

MINES MAGAZINE

COLORADO SCHOOL OF MINES ALUMNI MAGAZINE

Fall 2019 Volume 110 Number 4



WHAT MAKES AN OREDIGGER?

Times change, but Mines graduates remain the same—effective problem solvers who know their discipline inside and out.



COLORADO SCHOOL OF MINES
EARTH • ENERGY • ENVIRONMENT



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Cover image: Dennis Fagerstone '71 and current metallurgical and materials engineering student Heather Hoffman stand outside Guggenheim Hall with a hard hat and a rock used for the M Climb—two symbols of a Mines experience all Orediggers share. (Photo by Joe DelNero)

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FEATURES



WHAT MAKES AN OREDIGGER?

Despite some changes at Mines over the years, our graduates remain the same—dedicated problem solvers you can count on to get the job done well.

OREDIGGER SNAPSHOTS

Recent graduates talk about their time at Mines and what the future holds for them.

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Contributing Writers
Lori Ferguson, Tim Flynn, Kateri Kramer,
Sarah Kuta, Teresa Meek, Emilie Rusch,
Amanda Schuster, Anica Wong

Graphic Design
Wendy Kent, WKent Designs

Advertising Contact
Ashley Spurgeon
aspurgeon@mines.edu | 303-273-3959

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Comments and suggestions are welcome. Contact us via our contact form at minesmagazine.com/contact-us or via mail at *Mines Magazine*, 1500 Illinois St., Golden, CO 80401. To update your address, go to minesalumni.com/update or email minesalumni@mines.edu.

OPENING REMARKS

SOME THINGS CHANGE, BUT THE QUALITY OF OREDIGGERS REMAINS STEADFAST

There is a line in this edition's feature story on page 14 that captures the essence of the Mines graduate, past, present and future: "a strong work ethic, superb expertise and an outstanding ability to work collaboratively to get the job done well." These qualities are a consistent thread that links generations of alumni together.

It is because of these characteristics that so many companies recruit at Mines. When I arrived at Mines in 2015, about 240 companies attended our Fall Career Day. For the recent 2019 Fall Career Day, there were 350, filling all available space in the Student Recreation Center as well as Steinhauer Fieldhouse.

When asked why they come to Mines, recruiters and managers from the energy, aerospace, IT and infrastructure industries all identified the traits listed above, plus proven success in their companies, as the primary reasons.

Asked what they would change about Mines graduates, companies and alumni pretty quickly identify business acumen first, then the need for a broader awareness of the corporate and societal context of their efforts as engineers and scientists. And when we ask students what they feel is missing from our programs, they frequently identify opportunities to be entrepreneurial and a desire to learn within the context of their passions and future interests.

Listening to and acting on this input is key to our future. As we look to Mines' 150th anniversary in 2024 and beyond, our goal is to retain those timeless qualities in Mines graduates while complementing them with business and leadership skills and offering a learning environment that attracts and inspires bright and hardworking students. We have to do this to remain relevant and to continue to attract recruiters and new students.

With respect to the changing student experience, I know from emails and conversations with alumni that some of you worry that Mines is less demanding today than in the past. After all, from afar, things look more cozy. And in some ways they are. But some things haven't changed—and won't.

The students coming to Mines today will be challenged and prepared for the futures they will work in, just as past generations of Orediggers have been well prepared for their times. Achievement will always be something that is earned at Mines. Our students are hungry, hearty, hardworking, ambitious and confident. They want to extract knowledge (and yes, other things) and change not only their lives but the industries and communities they're about to enter. They still come to Mines for the challenge, and they get just that—read Julia Payne's comments in this edition's feature story as an example.

I invite you to visit Mines and have coffee or a meal with today's students. I believe that 30 minutes with a couple of students will convince you that, while some things have changed, the essence of Mines has not, and that the future is bright for them and for Mines.

Go Orediggers!



Paul C. Johnson, PhD
President and Professor



BEGINNING THE CLIMB

A SNAPSHOT OF THE CLASS OF 2023

1,450 Incoming freshmen and transfer students | **33%** Women

14% First-generation students | **4.9%** International students

640 New students attended Oredigger Camp ahead of the start of the academic year

48 STATES AND U.S. TERRITORIES
and **19** COUNTRIES represented

TOP 5 U.S. STATES

Colorado, Texas, California, Washington, Illinois

INTERNATIONAL FRESHMEN ARE FROM:

Belgium	Kuwait	South Korea
Canada	Malaysia	Sweden
Chile	Mexico	Trinidad & Tobago
China	Paraguay	Ukraine
India	Peru	United Arab Emirates
Kazakhstan	Saudi Arabia	United Kingdom



BOOTS ON THE GROUND, IN THE LAB

LT. COL. ADAM BRADY BALANCES GRADUATE STUDIES WITH MILITARY SERVICE

Though Lt. Col. Adam Brady MS '12 is in Golden, Colorado, on assignment for the U.S. Army, you won't find him shouting commands or driving a tank. Instead, you'll find him in the lab or conducting field research as he pursues a PhD.

Unlike the average graduate student, Brady remains on active duty while working toward his doctorate in environmental engineering science and will eventually return to the United States Military Academy at West Point—his undergraduate alma mater—to teach environmental science courses.

"I have no other Army commitments right now—my job is to get my degree," Brady said.

Brady has traveled all over the world during his 17-year military career, including four deployments to Iraq, a deployment to eastern Africa and assignments in Kentucky, Texas, New York and Hawaii. For now, though, he's happy to be in Colorado.

This is the second time Brady has been stationed in Golden. After serving in a variety of military roles, Brady decided he wanted to teach at West Point, a position that requires at least a master's degree. He applied to a special military program that sends officers to graduate school and earned his master's degree in environmental science and engineering from Mines in 2012. Afterward, he taught at West Point for two years before returning to Army operations positions. He came back to Mines in 2018 through the same program to earn his doctorate.

The U.S. military academies produce almost one-fifth of all officers, so Brady was excited to help shape the next generation of military leadership at West Point. "I enjoy providing mentorship, guidance and support in the development of those soon-to-be leaders," he said.

With several deployments and far-flung assignments already on his resume, Brady is grateful for the stability this assignment provides his family. And assigning Brady to earn a PhD from a leading institution also helps West Point achieve its primary mission of educating the Corps of Cadets, while also strengthening the Army as a whole.

"The military uses these 'broadening assignments' as an opportunity to expand the experiences of an officer and to demonstrate a different way of thinking about problems and possible solutions," Brady said. "By providing opportunities to attend graduate school, the military is creating diversity of thought. In turn, this adds diversity to any organization those officers join, creating a stronger team."



Lt. Col. Adam Brady MS '12 is on assignment in Golden, Colorado, for the U.S. Army—to get a PhD—before he'll return to the United States Military Academy at West Point to teach the next generation of military leaders.

Photo by Myriah Brady

Brady's doctoral research centers on the use of wetlands for passive treatment of impaired waters. More specifically, he's interested in making wetlands smaller and more efficient so they're viable options in urban areas where land is in short supply.

His group is focused on water systems that are impaired by nitrogen, which comes from wastewater treatment plants, runoff from agricultural uses and industrial discharges.

"Right now, if you imagine a wetland, you might think of a big pond with plants growing out of it," he said. "But land is expensive, especially in cities and urban areas. We're looking at how to keep the same level of nitrogen removal but making the footprint smaller so that municipalities are more willing to use them."

Though the research isn't directly related to any specific military projects or initiatives, it will inform Brady's teaching of ecology, environmental science and environmental engineering classes back at West Point.

So while his path may be unconventional, Brady's military assignments have taught him how to be an effective team leader—both overseas and in the classroom.

By **Sarah Kuta**

► Mines has a long history of supporting veterans. If you'd like to share your ROTC or military experiences with us, contact Fran Aguilar at faguilar@mines.edu.

ATHLETICS

A BALANCING ACT

The balance between the classroom and competition is one that Mines student-athletes master every year. It's not easy fitting in lectures, labs, homework and projects with training, practices, travel and competition. But despite these pressures, Orediggers have continued to excel at both sides of the equation.

In 2018-19 alone, Mines Athletics had five RMAC Academic Athletes of the Year and an all-time record of 16 Academic All-Americans, while distance runner Megan Wenham '19 became the first Oredigger to earn the RMAC's highest honor, the Scholar-Athlete of the Year Award. More than half of the more than 400 Mines student-athletes held a 3.0 or above cumulative GPA after the spring 2019 semester, including 142 with a 3.5 or better. Oredigger teams combined held a 3.18 departmental GPA in 2018-19, on par with the student body as a whole.



“It’s the little things you do every day, like drinking water and getting sleep, that really make a difference in how you perform, both academically and in athletics.”

—Megan Wenham '19, RMAC Scholar-Athlete of the Year

To reach those lofty heights, organization and resourcefulness are key.

“When I’m training, and I have multiple workouts a day, I have to prioritize a lot more,” said Jake Feldman '19, a starter for the RMAC-champion wrestling team. Feldman received his bachelor’s degree in metallurgical and materials engineering in May and is currently working on a master’s degree in engineering and technology management while competing in his final season. “I’ll build a list every day—practice at this time, lifting at this time, classes later in the day. Some weeks are worse than others, but it works out.”

While carefully budgeting her time was also important for Wenham, she explained that self-care was key to her success both on and off the field, a practice that contributed to her RMAC Scholar Athlete Award win this year. “Athletics gets exponentially more difficult the second you stop taking care of yourself, so I always made a conscious effort to get enough sleep and eat good foods between all the homework and training,” she said. “It’s the little things you do every day, like drinking water and getting sleep, that really make a difference in how you perform, both academically and in athletics.”

Traveling for competition puts extra pressure on academics because it often takes student-athletes out of the classroom and lab. In 2018-19 alone, the Mines wrestling team covered more than 8,000 miles on the road and in the air, but that doesn’t mean they’re given a free pass in class.

“I’m really used to studying on buses,” Feldman said. “And if we’re at a hotel and we have breakfast at 9 a.m., I’m up at 7 a.m. studying, and most of my teammates are doing the same thing. We know we have a job to do at the meet but also have to take care of business at home.”

