

# ARIZONA

A Supplement to *Engineering & Mining Journal (E&MJ)*

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# Mining

## Leach to the Last Drop

— Freeport unlocks more copper from existing stockpiles

Elevation Improves Operations at the Moss Mine

UofA to Provide Future Mining Talent

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# A Message from Arizona Mining and Industry Get Our Support – AMIGOS



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AMIGOS will also continue to help our member companies to thrive. Our online meetings now connect our members face-to-face with mines near and far. Our Reverse

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**“As our nation moves toward an ever-greener economy, mining will be more important in the future than ever before. Green technological innovations need vast amounts of copper, silver, gold, rare-earth elements, and more. The future of mining is a bright one and an exciting one.”**

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# Elevation Gold Focuses on Improvement and Exploration

*With a better understanding of the geology that surrounds the Moss mine, the company can plan and budget accordingly*

By Steve Fiscor, Editor-in-Chief, *E&MJ*

Operations have been steadily improving at Elevation Gold's Moss mine, which operates in the Oatman District of northwestern Arizona. The company recently reported that it sold 31,666 ounces (oz) of gold during 2022, very close to the guidance of between 32,000 to 34,000 oz sold for the year despite undergoing a change of its contract miner. The company's Q3 2022 financial results reflect a significant improvement in operations at the Moss mine, with total revenue increasing 40% over Q3 2021 and 18% over Q2 2022 and gold ounces sold increasing 46% from Q3 2021 and 30% from Q2 2022. The operation's cash costs remain high, at \$1,479/oz, so there's more work to be done.

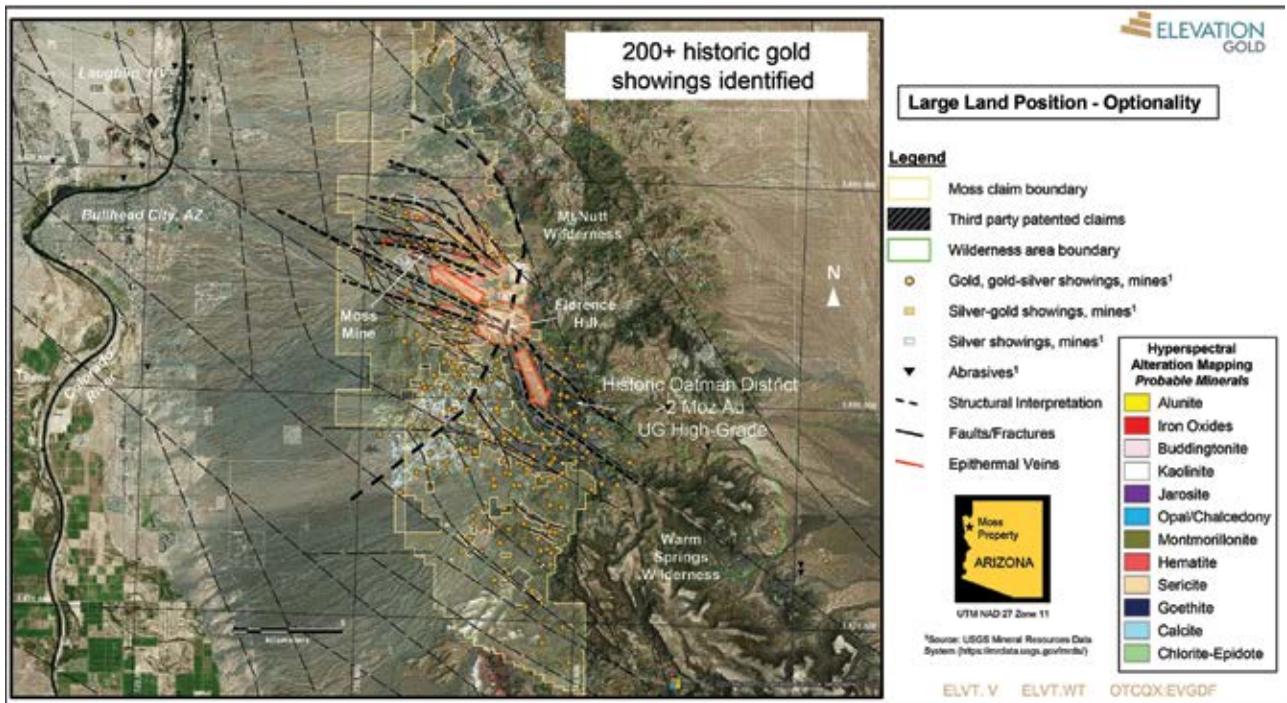
In December of 2021, Elevation Gold brought Tim Swendseid aboard as COO, and he was tasked with turning

operations around. He was promoted to president in August 2022 and CEO in December 2022. A former Phelps Dodge executive, who managed mining operations in Arizona and Chile, Swendseid knows open-pit metal mining and he's very familiar with operating in the region.

The Moss mine is a heap leaching operation. Determining the yield within a certain timeframe for a loaded leach pad can be a little tricky, but the head grade for the ore (and the amount of gold) placed on the pads increased steadily throughout 2022. "Gold production rates vary and depend on tons and grade of the material, the height of the ore stacked on the pad and percolation rates," Swendseid said. "We crush the ore relatively small here, at 80% minus 0.25-in. The ore at the Moss mine is very hard, but we're blessed by not having clay



The vein at the Moss mine's East Pit strikes nearly vertical. The crushing installation sits to the left of the pit. (Photo: Elevation Gold)



Elevation is currently drilling the Florence Hill area southwest of the Moss mine.

or other deleterious material that consume cyanide. The leach solution containing cyanide percolates through the pile relatively fast, and we get a reasonably high recovery, about 80% for gold and 43% for silver.”

These days Swendseid and his team are focusing on continual improvement and long-term planning.

The East Pit has a large vein that strikes pretty much vertically, and it has been mined since the operation began. “The vein is about 5- to 10-meters (m) wide until it hits the Canyon fault, which separates East Pit from West Pit and then it splays, and we see a lot of sub-veining, stockwork, and more dissemination,” Swendseid said. “In West Pit, we also find the deeper portion of that deposit carries a higher grade; it’s turning out to be a decent orebody.”

The Moss mine was probably brought into production too soon, Swendseid explained. “They should have done a lot more definition and condemnation drilling, and some of the processing facilities could have been better located,” Swendseid said. “We’ve completed a lot of drilling, including condemnation drilling, to find out what lies beneath the existing infrastructure.”

### Operational Improvement

During Q3 2022, the Moss mine was stacking 8,162 metric tons per day (mt/d) on the leach pads, which was 9% improvement over the same period last year. “The Moss mine targets an operational throughput of 11,000 tons per operational day,” Swendseid said. “We’ve hit that goal during 2022, and of course it is less on a calendar day basis, but we are showing steady improvement year over year.”

In hindsight, the 5,000 mt/d jaw crusher that was initially installed was too small, Swendseid explained. “We’ve figured out how to get the capacity up to 11,000 t/d,” Swendseid said. “Hopefully, the ore that lies below the crusher will be economic enough to justify its relocation and an upgrade. That’s one of our long-term goals for that area.”

Elevation Gold also completed the construction of the 2C Leach pad in 2022, and during December they began stacking ore on it. The company is planning to build another leach pad in 2023. Once that’s completed, they shouldn’t need to build another leach pad until 2025.

“We have not updated our 43-101 yet, but we have found enough material that is economic to mine and process through 2027,” Swendseid said. “The plan is to keep drilling and continue to add more reserves. The drilling that we reported in October was completed in May and it allowed us to bolt on about another 14 to 15 months to the mine life. It takes several months to complete drilling, assaying and orebody modeling, and we are currently drilling with extension of mine life in-mind.”

The Moss mine also installed two more water wells during 2022, which now makes the operation completely self-sufficient for its water needs. “We have been getting most of our water (85%) from existing wells that were near the pit,” Swendseid said. “We were also buying some water from an outside supplier. We are very pleased being self-sufficient with our water requirements.”

The Moss mine has been accessing higher grades in the East Pit, which has about twice the grade of the more disseminated West Pit. In 2021, the East Pit suffered a small

failure during a pushback. “To overcome that failure required starting another pushback,” Swendseid said. “We didn’t get back into the higher-grade ore until late July 2022. We were able to mine there the second half of the year, and we will continue mining there throughout 2023, as well.”

The East Pit represents 25% to 30% of the Moss mine’s average daily ore production. “The higher-grade ore provides a really good boost,” Swendseid said. “Our production for 2023 will be more on the order of 40,000 oz versus 32,000 oz/y in 2022. So, for us, it’s great to be in that higher grade zone. It helps us pay for our capital investment.”

The average head grade for the Moss mine is nothing like a lot of the great gold grades in Nevada, but it has a low stripping ratio and relatively low processing costs as a result of having a very clean ore.

### More Drilling, More Opportunities

Elevation Gold has a large land package and they have been using different exploration techniques to determine where to focus its exploration efforts. They are currently drilling the Florence Hill and Grapevine area, which lies almost halfway between the Gold Road mine and the Moss mine. “The drilling program at Florence Hill is revealing some very exciting results,” Swendseid said. “We look forward to receiving assays sometime in Q1 2023.”

Elevation Gold’s exploration geologists are focusing their drilling efforts on targets identified from a 2021 geophysical survey. “We flew the entire land package with an airborne geophysical survey at 50 m and 100 m line spacing that included magnetic and radiometric surveys. The interpretation of the data has yielded numerous geophysical anomalies, and one of particular interest included coincidental magnetic high and high potassium radiometric surrounded by a magnetic low,” Swendseid said. “This signature may indicate a magma-hydrothermal system at depth, an example of which could be a porphyry-style deposit.” The Florence Hill area is a fair distance from the Moss mine, and if developed, it could be a standalone mining operation.

“Our big story is that we have a successful, producing operation and a great exploration potential. We need to continue to invest in drilling to expand the mine life. Finding more ore gives us upside opportunities like increasing the cutoff grade and considering expansions.”



Last year, Elevation completed the 2C Leach Pad at the Moss mine. (Photo: Elevation Gold)

With a longer mine life, Elevation Gold could operate the mining equipment itself. The company is currently using a contractor at the Moss mine. “We recently switched to a different contract miner,” Swendseid said. “We brought in Ledcor, who are well-known in Nevada and throughout Canada. We’re very pleased with their performance thus far.

Swendseid also noted that Elevation Gold has a top-notch staff, and they are doing a lot of things to drive down costs and improve production. “We are in the process of turning an operation around and that’s exciting,” Swendseid said. “We’re focusing on all areas that need attention, and we’re seeing very good results. Mine planning efforts have been largely improved by new geologic information and modeling, and crushing and processing optimization are all adding up into significant improvements.”

These types of changes are inspirational to the entire team, many of whom worked for larger mines in Nevada and Arizona, mining professionals like Swendseid. “Frankly, this used to be a frustrating place to work,” Swendseid said. “We have turned it around. We’re doing proper maintenance and continually improving the entire operation. The results are gratifying, and we can now provide the market guidance on ounces produced and sold, which was not done before.” Swendseid and the team at Elevation Gold are operating with a lot more confidence as far as the plans they have announced and the goals they have set.



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# Leach to the Last Drop

*A leader in copper leaching, Freeport-McMoRan is implementing new strategies to unlock more copper cost effectively*

By Steve Fiscor, Editor-in-Chief, *E&MJ*

Copper leaching is experiencing a renaissance these days. In the past, copper produced from leached solution supplemented a fraction of a copper mining company's production portfolio, but today it's clearly much more important. The headwinds associated with building and operating a concentrator has changed the mindset toward leaching operations. Leaching is more ESG friendly, less capital intensive, and uses less than 50% of the water.

Historically, leaching copper from crushed rock gained in popularity during the 1980s with the advent of the solvent extraction/electrowinning (SX/EW) method of recovery. Phelps Dodge, a company that was acquired by Freeport-McMoRan in 2007, pioneered those efforts. During the early days, it was generally understood that copper could be recovered in solution by dissolving the host rock, but the recovery at the time was ineffective and often produced a poor-quality product. Phelps Dodge solved the puzzle, which allowed them to boost their portfolio of leach properties by converting waste piles into leachable stockpiles. Leached copper grew to eventually become about 50% of the production portfolio, and moreover it of-

fered the company a competitive advantage. When copper prices cycled downward, Phelps Dodge could reduce the traditional method of truck-shovel mining and milling and maintain cash flow by selling the cheaper leached copper.

