

The Drift Magazine

ISSUE 10 | JULY 9, 2023

# A Good Prospect | Mining Climate Anxiety for Profit

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*Image by John Kazior*

Four billion years ago, our planet was a restive place, full of geological commotion. At the earth's center, a molten metal core began to coalesce, while heat and radioactive energy kept large swaths of the surface liquid. Violent volcanic forces made and remade the landscape. Over eons, magma pooled and hardened, forming some of the oldest and most stable parts of the earth's crust. Heat, pressure, and fluid heavy with chemicals left deposits of metals and minerals in these ancient, crystalline substrates of the planet.

In early March, I found myself examining a small cross section of one such deposit. Whitish gray quartz and feldspar were speckled with a pale, shimmering green silicate called spodumene. For millennia, this particular specimen had reposed deep below ground about 30 miles north of Lake Superior, part of a geologic formation called the Canadian Shield. It sat there until the invisible hand of

the global market reached down into the earth, removed it, and transported it to the Metro Toronto Convention Centre, where a friendly geologist named Ramin Ghaderpanah was calling my attention to the spodumene. Those green bits, he told me, can be refined into high-grade lithium. And right now, lithium is one of the most sought-after minerals in the world, making it “such an attractive investment,” according to Ghaderpanah, who works for a Canadian mining company with additional lithium projects in Argentina and Nevada. Even as recently as three to four years ago, he said, lithium was not in high demand here. By “here,” the geologist was referring to our immediate surroundings: a commotion of excited dealmaking and unrestrained investment taking place over four days at the largest annual mining conference in the world, held in Toronto by the Prospectors & Developers Association of Canada (PDAC).

The geologist and I were standing at one of the more than 1,500 booths that filled the cavernous convention center, which this year welcomed nearly 24,000 attendees representing more than 130 countries. At times, the mining crowd seemed to outnumber the locals, filling the sidewalks beneath the smooth, gleaming high-rises of downtown Toronto. PDAC is where the people, companies, governments, and other institutions that constitute the global metal-mining industry commiserate in the bad times and celebrate the good. The names of the world’s mining titans, each worth many billions of dollars, were plastered on every available surface. A massive Newmont banner hung over the escalator. Freeport provided a café and lounge; BHP sponsored admirably fast Wi-Fi.

There were also investors, both large firms and individual traders. All were looking for the right stock — an up-and-coming miner, or an obscure mineral deposit with promise. They spent their days talking to company representatives, geologists, prospectors, and mineral officials from all over the world. In addition to the registered attendees, many more showed up for the informal, but no less important, conference behind the conference — the backroom meetings, the chats in hotel bars, the parties. Perhaps especially the parties. These happened every night, often sponsored by some firm or investor. I spent one late night at a pub called the Walrus, and struggled for a time to find an actual mining employee. Instead, I met a transit technology salesman, a software designer, a few people who work for market makers, and a securities analyst from Australia. All had come to cut deals, schmooze, and see old friends.

It has been several years since the industry felt inclined to let loose. Metal prices took a dive in the mid-2010s, with gold, silver, and copper prices all bottoming out in 2014 and 2015. Mass layoffs ensued. Reuters described the 2015 PDAC as cowed, with fewer parties and empty floor space; the CEO of a gold-mining company described “far less prime rib, far more chips, far more salsa.” By the end of the decade, metal prices had recovered; they have now recovered again after a brief, Covid-related slump in 2020. At the height of the pandemic PDAC was held online and then, last year, in hybrid form.

This year, prime rib was back — metaphorically, but also on top of a cracker that I ate at a swank open bar. If PDAC is a weather vane for global mining, this year’s event made one thing clear: the industry thinks that the winds of commerce are at its back. Metal miners stand on the verge of a planet-spanning, multi-decade mineral boom, driven by the demands of an electrifying world. Global decarbonization to address climate change will require enormous amounts of graphite and manganese, nickel and cobalt. Above all, it will require copper. Without copper, we cannot build solar panels, wind turbines, or electric cars and their battery chargers. S&P Global, the market research firm, expects copper demand to double by 2035 and climb thereafter, dramatically outstripping supply. “In the 21st century, copper scarcity may emerge as a key destabilizing threat to international security,” its 2022 report found.

Lithium is also expected to win big. A world that does not rely on fossil fuel combustion will need rechargeable battery technology at an unprecedented scale, in everything from the cars we drive to grid-scale energy storage infrastructure, with enough capacity to power a city when the sun sets and everyone turns on their lights. None of this will be possible without lithium. The Biden White House estimates that demand for lithium and other electric vehicle (E.V.) battery minerals could swell by 4,000 percent in the coming decades. And, as with copper, there's evidence that global lithium supply will soon be insufficient — without a production boom, we'll have only half the lithium and cobalt we need to hit 2030 climate goals, according to the International Energy Agency (IEA). A May report by the Carnegie Endowment for International Peace laid out still more dire projections: in 2030, lithium, cobalt, and graphite demand may outpace production for the U.S. and its allies tenfold, thirtyfold, and eightyfold, respectively.

