

ASX Announcement (ASX:AXE)

22 January 2020

## Second Quarter Activities Report

For the three months ending 31 December 2019

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### Significant Activities

- Archer raises \$2.0 million through a successful share purchase plan.
  - Scalable array of qubit components assembled in the<sup>12</sup>CQ quantum computing chip.
  - Graphene ink formulations printed and tested in a first-phase biosensor prototype.
  - PEPR submitted for Campoona Graphite Project.
  - Independent review confirms Albion Downs Project prospective for nickel.
  - Drilling completed at the Franklyn Halloysite-Kaolin Project.
  - Leigh Creek Magnesite project sale price increased from \$2.0 to \$2.25 million.
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Archer Materials Limited (“Archer”, the “Company”, ASX:AXE) is pleased to report on its activities for the three-month period ending 31 December 2019 (“Quarter”).

**Commenting on the second Quarter activities Greg English, Executive Chairman of Archer, said,** “The assembly and patterning of a nano-size array of several individual qubit material components was a significant achievement during the Quarter. This excellent achievement advances our room temperature quantum computer chip technology development towards a minimum viable product, and strengthens our commercial readiness by providing credibility to the claim of <sup>12</sup>CQ chips being potentially scalable [and therefore useful].”

“We have also progressed development of our graphene-based biosensor technology by building a first-phase prototype device (“prototype”) to test the printing and performance of graphene inks. This achievement provides support for a full patent application, that would give Archer exclusive rights to commercially benefit from the IP. The high-quality graphene used in the graphene ink formulations was prepared from non-graphitic feedstocks and is available in the inventory of Carbon Allotropes, a wholly owned subsidiary of Archer.”

“An independent review of the Albion Downs Nickel Project supported our view on the prospectivity of this project. The tenement is within a known nickel province and the potential for accumulation of massive nickel sulphide mineralisation at or near the footwall contact positions of the ultra-mafic remains high. We hope to complete a ground based electromagnetic survey during the current quarter.”

“The change in company name to Archer Materials Ltd, approved at the 2019 AGM, reflects our commitment to the growth of our Advanced Materials business and in particular, the development of the room temperature quantum computer chip.”

“We successfully raised \$2.0 million from shareholders under a share purchase plan completed during the Quarter and the Company is now well funded.”

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## Quarterly Activities to 31 December 2019

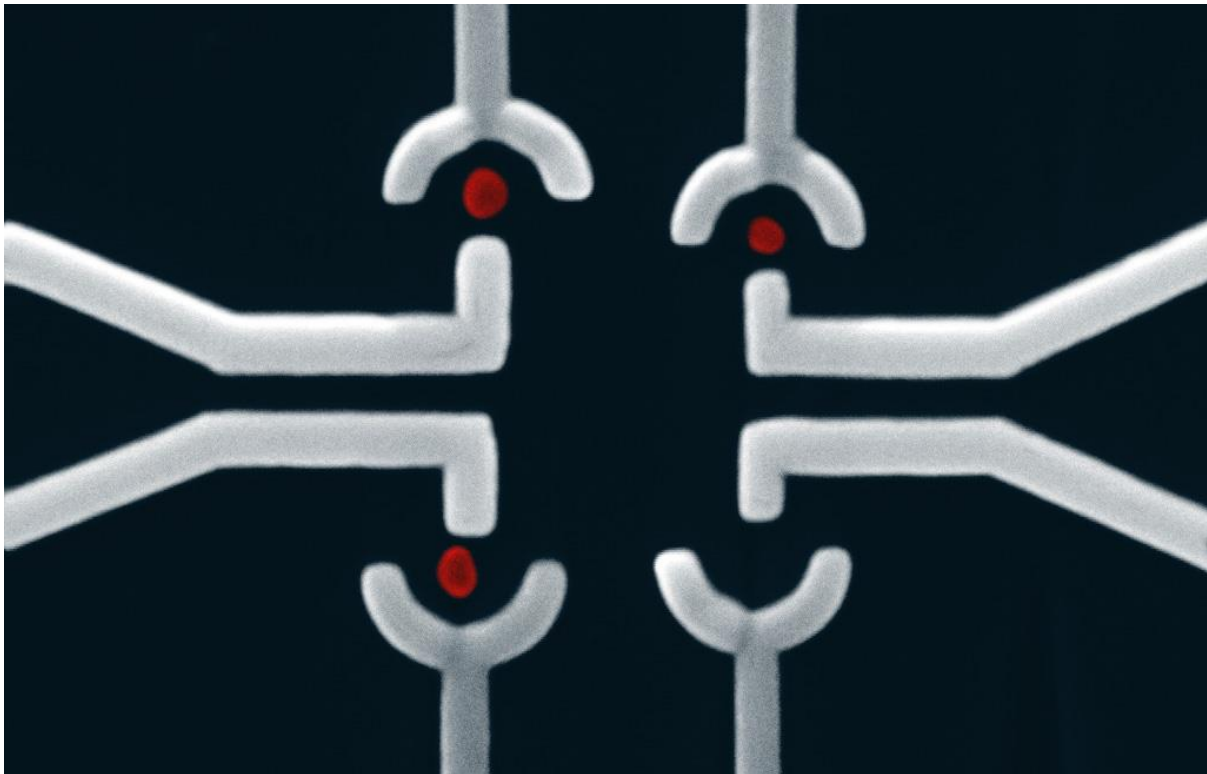
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Archer is a materials technology company developing materials in quantum computing, biotechnology, and lithium-ion batteries, and exploring for minerals in Australia. The Company has strong intellectual property, broad-scope mineral tenements, world-class in-house expertise, a diverse advanced materials inventory, and access to over \$300 million of R&D infrastructure.

