

MINING MISSIONS ON MARS

HOW NASA WILL USE MINING TO BOOTSTRAP
THE SOLAR SYSTEM ECONOMY

CONTENTS

04 MINING MISSIONS ON MARS

How NASA will use mining to bootstrap the solar system economy

10 AN S.D.R & GOLD ANCHOR FOR A GLOBAL “CURRENCY RESET”?

I wondered if you have seen the recent evidence of the gold price having been linked, some say, to either Chinese yuan or the I.M.F.’s currency basket called SDR’s.

12 ECUADOR A RENAISSANCE IN MINING INVESTMENT ATTRACTIVENESS?

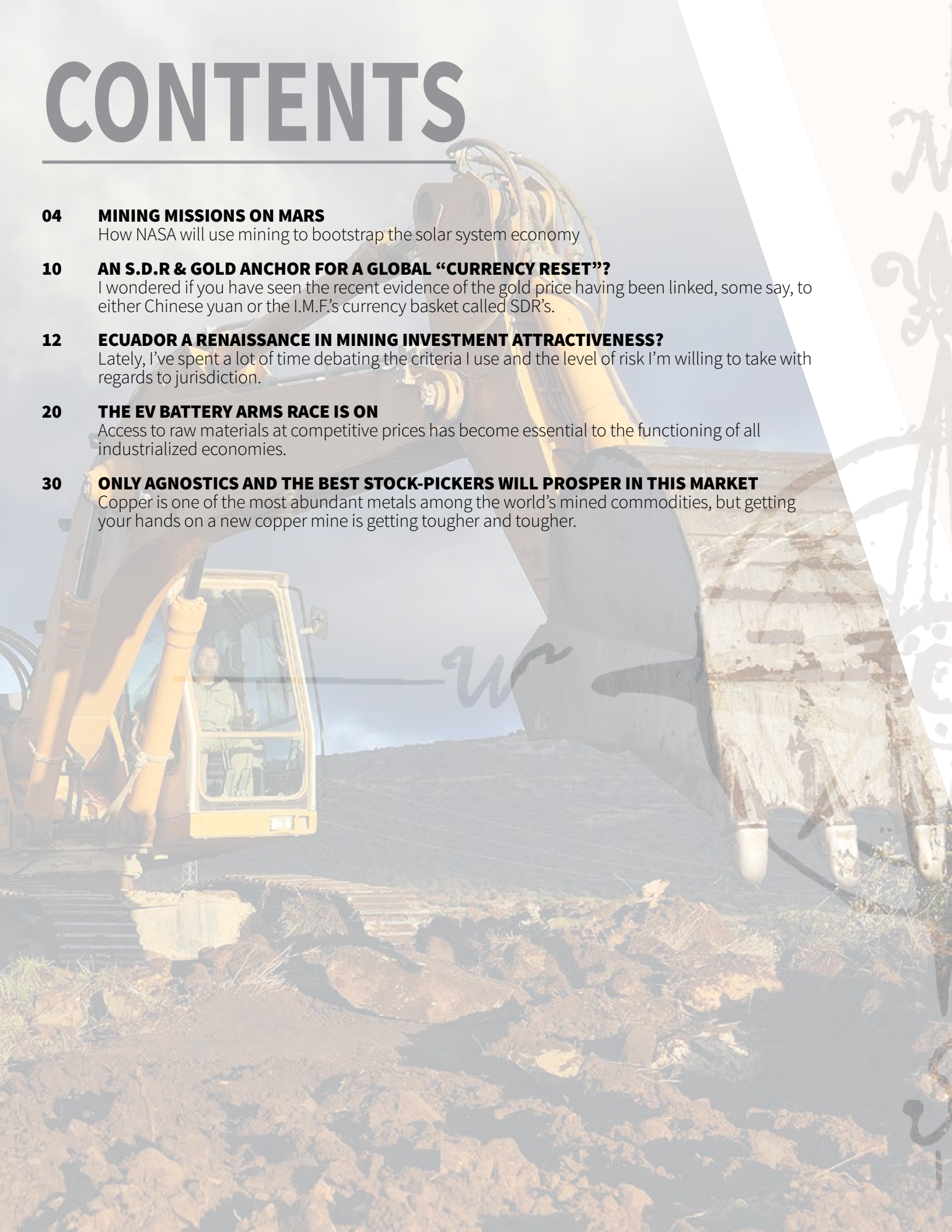
Lately, I’ve spent a lot of time debating the criteria I use and the level of risk I’m willing to take with regards to jurisdiction.

20 THE EV BATTERY ARMS RACE IS ON

Access to raw materials at competitive prices has become essential to the functioning of all industrialized economies.

30 ONLY AGNOSTICS AND THE BEST STOCK-PICKERS WILL PROSPER IN THIS MARKET

Copper is one of the most abundant metals among the world’s mined commodities, but getting your hands on a new copper mine is getting tougher and tougher.



PUBLISHED BY
THE PROSPECTOR NEWS
www.theprospectornews.com

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A remote-controlled robot miner has completed its 10-minute run to mine and deposit regolith simulant, or dirt and small rocks, into a bin in the robot mining arena during NASA's 6th Annual Robotic Mining Competition at the Kennedy Space Center Visitor Complex in Florida. More than 40 student teams from colleges and universities around the U.S. will use their mining robots to dig in a supersized sandbox filled with regolith simulant. The competition is a NASA Human Exploration and Operations Mission Directorate project designed to engage and retain students in science, technology, engineering and mathematics fields by expanding opportunities for student research and design. Photo credit: Amber Watson



MINING MISSIONS ON MARS

HOW NASA WILL USE MINING TO BOOTSTRAP THE SOLAR SYSTEM ECONOMY

by Christian Granholm

*A nomad stands at the edge of a vast, unexplored desert.
Radiation from the sun beats down upon the hard-packed
surface, like a hammer whose blows seek to bleach his very
bones and turn him back into the space dust from which he
surely came.
He knows he'll need three things if he's to make it across that
trackless wasteland and survive to tell the tale.
Fuel, shelter, water.
The tools of the successful nomad, now as in times past, are
simple.
Know when to move and when to stay still. Know how to
recognize the signs of an oasis. And know where to dig.*

At NASA's Kennedy Space Center, Rob Mueller is a senior technologist for Advanced Products Development in the Exploration Research and Technology Programs Directorate. He is the co-founder of both the NASA Swamp Works innovation labs and the annual NASA Robotic Mining Competition, for which he is the head judge.

His technical expertise includes robotics, mechanical systems design, planetary outpost construction, surface and ground operations, conceptual systems design and mission architecture design.

He has worked on the Space Shuttle, International Space Station, X-33, Atlas V, Orbital Space Plane, Second Generation Reusable Launch Vehicles, Mars Exploration Studies and Lunar Exploration programs.

Rob is what I call, 'a *hella smart guy*'. Which is exactly what you'd hope to have around, if you were a nomad planning on crossing an uncrossable desert, and looking to set up shop on the other side.

He's also remarkably easy to talk to.

The Prospector reached Rob at his office in Kennedy Space Center in Florida to discuss his work of late, and among other things, how to dominate the other planets and jump start the solar system economy through mining. Rob's recipe for writing the next chapter of *Have Spacesuit, Will Travel* relies heavily on mining as the key underpinning for mankind's exploration of outer space.

Mine the moon, mine on Mars and the other planets too. Then mine the asteroid belts and... beyond.



Robert Mueller, NASA senior technologist in the Science and Technology Projects Division of the Spaceport Systems Branch announces the on-site mining winners during NASA's 6th Annual Robotic Mining Competition award ceremony inside the Kennedy Space Center Visitor Complex Saturn V Center in Florida. More than 40 student teams from colleges and universities around the country used their remote-controlled or autonomous robots to dig in a supersized sandbox filled with regolith simulant and participate in other competition requirements. The competition is a NASA Human Exploration and Operations Mission Directorate project designed to engage and retain students in science, technology, engineering and mathematics fields by expanding opportunities for student research and design. Photo credit: Amber Watson

"What we call regolith is the crushed rock on the surface of another planet or moon," Rob patiently explained to me.

I felt like telling him I'd seen every episode of *Star Trek* ever made and just about every space-related doc on Netflix, so of course I understood the importance of using in-situ resources for exo-planet exploration but decided against it as he might have hung up.

"There is a variety of reasons why you would use local resources at your destination," Rob continued, blithely unaware of my momentary inner conflict.

"Ultimately, we want to be Earth-independent and have everything we need be provided by local resources, but in the early stages of human exploration the most important thing is propellant."

"Because 80% of the mass of a spacecraft which uses chemical propulsion is the propellant. So if you can avoid launching that propellant from Earth..."

I admit Rob lost me here with a bit of quick math but I caught up in time to grasp...



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“...then if you go to Mars there’s an 11 to 1 ratio from lower earth orbit to the surface of Mars. So you have to multiply the propellant you need by 11 and you need 30 tons of propellant on Mars to bring a crew of four home. So if you multiply 30 x 11 that’s 330 tons of propellant that you have to launch. But if you make it (the propellant) there (on Mars), you can avoid launching 330 tons which is the equivalent of two SLS rockets.”

I Googled SLS rockets. They’re huge with a silent ‘h’. I can see why we’d want to leave them on the ground whenever possible.

“The most efficient propellant from chemical production is what the space shuttle used and that’s liquid hydrogen and liquid oxygen. So if we were on Earth that’s what we’d use because it’s very efficient.”

“Now if we go to the moon for instance, that’s also what we’d use because we think there is water available on the

moon, and you can electrolyse the water and make hydrogen and oxygen.” “On Mars it’s a little bit different; we have carbon dioxide in the atmosphere. 95.5% of the atmosphere is carbon dioxide so you want to take advantage of having all that CO₂. You could actually acquire the carbon dioxide from the atmosphere and you can combine it with hydrogen which you get from water, which you mine from the soil and then you can make methane using the Sabatier process.”

“Terrestrial-size machines are too heavy, too big and they’re just not the right solution for space. So we had to reinvent what is a mining machine, what is an excavator.”

Wiki enlightened me as to the French chemist Paul Sabatier who in the 1910s discovered a process whereby the reaction of hydrogen with carbon dioxide at elevated temperatures and pressures in the presence of a nickel catalyst produce methane and water. It gets a bit sexier around 100 years later when the renewable-energy guys use the excess electricity generated by wind, solar, hydro, marine current, etc. to make methane (natural gas) via water electrolysis and the subsequent

application of the Sabatier reaction. “Now you have methane and oxygen,” Mueller carries along briskly, “and that’s the propellant for coming home from Mars.”

“For the moon and earth the propellant of choice is hydrogen and oxygen. But for Mars, it’s methane and oxygen. But we do use whatever we have available locally.”

My mind spins out for a moment, writing the jingle for an interstellar gas company, advertising the benefits of farm-to-table, locally-sourced propellants... ‘buy our gas, it’s made just one million miles awaaaaay’.

I snap back immediately when Rob seems to be reading my mind.

“...It’s just like a gas station on a highway,” Rob says pointedly.

