

MINES GEOPHYSICS

REVEALING THE DYNAMICS OF THE EARTH | SPRING 2022



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Spring 2022

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MINES GEOPHYSICS

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The Newsletter Staff wishes to express support for all those in our geophysical community who are, or have been impacted, by war and violence around the world.

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FROM THE DEPARTMENT HEAD

Dear friends of Mines Geophysics,

Welcome to the Spring 2022 edition of the Geophysics Newsletter. I am hopeful that this

newsletter finds you well and that we are approaching the end of the complicated C19 period that challenged us all, both professionally, and quite often also personally. Mines Geophysics is doing well and we are returning to a normal operating mode, including through 100% in-person classes, and more regular public seminars and social events. We hope that this trend continues, creating the opportunity to welcome more of you back on campus. I also hope that you will enjoy the brief updates shared on the following pages and that you will reach back with news about your own personal and professional accomplishments.

An exciting recent addition to our educational infrastructure is the “Ken Lerner” GeoMaker space, initiated by a generous donation from an alum and long-term supporter of our program. The donor elected to not establish this facility under his own name but instead took the opportunity to honor one of our most recognized faculty and promoters of student excellence. This new laboratory is built in close proximity to our Green Center offices, and under Jeff Shragge's leadership, is designed as a space of creativity and innovation. It will give students the infrastructure and resources needed to design new geoscience sensors and instruments and to experiment with automation and field deployment mechanisms. We envision that this space will facilitate greater collaboration with colleagues from other campus units and that it will boost and diversify the research and design components of our program. If you have the opportunity, please come by to see the GeoMaker space and consider ways in which you could take advantage of this opportunity to further engage with Geophysics students and faculty.

I would also like to highlight the recent professional accomplishments of two colleagues.

- Ebru Bozdog has been promoted to Associate Professor with tenure in recognition of her teaching and scholarly contributions, as well as service and engagement with a global professional network. As many of you know, Ebru is a computational seismologist using some of the largest computers available to our professional community at this time. She is closely involved with multiple flagship projects, including the unprecedented In-Sight mission to Mars.

- Rich Krahenbuhl has been promoted to Research Associate Professor rank, in recognition of his broad and growing research spectrum, including mineral exploration, near-surface, and humanitarian geophysics. Aside from his research, Rich has also contributed greatly to the Geophysics program by teaching many courses in our undergraduate curriculum.

Congratulations Ebru and Rich! We are proud of you and look forward to your many future professional accomplishments.

Finally, I would like to bring to your attention to an exciting milestone in the life of our Department: Geophysics will turn 100 in 2026! Quoting from a December 1926 article in the AAPG Geological Notes, “The world's first department of geophysics is being established at the Colorado School of Mines...” Much has changed in the department over this interval, but what has not changed is the rigor of the program, the focus on leading technology, the blend of theory and applications, and the focus on our multigenerational community. In the coming years, we intend to mark this event on a grand scale with multiple GP@100 activities organized both at Mines, and also at other locations where our alumni and friends reside. Please stay tuned for further communications and consider getting involved with this unique event.

I wish you only the best, with good health and professional success.

Be safe! Stay in touch!

Paul



Iga Pawelec

Ken Larner GeoMaker Space

Teaching, Research, & Design Lab Opens

Big things have been happening this year in Green Center 228! With the official opening of the Ken Lerner Geomaker Space this April, the Department now has a novel geoscience teaching, research and design laboratory that will encourage students and researchers to develop, prototype, and validate innovative technology solutions to address important, socially relevant 21st century challenges.

“The Geomaker Space is a place that makes technology more accessible to students and gives them the freedom to create,” said Dr. Jeffrey Shragge, who has been working on the project since October.

Combining low-cost computing, sensors and microelectronics with open-source software and affordable, pervasive wireless connectivity, the Geomaker Space could lead to new approaches to large-scale Earth-science data acquisition, potentially involving thousands to millions of sensors. The space includes several geoscience components including:

- Electronics and fabrication tool library,
- Microcomputer library,
- Low-cost geoscience sensor library,
- Robots and drones for data acquisition,
- Scale geomodel test facilities,
- Hardware for photogrammetry, hyper-spectral and LiDAR imagery creation,
- GPS, Bluetooth and cell network telemetry components.

However, this space is not just for the Department. Another motivation behind the creation of the Geomaker Space is the idea of collaboration. With the tools provided, students from other departments and programs such as electrical engineering, civil and environmental engineering, and hydrological science and engineering can work with geophysics students to gain hands-on experience and create projects with a purpose.

One class, GPGN 590, is already being taught in the room, where students are taking

The Geomaker Space is a place that makes technology more accessible to students and gives them the freedom to create.

advantage of the space’s many features such as 3D printing, printed circuit board printing, two soldering stations, and a sensor and electronics library. Shragge says his favorite thing about the Geomaker Space right now is “seeing all of the cool maker projects that students collaborate on.” Some of the things they are working on include a drone-based magnetometer, an autonomous rover that acquires geophysical data viewable in real time, and a WIFI-enabled prototype device that could remotely control fluid flow for a flow loop experiment at the Edgar Mine.

The Geomaker Space is named after Dr. Ken Lerner, who provided years of impressive service to the Department and to the Society of Exploration Geophysicists. The Ken Lerner Geomaker Space was funded by a generous seed-fund donation of a Mines Geophysics alumnus as well as a successful 2021 Tech Proposal.

All GP students can use the space after passing an online training course on Canvas. In the future, Shragge hopes to see the Geomaker Space be used for senior design, graduate projects, and geophysics course work at all levels. Overall, the Geomaker Space provides a place for students to apply what they learn and be creative, helping to shape the next generation of geophysicists and engineers.

—Chloe Locke

PARTNERS IN RESEARCH

Partnerships with industry play an important role in the Department. Through research consortia and sponsored research projects, industry partners provide real-world challenges for students and necessary funding to support extended problem-solving. Four long-standing consortia support some of our largest centers and projects, including the Center for Wave Phenomena; Center for Gravity, Electrical and Magnetic Studies; Center for Rock & Fluid Multiphysics; and the Reservoir Characterization Project. This issue highlights the people and research of these groups and how industry supports their work.

Center for Gravity, Electrical, and Magnetic Studies

The Center for Gravity, Electrical, and Magnetic Studies (CGEM) conducts innovative research to further understand gravity, magnetic, electrical, and electromagnetic problems. Within this group is an industry-sponsored research consortium entitled the Gravity and Magnetism Research Consortium (GMRC). This group brings students, faculty, and industry sponsors together to further scientific understanding and promote directly applicable research. Structurally, the CGEM receives funding and sponsorship from sources unavailable to the GMRC.

From its very inception, the CGEM has been diverse in its approach. Research has commonly brought together different geophysical methods that support a given research pro-

ject. This has included bringing gravity and magnetic data for reservoir characterization projects and incorporating computational science for optimal inversion practices. The group's research increasingly incorporates non-potential field data (e.g., seismic data) for joint inversions that provide well-constrained subsurface models for a particular application. Such efforts improve model accuracy and provide more accurate representations of whatever is of interest in the subsurface (e.g., a carbon reservoir, a mineral deposit, etc.). Importantly, these interdisciplinary approaches provide GMRC with the ability to produce world-class research that encompasses many applications. It is a holistic approach that brings together multiple corners of geo-

physics, and science in general, to conduct high-quality research.

