Battery Metals Report 2022

Everything you need to know about the battery metals lithium, nickel, cobalt and copper!

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Table of Contents

Disclaimer 02

Table of Contents I Imprint 07

Preface 09

The battery metals are running hot! – Lithium and nickel have already exploded, cobalt and copper will follow! 10

Interview with Tobias Tretter
Managing Partner of Commodity Capital AG 27

Company Profiles

Alpha Lithium 29

Canada Nickel 33

Cypress Development 38

Hannan Metals 42

IonEnergy 46

Kutcho Copper 50

Surge Copper 54

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Preface

Dear Readers,

We hereby present the latest edition of our Battery Metals Report.
Our special report series started in the fall of 2016 with lithium, as we see this metal, along with cobalt, nickel and copper, as one of the great energy metals of the future and as a great opportunity with a lot of potential. E-mobility is on the rise and the prices for lithium and nickel have already skyrocketed. Lithium in particular is showing signs of an enormous supply deficit, as was recently outlined by Rio Tinto in an impressive presentation. The company estimates that current supply and promised production expansions can meet only 15% of demand growth through 2050. 85% will have to be met from other sources, i.e., new mines. It also fits into the picture that two of our former report stocks (Millennial Lithium and NeoLithium) were recently acquired for a lot of money.
In the case of nickel, there was a short squeeze in March 2022, which was quite a surprise and shook the foundations of the LME. But this, too, is likely to be just the beginning of an unstoppable upward spiral in battery metal prices.
This is because the electric car has become established and has won a place among consumers, partly because politicians have recognized that a world that is as CO_2-free as possible will only be possible with electric mobility.
Lithium, nickel and cobalt are the main components of all batteries and accumulators available in large series and thus the main link in the electric vehicle dream. The movements in Germany are interesting, where not only Tesla was able to open a factory (Gigafactory) only recently, but in the meantime several well-known battery manufacturers have pitched their tents.
All these factories will be enormous drivers of demand for lithium, cobalt and nickel, but also for copper. Millions of tons of copper will be needed in the future not only for cars, but especially for the charging infrastructure. 2020 was clearly the start of a decade for raw materials, as they are – and will remain – the basis of everything we do economically.

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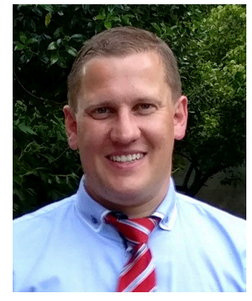
My team and I hope you enjoy reading the Battery Metals Special Report and we hope to provide you with lots of new information, impressions and ideas.

Yours, Jochen Staiger

Jochen Staiger is founder and CEO of Swiss Resource Capital AG, located in Herisau, Switzerland. As chief-editor and founder of the first two resource IP-TV-channels Commodity-TV and its German counterpart Rohstoff-TV, he reports about companies, experts, fund managers and various themes around the international mining business and the correspondent metals.



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The battery metals are running hot! –
Lithium and nickel have already exploded, cobalt and copper will follow!

Electromobility is still in its infancy, but is starting to move faster and faster

Almost 20 years after Tesla, the first commercial e-car manufacturer, was founded, electric mobility is still basically in its infancy. That‘s because many automakers initially derided Tesla and only belatedly realized that the electromobility revolution was closer than they thought. Increasing movements toward an ever more carbon-free world also played into the electric enthusiasts‘ hands. In the face of an increasing number of extreme weather phenomena and a growing climate protection protest movement, more and more governments around the world felt compelled to set CO_2 targets and further reduce emissions of the climate-damaging gas from year to year. This left the global automotive companies with no choice but to finally tackle the electrification of their vehicle fleets. Today, well over 300 electric car models are already on the market worldwide. And even though the number of new electric vehicles registered each year in 2015 was still just 450,000 worldwide, rising to over 2.5 million vehicles by 2021, that‘s nothing compared to the number of units that are expected to be registered each year in the coming years. According to estimates by experts at Bloomberg, there will be 8.5 million in 2025, 26 million in 2030 and 54 million per year in 2040. At the beginning of 2022, there were around 12 million electric vehicles driving around on the world‘s roads, and the latest estimates put the figure at over 130 million by 2030. Electromobility is still in its infancy, but it is now starting to pick up speed.

It will be exciting to see where the materials needed for the batteries will come from

However, one aspect of the upcoming electro revolution is still largely unresolved: the procurement of materials for the corresponding mobile batteries. This is because large quantities of metals are needed for them that have so far found little or much less use in conventional vehicles with internal combustion engines. These include primarily the battery metals lithium, nickel, manganese and cobalt, as well as copper and graphite. Even now, when quantities are still at a rather low level, there is a threat of glaring supply bottlenecks, which have already caused prices for most of these materials and metals to skyrocket. Especially in the case of lithium and nickel, the mining industry is miles away from being able to satisfy the coming demand volumes. It is not for nothing that Tesla CEO Elon Musk literally begged corresponding mining companies in 2020 to develop new nickel mines. For investors, therefore, there is an excellent entry opportunity into the world of battery metals right now, as we will explain in detail below.

Basic information about the lithium-ion battery

The lithium-ion battery is the heart of every electric vehicle

In addition to the engine, the heart of every electric vehicle is the energy storage unit, i.e., a rechargeable battery. In order to be operated economically in the long term, electric vehicles, but also increasingly emerging decentralized storage systems – such as for photovoltaic or wind power plants – require ever more powerful rechargeable batteries. The lithium-ion battery has emerged as the most efficient, mass-market type of energy storage currently available for vehicles. One of the reasons for this is that within a lithium-ion battery, the voltage is achieved by exchanging lithium ions. Because of their high energy density, lithium-ion batteries deliver constant power over the entire discharge period and do not exhibit any so-called memory effect, i.e., successive loss of capacity over many years of use or frequent partial discharge. The name „lithium-ion battery“ is only the generic term for a whole range of possible chemical structures, such as the lithium-cobalt (dioxide) battery, the lithium-manganese (dioxide) battery, the lithium-iron phosphate battery and – less commonly – the lithium-titanate battery and the tin-sulfur lithium-ion battery. The most common battery is currently the lithium-nickel-manganese-cobalt (abbreviated NMC) battery.

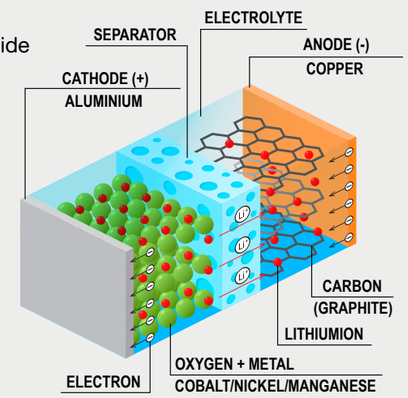
Cobalt is increasingly being replaced by nickel

Although the basic principle of the lithium-ion battery has not changed much over the past few years, development is continuing steadily. The main focus is on efficiency and charging capacity (in the case of electric vehicles, this is often referred to as range), but also on the use of metals and elements. In this respect, a transformation is currently taking place away from high proportions of cobalt (NMC 111, where the numbers indicate the ratio of nickel, manganese and cobalt) to a higher proportion of nickel (NMC 811), although development is currently still at the corresponding intermediate stages (NMC 622 / NMC 532). NMC 111 is considered the simplest battery version, based on an equal amount of the atoms of the three elements, NMC 532/622 have a higher energy density and a lower price than NMC 111 due to a lower cobalt content, and NMC 811 is the newest and most advanced battery version with the highest theoretical lithium and cobalt performance. It is precisely because of this trend toward higher nickel content that Tesla CEO Elon Musk implored relevant mining companies to develop new nickel mines in 2020.

Structure and function of a lithium-ion battery

Essentially a lithium-ion accumulator consists of the following components and materials:

- **Positive electrode (cathode):**
  Lithium-Cobalt(III)-oxide
  Lithium-Nickel-Manganese-Cobalt-Oxide
  Oxygen
  Aluminum as conductor material
- **Negative electrode (anode):**
  Graphite or related carbon materials
  Silicon
  Tin dioxide
  Copper as conductor material
- **Electrolyte (solution)**
- **Polymer membrane separator**



How a lithium-ion battery works

In simple terms, a lithium-ion battery generates an electromotive force through the displacement of lithium ions. During the charging process, positively charged lithium ions move through an electrolyte and the separator from the positive to the negative electrode. In the process, lithium ions can move freely within the battery through the electrolyte between the two electrodes. Unlike the lithium ions, the transition metal and graphite structures of the electrodes are stationary and protected from direct contact by a separator. The mobility of the lithium ions is necessary to balance the external current flow during charging and discharging so that the electrodes themselves remain (largely) electrically neutral. The negative electrode is a so-called graphite intercalation compound, with lithium present as a cation. During discharging, the intercalation compound emits electrons that flow back to the positive electrode via the external circuit. At the same time, an equal number of Li+ ions from the intercalation compound also migrate through the electrolyte to the positive electrode. At the positive electrode, it is not the lithium ions that accept the electrons from the external circuit, but the structures of the transition metal compounds present there. Depending on the type of accumulator, these are cobalt, nickel, manganese or iron ions, which change their charge.

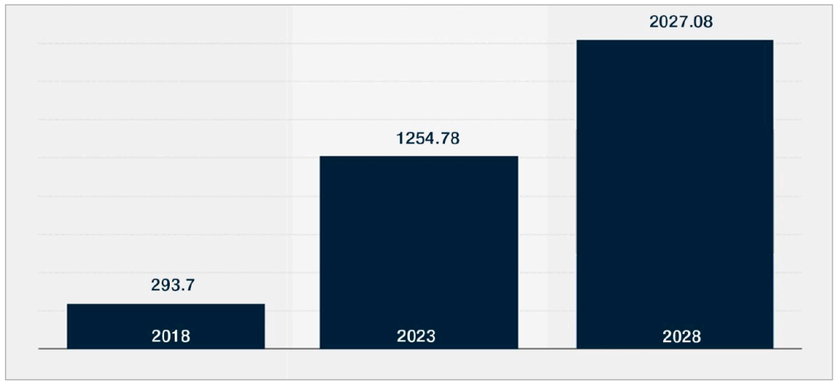
Basic information about the battery sector

Gigafactories: From individual plants to an absolute boom

About 36 months ago, only very limited larger manufacturing facilities for rechargeable batteries (so-called „gigafactories“) were already online. Since the beginning of the new decade, however, this has changed abruptly. China in particular has shone with ever new production facilities and capacity expansions. Currently, about 160 of the world‘s 215 gigafactories are in the pipeline in China, while Europe has about 40 and North America only about 15 gigafactories in the pipeline. Globally, about 140 gigafactories are already in operation, of which only about 10 are currently producing in the EU (recently, Tesla‘s gigafactory (pure vehicle manufacturing) in Brandenburg, Germany, was officially commissioned and is already delivering its first vehicles). Global lithium-ion cell production capacity is expected to reach 1,250 GWh by the end of 2023 – a fourfold increase compared to 2018, with an additional expansion of production capacity to around 2,000 GWh expected in 2028. (see graphic on right side).

Asia is clearly ahead in battery production

Today, China alone provides a large share of the total demand for lithium-ion batteries. China is expected to continue to see the strongest annual increase in battery metal demand of any major market player over the next 5 to 10 years, largely due to an expected multiplication in the number of units of rechargeable batteries. Other major suppliers of lithium-ion batteries, including South Korea and Japan, are also expected to guarantee robust increases in lithium and cobalt demand. Foremost among these are electronics giants Panasonic, Samsung, LG Chem, BYD, Boston Power, Lishen, CATL, Dynavolt and Great Wall.



Expected global production capacity of lithium-ion cells in GWh (Source: own representation)

The EU is catching up

The EU, which seemed to sleep through the development of battery production for years, has been able to catch up powerfully with China thanks to many governmental and also private support programs and not least thanks to its strong industrial base.

Tesla‘s Gigafactory near Berlin and Northvolt‘s Gigafactory in Skellefteå in northern Sweden are just a taste of what is to come in the next 10 years. By 2030 alone, more than 40 corresponding production sites for batteries and/or cathode materials are planned. Currently, the planned battery capacity is at least 600 GWh by 2030.

North America dominated by Tesla

In North America, Tesla holds the dominant position in lithium-ion battery production. The company has been operating the so-called „Gigafactory 1“ in Nevada since 2016. Lithium-ion batteries, battery packs, electric motors and drive units for up to 500,000 electric vehicles per year are built there. „Gigafactory 5“ was opened in Austin/Texas in April 2022 and is by far the largest gigafactory in North America.

However, Tesla is far from the only lithium and cobalt consumer planning a larger production of lithium-ion batteries. LG Chem already started production for Chevy in Michigan in October 2015 and is currently working with General Motors on a larger battery production. Foxconn, BYD (the world‘s largest producer of rechargeable batteries, especially for cell phones), Lishen, CATL and Boston Power are also working on the construction of their own gigafactories, including for so-called power banks, i.e., decentralized power storage systems, which are likely to become increasingly important in the future.

The most important battery metals are lithium, nickel and cobalt – copper provides the component linkage

In addition to the already mentioned raw materials lithium, cobalt, nickel and manganese, a lithium-ion battery essentially also consists of aluminum, graphite, zinc, tin and steel. The majority of (lithium-ion) batteries currently on the market are lithium-cobalt (dioxide) batteries, which is why this report deals primarily with the battery metals lithium, nickel and cobalt. We will also take a look at copper, which is becoming increasingly important.

Lithium

The element lithium

Lithium is a light metal from the group of alkali metals. It has the lowest density of all known solid elements. It is only about half as heavy as water, naturally silvery white and relatively soft. Lithium is highly reactive, which is why it basically always occurs as a lithium compound in the wild. It tarnishes rapidly in air, due to the formation of lithium oxide and lithium nitride. In pure oxygen, it burns with a bright red flame at 180°C to form lithium oxide. Lithium reacts very strongly with water to form lithium hydroxide.

Lithium extraction is either lengthy or expensive

Global lithium production is divided into several different variants, producing the following types of lithium compounds:

1. Lithium carbonate,
2. Lithium hydroxide,
3. Lithium chloride,
4. Butyllithium and
5. Lithium metal.

Metallic lithium is usually produced from lithium carbonate in a multi-stage process and is usually traded with a purity of 99.5%. This metallic lithium is used as a catalyst in the chemical and pharmaceutical industries as well as for the production of aluminum-lithium alloys.
The industry essentially distinguishes between three types or qualities of lithium compounds:

1. „Industrial Grade“, with purity over 96%, mainly for glass, casting powder and lubricant,
2. „Technical Grade“, with a purity of about 99.5%, mainly for ceramics, lubricants and batteries, and
3. „Battery Grade“, with purity above 99.5%, mainly for high-end cathode materials in batteries and rechargeable batteries.

There are two types of lithium deposits

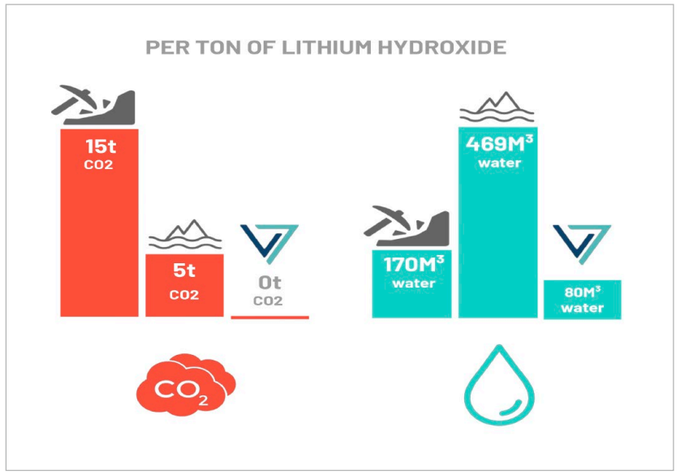
Lithium is generally obtained from two different sources:

1. So-called „brine“, i.e. (salt) sheet or brine deposits: Mainly in salt lakes, lithium carbonate is extracted from lithium-containing salt solutions by evaporation of the water and addition of sodium carbonate. To extract metallic lithium, the lithium carbonate is first reacted with hydrochloric acid. This produces carbon dioxide, which escapes as a gas, and dissolved lithium chloride. This solution is concentrated in a vacuum evaporator until the chloride crystallizes out.
2. So-called „hard rock spodumene“, i.e., hard rock pegmatite deposits: Here, lithium compounds are not extracted from the salt of lakes, but from spodumene, a lithium-bearing aluminum silicate mineral. Mined by conventional mining technology, the concentrate obtained is often converted to lithium carbonate with a purity of more than 99.5%. The intensive thermal and hydrometallurgical process required for this is considered to be very costly. Such deposits are currently exploited almost exclusively in Australia, with most of the further processing taking place in Chinese facilities.

Water consumption or CO_2 emissions: What weighs heavier?

The two sources (brine deposits/hard rock deposits) each have opposite advantages and disadvantages with regard to the extraction of lithium. While the extraction of one ton of lithium hydroxide from brine deposits requires about 469 cubic meters of water, one ton of lithium hydroxide from hard rock deposits requires only about 170 cubic meters of water. The opposite is true for the CO_2 balance. While the extraction of one ton of lithium hydroxide from brine deposits produces only about 5 tons of CO_2, one ton of lithium hydroxide from hard rock deposits produces about 15 tons.