I’d been peppering him with regular ‘right... uhuh’s and the occasional ‘ahh I see’.

My silence must have been the clue that I needed to know what was like a gas station.

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NASA's Regolith Advanced Surface Systems Operations Robot 2.0 (RASSOR, pronounced "razor"), shown here in Kennedy Space Center's Swamp Works, has several upgraded features that include being nearly half the weight of its predecessor and the ability to collect nearly three time more material and to operate autonomously. RASSOR 2.0 is one of NASA's robots designed to excavate material from other planets, a critical aspect of NASA's deep-space travel plans. For more information, go to go.nasa.gov/1RtcRES. Photo credit: NASA/Bill White

"Space stations," he explained. "They can be way points. Think of them like adaptations on the solar system highway. You mine the water and then bring the propellants to these space stations, which become way points in your transportation architecture. And then at that point you can refuel just like a gas station on a highway. You get food there, you can refuel, maybe there's a hotel. And that becomes a node in your transportation system."

Alright gas station in space, got it. I wanted to turn the discussion back to mining, but as usual, Rob was way ahead of me. His next comment sparked some fascinating tangents.

"The scale of space mining is much, much smaller than that of terrestrial mining. You only have to mine an area the size of a football field, and only to a depth of 5 to 10 cm to get enough propellant for one year of missions."

"I would almost call it micro-mining compared to what we do on Earth."

"And that's one reason space mining machines are small. But the other reason is that we can't have big heavy machines in space – it's not affordable."

"The cost of launching 1 kg into low Earth orbit today is about \$4200 (US). Terrestrial-size machines are too heavy, too big and they're just not the right solution for space. So we had to reinvent what is a mining machine, what is an excavator."

"And when we did that, the first thing we had to think about was a low gravity. When you have low gravity there is very little reaction force available. Of course on Earth you have these big heavy machines and they're heavy for a reason: to give you a lot of reaction force. You can push it against the ore and you can acquire ore in a large bucket or similar device. In a low gravity environment you don't have a

lot of reaction force so the first thing you have to do is take a big bucket and turn it into small scoops."

"We took the big bucket and turned it into a bucket wheel with lots of scoops on it. Then we took the bucket wheel and we stacked the bucket wheels together to make a bucket drum. Now you don't need to dump it anymore because the soil tumbles around inside the drum – rotate the bucket one way it digs,

rotate the other way it dumps and so it's a very nice way of mining because it is lightweight and efficient."

I questioned the wisdom and efficacy of such tiny mining equipment and for a nanosecond worried I'd perhaps hurt his feelings. Mueller was simply taking a breath before he happily regaled me with the details of what they've been so busy with at the Swamp Works.

"We call it RASSOR for Regolith Advanced Surface Systems Operations Robot."

"You see, we have to send small mining machines into space – we're not dealing with massive quantities of ore or machines, nor do we want to be."

"So if you had transportation which doesn't rely on propellants or spare parts from earth, that's the beginning of bootstrapping the solar system economy."

➤ Also, by sending several smaller robots, we create massive redundancies.”

Mueller describes the nightmare scenario for any mine manager: the breakdown of your single largest machine brings your whole mining operation grinding to a halt.

“Think in terms of a fleet,” coaxed Mueller, “A fleet of small mining robots; if one breaks down the operation is still able to continue.”

Space exploration is about having back-ups for your back-ups. Mission critical machines that are one-of-a-kind are simply not going to fly on NASA’s watch.

So RASSOR, or perhaps a whole fleet of mining machines, sallies forth and collects the space rock.

Once the regolith is collected, the extraction process is similar to what we’d do on Earth: separate the ore, refine it, then package it up and send it to where it’s most useful.

The big difference with mining on another planet is not only what type of ore we’re looking for, but the concentrations it can be found in.

“On the moon, the regolith has 42% by mass of oxygen in some areas, and that’s a very high grade ore!”

Later in my office, I had to play back the tape of our conversation several times to make sure I’d gotten that number right.

Here on Earth, gold mining operations measure output by just a few grams of ore per ton, or a millionth of a percentage. Mueller is talking about ore that is 42% pure.

It’s clear that in space, miners won’t be scratching in the dirt, sifting minuscule amounts of ore from vast piles of overburden.

It turns out that the ore percentages were Rob’s second most shocking revelation. It’s not how much ore NASA wants to mine, it’s what ore.

Turns out, water is what a space miner considers to be pay dirt.

“In the initial stages, precious metals are not so important for us in space. It’s more important to have water, because it lets you survive. The number one orebody everyone will be looking for in space is water – in space, it is far more valuable than platinum or gold.”

“The main thing we’re looking for is water. Using the hydrogen reduction process: iron oxides in the regolith reacts with hydrogen and it makes H₂O and then you can electrolyse the H₂O into hydrogen and oxygen, then you run the hydrogen through again for more hydrogen reduction. That’s what you would do on the moon.”

“If you were at the poles of the moon, you might have water-ice mixed in with the regolith. So you’d mine it all and heat up the ice, turn it into steam, condense the steam into a liquid and electrolyse the liquid and you have hydrogen and oxygen.”

“On Mars however, you have hydrated minerals. We think that the ore grade is 1% to 8% water in the equatorial regions. So for example, gypsum is one of the minerals we find on Mars and gypsum is thought to have 8% water content.”

“If you go further north on Mars, you might run into glaciers. There was a mission call the Phoenix Mission, which landed quite far north, about 70° north, and it landed and uncovered a sheet of pure ice. We think there are glaciers on Mars where if you excavate and remove the overburden,

you can then get to 100% pure water orebody.”

It was then that I understood the number one rule of real estate will never change. Regardless of which rock you’re standing on, whether it’s Earth, the Moon, or Mars it’s always about location, location, location.

“It becomes a trade-off between where you land. Can you find the glaciers at the poles? Is it worth removing the overburden? Or is it more economical to use the hydrated minerals in the equatorial regions?” Rob seemed to ask me directly, as if I had any answers for him.

This is one area where Mueller admits his scientific background might take a backseat to say, the unique skill-sets deployed by top mining management teams on mother Earth.

“It becomes an economic analysis,” Mueller admits. “Miners are very well-versed in the art of determining whether a mine is economically feasible. We’re going to run into the same issues as the miners on Earth, just in a little bit different environment.”

“...on Earth, gold mining operations measure output by just a few grams of ore per ton, or a millionth of a percentage. Mueller is talking about ore that is 42% pure.”

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A robotic excavator stands in an assembly area ahead of NASA's 7th annual Robotic Mining Competition. The RMC is set up for college students to design and build a mining robot that can travel over a simulated Martian surface, excavate regolith and deposit as much of it as possible into a bin, all within 10 minutes. Team members may control their bots remotely from a trailer where their only line of sight is via a computer screen, or completely autonomously, with their programming skills put to the test as their robot handles the mission on its own. The competition, which takes place May 16 to 20 at the Kennedy Space Center Visitor Complex in Florida, focuses on technologies necessary to extract consumables such as oxygen and water to support human life and provide methane fuel to spacecraft. Photo credit: NASA/Bill White

Mining water may be our first and most important ore target, but building new ships and stations to serve them will require the specialized talents that only hard rock miners can provide.

"We will need metals in space. We could use a process called molten regolith electrolysis; essentially you turn the regolith into lava and then you electrolyse it."

3D printers are rapidly becoming more popular and widespread in both industry and home use, but I'll admit until now that I've lacked the vision to see where the tech can take us beyond faster prototyping and a growing collection of plastic nicknacks on my desk (I derive unreasonable amounts of joy from a doorstop I 3D printed which spells out HODOR).

Unlike me, NASA grasped the concept early on and ran away with it, at light speed.

The Swamp Works is working on launching their own 3D printer into space, where it can be used to print bases on other planets from scratch.

"So you have the lava from regolith; once you electrolyse it, on one electrode you get oxygen and on the other electrode

you get metals accumulating. Then you separate out the metals and turn them into a feedstock for 3D printing."

"Now we can 3D print our spare parts in space using local resources; metals extracted from the minerals in the regolith."

"That's the beginning of the solar system economy."

I'm hanging on every word at this point - Rob has me sold on a solar empire - where we ride RASSORS on distant red planets, like tiny versions of the worms of Frank Herbert's DUNE, crying 'Water is the Spice!'

"Next, we make propellant and that gives us the fuel and oxidizer to power the solar system highway."

At this point, I'm choosing which House I should belong to: Atreides? Harkonnen?

Rob isn't waiting for me to catch up anymore, he's past the breakers and chugging steadily out into starry skies:

"So if you had transportation which doesn't rely on propellants or spare parts from earth, that's the beginning of bootstrapping the solar system economy."

"Beyond Mars is the asteroid belt."

NASA's long term vision for exploration lays out much like you think it would, if you spent enough time thinking about it. Like a nomad dreaming of one day controlling a vast desert empire, the careful first steps are all about setting up camps, one oasis at a time.

"The logical place in the solar system for our industry to be is the asteroid belt. Think of the asteroid belt as being the industrial park of the solar system. All the industry will be in the asteroid belt because that's where the resources are."

"If you have propellants that are economically feasible, now you can transport resources across the solar system because you stay outside of the gravity well."

"When you go to Mars or the Moon you're inside the gravity well; when you're at the asteroid belt you're outside the gravity well. This radically reduces the cost of transportation."

"Industry is in the belt; factories manufacture the goods out there and the transportation system delivers the finished goods to the end users which will be all across the solar system, including here (Earth)."

I feel like we've gone beyond the scope of what I'm supposed to be writing about, so I ask Rob about a talk he gave in New York recently, where he met my publisher, Mike Fox and, I assume, the two of them cooked up the idea for this article.

Mueller is uncharacteristically quiet for a moment then he comes back with, "I go to mining conferences. I speak to miners. Sometimes there's a disconnect. They ask, 'What's in it for us?' I try to get them understand that the advanced technology we're working on at NASA is applicable to what they themselves are doing."

"Mines on Earth are getting deeper and hotter. The environments are increasingly hostile to humans. We have the same problems they do - both of our mines are in hostile extreme environments that are not welcoming to humans."

"So if we both collaborate on the technology, and if the mining industry invests in it such that we can also develop technology on Earth which is also useful in space, then the whole thing starts to build a synergy which feeds on itself."

I ask him if deeper cooperation between terrestrial miners and NASA is, if not inevitable, then surely best case scenario.

"Absolutely! We have the technology and they have the expertise from their day-to-day operations. We should put those two things together and both industries will benefit from that."

If we view the entire race of mankind as one nomadic being, standing on the brink of an endless desert, we can conceptualize the enormity of the challenge that splays out before us.

And yet we remember that our core needs remain few. Find fuel, shelter, water.

And those needs are met by knowing only one thing. Know where to dig.

AN S.D.R. & GOLD ANCHOR FOR A GLOBAL “CURRENCY RESET”?

By Chris Temple

I wondered if you have seen the recent evidence of the gold price having been linked, some say, to either Chinese yuan or the I.M.F.’s currency basket called SDR’s. Do you put any stock in this in the context of a coming currency reset? Some say this is already in the works, to get the world off the dollar. . .