Tyler Kimble, who is entering his 14th season as the head coach of men’s golf, has seen how his golfers have adapted to being away from home as they often compete on weekdays.

“It’s very easy to get behind here because we have so much hands-on lab work,” Kimble said. “[Athletes] have to be really proactive—they have to learn when other lab times

Cross country and track & field standout Megan Wenham (left, with RMAC Commissioner Chris Graham) became the first Mines student-athlete to receive the conference’s highest academic honor, the RMAC Scholar-Athlete of the Year, in July 2019.

Photo by Tim Flynn

Wrestling’s Jake Feldman says time management while traveling has been a key to earning his degree while finding success as a Mines student-athlete.

Photo by Tim Flynn



are to make it up and constantly communicate with teachers to reschedule and make up the work.”

Kimble also credits relatively new learning tools, such as digital textbooks and online homework portals, with making a positive impact on his student-athletes’ success. Taking advantage of those resources helps keep them on track. “Some of our coaches even find that the grades are a little bit better in-season because they’re so focused,” he said. “They’re constantly on point—they can’t slack off at all.”

But Mines student-athletes also have to contend with the pressure of remaining eligible to play in such a challenging academic environment. Under NCAA Division II rules, Mines student-athletes have to pass nine credits every semester. On top of that, they need to complete 24 credits in any given year, meaning that if they’ve only done the minimum nine in a semester, summer classes will be required to make up the difference. By the end of each summer term, a student-athlete’s cumulative GPA must be a 2.0 or above.

NCAA rules and Mines academic offerings have evolved over time, and in some ways, that’s been to student-athletes’ advantage. Dixie Cirillo has seen the changes firsthand working at Mines since 1991, including as Mines’ associate athletic director in charge of NCAA compliance and

“I’m really used to studying on buses. If we’re at a hotel and we have breakfast at 9 a.m., I’m up at 7 a.m. studying, and most of my teammates are doing the same thing.”

—Jake Feldman '19

academics since 2005. She points to the expansion of support resources such as the Center for Academic Services and Advising and the Multicultural Engineering Program as a major factor in student-athlete success. As a result, out of approximately 425 student-athletes in any given season, you can usually count the number who are ineligible on one hand.

“There are more places for kids to fit now,” said Cirillo. “With changes to the engineering program over the years, adding majors like electrical, mechanical, environmental and computer science, it’s been huge for athletics and our athletes.”

By Tim Flynn

► For more on Mines Athletics, visit minesathletics.com.



BRAVING THE WIND

PALM TREE-INSPIRED TURBINES COULD BE THE FUTURE OF WIND ENERGY



Mines researchers are working on a new wind turbines with a different kind of look—one that's inspired by palm trees.

Photo courtesy of UVA Communications

The future of wind turbines is just a drive down the road from the Mines campus.

The scaled-down prototype at the National Wind Technology Center in Boulder, though, was inspired from a decidedly un-Colorado source. The Segmented Ultralight Morphing Rotor, or SUMR, is more palm tree than pine.

“Palm trees bend in the wind but don't break,” said Kathryn Johnson, associate professor of electrical engineering at Mines. “The idea that Eric Loth at the University of Virginia came up with is to use that same bio-inspired load alignment for wind turbine blades.”

The end result could be the largest wind turbine ever built, a behemoth capable of producing 50 megawatts of power from an offshore wind farm versus the 5-10 megawatts the largest turbines produce today.

The key is flexibility. The turbine's two ultralight, ultralong blades are affixed in a downwind position, instead of the traditional upwind configuration. That will allow the blades

to bend out of strong wind, therefore putting less stress on the other turbine components.

Making sure the turbine behaves as desired is where Johnson and her PhD students come in. A control systems expert, Johnson is working with colleagues at the University of Colorado on the system that oversees the turbine's blade pitch, generator torque and more.

“When things get more flexible, they get harder to control,” Johnson said. “The big thing because of the flexibility is the deflection of the blade tips—how much it's moving out of the normal position, upwind and downwind. We're making sure it doesn't come too far upwind and hit the tower—because that would destroy everything.”

So, if you drive by the National Renewable Energy Laboratory's National Wind Technology Center and find yourself concerned by one of the turbine's blades flapping in the wind, that's entirely the point.

By **Emilie Rusch**

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Shareholder

B.S., Engineering, with honors, 2003; M.S., Engineering Technology Management, 2005 Top Graduating Electrical Engineer

Bruce Kugler
Patent Attorney,
Shareholder

B.S., Petroleum Engineering, 1981

Doug Swartz
Patent Attorney,
Shareholder

B.S., Mining Engineering, Minor in Metallurgical Engineering, 1982

Brad Knepper
Patent Attorney,
Shareholder

B.S., Electrical Engineering, 1998

Kristen Gruber
Patent Attorney,
Associate

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

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BLAZING THEIR OWN TRAILS

A PANEL OF LEADING WOMEN SHARE THEIR PERSPECTIVES

Some of the best women cyclists in the United States raced through Colorado at the end of August for the Colorado Classic, a four-stage cycling race that followed a trail through Steamboat Springs, Avon, Golden and Denver.

Ahead of the event, Mines and the Colorado Classic convened a panel of women who are leading the pack in their respective sports, fields and communities to address the topic of “Women Engineering Change and Blazing Their Own Trails.” Panelists included Erica Clevenger, the 2017 Collegiate Cycling Road Race National Champion, a USA Cycling Board Member and PhD student in environmental engineering at Mines; Tricia Downing, author and first female paraplegic to complete an Ironman triathlon; and Lauren Revis '15, a competitive equestrian and process development engineer at Gates Corporation.

Here are some observations and words of wisdom each panelist shared:

“Your path isn't set. You have to decide what you want out of your career. We wanted to show the younger generations that whatever you think is possible, is possible.”
—**Lauren Revis '15**

“One of the biggest challenges facing female athletes and engineers in general is awareness. We still have biases in our communities, and we culturally don't see women the same as men.”
—**Erica Clevenger**

“There have been many times where I've been the only woman in the room and the only one with a disability. But that shouldn't deter you. Everyone has the opportunity to reach for their dream. Be in touch with the person you are and what you value. You have the ability within you—it's just about putting in the time, hard work and effort.”
—**Tricia Downing**

▶ Watch a video on our website to hear more advice and words of encouragement from each of these women.

Ahead of the Colorado Classic cycling race, Mines convened a panel of women who are leaders in their respective sports, fields and communities.

Photo courtesy of the Colorado Classic

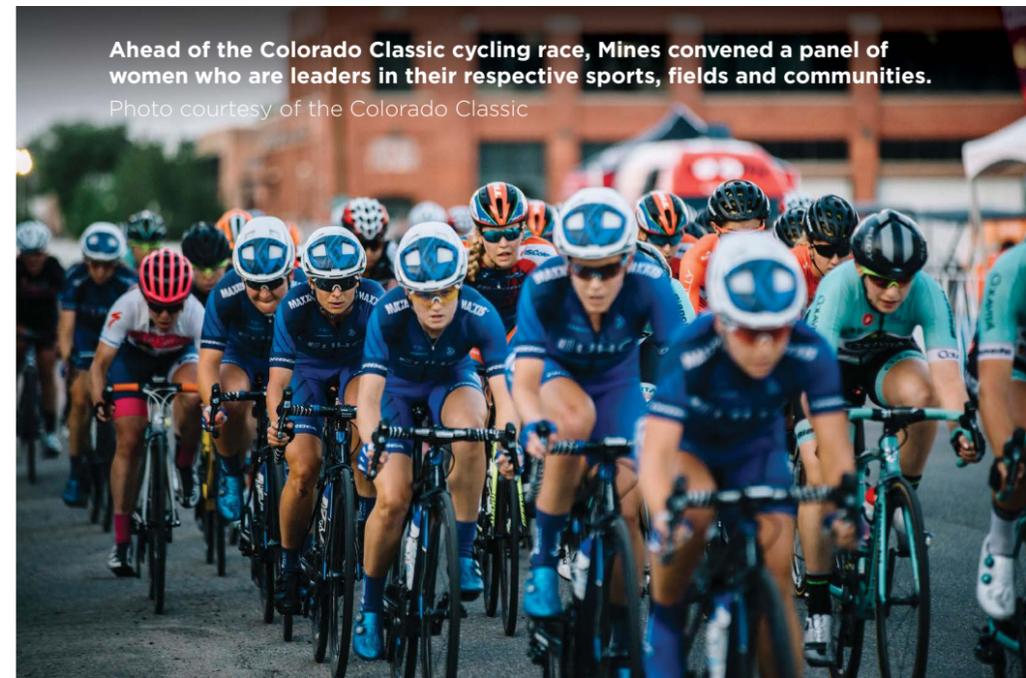


Photo courtesy of the Discovery Channel

IN CASE YOU MISSED IT... THINKING OUTSIDE THE COMIC BOOK

Build a real-life superhero suit? No problem.

Since Iron Man's first appearance in *Tales of Suspense* #39 in 1963, the technology behind his suit of armor has been limited to sequential comic book panels and computer-generated graphics on the silver screen. That is, until Adam Savage—of *MythBusters* fame—got involved.

Knowing Mines' strengths in 3D engineering, Savage approached Mines with the idea to create a suit out of 3D-printed titanium for his new TV show, *Savage Builds*, modeled after the armor Tony Stark builds in the first *Iron Man* film.

With 3D computer-model representations from Marvel Entertainment, Craig Brice, director of the advanced manufacturing program at Mines, and a team of students helped turn the digital designs into real-world, functional parts that could withstand immense force (like the impact of a bullet), yet still be light enough to fly. The end result may not have had all the bells and whistles featured in the blockbuster films, but the suit is certainly an impressive feat of engineering creativity.

▶ If you missed the “Building Iron Man” episode of *Savage Builds*, stream it online at go.discovery.com.

AN INTERDISCIPLINARY PERSPECTIVE

EXPANDING THE INTERSECTIONS OF GEOLOGY AND MINING

In many ways, a thorough knowledge of geology establishes much of the foundation for mining, which was certainly the case for Elizabeth Holley PhD '12, a geologist by training who is now a faculty member in the Mining Engineering Department at Mines.

