In April 2023, STARR principal investigator Lorena Moscardelli gave a talk on the hydrogen economy and subsurface storage to TOPCORP, a program for state and federal regulators, field inspectors and policymakers to learn about the technologies used in energy field operations.

Moscardelli emphasized how hydrogen storage in salt caverns could help support the emerging hydrogen economy in the state. And STARR postdoctoral researcher Ander Martinez-Doñate showcased a series of cores from bedded salt formations in West Texas and Louann domal salt from the Texas Gulf Coast.

A month later, STARR researchers traveled to the Southwest Section of the American Association of Petroleum Geologists (AAPG) in Wichita Falls to present research at the annual convention and 100th anniversary of the organization. Lucy Ko, Peter Flaig, Kelly Hattori, Bill Ambrose and Eric Radjef delivered a series of technical talks and shared research news from STARR, including research on the Strawn Formation, Cisco Group and Barnett Shale.

STARR closed out 2024 with a series of core workshops, sharing insights on formations that could assist with oil and gas exploration and production, carbon dioxide storage, geothermal energy and waste disposal. The workshops included the Strawn Core Workshop at the Fort Worth Oil Library in September, a two-day Wilcox Core Workshop and Bastrop field trip in October, and the Ordovician Ellenburger Core Workshop in Austin in November.

To stay updated on future STARR events, visit: ***starr.beg.utexas.edu/news-events/calendar***

ABOVE: THE LEADER OF THE STARR PROGRAM, LORENA MOSCARDELLI, DELIVERING A TALK TO TOPCORP. **PHOTO:** STARR.

Andrey Bakulin
Research Professor

Andrey Bakulin is a research professor at the Bureau of Economic Geology, where he co-leads the Texas Consortium for Computational Seismology alongside Professor Sergey Fomel. He focuses his research on advancing seismic monitoring technologies and instrumentation, with an emphasis on land seismic techniques.

His work supports both conventional energy exploration and emerging fields in the energy transition. He also leads the H_2 injection field test at the Devine site, spearheaded by the GeoH_2 consortium.

Bakulin's development of the virtual source method revolutionized seismic monitoring by transforming downhole receivers into virtual sources, significantly improving velocity estimation and imaging. His leadership in 4D seismic monitoring, particularly in the use of shallow buried receivers for sensitive subsurface monitoring, has set new standards. He has been selected as a Society of Exploration Geophysicists (SEG) distinguished lecturer, receiving two SEG Best Paper awards, and earning numerous other industry accolades. He was the 2023 recipient of the Reginald Fessenden Award.

Jani Das
Research Assistant Professor

Jani Das joined the Bureau of Economic Geology in May. She is currently working with Michael Young, the Jackson School's associate dean of research, on a life cycle analysis that is comparing different electricity options. She is also involved in electricity grid dispatch modeling and related studies. Das holds a doctoral degree in energy science and engineering from the Indian Institute of Technology, Bombay, India, and a master's degree in electrical engineering from the National Institute of Technology Calicut, India. Prior to joining the bureau, she was dean of the research and consultancy cell, head of the department, and associate professor in the Department of Electrical and Electronics Engineering at Muthoot Institute of Technology and Science, in Kerala, India. She was also a part of the collaborative project "Intelligent Microgrids with Appropriate Storage of Energy" at IIT Bombay and the University of Nottingham. Since 2024, she has been a senior member of the Institute of Electrical and Electronics Engineers.

Xuesong Ding
Research Assistant Professor

Xuesong Ding joined the Bureau of Economic Geology in March 2023. Her research focuses on landscape and basin evolution modeling at various spatial and temporal scales. She also works on salt tectonic modeling by coupling thermo-mechanical and surface processes. Before joining The University of Texas at Austin, Ding earned a doctoral degree at the University of Sydney, Australia, and then worked as a postdoctoral fellow at the University of California, Los Angeles, where she researched linking lithospheric dynamics and surface topography to basin evolution.

Brent Elliott
Research Associate Professor

Brent A. Elliott is an economic geologist, associate research professor and professional geoscientist who has been involved in mining and exploration-related research for the past 25 years. Elliott previously worked at the Bureau of Economic Geology from August 2012 to February 2020. He returned after serving as the director of surface mining at the state's energy regulatory agency. His professional background and research include a wide variety of mined commodities, including geochemical modeling of all types of resources and metallic deposits, geospatial tools for predictive mapping and exploration, industrial sand, aggregate and stone materials, coal, uranium, critical minerals (especially lithium) in produced water and brines, rare earth element occurrences and other critical elements, novel approaches to exploration, mineral extraction methods, characterization, assessment, inventory and valuation of mineral resources.

Sophia Gong
Research Assistant Professor

Sophia Gong joined the Bureau of Economic Geology in March 2024. Her research focuses on fracture propagation and reservoir simulation of unconventional reservoirs, decline curve analysis, and basin-scale productivity driver analysis using machine learning approaches. Prior to joining the bureau, she worked as a petroleum engineer at an oil service firm in Houston for three years. Her previous work experience involved unconventional reservoir completion design and optimization,

and integrated simulation workflow (fracture and reservoir simulation) of unconventional reservoirs. Gong holds a doctoral degree in chemical engineering from The Ohio State University and a master's degree in petroleum engineering from The University of Oklahoma.

Anna Ruth Halberstadt
Assistant Professor

Anna Ruth "Ruthie" Halberstadt joined the Jackson School of Geosciences in fall 2024 as an assistant professor in the Department of Earth and Planetary Sciences. Halberstadt is a glaciologist. She studies Antarctica's warm periods and how this history can provide insights about future ice sheet changes as the climate continues to change. Halberstadt's niche is that she uses both geologic data and climate and ice sheet modeling in her research. She earned a doctoral degree from the University of Massachusetts Amherst and was previously a postdoctoral research associate at the Berkeley Geochronology Center at the University of California, Berkeley.

Zhe Jia
Research Assistant Professor

Seismologist Zhe Jia joined the University of Texas Institute for Geophysics as a research assistant professor. Among Jia's research achievements, he discovered that many earthquakes happen as a series of rapid jolts along connected faults. Jia published an analysis in *Science* of the 2023 Turkey-Syria earthquakes. He also discovered that a mysterious 2022 tsunami was set off by a previously undetected earthquake in the South Atlantic. Jia's current projects include an investigation of deep earthquakes, an effort to map unknown faults, and a new exploration of Chile's earthquakes. Jia earned a doctorate in geophysics from the California Institute of Technology. Prior to joining UTIG, Jia was the Green Postdoctoral Scholar at Scripps Institution of Oceanography.

Marek Locmelis
Associate Professor

In August 2024, Marek Locmelis joined both the Bureau of Economic Geology and Department of Earth and Planetary Sciences as an associate professor. He specializes in critical minerals that are important for the energy transition, such as nickel, cobalt and the rare earth elements, as well as sustainable and ethical approaches to mining. Currently, he is most interested in what is known as "conceptual exploration targeting" for critical minerals. He studies what geologic key ingredients had to come together in space and time to form critical mineral deposits. Locmelis has been teaching and conducting economic geology research for eight years, most recently at the Missouri University of Science and Technology. He earned a doctoral degree in earth and planetary sciences from Macquarie University in Sydney, Australia.

Shujuan Mao
Assistant Professor

Shujuan Mao joined the Department of Earth and Planetary Sciences as an assistant professor in fall 2024. In her research, Mao uses passive seismic measurements to monitor environmental processes such as changes in groundwater and geothermal energy, and to research carbon capture and storage opportunities. This is an emerging area in seismology that Mao is hoping to apply to study groundwater in Austin and the surrounding areas. Mao earned a doctoral degree in geophysics from the Massachusetts Institute of Technology and was previously a postdoctoral researcher at CNRS at L'Institut des Sciences de la Terre in Grenoble, France.

Craig Martin
Assistant Professor

Craig Martin joined the Department of Earth and Planetary Sciences in fall 2023. His research focuses on plate tectonics, employing paleomagnetism, field-based structural geology and geochronology to answer questions about where Earth's plates were tens of millions of years ago, and how they moved. Martin earned a doctoral degree from the Massachusetts Institute of Technology studying the collision history of the Western Himalayas. This research involved traveling to remote regions of northwest India, conducting geological mapping and collecting rock samples to analyze.

Abouzar Mirzaei Paiaman
Research Assistant Professor

Abouzar Mirzaei Paiaman's research focuses on both fundamental and applied studies in energy production and storage and carbon management through reservoir simulation, mathematical modeling, laboratory experimentation, field research, and economic analysis. Before joining the Bureau of Economic Geology, he worked as a research associate at The University of Texas at Austin's Hildebrand Department of Petroleum and Geosystems Engineering. Prior to that, he was a postdoctoral researcher at the Center for Energy and Petroleum Studies in Brazil. He holds a doctoral degree in petroleum engineering from Sharif University of Technology in Iran. Paiaman has held positions in both industry and academia, and he has published more than 60 scholarly articles.

Hailun Ni
Research Assistant Professor

Hailun Ni is part of the Gulf Coast Carbon Center at the Bureau of Economic Geology, where she was formerly a postdoctoral fellow. Her research focuses on the impact of geologic heterogeneity on plume migration and trapping in the geologic storage of carbon dioxide. She also manages the Sandtank Lab and uses laboratory experiments to better understand subsurface fluid flow. Prior to joining the bureau, Ni earned a doctoral degree in energy resources engineering from Stanford University.

C. Nur Schuba
Research Assistant Professor

Nur Schuba was previously a postdoctoral researcher for the State of Texas Advanced Resource Recovery (STARR) program at the Bureau of Economic Geology, which she joined in 2022. She now works for the same program as a research assistant professor and focuses on the characterization of bedded and domal salt formations for underground storage purposes. Schuba's research includes salt deposition and tectonics, continental rifting processes such as detachment faulting and serpentinization, and geological storage of hydrogen. Outside of research, she is interested in science communication using illustration, especially for younger demographics. Prior to joining the bureau, Schuba worked as a visiting scientist for Yellowstone National Park and as a geoscientist for ExxonMobil, and she conducted measurements and logging as a drilling engineer for SLB, where she acquired and interpreted data to make sense of planet Earth.

James Thompson
Research Assistant Professor

James Thompson is a research assistant professor at the Bureau of Economic Geology. Previously, Thompson was a postdoctoral fellow at Baylor University and the University of Pittsburgh. Thompson earned a doctoral degree in remote sensing and volcanology from the University of Pittsburgh, focusing on the thermophysical evolution of propagating lava flows in Hawaii and Guatemala. His principal expertise focuses on developing novel remote sensing and geospatial techniques to understand thermodynamics of terrestrial processes across spatial and temporal scales and determine societal impacts. Currently, Thompson is leading an effort developing miniature thermal infrared (TIR) imaging systems for deployment on uncrewed aerial vehicles (UAV) to improve understanding of wildfire behavior in Texas. This effort advances the derivation of critical heat and gas flux rates in 3D (SO_2, CO_2, and NH_3) that influence wildland fire dynamics and the impacts of fires on ecosystems and air quality.

Justin Thompson
Research Assistant Professor

Justin Thompson joined the Bureau of Economic Geology as a research assistant professor in August 2023. He was previously a postdoctoral fellow and a graduate research assistant. His research interests are in water resource management and planning: a nexus of hydrology, policy and economics. He is passionate about applying the latest scientific data and approaches to address key economic and policy challenges for water resources, particularly groundwater. He recently developed a new method for quantifying the hydro-economic impacts of changes in groundwater levels and led a pilot program to test those methods with a cohort of Texas groundwater management entities. Thompson brings a multifaceted perspective to his research, having been an international project finance professional, manager of a wastewater utility, a paralegal, and a technical volunteer with a nonprofit bringing ground and rainwater solutions to underserved communities in East Africa.

In Recognition of Donors

WE ARE GRATEFUL TO OUR DONORS, WHETHER IT IS THEIR FIRST OR 100TH TIME GIVING TO THE JACKSON SCHOOL OF GEOSCIENCES. WE WOULD LIKE TO RECOGNIZE ALL DONORS WHO HAVE DESIGNATED THE JACKSON SCHOOL IN THEIR ESTATE PLANS, DONORS WHO ARE MEMBERS OF OUR GIVING SOCIETIES, AND ANNUAL DONORS FOR THEIR LONG-STANDING FAITHFUL CONTRIBUTIONS. THANK YOU FOR YOUR CONTINUED SUPPORT TO ENSURE THE JACKSON SCHOOL PROVIDES A SUPERIOR EDUCATION TO BUDDING GEOSCIENTISTS AND CONTINUES TO LEAD THE WAY IN TRANSFORMATIVE RESEARCH.

Texas Leadership Society

The Texas Leadership Society is composed of a distinguished group of friends and alumni who have included The University of Texas at Austin in their estate plans. Estate gifts support faculty and research, provide scholarships and graduate fellowships, and keep libraries, laboratories and facilities up to date. We would like to recognize those members who have designated the Jackson School as their beneficiary.

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David Arctur
Philip Bennett
Marta Bianchi & John* Boone
Vada & Walt* Boyle
David Boyles
Barbara & Philip Braithwaite
Ina* & Jesse* Brundrett
Susan* Cage
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Flawn Circle of Excellence

The Flawn Circle of Excellence recognizes individuals who have given cumulative gifts of $1 million or more. Established in 2014, this society is named after Peter T. Flawn, former president of The University of Texas at Austin, professor emeritus at the Jackson School of Geosciences and lifetime member of the Geology Foundation Advisory Council.

