

## CEYLON GRAPHITE: BACK TO GRAPHITE'S ORIGINAL SOURCE

### Ceylon Graphite: Back to Graphite's Original Source

#### Summary

Ceylon Graphite Corp, is listed on the TSX Venture Exchange. The company is an explorer for graphite and engaged in the development of graphite mines in Sri Lanka. The company holds exploration rights over a land package of around 121km<sup>2</sup>. These rights cover areas of historic graphite production from the early twentieth century and represent a majority of the known graphite occurrences in Sri Lanka.

#### Positives and Negatives

- The price of most categories of graphite have picked up since 2017 but without going crazy
- Ceylon Graphite has accumulated a large land package with significant evidence of past production from the glory days of Sri Lanka as the world's prime producer of graphite
- Except for Syrah, most entrants are moderately sized and should not "spoil" the market
- China has now switched over to being a graphite importer
- Graphite price movements and stockpiled quantities remain essentially at the discretion of the Chinese
- The market could be flooded short-term by the massively oversized Syrah mine in Mozambique

#### Conclusion

The retreat of lithium and cobalt from their frenzied heights of 2017 and early 2018 has allowed for calmer minds to prevail and attention has turned back to graphite, a key component in the lithium-ion battery configuration that had been pushed to the side during the hype over other battery minerals. Ceylon Graphite is dedicated to production and is focussed intensely upon achieving that goal. With highly prospective past-producing territory the task is made that much easier

#### MINING

19/02/2019

SHARE PRICE	52 WEEK LOW
▲ C\$0.15	▲ C\$0.14
MARKET CAP	52 WEEK HIGH
▲ C\$8.49M	▲ C\$0.23
NAV	INDEX
▲ C\$2.97	▲ TSXV

#### MAJOR SHAREHOLDERS

Jacob Capital Management 47%

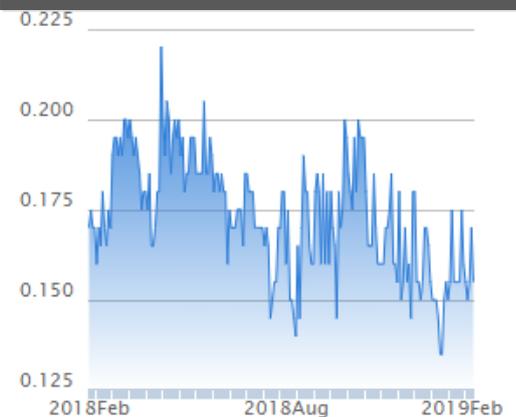
Shares in Issue 55,766,181

Index TSXV

EPIC CYL

Sector Mining

#### SHARE PRICE CHART



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#### Company Information

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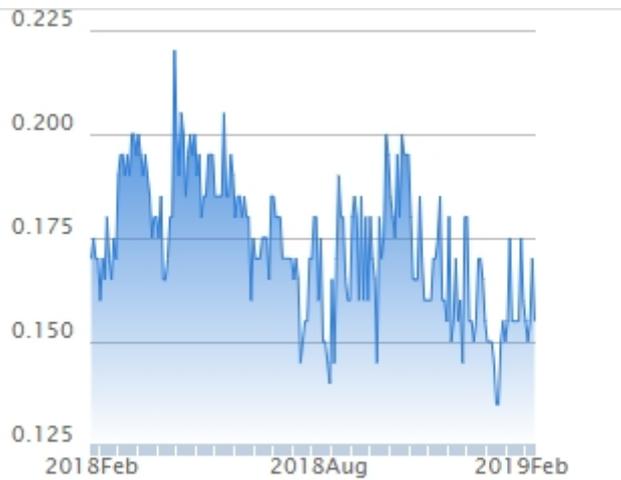
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## Share Price

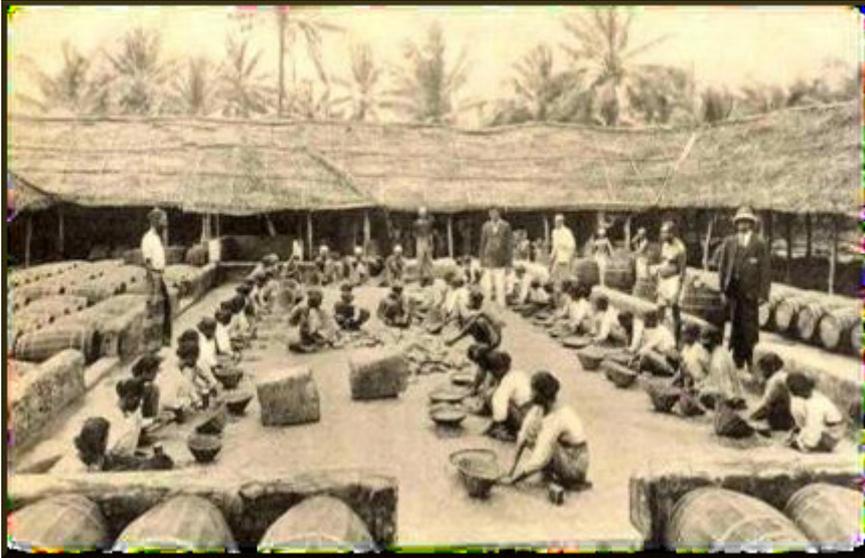


## Some Background on Graphite in Sri Lanka

To most mining mavens, Sri Lanka was a land of mystery, onerous state intervention and certainly not one of mining; however, Ceylon (as it was then known) and graphite were synonymous for hundreds of years. Graphite mined in Sri Lanka is known to be some of the purest in the world but currently accounts for less than 1% of the world graphite production.