We sat down with Holley to talk about the intersections between the two disciplines, one of her recent projects and what the Mines experience is like for her. Here's what we learned:

SHE BUILDS BRIDGES BETWEEN GEOLOGY AND MINING TO BENEFIT BOTH FIELDS.

Holley first came to Mines for her PhD in geology, which she completed in 2012. But she didn't leave Mines after graduation—instead, she became an assistant professor of mining engineering to help bring an interdisciplinary focus to both mining and geology at the university.

"We use geological tools to solve problems throughout the mining life cycle, whether it's in exploration, mine development, mineral processing, safety or reclamation," Holley said. "Mines is really the place to be working on the application of geology to sustainable use of earth resources. I think by intersecting with other disciplines, we can create a more informed and even better industry."

SHE LIKES SCIENTIFIC CONTROVERSY.

Nearly 80 percent of all gold produced in the U.S. comes from Carlin-type deposits—sedimentary rock-hosted, low-grade disseminated gold deposits—in northern Nevada, but scientists still don't agree on how they came to be and whether or not the deposits were created from magmatic fluids. Holley was awarded a National Science Foundation CAREER Award last year to study these deposits and tackle the scientific debate.

"These deposits are fascinating, because there's so much gold there, but we don't fully understand how it got there," Holley said. "Carlin-type deposits are, by their physical characteristics, very difficult to study scientifically. The ore minerals are very small, and they're not associated with many other minerals that are easy to examine using common geological techniques. If we're trying to understand how the gold was emplaced in these deposits, we need to find a Rosetta Stone that explains it to us."

Holley and her research team are focusing on a less-studied region in Nevada called the Battle Mountain district and will employ geochronology and thermochronology



Elizabeth Holley PhD '12 is an assistant professor of mining engineering, whose work focuses on the connections between geology and mining.

techniques as well as stable isotope geochemistry to try to fingerprint the processes that emplace the gold.

"One of the newer things we're doing is using nanoscale secondary ion mass spectrometry, which hasn't ever been thoroughly applied in these kinds of deposits and is ideal for very fine-grained materials," Holley said. "We're also working in a district with a range of deposit types rather than just studying the biggest, most world-class Carlin-type deposits. We're trying to investigate whether there's a continuum between definitively magmatic deposits and Carlin-style gold. Whether or not we can solve that problem, we will certainly learn interesting things."

HER WORK SUPPORTS OTHER EDUCATORS, SPECIFICALLY THOSE AT THE K-12 LEVEL.

As part of her CAREER Award, Holley is partnering with the Colorado Mining Association Education Foundation's All About Mining program to provide training for K-12 teachers in mining and related subjects that they can take back to their classrooms.

"Teachers in the program are invited to work with our research group, and we hope to help them develop curricula related to our project that they can bring into their own K-12 classrooms," she explained.

Holley and her mining geology research group also make themselves available for in-person or virtual classroom visits to talk about a variety of things, from technical subject matter related to geology and mining to more generalized topics, like what it's like to work in STEM. And being able to connect with other teachers and younger students is something that's close to Holley's heart.

"I've always wanted to teach because it provides me with the opportunity to have the highest impact on the world. The students are the ones who are going to go out and make big changes in industry, government, academia and public policy," she said. "Getting to work with them is a real privilege."

THE CONNECTIONS THE UNIVERSITY PROVIDES IS ONE ASPECT OF THE MINES EXPERIENCE THAT IS INVALUABLE TO HER.

"I'm privileged to be at an institution that supports excellence in both fundamental and applied research, specifically in natural resources, and I've had the opportunity to work with excellent students, and my

industry collaborations have been very positive." Holley said. "Mines is really a meeting place for very high-quality people. It's a great place to engage with problem solvers and thinkers in my field."

By Ashley Spurgeon



Holley and Mines graduate students on a field trip in Nevada.

Photo courtesy of Elizabeth Holley

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WHAT MAKES AN OREDIGGER?



Times change, but Mines graduates remain the same—hard workers who know their discipline cold.

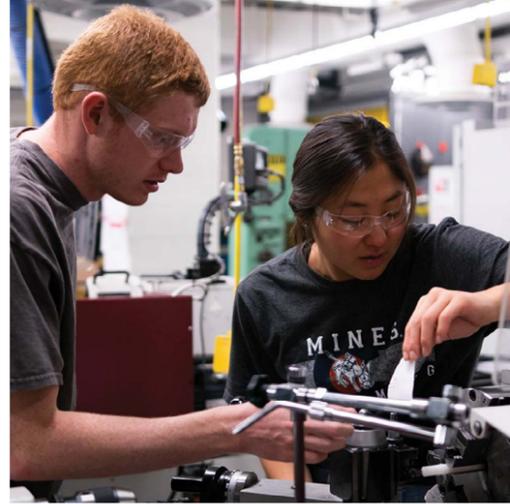
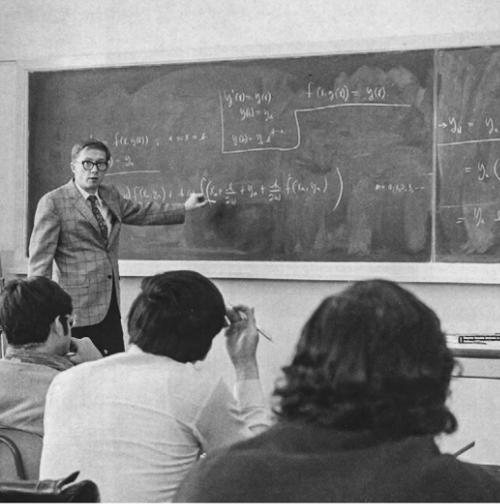
By **Lori Ferguson**

For more than 100 years, Mines has enjoyed a reputation as a tough, no-nonsense educator of engineers in the earth sciences. Although that ethos has not changed, aspects of the Mines educational experience have transformed over the past several decades to keep up with societal changes and evolving industry demands.

In years past, for example, students learned foundational skills by completing countless problem sets, a practice known variously as “drill and kill” or “plug and chug.” Today, students leverage technological innovations such as high-powered calculators and computers to learn the basics and more quickly begin to focus on higher-order thinking skills like synthesis, analysis, evaluation and design.

The approach to learning has also evolved, expanding from a predominantly lecture-based format to a more collaborative approach. The student body has grown from two graduates in the inaugural class of 1883 to more than 6,200 undergraduates, graduates and non-degree students; the campus' square footage has grown exponentially; and diversity within the student body is much greater—there are more women, more underrepresented minorities and more students from outside the state of Colorado.

Despite these generational shifts, conversations with alumni, faculty and administrators reveal that there are three characteristics to a Mines education that remain steadfast: a strong work ethic, superb expertise and an outstanding ability to work collaboratively to get the job done well, whatever it takes.



“The standards for admission to Mines have gone up over the years. Now, in addition to good grades and a strong work ethic within the classroom, students are expected to be involved in a host of other interests outside those four walls.”

—Teaching Professor Tracy Gardner '96, MS '98

MINES IS (STILL) HARD

“When I came to Mines as a freshman in 1955, I remember being told on the first day, ‘Look to your right. Now look to your left. In a year, one of those people will be gone,’” recalled Jim Payne, a geophysical engineering major from the Class of 1959.

Mining engineer Bruce Grewcock '76—now chairman and CEO of construction engineering company Peter Kiewit Sons' Inc.—has a similar recollection. “We were told at freshman orientation that a number of us were going to flunk out,” he said. “There was a sense that this place was different, and we all knew it was going to be tough. My freshman year, I remember walking up to a booth in the fieldhouse to sign up for a course, and the professor gave me my first homework assignment at the booth—I hadn't even attended class yet.”

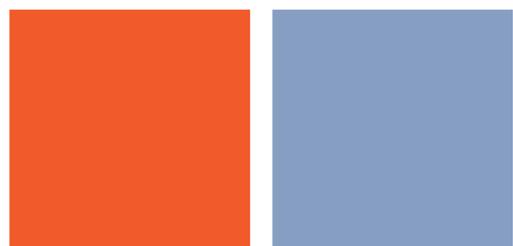
While today's students are no longer looking over their shoulders in the same ways as their predecessors, Jim Payne's granddaughter, Julia Payne '19, maintains that Mines still has a very challenging undergraduate program. “My grandfather always says, ‘Y'all have it so easy,’ but I can't really believe it was that much harder in his day,” she said.

In fact, it was her grandfather's good-natured ribbing that motivated Julia Payne to attend Mines in the first place. “He said I couldn't do it, so I said, ‘I'm gonna do it,’” she noted with a chuckle.

And she did. Julia completed her degree in geological engineering and is now an engineer-in-training with Austin-based Corsair Consulting. Attending Mines taught her what it means to work as hard as it takes for as long as it takes, she said. “For example, my senior year, I only had one class at 8 a.m. on Mondays, Wednesdays and Fridays, but I still did homework until 4 p.m. every day.”

While Julia argues that the difficulty of securing a degree from Mines has not changed, she does believe the approach to teaching is different. Teachers' expectations remain high, she asserts, but their approach is softer. “I think teachers are nicer and more willing to help than they were in my grandfather's day,” she observed. “My professors were willing to meet me outside of regular office hours and answered my emails at off hours. Their attitude was, ‘I'm a teacher, and I'm here to help.’”

Longtime faculty member Tom Boyd, an associate professor of geophysics and associate provost, agrees. “The learning experience has changed radically,” he said. “Thirty years ago, we lectured at students—and I say ‘at’ very intentionally. We lectured, then gave them six to ten hours of homework to do every week and called it good.”



But today, Boyd said, faculty approach teaching quite differently. “Thanks in part to guidance from staff at the Trefny Innovative Instruction Center, we've rethought our approach to residential instruction, and we're much less reliant on lectures,” he explained.

Instead, teachers are asking students to be more engaged in the learning process. “Alumni from the '50s, '60s and '70s wouldn't recognize our classrooms today,” Boyd asserted. “Nowadays, instructors are expected to help facilitate student learning—students take the lead in their educational experience.”

