



PERSPECTIVE

Mining for Opportunities in Peru and Chile

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Landscape in Peru

Earlier this year, my colleagues and I visited the Latin American countries of Peru and Chile in search of investment opportunities. Mining is an important industry in both countries, with gold, silver, copper and zinc among the key metals and minerals extracted.

Setting up a visit to a mine high in the mountains of Peru was one of the most difficult arrangements our team has had to make! Negotiations with the company were lengthy, and we were close to giving up. Then a couple of days prior to our planned visit, the company asked us for proof of life insurance and a medical exam, which for older folks like me included an electrocardiogram. We almost gave up at that point, but with determination I ended up on my Lima hotel bed attended by a doctor who stuck suction cup wires on my body for the required electrocardiogram. It was an experience I certainly won't forget, particularly when she discovered her equipment wasn't working properly. But she passed me anyway, figuring that I would be able to stand the high altitude!

I could understand the company's concerns about having visitors in a dangerous mining site. In any case, we were on our way after I passed the exam.



The terrain at the airport in the coastal city where we landed and all the way to the mine could have been used as a set location for a movie about the moon or a *Star Wars* feature. No vegetation and just light-brown, hilly, rocky ground. The two-lane highway was excellent, winding around the mountains as we climbed. On the way, we occasionally saw small concrete-block homes with corrugated metal roofs. It took one and a half hours to drive from the Pacific coast all the way up to the mine at 3,400 meters above sea level.

Once we arrived at the summit, we found what could be described as a little town in the middle of nowhere, with some 20,000 residents including 1,500 miners, 500 contractors, their support staff and families. Amenities included a church, a golf course carved from the dry land but with a few green patches, a soccer (football) field, hospital, bank branches, schools, etc.

The whole visit was an exciting and interesting experience for all of us. We were impressed by the high caliber of people working at the mine. They all seemed to be very motivated and proud of their work, talking constantly of important KPIs (key performance indicators), such as production growth and cost per unit. It was quite remarkable to us that the company could retain and develop talent in such an inhospitable and isolated environment. It was also interesting to see the level of detail in operational and safety processes.



Truck used for mining operations in Peru

The enormous US\$4.5 million trucks they were using at the mine were able to haul 400 tons of material in one go. I learned that each tire on those trucks cost US\$50,000! Because of their size, the trucks can't be driven up the mountain, so they are disassembled and shipped to the mine site where they are then reassembled. It takes them two to three months to assemble one truck. Although powered by an enormous diesel engine, they are technically electric vehicles because the diesel engine generates electricity, and it is that electricity that powers the wheels.

Donning hard hats and safety vests, we visited the actual open pit mine site, the most impressive part of the visit. The pit was almost three kilometers in diameter and one kilometer deep. The mine design is actually quite technical in nature, taking into account hauling roads, bench angles and heights, and ditches. They had electronic slope monitoring stations across the pit to make sure there were no unwanted movements that could compromise the stability of any of its walls. We were very lucky, because when we reached the top viewing point we got to see them dynamiting a section of the pit. At another part of the site there was a great deal of equipment, including an ore concentrator and a solvent-extraction electrowinning process to purify the ore for final smelting.



Mine in Peru

Copper analysts have expressed concern about demand in view of the slowdown in China's economy, which has impacted the commodity's price. Currently, China is the largest consumer of copper, accounting for 45% of global demand.¹ Copper is a key component for the housing industry, and despite China's slowing economic growth, overall consumption of copper has been increasing in China as well as in the United States, Japan and Europe—a trend that is expected to continue.² While there had been a reduction in production at high-cost mines, more efficient new mines were now coming into the market, which was putting a lid on prices not only for copper but for other natural resources including molybdenum, silver, zinc and gold. Despite these declines, mining companies continued to expand production either because they had already started creating a new mine and had spent so much money it did not make sense not to complete the facility, or they expected prices would eventually recover, thereby justifying the investment. The investment amounts are so large and the time required to start a new mine is normally five or more years, so it's necessary for companies in this industry to think long term. Of course, there is still near-term concern about weak prices.

The largest use for copper is in construction, and it is also used in consumer products, including automobiles, appliances and electronics, and plays a key role in information and communications technologies. Some executives at the mine we visited were optimistic that there would be strong economic recovery in the United States and Europe, and estimated demand growth in China would be about 3% in 2016.³ They expected that copper used in automobile manufacturing and electric grids would increase the demand for copper cables, offsetting the weak housing market demands. A scarcity of scrap copper was another factor they saw limiting the supply and potentially boosting prices. Also, with copper prices low, the incentive for mining companies around the world to start new mines has declined, which will also eventually impact supply. Nevertheless, the copper company's profits were under pressure in view of the low mineral prices.