### Advanced Materials

#### Quantum Technology

The  $^{12}\text{CQ}$  Project commenced in April 2019 (ASX Announcement 3 Apr 2019). The Archer team is now building  $^{12}\text{CQ}$  room-temperature qubit processor (“chip”) prototypes (ASX Announcement 26 Jun 2019). Archer has assembled the first qubit material component (“qubit”) of the  $^{12}\text{CQ}$  chip with nanometre precision (ASX Announcement 26 Aug 2019). In the Quarter, Archer commercially advanced the  $^{12}\text{CQ}$  Project by assembling and patterning a nanometre-size array (“few-qubit array”) of several individual qubits (Fig. 1). Successful development of Archer’s  $^{12}\text{CQ}$  chip could potentially enable widespread ownership of quantum computing powered technology and catalyse a global multibillion-dollar industry.



**Fig. 1.** Electron microscopy image of three isolated qubits (spherical shapes false-coloured in red-orange), positioned into an array on a silicon wafer surface, with each approximately 50 nanometres in size. Metallic control electrodes (false-coloured in grey-blue) aligned with nanoscale precision to the qubits. The width and height of the electrodes are comparable to the dimensions of the qubits, and compatible with modern electronic device features.

The ability to build qubit arrays is a key requirement for developing a scalable and useful chip. To achieve this, Archer uses a unique carbon-based qubit that has the potential to enable chip operation **at room-temperature and integrate onboard modern devices**. The qubit is the fundamental component of Archer's <sup>12</sup>CQ prototype chip, as without the qubit, quantum computing cannot be performed.

To assemble the few-qubit array of Archer's chip, three individual qubits were isolated on a silicon wafer with metallic control electrode components ("electrodes") aligned and deposited around the qubit array with nanoscale precision ("Process") as shown in Fig. 1. The electrodes will allow for the next stage of <sup>12</sup>CQ chip development involving the **measurement of quantum information** stored on the individual qubits.

The achievement is definitive proof for addressing a global quantum computing industry key success driver for early-stage quantum computing technology development related to scalability, practicality and use as today's quantum computers have at best a few dozen qubits<sup>†</sup>. A useful chip will need to have a number of qubits arranged in various patterns in order to run a number of algorithms, for example to perform transactions, secure communication, or in error-correcting quantum information processing.

Following the Company's significant commercial progress achieved in the development of the <sup>12</sup>CQ chip, and as part of the Company's strategy to advance its quantum technology vertical, the Company accepted an opportunity to Chair an entire session on the topic of Quantum Computing at the Quantum.Tech Conference in London, UK, from Apr 20 - 22, 2020 (ASX Announcement 28 Nov 2019). The Conference is a high-level international event with a strong focus on the commercial applications of quantum technology.