The existence of graphite in Sri Lanka has been known since 1675 when the Dutch governor at the time, recorded its existence. Serious mining and export of Ceylon graphite began about 1824 with graphite exports peaking in 1899. when export tonnage was recorded as 33,411 metric tonnes or 35% of the world 's consumption. Export of graphite at the time counted for 22% of Sri Lanka's trade. Most of the graphite mines closed down after WWI and the 1929 Great Depression.

Below one can see the labour intensive "preparation" of graphite in 1910 at a Ceylonese factory.



Independence came in the 1950s and then there was a distinct socialistic trend in governments in the following decades culminating in the nationalisation of the graphite sector in 1971. The private sector was allowed back into Sri Lanka's graphite industry in the early 1990s, but by that time problems with the civil war were preventing development on a large scale. Additionally, many of the state-owned mines had been over-exploited, allowed to deteriorate and had not been subject to meaningful exploration to find new reserves. The opening of the mining sector in recent years has presented an opportunity for foreign companies to pursue Sri Lankan graphite on a significant scale.

## Geology

Sri Lanka is known to be underlain up to 90% by Proterozoic high-grade metamorphic rocks with Proterozoic sediments, particularly along the coastal regions. Vein graphite is known under various names including crystalline vein, Plumbago, Sri Lankan graphite, and Ceylon graphite. The name "Sri Lankan" and "Ceylon" are commonly used for vein graphite since the island is the only area to produce this material in commercial quantities.

Of all the natural graphite materials vein graphite is probably the most difficult to describe geologically and various theories of its origin have been presented. As the name suggests, vein graphite is a true vein mineral as opposed to a seam mineral (amorphous graphite) or a mineral that is disseminated throughout the ore rock (as in flake graphite). Seam minerals have some unique properties including their being non-contemporaneous with the country rock, steeply inclined (vein orientation), and subjected to filling by a host of minerals, especially those of hydrothermal origin.

According to the US Geological Survey Sri Lanka currently produces a very small amount of graphite, about 4,000 metric tonnes per annum. Sri Lanka's graphite is a unique product. The country produces lump and vein graphite and is the world's only source of these particular materials. Lump and chippy dust graphite are the highest-value graphite products found globally. These unique and comparatively higher margin vein (lump) deposits currently make-up less than 1% of the world graphite production. In 2018, prices for Sri Lankan vein graphite averaged \$2,300 per metric tonne - significantly higher than prices reported for other products, such as flake or amorphous graphite.

## Reactivation

This is not the first time that the Sri Lankan mining sector has opened up. The Sri Lankan mining scene had an outburst of activity during the late 1990s, during which time companies like mineral sands producer Iluka

Resources (ASX:ILU) actively explored the country; however, as is well-known, the country was long wracked by civil war with a Tamil insurgency that was finally quashed in recent years.

The disruption resulted in Iluka departing Sri Lanka in 2003, citing “accessibility” as a concern. The final defeat of the separatist forces in 2009 paved the way for the country to invite foreign investors to come back with even Iluka said to be considering a return to Sri Lanka’s deposits.

The Wall Street Journal reported that the government intended to offer significant tax incentives and a liberal regulatory framework to woo incoming investors in the mining sector. These would include a royalty rate of 5%, according to the country’s minister of environment and renewable energy, Susil Premajayantha. The minister added that the government “won’t levy any other charges”, presumably referring to extra taxes on mineral products.

## Other Players in Recent Times

Production in recent years has been sourced from two graphite mines:

Kahatagaha Graphite Lanka Ltd., owned by the government of Sri Lanka

- Producing 80-100 tonnes monthly
- Currently mining at a depth of 650m (2,000 feet)
- Minimum 90% purity with the majority by weight being lump type at 95% carbon, +10mm

Kahatagaha Kolongaha is one of the high-value mines accounting for Sri Lanka’s current output of lump and chip graphite. The mine has been in production since 1872 and reportedly produces a product with total graphitic carbon content greater than 90%.

