

ASX Announcement ([ASX: AXE](#))

29 January 2020

Second Quarter Activities Report

For the three months ending 31 December 2020

Significant Activities

- The Company is well capitalised with approximately \$6.93 million cash and no debt.
 - Quantum computing collaboration established with leading AI firm Max Kelsen.
 - First stages of ¹²CQ[®] quantum computing chip control measurements completed.
 - ¹²CQ[®] chip build fast-tracked with world-first qubit modelling.
 - A1 Biochip[™] lab-on-a-chip biotechnology development commenced.
 - Sale of two Eyre Peninsula tenements for \$2.0 million plus bonus payment.
 - Campoona Graphite Project fully permitted.
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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 2020 (“Quarter”).

Commenting on the second quarter activities Greg English, Executive Chairman of Archer, said, “The development of computational models to accurately predict qubit behaviour was a great achievement. The computational models allow Archer to accurately predict the ¹²CQ qubit materials’ future behaviour and performance.”

“In addition to building the qubit computational models, during the Quarter, the Company successfully engineered and commenced operating the infrastructure and specialised equipment required to perform qubit control. Achieving qubit control is required for operational devices and would be major validation of the commercial viability of the ¹²CQ chip.”

“The execution of a collaboration agreement with company Max Kelsen (a leading Artificial Intelligence and Machine Learning company) will allow the Company to expedite development of software essential for the development and operation of Archer’s ¹²CQ chip technology. Archer and Max Kelsen will use IBM’s Qiskit open source programming framework and cloud-based quantum computers to implement novel quantum algorithms.”

“During the Quarter, the Company commenced its A1 Biochip[™] development with the aim of building a lab-on-chip biosensing device capable of simplifying disease detection. Archer’s biochip development involves miniaturising medical lab tests onto an integrated circuit, a single chip, that is only a few millimetres in size.”

“The sale of the two Eyre Peninsula mineral exploration licences was a great achievement and a continuation of Archer’s strategy of monetising its non-core mineral exploration assets to fund and grow the Company’s Advanced Materials business.”

Quarterly Activities to 31 December 2020

Archer is developing innovative deep tech for commercialisation in the multibillion-dollar global industries of quantum technology, human health, and reliable energy. The Company is rapidly progressing the development of its ^{12}CQ qubit processor chip and A1 Biochip technology, while continuing to divest its mineral exploration projects.

Advanced Materials

Quantum Technology

The ^{12}CQ qubit processor chip (“chip”) is a world-first technology that Archer aims to build for quantum computing operation at room-temperature and integration onboard modern electronic devices.

During the Quarter, Archer progressed its development towards its first major technological milestone in the operation of its ^{12}CQ chip (ASX Ann. [19 Nov 2021](#)) related to ‘qubit control’. The successful completion of the control measurements would be major validation of the commercial viability of the ^{12}CQ chip.

