

# MINES MAGAZINE

For Colorado School of Mines Alumni and Friends • Fall 2020

## DEPLOYING DATA AGAINST DISEASE

Running the numbers  
to adapt to the  
COVID-19 pandemic

**Plus:**

Challenging scientists and engineers  
to be forces for change in STEM

Setting off on an ambitious climb  
ahead of Mines' sesquicentennial

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Mines' famous mountainside "M" was temporarily lit with red lights arranged in a heart shape for the last two weeks of the spring semester in a show of support for health care workers, first responders and other essential workers.

▶ Follow Mines on social media for more photos of the Mines campus and Golden community and to keep up with everything happening with your fellow Orediggers.



FEATURE

## DEPLOYING DATA AGAINST DISEASE 18

From projecting health care impacts to informing decisions about closing and reopening nonessential businesses and supporting stimulus-fund decisions, data science has been at the center of the world's response to the COVID-19 pandemic.

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- A mining center for excellence



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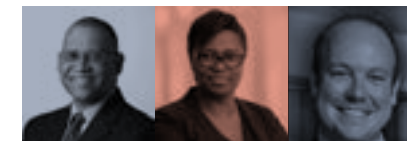


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**ON THE COVER:** Data science has played a crucial role in the battle against COVID-19, helping the world understand and respond to the pandemic's numerous effects on society in 2020. Illustrated by Christina Vessa

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## EDITOR'S LETTER

### Moving forward

When *Mines Magazine's* editorial board and I sat down to plan this issue months ago, there was still a lot of uncertainty as to what Mines would look like this fall and what the future might hold for all of us as we continue to navigate the nuances of the COVID-19 pandemic. We were also uncertain as to what role an alumni magazine had in the conversation.

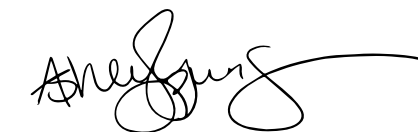
With so much of our daily lives consumed by news about illness, a falling economy, job losses and more, we weren't sure that pandemic-related content was the right fit for this issue. Would our alumni readers want a break from these topics and prefer to sink into the nostalgia of their alma mater for an hour?

But we came to the agreement that if anyone is going to spur innovation and change during this time, it's scientists and engineers—specifically, the Mines alumni reading this magazine and the others who make up the Mines community. So we set out to tell the success stories, sharing how Orediggers are helping move the world forward in spite of this crisis. And we also looked to the other challenges we're facing, such as the fight against

racism and inequality, to inform conversations about how scientists and engineers can be forces for positive change in their professional lives and industries.

And although we're focused on getting through these challenging times and taking care of the Oredigger community in the current moment, Mines also has an eye on the future. With the launch of the Campaign for MINES@150 this fall, we're focusing in on how we can spend the next four years further distinguishing Mines as a world leader in providing the innovation and knowledge the world needs. And Mines alumni will have a vital role in that effort.

I'm continually inspired by the hard work and dedication Mines alumni bring to the world, especially during difficult times such as these. I can't wait to hear more about your work, successes and great ideas. Stay well, and keep thriving.



Ashley Spurgeon



## ONE FOR THE TEAM (AND THE FANS) BY TIM FLYNN

### Mines' softball facility gets a new name—and a face-lift

Mines' softball facility has a new name: the Joe Coors, Jr. Softball Field, after the alumnus and longtime supporter of Mines Athletics.

The stadium underwent significant renovations in the 2018-19 academic year, made possible by an anonymous donation in Coors' honor. The stadium was extensively redeveloped, with the original dugouts, press box and backstop replaced with new versions, and there were a few new additions, including restrooms, storage, a visitor's bullpen and an umpires' dressing room. The renovations also improved sightlines for fans and added seating behind home plate.

Coors served on the Mines Board of Trustees from 1991 to 1999 and was on the metallurgical and materials engineering and athletics visiting



committees. Along with his wife, Gail, Coors was a generous philanthropic leader and dedicated Mines supporter. The athletics department continues to hold the Joe Coors, Jr. Memorial Golf Outing each summer in his honor.

Director of Athletics David Hansburg said, "I am very proud to be able to recognize Joe Coors' lasting impact at Mines by placing his name on our beautiful home for Mines Softball."

**"JOE WAS DEDICATED TO MAKING SURE EVERY MINES STUDENT HAD AN EXCEPTIONAL EXPERIENCE, AND HE WAS A GREAT FAN OF OUR ENTIRE ATHLETICS PROGRAM."**





## FOUR YEARS OF PROGRESS

Prioritizing a distinctive experience, future ahead of Mines' sesquicentennial

A few years ago, you—Mines alumni—provided input leading to the creation of our MINES@150 strategic plan. At the time, you said we needed to come together to move Mines to the next level—on par with the world's top universities but still distinctly different. You also said we needed to act with urgency or risk Mines becoming irrelevant in this rapidly changing and increasingly technology-complex world. As a result, we targeted 2024, the year of Mines' 150th anniversary, as the due date for this assignment.

That date is now just four years in the future. Four years seems long when you are a new Oredigger entering Mines but very short when reflecting back on your time since crossing Mines' graduation stage.

The onset of the COVID-19 pandemic has certainly added an extra degree of difficulty. But we're Orediggers, and we thrive on challenge. We know this is important to the future of the university we all love and have high aspirations for. We've made great progress, and I'm particularly excited to see how everyone is coming together and how our efforts are coalescing on initiatives that will ensure that Mines continues to attract top students and produce distinctive and highly valued graduates while remaining at the forefront of discovery and innovations in engineering, science and education.

We've just launched the Campaign for MINES@150 to support those efforts, and it's on a great trajectory. But

we can't accomplish the MINES@150 vision without philanthropic support. State support funds less than 10 percent of our operations today, and students and their families already carry a heavy burden due to that declining support. Recognizing this, members of our Oredigger family have already stepped up to support the priorities we've set for the next four years. I encourage you to learn more about these priorities and find a way to be part of this important effort at [campaign.mines.edu](https://campaign.mines.edu).

Four years will pass quickly, and we won't procrastinate. In 2024, we will celebrate all we have accomplished together to position Mines for success in its next 150 years. Let's get to work.

I hope all of you are well. Go Orediggers!

**Paul C. Johnson**  
President and Professor

P.S. One other thing—I know many of you want to know how Mines is doing in the COVID-19-era. We periodically hold virtual town halls to provide updates, so be on the lookout for more of those. I'll just say here that I'm incredibly proud of how everyone has stepped up—students, faculty and staff, and also our alumni and donors who have found new finding ways to be involved, support Mines and our student emergency fund.



# READY, SET, THE CAMPAIGN FOR MINES@150 HAS LAUNCHED!

In 2024, the year of our 150th anniversary, we will celebrate Colorado School of Mines as the first-choice university for students, faculty, recruiters and external partners.

## CAMPAIGN PRIORITIES

<b>INVESTMENT IN STUDENTS</b>	<b>THE MINES SIGNATURE STUDENT EXPERIENCE</b>
<b>ENTREPRENEURSHIP, INNOVATION AND BUSINESS PROGRAMS</b>	<b>THE PURSUIT OF EXCELLENCE AND DISTINCTION</b>

Honor the past, impact the present and inspire future possibilities—invest in Mines to engineer our next 150 years. Visit [campaign.mines.edu](https://campaign.mines.edu) often for inspiration and engagement.





**ROOM TO LEARN**

■ Mines opened two new residence halls on campus this fall: 1750 Jackson and Spruce Hall.

A four-story building, 1750 Jackson features 360 beds in apartment-style units with private bathrooms and kitchens, as well as a fitness area, outdoor courtyards, on-site parking and bike storage, lounges and study areas, and ground-floor commercial spaces.

Spruce Hall, located between the Starzer Welcome Center and Weaver Towers, is home to 400 beds in traditional residence hall-style rooms with en suite bathrooms, common social and study areas, an exercise facility and a café.

The two new residence halls add much-needed beds to Mines' on-campus housing inventory and are the first residence halls to open on the Mines campus since 2014.

**BRINGING NEW ENERGY TO BUILDING DISTRICTS**

■ A team of Mines students took second place in their division this spring at the inaugural U.S. Department of Energy Solar District Cup, a competition for student teams to design and model optimized energy systems for multi-building districts. With state-of-the-art modeling software from NREL



and Aurora Solar, a San Francisco-based solar energy startup, the team proposed two solutions for a five-building commercial office development in Arlington, Virginia: rooftop photovoltaic systems for all five buildings, ranging from 160 to 290 kilowatts on each rooftop, and an off-site photovoltaic system at a decommissioned landfill 23 miles west of Arlington, which could offset 100 percent of the district's energy usage when combined with the five rooftop systems.

"It was a good introduction to renewable energy and the general considerations for companies that want to be more sustainable," said Cara Fragomeni, who graduated in May with a bachelor's degree in civil engineering. "The other schools had economists and electrical engineers on their teams. We had civil and environmental engineers and a physics student—it was very exciting to have two mechanical and electrical engineering students on our team for the second semester."

**A MINE TAILINGS CENTER FOR EXCELLENCE**

■ Mines joined forces with Colorado State University and the University of Arizona to develop a center of excellence dedicated to mine tailings research and education. The center will focus on two main goals: the education of engineers to responsibly and sustainably manage mine tailings and the advancement of best practices in tailings management through applied science and engineering research.

"Mining is key to meeting the need for resources with the immense demands of growing renewable energy and the tech industry. With this growth comes the need to manage tailings in an environmentally sound and sustainable way," said John Bradford, vice president for global initiatives at Mines. "This center is a great example of Mines being responsive to the needs of society and industry."

**A NEW TAKE ON FIELD SESSION**

■ Field session is a signature aspect of the Mines experience—but this year, four Denver-area high school teachers joined Mines students for a one-of-a-kind professional development opportunity building an online database and web application



for Be More Adaptive, a Texas-based nonprofit dedicated to connecting people with disabilities to adaptive resources.

"An industry experience was a missing link in my skill set," said Jocelyn Nguyen-Reed, who teaches computer science and cybersecurity in the Cherry Creek School District in Denver. "Outside of teaching, I never had an opportunity to work on a larger project with a larger team and see it through a full development cycle. When working with students on larger-scale projects, I didn't feel I had the ability to give valuable

**SESQUICENTENNIAL CLASS OF 2024 MAKES ITS MARK**

- 1,370** new students this fall
- 30%** women
- 20%** first-generation students
- 3%** international students
- 47** states represented
- 18** countries represented
- 3.9** average GPA

insight." Now, she said she has new experiences she can take into her own classroom.

"Field session is very different from any other professional development they do as teachers," said Christopher Painter-Wakefield, teaching professor of computer science and the teachers' field session advisor. "It's all about filling in the blanks—you've got a set of skills, but how do they all go together and how do they actually produce something? This really filled in the blanks for the teachers, as it does for our students."

**CONNECTIONS**

▶ Have you run into a fellow Oredigger in an unusual place? Gone on a trip with classmates? Visited campus to share your expertise? We want to know all about it! Send us your connections at [minesmagazine.com/connection](https://minesmagazine.com/connection).