I’ve seen a few different versions of this latest “SHOCKING PREDICTION” myself. One says it’s something President Trump will actually be part of or allow in a “reboot” of the U.S. dollar, etc. Another says that this coming event is being engineered by others to torpedo Trump; “. . .the global elites’ secret plan to destroy Trump’s administration.” One video version warned that “Viewer discretion is advised.” I’m sure glad they warned me; I was so startled I could have soiled myself!



Seriously, the notion of either a malevolent or benevolent/planned “currency reset” has been around in one form or another for years.

One of the first things I couldn’t help noticing about this latest new “SHOCKING PREDICTION” is that one of its key purveyors is the same “former government insider” who—among other

sensational but most always wrong predictions—told us that back on September 30, 2016 (and at about 4:00 pm Eastern time, no less!) the U.S.

HERE WE GO AGAIN . . .

dollar would be relegated to the dust bin of history. In its place “a new I.M.F. currency” was to be revealed which we would shortly be using in lieu of the greenback to buy a cup of coffee.

Of course this, as I sarcastically pointed out at the time and a few times since, was a very disingenuous portrayal of what REALLY happened back then. The grain of truth within this fanciful story was that the International Monetary Fund had decided to make the Chinese yuan the newest currency to be included with several other key global fiat currencies in the formula for its SDR’s: Special Drawing Rights. For the average consumer and even investor in the world this meant

pretty much NOTHING. Nor does it mean anything today. (For a look back at that past dopey story, it’s archived at my web site, at <https://nationalinvestor.com/wp-content/uploads/August-2016-One-world-currency-hucksters.pdf>

The new dusting off of this hokum suggests that the I.M.F.’s S.D.R. basket is being “linked” to gold somehow or other as part of a “global currency re-set” of some kind. That, of course, is the latest explanation for why the dollar is about to go the way of the brontosaurus, and you’d better rush out yesterday and buy gold and/or whatever other “SHOCKING REVELATIONS” these carnival barkers are selling. In another twist, the same “expert” who put out **that blatantly phony previous pitch at right** suggests that this whole thing to undermine the dollar



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will be run via the block chain, seizing on another hot theme of the recent past for some “support.” (Maybe another aspect of this pitch, soon, will be that those who are putting together this world currency to dethrone the greenback are healthy and feeling GREAT, as they are on medical marijuana?)

The first thing I would ask these guys if I thought it was important/serious enough to worry about this is **how or why the I.M.F.- an institution that is controlled by the U.S. of A. and is an integral part of the global credit structure- would in ANY way work to bring about the dollar's undoing.**



Second, even if some at that body were of a mind to, in the fashion being expounded on, bring about the dollar's demise as the global reserve currency, I think Uncle Sam's

military is a little bit bigger than anything the I.M.F. can muster.

Make no mistake: As I have said many a time, NOBODY will be happier than me if God lets me live long enough to be able to dance not only on the dollar's grave, but on that of the Deep State-controlled American Empire. And yes, even I have recently suggested that a move away from global dollar hegemony could be accelerating right now.

But were anything on the order of this latest fairy tale going to materialize, it would decidedly NOT be based on the involvement of the I.M.F. or ANY part of the global monetary apparatus that America has controlled for some seven decades now.

More plausible will be when/as Russia or (more likely) China are able to get some real traction and flows with and through their respective development banks, for starters. Nice thoughts, to be sure; but though those countries have for several years now been building the infrastructure for their replacements (?) of the present order, to date these banks' activity is negligible.

I also am not dismissing the possibility that the well-publicized and ever-increasing gold hordes of Russia and China particularly may well be an anchor one day for a more credible and widely-used alternative to the dollar; at least in their own parts of the world. More power to them if they can pull such a thing off.

But in short, this latest dopey story has no more meat to it than that one of two years ago.

In doing my own surfing on this subject, I ran across an EXCELLENT archive chronicling this whole business, complete with a free book excerpt and numerous videos (I'd forgotten that some of these same clowns were the ones a while back behind the idea of Iraq's dinar having some magical monetary powers.) LOTS of stuff to debunk all of this crapola is at <https://www.globalcurrencyresetfacts.com/>; for all the videos, see <https://www.globalcurrencyresetfacts.com/global-currency-reset-videos-and-media/>


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Including	27.4	29.0	1.52	340.90
P17-12	57.9	62.5	4.57	14.52
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ECUADOR A RENAISSANCE IN MINING INVESTMENT ATTRACTIVENESS?

By Brian Leni

Lately, I've spent a lot of time debating the criteria I use and the level of risk I'm willing to take with regards to jurisdiction. I find the topic of jurisdictional risk very interesting because, although, there's a quantifiable aspect to jurisdiction, I believe many of the general opinions regarding jurisdictional risk are based on qualitative observations or anecdotal themes that are proliferated through the mainstream media.

A good example is Russia. Many jump to the conclusion that it's a VERY risky country and, therefore, not a place to invest. I don't necessarily disagree; most of the propaganda about Russia, today, is 'negative.'

Let's, however, take a look at one of the criteria listed by the Fraser Institute in its examination of jurisdictional risk; political stability. Relative to its peers, Russia scored low, which too many translate into 'stay away.' While political stability is a complex factor, I was taken aback when a friend, whose company does business in Russia, said he finds this scoring comical; "does anyone really think there's going to be some serious political upheaval while Putin is in charge?" Given the complexity of evaluating political stability, his answer isn't complete, but it still reveals the contrast in views - those who have experience in these 'risky' jurisdictions, and those who rely solely on narrative to form their opinions.

Last year, one of the mining industry's best, Rick Rule, gave me some sage advice regarding jurisdictional risk; "My

own experience is that most investors equate political risk to their emotion rather than to reality, and you tend to react more strongly to political risk that you haven't experienced or don't understand. My own belief is that money that is stolen from me by white people in English, according to the rule of law, is just as gone as money that is extorted from me in some third world kleptocracy.

My experience, further, by doing business internationally, and this is going to sound like a generality, which it is, but it is also true, countries that can't get any worse don't, and countries that can't get any better don't, either. This plays out over time, not immediately, but the truth is, the countries that have rewarded me the best are countries that have been coming off low bottoms. An example would be Chile, with a superb exploration endowment coming off, first, the idiocy of socialism under Allende, and then, the murderous regime of Pinochet. The response of the geology in Chile to stability and the sort of social sense that they had had enough of rightist and leftist autocracy was spectacularly good for me. I made money in hard places like Russia, Sudan, Congo. The truth is that most of the great, easy to find, tier one deposits that exist in countries that have been able to be explored efficiently in the last 40 years have been made. The big tier 1 discoveries that have yet to be made are going to be made in places where there

have been problems with access or problems with cost of capital. Places like the Tethyan metalagentic belt, running through Turkey, Pakistan, Kazakhstan, Afghanistan, Uzbekistan, Kyrgyzstan, Mongolia, those types of places. The easy deposits in safe places have mostly been found." ~ A Conversation with Rick Rule, CEO of Sprott US Holdings

With this in mind, and through my process of due diligence, I believe Ecuador is a country which is coming off a bottom in terms of mining investment attractiveness. I'm a buyer of what I believe are the highest quality junior mining companies exploring and developing projects in Ecuador, and believe that money invested now, near the bottom, gives the investor a great risk to reward opportunity.

ECUADOR

- Capital City – Quito
- Population – 16.529 million
- Currency – U.S. Dollar
- 2017 GDP – \$70.955 billion USD
- 2017 Unemployment Rate – 4.34%
- Main Industries – Petroleum (more than 40% of exports), food processing, textiles, wood products and chemicals
- Main Export Partners – United States, Chile, Peru, Colombia, Japan and Russia

*All Figures taken from IMF website

Ecuador's economy is the 8th largest in South America and is driven by the oil industry, where petroleum makes up almost half of the country's exports. The agriculture sector is a distant second with a little more than 10% of exports.

NOTE: Ecuador is the largest banana producer and exporter in the world.

Ecuador's oil production began in the early 1970s and is clearly the main driver of the economy. In the years before oil production, Ecuador was a country whose people identified with an agrarian social philosophy, meaning they valued rural society as superior to urban society. With the influx of cash into the country, this has slowly started to change and, in my opinion, is a key point in understanding the Ecuadorian culture.

SOCIAL UNREST – TAXES AND THE ENVIRONMENT

Looking into Ecuador's past, it's evident that its people are not afraid to protest, especially when it comes to

the environment or a number of social issues. Ultimately, moving forward, the government will have to choose how they deal with future protests but, either way, social unrest surrounding a potential mine site could have a major impact on the success of the project.

ENVIRONMENT

If I were to pick the most likely point of contention regarding mining's future in Ecuador, it would be related to the environment. Ecuador is near the top of the world list of biodiversity hotspots in terms of vertebrate species, endemic vertebrates and plants. Specifically, the Intag region, named for the river that runs through it, spans two of the world's 34 most biologically important areas.

This biodiversity is highly coveted by many who live within Ecuador and many of the environmental NGOs around the world. Doing a quick search of environmental organizations with propaganda referencing Ecuador reveals a long list of interested parties including, The Ecologist and Fund My Planet.

While there is the potential for turmoil regarding the environment, I think that the probability of there being issues can be reduced if handled correctly by the mining companies. By 'handled correctly,' I think it's really important to educate and support the local communities in the region with which you're developing or exploring. Educate on the benefits of mining and how the company intends to protect the environment in which it's working.

Additionally, an X-Factor in this type of relationship are ties with Ecuadorian companies that have operated within the country for many years. I think the companies that leverage their relationships within Ecuador are miles ahead of those who try to navigate the culture and government from the ground floor.

There's one such relationship which I think has a ton of potential to bring shareholders value through their expertise and recognition within the local communities. Adventus Zinc Corporation and Salazar Resources (SRL:TSXV) have this type of agreement,

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> and I had the opportunity to ask Sam Leung, Adventus' VP Corporate Development, about it.



Adventus Zinc Corp. (ADZN:TSXV)
MCAP – \$45.5 million (at the time of writing)

Brian: In your opinion, why was it important to have a partner, such as Salazar, in Ecuador?

Sam: Local know-how is often invaluable, particularly in the mining sector and developing jurisdictions such as Ecuador. Many foreign companies and corporate personnel often fail to recognize what they do not know about a project jurisdiction and its normal business and community practices, so a

trusted local partner can add significant value with operational experience and local networks. For Adventus' Curipamba Project and the Ecuador country-wide alliance, a strong partnership has been formed with Fredy Salazar and his local Salazar Resource team, who are pioneers in Ecuadorean mineral exploration with over 30 years in their home country. The Salazar team work closely with Adventus to help expedite and complete tasks in country with minimal complications, and share important business insights from domestic developments.

Brian: What do you see as the biggest risk for mining investment in Ecuador?

Sam: We perceive community relations and integration to be the biggest risk not just for mining investment in Ecuador but most other developing countries. Each project has different stakeholders and dynamics, so investors need to be aware of management teams' capabilities and limits in addressing social needs in project development. For the Curipamba Project, the Salazar team are well-respected members of the project communities, while

Adventus brings additional resources and international best-practices to address social needs.

