ASX: EV1 | 6 July 2022

ASX ANNOUNCEMENT

Extremely low level of impurities open door to advanced battery and nuclear applications

HIGHLIGHTS

- **Evolution is undertaking a commercial verification program with an established US manufacturer of battery graphite products to evaluate the amenability of Chilalo graphite fines to producing coated battery anode materials using thermal purification and proprietary coating technologies.[1]**
- **Detailed analysis of impurities in Chilalo's 95% C flake graphite fines concentrate has identified extremely low levels of naturally occurring Molybdenum and Boron, opening the pathway to two value-added markets:**
    - **Premium performance batteries – where extremely low concentrations of molybdenum are a prerequisite; and**
    - **Nuclear-grade graphite – which requires naturally low levels of boron.**
- **Both applications require high-purity graphite (99.95% - 99.995% C respectively) with Evolution and its US technology partner utilising environmentally friendly thermal purification as the first step in its flowsheet to produce battery anode materials.**
- **Low molybdenum purified graphite for use in the advanced battery industry currently sells for between US$8,000-18,000 per tonne.**
- **Qualified purified graphite sells for approximately US$30,000 per tonne into the nuclear industry.**
- **Battery anode testwork is ongoing with results to be reported to the market over the coming weeks.**

Evolution Energy Minerals ("Evolution" or the "Company") (ASX: EV1, FSE: P77) is pleased to report on initial results from its commercial verification program to assess the suitability of the fines fraction of graphite from the Company's Chilalo Graphite Project for advanced battery applications.

Chilalo is planned to primarily produce coarse flake graphite products suitable for expandable graphite and graphite foil applications, with 64% of the flakes reporting to the coarse fraction (+100, +80, +50, +32 mesh). Evolution has entered into a binding offtake agreement with YXGC for the sale of 30,000tpa of coarse flake graphite for a minimum of three years[2].

The fines fraction (-100 mesh) represents 36% of the Chilalo output and is the subject of this commercial verification program. Evolution is assessing the potential for fines material from Chilalo to be used in coated battery anodes for lithium-ion batteries. To be suitable for battery usage (ie. battery grade), graphite needs to be purified to at least 99.95% C and contain maximum levels of certain impurities.

The first stage of testwork in the US has confirmed that the levels of Boron (**B**) and Molybdenum (**Mo**) remaining in the Chilalo fines concentrate (even prior to purification) are extremely low compared to industry standards. Both of these elements are relatively difficult to remove from concentrates and impact

[1] For further information on Evolution's sustainable battery anode materials strategy, see ASX announcement 14 February 2022.
[2] ASX Announcement 9 May 2022 – Binding offtake agreement for Chilalo coarse flake graphite.

performance, so very low levels are expected to be viewed extremely positively by battery manufacturers. It also opens up a pathway to produce a high-purity, low-Boron product that is suitable for the nuclear industry.

The next stage in the testwork process is to assess the purification, milling and shaping and electrochemical properties of the fines product. In consultation with the Company's US technology partner, Evolution intends to adopt a process whereby the fines material is purified first before being milled and shaped (the opposite of conventional battery anode processing).

Phil Hoskins, Managing Director of Evolution Energy Minerals, commented, "*It is very pleasing that the exceptionally low Molybdenum and Boron content of Chilalo graphite opens two pathways for use of our graphite in value-added markets: a range of premium performance batteries, where extremely low concentrations of molybdenum are a prerequisite, and nuclear-grade graphite, which requires naturally low levels of boron.*

"Our US technology partner will aim to use advanced technologies to build on this foundation, to size, shape, coat, and otherwise process our premium-quality flake graphite and turn them into battery and nuclear industry-ready graphite commanding premium prices."

Technical Discussion

Elemental impurity analysis

Elemental impurity analysis has confirmed extremely low levels of impurities which indicate suitability for advanced battery materials and nuclear applications. The testwork was performed by Evolution's technology partner in the United States, using a representative sample of Chilalo graphite concentrate produced by SGS Lakefield. Evolution's technology partner is an established developer and manufacturer of various industrial graphite products for batteries, premium-performance electrically conductive coatings, and graphite shapes and parts.

The concentrate grade from SGS Lakefield was measured to contain 95.7 wt.% C and a specific surface area of 2.83 m^2/g. Elemental impurity analysis performed by two concurrent methods of Glow Discharge Mass Spectroscopy and Inductively Coupled Plasma on Solids revealed extremely low concentrations of deleterious elements, even in this concentrate-purity material. Of particular relevance are the extremely low levels of naturally occurring molybdenum and boron. Refer to Appendix 1 for the detailed results of elemental impurity analysis.

Molybdenum levels indicate suitability for advanced battery materials

The concentration of Molybdenum (**"Mo"**) was measured to be below 0.5 parts per million (**"ppm"**) (see Appendix 1). This makes Chilalo flake graphite a prime candidate for a variety of advanced battery systems including lithium-ion, lithium primary and alkaline battery platforms.

