

ASX Announcement (ASX:AXE)

12 March 2019

## Spherical graphite produced from Campoona deposit

### Highlights

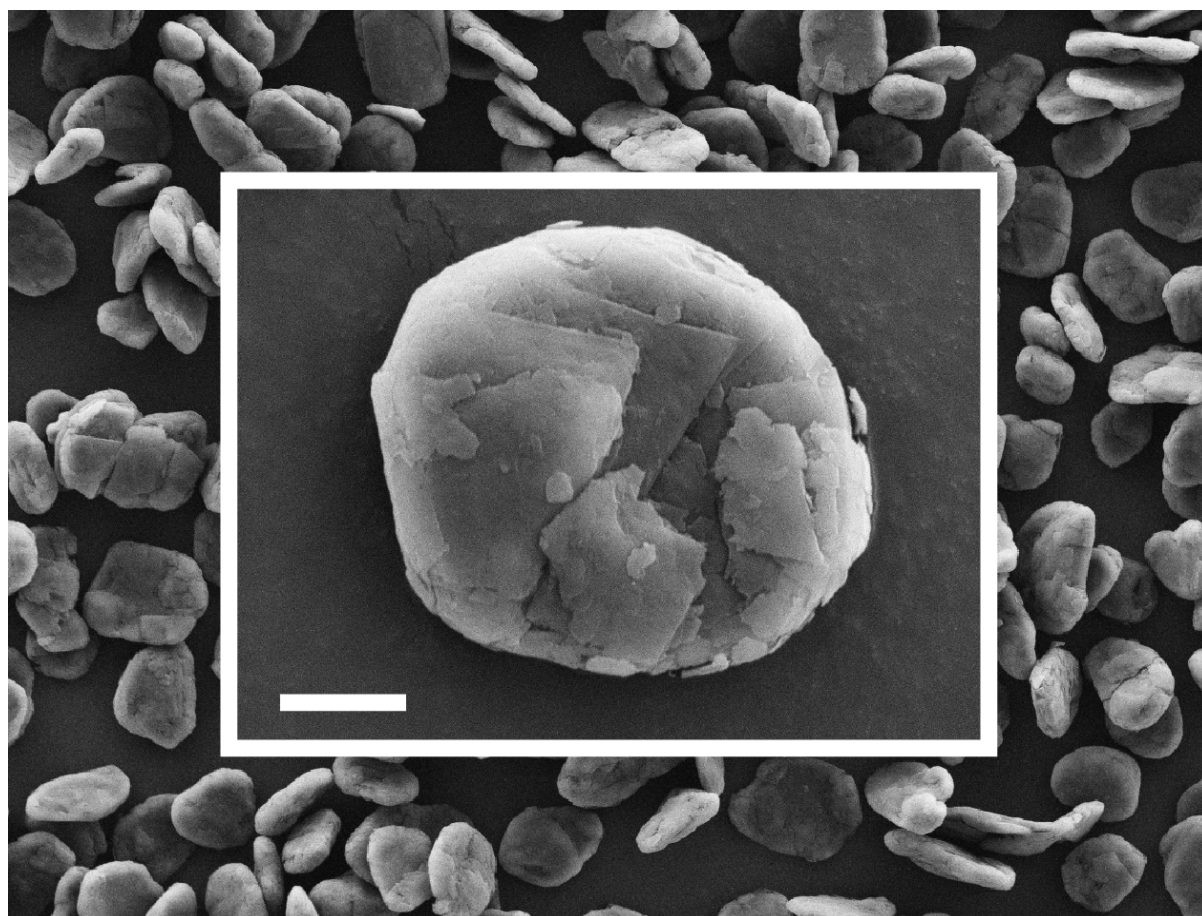
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- Small-scale mechanical mill processing of Archer's Campoona graphite is successful in converting 95% and 99%+ total carbon content (TCC) flake products into spherical graphite.
  - Campoona feedstock materials of 40-micron flake size yield spherical graphite with uniform 15-micron particle size ( $D_{50}$ ) and a favourable  $D_{90/10}$  ratio less than 3: morphology properties which meet a key established market requirement for use in lithium-ion battery applications<sup>1</sup>.
  - Spherical graphite materials represent a high-value (US\$3,400 to US\$4,400 per tonne)<sup>1</sup> materials entry point for high-volume anode componentry used specifically in the global lithium-ion battery market that is forecast to grow to US\$130 billion by 2028 with growth concentrated in the Asia Pacific region<sup>2</sup>.
  - Archer will test the purification of the post-processed materials and their suitability for integration in full- and half-cell lithium-ion batteries to enable the downstream screening and qualification of potential off-take partners and end users.
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Archer Exploration Limited (Archer, Company) is pleased to announce that the Company has successfully demonstrated the processing of graphite material from its wholly owned Campoona deposit into a spherical graphite product. The production of high-value commodities for high-volume use downstream in the lithium-ion battery market directly aligns to the Company's strategic focus in commercially exploiting a potential source of long-term revenue through vertical integration of the critical mineral value-chain.

