

geophysics

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FALL 2020



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MINES DEPARTMENT of GEOPHYSICS

Fall 2020

Colorado School of Mines
Department of Geophysics
Newsletter

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Cover Page: Geophysics Faculty and
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Welcome from the Department Head

Dear Friends and Colleagues,

This has been a year like no other in recent memory. My first thoughts are with you and your families, and on behalf of my colleagues in the Department, I wish you good health and strength to navigate these troubled times. I do not doubt that many of you have been impacted one way or another by the ongoing COVID-19 pandemic, either through challenges to your own health, or maybe through economic hardship, or simply through the undesirable distancing from family, friends, and colleagues. We are missing you, too, and hope that we will soon be able to get back to our normal forms of interaction, including through your visits to the Mines campus, as well as through our own travels to all corners of the world where you live.

Overall, our geophysics family is doing well, despite a much more complex and solitary environment in which we are operating these days. As expected, and worth repeating, our students, staff, and faculty are rising to the occasion by recognizing that the only way we can control the negative impact of this pandemic is by embracing the safety protocols recommended by health experts, including by severely limiting our close personal interactions, as well as by using face masks and other barriers in the proximity of others to limit airborne transmission of the virus.

In line with state and campus policies, we have conducted most of our 2020 work remotely, with only the most essential activities returning to the Green Center in recent months. This process started in March 2020 with an abrupt transition from our normal interactive teaching and research ways, to the isolating corners of the virtual zoom land. Over the summer, we engaged the faculty and staff to plan for the current school year, and to implement the office protocols that enable us to advance towards an eventual return to normal operations.

We have made progress, although much more remains to be done before we can say that we are back to normal. We are currently operating in a hybrid model, with parts of our teaching program delivered in the classroom, and others delivered using remote mechanisms. Some of our researchers are back in the office, while others continue to work remotely from the safety of their homes. We are exploring new mechanisms to implement our Diversity, Inclusion, and Access programs and to keep students, staff, and faculty in touch with one another as much as possible. We have moved the Heiland lecture online in order to make it accessible to all our students and faculty and to reach out to the broader community of Geophysics friends and colleagues. We are also hosting online coffee hours every Friday at 3 pm MT and would love to catch up with all of you. Please check <https://geophysics.mines.edu> for information about how to connect to our open virtual events.

One unfortunate casualty of the COVID-19 environment was the 2020 Summer Field Camp. Arguably, this is the highlight of the year and many of us cannot wait to get out in the field and do what we do best - work hard and play hard. We decided in Spring 2020 to postpone this year's Field Camp to Summer 2021 when, hopefully, we will be able to bring both the Junior and Senior classes to beautiful Western Colorado outdoors. Our Department remains committed to our flagship summer activity which has enchanted (and challenged) so many generations of the Geophysics family in the past.

Another unfortunate casualty of the COVID-19 environment was the 2020 May Commencement. Celebrating our graduates is an event we all enjoy the most, and this year we missed the opportunity to congratulate our graduates before their departure from the Mines campus. We organized a virtual event on that occasion, but we recognized that it could not come anywhere near the joyful celebration we normally organize on campus at that time of the year. We will not forget our Class of 2020 and look forward to a time when we will be able to bring them back to Mines for an appropriate send-off worthy of their hard work, commitment, and accomplishments.

The Geophysics family - students, faculty, staff, alumni, friends, colleagues, supporters - is resilient and I have no doubt that we will find ourselves on the other side of the chasm with rediscovered energy and ingenuity, and a stronger desire for partnership and commitment to one another than ever before. I hope that you will enjoy reading the newsletter to learn about last year's highlights, and be inspired to reach back to us to share your own accomplishments, and also to build stronger bridges across our community.

Be safe! Stay in touch!

Paul Sava

Welcome to Geophysics!

We are pleased to welcome Danica Roth and Elizabeth Reddy to the Geophysics Faculty



Danica Roth

Danica Roth is a new Assistant Professor who has joined Geophysics under a joint appointment with the Department of Geology and Geological Engineering at the Colorado School of Mines. Previously, she was an NSF Postdoctoral Fellow at the University of Oregon. She holds BA degrees in Physics and Astrophysics from the University of California, Berkeley, and a PhD in Earth Science from the University of California, Santa Cruz (2016). Danica's primary research interests lie at the intersections of process geomorphology, hazards and environmental seismology. Her work combines analytical and geophysical techniques with theory development to better understand the coupling of Earth surface processes with climate, biology and anthropogenic influences.

Elizabeth Reddy is a teaching Assistant Professor in Engineering, Design, and Society. She studies how experts consider, respond to, and communicate about risk. She holds a bachelor's degree in cultural anthropology from Reed College a master's in social science from the University of Chicago and a PhD in cultural anthropology from the University of California at Irvine. She has done research in clinics, laboratories, field stations, archives, and offices to study how engineers, scientists, medical professionals, and technicians address hazards to human wellbeing. Her work on earthquakes and risk mitigation technology in Mexico and the US has been funded by research grants from the NSF, the Society for the History of Technology, the American Institute for Physics, and others.

She is developing new research on how environmental data can be made public in ways that support just and equitable outcomes and about how engineering and earth science students learn about geohazards. She designs and studies innovative techniques to train engineering students, and comes to Mines after working in engineering education as a Post Doctoral Research Associate on University of San Diego's NSF RED (REvolutionizing Engineering and Computer Science Departments) grant.