## **Human Health**

**Archer has provisionally patented a potential solution to printable biosensors capable of complex detection of disease** (ASX Announcement 19 Feb 2019). Archer is the sole applicant of the provisional patent, maintaining 100% ownership of the biosensor technology IP. **Archer has until 15 February 2020 to consider maturing the application to a full patent.**

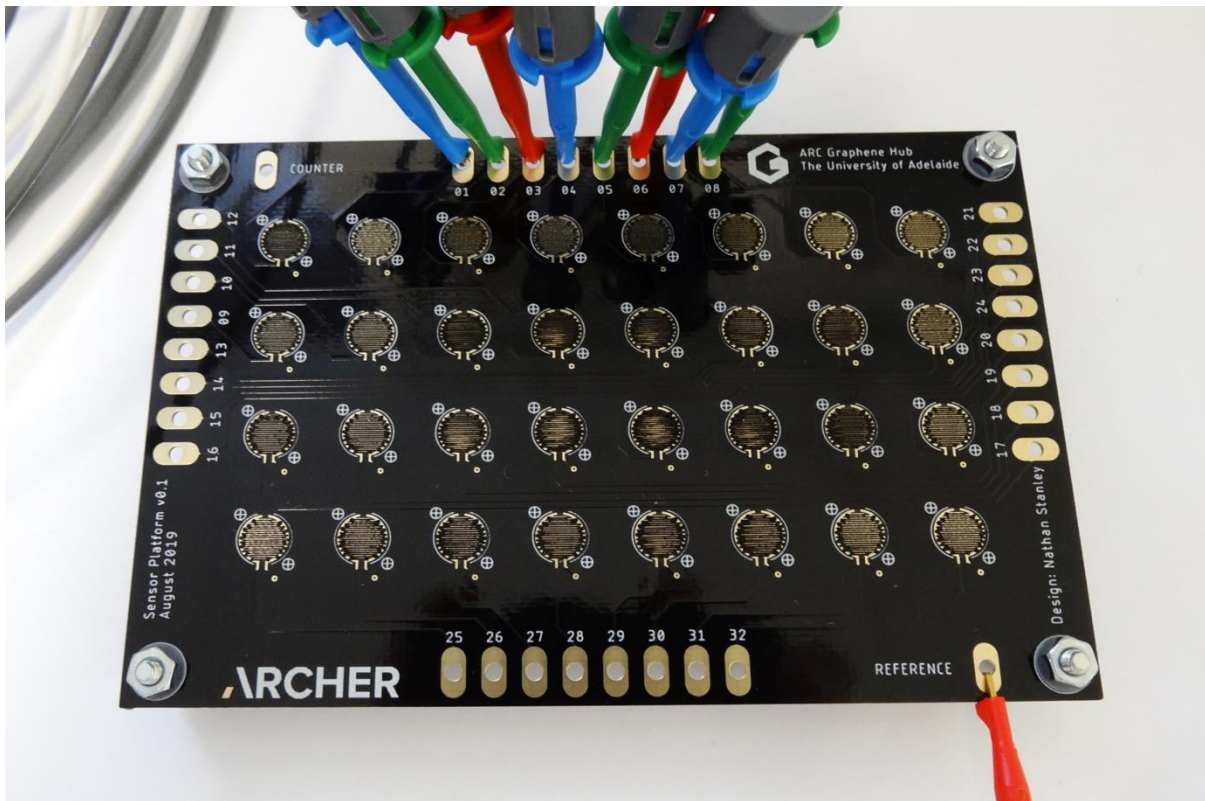
This potentially disruptive solution to point of care diagnostics involves the use of graphene, the thinnest material known, which could act as an ultrasensitive biochemical interface. The uniqueness of such a biosensor is the use of digital manufacturing to print critical graphene components integrated into one sensor.

To mature the provisional patent and support the claims in the application, Archer is engaged in a collaboration agreement with the University of Adelaide ARC Graphene Hub and a material transfer agreement with a leading German Biotech ("Collaborations").

During the Quarter, the Company progressed its graphene-based biosensor technology development by building a **first-phase prototype device** ("prototype") to test the printing and performance of graphene inks produced from the inventory of Carbon Allotropes ("graphene inks"), Fig. 2. Graphene inks were printed using aligned extrusion printing to create the sensors. This process could potentially be translated to **automated screen-printing, for low-cost prototype manufacturing**.

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<sup>†</sup> <https://www.bcg.com/en-au/publications/2018/next-decade-quantum-computing-how-play.aspx>



**Fig. 2.** Archer’s first-phase prototype graphene biosensor technology built at the University of Adelaide ARC Graphene Hub. To create the biosensor components, graphene ink formulations are printed on a 4 x 8 array of interdigitated gold-plated-nickel electrodes (with micron-scale features). Graphene acts as a sensing interface to detect biochemicals. The 32 sensing electrodes are connected to a computer to monitor, test, and collect data in real-time.

## **Reliable Energy**

The ongoing work with UNSW (ASX Announcement 18 Apr 2018) is focused on addressing the trade-off between cost and battery performance using Archer’s Campoona graphite at the anode of lithium-ion batteries and formulating, building, and testing full-cell batteries. Technical development with UNSW to test spherical graphite products in lithium-ion (Li-ion) batteries continued during the Quarter.