Today, Freeport has launched its Leach to the Last Drop initiative. Cory Stevens, president of FM Mining Services, is leading those efforts. A 30-year industry veteran, who worked with Phelps Dodge and rose through the ranks at Freeport, he has overseen the evolution of leaching operations. Today, he manages several facets of the Leach to the Last Drop initiative, including growth, engineering, construction, continuous improvement, and research and development (R&D).

Summing up the situation, Stevens noted that as mines access the deeper sulphide portions of the orebody, they encounter more chalcopyrite, which can be difficult to leach. "We have that facing us, and we also have a bunch of leach stockpiles from which 50% of the copper has been economically leached, and so there's 50% remaining," Stevens said. "That remaining copper has a huge value proposition. It's already permitted, and it's sitting there, ready to go."



Freeport has launched its Leach to the Last Drop initiative, which looks at recovering more copper from existing stockpiles.

A large portion of that remaining copper is locked in chalcopyrite. There are ways to leach chalcopyrite and they have been around for a very long time, Stevens explained. “What’s different today? The capital costs to install a mill are high as are the operating costs, but mills do offer a fixed recovery rate of 80%-90%,” Stevens said. “The recoveries and costs associated with leaching chalcopyrite are lower. We’re working to improve the recovery. Coupling new technologies with traditional methods, allows us to leverage some of the ideas from the past in a new way that provides more deliberate results.”

The Leach to the Last Drop initiative encompasses several areas of possible improvement, one of which is leach analytics.

### Leach Analytics

Leaching requires a long timeframe to complete an ultimate recovery leach cycle. “To recover the full 50% from these complex ore bodies, it takes years,” Stevens said. “Over the decades, the mine has placed billions of tons of ore that continues to be leached as new layers are added to the heaps. Some amount of production continues from those lower layers. We monitor various parameters to understand what’s happening within these stockpiles.”

Stevens and his team started combining different technologies, such as resistivity testing to assess the moisture content and the hydrodynamics, or flow patterns, within the pile. They monitor the temperature inside the pile, and they also use data analytics to compile years of data to look for hidden correlations that might answer questions. Questions like: How long should this ore be under leach to be effective? What level of fragmentation works best?

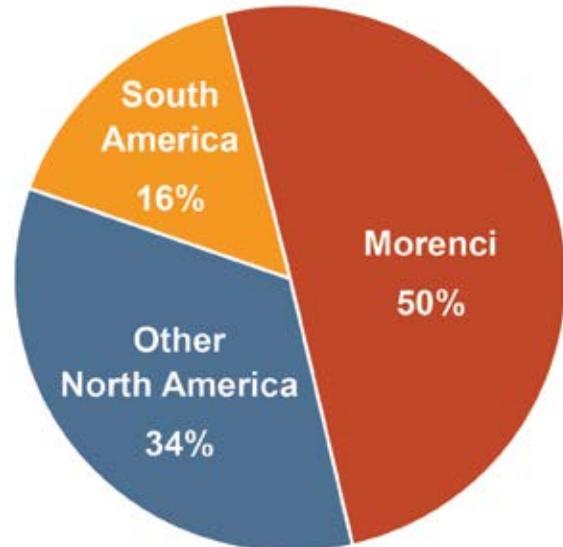
“In general, we know smaller size fractions leach better, but now we can get more quantitative evidence,” Stevens said. “It’s difficult and time consuming to do this work in a lab, especially with the larger size fractions. So, in a way, we’re making the field our lab experiment. Once we determine what these correlations are telling us, we can translate those quantitative results into business action.”

Usually, when the leach metallurgist tells the mine manager that leach recovery will improve 3% or 4% if the P80 coming from the mine is minus 4 in., the mine manager would push back with increased drill-and-blast costs and other expenses, Stevens explained. “Now the leach metallurgist can say yes with confidence,” he said.

**“Freeport is currently discussing an additional 200 million lb/y of copper by the end of 2023.”**

## Copper in Leach Stockpiles Unrecoverable by Traditional Leach Methods

**38 bn lbs Contained\***



*\* Copper from historical placements beyond assumed recovery estimates and is not included in mineral reserves and mineral resources.*

Roughly half the copper has been economically leached from Freeport’s stockpiles, which also means that 50% still remains.

“The improved fragmentation will generate more value and we can make that investment. We also can justify increased acid application that we either purchase or recover from the smelters.”

Stevens said the use of data analytics could answer all kinds of other questions. “For example, what if we knew what the oxygen level was inside the stockpile so that we can leverage that?” Stevens asked. “Or, what if we knew what the correlation was more quantitatively with temperature within the stockpile? And, how do we correlate the pyrite coming out of the open pit to be able to aerate it properly to generate the heat and leverage that more meaningfully in a way that drives up recovery across the portfolio?” Combining this work, which is organized around various sub efforts that basically feed into the leach analytics, with an inquisitive mindset will drive value significantly for Freeport.

### Capturing the Data

Freeport also is making use of sensor technology in many aspects of its business, including leaching from stockpiles. They are placing sensors at a depth of 300 feet into the pile, which transmit data that feeds into the leach analytics.



Freeport is using leach covers to retain the heat from the aerated chalcopyrite, which could improve recovery by as much as 3% to 5%.

One important parameter for leach recovery is heat. “We have deployed leach covers, a simple plastic sheeting that’s analogous to placing a cover on a pool,” Stevens said. “It doesn’t take much heat to make a difference. And, if you can get an additional 3% to 5% recovery within these stockpiles that have 38 billion lb of copper remaining, it doesn’t take long to do the math to justify the covers. Once the aerated chalcopyrite begins to generate heat, you don’t want to lose the heat. With covers, you get an additional bump.”

Freeport drills the leach stockpiles, some of which are 600-ft thick, taking core samples to understand how much copper remains. Once the drilling is complete, they slip daisy-chained sensors down the empty borehole. The sensors connect to a wireless transmitter, which feeds the data acquisition system. “With that configuration, we can determine what application rate with this mineralogy generates the greatest increase in temperature,” Stevens said. “Also, we can assess the oxygen levels and deploy various interventions to see what happens with the parameters. Ambient temperature, for example, plays a huge role. We know the stockpile will cool in the wintertime and vice versa. Knowing what we know now, we could deploy more air, cover certain areas, or consider adding more heat.”

The leach metallurgists also must strike a balance with the acid solution. “Adding too much could work against the pile kinetics as it acts as a coolant,” Stevens said. “You want to make sure that you’re only adding enough solu-

tion to facilitate reactions without cooling the pile. We also have explored adding geothermal heat, but the primary efforts have been around exploiting the naturally occurring heat from the pyrite and the covers.”

Another area that has received a lot of attention in the media lately is additives. “For us, that’s probably a little farther out on the timeline,” Stevens said. “We have been approached by third parties offering additives. We are aware of what they claim, and we talk to other mining companies that are using additives. We are exploring their use with different leaching processes altogether, as well as additives that could be used with our traditional techniques. We also have novel concepts generated through internal R&D efforts that we’re really fleshing out to scale.” Stevens said. With so many different avenues to develop, Freeport will determine what works best and then move forward.

### Processing More Solution

If copper production from leaching is going to grow significantly, then Freeport’s ability to process it will have to grow, which means new plants or plant expansions, or refurbishing old plants. “As the initial heydays of leaching passed, we were left with some latent capacity,” Stevens said. “We have nine mine sites and we’re currently producing about 1.4 billion lb/y of copper from leach, about 50% of Freeport’s Americas’ portfolio. The installed nameplate

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Most suspected that consistent fragmentation improved leach recoveries and now the data supports that notion.

capacity of all the SX/EW plants combined is an additional 1 billion lb/y more. Some of those production lines we can simply switch on, while others will need to be refurbished.”

The latent capacity, however, does not necessarily align with the future opportunities. Freeport will explore expansions where it makes sense. The Safford facility in particular is already at capacity and they are finding more resources. The Chino, Tyrone, Bagdad, and Miami operations have capacities that exceed their current production profile and that is where Freeport will leverage the additional processing capacities.

Freeport is currently discussing an additional 200 million lb/y of copper by the end of 2023.

“That figure seems overwhelming at first,” Stevens said. “Freeport has 38 billion lb, which is equivalent to one-third of the company’s resource, that’s currently not included in its reserves. The 200 million lb/y is an achievable goal, a base camp, and we will get there through improved operating practices and leveraging better what we know today.”

By the way, that 200 million lb/y is equivalent to a medium sized mine today, Stevens explained. “It’s equivalent to what we’re contemplating with the Bagdad expansion or some of the other growth opportunities,” Stevens said. “While it’s a meaningful amount of copper, it doesn’t define the whole opportunity that we’re chasing.”

Stevens and his team systematically mapped out the potential for every single property, pile by pile. Viewed collectively, there is tremendous potential. But how much could be meaningfully accomplished during 2023? There was a lot to consider, Stevens explained, such as the resources, manpower and technology. “If we need to install more booster stations, or solution distribution centers, can we do it with today’s supply chain issues?” Stevens said. He believes that at some point during 2023, they will achieve 100 million lb/y and it

will grow to 200 million lb/y by year end and deliver consistently after that. While in parallel, Freeport will be working on longer-term activities with additives that will take it to that next base camp.

The Leach to the Last Drop program also dovetails with Freeport’s ESG initiatives. “That’s what’s so neat about this,” Stevens said. “It really allows us to not only meet demand with potentially low-cost copper, but when you’re leveraging material that’s already been mined and just improving recovery, it comes at a significantly less carbon footprint. We’re talking 75% less and potentially carbon free in areas where electricity is sourced

from all renewables. Water consumption is 50% less or more. We’re going to be making the copper that everybody wants. It’s a win-win all the way around.”

Stevens takes pride in being part of the industry, knowing it provides products that improve the standard of living for everyone around the world. Beyond the technology, he gets excited

about the people who are involved in these projects. “It’s like a light switch sometimes,” Stevens said. “You have people that have been working in this business for decades. When they start seeing some of the things we are doing and start asking the questions about the what-ifs and the art of the possible, it’s super exciting.”

On the flip side, Freeport’s leaching initiative is attracting new sources of talent, new people that have never been affiliated with it. “We have folks from the mining or milling side, who are working on the leaching side now,” Stevens said. “And, you get this diversity of career experiences, diversity of perspectives and thought, and diversity of energy. It’s where the magic happens.

“Engineers tend to get excited about the technology, but it’s really about the people that make it happen,” Stevens said. “Technology is the catalyst that allows people to be their best.”

**“Engineers tend to get excited about the technology, but it’s really about the people that make it happen,” Stevens said. “Technology is the catalyst that allows people to be their best.”**

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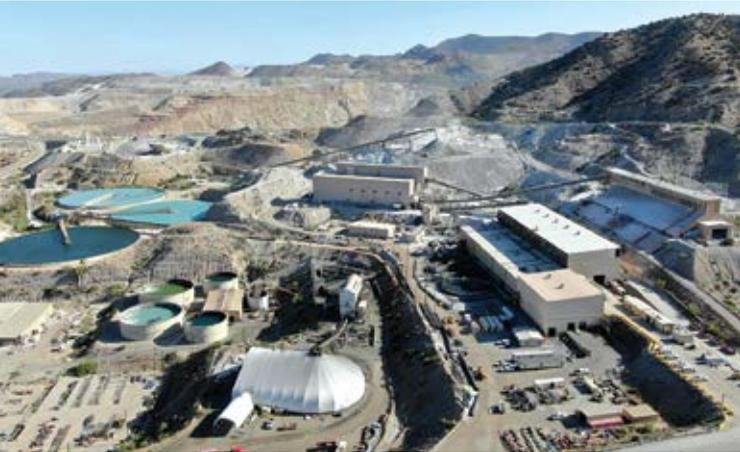
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# Highlighting the Regional Impacts of Copper Mining in Arizona

*Community engagement remains a priority for Capstone's Pinto Valley mine*

By Steve Fiscor, Editor-in-Chief, E&MJ



The Pinto Valley mine (above) was expected to produce 55,000 to 59,000 metric tons of copper in 2022.

Capstone Mining Corp. operates the Pinto Valley mine located near Miami in the historic Globe-Miami mining district in Gila County, Arizona. This area is one of the oldest and most productive copper mining regions in the nation. Daily operations of the Pinto Valley mine generate more than \$320 million in state and local tax revenues annually. These revenues are generated as employees spend money on local goods and services, as the mine purchases equipment and supplies, and as they pay taxes.