Elizabeth Reddy

Computational & Global Seismology



Ebru Bozdag wins NSF CAREER Award

The National Science Foundation CAREER Award is for work to improve multi-scale (an)elastic structure of the Earth's mantle and D'' region. Bozdag will receive \$620,624 over five years for the project, ["\(An\)elastic mantle structure based on 3D wave simulations & full waveform inversion: From Global ADjoint models to visualization of Slabs, Plumes And Convection in MANTle."](#)

The project will use state-of-the art tomographic techniques and emerging datasets from oceans to construct high-resolution models for understanding the structure, composition and dynamics of the Earth's mantle, which shape the surface of the planet through tectonic processes such as earthquakes and volcanic activity. As part of the project, to facilitate effective exploration of Earth's mantle for research and educational activities, constructed models together with data from other disciplines will be used to design an interactive, collaborative Earth model called SPAC-MAN (Slabs, Plumes And Convection in MANTle), for visualization in virtual and augmented reality environments and planetariums.

The collaboration with the [Denver Museum of Nature & Science](#), and potentially with other natural sciences museums in the U.S., will reach a range of age groups from children to adults, educating them on the interior of our planet and its dynamics while promoting STEM fields.

The Earth's fluid outer core, with a radius that is slightly larger than the planet Mars, and which is below roughly ~2900 km below Earth's surface, holds high importance for a number of reasons. These include the generation of Earth's magnetic field, and being an important mechanism to transfer heat to the mantle, which helps to drive the convective engine responsible for plate tectonics. Bozdag also received \$269,379 for a three-year collaborative NSF-EAR project "**Collaborative Research: Towards improved imaging of the outermost core through determination of the effects of lowermost mantle heterogeneity and anisotropy**" to better understand the degree to which Earth's heterogeneous mantle affects core measurements, and work towards full-waveform inversion of the Earth's outermost outer core using the best data which are demonstrated to be minimally affected by the mantle. As of September 1, 2020, Bozdag also joined the **Editorial Board** of **Geophysical Journal International**.

The Computational & Global Seismology Group welcomed the postdoctoral researchers **Susini Desilva** and **Neala Creasy** (NSF postdoctoral fellow), and graduate students **Glendon Rewerts** and **Rachel Willis**.

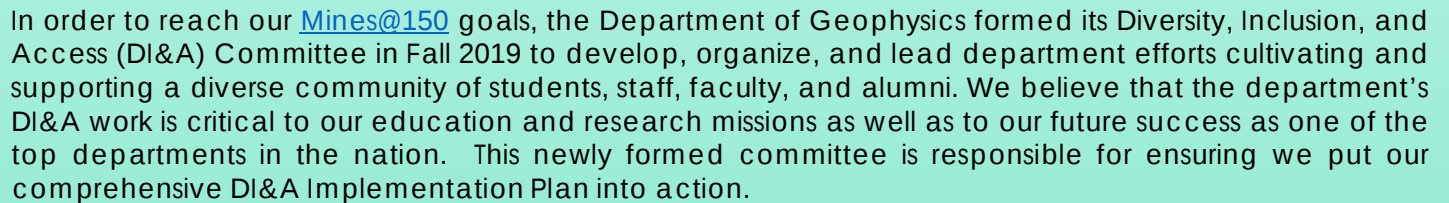
Humanitarian Geophysics

[humanitarian.mines.edu/mshes/]

Over the past few years, Geophysics Department faculty have been working on developing our portfolio in the field of Humanitarian Geophysics, which may be broadly defined as the “practice of applying geoscientific principles to improve the quality of life and standard of living for under-resourced communities,” Geoscientists and engineers can play an important role in the development of communities in need by applying their domain-specific knowledge to address a wide range of problems. Generating solutions to these challenges, though, requires developing and improving interdisciplinary approaches to problem solving as well as designing novel aspects of teaching and learning of Humanitarian Geosciences in Mines undergraduate and graduate curriculum.

- Geophysics faculty have been working with our colleagues in Engineering, Design and Society (EDS), Geology and Geological Engineering, and Civil and Environmental Engineering on developing a new MSc degree program in Humanitarian Engineering and Science (HES). We are pleased to announce that the new HES MSc program is up and running with the focus areas of Geophysics, Geology, and Environmental Engineering.
- In summer 2020, Dr. Richard Krahenbuhl extended his role at MINES from research faculty and instructor in the department of Geophysics to include that of Associate Director for the new Humanitarian Engineering and Science (HES) graduate program
- Our first Humanitarian Geophysics MSc student, Dana Sirota (CSM Geophysics MSc, 2020), defended her thesis “Development and Validation of Low-cost DC Resistivity Meters for Humanitarian Geophysics Applications,” Dana’s work was integrated into the Mines Geophysics Department’s *Geoscientists without Borders* project in Bénin, West Africa, which aims to provide low-cost geophysics instrumentation and open-source software to West African hydrogeophysicists.
- Mines Geophysics welcomes our second Humanitarian Geophysics student, Gavin Wilson (CSM Geophysics BSc, 2020), to our Masters degree program. Gavin will be looking to extend Dana Sirota’s work to multi-instrument time-lapse DC resistivity analysis with a focus on low-cost geophysical monitoring of tailings dams in central Colombia.
- We look forward to welcoming Sigourney Burch as a future Humanitarian Geophysics MSc student in the Fall of 2021. Sigourney Burch is currently a senior in the Department of Geophysics with a passion for cultural and historical preservation. Her current plan is to complete her BSc in Geophysics in Spring of 2021 and then join the HES Geophysics program where her thesis will focus on archaeo-geophysics.