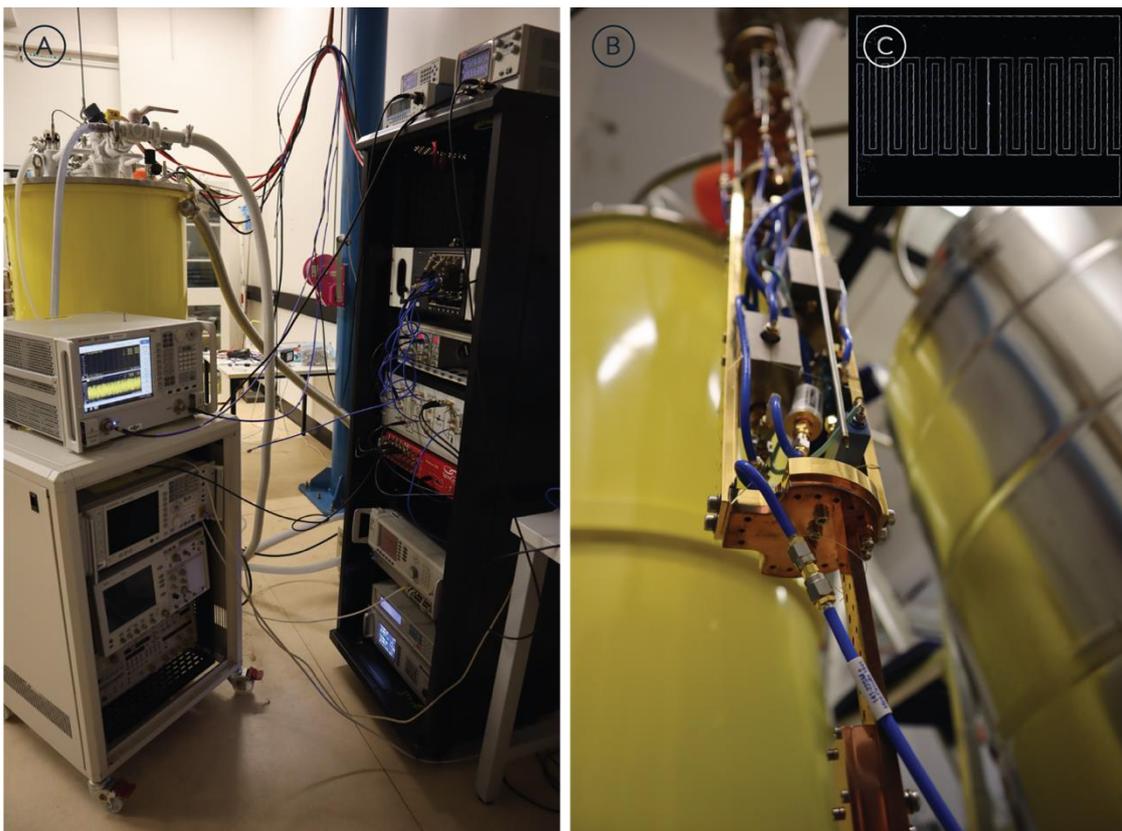


Image 1. Quantum measurement setup for qubit control. The state-of-the-art setup where the first quantum control measurements are being performed on Archer’s ^{12}CQ qubit material. **A** The cryogenic chamber (yellow) together with quantum control instrumentation to perform the sophisticated quantum measurements. **B** The QC Devices (about half a millimetre in size, inset **C**) are mounted at the bottom of the cryogenic insert which is cooled to very low temperatures during the preliminary measurements. The setup and infrastructure shown here is worth over \$10 million.

Archer has now built a number of the qubit control devices (“QC Devices”) required for ¹²CQ chip development. The Company has engineered and commenced operating the infrastructure and specialised equipment required to perform qubit control using various QC Device configurations (Image 1).

The Company has completed the preliminary stages of its quantum measurements towards qubit control by successfully characterising optimised and unoptimised QC Devices. The information obtained (e.g. device response to ‘pulse sequences’) will greatly expedite further progress in the ¹²CQ qubit control measurements.

Archer designs and builds its QC Devices in a world-class \$150 million semiconductor chip prototyping foundry. The qubit control measurements are ongoing and are being performed in parallel to other technology development work packages and international patent applications (“IPAs”) and commercialisation (Exhibit 1 & Exhibit 2) (ASX ann. [6 Oct 2020](#)).