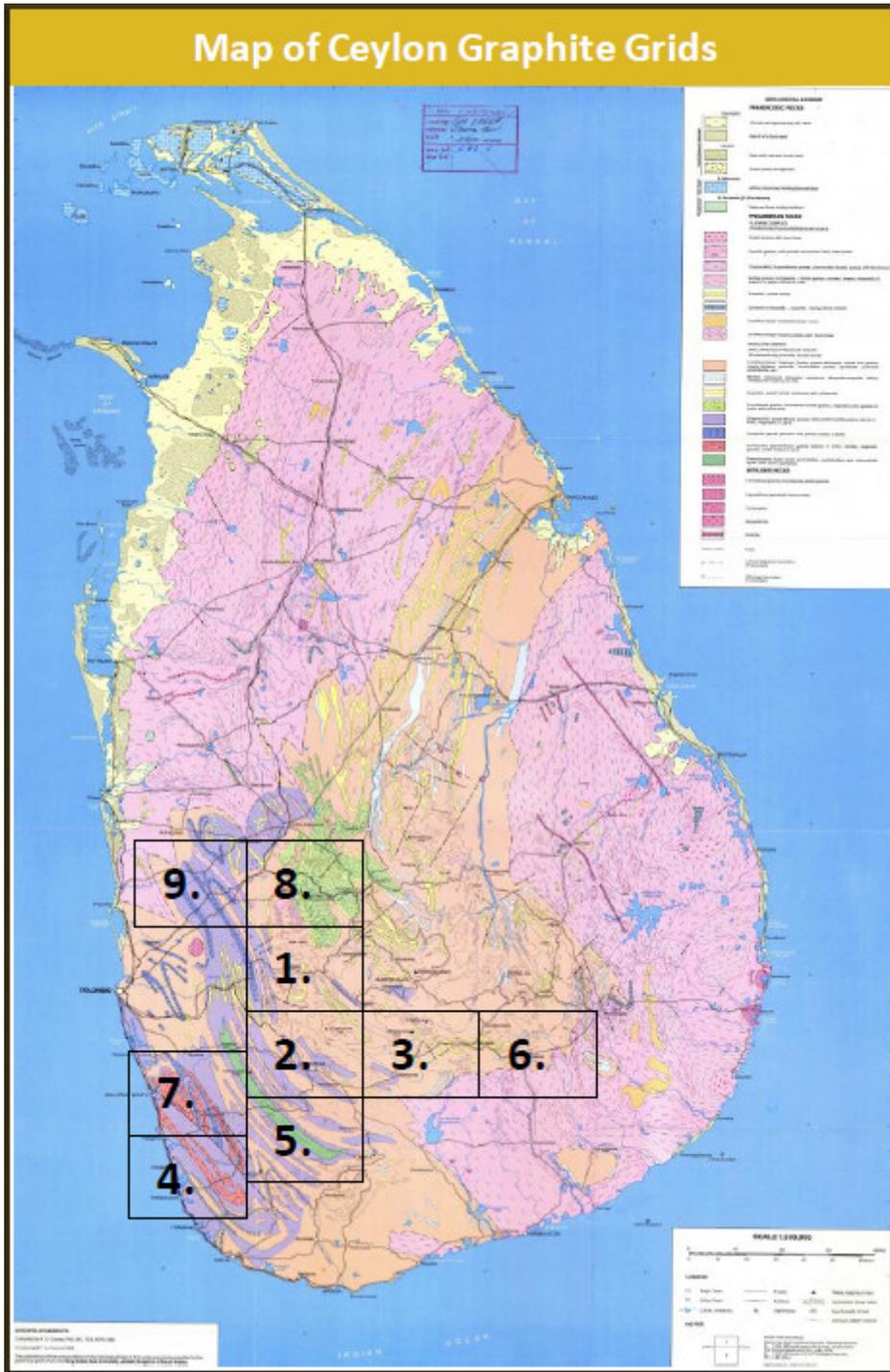
Bogala Graphite Ltd., a 90%-owned subsidiary of Germany’s Graphit Kropfmühl AG (ETR:GKR)

- Producing 250 tonnes monthly from one single vein mine
- Being mined from both ends at 2,299 feet from underground
- Was producing 600 tonnes of value-added graphite annually prior to the global recession

That company entered the Sri Lankan sector in 2000, buying control of the Bogala graphite mine, a historic operation dating back to 1847.

## Ceylon Graphite’s Assets

Total land package: 121 km<sup>2</sup> (121 grids at 1x1 km) that comprises most of the geologically identified graphite resources on government land in Sri Lanka (excluding mines currently in production).



The projects and the number of grids of which they are comprised are:

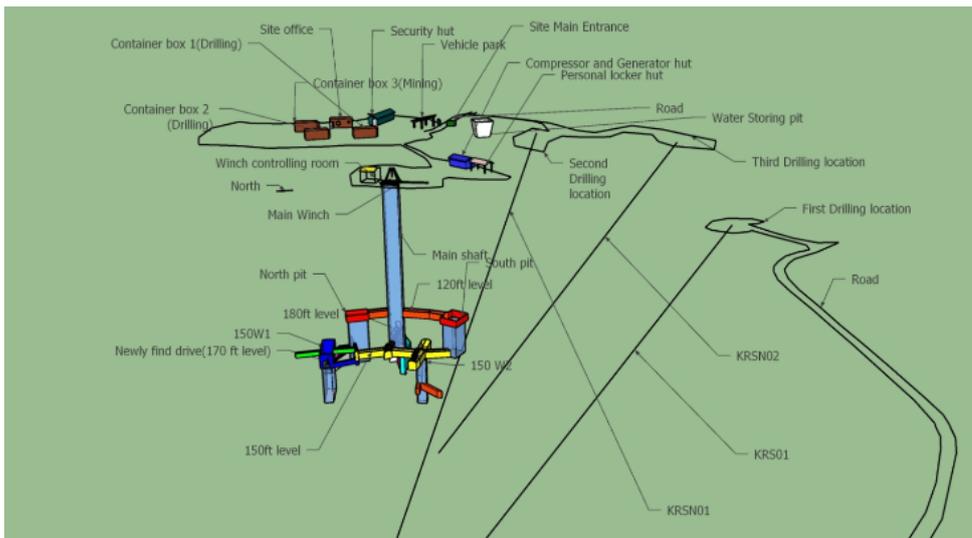
- 1. Avisawella 3 grids
- 2. Rathnapura 25 grids
- 3. Balangoda 1 grid
- 4. Ambalangoda 8 grids
- 5. Morawaka 2 grids
- 6. Nuwaraeliya 2 grids

7. Mathugama 24 grids
8. Kegalle 22 grids
9. Attanagalle 29 grids
10. Malsiripura 5 grids

AMC Mining Consultants conducted an explorative site visit of 43 of the 121 grids in the first half of 2013 in the Western Province of Sri Lanka. Ceylon Graphite has exclusive exploration licences on the majority of the most prospective areas, as identified by the Company in consultation with the Sri Lankan Geological Survey and Mining Bureau (GSMB)

## The K1 Project

The K1 project is Ceylon Graphite's prime development focus. The K1 site was selected for its historic crystalline graphite production as it contains a number of abandoned mine shafts and adits, and has ample dump material.