Expected shortages and bottomless demand have automakers scrambling to secure their supply chains. In January, General Motors announced a \$650 million investment in Lithium Americas, which is developing what will likely be the U.S.'s largest lithium mine. Since then, G.M. has also invested in a lithium-extraction startup and announced a fourth planned battery manufacturing plant in the U.S. And in the past year, mining giant Rio Tinto and Chinese battery manufacturer CATL both signed deals with Ford.

To call the mood at PDAC optimistic would be an understatement. The conference was awash with talk of new mines and big profits. Amid the hubbub, I caught up with John Thompson, a geoscientist and longtime mining insider who seemed to know everyone. Thompson spoke softly, in a British accent, and projected an ironic detachment from the surrounding commotion, born of many years in the industry. "The buzz," he said, "is related to the perceived importance of critical metals and minerals. You can debate lots of issues around that, but the industry is just feeling ecstatic. Everybody loves us, and that hasn't traditionally been the case."

Mining is getting a makeover. To build a mine, a company needs legal permits, and in the old days, perhaps those were enough. Today, though, the industry and its investors increasingly believe that in order to be successful — and maximize profits — a company also needs what the industry calls a "social license to operate," or moral permission to reap the benefits of tearing up the earth to extract minerals. Social license and profit go hand in hand. With that in mind, companies are trying to reinvent themselves as part of the solution to the climate crisis, allies to the environmentally minded with carbon-neutral targets for their global operations. And that's not all: this year's PDAC also displayed a heightened interest in the concerns of Indigenous nations and a focus on increasing the number of women in the industry. Many panels and speeches began with land acknowledgements. Sessions on offer included "Why Indigenous women in mining is a golden opportunity," "The amazing race to decarbonize," and "Operationalizing the 'S' in ESG: Does it matter to investors?" (ESG stands for environmental, social, and governance, a shorthand for a supposedly more socially conscious form of investment.) Unequivocally, the answer was yes.

From the opening keynote address, it was clear that the climate crisis itself has become a means for mining interests to obtain social license, providing a ready justification for the industry's activities. Following a land acknowledgement, Ken Hoffman, head of the battery materials team at McKinsey, took the podium in front of a large room packed with hundreds of people. Hoffman summarized the state of global supply, demand, and pricing trends for various key metals. He discussed the significant material needs of electric vehicles and several renewable energy technologies. An electric car requires six times the amount of mineral resources as a gas-powered car, according to the IEA; an onshore wind

turbine outstrips a natural gas-fired power plant in mineral inputs by a factor of nine. He encouraged the industry to position itself to deliver ethically sourced, low-carbon metals and minerals to meet specifications laid out by regulators in the U.S. and E.U., and discussed various advances in E.V. technology. The upshot of each of these topics, though, was the same. Decarbonizing the modern world is going to make the mining world a lot of money — by Hoffman’s estimate, on the order of fifteen to twenty trillion dollars. At one point, Hoffman seemed to address a nameless, climate-conscious consumer, the sort of person who wants their personal choices to reflect their desire to save the planet — a desire that, in all likelihood, will enrich the people in that room.

“To stop global warming,” he said, “you need us.”

The phrase “energy transition” is a common shorthand for the elimination of fossil fuels. But, as the economic historian Adam Tooze argued in March, its suggestion of a smooth shift from one mode to another fails to adequately capture the radical nature of the challenge ahead — the total transformation of global energy production required to address the climate crisis. Coal, gas, and oil still account for more than 60 percent of humanity’s total electricity generation. These need to be phased out immediately; extant and planned fossil fuel projects are almost certain to push the globe past two degrees Celsius of warming. And new energy sources will need to meet surging global electricity demand, which is expected to double, at minimum, in the coming decades. “The wholesale displacement of fossil fuels across global electricity generation, with overall capacity expanded to twice its current size, in the space of a single generation, will be a truly staggering undertaking,” Tooze writes.

This monumental economic transformation will require a lot — and I mean a lot — of minerals and metals. As a result, Western governments and corporations are scrambling to secure their mineral supply, keen to enact the necessary changes while also meeting the quality-of-life expectations of first-world consumers. In the U.S., the Inflation Reduction Act (IRA) provides half a trillion dollars for clean-energy and climate policies, which includes tax breaks and incentives for electric cars and battery-metal supply chains. PDAC attendees approve, of course. As Hoffman, the McKinsey analyst, said, the IRA changed “everything.” But it also led to some jokes poking fun at the U.S. as a great consumer of metals with a longstanding aversion to doing the mining or refining itself. “In the U.S. they don’t want to mine,” Hoffman told the amused crowd, “but they want to buy from sources deemed acceptable to U.S. regulators. Canada, we love you.”