▶ M Club Northern Colorado hosted a Zoom call in mid-August to welcome new students to Mines.

Despite playing more than 100 years ago, the 1918 Mines football team dealt with similar restrictions and a shortened season that today's Orediggers are contending with because of a pandemic.



## GAME ON

No football in the fall? The Orediggers have seen it before

BY TIM FLYNN

When the Rocky Mountain Athletic Conference announced that collegiate football would be one of several fall sports moving to Spring 2021, it came with more questions than answers. What's a fall like without football? Will football in the spring be the same? How can we play in the midst of a pandemic? But Mines' football program has faced each of those questions before—it's just been a while.

The last fall season without football was in 1944, when the Orediggers were on hiatus for nearly three full seasons due to World War II. Although the team played a relatively normal seven-game schedule in 1942, by the fall of 1943, it became clear that due to a combination of opponents suspending their programs, students joining the military and wartime travel restrictions, football needed to be put on hold. Games didn't return until the program rebooted in 1946, and football has been played at Mines every fall since.

But football played in the spring? You'd have to look back to the 1800s—1888, to be exact. In Mines' very first football season, the Orediggers began play in November, but, uniquely, their last two games were played after the new year. Mines defeated Denver High School 10-0 on Jan. 12, 1889, and the Denver Cricket Club 22-2 on Feb. 2 in what was touted by local newspapers as the first "Championship of Colorado" game. This spring, 132 years later, will be the first time since then that the Orediggers will play a game in the second semester.

And the last time Mines played football during a pandemic is perhaps one of the wildest, weirdest and most successful Oredigger seasons in history: 1918. With influenza sweeping the globe and World War I raging in Europe, new head coach Irving Barron cobbled together 17 men to play a seven-game schedule. He had to replace his star player and quarterback, F.M. Bell '21, who had broken his leg falling down a mine shaft before the season, and turned to basketball player George Dunn '20, who had never played a snap of football in his life. Coach Barron himself was a replacement after his predecessor, Poss Parsons, was drafted into service. And

much like in 2020, the looming flu pandemic threatened to halt play at a moment's notice. The 1918 season seemed doomed from the start.

The Orediggers managed to play a preseason game in early October, but games later that month were canceled due to flu-related travel restrictions and outbreaks. Mines finally got back on the field on Nov. 9 with a crowd consisting solely of ROTC cadets after the City of Golden ordered the game closed to the public.

On Nov. 15, flu conditions improved, and Mines walloped Colorado College 48-6 with fans in attendance, but by Nov. 23, the flu had returned to Golden, and the team would only be able to play one more game. With the RMAC title on the line, the Orediggers shut out Northern Colorado, 41-0. The Orediggers' last game of the season was canceled, ending the "pandemic season" with an unbeaten record.

Through stoppages and adversity, one theme remained constant: the Orediggers prevailed. From championships in 1889 and 1918 to the return in 1946, football has remained an indelible part of life at Mines, and whenever "normal" returns, it's a sure bet that the Orediggers will continue that legacy.



Members of the Red Cross in Golden, Colorado in 1915, only a few years before the 1918 pandemic. Photo courtesy of Golden History Museum & Park, City of Golden Collection

## LEARNING FROM CENTURY-OLD LESSONS

When it comes to pandemic response, we must look back to 1918 BY SARAH KUTA

"Flu situation here is getting dangerous," blared a headline on the front page of Golden's *Colorado Transcript* newspaper on Dec. 5, 1918.

Though it's more than 100 years old, this historic news story about Spanish influenza could've been written in 2020. "Clearly, there are similarities between the current pandemic and its 1918 predecessor," said Mark Dodge, curator of the Golden History Museum. "Amazingly, the 1918 pandemic was mostly forgotten history until now."

In many ways, our response to the coronavirus pandemic today mirrors what happened a century ago. As the virulent influenza strain made its way to Golden in October 1918, city and county health officials closed all public gathering places, including schools, churches, movie theaters, soda fountains and dance halls.

Though scientists and doctors didn't yet know what caused influenza—or how to stop it—they correctly guessed it was transmitted from person to person. Their advice for preventing the spread of the disease still resonates today: quarantine if you feel sick, avoid crowds, smother your coughs and sneezes, open the windows, wash your hands and don't share napkins or utensils that have been used by another person.

And Mines was not immune from influenza, either. In early December 1918, 50 members of the Student Army

Training Corps and two international students at Mines became sick with the disease, according to news reports. The campus shut down for more than a month in late 1918 and early 1919.

Unfortunately, obituaries of Golden residents who died from the disease or related complications began to fill the newspapers. The American Red Cross opened an emergency civilian hospital in the Colorado National Guard Armory building. As is the case today, the 1918 pandemic inspired feelings of fear, uncertainty and sadness as people worried about losing family members and friends to the disease.

"These obituaries start rattling people," said Dodge. "It was making this thing real to see that these well-known community members died in the prime of their lives. It starts making it scarier."

Influenza cases began to wane in 1919, but the virus reappeared in 1920. Fortunately, Golden residents took the recommendations of public health officials seriously, which helped temper the new outbreak.

"History is endlessly fascinating and a deep source for greater understanding of our shared human experience," said Dodge. "We see how people dealt with challenges, study their responses and hopefully learn from others."

### CONNECTIONS

► To help keep Orediggers safe when returning to Mines, 275 students, alumni, faculty, staff and friends volunteered to make more than 13,000 face masks before the start of the fall semester. •

► Of the volunteers who made cloth masks for Mines over the summer, 12 percent were Mines alumni. •



## INNOVATION NEVER SLEEPS

Mines researchers continue to advance knowledge—even during a pandemic

BY EMILIE RUSCH

While much of the world was shut down this year, Mines researchers pressed on, developing new ideas to improve our understanding of science and the world—and with accolades to show for it. In fact, just this year, six Mines researchers were awarded National Science Foundation CAREER Awards, which support junior faculty who have the potential to serve as academic role models in research and education and advance their organization.

### 3D-scanning the Earth's mantle

Ebru Bozdogan, assistant professor of geophysics, is working to improve the resolution of 3D scans of the Earth's mantle—research that will lead to better insight into the inner dynamics of the planet. “High-resolution present-day snapshots of Earth's interior are essential for understanding the past and present

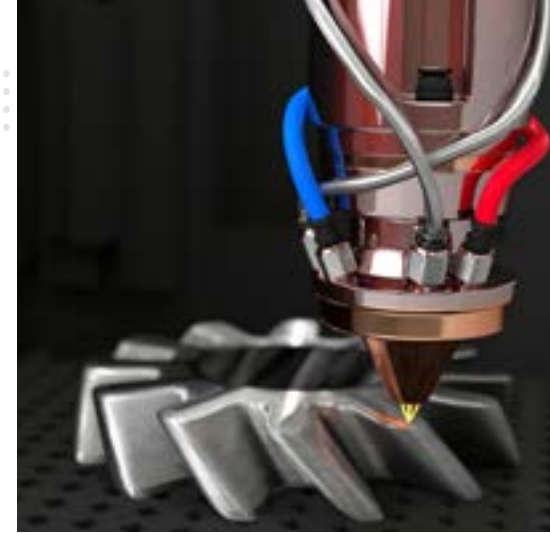
dynamics of the mantle, which directly shape the surface of our planet through tectonic processes such as earthquakes and volcanic activities,” Bozdogan said. “Higher-resolution models are also crucial for better understanding the source of earthquakes, accurately locating them, and are required from an engineering point of view to assess and mitigate seismic hazard and to detect nuclear explosions.”

### Sensing what's between bacteria

Kevin Cash, assistant professor of chemical and biological engineering, is developing an optical nanosensor platform that can measure linked metabolism—with sensors small enough to fit in the tiny spaces between bacteria. While interdependent microbial communities are all around us, much of the laboratory microbiology



is done on one species in isolation. But “determining how nutrients flow between different species is essential to predicting how microbial communities can process heavy metal pollution, impact bioremediation or adapt to new ecological settings,” Cash said. “The ability to spatiotemporally monitor metabolism with nanosensors will enable a wide range of advances in all of these complex metabolically linked systems.”



### It's all in the 3D-printed details

Owen Hildreth, assistant professor of mechanical engineering, is working on speeding up the commercialization of a low-cost chemical method for the post-processing of 3D-printed metal parts—a project that could cut out the labor-intensive, detailed work that must occur after an additively manufactured part is printed. “Surface finishes are a really big consideration for 3D-printed parts right now,” Hildreth said. “Currently, the go-to strategy is machining the surfaces. As a result, the 3D-printed parts are near net shape, printed in close to the shape, and then you machine the rest of it. That means the part has to be machinable and that's a limitation on what those shapes can be.”



### The potential of two-dimensional particles

Joseph Samaniuk, assistant professor of chemical and biological engineering, is working on

improving the understanding of interactions between ultra-thin, 2D particles. Atomically thin particles—typically only one to three atoms thick—have unique properties that can significantly enhance electrical conductivity, mechanical strength and optical transparency compared with their bulk material counterparts. Samaniuk said understanding this system is a “potential route to making large quantities of low-cost films for photovoltaics, or more generally what are called optoelectronic devices—devices that take optics and integrate them with electronics.”



### Discovering new materials

Vladan Stevanovic, assistant professor of metallurgical and materials engineering, is working on a project that could accelerate the discovery of new metastable materials, or materials that eventually transform into another, like how diamond is a metastable form of carbon, for example. Metastable materials remain a bit of a mystery to scientists, but Stevanovic said in his work with semiconductors, “you could find the coexistence of electric conductivity and optical transparency, which isn't common. That coexistence could enable having a fully transparent and conductive material—imagine something that looked like glass but with the functionality of a TV screen, like in that Tom Cruise movie

*Minority Report.* You could enable better materials for renewable energy applications. You could make things more efficient.”



### A world of pure imagination

Hao Zhang, assistant professor of computer science, is developing reflection and imagination capabilities in robots to help create lifelong collaborative robots that adapt at near-human levels in an unstructured and ever-evolving world. “Inspired by theories of cognitive reflection for human adaptation, the robot reflection paradigm will allow a robot to reason about itself and adjust its own adaptation process without requiring human supervision,” Zhang said. “This research also provides a vital solution to improve safety, productivity and cost efficiency of using robots to address environmental, social and economic issues.”

▶ Between the time Mines shifted to remote learning in mid-March and the start of the fall semester in August, more than 90 research projects at Mines were awarded funding. Visit [research.mines.edu](https://research.mines.edu) to learn more.

## CONNECTIONS

▶ Alumni teed off for the 36th Annual Golden Endowed Scholarship Golf Tournament in late August 2020 to support scholarship opportunities for Mines students. •

▶ Like most events this year, the monthly Golden Lunch Bunch went virtual this spring—but with a silver lining. Attendance increased from around 10 people to more than 30 as more people were able to tune in from home. •



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## MOVING THE NEEDLE BY ASHLEY SPURGEON

### Scientists and engineers can be forces for change in STEM

Moving the needle toward equitable inclusivity and diversity in science, technology, engineering and math is no small feat, but it has been brought to the forefront for many industries as they work toward combating racism and inequality within their companies and workspaces. We sat down with three of Mines' industry partners to get their thoughts on diversity and inclusion in STEM and how engineers and scientists can be forces for positive change within their industries. Here's what we learned.

