



Battery Minerals and their industrial implications for the future

We are on the cusp of a transportation revolution made possible by various metals and minerals that make up the batteries in electric vehicles.

by Jane Bratun

Established in 2014, London-based Benchmark Minerals Intelligence Ltd. is a consultancy and research house focusing on niche, critical and industrial minerals, and metals. Benchmark recently sponsored the Benchmark Minerals Week in Newport Beach, California which brought together the leading players on both sides of the lithium-ion battery supply chain at two conferences: Graphite and Anodes 2018 and Cathodes 2018.

GRAPHITE AND ANODES 2018

According to literature from Northern Graphite Corp. [NGC-TSXV; HGPHF-OTCQX], graphite for lithium-ion batteries (LiB), is a \$20 billion market, growing at over 20% per year due to demand for consumer products such as cell phones, cameras, laptops, and power tools. Electric vehicles (EVs) and grid storage are huge battery markets that will provide continued strong demand growth. China controls 80% of world graphite supply, and

TOP: Left, Dakota Semler, Co-Founder and CEO, and Giordano Sordoni, Co-Founder and COO, of Thor Trucks, with the ET-One Electric Class 8 Semi-Truck. Built in Los Angeles, California, the truck is good for 300 miles when fully loaded to 40 tons. The cylindrical lithium-ion battery was designed in-house. Photo Courtesy Thor Trucks, Inc.

RIGHT: The Proterra Catalyst® electric bus, powered by lithium-ion batteries, is available in 35-foot and 40-foot lengths. Photo courtesy Proterra, Inc.

both the EU and the US have named graphite a supply-critical mineral.

The Graphite and Anodes Conference focused on markets for graphite materials and provided insight into how these markets will change. In his opening comments, Simon Moores, Managing Director at Benchmark, noted that general investors lost nerve in 2018; however, the demand for graphite is up 22%. As a key component of the lithium-ion battery, and an area where technological developments are improving energy density, life cycle and cost, anode materials are at the centre of the lithium-ion battery revolution.

A keynote speaker on the state of the industry, Andrew Miller, Senior Analyst at Benchmark, stated that the demand outlook for the graphite market is positive, given growing consumption from industrial markets and emerging value-added applications. Miller added that graphite is a key anode material, and the demand for lithium-ion batteries is growing aggressively. This demand began in 2000 with the advent of smart phones, increased in 2015 with the adoption of EVs, and continued with the addition of stationary storage. Miller projects that anode producers will require major supply expansions to meet the expected

A look at 300-mile Thor electric semi trucks

Thor Trucks, Inc. recently hosted the Benchmark Minerals Intelligence conference delegates on a tour of their Los Angeles-based laboratory. Thor is privately funded, and co-founders, Dakota Semler and Giordano Sordoni, revealed their innovative electric truck design in 2017. It's a fully capable, fully electric semi that can haul 80,000 pounds of cargo and can travel 300 miles on a single charge. Thor is the Fast Company 2018 World Changing Ideas Awards winner in the transportation category.

"The majority of the Class 8, heavy duty truck market is more local and regional," Semler says. The Thor truck is designed for partners like **United Parcel Service** [UPS-NYSE], who drive predictable routes, have return-to-base operations, experience stop and go driving, and drive less than 150 miles per day. The Thor truck can recharge after a work day in 90 minutes, and the battery pack is designed specifically for commercial heavy-duty applications. It contains the highest-energy density lithium-ion cylindrical cells available.

Thor Trucks plans to use many off-the-shelf components and to partner with other companies for those parts, along with manufacturing, distribution, and maintenance. Says Semler, "Gone is everything you knew about electric vehicles. Electric is powerful, electric is sexy, and electric is here to stay." ■



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growth in battery production capacity. He says graphite will be the core raw material for lithium-ion battery anodes for at least the next five years and he expects that new technologies will begin to gain traction.

According to Miller, the graphite industry has strong industrial foundations in markets where substitution is limited, such as steel. The World Steel Association forecasts 3.9% growth in steel demand in 2018, and a 1.4% growth in 2019. New value-added markets, such as batteries and stationary storage application, are emerging and challenging the supply going into industrial sectors. These markets will be the main demand drivers for the graphite market. Batteries still play a secondary role to traditional applications, but the demand for graphite in lithium-ion batteries is growing smartly and lithium-ion batteries will eventually become the number one market for graphite.