All that cash, however, cannot hide the plain fact that the U.S. and other Western governments no longer call all the shots. To obtain battery metals, countries are forming and breaking partnerships, striking deals and making enemies, in ways that mirror the shifting alliances of our increasingly multipolar world. In the Anglophone sphere, governments have closed ranks against China, which refines more than half of the world’s lithium and controls some 85 percent of the processing capacity for rare-earth metals. In recent decades, this arrangement seemed to satisfy the scions of global mining, whose headquarters are in the industrial core: Canada, the U.K., Australia, Switzerland. Minerals are often extracted in the Global South, processed in China, and turned into capital back home on a few key stock exchanges. (Australia, London, and Toronto host the primary metal markets. PDAC’s location is no accident; most large mining firms are either based in Canada or have large offices there.)

Chafing against its status as a mere stop on the supply chain, China has become a producer and consumer of metals and rare-earth minerals at levels rivaling those of the West. Several Chinese

companies challenge the Western heavyweights in market capitalization, with huge operations in places like Tibet, Mongolia, and sub-Saharan Africa. In February, Nigeria's government announced a large lithium deal with one of the major Chinese miners, months after rejecting a bid from Tesla. Fearing competition from the new superpower, Canada forced three Chinese companies to divest from lithium holdings last November. A few months later, Australia blocked an attempt by a Chinese firm to buy a greater share in a mining company. Both governments cited national security concerns.

Now that Western governments' influence is on the wane, countries rich in deposits of battery minerals across the Global South have discovered that they have leverage. More than half of the world's lithium reserves are concentrated in South America's "Lithium Triangle" — Chile, Bolivia, and Argentina — and in the past few years, a wave of left-wing and socialist governments have come to power on the continent. This is not a coincidence. Most of the winning candidates promised some combination of a crackdown on mining pollution and increased respect for the rights and wishes of Indigenous communities, who have historically been forced to bear the costs of mineral extraction. For many of these countries, mineral wealth has meant impoverishment for the people who live on the richest land. Former Peruvian President Pedro Castillo and President Gabriel Boric of Chile were elected after campaigning on redistributing mining profits and stronger mining regulations. In February, Mexican President Andrés Manuel López Obrador signed a decree that placed all the country's lithium under state control. And Gustavo Petro, Colombia's furthest-left president in 75 years, has seized the assets of two gold companies, proposed huge taxes on the mining sector, and vowed to form a state-owned mining company. In April, The New Republic reported on attempts to undermine Petro, backed by right-wing military and business elites.

Naturally, this trend has left companies and investors anxious for friendlier sites to mine. In February, just before PDAC, a prominent mining podcast warned about escalating "jurisdiction risk," noting that investors "hear all sorts of stories about South America, you know with Peru and protests, and all this sort of stuff." This gave the episode's guest, Argentina Lithium & Energy CEO Nikolaos Cacos, a chance to tout the stability and pro-mining governance in Argentina, where his company has several large lithium claims (which give a company the right to explore for minerals on a specific parcel of land). "There's elections coming up," he said, "and there's projections for a pro-business government to win." Other global players, it seems, are willing to submit to the new demands of South American governments. German Chancellor Olaf Scholz recently visited Chile, hoping to divert some of its lithium, which predominantly goes to China, to his country's automakers. According to Bloomberg, Scholz pledged to invest in Chilean processing of raw materials, rather than exporting them.

Demands for greater domestic rewards from mineral exploitation can be heard far beyond South America. Indonesia banned nickel exports, which has helped promote a fast-growing battery industry, and is trying to organize an OPEC-like consortium for metal processing. In January, the Philippines proposed a ten percent nickel ore export tax, prompting outcry from private-sector firms, which argued that the move would "kill" the industry, Reuters reported. And a government watchdog from the Democratic Republic of the Congo, home to large copper and cobalt deposits, which state-run Chinese companies have mined for over a decade, recently took the superpower to task for delivering less than a third of a promised three billion dollars for infrastructure improvements. It seems China, wary of losing those deposits, will play ball. According to Reuters, the two are negotiating an additional seventeen billion dollars and a larger stake for the DRC's state-run mining company.

Political power and economics have always been entwined, free trade and international markets backstopped by military might and geopolitical muscle. Still, it seems that, in the frantic race for limited battery-metal supplies, governments are unwilling to leave things to the market, wielding their

power in increasingly explicit ways. All the rapid shifts in the global mining industry's geography introduced a current of doubt into PDAC's party atmosphere. The green metals boom is indeed here. Beyond that, uncertainty abounds.