**Leveraging differences has a multitude of benefits.**

Taking innovation and ideas to the next level requires bringing a wide range of perspectives and experiences to the table.

"Having a diverse talent pipeline and an inclusive workplace actually enables us to make richer decisions," said Beatrice Opoku-Asare, global director of inclusion and diversity at Newmont Mining. "And you can manage risks better and manage a wider scope of unintended consequences before you actually implement the work you're doing."

Bringing people onto a team or filling industry with a variety of worldviews, experiences and backgrounds immediately lowers the chance of implementing a decision that may seem low-risk to one person but could actually have high-risk consequences, and business leaders are able to focus on ensuring a decision is well received and successful right from the start.

In fact, Calvin Moniz, senior advisor for university relations at Phillips 66, said his company actively looks for interns and employees who have the ability to seek different

perspectives to "open the idea box that can help leverage ideas that aren't normally presented."

And he said there's truly a business case around it. "We're able to really capture innovation through diverse and inclusive backgrounds," he explained.

**Increasing diversity is important but meaningless if inclusion isn't considered as well.**

With many in industry taking a hard look at their current business and hiring practices for disparities in who is being hired or promoted into leadership positions, organizations must look beyond merely improving representation.

"When you see somebody who is like you doing work in your industry, you get that feeling that you can do this, too, so representation definitely matters and is important," Opoku-Asare said. "But representation without creating the culture to support that, you don't get the full benefit of representation, and it becomes more difficult for the person who looks different to be successful and thrive in the environment."

Cultural changes within a workplace or industry as a whole are at the heart of making strides in the efforts to create meaningful change. And Moniz said a comfortable workplace culture where people can be themselves is key for company success—something he's seen firsthand. "By being inclusive, we're creating an environment of trust that allows us to seek different perspectives, which helps us work for the greater good and achieve excellence at Phillips 66," he said.

**Real change comes from self-awareness.**

Creating change within an industry—or within a society—can seem like a daunting task, but change actually begins on a much smaller scale. Self-reflection and recognizing personal biases, blind spots and knowledge gaps around issues related to diversity and inclusion are key for taking the next steps toward meaningful action.

"Knowing the problem is half of the problem solved," Opoku-Asare said. "Really do some reflection. Talk to people if you don't understand something, and then take an active role and take more meaningful action."

Bill Kindred, diversity and inclusion officer at the National Renewable Energy Laboratory, said listening to others' experiences before making change is essential. "That's the active listening piece and trying to really understand, listen, pay attention and then adapt your approach to that," he explained.

**"I THINK IF ANY INDUSTRY CAN SOLVE SOME OF THE CHALLENGES AROUND INCLUSION AND DIVERSITY, IT'S THE MINING INDUSTRY OR STEM FIELDS, BECAUSE WE HAVE GREAT PROBLEM SOLVERS."**

But Kindred pointed out that people from underrepresented communities must also be understanding of others who are working to learn. "Part of this is accepting allyship from other people and supporting them," he said.

This work at the individual level can eventually trigger more widespread changes

within a company or industry. "Engaging and starting the conversation and being willing to be vulnerable and express the gaps that you have so you can address them are some great ways to be a change agent for good within a company," Moniz said.

**Engineers and scientists are the best people to tackle this challenge.**

Although diversity issues and change may be top of mind at the moment, lasting positive change won't happen overnight. Tackling these issues will have to remain a conscious priority and something that will have to be a continuous effort—for individuals, industry and society at large. But those working in STEM industries can lead the effort.

"I think if any industry can solve some of the challenges around inclusion and diversity, it's the mining industry or STEM fields, because we have great problem solvers," Opoku-Asare said. "If all the scientists and all the engineers in the world apply their engineering skills and science to this work, we will find a solution pretty quickly. It may not be perfect—it may need a tweak here or there—but we will come up with a solution."

**CONNECTIONS**

▶ The Mines Aerospace Interest Group and the American Institute of Aeronautics and Astronautics held its annual Trajectories networking event online in September 2020. •

▶ Mines' annual Homecoming weekend was held virtually this year on October 7-10 to celebrate the Oredigger spirit, with events such as a virtual 5K, thought-provoking discussions, virtual lab tours and more. •





# RESPONSIBLE MINING, RESILIENT COMMUNITIES

## Supporting sustainability in small-scale mining communities in Peru

BY EMILIE RUSCH

Here's a surprising fact for many consumers: Roughly 30 percent of all gold produced each year for electronics, jewelry, currency and more still comes from small-scale and artisanal mining operations around the world.

From subsistence miners with a shovel and gold pan to small mining outfits equipped with basic machinery, these small-scale operations come at a high cost, however. Large-scale deforestation, air and water contamination and chronic human diseases are all tied to the mercury used to process gold ore.

But the solution isn't as simple as bringing the latest mercury-free processing technology to these small mining communities, said Nicole Smith, a cultural anthropologist and assistant professor of mining engineering.

"We worked with a group of women working at a newly formalized mine in Peru, meaning they have now permission from the Peruvian government to operate, something that most artisanal and small-scale operations lack," Smith said. "It was the women in this mining operation who were delegated to some of the most dangerous positions—working directly with the mercury. But in the transition to more sustainable practices, if you eliminate the mercury, their jobs are eliminated, too."

At Mines, Smith is part of an interdisciplinary group of researchers that has become a go-to partner for both miners and government officials in Peru, helping them navigate the complexities of transitioning to more responsible mining practices.

In many ways, Mines is perfectly suited to the task. "We're the bridge between both sides," said PhD student Gerardo Martinez. "The miners know we



Photo by Gerardo Martinez

communicate with the government and NGOs but that we're there to help them, not to criminalize or marginalize them. Government likes us, because they know we're in the field, as opposed to other people who are writing proposals and making assumptions."

Smith and Martinez have organized a number of workshops for small-scale miners in Puno, a remote district that is home to the greatest number of formalized mining operations, as well as La Rinconada, a zone infamous for its illicit mining.

Because of the relationships they've forged with these miners, Peruvian government officials are now coming to Martinez and Smith for input on policy related to artisanal and small-scale mining.

"A lot of the time, these miners are criminalized—they're seen as contaminators, they don't care, they don't know," Martinez said. "But in reality, they're the experts. They've been there 20, 30, 40 years. It's ancestral, and they know better than anyone else what will work."

And in the case of the women miners, working together meant building economic capacity by making jewelry findings for a woman-owned company in Lima. With Mines' help, the women received training, funding and help setting up a workshop and registering their business.

"Now, these women are making their own jewelry," Martinez said. "It's the idea of value-added instead of just selling their gold and exporting to international markets."



## We're inspired by those who donate their time, talent and treasure to Mines and through Mines.

Tell us about the OreGivers you know so we can celebrate the impact they have on campus and in their communities. Open the camera on your phone and scan the QR code to learn more about the OreGivers below.

For 57 years, **Marv Kay '63** has helped the Mines community and athletic programs strive for excellence through coaching and mentoring and has taught fellow Orediggers the value of supporting your alma mater.

**Melanie Westergaard '87** has been participating in various alumni and campus volunteer initiatives for over a decade and believes in giving back through her time.

**Justin Dvorak '16** was one of Mines' most successful quarterbacks and continues to have an impact by creating a scholarship with fellow alumni and football players to support student athletes.



OreGivers



# YOU ASKED, OUR EXPERTS ANSWERED



**David Van Dyke '10 asked:**

How does the pandemic affect the world's conversion to renewable energy? Does it likely help increase the speed at which we change, or does it slow down the process and keep us with a higher mix of fossil fuel usage?

**Morgan Bazilian, director of the Payne Institute for Public Policy, answered:**

Public health measures implemented during the coronavirus pandemic have had significant global impacts to energy systems. Some changes may be ephemeral—as urban air pollution rebounds to normal activity, supply chains relink once production resumes and industries go back to work. Some may be more durable, such as reductions in commuter and business travel and increases in teleworking.

These disruptions to the energy sector are occurring in a period of rapid structural change. Driven by the decarbonization imperative, energy security concerns, the energy access challenge, other environmental impacts and strategic competition for new technologies, global energy systems are rapidly diversifying, downscaling and focusing on resilience and issues of inequality. The pandemic poses a critical juncture point for the clean-energy transition as government responses in terms of disaster recovery and stimulus will affect the trajectories of systematic change. Meeting these goals will also require consideration of "just" transition criteria to ensure local jobs and communities are able to recover from COVID-19's economic effects as the energy transition continues.

Future research should focus less on the temporary disruptions in pollution, energy use and supply chains and more on the durable disruptions in social norms, production system interdependencies and public policy that can be mobilized to inform a better post-pandemic future.

**Have a question about science, engineering or anything else?**

▶ Submit it at [minesmagazine.com/contact-us](https://minesmagazine.com/contact-us) for a chance to be featured in this column.

### CONNECTIONS

▶ Charles McNeil '71 and his wife, Judy, made a \$5 million gift to Mines to support entrepreneurship and innovation programming, and the new McNeil Hall was named in their honor. •



# DEPLOYING DATA AGAINST DISEASE

Scientists dig into the numbers  
to adapt to COVID-19 pandemic By Jenn Fields

**Like so many college students in 2020, Orediggers lived and studied through an unprecedented spring semester.**

With COVID-19 spreading rampantly through the country, Mines closed campus the week before spring break, then decided to keep it closed for the remainder of the spring semester. Laura Albrecht, a PhD student in applied mathematics and statistics, was using data science to study blood coagulation throughout her semester in lockdown, but as data science emerged as essential behind-the-scenes work during the pandemic, she found herself wishing she could contribute directly to the emerging body of knowledge in her field.

```
lockdown_correlation <-  
no2_name <- paste(co  
ld_name <- paste(co  
  
# Subset the data  
no2 <- no2_data[  
no2 <- no2[,no2[  
names(no2) <- c  
no2_avgs <- coun  
no2_new <- merg  
no2_new <- no2  
no2_new["Pastav  
expand", 0))  
no2_new["2020  
expand", 0))  
# Percent ch  
no2_new["C  
no2_new[, "20  
plot(no2  
abline(  
  
no2 <  
ld <  
  
plot  
rt
```



```
# Percent change is (2020 - pastavg)/pastavg:  
no2_new["Change"] <-  
(no2_new["2020"]-no2_new["Pastavg"])/no2_new["Pastavg"]  
plot(no2_new["Date_official"], no2_new["Change"])  
abline(h=0, col=2)  
  
no2 <- no2_new[,c("Change", "Date_official")]  
ld <- ld_data[,c("country", "Date_official")]
```

**“That said, there’s a lot behind these numbers. For example, there might be delays in reporting. If these are test results that have been reported a week ago, that is not a snapshot of what is happening right now and may not give you a handle to get ahead of the infection. You are always playing catch-up. And there can be other less obvious problems and biases by taking the raw data at face value.”**

**–Doug Nychka**

An opportunity appeared for the statistician at the start of summer: The American Institute of Mathematics announced a workshop on modeling data-driven solutions to the coronavirus pandemic. Albrecht quickly applied and was soon on a team of students and faculty from universities around the country, working in four time zones, brainstorming problems they could solve using mathematical and statistical models.