In May of 2017, the company announced assays conducted on a “pre-drilling” grab sample of historic dump material (graphite and quartzite) including substantial rock fragments of graphite from the K1 site. Samples of dump site material from history production yielded 86.63% carbon, and samples were subject to weather and oxidation from over 50 years.

K1 also has a drill rig on the property and shaft and adit refurbishment is currently underway. There is no NI 43-101 compliant resource at this time on this asset.

In April of 2018, the company announced the discovery of two new large graphite veins at a depth of more than 200 ft at the K1 site. Each vein is around 18 inches (46 cm) across and is situated in the ceiling of a drive on the Northside of the tunnel (shown in the picture below). Samples were taken from the veins and sent to the country’s Geological Survey and Mining Bureau for carbon testing. Laboratory tests indicated a Cg level of 89.2 %. These samples were sent to laboratories for micronization to 20 microns and then spheronization tests.



Further work resulted in an announcement in September that assay test results of samples from the large, untapped natural graphite vein discovered in late August 2018 at its K1 site came in at 97.61%. K1 has now yielded up six sizeable veins over a relatively short period of work.

The company's geologists expect there to be additional similar sized or larger veins at lower depths and the company continues to actively pursue its aggressive exploration plan at its K1 site, while rehabilitating the main shaft.

Samples were also sent to the leading graphite testing laboratory, Dorfner Anzaplan, in Germany that certified that graphite from the K1 meets the specifications of **marketable battery-grade graphite**. They also confirmed that the graphite obtained from the K1 project is upgradable and has a carbon content of about 99.96%. The test results show that K1 can supply high-quality graphite that lithium-ion battery manufacturers can use in their products. The company's next step is to evaluate the production of spherical graphite and how feasible it is.

### **The Malsiripura Graphite Project**

This project (also abbreviated to M1) is located at about 120 km NE of Colombo, the capital of Sri Lanka. Within 30 kilometres of the licence area, are the larger regional centres of Kurunegala and Dambulla. The smaller village of Melsiripura, located some 15 kilometres south from the mining property, acts as a support base.

The area had not been subject to any modern exploration work prior to 2012. In that year, the acquisition of 75% of licence EL/211 by Bora Bora Resources (ASX:BBR) from Australia spurred an exploration programme. The lands surround the aforementioned Kahatagaha Kolongaha graphite mine.

BBR's programme comprised a compilation of all previous data by the Geological Survey and Mine Bureau of Sri Lanka, a helicopter-borne magnetic and VTEM survey, road building, trenching, followed by a 5,000m drilling programme, assaying and a bench metallurgical test. Exploration ceased in 2016. Ceylon Graphite picked up the property in mid-2018.

Numerous narrow veins and some meter- scale massive graphite veins were intersected. The mineralised zones encountered during the drilling programme have returned several high-grade intersections of crystalline graphite. The digitalisation of the drill results with the assays showed the presence of several mineralised zones comprising high-grade veinlets and veins (80% to 98.6% Cg) and disseminated to semi-massive graphite mineralisation ( 5% to 50% Cg).

Below can be seen one of the surface graphite veins at M1.