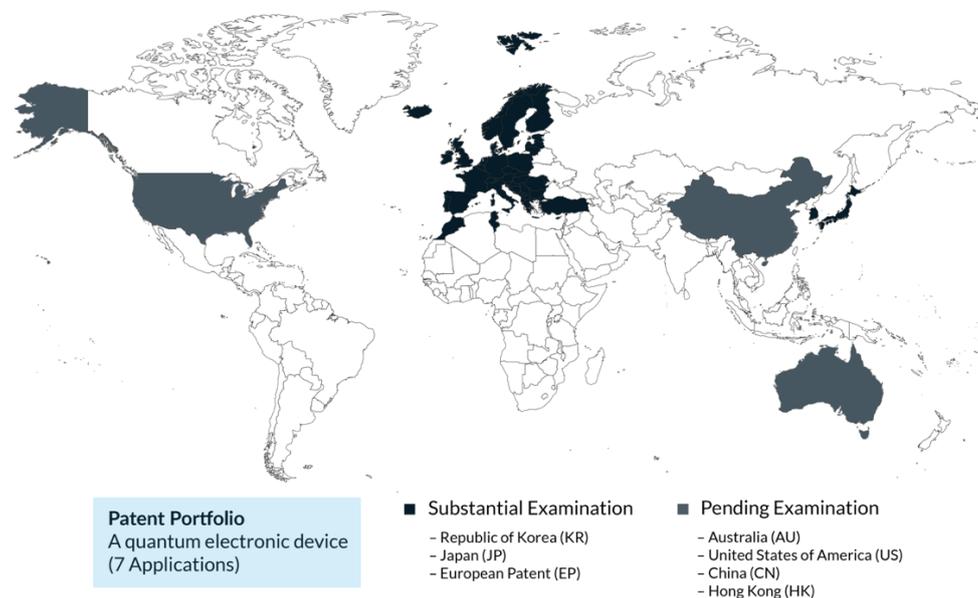


Exhibit 1. Map showing the geographic coverage of ¹²CQ chip IPAs as of Oct 2020. IPAs formally titled “A quantum electronic device”. EP, JP, and KR IPAs entered substantial examination in [May](#), [June](#), and [Aug 2020](#) respectively. All IPAs have now been published and are pending examination.

Patents Pending		
Priority Date	Technology Summary	Stage & Coverage
3 Dec 2015	■ A quantum electronic device. Quantum electronic devices for processing qubits represented by an electron spin on a new type of carbon nanomaterial and methods for using this material in quantum computing.	National Phase. AU, US, KR, HK, CN, EP, JP
15 Feb 2019	■ Graphene complexes and compositions thereof. Complexes comprising graphene compositions, methods of synthesising these complexes and compositions, and the use of these complexes and compositions in biomolecular sensing.	International Phase. AU

Archer strategic themes
■ Quantum Technology ■ Human Health

Term of protection available would typically be 20+ years from the Priority Date.

Exhibit 2. Description of patent applications pending in various jurisdictions and the respective portfolio alignment to Archer’s key strategic technology themes.

During the Quarter, the Company announced for the first-time computational quantum mechanical theory was developed that accurately models the behaviour of the qubit material at the core of Archer's ^{12}CQ quantum computing chip (Image 2) (ASX Ann. [12 Oct 2020](#)).

The computational models validate the origins of experimentally observed quantum phenomena in the qubit material and allow the Company to predict future quantum behaviour. This achievement is fundamental to the successful development of the chip.

There are very few people and institutions in the world that can do this type of work and the complexity and importance of this work to Archer's ^{12}CQ technology development cannot be overstated, as the greatest amount of value creation in the quantum computing economy is generated from technology development.

The qubit material models were derived from first principles and to the highest scientific standards internationally in the field of theoretical condensed matter physics (*i.e.* not obtained using simple analytical formulas found in spreadsheets or similar analysis software).

The quantum information ("qubit") in Archer's chip design is in the form of an electron's quantum property of 'spin', so it is critical to have developed accurate models predicting the electronic properties of the qubit material for the successful development of the ^{12}CQ chip.