**Commenting on the development milestone, Archer CEO Dr Mohammad Choucair said,** "This was a critical milestone that was achieved, and by doing so, we have overcome a high barrier to entry to the lithium ion battery market. We still have the question of yield, which determines product viability, however this is a matter of scale and process optimisation. Intrinsically, our material is of excellent quality, and suitable for processing into high-value anode materials."

"It is interesting that we were able to convert the 95% float product into a high-quality spherical graphite. This may allow us to segment the purification and material production processes into more efficient stages of development directly relevant to end-users and capitalise on opportunities to capture value-add abroad in the supply chain. This is an example of the pragmatic approach we are taking to developing Campoona", Dr Choucair concluded.



**Fig. 1.** Microscopy images of Archer's Campoona 95% TCC flake graphite that has undergone processing to form spherical graphite. The images show the normally planar natural graphite has been rounded (magnified in inset) and compacted in morphology to individual particles with a narrow size distribution centred around approximately 15 microns. Individual graphite sheets are visible in the particle shown in the inset, with the white scale bar representing 5 microns.

Spherical graphite was produced from Campoona graphite materials of uniform 40-micron flake size (99%+ and 95% TCC) using small-scale (kilogram quantity) mechanical milling processes (Fig. 1). The spherical graphite products were produced with a particle size centred around 15-microns with a narrow size distribution (i.e.  $D_{90/10}$  ratio of less than 3). Non-optimised processes were also employed to produce spherical graphite material with uniform particle sizes ranging from 8-microns to 18-microns with broader size distributions. These structural properties of the spherical graphite produced meet a key established market requirement for use in anode materials componentry in lithium-ion battery applications<sup>1</sup>.

The processing was performed by a Japanese company (Partner) using proprietary technology developed by the Partner. The results were verified by Archer using world-class microscopy and analysis facilities at the University of Sydney. Archer and the Partner intend to progress the work in the near term by focusing on scaling quantities of graphite using processes available to the Partner, to accurately obtain and optimise measures of yield and efficiencies of scale for Archer's Campoona graphite feedstocks.

## Next Steps

Archer will continue to target partnerships with lithium ion battery manufacturers to scale and integrate Campoona graphite further downstream in the supply chain. This will involve testing the spherical graphite materials produced in full-cell lithium-ion batteries for minimum performance requirements and market accepted benchmarks, and in establishing a basic measure of commercial viability related to the efficient scaling of post-concentrate processes with industry partners for potential off-take agreements.

## Background

The global lithium-ion battery market is forecast to increase to US\$130 billion by 2028 with growth concentrated in the Asia Pacific region<sup>2</sup>. Lithium-ion batteries consist of a group of batteries which operate with graphite in the anode<sup>3</sup>. Improvements in the anode are based on using graphite with high structural quality and purity, and an appropriate particle size and optimal morphology for effective lithium-ion intercalation chemistry.

Materials processing can lead to graphite morphologies that contribute to positive performance trade-offs, with typical examples including spherical graphite. Archer has recently demonstrated the successful implementation of commercially scalable full-cell configuration lithium-ion batteries that are in-line with industry state-of-art values of performance using unoptimised Campoona graphite (ASX Announcement 21 August 2018).

## About Archer

Archer provides shareholders exposure to innovative technologies and the advanced materials that underpin them. The Company has a focused strategy targeting globally relevant advanced materials markets of human health, reliable energy, and quantum technology.

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### Shareholders

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Twitter:  
<https://twitter.com/archerxau?lang=en>

YouTube:  
[https://youtu.be/Li\\_YYkOTxD0](https://youtu.be/Li_YYkOTxD0)

<sup>1</sup>Benchmark Mineral Intelligence. *Heilongjiang, China, Tops 90,000 tpa Spherical Graphite Output as EV Battery Demand Surges*. December 2018. <https://www.benchmarkminerals.com/heilongjiang-china-tops-90000-tpa-spherical-graphite-output-as-ev-battery-demand-surges/>

<sup>2</sup>IDTechEx. *Li-ion Batteries 2018-2028 From raw materials to new materials, through gigafactories and emerging markets*. October 2017. <https://www.idtechex.com/research/reports/li-ion-batteries-2018-2028-000557.asp>

<sup>3</sup>Buchmann, I. *Lithium-Ion Batteries: Fundamentals and Safety*. In *Encyclopedia of Inorganic and Bioinorganic Chemistry*, R. A. Scott (Ed.), 2015. <https://onlinelibrary.wiley.com/doi/full/10.1002/9781119951438.eibc2300>