[Geophysics.mines.edu/dia/]



The new academic year brings exciting changes to our DI&A Committee. While we work to continue last year's initiatives with socially distanced guidelines, we are also building a stronger student voice in DI&A efforts by expanding our student membership to four in order to have equal representation of faculty/staff and students, expanding our presence at minority-serving conferences to develop new recruiting pipelines for our department, and inviting the entire community to participate in DI&A activities by making our committee meetings public. Stay up-to-date on our progress at our new website: <https://geophysics.mines.edu/dia/>.

Geophysics Field Camp

[Geophysics.mines.edu/field-camp/]

The 2021 Geophysics Field Camp will head to Gunnison, Colorado after many years of running the class in Pagosa Springs, Colorado. We have made contact with colleagues in the Natural & Environmental Sciences Department at Colorado Western University who are experts in the local geology of the area. Through surficial mapping, they have developed a number of geological models of the area (shown in figures 1 and 2), but geophysical imaging is required to test their hypotheses and answer a number of open questions that cannot be addressed from surface observations. Most of these questions are related to the nature of the various faults in the area, particularly those which juxtapose Precambrian rocks upon much younger Jurassic and Cretaceous sediments. Such faults can act as pathways for important fluids such as hydrocarbons, water and hot springs. In the long term, our ultimate goal will be to develop a set of geophysical images from seismic, gravity, magnetic, electrical and EM surveys which overlap the cross section shown in figure 2, and which can be used to confirm, deny and/or refine elements of the geological model. While the 2020 Field Camp had the same plan, it was unfortunately cancelled in May & June due to COVID-19 concerns (most students who intended to participate in the 2020 camp will join the 2021 class next May & June).

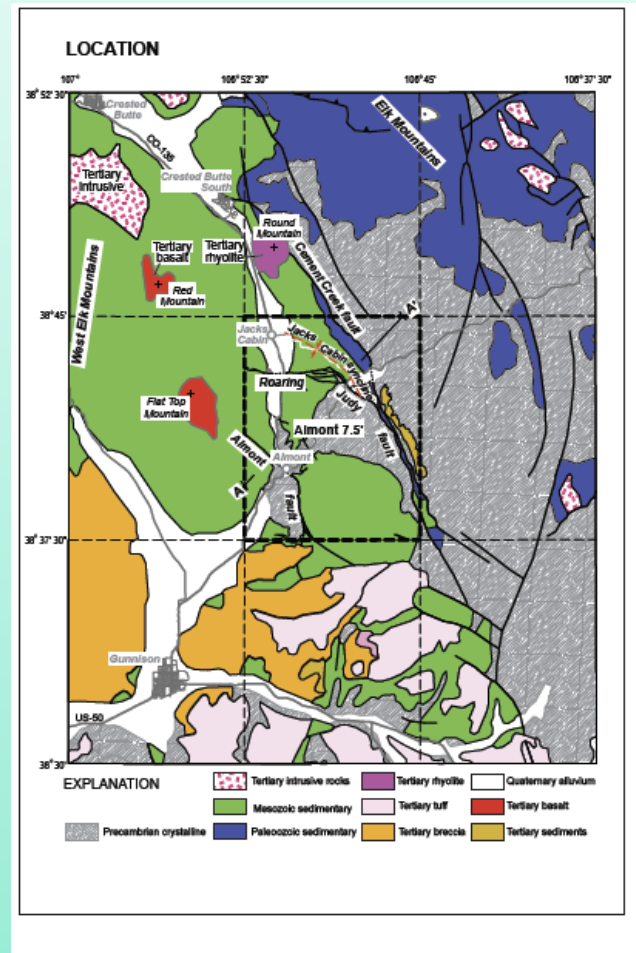


Figure 1. Generalized bedrock geologic map and topographic index map for the area surrounding the Almont 7.5' quadrangle. Modified from Tweto, O., 1979, Geologic map of Colorado: Reston, U.S. Geological Survey, scale 1:500,000.

