

Liontown Resources Limited  
(ASX: LTR)

September 2018

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**Note:** This report is based on information provided by the Company as of September 25, 2018.

### Investment Profile

Share Price - Sept 25, 2018	A\$0.025
12 Month L/H	A\$0.008/ A\$0.057
Issued Capital:	
Ordinary Shares	1,114 m
Unlisted Options	34.74 m
In The Money Options	18.70 m
Diluted for In Money Options	1,132 m
Fully Diluted	1,149 m
Market Capitalisation UD	A\$28.72 m
Cash - June 30, 2018	A\$2.86 m
Receipt - Sale of Consideration Shares, July 2018	A\$1.1 m
Cash on Option Conversion	A\$0.37 m

### Board and Management

Mr Tim Goyder: Chairman
Mr David Richards: Managing Director
Mr Craig Williams: Non-Executive Director
Mr Anthony Cipriano: Non-Executive Director
Mr Richard Hacker: Chief Financial Officer
Ms Kym Verheyen: Finance Office and Company Secretary

### Major Shareholders

Mr Tim Goyder	20.30%
JP Morgan Noms Aust P/L	5.60%
Board	22.50%
Top 20	50.90%

### Share Price Performance



### Mark Gordon - Senior Analyst

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## LITHIUM'S RISING STAR

Liontown Resources Limited ("Liontown" or the "Company") has made significant progress on its battery metals strategy since we first covered the Company in early 2017. This has included an almost complete refresh and rationalisation of projects, with the Kathleen Valley Lithium Project ("Kathleen Valley") in Western Australia being the only "survivor", and one of two lithium discoveries by Liontown.

A key advance at Kathleen Valley has been the release of an initial Mineral Resource Estimate ("MRE") for Kathleen Valley, with this presenting a high grade Resource of 21.2Mt @ 1.37% Li<sub>2</sub>O (with significant upside). This compares very favourably with (including having higher grades than) Resources at some current operations, including Tawana's 50% owned Bald Hill mine in southern Western Australia (26.5Mt @ 0.97% Li<sub>2</sub>O) and Galaxy's Mt Cattlin operation (which had a pre-mining Resource of 18.2Mt @ 1.08% Li<sub>2</sub>O, and with current Resources of 9.7Mt @ 1.35% Li<sub>2</sub>O excluding low grade stockpiles). Metallurgical test work is now underway on samples from Kathleen Valley, with the results to be incorporated into a Scoping Study due for completion in 4Q18.

Also on the lithium front, initial and ongoing drilling at the Buldania Lithium Project ("Buldania", and the second lithium discovery), located near Norseman, has returned some impressive results, including a near surface intersection of 58m @ 1.2% Li<sub>2</sub>O, highlighting the potential for a large, near surface resource. A second drilling programme is currently underway - this has been expanded from that originally planned due to strong intersections, with the results of this and the initial programme to be used in a fast tracked initial MRE. There is also exploration upside, with a number of addition pegmatites being recognised within the Company's ground along strike from Buldania.

The Company has also entered the vanadium space, with the granting of exploration licences for the Toolebuc Vanadium Project ("Toolebuc"), located near Julia Creek in western Queensland. It is early days, however the results of historic work highlight the potential to host a large, albeit relatively low grade vanadium resource; a key aspect here will be metallurgy.

Liontown is well placed to take advantage of the forecast continuing strong markets for lithium and vanadium. The lithium projects, should they prove economically viable (and subject to funding and permitting), present ideal opportunities for relatively low cost, short lead time start-ups.

## KEY POINTS

**Quality projects;** Results to date from the three key projects, Kathleen Valley, Buldania and Toolebuc have been very encouraging, highlighting their prospectivity to host potentially economically viable mineralisation for both lithium and vanadium.

**Quality Kathleen Valley Resource:** As they say, "grade is king", and Kathleen Valley has one of the highest grade and most robust Resources of its peers, in addition 75% is in the Indicated and Measured categories.

**Near infrastructure:** All of the company's projects are located near infrastructure, particularly in regards to transport; this proximity to infrastructure should help to cut operating and capital costs should any of the projects progress to production, and thus may help positively differentiate them from other projects.

**Experienced and committed personnel:** Company personnel are well respected and have extensive experience in the junior resources space, and have been involved with companies that have returned significant value to shareholders, including Chalice Gold Mines (ASX: CHN) and Equinox Minerals, subsequently taken over by Barrick Gold. In addition insiders hold close to 23% of the shares in Liontown, a key strength that aligns the interests of company personnel with that of the other shareholders.

**Leveraged to exploration success:** With an enterprise value ("EV") of just \$27 million, Liontown is well leveraged to exploration success. In the hard rock lithium space we have companies such as Pilbara Minerals (ASX: PLS, "Pilbara") and Altura Mining (ASX: AJM, "Altura") having current EVs of \$1,342 million and \$543 million respectively with significant share price rises over the past few years.

**Steady News Flow:** We expect to see a steady news flow with ongoing exploration activities, including a number of drilling programmes throughout the rest of the year.

## SWOT ANALYSIS

### Strengths

- ◆ **Highly prospective holdings:** The lithium discoveries to date have highlighted the prospectivity of Liontown's lithium projects; likewise, the Toolebuc Formation in Queensland is recognised as a major vanadium bearing unit.
- ◆ **High grade and robust Resource:** At 1.37% Li<sub>2</sub>O, the Kathleen Valley Resource is high grade, and one of the highest amongst peers; in addition, the grade-tonnage curve highlights a robust resource with very little of the mineralisation having a grade of less than 0.9% Li<sub>2</sub>O.
- ◆ **Experienced people with skin in the game:** Company personnel have significant experience in the resources sector and a record of delivering value to shareholders. In addition insiders hold some 23% of the stock, thus aligning their interests with those of other shareholders.
- ◆ **Infrastructure and skills:** All projects are located close to infrastructure, a key consideration in differentiating projects; as well, they are in locations with ready access to skills and services.
- ◆ **Jurisdiction:** Liontown's key projects, being located in Western Australia and Queensland are located in well-known and understood mining jurisdictions, with ready access to skilled labour and services.
- ◆ **Granted mining lease:** Kathleen Valley is on a granted mining lease, which, should the project prove viable, will held streamline and shorten the approvals process.

### Weaknesses

- ◆ **One of many:** Liontown is one of many hopefuls in the lithium space, with these companies vying for what we would see is a relatively limited pool of funding and potentially offtake agreements – this will become more critical when companies approach development and will need development finance, with the players then needing to differentiate themselves to attract funding.
- ◆ **Resource tonnage - Kathleen Valley:** The Kathleen Valley Resource is relatively small when compared to most peers, however when compared with current producers Bald Hill (held 50:50 between Tawana Resources, ASX: TAW, and Singapore listed Alliance Mineral Assets Limited "AMAL") and Mt Cattlin (Galaxy Resources, ASX: GXY), the Resource may be interpreted as being sufficient to support a viable operation.
- ◆ **Metallurgy -Toolebuc:** Historical work over areas of the Toolebuc Formation has highlighted the difficult and potentially high cost metallurgy of the vanadium mineralisation; on the other hand an opportunity arises here to develop a viable and cost effective treatment process.

### Opportunities

- ◆ **Exploration and drilling success:** Given the quality of the exploration ground and the results of work to date, there is a good opportunity for ongoing exploration success; this also applies to potential expansions of the Kathleen Valley Resource and drilling at Buldania resulting in a meaningful Resource.
- ◆ **Acquisitions and earn-ins:** This is a perennial opportunity should the right project come up – Liontown has shown, through the acquisition of a number of lithium projects over the past few years that it is prepared to make acquisitions where it sees potential value .
- ◆ **Farm-outs or divestment:** Conversely, there is the potential to farm out whole or parts of projects, and let someone else's money do the work when results don't meet the Company's criteria. We have also seen Liontown divest projects where required, with a recent example being the sale of the Bynoe Project in the Northern Territory to Core Exploration (ASX: CXO, "Core"), which has returned ~A\$3.5 million in cash to Liontown.

### Threats

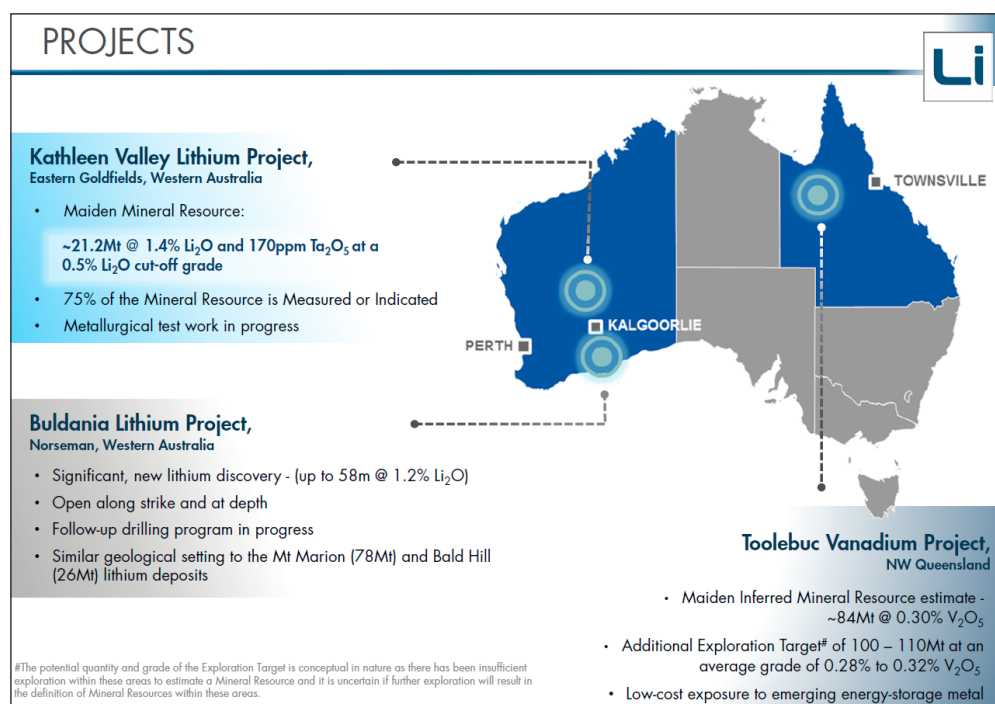
- ◆ **Markets and funding:** These are perennial threats for resource companies, and although the markets seemed to have turned, they can turn back on a dime – Liontown is somewhat insulated from this with cash in the bank from a recent raising, however should things turn they will need to conserve cash – this could mean also having to divest some properties due to not being able to service them.
- ◆ **Lithium markets:** This is a large unknown, with demand and supply forecasts varying between different analysts and stakeholders – there is the potential for the major players to plug the expected supply hole through expansions, and thus close the door on the up and coming developers.