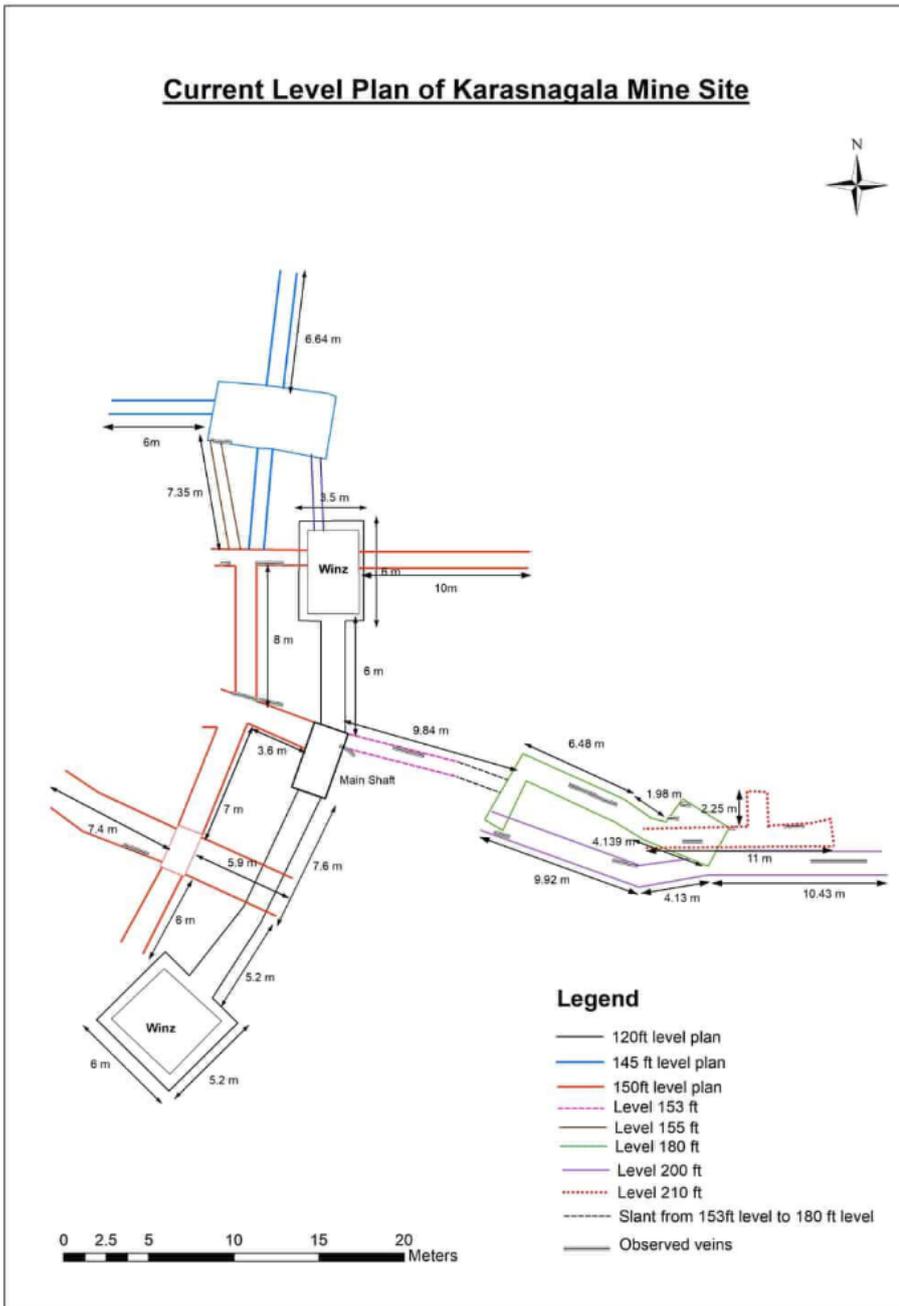


In May 2018, the company commissioned a senior mine geologist to prepare a mineral estimation based on the 2015 borehole data. The consulting geologist interpreted the presence of four E-W (east-to-west) orientated veins (Kahatagaha vein-type) which gave a mineral resource of 76,574 tonnes with no specified Cg grade. Sinking of a shaft on the south vein and the boring of a NNE oriented adit were recommended.

In an NI43-101 report published in August 2018 the consultants (CDGC of Quebec), using a low cut-off grade of 2% Cg, calculated a mineral resource of 159,544 tonnes averaging 8.15% Cg. This scenario was identified as the base case for an Indicated Mineral Resource of 37,234 tonnes at 9.79% Cg and 122,309 tonnes at 2.76 % Cg classified as inferred mineral resources. These mineral resources contained all the known lump veins grading between 80.20% and 98.60% Cg over thicknesses ranging from few centimetres to 0.72 m. Their length ranges from a few metres to a maximum of 75 m. A total of 13,000 tonnes of Carbon Graphite is contained within the mineralised envelope.

## **Strategy Going Forward**

The mantra at Ceylon Graphite is production, production and production. To this end, applications have been made for mining licences at both K1 and M1 projects. It is viewed as most likely that K1 will come through first. There is an expectation that this may be achievable in the first quarter of 2019 (1Q19). At that mine, the company has already refurbished the shaft down to 150ft from where it can access other parts of the old mine. Below is a plan of the mine.



Reactivation of the mine is an exceedingly low capital expenditure (capex) operation in Sri Lanka. Each 100ft of shaft refurbishment only costs around US\$40,000. Below can be seen the entrance to the rehabilitated shaft.



Once the facility is ready for production the further processing of the high-grade material will be undertaken by one or various sources inside or outside Sri Lanka. To this end, the company is engaged in talks with several groups at this time, including the potential for a joint venture (JV) with a local processor.

We would emphasise that the company is *not* looking to get into the business of spheronization in the short-term.