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Kenneth Neavel
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Rita* & Jimmie* Russell
Dick Stoneburner
Elizabeth & Joe* Walter
Kathy & Steve Weiner
Pam & Rom Welborn
Dianne & Les* White
Cathy & Chuck Williamson

Katie Society

The Katie Society recognizes individuals who have given cumulative gifts of $500,000 or more. It was established in 2014 in fond remembrance of Katherine G. "Katie" Jackson, beloved wife of the late John A. Jackson. Katie was a great philanthropist and Jack's partner in all things, including the creation and naming of the Jackson School of Geosciences.

David Arctur
Annell Bay & Robert Suchecki
Carol Crawford
Carol & Jim Farnsworth
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Cala Ferrand & Albert Haertlein
Grace and Hugh Hay-Roe
Kathleen Howard
Julia Trimble & Tim Diggs
Mark Ver Hoeve
Edith* & Robert Zinn

L.T. Barrow Founders Circle

The L.T. Barrow Founders Circle recognizes friends and alumni who have given cumulative gifts of $100,000 and above. Named after Leonidas T. and Laura T. Barrow, creators of the first Geology Foundation endowment in 1953, Barrow Founders Circle members honor the legacy of these two guiding spirits of geoscience education at The University of Texas at Austin.

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Dan Barnes
Patricia Boyd
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ALUMNI NOTES

1940s

Howard Lowe (B.S. '48) says, "Guess I am the dinosaur – I'm celebrating my 100th on December 5. Fortunately, I still have all my marbles intact. In 2013, I was invited to join an organization of retired NASA scientists and engineers...TRC (the right climate stuff). The group is involved in extensive climate research. For me it was a great opportunity to be exposed to climate research and to contribute my expertise on climate from a historical geological viewpoint. Many of the 33 members are highly regarded scientists. Well, that speaks for my activity. However I will have many of the Lowe tribe attending my birthday party, about 40. One group of four - a greatgranddaughter and husband will be present with my two greatgreat grandchildren."

1950s

Gene Ames (B.S. '55) writes, "Not too old to manage a powerful global bucket list of billion-barrel prospects. Can't wait for when the search for billionbarrel fields can restart! Hook 'Em!"

Wade Harry Burke (B.S. '57) shares, "Turned 91 in January 2024; still own and operate one oil well in Nueces, West Texas since 1974. My wife Frances (UT 1955) and I celebrated our 70th anniversary in August 2023. Life is good!! Go Horns!!"

James V. Richards (B.S. '56)
Jim is still living in Houston, Texas and celebrated his 90th birthday in April 2024. He is still a consultant participating in several drilling projects in Texas and Louisiana. Retired from the US Navy as a Commander with 20 years of service.

Robert Travis (B.A. '57) says, "Still having a great time. Spend our travel budget going to the mountains to get cool. All grandkids have graduated, and are in grad school or working. Life is good! I don't see very many notes from the class of '57 or '56 that I started in. I just had my 90th which hasn't changed much in my life. No more hiking in the Grand Canyon or mountain peaks, but I am still kicking...I live in Austin now, so call if in town."

1960s

Rubin A. Schultz (B.S. '61) shares, "Not a lot new: still enjoying grandkids and now great-grandkids. Nancy and I celebrated our 50th wedding anniversary with a Hawaiian Luau at the country club on July 8, 2023."

1970s

C. Elmo Brown (B.A. '76) writes, "Kathy and I are still enjoying the good life in retirement while living in Kerrville, Texas. In addition to several trips to Big Bend and a couple of trips to Colorado, we just recently returned from a South American adventure. We spent a week hiking through the Inca ruins scattered across south-central Peru and then a week in Ecuador. The highlight there was a tour of one of the islands of the Galapagos, where we wandered through massive rookeries of frigate birds and blue-footed boobies, watched the acrobatic antics of sea lions, tried to keep from tripping over iguanas, both land and marine and marveled at all of the wild tortoises as they roamed freely across the island. Who knows where our next adventure may take us."

Patricia W. Dickerson (B.A. '70, Ph.D. '95) says, "Volcanoes and glaciers have been the geo-focus of my wanderings this year, while instructing on Smithsonian excursions in Alaska and Iceland. Checked out the young volcano in S. Iceland and explored outer Siglufjördur in the company of fluke-walking whales, within sight of the Arctic Circle. And the cosmos regaled us with aurorae! Just back from Alaska -- no volcanic action along our route but additional soberingly fast-changing ice-scapes. Cruised Kenai Fjords on a rare clear, windless day and saw humpback whales bubble-feeding -- enthralling. And at the other pole, I'm excited to be involved in a new study in Antarctica -- a new continent for me. Co-authoring a talk for an Antarctic science meeting in Chile next month; we have a manuscript in progress on that work. No, I won't get to either Chile or Antarctica this time, but I will cross the Tropic of Capricorn to Córdoba, Argentina for the IGCP 735 field conference in October (perhaps stopping over in Buenos Aires for a tango or twelve...) Shorter on whales but long on intriguing lower Paleozoic rocks -- we'll be in the Precordillera, the area that propelled me into one of my ongoing research projects; we have a new publication in progress on that. Another West Texas study (Devils River Uplift) appeared this spring in a volume on world rifts. Meanwhile, here in River City, ongoing GeoRef work with favorite folks at AGI and UT is edifying and enjoyable. And volunteering for Austin Classical Guitar embellishes all those themes."

Armando Garza (B.A. '71) shares, "Hello to all my classmates and contemporaries. Just enjoying retirement these days. It is so encouraging to see the bright young people who are now enrolled at the Jackson School."

Don Parker (B.S. '70, M.A. '72, Ph.D. '76) says, "Becky and I have moved to Colorado Springs, but my email (don_parker@baylor.edu) remains the same. I continue to complete unpublished work on the Davis Mountains. See my

ResearchGate site if you are interested. While we will miss occasional visits to the Jackson School, we are enjoying the geology of Colorado (and cooler summers!). Please visit us if you are in the area."

1980s

Richard F. Carroll (B.S. '80) writes, "After 43 years in the oil business, I am finally retired."

Tatiana Frierson (B.S. '85) says, "Approaching my 5-year service Anniversary as CEO of Inspirus (A Pluxee Company). We are a software and services firm focused on Employee Recognition and Engagement. It's a very rewarding experience -- where in the world of the Great Resignation/Quiet Quitting -- recognizing your people and their contributions are paramount for successful organizations. I'm still in Dallas but am traveling more post-pandemic --- although the travels are exhausting, its wonderful getting re-connected in 3D!!! If you are in Dallas -- please do reach out, would love to see some of my old Geo Dogs from '85. Also, if your firm is in need of recognition / engagement -- please do ping me! Kind regards!"

Charles A. Goebel (B.S. '80) shares, "Semi-retired and enjoying life in Fort Worth."

Ben Hooper (B.S. '80) writes, "Exploration Manager for Joy Resources and John Young Inc. in Houston. Learning about Carbon Sequestration. Took a long trip to Poland last year and a visit to Vienna at Christmas. Three grandchildren in St. Louis. Hope all are well!"

Jim Immitt (M.A. '81) says, "Hello to my fellow Longhorn Alums! The beat goes on (it has too) for me as I am doing wellsite geology (aka mudlogging) in the Permian, DJ, and Powder River Basins. The downturn from 2015-2020 hit me hard and I'll be making up time with someone who will have me! It is tough work, but I am grateful for it. It never ceases to amaze me when I think about what these drill rigs are capable of doing with horizontal drilling and miles-long laterals. And yes, geology changes even though you are in the "same" source rock! Pam and I live in Corpus Christi now and we get to walk the beach often for therapeutic benefit and monitoring of sea level rise due to climate change. :) Our two children, Adrian and Angela, both live in the Denver area and work in healthcare. All is well. Peace be with all of you."

Charles G. Johnson (B.S. '83) shares, "Still producing crude oil and looking for Gulf Coast conventional producing opportunities to acquire. Ellen and I are traveling more frequently since our baby girl Lauren is now a sophomore Chi Omega sister at the University of Alabama. I never thought I would utter "Roll Tide," but now we have season tix and a condo in Tuscaloosa. As a consolation, my first game in Bryant-Denny was wearing my burnt orange and watching the Longhorns roll to victory in September 2023. My Longhorn friends have shamed me enough, and now we are also season tickets holders in Austin! Soooooooo, Hook 'em Horns!"

Richard A. Kolb (M.A. '81) writes, "After 8 years in the oil patch in New Orleans and 31 years as a consulting environmental geologist, I retired in 2021 and started working as a volunteer, building houses for Habitat for Humanity and driving the Red Cross vans to pick up blood at blood drives. I am still active in the Association of Environmental & Engineering Geology, co-chairing the Student & Young Professional Support Committee and Membership Committee, and as field trip chair and sponsor chair for the Carolinas Chapter of AEG. I took cross-country motorcycle trips on my Yamaha FJR-1300 in 2022 and 2023, 14,000 miles altogether, to the American/Canadian Rockies and the US and Canadian West Coast. I made stops in Austin to see my daughter Jennifer (MS in Social Work from the Steve Hicks School at UT) and son Travis, who went to Texas State and works at ERIS, and visited campus and the Jackson School. In February 2024, I got a little bored and started work as a part-time temp in the Brownfields Redevelopment Section of the North Carolina Department of Environmental Quality to see life from "the other side," and then in May and June I took a road trip in my car to the southern Colorado Rockies in search of a place to spend summers out of the heat and humidity of North Carolina. The Sangre de Cristo and San Juan mountains are gorgeous - all the exposed rocks! On the way home, I visited Palo Duro Canyon in north Texas. I plan to spend summers in southern Colorado starting next year."

Robert Murray (M.A. '85) says, "Retiring after nearly 40 years of trying to put stuff back in the ground. In 1983, on the heels of an acrimonious divorce from my first advisor and determined to finish what I had started, a dear friend said, "go talk to Luigi." So I did and he said, "sure." Then he handed me a rock and said, "in 1951 on a field trip with S.P. Ellison himself, I found this by the side of a road. Go see if there are any others and what they are doing there." And so began the culmination of my formal education with a study of a siliceous conglomerate in North Texas and the honor of doing so with Dr. Robert Folk. In 1985, with jobs scarce and a passable draft of my thesis under my arm, I abandoned Austin in a snowstorm to become a Field Geologist at a place called Yucca Mountain, Nevada. There, the Department of Energy had started trying to site a geologic repository for high-level radioactive waste and I figured a couple of years in Las Vegas would make for good stories later in life. That turned into 21 years (a very Vegas number) and the repository never did happen, but among the stories to tell is that I met my best friend, love of my life, and wife, Donna. In 2009, believing that if I knew something about putting one hazard in the ground, I might be able to help with another, we moved to Pittsburgh and the National Energy Technology Laboratory to help develop carbon capture and sequestration. Five years later, and thinking I'd finally found a place where DOE really was putting something in the ground, I joined a new team at the Strategic Petroleum Reserve in New Orleans and took over Cavern Integrity for the salt dome storage caverns in Louisiana and Texas. With a few side trips into groundwater protection, hazardous waste, and unconventional oil and gas production, I have opportunities to do field and lab science, modeling, regulations, and plan and manage geoscience programs in sands, shales, volcanics, and salt. Funny, this all started with the Department of Geological Sciences - the DOGS in the pre-Jacksonian epoch - and am finishing with the DOGS - Drilling Operations General Services - as we drill two microseismic observation wells to better understand salt dome and cavern dynamics. It turns out you need Long Horns to run with the Big Dogs! It's been a grand adventure. Let's see what's next. Hook 'em!"

David C. Noe (M.A. '84) writes, "Greetings to my old schoolmates. Hope you're doing well! This was an auspicious year for me. In April, I married Ms. Jo Ann Jarreau. Jo Ann and I met as employees in Rocky Mountain National Park in 1978. We dated twice and went our own ways. Later in life we came together again - our third date was 40 years later! A number of UT geology grad school friends made it to our wedding in Baton Rouge. It was a joyous reunion! On the work front, I am working for OMI, Inc., a consulting geotechnical-engineering company in Huntsville, Alabama. I work on small drilling rigs, recovering and describing soil samples, run foundation and retaining wall design models, write technical reports, and write project proposals. Occasionally, I experience the wonder of looking down the maw of a sinkhole!"

Jerry Schwarzbach (B.A. '83) shares, "Enjoying working, ranching, flying, family & being involved with the East Texas Gem & Mineral Society. Also have enjoyed being the President of the Tyler-Smith County Texas Exes for the last 3 years. We've had some great speakers at our annual Scholarship Dinners."

William Wethington (B.S. '85) says, "Greetings to the Class of '85! I have been retired for 4 years now and am enjoying our 6 grandchildren and life at the lake in Virginia and winters in Texas & beyond. Retired means semi-retired as I contribute to a couple of Energy-related boards and consult on oil and gas developments."

Arnold Woods (M.A. '81) writes, "Had quadruple bypass surgery a little over a year ago. Slow recovery (to me) but I'm back lumping 80lb concrete bags, building rock walls and terraces, etc. (Never retire – I'm working more now and not getting paid for it) Still volunteering at the local library, and I do the 'real antique' road show for the college geology museum when I ID rocks, fossils etc. Not sure if the kids or the parents enjoy it more, but it's fun to see them get excited when you explain what they have and why it's special."

1990s

Christi Gell (B.S. '96) shares, "Hi all! The Gells had a really fun summer. Part of it included a trip to Austin, where I

got to hang out with Earle McBride and Ernie Lundelius throughout the week! Was so great being with these UT geo legends. Finished the summer with a geology-filled trip to New Mexico."

Dan R. McConnell (B.S. '95) says, "I continue to pick up contract work in marine site characterization, offshore wind, and in marine minerals. Sometimes the work is not offshore but can be done from the home office. I was happy to be subcontracted as a subject matter expert to compile known marine minerals and prospects for marine minerals in the US and Territorial OCS and EEZ for the US Dept. of Interior (BOEM) in a commissioned study they just published. I am always busy year-round with the Offshore Technology Conference where I serve on the Board of Directors. On the family front, we had the joy of seeing our older daughter married this year. Our younger daughter is planning her wedding for next year. This September, my wife and I are looking forward to a working vacation in the Cook Islands, followed by some time in Hawaii. Glad to see the Jackson School prosper."