## OVERVIEW

### STRATEGY AND PROJECT OVERVIEW

- ◆ We initially wrote up Liontown in early 2017, when the Company had embarked on its “battery metal” strategy, at that stage concentrating on lithium, with projects in Australia and Tanzania.
- ◆ The Company has subsequently developed the strategy and strengthened/rationalised the property portfolio, with activities now concentrated on three key properties, as shown in Figure 1; this has also seen a close to doubling in the enterprise value (“EV”) of Liontown, vindicating the strategy:
  - Kathleen Valley in WA, for which an initial MRE of 21.2Mt @ 1.4% Li<sub>2</sub>O has recently been announced and for which a Scoping Study is planned,
  - Buldania in WA, over which initial drilling has highlighted the potential for a significant lithium Resource; and,
  - The Toolebuc Vanadium Project in Queensland (which was granted in 2Q17), which has a vanadium Resource and Exploration Target.
- ◆ Buldania includes three areas, the eponymous Buldania Project, and the adjacent Norcott and Killaloe Projects.

Figure 1: Liontown project location map



Source: Liontown

- ◆ The tenement rationalisation included the September 2017 sale of the non-core Bynoe Lithium Project in the Northern Territory to Core; the initial consideration for the sale was A\$1.5 million in cash and A\$2 million in Core shares, with A\$1.5 million in shares or cash (at Liontown's election) due on the estimation of a 5Mt MRE.
- ◆ Liontown has subsequently liquidated the holding in Core, which has brought in A\$1.9 million cash.
- ◆ The Company also sold seven non-core Mining Leases at the Kathleen Valley Project to Draig Resources Limited (ASX:DRG), with the consideration being A\$25,000 cash and one million Draig shares.
- ◆ The company is in the process of relinquishing its interests in the Jubilee Project in Tanzania, and has already exited its position in the Mohanga Project - when the Jubilee divestment is complete Liontown will have no interests in Tanzania.

## FINANCIAL POSITION

- ◆ As of June 30, 2018 the Company had \$2.857 million in the bank and no debt.
- ◆ Over the twelve months to June 30, 2018 the Company spent A\$3.046 million on exploration, and A\$0.843 million on administration and staff costs.
- ◆ In June 2018 the Company raised A\$3.0 million through the placement of ~111.1 million shares at a price of A\$0.027/share to professional and sophisticated investors.
- ◆ Over the same period Liontown received A\$2.514 million from the sale of projects (including for shares issued as part of the consideration); subsequent to the end of 2Q18 the Company sold the remaining shares in Core for proceeds in the order of A\$1.1 million before transaction fees.

## CAPITAL STRUCTURE

- ◆ Liontown currently has 1,104 million shares and 34.75 million unlisted options on issue (Table 1) - 18.7 million options are currently in the money with the potential to bring in A\$374,000 if exercised.
- ◆ The largest shareholder is the Chairman, Mr Tim Goyder, with direct and indirect interests in 226 million shares, or 20.30% of the Company.
- ◆ Total insiders interests are 22.50%, with the top 20 holding 50.90%.

**Table 1: Unlisted options**

Unlisted options			
Expiry Date	Number	Exercise Price	Cash on Exercise
31/03/2021	9,300,000	A\$0.035	\$325,500
31/10/2022	18,700,000	A\$0.020	\$374,000
22/10/2020	5,000,000	A\$0.026	\$130,000
30/04/2021	750,000	A\$0.050	\$37,500
29/08/2021	1,000,000	A\$0.038	\$38,000
<b>Total</b>	<b>34,750,000</b>	<b>N/A</b>	<b>\$905,000</b>

Source: Liontown

## JUNIOR MINERAL RESOURCE INCENTIVE ELIGIBILITY

- ◆ On July 5, 2018, the Company announced that it was successful in its application for participation in the Federal Government's Junior Mineral Resource Incentive ("JMEI") scheme for the 2018/2019 tax year; the scheme is voluntary and the Company needs to make a new application each year.
- ◆ This allows for credits of up to A\$1,127,500 to be distributed to shareholders as a tax offset or franking credit, and is in effect a transfer of tax losses from the Company to the eligible shareholders, and is designed to boost investment in the junior resources sector.
- ◆ Eligible shareholders include Australian residents who applied for and were issued new shares in Liontown's capital raisings between July 1, 2018 and June 30, 2019, with the maximum credit for each shareholder being the capital issued multiplied by the corporate tax rate; the credits will be issued to eligible shareholders on a pro-rata basis.

## PROJECT DESCRIPTIONS

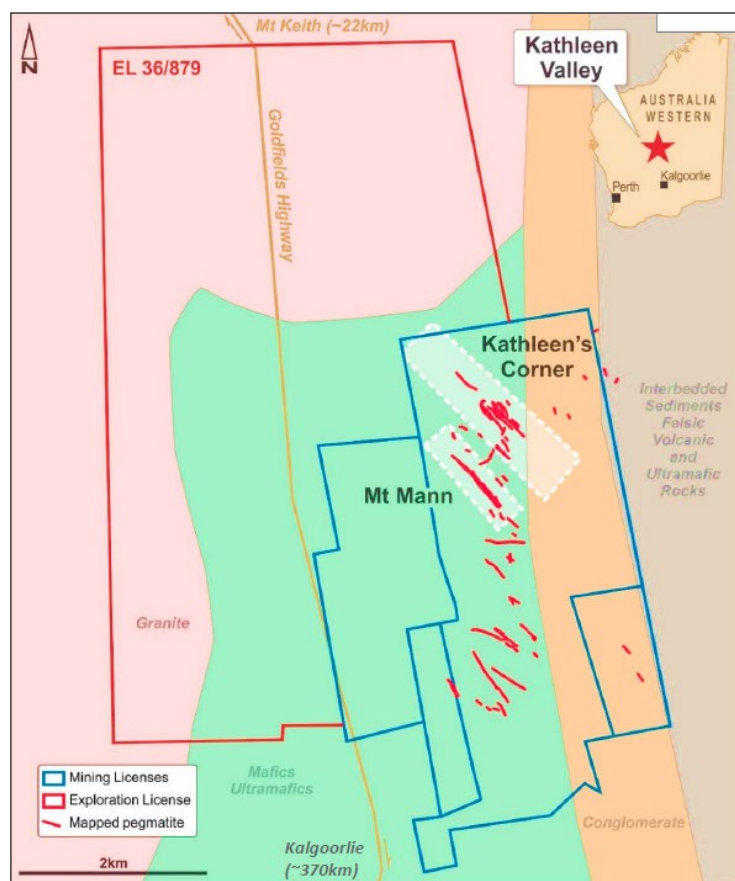
### KATHLEEN VALLEY, WA - LTR 100%

#### Location and Tenure

- ◆ Kathleen Valley comprises 4 granted mining leases ("ML" 1,463ha) and one exploration licence ("EL" ~23km<sup>2</sup>), located approximately 45km NNW of Leinster in Western Australia (Figures 1 and 2).
- ◆ The tenement package, with all in good standing, is located along the Goldfields Highway, between Leinster and Wiluna, and is situated ~30km south of BHP Billiton Nickel West's Mount Keith Nickel Mine (Figure 2).



Figure 2: Kathleen Valley project location and geology



Source: Liontown

- ◆ The project area is covered by the Tjiwari Determined Native Title Claim (WC11/7).
- ◆ The acquisition of the original MLs from Ramelius Resources (ASX: RMS) was announced to the market on August 4, 2016, under the following terms:
  - Issuing 25 million shares for the acquisition of 100% of the tenements,
  - Liontown to pay Ramelius a royalty of 1% of gross sales of any concentrate produced from pegmatite ores, as well as \$0.50/tonne of any rare metal pegmatite-hosted ore mined and milled; and,
  - Ramelius will retain the exclusive gold rights, with unfettered access to the tenements for gold exploration.
- ◆ The Company subsequently sold seven MLs to Draig Resources for A\$25,000 cash and 1 million Draig shares, and surrendered its interests in four MLs, with these reverting back to Ramelius.
- ◆ Xstrata Nickel Operations Pty Ltd (“Xstrata”) retain 100% of the nickel rights through an offtake and claw-back agreement by virtue of Xstrata’s original sale of the tenements to Ramelius in 2014 – Ramelius, and hence now Liontown have also assumed obligations for one royalty agreement:
  - Bullion and Non-Bullion Royalty Agreement of a 2% Gross Production Royalty affecting M264, 265, 459 and 460.