Teaching Professor of Chemical and Biological Engineering Tracy Gardner '96, MS '98 applauds the change. “Research on the ways that people obtain—and retain—information has shown that students who are involved in their own learning process are more successful, so I think it's much more helpful to think of ourselves as learning facilitators than as teachers or professors,” she said.

Gardner is quick to acknowledge that the landscape has changed for students as well. “The standards for admission to Mines have gone up over the years, not down,” she asserted. “Now, in addition to good grades and a strong work ethic within the classroom, students are expected to be involved in a host of other interests outside those

four walls.” And when they graduate, they will find that employers are also looking for well-rounded individuals, Gardner continued. “These days, companies are also not just looking at GPAs, they're looking at the whole person.”

The number of hours required to complete an undergraduate degree has also changed, decreasing from 160 hours to around 130. Boyd said that some alumni have expressed alarm at the new standard, and while he understands their concerns, he believes they are misplaced.

The reduction in hours doesn't reflect a dilution of curriculum, he argued. Instead, it's a reflection of changing times. “Although today's students aren't completing as many hours, they're gaining other extracurricular experience that's equally important to their education,” he pointed out. “They're involved in internships and more extracurricular activities off-campus. Today's students are more problem-based in focus rather than disciplinary-based, and they're constantly looking for ways to connect their passions with their expertise.”

Electrical Engineering Professor Kevin Moore, who also serves as Mines' vice provost for strategic initiatives and dean of integrative programs, seconds that opinion. “It's true that students are taking fewer credits these days, but nearly all students are doing an internship at some



point during their four years, and many are doing multiple internships,” he said. Moore also posited that virtually every student on campus is involved in at least two extracurricular activities. “They’re learning valuable lessons outside the classroom as well.”

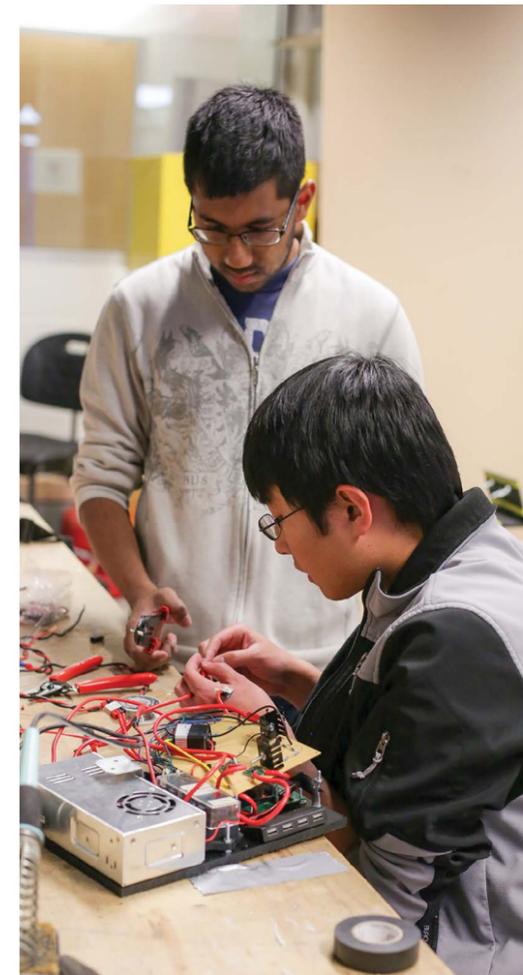
Standards remain high, and faculty retain their dedication to equipping students with a strong professional foundation, Boyd said, but they also recognize that students are less tolerant of homework that seems redundant or repetitive. “Our students want to understand connections between their studies and the real world and exploit the computational and visualization resources available to them—it’s the way they’re accustomed to learning.”

“Today’s pedagogy lends itself to learning better and faster,” explained Moore. “These days, we don’t need to assign 50 homework problems when we can use a team-based approach and three problem sets to convey the same lesson.”

Gardner agrees, but admitted she’s seen a change in the way students respond to the expectations placed upon them. “Being a student here is tough, and expectations are high,” she said. “At Mines, getting a B in a course is perceived by some students as failing, because they are used to earning A’s only—or primarily—and students sometimes struggle with that. As a teacher, I’m interested in what students do when they hit a wall and how they handle that perceived failure. I believe a student’s ability to persist and continue to learn when faced with something more challenging will correlate positively with their happiness as a working professional. It’s important to me that students graduate knowing how to think, solve problems and handle a situation well when it’s harder than they anticipated.”

Faculty are committed to helping students manage expectations and become more resilient and resourceful using the many campus resources at their disposal, Gardner continued, but she also encourages understanding. “Students sometimes forget that faculty are scientists and engineers, too, and students may misinterpret a faculty member’s seeming lack of enthusiasm or approachability as an indication that they’re disinterested or uncaring, which isn’t the case. We want to see these kids succeed,” she said.

This new approach delights Jim Payne. “Nowadays, the message that incoming students receive is, ‘Look to your left, and now to your right and know that we’re going to do our best to get you all through.’ And I think that’s a much better approach,” he said.



“Today’s pedagogy lends itself to learning better and faster. These days, we don’t need to assign 50 homework problems when we can use a team-based approach and three problem sets to convey the same lesson.”

—Professor Kevin Moore



TRADITIONALLY GROUNDED, FORWARD THINKING

For Julia Payne, this collaborative approach proved fruitful. She landed a job immediately after graduation and is already applying her education in the field.

“Professor [Paul] Santi always told us that getting an education at Mines isn’t about memorizing stuff—it’s about learning to work hard and learn on the spot,” she observed. “Working toward my degree at Mines, I learned to pick things up quickly and take criticism well, skills that have helped me to hit the ground running in my new job.”

While he graduated 60 years earlier, her grandfather said he realized the same benefits from his education. “My Mines experience gave me the background to compete with anyone in the oil and gas industry on a technical basis,” Jim explained.

Today’s students receive the same strong foundation, said Boyd, but they must be prepared to apply it within a different occupational landscape. “In the ’50s and ’60s, people were typically looking at a career path in one industry,” he observed. “Today, however, students expect to change careers and directions multiple times. They know they need to be able to embrace change and retool themselves mid-career, and they’re actually leading faculty in determining what skills they’ll need to thrive and survive in careers 10, 15 and 20 years out.”

And faculty are responding, employing new teaching strategies such as the studio model, which relies heavily on teamwork, and flipped classrooms, where teachers present the lecture materials online and lead students in more engaging, higher-level thinking in the classroom.

Online learning is also becoming increasingly commonplace, a trend that Gardner welcomes. “Students will inevitably have to do online training in the workplace, so gaining familiarity with this style of learning now can only benefit them,” she observed.

Gardner recently offered her Material and Energy Balances course to students online with what she feels to be great success. “This course is one of the toughest chemical engineering courses that students have to take, and every single kid in my online course had been unsuccessful in the traditional, residential class at least once. Overall, they all did great with the online offering,” she said. “It’s also the most interactive course I’ve ever had—the students asked lots of questions and helped each other tremendously in the online forum, and I was able to provide more individualized feedback than I have before in face-to-face courses. I feel it was rewarding for all of us.”

TACKLING TOMORROW’S PROBLEMS...TODAY

An ability to communicate well with others and work effectively in teams using the technology at hand is critical in today’s workplace, noted Kiewit CEO Grewcock. “Engineers and scientists today need to deal with multiple constituencies—politicians, regulators, members of the public—so they need to be well-read, well-rounded, and they need to know how to interface with society at large.”

“I’m pleased that the school maintains its sharp focus on a math and science expertise, but importantly has expanded its reach into the other engineering and science disciplines,” Grewcock continued. “Mines, in my humble opinion, is the go-to place in the world for tackling issues of earth, energy and the environment. No place else that I am aware of is preparing undergraduate or graduate students



“Earning a degree here is still challenging—that’s an inherent part of Mines—and that’s what produces such outstanding graduates.”

—President Paul C. Johnson



or doing the research necessary to ensure we continue to raise the standard of living of the world and solve some of our most pressing challenges.”

“Earning a degree here is still challenging—that’s an inherent part of Mines—and that’s what produces such outstanding graduates,” observed President Paul C. Johnson in a July 2019 episode of the *Getting Smart Podcast*. “The value of an engineer going into the future is not only how well they do the calculations—that will always be an element—but also how they view the connections between the problems that they’re working on and the impact on society and industry.”

Mines students have always been recognized for their superb disciplinary expertise, strong work ethic and ability to work collaboratively to solve a problem, noted Boyd, and that will never change.

“Students from other institutions compete with each other, but that doesn’t happen at Mines. Our curriculum has always been so difficult that students had to work together in order to survive—we’ve come to realize that’s what makes us unique.”

Nowadays, however, faculty are trying to be more thoughtful in incorporating this trait into the Mines experience. “Older alums never say they graduated Mines, they say they

survived and got out,” Boyd said with a rueful laugh. “Our aim is to maintain those high standards while also enabling students to recognize and value the learning experience as soon as they graduate, rather than 10 or 15 years later.”

“We’re on a very positive trajectory here at Mines,” said Gardner. “The current administration, faculty and staff are keenly focused on the fact that the higher education landscape is changing. Mines was already doing a great job of providing an excellent education when I was a student—that’s why I wanted to become a professor—but I believe the current learning experience is even richer now than it was for previous generations. Mines offers students an outstanding learning experience, and we’re poised to become even better. I feel really lucky to be a part of it.”

“Faculty expect students to be serious, grown-up and committed to their studies—that hasn’t changed,” Moore observed. “Mines graduates have always seen themselves as people who can have an impact and make the world a better place. Today’s students are working hard to continue that legacy.”

OREDIGGER SNAPSHOTS

New alumni open up about their Mines experience

By **Ashley Spurgeon**



MECHANICAL ENGINEERING

Austin Hayes '19
Technical sales engineer,
ABB Motors and Mechanical Inc.

Q: What attracted you to ABB Motors and Mechanical Inc.?

A: I was looking for a company that could provide me with a long-term career. ABB is a large, successful company with lots of opportunity for me to grow within the company. I also wanted a job where I could stay active and socialize with people instead of doing technical work and sitting at a desk.