LEFT-LEANING SOCIALISM

The political philosophy which I'm most apprehensive about, especially from an economic standpoint, is left-leaning socialism. Throughout history, political structures rooted within these frameworks have been bad for business. I believe, however, that given the obvious PUSH toward reducing taxes and attracting mining investment dollars, at least in the short-term, the risk associated with this form of political philosophy is reduced, but never too far away.

For me, when a political philosophy is so ingrained in the culture of a country, it's only a matter of time before the cycle shifts and once again reflects the country's history during Correa's rein. I'm very optimistic that the next few years will remain positive for mining investment, but will remain open-minded about the subtleties that may be indicating a reversion back to the mean!

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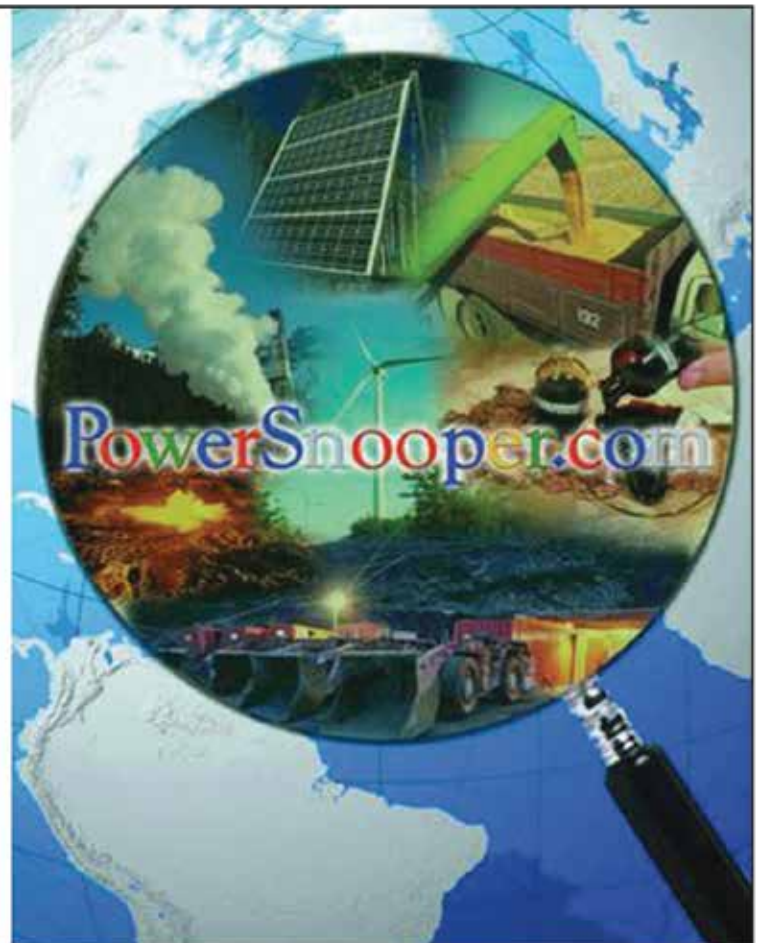
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THE LAST 10 YEARS

A major turning point in Ecuador's history, in terms of how it relates to mining, occurred in November 2006 with the election of Rafael Correa as President. Interestingly, Correa's 10 years as President was unusual given the fact that there had been 7 different Presidents in the previous decade.

Correa's appeal to the Ecuadorian people appears to have been rooted within socialist or left-leaning political philosophy, which saw a major portion of tax dollars diverted into social causes, such as healthcare, education and agricultural subsidies. Additionally, and more to the point of this article, Correa focused his attention on extracting more cash from the mining business.

In April of 2008, Correa's government adopted a new mining mandate which restricted companies to holding a maximum of three concessions and instilled a 180-day suspension of activities for almost all mining concessions in Ecuador while a new mining law was put together. This controversial move did not go over well with investors, and most of the mining companies which held property in Ecuador, as they saw their share prices fall in response to the news.

Months after, still under the guise of the new mining mandate, Aurelian Resources sold their multi-million gold ounce deposit, Fruta del Norte, to Kinross Gold Corporation for \$1.2 billion. I believe this deal single-handedly marked the height of 'doom,' so-to-speak, of the hard-rock mining industry within Ecuador. Over the coming years, Kinross participated in negotiations with the government over terms to develop Fruta del Norte into a mine but, ultimately, couldn't come to an agreement.

As cited in many articles relating to the negotiations, the Ecuadorian Government insisted on a 70% windfall profits tax, which, in essence, would limit the profitability of the mine in a rising gold price environment. Ultimately, this led to negotiations falling apart in 2013. Within a year, Kinross formally stepped away from Fruta del Norte with its sale to Lundin gold for \$240 million - a whopping 80% loss!

As I stated, I believe this marked the low point for hard-rock mining in Ecuador; outside of nationalizing Fruta del Norte,

selling it for a fraction of the purchase price because of negotiations with the government had a major effect on how the mining industry viewed investment within Ecuador's borders.

The failure of these negotiations is clearly visible in the popular Fraser Institute Rankings, as Ecuador's score for mining investment attractiveness fell to a low of 38.1, ranking it 80th out of the 122 countries that were covered by the 2013 report. In the years since, Ecuador has slowly improved its ranking with a score of 45.9 in 2014, 45.36 in 2015, 50.38 in 2016, and 52.09 in 2017. While this is a marginal improvement year over year, the score is headed in the right direction, and one which, I believe, will improve again in 2018.

2018

Why do I believe that Ecuador's mining investment attractiveness score is going to continue to improve in 2018? Great question and one that needs to be explained in further detail, as Ecuador's past needs to be kept in perspective when making prognostications.

GOAL OF ATTRACTING \$4.6 BILLION INVESTMENT DOLLARS OVER THE NEXT 4 YEARS (2021)

In May 2017, Lenin Moreno replaced Correa as President of Ecuador. While much of what I have read describes Moreno as having a socialist or leftist political philosophy that's very similar to Correa's, Moreno has publicly stated a desire to attract close to \$5 billion for Ecuador's mining sector. This is a lofty goal because, in my opinion, they will have to make great strides with regards to changing their image in the mining sector in order to accomplish this.

At this year's PDAC, Ecuador may have made a crucial step in improving their image, as they were the headline country sponsor for the event and had a large booth at the show. While advertising is great and a step in the right direction, if they don't take action to improve the country's mining investment attractiveness, it may be all for not.

Even before this advertising PUSH, however, Ecuador has shown that it's poised to change. The biggest change,

in my mind, comes with hiring Wood Mackenzie as a consultant to assist in changing Ecuador's mining tax regime, making it competitive with the rest of the world.

Here's a list of some of the positive fiscal and financial reforms made over the last few years:

- Value Added Tax (VAT) Recovery – Starting in 2018, VAT will be recoverable for mineral exports
- Windfall Tax – A bill has been expedite to remove the windfall tax, and should be approved in the next 30 days.
- Sovereign Adjustment
- Currency Transaction Tax – exemption on tax relating to currency outflows
- Accelerated Depreciation – Investors' choice of 5-10 years (locked in fiscal stability contract)
- Fiscal Burden – For example, the fiscal burden on a large scale copper project has dropped from 30% to 23% with the changes to the tax regime

NOTE: Review Wood Mackenzie "Ecuador Tax Regime"

Brian: Of the positive fiscal and financial reforms made by the Ecuadorian government to date, which do you feel will be the most effective in changing perception of the mining community?

Sam: We believe the significant reduction in the Windfall Tax terms over the past few years has been integral to changing the investment perception. Due to the negative connotations, we also believe the government of Ecuador could go further and remove the Windfall Tax outright, but that remains to be seen. Please refer to our corporate presentation on the Adventus website for more details on the Windfall Tax.

Brian: In your opinion, is there anything else that needs to occur to change the perception of the mining and investment communities?

Sam: With regards to exploration investment jurisdictions globally, Ecuador has been arguably the hottest over the past 12 months and this momentum continues. Longer term, we believe a significant milestone for Ecuador will be the completion and successful commercial operation of the

> first large mines which are currently in construction. Once these foreign companies demonstrate returns on their investments, many more deep-pocketed investors will be drawn into Ecuador.

CASH FLOW BACK INTO ECUADOR

As Ecuador's actions align with the statements they've made about bringing mining investment dollars to the country, cash has begun to flow back into the country's hard-rock mining sector. Arguably the best example of this comes from Lundin Gold and their push toward the development of Fruta del Norte.

FRUTA DEL NORTE

On January 14th, 2016, Lundin Gold announced that they had completed the negotiation of the definitive form of the Exploitation Agreement for the Fruta del Norte Project with the Government of Ecuador. The completion of this Agreement is a huge milestone given the controversy associated with its history. For those interested in reviewing the details of the Agreement, please follow the link to the news release.

The completion of the Agreement was very important, but most important is Lundin's ability to take the Agreement and put it into action via financing for the development of the Fruta del Norte Project. On March 26, 2018, Lundin Gold took a major step forward by announcing that they would be closing their \$400 million USD equity private placement. In my opinion, while the risk to reward ratio is very much in favour of Lundin Gold, considering the upfront capital cost versus upside potential related to expected gold production, the raising of this amount of cash for a gold project located in Ecuador speaks volumes about how the market is changing its view of the country, and Lundin's level of influence within the industry.

COLLABORATION – CHILE AND ECUADOR

On March 10th, 2018 Codelco, the world's largest copper miner, announced that Chile's Minister of Mining, Aurora Williams, and her counterpart in Ecuador, Rebecca Illescas, signed a joint declaration that strengthens the agreements of the Codelco-Enami EP alliance, and expedites the execution

of the Llurimagua bi-national copper project, located in northeast Ecuador.

To date, there has been \$34 million USD spent on the Llurimagua Project. It's expected that the total will be upwards of \$50 million USD by the end of the advanced exploration phase. The signing of the agreement and the money being spent by Codelco on the Llurimagua Project is another example of the changing tides in Ecuador.

CASCABEL

One of the hottest stories in the junior mining sector in 2017 was about Sol Gold, which is developing Cascabel, its porphyry copper-gold deposit, located in the Imbabura province in the northwest region of Ecuador.

Cascabel is a great example of the mineral potential that exists within Ecuador. Clearly, investors are attracted to Sol Gold with their high-grade copper over wide intervals, such as that which was found in Cascabel Hole 12 and produced an interval of 1560 meters at 0.93% CuEq, or Hole 9, which produced an interval of 1197.4 meters at 1.16% CuEq.