The question is: What weighs more with the battery and car manufacturers? And CO_2 neutrality seems to have the edge here. By the way, currently about 60% of all lithium hydroxide mined worldwide is extracted from hard rock deposits and only 40% from brine deposits.



(Source: Vulcan Energy)

New processing methods and lithium sources improve CO_2 and water balance

Recently, more and more exploration and development companies are focusing on new technologies that will help to extract lithium from brine deposits within days and even hours instead of using natural evaporation. The processes of Tenova Bateman and IBC Advanced Technologies are worth mentioning in this context.
In addition, several lithium development companies have identified a third lithium source. There is the possibility to extract lithium from old, exploited oil reservoirs. The lithium is extracted from the wastewater remaining in the reservoirs. It has already been proven several times that this process works. In addition, this unusual lithium extraction process also appears to be economically feasible. Thus, brine-bearing (former) oil fields are also becoming a focus of the lithium industry.

Larger lithium deposits exist only in a few regions

Lithium accounts for about 0.006% of the Earth‘s crust, making it slightly less abundant than zinc, copper, and tungsten, and slightly more abundant than cobalt, tin, and lead. Estimates from the U.S. Geological Survey (USGS) in 2021 suggest that about 22 million metric tons of lithium are recoverable as reserves and 89 million tons are recoverable as resources worldwide. About 51.8% of the reserves are located in the South American countries of Chile and Argentina alone, and 25.9% in Australia. The largest lithium carbonate production currently takes place in the Salar de Atacama, a salt lake in the northern Chilean province of Antofagasta. However, about 50% of global lithium production of about 105,000 metric tons in 2021 came from Australia, but at a much higher cost than in South America. In addition, significant lithium deposits are found mainly in North America and China.

Lithium production is currently concentrated in a few countries and companies

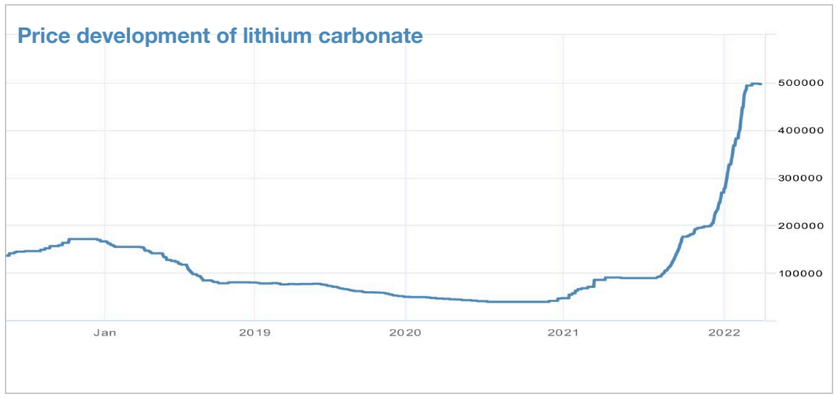
Australia, Chile, China and Argentina currently account for about 95 percent of the world‘s lithium production, which is shared among only a few companies. As a result of this supply oligopoly, lithium is currently not traded on the stock exchange, and the actual trading prices are kept strictly confidential. One reason for this, which the few suppliers always like to give, is that the available and required lithium qualities are too different for a standardized exchange trading place.

Main applications have been alloys and lubricants and will be batteries in the future

Its above-mentioned special and versatile characteristics make lithium a sought-after material in very many different areas of application. It should therefore come as no surprise that the main area of application for lithium has changed constantly in the past. Initially used mainly in medicine, the element began its triumphant advance in the 1950s as a component of alloys. Its low weight, but also its positive characteristics in terms of tensile strength, hardness and elasticity, made it an integral part of aerospace technology in particular. In the past 20 years, this picture has changed once again. As the electric revolution got underway, it was quickly recognized that its low normal potential made it almost perfect for use as an anode in batteries. Lithium batteries are characterized by a very high energy density and can generate particularly high voltages. However, lithium batteries are not rechargeable. Lithium-ion batteries, on the other hand, have this characteristic, with lithium metal oxides such as lithium cobalt oxide connected as the cathode. However, as a raw material for the production of accumulators and batteries, purity levels higher than 99.5% are required. Lithium hydroxide in the „Industrial“ grade is used, among other things, as a raw material for lubricants and coolants; with the higher „Technical“ grade, it is also used in accumulator and battery production. Lithium carbonate – crystalline, granulated or in powder form – is used, for example, in the electrolytic production of aluminum, in the ceramics and pharmaceutical industries, and in alloying technology. Special purity grades of lithium carbonate in the form of very fine powder (battery grade powder) are suitable as a raw material for the production of lithium-ion batteries. The extraction and processing of (especially high-grade) lithium is considered very costly.

The production of lithium-ion batteries requires a large amount of lithium

A large amount of lithium is required for the production and operation of lithium-ion batteries. Each smartphone contains between 5 and 7 grams of LCE (lithium carbonate equivalent; conversion factor LCE: pure lithium = 5.323:1). For a notebook or tablet, this is already 20 to 45 grams. Power tools such as cordless screwdrivers or electric saws require about 40 to 60 grams for their batteries. A 10



Lithium carbonate price in yuan/tonne
(Source: own representation)

KWh storage unit for household use requires about 23 kilograms of LCE, while batteries for electric cars need between 40 and 80 kilograms. An energy storage system with 650 MWh capacity needs about 1.5 tons of LCE.

Lithium production will (and must) increase sharply

In 2021, global lithium production was around 560,000 tons of LCE. Projections assume that this figure could be increased to a maximum of about 700,000 tons LCE with today‘s mining activity, whereby only very few efforts for concrete mine expansions or new mines have been made so far, so that lithium is practically likely to run into a huge supply deficit. In addition, recent reports about several postponed mine starts caused additional uncertainty on the supply side.

The recent price explosion of lithium is relatively insignificant for battery manufacturing!

Ultimately, it is the price alone that determines the economic extractability of the existing lithium deposits. While the price was still around US$6,000 per ton of lithium carbonate in mid-2015, it recently shot up to around US$78,700 (500,000 yuan). This is a lucrative business for the producers, as the pure extraction costs for the current projects are only around US$2,500 (Chile) to US$8,000 (China) per ton. This is similarly the case for lithium hydroxide. **Since lithium makes up a significant part of a battery in terms of volume but is only responsible for less than 10% of the costs of a battery, the lithium price is ultimately relatively insignificant for the production of lithium-ion batteries and should therefore be able to be maintained at an economic level for the lithium producers.**

Demand for lithium is increasing rapidly – high supply deficit foreseeable from 2023!

The demand for lithium appears to be almost gigantic, not only due to, but primarily because of the new boom sector of electromobility! While in the case of lithium this was still around 65,000 tons of LCE in 2000, in 2020 there was already 305,000 tons of LCE in demand per year. For 2022, experts expect LCE demand to rise to over 600,000 tons, and by 2025 to over 800,000 tons per year.

The main driving factor will be demand from the battery sector and the associated automotive industry. Assuming that a maximum of 700,000 tons of LCE per year can be extracted from existing mines and that new mines cannot be brought on stream in the short term, a supply deficit of well over 100,000 tons is indicated for 2025 alone! For 2030, the outlook is even bleaker. A bottleneck of unimagined proportions is looming here.

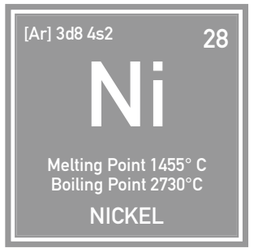
Nickel

The element nickel

Nickel is a metallic, silvery shiny transition metal. It is medium hard, malleable and easily polished. Like cobalt, nickel is ferromagnetic and also highly resistant to air, water, hydrochloric acid and alkalis at room temperature, which makes it ideal for use in lithium-ion batteries.

Extraction

Most of the nickel is extracted from nickel- and copper-bearing iron ores. A multi-layer process is used to produce copper-nickel fines, which consist of about 80% copper and nickel and about 20% sulfur. To obtain the crude nickel, the nickel must be separated from the copper. To obtain pure nickel, the crude nickel is electrolytically refined. The purity of electrolytic nickel is about 99.9%.



Occurrence and production

Nickel occurs in the earth‘s crust with a content of about 0.008%, i.e., with about twice the amount of cobalt and somewhat more frequently than lithium. Solid nickel, i.e., in elemental form, occurs only rarely. As of 2020, only about 50 occurrences of native nickel were known worldwide. The most important deposits are found in Canada, New Caledonia, Russia, Australia and Cuba.

The majority of nickel production comes from sulfide ores. In addition, lateritic nickel ores are also mined as raw materials for nickel production. Due to the exploitation of the classic sulfide deposits, mining is increasingly shifting to lateritic nickel ores, which, however, means more expensive extraction.

In 2021, around 2.7 million tons of nickel were mined worldwide. The largest producer was Indonesia with around 1,000,000 tons. However, the country imposed an export ban on nickel at the beginning of 2020, mainly to promote its own stainless-steel industry and conserve its own resources. Other major producers include the Philippines (370,000 tons), Russia (250,000 tons) and New Caledonia (190,000 tons). These countries account for around 60% of total nickel production worldwide.

Main application: steels and nickel alloys

Most of the annual nickel production (around 85%) goes into the production of stainless steels and nickel alloys. Nickel is one of the most important alloying metals, used mainly for steel refining. It makes steel corrosion resistant and increases its hardness, toughness and ductility. Steels highly alloyed with nickel are used in particularly corrosive environments. Around 20% of the nickel mined is used to produce nickel alloys such as constantan, nickel silver and monel.

Other uses

Pure nickel metal is used in finely divided form as a catalyst in the hydrogenation of unsaturated fatty acids. Due to its chemical resistance, nickel is used for apparatus in chemical laboratories and the chemical industry, such as nickel crucibles for digestions. Nickel alloys, for example for coins, are produced from nickel metal. Nickel-based superalloys are alloys specially designed for use at high temperatures and under corrosive media. They are used, for example, in aircraft turbines and gas turbines in power plants.

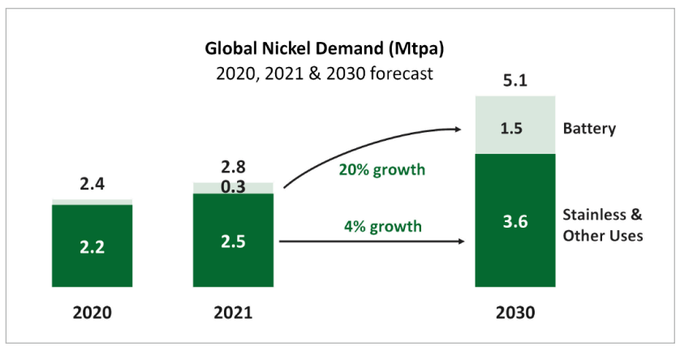
High-purity nickel is needed for rechargeable batteries

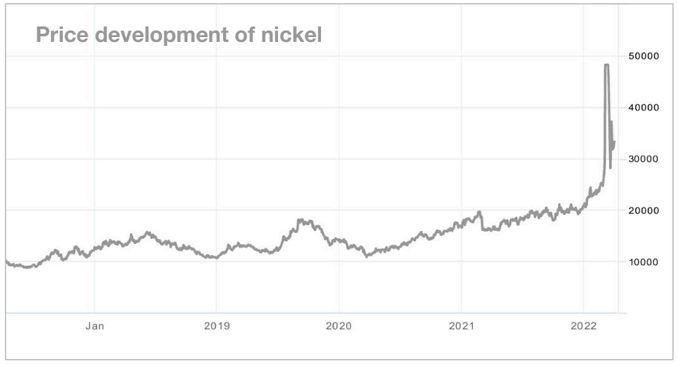
So-called class 1 nickel with a purity of at least 99.98% is required for rechargeable batteries. Only about 45% of the total nickel production of about 2.7 million tons per year is suitable for the production of class 1 nickel. Of this, more than half is required for alloys and other applications. Less valuable Class 2 nickel is used exclusively in steel production.

The move from cobalt- to nickel-dominated batteries further promotes the supply deficit

Due to the fact that the development of lithium-ion batteries is increasingly shifting from cobalt to nickel-dominant cathode materials and the required quantities will rise sharply, especially in the automotive sector, an expansion of an already existing supply deficit can be expected in the coming years. This has already been the case for the nickel market as a whole since 2016. For class 1 nickel, such a supply deficit is expected from 2023 at the latest, with a strong upward trend. For 2030, a shortage of 900,000 tons of nickel is expected. In 2040, the supply deficit is expected to widen to as much as 2 million tons per year – and this includes new nickel projects. It is estimated that demand for nickel from the automotive sector will increase more than tenfold from 130,000 tons in 2020 to 1.5 million tons in 2030.

Global nickel demand (Mtpa) for 2020, 2021 and estimate for 2030 (Source: Canada Nickel)





Nickel price development over the last 5 years (Source: own representation)

A severe supply deficit is inevitable – Nickel short squeeze – Russia sanctions may further fuel deficit

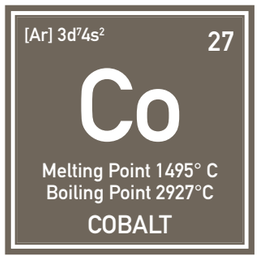
A foretaste of what may lie ahead was provided by LME inventories, which recently fell below 80,000 tons. In March 2022, one of the most spectacular short squeezes of all time took place. Nickel futures, which had already risen 66 percent the previous day, March 7, 2022, rallied vertically early in the morning. In a few minutes, it went up by US$30,000 until the price broke through the US$100,000 per tonne mark after a few minutes. Within less than 20 minutes, an entire commodity market was unhinged. The main player was the Chinese Tsingshan Group, which had built up a large short position of about 150,000 tons over months to hedge its own expected future production increase. Russia could become another uncertainty factor in the coming months and years. Should the global sanctions against the giant empire also affect Russian nickel exports, around 10% of the global production volume could no longer be available for the world market and further fuel an emerging supply deficit.

All in all, it looks as if nickel and the corresponding producers and developers will be the next big beneficiaries of the electric (mobility) boom! It is not for nothing that Elon Musk called nickel the „New Gold“ in the middle of 2020 and literally begged the corresponding mining companies to develop new nickel mines.

Cobalt

The element cobalt

Cobalt is a steel-gray, very tough heavy metal (ferromagnetic transition metal) with a density of 8.89 g/cm^3. As a typical metal, it conducts heat and electricity well, the electrical conductivity is 26 percent of that of copper. In chemical behavior it is similar to iron and nickel, resistant to air by passivation; it is dissolved only by oxidizing acids.



Cobalt extraction is relatively simple and inexpensive

Cobalt extraction is a well-known, relatively simple process. Cobalt is mainly extracted as a by-product from copper and nickel ores. First, some of the iron sulfides present are converted into iron oxide by roasting and slagged with silicon dioxide as iron silicate. The result is the so-called crude stone, which, in addition to cobalt, also contains nickel, copper and other iron as sulfide or arsenide. Further sulfur is removed by further roasting with sodium carbonate and sodium nitrate. In the process, sulfates and arsenates are formed from some of the sulfur and arsenic, which are leached out with water. The corresponding metal oxides remain, which are treated with sulfuric or hydrochloric acid. Only copper does not dissolve, while nickel, cobalt and iron go into solution. With chlorinated lime, cobalt can then be selectively precipitated as cobalt hydroxide and thus separated. This is converted to Co_3O_4 by heating and then reduced to cobalt with coke or aluminum powder.


(Source #406890434, adobestock)

The majority of global cobalt deposits lie beneath the seabed

Cobalt is a rare element with a frequency of 0.004 percent in the earth‘s crust. This puts it in thirtieth place in the list of elements ordered by frequency. Cobalt is found in many minerals, but usually occurs only in small amounts. The element is always associated with nickel, often also with copper, silver, iron or uranium.

The world‘s known cobalt resources are about 25 million tons, reserves 7.6 million tons, with the largest deposits located in the Democratic Republic of Congo, Zambia, Canada, Morocco, Cuba, Russia, Australia, Uganda and the USA. Cobalt deposits of more than 120 million tons have been identified in polymetallic nodules and crusts on the floor of the Atlantic, Indian and Pacific Oceans.

Cobalt mining mainly takes place in „problematic“ regions

The majority of the annual cobalt production of 170,000 tons comes from mines in the Democratic Republic of Congo. Around 70% of the total production volume in 2021 came from the Central African civil war country. Russia accounted for a further 4.5%, the Philippines for 2.6% and China for 1.3% at last count. All countries that are not necessarily considered to inspire confidence. The remaining production is split between Canada (2.5%), Australia (3.3%) and several other countries, some with even lower production volumes.

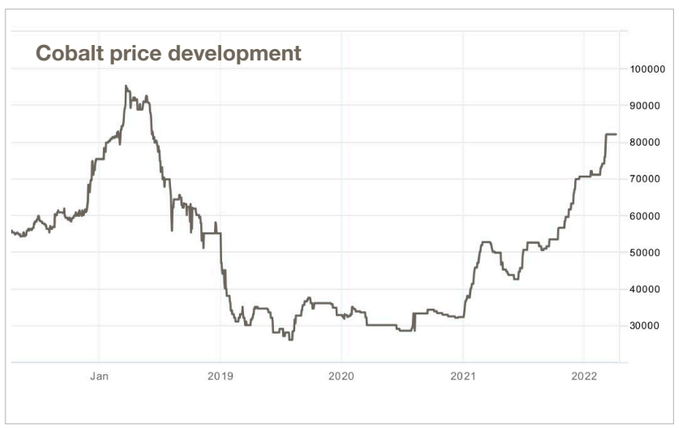
Future security of supply appears to be extremely critical based on current producers, which is why more and more attempts have been made recently to develop new mines and increase production accordingly, especially in Canada, Australia, the USA and Finland.