### Geology and Mineralisation

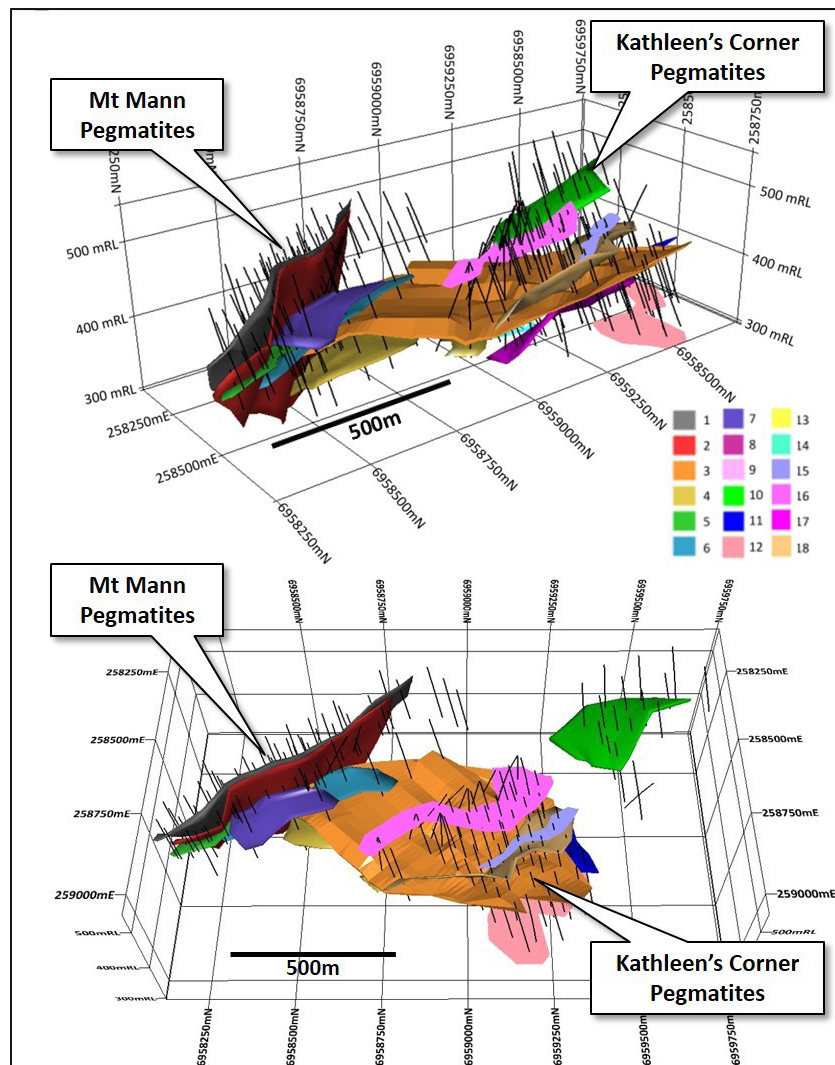
- ◆ Kathleen Valley is located over greenstone units on the western edge of the Norseman-Wiluna Belt in the Archaean Yilgarn Craton, with a dominant north-south structural/lithological trend.
- ◆ Greenstone units are dominated by mafic/ultramafic lithologies, including the Kathleen Valley Gabbro and Mt. Goode Basalt, with younger felsic volcanics and sedimentary rocks present on the eastern edge (Figure 2).
- ◆ Pegmatites have largely intruded into the ultramafic/mafic units, with the main trend being northwest, and with the northwestern end disappearing under transported cover where they are still open (Figure 2) - pegmatites are of the lithium-caesium-tantalum (“LCT”)



type, which are the host to economic lithium mineralisation in Western Australia, and the key targets for lithium exploration.

- ◆ Two main groups of pegmatites have been recognised, Kathleen's Corner and Mt Mann (Figures 2 and 3), with a number of mapped pegmatites also occurring to the south.

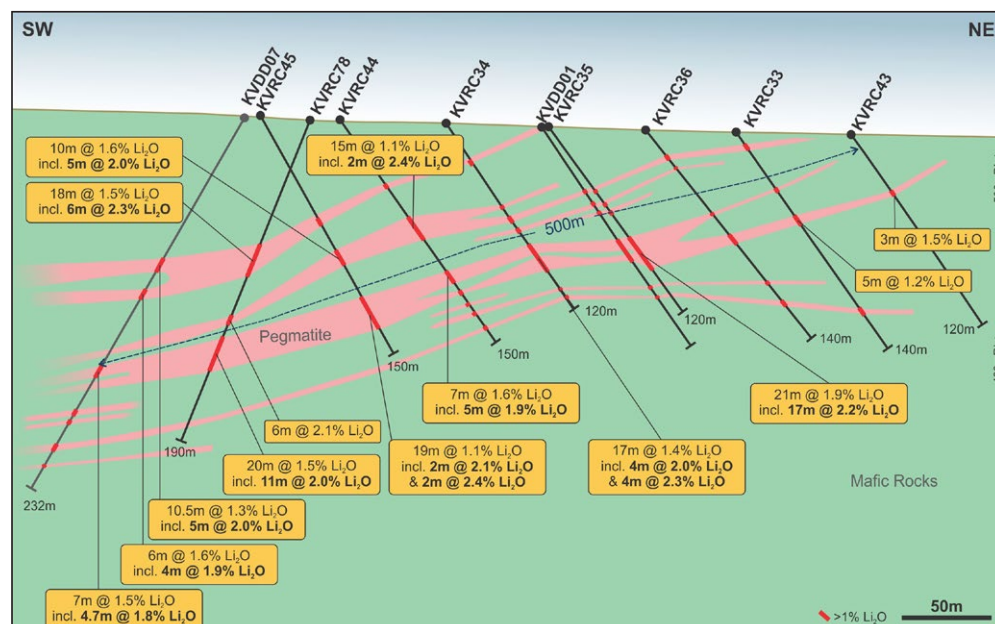
**Figure 3: Kathleen Valley pegmatites looking northwest (top) and west (bottom).**



Source: Liontown

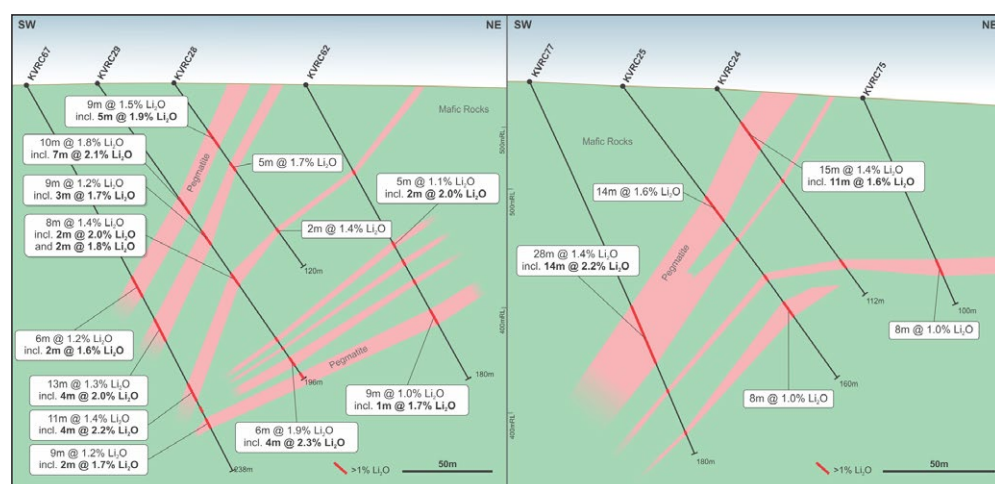
- ◆ Kathleen's Corner comprises eleven gently southwest dipping pegmatites that have been drilled over an area of 1,000m x 600m; these outcrop at Kathleen's Corner and extend down dip to Mt Mann (Figure 4).
- ◆ Individual pegmatites are up to 20m in thickness, however the average thickness is 5m; in addition there are four moderately dipping (15° to 45° SW) pegmatites, with an average thickness of 9m and an average of 3m - a single, flat-lying pegmatite with an average thickness of 7m has been drilled over a strike length of 400m within the northwestern area of Kathleen's Corner.
- ◆ Mt Mann includes two 70° southwest dipping pegmatites, that have been drilled over a strike length of 900m and for a down-dip extent of 180m; these have a maximum thickness of 12m and average thicknesses of 8m to 10m (Figure 5); dips of the pegmatites are ideal for open cut mining.
- ◆ The Kathleen's Corner pegmatites are open to the southeast, with the northern section also open down-dip to the south-west; likewise Mt Mann is open down-dip to the southwest (Figure 6).