The convention floor at PDAC was overwhelming. There was a booth for a diamond mine in Angola; a booth for Greenland's mining delegation; another for a geochemistry consulting firm. There were advertisements for copper mines from Arizona and the Xanadu copper-and-gold project in Mongolia. The national mining company of Chad offered pamphlets. "The country is virgin from an industrial point of view," they read, "an open market with little competition." There were smiles and handshakes. Everyone was selling hope and excitement and the promise of profit. One booth displayed bars of gold bullion. Some exhibits were clean and modern; others were cluttered with technical maps and dense data that required an advanced degree in geology to decipher.

I passed the Core Shack and the Investors Exchange and found my way to the last row of booths, set against the back wall of the gigantic building. This is where PDAC puts the prospectors, the treasure hunters who scour maps and mineral reports for deposits of ore that the major companies have passed over. They stake a claim, maybe drill a few exploratory core samples, and bring their finds to the conference, hoping that a small mining or exploration company will throw some capital their way. It's "about the riskiest thing you can do for money," an American prospector once told me.

I stopped by one booth, an outfit from the island of Newfoundland, and met Neal Blackmore, who was glad to talk me through the travails of prospecting. "We're pretty low on the food chain," he told me. In some Canadian provinces, staking a mining claim still requires actually driving wooden posts into the ground. With his tangled beard and long hair, a rumpled blazer worn over a graphic t-shirt, Blackmore seemed out of place at the buttoned-up corporate conference. It was easy to imagine him bushwhacking through the woods and pounding stakes.

Still, his look seemed to serve him well at PDAC. While we were talking, two capital markets investors and the CEO of an exploration company stopped by. All were working with him on potential mines, building on deals hammered out, in part, at previous PDACs. He made dinner plans with the men and discussed the group's mining camp in Newfoundland, where the main danger comes in the form of trigger-happy big-game hunters from America. Blackmore's table displayed a few copper-gold sulfide samples, as well as papers describing gold and silver deposits — and a single lithium claim, which a woman scooped up while we were talking. Blackmore is new to lithium. He started learning about it only last year. "We were always gold guys," he said. "We go wherever the market is."

I told Blackmore that it was my first time at PDAC and asked him what I should know. "A mine is a hole in the ground with a liar standing on the edge," he said. His point was not that PDAC was full of scam artists, though the conference's history does include some notable grifts. Backers of the notorious Bre-X fraud amplified a fake gold claim in Indonesia over the course of several PDACs in the 1990s. The company went from trading as a penny stock to reaching six billion Canadian dollars in market value before the sham fell apart. A geologist involved in the scheme allegedly committed suicide by jumping out of a helicopter over the jungle. One investigation concluded that the geologist had been strangled, his suicide faked, according to the Calgary Herald. There are persistent rumors that he was later spotted alive, according to a well-connected international-mining source who knew some of the players firsthand. The affair was loosely adapted into a 2016 movie starring Matthew McConaughey.

Blackmore meant that mining is risky. Markets are fickle. And promising ore deposits often prove disappointing. When someone says that a mine or a trend is a sure thing, some skepticism is probably warranted. Just a few years ago, cobalt was the battery metal of the day, but its scorching stock-market rise led to an attendant bust — and now other minerals, like manganese, are replacing it in the supply chain. All of this adds an extra layer of intrigue at PDAC. While the schedule includes numerous technical panels that cater to geologists and data nerds, PDAC is, ultimately, an investment conference. Companies large and small spend four days certifying the quality of their ore deposits, the cozy relationships they have with government regulators, the heights they expect their stock to climb. Investors, meanwhile, are seeking good bets for their money.

These are not the sort of people, in other words, who tend to endorse nascent left-wing governments asking multinational mining companies to pay up. But that's precisely what the leaders of Chile, which has the largest lithium reserves in the world, plan to do. The conflict between Western financial interests and an empowered Global South has rapidly come to define the shape of the battery-metals boom. And it became concrete on PDAC's second morning, at a presentation by Chile's mining delegation. Outside the conference room, the hallway was packed. Men in navy suits soberly conversed in English and Spanish over weak coffee, filling every seat once the doors opened. On a raised dais at the front of the room sat a group of Chilean mineral and diplomatic officials, including Raúl Fernández, the ambassador to Canada, and the country's undersecretary for mining, Willy Kracht.