Miller said the natural graphite versus synthetic graphite debate rages on. Steve Riddle, CEO of New Jersey-based Asbury Carbons, noted in an interview that natural graphite is not easy to sell, mine and produce to market requirements. For example, natural graphite can't be used to make carbon fibre or used in the nuclear industry, and processing synthetic graphite increases cost. Miller remarked that most anode producers aim to mix input raw materials to

gain benefits from both types.

Supply chain concerns persist for natural anode materials. Emphasis for these materials is on grade, environmental footprint and supply consistency. Synthetic supply is also a concern, despite major attempts to increase production and efficiency in China; for example, in production timescales, capital intensity of expansions and environmental footprint.

Mark Thompson, Managing Director of Australia's **Talga Resources Ltd.** [TLG-ASX], expects markets to see a disruption in traditional purchase patterns and pricing for next few years. He says multiple lithium-ion 'megafactories' are under construction or planned in the European Union (EU) and major car markets are now starting to turn to EVs. He says the majority of raw materials (cobalt and graphite) are imported into Europe from Africa or from China (graphite). This rocketing growth is underwritten by many EU governments legislating against internal combustion engine powered cars.

CATHODES 2018

The Cathodes Conference focused on lithium-ion battery cathode components, and the area where most technological developments are being made to improve energy density, life cycle, and cost. Cathode materials are at the centre of the lithium-ion

battery revolution. Andy Leyland, Head of Forecasting and Consultancy, Benchmark Mineral Intelligence, says the lithium market in 2018 is confusing when it comes to supply and price. He assumes significant battery growth and says the threat of oversupply is greatly exaggerated. Leyland says investments are not coming fast enough due to a lack of certainty in pricing in lithium, graphite, nickel and cobalt. He says new lithium supplies will come from South American brine. Brine also comes from China, but the quality is questionable. He says new hard rock projects are unlikely to result in a significant chemical supply.

Like Miller, Leyland points out that a lot of money is available for EVs, but not for mines. He says that despite bullishness on demand, financing major projects is difficult. Large companies like **SQM** [SQM-NYSE] are self-financing; however, even with acquisitions, they can't keep up with demand growth. Volatile short-term prices in China are a poor market indicator. SQM's quarterly price change is the best indicator. Leyland advises not to expect prices greater than the "new normal" of US \$12-14 per kilogram "any time soon."

Like Thompson, Leyland notes that government policies continue to drive investments in batteries, EVs and the charging infrastructure, but not in investments to produce the raw materials to support them.



The Electra Meccanica Solo single-seat, three-wheel electric car is manufactured in Vancouver, British Columbia, Canada. In addition to its dealership in downtown Vancouver, its first US dealership is located in the Los Angeles suburb of Studio City. Powered by a lithium-ion battery, the car goes zero to 100 kph in eight seconds with a top speed of over 130 kph with a 160-km (100 mile) range. Retail price is CDN \$19,888 (US \$15,500). A two-seat roadster is in the works. Photo courtesy Electra Meccanica Vehicles Corp.

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A prototype of the 2020 Tesla Roadster. The four-seater vehicle will accelerate 0-60 mph in 1.9 seconds. With its 200 kWh battery pack, the car has a range of 620 miles. Photo courtesy Tesla, Inc.

Auto makers are actively locking in raw materials to increase margins in EVs. Leyland predicts a structural deficit for lithium will be reached in 2026, assuming most current projects are funded, with some substitution risk from silicon, solid state and manufacturing advances.

Julia Atwood, Team Leader, Advanced Materials, Bloomberg New Energy Finance, discussed stationary storage. She says the demand profile for energy is 'peakier' when such items as solar panels go offline at night, and this presents an opportunity for energy storage, for which the demand is rising. She expects energy storage systems to reach 120 gigawatts by 2030 in the US, China and Japan. South Korea became the largest energy storage systems consumer in 2017 and 2018. Atwood commented that costs are falling across the board more rapidly than expected, and this makes stationary storage batteries competitive. And new applications such as EV battery charging systems are emerging. She noted, though, that storage is still a small piece of the market. For metals, this means more lithium, cobalt and nickel will continue as sources.

Robert Privette, Business Development Manager, North America, of Umicore [UMICF-OTC; UMI-EBR], says cathode material values will show double-digit growth over the next 10+ years. Established raw material sourcing is a requirement

and he predicts significant impacts on raw material markets, including nickel. He says ethical sourcing is non-negotiable. Clean, sustainable practices throughout the supply chain and "closed-loop" materials recycling are mandatory. "Putting out pollution in a battery plant does not make it green technology," says Privette.