Those that are involved in day-to-day operations realize the importance to the local economy as do the local businesses and government, but what about the people who reside in the area who are not involved in the copper mining business?

Directly and indirectly, the Pinto Valley mine employs 2,245, which works out to about \$15.6 million in annual wages. “For us, our people are our No. 1 resource,” said Scott Harrell, manager employee services for Capstone. “Yes, we produce copper, but you need a social license to operate, and there’s a social system inside the organization and outside the organization. All that starts with people.”

The workforce is vital for any mine and attracting, training, and retaining the right people defines that operation. “We do that by making sure that they arrive safely, work safely, and travel home safely,” Harrell said. “With 640 employees, the Pinto Valley mine is the second largest employer in Gila County. We are looking to add about 80 more people during the next year. Most of those people will likely be hired locally.”

Obviously, a mine would find it difficult to sustain itself, let alone grow its operations, if the surrounding com-

munities failed to understand the importance of mining or worse, refused to accept it. Because of its high retention levels, Capstone feels it has a handle on human resources internally, but they were unsure of its perception and that of copper mining externally, so they conducted a study, and the results were impressive.

## Public Perception

Over the analyzed 10-year period, Pinto Valley will generate \$6.6 billion in economic activity. That’s approximately equal to having a Super Bowl every year.

To better understand the external perception of copper mining in general and Capstone Mining and the Pinto Valley mine specifically, the company commissioned an independent third party to conduct an unbiased survey of local citizens during June of 2021. “They went into the field with the polling in June and we had the results by July,” Harrell said.

The pollsters engaged 250 registered voters. As far as sex and demographics, the group was evenly divided between male and female, and political party affiliation was also evenly split. The ages of the group were: 49 years or less (33.2%), 50 to 64 years old (26.8%) and 65 years and greater (42%). A little less than half of the participants were from Globe and the rest were from communities within the Copper Triangle, which extends from the Globe-Miami area to Superior to Kearney, most of which were founded by copper mining.

Like much of the U.S. today, the survey indicated that respondents were evenly split when asked whether Arizona was headed in the right direction. As far as top issues facing their area, they ranked jobs and the economy as No. 1, followed by immigration and borders issues, education, and water.

The results of the survey showed that most of the citizens had a favorable opinion about copper mining. Among industries of importance, they ranked mining as No. 1, followed by healthcare, agriculture and ranching, and tourism. Unprompted, 92% said they supported copper mining in Arizona. When they were informed on the economic and employment figures, that number grew to 94.8%. “For most of the folks who are in this region, if you are not in the mining industry, you are not far from it,” Harrell said.

As far as regional name recognition, they ranked Freeport-McMoRan as No.1, followed by Pinto Valley, Resolution Copper, the Carlotta mine and Florence Copper. “We’re a major player in the area,” Harrell said. “In January of 2023, we will celebrate 10 years of continuous operation. Since

# Komatsu — at work in the Copper State



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Capstone acquired the mine, we have not had any work stoppages or layoffs. Even during COVID-19, which was a defining moment for us, when many other places were shutting down and cutting back, we were still growing.” Pinto Valley set production records in 2020 and 2021.

The polling also indicated that 87.2% of respondents support the Pinto Valley mine. “This speaks to what this company has been able to achieve since resuming operations,” Harrell said. “The respondents placed a priority on jobs and the economy, and that’s where we make the biggest impact for the community. We’ve also become more involved with the community, investing in programs that improve the quality of life.

Community service is important to Capstone Mining. “These are historic mining towns,” Harrell said. “More than half of our employees were raised in these communities and we like to give back.”

Monthly, Pinto Valley’s employees participate in the Second Saturday Cleanup. They gather at one of the local communities and pick up trash for a couple of hours. Capstone provides the trash bags, gloves and litter pickers.

“During Old Dominion Days this past summer, we were asked if we would provide public tours,” Harrell said. “We provided transportation from downtown Globe and we had four different tour groups visit the mine. Some of our managers gave short overviews on mining and processing, which helped the tour groups better understand how copper is produced and its importance to our region.”

Capstone is also involved in the United Fund and local community program such as 4-H and youth sports. “Financially we support most of the local school districts,” Harrell said. “We regularly donate our time and talent. We recently donated \$100,000 to the United Fund to support the local community. We also made another \$100,000 donation to help Globe fund the construction of a new public pool. These are significant reinvestments in the community.”

### The Changing Face of Mining

As the world moves toward a more electrified future, copper is expected to remain in high demand. Pinto Valley is currently looking at different ways to scale up copper production to meet this future demand. Hiring and retaining the right people will play a valuable role in successfully meeting those goals.

One of the signs that tells Harrell that Pinto Valley is on the right track is their new hire retention rate. “We can’t expect people to perform at the highest level if they are not happy,” Harrell said. “We track our retention rates after one year, and then periodically after that. After one year, we retain about 84% of our new hires.

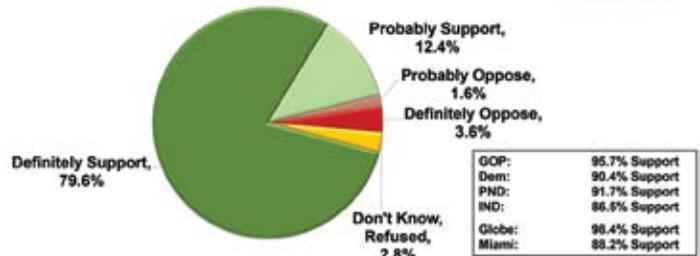
“We’re fortunate that, through our vetting and hiring process, we’re making pretty good decisions most of the time and are able to retain those new hires,” Harrell said.

Capstone also employs a diverse group at the Pinto Valley mine, and they are always looking at ways to increase diver-

### Poll Question

In general, do you support or oppose copper mining in Arizona?

Total: 92.0% Support  
5.2% Oppose



A recent survey of registered voters who live near the Pinto Valley mine indicated that 92% support copper mining in Arizona.

sity. In November, Capstone appointed Lyndsay Potts as general manager of the Pinto Valley mine. She is an Australian geotechnical engineer with 17 years of experience. She held several leadership roles with Newcrest Mining at the Cadia mine in New South Wales, Australia, before moving to Arizona. Potts will be Pinto Valley’s first female general manager.

“Nearly 18% of our superintendent roles are filled by females and just under 17% of our total workforce are women,” Harrell said. “We encourage women to get involved with the mining industry and we support a lot of different events geared toward women in mining.”

Pinto Valley also actively recruits veterans. “We are currently adding a military-focused career site, which specifically targets people transitioning out of the military,” Harrell said.

The mine is located relatively close to the San Carlos reservation and the mine employs a significant number of Native Americans. “We have also initiated a direct outreach campaign to other tribal organizations throughout the state,” Harrell said. “Right now, 7% of our workforce identifies as Native American. We’re offering employment opportunities to areas that are economically disadvantaged. Hopefully, we can attract some of those families to this area.”

“What we found was that of all of the companies operating in the area, we ranked second highest with name recognition and public awareness with the public with a highly favorable perception,” Harrell said. “That has to do with the fact that we do a lot of community outreach. We pay well. We have good benefits, and we are environmentally responsible.

“Most of our operation is in the Tonto National Forest,” Harrell said. “We have some private land, but a lot of it is leased through the U.S. Forest Service. Everything we do is closely watched, and we are good stewards of the land, especially when it comes to water use, which is a big issue in Arizona.”

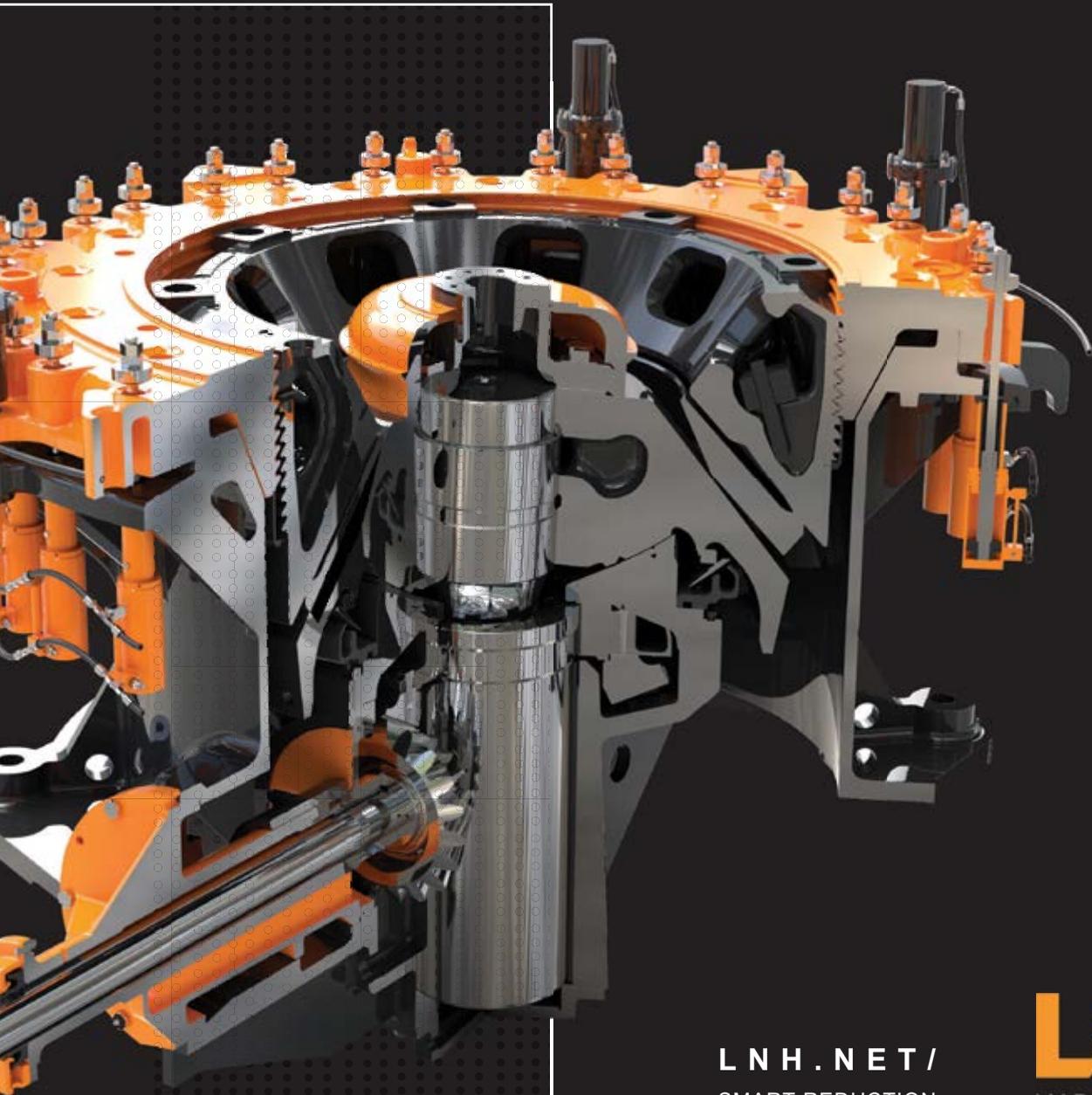
Capstone’s Pinto Valley mine is permitted to operate through 2039. The company’s values align with those of the surrounding community. The seeds they are planting today will allow them to continue to grow the mine’s positive impact on the community socially and economically, perhaps even doubling today’s economic figures during that timeframe.