The Chilean economy is inextricably tied to mining. It is the world's largest copper producer and second-largest lithium producer behind Australia. The industry makes up more than half of Chile's exports and employs one out of every thirteen workers. Kracht, who has a thick black beard and a calm demeanor, is a top mining official in Gabriel Boric's government. A leftist elected in 2021, Boric pledged to overhaul decades of pro-business, low-regulation governance in Chile — especially related to natural resources. Last year, the administration held a constitutional referendum, meant to replace Chile's Pinochet-era governing framework. At one point, it looked like the new constitution was going to nationalize all lithium resources. Voters ultimately rejected the proposal. Kracht told the PDAC crowd that the reforms were overly ambitious; they contained “too much of everything.” He reassured investors that future constitutional measures were unlikely to include full nationalization of the sought-after mineral. Going forward, he said, Chile would create a publicly managed lithium company and pursue other reforms, like raising the royalty tax on mining companies and increasing its domestic copper smelting capacity, rather than shipping the concentrate overseas. “We have the right as a country to have ownership in the industry,” he told the crowd.

Kracht then turned to the elephant in the room — the “social unrest” that had “people around the world worried.” In 2019, protests against public-transit prices, police corruption, and widespread unemployment spread from the capital city of Santiago to every region in Chile. The protests led to the downfall of President Sebastián Piñera, a billionaire businessman with a cozy relationship to the mining industry — the Pandora Papers revealed that Piñera took money from a mining executive in exchange for support of an environmentally destructive copper and iron mine — and propelled Boric into office. Kracht seemed intent on reassuring the crowd that investing in Chile would be worth it. He pulled up a graph that showed foreign financing of Chilean mining had increased since 2018, despite the ongoing protests. “Markets understand,” he said.

It was hard to gauge the impact of Kracht's reassurances. Even among their own, in a boom-time atmosphere, PDAC attendees were noticeably wary about making definitive statements about much of anything. At a booth for Albemarle, one of two private companies currently producing Chilean lithium, I asked a representative whether the country's new left-wing government and years of protests worried

potential investors. “Yes,” she said, but wouldn’t elaborate. She directed me to her supervisor, who wasn’t there and declined to comment over email. (Kracht’s chief of staff suggested that some of his remarks “may be misinterpreted,” but didn’t dispute any specific claim.)

As it turned out, Kracht’s conciliatory tone was a head fake. In April, about six weeks after PDAC, Boric announced in a nationally televised speech that his administration planned to do what PDAC attendees might not have been led to expect: establish state ownership of all Chile’s lithium. This transition, per Reuters, will require that private companies either partner with the state, which will command majority ownership, or give up their operations after their mining permits expire. In his speech, Boric referenced Chile’s nationalization of copper in 1971 under President Salvador Allende, who was subsequently deposed by Pinochet in a coup supported by the CIA. Public lithium ownership, Boric said, will help create “a Chile that distributes wealth we all generate in a more just way.” (Stock prices for lithium-mining companies in the country dipped after this news, as media reports described investors as “spooked.”)

This news came after PDAC, but corporate unease about unruly left-wing governments was in evidence at the conference, if you found the right room. One panel, called “Mining related disputes with a focus on Latin America: political risk and mitigation tools,” featured representatives from two law firms — one Colombian, the other Ecuadorian. Panelists instructed audience members on how they might use international commerce agreements to protect their investments from leftists. The platform of Colombian President Petro, who has pledged to support Indigenous rights against mining companies, “is based unfortunately on the rights of ethnic communities,” said Álvaro José Rodríguez, a Colombian natural resource lawyer. (Rodríguez later elaborated over email, writing, “What I meant when I said that Gustavo Petro’s political platform ‘is based unfortunately on the rights of ethnic communities’ is that the Petro government is too focused on the rights of ethnic communities and less so on the rights of other stakeholders and the needs of the country.”)

“He is not only a leftist, but it is fair to call him a populist,” Rodríguez said. “He was elected on a pro-minority and pro-environmental platform.”

There was at least one person at PDAC free — and by that I mean rich enough — to speak his mind. That was Robert Friedland, a billionaire financier with a knack for funding the exploration of rich and obscure mineral deposits. These include a nickel find in Labrador, which he sold in the 1990s for more than four billion Canadian dollars, and a colossal gold mine in Mongolia. Like so many others, Friedland had something to sell at this year’s conference. A PDAC luminary, he was given a headline speaking slot to make his pitch to a packed conference hall. By the time I got there, nearly every chair was claimed. I stood in a crowd at the back, awkwardly taking notes against a pillar.

At 72, Friedland speaks with the meandering cadence of an old hippie, which his biography suggests that he is. In the 1970s, he left Bowdoin College after he and two others were caught with 24,000 tablets of LSD in what was then, according to The New York Times, the “largest ever” seizure of the drug in New England. Later, he ran an apple orchard where Steve Jobs took psychedelics (the experience helped inspire the name “Apple”). In his speech, Friedland touched on topics ranging from the steam engine to the Blues Brothers and the Harvard-Yale football game, made fun of Joe Biden, and suggested that the U.S. should not go to war with China over Taiwan because Taiwanese and Chinese people are hard to tell apart. Friedland also touted his new mining technology startup, I-Pulse, with funding from Bill Gates, Jeff Bezos, and mining giant BHP. He lamented the good old days of a more



integrated global economy, back before the financial crisis, tariff fights, and trade wars, when China was “making almost everything the world consumed.” Friedland was especially unhappy with the political shifts in South America. As examples he listed the “crazy people running Colombia”; the “36-year-old communist” in Chile; “Evo” (who is no longer the president of Bolivia); and Brazilian president “Lula, a proven crook.”