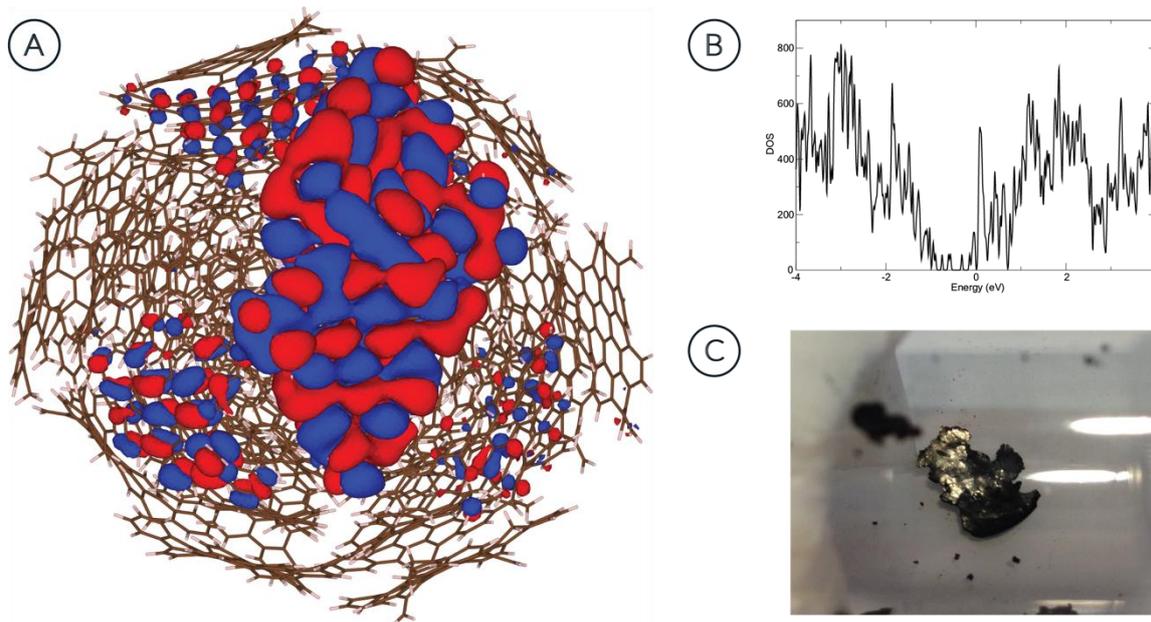


Image 2. The critical qubit material component in Archer's ^{12}CQ chip technology. A Part of the computational model developed that accurately represents the atom-scale structure of the nanosized qubit material, used for calculating the qubit materials' electronic properties for the first time including in B the [density of states](#) (DOS) confirming the unique metallic-like character of the material which in C can be seen in reality in bulk quantities of qubit material having a metallic shimmer. Properties theoretically determined in A and B validate R&D underpinning Archer's ^{12}CQ quantum computing technology[†].

[†] <https://www.nature.com/articles/ncomms12232>

During the Quarter, the Company also announced that it had entered into a collaboration with a leading Artificial Intelligence and Machine Learning company, [Max Kelsen](#) (“the Collaboration”) (ASX Ann. [9 Dec 2020](#)). Archer and Max Kelsen are members of the global IBM Q Network^{Error! Bookmark not defined.}.

The collaboration is a critical step in the commercialisation of the ¹²CQ chip because the principal purpose of building quantum computing processors is to apply and run quantum algorithms to generate value from outperforming modern computing.

Archer and Max Kelsen will use IBM’s Qiskit open source programming framework and cloud-based quantum computers to implement novel quantum algorithms developed that validate practical quantum computing applications relevant to Archer’s ¹²CQ chip technology, *i.e.* real uses that would benefit from quantum processors onboard technology at room temperature, such as Quantum Artificial Neural Networks.

Human Health

During the Quarter, Archer made a step-change in advancing its graphene-based biosensor technology development to newly commence its lab-on-a-chip A1 Biochip™ (ASX Ann. [5 Nov 2020](#)). This was possible in a short period of time as Archer brought its biotechnology development in-house and is now able to miniaturise its biosensing processes to chip-formats while retaining its IP (Image 3).

