

## Huge Open-Pit Copper Mine Goes Underground

LUIS ANDRES HENAO, Associated Press



CHUQUICAMATA, Chile (AP) — From above, it looks like a colossal amphitheater carved from rock, or the vast crater from a meteorite that crashed into Chile's Atacama desert ages ago.

Inside the world's largest open-pit copper mine, dump trucks as big as two-story houses work around the clock to haul hundreds of tons of rock and minerals 2,790 feet (850 meters) to the surface of this elliptical, seemingly endless, man-made hole.

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But the open pit has run its course at Chuquicamata — the storied mine that awoke the political awareness of a young Ernesto "Che" Guevara in the 1950s, inspired Marxist President Salvador Allende to nationalize the copper industry in 1971 and generated decades of prosperity for Chile.

After a century of exploitation, Chuquicamata has become too big, too deep and too old to continue digging in the open-pit method. The giant trucks that carry copper ore each guzzle 819 gallons (3,100 liters) of fuel a day driving 7 miles (11 kilometers) to the surface with ever-poorer loads as ore grades decline and copper yields fall.

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Chuquicamata produced 443,000 tons of copper last year, but experts say that by 2019 it will be unprofitable.

So state-owned mining company Codelco is trying to head off closure by taking the daring step of converting the open pit into the world's largest underground mine.



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Codelco believes the mine still has much more to give, with reserves equal to about 60 percent of all the copper exploited in the mine's history still buried deep beneath the crater. It has started digging more than 620 miles (1,000 kilometers) of tunnels underneath the pit in a \$3.8 billion project to revive the mine.

"The technological challenges are enormous. We're talking about changing the biggest open pit copper mine in the world to the biggest underground mine in the world. This type of project is unique," said Juan Carlos Guajardo, head of CESCO, a Santiago-based mining think tank.

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Engineers are building four huge floors underneath the pit, in addition to the tunnels, to extract 340,000 tons of copper a year from beneath the ground. The trucks will be replaced by conveyer belts that will carry ore to the grinding machines and the smelter.

Alvaro Aliaga, general manager of Chuquicamata's underground project, said the project will put Chile on "the vanguard of global mining."

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All over the world, the race for resources is forcing countries to spend more and drill deeper than they ever have before. Energy companies in the United States are using hydraulic fracturing to tap huge gas and oil reserves from Pennsylvania to Alaska. Argentina is preparing to explode rock to get unconventional oil and gas in Patagonia. Brazil has pioneered deep-water drilling techniques in the Atlantic.

These long-term, multibillion-dollar projects are creating technological feats and opportunities for new industries unseen since the U.S. space race.



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"This resembles some of the projects in Argentina and Brazil in terms of its magnitude and the challenge they represent for engineering because they're works of a tremendous scope and with a huge impact on the national economy," said Aliaga.

Work has already begun on the tunnels at the mine, which is 745 miles (1,200 kilometers) north of Santiago in the world's driest desert.

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Perforating the rock with a machine that looks like a giant yellow praying mantis, engineers lay explosives that blast through the cavernous walls for ventilation shafts.

"Two of these five tunnels are going to be built to inject clean air and make sure the dirty one comes out," Maria Cristina Vallejos, the only female miner at Chuquicamata, said as she took cover from a nearby blast. "They'll give us the best environmental conditions for the underground work."



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Inside one of the tunnels, a bulldozer removed rock and dirt while miners installed a steel mesh to avoid a cave-in, advancing at a painstaking pace of about 13 feet (4 meters) per day. The main tunnel will eventually stretch for more than 4.5 miles (7.5 kilometers).

The future for Chuquicamata, and Codelco, is likely to determine the prosperity of Chile, which has been growing fast and attracting foreign investment thanks largely to the stability that copper royalties provide.

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"This (project) is not only seeking to guarantee the production of Chuquicamata but ensure the competitive position of Codelco," Aliaga said.

Everything about Chuquicamata, affectionately known as "Chuqui" by Chileans, is epic in scale, and its history is in many ways the history of Chile.

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The area has been mined since before Spanish colonial times, but the current operation began in 1915 under foreign and local interests. When it was owned by Anaconda, the U.S. company built a whole town in the desert to support it, equipped with a railroad, schools, soccer fields and social clubs. Although many benefited, working conditions were risky, many miners died and a wave of strikes and crackdowns roiled the project, making it a symbol of the struggle for workers' rights.

"Che" Guevara visited the mine in March 1952 and deplored the treatment of the miners in his "Motorcycle Diaries."



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Pablo Neruda, Chile's best-known poet and a life-long communist, also criticized Anaconda's grip on the Chilean miners.

"It was a grimy multitude, hunger and shreds, solitude, that excavated the gallery. That night I didn't see the countless wounds file by along the mine's cruel rim. But I was part of those torments," Neruda wrote in "Night in Chuquicamata."

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The mine became Chilean state property when Allende nationalized copper in 1971 — one of the acts that infuriated U.S. President Richard Nixon. Washington backed Allende's opponents, encouraged his overthrow and knew the coup that toppled him was in the works, though there is no evidence it directly participated.

But when Gen. Augusto Pinochet seized power in 1973, he declined to return copper to private hands. Ever since, Codelco has kept Chile's economy strong.

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Conditions at Chuquicamata today are nothing like what Guevara and Neruda described. Mining remains a dangerous occupation and many workers still suffer injuries at marginal private operations, such as the San Jose mine that collapsed in 2010, trapping 33 workers underground for 69 days.

But mining deaths nationally fell 36 percent last year and it was Codelco that led the rescue of the trapped miners at San Jose, mesmerizing millions worldwide.

The seven-floor hospital Anaconda built in the 1960s is now buried under thousands of tons of rock from the expanding mine. The school's windows are broken and boarded up, and empty homes are caked in dirt. A flattened, dusty soccer ball lies on one of its abandoned streets. The town of 20,000 people was evacuated in 2007 to nearby Calama to make room for the mountains of mine waste now baking like elephants in the sun.

President Sebastian Pinera says Chileans should put nostalgia aside and look at the Chuqui of the future — an underground mine that will keep delivering wealth to the nation for another 50 years.

"We have to prepare ourselves for the end of the old Chuquicamata and at the same time the new Chuqui, that starts today," Pinera said in July as he ordered the blast that began the work.

"It's nostalgic but we feel we're making history," said Mauricio Vivero, a construction engineer at Chuqui. "Perhaps the grandchildren of some of the miners that Che saw are now doctors, engineers, or even work right here. This mine gave



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us everything. Behind this mine, rests a whole country."

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