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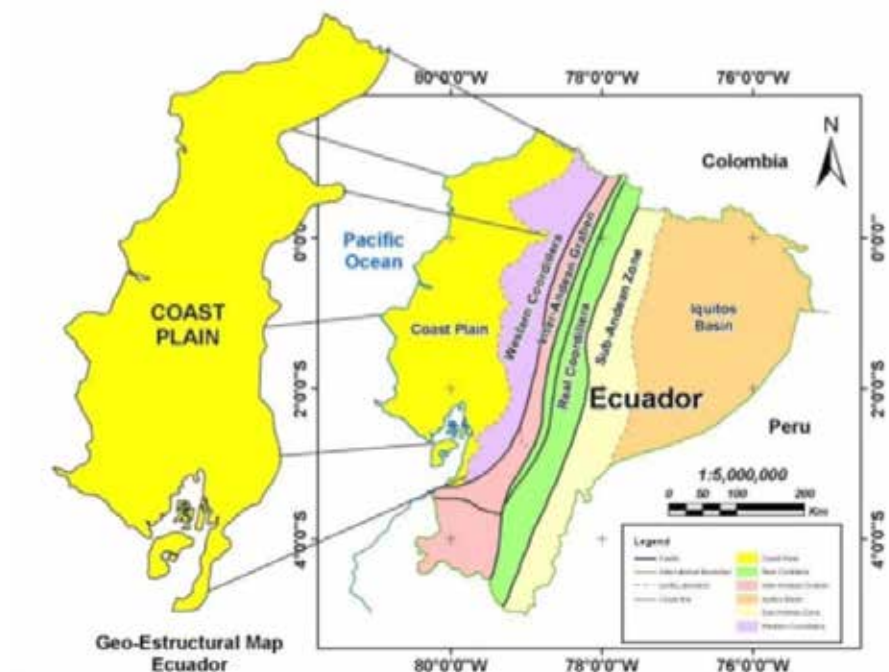
Are mining investors avoiding Ecuador? Glancing at Sol Gold's stock chart, I think the answer is no. With Ecuador's push toward change in its hard-rock mining policy, and what looks to be world-class mineral potential, investors are clearly interested in the risk to reward potential.

ECUADOR'S POTENTIAL

In my opinion, the top reason for investing in junior mining companies that are exploring or developing projects in Ecuador is the mineral potential that exists within its under explored borders. Also, more with regards to the projects that are in development, Ecuador produces 90% of its internal energy requirements via hydro electric dams, giving Ecuador some of the cheapest electricity in the world.

MINERAL POTENTIAL

Ecuador is located on the northwest coast of South America and is host to the northern portion of the Andes Mountain chain. The Andes are famous for their mineral endowment, as a



couple of South America's most prolific mining countries, Chile and Peru, have produced some of the richest deposits in the world.

In a presentation entitled, Geological and Mining Potential in Ecuador, John Efrain Bolanos cites, "the spatial-time

Source: John Efrain Bolanos
Presentation – Geological and
Mining Potential of Ecuador

distribution of the Cu porphyries and related epithermal mineralizations of the Peru metallogenic belts are very similar to those ones in Ecuador."



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> From Bolanos' presentation, Ecuador can be broken down into 6 geo-structural domains, which showcase Ecuador's geological potential:

- The Fore Arc Basin of the Coast
 - Cretaceous to Cenozoic basin underlain by alloctonous basaltic ocean crust
- Western Cordilera
 - Formed by an accretionary prism mainly of ocean crust composition, continental crust and accreted Late Mesozoic to Cenozoic ocean terrains
- Interandean Graven
 - Formed by thick and large Oligocene to Miocene volcano-sedimentary sequences
- Real of Central Cordilera
 - Formed by several litho-tectonic divisions of Andean bearing and separated by regional faults. Guamote division, Alao division, Loja division, Salado division and Zamora division
- Eastern Subandean Zone
 - Formed by forearc belt of the basement covered by volcano-sedimentary sequences
- Back Arc Basin of Iquitos
 - Comprises of Oriente or Amazonian basin mainly formed by sedimentary and volcano-sedimentary sequences

Given Ecuador's favourable geography, similarities to a couple of the world's most prolific mining countries and lack of modern exploration activity, Ecuador may be one of the world's last frontiers for potential world-class deposit discoveries.

Brian: Was Ecuador's mineral potential a factor, first, in choosing the Curipamba Project, and second, in expanding upon the exploration and development deal with Salazar?

Sam: In our global hunt for zinc-related projects in 2017, the quality of the Curipamba Project with respect to its high grade El Domo deposit and the additional exploration potential over its 22,000 hectare area stood out when compared with other known projects and operations globally. During our due diligence process, we also recognized the scale of potential discoveries within under-explored Ecuador and how a well-aligned partnership with Salazar would provide us with first-mover advantages during Ecuador's adolescence as a mining jurisdiction. Ecuador's mineral potential, located between Peru and Colombia, is at the heart of the investment thesis.

CONCLUDING REMARKS

It's my contention that Ecuador is in the midst of a renaissance toward perceived mining investment attractiveness. While there's a conscious effort being made by the Ecuadorian government to attract investment from the global mining industry, I believe investors and mining companies are rightly skeptical about placing their money in a place where so much destruction to capital has occurred in the past.

In my opinion, the risks that pose the largest threat to investment dollars still exist and will not cease to exist at any point in the future. I believe the Ecuadorian people have a culture which is rooted in left-leaning socialism. Currently, the pendulum, while still hanging under the socialist umbrella, has pushed further right and will remain there for the next few years, but will revert back to the mean at some point in the future - to that I think it's inevitable.

within Ecuador's borders will always 'walk the line' between being accepted and being protested. Companies that do not make an effort to explain how they will protect the environment and the other benefits of mining to the communities will not be successful.

While the risk associated with investing in Ecuador is very real, I believe there's tremendous opportunity in Ecuador right now. This is based on the following:

- Current President, Lenin Moreno, has stated that it's his goal to attract close to \$5 billion in mining investment dollars over the course of his 4 years as President. Lundin Gold's \$400 million financing for the development of Fruta del Norte speaks to the market beginning to turn in favour of investment within Ecuador.
- Adventus Zinc, Lundin Gold, Codelco, BHP and Sol Gold are all examples of companies that have started putting investment dollars to work within Ecuador. It's my opinion that smart money begins to flow into the smart contrarian markets first.
- Wood Mackenzie's influence in Ecuador's mining taxes is a major step toward becoming a world-class destination for mining exploration and development. Reductions in VAT and the company's fiscal burden, along with the proposed elimination of the windfall tax, are all integral steps in attracting further investment dollars.
- Immense mineral potential – Much of Ecuador has not been explored with modern exploration techniques. Given Ecuador's geographical location, I believe it's safe to say that Ecuador may be one of the world's last remaining jurisdictions with tier 1 deposit type discovery upside potential.

I'm investing my money in Ecuador and believe it's just a matter of time before the market recognizes the changes that have been made and will follow suit.



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Additionally, given the biodiversity of Ecuador and the global push toward environmental diligence, mining

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Access to raw materials at competitive prices has become essential to the functioning of all industrialized economies. As we modernize, developed and developing countries will continue to place extraordinary demands on our ability to access and distribute the planet's natural resources.

By Richard (Rick) Mills

A sustainable, and secure, supply of raw materials is going to become the number one priority for all countries. Increasingly we are going to see countries ensuring their own industries have first rights of access to internally produced commodities and they will look for such privileged access from other countries.

We see this right now in the protectionism of the United States, which has realized after many years of government inaction that it no longer has a local supply of important metals to feed its growing economy. Security of supply also underpins the entire intermodal transportation system - ships, railways and trucks - all carrying containerized goods that rely on "just in time" supply chains. Imagine the grocery industry or auto-parts manufacturers having to wait for shipments before moving on to the next point of distribution. The whole system would fall apart. Most industries cannot function without security of supply.

However the "metallurgical Achilles heel" of the United States is its dependence on foreign imports of strategic metals. Trump has to be credited for being the first President in decades to recognize

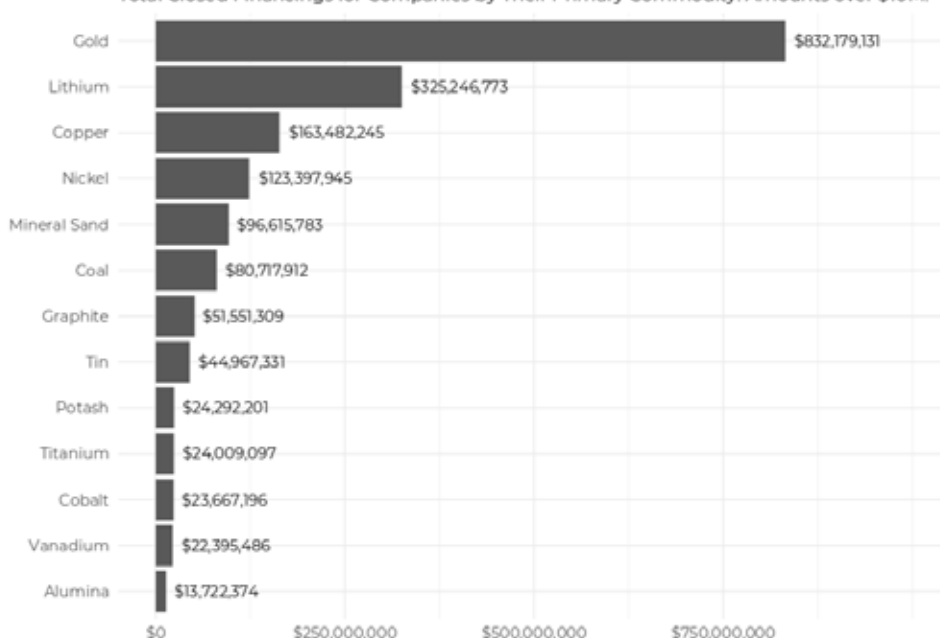
this. In December Trump signed an executive order to reduce dependency on 23 minerals deemed critical to national security. "The comprehensive order aims to identify new sources of critical minerals, ensure miners and producers have access to the best data, and streamline the leasing and permitting process to expedite production, reprocessing and recycling of minerals at all levels of the supply chain," said a statement from the White House.

Included on this list is lithium - the key ingredient in lithium-ion batteries used in electric vehicles as well as cell phones, power tools and many other electronic devices. EV batteries also contain nickel, cobalt, and graphite. The United States currently imports most of the lithium that it consumes - with import reliance today pegged at over 70%. Due to junior lithium explorers having a hard time raising funds in North America, many are heading to Asia to sign agreements with battery-makers.

An example is Japan's SoftBank which invested \$100 million into Nemaska Lithium's mine and electrochemical plant

Financings by Commodity Q1 2018

Total Closed Financings for Companies by Their Primary Commodity. Amounts over \$10M.



Data from Mining Intelligence

CAMINO MINERALS CORP

Los Chapitos Copper Project

- Located in southern Peru in the Peruvian iron ore-copper-silver belt
- Over 16,000 m of diamond drilling in 2017 with up to 0.93% copper over 96.5 meters
- 2018 will see drilling between two significant new copper oxide discoveries and testing of new targets
- Targeting open pit, copper oxide resources for low capex Heap Leach - SXEW processing

Villa Hermosa High-grade Gold Property

- Located in west-central Peru in an orogenic gold district
- Due diligence sampling of veins averaged 28.9 grams of gold per tonne
- Two private mines nearby produce over 400,000 ounces of gold annually
- Targeting high-grade gold resources contained within quartz veins and stockworks

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TSX.V : COR
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in northern Quebec, Canada. SoftBank owns a 15% stake in Uber and wants to convert its taxis in China and India to electric vehicles.