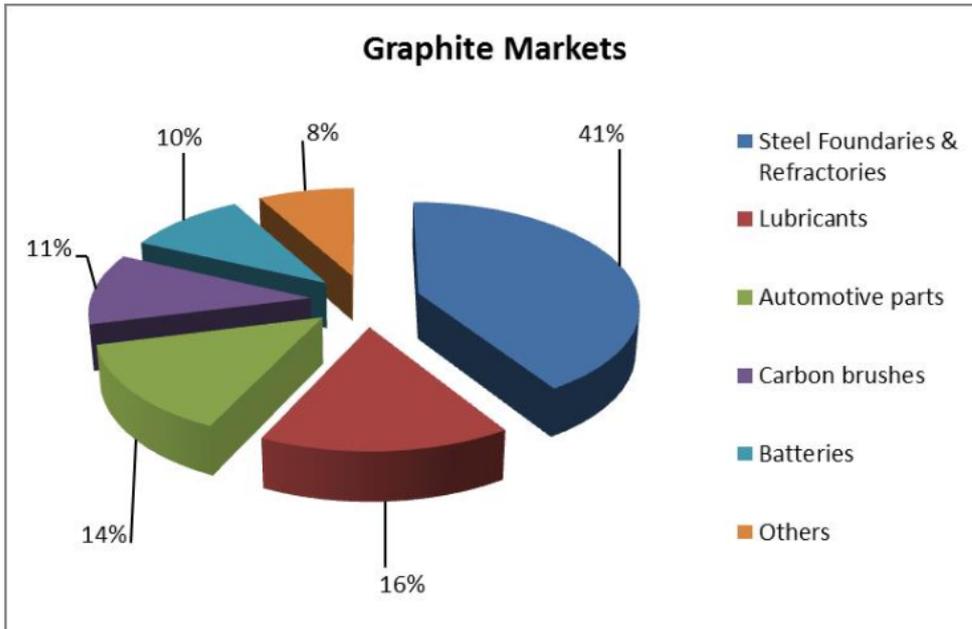
Management estimates the operating expenditure (opex) to be slightly less than US\$200 per tonne of graphite. As noted, Sri Lankan vein graphite sells at around USD\$2,300 per tonne in its raw form. Even if the upgrading to battery grade graphite costs US\$100 per tonne (and that is a far cry from reality), with the selling price of the upgraded material in the US\$5,000 per tonne range the economics are very favourable for Ceylon Graphite

## Graphite - Applications

The mineral graphite has the chemical symbol C (as do diamonds and coal). The application for graphitic material is constantly evolving due to its unique chemical, electrical and thermal properties. It maintains its stability and strength under temperatures in excess of 3,000°C and is very resistant to chemical corrosion. It is also one of the lightest of all reinforcing elements and has high natural lubricating abilities.

The mineral is considered as one of the more strategic elements in some surveys coming out of leading industrial nations, though this is relatively new as its main uses were for cathodes (as in aluminium smelting) and steel-industry crucibles which, while important, scarcely rank as strategic uses. Two qualities of graphite that are driving the new applications are its electrical conducting powers and its lubricant qualities (both in wet and dry forms). Much talk relates to the new application known as grapheme that has been endowed with a variety of powers by its enthusiasts.

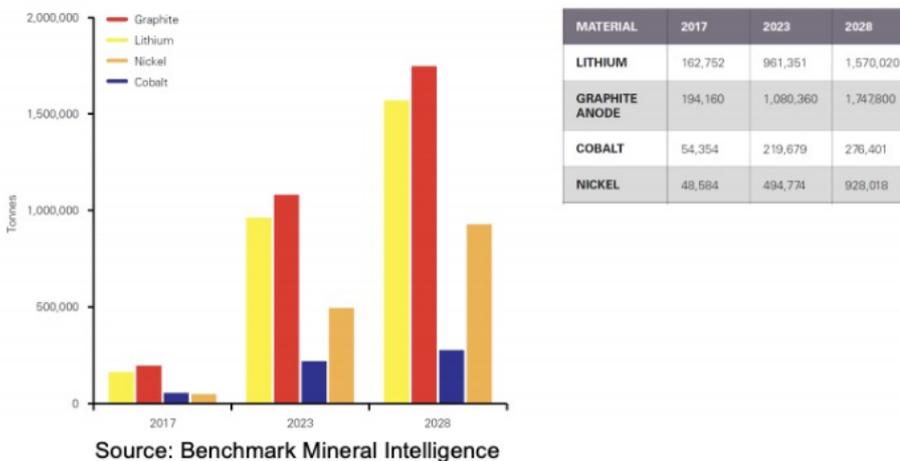
Below can be seen the current usages for graphite:



The proven usage that has generated most excitement in recent times is that of batteries, primarily nickel-metal-hydride and lithium-ion batteries. The demand is not phantom by any means as it has been a prime driver of graphite demand since the late 1980s. The underlying reason for this growth was the expansion in the usage of portable electronics, such as portable CD players and power tools. Laptops, mobile phones, tablet, and smartphone products have increased the demand for batteries. Electric vehicle batteries are anticipated to increase graphite demand.

Natural and synthetic graphite are used to construct the anode of all major battery technologies. The lithium-ion battery uses roughly twice as much graphite as a lithium carbonate battery. As an example, a lithium-ion battery in a fully electric Nissan Leaf contains nearly 40 kg of graphite. An oft-quoted statistic is that the average lithium-ion battery in a mobile phone or laptop has ten times as much graphite as there is lithium.