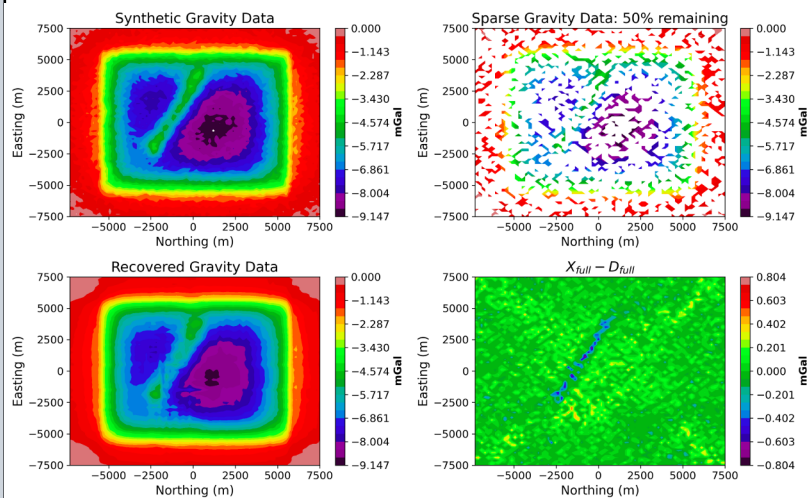
While the GMRC effectively collaborates with industry sponsors for research, the group also greatly values the role of educating students on how to move through the research process. Faculty members in the GMRC not only see themselves as educating students on matters of science but also on matters of communication, time management, and the cycle of academic research. This provides a larger goal for the GMRC, and for the all-encompassing entity of CGEM, of fostering student growth into mature and effective members of the scientific community. This bears itself out in the project cycle of the GMRC. Initially, students work closely with faculty members to

select project ideas and goals for their first year. However, over time this changes as the students become more independent in how they conduct research. Eventually, students walk away from the CGEM with a greater appreciation for scientific understanding and its numerous applications.

Both the CGEM and the GMRC provide excellent avenues through which students and faculty can conduct research on gravity, magnetic, electrical, and electromagnetic applications of geophysical principles. This is a trend that will continue as the projects of CGEM and GMRC change to incorporate new research directions. CGEM Director Dr. Yaoguo Li is excited about these directions. He acknowledges that research must still continue on oil and gas-related problems as they are necessary for the energy transition occurring within the global energy system. This will maintain strong relationships with many current sponsors and provide students incredible research opportunities. However, Li also looks forward to critical mineral exploration. “We are the best program to leverage mineral exploration needs and contribute to it,” Li stated. In particular, geology differentiation is a specific way in which the research activities of CGEM and GMRC can lend themselves to this application. However, whether the groups work on reservoir characterization or critical mineral extents, their innovative research and renowned education will still reverberate throughout the Department and among industry collaborators.

—David Churchwell

CGEM Student Research Project Brett Bernstein



Synthetic gravity data created from a basin-range model with an igneous dike cutting through diagonally (top left). We randomly sample 50% of the data points (top right), recover the data using matrix completion (bottom left), and observe the difference between the original and recovered data (bottom right).

The GMRC is currently funding multiple projects focused on sparse signal acquisition and reconstruction. Two primary techniques, compressed sensing and matrix completion, are being studied as a means of recovering these sparse signals.

My project is specifically focused on matrix completion. Matrix completion, as the name implies, aims to recover all missing values in an incomplete grid of data. This is possible due to the assumption that the resulting completed data are low-rank, or the columns of the data grid are as similar to each other as possible. Put differently, matrix completion reconstructs missing data such that they are similar to existing data. This is nearly identical to how services such as Netflix recommend movies for their viewers; User A watched both Batman and Superman, so User B, who also watched Batman, will likely enjoy Superman based on the similarity to User A.

Our aim with these lines of research is to reduce the quantity of data that is needed to perform an effective geophysical study, which in turn saves engineers time and money. Such sparse recovery techniques show great promise in the data-dependent geophysics industry and are just some examples of the cutting-edge research that is being conducted through the support of the GMRC.



Center for Rock & Fluid Multiphysics

The Center for Rock & Fluid Multiphysics (CRFM) is a group of rock crushers! Yes, we crush rocks for a living. At CRFM, we combine state-of-the-art experiments and rock physics modeling to understand the multiphysical properties of rocks, their fluids, and their interactions. The Center is well known for advancing cutting-edge research by integrating science, engineering, and technology concepts to answer challenging research questions. CRFM members are intrigued by the what, the when, and the how.

Our research spans multiphysics measurements, poroelasticity, anisotropy, multiscale modeling, CO₂ and enhanced oil recovery (EOR), fracture characterization, understanding the frequency dependence of rock properties, forward and inverse modeling incorporating physics-based machine learning.

Under the tutelage of Dr. Louis Zerpa (Director), Dr. Manika Prasad and Dr. Jyoti Behura (Co-directors), the fantastic rock crushers perform various experiments in the adsorption lab, the fluids lab, the nuclear lab, or the poroelasticity lab, depending on their

interests. The consortium is funded by industry members, including Chevron, Equinor, Hess, Petrobras, and Shell. Member representatives communicate with CRFM by providing research guidance and student mentoring. According to an industry representative in the consortium Luca Duranti, CRFM stands out because the “consortium is a fundamental gathering point for discussion of problems in rock physics. There is expertise, theory, and experiments, and a strong desire to do the right thing as well as to tackle relevant problems.” Duranti highlighted that “In spite of what is often reported about the foundational role of rock physics, the discipline is in the hands of very few people in energy companies. The CRFM consortium provides additional expertise not present in the corporate environment, which is necessary to make informed decisions.”

The research group includes diverse individuals of several nationalities who carry out amazing research. Here we highlight some of the research done by students who recently graduated and those graduating this Spring.

—Maureen James

Rock Crushers at Work



Experiments in the Adsorption Lab

Simi Oduwale graduated with a master's degree in PE. Her research involved the reservoir analysis of a CO₂ sequestration site using experiment-guided field-scale modeling. The simulation results incorporated a flow model, and her study showed that injection and producing wells have different geophysical responses to CO₂ injection. The added effects of changing fluid mobility of the different oil components allow for better simulation of seismic responses. This research is invaluable towards understanding CO₂ interactions critical for geosequestration projects.

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Hal Riyami is a PhD candidate in the Petroleum Engineering (PE) department who will graduate this Spring. His research is on the visual investigation of foam behavior at high temperatures. His research is impactful in production engineering for the formulation of better surfactants and stabilizers for high-temperature foams, as his study highlights the mechanisms that drive the decay of foams at elevated temperatures. For Riyami, CRFM stands out because of its people. He says, "The fun, cheery and helpful CRFM members make the trudge more bearable."