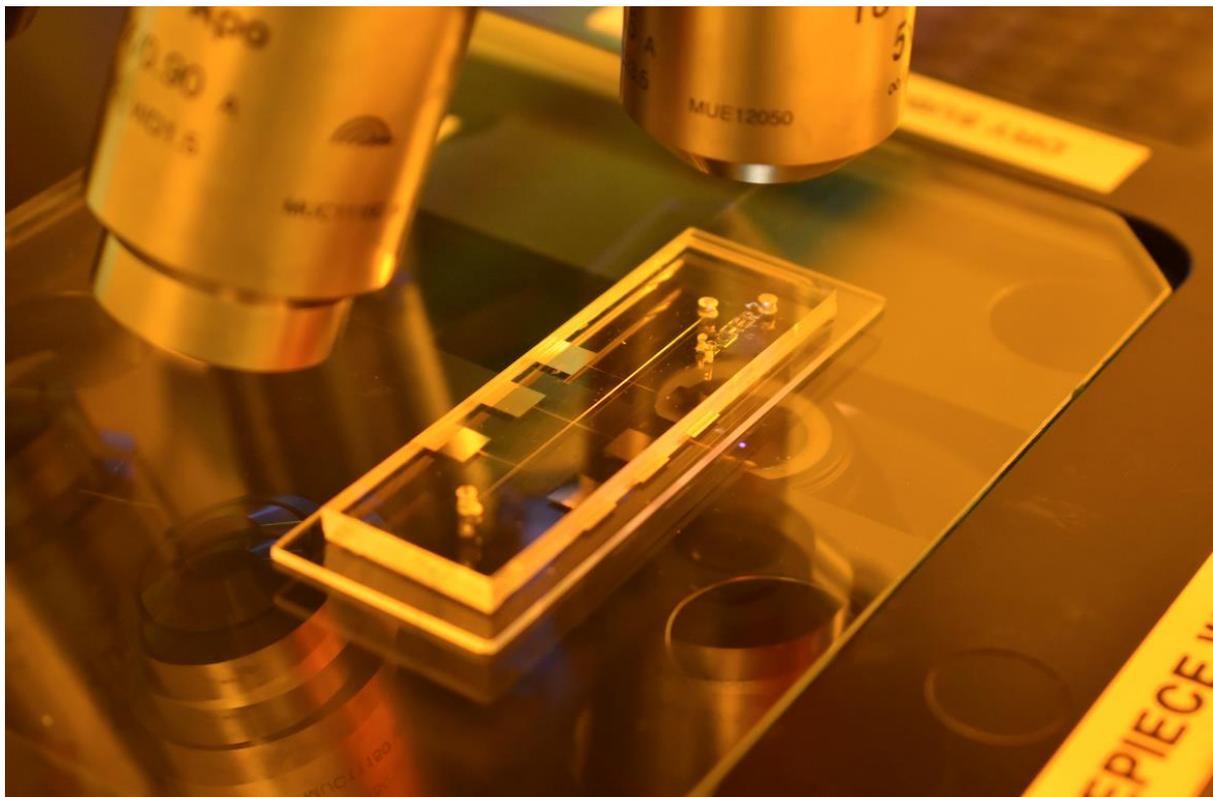


Image 3. Building Archer’s A1 Biochip™. The first componentry is shown. Archer’s biochip development involves miniaturising medical lab tests onto an integrated circuit, a single chip, that is only a few millimetres in size. The chip includes a number of functional areas and componentry, including microfluidic channels and active biosensing areas – all smaller than the thickness of a human hair.

The A1 Biochip™ related patent application titled 'Graphene complexes and compositions thereof' filed under the Patent Cooperation Treaty ("PCT") is progressing in the International Phase in the patent granting procedure, which is the first of two main phases, the second being the [National Phase](#) (Exhibit 2).

Archer will be designing and building its own biochip which means that the Company no longer requires prototyping sensor materials, graphene inks, graphite, 2D/3D printing, or circuit boards (manufactured in Asia) (ASX Ann. [31 Aug 2020](#)). Developing the biochip in-house should allow Archer to accelerate commercialisation of the biochip.