Fortunately for the audience, Friedland has a solution for investors who share his fear of South America’s leftward turn: southern Africa, where, it turns out, Friedland is developing some enormous projects with his company, Ivanhoe Mines. He described the region as “relatively unexplored” in its mineral resources and boasting a ready workforce. “The virus bounced off them because they’re young,” he told the crowd.

Mid-speech, Friedland paused to play videos that stitched together dramatic footage of mining equipment in motion and hydroelectric power generation for net-zero carbon operations, interspersed with shots of smiling local workers, all backed by a pounding EDM soundtrack. The first project he was promoting, Kamoakakula in the DRC, is set to produce more than 500,000 tons per year of the highest grade copper. Here, Ivanhoe is partnering with Zijin Mining Group, one of China’s largest companies. The second, which Friedland called the largest precious-metals project in the world, is in South Africa. Beginning next year, the Platreef mine is expected to yield a treasure trove of sought-after minerals — platinum, palladium, nickel, gold, rhodium.

Friedland is far from alone in turning to Africa to feed the world’s infinite appetite for battery metals. In a bid to counter China’s tightening hold on southern Africa’s mining industry, this past January the U.S. signed a memorandum of understanding to create a battery supply chain with the DRC and Zambia. The DRC supplies about 70 percent of the cobalt used in rechargeable batteries, with approximately a quarter of that coming from what are known as “artisanal small-scale mines,” according to a report from the NYU Stern Center for Business and Human Rights. These are often illegal operations that use child laborers. Hundreds of thousands of Congolese artisanal miners dig for cobalt and copper with picks and shovels, handling toxic heavy metals with their bare hands for as little as one dollar per day. Through tangled networks of traders, buyers, and processing firms, these metals end up in the products of the largest companies in the world, including Tesla and General Motors. (In 2022, Tesla’s shareholders rejected a proposal that would have required detailed reporting on child labor in its mineral sources.)

Governments and companies descending on the Congo and exploiting its resources: there’s a term for it. “This economic model is a colonial model,” Jacques Nzumbu, a Congolese Jesuit priest, told me. Nzumbu recently moved to Montreal for a graduate program, but before that he spent years in the Congo working with artisanal miners in Lualaba, a province in the southern DRC that is a significant source of cobalt and copper. Nzumbu described protests — put down by the Congolese army in 2019 — against the mining giant Glencore. After a cave-in killed at least 43 small-scale miners, who had been sneaking into a Glencore-run copper-and-cobalt site to do their own mining, state security forces brutally evicted thousands of other independent miners nearby. “Local people were very angry with Glencore,” Nzumbu recalled. “We see in the Congo every day, more than 5,000, 7,000 trucks, with cobalt and copper going out of our country without transformation” of Congolese society.

At PDAC, though, the general sense was that metal mining will be transformative. It will help save the planet and provide jobs, an assumption summed up in the title of the panel “Better lives, better climate: Latin America and its minerals.” Mining’s necessity was accepted; its toll on people and land was quickly smoothed over, when mentioned at all. Most expressions of environmental concern seemed

calculated to justify more mining. Indeed, this was how Friedland ended his speech: with a Carl Sagan quote and a call for the mining industry to save the planet. The slogan of one of Friedland's subsidiary companies, Ivanhoe Electric, drove home the point: "Reinventing mining for the electrification of everything."

If you've seen photos of lithium extraction, they are probably of brine ponds: huge neon-turquoise lakes that stand in striking contrast to the surrounding white-gray desert. Lithium tends to occur in alkaline, mineral-rich brines on salt flats. This water is pumped to the surface, mixed with other chemicals, and left to evaporate in the scorching desert sun, leaving a concentrate behind. Lithium production requires more water than other battery metals, but when it comes to sheer environmental destruction, it's hard to beat copper. Copper is extracted from gigantic open-pit mines, hundreds to thousands of feet deep. To refine copper ore, sulfuric acid solutions are typically leached through the rock piles, which creates toxic slurries that carry mercury, arsenic, and other poisonous metals. At large copper mines — like Bingham Canyon in Utah, the world's deepest open-pit mine — this pollution requires treatment "in perpetuity" to prevent spills and damage to groundwater, according to a report by the environmental nonprofit Earthworks. Every day at the small mines in the Congo, artisanal miners climb into pits and tunnels filled with toxic water from cobalt and copper extraction. Specifics of production vary by mineral type, but spiking demand for battery metals will mean a lot more mining of this sort all over the world.