Significant progress has been made by Archer on the development of Campoona since the granting of a Mining Lease (ASX Announcement Dec 1 2017). On 6 April 2018, Archer announced that graphite from Campoona is structurally near-perfect down to the atomic scale and on 21 August 2018, it was announced that 99%+ and 95% natural Campoona flake graphite was used to produce commercially scalable full-cell configuration Li-ion batteries at UNSW. On 12 March 2019, Archer announced the successful conversion of 95% and 99%+ natural flake graphite from Campoona into high value spherical graphite using proprietary technology developed by Archer’s Japanese Partner for integration into Li-ion batteries.

## Mineral Exploration

### Eyre Peninsula Campoona Graphite Project

During the Quarter, the Company's wholly owned subsidiary Pirie Resources Pty. Ltd. submitted a Program for Environment Protection and Rehabilitation ("PEPR") to the South Australian Government to seek authorisation to conduct drilling and mining operations in relation to the Campoona Mineral Lease (ML 6470), the site of the proposed Campoona Shaft graphite mine, in South Australia (ASX Announcement 2 Dec 2019).

Submitting the PEPR application was done within the period prescribed by the Mining Act. The work program described in the PEPR allows for a bulk sample up to 60 tonnes to be collected, and for the sample to be processed off-site, including into graphite and graphene materials. The collection of bulk graphite samples would allow Archer to pursue downstream opportunities with lithium-ion battery manufacturers.

### Franklyn Halloysite-Kaolin Project

#### Exploration Target

In November 2019, the Company announced a maiden Exploration Target for the Franklyn Halloysite-Kaolin Project ("Franklyn Project") located approximately 80km East of Jamestown, South Australia (ASX announcement 7 Nov 2019).

A review of historical drill information resulted in the establishment of a maiden kaolin Exploration Target at Franklyn of 45Mt – 91Mt at a grade of 30 – 36% Al<sub>2</sub>O<sub>3</sub> (-45 µm size fraction). The Franklyn Exploration Target is based on historical drilling, across 40 Rotary drill holes and auger drilling was undertaken by the SA Government (1971 to 1992). This historical drilling intersected substantial widths of kaolin mineralisation over an extensive area during their search for copper and gold mineralisation. Limited work was undertaken on the kaolin material as it was not the focus of exploration, however halloysite comprising over 15% of one sample was reported.

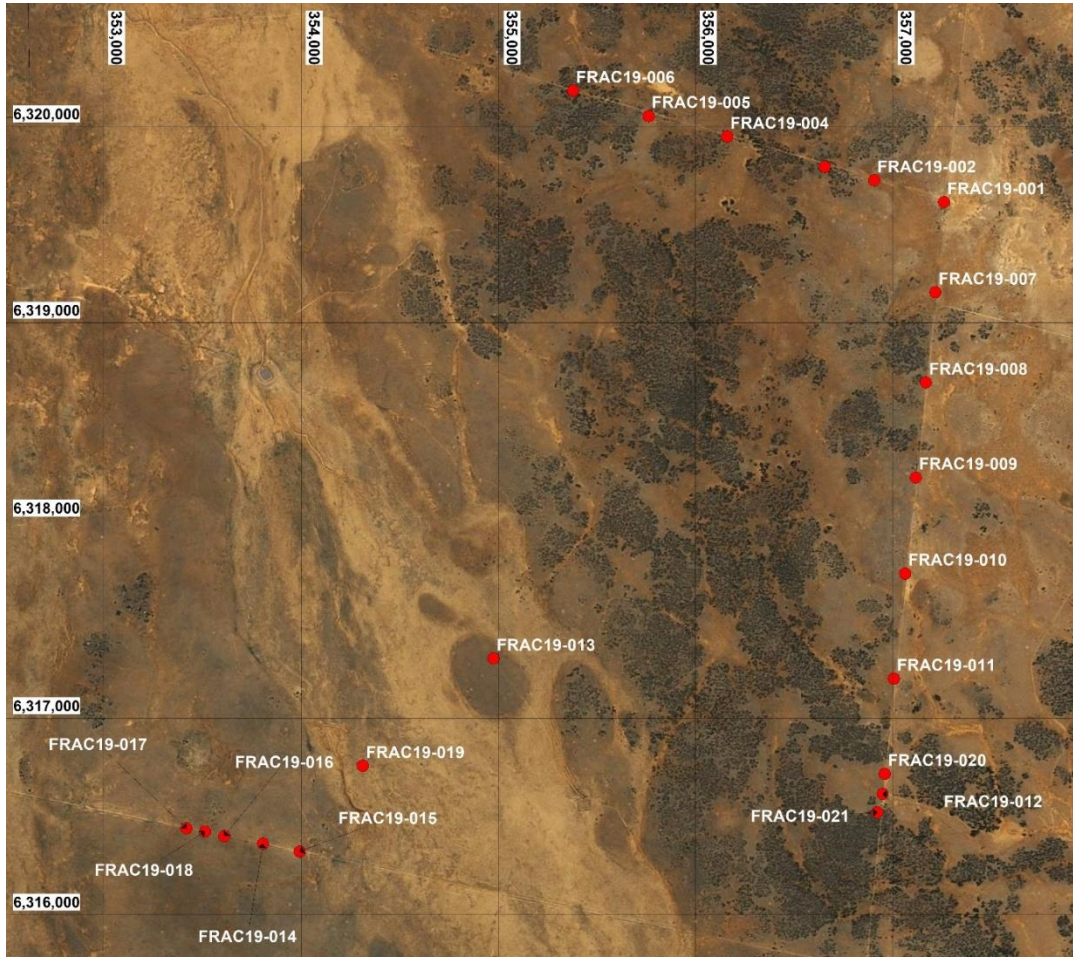
Investors should be aware that the potential quantity and grade of the Exploration Target reported is conceptual in nature, there has been insufficient exploration to estimate a Mineral Resource and it is uncertain if further exploration will result in the estimation of a Mineral Resource at the Franklyn Project.