Hal in the Lab

—Maureen James

Exploring Poroelasticity

Peteroleum Engineering Master's student Arkhat Kalbekov and PhD student Gama Firdaus prepare a sample for a poroelastic experiment. Arkhat's research ranges from obtaining pore compressibility and other poroelastic properties of carbonates to using static and dynamic measurements. He measures Biot coefficients, α , under pressure-dependent conditions and compares them to the industry rule-of-thumb; using the latter can lead to significant effective pressure miscalculations.

—Maureen James



Reservoir Characterization Project

The Reservoir Characterization Project (RCP) is an independently funded geophysical research consortium that was founded in 1983 and is widely recognized as an early leader in advancing key technologies for 4D multi-component seismic applications.

Today, the RCP's applied research field projects cover a variety of geologic settings across the globe. More specifically, RCP field projects study the Denver-Julesburg (D-J) Basin in Colorado, the Permian Basin in Texas, the Powder River Basin in Wyoming, the Raudhatain field in Kuwait, the Edvard Grieg field in the Norwegian North Sea, the Jubarte field offshore Brazil, 3D Gorgon OBN seismic survey offshore Australia, and fields in the Gulf of Mexico. In addition to applied research, the RCP engages in Research and Development (R&D) projects that explore the applicability and value of leading-edge technologies, such as distributed fiber-optic sensing, compressive sensing for seismic data acquisition, enhanced oil recovery for unconventionals, and carbon capture, utilization, and storage. The RCP enhances its R&D projects by blending R&D results directly into active field projects to challenge and improve the derived methods and algorithms in real-world situations. The RCP's practical research is conducted by a multidisciplinary team in collaboration with industry partners.

The RCP leadership team includes Dr. Ali Tura, Dr. Ge Jin, Dr. James Simmons, Melinda Gale, and Larry Irons. Their technical

excellence and industry experience provide RCP students with the best environment to fulfill research objectives and grow as geoscience professionals.

Important components of the RCP academic program begin with the typical coursework of RCP students, which includes courses from the Geology, Petroleum Engineering, Computer Science, and Electrical Engineering departments. RCP students are equipped with computer and software resources, laboratory facilities, and most importantly, field datasets to solve real-world problems. Finally, the RCP leadership facilitates student interaction with industry sponsors during regular research meetings and the semi-annual RCP Members' meetings. As a result, RCP students have a broad background of research experience and knowledge in geophysics, geology, petrophysics, and petroleum engineering and well-developed soft skills such as public speaking, professionalism, and intercultural fluency.

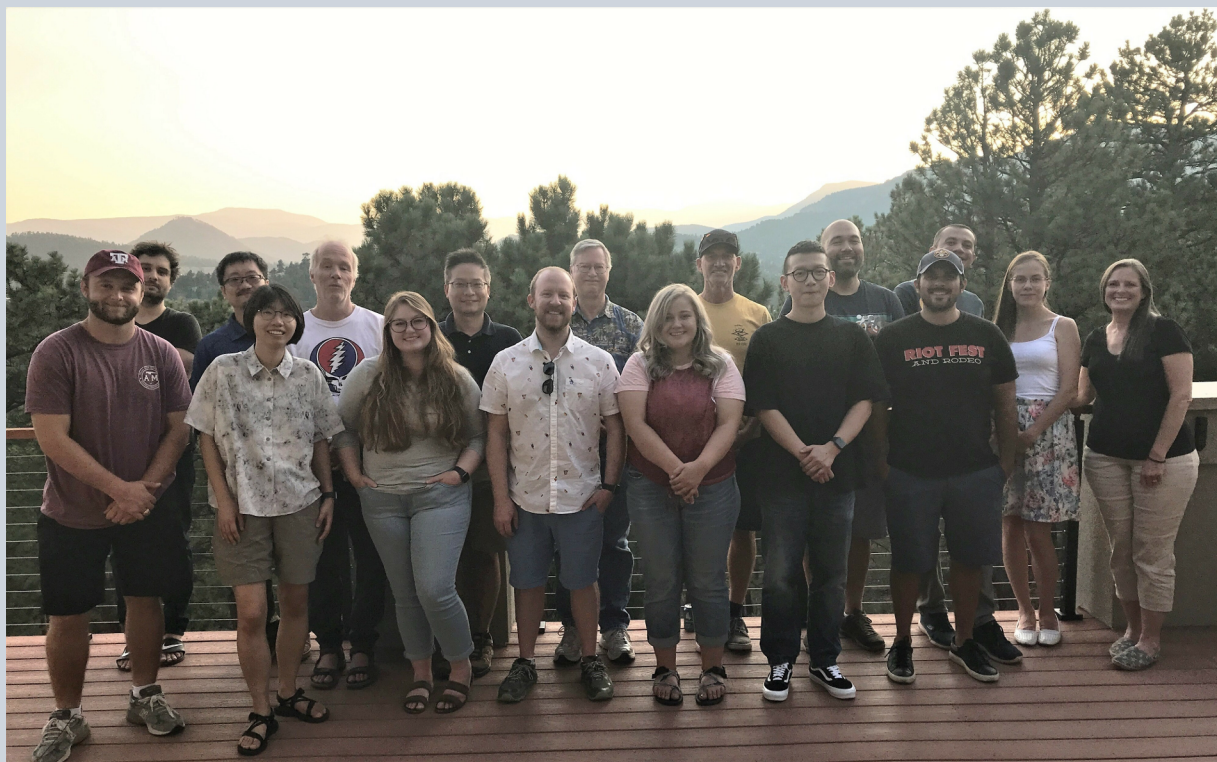
With nine master's and ten doctoral students, the RCP is one of the largest multidisciplinary graduate student consortia. Additionally, the mix of master's and doctoral students creates a robust research portfolio allowing for in-depth R&D combined with active field applications of this research.

—Anna Titova

Student Researcher: Rosie Zhu



Xiaoyu (Rosie) Zhu has been working on using low-frequency Distributed Acoustic Sensing (DAS) data to characterize hydraulic fractures in the D-J Basin. Her master's thesis is focused on integrating the learnings from low-frequency DAS data with petroleum engineering data and geology and developing a machine learning early detection system to prevent fracture hits. Rosie graduated from Mines with a Bachelor's degree in Geophysical Engineering in 2019. Rosie reflected on the role of the RCP during her stay in Mines for the past three years "RCP is a great group of people that helped me throughout my master's study. RCP peers and faculties not only help me learn and grow academically, they're always supportive emotionally as well. I'm also grateful for the amazing sponsors and alumni we have; they are very responsive and passionate about our research."—Anna Titova



RCP Student Researchers



Kagan Kutun is a PhD candidate in Petroleum Engineering's Fracturing Acidizing Stimulation Technologies (FAST) research consortium. Working with Dr. Jennifer Miskimins, he concentrates on the numerical modeling of the reservoir

and hydraulic fracturing phenomena. His field of study is related to numerical modeling of Distributed Temperature Sensing (DTS) responses in horizontal wells. Through his doctoral research, he determined that DTS sensors have varying sensitivity to different temperature transients and wellbore conditions. He was able to provide a way to predict this sensitivity ahead of time. Also, he used the warmback data to invert for near-wellbore temperatures to better identify cold zones associated with hydraulic fracture fluid placement. As an affiliate RCP student, Kagan acknowledges Dr. Jin for providing guidance: "His industry experience and knowledge about fiber sensing are phenomenal." In addition, Kagan highlights that "RCP provided me an opportunity to work cross-discipline alongside geophysicists."