Main applications are paints, alloys, medicine, magnets and rechargeable batteries

Historically, cobalt has been used in the form of oxides, sulfates, hydroxides or carbonates for heat-resistant paints and pigments. Probably the best-known decorative application is blue cobalt glass. Today, cobalt is used primarily as an alloying component to increase the high-temperature strength of alloyed and high-alloy steels, especially high-speed steel and superalloys, as a binder phase in hard metals and diamond tools, as a component of magnetic alloys, as a drier for paints and coatings, as a catalyst for desulfurization and hydrogenation, as a hydroxide or lithium cobalt dioxide (LiCoO2) in batteries, in corrosion- or wear-resistant alloys, and as a trace element for medicine and agriculture. In addition, cobalt is used in the production of magnetic data media such as tape and video cassettes, where it improves magnetic properties through doping. Since the 1990s, cobalt has served as an anode material in the anode of lithium-ion batteries.

Electric vehicles in particular require a lot of cobalt

As with lithium, the quantities of cobalt used in the corresponding batteries are similar. Depending on the model, between 5 and 10 grams of cobalt are used in a single smartphone. For a notebook or tablet, the figure is 30 to 100 grams. Power tools need about 50 grams for their batteries. A 10 KWh storage unit for home use (such as Tesla's Powerwall) requires about 7 kilograms of cobalt, while the batteries for hybrid vehicles need about 4 kilograms and for purely electric cars 10 kilograms of cobalt. Tesla's Model S even comes in at 22.5 kilograms. A passenger plane gobbles up about 4,000 kilograms of cobalt.



Cobalt price development (US$/ton) over the last 5 years
(Source: own representation)

Cobalt supply must be increased

An increase in supply is urgently needed because the lithium-ion battery sector will demand ever larger quantities and therefore ever larger quantities of cobalt in the coming years – even if the further development of batteries suggests that cobalt will increasingly be replaced by nickel. Leading experts believe that it will be difficult to expand production above 180,000 tons per year with the current mines. The fact is that despite this, Congo will remain the absolute world market leader for the time being and will even expand its market share to over 75%. The two largest cobalt mines in the world, Kamoto and Kolwezi, which alone can produce about 50,000 tons of cobalt per year, have a large share in this. Outside Congo, several companies are working to expand their existing mines (including Glencore, Norilsk, Umicore, Sumitomo and Vale).

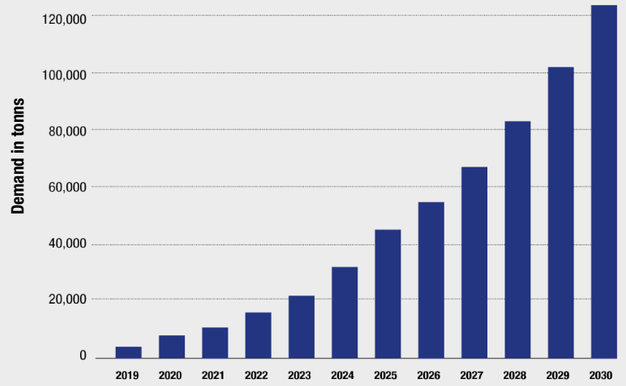
Cobalt price has increased more than tenfold

Many market participants have already recognized that cobalt production cannot be expanded quite so easily from one day to the next, which is why the cobalt price has exploded from around US$5,000 to the current US$82,000 per metric ton since mid-2016. A similar increase can be expected as soon as the leading automakers drastically expand their model range.

Cobalt will experience an immense demand surge and supply deficit in the coming years!

The demand for cobalt will almost certainly explode in the coming years! While this was still at around 60,000 tons in 2008, in 2017 it was already 125,000 tons that were demanded per year. By 2025, experts expect cobalt demand to rise to over 270,000 tons per year. The main driving factor will be demand from the battery sector. Experts estimate that demand for cobalt from the automotive sector alone will rise from 26,000 tons in 2020 to up to 130,000 tons in 2025 and 263,000 tons per year in 2030 (again for comparison: total annual global production in 2021 was 170,000 tons). Due to the current situation that demand is rising strongly, but at the same time only a few existing mines even have the possibility to ramp up their production, a huge supply deficit is therefore looming for cobalt in the coming years.

Cobalt used in electric vehicles in the European Union from 2019 to 2030.



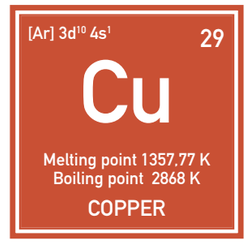
(Source: own representation)

Copper

Although copper is not a classic battery metal, nothing works without the red metal in the implementation of the electric revolution. After all, copper has the property of being the most conductive of all known metals after silver. And without reliable interconnection of the individual electrical components, a world of electromobility and electrical storage cannot function.

The element copper

Copper is a chemical element with the element symbol Cu and the atomic number 29. Like silver and gold, it is one of the transition metals that occur naturally as doped elements. The name copper comes from the Latin cuprum, which is derived from Cyprus, where the most important copper mines were located in ancient times. It is the 26th most common element in the earth's crust (share of about 0.006%) and has been mined for about 7,000 years. Copper has a reddish luster and, as a relatively soft metal, is easily malleable and ductile. It has a very high thermal and electrical conductivity.



The deposits are quite concentrated, the extraction simple

There are several thousand sites around the globe. Significant copper production, however, exists in only a few regions. By far the most recent leader in copper production was


(Quelle: D-Vu, Pixabay)

Chile, with an annual production of 5.6 million tons in 2021. It was followed by Peru (2.2 million tons), China (1.8 million tons), the Democratic Republic of the Congo (also 1.8 million tons) and the USA (1.2 million tons). Together, these five countries account for around 60% of world production of around 21 million tons per year. In smelting, China (10 million tons) is by far the leader. In addition, there is recycled copper of about 900,000 tons per year.

Copper is extracted by smelting and refining. The corresponding processes have long been perfected, and processing is correspondingly simple and relatively inexpensive. The USGS estimates that around 5.6 billion tons of copper are available worldwide as resources and 880 million tons of copper are mineable as reserves.

Main features: High thermal and electrical conductivity, soft, antibacterial, red.

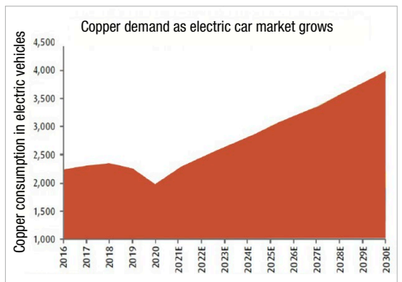
By far the most important ability of copper is its high electrical conductivity. Its conductivity is only slightly worse than that of silver and significantly better than that of gold, but copper is far less expensive than the other two metals. Since all admixtures dissolved in copper, especially impurities such as phosphorus and iron, greatly reduce its conductivity, the highest degrees of purity are often sought for conductor materials. Its softness and red color also make it interesting for the jewelry and art industries, among others in the form of alloys (brass, bronze, nickel silver, red gold). In addition, it has an antibacterial and partially antiviral effect and can render bacteria, viruses and fungi harmless within a few hours.

Main fields of application: Electrical engineering, piping, art, construction

By far the largest area of application for copper is electronics and electrical engineering as well as piping, i.e., infrastructure. It is used, among other things, for electrical lines, switching wires, power cables, overhead lines, conductors on printed circuit boards, wire windings in transformers, chokes/coils and in electric motors. Furthermore, as cable connection between electrical components like accumulators, motors and applications. Other applications include water piping, roofing, glass coatings, tableware, as well as in the arts and crafts sector for the production of printing plates for copper engravings and etchings and in the jewelry sector for alloys.

Supply deficit already exists – Drastic expansion is to be expected

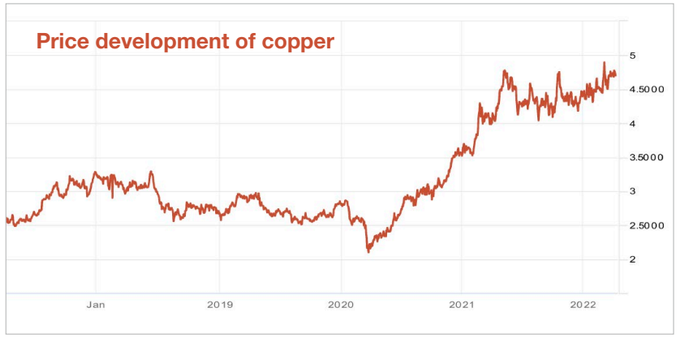
The International Copper Study Group calculated a supply deficit of around 300,000 tons for 2020. Due to the fact that in the future more and more copper will be used in electromobility (an electric car requires about 90 to 100 kilograms of copper, while a combustion vehicle often gets by with 20 kilograms), but also in the connection of regenerative power generators to the power grid (an onshore wind power plant requires about 5,4 tons of copper per megawatt, an offshore wind power plant even 15.3 tons of copper per megawatt), experts reckon that by 2035 there will be a gap of no less than 15 million tons per year, i.e. about 75% of current production. Furthermore, infrastructure and electric vehicle support programs of many governments are likely to lead to a further boom in demand for copper. Experts predict that copper demand from the automotive sector alone will increase to over 4 million tons per year by 2030.



(Source: own representation)

Mining activities can no longer meet higher demand

In addition to an expected increase in demand from the current level of around 21 million tons of copper per year to 25 million tons



Copper price development over the last 5 years
(Source: own representation)

in 2030 and 28 million tons by 2035, copper production with the current mines is expected to fall to less than 15 million tons at the same time. This is because at present it is mainly the expansion of existing mines that accounts for the bulk of new copper production, which is expected to come on stream by 2025. After that, new projects will be needed to close the growing gap expected by analysts. However, this will require significant investment. Many copper projects benefit from the production of valuable by-products such as gold, silver, cobalt and molybdenum, without which copper production would often not even be possible, i.e., profitable. Another aspect is the lack of exploration for large copper projects, which has been extremely sparse over the past ten years.

There will be a (further) copper price adjustment upwards

As a result, there is currently a shortage of high-quality development projects. As the quality of many new copper projects is far inferior to that of current mines, an increase in production, i.e. exploitation of poorer quality mines, can only be achieved by adjusting the price. Copper speculators have recently recognized that this is the case and have caused the copper price to break out to as much as US$5 per pound. In mid-2020, the copper price was still at half that level. Nevertheless, there are already signs of a further increase in the copper price, as the expected increase in demand cannot even be nearly offset by the increase in supply.

<u>Conclusion:</u> The electric revolution is still in its infancy and will lead to an explosion in demand and, in the further course, to an additional price explosion for battery metals

The demand for lithium, cobalt, nickel and, to a lesser extent, copper will be determined by three different parties in the future:

1. From the Asian electronics companies, which are mainly targeting the mass production of powerful lithium-ion batteries and accumulators for daily use, in multimedia devices, etc.
2. From the car manufacturers, and (initially) first and foremost from Tesla Motors, but also from almost all established car manufacturers worldwide.
3. From the manufacturers of decentralized energy storage systems, which are used wherever electricity is generated by means of photovoltaic or wind power plants and is to be used later by means of storage.

This constellation will cause demand for lithium, cobalt and nickel to increase many times over in the coming years in some cases, and for copper it will also increase sharply, with decentralized storage in particular generating the greatest growth in demand and likely to dwarf even the other two areas.

A look at the most important number estimates is basically enough to come to this conclusion. The number of electric vehicles will multiply in the coming years: From 1.2 million electric cars in 2017 to at least 20 million electric vehicles per year starting in 2025. From 2030, 25 million electrically powered vehicles can be expected annually, and from 2040, as many as 60 million vehicles per year. In parallel, lithium-ion battery capacity increases from 290 GWh in 2018 to 2,000 GWh in 2028! In 2020, capacity was an estimated 250 GWh, driven by expansions by upcoming giants LG Chem, Samsung SDI, CATL, Lishen, Tesla and others.

Procurement from dubious sources as well as China‘s market power in reprocessing

In the EU and thus also in Germany, lithium, cobalt and graphite belong to the so-called „red group“, i.e., materials with a very high supply risk. For the most part, they come from countries with dubious mining methods or high political risk. In addition to the actual procurement risk, issues such as poor environmental compatibility or lack of social acceptance also play a role here. Another crucial point is that China currently controls a large part of the cobalt and lithium processing. A circumstance that will either lead to more projects outside China‘s sphere of influence or to higher prices in the future. Recycling currently plays no role at all and therefore cannot be seen as a source of needed materials.

The upcoming supply deficit in all battery metals will reward especially the far advanced developers

Overall, there are signs of a supply deficit in the near future for the lithium, cobalt, nickel and copper markets, as the increase in demand is likely to (far) exceed the expansion in supply in the future. It can be assumed that the supply shortage will be brought forward from around 2025/26 to 2023. This is strongly indicated by recent reports of projects stalling, production being curtailed, and expansion plans being delayed.

As there is no end in sight to the increase in demand beyond 2025 and, moreover, there are still no significant large production projects in the pipeline, this situation is likely to continue for the foreseeable future.

The development companies in particular, which have already advanced their respective projects, should offer the greatest share price opportunities in the coming months, also with regard to a possible consolidation, i.e., through takeover scenarios.

Some of these dedicated development companies, as well as prospective producers, are presented below.

Interview with Tobias Tretter –
Managing Partner of Commodity Capital AG

Mr. Tretter, battery metals have recently gone completely crazy. Lithium and nickel in particular have seen price increases of several hundred percent. What do you think was the reason for this?

The developments of the two metals were admittedly extreme. However, they also had completely different reasons. Lithium has continued the price increase from last year unabated in 2022 and increased in price by 100% in the first two months alone. However, we do not see any euphoria or exaggeration here. There is simply not enough lithium, and we see no hope for a short-term solution to the supply shortage. The best example is that Australia, the world‘s largest producer, is only expected to bring one new project into production in 2022, which will not reach commercial production until 2023. We continue to see potential in lithium and view analyst expectations and estimates as still far too optimistic. Nickel demand is also increasing, but nowhere near as much. For LFP batteries, for example, they don‘t need nickel at all. Nickel production increased by 8% last year and there should be no short-term supply bottlenecks here. In the medium term, however, we see a supply shortage here as well. The 250% increase in the nickel price within two days was therefore also primarily based on a bad speculation by Tsingshan Holding, which was unable to close its short position and pay its margin calls. Short-term speculative errors do lead to considerable volatility, but they are usually short-lived. We only need to recall the short-term negative oil price in April 2020, which can only be dreamed of today.

In addition to special effects such as the Russia-Ukraine crisis, the expected demand forecasts will certainly play an important role. What do you expect in this respect in the coming months and years?

Since we launched our lithium fund in 2009, there was one constant. And that was that the demand forecast was seen as far too conservative every year and the build-up of new production was seen as too positive every year. Currently, we also see little reason for the forecasts to become more accurate in the coming years. In our view, demand in the coming years is still being significantly underestimated. We are currently at the beginning of a new era, and it is perfectly normal that it will take a decade or two for the industry to adjust to the increasing demand resulting from electromobility. We are primarily looking at the construction and expansion of new battery factories to estimate the future demand for lithium and the other metals. I don‘t think anyone can estimate future demand better than the battery manufacturers themselves. And here we continue to see a clear trend – an exponentially increasing expansion of capacity. The war in Ukraine or even a global recession is likely to have only a very short-term impact on the expansion of electromobility and thus the demand for lithium. Politicians worldwide have committed themselves to the expansion of electromobility and, in our opinion, will no longer leave this path. A global recession, for example, is therefore even likely to lead to an accelerated expansion of infrastructure and additional subsidies for electromobility to boost the economy and lead it out of a possible recession. The biggest problem I currently see for the demand for lithium is that there could be such a massive undersupply of lithium in the coming years that ultimately it is no longer decisive what price you have to pay for lithium, but whether and where you can get the necessary lithium at all.

Is a move away from lithium-based batteries to other storage technologies expected in the foreseeable future, and if so, what impact would this have?

The developments in lithium batteries are enormous and a wide variety of compositions are being worked on and researched. However, all batteries have one constant and that is the proportion of lithium, which changes only marginally. Ultimately, we believe the solid-state battery will prevail as the „ideal“ battery, but it will still take a few years until commercial production. Alternatives such as hydrogen or synthetic fuel will

Tobias Tretter

As Managing Partner, Tobias Tretter has led Commodity Capital AG since its foundation in 2009 and supports it with his many years of experience and expertise in the commodities sector as Portfolio Manager and Chief Investment Officer (CIO).
He is responsible for the investment advice for the Commodity Capital Global Mining Fund and establishes the basis for the long-term success of Commodity Capital AG with his analyses on mining companies.
Tobias Tretter obtained his predicate degree at the University of Bayreuth, where he wrote his diploma thesis on a practical basis on the life cycle analysis of commodity companies. This study as well as various further education such as the DITA (diploma of international technical analysis) form the theoretical background and thus the basis for his daily work.
Tobias Tretter started his career at Credit Suisse Asset Management and applied his practical experience in advising and supporting the DJE Gold und Ressourcen Fonds of the Dr. Jens Ehrhard Group. The result was the award as "best gold fund 2003" as well as a self-employment in the consulting of commodity funds. Together with the fund management of Stabilitas Fonds he again achieved the award as "best gold fund 2006".