Benjamin Sloan (Ph.D. '95) Ben Sloan lives in Eugene, Oregon and has been consulting since 2023 on a challenging team management project in Qatar. Aside from crippling jet-lag, he enjoys the people, project and place. Ben has fond memories of GEO660 summer 1989 when trusty #22, the 2WD "Stink Pig," was stuck on a steep New Mexico hill with the rear differential lodged on a tree stump and the rear wheels off the ground.

Christopher S. Swezey (M.A. '91, Ph.D. '97) shares, "I am still working for the U.S. Geological Survey (USGS) in Reston, Virginia. However, in January 2024, I took a new job at the USGS -- I am now the Program Coordinator of the USGS National Cooperative Geologic Mapping Program (NCGMP). This is the Program that funds: (1) FEDMAP, which is geologic mapping by USGS geologists; (2) STATEMAP, which provides grants to State Geological Surveys for geologic mapping; (3) EDMAP, which provides grants to colleges and universities for geologic mapping; and (4) the National Geologic Map Database, which is the on-line National Archive of geologic maps of the Nation. More information about this program may be found at: https://www.usgs.gov/programs/national-cooperative-geologic-mapping-program."

2000s

Fernando Cerda (M.S. GSC '01) writes, "My journey in the field of geosciences has been both dynamic and fulfilling, spanning multiple continents and diverse roles. I graduated with a master's degree in Geological Sciences with a specialization in Geophysics from The University of Texas at Austin, an institution renowned for its expert faculty and inspiring research environment. My time in Austin was marked by extensive work and dedication, but the sacrifices made during my studies were well worth it, providing a strong foundation for my professional career. Upon graduation, I began my career with Schlumberger in Houston, Texas, where I specialized in seismic attribute analysis. Over the course of eight years, I honed my skills in seismic data processing, reservoir characterization, and seismic attribute analysis. This period was pivotal in shaping my technical expertise and understanding of the energy industry. In 2008, I was transferred to Perth, Western Australia, where I spent two years working on advanced seismic projects. The experience in Perth broadened my horizons and allowed me to engage with complex geological settings, further enriching my professional journey. My next career move took me to London, UK, where I joined Petroleum Geo-Services (PGS). At PGS, I delved deeper into seismic data analysis and played a key role in various international projects. This opportunity enabled me to work with a diverse team of experts and contribute to cutting-edge geophysical research. In 2014, I relocated to Calgary, Canada, where I transitioned into consulting roles for small independent contractors. Here, I focused on reservoir characterization, leveraging my extensive experience to provide valuable insights and solutions to clients. Consulting allowed me to apply my knowledge in a practical, client-focused setting, further enhancing my problem-solving skills. Reflecting on my academic and professional journey, my time at the University of Texas at Austin stands out as a cornerstone of my career. The rigorous academic environment, combined with the support of distinguished faculty members like Dr. William Fisher, Dr. Bob Hardage, Dr. Bob Tatham, Dr. James Simmons, and Dr. William Galloway, inspired a lifelong passion for geosciences. The experiences and knowledge gained at UT Austin have been instrumental in my career development, driving me to excel in various roles across the globe. As I continue my professional journey, I remain committed to advancing the field of geosciences through innovative research and practical application. The path from a dedicated student in Austin to a seasoned geophysicist and consultant has been a rewarding adventure, and I am excited about the future contributions I can make to the energy sector." Phone: 403 630 9499 Email: f_cerda@hotmail.com

Diego van Berkel (M.S. GSC '06) says, "As a former international graduate student at UT, I am filled with a deep sense of nostalgia and immense gratitude. The experience of studying and living in Austin brought unique benefits and unforgettable experiences for me and my family. Since graduation, I've been fortunate to pursue a successful career in geosciences. We are eternally grateful to the Jackson School of Geoscience. Love and blessings."

2010s

Taylor Canada (B.S. '15, M.S. GSC '18) and Kiara Gomez (Ph.D. '22) Taylor Canada and his wife Kiara Gomez celebrated their daughter Isabella's first birthday in July 2024 and are happily together in Houston. Taylor started a new role with Shell as a development geoscientist in their Gulf of Mexico asset team after 5 years with Equinor. Kiara is entering her second year as a data engineer supporting Chevron's Gulf of Mexico business unit. They are excited to share their love of geology and the outdoors with their daughter.

Katie Fry (M.S. GSC '15) After 10 years in Houston working in the oil and gas sector, Katie sailed into uncharted territory and joined the Geothermal Program Office, a division of the United States Navy. This pivot comes with a west coast relocation, renewed focus on field work, and opportunities to influence the adoption of renewable energy across Department of Defense installations.

Adam Marsh (M.S. GSC '13, Ph.D. '18) and Colleen Marsh (M.S. EER '14) Adam and Colleen have had a busy year in Holbrook, Arizona. Adam named a new genus and species of fossil caecilian from the Triassic of Petrified Forest National Park (https://www.nature.com/articles/s41586-022-05646-5), Colleen started a new job as a project manager for the local Northland Pioneer College system, and they welcomed a new Australian Shepherd puppy named Pepper.

Frank Leslie Morgan (B.S. '11) shares, "Currently working for TRP Energy up in Denver, CO. My wife and I made the leap up to Colorado from Texas this past spring and have been enjoying the outdoors & great weather."

Lauren Redmond (M.S. GSC '16) and David Tang (Ph.D. 2020) Lauren and David welcomed a baby boy in May of 2024!

Enrique Reyes (B.S. '16) writes, "Hey y'all! I completed my 8th year in education and have successfully transitioned out of the classroom. I started a new career in professional learning for EdTech with a start-up called Abre!"

2020s

Anthony Edgington (B.S. '20) Anthony graduated from the University of Connecticut in 2023 with a Master's in Geological Sciences. He was awarded a National Science Foundation Graduate Research Fellowship (GRFP) in 2022., and enrolled in a PhD program in Earth & Environmental Science at Boston College in 2023.

Paul Morris (Ph.D. '22) Paul is currently an exploration geologist offshore Brazil with bp.

Bethany Rysak (M.S. GSC '21) says, "Coming up on three years working for Ovintiv in Denver, Colorado! Loving the mountains, the beer, and the continued focus on good technical geoscience work!"

Marlowe Enrique Zamora (B.S. '20) shares, "Currently serving as an Assistant District Attorney!"

FRIENDS

Richard T. Buffler (B.S. '59) writes, "Christine Boss, my partner, and I continue enjoying life in Santa Fe, NM. We also still manage to travel a bit. Please come see us." Richard can be reached at rbuffler@gmail.com.

Tom S. Patty (M.A. '68 in Botany) says, "The year I left UT, I was hired by TxDOT to set up a geologic/petrography lab for the Materials and Test Division and studied concrete deterioration and aggregate sources. I worked state-wide and examined all crushed stone and sand and gravel plants that shipped to the highway projects. In 1981, I opened an office for Wiess Janney Elstner Assoc. (WJE), and for almost 30 years I served the Central Texas Area as a concrete petrographer and aggregate geologist. I retired from WJE in 2011 after 30 years but have remained a part of the almost 50-employee Austin office as an Affiliated Consultant. In 2020, I started working with landowners using equipment to sample to depths of nearly 30 feet and below the blackland gumbo (3 to 6 ft) was a caliche marl layer on top of gravel. Some of the gravel was over 30 ft thick and is part of the Qhg formation. A state-of-the-art plant came on line at the end of May 2024 and produces sand and gravel for the ready-mix concrete industry."

Bill Woods Retired Executive Assistant in the Department of Geological Sciences (now the Department of Earth and Planetary Sciences), shares, "I continue to volunteer at the Heart Hospital of Austin, and am Treasurer and on the Board of Directors of the Bryker Woods Neighborhood Association, which takes a good bit of my time. Francisco and I took his Mom to El Salvador last year to visit her family there and that was a great trip. This summer we are looking at a possible trip to Nova Scotia. I had a great visit with Mark Cloos and we caught up on old times. If anyone would like to contact me, I still use billw@utexas.edu as my email."

PROFESSORS EMERITI

James Sprinkle, Professor Emeritus, writes: "I've just completed my first year in my new office with Jack Sharp and Clark Wilson. It is a comfortable place and we have different schedules that allow us to work very much like when we had separate offices.

Last October, I had a stroke which required a hospital stay of 8 days and an operation to remove plaque in my left carotid artery. While I have recovered and remain free of additional risk, I have some difficulty with my speech. I am glad that I have been cleared for driving. I appreciate the many individuals in the department who have sent their well wishes over this time. I am still working with several colleagues on projects that were in process before the stroke.

During 2024, I continued to work on three such projects. My project with James Saulsbury and Tomasz Baumiller on New Comatulid crinoids from the Early Cretaceous Glen Rose Formation is, as far as I know, in press and I expect it to be out sometime soon if it already has not been published by the time this Newsletter is out. Brad Macurda and I have recently submitted a memoir to the Journal of Paleontology on Early Mississippian Blastoid faunas from the Canadian Rockies. It is in the Journal's review process and we hope to see it published sometime in the next year. My last project with Samuel Zamora and Tom Guensburg on early echinoderms is still in development and I will have more information soon."

Alumni

John Aldridge (B.A. '70), 76, passed away peacefully at his home on November 16, 2023. His family and the Tulsa community are abundantly grateful for his life, a life well-lived. John was born in San Francisco, California in 1947 to John Vernon and Beverly Nan Aldridge. His family moved to Plainview, Texas, shortly after his birth. After his father's death in 1961, his mother moved the family to Austin, Texas, where he attended McCallum High School and gained life-long friends. He studied geology at The University of Texas at Austin, graduating with a bachelor's of science degree in 1970. He graduated from The University of Texas Medical Branch at Galveston in 1975. Following his residency in anesthesiology at Scott & White Medical Center in Temple, Texas, he began his 40 plus year career with St. Francis Hospital-based Associated Anesthesiologists Inc. He married Jeanie Marie Northcutt in 1983. John and Jeanie raised their children, John and Sidney, in Tulsa. John was a thought leader within his large anesthesia group, of which he was a past president. He was appreciated for his wonderful compassion, willingness and ability to take care of very sick patients, and his famous wit. He was a past president of the Oklahoma Society of Anesthesiologists. John pursued his passion for all things car-related. He maintained an ever-changing group of vintage cars. He collected Cushman motor scooters and was active in the Cushman community, attending meets with his wife, Jeanie, on their beautifully restored scooters. John was a devoted son, brother, husband, father, grandfather, friend, and physician. He adored and provided for his whole family. He took loving care of his widowed mother until she died at the age of 100. John is survived by his wife, Jeanie Marie Aldridge; his son John Vernon Aldridge (Genevieve), daughter Sidney Aldridge Gnaedig (Christopher); his adorable grandchildren Petra, Declan, and Hendrick; his brother Bryan and his sister, Sidney.

Theodore Bartling (B.A. '79), 69, of Austin, Texas, passed away on October 27, 2023 in Temple, Texas. Theodore was born to Theodore Charles and Phyllis McGuinnis of Houston, Texas. Theodore grew up primarily in Houston, Texas. He attended the University of Texas for his Bachelor's in Geology. Theodore loved being with family and friends, being on the lake, playing sports with kids, and had a burning passion for music. He owned and operated Bartling Oil Co. and Heart Music. Theodore was a caring and loving person who loved generously. He consistently was interested in other people's passions and had an amazing way of remembering and inspiring them. Theodore is survived by his son Theodore Adams Bartling, Jr. and wife Paige Bartling, daughter Lauren Bartling; grandchild Cannon Bartling; his sister Pam Bartling.

Pat Burbridge (B.A. '58), Helen Patricia Burbridge was called home by the Lord on May 14, 2024 at the age of 87. She lived a beautiful, full life and was loved by everyone who met her. She was known for her gentle demeanor, keen intellect, and a curiosity that did not diminish with age. She is survived by her daughters Julie Tanner and Ellen Comer, sons-in-law Scott Tanner, Tim Comer and Don Owen, and siblings Richard Parks and Sue Lilley. She was a loving and devoted "Nonnie" to her grandchildren Brian and Colin Tanner, Grace and Nathan Comer, Adele Owen, and great-grandson Ray Tanner. She is preceded in death by husband Wallace Burbridge, daughter Kay Owen, and sister Martha Goodman. Pat graduated from the University of Texas, Austin, with a degree in Geology and spent a long and successful career with Sun Oil Company. An avid reader, Pat was a member of multiple book clubs, and she loved all things in nature with a particular fondness for wildflowers. She had a heart for serving and was a long-time member of the Richardson Woman's Club and a nursery worker for her church. She will be deeply missed.

Burke Burkart (B.A. '54) of Arlington, Texas, passed away in late July in the presence of his beloved wife, Marilyn, and his family near his residence at the Texas Masonic Retirement Community. Burke was a Professor of Geology at the University of Texas at Arlington for thirty-five years whose research focused on Central American plate tectonics. He was born and raised in Dallas, Texas, by his parents, Velma and Herman. He attended Highland Park High School before leaving for Austin, Texas, to attend The University of Texas at Austin, where Burke graduated with Bachelor's and Master's degrees in Geology. He served as an Air Force officer in Germany before returning to Texas to complete a Ph.D. in Geology at Rice University. Burke and Marilyn married in Philadelphia before moving to Arlington in 1970, where they raised sons Patrick and Michael. Burke is survived by his wife Marilyn, sons, grandchildren Zoe and Felix, and brother Robert.