Joseph Mjehovich was a recruiter for about seven years in a few different industries. He returned to school in 2018 to finish his BS in Physics at the Metropolitan State University of Denver.

Then Joseph joined the Department in 2020 to pursue his MS in Geophysics. His research focuses on Distributed Acoustic Sensing (DAS). He has developed a methodology promoting the use of DAS for rapid deployment of seismic acquisitions directly on the ground surface, which is very useful for geotechnical surveys. He has also advanced the use of DAS as a diagnostic method for hydraulic fracture treatments in unconventional wells. Joseph thinks that "the best thing RCP has provided me is the opportunity to work with individuals of different backgrounds (e.g., geology, geophysics, petroleum engineering) to solve real-world industry problems. The diverse experience and educational background of the students and faculty in the RCP has really helped me navigate my research."

—Anna Titova



Center for Wave Phenomena

Since 1983, the Center for Wave Phenomena (CWP) has pushed the bounds of seismic exploration, monitoring, and wave propagation research while engaging students and industry partners in a collaborative way.

Under the leadership of current CWP director Dr. Roelof Snieder, such traits are still thriving. With the benefits of bringing students and industry partners together for valuable information exchanges, about 20 companies subscribe to the research products that the CWP produces each year for use in their particular contexts.

CWP has five research teams: the Anisotropy Team (A-Team), the Computational Team (C-Team), the Data Team (D-Team), the Imaging and Inversion Team (I-Team), and the Seismicity Team (S-Team). The A-Team, led by Dr. Ilya Tsvankin, focuses on modeling, inversion, and imaging of seismic reflection data from anisotropic media. The C-Team, led by Dr. Jeffrey Shragge, focuses on the theory and applications of computational seismology. The D-Team, led by Dr. Eileen Martin, focuses on strategies for large-scale data acquisition and analysis. The

I-Team, led by Dr. Paul Sava, focuses on developing a full wavefield methodology for imaging the interior of the earth and other planetary bodies. Finally, the S-Team, led by Dr. Roelof Snieder, focuses on developing new techniques that use wavefield measurements for imaging, with a particular emphasis on time-dependent changes in the subsurface. Ultimately, these teams collaborate with one another, other Mines departments, academic groups in other universities, and industry sponsors to produce world class research and train students. There are 16 graduate students currently involved in CWP.

Oil and gas companies have traditionally played an important role in sponsoring the research of CWP through the CWP industry consortium. However, CWP does not see itself as producing overly narrow research products. Shragge emphasized this when outlining the

Learn more about CWP at
cwp.mines.edu

PARTNERS IN RESEARCH

broader importance of CWP's work. "We like our science to be for different applications," said Shragge. Research on seismic inversion techniques, for example, can be useful to oil and gas sponsors but also for other contexts such as planetary sciences. Such reach indicates the breadth of opportunities for CWP members to contribute to geophysical research. As to the generation of project ideas, the scientific questions researchers ask are often formed in collaboration with industry sponsors. This ensures that student, faculty, and sponsor perspectives can culminate in an all-encompassing, yet accomplishable, research project.

What helps achieve this is the academically diverse nature of the faculty members. Tsvankin highlighted this in describing the wide-reaching influence of CWP on scientific and industry endeavors. "What distinguishes CWP are faculty members who have different research interests in a wide range of topics," he said.

This is on full display at the annual meetings between the consortium and the industry sponsors. At these meetings, students present their research and discuss how their work would be applicable in a wide variety of environments. Additionally, students from different teams usually present on the same day, rather than having an "A-Team Day". This schedule inherently depicts the breadth of research that CWP conducts. The COVID-19 pandemic did change this in the short-term by making these meetings virtual. However, the student presentations were still of high quality, and sponsors provided valuable feedback that broadened the group's understanding of the topics.

While CWP achieves its main goal by conducting research, educating and training students is always in focus. CWP faculty members do not want students to simply move from project to project. Rather, they teach students how to conduct research in general. Faculty members teach students how to formulate research questions, how to ascribe goals and hypotheses centered on those questions, and how to act so that results reveal the success or failure of those propositions. Additionally, communication and writing skills are emphasized so students can learn how to interact with research partners, sponsors, and colleagues in a wide variety of environments such as writing a scientific publication or presenting at the Society of Exploration Geophysicists' (SEG) conference. The result is that CWP students not only conduct world class research but also become effective scientists in general. The CWP model engages students' curiosity while making them effective members of the scientific community.

The CWP has spent nearly 40 years studying seismic waves and their intersection with geophysics. With a motivated group of students, faculty, and industry sponsors, the CWP hopes to broaden its interests while maintaining those connections it has had for such a duration. Whatever that new direction takes – whether it is carbon capture and storage, or if it is mining safety applications – the CWP will continue its trend of producing innovative research and successful students.

—David Churchwell



Student Research: Cullen Young

Gas hydrates are found in significant quantities on the Alaskan North Slope in sub-permafrost sand units. Additionally, they are intermixed in lower portions of permafrost within the hydrate stability window. While conventional surface seismic data and established imaging methods can identify the presence of gas hydrate reservoirs, producing high-resolution images remains challenging due to the attenuation of high-frequency waves. An alternative strategy is to use distributed acoustic sensing (DAS) that involves cementing optical fibers into boreholes to measure seismic wavefield energy closer to the area of interest by conducting vertical seismic profiling (VSP). DAS fiber has a high spatial and temporal resolution that yields high-quality and finely sampled observations when compared to traditional methods. This promotes the development of three-dimensional (3D) imaging frameworks that describe the geology in a more accurate way. My research takes these facets to produce a 3D DAS VSP framework to create high-quality, accurate images of gas hydrate reservoirs. My framework can handle complex Earth models, sharp velocity changes, and significant structural features. The resulting images are then validated with borehole observations to ensure the methodology is successful.

News Briefs

Field Camp Changes Locations

This summer the Geophysics Field Camp is moving to a new location! For over 70 years, the Department's comprehensive summer field geophysics course for students in our Geophysical Engineering program has been a capstone of our core geophysics curriculum. Providing students with hands-on experience in developing, executing, and interpreting geophysical field investigations, field camp is a signature Mines course remembered by our alumni. There are few comparable courses like Field Camp in terms of breadth or depth.

We have spent eight of the past ten years surveying a geothermal system near Pagosa Springs, Colorado (the other two years were interrupted by the COVID-19 pandemic), with our undergraduates learning the ropes of field geophysics and making new discoveries about this geothermal system each year. But this year, our undergraduate majors will start building a geophysical map in a place where one currently does not exist: Steamboat Springs.