#### Archer drilling

The high grade of the reported kaolin, the presence of halloysite and the large Exploration Target identified led to the Company undertaking a 21-hole aircore drill program at Franklyn during the Quarter.

The aircore drill program was completed in less than a week with 21 holes drilled for a total of 676 drill metres and an average depth of 32 metres per hole (ASX announcement 3 December 2019). The kaolin was found to be closer to the surface than originally anticipated meaning that shallower drill holes were required.

All holes were drilled either adjacent to, or on, existing tracks (Fig. 3) to avoid the need to excavate new tracks and minimise costs. The kaolin mineralisation at Franklyn covers an extensive area and the positioning of the existing tracks allowed Archer to drill test the weathered granite that forms the kaolin mineralisation.



**Fig. 3.** Google Earth image with collar location of drill holes at Franklyn Project and 1km x 1km grid (e.g. distance from 6,318,000m to 6,319,00m = 1km).

### Drill results

Weathered Bendigo granite kaolinitic clays were intersected in 18 of the holes with siltstones intersected in other three holes (drill holes FRAC19-12, 19-13 and 19-18). The clays vary in colour from white, through to cream, yellow and pink in places, with the red colours potentially being derived from weathered (hematite rich) veins. The rock and clay profiles for drill holes FRAC 19-04, 19-16 and 19-21 are shown below (Image 1).

All drill holes samples were submitted to the laboratory for testing and assay. Assay results were announced by Archer in mid-January 2020 (ASX announcement 15 Jan 2020) with results from the X-Ray Diffraction (XRD) test work to determine the halloysite content expected in the coming weeks.

The sample collected by Archer from the Franklyn drilling appears to be consistent with the results from early explorers and confirm the presence of the previously discovered kaolin

mineralisation. However, Archer will not be able to confirm the quality of the mineralisation until all assay and other test results are received and analysed.



**Image 1.** Photos of rock chip trays showing rock chip samples from one metre intervals in drill holes FRAC 19-04 (left), FRAC 19-16 (middle) and FRAC 19-21 (right).

## **Eyre Peninsula Halloysite-Kaolin Project**

In August 2019, the Company announced a maiden Exploration Target for the Eyre Peninsula Halloysite Kaolin Project (EP Project). The EP Project is located 12km south of Kimba, South Australia, approximately 150km south east of Andromeda Metals Ltd (ASX:ADN) Pochera Project and is within close proximity to existing power, water, road, rail and other critical infrastructure.