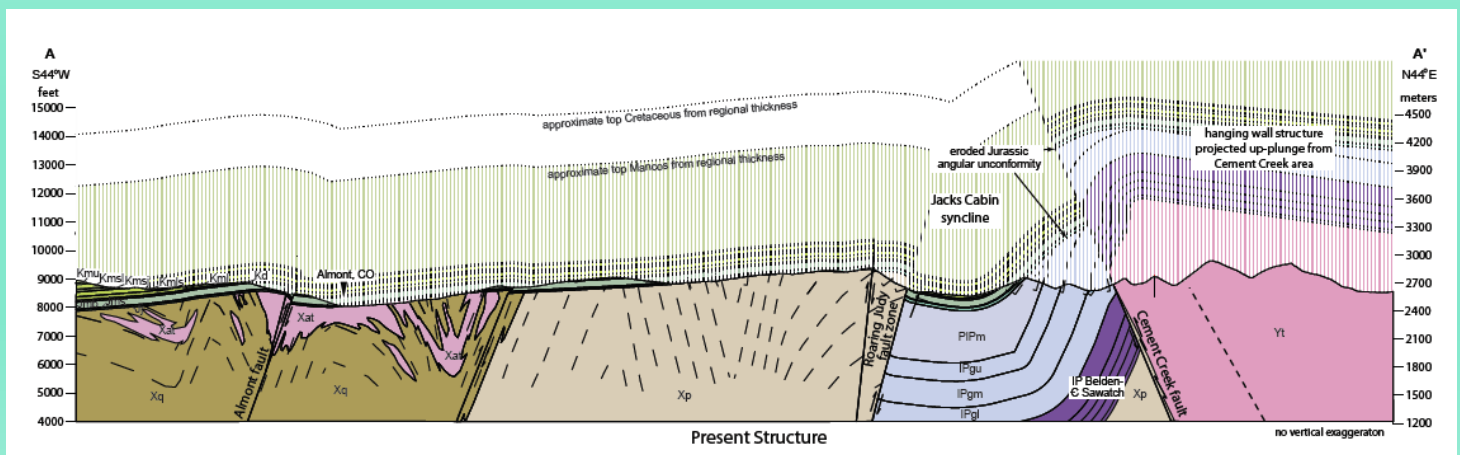


Figure 2. Structural cross section A-A' across the Almont 7.5' quadrangle, courtesy of James Coogan, Allen Stork and Robert Fillmore (Colorado Western University)

Center for Rock and Fluid Multiphysics

[crusher.mines.edu]

We have a new name! Our group is now called the **Center for Rock and Fluid Multiphysics (CRFM)**. We will present our new logo soon on crusher.mines.edu

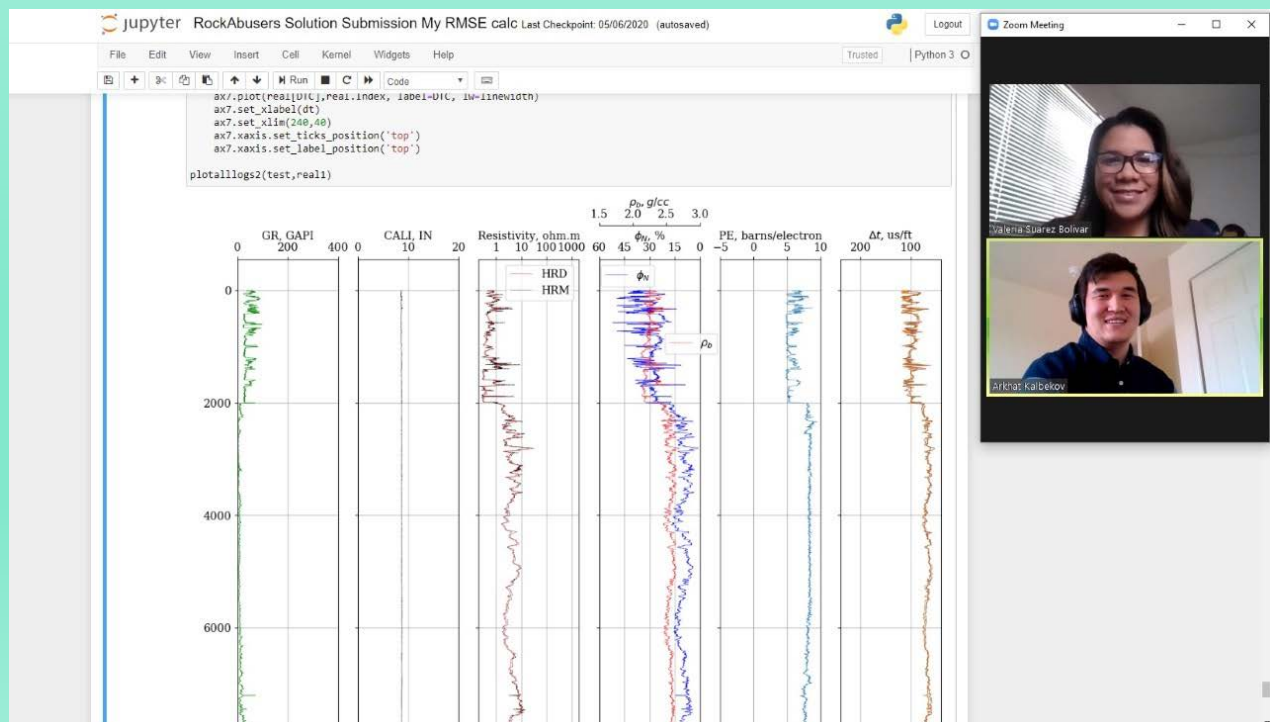
A lot has changed this year. In addition to all the pandemic-related changes, we also have significant changes in our group! We have a new Program Manager – Noelle Vance has joined us. Two students have graduated and will receive their degrees: Bianca Geranutti (MS-PE): Thesis: “Investigation of Gas Hydrate Formation During Sea Water Injection Based on Undersaturated Oil Core Flooding Experiments” and Aun al Gaithi (MS-GP): Thesis: “Deep Learning Methods for Shear Log Predictions in the Volve Field Norwegian North Sea”.