The increasing trend, almost all the major moves being made to lock up lithium supplies is not in North America; it's in the South American salars (evaporated salt lakes), where three-quarters of the world's lithium is produced. And with 50% of the world's lithium resources in Chile, as well as the country being the lowest cost producer, Chile, if you're a junior resource company in the lithium space, is the place to own lithium projects.

LITHIUM CHILE

Lithium Chile (TSX-V:LITH, OTC-QB:LTMCF) is one such company with excellent potential for partnerships and offtake agreements from its sprawling collection

of properties in Chile that it managed to pick up at rock-bottom prices.

Lithium Chile's Chief Geologist Terry Walker staked the highly prospective land blocks for not much more than \$3 a hectare.

The small-cap lithium junior holds 152,900 hectares across 14 salars and one "laguna" (lagoon in Spanish), surrounding the world's most important lithium reserves in the Salar de Atacama. LITH's land package (video) is the largest privately-owned lithium amassment in Chile. Now, prospective lithium blocks in Chile are going for \$1,000 a hectare; not only that, the low-hanging fruit is gone. To assemble the same land package at today's prices would cost over \$150 million.

Two of The Big Three lithium producers - US-based Albemarle and SQM, Chile's largest lithium producer - control nearby

Top Projects: From N to S

Salar de Coipasa

Sampled 310 - 1410 mg/L Lithium

Salar de Ollague

Sampled 160 - 1140 mg/L Lithium

Salar de Helados

Sampled 390 - 1280 mg/L Lithium

Salar de Atacama

Sampled 210 - 1330 mg/L Lithium

Salar de Turi

Sampled 260 - 525 mg/L Lithium

Salar de Talar

Sampled 290 - 740 mg/L Lithium



ground. Moreover, Chile has become recognized as an excellent mining country, with a low risk of resource nationalism (resource nationalism is the tendency of people and governments to assert control, for strategic and economic reasons, over natural resources located on their territory), a new mining code, and clear permitting rules - all major pluses for mining and exploration companies hoping to do business there. Some other key points about LITH:

The company has the grades and the size that would interest a potential acquirer or partner. Surface and auger sampling at its four main prospects returned grades ranging from 580 milligrams per liter (mg/l) at Salar de Turi, to 1,410 mg/l at Salar de Coipasa, found a meter below surface. Surface and near-surface sample grades on the four properties were north of 1,000 mg/l.

In lithium brine mining, size is important because you need large evaporation ponds. Anything less than 3,000 hectares is too small. Lithium Chile's Coipasa and Helados salars size up at a respective 11,000 and 30,000 hectares - making them suitable for building a lithium production facility in the future.

Lithium Chile has attempted to control the majority of the land in their most prospective targets. For example they control over 70% of the Salar de Coipasa. Majority ownership in the salars is key, in ensuring that they don't get diluted by competitors.

Most of the samples taken by Lithium Chile have been taken at or near surface. This is important because the deeper the target, the more brine needs to be pumped to the evaporation pond - adding costs and time.

Finally, most of the samples LITH has taken so far are running at around a 4:1 ratio of lithium brine to magnesium. This is significantly lower than brine-magnesium ratios in Argentina, which run between 5:1 and 10:1. Magnesium, a contaminant, has to be removed by adding slaked lime to the brine, increasing costs.

Speaking of Argentina, Lithium Chile has the advantage of being in a country with significantly higher grades and reserves than its neighbor, due to geography. The Salar de Atacama has just the right amount of heat, wind and lack of rain to ensure high evaporation rates, making it the ideal location for lithium mining.

"Lithium brine production in Chile is the cheapest in the world and it's less than half of our nearest competitors. Brine production here is in the order of \$1,500-\$1,800 per ton, while hard rock mining costs \$5,000 per ton," Terry Walker, VP

Exploration and Chief Geologist, stated in a news release.

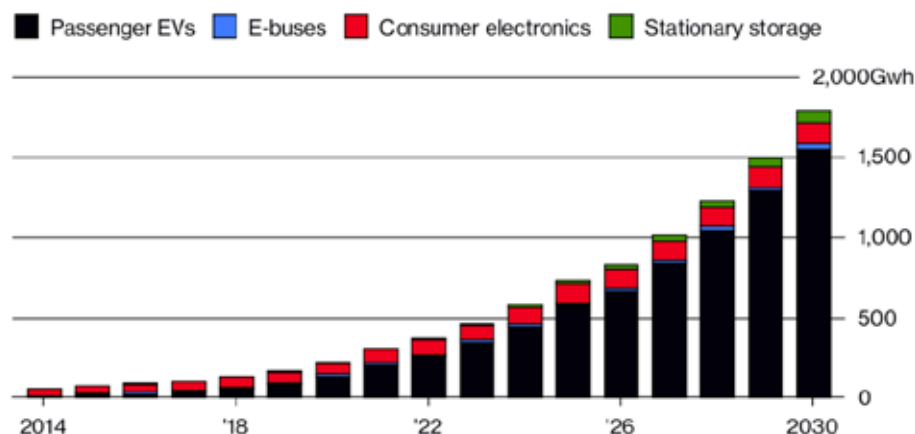
Argentina is also considered to be a risky place for mining companies to do business. Despite the end of 12 years of leftist rule, a shaky economy and a lack of regulatory clarity has meant the mining industry and its investors are still hesitant.

RISING EV OUTPUT FUELING BATTERY DEMAND

Asia and particularly China is going after lithium, and is years ahead of North America in terms of EV penetration and battery supply chains. Last year China sold about 700,000 electric cars, 200,000 more than 2016. Government subsidies to EVs

All Ahead for Electric Vehicles

Transport demand for lithium-ion batteries will soon overtake consumer gadgets



Data: Bloomberg New Energy Finance; graphic by Bloomberg Businessweek



Bravada Gold Corporation (BVA-TSX.V; BGAUF-OTCQB; BRTN-Stuttgart) is an exploration and development company with a portfolio of eleven high-quality properties in Nevada. During the past 14 years, the Company has successfully identified and advanced properties that have the potential to host high-margin deposits while successfully attracting partners to fund later stages of project development. Currently, three of its properties are funded by partners. The Company also holds a royalty on a high-grade gold property in Ontario.

Partners spent approximately US\$750,000 on Bravada's properties during 2017, resulting in the discovery of shallow, oxide gold mineralization at the Sinter Target on the Baxter property and in the refinement of the high-grade Quito Extension Target, which was successfully permitted for 2018 drilling.

- **Baxter** – 13 RC holes in 2017 for 2,448 metres; 7 holes intersected anomalous concentrations of gold, including hole BAX17-07 with 3.0m of 3.7g/t Au within 9.1m of 1.38g/t Au 600m west of the Sinter target.
- **Quito** – Drill permit received for the Quito Extension target. Modeling indicates the high-grade gold mineralization exploited in the shallow Quito open pit is associated with fault intersections that are untested down plunge.
- **Shoshone Pediment** – Mine permitting continues by Baker Hughes, with Bravada holding a royalty on eventual barite production.
- **North Lone Mountain and South Lone Mountain** – Nevada Zinc continues drilling on their adjoining claims, expanding zinc mineralization towards Bravada's claims. Should Nevada Zinc complete the purchase of Bravada's South Lone Mountain claims, Bravada will retain an attractive royalty on base and precious metals. Drill targets have been identified on Bravada's North Lone Mountain property, an earn-in option with Nevada Zinc.
- **Wind Mountain property** – Two proof-of-concept deep drill holes completed by Bravada 2017/2018; drill results, refinement of existing geophysics, and other data restrict the location of the feeder to a predominately covered area south of the existing open pits and current Resources.
 - Independent Resource update and positive PEA for shallow gold/silver mineralization at Wind Mountain in 2012 (see news release NR-07-12, dated May 1, 2012).
- **SF property** – Drill-testing planned Q3 2018, subject to funding, for high-grade "Carlin-type" gold mineralization similar to Barrick's Goldrush deposit to the west.
- **Other properties** – The Company continues to seek appropriate funding partners to advance its properties, many of which have significant gold intercepts in drill holes and have targets delineated for additional drilling.

TSX: BVA.V | BRTN: STUTTGART | BGAUF: OTCQB

WEBSITE: www.bravadagold.com

EMAIL: ir@mnxlttd.com

have been reduced by 20%. Beijing sees EVs as the key to unlocking the pollution dilemma that has plagued its car-choked cities, governments across the globe see EV's as a major weapon in the fight against global warming. China represents over a quarter of the global EV market, and will own 40% by 2040 according to the International Energy Agency (IEA). The country has signed lithium offtake agreements with mines in Australia, Canada and Africa, and despite Tianqi Lithium – which owns 51% of Talison's Greenbushes mine in Australia, the largest hard rock lithium mine in the world – being recently denied a 32% ownership stake in SQM, China isn't giving up.

Other Asian companies, such as Japan's Panasonic and Korean conglomerate Samsung, are also looking to ink deals. Lithium X Energy accepted a buyout offer from NextView, a Chinese investor consortium, for its flagship lithium property in Argentina. NextView also acquired a 20% stake in Bacanora Minerals' Sonora lithium project in Mexico.

China and India are both going to 100% electric vehicles. Every major car

manufacturer has electric models. Volvo has even promised to phase out internal combustion engines (ICEs) from 2019. France has vowed to end the sale of gasoline and diesel vehicles by 2040; the UK quickly followed suit. Almost a third of cars sold in Norway in 2016 were electric and Germany could outpace its neighbors as Volkswagen aims to become a leader in both EVs and automated vehicles. EVs surpassed 2 million units in 2016 and Bloomberg New Energy Finance predicts they will make up an astounding 54% of new car sales by 2040.

In 2016, Chinese carmakers sold 28.03 million cars. If China follows through on its promise to go 100% electric that's a minimum 28.03 million lithium-ion battery packs for EVs per year. Last year China sold 777,000 units of battery-powered, plug-in hybrids, and fuel-cell vehicles, and could surpass a million this year according to estimates from the China Association of Automobile Manufacturers.

Add in the UK's 2.7 million car sales in 2016 and France's 2 million car sales in 2016. That's 32.73 million electric vehicles all requiring lithium-ion battery packs, without counting electric buses (a big deal in China, and going to be in India as well) or annual growth rates in auto sales. One Tesla car battery uses 45 kg or 100 pounds of lithium carbonate.

The IEA said recently that it expects the number of EVs to more than triple by the end of the decade, from 3.7 million last year to 13 million in 2020. According to the organization the biggest adopters will be Europe and China, due to credits and subsidies provided by the Chinese government, and tighter fuel emissions standards plus higher fuel taxes in Europe.