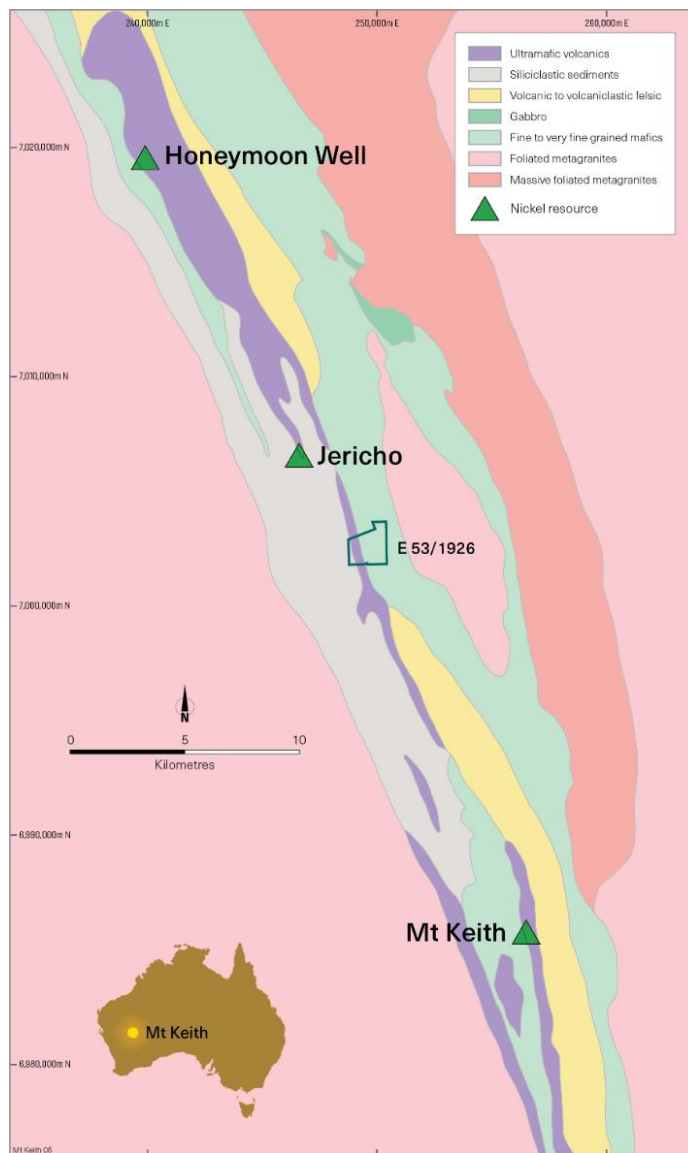
Whilst no direct exploration work was undertaken at the EP Project, the Company spent the Quarter obtaining the necessary government and landowner consents required to undertake an aircore drill program on the EP Project. The Company hopes to commence this drilling in February 2020.

**Albion Downs Nickel Project**

During the Quarter, the Company announced (ASX announcement 8 Oct 2019) the results from an independent review of the Company’s 100% owned Albion Downs Nickel Project (Project). The Project comprises mineral exploration licence E53/1926 and is located approximately 18 km NNW of BHP’s Mount Keith Nickel Mine, Western Australia.

The review concluded that:

- The ultramafic stratigraphy present within E53/1926 forms part of a larger unit which is considered prospective for magmatic nickel sulphides, based on previous drill hole data immediately to the north (BHP) and south (Norilsk) of the tenement.
- Potential exists for Type 1 (e.g. Mount Keith and Jericho) massive sulphides within E53/1926 given the occurrence of massive sulphides at BHP’s nearby Jericho prospect and the presence of disseminated sulphides immediately to the south (Norilsk).



**Fig. 4.** Location of E53/1926 within the Norseman-Wiluna greenstone belt.



E53/1926 is situated within the northern part of the Norseman-Wiluna greenstone belt of the Eastern Goldfields Province. This part of the belt consists of a lower metamorphosed ultramafic to mafic volcanic sequence which passes into an upper succession of felsic to intermediate volcanic rocks and sedimentary lithologies. Numerous porphyries and dolerites have intruded the sequences. The belt is host to significant gold and nickel deposits including the nearby Wiluna gold deposits and the ultramafic-hosted Mount Keith, Perseverance, Six Mile, and Honeymoon Well nickel deposits (Fig. 4).

Archer's tenement has been sparsely drilled with most drilling in the area undertaken in the mid-1990's. Limited drilling and other exploration undertaken by WMC and others in the Project area confirmed the presence of disseminated nickel sulphides to the north and south of Archer's tenement (E53/1926) with minimal historic drilling within the area of Archer's tenement. Only two RC holes were drilled on E53/1926 with the assay data indicating elevated nickel mineralisation, however the limited information does not indicate if this is in weathered rocks or fresh komatiite.

The Project tenement area covers ultramafic and surrounding mafic to felsic volcanic and sedimentary rocks that are generally overlain by transported alluvial and colluvial material. The depth of transported material (up to 45m) and depth of weathering varies significantly and depends largely on underlying geology, structures and alteration. This means that conventional soil sampling is not suitable and that Archer will need to use geophysics to generate drill targets.