Our group now has three faculty directors (Jyoti Behura, Manika Prasad, Luis Zerpa). We have additionally research faculty (Mathias Pohl), laboratory manager, (Weiping Wang), post doctoral researcher, (Savini Samarasingerhe), PhD students (Gama Firdaus, Kurt Livo), and MS students (Maitham Alabbad, Aun al Gaithi, Arkhat Kalbekov, Similoluwa Oduwole, Valeria Suarez). Our two visiting scholars from Nigeria (Janet Ayorinde) and India (Shruti Malik) were evacuated and have reached home safely. Janet got married on Sept 5th and Shruti will be married in Fall.

In the initial days of the pandemic shutdown with many students struggling to adjust to loss of income, Dessy Sapardina, a geology student, and our own Gama Firdaus organized an Indonesian-Iftar-To-Go program – they cooked and distributed free food.

During lockdown amid the pandemic, Arkhat Kalbekov and Valeria Suarez Bolivar (RockAbusers Team) participated remotely in SPWLA PDDA's 1st Petrophysical Data-Driven Analytics Contest on Sonic Log Synthesis. The competition was open for all SPWLA members, including industry professionals. We are proud to announce the team was awarded third place!

More info about the contest and final results can be found at <https://github.com/pddasig/Machine-Learning-Competition-2020>.



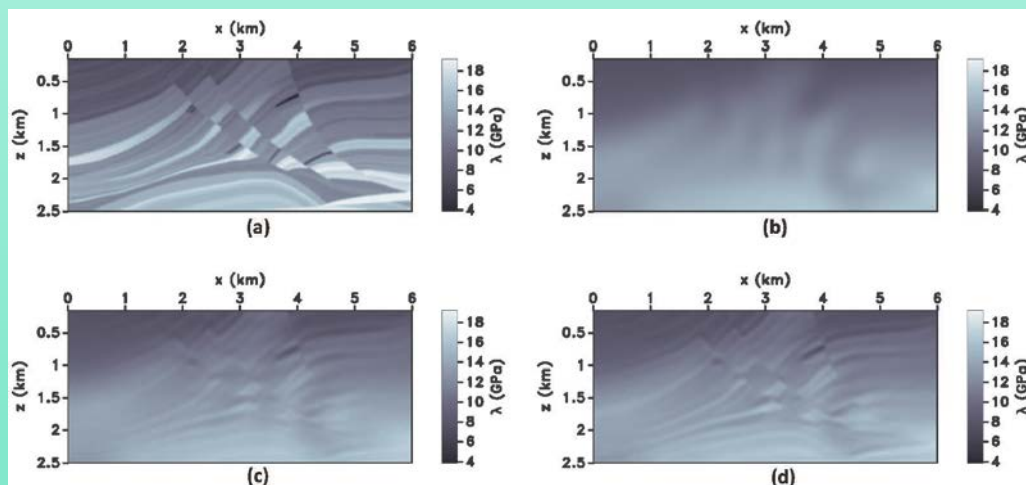
Center for Wave Phenomena

[cwp.mines.edu]

Despite the challenges posed by the COVID pandemic and a sharp downturn in the oil industry, the Center for Wave Phenomena (CWP) successfully continues its world-renowned research and educational program. CWP is actively working on such novel, increasingly important research topics as geophysical applications of machine learning, robotics-based seismic acquisition methods, and distributed acoustic sensing (DAS). The consortium remains a leader in 3D modeling of acoustic/elastic wave propagation, full-waveform inversion (FWI) and wave-equation velocity-analysis for anisotropic media, seismic interferometry, and Marchenko imaging. The high quality of CWP research has been confirmed yet again by recent awards – the papers given by PhD students Odette Aragao and Tugrul Konuk at the 2019 Annual Convention of the Society of Exploration Geophysicists (SEG) have made the list of the top 25 meeting presentations.

CWP is led by Geophysics faculty members Paul Sava, Jeff Shragge, and Ilya Tsvankin (CWP director) and Roel Snieder, who oversees the CSM professional development education program. As interim Department Head, Paul continues to guide the department through numerous challenges caused by the pandemic, and his efforts were recognized last Spring by the T. K. Young Leadership Award. Jeff has begun serving as Editor-in-Chief of the journal *Geophysics*, the flagship SEG publication. For his multifaceted contributions to geophysics education, Ilya received the 2020 SEG Outstanding Educator Award. The School of Mines has recently recognized Roel by the Ange Melagro Award for his outstanding work on the CSM McBride Honors Program.

CWP has welcomed Larry Irons as our part-time IT administrator. Larry brings many years of experience in both computing and geoscience, and has been very helpful at, among other things, expanding our IT infrastructure to include a 200 TB data storage and preprocessing server. Larry works closely with CWP postdoc Aaron Girard, who contributes to maintaining the CWP software environment on our workstations and on CSM HPC CPU/GPU cluster systems.