All of this, of course, is good news for miners of lithium, nickel, cobalt and copper, which are essential to the manufacture of electric vehicles. The IEA says demand for these metals could rise 10-fold, which is having an effect on prices. Nickel, copper and cobalt have all been enjoying great runs. The price of lithium carbonate equivalent (LCE) has risen 25% compared to 2017, and is now trading around US\$16,000 per tonne.



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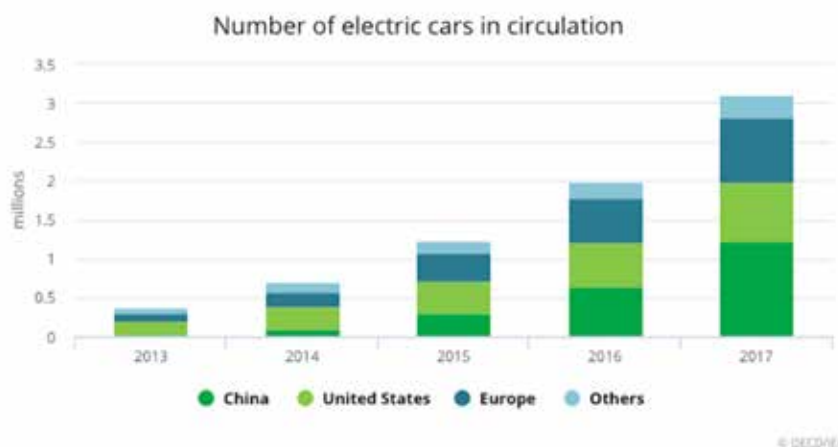
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Source: IEA's Global Electric Vehicle Outlook 2018.

VW'S 40-BILLION EURO COMMITMENT

One of the most telling signs of the tectonic shift from gas-powered vehicles to EVs was the \$40-billion-euro deal that Volkswagen inked with major EV battery suppliers. 40 billion euros. That's almost

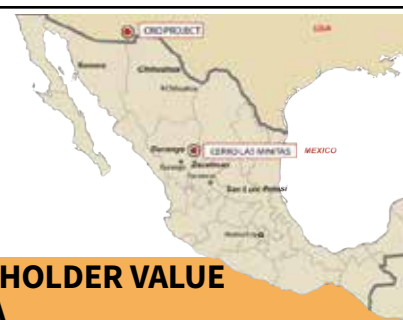
as much as Tesla's market cap in dollars (\$46 billion vs \$50B). According to Fortune, Volkswagen is planning to sell up to 3 million EVs a year. The German company dwarfs Tesla's production by a long shot. It makes more cars in four days than Tesla does in a year. In fact VW is so gung-ho on EVs, it's planning to establish battery cells in Europe to satisfy emerging demand.

As mentioned Japan's SoftBank invested \$100 million into Nemaska Lithium's mine in Quebec. Nemaska also has an offtake agreement with Northvolt, which is aiming to have Europe's largest battery factory. Under the deal announced in April, Northvolt agreed to purchase between 3,500 and 5,000 tonnes of lithium hydroxide, for five years, from Nemaska's Shawinigan plant.

These multi-million and multi-billion-dollar deals show that the world's largest car and battery companies – that big business, governments and consumers get it, that they are all serious about combating pollution and climate change, the electrification of our transportation system is underway. And it all comes down to security of supply of lithium because it is all about the batteries. As automakers cut deals for large scale battery production they also see massive potential in the residential/commercial energy storage business through the lithium battery packs they're already building. But without batteries, read that as lithium, they're dead in the water because without battery materials, their production lines grind to a halt.



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Cerro Las Minitas Ag-Pb-Zn, 265 sq. km Project, Durango, Mexico (Faja de Plata):

Updated January 2018 Mineral Resource Estimate (175g/t AgEq cut-off):

Indicated: 33.6Mozs Ag, 319Mlbs Pb and 813Mlbs Zn (**116.1Mozs AgEq; 1.69Blbs ZnEq**); and

Inferred: 20.7Mozs Ag, 131Mlbs Pb and 870Mlbs Zn (**92.7Mozs AgEq; 1.35Blbs ZnEq**)



- US\$ 3.0M 2018 Drill Program underway will add tonnage/ounces and define the overall size of the project
- 70% of resource Identified in new high-grade Ag-Zn-Pb-Cu Skarn Front Deposit; open for expansion
- 2nd drill testing strategic new claims w/ Au-Ag targets similar to vein systems in nearby Avino or La Preciosa mines
- 108 drill holes, 49,500 metres, US\$15.5M spent in acquisition and exploration to date

Oro Cu-Mo-Au Project, New Mexico, USA:

- Cu-Mo-Au Porphyry Target - multiple drill-ready targets within six sq km alteration footprint
- Stockpond Gold Target -Phase II drill program 8-10 holes, 1500metres completed
- Z-TEM survey over entire property completed and evaluated; additional claims staked

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CHINA'S DOMINANCE

Most North Americans consider Tesla to be the market leader in electric vehicles with its Gigafactory in Nevada but the real action is taking place in China. Who is the largest EV battery maker in the world?

Among its clients are Volkswagen, BMW, Hyundai Motor and Nissan. CATL is trying to get financing to build a new 24-gigawatt-hour factory in its home province of Fujian, and is supplying its cells to a number of number of major automakers in China who are rolling out

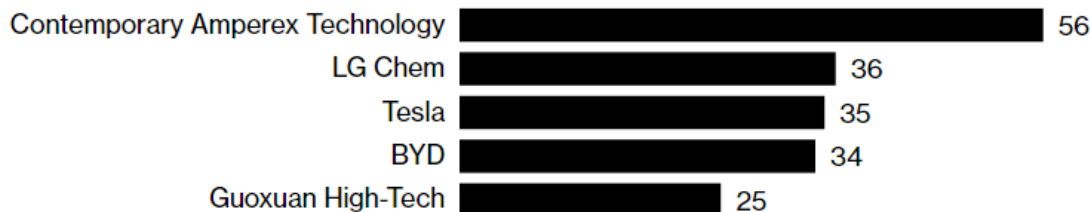
Sonata, and BMW's 530Le sedan. CATL opened an office in Yokohama, Japan, and is looking to build plants in Europe.

Adding the plant in Fujian would mean that CATL surpasses the output of Tesla's Gigafactory in Nevada, BYD Co., backed by Warren Buffet, and South Korea's LG Chem Ltd., making it the world's largest EV battery supplier, according to Bloomberg New Energy Finance. CATL already supplies batteries for BAIC Motor Corp, the biggest EV seller in China, and Zhengzhou Yutong Group, the world's largest bus maker, states Bloomberg.

Financing the \$1.3 billion factory is to come from an IPO which CATL recently had to more than halve. It planned to raise \$2 billion by selling a 10% stake, valuing the company at \$20 billion, but the IPO price was reduced to 25.14 yuan a share, valuing the company at just \$8.5 billion. The lessened IPO value was a result of a decline in CATL's margins due to China's decision to reduce subsidies for electric vehicle purchases.

Top Battery Makers

■ Actual and anticipated annual production in gigawatt-hours



Source: Bloomberg New Energy Finance

Note: Amounts include capacity announced, under construction and commissioned

If you said Panasonic, which supplies Tesla, you'd be wrong. It's actually Contemporary Amperex Technology Ltd. (CATL), a Chinese company.

new EV models including Toyota's ix4, a rebranded EV being developed by its Chinese partner, Guangzhou Automobile Group, a plug-in version of Hyundai's



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Project Map

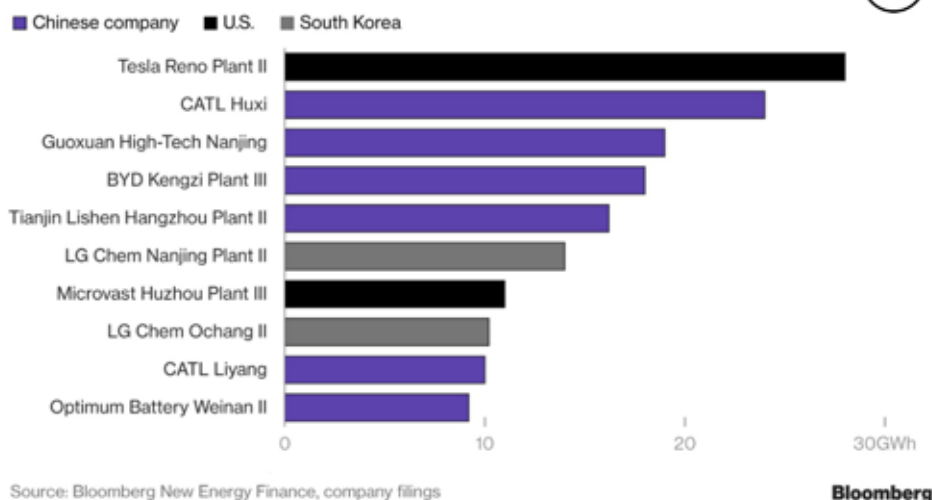


Gold Bar – Gold Canyon



Beyond the Gigafactory

CATL's planned Huxi battery cell plant will be the world's second-largest by capacity



Beijing has also put a cap on price-earnings ratios in IPOs in order to curb speculation, which factored into the

Also electric vehicles (EVs) have far fewer moving parts than Internal Combustion Engine (ICE) gasoline-powered cars - they

don't have mufflers, gas tanks, catalytic converters or ignition systems, there's also never an oil change or tune-up to worry about getting done.

A lot of the new growth will be in China. Of that 441GWh, about 130GWh are expected to be built in the world's second largest economy - which is three times the rest of the world combined.

CHILE, THE BEST PLACE TO BE

So where all these new gigafactories going to source their lithium hydroxide and lithium carbonate? It's likely that a great deal of it will come from the lithium salars in Chile, which is the lowest-cost jurisdiction for lithium mining and home to 52% of global supply.

As mentioned Asian firms are already active in South American lithium salars. Eight years ago Lithium One formed a joint venture with Korea Resources Corporation to develop its Sal de Vida lithium brine project in Argentina.

"Effectively, Strydom notes, the "middle man", who will be adding value to the mineral and end product, will be sitting in a bottleneck squeeze as the raw material prices will be increasing, while product prices are decreasing.

This means that margins are coming under threat, he warned, adding that the market tendency has been to see

Set to Dominate

China's pipeline of planned battery plants is about triple the rest of the world combined



Source: Bloomberg New Energy Finance

Bloomberg

reduced IPO price (valuations can't be more than 23 times profit).