Q: What part of the Mines experience has benefited you even after graduation?

A: I think the most critical part of the Mines experience that has helped me was my involvement on campus. Being involved helped me come out of my shell, develop my communication and collaboration skills and become a very sociable person. In a professional setting, the ability to communicate effectively and develop relationships with others has been crucial to success in my career.

Q: What was the most helpful thing you learned at Mines?

A: One of the most valuable things I learned in the classroom was networking and collaboration. Mines was too difficult to do by myself. Oftentimes, who I knew was more important than what I knew. When I worked on homework, projects or studied with classmates, it was more beneficial to work with others than do it by myself. It allowed us to solve problems faster and talk about what we were learning, overall better developing our understanding of the material.

Beyond the classroom

- Men's Club Soccer
- Kappa Sigma Fraternity



ME GRADUATES IN MAY 2019
252 BACHELOR'S DEGREES
46 GRADUATE DEGREES



MINING ENGINEERING

Roy Bryant Megaptche Kouteu '19
Mines graduate student

Q: What attracted you to mining engineering?

A: I wanted a career with the opportunity to travel across the world, be exposed to different cultures and be able to give back and help solve important issues. I also wanted to have the flexibility of either working in the field or in the office, so mining engineering was the perfect fit.

Q: What do you think was a critical part of the Mines experience that has helped you get to where you are today?

A: Being part of the Mines community is quite rewarding. We get to interact with the brightest people in many industries. Because people come from different backgrounds and different places around the world, they also think differently, and that helps us understand the dynamics of the fast-paced work environment.

Q: Why did you decide to come back to Mines to pursue a double master's degree in mineral and energy economics and petroleum economics and management?

A: As an undergraduate, mine valuation was one of the best classes I took. Dr. John Grubb introduced us to multiple economic concepts related to the mining industry, and the course emphasized the business aspects of mining. The semester went by too fast, and I wanted to learn more. I applied to graduate school to both expand my existing knowledge and to create additional opportunities for myself in the future. I believe graduate school will prepare me for a more successful and challenging career.

Beyond the classroom

- Society of Mining Engineers
- Society of Petroleum Engineering
- National Society of Black Engineers
- Co-founder of the Mines African Student Union



MN GRADUATES IN MAY 2019
18 BACHELOR'S DEGREES
2 GRADUATE DEGREES



PETROLEUM ENGINEERING

Nadya Sri Rushdi '19
Field engineer, Schlumberger

Q: Why did you study petroleum engineering?

A: Petroleum engineering allows various opportunities to work in the field and gain the necessary hands-on experiences. Although a significant number of people view petroleum engineering as a dying industry, it still thrives and continues to improve with new technologies. It is also stigmatized as a polluting industry, which motivates me to change that mindset.

Q: How do you think Mines helped you get to where you are today?

A: I really appreciated how Mines encouraged students to be open-minded, and it taught me to appreciate everyone's differences and play to each other's strengths, especially when dealing with group projects. The industry exposure also helped introduce me to new developments in the field, better understand the workings of industry and create valuable connections.

Q: What was one of the most valuable things you learned in the classroom?

A: The most important lesson was to always be ethical and maintain my integrity at all times. There will come a time where one will be tempted to take the easy route, but if it means having to turn a blind eye and give up my integrity, then it's not worth it. But I also learned that not everything can be learned in a classroom setting. Books and computers can only go so far, but being able to apply that knowledge is critical.

Beyond the classroom

- Tau Beta Pi Engineering Honors Society
- Pi Epsilon Tau Petroleum Engineering Honors Society
- Golden Key International Honour Society
- Malaysian Society



PE GRADUATES IN MAY 2019
99 BACHELOR'S DEGREES
10 GRADUATE DEGREES



CIVIL AND ENVIRONMENTAL ENGINEERING

Megan Freytag '19
Engineer in training,
Alan Plummer Associates Inc.

Q: Why did you want to work at Plummer?

A: They have an excellent reputation, both as engineers and people. The company values are meaningful, and the company provides their employees with challenging and meaningful careers.

Q: What part of the Mines experience has helped you get to where you are today?

A: A critical part of my Mines experience was my senior design project designing a sustainable toilet system for the Everest base camp in Nepal, an area which has waste management issues due to the high tourism rates. For this project, I had the opportunity to travel to Nepal and see why previous toilet designs failed and meet many amazing people who could benefit from our new design. It was an eye-opening and invaluable experience to see how these people lived, and it helped us create the best solution.

Q: What did you learn in the classroom that has proved to be invaluable?

A: One of the most valuable things I learned in the classroom was unit analysis. Unit analysis was the majority of the fundamentals of engineering exam, so I could not have passed without it.

Beyond the classroom

- Undergraduate research developing hydraulic selection technology for wastewater
- Worked at the Book and Brew coffee shop in the Arthur Lakes Library
- Hike for Help



CEE GRADUATES IN MAY 2019
63 BACHELOR'S DEGREES
18 GRADUATE DEGREES

THE PROGRESSION OF INNOVATION

QUICK HITS OF DECADES PAST

1960s

On July 20, 1969, Apollo 11 landed on the Moon, marking the first time humans set foot—literally—on terrain beyond Earth. This defining moment spurred a fascination with space for many and propelled future explorations and discoveries within our solar system and beyond.

Average student population: 1,252
Tuition in 1960: Resident: \$235 | Non-resident: \$650

Campus expansions:
 1960: Volk Gymnasium
 1963: Meyer Hall
 1964: Ben H. Parker Student Center



ALUMNI PERSPECTIVE

“Mines was a campus whose culture transformed me and fulfilled my life’s purpose. The opportunities at Mines gave me an education, creative interest and confidence to solve and deal with any problems that I have encountered.” —**Phil Bowman '67**

1970s

The first commercially available microprocessor, the Intel 4004, was released by Intel Corporation in 1971. The 4-bit central processing unit shook up the IT world, becoming the core of personal computers and most electronic devices in use today.

Average student population: 1,880
Tuition in 1970: Resident: \$350 | Non-resident: \$1,100

Campus expansions:
 1972: Green Center
 1975: Aspen Hall
 1977: U.S. Geological Survey
 1979: Earth Mechanics Institute | Weaver Towers



ALUMNI PERSPECTIVE

“There are several things a Mines education drills into you that are critically important. One is learning how to work hard. Mines teaches you how to buckle down, stay focused and wrangle whatever the challenge is you’re trying to conquer. All of that leads to confidence—you have to have confidence to be able to tackle obstacles and be a leader in business, have people be willing to follow, be a good role model and a good example.” —**Howard Janzen '76, MS '77**

1980s

In the early 1970s, it was believed the U.S. would source a large portion of its energy from nuclear power. But the 1979 Three Mile Island accident in Pennsylvania and the April 1986 disaster at the Chernobyl nuclear power plant in Ukraine significantly changed these projections.

Average student population: 2,052
Tuition in 1980: Resident: \$694 | Non-resident: \$3,672

Campus expansions:
 1980: Brown Hall



ALUMNI PERSPECTIVE

“One of the key learnings a lot of us had at Mines is that if you take on a challenge and find a way to persevere, you develop confidence. I’ve grown up in industry with other Mines alumni, and we have a lot of good networks professionally and socially. At Mines, we got a solid foundation for some great, fun and challenging opportunities along the way.” —**Steve Enger '81**

Mines is continuously at the forefront of scientific and technological innovation, adapting to evolving societal needs and solving some of the world’s complex problems. To continue being a preferred partner in industry and the place for educating top scientists and engineers, Mines has had to expand its educational scope, campus size and more over the years while remaining true to its commitment of tackling the biggest challenges in earth, energy and environment.

Although Mines often looks to the future, we’re taking a moment to look back. Here’s a brief breakdown of what Mines has looked like in the past six decades and some defining moments in science and technology that have shaped how graduates of the time viewed the world.

1990s

The World Wide Web was made available on a royalty-free basis in April 1993, creating the basis for new methods of communication, information access and social interaction.

Average student population: 2,446
Tuition in 1990: Resident: \$3,540 | Non-resident: \$9,812

Campus expansions:
 1998: Mines Park



ALUMNI PERSPECTIVE

“When I did a trip to Everest base camp, I wore a Mines baseball cap. As I was coming down the trail, this woman and man came up and said, ‘We go to Mines.’ So anywhere you go you can find a Mines alum—I know people from all over the world because of Mines.” —**Donna Anderson PhD '97**

2000s

In 2003, the Human Genome Project was completed, determining the sequence of nucleotide base pairs that make up human DNA and mapping the genes of the human genome from both a physical and functional standpoint. The project has helped shed light on human migration, common diseases, new energy sources and more.

Average student population: 3,278
Tuition in 2000: Resident: \$4,750 | Non-resident: \$15,304

Campus expansions:
 2001: CTLM | Phi Gamma Delta Fraternity House
 2002: General Research Laboratory (and new home of the Geology Museum)
 2004: Alpha Phi, Pi Phi and Sigma Kappa Sorority Houses
 2007: Student Recreation Center



ALUMNI PERSPECTIVE

“Mines is unique in that it educates a wide range of sectors tied to the mining industry. Consequently, when we engage with Mines students and alumni, we can feel comforted that the same discipline and rigor is being applied across the various aspects of the mining industry, not just a targeted area of focus. This fact also allows us to increase the diversity of our teams by bringing in people with complementary skill sets.” —**Josh Parrill '03, MS '08**

2010s

IBM unveiled the IBM Q System One—its first-ever quantum computer designed for commercial use—in January 2019. Quantum computers promise to vastly outperform regular machines and could spur the development of new breakthroughs in science.