The Company intends to undertake a ground based electromagnetic survey at Albion Downs during March / April 2020 to identify possible targets for drill testing in mid-2020.

### **Leigh Creek Magnesite Project**

At the end of the Quarter, the Company announced (ASX announcement 30 Dec 20219) that some of the key terms of the Leigh Creek Magnesite Project Sale and Purchase Agreement ("2018 Agreement") had been amended as follows:

- The purchase price has increased from \$2.0 million to \$2.25 million. Archer has already received \$250,000 meaning that the Company will receive \$2.0 million at Completion.
- The deadline for achievement of certain pre-conditions prior to Completion has been extended from 31 December 2019 to 30 June 2020 (the "Cut-Off Date").
- The 5% bonus payment ("Bonus") was originally payable if the buyer achieved a stock exchange listing within 6 months of Completion. The Bonus is now payable if the buyer is listed or sells the underlying tenements at any time in the future.

The Buyer informed Archer of its intention to list on a regulated stock exchange in early 2020, which is after Completion date specified in the 2018 Agreement. At the request of the Buyer to extend the date for Completion, Archer renegotiated an increase to the Purchase Price and an indefinite extension to the period for the payment of the 5% bonus payment.

The ASX announcement dated 30 December 2019 contains a more detailed summary of the terms of the new agreement and a comparison between the 2018 Agreement and the new agreement.

### **Bartels Gold Project**

The Bartels Epithermal Gold Prospect is located 15km north of the township of Cleve on South Australia's Eyre Peninsula. The Bartels area contains three low sulphidation epithermal systems: Teresa, Bartels and Patricia.

No exploration work was conducted at Bartels during the Quarter and no exploration work is planned at Bartels during the current quarter.

### **Tin and Tungsten Projects**

The Company's Broken Hill, Crowie Creek and Stanthorpe Projects are prospective for the discovery of tungsten and tin mineralisation. In the mid-1970's approximately 66,000t of tin concentrate was produced from within the area of Archer's Stanthorpe tenement which accounted for 8% of Australian tin production at the time.

No exploration was undertaken on these tin and tungsten projects during the Quarter and no exploration is planned on these projects during the first half of 2020.

### **Blue Hills Copper-Gold Project**

The Blue Hills Copper-Gold Prospect is a large district scale copper anomaly covering an area of 25km<sup>2</sup>, located approximately 240km north of Adelaide, South Australia. At Blue Hills, Archer has discovered three large scale gold and copper in soil anomalies (Hood, Hawkeye and Katniss).

No exploration was undertaken at Blue Hills during the Quarter and no exploration is planned on this project during the first half of 2020.

## **Corporate**

### **Cash balance**

The Company's cash balance at the end of the Quarter was \$2,743,000.

The Company successfully completed a Share Purchase Plan ("SPP") during the Quarter (ASX Announcement 11 Dec 2019), receiving \$1.99 million through the SPP with no scale back and 15,327,790 new shares allotted (ASX Announcement 13 Dec 2019). Under the SPP, eligible shareholders were offered the opportunity to apply for new shares at a price of 13 cents per new share.

During the Quarter the Company received \$102,000 from the ATO in respect of Archer's R&D tax incentive for the year ended 30 June 2019.

### **JMEI Entitlement Statements**

At the end of October 2019, JMEI - 2018/19 Entitlement Statements were sent to Eligible Shareholders (ASX announcement 3 Oct 2019). Following the lodgement of the Company's income tax return for the year ending 30 June 2019, the Company was able to issue a total of \$120,212 JMEI credits to those shareholders who received new Archer shares during the period 1 July 2018 and 30 June 2019 (Eligible Shareholders) on the exercise of SPP Options or participation in the May 2019 share placement.

### **Shareholder Events and Outreach**

During the Quarter, Archer held its Annual General Meeting ("AGM") (ASX Announcements 24 Sept 2019 and 30 Oct 2019). At the AGM, shareholders voted to change the Company name from Archer Exploration Limited to Archer Materials Limited (ASX Announcement 31 Oct 2019). The change of name took effect from 30 October 2019. The Company's ASX code remained unchanged (ASX:AXE).

Following the Company's Annual General Meeting ("AGM"), shareholders attended a site visit of the Research and Prototype Foundry at the University of Sydney where the Company is building its <sup>12</sup>CQ qubit processor chip.