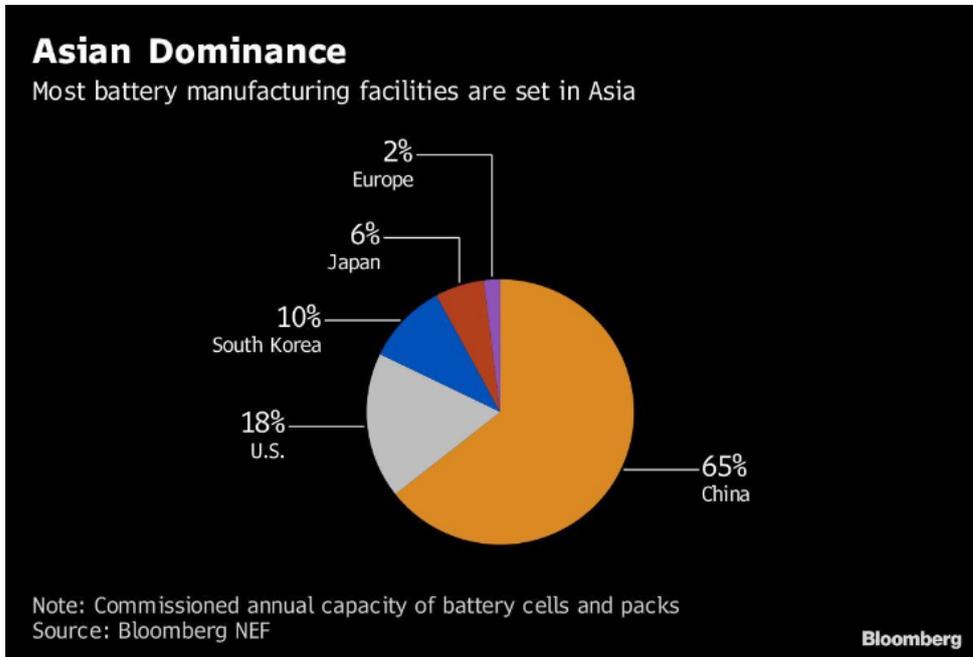
**Lithium ion Battery Megafactory Raw Material Demand (tonnes)at 100% Utilisation Rate**



A lot of the more bulk uses of graphite utilize the more prolific grades; hence the lack of crisis mode in government circles in the West with relation to this mineral.

## Asian Dominance

Ceylon Graphite is well positioned geographically as the overwhelming weighting of the battery production space is still (for the moment) in Asia as the chart below shows:



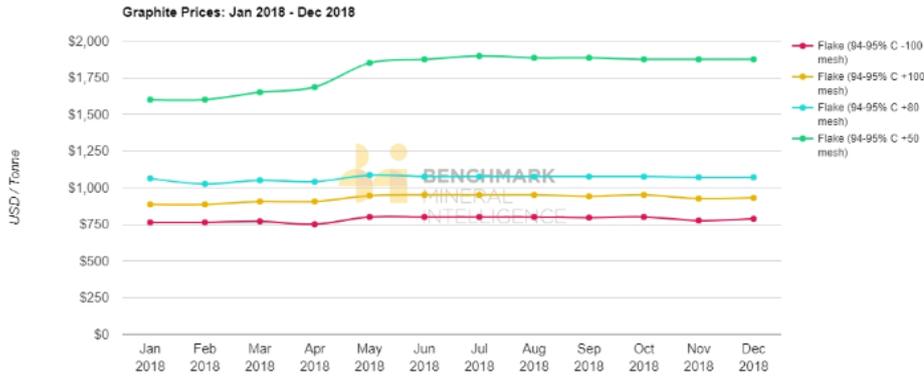
## Graphite - the Ups & Downs

While graphite shows little potential for the same type of price squeeze that has propelled other battery metals higher, there is a distinct feeling that major Western end-users want to see a non-Chinese graphite supply (and downstream value-added chain) industry evolve so they will not be vulnerable to Chinese policy gyrations or attempts at market manipulation.

The turn in graphite prices occurred in mid-2017 with the price of large flake (+80 mesh) graphite increasing by around 30% in the space of a few months, again breaching the key US\$1,000/tonne (FOB China) level. The move was driven by tightness in the supply of large and XL flake graphite and some speculative investment.

European and North American prices usually trade US\$50-100/tonne higher than China FOB, most of the time. XL flake (+50 mesh) prices have also risen significantly while smaller flake sizes have experienced more moderate price increases.

Since the price uplift of 2017/18 the mineral in all its categories has largely flat-lined:



Source: Benchmark Minerals

Reasons cited for the revival in graphite prices include:

- Production and supply problems in China due to stricter enforcement of environmental and safety standards and restrictions on the use of dynamite in some areas. High purity and large flake sizes have been particularly affected. Also, production costs have continued to increase due to environmental regulations, higher taxes and land fees, labour and power cost inflation and shortages of ore supply. China is introducing a new environmental tax in January, 2018 which is expected to have a significant effect on the graphite industry and has announced its intention to build a graphite stockpile equal to 80 per cent of annual production by 2020.
- The steel industry started to recover in 2017 but has been flat-lining of late. Refractories remain the largest market for flake graphite and mainly require larger flake sizes.
- Continued strong growth in lithium-ion battery demand. Small flake graphite is used to make LiB anode material because it has been plentiful and low cost. If LiB demand growth meets expectations, anode material suppliers will likely have to start using larger flake sizes and competing with traditional markets for supply creating further pressure on prices. Also, synthetic graphite prices have surged due to environmental and capacity problems relating to its main use in electrodes for the steel industry. This is seriously affecting the supply and pricing of synthetic LiB anode material, which makes natural graphite more attractive.
- XL flake production is declining as resources in Shandong Province, a major source, are being depleted and it has also been heavily affected by environmental closures. Heilongjiang Province, the largest producing region, has mainly smaller flake. The expandable graphite market, which is largely based on XL flake, is one of the fastest growing along with LiBs and this is putting additional pressure on prices. Expandable graphite is used for thermal management in consumer electronics, as a gasket material in the automotive, petroleum, chemical and nuclear industries, to make conductive plates for fuel cells and flow batteries, and as a fire retardant.

## Other Factors

There is a 6% royalty payable on industrial minerals not exported and 7% royalty payable on exported industrial minerals. These payments are not required until mining operations commence and are then payable from sales or determined market value of mine output.