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# Copper World's Permitting Process Advances

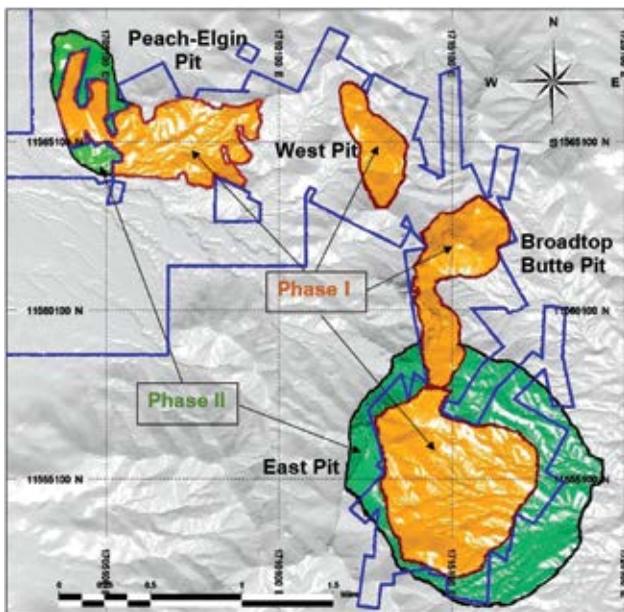
*Hudbay sets its sights on developing one of the largest copper discoveries of the last decade*

By Steve Fiscor, Editor-in-Chief, E&MJ

Hudbay Minerals entered the Arizona scene when it purchased Augusta Resources and the Rosemont copper deposit in 2014. The company began proving up the Rosemont project, and eventually received a Final Record of Decision from the U.S. Forest Service (USFS) in 2017, which was revoked during July of 2019 based on a decision from the U.S. District Court in Arizona. Hudbay appealed the decision in what has become another example of the legal nightmares mining companies face trying to permit new mines on federal lands.

A Canadian company, Hudbay has mines and projects in Canada, the U.S., and Peru. Copper represents about 60% of the company's revenues. While the company traditionally operated underground metal mines in Manitoba, it opened the Constancia open-pit mine in Peru in 2014 and it is now setting its sights on the Copper World project in Arizona as well as other organic projects in its pipeline.

In September 2021, Hudbay revealed that it had discovered a large copper deposit, now known as Copper World, on private lands located near the Rosemont project. By December, it published an initial mineral resource estimate and in June 2022 it published a preliminary economic assessment (PEA), which contemplated the development of the Copper World deposits in conjunction with an alternative plan for the Rosemont deposit. The PEA calls for a two-phase mine plan with the first being a standalone operation on Hudbay's private land with the second phase expanding onto Rosemont's patented mining claims.



Hudbay plans to mine the Copper World deposits in two phases.

Shortly after that announcement, the company received good and bad news from the Arizona district court. It had lost the appeal on Rosemont, but it received a favorable decision related to Copper World. The court ruled that Copper World and Rosemont are not connected under the National Environmental Policy Act (NEPA) and Hudbay did not have to include Copper World as part of its NEPA review of Rosemont.

## Defining Copper World

According to the Copper World PEA, which is now supported by a 43-101 technical report, Phase I would require a \$1.9 billion capital investment to build an operation with a 16-year mine life. The average annual copper production for Phase I would be approximately 86,000 metric tons (mt) of copper at cash costs and sustaining cash costs of \$1.15/lb and \$1.44/lb respectively. It would consist of a 60,000 ton per day (t/d) sulphide concentrator, a 20,000 t/d oxide heap leach, a solvent extraction/electrowinning (SX/EW) facility. The concentrator is intended to expand to 90,000 t/d in Phase II.

Phase II expands mining activities onto federal lands and extends the mine life to 44 years with average annual copper production of approximately 101,000 mt at similar cash costs and sustaining cash costs.

“Copper World’s processing facilities would be designed in a way that minimizes its carbon footprint,” said Javier Del Rio, vice president, South America and USA for Hudbay Minerals. “The operation would provide the U.S. with an onshore supply of copper cathode, which would also eliminate the greenhouse gases and sulphur emissions associated with overseas shipping and processing.”

With more than 30 years of experience, Del Rio has managed several open-pit and underground projects, and expansion initiatives. He is responsible for the strategic and operational performance of Hudbay’s business units located in Peru, Arizona, and Nevada.

Hudbay had its skeptics, Del Rio noted. “After all, how could a small, mid-tier, Canadian mining company, that had only operated underground mines in Canada, develop and operate an open-pit mine?” Del Rio said. “Well, we completed construction of Constancia in 2014, and the mine went from first production to full production in just five months. And, we did it with zero lost time accidents. That’s the experience we are bringing to the table.” Today, Constancia produces 78,000 mt/y of copper, 50,000 oz/y of gold and 2 million oz/y of silver.

Del Rio said the company recognized the potential of the Helvetia copper district while proving up the Rosemont project and started acquiring private lands that sit just over

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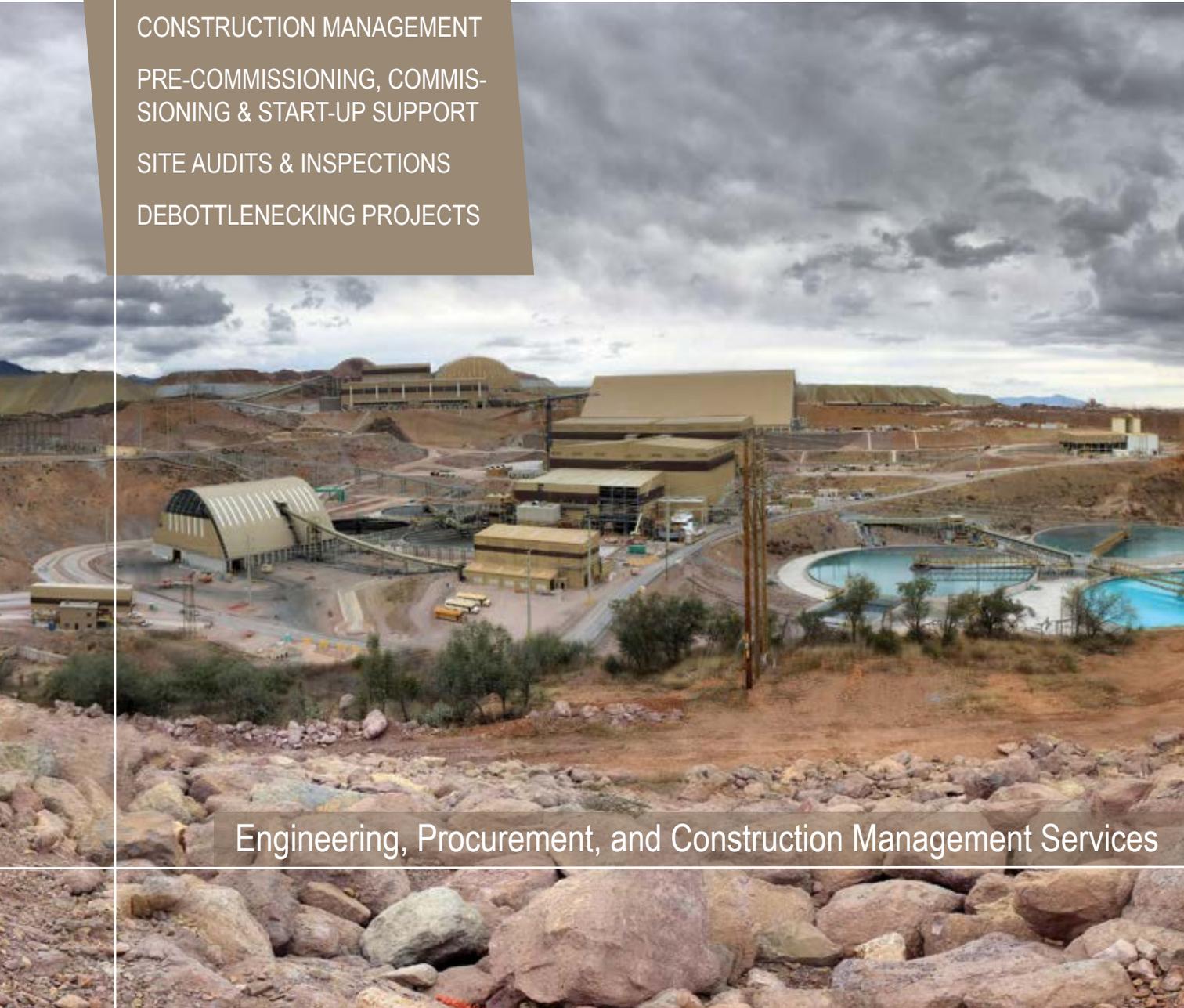
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the ridge. “We identified seven satellite deposits through our exploration program, and it’s been intensive,” Del Rio said. “A year and a half ago, we started working on the PEA, which was published in June. It shows robust economic potential. We are basically talking about measured and indicated resources of basically 1.3 million tons of copper. And, we have almost 290 million tons of inferred resources. It’s a very interesting and unique project located entirely on private land.” When rigs started drilling the property, Hudbay discovered a low-grade oxide cap above the main sulphide deposit. Oxides lend themselves to leaching operations, which is not as capital intensive as the concentrators needed to process the sulphide ore.

Ultimately Copper World would provide two products, concentrate and cathode. “These are the types of projects that the U.S. really needs to be self-sufficient,” Del Rio said. “That is what we are offering. The opportunity to have a self-sustainable copper supply chain.”

## Permitting Copper World

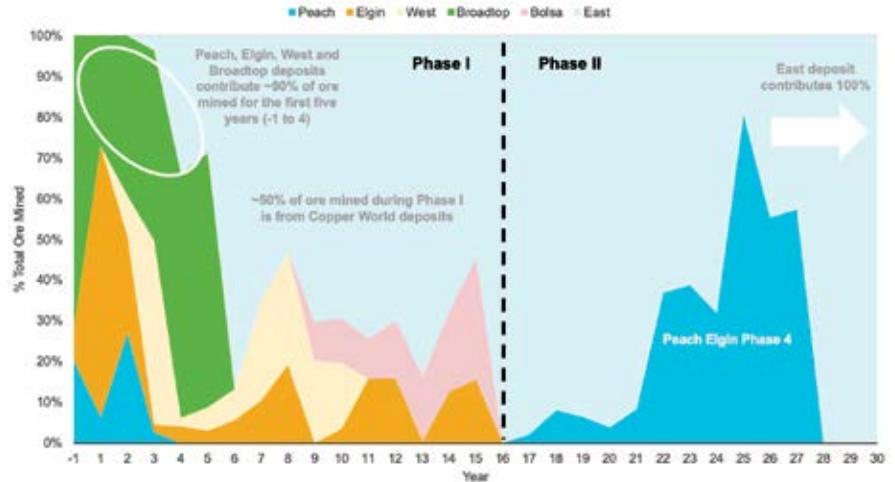
At the peak of its exploration activities, Hudbay had eight drills turning and more than 200 people working on the project. “They are not only developing the geological model, they are also studying the metallurgical characteristics of the deposits. We have been pleasantly surprised with what we are seeing.”

By pleasantly surprised, Del Rio said he appreciated the continuity of the geologic formation and the confirmation of the head grade established in the PEA. “We were also able to better define the amount of oxide and sulphide ore,” Del Rio said. “The PEA has some level of uncertainty, and the subsequent prefeasibility study (PFS) will reduce that uncertainty.”

One of the other things that they were pleased with was Copper World’s lack of overburden. A lot of the mineralization is close to the surface, Del Rio explained.

The stripping ratio in the first five years is less than 1. “During that period, we plan to mine 34 million tons and of that, only 11 million tons are waste, and we can also stockpile the oxide ore,” Del Rio said. “At Constancia, we had to move 50 or 60 million tons to get to the ore, which meant the fleet had to be assembled 18 to 24 months before we started production. That had a significant impact, driving up capital costs prematurely. This is not the case with Copper World.”

Hudbay is hoping to complete and publish a PFS for Copper World during 2023. “Following that, we will start the feasibility study,” Del Rio said. “In the meantime, we’re applying for state permits, the air quality permit and the aquifer protection permit. We have already received the



During the first 16 years (Phase 1), Copper World would average 86,000 mt/y of copper. Phase II expands mining activities onto federal lands and extends the mine life to 44 years with an average annual copper production of 101,000 mt.

certificate of environmental completion. The Arizona mine inspector has approved the mined lands reclamation plan. We’re on track with the permitting process for Copper World.” Once the feasibility study is completed in 2024, Hudbay will make an investment decision.

“We have worked successfully with the State of Arizona with permits in the past,” Del Rio said. “The great thing about the state permitting process is it really is a very straightforward, science-based regulatory process. It’s a direct predictable path to get to the finish line. It is nowhere near as subjective as the federal permitting system.”

Phase II provides room for an expansion. With Phase I, Copper World is landlocked in terms of private land. “We have pretty much acquired all of the available private land surrounding the project,” Del Rio said. “There’s state land to the west. Lands managed by the federal Bureau of Land Management to the north and USFS land to the east.”

“With Phase I, we are looking at 60,000 t/d of flotation and 20,000 t/d heap leach,” Del Rio said. “This is significant. We are really excited about this. It’s a nice copper grade. It’s aligned with our future strategy of a greener landscape in the US.”