Anthony Tse, Managing Director and CEO of Galaxy Resources Ltd. [GXY-ASX], said rapid growth in lithium demand is driven beyond normal consumer applications such as transportation and storage to what he calls "disruptive consumption" of lithium-ion [power storage]. He said key demand drivers for his company are EVs, energy storage systems, and consumer electronics. He expects a global EV penetration forecast to reach 15% by 2025, underwritten by rapidly increasing consumer demand and mandatory government policies globally. He expects 5x the lithium-ion battery demand by 2020. Tse said energy storage systems have emerged as a key resource in managing grid stability and the growing penetration of renewable energy. He says the storage system consumption potential may outpace EVs in the medium term as well as consumer electronics, driven by a high level of obsolescence and new growth in adoption across non-computing applications. He said the future demand for cathode material will comprise a wide range of chemistries, given per-

formance and technical challenges (for example, cost and safety).

Speaking about consumer electronics, Jeff Bruce, Director of Battery Technologies at Microsoft Corporation [MSFT-NASDAQ], said that on the IT side, demand will be flat for batteries. For laptop use, batteries are a three-year product; no one wants a 10-year old laptop.

Henrik Fisker, Chairman and CEO at Fisker Inc., envisions the biggest change in the transportation industry since we moved from the horse to the internal combustion engine. He expects that by 2025 traditional car companies will not exist. Instead, what Fisker calls mobility companies will provide transportation vehicles. To solve congestion and emissions problems, mobility companies will manufacture autonomous shuttles powered by EVs that would hook together for peak travel times and set routes, then detach into individual shuttles to get passengers closer to their destinations during off-peak times. He envisions closed campuses, such as airports would be a good starting use case for these shuttles.

He says consumer demand is shifting and young people are now more likely to call for a ride than to buy their own car; families will still want cars, but they will want "emotional, premium cool cars," and the aging population will want some autonomous features, for example ease of use. Fisker envisions that private cars will

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be for fun and leisure, while the shuttles will provide most daily transportation.

He said China could ban sale of gas cars by 2030 and this would mean the largest car manufacturer in world would export only EVs to the US and Europe. For other countries to compete, they must also manufacture EVs. Another push to EVs is coming from towns that use “punishment” policies, for example, only allowing EVs to drive in a city centre.

In the area of technology, Fisker predicts 20% of all vehicles will be “plug-in” in about 10 years. He would like to see manufacturers collaborate by sharing components to get prices down. In the future, said Fisker, all EV batteries will have about the same power so car manufacturers will have to find other ways define their brand to attract and excite consumers.

A SNAPSHOT SUMMARY

Miller concluded that developments in battery technology will improve range, weight, and cost, but graphite will remain a central component of advanced lithium-ion chemistries for at least the next 5-10 years. Silicon could play a crucial role in improving energy density, but commercialization will take time.

Solid-state batteries are the natural successor to advanced lithium-ion and we could see a gradual replacement of graphite-based anodes in high-end applications. Solid-state batteries, however, are a long way from production. Cost and safety concerns remain paramount in adopting new technologies and graphite will continue to play a major role in anode development.

For the lithium market, according to Leyland, confusion about supply and price reigns in 2018. The “oversupply myth” is creating market confusion, and stock prices for majors and juniors are impacted. Caspar Rawles, an analyst at Benchmark, noted the shift towards lithium-hydroxide intensive cathodes is under way. Forty-four percent of megafactory cathodes will need this as raw material by 2018 (534,000 tonnes). Lithium carbonate will still be the number one in-demand product in 2018 and cobalt demand will continue to surge. ■

Battery Mineral Companies

by Ellsworth Dickson



A NEW INDUSTRY is being born, the heart of which comprises the electric vehicle and stationary power storage sectors. Below are corporate summaries of explorers and miners targeting minerals that make up batteries; namely cobalt, graphite, lithium, manganese and vanadium.

LITHIUM COMPANIES

Argentina Lithium & Energy Corp. [LIT-TSXV; PNXL-FOTCQB; OAY1-FSE] has been exploring lithium brine exploration programs at its three projects: Antofalla, Arizaro, and Incahuasi in the Lithium Triangle in Argentina. Results have been received from CSAMT deep geophysical survey on the Antofalla Norte Lithium Project that identified four initial lithium-bearing brine drill targets. Several other companies are exploring properties on the Antofalla salar, including global lithium producer Albemarle. Argentina Lithium recently dropped the Arizaro option.