“It’s been hard, as someone who works in a semi-related field, to see all these papers and data coming out and not feel like I had the skills or time to do anything with it,” Albrecht said. “So it’s been nice to immerse myself in that.”

Data science is at the heart of countless decisions officials are making during the pandemic to help keep people safe. Predictions based on hospitalization and testing rates have informed decisions on the scale of lockdowns, mask-up orders and school reopenings. Employment, business and tax data have fueled battles in the halls of Congress over stimulus funding.

And data’s also in play on a smaller scale: Mines has partnered with COVIDCheck Colorado to launch voluntary “surveillance” testing on campus for those who don’t have symptoms (and who want to contribute to science) to minimize spread. “We will be using the testing data in mathematical and statistical models to simulate the disease spread on campus to determine which groups are most at risk and should be included in the testing pool and determine how frequently people should be tested,” said Albrecht, who was tapped to work on the program this fall.

Data science is also being used to tackle novel research questions, such as whether there are racial disparities in COVID-19 infection rates and outcomes (there are), but it’s also humming along in the background elsewhere. Companies that had already invested in data analysis and AI have made quick pivots to the rapid changes the pandemic brought, even in hard-hit sectors of the economy.

“When COVID hit, everyone started producing less oil,” said Nick Sellers ’18, a database developer at Engage, an oil-and-gas production services platform. “Our system just started calculating everything automatically.” Their system uses predictive calculations to determine

```
ld <- ld_data[,c("country", "Date_official")]  
  
df <- merge(no2, ld)  
out <- cor(df[,c("Change", "country")], use="complete.obs")
```

whether there's enough oil at a particular site to pick up or whether a worker needs to go to a site to service equipment. The quick data analysis prevented surpluses from getting stuck in one place when demand suddenly shifted—a scenario that temporarily sunk oil into negative pricing. “We were able to get right ahead of that,” he said.

While data science is being wielded by experts to draw useful predictions and reveal real-time outcomes, large-scale data has been accessible to everyone, every day throughout the pandemic. Open-source projects, such as the COVID Tracking Project, have democratized COVID-19 data, providing an easy resource for data scientists to draw from to inform states on how to scale reopening (even the White House uses its data).

“It’s a great way just to keep track of the pulse of the pandemic,” said Doug Nychka, professor of applied math and statistics and co-director of Mines’ new graduate program in data science. “And the transparency is impressive—I can go to the *New York Times* and get the counts county by county across the U.S., and that’s fantastic.”

“That said, there’s a lot behind these numbers,” he continued. “For example, there might be delays in reporting. If these are test results that have been reported a week ago, that is not a snapshot of what is happening right now and may not give you a handle to get ahead of the infection. You are always playing catch-up. And there can be other less obvious problems and biases by taking the raw data at face value.”

That line of thinking is just the start of what happens when data scientists dig into the numbers—and the

**“I think that’s one of the things that makes working in COVID right now so difficult. There are not a lot of consistencies across data sources, even city to city or country to country. You kind of have to be making large error bounds on your predictions. I don’t really know what the answer is to get better data integrity at the moment, but it’s definitely one of the biggest issues in trying to work with this right now.”**

—Laura Albrecht

pandemic is producing a deluge of information. However, for a data scientist, the question is not whether the data set is big or small but whether it can be used to answer important questions.

“Our faculty at Mines deal with data issues like this all the time,” Nychka said. “For example, for a grad student collecting data off an instrument, there is always the issue of what does it mean? Beyond the data collection, there is always a next step of interpretation and modeling to make sense of the results. You use the raw data, of course, but you also apply a modeling framework to interpret it. And that’s a hook for why we need data science. Rarely is data by itself informative—it requires some analysis and assumptions to be useful.”

## WORKING THE COVID-19 DATA

Data scientists can develop models and algorithms to attempt to answer questions in virtually any field, which means they often end up working in tandem with experts in other scientific disciplines. “There’s a very strong thread in our profession that we come into interesting research problems by working with people outside of the field,” said Nychka, who has worked on projects as varied as measles outbreaks, climate and transportation.

At AIM’s COVID-19 data workshop, participants worked alongside disease-modeling experts. “We spent a few weeks looking at just what mathematical and statistical models we could use for COVID,” Albrecht said. They split into groups, and her group dove into two projects.

They first looked at the relationship between air quality and COVID-19 transmission. “You have to control for how much lockdown is going on versus how bad is the air quality,” she said. “In the U.S., that’s a difficult thing to do right now, because it varies from region to region.” To account for this, her team decided to use data from one region of Italy. “Italy had a uniform response across the country—essentially, they locked down their country at the same time.”

The team found a paper that previously had developed a similar model to look at the relationship between the flu and air quality and pulled in data on fine particulates and other factors that affect air quality. “We built a statistical model controlling for all these other

things—temperature, humidity,” she said. “We used Google mobility data to find out how much people have been at home.”

Their results aren’t finalized, Albrecht said, but “it does seem like if the air quality gets bad enough, there is an increased risk. If you’re in the normal range of air quality, it’s not a risk.”

Theoretically, hospitals could use this sort of analysis to plan for a spike in new COVID-19 patients after an extended period of poor air quality.

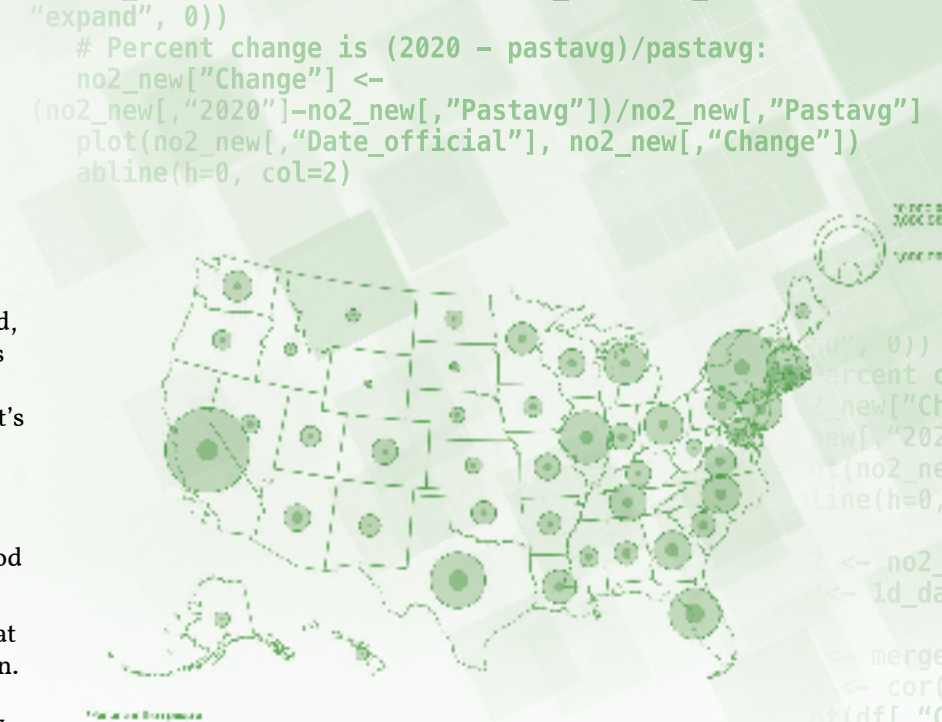
For their second project, her team looked at the decrease in emissions during lockdown. “We looked at satellite data and a few countries—the biggest carbon emitters. We haven’t come to a conclusion yet, but we’re trying to see if we can quantify [emissions reductions] based on particular lockdown measures.”

This question has practical applications as well—policymakers could use the analysis to determine whether there’s a long-term sustainable solution amid the closing of workplaces and schools, such as having a certain percentage of the workforce stay home if it reduces emissions in a meaningful way.

## DATA CHALLENGES DURING THE PANDEMIC

When making predictions amid a deadly pandemic, the cost of an error in the numbers could be high. “I think that’s one of the things that makes working in COVID right now so difficult,” Albrecht said. “There are not a lot of consistencies across data sources, even city to city or country to country. You kind of have to be making large error bounds on your predictions. I don’t really know what the answer is to get better data integrity at the moment, but it’s definitely one of the biggest issues in trying to work with this right now.”

Quality control starts with the data and runs through the modeling. Good analysis is reproducible, Nychka said. “One thing that a data analysis should have is a trail of breadcrumbs from the original source of the data all the way to the figures or tables in the conclusions. This will allow someone else to reproduce all of their work. Reproducibility builds trust and objectivity in the conclusions, because then there’s nothing mysterious about what the person did, and they can see all the choices they made along the way.”



This map shows the spread of COVID-19 in the United States as of September 28, 2020.

Image courtesy of the COVID Tracking Project

Mines’ new graduate program in data science, which launched this fall, will give students the skills to tackle complex data problems in many different areas of application. Though the program is a “big tent” that includes faculty across many different disciplines—which is a unique feature of the Mines program compared to other data science programs—Nychka said the goal was to zero in on data science as its own area of study and help students develop expertise in the specialized skills this field requires.

Mines added data science as a focus for undergraduates in computer science several years ago as well, and it’s already serving those who graduated from the program well. “I switched in 2017 as soon as they opened the new data science branch, so I graduated with that,” said Mady Deeter ’19. She found her job as a machine learning engineer at defense contractor CACI relatively quickly, she said. “It’s very versatile. Even other people I graduated with in computer science, we all work in very different places.”

As recent Mines graduates who are now working in data science, neither Deeter nor Sellers have been surprised to see data science emerge as essential in the pandemic and well beyond.

“There is no avoiding that data science will break into pretty much every field in the next few years, decades,” Sellers said. “Data science is going to drive a lot of our day-to-day lives, whether we realize it or recognize it or not.”

## EXPERIENCING OTHER CULTURES

For Norma Mozeé '83, foreign service felt like a calling

BY ASHLEY SPURGEON

Working in another country as a foreign service officer may seem like a daunting job, but for Norma Mozeé '83, it's her bread and butter.

Within the past three years, Mozeé has served at the U.S. embassies in Caracas, Venezuela, and Copenhagen, Denmark, representing the United States' interests and implementing foreign policy. In Caracas, she served as a political officer, talking to various leaders and putting together policy recommendations for stakeholders in Washington, D.C., to fine-tune policy efforts. But her current position in Copenhagen is much different: She works with American expats living in Denmark and helps Danes and other nationals looking to obtain visas to enter the U.S.

This foreign service work felt like a natural next step in her career after spending many years in the software and energy industries. "Foreign service was a perfect next act that takes all the skills and knowledge that I had but then opened up the opportunity to live and work worldwide, because we have embassies and consulates all over the world," Mozeé said.

The skills she built up proved to be an advantage when entering public service—particularly her experience with international businesses and markets. Much of her work within the software



industry focused on helping software companies enter the Latin American market. And when she created an energy consultancy business, she focused on helping U.S.-based companies get into the Mexican energy market at a critical time in 2014 when the country opened their energy market to foreign and private investment after being a monopoly for 76 years.