The Company electronically distributed a number of Newsletters and News Spotlights to shareholders during the Quarter, including:

- *Archer's 2019 Annual General Meeting: Message From The CEO*
- *Archer Newsletter: Archer Materials Hits A 12CQ Quantum Computing Project Milestone*
- *News Spotlight: Archer Materialises The Road To Commercialisation*
- *AXE's Critical Minerals Could be Vital for Australia's Future?*

Archer CEO, Dr Mohammad Choucair, also gave interviews with Proactive Investor and Boardroom Media:

- *Archer Exploration to open 12CQ qubit processor chip site to investors at AGM*
- *Archer Exploration discusses mineral exploration side of material technologies business*
- *Archer Exploration changes name to Archer Materials and hits a milestone with 12CQ quantum computing project*
- *Archer Materials advances first-phase prototype of graphene biosensor technology*
- *Archer Materials invited to chair quantum computing session at London conference*
- *Archer Materials submits PEPR for Campoona Graphite Project*
- *Archer Materials gives overview of mineral exploration part of business*
- *Archer Materials scalable assembly of qubit array components*

**Issued Capital**

Time	Shares	Options	Performance Rights
Start of Quarter	197,091,783	Nil	Nil
New issues during Quarter	15,327,790 <sup>(1)</sup>	17,500,000 <sup>(2)</sup>	Nil
Exercised/cancelled during Quarter	Nil	Nil	Nil
End of Quarter	212,419,573	17,500,000	Nil
Date of this Report	212,419,573	17,500,000	Nil

(1) Ordinary shares issued to eligible shareholders under the SPP.

(2) Options are unlisted and are exercisable at \$0.1929 each on or before 31 March 2023. The Options were issued to directors, employees and contractors, following shareholder approval at the Company's Annual General Meeting held on 30 October 2019.

**Competent Person Statement**

The exploration results reported herein, insofar as they relate to mineralisation, are based on information compiled by Mr. Wade Bollenhagen, Exploration Manager. Mr. Bollenhagen is a Member of the Australasian Institute of Mining and Metallurgy who has more than 20 years' experience in the field of activity being reported. Mr Bollenhagen has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity that he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves" relating to the reporting of Exploration Results. Mr. Bollenhagen consents to the inclusion in the report of matters based on his information in the form and context in which it appears.

### List of Archer Tenements

Tenement	Location	Commodity
<b>South Australia</b>		
EL 6363	North Cowell	Graphite
EL 5791	Cockabidnie	Graphite
EL 5804	Wildhorse Plains	Graphite
EL 5815	Waddikee	Graphite
EL 5870	Carpie Puntha	Graphite
EL 5920	Carappee Hill	Graphite
EL 6019 <sup>(1)</sup>	Witchelina	Magnesite
EL 5730 <sup>(1)</sup>	Termination Hill	Magnesite
EL 6351	Burra North	Base Metals
EL 5769	Napoleons Hat	Copper / Gold
EL 5794	Blue Hills	Copper / Gold
EL 5935	Whyte Yarcowie	Cobalt / Copper
EL 6000	Pine Creek	Copper / Gold
EL 6029	Altimeter	Copper / Gold
EL 6160	Franklyn	Copper / Gold
EL 6287	Peterborough	Copper / Gold
EL 6354	Bendigo	Copper/Gold
ML 6470	Campoona Shaft	Graphite mining
MPL 150	Sugarloaf	Graphite and graphene processing
MPL 151	Pindari	Process water for Sugarloaf
<b>New South Wales</b>		
EL 8592	Morris's Blow	Cobalt / Copper
EL 8593	Broken Hill	Cobalt / Copper
EL 8594	Broken Hill	Cobalt / Copper
EL 8595	Broken Hill	Cobalt / Copper
EL 8779	Campbells Creek	Cobalt / Copper
EL 8894	Stanthorpe	Tungsten / Tin
EL 8871	Crowie Creek	Copper/Gold
<b>Western Australia</b>		
E53/1926	Mt Keith	Nickel

#### Notes

- (1) These tenements have been sold with Completion expected to occur by 30 June 2020.

## About Archer

A materials technology company developing materials in quantum computing, biotechnology, and lithium-ion batteries, and exploring for minerals in Australia. The Company has strong intellectual property, broad-scope mineral tenements, world-class in-house expertise, a diverse advanced materials inventory, and access to over \$300 million of R&D infrastructure.

The Board of Archer authorised this announcement to be given to ASX.

### General Enquiries

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### Media Enquiries

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For more information about Archer's activities, please visit our:

Website:

<https://archerx.com.au/>

Twitter:

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

YouTube:

<https://bit.ly/2UKBBmG>

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