“Once we started deploying modern exploration technologies and best practices, what we found quickly exceeded our expectations, as far as the volumes, the grades, the diversity in mineralization, and how much of it was at or near the surface,” Del Rio said. “Copper World has turned out to be one of the largest discoveries of copper globally in the last decade.”

After having developed a world-class mine in the highlands of Peru, Del Rio said he is looking forward to mentoring people with the development of Copper World and making a difference. “It can be done and I’m excited because this will be a transcending experience in so many ways. We will produce a product that provides a cleaner future. We will lift a community. It will also be a good experience for the young professionals, looking for a future in mining.”

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# Arizona Sets Out to Be the World’s Leading Producer of Mining Talent and Innovation

*If you could design a brand-new school to meet the emerging talent and innovation needs of the minerals industry, what would it look like? That’s exactly the question faculty and staff at the University of Arizona asked as the institution set out to address the growing global talent crisis the industry faces.*

While demand for mineral resources and talent is increasing, fewer and fewer students are studying this field, let alone joining it. Enrollment in mining and mineral resource education programs has been falling sharply around the world. And it’s not just more workers that are needed, but varied talents. The future of mining calls for skills that are broader and more sophisticated, including things like communications and systems expertise, as well as a wide range of disciplines.

With so many active industry partners, getting input was easy, but the University of Arizona (UofA) wanted a clear picture of what the future state of mining education needed to look like, and they got it.

First, to produce the mining workforce of the future, the UofA found it needed to offer holistic education to produce a full range of mining professionals with the breadth of skills needed, integrating disciplines where necessary.

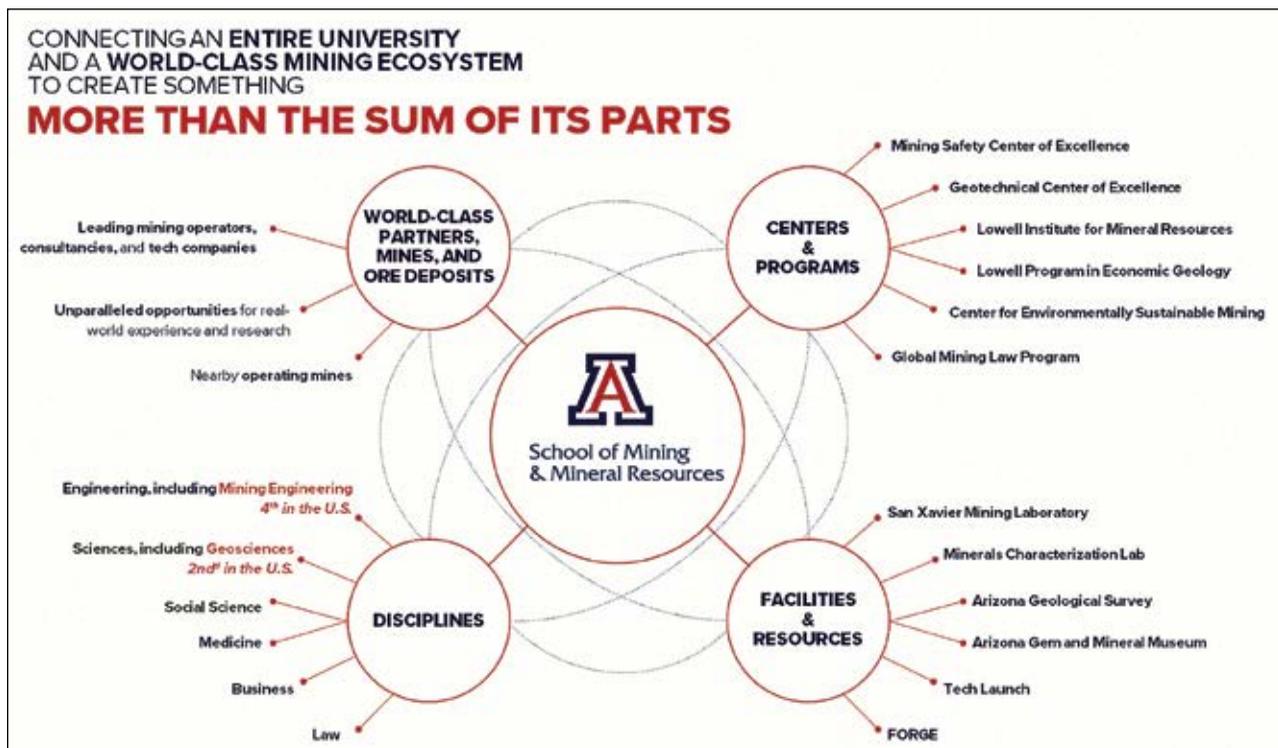
Second, the program must be inclusive, providing an opportunity for students with diverse interests, backgrounds, and career aspirations to learn about mining and mineral resources

to “broaden the aperture of who studies mining,” as one mining industry CEO put it. That’s critical to filling the pipeline.

Third, tackling the toughest challenges facing mining is too big for any one discipline, university, company, or country — it requires an all-hands-on-deck approach. Creating a network of experts across campus and around the world to collaboratively solve big problems is what’s really needed.

Fourth, the program must be dynamic — able to scale up or down, capitalize on emerging opportunities, and keep pace with change.

Arizona is the perfect place to accomplish these goals. The state boasts not only the UofA, with over a century of mining education experience and unmatched breadth of disciplines, it also produces about three-quarters of the nation’s copper and offers a rich ecosystem of world-class operating mines, ore deposits, and leading mining technology companies. This unique combination gives Arizona an unequalled advantage in becoming the world’s leading producer of mining talent and innovation.



The University of Arizona’s mining innovation ecosystem.

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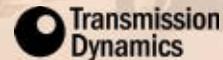
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## Mineral Resources Education, Reimagined

In investigating solutions, one realization was immediately apparent, and it's an observation made by others about the industry itself: It's not enough to do the same thing bigger and better, things must be done differently.

Simply expanding or improving the mining engineering program wouldn't solve the problem. Mining industry partners also come to the university to recruit geoscientists, accountants, industrial hygienists, data scientists, and just about every other kind of engineer (to name only a few).

For those reasons, The UofA has created a new, interdisciplinary, future-focused School of Mining and Mineral Resources.

But it didn't start from scratch. The university has been preparing mining engineers and geologists for more than 100 years, with top-ranked programs for each, and more recently lawyers who specialize in mining. It also has a business school, a medical school, social sciences and humanities, dozens of STEM degrees, experts in Native American relations and water resource management, a Center for Environmentally Sustainable Mining, even a student-run mine — name it, and the UofA has it.

"I always like to tell people that if you want to make a big difference in this world, engineering is the place to do it," said David W. Hahn, Craig M. Berge Dean of the UofA College of Engineering. "And mining is one of the areas in which the creative problem-solving abilities and technical expertise of engineers is becoming increasingly important. By partnering with other campus units and seeking input from industry, we are building a school in which our students will be building the future."

## Integrative and Inclusive

The opportunity — and challenge — lies in integration. To underpin this, the School of Mining and Mineral Resources is a collaboration between the College of Engineering and the College of Science. And unlike a traditional academic unit, the school doesn't have dedicated faculty. Rather, the School of Mining and Mineral Resources connects and



Students of various degree programs on a field trip to Resolution Copper's core facility.

leverages the vast resources that already exist across disciplines at the university, tapping into and combining specific resources as needed. Faculty from any department in any college can become members of the school and contribute to its education and research. This allows for greater flexibility and scalability, and a wider, more diverse resource base.

"We are excited about the cross-college collaboration," said Carmala Garziona, dean of the College of Science. "A number of departments in the College of Science are working with the school to bring unique academic and career opportunities to our students. We expect that this new school will become a nexus of activities directed toward more sustainable acquisition of minerals that are critical to cleaner and more efficient energy practices."

This inclusive model helps build the school's network of experts, engaging more diverse talent. To attract participation, the school's competitive innovation grants program incentivizes faculty from any discipline to apply their talent to mining and mineral resources problems. The grants bring much needed awareness to the fascinating research opportunities mining offers, something most faculty would otherwise never know of. In just 12 months, the program has engaged more than 50 faculty, researchers, students and staff from a dozen disciplines on 25 research projects, ranging from strategies for sustainable materials use in design and manufacturing, to eco-friendly dust suppression, even an app for hazard recognition in underground mines.

Many projects have resulted in new industry and government agency collaborations. It is multidisciplinary, multi-stakeholder collaborations like these that advance progress on tough issues such as maximizing resource recovery from traditional and alternative sources, such as waste, or improving tribal relations. Arizona is home to hundreds of abandoned mines and 22 tribes, offering ample opportunities for research in both areas, as well as where they intersect. This is just one example of how the university's expertise and Arizona's mining ecosystem complement each other.



Mining engineering professor Moe Momayez demonstrates the use of LiDAR in the new decline of the San Xavier Mining Laboratory during a mine tour for engineering students.



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This inclusive model is also critical for engaging students. Since mining covers a wide range of disciplines, jobs, and backgrounds, the new interdisciplinary school does, too. Future mining and mineral resource professionals will need to cover a lot of territory. Disciplines like policy, business, communications, and environmental science are critical to the mining workforce of the future. The university already offers every undergraduate major degree needed for mining and mineral education, so the school does not replicate these programs. Instead, we complement those offerings by providing an opportunity for students and professionals with diverse interests and career aspirations to learn about mining and mineral resources, and for mining and geosciences students to learn about other critical fields. By cross-pollinating mining and mineral knowledge with other disciplines, the school is helping people find their own unique path into the world of mining and minerals, and to work across disciplinary boundaries once they do.

The school's flagship academic program is an interdisciplinary undergraduate minor degree in sustainable mineral resources that students in any major can take. Core courses in the minor teach what every student should know about mining and minerals, while electives in seven tracks allow students to explore specific themes, like automation and analytics, or society and policy.

Inaugural enrollees come from fields like operations and supply chain management, environmental studies,

chemical engineering, geoscience, and mining engineering. The potential for future education offerings is nearly limitless. The school's curricular innovation process and network of experts help it stay connected to emerging needs and take new programs to market efficiently. Future offerings will include certificates and interdisciplinary graduate degree programs.

Combining cutting-edge knowledge with hands-on experiences is essential for preparing tomorrow's professionals. The university's San Xavier Mining Laboratory provides students an opportunity to see in action what was taught in the classroom and get hands-on experience. Additionally, students have ample internship opportunities through industry partners here in Arizona and around the globe. As a Tier 1 research institution, the UofA is uniquely placed to prepare the next generation of mining innovators, with world-class laboratories, research mentors, and real-world projects sourced from industry partners.

No one is too experienced to learn! The school also offers professional education to upskill and reskill existing professionals at any point in their career.

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through mining and minerals. While the UofA's research shows students are aware of mining and its importance for the economy, most students don't know about the many ways mining can help secure our world's future, or how they can be a part of it. So, the school shares this information with them as early as possible by providing informative and engaging K-12 education outreach. Virtual and in-person presentations and hands-on activities show students what it's like to design a mine, extract minerals with electrowinning, and perform mine site reclamation. Creating and maintaining visibility for mining and minerals education and career pathways, helping students find the right one for them, and making those pathways as accessible as possible is important for filling the pipeline with the next generation of talent.

The public's knowledge of mining is also important to a secure supply of responsibly sourced mineral resources. A public informed about what we use mineral resources for (like green energy), where and how we get them, and potential impacts can help lead to better policy and permitting decisions. Empowering communities with basic knowledge of mining may improve conditions for engagement — after all, it's not unusual to fear or distrust what we don't understand. That's why the school is creating basic education modules for communities and working with our partners to help them explore these resources.



School of Mining and Mineral Resources' Education Outreach Coordinator, Chris Earnest, demonstrates to students how to plate their own copper using a hands-on solvent extraction-electrowinning activity during the virtual mining engineering themed day of the Summer Engineering Academy.

### There's Room for You, Too

Everyone has a role to play in achieving a sustainable mineral resource future. Through the School of Mining and Mineral Resources and its many partner programs, the UofA is committed to doing its part. But it couldn't do any of this without the great mining and minerals community in Arizona and beyond. To find out how you can get involved, visit [mining.arizona.edu](http://mining.arizona.edu).