"The work I did, especially when I was focused on Latin America, really put me in touch with multiple cultures and how to successfully communicate, collaborate and manage, and that is a critical skill set," she said.

Mozeé said that skill set was really tested as she transitioned from the two years she spent in Caracas to her current role in Copenhagen and noticed the cultural differences between the hierarchical structure she was familiar with in Venezuela and the more egalitarian society favored by the Danes. "I had to take a totally different approach in my managerial skills," she said.

Mozeé's technical skills also played a major role in working with international leaders and gave her an unparalleled credibility. "All the technical skills came into play throughout my career when I was focused on energy in Latin America and Mexico, and it helped me in Venezuela," she said. "Because of that background, my colleagues asked if I would help develop the oil recovery plan for Venezuela, and I found that my Mines degree and knowledge and experience made me a real credible interlocutor with the Venezuelan stakeholders. I could talk about the focus on reviving mature oil fields and what it meant from a technical standpoint."

But while her technical background allowed her to effectively communicate and implement industry-specific ideas, Mozeé said the personal experiences she had at Mines also informed her public service work, just in more indirect ways. "Back when I graduated,

**"THE WORK I DID, ESPECIALLY WHEN I WAS FOCUSED ON LATIN AMERICA, REALLY PUT ME IN TOUCH WITH MULTIPLE CULTURES AND HOW TO SUCCESSFULLY COMMUNICATE, COLLABORATE AND MANAGE, AND THAT IS A CRITICAL SKILL SET."**

there were only 13 women in my graduating class, but I think it gave me a lot of skill sets I use today in addition to technical skills," she said. "I learned how to work in a very nontraditional environment, especially for women and for women

of color, and it really tested me to be able to be successful and not only survive but really thrive in industries like oil and gas. That made me comfortable in nontraditional industries and in industries where they're much more male-dominated."

No matter where she is in the world, Mozeé knows this is exactly the right kind of work for her and what she finds most fulfilling. As she said, it's "like I'm really living out a higher purpose in my life."

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**Bruce Kugler**  
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B.S., Petroleum Engineering, 1981

**Doug Swartz**  
Patent Attorney,  
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B.S., Mining Engineering, Minor in Metallurgical Engineering, 1982

**Brad Knepper**  
Patent Attorney,  
Shareholder

B.S., Electrical Engineering, 1998

**Kristen Gruber**  
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Associate

B.S., Chemical and Petroleum Refining Engineering, 2000

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### CONNECTIONS

► More than 150 Mines alumni attended this fall's virtual Career Day in September to talk with students about available job and internship opportunities. •

# FOUR YEARS AND COUNTING

## The Campaign for MINES@150 kicks off ambitious climb to sesquicentennial

Mines officially launched the Campaign for MINES@150 this fall and invited alumni and friends to join the effort to solidify the university's standing as a world leader in producing distinctive and highly valued graduates and the innovations and knowledge the world needs. The campaign aims to raise the resources and partners required to accomplish this and more before Mines' 150th anniversary in 2024.

"We're going to leverage our size, location and history—and then double down on hands-on learning, focus on professional preparation and make sure our graduates have the business acumen and other skills that are needed to be technical innovators and entrepreneurs and leaders in industry, government and companies that they launch on their own," said President Paul C. Johnson at the virtual launch event.

The campaign's launch comes at a challenging time in higher education, industry and the world. But as Brian Winkelbauer, president and CEO of the Mines Foundation, said, "Now is the time to show that we are Mines, and we come together in pride to create progress for this beloved university."

And the campaign already has the wind at its back. Prior to the public launch, \$226 million was raised in lead gifts and privately funded research grants for the MINES@150 strategic plan. But there's still more to do—and a part for every Oredigger to play.

Support for students and the impact our graduates will have on industry is at the heart of MINES@150. Industry partners count on Mines graduates for their grit, rigor and teamwork, but want them to be further distinguished with strong business, entrepreneurial and innovation skills. And hardworking, highly qualified students need Mines' support to not only deliver that hands-on education and interdisciplinary research experience but to make attending Mines attainable. With state funding paying for less than 10 percent of Mines' operations, students and families shoulder much higher costs than previous generations of Orediggers.

Support from Orediggers, partners and families is what will deliver outsized excellence for Mines. Their generosity will mean the difference between "status quo and silver-plated," as Johnson put it, referencing Mines' unique silver-plated diplomas. By coming together, Orediggers can shape Mines' future and deliver on the ambitious challenges set ahead of the university's sesquicentennial.

► Learn more about the Campaign for MINES@150 and how you can support Mines' future at [campaign.mines.edu](https://campaign.mines.edu).



Charlie McNeil '71 and his wife, Judy, supported Mines' long-term goals by opening McNeil Hall, the building that wraps the front of the new parking structure on campus.

### MINES@150 PRIORITIES

#### Investing in students

Students are at the heart of everything Mines does, and attracting the best and brightest remains a top priority. From K-14 outreach to scholarships, fellowships and student scholar communities, Mines will set all Orediggers up for success.

#### A signature student experience

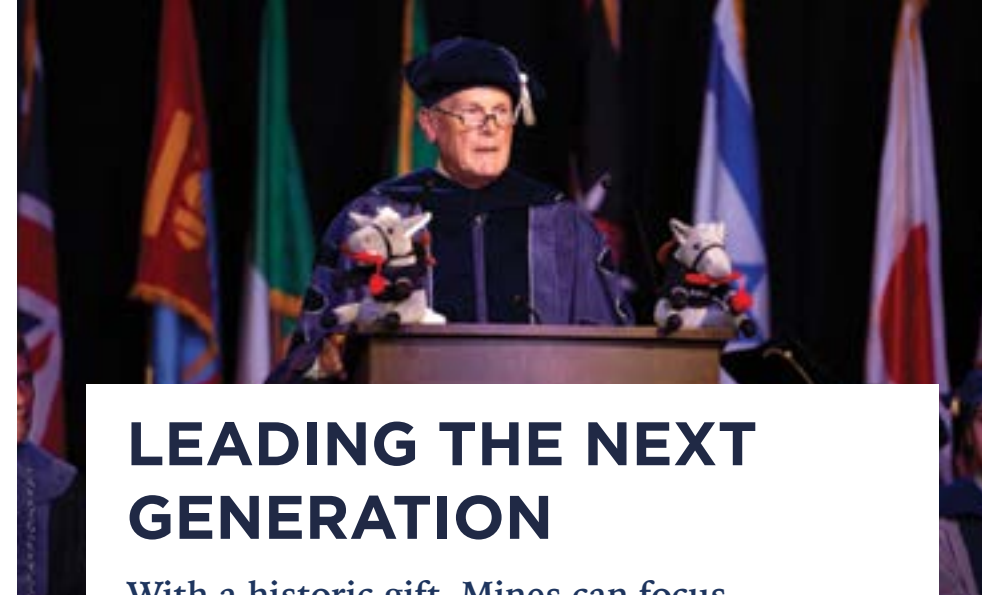
Preparing future Mines graduates will require a combination of challenging coursework, workshops and seminars, practical experiences and mentoring for students to develop technical prowess, leadership, professional skills and a broad understanding of the world they will lead.

#### Entrepreneurship, innovation and business programs

As they leave Mines, all graduates will be well-versed in business after being immersed in a rich and thriving entrepreneurial and innovative ecosystem across campus. Graduates will be able to meet the challenging demands they face in industry and society well into the future.

#### The pursuit of excellence and distinction

Mines has long been recognized for all that we do, from our academic programs and research to athletics and extracurricular activities. We want to keep it that way—and rise even higher.



## LEADING THE NEXT GENERATION

### With a historic gift, Mines can focus on building leaders

Bruce Grewcock '76 and his wife, Debra, made a historic gift to Mines this year—\$30 million to support full scholarships and unique experiential opportunities for Mines students, with the goal of developing tomorrow's industry, government and business leaders.

The Grewcock Presidential Scholars Program will develop the skills needed for effective leadership, promote intellectual curiosity and provide an insider's view of government, business and industry. The four-year program is in addition and complementary to each scholar's degree pursuit.

"Mines has long been known for producing distinctive engineers and scientists, but—as prioritized in our MINES@150 strategic plan—there clearly is also a need to prepare them to be leaders," said President Paul C. Johnson. "The Grewcocks' investment enables us to do that and also to attract the top students nationally to Mines as Grewcock Scholars. This is exciting and inspiring. I look forward to watching the Grewcock Presidential Scholars develop as leaders at Mines and then, after graduation, seeing the impact they have on society, government, business and industry."

#### Grewcock Presidential Scholars Program

**Who:** 10 new Mines students will be competitively selected based on high academic credentials, noteworthy leadership potential, leadership aspirations and a strong commitment to being leaders at Mines and active participants in the Grewcock Scholars Program.

**What:** This new scholars program will provide full tuition and fees to 10 new Mines students each year, renewable over eight semesters. Students in the program will receive personalized mentorship from professional leaders, regular group meetings and activities and unique leadership-focused travel opportunities.

**Why:** "Debra and I believe in a Mines education and the importance of good leadership, and we are proud to make a substantial investment in this first-of-its-kind program at Mines," Bruce Grewcock said. "Mines students are already high achievers with great drive and technical savvy. Through this program, students with exceptional leadership potential will gain the skills and knowledge they need to take initiative, inspire others and successfully advance our ever-changing world."

### GIVE AND TAKE

Alumni now have more ways to get involved with—and benefit from—their alma mater

In the past few years, the role of Mines alumni within the campus community has dramatically evolved, with more ways to get involved and soak up all the benefits of being a Mines graduate.

Building and strengthening these connections not only helps maintain and promote the value of a Mines education but can also provide personal and professional enhancements for all alumni.

"After each campus visit, I'm impressed by the quality of the programs, the administration, staff and faculty," said Bill Zisch '79, who currently serves as president of the alumni board. "But most of all, I continue to be impressed by the quality and character of the students at Mines today. Each interaction with students reinvigorates and encourages me greatly. So in the end, I'm the one that benefits from engaging with Mines."

### READY TO GET INVOLVED?

#### Join an interest group.

If you have an interest in aerospace, women representation in STEM, entrepreneurship and innovation or social responsibility, there are connections for you.

#### Check out your local M Club.

There's an M Club in almost every major city across the U.S. (and even several internationally) for Orediggers to get together to network, have fun and celebrate being Mines graduates.

#### Give and get advice through the Oredigger Network.

Looking for a mentor or want to mentor others? Learn with industry partners, fellow alumni, students, faculty and staff while lending your expertise to build a supportive Oredigger community.

► Visit [weare.mines.edu](https://weare.mines.edu) to learn more about these opportunities and the benefits available to you as a Mines graduate.