Archer will work with its German Biotech partner to determine potential candidate biomolecules relevant to in-demand disease diagnostic tests, as part of the commercial development of Archer's A1 Biochip™.

Biochip development will involve designing these components for further miniaturisation (micron to nanoscale) and **are intended to incorporate graphene materials**; both aspects which are required to validate commercial advantages of ultra-sensitivity and device integration.

Mineral Exploration

Sale of Two Eyre Peninsula Tenements

The Company has previously stated its intention to divest or otherwise commercialise its mineral tenements. Funds raised from the divestment of exploration projects will be used to progress the ¹²CQ® chip and A1 Biochip™ technology development and commercialisation.

During the Quarter, the Company announced that it has signed a legally binding sale agreement ("Agreement") with private company Baudin Minerals Pty Ltd ("Buyer") for the sale of mineral exploration licences EL 5815 and EL 5920 ("Tenements") (ASX Ann. [22 Dec 2020](#)).

The purchase price payable to Archer is \$2.0 million ("Base Payment") plus a Bonus. The Buyer must pay a \$50,000 non-refundable deposit (Deposit) at the signing of the Agreement and a further non-refundable \$100,000 ("Additional Deposit") if the Buyer elects to proceed after the end of the due diligence period. The Deposit, Additional Deposit and Extension Payments (if any) all form part of the Base Payment, the balance of which may be satisfied in cash or shares in the relevant listed entity (or a combination of both) at the election of the Buyer.

The Bonus amount is an additional payment calculated as 5.0% of the enterprise value of the listed entity. Archer is to be granted a 2% Net Smelter Return royalty on the value of all minerals (excluding graphite) extracted from the Tenements. Also, the Company retains the right to explore for, and if warranted, mine graphite on the area of the Tenements.

Completion of the sale and purchase of the Tenements ("Completion") is conditional upon: the Buyer conducting due diligence by 15 March 2021 and the results of those enquiries being to the satisfaction of the Buyer; South Australian Government approval to the sale of the Tenements; and the Buyer listing on a stock exchange.

Completion will take place on 30 June 2021 or such other date agreed by Archer and the Buyer. The date for Completion may be extended by Buyer for three months at a time (up to 31 December 2021) by paying to Archer \$100,000 per extension (up to a total of \$200,000) ("Extension Payments").

Campoona Graphite Project Fully Permitted

During the Quarter, the South Australian Government has approved the Program for Environment Protection and Rehabilitation (“PEPR”) for the Campoona Graphite Project (ASX Ann. [16 Dec 2020](#)). Approval of the PEPR is the final step in the approvals process for the activities described in the PEPR.

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. This type of work is suitable for small-scale pilot testing and processing of Archer’s graphite materials in end-uses including lithium-ion batteries.

Other Projects

No work was undertaken during the Quarter at Archer’s other project areas not mentioned in this report.

Corporate

Cash Balance

The Company’s cash balance at the end of the Quarter was \$6,932,000.

Exercise of Unlisted Options

During the Quarter, the Company received \$92,924 from the exercise of unlisted options.

Research and Development Tax Incentive

During the Quarter the Company received \$238,858 from the ATO in respect of Archer’s R&D tax incentive for the year ended 30 June 2020.

Annual General Meeting

The Company’s Annual General Meeting was held online this year due to COVID-19 and a recording is available on the [Company website](#). The Chairman’s 2020 AGM Address was lodged with ASX (ASX Ann. [30 Nov 2020](#)). All resolutions put to the meeting were passed on a poll (ASX Ann. [30 Nov 2020](#)). The Company also adopted a new Constitution (ASX Ann. [30 Nov 2020](#)).