According to Evolution's US technology partner, the majority of flake graphite available on the market has high Molybdenum concentrations (ranging from 20-200 ppm in concentrate-purity graphite). Finding sources with a Molybdenum concentration of <15 ppm poses a significant challenge for the advanced battery materials industry. At <0.5ppm molybdenum, Chilalo graphite is two orders of magnitude smaller in concentration than the lower threshold required for application in advanced battery materials.

Molybdenum is widely recognized as a deleterious element in batteries, ranging from lithium-ion to alkaline technologies. Molybdenum forms high-temperature alloys with carbon and is very hard to remove from the graphite particles as a result. Any Molybdenum remaining in the body of graphite flakes, if put within a corrosive battery environment, will leach out, diffuse through the separator, and enter into parasitic side reactions that lead to gas evolution and compromise cell hermetic sealing.

To suppress gas evolution, costly additives are necessary. For example, in alkaline cells, Indium and Bismuth are added to Zinc anode gel to prevent Hydrogen evolution. More Indium is needed to counter the effects of Molybdenum impurities, if the latter is found in cathode, as part of graphite in particular. Indium is one of the most expensive components of an alkaline battery at approximately US$500/kg. The ability to use flake graphite with low Molybdenum will therefore assist alkaline battery manufacturers to reduce the cost of their battery product by allowing for lower gas suppressant expenses.

Boron levels indicate suitability for nuclear applications

Besides its use in batteries, low-Boron (**B**) feedstock is preferred for nuclear applications. In order to supply graphite into the nuclear industry, graphite must meet the purity specification of 99.995% C whilst having a total equivalent boron concentration less than 2 ppm per ASTM Standard C1233-15. The concentration of Boron in Chilalo concentrate (95.7% C) was measured at 0.77 ppm (see Appendix 1). It is expected that this Boron concentration would reduce even further with thermal purification of the graphite.

Based on ASTM standard *D7219-08 – Standard Specification for Isotropic and Near-isotropic Nuclear Graphites*, Chilalo flake, even in its concentrate form – meets this standard. The primary demand driver for ultra-high-purity graphite is nuclear applications, specifically Pebble Bed Modular Reactors which consume approximately 60,000 tonnes of purified graphite per annum, noting there are several other uses for graphite in the nuclear industry.

Market pricing

It is expected that after thermal purification, elemental analysis of thermally purified Chilalo graphite will reveal even lower levels of molybdenum and boron. Advanced, low-Molybdenum purified graphite for use in the alkaline battery industry currently sells for US$8,000-18,000 per tonne, depending on the grade of battery-ready product.

In the nuclear industry, qualified graphite sells for US$30,000 per tonne. Chilalo graphite's unique and favourable mineral content means that both markets represent lucrative opportunities for Evolution's commercialization efforts.

Evolution's technology partnership

Evolution has now been working with its US technology partner for over five months. While the primary focus of this work relates to a commercial verification program to evaluate the production of coated battery anode materials using commercially proven thermal purification and proprietary coating technologies, the work is also assessing the suitability of Chilalo graphite for a range of high-value downstream applications. The Company has commenced a process to formalize a technology partnership that will allow Evolution to utilize advanced technologies developed by its US partner as well as utilising their production facilities to toll treat Chilalo graphite for the purposes of product qualification initiatives with battery manufacturers.

Next steps

Battery anode testwork is ongoing, with further results expected in the coming weeks. The testwork will now assess the purification and milling and shaping processes to determine the purification levels and yields achievable into finished product, coated spherical graphite. Thereafter, if successful, the program will incorporate the proprietary coating technology of the Company's US technology partner and test the electrochemical properties (ie. performance in a battery), long term cycling (how it performs over time) and specific end use analysis.

This announcement has been approved for release by the Evolution board of directors.

For further information please contact:

Phil Hoskins
Managing Director
phoskins@ev1minerals.com.au
T: +61 8 9200 4960

Michael Bourguignon
Executive Director
mbourguignon@ev1minerals.com.au
T: +61 8 9200 4960

Andrew Rowell
White Noise Communications
andrew@whitenoisecomms.com
T: +61 400 466 226

European investor relations
Eva Reuter
Dr Reuter Investor Relations
e.reuter@dr-reuter.eu
T: +49 69 1532 5857

Appendix 1: Elemental impurity analysis of Chilalo's flake graphite concentrate

Element	Concentration, PPM (unless otherwise stated)	Element	Concentration, PPM (unless otherwise stated)	Element	Concentration, PPM (unless otherwise stated)
Li	3.3	Sc	0.12	**Mo**	**<0.05**
Be	0.55	Ti	9.4	Ba	0.51
B	**0.77**	V	8.5	Sr	0.25
F	2	Cr	13	Y	0.28
Na	19	Mn	16	Zr	5.9
Mg	45	Fe	830	Nb	0.07
Al	0.7%	Co	0.97	Cl	1.3
Si	2%	Ni	19	K	6.8
P	26	Cu	11	Ca	49
S	33	Zn	2.5	**C**	**95.7%**