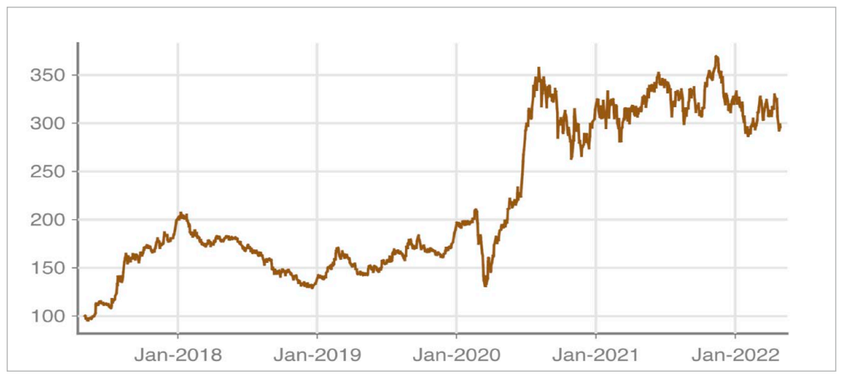
certainly find their niche, but we do not believe that the success story of electromobility can be stopped. The efficiency of a lithium battery is clearly superior to the two alternatives and is also preferred by politicians.

Although copper is not a classic battery metal, it is considered an important link between the battery and the corresponding control units. What can we expect from the red metal in the future?

Copper plays a crucial role in electromobility. Not only does an electric car require significantly more copper than a car with an internal combustion engine, but the entire charging infrastructure will need vast amounts of copper. Not to mention the consumption for wind turbines, solar cells and their connection to the power grid. Copper has historically doubled in demand every 10 years regardless of economic crises or wars, and we expect demand to at least double in the next 10 years. Knowing full well that this forecast is almost certainly too conservative. In recent years, the industry has primarily lived off existing storage capacity and, while not in the short term, we see a significant undersupply of copper over the next 5 to 10 years. Finding and developing new projects is becoming more difficult every year and it will be almost impossible to adequately replace the old mines that will be phased out in the coming years. Let alone to serve an increasing demand. For us as investors, however, it is difficult to invest in copper mines because most of the „new" projects are located in unstable regions such as Africa or South America, or the initial investment is too high for smaller or even medium-sized companies to bring into production themselves.

Many investors still see battery metals as a hot potato. What advice do you have for investors who want to get involved in this sector? What should they pay attention to?

Electromobility and therefore battery metals are still in their infancy, and it is therefore normal for investors to expect higher volatility. We have been investing in lithium stocks since 2009 and in our investments, we stick to Andre Kostolany's stock market wisdom of buying the shares, taking a sleeping pill and looking at the shares again in many years to find that they are worth much more. Of course, that's not really possible for us as fund managers, however, I think the best strategy is to pick companies with excellent management, invest early and benefit from the sector's long-term prospects. Timing short-term fluctuations correctly is almost impossible and is not in line with our investment philosophy. The primary goal is to participate in the success of e-mobility, and the best way to do this continues to be lithium stocks.



Performance of the Next Generation Resources Fund over the last 5 years in EUR (Source: commoditycapital)

Alpha Lithium
In Lithium Country with first positive results

Brad Nichol, CEO

Alpha Lithium is a Canadian mining development company specializing in the discovery and development of high-grade lithium projects. Alpha Lithium has found a project in the South American lithium triangle, an area with a large number of high-caliber lithium deposits on the border of the three countries Argentina, Chile and Bolivia. There, the company is developing two projects surrounded by several major lithium mines.

Tolillar Salar – Location and infrastructure

Alpha Lithium's flagship project is called Tolillar and is located in the Tolillar Salar salt lake of the same name. The acquisition was made in March 2020, essentially through the acquisition of a private Canadian company through the issuance of treasury shares. The project comprises 10 concessions covering a total area of 27,500 hectares. Tolillar Salar is thus located in the well-known lithium triangle of Argentina, Bolivia and Chile and within the Puna geological region in northwestern Argentina. Tolillar Salar is surrounded by multi-billion-dollar lithium assets.

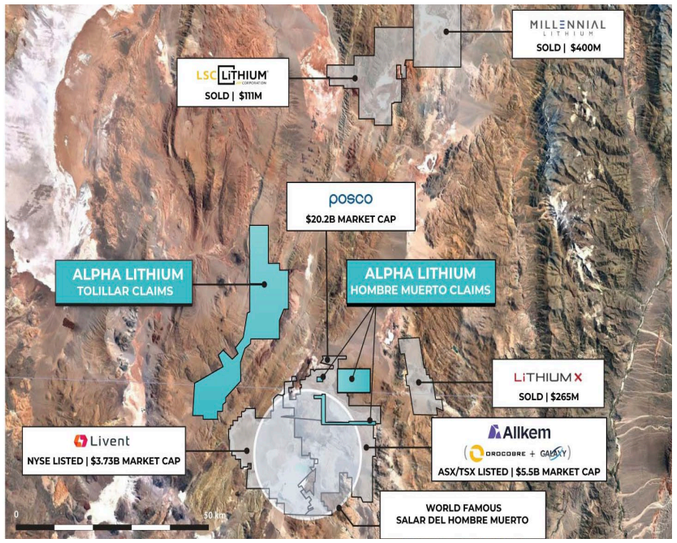
Tolillar Salar is located approximately 3 hours by car from San Antonio de los Cobres (presence of all major services including fuel and medical supplies) and 6 hours by car from the provincial capital of Salta. The project site is served by a well-maintained paved and unpaved road network, as well as a gravel and dirt road that runs within 10 kilometers of the project. The nearest rail line in the region is an existing narrow-gauge railroad between Salta, Argentina and the Pacific Coast port of Antofagasta, Chile. A 600-megawatt, 375-kilovolt power line between Salta and Mejillones, Chile runs approximately 150 kilometers north of the property. A natural gas pipeline runs less than 10 kilometers east of the project area.

Tolillar Salar – Historical Exploration Activities

Several explorations have taken place on the project site since 2012, including surface brine sampling campaigns, trench brine sampling, shallow borehole sampling, and a Vertical Electrical Sounding (VES) survey. Exploration and drill samples were collected from shallow trenches and shallow drill holes in 2018. This included pumped samples during drilling. Laboratory results from the pumping tests showed, among other things, that the subsurface brine in the northern part of the concession area also has enriched lithium concentrations. Overall, lithium concentrations of up to 504 mg/L were detected in borehole samples. The ratio of magnesium to lithium appears to be very low at Tolillar Solar, which is favorable for traditional processing. Initial results for lithium & potassium concentrations from surface samples support a very favorable production scenario, especially since solar radiation is very intense, particularly during the summer months of October through March, resulting in extremely high evaporation rates. Despite the aforementioned exploration activities, much of the concession area has never been extensively explored using modern exploration methods.

Tolillar Solar – Own exploration activities ...

In November 2020, the Company announced that a VES survey suggests that the brine body that predominates in the northern part of the salar extends far to the south and also supports the concept that the basin in the Tolillar salar is similar to the neighboring prolific Hombre Muerto salar. Similar to Hombre Muerto and other nearby lithium-rich salar basins in the region, Tertiary sedimentary rocks form the basin-bounding rocks to the west of Tolillar Salar and likely resulted in similar basin-filling conditions. The potentially favorable aquifer target identified in the VES study extends beyond the southernmost



Alpha Lithium is in the midst of an area that has seen a flurry of acquisitions in recent months.
(Source: Alpha Lithium)

extent of the surveyed area and appears to extend deeper than what the instruments could measure, yielding a thickness of at least 170 meters. In addition, the VES results showed that the brine body, which was identified as pervasive during the initial geophysical survey, extends an additional 10 square kilometers into the southern portion of Tolillar Salar. It is measured to be between 73 meters and at least 267 meters thick and extends deeper than what the VES equipment was able to measure.

... lead to first positive results

Based on these findings, Alpha Lithium initiated a three-phase drilling campaign in December 2020, the purpose of which is to collect lithium brine samples from depth and use them to begin evaluating the Direct Lithium Extraction (DLE) process that the Company intends to deploy. By November 2021, the drilling campaign was completed with a total of 6 production holes. Drilling results showed continued improvement and the most recently tested holes showed consistent lithium grades between 345 and 351 mg/L. The first three exploration wells returned lithium grades between 194 and 218 mg/L on pump tests at flow rates between 55 and 100 m^3/hour. In the last well with a lithium concentration of 351 mg/L, the flow rate reached 130 m^3/hour. A higher pumping rate was feasible but was limited by the maximum achievable capacity of the pumping equipment. In addition to the high flow rates and lithium concentrations, the Tolillar Salar also produced brine with very low impurities. For example, the magnesium to lithium ratio ranged from 4.90 to 5.37, with the average of the five wells being 5.0, a result that is in the upper quartile of salars in Argentina. Based on promising historical data in the Tolillar Salar, Alpha Lithium elected to drill all holes as production holes rather than core holes. Core drilling, while faster to drill, does not result in pumpable wells where traditional aquifer testing can be conducted to obtain hydraulic parameters. Core samples provide lithologic data that can take months to analyze, with the goal being simply to improve knowledge of reservoir properties, such as drainable porosity. Production wells are immediately ready for production, can be logged to determine effective porosity and permeability, and can be flow tested to determine brine pumpability parameters and the chemistry of the composite brine ultimately required for lithium processing.
The objective is to prepare and publish a maiden proprietary resource estimate for Tolillar Salar upon completion of the entire drilling campaign.

Entry of Uranium One – Suspended for the time being

In November 2021, Alpha Lithium announced that it had entered into an asset transaction with international billion-dollar chemical conglomerate Uranium One Group. Its wholly owned subsidiary, Uranium One Holding N.V., plans to invest US$30 million in exchange for a 15% interest in Alpha Lithium's 27,500-hectare Tolillar Salar in Argentina. Further, Uranium One would receive an option to acquire an additional 35% of Tolillar for US$185 million. This would give Alpha Lithium a 50% interest in Tolillar, which would be fully funded to the point of commercial production. Due to the events surrounding the war in Ukraine, Alpha Lithium decided to temporarily suspend the closing of this transaction in March 2022.

Hombre Muerto

As of March 2022, Alpha Lithium owns more than 5,000 hectares in Argentina's Hombre Muerto Salar, widely regarded as one of the highest-grade producing lithium brine salars in the world, comparable only to Chile's Salar de Atacama. The Company will be surrounded by key players in the Hombre Muerto Salar, which is known for its high-grade brine with record high lithium concentrations and exceptionally low impurities. It hosts Livent Corp's Fenix operation, which has been in commercial production for over 25 years. Hombre Muerto is also home to the Sal de Oro project of Korean giant POSCO, which it acquired from Galaxy Resources Limited for US$280 million. In addition, the southern part of Hombre Muerto is home to Galaxy, which recently announced an AU$4 billion merger with Orocobre Limited. A small VES survey was carried out on the property which confirmed the presence of the known underlying productive zones of the Hombre Muerto Salar.

Summary: Great investor interest is guaranteed

Alpha Lithium has immediately stepped on the gas in the Lithium Triangle and, in addition to exploration, immediately evaluated the possibility of processing. The management around CEO Brad Nichol and Country Manager David Guerrero, who knows the area very well and already has successes to show in the Hombre Muerto Salar, must be incredibly sure with the not yet determined resource base, if they immediately let production drillings be carried out. Just as confident as a dozen or so high-profile lithium investors who helped Alpha Lithium raise a whopping CA$23 million in fresh capital in February 2021 instead of the originally planned CA$10 million. In November 2021, Alpha Lithium attempted to generate another CA$13 million in fresh funds, which ultimately turned into CA$25 million. Alpha Lithium is thus sufficiently financed for the upcoming development steps. Whether the Uranium One deal will still work out is written in the stars. Should this not be the case, the next interested party should not be long in coming. The situation of the projects is too good, and the lithium sector is too hot for tactics to be worthwhile.

Exclusive interview with Brad Nichol, CEO of Alpha Lithium

What have you and your company achieved in the past 12 months?

Three major accomplishments:
1) We established a base valuation of the Tolillar Salar of US$200 million and have garnered significant, diverse interest in partnering with us or acquiring the asset outright.
2) We established a $45 million treasury, which gives us ultimate flexibility and strength, uncommon in junior exploration companies.
3) We added more than 5,000 hectares of the world's best lithium brine salar to our portfolio at a time when it was almost impossible to acquire lithium assets.

What are the most important company catalysts for the next 6 to 12 months?

We have four drilling rigs in operation in Tolillar Salar – we expect to see expansion of the salar, both vertically and horizontally, as we realize the drilling results. We are also shooting additional, detailed, high-powered, VES surveys to expand the boundaries of the salar. While it may not be exciting to those who don't

understand lithium production technologies and processes, we are very excited to be expanding our freshwater basin and production. Fresh water is extremely rare and extremely necessary for production in the high-altitude, Andes Mountain, salars. We intend to construct a 400-person camp, and build and operate a pilot plant, which will be used to evaluate several DLE, traditional and hybrid production technologies. We also intend to construct several evaporation ponds in Tolillar, which will be used to feed and evaluate the pilot plant.

Finally, we expect to commence drilling in Hombre Muerto, the world's best lithium brine salar. We have a significant foothold in Hombre Muerto and we are surrounded by giants in the lithium industry (Livent, POSCO, Galaxy/Orocobre, etc). Hombre Muerto has consistently produced brine with near, or better than, 1000 mg/L of lithium, and very low impurities. This is why Livent has been producing from a property adjacent to ours for nearly 25 years and why POSCO, also an adjacent landowner, has budgeted close to $1 billion to develop their own production facility.

How do you see the current situation on the market for battery metals?

I predict a substantive re-pricing of battery metal equities. Share prices have largely decoupled from lithium prices, for example. In the last 6 months, the price of lithium has increased over 400%; however, the share prices of a basket of lithium names has actually decreased over that same period! I do not think this is sustainable. We have seen an unprecedented frenzy to acquire lithium assets – especially in Argentina, where the operating environment is excellent (especially compared to Chile or Bolivia, for example). There has also been a general lack of capital injected into the development of lithium recovery and production facilities over the last five years and, given the increasing demand for lithium, this is not a sustainable situation. I am very long in lithium, which is probably expected, given my position.

ISIN: CA02075W1059
WKN: A2PNLY
FRA: 2P62
TSX-V: ALLI

Shares outstanding: 154.4 million
Options: 13.5 million
Warrants: 54.5 million
Fully diluted: 168.6 million

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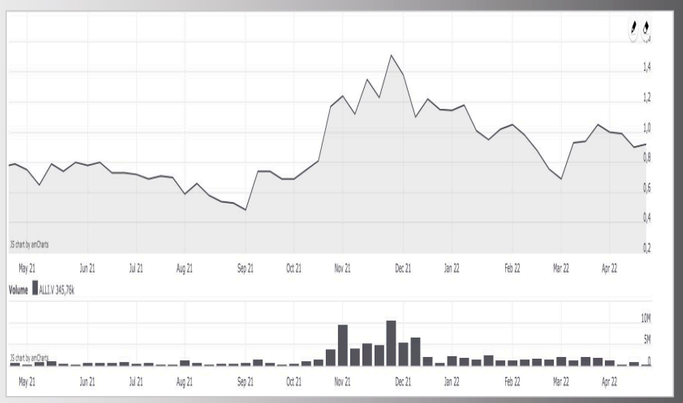
Alpha Lithium Corp



Canada Nickel

Huge nickel deposit with gigantic growth potential


Mark Selby, CEO

Canada Nickel is a Canadian mining development company specializing in the battery metal nickel. The company was listed on the stock exchange at the end of February 2020. Canada Nickel owns 100% of the Crawford nickel-cobalt sulfide project, which hosts one of the world's largest nickel deposits in an established mining camp and is adjacent to existing infrastructure north of Timmins, Ontario, Canada. A preliminary economic assessment recently showed robust numbers. The Company is working hard to establish a new nickel district and net zero CO_2 footprint. Furthermore, it was able to acquire additional project areas, which can again significantly increase the already huge resource.

Crawford Project – Location and infrastructure

Originally about 2,300 hectares in size, the Crawford nickel-cobalt core project is located about 35 kilometers north of the mining town of Timmins, within the Timmins Mining Camp of the same name, which has a history of over a century as a mining area. Highway 655 runs directly through the project site, as does a 550 kV power line. The Lower Sturgeon Falls hydroelectric power plant is just three kilometers away. Glencore's Kidd Creek mine and mill, including train service, is only about 10 kilometers away, and the Hoyle smelter/refinery is about 40 kilometers by road and 25 kilometers by rail from Kidd Creek. Timmins itself has sufficient experienced mining personnel.

Crawford Project – Resource

In October 2020, Canada Nickel released a resource estimate based on Canadian Resource Calculation Standard NI43-101. This indicated that Crawford hosts a higher-grade core resource of approximately 280.2 million tonnes of measured and indicated resources of 0.31% nickel, 0.013% cobalt and 0.040 g/t palladium + platinum within a total measured and indicated resource of approximately 653 million tonnes of 0.26% nickel and 0.013% cobalt. In addition, a higher grade inferred resource of approximately 109.9 million tonnes of 0.29% nickel and 0.013% cobalt within a total inferred resource of approximately 497 million tonnes of 0.24% nickel and 0.013% cobalt. This makes the Crawford resource one of the 10 largest nickel deposits in the world!