### CONNECTIONS

► To welcome students back to campus this fall, Mines parents and staff painted rocks with messages of positivity and support that were given to students and placed around campus, similar to the oSTEM event during Ally Week. •

Left to right: Scott '89, Eric '89, MS '93, Jim '64, Laura '90, James and Heather White



## ALL IN THE (OREDIGGER) FAMILY BY KAT HEIDEN

With eight Mines graduates in the family, the Whites make carrying on a legacy look effortless

Take a look in Jim White's home office, and there's no doubt he's an Oredigger through and through. Often wearing Mines gear, Jim '64, who has an engineer of mines degree, will show any visitor his Mines memorabilia, as well as awards for his service to the university.

But Jim's pride and passion for Mines extends far beyond being an alumnus. His father (Edwin '36), brother (Joe '71), two sons and daughter-in-law share his alma mater, and two of his grandchildren are current Mines students, for a total of eight White family members with Mines connections.

Scott '89 and Eric '89, MS '93, twin sons to Jim and his wife, Lee, said these family connections gave them unique insight into what it means to be an Oredigger. "One of the best lessons [I learned] at Mines is that you're never going to do it alone," said Eric, who, with Scott, co-owns Denver Machine Shop, a business the White family has owned and operated since 1916.

As students and alumni, members of the White family (which also includes Scott's wife, Laura '90) have always been involved in Mines activities, including Homecoming, football games and E-Days. They also remember working with fellow Orediggers through

late-night study sessions, getting hands-on drilling experience at Edgar Mine and learning to balance their activities and studies.

And while current Mines students participate in these same activities and traditions that are signatures of the Mines experience, Eric's son, James—a geological engineering student expected to graduate in 2022—admits there are some differences. "The advancement in technology has created a completely different, more convenient education experience for all students," he said.

"[There are] a larger number of educational paths than my parents had available to them at the time of their enrollment," added Heather, Scott and Laura's daughter who is pursuing a computer science degree at Mines. "There wasn't a computer science department, so I know that my curriculum is definitely different."

But despite the few differences, how Orediggers adapt and respond to challenges remains the same. "Mines

prepares a student to face whatever situation they're in," Scott said. "[At Mines], we learned how to learn." This critical thinking and adaptability are both crucial to success at Mines and long after graduation, often setting Orediggers apart as leaders and innovators in their careers.

**"DESPITE THE DIFFERENCES DUE TO TIMES CHANGING, WE ARE ALL OREDIGGERS, AND WE ARE PROUD OF THAT."**

James and Heather are grateful to their family members for sharing their insights about Mines, something that helped prepare the cousins for their own experiences on campus. "Even though Mines is such a rigorous university, I know I can get through it,"

Heather said, reflecting on the support and advice she's received from the fellow Orediggers in her family.

And being the fourth generation of the White family to attend Mines is something James knows is special. "I cherish the opportunity to honor my family legacy," he said. "Despite the differences due to times changing, we are all Orediggers, and we are proud of that."



## Making an impact at Mines is as easy as $E=mc^2$ .

A simple change in your will can help support the university and those you love.

Learn more at [plannedgiving.mines.edu/wills-and-living-trusts](https://plannedgiving.mines.edu/wills-and-living-trusts).



### CONNECTIONS

- ▶ Mines alumni were invited to attend an online event hosted by Catalyst HTI in September 2020 to celebrate Mines' impact in health research and find new networking and collaboration opportunities. •

## BUCKLE IN FOR THE RIDE

In the face of a pandemic, companies must stay true to their values—while changing business models

BY ASHLEY SPURGEON

As much of the world slowed to a halt in early 2020, many industries suddenly faced a new reality that shocked their business models and drastically changed projections for the year ahead. The oil and gas industry saw prices reach 30-year lows and an unprecedented drop in demand, with very few clues as to when the downturn will end and the long-term effects on the industry.

But many of those companies aren't waiting to see what happens next—they're already looking ahead. We sat down with Matt Gallagher '05, president and CEO of Parsley Energy, to talk about how oil and gas companies can overcome the COVID-19 crisis and lead an energy future in such unprecedented times.

**How do you think companies in your industry can recover from the effects of the COVID-19 pandemic?**

**Matt Gallagher:** I think we have to look at it from a whole new perspective and refresh the business models. We need to deliver steady profits and recognize that over the past four decades, we've been in a volatile industry. We need to always be prepared for a future shock. I think we have to run very focused on our cost structure, being the fact that we do produce a commodity, and at the same time, we have to lean on



Photo courtesy of Parsley Energy

collaboration and technology and use those to our benefit.

**How do you begin to adjust to a sudden new normal and come out ahead?**

**Gallagher:** Although our approaches might change, if we double down on our values and our principles, I think we'll stay out front as a leader. We're providing affordable, reliable energy to the masses, helping better the way of life for many every day.

**How might the recovery from the COVID-19 pandemic be seen as an age of opportunity for oil and gas to lead the next steps in our energy future?**

**Gallagher:** It highlights just how important our industry and our products are. The N95 mask is made with extruded plastic fibers that are saving millions of lives, as long as we can manufacture them quickly enough. [The pandemic]

has highlighted how challenging it is to see family and loved ones without air travel and what our products can truly provide. It's really an opportunity to recognize how important it is, and at the same time, from our industry, to recognize we've got to look at it with a different lens and be more aggressive in achieving our environmental, social and corporate governance goals.

**What do you think someone needs to be successful in the oil and gas industry today?**

**Gallagher:** To a certain degree, resilience. This is a volatile industry, and this COVID-19 situation has magnified the volatility, but we know these things are coming. You have to buckle in for the ride in this industry—you have to keep your head up during the down times and not run too fast during the high times. Resilience, creativity and a little bit of optimism.



## BUILDING BACK BETTER

BY SARAH KUTA

For the oil and gas industry, a “green recovery” is a chance to lead

If governments around the world are already spending trillions of dollars on coronavirus recovery efforts, why not spend some of that money in ways that would help the environment at the same time? That's the question proponents of a “green recovery” have been asking in recent months.

Though shelter-in-place mandates, travel bans and the shift to remote work temporarily reduced global greenhouse gas emissions, environmental advocates are taking a longer-term view of recovery. They're proposing a “build back better” approach that shifts the world decisively toward a clean-energy future.

But where do oil and gas companies fit in this conversation? And is a major worldwide shift away from fossil fuels at odds with their business models?

Not at all, according to Tisha Schuller, founder of consulting company Adamantine Energy and advisory board member of the Payne Institute for Public Policy at Mines. Instead, Schuller said, the massive disruption caused by the coronavirus pandemic is an opportunity for the industry to take a leading role in creating our energy future.

“We talk about it with our clients in terms of, ‘This is a train—not only do you need to get on, you need to be conducting,’” Schuller said.

At the same time, Schuller cautions that green recovery proponents need to give the industry a meaningful seat at the table. The industry has the infrastructure, resources, talent pool and research and development capabilities to make an energy transition happen more quickly, more efficiently and with a smaller environmental impact.

To be part of the path forward, oil and gas companies should adopt or strengthen an innovation mindset, Schuller said. Instead of trying to recreate or recapture the past, these companies should shift their gaze squarely to the future. Many are already forging ahead with research and implementation of clean-energy practices, but it's important to make those initiatives more visible.

Oil and gas companies should also seek out and be willing to form potentially unconventional partnerships, such as with environmental NGOs or bipartisan political coalitions.

“A lot of this is just about taking the political identity out of it and contemplating the leadership and entrepreneurial framework instead,” Schuller said. “Let's spend less and less time bickering about logistics and more time sharing the ambitions and then articulating a path to get there.”

### CONNECTIONS

► Mines launched the new Campaign for MINES@150 with a virtual event on October 7 that celebrated the university's past and explored future possibilities as Mines approaches its sesquicentennial. •

► Kenji Farinelli '74 recently shared some thoughts on the Mines experience: “Education, learning and wisdom are more than classrooms, labs and fieldwork. It's also common sense, concern for others and the ability to work as a team.” •





## STACKING THE DECK

**A new education approach might be just the thing to get professionals back on their feet**

There's a new trend in the pursuit of higher education: "stacking credentials." As many professionals seek new skills and knowledge to advance their careers, some are taking a nontraditional approach that allows them to complete short courses and certificates that can eventually add up to the equivalent of a complete degree. And now might be exactly the right time to make that decision.

Given the economic toll and job losses due to the COVID-19 pandemic, many people are looking for ways to gain the education and skills needed to get back into the workforce quickly and at a low cost. According to the Strada Education Network, "2 in 5 Americans say the most important factors in choosing an education program are whether it is related to their work and suited to their personal needs."

So what are the advantages of taking this nontraditional route?

### **Certificates show off specific skills.**

Many certificate programs focus on a narrow set of skills and knowledge, and employers can easily see the practical skills students have learned rather than the perceived broad foundational knowledge that can come with a traditional graduate degree. Instead, prospective hires can easily demonstrate they are prepared and have the knowledge necessary to get the job done well.

### **Stacking certificates may be more affordable.**

With the rise of economic uncertainty—not to mention the rising costs of a graduate-level education—many people are wary of investing a large sum of money when upgrading their skill sets. But certificate programs typically cost far less than the average \$633 per-credit cost in a traditional degree program.

## PROGRAMS FOR OPTIMAL SKILL SHARPENING

**Mines is getting on board with this stacking trend and launched several new graduate certificate programs this year.**

- Advanced Manufacturing
- Business Analytics
- Computer Science
- Cybersecurity
- Data Science—Computer Science
- Data Science—Foundations
- Data Science—Earth Resources
- Data Science—Petroleum Data Analytics
- Data Science—Statistical Learning
- Environmental Modeling
- FEA Professional
- Humanitarian Engineering & Science
- Petroleum Geophysics
- Smart Manufacturing
- Space Resources
- Underground Construction and Tunnel Engineering

### **Certificate programs require a smaller time commitment.**

People who have been furloughed or are now unemployed are looking to learn skills that will help them get new jobs—with a fast turnaround time. The stacking approach can help with that by allowing people to reenter the workforce sooner and isn't as daunting as a multiyear degree option.

While the traditional approach to education certainly isn't going to be replaced anytime soon, this new way to gain credentials may be just the thing to open new doors and get people well on their way to advancement in their professional lives.



SPRING 2021  
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Details and registration information for the spring event will be available in mid-November.



Attract the best and brightest engineers for your company. Don't miss out on this huge event to interact with 2,000+ Mines students and alumni.

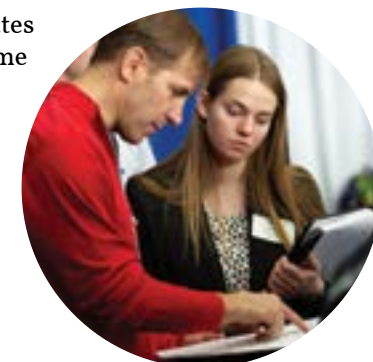
For more information, contact Associate Director of Employer Relations James Saulsbury at 303-273-3205.

**CAREERS.MINES.EDU**

## BEST FOOT FORWARD

**Finding new opportunities amid uncertainty**

For many new college graduates in 2020, the job market became much more difficult to navigate as the COVID-19 pandemic halted many prospects and limited the number of opportunities available for graduates looking to find their place in the workforce. But the Mines Career Center has pulled out all the stops to help students and recent graduates find new opportunities.