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# Activities Advance at South32's Hermosa Project

*The ability to produce battery-grade manganese reshapes the project*

By Steve Fiscor, Editor-in-Chief, E&MJ

Last year was a busy year for South32's Hermosa project in Arizona. The group is working on a final feasibility study for the Taylor deposit. They are also drilling water wells and building a water treatment plant as part of a dewatering program to access the Taylor deposit and the Clark deposit, which sits above the Taylor deposit. The Clark deposit has been identified as a major domestic source of manganese for the U.S. Meanwhile, exploration continues on Hermosa's large land package.

A year ago, Hermosa completed a pre-feasibility study for the Taylor deposit, which is a 138-million-ton, zinc-lead-silver sulphide deposit. The final study on Taylor, a feasibility study, is well advanced and remains on schedule for completion by the middle of 2023, explained Pat Risner, president of the Hermosa Project. "Once we finish the final feasibility, we will approach the South32 Board for a final investment decision on the initial development for Taylor," Risner said. "We've previously disclosed an initial capital investment of \$1.7 billion to get the Taylor resource to first production. That's not far away."

Based in Tucson, Risner looks after Hermosa as well as South32's efforts to establish a presence in the U.S. South32 is headquartered in Australia and Hermosa is the company's most advanced project in the U.S. They are also involved with the Ambler and Roosevelt projects in Alaska. South 32 owns Roosevelt and Ambler is a joint venture with Trilogy Metals. "The Hermosa project is an exciting greenfield project, that could become a vital domestic source for critical minerals and base metals for the U.S., while helping to establish South32 in the U.S. as well," Risner said.

The middle of 2023 is shaping up to be an important period for Hermosa with a final investment decision on the Taylor deposit and commissioning of the dewatering infrastructure. Should the South32 Board decide to proceed, the dewatering project would allow Hermosa to start sinking shafts.

## Dewatering Program Advances

The South32 Board approved the capital spend for early works on a dewatering program at Hermosa. "Those activities began early last year and they also remain on schedule," Risner said. "The dewatering program comprises two major elements, construction of a large new water treatment plant and installing a large wellfield around the Taylor orebody. The planned commissioning for the water treatment plant and the wellfield is midyear 2023."

Hermosa also secured permits last July from the Arizona Department of Environmental Quality as part of the dewatering program. "We're installing a large diameter wellfield in and around the Taylor orebody," Risner said. "We have groundwater that we need to move away from the orebody to be able to sink two shafts. The Clark resource sits above Taylor, so we're essentially dewatering both deposits."

The initial plan calls for nine 24-in.-dia. wells. The Taylor orebody sits between 1,200 ft and 4,200 ft below the surface, so the depth of the wells varies from 2,000- to 4,000-ft deep. "We're drilling the first four now, and those will be drilled down to the same level as the base of the Taylor orebody so that we can dewater the entire orebody in advance of shaft sinking and eventually lateral development," Risner said. "We expect to have six of the nine wells completed before the water treatment plant is commissioned. That will allow the plant to operate at full capacity. The plant will treat the groundwater to an Arizona surface water quality standard before it's discharged into Harshaw Creek, where it eventually infiltrates back into the environment further downstream."

## Manganese: The Fifth Battery Mineral Potential

The second component of Hermosa, which has gained a lot of attention recently, is the Clark resource. The Clark resource is a 55-million-ton oxide deposit that primarily contains manganese, along with zinc and silver as well. It's the oxide cap that sits above the major sulphide deposit.

"The big news that we shared last year was the metallurgical test work that we performed on the Clark resource," Risner said. "A second phase of metallurgical test work has now demonstrated that we can produce a battery-grade manganese product from the Clark deposit."



The Hermosa dewatering program will pump water from the Taylor orebody and treat it before it's released.

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The Clark resource is the only advanced manganese deposit in the United States. “We’re just about finished with a pre-feasibility study on Clark, looking to develop it to produce a battery-grade manganese for the domestic battery-electric vehicle (BEV) market.”

The cathode of a lithium-ion battery contains lithium, nickel, cobalt, graphite, and manganese. “Manganese

is one of the five battery metals that’s often overlooked, but it’s very important nonetheless,” Risner said. “Manganese has not been produced in North America for more than 50 years. The U.S. is 100% reliant on Chinese supply chains from a processing standpoint. Now we have an opportunity to create a domestic supply chain to help the U.S. achieve its decarbonization goals and create jobs for Santa Cruz County, which is a part of Arizona that has not benefited from modern mining.”

When U.S. President Joe Biden invoked the Defense Production Act in March 2022 for the five battery metals, Hermosa started to evaluate opportunities to potentially accelerate the development of the Clark resource to produce a battery-grade manganese sooner than originally planned. They are currently discussing potential offtake deals with BEV manufacturers, and cathode and battery manufacturers that have plans to build facilities to support BEV manufacturers in the U.S.

Depending on the outcome of those discussions, Hermosa could conceivably bring the Clark resource into production before the Taylor resource. “There’s certainly a high sense of urgency from the Federal Government to get domestic supply of the five battery metals online sooner rather than later,” Risner said. “Based on customer discussions and what we’re seeing in terms of timing with the Defense Production Act and some of the incentives in the Inflation Reduction Act and other things, we are evaluating what it would take to bring the Clark resource forward.”

### Exploring Future Opportunities

Hermosa has 45,000 acres of mining claims around the Taylor and Clark resources, and they have identified a dozen exploration prospects through a couple of years of surface geophysics, soil sampling and a number of other exploration programs. “We’re testing one of those now, which is the Peake prospect,” Risner said. “We have previously reported some high-grade copper intercepts for the Peake prospect. It’s immediately adjacent to the deeper parts of the Taylor resource to the southwest.”

Hermosa is also in the permitting process to begin drilling the Flux prospect. “The Flux prospect sits below



The sun rises and construction continues on the new water treatment plant at Hermosa. (Photo: South32)

a historic mining area to the northwest of Taylor,” Risner said. “Geologically, it looks a lot like the Taylor resource as another possible zinc-lead-silver sulphide resource. We believe there’s potentially additional undiscovered resources on the land package as well.”

After years of studies, Risner said seeing construction activity makes him happy. “The fact that we’re progressing the critical path items, like the water wells, and pouring concrete and erecting steel is rewarding,” Risner said. “But the developments around Clark in the last 12 months are probably the most exciting.”

Risner sees the development of the Taylor and Clark resources as a possibly transformational project for South32. “It’s one of the only projects progressing in the U.S. that would produce two federally listed critical minerals, zinc and manganese, as its primary product, not by-product. It would greatly benefit Santa Cruz County.”

Santa Cruz County is one of the poorest counties in Arizona. “We have the opportunity for a real socio-economic transformation and to create a domestic supply of a critical mineral we haven’t produced in North America for more than 50 years,” Risner said. “And we will do it in a unique way, dry-stacking and backfilling tailings.” South32 is applying low-carbon design principles at Hermosa to achieve net-zero operational greenhouse gases.

Hermosa already built one of the first new dry-stack tailings facilities in the U.S. as part of a remediation program that it will continue to use once Hermosa is in production. “With underground development and paste backfill, the mine will have a minimal environmental footprint,” Risner said. “With a small surface footprint, dry-stack tailings and net zero operations, Hermosa would set a new standard from a sustainability standpoint, while creating a socio-economic uplift for a community that needs economic development.”

Unemployment in the Santa Cruz County is nearly double the state average and individual income levels are almost 40% below the state average. The Hermosa project really could be a significant uplift for the people of Santa Cruz County, and would provide a secure supply of critical minerals for the U.S.



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# Western Rare Earths Evaluates the Potential of the La Paz Project

*A large Arizona resource could represent an opportunity for the U.S. to become more self-reliant for high-performance permanent magnets*

By Steve Fiscor, Editor-in-Chief, *E&MJ*

Western Rare Earths is an Australian-owned exploration and development company that holds three mineral deposits in the United States, the La Paz project in Arizona, the Halleck Creek project in Wyoming, and the Searchlight project in Nevada. All three are magnet metals projects and La Paz has the potential to be among the largest rare earth metals resource in North America.

“The U.S. no longer has much experience mining and processing rare earths,” said Marty Weems, president of Western Rare Earths’ North American operations. “The Australians have as much experience as anybody else that’s currently extracting rare earths, if not more. So, it makes sense to let them chase, explore, and develop projects in the U.S.”

Rare earth elements, or rare earths, are often lumped together incorrectly with battery minerals. Battery-electric vehicles (BEVs) use rare earths. The battery minerals are lithium, cobalt, nickel, graphite, and manganese. The battery is an important component, but BEVs also need electric

traction motors to turn the wheels and those motors use high performance permanent magnets made with rare earths.

“The real demand growth from BEVs will be extraordinary,” Weems said. “The projected levels of demand growth cannot rely on recycling alone. The primary source of those rare earths will have to be mined and processed.” In addition to BEVs, rare earths are also required for generators on wind turbines. Many future clean energy ambitions will create more demand for high-performance permanent magnets and rare earths.

The four rare earths needed to make high-performance permanent magnets that can withstand extreme temperatures are neodymium (the largest by volume), praseodymium, dysprosium, and terbium. “Every weapons system, whether it flies through the air, drives across the ground, or sails the ocean, requires anywhere from grams to many tons of rare earths in the form of these high-performance permanent magnets,” Weems said. “Relying on China for that supply chain is far from ideal for the U.S. In addition to the renewable energy future, which will drive the economics for the project, we also have a national security component that’s critical for long-term security for the U.S.”

The U.S. recently passed the Inflation Reduction Act, the CHIPS Plus Act, and the Bipartisan Infrastructure Bill, and those three pieces of legislation will create the largest shift in industrial policy focused on critical minerals since World War II. On the supply chain side of that equation, large rare earths deposits, especially in mining-friendly districts like Arizona, will become extraordinarily important.

## La Paz: An Enormous Rare Earths Resource

The La Paz deposit, which sits about 150 miles northwest of Phoenix in La Paz County, Arizona, comprises 218 federal load claims on 7,000 acres. The mineralized resource amounts to more than 170 million metric tons (mt). Most of it sits in one section, which is a square mile, on Arizona state land. The rest of the resource is on land managed by the federal Bureau of Land Management. “Arizona is very mining friendly and the permitting process for Arizona state will be much simpler than the permitting process for federal lands,” Weems said.

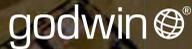
Western Rare Earths completed some exploration drilling in early 2022 and now they are conducting research on beneficiation with various metallurgical assessments. “We are looking to do a scoping study that would then lead into



The La Paz project sits about 150 miles northwest of Phoenix, Arizona.

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Western Rare Earths completed a drilling program in early 2022.

a preliminary economic assessment (PEA), hopefully in the coming year,” Weems said. “We need to see what the data tells us from the mineral processing studies and the scoping study before we start the PEA.”

The drilling results were consistent and positive. “The drilling program allowed us to expand the resource primarily at depth and a bit laterally and it remains open at depth and laterally,” Weems said.

With the metallurgical testing, Western Rare Earths has found that the ore responds well to high-intensity magnetic sepa-

ration. “When you’re talking about a large resource like we have here, processing a great amount of material, inexpensive concentration of that ore early in the flowsheet is critical,” Weems said. “The ore responds well to simple high-intensity magnetic separation and that will remove about 73% of the gangue material. That will significantly reduce the amount of total mass that would require processing with reagents. We’re really encouraged by how simply and how easily it concentrates.”

Recently, the company’s geologists noticed that the surface geology on the access road that cuts across the area looks a lot like the resource area. They explored and sampled it more closely and they now think a much larger twin ore body might exist about 3 km to the west of the established resource. “With this discovery, we might have the opportunity to establish a second resource at La Paz or add to the existing resource,” Weems said. “We believe this additional area could be much larger than the maiden resource area, at least on the surface footprint. We’ve done a bit of exploration drilling across this additional area, but not enough to be able to estimate a resource yet.”

Because Western Rare Earths is Australian owned, it uses JORC guidelines for resource estimates, which allows explorers to establish an exploration target, or a preliminary estimate, before they establish a resource estimate. The exploration target estimate for this new area is currently between 700 and 900 million tons.

“Hypothetically, there could be a space in between these two areas, which would be a fantastic location for

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pit-side operational facilities,” Weems said. “It would also extend the La Paz project’s life, if we can work that original maiden resource and then develop a second orebody that would continue to feed that plant down the road.”