Susan Cage (B.A. '50), 95, of Georgetown, Texas passed away peacefully on Saturday, April 13, 2024. Susan was born September 28, 1928 in Houston, Texas. She was the only child of Rene Lowry Kiefner and Charles Harold Kiefner. Her early schooling was scattered in several Texas cities but was mainly in Houston. She attended Woodrow Wilson Elementary School and Sidney Lanier Junior High School. She graduated from Lamar High School in 1945. Susan received an Associate of Arts Degree from Stephens College in

Columbia, Missouri in 1947, and a Bachelor of Arts Degree in Geology from The University of Texas at Austin in 1950. Susan met her future husband while both were majoring in Geology at the University of Texas. She and Warren Jackson Cage Jr. (Jack) were married on April 11, 1953. Susan was employed with Gulf Oil Corporation in August of 1950 as a file clerk, then draftsman. Later, she was promoted to geologist, retiring in 1983. She and Jack lived in Houston, Corpus Christi, and Bakersfield, California. Both she and Jack enjoyed traveling, especially in the western United States. After retiring, they built a home in Fair Oaks Ranch, north of San Antonio, Texas. In 1998, after Jack's health deteriorated due to Parkinson's disease, they moved to Sun City, Georgetown, Texas. She again pursued her interests in nature as a member of the Sun City Nature Club. Jack passed away on November 13, 2006.

Royce Carr (B.S. '76), beloved husband, father, grandfather, and friend, passed away peacefully with family on February 25, 2024 in Ft. Worth, Texas. He was 72 years old. Born on September 28, 1951 in Texarkana, Arkansas, Royce was the son of John Preston Carr and Evelyn Faye Kirby Carr. He is survived by his loving wife, Deborah Carr; sons & daughters-in-law, Preston & Stephanie Carr, Patrick & Lindsey Carr, Paul & Anna Carr; grandchildren, Royce Preston "Tres" Carr III, Clifton Payne Carr, Emma Claire Carr, Catherine Elizabeth Carr, Lyla Lorraine Carr; sister, Marilyn Carr Chappell & husband, Wayne, numerous nieces, nephews, cousins and his beloved uncle, Royce Kirby. Royce graduated from The University of Texas at Austin with a Bachelor of Arts in Sociology and a Bachelor of Science in Geological Sciences. He went on to have a successful career as a geologist in the oil and natural gas industry. Royce began his career with the Montana Power Company in Huntsville, TX. He went on to work for Superior Oil in The Woodlands, TX, and then went to work for The King Ranch in Kingsville, TX. Royce started working for himself in Mt. Pleasant, TX with his business partner Bill Silk. He was active in the American Association of Petroleum Geologists. Royce served as President of the DPA and received the distinguished services award in 2004. Royce had a passion for University of Texas Athletics. He loved watching his beloved Texas Longhorns play football, basketball, baseball, and all the post-game discussions with his family and friends. In his community, Royce was admired for his many efforts in service. He enjoyed coaching his sons, their teammates, and many more Mt. Pleasant youth in baseball and soccer. Royce served on the MPISD School board from 1997 to 2009. He served on the Titus Regional Medical Center hospital board from 2017 to 2024. He was a longtime deacon at First Baptist Church Mt. Pleasant and was very passionate about his Young Adult Sunday school class. Royce leaves behind a legacy of love, kindness and integrity. He will be deeply missed by his family, friends, and all who had the privilege of knowing him.

William Carr (B.S. '58) was born on September 12, 1936, in Houston, Texas to Henrietta Teel and John Ellis Carr and passed away on June 5, 2024, at the age of 87. He was predeceased by his two brothers. He graduated from WB Ray High School and earned his degree in Geology from The University of Texas at Austin where he was a member of Sigma Alpha Epsilon Fraternity. He also received his law degree from UT and went on to become a certified landman and real estate broker. After initially practicing law and working in the oil and gas industry for Southern Minerals, he eventually began full-time cattle ranching. After an initial series of land purchases with his parents and brothers, by the early 1970s, he had become the sole owner of 12,000 acres in Webb County, Texas, and began breeding Beefmaster cattle. He eventually acquired two additional ranches in Wilson and Kendall Counties for a total of 14,500 acres and continued to breed Beefmaster cattle on all three ranches. He was passionate about Beefmaster cattle and has served the Beefmaster Breeder United organization in numerous ways, including as President and chairing various committees. He received the prestigious Breeder of the Year award a record two times, in 1993 and again in 2021, as well as the BBU Environmental Award, BBU Performance Award, Live Oak Legend Award, JBBA Helping Hand Award, and along with his wife Dusty, was inducted into the BBU Hall of Fame in 1996. He recently said "I have been raising cattle and acquiring and improving land solely to raise cattle for 70 years. I will be continuing to do so as long as I can pull my boots on each day." And that he did. He leaves behind his wife of 55 years, Edith Joyce "Dusty" Carr and two children, Kirk Andrew Carr, of Pleasanton, Texas, and Courtney Carr Baxter (Todd) as well as three grandchildren, Claire Elizabeth Baxter, Kate Teel Baxter and Tessa Autrey Baxter, all of Austin, Texas.

Jack Cartwright (B.S. '51, M.A. '55) passed away peacefully at Midland Memorial Hospital after a brief illness. He was 93. Jack Cleveland Cartwright was born on June 24, 1930, to Grover Cleveland Cartwright and Laura Thelma Cartwright. Jack was the oldest of three children. He had a younger brother, Richard Cartwright and a sister Ann Hodge. The Cartwright family lived on farmland that had been in the family since 1856. He started his education in a two-room country school. Education was always important to Jack and he graduated from Gainesville High School in 1947, earned a BS Degree at the University of Texas in 1951. He was hired to work at Standard Oil & Gas in Monahans, TX during the severe drought of the 1950s. His parents were sure he was going to the "end of the earth." He returned to UT in 1953 and earned his Master's Degree. He also met and fell in love with Barbara Wells who worked in the Geology Library. He married Barbara in Wellington, TX on June 4, 1955. Jack

and Barbara started their married life in Midland, TX. Jack was employed as a geologist throughout his life. He worked for Texas Pacific and later for MGF. In 1971 he formed a partnership with Ross Roberts and Charlie Koch. Jack truly believed in service to his church and community. He was very active at First Methodist Church, serving on numerous committees, boards and classes. His community service included Midland Junior Baseball Association, Leadership Midland, Midland Planning and Zoning board, Board of Adjustment and the Community Service Award Committee. His professional activities included the West Texas Geological Society, AAPG and SIPES organizations. He was a founding member and officer of the Midland Energy Library as well as a member of AAPG's House of Delegates. In later years, Jack was an active board member of The Samaritan Counseling Center of West Texas and continued as an Advisory Board Member. In 2005, Jack and Barbara moved to Manor Park Village where they resided until July of 2022. Their final home was Cimarron Place in Midland.

Gerald Eubanks (M.A. '66), lovingly known as Jerry, peacefully passed on September 2, 2023. He was born on November 6, 1940, in Port Arthur, TX. Jerry's life journey was one filled with remarkable accomplishments and unwavering dedication. He pursued an academic path that led him to Lamar Tech University, where he studied Geology. He then went on to earn his Master of Science from the University of Texas. Jerry then pursued Petroleum Geology as his career. Beyond his professional achievements, Jerry held dear the values of faith and family. He embodied integrity and honor in all aspects of his life. Jerry was deeply devoted to his family, friends, and the Lord and valued these relationships above all else. Jerry had many different interests. Devoting more than two decades as a dedicated guitarist for his church community, Jerry used music to express his deep spirituality. He also shared his musical talent with the Brazos Valley Band. He had a deep love for geology and meteorology. He even collected rocks. Jerry had a green thumb and spent countless hours tending to his yard. He also loved to swim and hunt. Above all else, Jerry cherished his role as a family man. In Bulinda Ebanks, his beloved wife, he found a partner whose unwavering support and love sustained him throughout their journey together. They celebrated 59 years of marriage in August.

Tom Fanning (B.S. '56), a much-loved father, husband, and grandfather passed away on September 1 at the age of 89. Born in Dallas in 1934, Tom graduated from Sunset High School as an honor student and president of the Student Council. He went on to the University of Texas in Austin and married his high school sweetheart, Anne. He obtained a BS degree in geology and served as a member of Sigma Gamma Epsilon honorary society and president of the honorary Arnold Air Society. He was called to a three-year tour of active duty in the United States Air Force where he served as an instructor navigator in The Strategic Air Command. Tom was employed by Marathon Oil Company with a career spanning 38 years. After several relocations, he and Anne resided in Houston during the last 20 years of his career. He advanced through various professional and managerial assignments, serving first as Vice President of North American Exploration and later as International Exploration Vice President. He was a graduate of the Program for Management at the Harvard School of Business. Tom was active in the American Association of Petroleum Geologists and served as Treasurer of the Board of Trustees of the American Geological Institute. He was an Honorary Lifetime member of the Jackson School of Geosciences Advisory Council. He served a term as Chairman and subsequently chaired the Nominating Committee for over a decade. He also created an endowed Scholarship for Geosciences Honors Undergraduates.. He is preceded in death by his wife, Anne, and his grandson Hunter Fanning. He is survived by his two children and spouses, Cynthia and Jim Seeba of Milton, Georgia, and Tom and Rhonda Fanning of Houston, Texas, grandchildren Ainsley, Drew and Meredith McKay, Gary Seeba, Max and Katie Fanning, and Grace Fanning, and great-grandson Ford Hunter Fanning.

Frank Felcman (B.S. '49) passed away on May 10, 2024, two days after his 100th birthday. He was born May 8, 1924, to Elsie Ferrell Fuller Felcman and Frank Joe Felcman in Sealy, Texas. On graduation from Sealy High School Class of 1941, he attended Southwest Texas State Teacher's College in San Marcos for a year. He then worked with his sister, Leah, in Tulsa OK, as a post office file clerk and mimeograph operator before enlisting in the U.S. Navy in December 1942. He was called to active duty in June 1943 as an Aviation Cadet. He was based at the University of Texas facilities in Austin where he began ground school, flight training, and physical conditioning. Following earning his Naval Aviator wings (24 Oct 1944), he flew patrol missions over the Atlantic coast for the remainder of World War II. He was commissioned an Ensign, serving a total of 3 years. He also served 9.5 years in the Naval Reserves where he achieved the rank of Lieutenant. After release from the Navy in December 1945, he attended The University of Texas at Austin, graduated with a Bachelor of Science in geology in 1949, and began working for a geophysical exploration company. In 1950, he married Shirley Newman, his college sweetheart, and continued his oil exploration work, which took him to many small towns in Texas, the swamplands of Louisiana, and as far north as the Badlands in North Dakota. In 1963, he was transferred to Perth, Western Australia for a period of two years to work for West Australian Petroleum Pty. Ltd. (WAPET), a division of Standard Oil of California. He was transferred from Perth back to Texas and resided in Houston until his death.

Following an urge to work for himself, Frank researched franchises in various industries and chose to move into the printing industry in 1971 when he purchased Kwik Kopying #47. In 1981, he purchased a second location in Austin. He sold both businesses to his daughters in the mid-1980s, then worked for a variety of others until his retirement. He was predeceased by his parents and his sisters Leah Mayeaux, Helen Tomlinson (Lloyd), and Doris Nastoupil (Carl Jr.). He is survived by his wife, Geneva Felcman; 3 children, Kathleen Barkley, Frank L. Felcman Jr. (Katherine), and Leah Linney; grandchildren, Charlotte Felcman Whitaker (Robert) and Kimberly Felcman Hatcher (Adam), and two great-grandchildren.

Don Ford (B.S. '60) passed away peacefully at home on Monday, the 13th of May 2024, following a lengthy illness. Don was born in Houston on the 27th of February 1937, to Lucile and Don D. Ford. After graduating from Houston's Lamar High School in 1955, he attended the University of Texas in Austin, where he pledged Delta Kappa Epsilon fraternity. Don earned his Bachelor of Science degree in Geology, and following graduation, he entered the U.S. Army as an officer serving in the peace-keeping mission in Korea. While in the Army, Don used all his leave time traveling through Southeast Asia and Europe. After the Army, Don took his first job with an oil well service company and was transferred to Tyler, Texas. While in Tyler, he also served as the company's international trouble-shooter, adding even more foreign countries to his experiences. While living in Tyler, Don began dating Ann Suggs. Don and Ann married on April 30, 1966, and they immediately moved to Tripoli, Libya, the first of several overseas homes for them. By 1969, the Fords had returned to Houston where they decided to stay to happily raise their family. Don spent many years working in the oil industry, and upon retirement, he indulged his passion for investing in the stock market. Following Ann's retirement from teaching, Don and Ann began spending several months a year at their beloved condo at Lake Tahoe and traveling to countless foreign countries. They truly had some great adventures, with Don doing all the planning, including celebrating their 80th birthdays in a tent in the desert of Mongolia. Don was a 40-year member of the Houston Petroleum Club, and he cherished his Friday lunches at the Men's Roundtable. In his retirement, Don also greatly enjoyed spending Tuesdays at the Woodshop of St. Luke's United Methodist Church, where he helped make toys for underprivileged children. Don is preceded in death by his parents, Lucile and Don D. Ford. He is survived by Ann, his beloved wife of 58 years; their sons Don D. Ford III and Spencer Carrollton Ford and his wife Catherine; and their grandchildren .

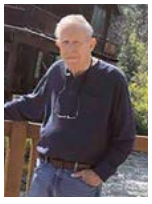
Ronald Gieger (B.S. '63, M.A. '65), 88, born in Summer 1935 in Baytown (Goose Creek), TX, passed away on September 22, 2023, in Diboll, TX. Ronald attended Ashbel Smith Elementary, Robert E Lee High School, and The University of Texas. He served in the US Navy.