Steamboat Springs has not had any significant, publicly available geophysical surveying in more than 40 years, yet it is consistently identified as a potential geothermal target for power generation. For two weeks, our undergraduates, with a team of graduate student, faculty, industry, and federal



Rich Krahenbuhl

Students preparing for last year's field camp.

researcher instructors guiding them, will stay in the Colorado Mountain College dorms and collect a comprehensive set of modern geophysical surveys using the latest technology, including wireless nodes and distributed acoustic sensing. After collecting their data, the students will return to Golden and spend two weeks processing, integrating, and interpreting their data to investigate the nature of the Steamboat Springs geothermal system. The camp will culminate with a series of extended abstracts and a public presentation that is open to everyone; so stay tuned for some exciting discoveries made by our students!

—Matthew Siegfried and Brandon Dugan

Welcome to the Department

We welcome Dr. Eileen Martin as an assistant professor jointly appointed in the Departments of Geophysics and Applied Math and Statistics. She is also an assistant professor on-leave at Virginia Tech in the Department of Mathematics and Division of Computational Modeling and Data Analytics. She earned her Ph.D. from the Institute for Computational and Mathematical Engineering at Stanford in 2018, where she was a member of the Stanford Exploration Pro-



ject seismic imaging group and an affiliate in the geophysics department at Lawrence Berkeley National Lab (through 2020). She holds an MS in geophysics from Stanford and a BS with a double-major in math and computational physics from UT-Austin. She is joining the Center of Wave Phenomena (CWP) and will bring expertise in fiber optic sensing, data-intensive high-performance computing, near-surface engineering, environmental and urban geophysics. Welcome, Eileen!

—Anna Titova

Society of Student Geophysicists (SSG)

This semester SSG continues our lecture series with a variety of Earth Scientists. Thus far, SSG has heard from new faculty member Dr. Eric Anderson, who is jointly appointed to Civil and Environmental Engineering and Geophysics. Dr. Anderson spoke about his diverse career as a fluid dynamicist and modeler. SSG

also held a graduate student panel to offer some information and advice to undergraduate students interested in graduate school. SSG is looking forward to completing volunteering efforts on campus and in the community and planning the end of year banquet.

—Michael Field

Society of Graduate Geophysics Students (SGGS)

SGGS aims to bring graduate students together with events and celebrations to showcase the camaraderie of the Geophysics' Graduate Students and uplift students' spirits. This academic year was no exception. Throughout the year, SGGS hosted a plethora of events that celebrated holidays and the feeling of togetherness in general. This included a Thanksgiving celebration with mini-pies and a Lunar New Year gathering centered on Chinese snacks and Boba Tea. However, SGGS did not need a holiday to fulfill its mission. Numerous happy hours – centered on craft beer or coffee – provided a spontaneous break from the school environment for a given day, and, on some mornings, students would arrive to the welcome surprise of donuts or breakfast

burritos so that their days started off with a happy stomach. Additionally, SGGS created its own Instagram so that past, current, and future students can interact with the club and see how graduate students celebrate the Department's community. (Give us a follow! <https://www.instagram.com/sggsmine/?r=nametag>) Lastly, SGGS, partnered with the Diversity, Access, & Inclusion (DI&A) committee, hosted a relaunch event for the Society of Women in Geoscience (SWIG) on International Women's Day to signify the importance of having a more diverse and inclusive department. Thus, SGGS has succeeded in its mission for the year and is excited for the new ways graduate students will come together in the future.

—David Churchwell

Alumni Updates

John Rekoske '20 and PhD student at USCD Scripps Institute of Oceanography, was awarded a National Science Foundation (NSF) Graduate Fellowship in 2021. The fellowship program recognizes outstanding graduate students in NSF-supported STEM disciplines.

Devon Dunmire '18 won an Outstanding Student Presentation Award at the 2021 American Geophysical Union (AGU) Fall Meeting in New Orleans for her paper, "Contrasting Regional Variability of Buried

Meltwater Extent over Two Years across the Greenland Ice Sheet".

Lia Martinez '07 was awarded the "Rose Hard Hat" at the Mines' Women's Leadership Summit. The award recognizes women of Mines who work to elevate other women and make the world a better place for future generations of women and girls.

New alum **Andy McAliley** '21 received Best Paper presented at SEG Image 2021 for "Machine learning inversion of geophysical data by a conditional variational autoencoder."

Student Honors

PhD student **Elena Savidge** won a Natural Sciences and Engineering Research Council of Canada's "Canada Graduate Scholarship-Doctoral fellowship" (three-year fellowship equivalent to NSF's Graduate Research Fellowship).

PhD student **Reynaldo Vite** received a travel grant to attend the 2022 annual meeting of the Seismological Society of America in Bellevue, WA.

PhD student **Rachel Willis** is the recipient of an Honorary Mention for her NSF Graduate Fellowship proposal (2021) titled: "A novel machine learning algorithm to train big data for full-waveform inversion." She proposed the development of a fully automated phase detection and window selection process based on machine learning that could maximize the information that goes into FWI while facilitating the potential assimilation of 'big data' in inversions.

MS student **Maureen James** has received a Colorado Science and Engineering Policy fellowship. She will be working with State Senators Bob Rankin and Chris Hansen to design Colorado's Energy and Environmental sector policies. Maureen's research interests

are at the intersection of carbon sequestration, clean energy access, and energy and environmental policies.

PhD student **Hannah Verboncoeur** won "Best Student Presentation - In-person Poster" at the West Antarctic Ice Sheet Workshop in Sterling, VA for her poster titled "The Impact of Elevation-SMB Feedbacks on the Evolution of Thwaites Glacier, West Antarctica." Additionally, she won a United States Scientific Committee on Antarctic Research (US-SCAR) Early Career Advanced Antarctic Training Award - fellowship that funds her travel to teach at Juneau Icefield Research Program. And if that weren't enough, she also was awarded the AGU Flash Freeze Award (a funding competition through the AGU Cryosphere section) for her presentation on the "Glaciers in the South" Project. Glaciers in the South is an outreach initiative Hannah designed to increase accessibility of cryospheric science education throughout the Southern U.S. through the creation of science outreach materials, opportunities, and a network of cryospheric scientists throughout the South. To top off her awards, she received a three-year NSF graduate research fellowship.

Congratulations 2022 Graduates!