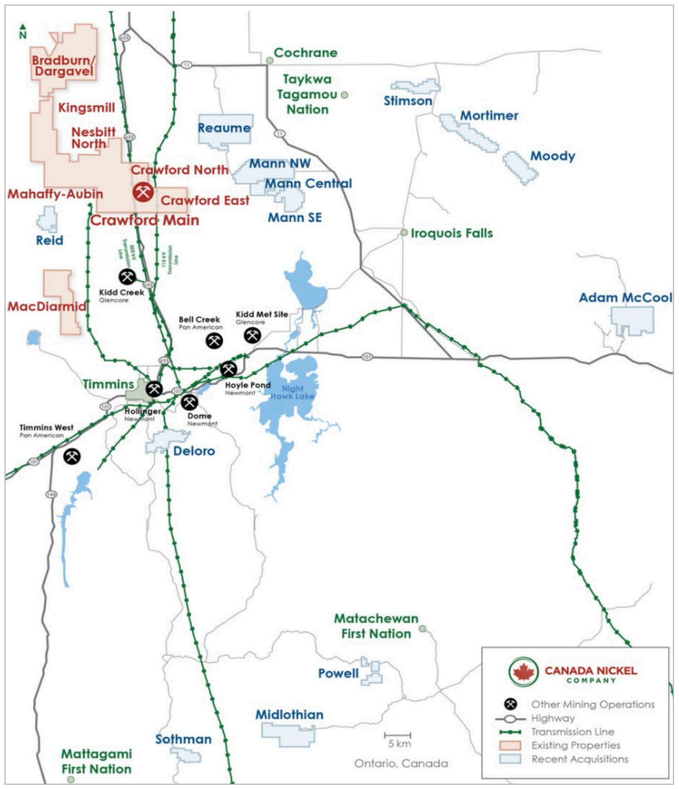
Crawford Project – Preliminary Economic Assessment

In May 2021, Canada Nickel published a preliminary economic assessment (PEA) for Crawford. This showed robust economics, supported by, among other things, an after-tax net present value (NPV) of US$1.2 billion and an after-tax economic rate of return (IRR) of 16%. Crawford could yield an annual average nickel production of 75 million pounds (34,000 tonnes) over a mine life of 25 years. It would also produce significant iron and chrome by-products of 860,000 tons per year and 59,000 tons per year, respectively. In total, production over the mine life would amount to approximately 842,000 tons of nickel, 21 million tons of iron and 1.5 million tons of chromium with a total value of US$24 billion. Net all-in sustaining costs were estimated at US$1.94 per pound of nickel, including by-products. Crawford would have annual EBITDA of US$439 million and free cash flow of US$274 million. The use of autonomous trolley trucks and electric shovels would reduce diesel consumption by 40%, contributing significantly to achieving a net zero CO_2 footprint.

With this PEA, the Company has been able to confirm the economics of Crawford, notwithstanding that they arguably have much greater potential.

Crawford Project – Exploration Potential

This is because although the Crawford resource already appears huge, only a small portion of the total strike length has been explored to date. The higher-grade core area has been defined over a length of 2.6 kilometers with a width of 150-220 meters and to a depth of about 650 meters. There is still enormous potential, especially at depth. For example, one hole was drilled to a vertical depth of 850 meters. The analyzed sample averaged 0.31% nickel, 0.013% cobalt, 0.022g/t palladium and 0.008g/t platinum over 901 meters. Continuous drilling has been conducted throughout 2020 and 2021 and has produced some spectacular results. Most recently, the highest-grade intercept of 0.71% nickel was reported over 64.5 meters.



One of the largest nickel sulphide resources located in a well-established mining camp with infrastructure (Source: Canada Nickel)

In addition, a new zone, the East Zone, was discovered in May 2020. There, 256 meters with 0.30% nickel and 0.05g/t palladium + platinum were detected, among others. In addition, a higher-grade core was also discovered there in 2021, which yielded 576 meters of 0.31% nickel, among others. In October 2020, Canada Nickel announced the discovery of a third zone called the West Zone. The company initially drilled 4 holes and found 30 meters of 0.29% nickel and 0.014% cobalt ending in mineralization. Finally, in late 2020, they were able to discover a fourth, the North Zone. This covers approximately 1,100 by 400 meters.

Metallurgical test results published in October 2021 confirmed very good nickel recoveries of 62%, iron recoveries of 45% and cobalt recoveries of 70%, values well above those from the PEA. Subsequent work showed that even low-grade nickel of less than 0.20% had significant nickel recoveries of over 60%.

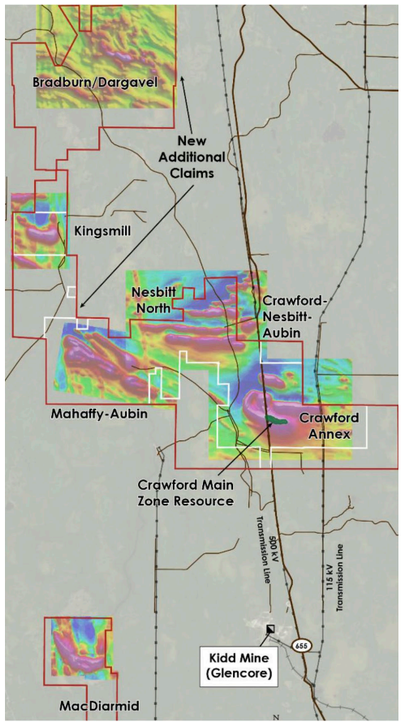
Crawford Project – Glencore deal

In January 2020, Canada Nickel announced a sensational deal with Glencore that should greatly improve the economics of the Crawford project. This allowed for the signing of a non-binding letter of intent for the potential use of Glencore‘s Kidd concentrator and metallurgical site in Timmins, Ontario, for the treatment and processing of material from Crawford. Crawford is located 40 kilometers north of Glencore‘s operations. The facility has a rated capacity of 12,500 tonnes per day and has a full water intake and discharge permit and a thickened tailings storage facility. The site has inbound and outbound rail access via the Ontario Northland Railway.

Massive expansion of the Crawford project and other bull‘s-eyes

In March 2020 and April 2021, Canada Nickel announced that it had entered into an agreement with Noble Mineral Resources to expand the Crawford Project whereby Canada Nickel acquired 100% of the previous option areas, Crawford-Nesbitt-Aubin, Nesbitt North, Aubin-Mahaffy, Kingsmill-Aubin and MacDiarmid and Bradburn-Dargravel. This was done on the basis that Canada Nickel had already identified a total of 7 nickel-bearing structures on the new concessions in mid-2020, extending over a strike length of approximately 30 kilometers with widths ranging from 150 to 600 meters. Airborne geophysical surveys were conducted in October 2020. This resulted in the identification of a 1,800 metre by 400 metre exploration target at MacDiarmid, which is 15% larger than the Crawford Main Zone. The first three holes drilled at MacDiarmid returned significant intercepts of mineralized dunite in 2021, similar to the average mineralization originally discovered by the Company at Crawford. All nine holes at Dargavel, Mahaffy, MacDiarmid and Kingsmill intersected mineralization over several hundred metres of mineralization with the best intercept from the first hole at Dargavel of 162 metres at 0.30% nickel, including 0.34% nickel over 28.5 metres.

In November 2021, Canada Nickel acquired an additional 13 exploration projects around Timmins, covering a total of 37.7 square kilometers – 40 times larger than the current Crawford Main Zone resource. Most of these new project areas are close to Crawford, with the most distant still within a 100-kilometer radius. Ten of the areas have a larger footprint than Crawford and nine are proven to contain the same base mineralization as Crawford. Sothman has a historic high-grade, near-surface resource of approximately 190,000 tonnes at 1.24% nickel over a strike length of 300 meters, with the remaining 2.2 kilometers of strike length largely untested. Drill intercepts greater than 0.3% nickel were encountered in four target areas, including at Sothman 2.31% nickel and 0.19% copper



All nine drill holes on the Dargavel, Mahaffy, MacDiarmid and Kingsmill properties (Noble properties) returned mineralized intercepts of several hundred metres in length (Source: Canada Nickel)

over 3.2 meters within 1.58% nickel and 0.12% copper over a thickness of 8.6 meters, at Deloro 0,38% nickel and 0.22g/t PGM over a core length of 15.5 metres within 0.28% nickel and 0.09g/t PGM over a core length of 299 metres, on Midlothian 0.24% nickel over a core length of 345 metres, including 0.30% nickel over 42 meters, and on Mann Southeast, several 3-meter intercepts grading 0.31-0.33% nickel within 111 meters. The first drill hole drilled on Deloro immediately returned a 480-meter intercept of dunite.

Establishment of NetZero Metals

In July 2020, a wholly owned subsidiary, NetZero Metals, was formed to begin research and development of a processing facility in the Timmins region to leverage existing technology to produce carbon-free nickel, cobalt and iron products. The Com-

pany has applied for trademarks for the terms NetZero NickelTM, NetZero CobaltTM and NetZero IronTM in the United States, Canada and other jurisdictions in connection with the carbon-free production of nickel, cobalt and iron products. Canada Nickel will explore the potential for producing nickel and cobalt products from existing pyrometallurgical processes such as roasting, sulfation and reduction using electric arc furnaces (which use natural gas as a reductant instead of coke or coal), capturing and discharging off-gases to capture CO_2 through waste rock and residues from the Crawford Nickel Cobalt Sulfide Project.

Summary:
New resource estimate and feasibility study later this year

Canada Nickel owns 100% of the Crawford nickel-cobalt sulphide project, a brand-new nickel discovery with huge potential in an established mining camp, one of the best infrastructures in Canada. Crawford continues to have significant expansion potential as only a fraction of the existing anomalies have been tested to date, as recent discoveries have clearly demonstrated. The newly acquired regional exploration targets are also exciting as they share the same geophysical signatures that led to the Crawford discovery. Given Crawford's proven track record, this provides much larger areas for full development of Crawford and additional exploration targets that could potentially host nickel-cobalt deposits similar to Crawford. In this context, it is interesting to note that MacDiarmid may have been discovered as a sort of second Crawford. Furthermore, the Glencore deal is likely to have a strong impact on the economics of the project, as this should eliminate high capital costs. A new resource estimate has been announced for the second quarter of 2022, and a feasibility study is to be published by the end of 2022. Then potential interested parties should not have to wait much longer. With a $12 million financing in mid-2021, an extended financing of CA$51.6 million in March 2022, and a CA$10 million credit facility, Canada Nickel is currently adequately funded.

Exclusive interview with Mark Selby, CEO of Canada Nickel

What have you and your company achieved in the past 12 months?

Canada Nickel has rapidly advanced its 100% owned Crawford Nickel-Sulphide Project, located in the world-class Timmins-Cochrane mining camp. The Preliminary Economic Assessment (PEA) confirmed robust economics showing an after-tax NPV8% of US$1.2 billion and an after-tax IRR of 16%, which was completed in May 2021. This also demonstrated that Crawford has the potential to be one of the five largest nickel-sulphide operations. We then immediately begun working on the feasibility study, which is expected to be completed in Q4 2022, just three years after drilling commenced.

There are a number of substantial improvements in project economics, which will be included in the feasibility study. We are targeting a significant increase in the resource by mid 2022, which will be utilized in the feasibility study. Recently announced results from successful infill drilling from the East Zone also uncovered a High-Grade Core running along the majority of the 2.1 km strike of the deposit.

A significant improvement in nickel recovery is targeted, as the PEA was completed with less than one year of metallurgy work. The initial results were recently announced and indicated a 6-16 percentage point improvement in recovery in the 4 samples that were tested with both the updated flowsheet and original feasibility study flowsheet and additional improvement in Co, Fe recovery and Fe concentrate grades. Each percentage point improvement in nickel recovery would yield a US$92 million improvement in the value of the NPV8% of the project, based on the PEA metrics.

What are the most important company catalysts for the next 6 to 12 months?

The most significant catalysts will be the completion of a Feasibility Study by the end of 2022, and a resource update, which will be utilized in the feasibility study, by mid-2022 with a substantial increase in the existing resource.
We are also advancing on a number of different fronts: quantifying the potential for the tailings and waste rock to spontaneously absorb CO_2 to allow NetZero carbon production of nickel, cobalt, and iron; advancing MOUs with the local First Nations to definitive agreements; initiating the permitting process for the project, as well as systematic district exploration

How do you see the current situation on the market for battery metals?

Nickel demand growth continues to be underestimated by most analysts – nickel demand is up 15% in 2021(3-5X other base metals) driven by a combination of demand from the EV sector growing by more than 100% and demand from stainless steel growing by more than 10%. This demand growth is leading to the largest nickel market deficit ever in 2021 – contrary to most analysts who forecast the market at the start of the year to be in a 3-5% surplus and consistent with the sour view of the emergence of a nickel super cycle by the middle of this decade.

Canada Nickel Company

ISIN: CA13515Q1037
WKN: A2P0XC
FRA: 4E0
TSX-V: CNC

Shares outstanding: 93.6 million
Options/RSUs: 8.3 million
Warrants: 0.2 million
Fully diluted: 102.1 million

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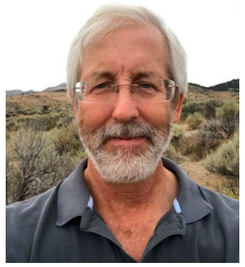
Cypress Development

Expansion of high-profile lithium project and first positive results from pilot plant



William Willoughby, CEO:

Cypress Development is a Canadian mining development company specializing in the base and battery metal lithium. The company is focused on the development of its 100% owned Clayton Valley Lithium Project in Nevada, USA. Cypress Development has already announced a high-profile discovery with a world-class resource of lithium-bearing mudstone near Albemarle‘s Silver Peak Mine, North America‘s only lithium brine operation, at its project site, which is also adjacent to several other advanced lithium projects. A 2021 enhanced pre-feasibility study certified excellent economics for the project. Currently, the company is working on optimizing the processing process with the help of its own pilot plant and has also commissioned a feasibility study. In addition, the project area has recently been extended.

Clayton Valley Lithium Project – Location, Infrastructure and Expansion

The Clayton Valley Lithium Project is located in the eponymous Clayton Valley, in the southeastern U.S. state of Nevada, adjacent to the east of Albemarle‘s Silver Peak Lithium Mine, which has been in operation since 1966. Cypress Development‘s project covers approximately 6,558 acres and is located amidst very well-developed infrastructure. Several state highways connect Silver Peak to the main road network in Nevada. Gravel roads connect Silver Peak to the southern half of Clayton Valley. Connection to the electric grid is available at the substation in Silver Peak. Water is currently supplied by Silver Peak‘s municipal water supply, with Cypress Development already in the process of securing extensive water rights. Nevada itself is considered to be the best mining region in the USA and is ranked third in the world in the prestigious Fraser Institute‘s annual Survey of Mining Countries.

In February 2022 Cypress Development announced that it had expanded the Clayton Valley Project. They were able to acquire Enertopia Corporation‘s Clayton Valley Lithium Claystone Project from their immediate neighbor. Enertopia‘s project includes 17 unpatented mining claims totaling 160 contiguous acres. A March 2020 NI 43-101-compliant technical report showed the project to have an indicated resource of 82 million tonnes at 1,121 ppm lithium and a inferred resource of 18 million tonnes hosting 1,131 ppm lithium using a cut-off grade of 400 ppm lithium. The resource was calculated using assay data from four core borings drilled on the property in 2018.

Clayton Valley Lithium Project – Exploration, Geology and Resource

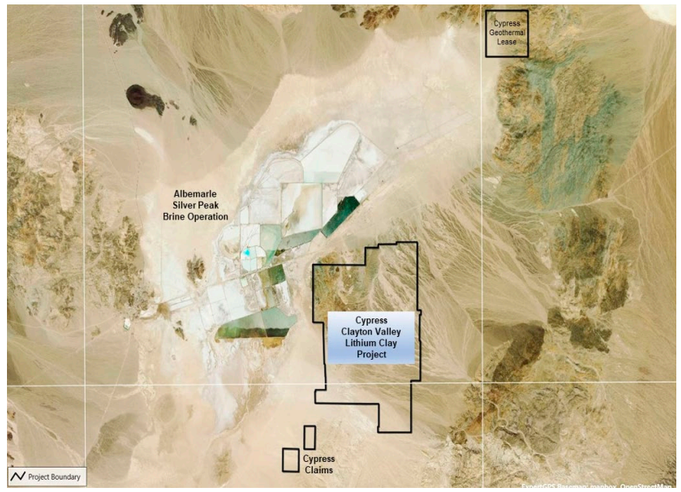
Cypress Development acquired the first project claims in 2016 and conducted extensive drilling campaigns and metallurgical testing over the next three years. Exploration and development work conducted by the Company quickly led to the discovery of a world-class resource of lithium-bearing mudstone near the brine field east and south of Angel Island, an outcrop of Paleozoic carbonates that outcrop from lake-bottom sediments. Lithium mineralization occurs within the montmorillonite clays in the sediments to a depth of at least 150 metres. Metallurgical tests have shown that low-cost processing is possible by leaching with low acid consumption and high lithium recovery of over 85% Li. These high extractions prove that the predominant lithium-bearing minerals are not hectorite, a refractory clay mineral that requires roasting and/or high acid consumption to liberate the lithium. The flat-lying deposit allows mining with a low overburden ratio. Open pit mining does not require drilling or blasting during excavation. Currently, Clayton Valley has a resource of 1,304 million tonnes of rock averaging 905 ppm lithium (6.28 million tonnes LCE – lithium carbonate equivalent) based on a cut-off grade of 400 ppm lithium. Reserves are 213 million tonnes averaging 1,129 ppm lithium (1.28 million tonnes LCE).