William (Bill) Glover (B.S. '85) passed away in Sarasota, Florida on 23 October 2023. Bill was born in Hartford, Connecticut to Claudette and William Glover on 15 December 1963. At the age of 8 Bill's family moved to a waterfront home on Narragansett Bay in Rhode Island where he took advantage of everything the bay had to offer—swimming, boating, sailing, waterskiing and most of all fishing and clamming. He worked hard as a paperboy through grade school and eventually bought himself a motorboat that he kept on a mooring off the backyard beach. Bill was very proud of that boat and kept it through high school until he graduated in 1981 and went off to college. After a fun-filled family trip to Texas in his teens, Bill wanted to experience a large prestigious school with a lively football tradition, an active social scene, and excellent academics. Bill chose to attend The University of Texas at Austin. Bill was a founding and instrumental member of the UT rowing club. Bill loved driving his CJ7 Jeep which took him on many adventures including cave spelunking where he broke his rocks open with a tiny hammer and spit on them regularly to see the minerals. Bill graduated with a Bachelor of Science in Geological Sciences from The University of Texas at Austin in December in 1985. In June 1989 Bill married Cynthia Schmidt Glover and in May of 1995 Jessica Lynn was born. Along with his Longhorns, Bill was an avid fan of his favorite teams the St. Louis Cardinals and the New York Giants. Bill was a top salesman in the oil business in chemical sales. Bill's career took him to locations including Houston, West Texas, New Mexico, and Alaska. Bill was very proud of his job on the North Slope and volunteered to be part of the environmental rescue team and the first response team. Bill had colleagues and customers alike who respected him and appreciated his professional qualities and expert knowledge. As an intellect, Bill's eloquent letter writing indicated a passion for science, philosophy, and poetry. Bill was charismatic, personable and playful and had the ability to make good friends everywhere he went! Bill is survived by his daughter Jessica (Jessie) Glover Klingemann (husband Miles) who resides in Texas, his mother Claudette Hebert Glover, older sister Suzanne Glover Cherau (husband Christian), and younger sister Michelle Glover Miller (husband Mark), and many nieces and nephews. Bill is preceded in death by his father, William DeForest Glover Jr.

Hyman "Lee" Harvard (B.A. '55), 91, went to be with his Lord and Savior, Jesus Christ, August 26, 2023, surrounded with love by his immediate family. Lee was born February 7, 1932, to Eva Mae Sheffield and Everett McGehee Harvard in Pinehurst, Georgia. In 1936, the family of six, later to be seven, moved to Corpus Christi, Texas. In 1938, the Harvard family moved to another part of Corpus Christi where Lee met four boys his age who would become friends for the rest of their lives. They stayed in close

contact for over 81 years. Lee always said that the two greatest blessings the Lord had given him were family and friends. All five friends decided to go to college at Texas A&M University, at that time an all-male, military corps campus. Lee was always very proud to be a part of the Aggie corps. He worked various jobs at A&M and in the oil field, including his first roughneck job, to put himself through school. After his third year at Texas A&M, Lee transferred to the University of Texas in Austin where his girlfriend and future wife-to-be, Joanne Wertz was enrolled. On August 21, 1954, Joanne and Lee were married in Corpus Christi, Texas. After a brief honeymoon, they returned to Austin to complete their college degrees. They enjoyed 63 years of marriage before Joanne's passing in 2017. Industrious and resourceful from an early age, Lee had a variety of jobs over the years, culminating in his career in the oil business. Upon college graduation, Lee and Joanne moved to Midland, Texas, to begin his career. Soon after in 1956, they moved to Roswell, New Mexico, for him to work for Sinclair Oil Company. In 1960, Lee left Sinclair Oil to become Exploration and Production Manager for Robert Enfield Oil Company, then moving on to manage Southwest Production Company. In 1970 Lee started his own company, Harvard Exploration Company. The company continues today as Harvard Petroleum Company, LLC, under the management of his son, Jeff Harvard. Lee and Joanne loved calling Roswell home and raising their two boys here. Lee and Joanne were very active in the Roswell community, and he served on numerous boards and with various organizations. They were lifelong members of First United Methodist Church where he served and led the Cowboy Bell Scholarship Fund. He was also an active member of Community Bible Study for many years. Lee was a long-time member of the American Association of Petroleum Geologists and the Roswell Geological Society, serving in various roles and positions, and traveling nationally and internationally to conventions and meetings. He was a strong supporter of the Roswell Desk and Derrick Club and the NM Landman's Association. He was also active in the Independent Petroleum Association of America and a founding member of the Independent Petroleum Association of New Mexico. Lee enjoyed the friendships that serving on the board of Valley Bank of Commerce afforded him over the years. He also served as President of the Alto Alps Homeowners' Association where he and Joanne built one of the first condo units in 1974. Lee was preceded in death by his beloved wife, Joanne Harvard; son, Alan Harvard; older sister, Mary Carter; and older brother, Tommy Harvard. Lee is survived by his oldest sister, Jean Lauderdale; sister-in-law, Mary Harvard; younger, brother Larry (Terry) Harvard; son, Jeff (Jane) Harvard; grandson, Jeremy (Ally) Harvard; granddaughter, Julia (Connor) Harvard Robertson; and great granddaughters, Stella and Goldie Harvard.

James Haynes (B.S. '56) passed away on May 11, 2024, at the age of 90. Born on January 12, 1934, he touched the lives of many with his warm heart and vibrant spirit. James was the last in a line of distinguished petroleum industry professionals, making his mark as a dedicated petroleum geologist. A graduate of the University of Texas, he spent most of his illustrious career in Corpus Christi, where he honed his expertise and earned the respect of his peers. With his sharp mind and unwavering dedication, James made a lasting impact on the industry, leaving behind a wealth of knowledge and a reputation that will endure for generations to come. His legacy as the last of his family's lineage in the petroleum industry will be remembered with reverence and respect. An active member of the Society of Independent Professional Earth Scientists, James was known for his passion for his work and his unwavering commitment to his community. Retiring to Wimberley, Texas, 40 years ago, James found solace in the beauty of nature and his love for golfing. He was a gracious host, known for his entertaining stories and infectious laughter that made everyone feel at home in his presence. A devoted family man, James cherished his relationships and worked diligently to keep his loved ones connected. James leaves behind a legacy of love and togetherness that will endure through the generations.



Harold Illich (B.S. '63) was born on December 17, 1940, in Kansas City, Missouri and died on July 15, 2024. Harold's family moved to Fort Worth, Texas within a year of his birth. Harold grew up in Fort Worth as the son of an aviator and a nurse. Harold graduated from Arlington Heights High School in Fort Worth before attending the University of Texas (Austin). At Texas, Harold studied geology. After graduating, Harold went to the University of Montana to study under the venerable professor, Don Winston. Harold graduated and enrolled in a Ph.D. program at the University of Texas but left to begin a distinguished career with Sun Oil Company. Harold believed that everyone had his enthusiasm for geochemistry, and in Sun, Oryx, GeoMark, and Pioneer, he found people who shared his passion. During this long career, Harold took special pride and interest in mentoring young scientists. In 1968 Harold married Nanette Dupont ("Netsy') of Houston. Together Harold and Nanette had three children, Niles (Amanda), Karli (Hunter), and Collins (Katie). They also had their beloved orchids. Together they formed wonderful family traditions: An annual trip to the Christmas Tree farm, summers at the YMCA of the Rockies, lunch on Saturday, orchids for every occasion or none at all, the gifting of books at high school graduation, and warm, loving gatherings of families and friends. Harold is survived by his cherished Netsy, his children and their spouses, his nine grandchildren (Angelica, Skylar, Dobie, Susan, Hailey, Cora, Elaine, Walter, and Corbin), and his dogs (Sherlock, Murphy, and Bruno).

Steven Johnson (B.S. '83) passed on March 20, 2024. He was a devoted husband, father, and best friend to so many people, and will be remembered for his kindness, generosity, humor, and faith. Steve was born in Houston on March 6, 1959. Steve attended Cy-Fair High School where he kept in contact with many lifelong friends. He graduated from the University of Texas in Austin and was a member of the Phi Gamma Delta fraternity. Steve loved his Texas Longhorns! Upon graduation, Steve moved back to his hometown of Houston, Texas, where he worked in media and commercial real estate for many years. In Houston, he met his wife Jenny, and together, they shared over 32 years of a wonderful marriage and were blessed with two children, Amanda and Travis. Steve's family was his top priority. He was the kind of dad who was always available for anything his family needed. In addition to spending time with his family, several of his favorite activities included playing golf, fishing, and loved hunting with good friends. Steve joins his parents Ron and Georgia and sister Pam in heaven where they are living in the fullness of eternal life. He is survived by his wife Jenny, two children, Amanda and Travis, his niece and nephew, Brian and Laura, brother-in-law Charlie Dunn, and many other family members and friends who will miss him dearly.

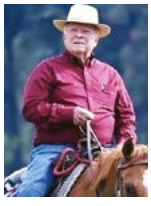
John Kimberly (M.A. '61), 87, passed away on Friday, April 19, 2024. John was born on April 15, 1937, in Norwalk, Connecticut, to Oliver and Bessie Kimberly. He graduated from Avon Old Farms prep school in Avon, Connecticut, from Williams College in Williamstown, Massachusetts with a B.A. in geology, and from The University of Texas at Austin with an M.S. in geology. He was a member of Phi Gamma Delta fraternity. He married his high school sweetheart, then Marion Conrow, on June 13, 1959. He started his long career as a geologist with Anadarko Petroleum Corp. in Liberal, Kansas. He and his wife Marion became Midland residents in 1965 when he was transferred here by Anadarko. He founded Grand Banks Energy Co. in 1977. Professional memberships included American Association of Petroleum Geologists, Independent Petroleum Association of America, and Society of Independent Petroleum Earth Scientists. He served on both the Presidents Advisory Board and the Business Advisory Council at the University of Texas at the Permian Basin. The latter was the founding board of the Permian Basin Water in Energy Conference. He also was a member of the West Texas Geological Society, Southwest Texas Oilman's Tennis Tournament, Exchange Club, Midland Country Club, and the Unitarian Universalist Church of Midland where he served as chairman of the board. Highly regarded in his profession, John's love for people showed in his many longtime friendships. John and Marion are big supporters of education and the arts. John is survived by his wife Marion of 64 years, his children and their spouses, Karen and Peter Finklea of Austin, John and Marlene Kimberly of Fairfield, Connecticut, and David and Stephanie Kimberly of Lubbock. He is also survived by his grandchildren, Andrew Kimberly, Griffin Kimberly, Eli Kimberly and Lauren Kimberly, his sister Joan Campbell of Florida

Leon Lampert (B.S. '51, M.A. '53), 93, beloved husband, father, grandfather and brother, passed away Dec. 30, 2023, in Dallas. Leon was born in San Antonio to Abraham and Elsa Lampert on Sept. 14, 1930. Leon was a second lieutenant commissioned as an engineer in the U.S. Army Corps of Engineers as a military terrain analyst, serving stateside during the Korean War. Leon attended The University of Texas at Austin, where he received a Bachelor of Science in geology in 1951 and a Master of Arts in geology in 1953. Leon was a member of the Alpha Epsilon Pi Fraternity. Leon met his future wife, Barbara Oster, in the summer before his sophomore year at UT and Barbara's freshman year at UT. After Leon completed his master's degree and Barbara graduated with a Bachelor of Music, they married in 1953 in Dallas. Leon and Barbara lived in Dallas, Midland, then back to Dallas. Leon spent his career as a petroleum exploration geologist, working for Dalport Oil Corporation as vice president and head of exploration from 1958 to 1993. While at Dalport, he discovered oil fields in Texas and New Mexico. In 1969, he discovered a wildcat oil field in Chaves County, New Mexico, which was named after him, the Double L Queen Field. Leon and Barbara had three children during these years, Gail, Wayne and Ellen. In 1964 they moved their family to Corpus Christi, where he continued to work for Dalport. Leon was very active in Jewish organizations. At B'nai Israel Synagogue in Corpus Christi, he was vice president and a board member for 15 years. He was president of B'nai B'rith twice. In 1995, Leon and Barbara moved back to Dallas to be close to Gail and her husband and two children, who were living in Dallas at that time. They joined and participated actively in the congregations of Shearith Israel Synagogue and Kehillat Chaverim in Dallas. He was a Biblical scholar and studied Torah and ancient Israelite societies. Leon was happiest when he was with his wife, children and grandchildren. He is survived by his adoring wife, Barbara; his children, Gail (David) Greenberg, Wayne (Pninit) Lampert, Ellen Lampert Pollock; and several grandchildren.

Matthew Ledvina (M.S. '17) passed away unexpectedly on March 24, 2023 at the age of 33. Matt was born on October 3, 1989 in Milwaukee, WI. He was born with a caring soul and a passion for nature, geology, food and other cultures that took him to all corners of the globe. Matt graduated from Marquette University High School in 2008 and went on to study Geology at the University of WI earning a BS in Geology. He continued his Masters studies at the University of Texas, Jackson School of Geosciences. After graduating he began his career at Hess Corporation in Houston. He shared his passions with friends and family in many ways... hiking Mt. Kilimanjaro, Glacier National Park, the Grand Canyon and Isle Royal

with close friends or family. When family and friends hiked with Matt, they were treated to a geology lesson on the structure and chemistry of the rocks and how they were formed. It's something his hiking partners looked forward to as part of the experience. He enjoyed cooking, baking, dining at the newest restaurant or best hole-in-the-wall in Houston; nurturing his gardens and sharing the harvest. Matt's enthusiasm for geology was an extension of his love of nature. Whether logging core, hiking in a slot canyon or dropping into a mine a mile deep, he found beauty in the rock. This passion led him to his career at Hess Corporation. He truly enjoyed his work and his work family. Matt sought to make the lives of those around him easier and better. He was a teacher, a mentor, a sounding board, a friend or whatever you needed. He wanted to bring joy to the lives of others, he wanted to help you with your career in whatever way he could, and just generally would 'walk through fire' for his loved ones and friends. He is survived by his parents Daniel and Susan Ledvina, his brother Steven Ledvina, his cousin Joe (Wellsley) Ledvina, his Goddaughter Abbie, his partner Moira Chapman, many loving Aunts, Uncles, cousins and friends.