**A Clean, Domestic Source of Rare Earths**

Beyond the extraordinary size of the resource, Weems said the ore is comparatively clean. Rare earths are the lanthanide series on the periodic table. “Their cousins, the actinides, which includes uranium and thorium, typically always occur in nature together with lanthanides,” Weems said. “When a rare earths deposit is discovered, they normally contain uranium and thorium and it’s a radioactive deposit. Surprisingly, the La Paz project is not radioactive. The amount of uranium and thorium is nearly negligible.”

The lack of radioactivity will be extremely beneficial to getting this project off the ground especially when it comes to permitting. Opening a rare earths mine in the United States that produces a lot of uranium and thorium would require a nuclear regulatory commission (NRC) permit for that mine. The U.S. has not issued a new NRC permit for a greenfield mine in the United States since 1998. Weems suspects that no one at the NRC knows how to write one now. “It has effectively become a permit that doesn’t really exist anymore,” Weems said.

Because the levels at La Paz are so extraordinarily low, near negligible, Weems said that processing ore would not

concentrate thorium or uranium to a level that requires an NRC permit. “Permitting a mine in the U.S. is challenging enough without an additional permit from the NRC,” Weems said. He joked that his favorite permit in the mining industry is the permit that his competitors need, and he does not.

Today, there is no midstream processing of rare earths in the United States. “If a project like this were to open today, the metals would be refined offshore,” Weems said. “When we talk about separation, purification and metal making, 85% of that happens in China and 15% happens in Estonia about 30 miles from the Russian border in Eastern Europe. That’s not the safest place to be these days and China’s probably not that much more spectacular, somewhere between suboptimal and terrible.”

Western Rare Earths wants to stand up midstream processing in the United States. “We want to do that in the United States, which means developing an additional purification smelting facility on top of opening a mine and a concentrating facility,” Weems said.

The ability to extract and refine rare earth was originally developed by American ingenuity in the 1950s and 1960s for the space race, Weems explained. “We chose to offshore those job to China in the 1980s and 1990s,” Weems said. “And, now we have an opportunity to not only bring those jobs and that supply line back to the United States to support national security, but also to supply the rare earths needed for the new energy future.”

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# Taseko, Mitsui Enter Strategic Partnership to Develop Florence Copper



Florence Copper will produce copper from in-situ recovery using a wellfield similar to this test wellfield, but larger in scale.

Taseko Mines Ltd. has signed agreements with Mitsui & Co. (USA) Inc. to form a strategic partnership to develop the company's Florence Copper project, located in Arizona, USA.

Mitsui has committed to an initial investment of \$50 million, with proceeds to be used for construction of the commercial production facility. The initial investment will be in the form of a copper stream agreement on 2.67% of the copper produced at Florence Copper.

In addition, Mitsui has the option to invest an additional \$50 million for a 10% equity interest in Florence Copper. The equity option is exercisable by Mitsui within a 3-year period following completion of construction of the commercial production facility. If Mitsui elects to exercise its equity option the copper stream will terminate.

As part of the arrangement, Taseko and Mitsui have entered an offtake contract for 81% of the copper cathode produced at Florence during the initial years of production. The parties intend to use this period to develop premium sales channels for 'green copper' in the United

States, leveraging Mitsui's existing U.S. cathode trading business and the unique environmental benefits of Florence Copper, which is expected to be the lowest carbon- and energy-intensity copper producer in North America.

"Mitsui's investment will complement Taseko's financing requirements and construction timeline and advance our goal of ensuring the copper produced at Florence is recognized for its unique low-carbon profile that will advantage U.S. manufacturers and consumers," said Stuart McDonald, president and CEO of Taseko. "In the future, Taseko and Mitsui will collectively evaluate additional investments toward establishing Florence Copper as a zero-carbon copper producer (Scope 1 and 2)."

Florence Copper uses in-situ recovery to extract copper from an orebody without disturbing much land. The commercial facility is expected to have a production capacity of 85 million lb/y of copper. It will consist of commercial scale solvent extraction/electrowinning (SX/EW) plant and the associated infrastructure needed to pump raffinate from 80 injection and recovery wells.

"When in production, Florence Copper will significantly expand our U.S. cathode trading business, while providing an environmentally sound, domestically produced product that can be marketed on the basis of its low-carbon advantages," said Sayu Ueno, president and CEO of Mitsui & Co. (USA). "We believe Florence Copper will be a preferred source of 'made-in-the-US' copper for many end users in North America."

Under the terms of the initial \$50 million Copper Stream agreement, Mitsui's first deposit payment of \$10 million will be available for drawdown after receipt of Florence Copper's underground injection control (UIC) permit, with additional \$10 million installments available each quarter thereafter to fund project construction. Mitsui will receive 2.67% of the copper metal produced at Florence and pay a delivery price equal to 25% of the market price of copper delivered under the contract.

If Mitsui elects to exercise its equity option and invest an additional \$50 million in the project, these additional funds and the copper stream will be converted into a 10% equity interest in Florence Copper. At that time, the initial offtake agreement will cease and be replaced with a marketing agency agreement.

If the copper stream is not converted into an equity interest Taseko will have the right to buy-back 100% of the copper stream, otherwise, it will terminate when

40 million lb of copper have been delivered under the agreement. Mitsui's offtake entitlement would also reduce to 30% until the copper stream deposit has been reduced to nil.

Taseko has also obtained an underwritten commitment for \$25 million from Banc of America Leasing & Capital, LLC. Proceeds from this financing will be available to Florence Copper to fund costs associated with the SX/EW plant for the its commercial production facility.

"This additional source of funds will further strengthen our balance sheet and provide financing flexibility as we prepare for construction of the project in 2023," McDonald said. "We have a long-standing relationship with Bank of America, a North American leader in equipment financing for mines and projects directly supporting low-carbon initiatives in the United States."

"In addition to Florence Copper's strong economics, the project has many environmental attributes, including low carbon emissions and a low footprint operation, which are attractive to financial partners," he said. "The financing commitment from Bank of America is a customized solution developed for Taseko."

The \$25 million of funding will be available for drawdown upon Florence Copper receiving the final UIC permit from the U.S. Environmental Protection Agency (EPA). The loan will be secured by specific treatment and processing equipment in the SX/EW plant with an initial term of five years. The facility can be repaid at any time and carries no financial covenants.

During October, the EPA concluded the public comment period for the draft UIC permit that it issued in August 2022. Public comments submitted to the EPA have demonstrated strong support for the Florence Copper project among local residents, business organizations, community leaders and state-wide organizations. More than 98% of written comments were supportive of the project and supplement the unanimous public support voiced at the EPA's public hearing on September 15, 2022. Taseko has reviewed all the submitted comments and is confident they will be fully addressed by the EPA during their review, prior to issuing the final UIC permit.

"We have taken considerable time and worked extremely hard to demonstrate the environmental and societal benefits of our Florence Copper project. Florence Copper will have one of the lowest carbon footprints of any copper mine in the world and will produce a critical metal needed for the United States domestic market," McDonald said.

The UIC permit is the last authorization required to advance the Florence Copper project to commercial production.



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# Ivanhoe Electric Continues Step-out Program at Santa Cruz

*Using Typhoon and software from Computational Geoscience, the company has located a new copper deposit and is better defining previously known, but hidden deposits*



Drilling confirms the deep targets (3,000 ft plus) that Ivanhoe Electric located with its Typhoon system.

Ivanhoe Electric (IE) is an American technology and mineral exploration company that is re-inventing mining for the electrification of everything by combining advanced mineral exploration technologies, renewable energy storage solutions and electric metals projects predominantly located in the United States. IE's Executive Chairman Robert Friedland is also the founder and chairman of Ivanhoe Mines Ltd. Describing himself as an entrepreneurial explorer, technology innovator and company builder, Friedland has made several major discoveries during his career, and he also developed the Typhoon system for deep exploration.

Using the Typhoon transmitter, an accurate and powerful geophysical survey system, together with advanced data analytics provided by its subsidiary, Computational Geosciences, IE can accelerate and de-risk the mineral exploration process for known deposits. The technology can also be used to discover deposits of metals as well as petroleum that may

otherwise be undetectable by traditional exploration technologies.

Today, IE is advancing its portfolio of metals projects located primarily in the United States, which include the Santa Cruz copper project in Arizona and the Tintic copper-gold project in Utah, as well as projects in Montana, Oregon and North Carolina.

At the end of November, IE provided an update on the drilling operations at Santa Cruz and a remarkable discovery of copper mineralization at the Far Southwest Anomaly. "With the terabits of information gained from our 6,500-acre Typhoon geophysical survey, we can leverage our exploration dollars by drilling precisely where Typhoon indicates we should," Friedland said. "We continue to demonstrate the exceptional reliability of the Typhoon data processed by Computational Geosciences, first by making the discovery of East Ridge and now by finding deep, intrusive-hosted copper mineralization at the Far Southwest Anomaly. We know of no other geophysical tech-

nology that directly detects deep copper mineralization at depths of more than 3,000 feet. This American-owned technology is truly revolutionary and should be celebrated as such."

## Santa Cruz Discovery

In the early 1970s, world-renowned geologist David Lowell led an extensive exploration program covering much of southwestern Arizona. He discovered the Santa Cruz copper deposit before discovering Escondida in Chile — now the world's largest copper mine. After drilling more than 120 holes at 20 projects across southwestern Arizona, Lowell and his team focused their attention on what they called "the Covered Area Project," now known as Santa Cruz.

Lowell was aware of the evidence for shallow-angle faulting and the potential for fault-dismembered porphyry mineralization under cover in the Casa Grande Valley.

Careful stream mapping and drainage analysis revealed that the Santa Cruz River had reversed flow directions at least twice in recent history, and it was this revelation that allowed Lowell to trace oxide copper pebbles found in water wells back to the Santa Cruz deposit area.

Lowell discovered evidence for porphyry mineralization in the first drill hole, which intersected leached capping, and the drilling eventually intersected ore-grade supergene-enriched copper mineralization at what would be called the Casa Grande West deposit, now known as the Santa Cruz deposit.

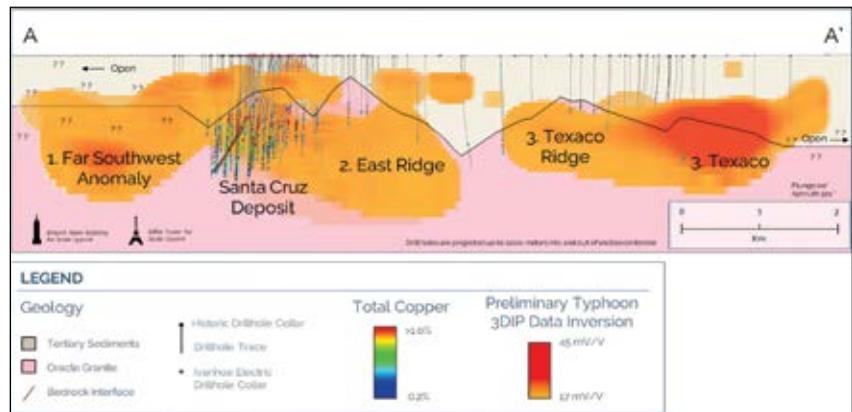
Drilling continued through to 1977, at which point M.A. Hanna Mining took over as operator under a joint venture with Getty Oil Corp.

Between 1977 and 1982, Hanna-Getty advanced a tightly-spaced drill program over Casa Grande West and in the surrounding Casa Grande valley. The fall of copper prices resulted in the Casa Grande West project becoming inactive in the early 1980s.

Several other deposits, including Santa Cruz North, Texaco and Park Salyer, were identified by Asarco drilling programs in the 1960s and subsequent drilling in the 1970s and 1980s by numerous exploration companies. In total, 362 drill holes totaling nearly 230,000 meters (m) have been drilled by previous owners to delineate the deposits.

### Typhoon Identifies Deep Targets

The Santa Cruz copper project lies to the west of Casa Grande, Arizona. After drilling through more than 1,000 m (3,300 ft) of basin-fill gravel cover, which obscures the underlying geology to conventional geophysical techniques, exploration drill hole SCC-098 crossed a fault and entered primary



Typhoon better defines the buried geology of the Santa Cruz deposits.

chalcopryite and pyrite mineralization within intrusive rocks, an area now known as the Far Southwest Anomaly.