Copper production in Peru

The environmental impact of the mine was a topic of intense discussion in the country and among the mine executives. Any expansion was subject to environmental impact assessment studies and had to be approved by the Peruvian Ministry of Energy and Mining, and consultants were hired to study surface and underground water resources. We learned that Peru's Agency for Environmental Assessment and Enforcement seemed diligent in inspecting the mines, citing infractions and levying fines for environmental transgressions. There have been cases in other countries where acid spills resulted in companies paying out tens of millions dollars in compensation to victims, along with other remedial actions. Accidents, and subsequent litigation, is clearly a risk in the mining industry.

Peru is generally a good jurisdiction for mining but politics have created some heightened uncertainty, with social unrest and protests halting some mining projects. However, the managers we talked to prior to Peru's presidential election felt the government could be incentivized to approve projects in order to improve employment numbers in view of recessionary forces. While we were in Peru, the government announced that it would be dropping corporate tax rates from the current 30% to 26% by 2019. Since then, the victory of Pedro Pablo Kuczynski, who takes office in July, is viewed as supportive for the industry going forward, as he has pledged pro-business policies and efforts to attract wider foreign investment.

After winding our way down the mountain back to the airport in town, we took off for Chile just as the sun was setting. I felt a hint of nostalgia for the isolated place with such hardworking, friendly people who were trying their best to supply the world with copper and other minerals in such a beautifully desolate place.

Chile's Salty Landscape

We arrived in Calama, Chile, one of the driest cities in the world with average annual rainfall of about 5 mm (0.20 inches). The Salar de Atacama, the largest salt flat in Chile, was our destination. The landscape was strewn with jagged mountains that took unusual forms, some looking to my imagination like animals or people. The area is a tourist destination, with people visiting to see the moon-like landscape as well as the salt flat. There are also active volcanoes and hot geysers in the region and the site of copper and lithium mining operations.



Salt flats in Chile

As we drove to our hotel, every house seemed to be sheltering and bowing low in line with the barren landscape; it almost seemed like they were hiding from the intense sun. It was dark out by the time we finally arrived at our small hotel, a rustic affair with stone floors and walkways, dry wood walls and motel-type cabins. I finally flopped into bed at midnight, and the next morning was on my way to see the salt flats and mining operations in the area.

The Salar de Atacama (or "salt lake") is 3,000 square kilometers of flat land with a mix of brilliant white, brown and gray salt. It's surrounded by mountains, the Andes being on the eastern side. The site contains the purest source of lithium in the world and is estimated to have nearly a third of the world's lithium reserves. Some have called this ancient lake "the Saudi Arabia of Lithium."

We visited a mining operation there with modern, well-designed offices and comfortable facilities, including rooms for visitors to stay. A company representative who had flown in from Santiago explained the entire operation to us, and particularly the safety procedures. Donning hard hats and safety vests, we headed out to the salt flats. We observed how the company formed small dirt borders to enclose part of the flats so that the brine pumped from below the surface could be dried in the sun in hundreds of such ponds. As it evaporates, it turns into shades of light blue and green, making the fields resemble a giant artist's pastel palette. Potassium compounds are produced, along with a viscous liquid, lithium chloride. This is taken by tanker to a plant near the coast where it is turned into finely powdered lithium carbonate and hydroxide, which are then shipped around the world.

These days, it would not be a stretch to say lithium is a hot product. Amid a surge in demand for lithium rechargeable batteries, companies have been scrambling for supplies. Although lithium accounts for only about 5% of the materials in some batteries, it is a vital component. Worldwide demand appears set to surge because of the growing use of lithium in not only for batteries in electric vehicles and other consumer goods like mobile phones and laptops, but also for its potential in electricity storage for use by electric utilities. Some electric utility companies have been installing large battery packs to provide short bursts of electricity at peak demand times. One firm is planning to have enough lithium-ion batteries to equal the output of an entire coal-fired power station.

Digging into the history of the company we visited, I realized that there was much more than I ever imagined related to those salt flats and wars were fought over them. I had heard reference to "sodium nitrate," "caliche," "saltpeter," "nitrate of soda" and a number of other names only to find out that they were all the same—a white solid that is water soluble. It is used in several chemical reactions to produce fertilizers, explosives, fireworks, glass, pottery, food preservatives and solid rocket propellant, and the type found in Chile's Atacama desert is rather unique. The sodium nitrate is bound in mineral deposits (called caliche ore) and for about 100 years, the Atacama desert was almost the exclusive source for the entire world. During the late 1800s, sodium nitrate was used for fertilizer and for the manufacture of gunpowder, but in the early 1900s German chemists found a way to produce ammonia from the air and convert it into synthetic saltpeter, which could be used to produce gunpowder. There are other uses for sodium nitrate as a food additive to preserve meats, for heat transfer in solar power plants, waste water treatment and even in mouthwash.

It's interesting to see how over the years the varying and newly discovered use for the salar's minerals have continued to yield new benefits.

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1. Source: International Copper Study Group, 2015/2016 forecast. There is no assurance that any estimate, projection or forecast will be realized.

2. There is no assurance that any estimate, projection or forecast will be realized.

3. There is no assurance that any estimate, projection or forecast will be realized.