Bachelor of Science in Geophysical Engineering

Kaitlyn Abernathy	Jared Low
Abdulaziz AlFozan	Cameron Modisett
Ghassan Alghamdi	Bailey Mullett
Zachary Bain	Rebecca Prentice
Elizabeth Bruce	Mona Sijeeni
Ryan Coulsey	Kacey Wade
Kieran Coumou	Hunter Klein
Michael Field	Cash Koning
Martis James-ravenell	



Brandon Dugan

Master's & PhD Degrees

Morgan Molesworth, MS, Geophysical Engineering (Non-thesis)
Jeremiah Pisarra, MS, Geophysical Engineering (Non-thesis)
Gavin Wilson, MS, Geophysical Engineering (Thesis)

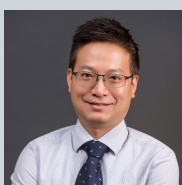
Jonah Bartrand, MS, Geophysics (Thesis)
Dylan Brazier, MS, Geophysics (Non-thesis)
Elaine Collins, MS, Geophysics (Non-thesis)
Matthew Oleszko, MS, Geophysics (Non-thesis)
Cullen Young, MS, Geophysics (Thesis)

Taqi Alyousuf, PhD, Geophysics
Tugrul Konuk, PhD, Geophysics
Can Oren, PhD, Geophysics
Gurban Orujov, PhD, Geophysics
Sagar Singh, PhD, Geophysics
Alekssei Titov, PhD, Geophysics



2021-2022 Academic Awards

Graduate Awards



Daniels Fellowship

PhD student Liwei Cheng received the Daniels Fellowship for his work related to the oil and gas industry. Cheng is researching rock physics and seismic internal-multiple suppression in the Reservoir

Characterization Project. He plans to continue in this field after graduation with a goal of reducing uncertainty and cost in exploration and development.



Chevron Fellowship and Meng Ersheng Scholarship

Third-year PhD student Yanhua Liu received the Chevron Fellowship and Meng Ersheng Scholarship to support her work related to the oil and

gas industry, which she conducts as part of the Center for Wave Phenomena. Her graduate work focuses on full-waveform inversion of time-lapse seismic data using physics-based and data-driven techniques. The method she is developing can be used in monitoring oil and gas production as well as CO2 sequestration. Liu, who is from China, plans to continue her work in industry there in the future.

PhD First-year Fellowship

Hannah Verboncoeur received a PhD first-year fellowship. Verboncoeur came



to the Department after completing her degree in Earth and Atmospheric Sciences at the Georgia Institute of Technology in 2021.

As part of the Mines' Geophysics Glaciology Laboratory, she is studying how ice shelves in Antarctica respond to a changing climate. By using ice-penetrating radar data, remote sensing, and numerical models, she is answering questions about how changes in ice dynamics, climate, and ocean conditions may change the ability of the ice shelves to slow the outflowing of ice, something she hopes to continue studying throughout her career.



Ashish Kumar received a PhD first-year fellowship. Kumar joined the Department after completing his MS in Geophysics from the University of Alabama and a BS in Geo-

physics from the Indian Institute of Technology in Dhanbad, India. He focuses his research on developing novel geophysical methods incorporating computational and statistical techniques to image subsurface processes and address the challenge to advance the sustainability of Earth's resources.

Pickett Graduate Fellowship



Master's student Nicolas Bufaliza received the Pickett Graduate Fellowship, which is awarded for the study of petrophysics, rock properties and their

relationships, and well logging in the broadest sense. Bufaliza, who has already created accurate petrophysical models for a heavy oil field in Argentina, allowing it to be re-exploited after it had been abandoned, continues his work with well logs and seismic data in the Center for Rock & Fluid Multiphysics. He is working on discriminating fizz water from commercial gas by focusing on well logging analysis, rock physic characterization, and fluid substitution to create models that can be compared later with the seismic data.

Chevron Fellowship



Master's student Joe Mjehovich received the Chevron Fellowship for his oil-and-gas-related work using fiber-optic cables that have been installed in unconventional wells to deter-

mine the height, width, and length of hydraulic fractures. Understanding the geometry of these fractures is important for optimizing the completion and production of unconventional wells. Mjehovich, whose research is part of the Reservoir Characterization Project, says this award is motivating as it is a recognition that his work has an impact on geophysics and its practical application in the oil and gas industry.

Undergraduate Awards

Cecil H. Green Medal Award
Michael Field

Outstanding Graduating Senior
Rebecca Prentice

Phillip R. Romig Award
Jared Low

John C. Hollister Award
Anna Valentine

George R. Pickett Memorial Award
Mohammed Alahmed

**George T. Merideth Award for Early Leadership
in Geophysical Engineering**
Martis James-Ravenell

E-Days Engineer
Michael Field

Mendenhall Awards



PhD graduates Tugrul Konuk and Aleksei Titov have received Mendenhall awards.



The awards are given to those who have shown the ability to conduct cutting edge research, who have demonstrated the highest standards of integrity and professional conduct throughout their studies at Mines and who may have a record of service to the Department and University beyond regular academic responsibilities.

Faculty Accolades

Dr. Roel Snieder was selected as the Faculty Senate Distinguished Lecturer for an in-person and virtual event on “Teaching with a Heart,” where he discussed the importance of educating students as whole persons, and provided simple steps, that are not time consuming, so that we help create a learning environment where we assist students in their personal growth and wellbeing.

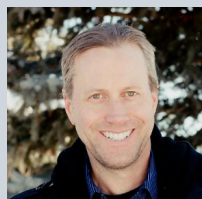


Dr. Manika Prasad received The Martin Luther King, Jr. Recognition Award which honors Mines community members (faculty, staff, and students) who are exceptional in their appreciation for diversity and understanding of its value on the Mines campus. Dr. Prasad was honored for her work within the Department to bring equity and inclusion to the forefront of discussion and spearheading efforts with the initiative “Unlearning Racism in the Geosciences (URGE)”.



Promoted!

Dr. Ebru Bozdag has been granted tenure and promotion to Associate Professor.



Dr. Rich Krahenbuhl has been promoted to Associate Research Professor.



Dr. Aaron Girard has been promoted to Research Associate.



Dr. Dave Wald was recognized with the Joyner Award, which is a lectureship jointly awarded by EERI and SSA to those who have provided outstanding earth science contributions to the theory and practice of earthquake engineering or outstanding earthquake engineering contributions to the direction and focus of earth science research—together with demonstrated skills of communication at the interface of earthquake science and earthquake engineering.

Society of Exploration Geophysicists (SEG) Awards



Dr. Kamini Singha received the Reginal Fessenden Award for making specific technical contributions to exploration geophysics.

SEG/Image '21 Best Paper Award:

Dr. Ali Tura with co-authors **James Simmons, Matthew Copley, Sima Daneshvar, Andrea Damasceno** and **Joseph Stitt** for "Impact of joint PP/PS inversion on shear-impedance estimation for exploration and production." This team was also named as a Top 25 Presenter.

SEG/Image '21 TOP 25 Presenters:

Dr. František Staněk with co-author **Ge Jin** for "Reservoir characterization using DAS micro-seismic events."

Dr. Aaron Girard with co-authors **Jeffrey Shragge** and **Bjorn Olofsson** for "Identifying salt flanks using low-frequency ambient OBN surface-wave seismology."

Dr. Bin Luo (recent post-doc) with co-authors **Frantisek Stanek** and **Ge Jin** for "Near-field strain of microseismic events in downhole DAS data." The published paper of this work, in Vol.

86, number 5, Sept.-Oct. 2021 of the SEG journal *Geophysics*, received Honorable Mention for Best Paper in *Geophysics*.

Dr. Andy McAilely (recent PhD/post-doc) with co-author **Yaoguo Li** for "Machine learning inversion of geophysical data by a conditional variational autoencoder."