Avalon Advanced Materials Inc. [AVL-TSX; AVLNF-FOTCQB; OU5-FSE] has prepared an independent Preliminary Economic Assessment (PEA) of its Separation Rapids lithium deposit, near Kenora, northwest Ontario. The updated

PEA reflects a simplified business model that focuses on initial production of lithium mineral concentrates, with potential for future expansion into production of the battery materials lithium carbonate and lithium hydroxide. This smaller scale development model reduces capital expenditure requirements substantially from the original model completed in September 2016, while generating attractive returns and reducing overall business risk.

Average annual revenue is estimated at \$90 million versus average annual costs of \$60 million, resulting in a pre-tax NPV (at 8% discount rate) of \$156 million and a pre-tax IRR of 27.1%. The post-tax NPV is calculated at \$102 million and the IRR at 22.7%.

Azincourt Energy Corp. [AAZ-TSXV; AZURF-FOTC] has options with **New Age Metals Inc.** [NAM-TSXV; PAWEF-FOTC; P7J-FSE] on eight lithium projects in the Winnipeg River pegmatite field located in southeast Manitoba. Mapping has extended the Eagle pegmatite approximately 300 metres west of the company claim boundary. A second phase of surface sampling at the Eagle pegmatite has returned assays up to 3.8% lithium oxide (Li₂O).

Belmont Resources Inc. [BEA-TSXV; L3L-FSE] reports further drilling is planned at its Kibby Basin property 65 km north of Clayton Valley, Nevada. In conjunction with drilling, exploration will include downhole geophysical surveys in order to identify lithium brine prospective permeable and conductive zones above and within the conductive anomaly identified by Quantec's MT survey in February 2018.

A September 12 news release described assays from samples between 970 and 1,210 feet (240-foot thickness) that contained an average of 390 parts per million lithium.

On September 28, the company reported 20 samples which exceeded 100 ppm lithium with seven samples assaying greater than 375 ppm, and up to 580 ppm Li at 1,791 feet. On October 31, 2018, Belmont reported a further 139-foot intersection averaging 393 ppm Li.

MGX Minerals Inc. [XMG-CSE; MGXMF-FOTCQB; 1MG-FSE] has until December 31, 2018 to earn another 25% (total 50%) interest in Belmont's Kibby Basin property with the goal of forming a 50/50 joint venture to utilize MGX's rapid lithium extraction technology.

Cypress Development Corp. [CYP-

LEFT: Drilling at the Belmont Resources Kibby Basin lithium prospect located 65 km north of the Clayton Valley, western Nevada. MGX Minerals is earning a 50% interest in the project. Photo courtesy Belmont Resources Inc.

TSXV; CYDVF-OTC] is focused on advancing its 100%-owned Clayton Valley, Nevada lithium project located adjacent to the producing Albemarle Corp. [ALB-NYSE] Silver Peak lithium mine. In September 2018, Cypress announced positive results from a PEA. Indicated resources are 3.835 million tonnes of lithium carbonate equivalent (LCE) contained in 831 million tonnes averaging 867 ppm Li and an inferred resource of 5.126 million tonnes of LCE contained in 1.12 billion tonnes averaging 860 ppm Li. Cypress' lithium deposit remains open at depth, with 21 of 23 drill holes ending in lithium mineralization.

Net present value is \$1.45 billion at 8% discount rate and 32.7% internal rate of return on after-tax cash flow at a lithium carbonate price of \$13,000/tonne; average annual production rate of 24,042 tonnes of lithium carbonate over a 40-year life. Capital cost estimate is \$482 million with pre-production and operating cost estimate averaging \$3,983/tonne of lithium carbonate. Payback period is 2.7 years.

Dajin Resources Corp. [DJI-TSXV; DJIFF-OTC; C2U-FSE] holds concessions or concession applications totalling over 93,000 hectares in Jujuy Province, Argentina that were acquired in regions prospective for brines containing lithium, potassium and boron. They are primarily in the Salinas Grandes and Guayatayoc salt lake basins. Dajin is partnered with **LSC Lithium Corp.** [LSC-TSXV], as operator, who must spend \$2,000,000 to earn a 51% interest in the properties. Exploration of the 4,400 hectares (10,873 acres) in San Jose/Navidad minas has commenced where 25 shallow brine samples were taken returning concentrations ranging from 281 mg/l to 1,353 mg/l averaging 591 mg/l lithium.