Figure 4: Kathleen's Corner drilling - representative section



Source: Liontown

Figure 5: Mt. Mann drilling - representative sections



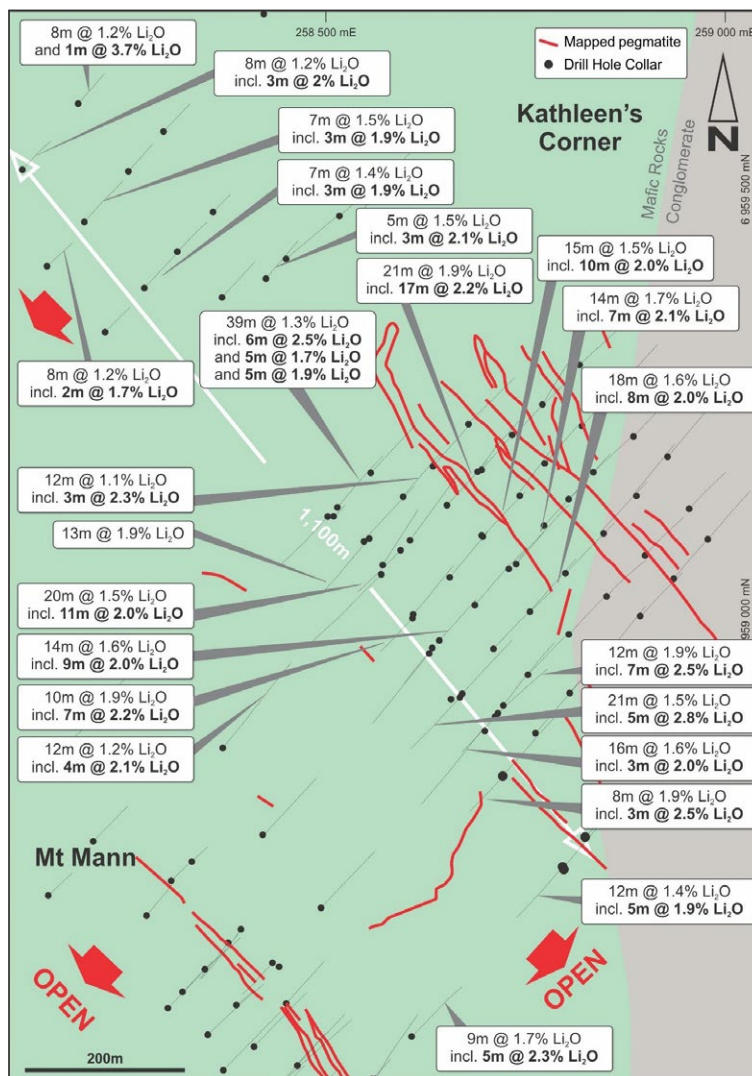
Source: Liontown

## Historical and Current Exploration Work

- ◆ There has only been limited historical exploration work for Li, Ta and Sn, with this limited to geological mapping, soil sampling and rock chip sampling by Jubilee Mines (subsequently taken over by XStrata) – no drilling had been completed on the pegmatites – most historical work has concentrated on gold and nickel sulphide mineralisation.
- ◆ Initial work by Liontown included geological mapping and rock chip sampling, with this outlining the two main prospects – Mt. Mann and Kathleen's Corner.
- ◆ This was then followed up by the drilling that was used in the initial MRE for the Project; initial drilling (19 holes for 2,057m) was completed over Mt Mann in early 2017, with a second phase of drilling completed in early 2018 following on from gaining access agreements from the Traditional Owners.
- ◆ In all Liontown has drilled 147 RC holes for 18,671m and nine diamond core holes for 1,610m - samples from the latter are currently subject to metallurgical test work.
- ◆ The holes were drilled on lines spaced at between 40m and 100m, with drill holes spaced at 30m to 60m on the sections.
- ◆ The drilling resulted in some very strong intersections, with examples shown in Figure 4 and 6 (Kathleen's Corner) and Figure 5 (Mt Mann); one feature of Kathleen's Valley is the relatively high TA<sub>2</sub>O<sub>5</sub> content which has the potential to be a valuable by-product in any future operation.

- ◆ A few examples of better intersections include:
  - 39m @ 1.3% Li<sub>2</sub>O from 99m (KVRC0122), including 6m @ 2.5% Li<sub>2</sub>O from 100m, 5m @ 1.7% Li<sub>2</sub>O from 108m and 5m @ 1.9% Li<sub>2</sub>O from 127m,
  - 12m @ 1.8% Li<sub>2</sub>O from 113m (KVRC0123), including 6m @ 2.5% Li<sub>2</sub>O; and,
  - 20m @ 1.5% Li<sub>2</sub>O and 147ppm Ta<sub>2</sub>O<sub>5</sub> from 73m (KVRC0078), including 11m @ 2.0% Li<sub>2</sub>O and 134ppm Ta<sub>2</sub>O<sub>5</sub> from 134m.

**Figure 6: Kathleen's Corner drilling results and pegmatite outcrops**



Source: Liontown

## Mineral Resources

- ◆ The initial MRE for Kathleen Valley is shown in Table 2, with this at various lower cuts shown in Table 3 - what Table 3 highlights is the robustness of the resource, in that very little of the mineralisation has a grade of less than 0.9% Li<sub>2</sub>O.

**Table 2: Kathleen Valley JORC 2012 MRE - 0.5% Li<sub>2</sub>O cutoff**

Kathleen Valley JORC 2012 MRE - 0.5% Li <sub>2</sub> O cutoff			
Resource category	Million tonnes	Li <sub>2</sub> O %	Ta <sub>2</sub> O <sub>5</sub> ppm
Measured	3.2	1.3	190
Indicated	12.7	1.4	160
Inferred	5.3	1.3	150
<b>Total</b>	<b>21.2</b>	<b>1.4</b>	<b>170</b>

Source: Liontown

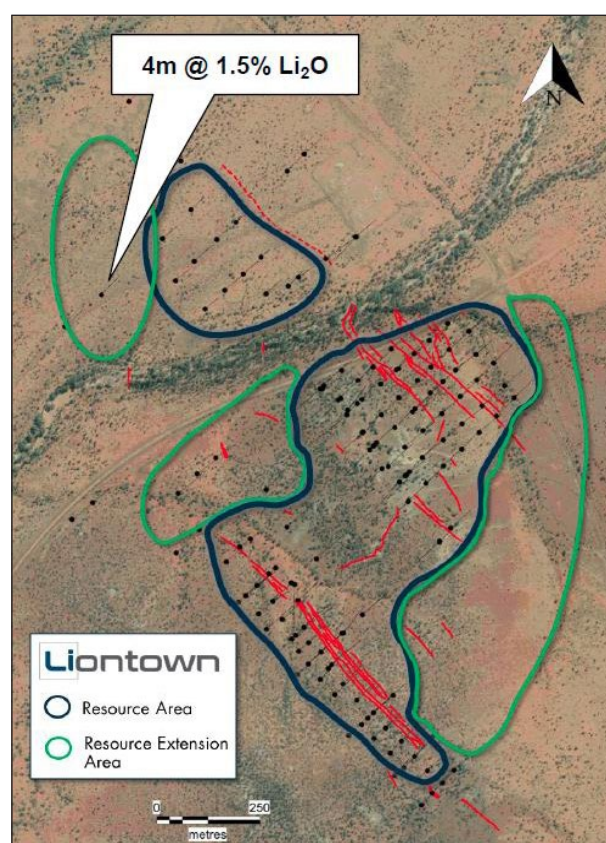


**Table 3: Kathleen Valley MRE - different cut-off grades**

Kathleen Valley MRE - different cut-off grades			
Cut-off Li <sub>2</sub> O %	Million tonnes	Li <sub>2</sub> O %	Ta <sub>2</sub> O <sub>5</sub> ppm
0.3	21.2	1.37	166
0.4	21.2	1.37	166
0.5	21.2	1.37	166
0.6	21.2	1.37	166
0.7	21	1.37	166
0.8	20.7	1.38	166
0.9	20.1	1.40	167
1	18.9	1.43	167
1.1	17.3	1.46	167
1.2	15.1	1.51	168
1.3	12.3	1.56	170
1.4	9.3	1.63	174
1.5	6.6	1.71	177

Source: Liontown

- ◆ Figure 7 shows the surface projection of the initial MRE, as well as the area considered to host upside potential, and which will be the target of upcoming drilling.

**Figure 7: Kathleen Valley current Resource outline (blue) and upside (green).**

Source: Liontown – note different scales

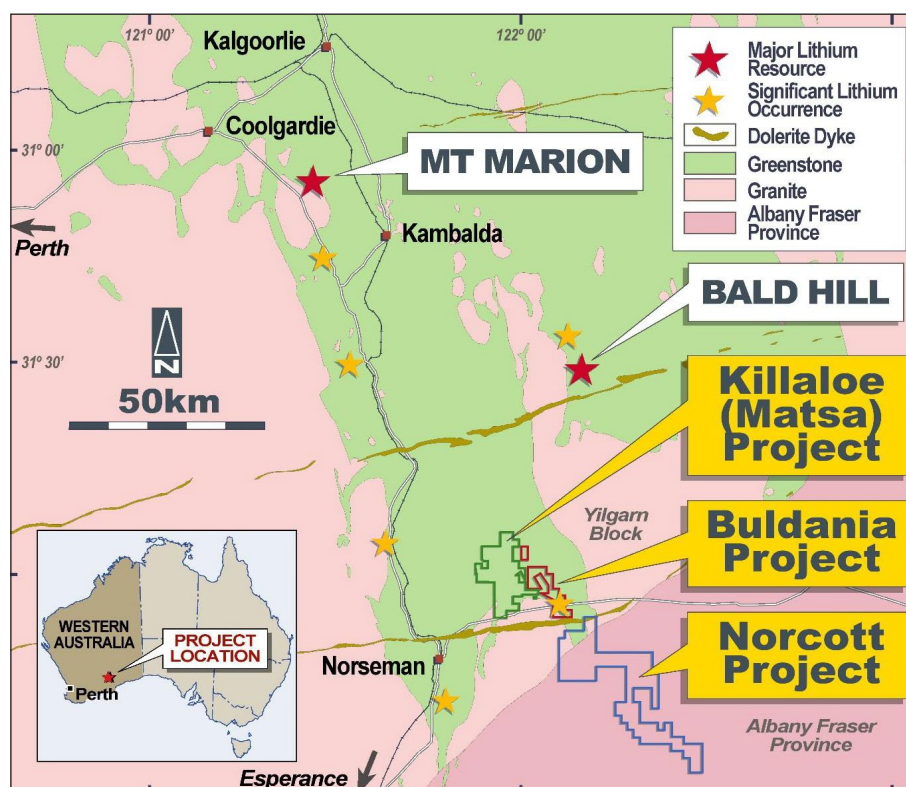
## BULDANIA PROJECT, WA - LTR 100%, 80%

### Location and Tenure

- ◆ The Buldania Project is part of a large, strategic land position including the neighbouring Norcott Project and Killaloe Project, centred over the Eyre Highway ~30km east of Norseman (and the Kalgoorlie Esperance railway); Norseman is located ~700km east by road from Perth and 200km north of the port at the regional centre of Esperance.