Honorable Mention for Best Paper

Dr. Manika Prasad, with co-authors Stanislav Glubokovskikh, Thomas Daley, **Similoluwa Oduwale**, and William Harbert, received Honorable Mention for Best Paper in the SEG publication *The Leading Edge* for "CO2 messes with rock physics", published in Vol. 40., no. 6, June 2021.

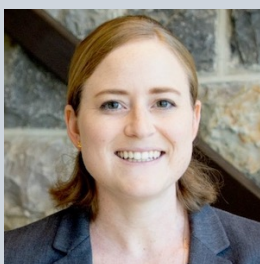
SEG Distinguished Lecturers

Dr. Roel Snieder will be the Fall 2022 SEG-AAPG Distinguished Lecturer with his talk "Measuring variations in the seismic velocity as a diagnostic of rock damage and healing."

Dr. Ali Tura was the 2021 SEG Distinguished Lecturer with his online talk "Recent advances in seismic reservoir characterization and monitoring."



Dr. Jeffrey Shragge was recognized by his colleagues and students with the T.K. Young award for his outstanding contributions to, and leadership, in many activities and initiatives in the Department, and with students and researchers at all levels.



Dr. Eileen Martin has been awarded a National Science Foundation (NSF) CAREER award. Under this award, Dr. Martin and her team will be developing new algorithms for more efficiently analyzing large-scale continuously recorded seismic data, which are often full of noise and require specialized techniques to extract weak signals. The aim of these algorithms is to process these large-scale datasets more efficiently, so scientists can analyze them faster or with fewer computer resources. This is often done by taking advantage of data compression or data features that require much less computer memory than the original data. Two of the primary application areas they will apply these methods to are glacier and urban seismology.

Interview with Dr. Eileen Martin

Anna: Dr. Martin, we are very excited that you joined the Colorado School of Mines. At the Geophysics department, your research group is a part of the CWP consortium. CWP has a tradition to name each research group as an "X"-team. You have named your group D-team, where "D" stands for Data. What motivated you to make this choice? What kind of datasets you are planning to work with? Was there a thought to take a letter from another alphabet, e.g., the Greek alphabet?

Dr. Martin: D also might mean Distributed sensing team; we are also working on Distributed computing. As for the Greek alphabet, I was considering Delta-team. Delta might represent different changes or growth within the area.

Distributed acoustic sensing creates a lot of data. During the recording we might get 1 TB per day. It is very problem dependent what is appropriate. I consider different geological settings where it is justified to have these large datasets. For example, the glaciology datasets, where icequakes are very high frequency and localized. Another example of the dataset is for a coal mine in southwestern Virginia, there is a lot of high velocities (limestones and sandstones). It's another scenario, where we might get these high frequency waves that propagate pretty far distances without a lot of attenuation. I also like scenarios where you might have a sort of remote recording and not be able to easily transfer that data, for example, in Alaska, for permafrost studies, and on glaciers it is very hard to transfer the data, real time data exploration and compression.

Anna: This sounds fascinating. I am definite your D-team will merge nicely into the research life of the CWP and the entire Geophysics department. My next question is about your cur-

rent experience at Mines. You have been here for a couple of months already. Moreover, you are jointly appointed with almost equal load at the Geophysics and Math and Statistics Departments. Is it hard to manage your roles and duties at both departments simultaneously? Do you find yourself doing and learning something new that expands your experience?

Dr. Martin: The cultures of applied math and math and statistics are kind of similar when compared to geophysics. When it comes to how to build and manage a research group, for example, how do I recruit students and what is their preparation - that's different. The availability of teaching assistants differs between the departments in that there's oftentimes more sections of math and stats courses being taught for all departments. That changes the way we operate, but those are little things.

The department heads Greg Fasshauer over in math and also Paul Sava right here in Geophysics, they both meet with me for things that are career development related. This makes sure that we all know what I'm doing for each of the departments, so I'm not double booked.

Another new experience is related to the management of the lab space. Jin, Jeff and I are managing the new lab for distributed fiber optic sensing that we're just getting started. It is great that we have a team of faculty since I am on the learning curve with this. Safety, training and new protocols are very important to get set up correctly. Another new experience is doing more fieldwork than in my prior job. This experimental design asset is very important because it is so closely connected to how we end up with large datasets that require improved computational methods.



Dr. Martin conducting a high-resolution study of Alaskan permafrost.

Anna: The last thing I wanted to ask you is a bit of career advice for recent, new, and soon-to-be graduates. The world constantly changes, and its changes are not necessarily synchronized with students' graduation timelines and plans. So, what would you suggest for students to do to secure their success in the job search and career path?

Dr. Martin: I think that one of the really good pieces of career advice that I got when I was an undergrad was that you should always think about having two or three possible career paths you could be happy with. Think about what would be a possible path to get there, and what would be the expectations to apply for those jobs. Even though some people might think they have one perfect career path that's a great fit, if that door ever gets closed off for whatever reason you've got two other doors that are still open. You can plan to make sure that you check the box of any minimal job requirements for all those paths. As I was going

to grad school, I thought the whole time I was going to work at a national lab or in industry, and so I had worked at and with national labs, spent a summer at a service company, and a summer at a major oil and gas company. That way, I could check off the boxes for each of those categories of jobs. But I also published at least a couple of papers, which really does help build the application for things like national labs, USGS or academic jobs. My last year of grad school I decided to apply for professor jobs and was glad to have published and to have taught twice, which meant I hadn't closed that academic door. Keeping options open is more important than overspecializing for one path.

Anna: Thank you so much so your time, I really enjoyed talking with you and learning about your research and role in Mines.

—Anna Titova

Fabulous Postdocs

Dylan Hickson hails from



Toronto, Canada, where he obtained an HBSc and BSc in Earth and Environmental Science and Physical Science from McMaster University, followed by a PhD in Earth & Space Science from York University in 2019. For his dissertation, Dylan developed laboratory experiments to measure the electromagnetic properties of geologic materials which he then applied to model radar observations of asteroids and the Moon. He spent two years at the Arecibo Observatory in Puerto Rico in the Planetary Radar Group, performing planetary radar observations and analyses to derive physical properties of planets, the Moon, and asteroids. In 2021, he joined the Department, working in the Center for Wave Phenomena with Dr. Paul Sava. Dylan is performing 3D analyses of SHARAD and MARSIS orbital radar sounding observations of Mars, as well as developing numerical simulations of radar scattering from asteroids. In the summer of 2022, Dylan will join MDA Geospatial Services Inc. in Ottawa, Canada

as a radar analyst working in interferometric synthetic aperture radar to continue this research and is looking to apply these findings to applications while continuing as a research associate in the Department.

Quancheng Huang is from Fujian Province in southeastern China. He obtained his BS



in Geology from Nanjing University. After graduation, he moved to the United

States for adventure and to pursue his academic career. In 2020, he obtained his PhD in Geophysics at the University of Maryland. His PhD research focused on the study of Earth's mantle transition zone structures as well as the interior structure of Mars. He used seismic reflections to investigate the topography of Earth's upper mantle discontinuities and seismic anisotropy in the deep mantle. In early 2019, he joined the science team of NASA's InSight Mission to Mars as a student collaborator. He contributed to the discovery of the Martian core as well as the initial seismic velocity models of Martian mantle. After briefly being a postdoc at New Mexico State University, in November 2021, he joined the Department as a postdoc to continue his journey on Mars. He is working with Dr. Ebru Bozdag to use the spectral el-

ement method to simulate 3-D seismic wave propagations on Mars.