Dajin has a 100% interest in 403 placer claims covering 3,202 hectares in the Teels Marsh valley of Mineral County, Nevada.

These claims are known to contain lithium and boron values and are adjacent to the birth place of US Borax's first borax mine.

Dajin also holds a 100% interest in 145 placer claims covering 1,182 hectares in the Alkali Spring valley (also known as Alkali Lake valley), Esmeralda County, Nevada 11 km northeast of Albemarle's Silver Peak lithium mine.

Lithium Americas Corp. [LAC-TSX, NYSE] has completed transactions with subsidiaries of Jiangxi Ganfeng Lithium Co. Ltd. and SQM with respect to the Cauchari-Olaroz lithium project in Jujuy, Argentina. Under the transaction, Ganfeng acquired a 37.5% interest in Minera Exar S.A., the holding company for Cauchari-Olaroz, from SQM. Lithium Americas holds the remaining 62.5% interest. Ganfeng provided Lithium Americas with a US \$100 million loan to fully finance Lithium Americas' increased share of Cauchari-Olaroz's Capex.

Nemaska Lithium Inc. [NMX-TSX; NMKEF-OTCQX] reports project construction at both sites – the Whabouchi Mine and the electrochemical plant in Shawinigan, Québec – are on track with timeline and budget. Concentrate production is expected to start in H2 2019 with lithium salts production expected in H2 2020. A total of \$272.4 million or 31% of the total project budget has been committed.

Neo Lithium Corp. [NLC-TSXV] has completed an independent comprehensive environmental base study and has submitted it to the authorities of the Catamarca province, while also making significant progress in other critical technical aspects at its Tres Quebradas lithium brine project in Catamarca province, Argentina.

The pilot ponds have been operating for over 18 months and are now producing high-grade concentrated brine of approximately 4% lithium to feed the pilot plant.

Plateau Uranium Inc. [PLU-TSXV] is focused on lithium and uranium exploration and development on its properties on the Macusani Plateau, southeast Peru. The company controls all reported uranium resources known in Peru, significant and

growing lithium resources and mineral concessions covering over 93,000 hectares. Drilling at Falchani West returned 65 metres of 3,374 ppm Li (0.73% Li₂O) from 9-74 metres in a Li-rich tuff unit within broader interval of 172 metres of 2,908 ppm Li (0.63% Li₂O) from 7-179 metres (end of hole).

Rock Tech Lithium Inc. [RCK-TSXV; RCKTF-OTC; RJIA FSE] is trenching the McVittie area on its 100%-owned Georgia Lake lithium property in the Thunder Bay mining district of northwest Ontario.

Martin Stephan, CEO, said, "We are excited to begin the trenching program following up on the positive results from our Preliminary Economic Assessment announced October 2, 2018. The program is aimed at developing drill targets for future resource definition drilling to increase our resource tonnage further and to build up the McVittie area as a second main resource zone of our property."

The McVittie pegmatite, located south of the Nama Creek pegmatite, hosts the majority of the NI 43-101 resource estimate. Results of the PEA include a pre-tax NPV of \$312 million at a discount rate of 8% and a pre-tax IRR of 62.2%.

Vision Lithium Inc. [VLI-TSXV; ABEPF-OTC] has received encouraging assays from its Sirmac lithium property, acquired from the company's largest shareholder, Nemaska Lithium. The project is about 180 road-km northwest of Chibougamau, Québec. Channel sampling on the East Zone returned 13.5 metres of 1.85% Li₂O and 11.70 metres of 1.58% Li₂O. Drilling on the East Zone returned 5.6 metres of 1.36% Li₂O. Drilling on the Main Dike returned 19.8 metres of 1.62% Li₂O and 59.7 ppm Ta₂O₅.

COBALT COMPANIES

Bankers Cobalt Corp. [BANC-TSXV; BC2-FSE] has 12 concessions in the DRC. The 100%-owned Kankutu Project is comprised of four contiguous concessions near the operating Kimpe copper-cobalt mine. Work to date includes 8 km of access roads, 1,108 soil samples, 139 pits, 11 trenches, 60 RAB holes (2,474 m) and

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The development-stage, 100%-owned, Fortune Minerals NICO cobalt-gold-bismuth-copper project located 160 km northwest of Yellowknife, Northwest Territories. Bulk concentrate will be shipped to a refinery that Fortune plans to build in Saskatchewan. Photo courtesy Fortune Minerals Ltd.