- ◆ The region contains two operating spodumene mines, Mt Marion (Neometals Limited 13.8%, ASX: NMT, "Neometals"; Jiangxi Ganfeng Lithium Co. Limited, 43.1%, SHE: 002460, "Ganfeng" and Mineral Resources Limited, 43.1%, ASX: MIN, "MinRes") and Bald Hill (Tawana 50%, AMAL 50%).
- ◆ Mt Marion has Resources of 77.8Mt @ 1.37% Li<sub>2</sub>O, with Bald Hill hosting 26.5Mt @ 0.97% Li<sub>2</sub>O; the former is ramping up to a planned production of 450,000tpa 6% concentrate (~67,000tpa LCE), with the latter having a planned production of 155,000tpa concentrate (~23,000tpa LCE).

**Figure 8: Buldania group of projects**



Source: Liontown

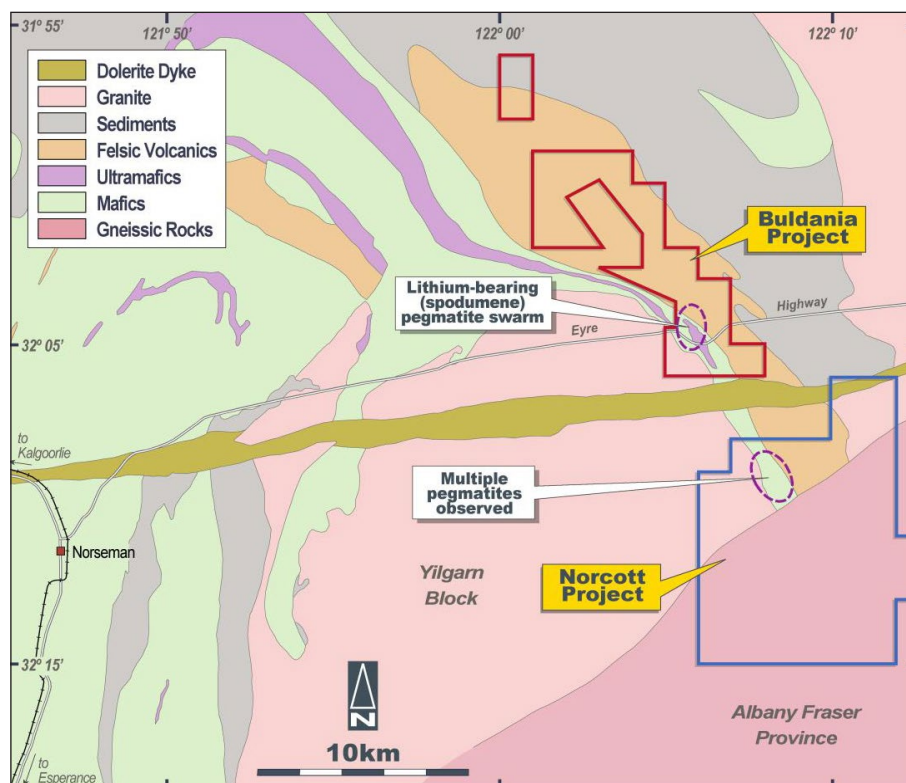
- ◆ Buldania includes one EL and one Prospecting Licence ("PL") for ~68km<sup>2</sup>; the EL is currently under renewal.
- ◆ The rights to 100% of lithium and associated minerals were acquired from Avoca Resources Pty Ltd ("Avoca"), a wholly owned subsidiary of Westgold Resources Limited (ASX: WGX) in October 2017; Avoca retains the rights to other metals.
- ◆ Terms of the Buldania acquisition were:
  - Pay ongoing statutory rents and rates for the tenements and spending a minimum of \$100,000 of meeting the statutory exploration expenditure (whichever is greater) with twelve months of execution of the agreement being having the right to withdraw; and,
  - Paying Avoca A\$2/tonne of ore mined and 1.5% of any gross revenue in respect of any lithium minerals mined.
- ◆ The Tenements are covered by the Ngadju Determined Native Title Claim (WCD2014/004). Avoca has an Access Agreement with the Ngadju which will apply to Liontown's exploration activities.
- ◆ Norcott includes one EL and one ELA for 360km<sup>2</sup>; both were applications when Liontown entered into an acquisition agreement with a private company Galahad Resources Pty Ltd ("Galahad").
- ◆ Terms of the acquisition include:
  - Paying Galahad an initial signing fee of A\$10,000.
- ◆ Once the applications are granted:
  - Reimbursing Galahad's previous costs up to A\$20,000,
  - Paying Galahad A\$50,000 cash,

- Issuing Galahad Liontown shares to the value of A\$50,000 based on a share price equivalent to the 5 day volume weighted average price for the 5 days prior to Completion; and,
  - Paying Galahad a royalty equivalent to 1.25% of the gross revenue in respect to any minerals extracted from the Tenements.
- ◆ The latest acquisition in the area was the Killaloe group of tenements, which, as announced in August 2018, Liontown is acquiring from Matsa Resources (ASX: MAT).
  - ◆ Killaloe covers an area of ~163km<sup>2</sup>, and includes eight granted ELS, one granted ML and one PLA.
  - ◆ Two ELs are held under an agreement with Cullen Resources (ASX: CUL), whereby Cullen holds 20%; all others are held 100%.
  - ◆ The acquisition price is 20 million fully paid ordinary shares in Liontown, issued according to the following schedule:
    - 10 million shares in relation to Matsa's wholly-owned tenure (Tranche 1, completed);
    - 10 million shares in relation to Matsa's 80%-owned tenure (Tranche 2); and
    - Paying Matsa a 1% NSR for all minerals produced by Liontown.
  - ◆ Tranche 2 is conditional on Cullen not exercising its pre-emptive rights under its agreement with Matsa - Cullen has elected not to exercise these, and will retain a 20% free carried interest in the applicable tenements.
  - ◆ The Tenements are covered by the Ngadju Determined Native Title Claim (WCD2014/004)
    - Matsa has an Access Agreement with the Ngadju which will apply to Liontown's exploration activities.

## Geology and Mineralisation

- ◆ The majority of the Project is situated over the southern-most extent of the Archaean Norseman-Wiluna greenstone belt, which includes north to northwest striking, steeply dipping ultramafic to felsic volcanics and sediments wrapping around a granite dome (Figure 9).

**Figure 9: Buldania and Norcott tenements, highlighting geology and prospective pegmatite belt**



Source: Liontown

- ◆ The southern end of Norcott is located over poorly exposed units of the Proterozoic Albany Fraser Province.
- ◆ Initial mapping identified two pegmatite swarms within Buldania and Norcott (Figure 9); these are some 10km apart along strike of a mafic-ultramafic unit.

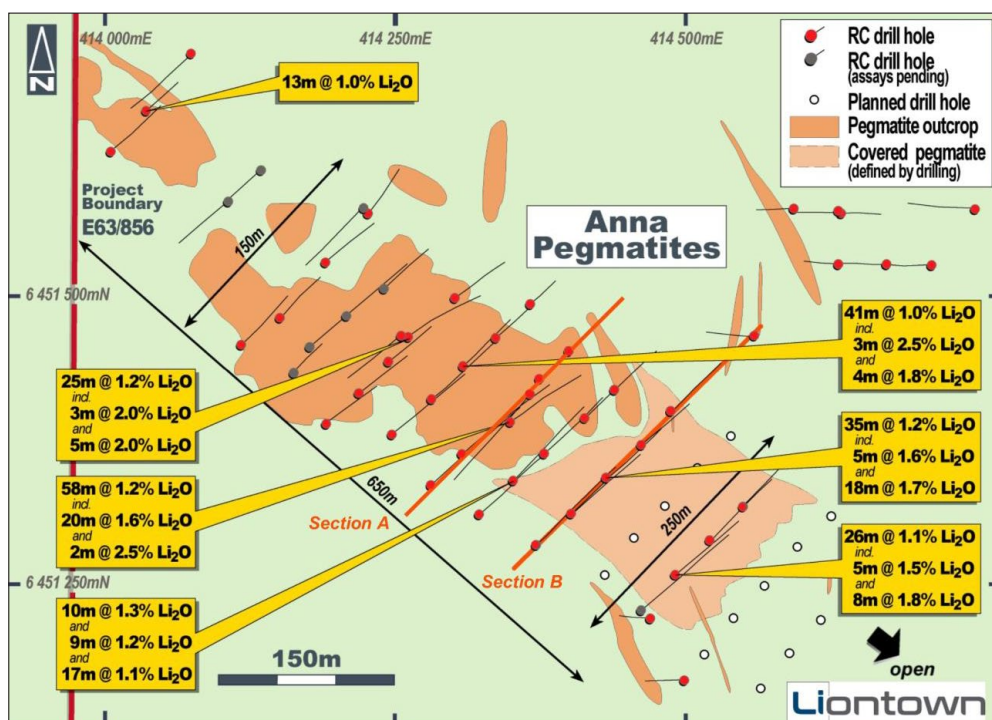


- ◆ At Buldania this identified a 2.0km x 1.3km area of pegmatites, with individual pegmatites up to 400m long and 160m wide; rock chips returned up to 4.6%  $\text{Li}_2\text{O}$ .