The mining industry has always provided an economic justification for the displacement and exploitation of people all over the world: the colonization of the Americas for gold, silver, iron, and copper; blood diamonds in West and Central Africa; child labor in cobalt mines in the DRC; and thousands of deaths linked to paramilitaries financed by multinational mining companies in Colombia. The move to renewable energy will likely expose the poorest people on the planet to more of the same from these fierce extractive forces. A Nature study published late last year found that more than half of the materials needed for the green energy transformation are located on or near relatively undeveloped land where Indigenous and peasant populations live. As mines encroach on these communities, they will be removed from their homelands or forced to live with profound industrial pollution.

The focus at this year's PDAC was primarily on the economic benefits for these communities. First Nations speakers attested that mining can be good for Indigenous communities. "Before the mine, we had nothing," Donny McCallum told the crowd at a panel on Indigenous economic inclusion. McCallum is a member of the Marcel Colomb First Nation (MCFN), in Manitoba. In 2022, the nation signed joint ventures with two contracting companies designed to help secure employment for members at a nearby gold mine. "We want a piece of the pie," McCallum explained. The panel's moderator, Christian Sinclair, who is Opaskwayak Cree, encouraged Canada's First Nations to follow MCFN's example and form Indigenous economic development corporations. He pointed to the Southern Ute Tribe of southwestern Colorado, which sits atop a rich formation of coal-bed methane. The tribe used these resources to build a three-billion-dollar organization.

The only note of hesitation about tying the well-being of First Nations to mining industry profits was sounded by an older man with a long ponytail during the Q&A portion of this session. "The land cannot sustain making the most amount of money in the least amount of time," he told the panelists.

I caught up with this man, Rick Cheechoo, later on, at a reception for PDAC's Indigenous Program over mini bison potpies and wild rice salad. He is a member of the Moose Cree First Nation. A large

gold mine operates near his nation's traditional territory, he told me. There have been benefits — he described agreements between the mining company and the First Nation that provide jobs and healthcare — but a company's drive for profit puts it at odds with some tribal needs, especially preserving their culture and treaty rights and ensuring that families displaced by industry are compensated.

Historically, mining has brought disruption and violence to Canada's First Nations, and there's no reason to believe that's changing. The past decade has seen numerous confrontations, with protestors blockading mines and arrested en masse by militarized police. Even as the conference was happening, members of the Naskapi and Innu nations were fighting an iron mine in Quebec — a situation that, as far as I could tell, was not addressed by anyone at PDAC.

Are there no alternatives to this rush to extract the world's metals and minerals? At PDAC, almost no one asks this question. The assumption was baked into virtually every convention-floor booth and conference-room panel: minerals must be extracted. The market and a cooler planet demand it. ESG and other signs of virtuous consumption, like partnerships with Indigenous communities, permit it.

Even beyond PDAC, alternate visions can be hard to come by, but a new study from the Climate and Community Project and the University of California, Davis aims to expand our imaginations. It is an important piece of scholarship, arguing that we may not need to accept a future in which the mining industry — with the blessing of governments — continues to tear up the world's forests and occupy its deserts. Focusing on lithium consumption, the report models different developmental pathways for the U.S., using variables like car ownership, the size of E.V. batteries, city density, public transit, and battery recycling. The worst-case scenario, the authors claim, would result in major lithium extraction, as PDAC attendees expect. But they show that reducing the size of E.V. batteries could shrink expected U.S. lithium demand in 2050 by 42 percent. (Car companies, it's worth noting, are not trending toward smaller vehicles. In April, G.M. announced that it was ending production of the Chevy Bolt, the company's smallest E.V., in order to build more electric trucks and SUVs.) But even if average battery size were to remain the same, cutting car ownership rates, largely by creating denser cities and better public transit, could shrink total lithium demand by somewhere between 18 percent and 66 percent, according to the study.

The spread, or not, of recycling and reusing minerals is another crucial variable. John Thompson, the longtime industry insider I spoke to, attended PDAC this year in part as a representative of Regeneration, a company that plans to re-mine abandoned sites and use the profits to restore their original ecosystems. He's a recycling proponent, and hopes that the rest of the industry will catch on soon. "Everybody would say recycling is important," he told me. But "most people in this conference aren't interested."

Even the most optimistic version of the future, involving reduced demand and robust recycling, will still require some mining. What this ought to look like increasingly preoccupies Patrick Donnelly, who works for the Center for Biological Diversity in Nevada. I know Donnelly — as do a lot of other journalists in the West who cover extractive industries — as a ferociously dedicated conservation advocate. A few years ago, Donnelly realized that no one was tracking all of the American lithium projects and decided to do so himself. His map now shows more than 115 potential mines, clustered in his home state. "It's the biggest mineral rush of our lifetime," he told me over the phone.