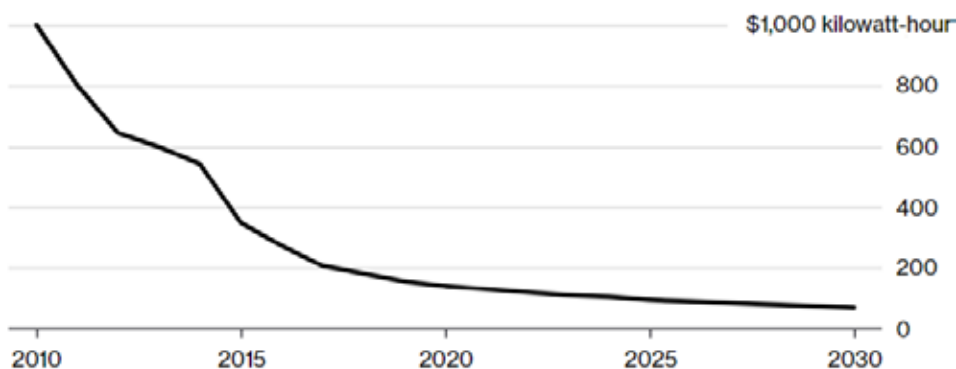
The scaled-back IPO however isn't expected to dent the building of new battery plants. In fact, Simon Moores, managing director of Benchmark Intelligence, says the world is in the midst of a "global battery arms race" with a massive spike in gigafactories coming in the next five years.

Benchmark Intelligence forecasts capacity at gigafactories to increase from 112 gigawatt hours last year to 441.5 GWh in 2023. Tellingly, the London-based research firm notes that prices for lithium-ion battery cells have fallen around 16% annually since 2014, putting the technology almost on par with internal combustion engines.

Tipping Point

Battery costs are expected to drop below \$100 per kilowatt-hour, making electric cars competitive on price by 2025

— Lithium-ion battery pack price



Source: Bloomberg New Energy Finance

Note: Prices starting in 2017 are forecasts

Dominating Supply

China dwarfs global rivals in planned and existing battery cell production capacity



Bloomberg

China has a stake in Argentina's Cauchari-Olaroz lithium project - a 50/50 JV between SQM and Lithium Americas. Having financed \$172 million, Jianxi Ganfeng Lithium is now Lithium America's largest shareholder with a 19.7% stake. Chinese and South Korean companies are among the bidders to construct the giant Salar de Uyuni lithium carbonate plant in Bolivia - which currently produces no lithium.

It's been reported that Chinese battery manufacturers expect to buy their lithium from Chinese-owned firms. And they'll want to get in on the ground floor of exploration companies with promising projects that can produce at the scale they need to supply their automaker customers. The same thing can be said of battery companies from other countries, including North America, but non-Chinese battery-cos have a lot of catching up to do.

end product manufacturers positioning themselves in securing mineral resources through capital investments." Battery

metals industry dependent on 'flavour of the month,' miningweekly.com

CONCLUSION

Carbon emissions from burning fossil fuels keep climbing.

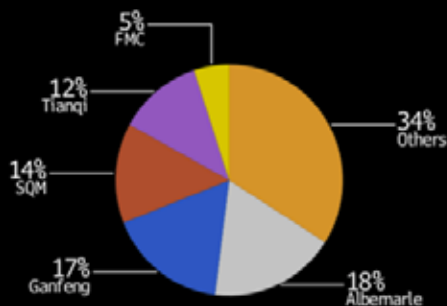
Governments around the world are looking at ways to reduce carbon emissions. Two ways we can reduce CO2 emissions are to stop burning fossil fuels to power our energy grid and by adopting electric vehicles for the transportation of people and goods.

The real story behind all electric vehicles is that they are totally emission free. Electric vehicles are going to become very popular.

Lithium Chile is uniquely positioned in the battery-metal supply chain to be exactly in the right place at the right time. The company has a highly prospective land package in the Salar de Atacama - surrounded by experienced producers SQM and Albemarle - making it an excellent candidate for a battery-maker looking to ink a supply deal with a reliable producer in the lowest-cost lithium mining jurisdiction in the world. With electric vehicle demand expected to remain robust, and supply limited due to the difficulties in processing lithium and the high costs of hard-rock lithium mining, prices should keep rising. This is good news for prospective lithium miners like Lithium Chile who are not only likely to receive a good price for their product, but have a captive market in EV suppliers who

Primed for Deals

The lithium sector is forecast to see more M&A as major players hunt for acquisitions



Data shows forecast share of 2018 lithium compounds capacity
Source: Ganfeng Lithium Co. filing, CRU estimates

Bloomberg

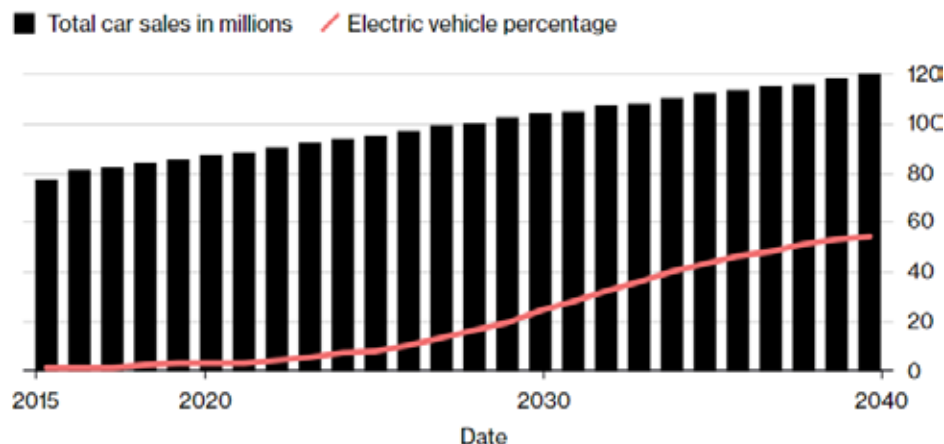
Heating Up

Lithium sector M&A is forecast to rise as key player hunt for growth



No Killing the Electric Car

Electric vehicles forecast to make up half of annual global car sales by 2040



Source: Bloomberg New Energy Finance

Note: Figures starting from 2017 are forecasts

are eager to lock up long-term contracts. Move over gas-guzzling cars, the EV era is here, and Lithium Chile is poised to play an important part in supplying the metal which has been called “the new gasoline.”

For all of these reasons, I’ve got LITH on my radar screen.

Just read, or participate in if you wish, our free Investors forums.

Ahead of the Herd is now on Twitter.

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WANNA BUY A COPPER MINE? ASK A JUNIOR

As a general rule, the most successful man in life is the man who has the best information

By Richard (Rick) Mills

Copper is one of the most abundant metals among the world's mined commodities, but getting your hands on a new copper mine is getting tougher and tougher. Despite

the major miners wanting to add new supply to their pipelines, nobody wants to sell, and that is putting a renewed focus on high-quality development projects like the Ootsa project being explored by Surge Copper (TSX.V:SURG).

an offer from Rio for their holdings in the giant Collahuasi deposit in Chile, according to people familiar with those talks, who asked not to be identified.

When it comes to listed companies, there aren't that many options — U.S.-based Freeport-McMoRan Inc. and Canada's First Quantum Minerals Ltd. are among the only copper-focused producers of any real size.

Bloomberg explains the dilemma being faced by potential acquirers:

So what's the problem? For a start, nobody who owns a copper mine wants to give it up. Even when Glencore and Anglo American Plc were crippled by debt during the 2015 commodity slump, neither was willing to entertain

They also know about the coming copper crunch. Mine supply has failed to come to fruition due to regular labor disruptions at the world's major copper mines like Grasberg in Indonesia and Escondida in Chile. KPMG is predicting that by 2020 global copper demand will outstrip mine output.

Lower ore grades are also expected to be painted into the waning supply picture. Copper grades have declined about

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25% in top producer Chile in the last decade - highlighting the urgent need for grassroots exploration to arrest the trend. Producing copper mines are feeling the pinch, having noticed a significant decline in resources.

London-based commodities analyst CRU says unless new investments arise, existing mine production will drop from 20 million tonnes to below 12 million tonnes by 2034, leading to a supply shortfall of more than 15 million tonnes. That's because over 200 copper mines are expected to run out of ore before 2035, with not enough new mines in the pipeline to take their place.

That brings us back to buyers and sellers. As Bloomberg's chart below indicates, big copper deals have all but ground to a halt.

Compared to 2012 and 2014, when around \$8 billion in copper mining M&A occurred, 2018 so far is under \$1 billion - despite Anglo American agreeing in June to a \$600 million investment by Mitsubishi for a 40% stake in its Quellaveco copper project in Peru. Even a hostile takeover attempt this week by Lundin Mining for Nevsun Resources, with a mine in Eritrea and Serbia, may not do the trick. Nevsun is saying the \$1.4 billion cash offer undervalues the company, even though it's at an 82% premium to Nevsun's closing price on Feb. 6, when Lundin first indicated an interest in the Timok copper-gold project in Serbia. Nevsun is reportedly looking for \$5 a share.

And despite the copper price taking a hit recently due to uncertainty over trade disputes, the red metal is still a popular item for thieves. Specialized gangs in Chile are regularly stealing copper cathodes and concentrate from trains running through the Atacama Desert in Chile, with about 40 incidents reported so far this year compared to just six in 2014. The "moles" as they called, are getting more brazen:

A new method is known as "the anchor." When trains slow down in steeper areas, gangs hook a mooring line to a pile of cathodes and throw an anchor onto the railway lines. As the train advances, the pile weighing about 350 kilos (772 pounds) is dragged off the wagon and quickly picked up by trucks.

If big, existing copper miners aren't selling

their properties - in whole or stakes - that leaves the smaller development companies to pick up the slack.

"Any company with half a balance sheet is not going to be selling a copper asset at this point," Bloomberg quotes Richard Knights, an analyst at Liberum Capital Markets. "The only place they can extract value is development assets, where they buy and develop themselves."

Where should they be looking? How about northwestern British Columbia. With excellent geology, a storied mining history, and a perfect storm of factors (new deposits, new infrastructure, declining snow cover, new geological theory, higher gold price, 2017 successes this mineral rich area is one of the safest bets for a copper play.

Surge Copper's Ootsa property is an advanced stage copper-gold exploration project containing the East Seel, West Seel and Ox porphyry deposits. It is located adjacent to the Huckleberry open-pit copper mine previously operated by Imperial Metals. Surge Copper completed a PEA in 2016 showing the potential for a 12-year mine that would produce 324 million pounds of copper, 185,000 ounces of gold, 15.8 million pounds molybdenum and 3 million ounces of silver. A resource estimate done the same year shows 1.1 billion pounds of copper and over a million ounces of gold, in the measured and indicated categories.

What is special about Surge Copper is that the company has three scenarios that could play out for it. On June 26 Surge announced the start of its 2018 exploration program with the construction of drill pads, with drilling starting the first week of July.

The proximity of Surge Copper to the currently-shuttered Huckleberry Mine means it is an ideal takeover target for Imperial Metals should Imperial need more mineralization to feed its aging, currently shuttered mine, which is estimated to only have about five more years of minelife. However, Surge also has enough potential reserves for a stand-alone operation, which could either interest an investor wanting to partner with it if Surge Copper goes mining, or a major who buys the company outright. All three scenarios

are good for Surge investors, who are bound to see a dramatic share price rise if any of these possibilities takes place.

A lack of sellers in the copper market right now bodes well for junior copper explorers like Surge, whose Ootsa property could turn into the next big copper mine that would be of interest to a potential acquirer. That's why I have SURG on my radar screen and own shares.

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Richard owns shares of Surge Copper (TSX.V:SURG).



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