We asked Wendy Winter-Searcy, director of the Mines Career Center, for her advice on seeking new prospects during a time with so much uncertainty. Here's what she offered:

### **Seize the moment, and take advantage of current opportunities.**

Don't wait for what might be coming around the bend. With the uncertainties of the pandemic and the effects on the economy and labor market unknown, take advantage of the need for skilled professionals in technology and engineering now.

### **Prepare for your virtual job search.**

Many of the same traditional job search principles apply, such as having a polished and professional resume and tailored cover letter, but you also need to become very comfortable speaking and presenting over Zoom and other videoconferencing tools. Make sure your tech tools are up to date and that you're familiar with troubleshooting common issues. Use virtual networking to your advantage by updating your LinkedIn profile and increasing your connections, especially those you have some affiliation with, such as other Mines alumni.

### **Keep learning.**

Take advantage of any lull in your schedule to enhance and build new skills and competencies. Increase in-demand skills and build career readiness through enhanced professionalism. Demonstrate that you're making the most of your time and being proactive to become more desirable as a candidate. Your positive attitude and taking action to develop yourself will be appreciated by potential employers.

## CONNECTIONS

► Mines launched the Mines Mentoring Program this year for students, alumni and employees to lend their time and expertise to other Orediggers or get support themselves from others in the Mines community. •

► Howard Janzen '76, Matt Gallagher '05 and David Zanetell '87 were part of a virtual CEO roundtable in October 2020 to talk about leadership and resilience when building a career. •

# MAKING STEM A BIGGER TENT

BY MARK RAMIREZ

## How to foster inclusion and engagement as organizations and individuals

Amid increased public discussion of racism in the United States, many organizations are putting more focus on diversity and inclusion, looking at new ways to build best practices that benefit all employees and create more equitable workplaces.

To learn more about this topic and the actions professionals can take, we spoke with Pam Jeffords, a partner in PwC's Workforce of the Future Practice with more than 25 years of experience helping organizations work toward sustainable diversity, inclusion and engagement. Jeffords also has a couple of Oredigger connections: her husband, Steven Jeffords '86, holds a geophysical engineering degree from Mines, and her daughter is currently a senior in civil engineering.

Jeffords said now is the perfect time for professionals to reassess their business practices and the ways in which they support inclusion in the workplace. "We are seeing a window," Jeffords said. "It's a combination of the pandemic and the reaction to George Floyd's killing. There is a sense of urgency."

### What do you say to the idea that STEM fields are a meritocracy and have less need for diversity efforts?

**Pam Jeffords:** If it were a true meritocracy, no one would ever need to apply to Mines or for a job. You would know who out there is the best. What if you don't have a

large network, come from an underrepresented group or just arrived here from another country?

I'm not looking at the job boards every day, but people in my network will let me know about openings. Those nudges—that's what makes people with bigger networks succeed faster.

### How can STEM organizations foster diversity and inclusion?

**Jeffords:** The first thing you want to do is look at your data. It can tell you where gaps are: hiring rates, promotion rates, every dimension of demographic. We allow the data to point us around that moment, then focus in and do interviews.

We use AI and gamification to conduct focus groups, allowing us to collect perspectives from thousands of people in a couple of days. It also allows us to engage everybody in conversations that can be sensitive, for example conversations about systemic racism.

### How can individuals contribute to these efforts?

**Jeffords:** Previously, the push was to think your way to a new way of acting: read this book, watch this movie, have a dinner party and invite people over who are different from you. However, you can't think your way to a new way of acting. We believe you can act your way into a new way of thinking.

For example, introverts, or individuals from underrepresented groups, might find it a challenge to speak up in meetings. If I send you a pre-read 48 hours in advance, I've given you the time to process the information and signaled that I really want your feedback. And if someone doesn't speak up or can't make the meeting, they still have the opportunity to share their thoughts or ask questions.

We also remind leaders that making eye contact with everyone is a form of inclusion. At PwC, we leverage a concept called "the critical few"—adopted from a book of the same name—that focuses on the few actions leaders can take to demonstrate inclusion. You don't have to do 100 behaviors—just do three repeatedly until it becomes a habit.

### What about combating racist behavior directly?

**Jeffords:** We can all start with calling people in to a conversation instead of calling them out for getting it wrong. But, if you are in a position of leadership, sometimes you do need to call out bad behavior. It does take some practice, because it might take a second to process something as bad behavior, then you let that slide and the moment is gone. It also helps to invite people to give you direct feedback when you yourself say something wrong—that is when you really develop into an inclusive leader.

## TECH TIP

Need help navigating the pandemic? Your map app can be even more useful.

While many people have been doing far less traveling this year, the map app on many smartphones remains as useful as ever. Both the iOS Maps app from Apple and Google Maps got some handy upgrades to help people navigate all the changes that have come with the COVID-19 pandemic. Here are just a couple of new features:



### See what's open (or closed)

With many cities in varying stages of closure over the past several months, it's hard to remember what's open. Both apps now note adjusted business hours, curbside pickup options and temporary closures. The apps also note the status of dine-in, takeout and delivery service for most restaurants.

### Find a COVID-19 testing site

If you have coronavirus symptoms and your medical provider advises you to get tested, finding a facility is just a tap away. Using data from government agencies, public health departments and health care institutions, a simple search of "COVID-19 testing" will bring up places where you can potentially get tested.

Your map app is no longer just for getting from point A to point B—it might be just what you need to help you get through the pandemic.

▶ Have a useful tech tip you'd like to share or want to know more about an everyday technology? Let us know at [minesmagazine.com/contact-us](https://minesmagazine.com/contact-us).

## CONNECTIONS

▶ Regina and Jim Bock, the parents of Logan Bock '17, MS '18, made a custom Mines face mask for President Paul C. Johnson, which he proudly sported around campus this summer. •

▶ Throughout the COVID-19 pandemic, Mines alumni have been helping their fellow Orediggers by supporting The Mines Fund and Student Emergency Fund, participating in a PPE drive, sharing job and internship opportunities and more. •



MARC GUERRA '08, MS '09

We're proud of Mines alumni. We want to cheer you on and celebrate your accomplishments. Tell us about your recent wedding, a new baby or your new job. Share a personal or professional accomplishment, volunteer activity or your favorite Mines memories. Stay connected to the Oredigger family.

▶ Submit a class note at [minesmagazine.com/classnote](https://minesmagazine.com/classnote).

## 1970s

**Gary Wilkinson '74** ended his service as mayor of Frisco, Colo., in May 2020 after two mayoral terms and a total of 12 years with the Frisco Town Council.

**Gary Prost MS '75, PhD '86** published the two-volume *Geologic Tours of the World: North America's Natural Wonders* in March 2020. The book guides readers through the most iconic, geologically significant scenery in North America, points out features of interest, explains what they are seeing and describes how these features came to be.

**R. Gordon Schupmann '76, MS '78** retired from Hitchiner Manufacturing Co. Inc. on July 31, 2020, after a 40-plus-year career in the investment casting foundry business.

## 1980s

**Mark Cevaal '87** was named an associate principal of Redland, a Colorado-based land planning, civil engineering, landscape architect and construction management consulting firm, in August 2020.

**Dan McElhinney '87** was selected as the Idaho Transportation

Department's new chief operations officer, starting in the position on Aug. 10, 2020.

**John Olsson '88**, executive vice president for consulting services at Olsson, is this year's recipient of the Charles Durham Achievement Award, presented annually by the American Council of Engineering Companies/Nebraska. The award honors a person who exhibits Charles Durham's leadership in the engineering profession and his community stewardship through civic involvement.

**Patrick Highsmith '89, MS '07** was appointed to the Idaho Champion



**M. Stephen Enders '76** was named Mines' new head of the Mining Engineering Department, officially beginning his new role on Aug. 1, 2020. Enders said he's looking forward to championing the story of the increasing importance of mining and mineral exploration to modern-day life. "I'm honored and humbled to be asked to continue to serve my alma mater as head of the Mining Engineering Department," he said. "I've worked in mining and mineral exploration my entire career. I've worked in copper and gold mines and on exploration and development projects all around the world. My job now is to use that unique mix of experience in industry, academia and management to lead the Mining Engineering Department into the future."

▶ Read more about Ender's vision for the department at [minesnewsroom.com](https://minesnewsroom.com).

Gold Mines Canada Inc. board of directors in August 2020.

## 1990s

**David Lawler '90** took over as BP America's chairman and president in July 2020.

**Victor Romero '90** was elected as underground division president at McMillen Jacobs Associates in June 2020.

**David Ray '91** retired from the U.S. Army in May 2020 after nearly 28 years of service in the U.S. Army Corps of Engineers and now works for HDR as a senior program manager.

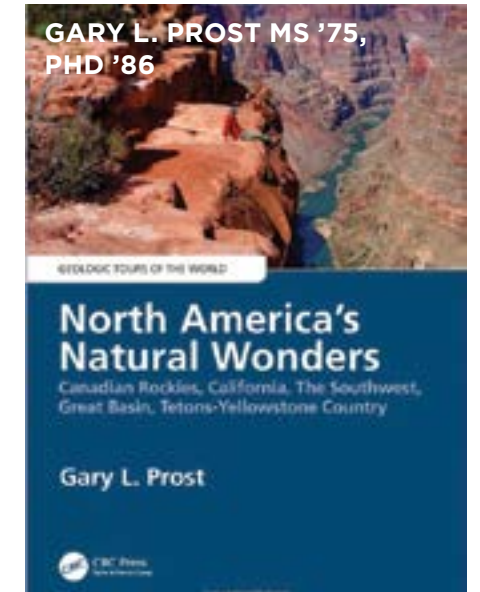
**Joshua Olmsted '92** was appointed as president and chief operation officer of Freeport-McMoRan in August 2020.

**Quinton Hennigh MS '93, PhD '96** was appointed to Condor Resources Inc.'s board of directors in June 2020.

**Sean McKenna PhD '94** was selected to lead the Desert Research Institute's Division of Hydrologic Sciences in June 2020.

**Christine Whelchel '94** joined Tatanka Midstream as chief operating officer in April 2020.

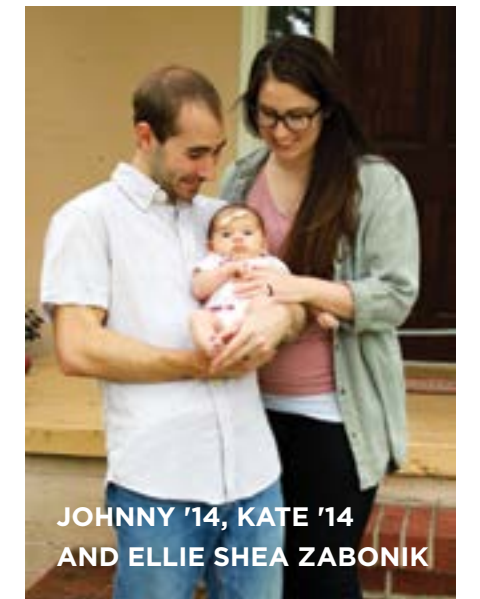
**Gregory Madden '95** was appointed as the chief strategic officer of H2O Innovation in July 2020.