In an ideal world, Donnelly said, the U.S. government would put a moratorium on speculative claims and instead survey all of the country's mineral deposits in order to identify the least harmful places to

mine. This isn't happening and won't anytime soon. In May, the U.S. fast-tracked a manganese and zinc mine in Arizona, the first mining project added to a program designed to expedite the clean-energy transition and other infrastructure developments. But Donnelly also fears that anti-mining sentiment is turning people against electric cars — and against lithium extraction altogether. “There is zero chance we can recycle our way out of the problem,” he said. This is true. There isn't enough lithium on the market for battery recycling to realistically meet present demand, let alone the expected increase.

“There is an element of the mining resistance movement that opposes not just particular mines but all lithium and all electric vehicles,” Donnelly went on. “Unless we're talking about deindustrializing society, which I don't think appeals to most people, we need to be thinking about how and where we're getting our lithium, and critically examine our own use of these minerals, like the cell phone I'm speaking to you on now, with minerals from South America, where locals say the mines are destroying their environment and community.”

Such are the paradoxes of the globalized green economy, in which blocking a mine in one place means shifting extraction somewhere else. We want to decarbonize, yet our lives require ever-increasing supplies of energy. And so climate-minded consumers and the mining industry are locked in a self-justifying embrace. We buy an E.V. and think we are doing right by those vulnerable to rising temperatures and tides. But in trying to continue consuming as we are used to, buying stuff and zipping down the highway, we have exposed many of those same vulnerable people to another threat — the market's readiness to kill, poison, and displace them to get minerals and metals. The mining industry, meanwhile, benefits from the self-satisfied consumerism of the E.V. buyer. For all of its disdain for environmentalists, the industry needs green consumers who seek absolution for their carbon-intensive ways of life. With their complacent inattention to the injustices inflicted by the green economy, these consumers not only fund the industry's expansion but give it moral cover.

PDAC started with a party and ended with another. After the first full day, I joined a horde of people streaming through the doors of a large conference hall for a networking event. Hundreds of people listened as a speaker gave a brief land acknowledgement, backlit by a facade emitting purple light. The crowd skewed male and young. Undercuts and blazers without ties were the dominant style. Then the real entertainment began, a deafening “dueling pianos” show that ruled out the possibility of my interviewing anyone. The first song: “Sweet Child O' Mine.”

The concluding party was an awards gala at the Fairmont Royal York hotel, an elegant art deco building a few blocks from the convention center. Tickets for the affair, which included a three-course meal, were \$225 per person, or \$2,250 for a table. I declined to buy a ticket, but stopped by the hotel anyway.

I got there just as it was getting dark. Fierce, cold winds blew off Lake Ontario and roared down the skyscraper canyons of downtown Toronto. A small crowd of protestors had congregated outside. They waved signs, prayed, and tried to pass tea-light candles to the mining officials who pushed past them into the lobby. Attached to the candles were small note cards that described water poisoned by a Canadian gold company in Argentina, land defenders murdered by security forces in Guatemala, and the 2019 dam collapse in Brazil, when a barrier holding back iron-mine waste gave way, releasing a massive toxic slurry that inundated a low-lying village and killed 270 people. (Top officials from Vale, a Brazilian company with offices in Toronto, face murder charges.)

Most of the protestors were members of Catholic social justice organizations, with connections to communities in the Global South impacted by mining. They were joined by solidarity organizations tied to the Philippines and Peru. I talked to one of the protestors, Dean Dettloff, as the event wound down. A nearby sign declared “Hands off Africa,” a quote from Pope Francis’s critique of conflict diamonds and the green-metals boom.

“We need to transition to green energy, but at whose expense?” Dettloff said. “Who is being thrown under the wheels of that transition? Those are the people we want to amplify and be in solidarity with.”

Dettloff and other protestors told me they had tried to have conversations with PDAC attendees. I brought up the industry’s emphasis on addressing climate change over the past few days. After all, the world cannot abandon fossil fuels without a good deal more lithium, copper, and many more minerals. I told him what the McKinsey analyst had said — “to stop global warming, you need us” — a sentiment that, however opportunistic, contains an uneasy truth. Did it suggest a possible area of shared interest with the industry, a possible path to a conversation? “My response to that would be that I need them to stop harming my friends in the Global South,” Dettloff said. “When we have that conversation first, maybe then we can have another conversation about sustainable minerals.”

I thanked the protestors and hurried off to the nearest streetcar, head down against the wind. The last of the activists packed up their cardboard coffee containers and signs. The lights from the Fairmont Royal York gave off a golden yellow glow. Inside, the party was going strong.

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The Drift Magazine  
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