Average student population: 6,117
Tuition in 2010: Resident: \$13,174 | Non-resident: \$24,750

Campus expansions:
 2011: Maple Hall
 2012: Marquez Hall | W. Lloyd Wright Student Wellness Center
 2014: Harold M. & Patricia Korell Athletic Center | Marv Kay Stadium | Elm Hall
 2015: GRL Annex | Starzer Welcome Center
 2017: CoorsTek Center for Applied Science and Engineering



ALUMNI PERSPECTIVE

“I think Mines tries to emphasize not only the technological piece but the ethical piece along with that. Not only does Mines encourage innovation and new technologies but also encourages students to ask how that is impacting the world.” —**Sydney Zywicki '10**

EXPANDING ENTREPRENEURIAL ROOTS

MINES IS BECOMING AN EPICENTER FOR DEVELOPING BUSINESS VENTURES

Long renowned for turning out top engineers and scientists, Mines is increasingly distinguishing itself in another way—as a hotbed for entrepreneurship.

Mines has tapped into a deep groundswell of enthusiasm among its students, faculty and alumni for cutting-edge ideas and the startups and other companies that bring them to life. As the culture of entrepreneurship at Mines grows, it is enhancing the school's reputation as a breeding ground for promising business ventures and helping local companies gain the support they need to climb the arduous ladder to success.

CENTER OF INNOVATION

Over the past year, Mines' entrepreneurial focus has expanded. The Division of Economics and Business, in collaboration with the Center for Entrepreneurship and Innovation, now offers several entrepreneurship classes, ranging from introductory subjects to the more advanced, such as "Hacking for Defense," in which students work to solve real-world national security challenges presented by the U.S. Department of Defense and the intelligence community.

All entrepreneurial classes emphasize the practical aspects of developing a business and are taught by professors with help from co-instructors from Denver-area startups, who serve as mentors to the students.

"We reach out through our alumni network and sources in the Golden community to find mentors who have experienced the trials and tribulations of starting a business. They can help students navigate barriers as they work through a business problem or validate their ideas," said Sid Saleh, an economics and business teaching associate professor who serves as associate director of the center.

Mines also interacts with the local startup community through The Wright, a nonprofit that sponsors an annual innovation challenge designed to help companies in the

outdoor activities industry. Ten companies come to campus to present "reverse pitches," describing their plans and obstacles and soliciting student help. Students from Mines and other Denver-area schools form teams that work with mentors to solve the problems.

"It's not abstract stuff from a class—they engage with real problems provided by real companies," Saleh explained.

This year's challenge illustrates how the program benefits both students and startups. Three Mines teams worked with Cipher Skin, a Denver startup that patented a sensor mesh material that can capture data on human movement to help athletes and people recovering from injuries. But first, the company needed help miniaturizing its sensors and incorporating them into clothing.

One Mines team designed a shirt that measures heart rate and arm movement. Another developed a working prototype of leggings that measure injury recovery. A third team took a completely different approach, using the material to wrap around an oil or gas pipeline to predict failure.

Working with real companies allows students to develop a new set of skills, said Werner Kuhr, director of the Center for E&I. "Mines students have always had a good reputation for their technical ability. But when they talk to stakeholders, they develop their personal skills and learn to understand the problems the company is trying to solve."

REACHING OUT TO ENTREPRENEURS

Entrepreneurs in the Front Range area get a boost from the E&I Interest Group, which facilitates networking opportunities with other startup owners, as well as experienced founders who remember the uncertainties and challenges they faced in early days.

"I'm able to connect with people who have been there and done that. They helped me step into the role of CEO and figure out how to put data behind my decisions while keeping the big picture in mind," said Blakelee Mills '10, the CEO of Golden Software. Though her company is not a startup, she made fundamental changes after purchasing it in 2014. The E&I Interest Group has provided guidance and confidence along the way.

A couple of years ago, a member connected her with a firm that provided training to help her team, many of whom work remotely, collaborate better. "The training pushed us outside of our technical comfort zone, as it forced us to better understand our behaviors and taught us how to adapt to our teammates to better communicate with one another. It definitely helped, and we still apply the concepts today," said Mills, who is also working with the firm for personal leadership coaching. "I know I can reach out to anyone in the E&I group and say, 'Can you help me out?' and they most certainly do."

The E&I Interest Group also connects startups to Mines students. William Loopesko MS '12 was invited to Saleh's entrepreneurship class to discuss his company PuppTech, which allows dog owners to monitor their pets in cars or kennels for signs of distress. Two students in the class volunteered to work with him as interns, designing the casing for his monitor.

"I'm not a mechanical engineer, and this turned into a significantly larger project than I imagined," Loopesko said. "There are specific design concerns for injection molding that I didn't know about, but these kids were learning about it in school." The students worked directly with his manufacturer to develop a smooth, cost-effective container for the monitor.

ANGEL INVESTORS

E&I members encourage startup founders to pitch their ideas to the Rockies Venture Club, an angel group that invests in 25 companies a year, mostly in Colorado and the surrounding area. Loopesko, who was invited to pitch, acquired several "followers"—investors with a serious interest in the company who provide the first step toward gaining funding.

The club became involved with Mines after E&I members began attending its workshops in Denver for entrepreneurs and investors. After seeing their enthusiasm and learning about Mines' growing culture of entrepreneurship, the club formed a new investor group in Golden in partnership with Golden-based venture catalyst Traxion. Many members are Mines alumni, and the group meets monthly at the school.

Though the Golden group is only a year old, 50 percent of its members have already made investments through the club. "That's a really high response rate for a newly formed group," said Rockies Venture Club Managing Director Dave Harris.

Because the group has taken a special interest in clean energy technology, the club will partner with the Colorado CleanTech Industries Association to launch a second investor group at Mines centering on startups in that industry.

Rockies Venture Club also works with the school, hiring entrepreneurial-minded students as interns, such as computer science student Torin Johnson.

"It's helping me understand a lot more about how startups work, especially in the early stages. I've also learned how investors think and look at financing," Johnson said.

Through his work with the club and his entrepreneurship classes at Mines, Johnson is learning important skills to complement his engineering training. "You're looking for pain points people have," he said. "It's not like engineering, where you're given problems to solve. You need to find the problems."

Through its classes, alumni groups and networking with investors and startups, Mines is rapidly becoming a force for innovation in the Denver area. But the school's work is nowhere near complete.

"We're just getting warmed up," Saleh said. Working with the E&I Interest Group, the center is considering developing workshops, boot camps and online courses for alumni who want to hone their entrepreneurial skills. Saleh continued, "We've got the student programs in place. Now we want to bring in companies and alumni. Sharing problems is hugely beneficial to students, entrepreneurs and industry."

By **Teresa Meek**

FALL 2019 ON OUR WALL

Would you recommend Mines to an incoming student today, and what would you tell them?

Mines teaches you to be humble. This will take you further in life than any other skill.

Gerald Hua '12

I learned a lot at Mines—perhaps less engineering and more about thinking linearly and showing up to work every day. But with that said, the school seems a lot tamer and a lot more like every other engineering school these days.

Nathan Alred '81

The most valuable and useful piece of paper I've ever held in my life: my Mines diploma. You might not know this for 20 or 30 years, but trust me, it is.

John Seibert '72

Yes, I would recommend Mines to students who are smart and ambitious. Specifically, I would tell them that if you work hard at Mines for four or five years, the rest of your life will be a little easier, and you'll be ready to take on opportunities as they come your way.

Phyl Porter '80

Mines is the gateway to professional respect and a future full of opportunity.

Gail Myer '80

Mines family can make it through anything.

Karan Amol Titus '16

MINES ALUMNI ASSOCIATION

STUART BENNETT '66

Interim Director of Alumni Engagement

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STARZER

WELCOME CENTER

1812 Illinois St.
Golden, CO 80402

303-273-3295
303-273-3583 (fax)

minesalumni@mines.edu
minesalumni.com



ALUMNA PROFILE

THE MOUNTAIN OF THE SPIRIT

Mount Manaslu, located in the Nepalese Himalayas, towers 8,163 meters (26,781 feet) above sea level and ranks as the highest peak in the Gorkha District. Its name comes from the Sanskrit word *manasa*, meaning “intellect” or “soul,” and means “mountain of the spirit.”

It was the height and magnitude of the mountain that inspired Jeannette McGill MS '07, PhD '10 to make the climb in September 2018, becoming the first South African woman to summit the peak.

“I really just wanted to see if I could get up to 8,000 meters,” she said. “Manaslu was never really on my horizon—I was actually supposed to do another peak, but it was obviously meant to be because I ended up doing Manaslu as my first 8,000-meter mountain.”

Growing up in an outdoorsy family—and later becoming a professional geologist and global mining executive—McGill has always been drawn to the mountains and understands the value of women getting outside and experiencing nature because of how it facilitates confidence. She even described her Manaslu expedition as “a climb for women’s empowerment.”

Women’s empowerment is close to McGill’s heart and something she feels is closely tied to climbing. “As a woman in mountaineering, you can learn to dig deep, you can go for these big goals and these big goals are available to everybody,” she said.

Whether it’s an 8,000-meter peak or a hike to a high alpine lake in Rocky Mountain National Park, McGill believes that women can learn a lot from being outside. “I’ve really seen globally how women get treated differently in terms of opportunities and what’s possible,” she explained.

McGill has been collaborating with Saray Khumalo—the first black African woman to summit Everest—on Summits with a Purpose, an initiative to create a community of female mountaineers and promote literacy.

“To be able to talk to and coach some of the ladies in South Africa has been great,” McGill said. “They have always thought life is about children and family, but I want to show them even small things are possible to do themselves. I think it’s really important that every woman is empowered to go, ‘You know what, this is what I feel like doing. It’s valid, it doesn’t matter what anyone else says and it’s possible.’ My journey happens to be big mountains, but it doesn’t have to be the same for everyone.”



Jeannette McGill MS '07, PhD '10 became the first South African woman to summit Mt. Manaslu in September 2018.

Photos by Lakpa Sherpa

“As a woman in mountaineering, you can learn to dig deep, you can go for these big goals and these big goals are available to everybody.”