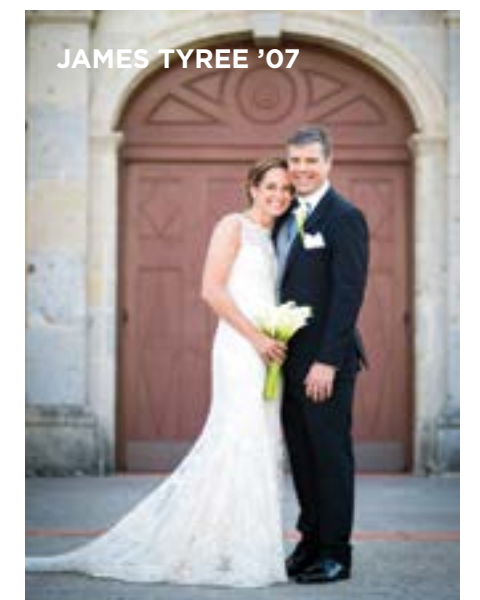
GARY L. PROST MS '75, PHD '86

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Gary L. Prost



JOHNNY '14, KATE '14 AND ELLIE SHEA ZABONIK



JAMES TYREE '07

HISHAM SAGER MS '11, PHD '15 AND FAMILY



**Mattieu Rouot MS '95** became CEO of MAXIS GBN, a multinational employee benefits network, in July 2020.

**Bill Eustes III PhD '96** was honored with the 2020 Distinguished Achievement Award for Petroleum Engineering Faculty by the Society of Petroleum Engineers' Rocky Mountain North America Region. The regional award recognizes superior teaching, excellence in research, significant contributions to the petroleum engineering profession and special effectiveness in advising and guiding students.

**Marshall Dougherty MS '97** was named a board member of Global Innovation Platform in August 2020.

**Jim Tucci MS '99** was promoted to national sales manager of Flomatic Corporation in August 2020 to lead the expansion of Flomatic valve products nationally and internationally and will oversee Flomatic's customer service department.

## 2000s

**Jesus Salazar '01, MS '02** was appointed to Pinnacol Assurance's board of directors in July 2020

and will serve as an employer representative.

**Alex Hrin '07, MS '08** joined the Baylor University faculty to teach physics in August 2020.

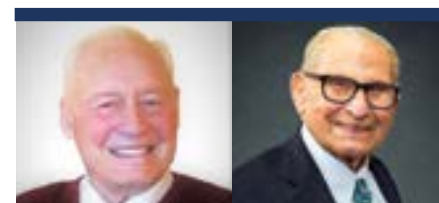
**James Tyree '07** and Robin Willison were married on June 8, 2019, in Corpus Christi, Texas. A few Orediggers made the trek to South Texas, including Vince Warner '08, Stephen Immel '08, James Reeves '08, David Pesek '09, MS '11, Drew Ferren '08, MS '09, Zachariah Ballard '08 and Casey Morse '08. The couple met while working at the U.S. Environmental Protection Agency.

**Marc Guerra '08, MS '09** and Sarai Galvan were married in Mexico on Oct. 6, 2019. Several Mines alumni were in attendance, including Shayne Berns '08, Alicia Thompson '09, Justin Green '07, Jake Sievers '08 and Dan Welsh '08. Despite sharing mutual friends and acquaintances, the couple did not meet until fellow Mines alumni Mandy Oanes '12 and Stephanie Corey '12 set the two up on a blind date.

**Jacob Davis '09, MS '11** and Jamie Davis welcomed twin girls to the family. Chloe and Ava arrived Nov. 25, 2019, joining big sister, Emma (3).



EMMA, CHLOE AND AVA DAVIS



**Hugh Evans '49** and **Roshan Bhappu '50, MS '51, PhD '53**

were two of five new members elected to the National Mining Hall of Fame in May 2020. Inductees are selected by the National Mining Hall of Fame's Board of Governors, and Evans and Bhappu were chosen for their groundbreaking work in biohydrometallurgy, economic geology, mine development, social responsibility and sustainability initiatives, as well as their unparalleled skill in creating shareholder value.



CASSIDY STEEN '18 AND MATTHEW RYAN '18



GRAHAM PELLERIN



**Joseph Kenrick '17, Justin Kilb '17** and **Matthew Rehberg '17** captured this photo in May 2020 by sending a camera attached to a weather balloon up to 90,000 feet. Using their extra time at home during quarantine, the friends spent two weeks designing, planning and building the requirements for the launch. Their tests included subjecting cameras, battery packs, GPS, Arduinos and sensors to -55 degrees Celsius temperatures for long periods of time. They also designed and built a parachute out of a bedsheet that required impact and flow testing with

the payload container. Then, a solid understanding of flight and weather patterns was essential for predicting where the payload would land and choosing a launch day in compliance with FAA regulations. Their first launch experienced a complete electronic failure from overheating, so although the balloon made it up to 90,000 feet, no photos or data were collected. Luckily, they were able to make the necessary adjustments and launch again the same day—with successful results.

**RYMAN AND LINKOLN  
SPURGEON**



**2010s**

**Hisham Sager MS '11, PhD '15** welcomed a new baby girl, Hajar, on March 30, 2020. That day also happened to be his first day teaching remote classes for the Electrical Engineering Department at Mines, and he worked remotely from the hospital after Hajar was born.

**Maria Rosa Gobitz '12** joined MetalMiner as a senior research analyst in June 2020.

**Taylor Pellerin '13 and Samantha (Hawkins) Pellerin '13** welcomed another baby boy to their family. Graham arrived on Feb. 4,

2020, joining big brothers Everett (1) and Sawyer (1).

**Kate (McParlane) Zabonik '14 and Johnny Zabonik '14** welcomed their baby girl, Ellie Shea Zabonik, into the world on March 23, 2020.

**Taylor Helbig-Spurgeon '15 and Cole Spurgeon '16** welcomed Ryman and Linkoln Spurgeon on May 28, 2020.

**Cassidy Steen '18 and Matthew Ryan '18** got engaged at Lake Tahoe in March 2020 after dating for four and a half years. The couple met through mutual friends while serving on the E-Days committee as students.

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**IN MEMORIAM**

Remembering Orediggers who have passed away but will always remain part of the Mines community

**Alex A. Briber '48** died March 3, 2020. Born in 1923, Alex served in the U.S. Army during World War II and received a Purple Heart. He spent his career working for Underwriters Laboratories, testing and setting flammability standards for building materials.

**William L. Burch '44** died May 11, 2020. Born in 1920, William was a member of the Tau Beta Pi fraternity as a Mines student. He joined Linde Corporation after graduation and later spent a 35-year career at the Bell Aircraft Corporation.

**Robert R. "Bob" Edison '49** died April 23, 2020. He was born in 1928 and served two years in the U.S. Army. He worked at Sinclair Research Center, and his career took him all over the world.

**Bruce T. Garrett MS '81** died March 31, 2019. Born in 1949, Bruce focused his engineering skills on water treatment projects including reverse osmosis and slow sand filtration.

**William D. "Bill" Gay Jr.** died April 4, 2020. Born in 1932, Bill served in the U.S. Navy before working for ASARCO for 30 years.

**Willard L. "Bud" Goodwin** died April 16, 2020. Bud was born in 1932. After fulfilling his U.S. Army ROTC obligation, Bud worked for Kaiser Aluminum, where he worked for 37 years. He retired in 1998.

**Dezsee Hajdu '63** died on May 31, 2020. Desi was born in 1933 and was a member of the Beta Theta Pi

fraternity and played on the men's soccer team as a Mines student. Desi spent his entire career in the petroleum industry.

**John M. "Mike" Hoppe '72** died April 16, 2020. Mike was born in 1948 and was a member of the Kappa Sigma fraternity as a Mines student. After briefly working in his field of study, he returned home to operate his family farm.

**Rebecca J. "Becca" Keller '14** died April 11, 2020. Born in 1990, Becca worked for Denver's Department of Transportation and Infrastructure. Her team received the Respect Award at the 2019 528 Awards for their work on the Denver Smart City project.

**Robert S. "Bob" Padboy '50** died April 6, 2020. Born in 1924, Bob served three years in the U.S. Army during World War II before spending his career working for Chevron and Argo Oil Corporation and doing consulting work.

**Richard L. "Lee" Peterson '41** died July 30, 2020. Lee joined the U.S. Army Air Corps before spending his career as a surveyor.

**William A. Preston '58** died Sept. 1, 2019. William was born in 1936 and served in the U.S. Army. He spent part of his career in the aerospace industry before later building a manufacturing and distribution company. William also served on the Mines Foundation Board of Governors.

**Kenneth L. Vaughn '61** died March 4, 2020. Ken was born in 1939 and served two years in the U.S. Army Chemical Corps before working for UNIVAC and then eventually Control Data Corporation for 25 years.

**Albert H. "Al" Wieder '60** died April 4, 2020. Born in 1937, Al was commissioned as a second lieutenant in the U.S. Army Reserve and spent his career working in the petroleum industry.

**Robert M. "Bob" Woodbury '65** died Feb. 17, 2020. Bob was born in 1941 and was a member of the Alpha Tau Omega fraternity and ROTC and played on the varsity football team as a Mines student. After graduation, he enlisted as an officer in the U.S. Marine Corps, and after his service spent the rest of his career in the mining industry.

**Tom Wyman '53** died Dec. 22, 2019. Tom was born in 1931 and spent his career as a metallurgical engineer and senior consultant for the DuPont Company for 35 years. He retired in 1988.

▶ To submit an obituary for publication in Mines Magazine, visit [minesmagazine.com/obituary](http://minesmagazine.com/obituary).

Memorial gifts to the Colorado School of Mines Foundation are a meaningful way to honor the legacy of friends and colleagues while communicating your support to survivors. For more information, call 303-273-3275 or visit [weare.mines.edu/givingguide](http://weare.mines.edu/givingguide).

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## A MODIFIED TRADITION

**When the M Climb was canceled, Orediggers found a way to carry on the tradition**

Due to local health and safety regulations this year, the annual M Climb looked like it wasn't going to happen. But Orediggers came up with a creative solution to ensure the tradition continued—in a safer way.

Instead of marching up Mount Zion with their 10-pound rock, new Mines students participated in a "revised" M Climb that divided the Class of 2024 into cohorts of about 30 to 50 students, all wearing face masks. After spray-painting their hard hats, students carried their rocks on a tour of campus while learning the Mines fight song. The tour ended on the hillside between the intramural fields and the fraternity and sorority houses. Orediggers painted their rocks with cups of whitewash and placed them in a temporary "M" until they can be relocated to Mount Zion.





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Excellence at Mines has endured for almost 150 years, forming traditions, building a stellar reputation and pushing the limits of what's possible for decades. Orediggers have long exceeded expectations in academic settings, such as this geology lab in 1932, to become successful industry leaders and leaving an indelible mark on the world. As Mines approaches our sesquicentennial, we're celebrating our past as we look to the future and what we aim to do next.

▶ Follow along at [mines.edu/mines-at-150](http://mines.edu/mines-at-150).