Ezgi Karasözen came to the Department from Ankara, Turkey in 2010.

After working on the tectonic structure of Mars and completing



her master's degree, she came back to "Earth" to do a PhD and investigate earthquake source characteristics. She is developing landslide detection techniques in southern Alaska, where coastal landslides near retreating glaciers present hazards as the climate warms and have the potential to initiate catastrophic local tsunamis. She focuses specifically on the unstable mountainside of Barry Arm to study a hazard that spans much of coastal Alaska.

Ezgi is also interested in using signal processing techniques to work on seismic data. She presented her work on developing a denoising algorithm to remove persistent culture noise at the recent American Geophysical Union (2021) conference and continues to work on investigating source characteristics of earthquakes by using earthquake location and waveform modeling techniques while complementing with geodesy.

She anticipates continuing to work on seismic hazard-related research in the future.

Kurt Livo was born and raised in Lakewood, Colorado. He joined the Department due to his interest in rock physics.



His background is in experimental research in petroleum engineering and geology with an emphasis on petrophysics and reservoir engineering. Kurt is working on research involving NMR, CT, and acoustic measurements on cores for carbon sequestration and storage (CSS) projects. After the postdoc, he anticipates getting a career position in any research capacity to continue his research interests and growth as a scientist. In his free time, Kurt enjoys the outdoors with his golden retriever and family.

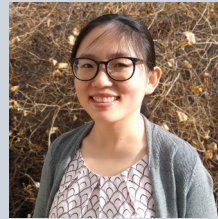
Roger Michaelides is a postdoc in Dr. Matt Siegfried's glaciology group. He completed his PhD at Stanford University in 2020, where



he used InSAR to look at permafrost physical processes and tundra wildfire behavior in the Alaskan Arctic. Currently, he uses InSAR, LiDAR, and other remote sensing methods to study a range of processes in the Arctic, as well as wildfire behavior, landslide susceptibility, and post-fire debris flows in the Col-

orado Rockies. He has accepted a position as an assistant professor at Washington University in St. Louis, and will be starting in August of this year.

Yanrui (Daisy) Ning is a Reservoir Characterization Project (RCP) alum and rejoined RCP as a postdoctoral fellow in January 2021. With a PhD degree in Petroleum Engineering and a minor in Geophysics, she worked as a reservoir engineer for two years. Daisy's research interests include reservoir simulation, machine learning and Low-Frequency Distributed Acoustic Sensing (LF-DAS) interpretation, focusing on hydraulic fracturing optimization, enhanced oil recovery (EOR) in unconventional reservoirs, as well as carbon capture, utilization, and storage (CCUS). After completing the postdoc, Daisy is expecting to obtain a faculty position in academia, continuing academic research and mentoring talented students.



Ridvan Örsvuran is from İstanbul, Turkey where he received his BS at İstanbul University and MS in Geophysics at Boğazici University. He received his PhD degree from Université Côte d'Azur (Nice, France) with advisor Dr. Ebru Bozdog, who is now in the

Department. His PhD work focused on global tomography using full-waveform methods. He investigated

the anelasticity and azimuthal anisotropy of the mantle and the misfit functions' role in the inversion process. As a post-doctoral researcher, he is continuing the same research. Ridvan spent a significant amount of his time at Mines during his PhD and is excited to be back while carrying on his studies about Earth's interior using seismic waves to further our understanding of its physical and chemical properties.

Andrea Riaño Escandon is from Colombia and studied Civil Engineering at Universidad de los Andes, where she also completed her master's studies. She re-



ceived a PhD from Carnegie Mellon University and Universidad de los Andes. During her PhD studies, she worked with Dr. Jacobo Bielak and Dr. Juan C. Reyes to integrate physics-based, large-scale simulations to the seismic risk assessment of deterministic scenarios, with the specific application to the case of Bogotá, Colombia. After graduation, Andrea worked as a postdoc at Centrale Supélec in Paris, France. During her

Postdocs cont'd.

postdoc, she worked with Dr. Fernando Lopez-Caballero to test a simulation's capacity to reproduce active and passive in-situ tests like MASW and SPAC. Andrea came to the Department to work with Dr. Ebru Bozdogan as a postdoc in the SCOPED project. This project aims to establish a computational platform that combines large-scale processing and modeling of seismic data with open-source seismic codes for the scientific community's use. Andrea's professional goal is to continue working on scientific research. She believes that Mines is a national and global leader in research where she can keep learning and contributing to science.

Tasha Snow grew up in California and Washington, completing her BS in Biological Oceanography at the University of Washington. Before studying for her master's degree, she took a detour to serve as an officer in the United States Navy. She was stationed in Jacksonville, Florida and travelled to 20 different countries during her two tours. Afterwards, she found her people and calling were still in academia, so she attended the University of South Florida to study past Greenland Ice Sheet variability using ocean sediments for her master's degree. After



several research cruises to Antarctica and finding a love for data analysis, she finally shifted to study Greenland glacier-ocean interactions using thermal infrared for her PhD in the University of Colorado Boulder Geography Department. In her postdoc with the Mines Glaciology Laboratory, Tasha continues to find new ways to apply thermal infrared and other satellite datasets with machine learning to study poorly understood glacier-ocean processes in Antarctica.

František Staněk is from Pilsen, Czech Republic, and studied geophysics at Charles University in Prague while working at the Czech Academy of Sciences. He joined the Department in November 2020 as a member of the Reservoir Characterization Project (RCP) where he spends most of his time analyzing data acquired by fiber optic cables (DAS). František is mainly interested in microseismicity induced by reservoir stimulation, data integration, and complex reservoir characterization. He enjoys collaborating with colleagues and learning something new from them every day. In cooperation with Dr. Ge Jin, he developed a methodology of imaging hydraulic fractures using microseismic events detected by DAS. František is



working with Dr. Eileen Martin on a project focused on cloud computing and machine learning features for DAS data analysis.

Shaked Stein started his postdoc in October 2020 and finishes this month. Originally from Israel, he completed his BSc, MSc, and PhD at the Ben Gurion University of the Negev in Israel, studying geology and hydrogeology. He came to Mines because of its reputation, the Rocky Mountains, and the great opportunity to work with Dr. Brandon Dugan.



He is working on the applicability of pumping water from onshore-offshore aquifers, specifically at Nantucket Island using field and modeling approaches. He is also investigating the option to inject desalination brine waste into the saline coastal aquifer as it may be an environmentally friendly solution for brine disposal. Shaked will return to Israel to start a position as a researcher at the Israel Oceanographic and Limnological Research (IOLR), where he will study the hydrology and physics of Lake Kinneret (the Sea of Galilee) as it is the only freshwater lake in the country. He looks forward to implementing in his research the many great things that he learned here in the Department. —Aaron Girard

Recent Publications

2022

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