Pamela Luttrell (B.A. '73, M.A. '77) was born in Dallas, Texas on September 26, 1947, to Margaret Ann Cheatham and George Howard Luttrell Sr. After graduating from Bryan Adams high school, she went on to attend the University of Texas in Austin. During her graduate studies, she met her future husband of 44 years, William John Flynn, a former Air Force instructor pilot, counsellor, and advocate for Austin's disabled community. Although she eventually earned her Master's in Geology, she also pursued microbiology and German, two fields of study that happened to be perfectly aligned to her first major assignment at Mobil Oil. After a few initial years working on rigs in the Gulf of Mexico, she was transferred to Celle, Germany, to lead an exploratory team of geologists analyzing the ancient layers of stone deep beneath the North Sea. In 1983, during that first international assignment, she and William celebrated the birth of their son Aaron. Over the next 25 years, Pamela's career would take her to every corner of the world, earning her the title of Mobil's VP of Global Exploration. In her early twenties, she had spent a year at the Lutheran Deaconess Mother House outside of Philadelphia doing charity work and had always exhibited a strong tie to her faith. But as she grew older, that faith expanded into a multitude of spiritual disciplines. Her spiritual practice would be invaluable in her long and courageous battle with Parkinson's Disease, but so would be her enduring wit, her sharp sense of humor, and her generous nature. She passed on at home, a little after midnight on the 24th of April, after a four-day vigil with family and friends. She is survived by her husband, William Flynn, her son, Aaron Flynn, and her brother, Howard.



Jack Mayfield (M.A. '65), age 86, departed his full and happy life on November 19, 2023. Jack was born in New Orleans, Louisiana to Nancy McCleskey Mayfield and Dr. Jack Hastings Mayfield. Raised in Houston, Texas, Jack graduated from San Jacinto High School, earned a B.S. in Geology from the University of Oklahoma, and a M.S. in Geology from the University of Texas. Jack was a member of the Kappa Sigma Fraternity at The University of Oklahoma where he met and later married his college sweetheart Patti Lynn Goldston in 1959. In Houston he joined Goldston Oil Corporation as a geologist and enjoyed satisfying careers in petroleum exploration and production as well as banking, and real estate. After Patti's death, Jack married Susan Ray Dunlap in 1976. Over their 39-year marriage, they raised a combined family of seven children. During his long business career, Jack was President, Chairman and CEO of Goldston Oil Corporation. He was a former director of University State Bank, Greenway Bank, Chairman of the Board of Riverway Bank, and Director of Texas State Bank. Additionally, he was a member of the Management Committee and a Founder of Coastal Conservation Association (CCA), former Trustee of CCA Foundation, Life Trustee and former Chairman of The Kinkaid School, former Trustee of Kinkaid Endowment, Member of the UTHealth Houston Development Board, Member of University of Texas Geology Advisory Council, former Director of the Seminary of the Southwest, and Director of Open Door Mission. Jack was also a member of the Independent Petroleum Association of America, American Association of Petroleum Geologists, Texas Independent Producers and Royalty Owners Association, and the Petroleum Club of Houston.

Joe Meadows (B.A. '62), 88, died peacefully in his sleep at St. Catherine's of Waco on July 8, 2024. Joe was born at home in McGregor, TX to the late Harry Hervey Meadows and Letha Estelle Dawson Meadows on December 1, 1935. He was the oldest of three brothers. Joe was a proud member of the McGregor Bulldog class of 1954. Growing up, Joe worked for his dad, Hervey, in the family water well drilling business, Meadows Drilling. He graduated from The University of Texas at Austin with a degree in geology. He was proud that his son, Mark, was a fellow UT grad. He enjoyed watching UT football on TV and going to UT track events with his friends. Joe served in the Army as part of the 2nd Armored Division ("Hell on Wheels") in West Germany. He earned the rank of Sergeant and received an advancement as the highest-ranking Boy Scout in his unit. While in the Army, Joe was a member of the Fort Hood U.S. Army Chorus. Joe married Margaret Ellen Tyer on June 18, 1966. Joe had a life-long interest in geology and worked as a geologist in Dallas and Houston. He earned his law degree in 1973 by working full-time and attending night school at South Texas College of Law in Houston. He was part of the State Bar of Texas 2023 Class of 50-Year Lawyers.

Joe practiced as an oil and gas attorney in Houston and Abilene, Texas, and he ran a title company in Abilene. Additionally, he owned and ran Builder's Title Company in Waco, Texas. Following the sale of Builder's Title, Joe practiced civil and criminal law in Waco. He also practiced civil law with his son-in-law, Chris Harris, in McGregor, TX. Joe served as McLennan County Justice of the Peace Precinct 1, Place 1, for several years. He was on the Stephen Ministry Team at FBC Waco where he was a member for almost forty years. Joe was preceded in death by his wife Margaret, brother Doug Meadows and sister-in-law Mary Meadows. He is survived by his daughter, Meredith Harris (and son-in-law Chris) of Hewitt, TX, and his son, Mark Meadows (and daughter-in-law Holly) of Nashville, TN, and several grandchildren. Joe is also survived by his brother Ray Meadows and sister-in-law Becky "Sis" of Waco; sister-in-law Pauline Tyer of Iowa City, Iowa.

Albert Muller Lt. Col., USAF, retired (B.S. '54) peacefully left this world in the company of family on November 16, 2023, at the age of 92. As shared by his grandson, Christopher, "Between his service in Vietnam, employment at Boeing, subsequent contributions to the US space program, and his inventive pursuits, coupled with his love for family and adventurous spirit, he forged a legacy that most men can only dream of." Al was born in Baytown, Texas, on May 28, 1931. Following his retirement from the Air Force, he established his home in Clear Lake City, Texas, residing with his wife, Janice, and near his children. Albert is survived by his son Mark Muller and wife Kim; his daughter Teresa "Tami" Scruggs and husband Bruce; grandchildren Crystal Mays, Christopher Muller and wife Virginia, Candice Griffith and husband Keith, Justin Scruggs and wife Teal, Melinda "Cricket" Engler, Dustin Weisinger and wife Lacey; and Brandon Weisinger; along with many great grandchildren and one great-great-grandchild. After obtaining a Geology degree from the University of Texas and an Aeronautical Engineering degree from the Air Force Institute of Technology, Al embarked on a dynamic and impressive career in the Air Force. While in the service, he became the inaugural chief of the System Safety Branch, playing a pivotal role in developing a program still utilized by the Department of Defense. Upon his retirement from the Air Force, Brig. Gen. Richard E. Merkling acknowledged, "There are still aircrews alive and irreplaceable military equipment still available that might have been lost were it not for your contributions to aerospace safety." Albert's involvement in the Corona Project Catch a Falling Star, retrieving spy satellites, and his service in Vietnam, flying an OV-10 as a spotter for bombing strikes, were aspects of his career he spoke passionately about. As the years passed, and missions and programs were declassified, his family discovered the profound contributions he made to his country's military and space endeavors. Throughout his years of service, Albert earned numerous decorations, medals, badges, commendations, citations, and campaign ribbons. A few of the honors bestowed upon him include: the Distinguished Flying Cross, Air Medal with ten Oak Leaf Clusters, and National Defense Service Medal. After retiring from the military, Al persisted in pursuing his passion for aerospace engineering. During his tenure at United Technologies and Boeing, he made significant contributions to various projects, including those related to the space shuttle. Among his favorites hobbies was the time spent piloting his two vintage classic airplanes, especially relishing moments when he could share those flights with family and friends. Albert's journey may have reached its earthly conclusion, but the impact of his warmth, generosity, and creativity will forever echo in the hearts of those who had the privilege of knowing him.

Andrew Parisi (M.S. '18), 34, passed away at home on March 2, 2024, surrounded by his loving family and nurses. Born in Niskayuna, NY, he is the son of Adam G. Parisi and the late Christine M. Parisi (Ruzzo). Andrew graduated from Mohonasen High School. He held a Bachelor of Arts degree (geology) from Hartwick College, a Master of Science degree (geology) from the University of Wisconsin-Milwaukee, a Master of Science degree (geology) from The University of Texas at Austin. He was a PhD candidate at the University of California at Los Angeles. He loved reading, geology field work, collecting dinosaur fossils in the Hell Creek Formation (Montana) with the Carthage Institute of Paleontology, and teaching. Andrew is survived by his father Adam G. Parisi, his siblings Aaron C. Parisi, Christopher R. Parisi and Sarah E. Parisi, his grandmother Marilyn D. Parisi, his grandfather Vincent J. Ruzzo, and many uncles, aunts and cousins. Andrew is predeceased by his mother Christine M. Parisi, his grandfather Frank N. Parisi and his grandmother AnnMarie C. Ruzzo (DiLorenzo).

Fred Lamar Oliver Sr., (B.S. '51) at the age of 100, passed away peacefully at his home in Granbury, Texas on Sept. 23, 2024. Fred was born in Amarillo, Texas on March 18, 1924 to Mac Donald Oliver and Bertie Prudence Oliver. A 1951 graduate of The University of Texas at Austin with degrees in General Geology and Physics, Fred had a distinguished career in the oil and gas industry. He served as President of Petroleum Ventures of Texas, Inc., a private oil and gas exploration and production company. Earlier, he was the President and CEO of Greenbrier Operating Company. Fred was a founding member of the Society of Petroleum Evaluation Engineers and a member of the Society of Petroleum Engineers, AAPG, the Dallas Geological Society, and the Society of Independent Petroleum Earth Scientists. Fred's passion for geosciences and commitment to education were evident in his generous gifts to the Jackson School. Together with his wife Frances, Fred established the Fred L. and Frances J. Oliver Lectureship in Texas Hydrology and Water Resources in 1985 to support visiting lecturers in

hydrology and water resources, fostering better education about the critical challenges concerning water resources. There have been over 40 official Oliver Lecturers given at UT Austin, by distinguished scientists from all over the United States and overseas. Fred frequently returned to UT to introduce many of these speakers personally. In 2012, they also created the Fred and Frances Oliver Endowed Scholarship to recruit the best graduate students in hydrogeology or to support upper-level undergraduates who have expressed an interest in this vital field. Fred was a valued member of the Jackson School of Geosciences Advisory Council whose dedication and support spanned decades, beginning in 1977, and was honored as a life member in 2013. Fred's generosity supported students, advanced research, and enriched learning experiences that have shaped the future of countless students. His involvement in and passion for geosciences and the Jackson School will be greatly missed.

Betsy Piercy (B.A. '95) loved books, music, dogs, cats, seniors, native plants and trees, dark skies and starry nights. Betsy Jolyn Piercy passed away on Saturday, July 20, 2024, surrounded by love and prayers from around the world. She was seventy-three. The third of five children born to Betty and J.C. Piercy, Jolyn is survived by her loving husband, David; sisters, Phyllis, Victoria, and Anne; nieces, nephews, and many dear friends. She was predeceased by her brother, Jason, and parents. Growing up in East Texas, Jolyn graduated from Jasper High School in 1969. From an early age, she developed a deep love of reading, the outdoors, gardening, and a sense of social justice. After living in Germany for a year with her sister, Phyllis, Jolyn moved to Austin in the early 1970s. After moving, Jolyn volunteered for Acorn, advocating for low-income families. She studied upholstery, apprenticed with an electrician, owned a motorcycle and managed a printing shop. She was generous with her time and resources, always willing to lend a hand to a friend or neighbor in need. She studied literature, botany and geology at The University of Texas at Austin and earned a Bachelor of Arts degree. She worked as an administrative assistant at the UT School of Law and retired in 2014. She was a member of the Native Plant Society, the Ladybird Johnson Wildflower Center, the Gulf States Mycological Society and the Native Prairies Association.

Walter Rainbolt (B.A. '57), 88, passed away on January 23, 2024. Walter K. "Dub" Rainbolt, Jr. was born on October 12, 1935 in Lafayette, Louisiana to W. K. Rainbolt, Sr. and Seldon Smith. After completing Lafayette High School, he enrolled in the University of Texas in Austin and graduated in 1957 with a degree in Geology. He met Lee Ann Gragg while attending UT and they were married shortly after graduation. As an ROTC midshipman at UT, he received an Ensign Commission in the US Naval Reserve and served two years aboard ship between San Diego and Japan. He was honorably discharged in 1963 as a lieutenant in the USNR. Although his degree was in Geology, his first job was as a Landman in Houston with Union Oil Company of California. He was eventually transferred to New Orleans and then Lafayette with his final position in Lafayette as District Land Manager. In 1973, he went independent and formed Melton & Rainbolt with a longtime friend and geologist, Roy Melton, generating oil and gas prospects for Sabine Royalty Corporation as well as other exploration companies. This eventually led to their association with Dynamic Exploration, Inc. in 1979. He happily spent his remaining years in the business as a partner with Dynamic drilling for oil and occasionally finding it. Dub was a longtime member of Asbury Church and was active in many area professional and social organizations including AAPL, LAPL, AAPG, LGS and LOGA. He was also a dedicated member of the Petroleum Club and served as President in 1986. When not searching for oil and gas, Dub really enjoyed time at his camp at Toledo Bend. He was an avid angler and a member of the Dirty Dozen Bass Club; although his fish stories always seemed a bit "fishier" than most. When not fishing, he spent many long weekends at the family "Ranch" in central Texas. No matter his location, he was always happiest when surrounded by his family and took great pride in his four grandsons. He is survived by his beloved wife of 66 years, Lee Ann Gragg Rainbolt; two sons, J. Walter Rainbolt (Carol), and David Rainbolt (Gayelyn); grandchildren, John Rainbolt (David Nguyen), Christopher Rainbolt, Matthew Rainbolt (Brianna), and Bryan Rainbolt.