## The Team

**Bharat Parashar** is the president & chief executive officer (CEO) and a director. He was formerly the

managing director and co-head of Salomon Smith Barney's investment banking business in South and South East Asia. He has 36 years of investment and corporate banking experience in Asia, including as chief executive for American Express Bank in India and the head of Chemical Bank's investment banking business in Asia (ex-Japan). He executed numerous debt and equity transactions, raising more than US\$8 billion for regional corporations and governments.

**Dr Christian Derosier** is the senior consulting geologist. He has served as a director of the Prospectors and Developers Association of Canada and served as a vice president and the president of the Quebec Prospectors Association. He has founded a number of Canadian junior exploration firms and served as their director and president. He has more than 40 years of exploration experience working on and heading up exploration programmes for Canadian and international exploration and mining companies in countries such as Canada, USA, Columbia, Peru, Chile, Argentina, Venezuela, Ecuador, the People's Republic of China, Belgium, France, Cameroon, Guinea, Ghana, Madagascar, Morocco, Algeria, Tunisia, Mali, Niger, Nigeria, Haiti, and Guyana.

**Robert Marvin** is a non-executive director. He is a resource geologist and has been involved in mineral exploration and evaluation of lithium, gold, copper, zinc and uranium deposits throughout the Americas as an employee and as an independent consultant. He graduated from the University of New Mexico with a Bachelor of Science degree in geology in 1984.

He has been involved in several successful gold-silver projects in Canada, most recently with Bayfield Ventures in the Rainy River gold district in Ontario but also at Meliadine and in the Committee Bay Belt of the far north.

**Kevin Aylward** is a non-executive director. He has extensive public/private sector management experience in the resource and transportation sectors. Most recently he has worked in the oil sands industry and with First Nations groups on business development and environmental technology issues. Previously, he served as CEO of the Goose Bay International Airport and Nunacor Development Corporation. He also served as a provincial cabinet minister for nine years with the government of Newfoundland and Labrador including the Environment, Labour and Forestry portfolios. Aylward also served as leader of the Liberal Party of Newfoundland and Labrador during the provincial election in 2011.

**Abbey Abdiye**, the chief financial officer, has extensive experience in the financial sector in both public and private companies. He is a chartered professional accountant (CPA), and current chief financial officer of reporting issuers, where he is responsible for all financial, fiscal management, regulatory compliance matters and reporting aspects of company operations. He also provides strategic guidance and direction in capital structuring and is engaged in innovative financing programmes that leverage sales and development.

**Brett James** is a non-executive director. He has been a partner and principal of Sussex Strategy Group since 2000. He provides clients with strategic counsel on major business issues; informed and intelligent guidance on their government interaction and communications advice to leverage public opinion on issues affected by government decisions. He continues to be a senior advisor and fundraiser for candidates and campaigns across the country.

**George Smitherman**, a non-executive director, has served at all three levels of Canadian government over three decades. During a five-year run as Minister of Health and Long Term Care he oversaw the largest government department in Canada with a budget of more than \$30 billion.

In response to the 2008 financial crisis, he was transferred to the newly formed Ministry of Energy and Infrastructure and was leading Ontario's economic renewal strategy.

On the Infrastructure side, he spearheaded negotiations with the Government of Canada over a shared multi-billion dollar infrastructure stimulus programme.

## Risks

It is important to highlight general and specific risks which, in the case of Ceylon Graphite, we perceive as being:

- Graphite price weakness
- Financing difficulties
- Country risk in Sri Lanka
- Excessive supply from too many projects coming online mid-term

Price weakness is less a case of potential demand faltering (which is highly unlikely) but rather of some sort of malevolent price-spoiling action emanating from China. If it did it would be self-harming in the first instance.

Financing is a perennial issue in mining markets but with a mine in Sri Lanka up and running (and on minimal capex) the company would be moving into that sweet spot where it does not need more money *per se* but has the luxury, as a producer, of being able to expand from cash flows or funding from off-takers that now realise that the company is “real”.

Exotic locations like Sri Lanka come with their tribulations, but the civil war in the country is now retreating farther into the past. Also left behind are the strange nationalist/socialist economic policies that ruled for decades after independence. The lessons have been learnt that these did not help the mining sector in particular.

As noted many of the remaining graphite projects won't be going anywhere due to excessive capex numbers attached to their aspirations. Syrah will most likely be the only “big” producer to come to market with the other likely entrants being non-disruptive smaller capex developers. Thus Ceylon Graphite is likely to be part of a small band of producers, rather than trampled in a rush of bigger players.

## Conclusion

Graphite was not the first battery metal to have its “day in the sun” for lithium was a first mover late last decade then fizzled. Graphite, however, had its own boomlet in 2012-13 and then went back into quiescence; however, prices snapped out of their doldrums in 2017 and have remained at reasonable levels since.

Ceylon Graphite mercifully missed the first go-around in the market so was not scarred by that event. It arrived fresh and could learn from the mistakes of others.

While graphite shows little potential for the same type of price squeeze that has propelled other battery metals higher, there is a distinct feeling that major Western end-users want to see a non-Chinese graphite supply (and elaboration) industry evolve so they will not be vulnerable to Chinese policy gyrations or attempts at market manipulation.

The new mantra in the graphite space is production, production and production. Ceylon Graphite's management is not interested in going through the motions of endless drilling and reporting to avoid the inevitable; they too want to get into production as soon as possible.

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