—Jeannette McGill MS '07, PhD '10

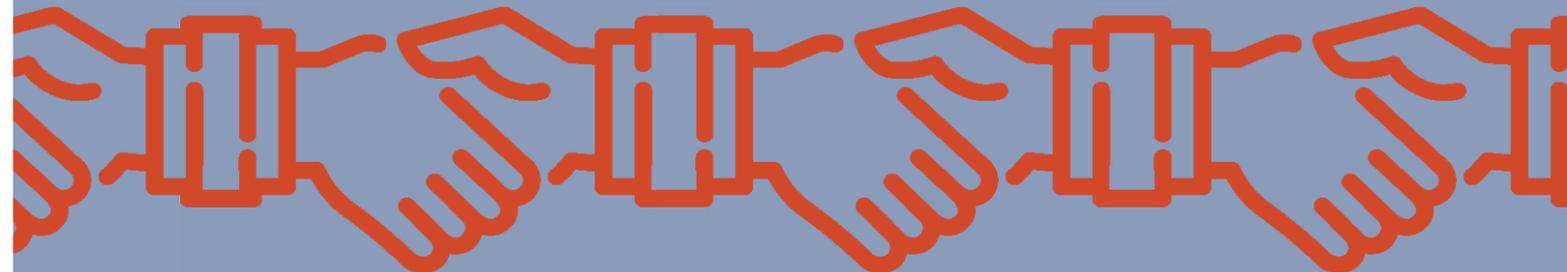
After Manaslu, McGill found that 8,000-meter mountains can be quite addictive, and her sights are set on others for the future. But don’t expect her to tackle Everest just yet. In climbing Manaslu, McGill learned the importance of choosing a goal that has personal significance—not just a mountain to check off a list.

Manaslu imprinted its *manasa* on McGill, seemingly appropriate for a woman whose spirit is so closely tied to the mountains. Just as she said, it must have been meant to be.

By Kateri Kramer



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OREDIGGERS GIVE BACK

BRINGING OREDIGGERS TOGETHER

The Mines community has always been something special to Greg '86 and Lanai Wolfe '85. For Greg, it was about being part of the Oredigger football and wrestling teams as a student and then, later, the continued bond with his teammates. For Lanai, the friendships she created at Mines are still important in her life, even as those friends live around the country. Now the Wolfes are nurturing new Oredigger friendships and cultivating the Mines community in Oregon, where they co-lead M Club Portland.

As Mines approaches its 150th anniversary, the university has plans to increase alumni affinity, visibility and involvement in engagement programs to foster loyalty, pride and a pay-it-forward attitude among students and graduates.

"We laugh about a Newsweek article in the '80s that was talking about a Mines education and the rigor of the academics and how the student body was so connected because they were all 'riding the same tumultuous boat together,'" Lanai said. "That binds people together, and that sense of community has stayed with us our whole lives."

The Wolfes recently hosted a Mines welcome party at their house, which brought together incoming students and their families, current students who were home for the summer and local alumni to celebrate the Oredigger spirit before the academic year began. This is the third year they've hosted the party—the couple enjoy the opportunity to engage with a variety of community members, and they are encouraged by the caliber of the incoming students.

"Mines is not that well-known up here, so the fact that [these students] have an interest in engineering, sought out good engineering schools and chose Mines is exciting for us," said Greg.

Lanai enjoys seeing the incoming students connect with current students and swap phone numbers so they can stay in touch when the fall semester starts. And she always provides guidance (and comfort) for new Oredigger parents.

The Wolfes also monetarily support the athletics department and have contributed to the Clear Creek Athletics Complex, the wrestling locker room improvement and other areas. Greg knows well that excellence on the field often leads to success in other areas.

"The strength of the Mines reputation and community benefits all of us. We continue to be involved because it's a great thing to see the best engineers in the world coming out," Greg said.

Lanai added that whether it's through time or treasure, she's proud to be able to support the Mines community. "It is very rewarding to be able to give back to an institution that has given us so much."

By Anica Wong



Lanai '85 and Greg Wolfe '86 are longtime Mines fans, and continue to help cultivate a community of Orediggers.

The Wolfes co-lead M Club Portland, encouraging local Orediggers to come together and celebrate being a part of the Mines community.

Photos courtesy of Lanai Wolfe

ALUMNUS PROFILE

BUILDING HOUSES IN THE SKY

Imagine a space surrounded by nature, removed from the rest of the world—a place to play, decompress and get away from it all... in your own backyard. A treehouse offers fun and relaxation for adults and children alike, and that's exactly what Cord Moody '07 provides through his business, Denver TreeHouse.

From small spaces a few feet off the ground to fantastical structures sprawling high in the trees, Moody has built more than 200 treehouses across Missouri, Kansas and Colorado since starting his first treehouse business, St. Louis Treehouse, in 2010.

Moody got the idea for the business when he was considering a play space for his then-6-month-old son. "We didn't have a swing or a slide, but we did have a bunch of great trees in the yard," he said. "So I thought, why build or buy a regular playset if I can do a treehouse?"

When Moody sat down to research the possibility, he came across Pete Nelson's treehouse website (which would later become the inspiration for Treehouse Masters, a TV show about designing and building custom treehouses). Moody quickly realized that not only could he build treehouses but there was also a viable market for customized play structures. "It just clicked that night that this was what I was supposed to be doing," he said.

Moody created a website and registered a company on the spot. Within five hours, the business was up and running, and two months later, the first orders started to come in. At first, he built treehouses part time, but two years in, it was a full-time job.

Moody attributes his ability to think through a project piece by piece, and to keep an open mind about how to get to the final outcome, to his Mines training. When working on design projects as a Mines student, he learned to use "new ways, new calculations and new methods to find a solution" to each problem, something he encounters with every new idea clients send his way.

It's the on-the-spot creativity and engineering challenge of building around a tree's natural structure that Moody loves about his work. "The way the slides, rope ladders and bridges are incorporated is different every time," Moody said.

Other things Moody loves about his job? Getting to spend time outdoors, the joy he sees in his clients—especially the



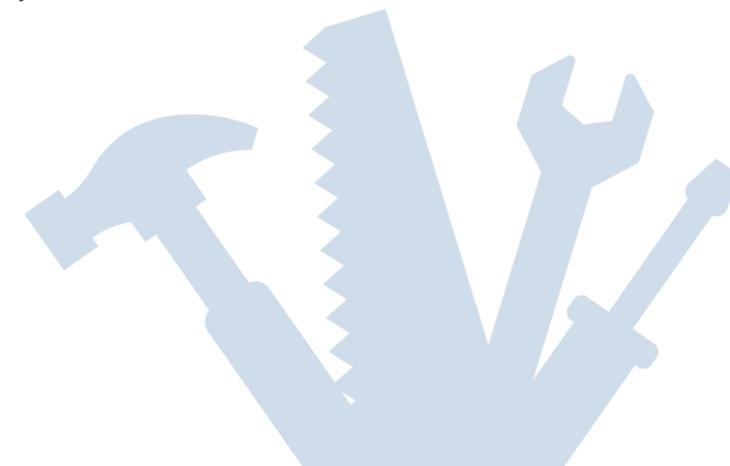
Engineering treehouses is no easy task, but Cord Moody '07 has turned it into a lucrative business.

Photo by Kyle Moody

kids—and working with his brother, Kyle Moody '12, who has helped build several of the structures.

"It takes enjoying being outside and enjoying nonstop challenges," Moody said of succeeding in the treehouse business. "There's always going to be something different from what you've done before."

By Amanda Schuster



BABIES



CONTINUING THE MINES TRADITION...IN 2036

Esther L. Wolfram was born on September 8, 2018, to Edward Wolfram '15 and Cassandra Wolfram. When Esther grows up, she wants to continue in the Wolfram tradition of attending Mines like her father and two uncles.



FUTURE OREDIGGER

Elis Robert Gower was born on February 3, 2019. He joins a family of Orediggers, including proud parents Dr. Michael Gower '04 and Eileen (McFadden) Gower '04, future engineer big brother Owen (2) and grandpa Dale McFadden '76.



WELCOMING A NEW FAMILY MEMBER

Jamie (Berghorn) Dineen '11 and Charles Dineen welcomed their second child, Emma Marie, on April 4, 2019.



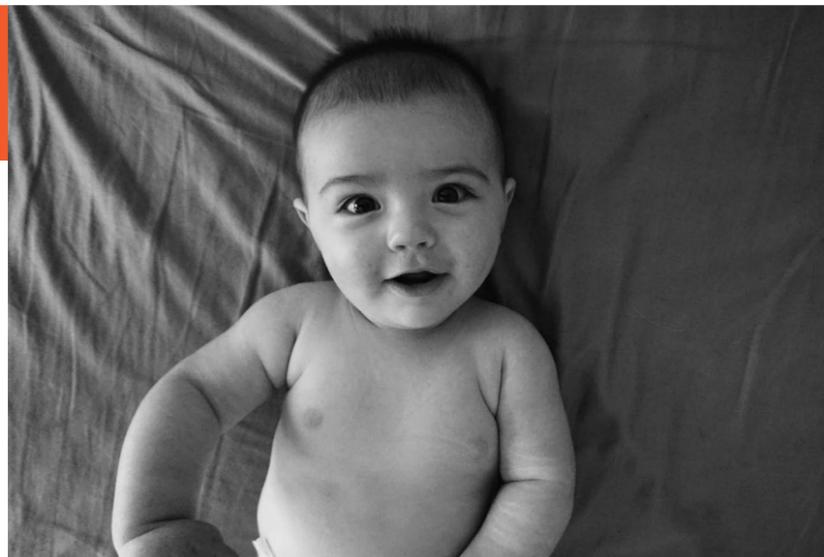
SUN'S OUT, TONGUES OUT

Joshua Reed '16 and Elizabeth Reed are proud to announce the birth of their daughter, Nova Mackenzie Reed, who arrived October 1, 2018. She has brought her parents much joy.



BEARY ADORABLE ADDITION

Cheyenne Lin Guiley was born on April 30, 2019, to Brooke (Sorenson) Guiley '15 and Jeremy Guiley '15. She enjoys long walks on the beach and drinking milk in Napa Valley.