26 RC holes that tested shallow mineralization. Exploration at the Kabolele and 292 projects included road building, drilling, trenching and sampling.

Brixton Metals Corp. [BBB-TSXV; BXTMF-OTC] released additional drill results from its 100%-owned Hudson Bay Project in the Cobalt Camp, northeast Ontario. Highlights from 11 holes included hole HB18-31 that intersected 1 metre of 3,290 g/t silver, 0.29% nickel and 0.14% cobalt within 2.00 metres of 1,667.30 g/t silver, 0.15% nickel and 0.07% cobalt from a 22-metre depth. Hole HB-18-34 intersected 1 metre of 1.96% cobalt and 16.20 g/t silver from 80 metres. Drill results from the nearby Langis Project included 6.00 metres of 4,719.33 g/t silver and 0.33% cobalt.

Cobalt 27 Capital Corp. [KBLT-TSXV; CBLIF-OTC] has warehoused almost 3,000 tonnes of cobalt metal in Europe and North America. Martin Vydra, Head of Strategy, told *Resource World* that the company's business plan is to offer investors direct exposure to cobalt and electric vehicle battery metals. That was the execution of a business plan. "That 3,000 tonnes of cobalt metal created the foundation of the company being able to launch an IPO and raise money in the capital markets and also raise credit so the cobalt metal is actually collateral against our credit line and it also creates a foundation for our ability to finance the projects we've gone after," he said.

"At some point in time, we will look to monetize that to maximize value to our shareholders and return to our shareholders," said Vydra.

Cobalt 27 has acquired a US \$300 million cobalt stream on Vale's Voisey's Bay Mine in Labrador, including from the planned Voisey's Bay Mine Expansion. The company's 32.6% Cobalt Stream is expected to deliver approximately 1.9 million pounds of cobalt per year to Cobalt 27, to be settled in physical delivery for the life of the mine, commencing January 1, 2021.

Cobalt 27 also has a 55% nickel stream and a 27.5% cobalt stream from Highland Pacific's Ramu Mine in Papua New Guinea as well as eight other royalty streams.

Cobalt Power Group Ltd. [CPO-TSXV; CBBWF-OTC] reported that three grab samples collected on the Silver Eagle lease in the Silver Centre area of the Cobalt Mining Camp returned cobalt values of 0.54%, 0.35% and 0.26%. A drill program of four to six holes (total 1000 m) is planned for fall. The company is acquiring the nearby Cliff Lake property.

Cruz Cobalt Corp.'s [CUZ-TSXV; BKTPF-OTC; A2DMG8-FSE] crews have mobilized for the start of diamond drilling on its Hector cobalt property located near the town of Cobalt, Ontario. The initial diamond drilling program will consist of four to seven holes. The company has completed Phase 1 exploration at the 4,980-acre Hector property that included rock, soil geochemical and ground magnetic geophysical. Cruz has nine cobalt projects throughout North America – five near Cobalt, two in British Columbia, one in Idaho and one in Montana.

First Cobalt Corp. [FCC-TSXV; FTSSF-OTC] reported drill results from its Iron Creek Cobalt Project in Idaho. Results demonstrate thicker cobalt mineralized zones as well as mineralization between the two recognized zones.

All drill holes reported contain mineralization over long widths and grades above the Inferred Resource average grade, including 25.7 metres of 0.35% cobalt and 0.62% copper (0.42% CoEq), 22.6 metres of 0.34% cobalt and 0.59% copper (0.40% CoEq) as well as 27.8 metres of 0.27% cobalt and 1.09% copper (0.38% CoEq). Higher grade mineralization occurs within the broader zones of mineralization, including 8.0 metres of 0.45% cobalt and 2.07% copper (0.65% CoEq). Several mineralized intersections occur in between the No Name and Waite zones, including 3.8 metres of 0.30% cobalt. Further drilling for an additional 300 metres along strike to the east of the current resource is planned to test extension of mineralization.