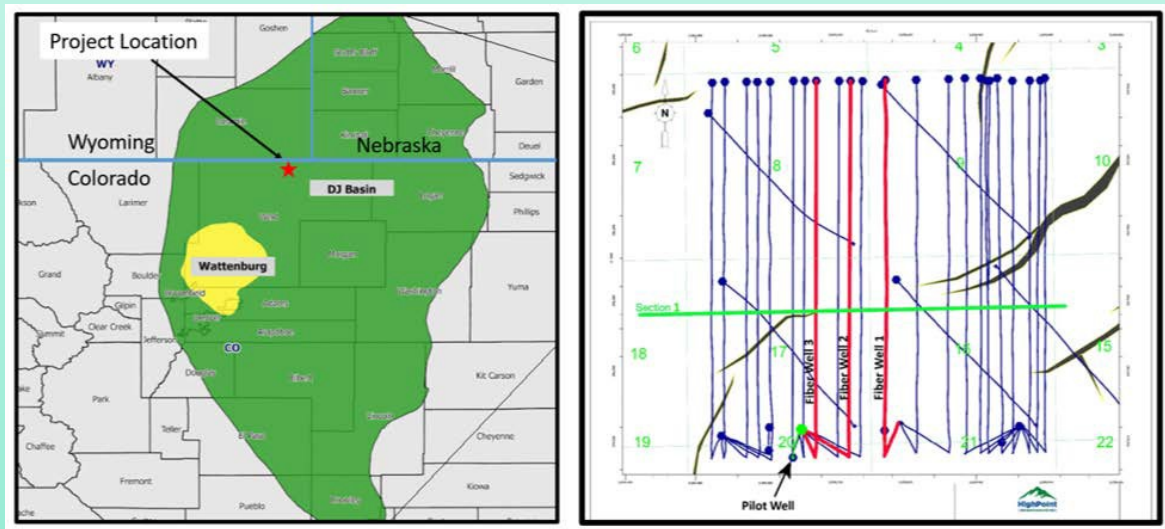
PhD candidate Odette Aragao and her advisor Paul Sava have developed a probabilistic approach to explicitly incorporate petrophysical information into elastic full-waveform inversion. This method addresses many key problems of elastic FWI and can become a state-of-the-art technique for estimating high-resolution, geologically feasible subsurface models of elastic properties that are consistent with the seismic data and the underlying petrophysics. The method uses probability density functions estimated without user-defined parameters, which avoids assuming explicit and potentially inaccurate petrophysical relations among the elastic parameters. The figure shows the Lamé parameter λ for a portion of the Marmousi-2 synthetic model: (a) the actual model of λ , (b) the initial model, (c) the model estimated without incorporating petrophysical information, and (d) the model estimated by incorporating petrophysical information. The developed technique obtained a more accurate estimate of λ , while maintaining robust and realistic petrophysical relationships between the pertinent elastic parameters.

Reservoir Characterization Project

[rcp.mines.edu]

RCP is a pioneering research group dedicated to solving real-world business problems through its diverse portfolio of sponsor-focused field projects. The most recent Chalk Bluff Niobrara Project with Highpoint Resources focused on the integration of a comprehensive data set to address multiple challenging questions in regard to recovery efficiency and cost-effective development of unconventional reservoirs. The uniqueness of this project is the ongoing collection and acquisition of data, presenting RCP with the opportunity to influence subsequent development and production of this reservoir. The variety of data provide the opportunity for a multidisciplinary team of petroleum engineering, geology, and geophysics students to collaborate on the project.

Phase XVIII: Chalk Bluffs



Ongoing field projects also include seismic monitoring and shale reservoir imaging using guided waves associated with hydraulic fracturing in Eagle Ford, time-lapse DAS VSP shot records in reservoir and stimulation characterization in Wolf Camp, 4D simultaneous PP-PS time lapse inversion and time shift analysis for overburden characterization in the North Sea, imaging the deep Jurassic shale and carbonate reservoirs below salt and anhydrite layers in the Middle East, and deepwater offshore conventional post-salt turbiditic sandstone reservoir characterization in Brazil.

RCP is also pushing the frontiers of R&D technologies for reservoir characterization. The Fiber Optics Research Program (FORP) is working to improve the acquisition, processing, and modeling of DAS and DTS data, pursuing laboratory tests of a flow loop on the CSM campus and in the Edgar Research Mine, and developing software to interpret the sheer amount of data produced by DAS acquisition. RCP is investigating new statistical analysis workflows and applications of new machine learning technologies like Deep Learning to solve a wide range of exploration and development problems. We utilize compressive sensing concepts for seismic data acquisition and investigate different sparse reconstruction techniques, and study machine learning-based noise attenuation, acquisition footprint removal, and regularization for improving land data quality. We test these acquisition algorithms on 3D field datasets from sponsoring companies. We also integrate reservoir simulation work with studies on core samples to calibrate EOR processes in unconventional.

Gravity and Magnetism Research Consortium

[CGEM.mines.edu]

Center for Gravity, Electrical, and Magnetic Studies (CGEM) and its anchoring research program Gravity and Magnetism Research Consortium (GMRC) specialize on research in the processing, inversion, and interpretation of gravity, magnetic, and electromagnetic data. We continue to develop new methodologies and tools for geophysical imaging of the subsurface in oil and gas exploration and production, mineral exploration, and carbon storage. We also aim to expand into a broader range of research topics by leveraging our unique expertise and emerging technologies in allied disciplines.