### Historic and Current Exploration Activities

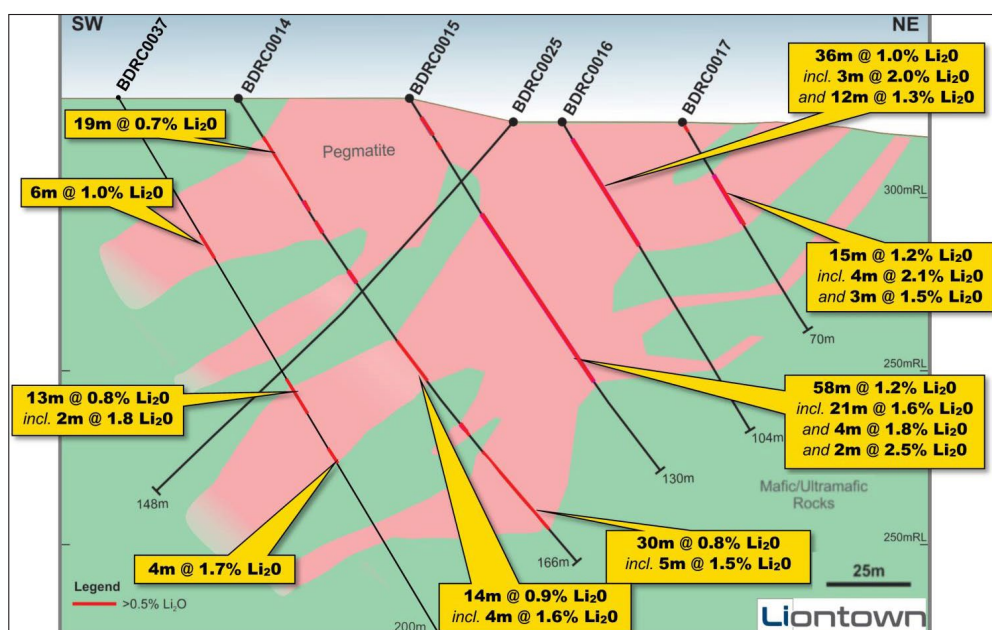
- ◆ No previous work has been carried out assessing the pegmatites at Buldania, however previous workers had noted the presence of them in the area.
- ◆ Liontown initially carried out geological mapping and rock chip sampling, with this followed up by a 36 hole, 3,339m RC drilling programme in early 2018; the Company is currently undertaking a follow up programme, with 32 holes for 4,030m being drilled as at the time of writing, and assays still awaited for six holes.
- ◆ Given the positive results of the drilling to date the programme has been extended to test the southeast strike extents (Figure 10).
- ◆ The majority of the drilling has been completed at the Anna prospect (Figures 10 and 11), with this indicating that the pegmatites dip moderately to the southwest; they were originally interpreted as being steeply dipping.

Figure 10: Anna prospect drilling plan



Source: Liontown

Figure 11: Anna prospect section



Source: Liontown



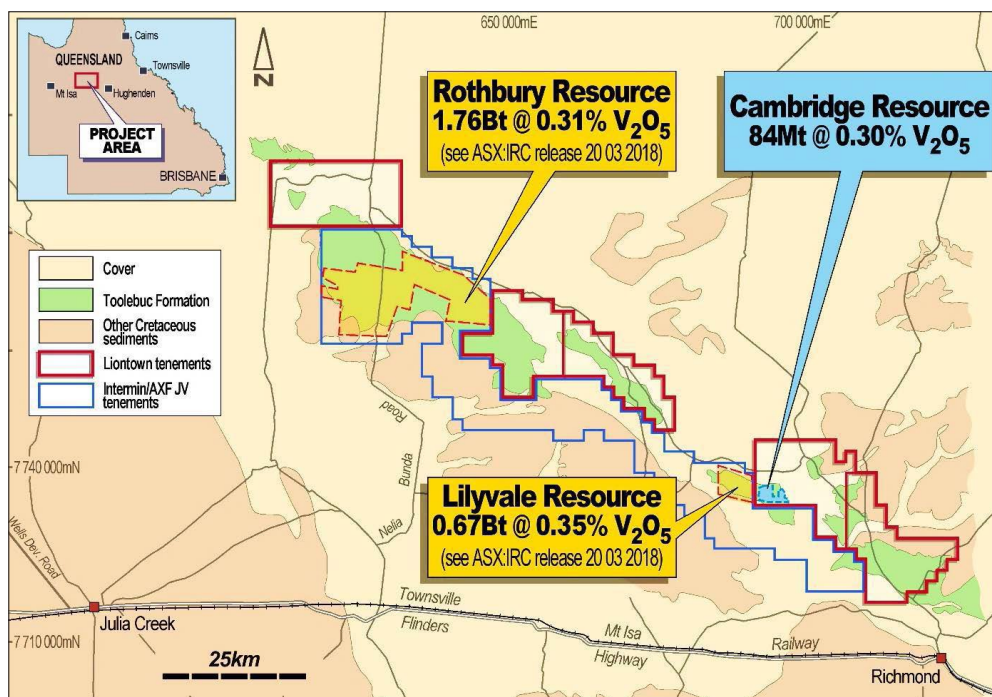
- ◆ Figure 11 highlights some of the very thick intersections (which are close to true width) at the Anna prospect; these include 58m @ 1.2%  $\text{Li}_2\text{O}$ , including 20m @ 1.2%  $\text{Li}_2\text{O}$ .
- ◆ Mineralisation has been intersected for a strike length of ~650m (and is still open to the southeast), and over widths of up to 250m across strike - mineralisation also occurs from surface, and thus, should an economic Resource be found, should be amenable to low strip ratio open pit mining.

## TOOLEBUC PROJECT, QLD - LTR 100%

### Location and Tenure

- ◆ The Project comprises five granted EPMS for an area of 323 graticular sub-blocks (1,072km<sup>2</sup>), with all being in good standing and with expiry/renewal dates ranging from July to October 2022 (Figure 12).

Figure 12: QEM tenement map



Source: Liontown

- ◆ The Project is centred approximately 75km north-east of the town of Julia Creek, with Julia Creek being located 655km west of Townsville and 255km east of Mt. Isa, both major regional centres.
- ◆ Both centres are a ready source of experienced mining personnel and services.
- ◆ Julia Creek is well served by infrastructure, being located both on the Flinders Highway and railway connecting Mt Isa with the coast and port facilities at Townsville.
- ◆ The tenements are along strike from those held by Intermin Resources (ASX: IRC), which host substantial vanadium resources (Figure 12) within the target Toolebuc Formation; Liontown's tenements contain significant areas of the Toolebuc that have not been drilled, and thus present significant resource upside.

### Geology

- ◆ The Project is located over the Allara Mudstone and Toolebuc Formation of the Rolling Downs Group, a Lower to Upper Cretaceous unit of the broader Eromanga Basin (Figures 2 and 3); the oil and vanadium bearing Toolebuc Formation is the target for exploration and development activities.
- ◆ The Eromanga Basin, which covers an area of some 1,500,000km<sup>2</sup> itself is part of the broader Great Artesian Basin and partially overlaps the Cooper Basin.
- ◆ The Toolebuc Formation is commonly covered by between 100m and 1,000m of younger units except near the basin margins, and also in the vicinity of Julia Creek, where it drapes over the St. Elmo Structure, which represents a basement high.

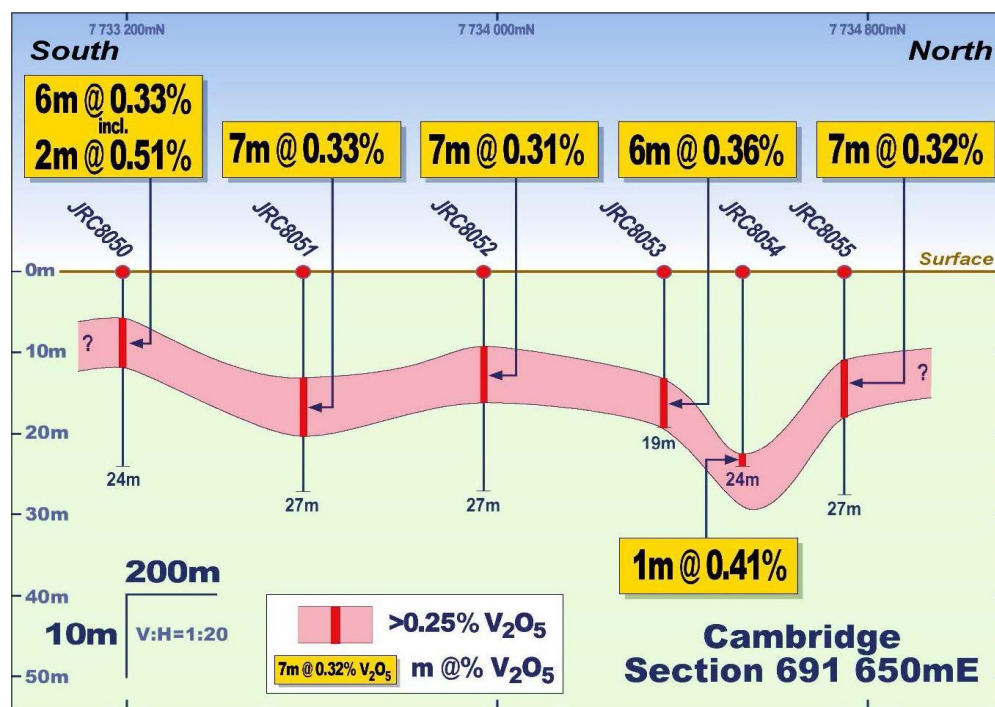
Figure 13: Eromanga Basin stratigraphy, Richmond/Julia Creek area.