Wayne Ritcheson (B.S. '91) was born in Dallas, Texas on November 23, 1960, to Don Edward Ritcheson and Sallie Rae Green Ritcheson Riddles. Wayne passed away on January 30, 2024. He was 63 years old. He is preceded in death by his mother and father and survived by his daughters, Ashlyn and Kirsten Ritcheson, his siblings, Dane Ritcheson, Karen McMillan, and Scott Ritcheson and stepbrothers A.J. and Patrick Riddles. Wayne graduated from Richardson High School and got his bachelor's degree in Geology with a geophysics option at The University of Texas at Austin. He worked for almost 25 years at DeGolyer and MacNaughton as a Vice-President and Senior Geophysicist, worked all over the world and retired in 2022. Wayne was known for his generosity, his warm smile, and his sense of humor. He was an avid golfer and finally got his score below one hundred. His favorite things were rocks, civil war history, and being a dad.

James Rowell (B.S. '54) passed away peacefully in the comfort of his own home after celebrating his 98th birthday with family and friends. Jim was born on October 19, 1925, to James A. Rowell and Helen Mounce Rowell in Shreveport, Louisiana. He graduated from C.E. Byrd High School, where he met Pauline Sands

Rowell. He and his high school sweetheart, Pauline, were married in 1945, until her passing after 58 years of marriage. In 1948, Jim entered in the Army Air-Corp. where he got his wings as a fighter pilot. Following his years of service, he went to work for Union Producing Company as a draftsman. After a short time, he was awarded a scholarship to attend the University of Texas, where he graduated with a Bachelor of Science in Geology. Following graduation, he continued working for Union Producing Company. An entrepreneur by heart, he decided it was time to begin paving his way in Geology. He enjoyed his career in Oil & Gas for the next 50 years and always said "If you love what you do, you will never work a day in your life." His accomplishments in business (Siesta Oil & Gas, Par Oil Corporation, Par Minerals, Remington Suite Hotel, Remington-Lott Farms) are remarkable. All of which he knew had no value without having friends and loved ones to share it with. In December of 2003, he married Elizabeth Pierce Rowell and moved to Mississippi shortly after. They loved spending time laughing and enjoying friends at Oil & Gas Conventions, hunting at Four Square Ranch in Rocksprings, Texas, fishing on the farm, the beach, and all things outdoors. James A. Rowell was a leader and mentor for so many people. His love and generosity will remain in the hearts of all who had the privilege of knowing and loving him. James A. Rowell Jr. was preceded in death by his mother, Helen Mounce Rowell; his father, James A. Rowell; stepmother, Fannie Rowell; daughter, Paula Rowell Burns; first wife, Pauline Sands Rowell; cousins, Hollis Rowell and W.E. Rowell and wife, Margaret; sisters, Marion Rowell Clifton and Marie Rowell Martin and niece, Dolly Knoer. He is survived by his wife, Elizabeth Rowell; son, Rob Rowell; grandson, James Burns; step-daughters, Kim Prisk and Christy Eaves; grandchildren, and great-grandchildren.

Holmes Semken (B.A. '58, M.A. '58) passed away peacefully on January 2, 2024. Born in Maryville, TN, January 28, 1935, he was brought up in Tennessee, Arkansas, and Texas, before finishing his college education with a PhD from the University of Michigan. He was employed at the University of Iowa in the Department of Geology from 1965 to 1999. He retired as a Professor Emeritus, still busy excavating a trio of giant ground sloths in SW Iowa. He was dedicated to teaching and research; had an insatiable passion for history and found great joy in traveling and exploring the world. A loyal friend of many, he loved his parents, Edith and Holmes Semken, Sr. He adored and married Elaine Friedrichs, his University of Texas sweetheart and wife of over sixty years. He is survived by a devoted family.

Charles Smith (B.S. '63), 86, passed away on June 28, 2024, in Northport, Alabama. Born on May 31, 1938, in Paris, Texas, Dr. Smith was a respected geologist and paleontologist whose career spanned several decades. Dr. Smith began his education in Honey Grove, Texas, and later graduated from Sunset High School in Dallas. He served in the Army Reserves, where he trained at Ft. Bliss and Ft. Belvoir, excelling as a marksman and later working as a gunner. He completed his B.S. in Geology at The University of Texas at Austin in 1963, followed by an M.S. in Geology in 1967 from the University of Houston, finally earning his Ph.D. in Geology in 1973. His professional journey started at Tenneco Oil Company, leading to significant roles at Phillips Petroleum Company and the United States Geological Survey at the Museum of Natural History in Washington, D.C. The Geological Survey of Alabama was fortunate in 1987 to persuade Charlie to join the staff of the Survey where he made significant contributions to the citizens of Alabama. His work, particularly in coastal plain stratigraphy and paleontology, remains influential. After his retirement from the Geological Survey of Alabama, Charlie took his love of research into a new arena; blowtorches. His interest in blowtorches began when he was a child watching his father solder copper pipe together to fix their farm equipment. He was an active member in the Blow Torch Collectors Association where he continued detailed research and documentation of the history of blowtorches. This led to co-authoring two blowtorch books sharing his knowledge and research with others. Beyond his professional life, Dr. Smith was a dedicated family man. He is survived by his son Gregory and daughter Deborah Smith Ward (Greg Ward). He had two grandchildren, Brett Ward (Chloe), and Blythe Ward and two beautiful great-granddaughters, Hallie and Bristol. He is preceded in death by his parents, Charles P. and Grayce Smith, his brothers, David Smith and James Dennis Smith. Dr. Smith's life was marked by his kindness, generosity, dedication to family and education, and his significant contributions to geology and paleontology.

Phillip Burton "PB" Snyder, 96, of Boerne, Texas passed away on Monday, March 25, 2024. P.B. Was born on June 25, 1927, in Vernon, Texas to Leslie J. Snyder and Gwendolyn Watston Snyder. He grew up in the "oil patch" as his father was a career petroleum explorer and Texas Railroad Commission superintendent. From 1930, he lived in San Antonio where he graduated from Harlandale High School in 1944. At age 17 he enlisted in the U.S. Navy, serving in the World War II Asia-Pacific theater as a radarman. In 1946, he met Betty Jean Wentworth, and they were married for 63 years until her passing in 2009. PB received a B.S. Degree in chemistry/geology from Trinity University in 1951; a master's of science degree in geology from The University of Texas at Austin in 1968; and a Ph.D. in geology from The University of Texas at Austin in 1972. He retired in 1989 as professor emeritus of geology from Lamar University in Beaumont, Texas. After his retirement, PB and Betty engaged in many adventures traveling the world. They finally settled in Kendall County in 2003. He is survived by his sons, "Rocky" Snyder and wife Kim James; Grant

Snyder and wife "Luly" Snyder; two grandchildren and two great-grandchildren. He was preceded in death by his beloved wife, Betty Jean Wentworth Snyder; his parents; and brother, Donald A. Snyder.

Leslie Pittman White (B.S. '56) was born May 24, 1932, in Belton, Texas to Charles Kennedy White and Alma Bownds White. Les enrolled in The University of Texas at Austin where he was proudly a self-supporting student, working an afternoon job and then an evening job at the girl's dorm for meals. Again, he was a diligent student, earning a Phi Beta Kappa key and receiving the W. A. Tarr Award as the top graduate in his class. Upon completing his degree, a B.S. in Geology, he went to work for Humble Oil and Refining Co., now ExxonMobil. He often said the best day of his life happened in 1961 when he returned to Corpus Christi on the heels of Hurricane Carla to find a new employee at the office. She was Dianne Marie Gardes, who would become his beloved wife and partner for the rest of his life. Les loved his geological work. He said it never ceased to be captivating. In 1958 he spent six months on a mapping assignment, camped out in Alaska in sight of Mt. McKinley, flitting around in a small helicopter. He often said this was a highlight of his career. He worked in several localities, both domestic and foreign, before retiring after 36 years. In 2018 the family donated their ranch land, near Dripping Springs, to the Jackson School of Geosciences at UT to provide field access for teaching and research. It is named the White Family Outdoor Learning Center. He was very proud to be inducted into the Hall of Distinction at the Jackson School in 2019. Les is survived by family he adored: Dianne, son Leslie Daniel White and daughter-in-law Jana Gay White of Lakeway and grandsons, Travis Gibson White and Jacob Daniel White; daughter Annette Marie Chambers of Austin and grandson Tyler Justice Chambers and granddaughters Kristen Marie Chambers, Rachel Lauren Chambers and Kaitlyn Leigh Chambers. He is also survived by a sister, Linda Wallace Smith of Crosby, Texas. He was predeceased by his son Andrew Clayton White and by a brother, Charles Kenneth White.

James Williams (B.S. '81), 67, passed away in the early morning hours on Wednesday, October 25, 2023, in his home. He was born on Friday, December 23, 1955, in Corpus Christi, Texas, to his loving parents Billye Roan Williams and Sally Armstrong Williams. Known to his family and friends as "Jamie," he is survived by his beautiful bride of 36 years, Shannon Pistole Williams. He was a devoted father to Theodore "Ted" Benjamin (Julie) Williams, and Amy Lynn (Christian) Phaneuf, Emily Ann Williams, and Katy Denee Williams. He was a cherished grandfather to five grandchildren: Abigail Armstrong Williams, Emma Kay Williams, Hunter Roan Williams, Olivia Rose Phaneuf, and Simon Robert Phaneuf. He was a dear brother to Carroll Ann Williams and Sally Jane (Doug) Kuni. Jamie was a third generation Texas oilman, like his father and grandfather before him. He graduated with a Bachelor of Science in Geology from The University of Texas at Austin. Jamie was the Senior Exploration Geologist and Geoscientist at Modern Exploration, Inc. for twenty-one years, and he was highly respected by his peers and colleagues for his geologic acumen and intense work ethic. He is referenced by most in the petroleum industry as being one of the original founders of the famed Eagle Ford Shale Play in South Texas. His deep passion for geology kept him working on rigs until his passing. As an active petroleum geologist on locations throughout his career, he became an avid spear and arrowhead collector and had a great appreciation of mineralogy. There wasn't a rock or mineral that Jamie could not identify. In his free time, Jamie had a passion for hunting his beloved south Texas brush country and fishing the beautiful Texas Gulf Coast. He possessed an unwavering loyalty and support for his family and friends. He could always be relied upon for kindness and generosity when needed. His memory will live on in the hearts of his beloved family and friends.

Jack Yovanovich (B.S. '59), 88, passed away peacefully with his wife and son by his side on Sunday, June 9, 2024. He grew up in Fort Worth, Texas, as the son of two immigrants from the former Yugoslavia and worked his way up to become a senior executive at Mitchell Energy and Development Corporation. He attended The University of Texas at Austin where he earned both his bachelor's and master's degrees and was an avid Longhorns fan. Jack's hobbies included fishing, tennis, golf, barbecuing, baking, and traveling. He was an outstanding provider for his family and had a strong work ethic. He had a brilliant mind with keen common sense, was a mentor to many, and enjoyed passing his traditions down to his grandchildren. He lived out his Christian faith by generously supporting missions in his parents' homeland and serving as a translator for individuals and families who travelled from the Balkans to Houston, Texas, for heart surgery. He was extremely proud of his heritage and maintained strong ties with his extended overseas family, making many trips to visit as well as welcoming them into his own home. His loss is deeply mourned by those in this country and around the world where his presence was felt. He was preceded in death by his parents, Zdravko and Mileva Yovanovich, and his sisters, Marie Pennington and Kay Jones. Survivors include his loving and devoted wife of 64 years, Betty Yovanovich; only son, Jack Yovanovich, Jr. and wife, Christine; grandchildren Caroline and Ki; nephew David with his wife Paula and their family; nephew Joel with his wife Kristen and their family; nephew Rod with his wife Joyce and their family; and numerous dear friends and relatives here and abroad.

Friends

Eugene "Everett" Deschner was born on July 7, 1940, in Bebe, Texas, the fourth son of Henry and Hannah Siepmann Deschner. The family soon moved "to town" and settled in Gonzales. He never forgot his Gonzales roots. It is there he met the love of his life, Carolyn Tinsley. They married on September 1, 1963, and had two daughters, Elizabeth Ann and Katherine. Everett felt he had three fulfilling and meaningful careers in his life. He completed his master's degree at The University of Texas at Austin in Petroleum Engineering and began a long career in the oil and gas industry. In his over forty years of active engineering, he authored or participated in well over thirty technical papers, reports, talks and proposals. His projects included studies in some of the world's largest oil and gas fields, and he retired as Vice President of International Production for Santa Fe Energy Resources. In his last few years, Everett enjoyed the company of Sara Norton, with whom he found new love, great conversation, and a new life after grief and loneliness. Everett will be remembered for his generosity, his professionalism, his humor, his wisdom, and his love for family.