Fortune Minerals Ltd. [FT-TSX; FTMDF-OTCQX] reported that the Canadian federal governments and the Northwest Territories (NWT) have accepted the company's environmental assessment approval for the Tlicho all-season road with modified measures developed together with the Tlicho government. The Tlicho road involves construction and operation of a permanent 97-km highway extending north from Highway 3 to the community of Whati, NWT.

Fortune's 100%-owned NICO cobalt-gold-bismuth-copper project is 50 km north of Whati and the company has already received environmental assessment approval to construct a spur road from Whati to the mine site. Construction of the NICO Mine and concentrator is

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planned using the existing winter ice road, but all-season road access is required for mine operations in order to transport metal concentrates to a refinery for downstream processing to value-added metals and chemicals.

Great Atlantic Resources Corp. [GR-TSXV; PRZCF-OTC; PHO-FSE] reports 75% optionee **Explorex Resources Inc.** [EX-CSE; EXPXF-OTC] has completed silt sampling at the Kagoot Brook cobalt-manganese-base metals project in New Brunswick. Historical work at Kagoot Brook delineated two drainages, 2 km apart, that exhibit remarkably high cobalt values, up to 6,000 parts per million in the silts. Drilling is planned.

Great Atlantic is also exploring its South Quarry tungsten-lithium project in east-central Newfoundland.

LiCo Energy Metals Inc. [LIC-TSXV; WCTXF-OTC] is conducting Phase 2 diamond drilling programs for its Teledyne Cobalt and Glencore Bucke properties 6 km east-northeast of Cobalt. A surface exploration program is also underway on both properties to define more drill targets. At Glencore Bucke, a two-phase diamond drilling program of up to 4,000 metres is testing mineralization at the Northwest and Main zones, as well as testing additional targets that may be generated from the surface exploration program, with the intent of completing a NI 43-101 resource estimate upon the completion of the program.

At the Teledyne Cobalt property, a two-phase drilling program of up to 1,500 metres aims to extend known mineralization on the Main Zone, as well as test additional targets that may be generated from the surface exploration program, also with the intent of completing a NI 43-101 resource estimate upon the completion of the program.

GRAPHITE COMPANIES:

Graphite One Resources Inc. [GPH-TSXV; GPHOF-OTCQX] has been carrying out a summer field program at its 100%-owned Graphite Creek deposit 59 km north of Nome, Alaska. The program is a key step

International Battery Metals licenses lithium extraction technology

International Battery Metals Ltd. [IBAT-TSXV] has signed a second licensing agreement to license its lithium extraction technology to Ensorcia Argentina for use in the extraction of lithium chloride from lithium-bearing brine sources in Argentina. The resulting lithium chloride will be converted to lithium carbonate and/or lithium hydroxide. It may also be exported as a feed stock.

Int'l Battery will receive a 6% royalty on the netback sales price of all products produced and sold using the licensed technology and has also been granted a 10% common membership interest in Ensorcia Argentina.

Earlier, Int'l Battery entered into a licensing agreement with **Ensorica Metals Corp.** and its wholly owned subsidiary, Sorcia Minerals LLC, to license its lithium extraction technology to Sorcia for use in extracting lithium carbonate from lithium-bearing brines in Chile.

Dr. John Burba, CEO of International Battery Metals, stated, "We are very excited to be forming this alliance with Sorcia in the heart of the Lithium Triangle. One of our goals is to produce commercially viable technology with the smallest environmental footprint possible. Our technology is designed to extract lithium without the use of traditional evaporation ponds and our process does not add anything to the source brine, so it can be returned to the salar aquifer after the extraction of the lithium." ■

in the ongoing field work in support of Pre-Feasibility Study. The field program followed a \$4 million+ financing.

Northern Graphite Corp. [NGC-TSXV; NGPHF-OTCQX] reported that SGS Canada Inc. has initiated a comprehensive metallurgical test program on ore from the company's 100%-owned Bissett Creek graphite project, Refrew County, Ontario, to confirm results of previous studies which identified a number of promising opportunities to reduce capital and operating costs and further improve project economics. This work must now be brought up to the standards required in a full feasibility study.

VANADIUM COMPANIES:

Bluebird Battery Metals Inc. [BTT-TSXV; BBBMF-OTC] has begun initial exploration of its 100%-owned Ashburton Project located 315 km south of Karratha and 950 km north of Perth, Western Australia. The first phase of exploration will consist of ground reconnaissance mapping and sampling focused on areas where historical surface sample results, collected by others,

yielded highly anomalous cobalt values.