AGE	FORMATION AND DOMINANT LITHOLOGY	
RECENT TERTIARY	Surficial deposits alluvium	
Unconformity		
LATE CRETACEOUS	ROLLING DOWNS GROUP	Winton Formation Shale, siltstone
EARLY CRETACEOUS		Mackunda Formation Siltstone, sandstone, minor shale
		Allaru Mudstone Shale, minor siltstone, sandstone
		Toolebuc Formation Siltstone, marl
		Wallumbilla Formation Shale, minor sandstone
		Coorikiana Ss
		Cadna-Owie Formation Shale, minor sandstone
		Wyandra Ss Mbr
Hooray Sandstone Sandstone, minor shale		
Murta Fm sandstone+shale		
Namur Fm sandy shale/ss, minor shale		
EARLY TO MIDDLE JURASSIC	Westbourne Formation Shale, siltstone/sandstone	
	Adori Sandstone sandstone	
	Birkhead Formation Shale, siltstone, coal	
EARLY TO MIDDLE JURASSIC	Hutton Sandstone Sandstone, minor shale	
	Poolawanna Formation	
Unconformity		

Source: QEM

- ◆ The Toolebuc Formation, which is laterally continuous and generally flat lying (Figure 14), reflects generally clear water deep marine to paralic (near marine shallow water) sediments, and has an age of ~110Ma.
- ◆ The lithologies evidence cyclical changes in sea-level, with a general trend from deeper, still water lower in the sequence to shallow marine in the upper parts.
- ◆ In other areas the Formation has a thickness of generally between 5m and 15m, and is comprised of a number of separate units, being (from upper to lower):
  - St Elmo Coquina or Coquina Upper Unit (CQU) - interbedded shelly limestone and kerogenous siltstone, with thin claystone (oil shale) bands between the limestone units,
  - Willats Crossing Siltstone (CQL) - similar to and gradational into the overlying St Elmo Coquina, but differentiated by having over 50% of oil shale bands,
  - Manfred Coquina (CQL) - this appears similar to the St Elmo Coquina, however is not as laterally extensive within other areas; the unit has a noticeably lower vanadium content and a spike in phosphorous, due to a distinctive phosphatic band at the base which is an accepted marker with the Toolebuc Formation; and,
  - Arrollo Siltstone (OSU and OSL) - this is the oil shale unit, and consists of dark grey finely laminated, pyritic and kerogenous shales; there is a marked increase in clay content and fall in oil yield and organic matter in the lower half with this marking the change from OSU to OSL.
- ◆ The upper contact of the Toolebuc Formation with the Allaru Mudstone is gradational, with the lower contact generally being sharp.

Figure 14: Toolebuc cross section - note vertical exaggeration of 20:1



Source: QEM

### Mineralisation

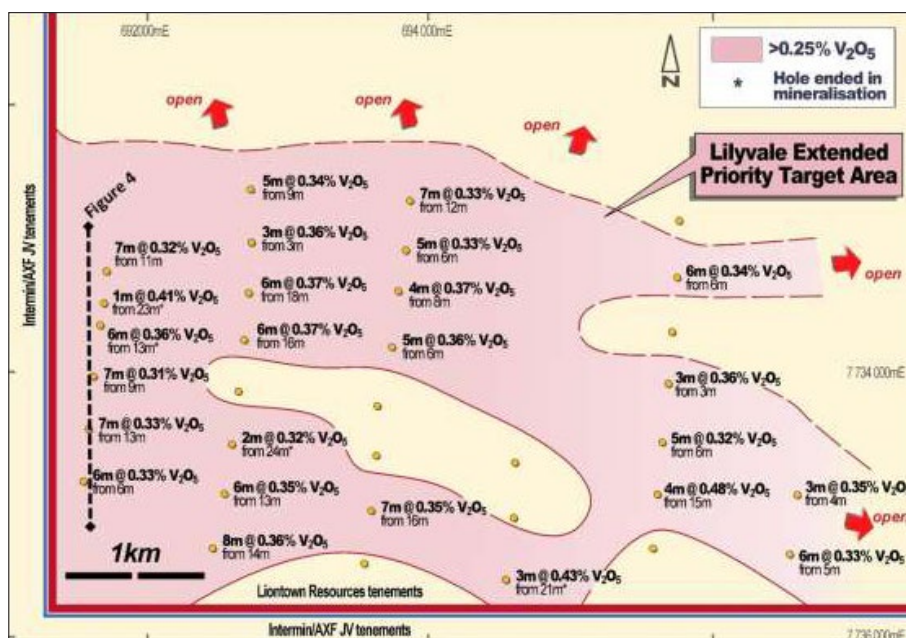
- ◆ The organic matter within the Toolebuc Formation, largely kerogen, is interpreted as being derived from planktonic algae and widespread benthic blue-green algal mats formed during deposition of the Toolebuc Formation, with the inorganic, largely carbonate matter reflecting the non-organic parts of benthic fauna, including algae.
- ◆ The presence of pyrite is indicative of anoxic conditions at the water sediment interface, which would have enhanced growth of the cyanobacterial community and preserved organic matter.
- ◆ Mineralogical work by others has determined that the Toolebuc Formation is largely composed of calcite, kerogen, quartz, kaolinite, smectite and pyrite; the presence of particularly calcite is vital with regards to vanadium metallurgy.
- ◆ The Toolebuc formation is anomalous in a number of metals, including vanadium, copper, zinc, nickel and molybdenum, with these interpreted as being fixed from the sea water by the living organisms, a process enhanced by anaerobic conditions.
- ◆ Vanadium is now largely associated with the mixed layer clays, which host 60% of the vanadium in the oil shale (with this possibly mobilising out of the organic material); the other 40% is hosted within other silicates, pyrite and organic compounds.

### Historical Work

- ◆ A number of companies have carried out work in the region since the 1970's, with a number of these, including CSR and CRA.
- ◆ Work on vanadium near Julia Creek was undertaken by Fimiston Mining in the late 1990s, with this summarised in a paper published by the AIG in 2000<sup>1</sup>.
- ◆ This included a summary of the results of metallurgical test work, with this including the potential to upgrade the coquina to 1.4% V<sub>2</sub>O<sub>5</sub>; however the high acid consumption, and in the case of alkali leaching, high sodium consumption (due to the formation of analcime in the autoclave) was noted, and has significant affects on the financial viability of any development.
- ◆ The potential for both petroleum and vanadium as by-products was discussed, particularly in light of then mooted sub-US\$10/bbl costs of the proposed Stuart Oil Shale Project, located near Gladstone in central Queensland (however with those costs not being achieved).

- ◆ More recent work has been that completed by Intermin Resources (ASX: IRC, "Intermin"), with this including extensive aircore drilling, and the estimation of the Lilyvale and Rothbury MRE's (Figure 12); these were originally estimated in 2017 and 2008, and subsequently updated in March 2018.
- ◆ Intermin has entered into a farm-out agreement with unlisted company AXF, with AXF looking to develop the properties.
- ◆ Results of aircore by Intermin drilling within Liontown's current tenure are shown in Figure 15, with this forming the basis of the recent MRE.

Figure 15: Intermin drilling, Cambridge prospect

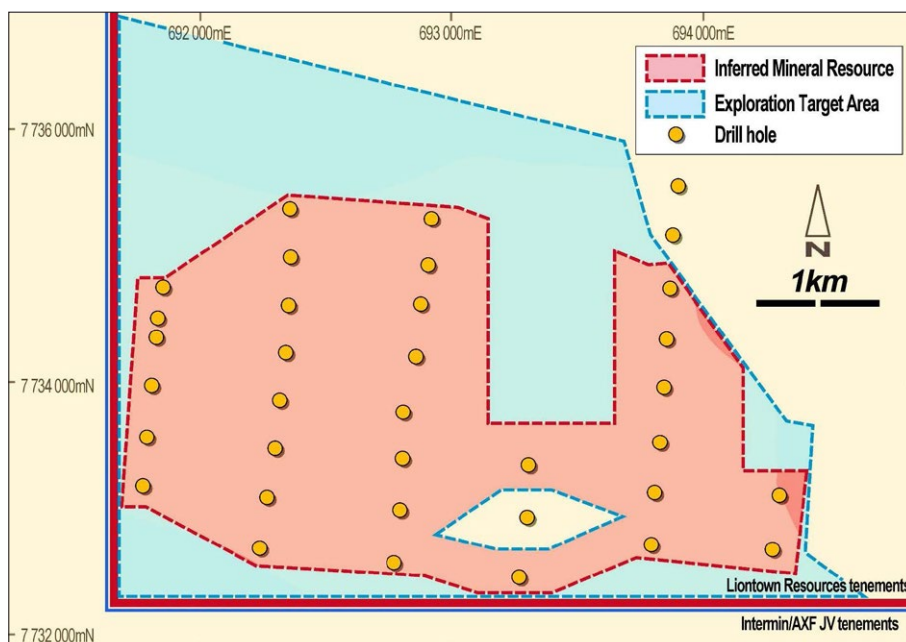


Source: Liontown

### Work by Liontown

- ◆ Recent work by Liontown has included the estimation of an MRE for the Cambridge area, immediately along strike from and contiguous with Intermin's Lilyvale MRE.
- ◆ This work has resulted in an Inferred MRE of 84Mt @ 0.3%  $V_2O_5$ , and an Exploration Target of 100-110Mt @ 0.28-0.32%  $V_2O_5$  - given the continuity of mineralisation within the Toolebuc Formation we would expect that the Exploration Target would be readily converted to a Resource with drilling.

Figure 16: MRE and Exploration Target areas, Cambridge prospect



Source: Liontown



## PLANNED ACTIVITIES

- ◆ The Company has an intensive, fully funded programme planned over the key properties over the coming few quarters - this should significantly advance all projects.
- ◆ Liontown is undertaking metallurgical testwork at Kathleen Valley, with the results of this to be used in a Scoping Study expected for completion in 4Q18; results will also be used in sourcing potential offtakers.
- ◆ A second phase drilling programme is underway at Buldania; the results of this and the previous drilling will be used to fast track an initial MRE which is expected to be completed in 4Q18; a regional exploration programme is also planned over the now expanded land position.
- ◆ Extensional drilling is planned at Toolebuc in 4Q18, with this also to provide samples for metallurgical testwork, which is expected to be undertaken during 4Q18 and 1Q19.