Clayton Valley Lithium Project – Positive PEA and Pre-Feasibility Studies

Already in 2018, a Preliminary Economic Assessment (PEA) was prepared, which certified a positive economic viability.
Cypress Development then commissioned the preparation of a pre-feasibility study, which was published in August 2020 and optimized again in a modified form by March 2021. This showed very good economics, even for a moderate base case lithium carbonate price of only US$9,500 per ton. Based on an average production rate of 15,000 tons per day, the pre-feasibility study calculated an annual production of 27,400 tons of lithium carbonate equivalent over a 40-year mine life. The estimated capital cost of this is US$493 million, with estimated pre-production and operating costs averaging US$3,387 per tonne of LCE. An after-tax NPV-8% of US$1.03 billion and an after-tax IRR of 25.8% were also determined. For a 50% higher lithium carbonate price of US$14,250, the NPV would be US$2.142 billion, and the IRR would be 41.3%.
A further bankable feasibility study is currently underway.

Clayton Valley Lithium Project – Metallurgical Studies

The lithium in the deposit is associated with illite and smectite clays and can be leached with dilute sulfuric acid, followed by filtration, solution purification, concentration and electrolysis to recover high purity lithium. Extensive metallurgical work determined optimal conditions for leaching, including time, acid concentration and temperature. Testing showed that there was little difference in sample depth, oxidation, or weathering state of the clays. Extensive leaching tests were performed on samples to obtain slurries for rheology, filtration, and lithium recovery tests. The tests gave average results of 86.5% recovery of lithium with only 126.5 kg/ton of acid consumption. Tests were conducted to identify a commercial means of solid-liquid separation, with specific conditions and equipment identified. Solids from filtration tests simulating the final cycle were generated. Solids after single-stage washing are suitable for transport via conveyor belt to a conventional dry tailings storage facility. NORAM Engineering & Constructors Ltd. and CMS designed and tested the flowsheet for recovering the lithium from solution. A very successful test program that delivered a purified, concentrated lithium solution suitable for the production of high purity lithium hydroxide (LiOH).



Cypress Clayton Valley Lithium Project, Nevada Claims Map
(Source: Cypress Development)

Clayton Valley Lithium Project – Pilot plant delivers first very good results

With the knowledge gained from the extensive metallurgical testing, Cypress Development was able to design its own pilot plant.

This utilizes an existing metallurgical facility near Beatty, Nevada. The plant could be commissioned in November 2021. This will operate at a rate of 1 ton per day and is designed to properly interact and test the major components within the extraction process and evaluate the resulting lithium products. Operation of the pilot plant will provide essential data for the planned feasibility study and will also enable Cypress to produce marketing samples to support negotiations with potential customers and strategic partners. The goal is to demonstrate lithium hydroxide production on a larger scale. Results from the various areas of the plant, from leaching and tailings handling to solution processing and recycling, chemical consumption and water balance, will provide the data necessary to advance the project to feasibility.

In December 2021, a 6-hour test of the plant provided better than expected results. Leaching yielded solution levels of 350 to 700 ppm lithium. Another series of tests, which ran continuously for 7 days, yielded over 400 samples of leach solutions and solids that were sent to a laboratory for further testing. An additional test, run continuously over 14 days in January/February 2022, showed 97% utilization of the entire plant, including leaching, filtration, and lithium extraction areas. The change in filtration equipment resulted in lower moisture content in the final product. In addition, reagent consumption was in line with the projected recovery of 83 to 85%. It was possible to produce a concentrate containing 2,700 ppm lithium.

Clayton Valley Lithium Project – Water Rights Secured

In May 2021, Cypress Development announced that it had entered into a letter of intent to acquire water rights. In early November 2021, the Nevada Division of Water Resources approved a term extension to the seller Nevada Sunrise Gold Corp for its Nevada Water Right Permit 44411, which was a key condition of the water rights purchase. The permit allows for the use of 1,770 acre/feet of water per year for mining, milling and other uses, and is an important milestone towards meeting the water supply requirements and development of the Clayton Valley Lithium Project. Finally, in December 2021, the Company successfully completed the purchase of Permit 44411 and Certificate 13631 from Intor Resources Corp, a subsidiary of Nevada Sunrise Gold Corp.

Summary: On the fast track to the feasibility study

Cypress Development has a very advanced lithium project in one of the best mining jurisdictions in the world, which has recently been further expanded. The company is already in the definitive feasibility phase. A bankable feasibility study has been commissioned. Furthermore, a pilot plant is already running, which will take further risk off the project. The project has the potential to recover other by-products besides lithium, including rare earths, primarily scandium, neodymium and dysprosium, which have been identified in solution, as well as alkali salts. However, these have not yet been included in the prefeasibility study, offering further upside potential. The important water rights have also been secured. Taken together, this is a top development that Cypress Development has to show and will still accomplish in the coming months. This is also the view of investors who provided the company with fresh capital in March 2021 (well oversubscribed CA$19.5 million financing), November 2021 (CA$6.9 million through the exercise of warrants) and February 2022 (well oversubscribed CA$18.1 million financing). Analysts at Alliance Global Partners see the fair value of Cypress stock at CA$3.75.

Exclusive interview with William Willoughby, CEO of Cypress Development

What have you and your company achieved in the past 12 months?

- Built a Pilot Plant and commenced testing
- Completed 3-, 7-, and 14-day continuous testing
- Positive interim results achieved
- Water Rights Permit Finalized
- Direct Lithium Extraction (DLE) license purchase with CHEMIONEX INC
- Expanded lease on pilot plant (Amargosa Valley)
- BOT Deal financing $18.1M
- Commenced Feasibility Study (Feb 28, 2022)
- Contracted Environmental consultants for permitting

What are the most important company catalysts for the next 6 to 12 months?

- Continue testing to support Feasibility Study and improve process flowsheet
- Complete on-site evaporation to produce high-grade lithium solution
- Feasibility Study to be completed in Q4
- Processing, tailings facility, power supply and renewable energy reviews underway
- Mine design pending close of Enertopia purchase
- Change and Extension applications on water rights with State Engineer
- Permit for metallurgical & geotechnical samples in progress off-site treatment of solution to produce final lithium product – Q2

How do you see the current situation on the market for battery metals?

Very good! Lithium is continuously trading at all time highs, and lithium development companies such as Cypress have gained support from the US federal government via grants.

ISIN: CA2327492005
WKN: A14L95
FRA: C1Z1
TSX-V: CYP

Shares outstanding: 143.2 million
Options: 6.3 million
Warrants: 21.2 million
Fully diluted: 170.7 million

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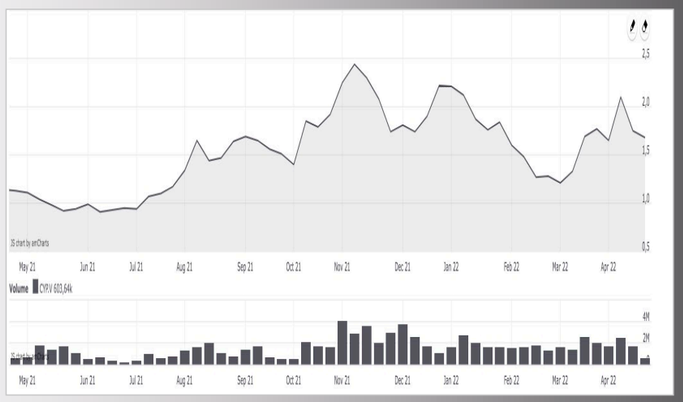
Cypress Development Corp.



Hannan Metals

Top partner and several large anomalies

Michael Robert Hudson, CEO

Hannan Metals is a Canadian mining development company focused on discovering and developing high-grade battery and precious metals projects in secure jurisdictions. In 2018, the company recognized an opportunity to diversify its base metals portfolio and staked claims for copper in Peru. There, they hold one of the 10 largest land packages of any foreign mining company, and were also able to secure JOGMEC, a real big player in the mining industry, as a joint venture partner. While JOGMEC finances the main project for years, Hannan Metals can put its own capital into the two other promising projects and has already made a find.

San Martin project – Location and infrastructure

The flagship project, which is called San Martin, covers 938 square kilometers and is located northwest of the city of Tarapoto. The concessions cover a total of 120 kilometers of the prospective host horizon. Hannan Metals has already received an exploration permit for much of the project area. Access to the project is excellent via a nearby paved highway, while elevations range from 400 to 1,600 meters in a region of high rainfall and predominantly forest cover.

San Martin Project – Geology

San Martin hosts a newly identified, high-grade copper-silver system that extends across the eastern Andes in Peru and adjacent countries. Geologically, this has striking similarities to sedimentary copper-silver deposits, including the giant copper shale deposits in Eastern Europe and the African Copper Belt deposits in sub-Saharan Africa, two of the largest copper areas on Earth. Hannan recognized the exceptional potential for large copper-silver deposits in this part of Peru and has aggressively staked out a dominant land position.

San Martin Project – JOGMEC Joint Venture

In November 2020, Hannan Metals entered into a binding option and joint venture agreement with Japan Oil, Gas and Metals National Corporation (JOGMEC), an independent administrative agency of the Japanese government. Under the agreement, JOGMEC has the option to earn up to a 75% interest in the San Martin project by spending up to US$35,000,000 to provide a feasibility study to the joint venture. This is not Hannan Metal‘s entire San Martin project, but approximately 660 of the 938 square kilometers of area.

Under the agreement, JOGMEC is granted the option to earn an initial 51% interest by funding project expenditures of $8,000,000 over a four-year period, which may be accelerated at JOGMEC‘s discretion. In addition, JOGMEC has agreed to reimburse Hannan for all project-related costs since April 1, 2020.

JOGMEC may receive an additional 16% share thereafter by either conducting a pre-feasibility study or making an additional $12,000,000 in project expenditures.

The Company will receive an additional 8% if it either conducts a feasibility study or funds an additional $15,000,000 in project expenses.

Should JOGMEC fail to complete a pre-feasibility study or spend a total of US$20,000,000, Hannan Metals has the option to buy back a 2% interest for as little as US$1.00, returning a 51% majority interest in the joint venture.

Upon completion of a feasibility study, JOGMEC has the option to receive either an additional 10% at a „fair“ value or an additional 10% in exchange for JOGMEC agreeing to fund the development of the project by providing Hannan with a loan until the San Martin project generates positive cash flow.

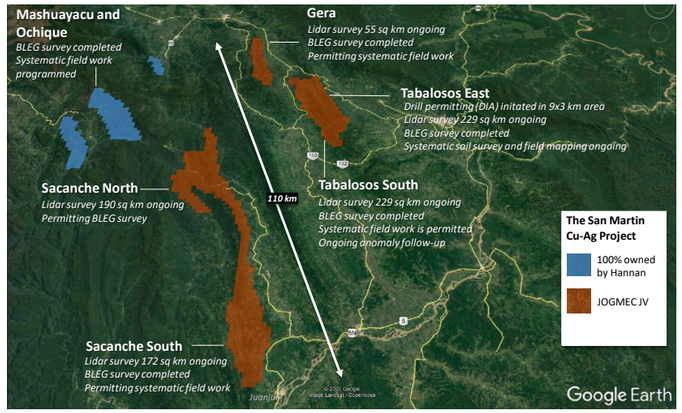
After JOGMEC has spent US$35,000,000 and before a feasibility study has been completed, both parties will fund the expenditure on a pro rata basis or dilute through an industry standard dilution formula. If either party‘s interest in the joint venture is diluted to less than 5%, that party‘s interest will automatically convert to a 2% net smelter royalty.

San Martin – JOGMEC Joint Venture: Exploration Successes

On the JOGMEC project area, Hannan Metals has already identified several potentially high-grade copper-silver zones. For example, in July 2020, they completed a 17,500 square kilometer regional remote geological survey that highlighted prospective mineralized trends over a strike length of 120 kilometers, as well as identifying several new stratiform copper-silver targets.

This led to the discovery of copper-silver mineralization over a strike length of 73 kilometers. There, trenching intercepts included 2.0 meters of 5.9% copper and 66 g/t silver, 0.6 meters of 8.7% copper and 59 g/t silver, 3.0 meters of 2.5% copper and 22 g/t silver, and 0.2 meters of 6.9% copper and 32 g/t silver. In another sub-area called Tabalosos, the combination of seismic and modern remote sensing of the surface from high resolution satellite imagery led to the discovery of 4 mineralized zones. This included trenching detecting 2.0 meters of 4.9% copper and 62 g/t silver, 1.3 meters of 3.5% copper and 86 g/t silver, 1.0 meter of 6.3% copper and 101 g/t silver, 1.8 meters of 3.7% copper and 42 g/t silver, and 2.2 meters of 2.4% copper and 29 g/t silver. During 2021, Hannan Metals was able to report further very good results from the soil geochemical sampling program on the Tabalosos East Prospect, demonstrating copper-silver mineralization over a combined length of 24 kilometers.

The Company also completed a large-scale LiDAR survey within the JOGMEC JV San Martin project in the third quarter of 2021.



Overview of ongoing exploration 2021
(Source: Hannan Metals)

Further trenching returned 2.8 meters of 3.0% copper including 1.6 meters of 5.3% copper and 83g/t silver. In the Tabalosos East area, 42 of 53 trenches averaged 1.0 metre at 2.1% copper and 29g/t silver over a systematic survey area of 8 kilometers by 1 kilometer. 3 kilometers to the south, 17 trenches averaged 1.1 meters of 2.1% copper and 29g/t silver. Samples contained up to 10.8% copper.

San Martin Hannan Copper Silver Project

The remaining 278 square kilometers of the entire San Martin Project, continues to be 100% owned by Hannan Metals and is not part of the JOGMEC Joint Venture. A boulder discovered during initial exploration grading 1.4% copper and 21 g/t silver on the Ochique property was located 20 kilometers northwest of the JOGMEC JV project. This was the first indication of sediment-hosted copper mineralization in the northwestern Huallaga Basin. The boulder source represents only a small portion of the Hannan area, which covers a total of 55 kilometers of prospective strike of the mineralized host unit. Field teams are currently actively conducting stream sediment sampling.

Hannanmetals

Valiente project – first successes make us sit up and take notice

Until Hannan Metals does not have to make its own exploration expenditures on the JOGMEC joint venture, it has the option to focus its own resources on its other projects.

The Valiente project, comprising 1,354 square kilometers of mining concession applications, consists of several sub-projects, with Previsto the current primary focus. Hannan Metals believes Previsto is highly prospective for alkaline porphyry copper-gold systems. Ingemmet, Peru‘s geological, mining and metallurgical institute, has previously proven intrusions on the project area.

2021 Hannan Metals has been able to report initial exploration success and a real bull‘s eye from Previsto. Initial reconnaissance work has identified a large-scale hydrothermal system within a 6 kilometer by 3-kilometer area on the project site that has the potential to host a porphyry copper-gold mineral system with an associated skarn. Several copper and gold mineralized float samples were taken in the process, with the best float sample returning 25.6% copper and 28 g/t silver in an interpreted supergene enrichment zone. The work carried out focused on an area extending 10 kilometers north south and remaining open to the north, west and south. Copper and gold mineralized porphyritic intrusive rocks were also detected within flotation samples in streams, along with iron oxides, copper oxides and pyrite. Uranium-lead zircon dating at four porphyritic intrusive centers in a 140 by 50-kilometer area has been used to define a previously unrecognized Miocene metallogenic belt associated with significant copper-gold geochemical anomalies in the BLEG, float and outcrop areas of the project.

Another 1.6 by 0.8-kilometer copper anomaly has been identified in the Belen area.

Summary: Something big is on the horizon

Hannan Metals was able to secure megapartner JOGMEC in the early stages of exploration at San Martin. Even a major player in the industry doesn‘t spend US$35 million just for fun. The company‘s own due diligence must have been correspondingly promising. While JOGMEC is initially pushing the development of San Martin financially alone, Hannan Metals can use its own money for the development of the second promising project Valiente and thus possibly land an additional top-class project. Several major anomalies on both projects, as well as initial trenching successes, strongly suggest that Hannan Metals has literally only scratched the surface of something big. Several exploration campaigns should provide plenty of news in the coming months.

Exclusive interview with Michael Robert Hudson, CEO of Hannan Metals

What have you and your company achieved in the past 12 months?

Hannan is a top 10 Peruvian concession holder in a country that is dominated by some of the world’s largest companies. Our aims are to find super scale mineralizing systems in new frontier areas which will be compelling targets for the major gold and copper mining houses. Hannan is uniquely leveraged to make a significant grassroots discovery.

At the San Martin Project we are in a US$35m joint venture with JOGMEC, the Japanese government arm that is tasked to source future metals for their industry. The project covers a new, basin-scale high-grade sediment-hosted copper-silver system situated along the foreland region of the eastern Andes Mountains, we have identified a mappable mineralized copper-shale horizon over 120km. To provide context, detailed work this year has provided widths and grade (0.9 metre @ 1.9 % copper and 27 g/t silver) from 105 channel surface samples, within an area of about 9 kilometres long and 1 kilometre wide, that compare with those found during the initial modern-day drill discovery of the Kupferschiefer copper-silver deposit which remains today one of the world’s largest producers of copper and silver.
At the 100% owned Valiente Project we are focused on back-arc Miocene age porphyry copper-gold systems (looking for the “next” Bajo de Alumbrera). At least 7 intrusive centres within a 140 km x 50 km area have been identified at the Valiente project and we see amazing potential.