While the first two decades had CGEM focusing on research for the tools and algorithms necessary for geophysical inversion algorithms, we have now advanced to the stage of multiphysics integration. We are currently focused on solving exploration, reservoir monitoring, and carbon storage problems using these tools. With the accumulated tools for inversion-based quantitative data interpretation and associated expertise, CGEM researchers have moved beyond the paradigm of obtaining a geophysical image from each geophysical data set. We now integrate geophysical data sets with a wide range of geoscientific data to image both the geology and subsurface dynamic processes. Among our new major research directions is utilizing the geology differentiation that integrates physical property models created from inversion to distinguish and characterize different geological units. In addition, working in parallel to geology differentiation is reservoir monitoring and characterization through integration of time-lapse gravity, electromagnetic, injection data, and 3D seismic images coupled with flow simulations.

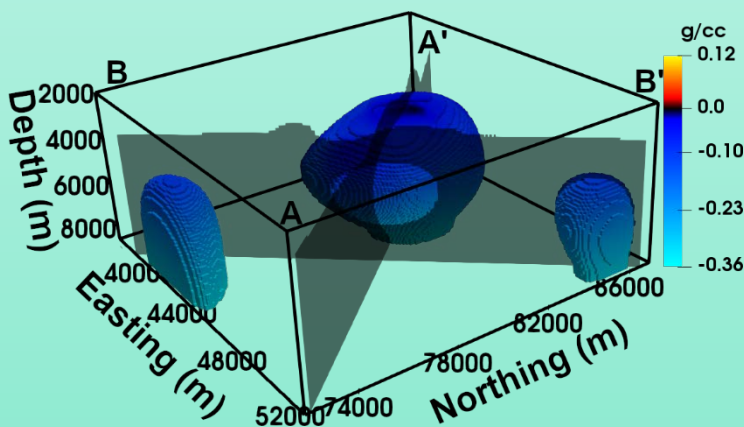


Figure 1. Newly developed discrete-valued inversion is able to “rediscover” the information hidden in a 20-year old set of marine gravity gradiometry data and to image salt bodies to a depth of 6 km, which was previously thought unlikely for this data set. The key to the success is the effective integration of the information in gravity gradient data and the petrophysical data. (Maag-Capriotti, 2020)

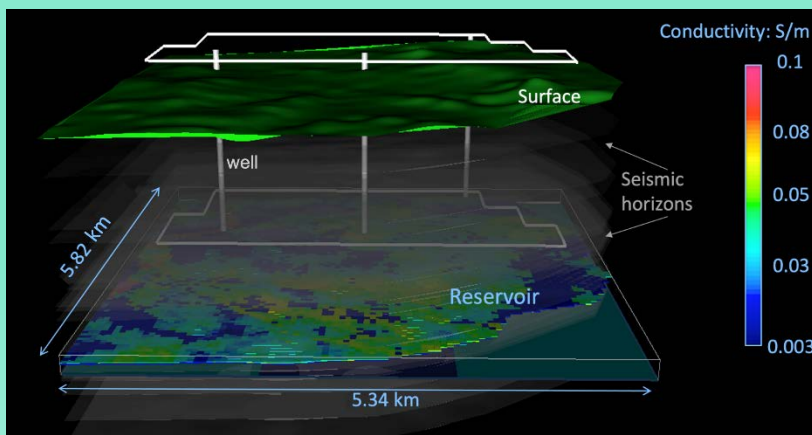


Figure 2. An integrated electrical 3D conductivity model constructed for monitoring CO₂ injection using time-lapse controlled-source electromagnetic measurements. The research is multiphysics in nature and uses structural information from 3D seismic images, well logs, petrophysical data, reservoir simulations, and three types of electromagnetic data. The multidisciplinary team led by CGEM consists of members from Mines, Montana Tech, University of Utah, USGS, and New Mexico Tech.

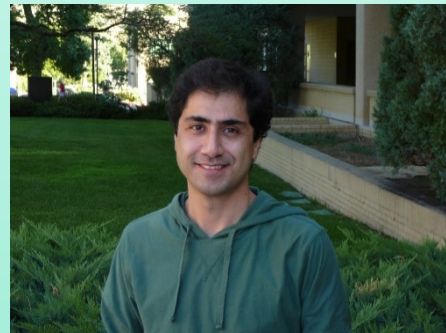
Geophysics Alumni News



Congratulations to Adam Tuppen (MSc '19) on winning first prize in the 2019 Halliburton Landmark Earth Model Award competition. Established in 2012 in affiliation with the Geological Society of London, the award is intended to advance the relationship between industry and academia by recognizing excellence in Master's level research.

Adam received recognition for his Master's thesis, [*Nine-Component Seismic Amplitude Inversion: A Case Study in the Eagle Ford Shale*](#). After defending his thesis, Adam joined BP in Houston as a geophysicist.

Congratulations to CWP Alumnus Farhad Bazargani for winning the Best Oral Presentation at 2019 SEG Annual Meeting. He is co-author of "Angle-dependent and angle-independent least-squares reverse-time migration (LSRTM) - case studies,"



SEG Update and Geophysics Alumni Reunion

We will miss seeing all of our alumni, colleagues, and friends at SEG in Houston this year, but catch us online at the SEG Virtual Event, October 11 – 16, 2020: <https://seg.org/AM/2020/>

Geophysics will be back in full force in 2021 and will look forward to seeing everyone right here at home, September 26 – October 1, 2021, as we busily make plans to host special events to celebrate the return to an in-person SEG, and your return to Colorado! Stay tuned!