A NEW BOY

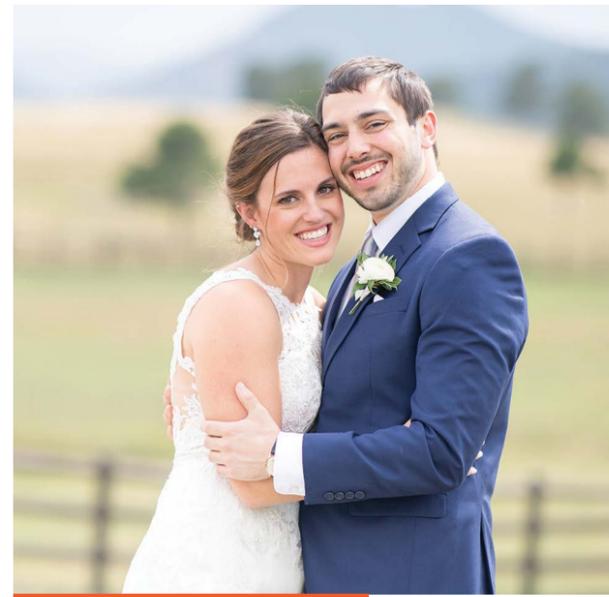
Lucas Adams '10 and Channele (Santilli) Adams are thrilled to announce the birth of their son, Isaac Oliver Adams, born on December 1, 2018.

WEDDINGS



MILE HIGH ROMANCE

Following a surprise engagement at the mile high step in front of the Colorado State Capitol Building, Lianne Nelsen '14 and Marty Droze were married May 25, 2019, in downtown Denver. Members of the wedding party included Sarah King '14, Breanna Stranges '14, Kevin Nelsen '18, Christian Eron '13 and Chad McKenna '11. Lianne is an application engineer at Sundyne and Marty is a civil engineer at HDR.



FINDING LOVE DURING E-DAYS

Christine Birkholz '14 and Max Moran '14 were married on August 4, 2018, at Spruce Mountain Ranch in Larkspur, Colorado. The couple met at E-Days during Christine's freshman year, and she couldn't help but fall for Max's cul-de-sac hairstyle. More than 30 Mines alumni attended their wedding, including maids of honor Lucia Guzman '14 and Nicole Kennedy '14 and groomsman Ryan Bott '14.

IN OTHER NEWS



EXCELLENCE IN COMMUNITY INVOLVEMENT

Ralph Dougherty '56 was named the 2018 recipient of Metrolina Business Council's Donald Haack Foundation Award for Excellence in Community Involvement. The award carries the name of Charlotte, North Carolina's late diamond expert and community leader and recognized Dougherty for his commitment to charitable organizations. MBC donated \$1,000 to his charity of choice, Parkview Community Foundation, Inc., an after-school program for at-risk children he leads as president.



RISING STAR IN ENGINEERING

Benny Lujan '07 was just named a Rising Star in Structural Engineering by *Civil + Structural Engineer* magazine, just one of 20 chosen among all of the nation's young engineers. The award recognizes younger professionals whose exceptional technical capability, leadership ability and public service has benefited the civil or structural engineering professions, their employers, project owners and society. Lujan was recognized for the breadth of his professional experience and his commitment to the engineering community.



BOCCE CHAMPION

Jolene Kramer '83, with her teammate Teresa Rea, won the 2019 U.S. National Bocce Championship Women's Doubles gold medal in San Francisco, California, on July 12, 2019.



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LEAVING THEIR MARK

MINES ALUMNI SHINE IN THE KUWAIT OIL SECTOR

Many Mines alumni have risen through the ranks at Kuwait Oil Company (KOC), receiving numerous prestigious awards and becoming influential leaders in the region and the petroleum industry overall. Here, we have highlighted a few who are making a positive impact on the Kuwait oil sector and who have been recently recognized for their achievements.



MARIA ANGELA CAPELLO MS '95 was granted an honorary membership to the Society of Petroleum Engineers on October 1, 2019. Honorary membership is the organization's highest honor for an individual and recognizes those who have given outstanding service to SPE or who have demonstrated distinguished scientific or engineering achievements in the fields within the technical scope of SPE. Capello steers several strategic initiatives at KOC as an executive consultant in the North Kuwait Directorate.



BADER AL-SAAD AL-MUNAIFI '92 became deputy CEO of KOC for the Burgan oil and gas fields in southern and eastern Kuwait in 2018, an asset that produces in excess of 1.6 million barrels of oil per day and is one of the most prolific and longtime oil producers in the world.



BADER AL-ATTAR '92 became deputy CEO at KOC for the planning and commercial directorate in 2019. He leads six groups and 22 teams related to the workflows of the company's capital expenditures, reservoir management, planning, commercial support, contracts and purchasing.



ABDULLAH A-RABAH ABDULKARIM '98 is the team leader for reservoir studies of heavy oil at KOC and is in charge of the integrated studies that shape the plans for the development of the heavy crude oil reserves in northern Kuwait. He leads a team of specialists in geology, petrophysics, reservoir engineering, petroleum engineering and land management at KOC and liaises with experts from Shell Oil Company.



MOHAMAD AL-BAHAR '99 recently became the team leader of resources at KOC and is responsible for managing and maintaining the hydrocarbon resources and reserves management system in Kuwait. He has implemented step changes in assessment, automation and reporting strategies at corporate level, elevating the quality of the workflows involved.



MOHAMMED F. AL-MATROOK MS '02, PHD '06 is part of the reservoir studies team for the heavy oil field development group in KOC's North Kuwait Directorate. After years working as a professor in Kuwait's academic sector, Matrook now lends his expertise for matters pertinent to petroleum engineering, such as field development.

IN MEMORIAM

"When you are sorrowful look again in your heart, and you shall see that in truth you are weeping for that which has been your delight."

-Kahlil Gibran



ROBERT T. "BOB" BECKMAN '57, MS '63 died May 14, 2019. Bob graduated from Mines with a professional degree in mining in 1957 and a master's degree in mining in 1963. He worked at Union Carbide Corporation in Niagara Falls, New York City and Bishop, California, before

settling in the Denver area working for MSHA until his retirement in 1993. His expertise in radiation and radon led to assignments in Europe and Egypt for the International Atomic Energy Agency and the Organisation for Economic Co-operation and Development.



WILLIAM P. "BILL" BURPEAU, JR. '53 died Feb. 16, 2018. He was born in 1931 and graduated from Mines in 1953 with a professional degree in geology. As a student, Bill was a member of Beta Theta Pi fraternity, Blue Key Society and ROTC. During his career, he served in

the U.S. Army Corps of Engineers, worked for the Superior Oil Company and consulted for independent companies in Louisiana and Texas before finishing his professional career with Pennzoil in Houston.



WALTER W. "WALT" TYLER '57 died Sept. 21, 2018. Walt was born in 1927 and served in the U.S. Marine Corps during World War II. He graduated from Mines in 1957 with a professional degree in geology. Walt's first professional experience

was in gold exploration in Costa Rica and later in French Guiana, managing a gold placer mine. After five years in South America, he moved to operating a silver mine in Kaslo, British Columbia, then returned to Santa Fe, New Mexico, in 1972 during the uranium boom. Walt then decided to develop oil and gas prospects for his own company in Oklahoma for five years before starting a consulting business in Lakewood, Colorado.



JOHN S. VOLOSIN '68 died Aug. 18, 2019. Born in 1939, John's Mines education was interrupted when he was drafted by the U.S. Army, but he returned to Mines after his service to complete his professional degree in metallurgy in 1968. In his career, he worked in the

smelters at St. Joe Lead Company in Missouri and then AMAX Lead Company, before moving on to become the superintendent of the upper plant at Bunker Hill Mining Company in Idaho. When the smelter closed, John became a metallurgist at the Rolla Division of the Bureau of Mines in Missouri.

▶ To submit an obituary for publication in the magazine, visit minesmagazine.com/submit-an-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](tel:303-273-3275) or visit giving.mines.edu/givingguide.

Compiled and written by **Ashley Spurgeon**

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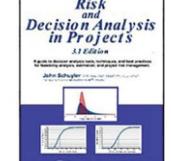
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MINER'S PIC



GONE FISHIN'

This past spring, three Mines alumni met up in Jardines de la Reina—an archipelago in southern Cuba—with a unique mission: to help tag migratory tarpon.

Kevin Small '78, Barth Whitham '79, MS '82 and Hugh Harvey Jr. '74, MS '80 joined the Fieldworkers Club and the University of Miami in their effort to better understand the migratory patterns of this breed of fish.

"We were charged with hooking and landing tarpon on a fly rod, handling and measuring the fish safely, tagging it properly, reviving it if necessary, while subjecting the fish to the least amount of stress possible," Small said, who is pictured holding one of the smaller tarpon he tagged.

A Cuban marine park nearly the size of the Florida Keys, Jardines de la Reina has some of the best diving and fly fishing in the world, with strict catch-and-release rules,

making it the perfect spot to study the animals that call the unique ecosystem home.

"The most important thing I've learned is how critical it is to plan and establish a marine preserve so that fish and wildlife have a protected place to live and breed," Small said. "It's astounding how many different species of birds and other wildlife we saw while we were down there."

While Small has been on many trips with the Fieldworkers Club to both Cuba and Belize and is experienced at tagging tarpon, it was a first for Whitham and Harvey. Reconnecting with two other Mines alumni turned out to be Small's favorite part of this year's trip, sharing stories about school, work, family and—of course—fishing.

Mines Magazine should be about you and the subjects you care about the most. That's why we sent out a survey to all Mines alumni earlier this year to see how we're doing and find out the ways in which we can improve the magazine so it remains a publication that serves and interests you.

The editorial board and I wanted you to know that we have listened to your feedback and have taken everyone's thoughts into consideration as we plan our upcoming issues. We are working on many new ideas, and don't worry—we won't get rid of anything you told us you liked.

As we read through your comments, we noticed some common themes that will shape how we approach future issues:

- You like reading about what your fellow alumni are up to, from notable alumni accomplishments and success stories to perspectives from alumni who have interesting hobbies or who are doing unusual things.
- You want to hear more about Mines' foundational disciplines, like mining and geology, while still learning about other disciplines in the school's educational scope.

Thanks again for sharing your thoughts on what would make *Mines Magazine* an even better representation of your alma mater and Oredigger pride. Mines alumni are truly the best, and we are honored to tell your stories.

Go Orediggers!

Ashley Spurgeon
Editor





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