What are the most important company catalysts for the next 6 to 12 months?

Hannan’s exploration programs are fully funded in 2022 with a Peru-wide exploration project budget of US$3M.

At San Martin, we are moving towards our maiden drill program which we expect to be permitted and take place later in 2022.

At Valiente, we will focus our soil and stream sediment sampling in an area of 10 km x 5 km with the aim to identify and expand the source areas to the Cu-Au mineralization with the support of the local communities and move to drill permitting. We also plan to fly an extensive 200-metre-spaced airborne magnetic survey over the entire 1,164 sq km Valiente project area.

How do you see the current situation on the market for battery metals?

Amazingly bullish. Copper consumption, driven in part by the electrification of everything will double over the next 30 years. We simply have not discovered enough metal to satisfy this demand. World-class new mine-ralized terrains, just like Hannan have found, will become incredibly valuable. The need for higher grade and low impact mines will become even more imperative.

Hannan Metals Limited

ISIN: CA4105841064
WKN: A2DJ8Y
FRA: C8MQ
TSX-V: HAN

Shares outstanding: 92.8 million
Options: 4.8 million
Warrants: 2.0 million
Fully diluted: 99.6 million

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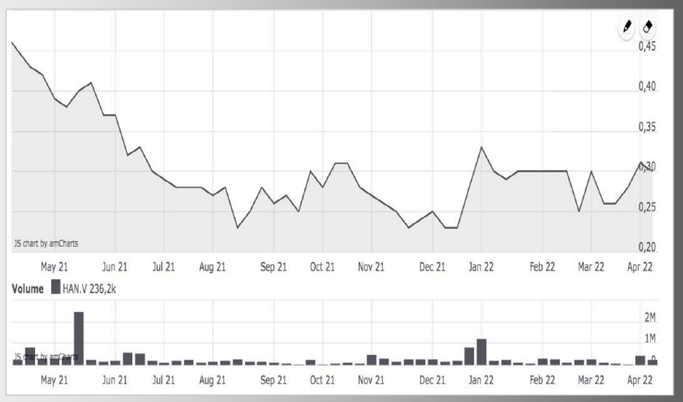

ION Energy

First important discovery and strategic partner

Ali Haji, CEO

ION Energy is a junior Canadian-Mongolian mining development company specializing in the aggressive development of lithium brine projects. Management has a high level of experience with resource projects in Mongolia, which is why ION Energy‘s flagship projects are also located in Mongolia. Initial exploration drilling confirmed the presence of significant lithium resources. The company benefits from a first mover advantage and has the large battery markets in Asia as potential customers right on its doorstep.

Baavhai Uul Lithium Brine Project – Location and Scope

ION Energy‘s flagship Baavhai Uul project is located in southeastern Mongolia, only about 24 road kilometers from the Chinese border and thus from the world‘s largest battery producer. The project site covers 81,000 hectares, making it one of the largest approved exploration licenses and also the first lithium brine license in Mongolia‘s history. The project is located in one of Mongolia‘s largest and also least explored salars.

Baavhai Uul Lithium Brine Project – First Exploration Successes

Baavhai-Uul has high potential for a high-caliber lithium brine resource, as drilling has already confirmed. Average lithium grades of 426ppm (parts per million) were detected directly at surface. The highest lithium concentration was 810.6ppm. All holes drilled contained lithium concentrations and also had low potassium and magnesium ratios, favoring the formation of large crystals at the present elevation and sometimes low temperatures. The project area is characterized by extremely high evaporation and concurrent low precipitation. It is a so-called endorheic basin, which has no outflow to external water bodies or the sea. Furthermore, it hosts shallow aquifers. Such Cretaceous volcanic and sedimentary rocks are the most suitable aquifers for lithium enrichment. Another advantage that lithium brine deposits possess is that they are cheaper to extract than hard rock projects.

Baavhai Uul Lithium Brine Project – New Discovery of Lithium-Nickel-Copper Resource.

In the fall of 2021, the Company began an initial surface drilling program of 222 holes with the assistance of three drill rigs. The holes were drilled to a maximum depth of six meters, with samples taken every 0.50 meters. The holes were drilled at a spacing of more than one kilometer, representing a first comprehensive pass through the licenses. Initial exploration success was seen in the first laboratory-verified drill holes. These included the detection of up to 1,502 ppm lithium in clays and evaporites, with the drill hole averaging 700 ppm lithium at a depth of 0.5 to 3.5 metres. Another drill hole averaged 650 ppm lithium at a depth of 4 meters to 6 meters, with the final drill hole sample returning 860 ppm lithium. This new discovery was subsequently named the White Wolf Prospect. Furthermore, traces of nickel and copper were found in several drill holes. One of these returned results of up to 2,150 ppm nickel from 5.0 to 5.5 metres depth in clay samples and an average of 202 ppm nickel. In the eastern area of the license, numerous drill holes assayed over 200 ppm and up to 480 ppm nickel, which will be the subject of further infill drill programs. The copper geochemical anomaly is over 4 square kilometers in size and the nickel geochemical anomaly is over 2 square kilometers in size, with overlapping anomalies in the central portion of the license. In April 2022, ION Energy started hydrogeological sampling and further exploration activities.

Urgakh Naran Lithium Brine Project

In February 2021, ION Energy acquired the Urgakh Naran Lithium Brine Project, which covers approximately 19,000 hectares and is located approximately 150 kilometers west-northwest of Baavhai-Uul. Previous work conducted at the project site included an extensive hydrochemical sampling program of identified shallow brine lithium. Although still at an early stage, this program has been extremely successful in identifying several targets for follow-up exploration. ION Energy commenced a drilling campaign in September 2021, which consists of 73 shallow auger holes on a wide spacing of 1 x 1 kilometer. The holes will be drilled to a depth of approximately six meters. Potentially lithium-bearing clays and evaporites will be sampled in each hole, as well as lithium brines intersected in these shallow holes. The main body of the Urgakh Naran Salar is approximately 10 x 3 kilometers in size.

Strategic partnership with Aranjin Resources

The discovery of nickel and copper resources at Baavhai Uul prompted ION Energy to form a strategic partnership with Aranjin Resources. The closed joint venture allows both companies to grant each other exploration rights to their respective exploration licenses in Mongolia. ION Energy and Aranjin will grant each other the right to explore each other‘s properties, with Aranjin receiving an 80% interest and ION Energy receiving a 20% interest in any base metal projects discovered on ION Energy‘s properties, and ION Energy receiving an 80% interest and Aranjin receiving a 20% interest in any lithium projects discovered on Aranjin‘s properties. Both companies will thereby be able to leverage each other‘s expertise in their respective metals, with Aranjin receiving the right to explore ION Energy‘s properties for base metals (including copper, lead, zinc, nickel, cobalt and associated metals) and ION Energy receiving the right to explore Aranjin‘s properties for lithium. The area covered by the joint venture includes all mineral rights in Mongolia currently owned by ION Energy and Aranjin. This includes the Sharga Project, the Bayan-Under Project, the Baruun Valley Project, the Baavhai-Uul Project, the Urgakh-Naran Project, as well as any mineral rights acquired by either company in Mongolia after the date of formation of the joint venture. This structured approach aims to increase their exploration acreage in the mineral-rich regions of Mongolia, ensuring that both ION Energy and Aranjin maximize their opportunities to take a property through to the development stage.

Strong management team

ION Energy has a very strong management team that has successfully operated in Mongolia for over a decade and has over 100 years of combined mining and exploration experience.

Chairman Matthew Wood is also currently Chairman of Steppe Gold. He was also the founding Chairman of Avanco Resources (sold in March 2018 for AU$440 million) and HunnuCoal (sold in 2012 for US$500 million). CEO Ali Haji is a current director of Antler Hill Mining Ltd and Spirit Banner II Capital Corp. he has over 13 years of international experience in asset management, risk analysis and program governance. He is also an advisor to ATMA Capital Markets Ltd and Steppe Gold and holds a BSc from the University of Western Ontario.

Director Bataa Tumur-Ochir is a Mongolian national who serves as CEO and Director of Steppe Gold. He is an advisor to the Ministry of Mines and Heavy Industry, holds a bachelor‘s degree in business administration and a diploma in international business adminis-

tration and marketing from Australia and Singapore.

Director Enkhtuvshin Kishigsuren has over 30 years of experience in resource projects for multinational companies. He has discovered several prospective gold, molybdenum and copper deposits, including the multi-million-ounce Olon Ovoot gold deposit.

Consultant Dr. Khashbat Dashteseren is a geologist and scientist with extensive experience in the exploration of various minerals in Mongolia and has worked for the Ministry of Urban Development and Investment in Mongolia. Dr. Dashteseren was also the Chief Geologist at Geolink LLC before assuming the role of CEO. Subsequently, Dr. Dashteseren worked as an exploration manager for Resource Partners Group. He spent a significant amount of time researching laboratory analytical methods for lithium at Akita University in Japan.

In March 2022, Wendy Li joined ION Energy‘s management team as another key building block. Li has more than 18 years of trade and business development experience in Asia, including Mongolia and China, and has worked in commodity brands and trading, supply chain management and asset development. Prior to joining ION Energy, Li served as General Manager of International Trade for Noble Resources Ltd. and General Manager of Marketing for SouthGobi Resources Ltd.

Summary: Strategic partnership brings additional opportunities for a direct hit

The lithium market is currently hot, which has been impressively demonstrated by an exorbitant price increase and the two acquisitions of Millennial Lithium and NeoLithium. Especially China is desperately looking for attractive lithium deposits. ION Energy was therefore one of the first to recognize the major location advantages of Mongolia. Especially the proximity to the largest battery market China is almost unbeatable. ION Energy‘s projects are so huge that they could even host several high-profile lithium brine deposits. Now add to that the Aranjin projects, which also offer high potential for an economic lithium resource. In 2022, ION Energy will provide increased newsflow.

Exclusive interview with Ali Haji, CEO of ION Energy

What have you and your company achieved in the past 12 months?

Since the Spring of 2021, our team has been on a fast-paced growth trajectory, even with the border closures, backed-up laboratories and supply chain delays felt across the globe! Last summer, we celebrated our 1-year anniversary of trading on the TSX-V. Through the Fall, the ION Energy team worked to advance the maiden drilling program at our flagship, Baavhai Uul Lithium Brine project, with some starts and stops. Our initial shallow drilling program of 222 drill holes was highly encouraging, with results of up to 1,502 ppm Lithium seen at our exciting new lithium discovery: the White Wolf Prospect.
And 2022 started out with ION entering into a strategic alliance with an emerging Mongolian copper explorer, Aranjin Resources. This partnership has enlarged our exploration area across the mineral-rich regions of Mongolia and will ensure that ION Energy maximizes its chances of carrying a project to the development stage.
Most recently, we strengthened the ION team by appointing a Director – Asia. Her exceptional track record of business development and forging long-term partnerships across the continent, will strategically support ION’s plan to play a pivotal role in Asia’s battery metals supply hub.
I just conducted a site visit in-country for the first time since the onset of the pandemic, accompanied by ION‘s senior technical and geological advisors. We kicked-off the next milestones in our projects‘ exploration programs, while we were there, and have lots in store for the rest of the year!

What are the most important company catalysts for the next 6 to 12 months?

The commencement of hydrogeological sampling is our next key milestone, as well as early resource indications at our flagship site. ION Energy looks forward to confirming our assets‘ value proposition to the market, as exploration results from our multiple programs continue to come in. And we are very focused on advancing talks with strategic investment partners.

How do you see the current situation on the market for battery metals?

It couldn’t be a more exciting time for an early-stage lithium explorer like ION Energy! As our world continues to focus on the energy transition, and trillions of dollars of clean energy investments continue to be announced, Lithium is a commodity with high global demand. Yet current demand for battery metals is highlighting serious supply pressures, and regional value chain hubs are strategically being built out by the majors. That’s where ION Energy is well-poised to become a player in a regional hub, with our project sites in close proximity to the world’s largest battery manufacturer and consumer base for electric vehicles.

Li Ion Energy

ION Energy Ltd.

ISIN: CA4620481099
WKN: A2QCU0
FRA: 5YB
TSXV: ION

Shares outstanding: 60.5 million
Options: 0.7 million
Warrants: 20.5 million
Fully diluted: 80.6 million

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Kutcho Copper

Top framework conditions lead to success

Vince Sorace, CEO

Kutcho Copper is a Canadian mining development company specializing in the development of high-grade copper deposits in British Columbia. There, the company was able to secure the eponymous Kutcho Copper project, which not only hosts a resource, but already an appealing reserve. A fresh feasibility study already came to an extremely positive result and could take a lot of risk off the project. Kutcho is thus already very advanced and also has a strong development partner in Wheaton Precious Metals. The consolidation of liabilities, royalties and offtake agreements recently provided for a dramatic improvement of the general conditions.

Kutcho Copper Project – Location and Infrastructure

The flagship Kutcho project is located approximately 100 kilometers east of Dease Lake in northern British Columbia and consists of a mining lease and 46 mineral exploration claims covering an area of approximately 17,060 hectares. The site is accessible by a 900-meter gravel airstrip for small aircraft located 10 kilometers from the deposit and a 100-kilometer seasonal road from Dease Lake suitable for tracked and low-use vehicles. A deepwater port is located at Stewart, approximately 400 kilometers from Dease Lake. Existing infrastructure has been greatly improved over the past 10 years with numerous infrastructure improvements. Among other things, Highway 37 runs through northern British Columbia.

Kutcho Copper Project – Geology and Mineralization

The Kutcho Copper Project lies within the King Salmon Allochthon, a narrow belt of Permo-Triassic Island arc volcanic rocks and Jurassic sediments that lies between two north-dipping overthrust folds: the Nahlin fault to the north and the King Salmon fault to the south. The belt of volcanic rocks is thickest in the area where it hosts the VMS deposits, due in part to primary deposition but also to stratigraphic repetition by folding and possibly overthrusting. The volcanic rocks are folded, and triple repeat the mineralized horizon on the project, including the deposit. The massive sulphide deposits are oriented east-west and dip 15° to the west.
Mineralization comprises three known „Kuroko-type“ VMS deposits aligned on a west-dipping linear trend. The largest, the Main deposit, comes to surface at the eastern end, followed by Sumac at depth and Esso at the western end, which occurs at a depth of approximately 400 meters below surface. „Kuroko-type“ VMS deposits are typically associated with felsic volcanism in island arc or back-arc tectonic settings. The characteristics of Kutcho-type deposits indicate that they formed at or near the water-soil interface in a structurally controlled depression, for example, in a „half-graben“ type structure. The chemical composition of the alteration around the Kutcho deposits is well zoned around the hydrothermal vent zones. Mineralization consists of a pyritic footwall with zoned copper and zinc towards a sharp hanging wall contact.

Kutcho Copper Project – Reserves and Resources

The Kutcho Copper Project already has a high-caliber reserve and resource base, primarily from the Main Zone. A 2017 estimate indicated a potential reserve of 10.4 million tonnes averaging 2.01% copper, 3.19% zinc, 34.61g/t silver and 0.37g/t gold.
The most recent resource estimate to date, from September 2021, produced measured and indicated resources of 22.8 million tonnes averaging 1.52% copper, 2.18% zinc for 765 million pounds of copper, 1.1 billion pounds of zinc, plus 288,000 ounces of gold and 20.6 million ounces of silver. In addition, there are inferred resources of 12.9 million tons averaging 1.10% copper and 1.58% zinc plus gold, silver and lead.

Kutcho Copper Project – Exploration Potential

The Kutcho Copper Project has great exploration potential.
The Main-Sumac Gap identifies a 400-meter-wide gap between the Main and Sumac lenses that has not yet been drill tested. A conductive geophysical anomaly coincides with this area and is 360 meters long. The easternmost hole, which intersected the Sumac lens and is located on the western edge of the gap, returned 5.12 meters at 1.29% copper, 0.49% zinc and 7g/t silver.
The Footwall Zone is stratigraphically below the Main Zone and represents a stacked massive sulphide horizon open in all directions. The last hole drilled to the east and down dip intersected 1.5 meters of 3.54% copper, 6.94% zinc, 316.9g/t silver and 1.47g/t gold.
MCF is located at the eastern end of the main deposit and coincides with a conductive VTEM geophysical anomaly and a copper-zinc soil anomaly. Three historic drill holes returned approximately 35 meters of semi-massive sulfide, while one hole intersected long intervals of strongly altered lapilli tuff with 2-8% pyrite, traces of chalcopyrite and sphalerite.
Overall, 36% of the Main Zone, 50% of the Esso Zone and 100% of Sumac remain open down dip and outside of the current resource model.
In addition to the deposits located close to the Main Zone, the project area hosts a number of other greenfield targets that remain to be explored.
In addition, there are several other promising target areas.
In October 2021, Kutcho Copper indicated that there are several open pit and underground targets at the Main, Sumac and Esso deposits that have the potential to expand the open pit and underground mineral resources beyond those being considered for inclusion in the Feasibility Study.