Bluebird also announced the discovery of new high-grade vanadium mineralization from the Phase One exploration program at its Canegrass Project, also in Western Australia. Hole BBRC001 returned 0.36% V_2O_5 over 102.0 metres, including 0.49% V_2O_5 over 20 metres and 0.78% V_2O_5 over 17 metres, including 1.03% V_2O_5 over 8 metres.

First Vanadium Corp. [FVAN-TSXV], formerly Cornerstone Metals Inc., has released the results from the first six of 69 reverse circulation drill holes from its Phase II drilling on the 100%-optioned Carlin vanadium project located six miles south of Carlin, Nevada. The objectives of this drill program were to infill and expand the Carlin vanadium deposit.

Drill results included 120 feet of 1.020% V_2O_5 , 70 feet of 0.651% V_2O_5 and 135 feet of 1.070% V_2O_5 . A total 216 historical and recent drill holes have been completed on the property.

Largo Resources Ltd. [LGO-TSX; LGORF-OTCQB] is involved in an expansion project to increase production

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capacity of the milling, fusion (deammoniator, furnace and flaking wheel), leaching and filtering areas at its Maracas Menchen Mine, Bahia State, Brazil. The expansion will see production capacity increase 25% from the nameplate rate of about 800 tonnes per month of vanadium pentoxide (V_2O_5) to 1,000 tonnes per month.

Capital expenditures for the plan are anticipated to total about US \$15.5 million. Construction began early June with completion expected in a year.

Maxtech Ventures Inc. [MVT-CSE] has planned detailed exploration on its two 100%-owned vanadium projects in Bahia, Brazil. The claims are on strike with Largo's producing Maracas Menchen vanadium mine. Exploration will be developed in stages with geological mapping throughout the area aimed at identifying the geological formation where vanadium mineralization is probable.

United Battery Metals Corp. [UBM-CSE] is advancing its Wray Mesa vanadium-uranium project in Montrose County, Colorado. The company states that the vanadium resource, based on a conservative vanadium:uranium ratio of 6:1, would be 1,626,000 (0.95% avg. grade) indicated and 1,014,000 (0.88% avg. grade) pounds inferred. For the uranium resource, there are indicated resources of 271,000 pounds of uranium (0.16% eU_3O_8) and 169,000 pounds of uranium (0.15% eU_3O_8) inferred.

Vanadium One Energy Corp. [VONE-TSXV; VDMRF-OTCQB;

9VR1-FSE] is expanding its Phase II drilling campaign at its Mont Sorcier vanadium-magnetite project 18 km east of Chibougamau, Québec. The company's plan is to continue outlining the South Zone by drilling an additional 2,000 metres in 10 drill holes, with each hole ~200 metres in length. Vanadium One also has a 100%-optioned manganese project near Clinton, BC.

Western Uranium & Vanadium Corp. [WUC-CSE; WSTRF-OTCQX] plans to reopen the Sunday Mine Complex (SMC) in Colorado. The company has a goal of upgrading the vanadium resource and monetizing these already significant vanadium resource holdings. The Sunday Mine Complex is an advanced-stage mine property comprising five individual mines (Sunday, St. Jude, West Sunday, Carnation and Topaz).

Zimtu Capital Corp. [ZC-TSXV; ZCT1-FSE] and one of its prospecting partners have signed an option agreement for Maxtech to earn a 100%-interest in the Lac Patu vanadium project in the Nunavik Region, Québec.

MANGANESE COMPANIES:

American Manganese Inc. [AMY-TSXV; AMYZF-OTC; 2AM-FSE] is a critical metal company with a patent pending hydrometallurgical process for recovering 100% cathode metals in lithium-ion batteries such as cobalt, lithium, nickel, manganese, and aluminum. AMY is focused on the recovery of these metals from lithium-ion batteries as their value can be as high as US \$75.8 million per GWh of energy, and the global demand for lithium-ion batteries is forecast to increase 18% annually to US \$46 billion in 2022.

Manganese X Energy Corp. [MN-TSXV; SNCGF-OTC; SSM-Lima] has been conducting metallurgical studies to upgrade ore and purification techniques to produce battery-grade material from its 100%-optioned Battery Hill manganese deposit in west-central New Brunswick. Several more stages in its research project have been completed.

The project is supported through an agreement with the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP). Further upgrading technologies and product purification methodologies will be evaluated in the coming weeks. ■