Brian Flynn, 76, walked into his Field of Dreams on Wednesday, Nov. 1, 2023 to play the game that he so loved. His team, the Texas Rangers, gave him a great send off by winning their first-ever World Series title. Brian was born in Jersey City, New Jersey, to William E. and Lillian T. Flynn. He attended St. Aloysius High School in Jersey City and, under the wings of one of his teachers, took an interest in chemistry. He went on to the Newark College of Engineering (now New Jersey Institute of Technology) and received a bachelor's degree in chemical engineering. He met and married Margaret "Peggy" O'Connor, also from Jersey City, and they went on to have three children, Judi, Mara, and David Flynn. Upon graduating college, he fled from Jersey City as fast as he could (his words). He would later realize what a formative effect it had on him. He landed a job with Dupont and moved to Wilmington, Delaware. He worked in their wastewater management department and rose quickly to a supervisory position. He had many wonderful stories of his time—and his colleagues—there. With a growing family to feed, he took a leave of absence from Dupont to graduate school and get his Master's of Chemical Engineering from the University of Connecticut. He moved back to Delaware and returned to Dupont for a few years. He eventually had an opportunity to join a young environmental engineering consulting firm that was opening an office in Houston, TX. He was an original founding partner of ERM Southwest, growing it from a three-person firm with one office in Houston to an operation that stretched across several major cities in Texas and Louisiana, employing hundreds of people. He eventually became the President. Upon retirement from ERM, he continued to consult on wastewater management projects for many years. Based on his experience at ERM, he wrote and published two books, Maximizing Engineering Firm Profits: Profit Fundamentals and the accompanying workbook. He then moved farther west to Castle Rock, CO for 12 years (wintering for 3 years in a second home in Bradenton, FL) and then headed back to his beloved Texas to Dripping Springs, in the Austin area. He eventually moved to central Austin, living in the Mueller development and in the Crestview neighborhood. In 2016, he joined Austin Community College as a chemistry and math tutor to give back to the community. He enjoyed helping students learn chemistry and math. In 2017, he married Soon Merz and looked forward to her retirement from Austin Community College. Upon her retirement, they moved to Leander, TX. Brian was also very active with the University of Texas Environmental Science Institute Advisory Board, the Texas A&M University Kingsville Environment Engineering Advisory Board, the Environmental Engineering and Science Foundation, and the American Academy of Environmental Engineers, where in 2008, he received their prestigious Stanley E. Kappe Award for outstanding service. Brian was a devoted husband, father, grandfather, brother, uncle, great uncle, and a great friend. He is survived by his wife, Soon Flynn, daughters Judith Flynn and Mara Flynn (Christopher Peddy), and son David Flynn (Joy); and his step-children Jonathan Merz and Rachel Harris (Troy); and seven grandchildren.

Ann Hamman was born in Arlington, Texas, to Dorothy and James Hufendick on the 27th of October 1937, and passed away on Sunday, the 4th of February 2024, after complications related to a heart condition. She was 86 years of age. Ann attended Arlington High School, Sweet Briar College, and The University of Texas at Austin where she earned a Bachelor of Arts Degree in the Plan II Honors Program. She loved the University, met lifelong friends, and was elected to be the Texas Sweetheart. There, Ann also met her late husband, Henry Hamman. They married after graduation and spent 63 wonderful years together until Henry's passing last May. Ann and Henry loved to travel together. It was not always easy or glamourous, but Ann was game for most adventures including a move to Sydney, Australia, in 1970. Ann and Henry embraced all that Australia offered, its people, culture, art, and natural beauty. The family moved back from Australia in time for the arrival of their only son, Russell. They easily fell back into a happy life in Houston where Ann always had many friends. An avid reader, Ann was a member of her book club Literatae for over 30 years. Following her lifelong interest in the arts, Ann served as a member of the Houston Ballet Board of Trustees, the Contemporary Arts Museum Houston Board and was on the Development committee of The Menil Collection for many years. Ann's active involvement in her community also included the Junior League of Houston, River Oaks Garden Club, Communities In Schools of Houston, where she was a

member of the Board of Directors, and Past President of the Town and Country Garden Club. Ann's sharp intellect, curious mind, and adventurous spirit were her passport to a fascinating and meaningful life. And Ann loved people. Her innate ability to connect with and attract so many kinds of people enriched her life and those fortunate enough to be around her. "Annie," as her Grandchildren called her, was also a force. She shared wisdom, life experiences, funny stories, and unconditional love with her nine grandchildren. Ann was predeceased by her husband, Henry Hamman. She is survived by her daughters, Anne Hamman Brollier and her husband Stephen, Kendall Hamman Connors and her husband Michael, and son, Russell Royden Hamman and his wife Kelly; grandchildren, George Henry Shepherd, Sam Hamman Shepherd, Maude Lenoir Shepherd, Emma Ann Shepherd, Royden Neal Connors, Kyle Margaret Connors, Margaret Jane Connors, Coretta Kathleen Hamman, and Robert Royden Hamman. She is also survived by her beloved sister, Jane Peterson Fossum; and her niece, Janet Peterson Forlines, and nephew, Curt Peterson.

Judith Lundelius, 94, of Austin, Texas died April 22, 2024, after a brief illness. She was a devoted daughter, wife, daughter-in-law, mother, mother-in-law, and grandmother. In addition, she had wide-ranging interests, from her scientific work in genetics to collecting natural history prints. Born January 7, 1930, during the Great Depression, Judy was the only child of George Weiser and Nettie Wolf Weiser. She grew up in Brooklyn, New York, and graduated from Thomas Jefferson High School. Judy attended the University of Chicago, where she studied geology and paleontology and earned her Bachelor's and Master's degrees. While at Chicago she met Ernest Lundelius, Jr. of Austin, Texas, a fellow student in the Geology Department; they married in 1953. Judy spent her early married life traveling with Ernie to Australia and Europe, doing field work and research into paleontology. After brief stays in Perth, Australia and Pasadena, California, Judy and Ernie settled in Austin where Ernie became a professor in the Geology Department at the University of Texas, and she worked as a researcher in the Zoology Department for over 30 years. In addition to her scientific work, Judy devoted herself to raising two children, to caring for her elderly relatives, and to her interests in literature and natural history art. Throughout her life, Judy enthusiastically embraced a love of learning, books and music which she strongly impressed upon her children and grandchildren to their great benefit. Judy enjoyed entertaining and corresponding with a large network of relatives, friends and colleagues in Austin, and across the United States and the world. Judy is survived by her husband, Ernest Lundelius, her children Jennifer Welch (George) of College Station, Texas, and Rolf Lundelius (Ann) of Great Neck, New York, and her grandchildren Glenn Welch of Austin, Texas, Samuel Welch of West Palm Beach, Florida, and Olivia Lundelius of Bayside, New York.

Joan Peterson White, 78, passed away peacefully on June 11, 2024, in Washington, DC, surrounded by her son Christopher and his family. Joan was a dedicated career woman and a supportive mother. She is survived by her son, daughter-in-law, grandson, and extended family.

Beverly Yager Ross, 96, passed away on September 14, 2023. Born in Fort Worth, Texas, she graduated from The University of Texas at Austin and later earned a master's degree from TCU. Beverly was a dedicated mother, grandmother, and community member, known for her brilliance, humor, and caring nature. She is survived by her four children, nine grandchildren, 12 great-grandchildren, and her brother.

Cherry Schwarz passed away on June 18, 2024. She was a devoted wife, mother, and member of St. Martin's Episcopal Church. Cherry is survived by her three children, nine grandchildren, two great-grandchildren, and extended family.

Aneita Weaver, 99, passed away peacefully on August 12, 2024. She was a dedicated community member in Houston, supporting her husband's (O.D. Weaver, Jr.) business and co-founding the Magic Circle Republican Women's Club. Aneita is survived by her children, grandchildren, great-grandchildren, and her brother.

Barbara Franklin Wiggins was born on February 13, 1930, in San Antonio, Texas. She was a devoted member of her community, involved in numerous civic, religious, and cultural organizations. Barbara is survived by her two sons, grandchildren, great-grandchildren, and extended family. She was predeceased by her husband, parents, and sister.

Edith Falk Zinn, of Houston, Texas, passed away March 23, 2024. She was the firstborn daughter of Sam and Frieda Falk, born on Nov. 8, 1931, in Cushing, Okla. Edith spent her years to age 8 in both Cushing and El Reno, Okla. The family then moved to Corpus Christi, Texas. It was at The University of Texas where Edith in Plan II (honors program), met Robert Zinn. They married in 1955, and she gave birth to four daughters over 10 years, Rebecca, Zelda, Shoshana and Natalie, and raised Zachary Cort Casper and Travis Craig Casper, children of Robert's older sister, Zelda Zinn Casper. Edith spent her career teaching both children and adults. Her students ran the gamut from the blind to extremely special needs, to highly gifted,

to non-native English speakers. For 22 years, Edith was a volunteer at the JCC, teaching adult immigrants from the former Soviet Union and other countries. Edith inspired her students with her infectious wit, wisdom and dedication. Edith and Robert shared a passion for classical music and were particularly fond of chamber music at multiple venues. They also shared curiosity about the world and traveled widely, often bringing some of their six children with them. Having an ear for languages, Edith spoke Spanish fluently and limited French. She used to carry a Russian/English dictionary in her purse for use when her Russian students got stuck in communication. Edith is survived by her husband, Robert Zinn; children, Zachary Cort Casper; Craig Casper (Sylvia); Rebecca Gallaher (Brendan); Zelda Zinn (Enrique); Shoshana Kahn (Steve); and Natalie Alikhan (Rishad); eight grandchildren and two great-grandchildren; sister, Rose Falk Watel; and several nieces and nephews.

Faculty

Gary Kocurek, 71, passed away suddenly on June 5, 2024 from injuries sustained in an unfortunate bicycle accident near Dubina, Texas. Gary was a complex personality, a non-stoppable thinker and doer. He was highly intelligent yet down to earth, hardworking and conscientious, thoughtful and caring and supportive, had a dry and sometimes bizarre sense of humor, was fascinated with history and weather, loved animals, and stood up for what was right. Gary was born on August 30, 1952 to Elick Kocurek and Lillie Knesek, and was the younger brother of big sister, Bernice. He was a quiet child but always observing, exploring, and collecting. At age six, he was featured in the Houston Chronicle as a budding archeologist, looking very scholarly surrounded by numerous artifacts he had collected. That interest eventually transitioned to geology as he earned his undergraduate and master's degrees in geology at the University of Houston in 1975 and 1977, respectively. Gary was a descendant of Czech immigrants to Texas from the mid-1800s. Up until Gary's generation, his ancestors spoke fluent Czech. Much to his dismay, his parents did not pass along the gift of the Czech language, but Gary sought to rectify the lack by enrolling in Czech language class at the University of Houston. It was in Czech class that he met his future wife, Dianna Stalinsky, who came from similar Czech/Polish heritage. After marrying on Jan. 7, 1978, they moved to Madison, Wisconsin to pursue graduate degrees. By the grace of God (and insulated parkas), they survived the Wisconsin winters and Gary received his Ph.D. in geology in 1980. Gary joined the geology faculty at The University of Texas at Austin in 1980. He and Dianna lived in Round Rock. His areas of expertise were sedimentology, geomorphology and stratigraphy of aeolian systems, fluid flow and grain transport, bedform dynamics and pattern evolution of dune fields, and the stratigraphic record of aeolian and related systems on Earth and Mars. His work took him to far-flung places such as Mali, Mauritania, Namibia, Ethiopia, Oman, and yes, even the Czech Republic. Colleagues and graduate students remember Gary for his supportive yet laidback approach to mentoring, his physical endurance in field work, his blunt yet insightful opinions, his work ethic and conscientiousness, and his aplomb and sense of humor under duress. Tiring of the big city, Gary and Dianna moved in 2006 to the rural countryside near Weimar, Texas (the farm). Gary continued to commute several days a week until his retirement in 2017 as Professor Emeritus. Gary spent his time on the farm split between continued geological research and transforming the 71-acre farm from scruffy hayfield and choked woodlands to native prairie and oak savanna. In 2020, along with four friends (Mark and Cheryl Brown, Rory and Virginia Johnston), Gary and Dianna started the Fayette Prairie Chapter under the umbrella of the statewide Native Prairies Association of Texas (NPAT). More recently, they developed the Smaller Acreage Restoration Program (SARP) in the Fayette Prairie Chapter to support projects on areas less than 25-acres. Gary spent many hours visiting landowners interested in prairie restoration to discuss how NPAT/SARP could support their efforts. With collaboration from NPAT, Texas Parks and Wildlife Department (TPWD), The Nature Conservancy, and too many others to name, the Kocureks were able to greatly advance their restoration goal. Spring on the property can be a glorious profusion of wildflowers, grasses, and butterflies. In 2023, the property received the TPWD Lone Star Land Steward Award for the Blackland Prairie ecoregion. Gary is survived by his wife, Dianna, sister Bernice King (husband Dennis), nephews Eric Huysman (children Lincoln and Lily) and Peter Carrico (wife Elizabeth; children Jacob, Sydney, and Zoey), and numerous cousins. Gary was preceded in death by his parents, Elick and Lillie Kocurek.

Inspired by Gary Kocurek's seminal research on aeolian systems and their depositional products, a conference is being planned for April 13-15, 2025, in Moab, Utah. Moab is on the Colorado Plateau, an area where Gary studied the superbly exposed wind-blown deposits of ancient continental systems for more than 40 years. Details are still under development. The plan is to spend half the time on the outcrop examining and discussing critical elements of aeolian sedimentology and stratigraphy that publications by Gary and his students paved the way to understanding. The rest of the time will involve informal presentations highlighting past, present, and future research on landscapes sculpted and constructed by wind-blown sediment. Former students, colleagues, and aeolian enthusiasts are welcome. Details will be posted at eps.jsg.utexas.edu. Individuals can also contact David Mohrig (mohrig@jsg.utexas.edu) and Michael Sweet (michael.sweet@austin.utexas.edu) with questions and suggestions.

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Class Notes for the 2025 Newsletter

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