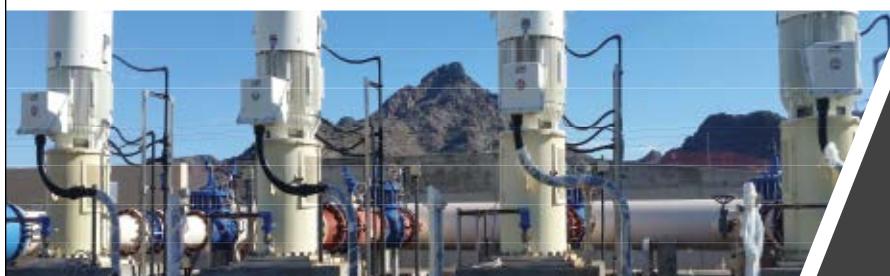
“This is an exciting time for the team at Ivanhoe Electric. Our repeated exploration drilling successes at the East Ridge discovery and now at the Far Southwest Anomaly demonstrate the power of the Typhoon technology and provide us with excellent opportunities for near-term resource expansion,” said IE President and CEO Taylor Melvin.

The intersection of these low to moderate concentrations of copper as chalcopryite and accessory pyrite within a Laramide-age diorite porphyry with potassic alteration is an excellent technical achievement and demonstrates the utility of Typhoon to find new copper, Melvin explained. “We expect this zone will represent relatively low-grade “primary-style” sulphide mineralization and believe it should be viewed as strong evidence in support of delineating another



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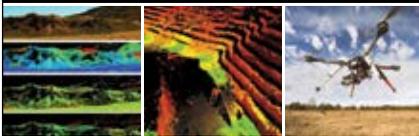
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faulted-off portion of the Santa Cruz mineral system,” Melvin said. “Based on our geological team’s understanding of the faults and structural relationships in the Santa Cruz district, we interpret the potential for leachable copper oxides, enriched copper sulphides and primary sulphides to exist within this fault block at somewhat shallower depths.”

This relationship of primary sulphides to the enriched and leachable copper zones is already well established at both the Santa Cruz Deposit and East Ridge and may or may not repeat at the Far Southwest Exploration Area.

### Drilling Confirms Typhoon’s Targets

During September, IE started drilling targets identified in a 26.5 km<sup>2</sup> (6,500-acre) Typhoon 3D induced polarization and resistivity geophysical survey that was completed in late July 2022. Computational Geosciences completed the data “inversions,” explained Friedland, who also discussed the significance of the technology.

“No geophysical survey technology, other than our Typhoon system, could have imaged the Santa Cruz mineral system as rapidly or to as great a depth as we have done,” Friedland said. “Additionally, no other data processing group has the same capability as Computational Geosciences to ‘invert’ or analyze the terabytes of data produced by Typhoon as quickly.”

Based on the interpretation of preliminary data, IE’s geologists and geophysicists identified multiple large-scale anomalies, which may indicate the potential to expand the currently known copper oxide and sulphide mineralization at Santa Cruz. Typhoon has clearly imaged areas of known mineralization as well as areas for future exploration.

The Santa Cruz in-fill drill program continues to expand understanding of this significant copper deposit. An attractive feature of the Santa Cruz mineral resource estimate is the amount of metal at relatively high cut-off grades. This higher-grade material tends to be in



This core sample shows exceptional chrysocolla and atacamite, which is soluble oxide copper mineralization.

the leachable copper categories, potentially allowing for a low-impact, underground mining operation that processes the ore through leaching and solvent extraction/electrowinning (SX/EW), which consumes less power and water.

At a 0.39% copper cut-off grade, the current mineral resource contains 2.5 million metric tons (mt) of copper in the indicated category, and 2.3 million mt of copper in the inferred category with an average grade of 0.9% copper. However, when a 1% copper cut-off grade is applied, Santa Cruz maintains nearly 60% of its contained metal, with 1.4 million mt of copper in the indicated category at an average grade of 1.7% copper and 1.4 million mt of copper in the inferred category at an average grade of 1.9% copper.

Eight drill rigs are currently operating (six diamond drill rigs, one reverse circulation rig and one sonic drill rig) to in-fill and expand the Santa Cruz deposit. The 75,000-m, in-fill drilling confirmed the East Ridge and the Far Southwest Anomaly in November.

“Drilling at East Ridge has returned impressive oxide copper mineralization in our first step-out exploration holes,” said Graham Boyd, Vice President of U.S. Projects for IE. “In particular, hole SCC-105 has returned strong visual results, intersecting over 100 m of consistent copper oxides. Further, at the Santa Cruz deposit area, the assays received for infill hole SCC-084 have demonstrated a broad zone of soluble oxide copper in exotic, oxide and chalcocite mineralization. These results suggest that we have only begun to uncover the potential of this district.”

IE has discovered additional oxide copper mineralization in drill hole SCC-109, located approximately 400 meters to the east-southeast of SCC-105, and approximately 125 m east of mineralized holes previously drilled by Asarco of Tucson, Arizona. SCC-109 intersected copper mineralization dominantly as atacamite in fractures beginning at a downhole depth of approximately 657 m and continuing for over 47 m. This area is open for expansion to the north, east and south from SCC-109.

“The recent visual results from the East Ridge hole SCC-109 shows oxide copper mineralization, which further demonstrate the potential for new discovery at the Santa Cruz copper project,” Melvin said.

Atacamite is a deep green, leachable copper-chloride mineral which is 60% copper by weight. Chrysocolla is a bright blue, leachable copper oxide mineral which is approximately 30% copper by weight. Chalcantite is a

dark blue, leachable copper-sulfate mineral which is approximately 25% copper by weight. These leachable minerals are amenable to SX/EW recovery, allowing for direct copper cathode production.

### Additional Targets

IE is also drilling the Texaco deposit and the Newmont Parcel. The Texaco deposit is the second-largest body of mineralization known at the Santa Cruz project. It is located 3.5 km northeast of the Santa Cruz deposit. Historical and IE drilling have confirmed that the deposit remains open, that supergene copper mineralization is sulphide-dominated, and that there are indications of underlying high-grade hypogene mineralization.

The Texaco exploration target conceptually includes 150 to 200 million mt of mineralized material with a target grade of 0.7% to 1.5% total copper. That’s based on nearly 24,000 m of



Samantha Pascarelli, an IE geologist, logs Santa Cruz drill core.

core from historical drilling, three drill holes completed by IE and the results

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Typhoon conducts geophysical surveys by sending electric charges deep into the Earth's crust.

of the recent Typhoon survey. Additional drilling is planned to test and determine the extent of the Texaco target.

Typhoon has identified a large zone of chargeable material in a shallower "ridge" environment in the subsurface basement topography. This area has been very sparsely drilled and is another

area with the potential for the discovery of additional enriched copper mineralization. IE plans to start drilling in this area in the near future.

The range of potential tons and grade of the Texaco exploration target are conceptual in nature as there has been insufficient exploration to estimate

a current mineral resource. The range of tons and grade could change as additional drilling is completed. It is anticipated that a thorough exploration program may be completed before the end of 2023.

The 80-acre Newmont Parcel is immediately contiguous to both the highest-grade zones of the Santa Cruz Deposit and the East Ridge discovery. It was not drilled by previous operators during any of the major exploration campaigns completed by Lowell, Hanna-Getty or Asarco. This specific parcel of land was owned by Newmont Corp. and they never drilled it. The parcel was subsequently consolidated by previous project owners, but was also never drilled. It now forms part of IE's interests, and is an important exploration area.

IE has drilled three holes on the Newmont Parcel and all three intersected significant zones of oxide copper mineralization that remain open in all directions.

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## Data Collection and Analytics

Ivanhoe Electric employs a comprehensive quality assurance and quality control protocol across all aspects of the company's data collection, sampling and analytical procedures. Recovered drill core is inspected, logged, and thoroughly marked for sampling at 2-m intervals. Sampled drill core is sawn into two lengthwise halves of which one-half of each drill core is maintained for future reference and the other half of each drill core is sent to Skyline Assayers and Laboratories of Tucson, Arizona, USA or Société Générale de Surveillance SA (SGS) of Vancouver, British Columbia, Canada, both of which are ISO 17025 accredited laboratories, to complete all sample preparation and assaying.

Samples are analyzed employing total copper, total molybdenum, and sequential copper assaying for acid-soluble and cyanide-soluble copper determinations. Laboratory analysis also employs four-acid ICP-MS anal-

ysis for silver and lithochemical determinations. For quality assurance and quality control purposes, certified standards, blank samples, and controlled sample duplicates are inserted into the sample stream at prescribed intervals and conditions to monitor laboratory performance.

The cutting and sampling efforts are currently averaging approximately 250 m/d, and there are currently 7,200 m of drill core at both Skyline and SGS and IE said is expecting a steady return of assay results from both labs in the near future.

IE's drill program has provided a better understanding of the mineralized areas of Santa Cruz, as well as future areas of focus, including increased delineation of the high-grade exotic and oxide/enriched zones. The company plans to update the mineral resource estimate after the completion of the current drilling program.

The program's emphasis is on the larger, higher-grade portions of the

deposit, which appear to have sufficient dimensions to support various bulk underground mining methods. While assays are still pending, mineralization encountered to date shows a strong correlation with the mineral resource block model.

"The results from our drill campaign at Santa Cruz have confirmed the spectacular grade of the known deposit," Friedland said. "With the steady pace of new information being received, we are increasing our understanding of this enriched copper deposit. With the knowledge of the Santa Cruz 'fingerprint,' we are encouraged by the prospect of additional copper discoveries in the area."

Mining, metallurgical, geotechnical and hydrological trade-off studies are nearly complete and will collectively form the overall framework to support the Preliminary Economic Assessment (PEA) for the Santa Cruz Project. The PEA is scheduled for completion during the second quarter of 2023.



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# Resolution Copper Receives the Copper Spade Award from AMA



The SPADE award recognizes Resolution Copper's partnership with the U.S. Forest Service, NAU and Western Apache Tribes in restoring the Emory Oak groves for the future generations of Native American Communities.

The Arizona Mining Association (AMA) awarded Resolution Copper the 2022 Sustainability, Preservation, and Diversity in the Environment (SPADE) Award for Public Education. The award recognizes mining companies that have led, financed, or hosted public education efforts for habitat preservation and enhancement or species protection and restoration.

“Over the past several years, AMA members have increased their efforts in safety practices and environmental protection, thereby raising the standard for SPADE excellence,” said AMA Executive Director Steve Trussell.

Resolution Copper began a multiyear partnership with the Tonto and Coconino National Forests, Northern Arizona University (NAU), and Apache Tribes in Arizona to create the Emory Oak Collaborative Tribal Restoration Initiative in response to concerns voiced by Western Apache Tribal elders that the health of Emory Oak groves is declining, with fewer and fewer acorns produced each year across Arizona.

The Emory Oak is a culturally significant tree to the Western Apache people. The acorns provide a traditional food source in addition to other cultural and ceremonial uses. In recent years, drought, fire suppression, livestock

over-grazing, species competition, and climate change have circumvented the growth of new Emory Oak seedlings and the production of acorns. The Emory Oak project partners with the Yavapai-Apache Nation, Tonto Apache Tribe, and White Mountain Apache Tribe, with assistance from San Carlos Apache tribal elders, to research the protection and restoration of Emory Oak groves across Arizona.

A fundamental component of the program involves transferring traditional ecological knowledge from elders to youth through education and collaboration. The Emory Oak project has sponsored multiple public education efforts, from planting Emory Oak saplings to training, outreach, and developing research papers and presentations. The program also aims to create a record of the traditional ecological knowledge used to manage the Emory Oak ecosystems so younger generations can access it in the years ahead.

“We are grateful for the collaborative partnership between the U.S. Forest Service, NAU and Western Apache Tribal elders,” said Victoria Peacey, acting project director for Resolution Copper. “Indigenous Traditional Ecological Knowledge has guided every aspect of this work from identifying priority Emory Oak groves to implementing best practices on the ground to preserve a critical aspect of Western Apache culture. By acknowledging, respecting and listening to the voice of Western Apache Tribal elders, mining companies can play a role in preserving this important species.”

Resolution Copper said it recognizes the importance of this legacy project and what it means to the Western Apache people. The company is grateful to deepen our consultation and partnership with Native American tribes to continue shaping the project, the benefits it can provide and the co-management and preservation of cultural heritage.

Resolution Copper is developing one of the largest copper deposits in the world in Superior, Arizona. The company plans to operate a 21<sup>st</sup> century mine while protecting and preserving the area’s unique natural surroundings and cultural heritage.

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