Kutcho Copper Project – Feasibility Study

In November 2021, Kutcho Copper published a positive feasibility study for the Kutcho Copper Project. The study was based on a copper price of US$3.50 per pound and a zinc price of US$1.15 per pound. For a production capacity of 4,500 tonnes per day (tpd) and a production capacity of 3,900 tonnes tpd, the study resulted in an after-tax NPV 7% of CA$461 million and an after-tax IRR of 25%. Initial capital costs were estimated at CA$483 million and all-in sustaining costs at US$1.80 per pound of copper equivalent. An estimated mine life of 8 years and production life of 10.75 years would result in after-tax cash flow of CA$841 million. The payback period was calculated to be 3.4 years.
Assuming current prices of US$4.50 per pound of copper and US$1.57 per pound of zinc, this would result in an after-tax NPV of CA$931 million and an IRR of 41%.

Development deal with Wheaton Precious Metals

To rapidly develop the Kutcho Copper Project, Kutcho Copper was able to enter into a development deal with silverstreaming company Wheaton Precious Metals. As part of the acquisition of the Kutcho Project from Capstone Mining in 2017, Kutcho Copper, still under its former name Desert Star, received a commitment from Wheaton Precious Metals to receive a total of up to US$100 million. In return, Wheaton Precious Metals is entitled to acquire 100% of the silver and gold production from the Kutcho project. Wheaton Precious Metals will make an ongoing cash payment equal to 20% of the respective spot price of silver and gold for each ounce delivered under the agreement. Since entering into the agreement, Wheaton Precious Metals has committed US$7 million to fund the feasibility study. Another US$58 million has been paid to develop the project. Kutcho Copper will receive up to US$20 million more if it expands to a

4,500 tpd operation. It is important to note that only about 8% of the estimated project revenues are impacted by the stream. 61% of the projected revenues generated will be attributed to copper, 31% to zinc, 5% to silver and 3% to gold. In February 2022, Kutcho Copper was able to eliminate all debt outstanding to Wheaton Precious Metals through a share deal.

Improved cash status + royalty buyback + flexibility in off-take agreements.

In June 2021, Kutcho Copper was able to generate CA$4.1 million in fresh capital through a financing and another CA$5 million in December 2021. Further, at the end of 2021, the Company was able to buy back an existing royalty from Sumac Mines and terminate Sumac's right of first refusal (ROFR) for concentrates. The termination of the Sumac ROFR thus restores the Company's full flexibility to freely engage in strategic discussions on offtake and customer financing arrangements. This will create a more competitive environment for concentrate offtake terms as 100% of concentrate offtake is now up for negotiation.

Summary: High resource potential and early construction decision

Kutcho Copper already has an attractive resource base at its eponymous copper project, although the site has yet to reveal its vast resource potential. Several potentially high-caliber exploration areas are waiting to be extensively explored. The recent positive feasibility study could take a lot of risk off the project and could possibly attract other interested parties besides top development partner Wheaton Precious Metals to what is arguably one of the most exciting copper-zinc projects in the world. The company is uniquely positioned with a high-grade, low-cost, feasibility-stage development project in a Tier 1 jurisdiction supported by a thriving copper market. Next milestones will be permitting and an early construction decision. Importantly, the royalty and offtake agreement was consolidated and the Wheaton deal was simplified, including the reduction of all debt. Given the current market capitalization relative to the robust nature of the project and the strong outlook for copper, Kutcho Copper represents a compelling investment opportunity.

Exclusive interview with Vince Sorace, CEO of Kutcho Copper

What have you and your company achieved in the past 12 months?

- Completed a feasibility study showcasing an after-tax Net Present Value at a 7% discount rate of $613 million and an Internal Rate of Return of 30% (at U$$4.00/lb copper), including:
  - A mine plan for a predominantly simplified open-pit mining operation. The optimized mine plan has resulted in a technically robust and capital-efficient project with a minimized footprint.
  - Annual production of 50 million lbs of copper and 78 million pounds of zinc over an 11-year mine life with cash costs of US$1.11/lb copper equivalent and all-in sustaining costs of US$1.80/lb copper equivalent.
- Expanded the Project's high grade mineral resources to 1.1 billion pounds of contained copper equivalent. The updated mineral resource in the measured and indicated category totals 22.8 million tonnes averaging 1.52% copper and 2.18% zinc (2.26% copper equivalent (CuEq) (refer to Company press release dated Sept 13, 2021).
- Completed approximately C$12 million in financings with fundamental investors.
- Deferred interest payments due under the Wheaton Precious Metals convertible debenture until the end of 2023.
- Completed a buyback of the royalty held by Sumac Mines Ltd. and terminated Sumac's right of first refusal (ROFR) to purchase concentrates from the Kutcho copper-zinc project opening access to a greatly expanded universe of potential concentrate off-takers and financial partners.
- Entered into negotiations for economic participation agreements with the Tahltan and Kaska First Nations.
- Developed a detailed exploration plan that provides numerous opportunities to increase the open pit and underground mineral resources available for inclusion in future mine plans at the existing Main, Sumac and Esso deposit.

What are the most important company catalysts for the next 6 to 12 months?

- Advancing both near-resource and greenfields exploration targets.
- Re-entering the Environmental Assessment process as the next step towards completion of permitting for mine development.
- Undertaking First Nation and community engagement and consultations, supporting field visits and completing economic participation agreements with both the Tahltan and Kaska First Nations.
- Evaluating and, if warranted, execute on a number of accretive and strategic opportunities.
- Continuing to evaluate and, if warranted, execute on identified opportunities to lower capital costs through strategic arrangements, enhanced engineering studies (including additional ore sorting studies).
- Continuing to de-risk and advance the Project towards a production decision.

How do you see the current situation on the market for battery metals?

Copper prices are robust, and I believe will continue the upward trajectory over the coming years being fueled by both the demand side (EV's and EV infrastructure, renewables – movement towards electrification and global emissions targets).

ISIN: CA5013771053
WKN: A2JAMG
FRA: 1QV
TSX-V: KC

Shares outstanding: 114.6 million
Options: 7.6 million
Warrants: 15.0 million
Fully diluted: 137.2 million

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Kutcho Copper Corp.

Surge Copper

Approximately 7 billion pounds of copper equivalent and a steady stream of spectacular new drill results

Leif Nilsson, CEO

Surge Copper is a Canadian mining development company specializing in the development of high-grade copper deposits in British Columbia. There, it holds majority interests in two large copper projects that are directly adjacent to each other and cover a total of about 122,000 hectares. The entire area is rich in copper, molybdenum, gold and silver and is also well developed in terms of infrastructure. Surge Copper is aggressively working to further increase its already very large resource base. In the process, the newly discovered copper mineralizations are becoming increasingly high-grade.

Ootsa – Location and infrastructure

The Ootsa project, which is 100% owned by Surge Copper, is located approximately 120 kilometers south of the city of Houston, British Columbia and has good all-weather road access. The claims, totaling approximately 87,500 hectares, contain a network of logging roads that provide excellent road access through the central and eastern portions of the claim block. Ootsa is bordered to the north by the Huckleberry mine and mill complex, which is owned by Imperial Metals Corporation, is currently in care and maintenance status, and hosts only minor remaining reserves. Ootsa has a 35-man exploration camp that is typically operational from May through November. However, the relatively mild climate allows for year-round exploration activity.

Ootsa – East & West Seel

Ootsa hosts several advanced copper-gold-molybdenum-silver porphyry deposits located in the northeastern portion of the project area.

The East and West Seel deposits represent two distinct styles of porphyry mineralization that form a large contiguous mineralized zone. The deposits are located in a gently dipping area of confined bedrock, only about 6 kilometers from Huckleberry Mill. The East Seel deposit is a smaller, higher grade mineralized zone containing copper-gold mineralization associated with quartz-magnetite-chalcopyrite veins. The West Seel deposit is a large zone of copper-gold-molybdenum-silver mineralization associated with quartz-pyrrhotite-chalcopyrite-molybdenite veins that extends from surface to a depth of over 1000 meters and is not yet fully delineated. Both deposits have high tonnage and copper mineralization, some of which extends for several hundred meters. For example, Surge Copper's previous drilling campaigns in the East Seel area included 238 meters of 0.73% copper equivalent and 186 meters of 0.78% copper equivalent. In the West Seel area, intersections included 817 metres at 0.45% copper equivalent, 1,013 metres at 0.42% copper equivalent, 830 metres at 0.38% copper equivalent, 432 metres at 0.61% copper equivalent, and 585 metres at 0.57% copper equivalent, 495 metres at 0.54% copper equivalent and 194 metres at 0.76% copper equivalent. Since November 2020, Surge Copper has drilled a total of 30,000 meters in the East and West Seel areas. In the process, the company recently encountered increasingly high-grade results. Among other results, the Company has intersected 52 meters of 0.71% copper equivalent, 42 meters of 0.87% copper equivalent, 28 meters of 0.90% copper equivalent including 16 meters of 1.27% copper equivalent, 80 meters of 1.16% copper equivalent including 32 meters of 2.02% copper equivalent, and 46 meters of 1.7% copper equivalent including 28 meters of 2.0% copper equivalent and 10 meters of 3.6% copper equivalent. All of these top results came from the Seel Breccia Zone, located approximately 200 meters north of the East Seel deposit.

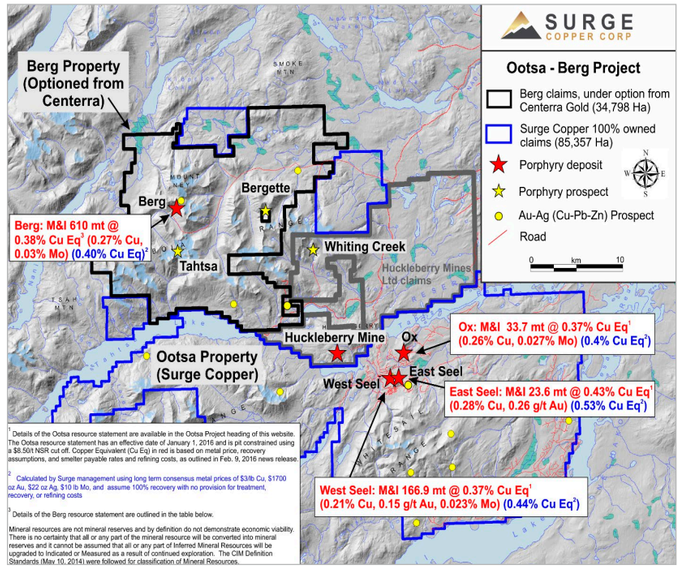
Ootsa – Ox

The third advanced deposit is called Ox and is located approximately 4 kilometers northeast of East and West Seel and contains a crescent-shaped zone of disseminated and vein-controlled porphyritic copper-molybdenum mineralization. This mineralization contains pyrite, chalcopyrite and molybdenite occurring in hornfelsic sedimentary rocks near the western margin of a granodiorite porphyry deposit. There, the Company encountered 359.4 meters of 0.41% copper equivalent and 227.7 meters of 0.53% copper equivalent, among others. In the summer of 2021, Surge Copper conducted minor drilling there to test several targets.

Ootsa – Resource + other deposits

For all three advanced deposits combined, Surge Copper last published a resource estimate in early 2016 based on over 350 drill holes totaling 144,000 meters of drilling. According to this, Ootsa has a total of 1.109 billion pounds of copper, 1.062 million ounces of gold, 104 million pounds of molybdenum and 20.457 million ounces of silver within these deposits alone. Converted, this equates to approximately 1.85 billion pounds of copper equivalent. All drilling conducted after 2016 is not included in this estimate. The Company is working on the preparation of a new resource estimate, which is expected to be published during 2022.

In addition, Ootsa has at least 7 other potentially high grade deposits that have already produced some high grades. For example, Troitsa Peak, where historic sampling has produced up to 41g/t gold and 9,238g/t silver, or the Hope Prospect, which has historically returned up to 6.3% copper and 1,305g/t silver in a 700 by 50-meter area. The intervening space between East and West Seel also hosts significant copper grades as impressively demonstrated by the Company in 2021 using 296 meters of 0.53% copper equivalent including 66 meters of 0.75% copper equivalent.



The Ootsa – Berg project (Source: Surge Copper)

Ootsa – PEA

An initial assessment of the project's economic viability (Preliminary Economic Assessment (PEA)) also dates from 2016. This was based on – from today's perspective – extremely conservative raw material prices of US$3.00 per pound of copper, US$1,260 per ounce of gold, US$10.30 per pound of molybdenum and US$17 per ounce of silver. In addition, only about one-third of the total resource was factored in. The result was an after-tax net present value (NPV/5% discount) of CA$186 million and an internal rate of return (IRR) of a sensational 81%. Accordingly, the mine life is 12 years, and the payback period is 1 year. This is based on the assumption that Ootsa can be exploited by contract mining and toll milling in the Huckleberry Mill, which is why the initial capital costs – for this type of mine – would be a mere CA$64 million.

At the moment, all assumed raw material prices are in part far above those from the PEA, which is why the profitability of the project can currently be estimated even better.

Berg – Acquisition, location and resource

In December 2020, Surge Copper announced that it had entered into a definitive option agreement with Thompson Creek Metals Company Inc, a wholly owned subsidiary of Centerra Gold Inc, giving Surge Copper the right to earn a 70% interest in the Berg copper-molybdenum-silver project. Berg hosts a large porphyry copper-molybdenum-silver deposit located approximately 28 kilometers northwest of Ootsa. Berg totals 34,798 hectares, is directly adjacent to Ootsa and was expanded again in April 2021 to include the Bergette Claims in the eastern area and the Sylvia Claims in September 2021. Some of the existing drilling, which includes 176 meters at 0.75% copper equivalent and 63 meters at 1.44% copper equivalent, is widely spaced. In addition, the main deposit remains open at depth and radially outward.

In March 2021, Surge Copper released a resource estimate that truly had it all. For example, Berg has 3.65 billion pounds of copper, 419 million pounds of molybdenum and 59.1 million ounces of silver in the measured and indicated categories. In total, this equates to 5.126 billion pounds of copper equivalent.

Berg – First own exploration successes

In 2021, the access road to the Berg camp was expanded, making Berg accessible to heavy vehicles for the first time in 10 years. Another important item is the review of existing drill core and drill core waste for precious metals, as about half of the historical drill holes have not been assayed for silver and none at all for gold. This should allow better definition of the higher-grade zones and reveal the best geochemical and geophysical anomalies. The Berg deposit forms an annular shape around a central intrusive stock and is characterized by an extensive supergene enrichment blanket in the upper portions of the deposit. Historical drilling defined high-grade fractured mineralized zones in the northeastern and southern portions of the ring. In September 2021, Surge Copper launched a renewed exploration campaign aimed at upgrading the drill hole database, including orientation surveys and full geochemical analysis data, improving the understanding of structural influences on mineralization, and improving drill hole density in the high-grade areas of the deposit. The included drilling campaign – the first conducted by Surge Copper itself on Berg – immediately yielded significant copper intercepts. Intersections included 325 meters of 0.42% copper equivalent, 357 meters of 0.59% copper equivalent and 105 meters of 0.74% copper equivalent. Furthermore, in March 2022, the Company was able to prove very high-grade mineralization of 0.83% copper over 132 meters.

Summary: Focus on drilling and metallurgical development

The Surge Claims comprise nearly 7 billion pounds of copper equivalent, with good copper grades, including over one million ounces of gold alone. The two huge project areas also have exploration potential based not only on possible additional deposits, but also on the fact that the re-evaluation of historical drill core alone could give an additional boost to the product. A new resource estimate for Ootsa follows, incorporating all drill results from 2018, 2020 and 2021, and will be completed shortly. A newly formed management team (most recently joined by the highly experienced Mark Wheeler as Vice President, Projects), has already impressively demonstrated in the past that it can both land major new discoveries and fund large sums of money. The coming weeks and months should continue to be marked by major advances in exploration and metallurgical development, potentially yielding additional high-grade mineralized intercepts.

Exclusive interview with Leif Nilsson, CEO of Surge Copper

What have you and your company achieved in the past 12 months?

Surge Copper has made great progress over the last year in positioning the company for the huge wave in spending on electrification metals that has begun as the world embarks on a multi-decade build-out of electric infrastructure. We control several advanced deposits in a large porphyry copper belt in an infrastructure-blessed part of British Columbia, Canada, and have been making investments in resource and exploration drilling, advanced metallurgy, and large-scale datasets to support future discovery. This work has resulted in resource growth, project derisking, and growth in our pipeline of exploration targets.

What are the most important company catalysts for the next 6 to 12 months?

In 2022, our key objectives are to undertake a regional exploration program that will test several priority targets generated by a large-scale regional geophysical survey completed in 2021, to complete advanced metallurgical test work on our key mineral deposits, and to complete an updated resource estimate to integrate the drilling completed during 2021.

How do you see the current situation on the market for battery metals?

The demand forces for electrification metals go well beyond battery applications. Colossal investments are being made to affect the electrification and decarbonization of the heavy industry and transport sectors, and in parallel to dramatically shift the electric power generation mix and grid infrastructure to zero-carbon emission technologies. These are multi-decade, global megatrends that are beginning to gather serious momentum, and recent geopolitical events have surfaced additional energy-security risks which will only hasten these trends. Surge's primary metal exposures are copper and molybdenum, which are quintessential in electrification and specialty alloy applications, and face limited substitution risk. In commodities cycles, high prices are often the cure for high prices, through some combination of supply response and demand destruction. However, the current market dynamics are a very different setup, with uncertain supply response due to lengthy development timelines and severe underinvestment in exploration and development, and multiple, massive, global tailwinds pushing demand.

Surge Copper Corp.

ISIN: CA86881M1041
WKN: A2JENX
FRA: G6D2
TSX-V: SURG

Shares outstanding: 167.0 million
Options/warrants: 69.9 million
Fully diluted: 236.9 million

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