The Geophysics Department is looking for a few great alums to help plan a reunion in Fall 2021. In anticipation of coronavirus declining due to a vaccine and the SEG convention being held in Denver, Fall 2021 should be a great time to get together in-person. We envision an event to be held September 24-25 and are seeking committee representatives from across the range of department programs to help bring it together. Contact Noelle Vance, nvance@mines.edu, for more information.

Geophysics New Program

The Geophysics Department is pleased to announce the addition of an **Online Petroleum Geophysics Certificate**. The Petroleum Geophysics Certificate provides an opportunity to get a valuable education that fills the gap between a graduate degree and an industry course. It is taught by industry-renown Mines faculty with vast experience in the technical areas. Fully on-line, deployed world-wide, and with Mines course credits, this certificate can be extremely valuable for the individual and for any company that wants an in-depth education for staff and management at an exceptional value. Don't miss this amazing opportunity!

Geophysics Faculty Accolades



Dr. Jeffrey Shragge has received the 2020 Outstanding Faculty Award for teaching in Geophysical Engineering. These awards are chosen by students and are, therefore, highly prized.



Dr. Matthew Siegfried has been named "Outstanding Reviewer" by the [American Geophysical Union](#) for his work on Geophysical Letters. This recognition is a testament to Dr. Siegfried's commitment to the field.



Ebru Bozdogan has won the NSF CAREER Award to improve seismic images of Earth's deep interior. As of September 1, 2020, Ebru also joined the **Editorial Board** of **Geophysical Journal International**.



Dr. Ilya Tsvankin, CWP Director was chosen as 2020 "Outstanding Educator" by the Society of Exploration Geophysicists. This award honors individuals for excellence in geophysical education and for providing mentoring and inspiration to the next generation of geophysicists.

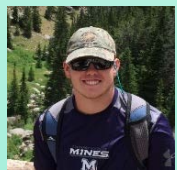
Class of May 2020 Graduation Honors

The pandemic did not stop us from honoring our graduates during a virtual event on May 8. Hosted by Department Head Paul Sava, we recognized all of our graduates for their hard work and perseverance. This year, we are proud to bestow awards to several graduates for particularly meritorious performance.

Graduating senior **John Rekoske** received the 2020 C.H. Green Gold Medal. Named for pioneer geophysicist and philanthropist Cecil H. Green, the award is bestowed to a student who, in the view of the Geophysics faculty, has attained the highest level of scholastic achievement, personality, and integrity. John will continue work with the USGS this year and plans to start graduate school in 2021.



Rekoske



Bonn

Our 2020 Outstanding Graduating Senior is **Paul Bonn**, for exemplary academic achievement during his time at Mines. Paul came to Mines wanting to do geophysics and we are thrilled that he chose us. After graduation, Paul joined a management consulting firm that focuses on operations and business improvement.

We presented to **Brett Bernstein** the George T. Merideth Award for Early Leadership in Geophysical Engineering. In addition to his academic accomplishments, Brett joined a team of students and faculty in 2019 to teach students in Benin how to build and use low-cost geophysical instruments. Brett began his MSc degree this fall with Dr. Yaoguo Li.



Bernstein



Teca

The Department was honored to present the John C. Hollister Award to two distinguished graduates in May: **Amabel Teca** and **Carlos Macedo**. Amabel and Carlos were two of our most actively involved students in their class, never declining requests

for assistance from faculty, staff, or their classmates, despite their academic loads and other obligations.



Macedo



Wiman

John Wiman received the 2020 Phillip R. Romig Award. John was a true leader at field camp, showing exceptional performance in field techniques, as well as true enjoyment in field work. An especially ambitious Mines student, John earned BSc degrees in both Geophysical Engineering and Petroleum Engineering in May.

The George R. Pickett Memorial Award, for demonstrated accomplishment and interest in the field of borehole geophysics, was awarded to **Jake McCaskill**. Jake is dividing his time this fall between an internship with an international civil engineering firm, and pursuing a MSc degree in Data Science, back here at Mines.



McCaskill



Sullivan

Bane Sullivan received the Mendenhall Prize for Outstanding MSc Students. A leader among his colleagues, Bane completed his MSc degree working with Dr. Whitney Trainor-Guitton, after completing his BSc in Geophysical Engineering in 2018. We proudly recognize him for his innovations in open-source framework for 3D geospatial visualization (virtual reality), as well as for his selfless contributions toward promoting geophysics and the Department.

The 2020 Mendenhall Prize for Outstanding PhD Students was awarded to **Dr. Joseph Capriotti**. Joe's leadership and scholarship span more than ten years, first as a Geophysics undergraduate and then later in our graduate program, where he completed his doctoral dissertation working with Dr. Yaoguo Li. Joe has made a substantial impact to research in geophysical inversion and gravity methods, and we look for even greater contributions from Joe in the future. In addition to cutting-edge research, Joe led the TA support for the Geophysics Field Camp for many years, and was a regular participant in Department events and recruiting.



Capriotti

We are proud of all of our graduates and look for great things from them in the years to come.

THANK YOU FOR YOUR CONTINUED SUPPORT!

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