Resignation and Appointment of Non-Executive Director

On 28 September 2020, Mr Ken Williams was appointed as a Non-Executive Director of the Company (ASX Ann. [28 Sep 2020](#)). Non-executive Director, Mr Paul Rix resigned from the Board of the Company on 30 October 2020 (ASX Ann. [13 Oct 2020](#)).

Shareholder Events and Outreach

Archer CEO Dr Mohammad Chouair presented virtually at the TechKnow Invest Perth investor conference and the presentation is available on the [Company website](#).

Archer's Quantum Technology Manager, Dr Martin Fuechsle, was invited as a panellist at the Australian Industry Information Association ("AIIA") event '[A Quantum Computing Tipping Point](#)'. The AIIA is Australia's peak representative body for the technology industry.

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

- + [The US National Quantum Initiative](#)
- + [First Quarter Highlights](#)
- + [It's Time For Financial Institutions To Place Their Quantum Bets](#)
- + [Deep tech, machine learning and artificial intelligence](#)
- + [Archer's Virtual Annual General Meeting](#)
- + [Archer Federal Budget Update](#)

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

- + [Archer Materials says collaboration with Max Kelsen is critical step in commercialising its chip](#)
- + [Archer Materials making 'significant progress' towards qubit control](#)
- + [Archer Materials CEO says start of Biochip build is 'step-change advance'](#)
- + [Archer Materials rapidly progressing development of its Quantum chip and biosensor technology](#)
- + [Archer Materials can fast-track development of its qubit chip with new computational models](#)

Appendix 5B Disclosures

Archer's accompanying Appendix 5B (Quarterly Cashflow Report) includes amounts in item 6.1 which were executive and non-executive director fees paid as salaries and wages. During the Quarter the Company spent \$87,000 on exploration activities, primarily being direct expenditure on tenure licence related fees. This amount does not include any costs associated with the Quantum Computing, Human Health and Reliable Energy projects, nor does it include other corporate salaries and other associated overheads.

Issued Capital

Date	Shares	Options	Performance Rights
Start of Quarter	224,654,823	15,870,000	Nil
New issues during Quarter	Nil	1,500,000 ⁽¹⁾	Nil
Exercised/forfeited during Quarter	481,723 ⁽²⁾	481,723 ⁽²⁾	Nil
End of Quarter	225,136,546	16,888,277	Nil
Date of this Report	225,136,546	16,888,277	Nil

(1) 1,500,000 unlisted options, exercisable at \$0.7695 each on or before 31 March 2024, were issued to director Kenneth Williams, following shareholder approval at the Company's Annual General Meeting held on 30 November 2020.

(2) 481,723 unlisted options, exercisable at \$0.1929 each on or before 31 March 2023, were exercised into shares. The unlisted options were previously issued under an employee incentive scheme.

List of Archer Tenements

Tenement*	Location	Commodity
South Australia		
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	Carapee Hill	Graphite
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
EL 6478 ⁽¹⁾	Caralue Bluff	Kaolin
ML 6470	Campoona Shaft	Graphite mining
MPL 150	Sugarloaf	Graphite and graphene processing
MPL 151	Pindari	Process water for Sugarloaf
New South Wales⁽²⁾		
EL 8894	Stanthorpe	Tungsten / Tin
EL 8871	Crowie Creek	Copper/Gold
Western Australia		
E53/1926	Albion Downs	Nickel

Notes

- * All tenements are 100% owned by Archer.
- (1) Tenement was granted during the Quarter
 - (2) Broken Hill tenements EL 8592, EL 8593, EL 8594, EL 8595 and EL 8779 were relinquished during the Quarter.
 - (3) Leigh Creek Magnesite Project tenements EL 5730 and EL 6019 were sold during the Quarter (refer to the commentary elsewhere in this report).

About Archer

A materials technology company developing innovative deep tech in quantum computing, biotechnology, and reliable energy. The Company has strong intellectual property, world-class in-house expertise, a unique materials inventory, and access to Tier 1 technology development infrastructure.

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

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

Website:

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

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

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