## PEER GROUP ANALYSIS

- ◆ Liontown is one of a number of hard rock lithium focussed companies listed on the ASX, which is our selected peer group for Liontown since the main focus is on the lithium projects; the Company could also be considered as a peer of the handful of vanadium focussed companies on the ASX, however most of these are looking at intrusive titanomagnetite hosted mineralisation, with the only other listed entity with sedimentary vanadium in Australia being Intermin.
- ◆ We have, in Table 4, included only those ASX-listed companies that have a published MRE for their key lithium project(s), and sorted these by decreasing EV per equity tonne of contained Li<sub>2</sub>O; project ownership is 100% unless noted otherwise.
- ◆ This should be treated with some caution, as our EV does not take into account the value of other projects that the companies hold.
- ◆ Table 4 highlights the general increase in this parameter with advancing project stage; all companies with a higher multiple than Liontown are more advanced, with most in production or in near production; the closest analogy may be Sayona, however a positive DFS has been now been completed for the Authier Project in Quebec.
- ◆ Tawana are currently in the process of a “merger of equals” with their Bald Hill partner, Alliance, with a pro-forma post-merger market capitalisation of A\$425 million, and an expected completion date around mid-October, 2018.

**Table 4: Liontown peer group**

Liontown Peer Group							
Company	EV	Key Projects	Stage	Global Resource (Mt)	Global Li <sub>2</sub> O Grade	Equity <sup>1</sup> Contained Li <sub>2</sub> O	EV/Equity Tonne Li <sub>2</sub> O
Galaxy Resources	A\$1,051m	Mt Cattlin, James Bay	Producer, 450,000tpa con	52.6 Mt	1.37%	720 kt	\$1,461
Tawana Resources	A\$150m	Bald Hill (50%)	Producer, 155,000tpa con	26.5 Mt	0.97%	128 kt	\$1,170
Altura Mining	A\$497m	Pilgangoora	Stage 1 ramp up to 230,000tpa con	50.5 Mt	1.01%	512 kt	\$970
Pilbara Minerals	A\$1,525m	Pilgangoora	Stage 1 ramp up to 330,000tpa con	156.4 Mt	1.25%	1,953 kt	\$781
Neometals	A\$111m	Mt Marion (13.8%)	Producer, 450,000tpa con	77.8 Mt	1.37%	147 kt	\$755
Kidman Resources	A\$403m	Earl Grey (50%)	Development studies	189.0 Mt	1.50%	1,421 kt	\$283
Sayona Mining	A\$46m	Authier	Development studies	20.5 Mt	1.02%	209 kt	\$220
Global Geoscience	A\$316m	Rhyolite Ridge	Development studies	459.5 Mt	0.36%	1,662 kt	\$190
Prospect Resources	A\$41m	Arcadia, (70%)	Development	43.2 Mt	1.41%	427 kt	\$96
Liontown Resources	A\$26m	Kathleen Valley, Buldania	Assessment	21.2 Mt	1.36%	288 kt	\$89
Birimian	A\$61m	Goulamina	Development studies	103.2 Mt	1.32%	1,367 kt	\$44
NovoLithio	A\$0m	Sepeda	Assessment	10.3 Mt	1.00%	103 kt	-\$4

Source: IRESS, Company reports, EV = undiluted market cap less cash plus debt. 1: Equity contained Li<sub>2</sub>O is Li<sub>2</sub>O in the global resource x project ownership.

- ◆ Table 5 provides a list of Resources for a number of spodumene lithium deposits.
- ◆ What this highlights is the relatively high grade of Kathleen Valley when compared to the others, being comparable to Mt Marion, and higher than a number of others coming into production (however these have larger resources and thus can have a higher throughput to take advantage of economies of scale).
- ◆ This however highlights the broad similarity, with a higher grade but lower tonnage, with the Bald Hill Resource (which is in production) and Authier, for which a positive DFS has been completed; it is also significantly larger than the current depleted Mt Cattlin Mine Resource - the pre-mining Resource at Mt Cattlin was 18.2 Mt @ 1.08% Li<sub>2</sub>O.

**Table 5: Hard rock lithium deposit details**

Hard rock lithium deposit details					
Company	Deposit	Mineralisation	Resource Tonnage	Resource Grade	Contained Li <sub>2</sub> O
Talison	Greenbushes	Spodumene	120.6 Mt	2.40%	2.89 Mt
Nemaska	Whabouchi	Spodumene	53.7 Mt	1.51%	0.81 Mt
Kidman (50%) SQM (50%)	Mount Holland	Spodumene	189.0 Mt	1.50%	2.84 Mt
Prospect (70%), Local Partner (30%)	Arcadia HG	Spodumene	43.2 Mt	1.41%	0.61 Mt
Galaxy	James Bay	Spodumene	40.8 Mt	1.40%	0.57 Mt
MinRes (43.1%) Jianqxi (43.1%) Neometals (13.8%)	Mt Marion	Spodumene	77.8 Mt	1.37%	1.06 Mt
Liontown	Kathleen Valley	Spodumene	21.2 Mt	1.36%	0.29 Mt
Galaxy	Mt Cattlin Mine	Spodumene	9.7 Mt	1.35%	0.13 Mt
Birimian	Goulamina	Spodumene	103.2 Mt	1.32%	1.37 Mt
Pilbara	Pilgangoora	Spodumene	156.4 Mt	1.25%	1.95 Mt
QLC	Quebec	Spodumene	47.0 Mt	1.19%	0.56 Mt
Prospect (70%) Local Partner (30%)	Arcadia Global	Spodumene	72.7 Mt	1.11%	0.81 Mt
Sayona	Authier	Spodumene	20.5 Mt	1.02%	0.21 Mt
Altura	Pilgangoora	Spodumene	50.5 Mt	1.01%	0.51 Mt
Tawana (50%) AMAL (50%)	Bald Hill	Spodumene	26.5 Mt	0.97%	0.26 Mt
Critical Elements	Rose	Spodumene	34.7 Mt	0.92%	0.32 Mt
Galaxy	Mt Cattlin Stockpiles	Spodumene	2.1 Mt	0.81%	0.02 Mt

Source: IRESS, Company reports

## RISKS

- ◆ **Exploration/drilling:** This is the key risk facing any junior explorer, and this is no different with Liontown. However the results of exploration to date partly mitigate this risk, with this work highlighting the prospectivity of the majority of projects; this also applies to further drilling on the more advanced projects.
- ◆ **Metallurgy:** The results of the metallurgical test work for Kathleen Valley will be important, in determining the possible quality of the concentrate that can be produced. Metallurgical test work however is critical at Toolebuc, in that historical work in the region has highlighted a number of issues with the metallurgy of the vanadiferous sediments.
- ◆ **Markets and funding:** As we have seen in recent years markets can be very fickle – although Liontown now has ~A\$3 million in the bank (including money from the latest sale of Core shares), given the active work programmes and average expenditures over the past two years of ~A\$3 million per year, we would expect to see Liontown go back to the market in six to nine months. Should the market turn in the meantime we could see difficulties in raising capital, although the positive ongoing exploration and assessment results would partly negate this.

## BOARD AND MANAGEMENT

- ◆ **Mr Tim Goyder – Chairman:** Tim has over 30 years' experience in the resource industry. He has been involved in the formation and management of a number of publicly listed companies and is currently Managing Director of Chalice Gold Mines Limited, the Chairman of DevEx Resources Limited and a Non-Executive Director of Strike Energy Ltd.
- ◆ **Mr David Richards – Managing Director:** David has 30 years' experience in mineral exploration in Australia, S.E. Asia and western U.S.A. His career includes exploration and resource definition for a variety of gold and base metal deposit styles and he led the team that discovered the multi-million ounce, high grade Vera-Nancy gold deposits in North Queensland. He has held senior positions with Battle Mountain Australia Inc, Delta Gold Limited and Aurion Gold Limited and was Managing Director of ASX-listed Glengarry Resources Limited from 2003-2009..
- ◆ **Mr Craig Williams – Non-Executive Director:** Craig is a geologist with over 30 years' experience in mineral exploration and development. Craig co-founded Equinox Minerals Limited in 1993 and was President, Chief Executive Officer and Director prior to Barrick Gold's takeover of Equinox. He is currently Chairman of OreCorp Limited. He has been directly involved in several significant discoveries, including the Ernest Henry Deposit in Queensland and a series of gold deposits in Western Australia. In addition to his technical capabilities, Craig also has extensive corporate management and financing experience.
- ◆ **Mr Anthony Cipriano – Non-Executive Director:** Anthony is a Chartered Accountant with 27 years accounting and finance experience. Anthony was formerly a partner at Deloitte and at the time of his retirement in 2013 he was the Deloitte National Tax Leader for Energy & Resources and leader of its Western Australian Tax Practice. Anthony has significant experience working across tax, accounting, legal and financial aspects of corporate transactions. Anthony is also a director of Lachlan Star Limited (administrator appointed) and Limeco Pty Ltd.
- ◆ **Mr Richard Hacker – Chief Financial Officer:** Richard has 20 years professional and corporate experience in the energy and resources sector in Australia and the United Kingdom. Richard has previously worked in senior finance roles with global energy companies including Woodside Petroleum Limited and Centrica Plc. Prior to this, Richard worked with leading accounting practices. Richard is both a Chartered Accountant and Chartered Secretary and a Non-Executive Director of DevEx Resources Limited.
- ◆ **Ms Kym Verheyn – Finance Manager and Company Secretary:** Kym is a Chartered Accountant with over 25 years' experience gained in both public practice and commerce. Kym commenced her career with Deloitte and has since held finance positions in a diverse range of industries. Kym is also the Company Secretary for DevEx Resources Limited.

## BACKGROUND – LITHIUM AND MARKETS

### What is Lithium?

- ◆ Lithium is an alkali metal; the lightest of all metals and the least dense of any of the elements that are solids at room temperature. Because of its inherent instability and reactivity it never occurs freely in nature, but only in compounds.

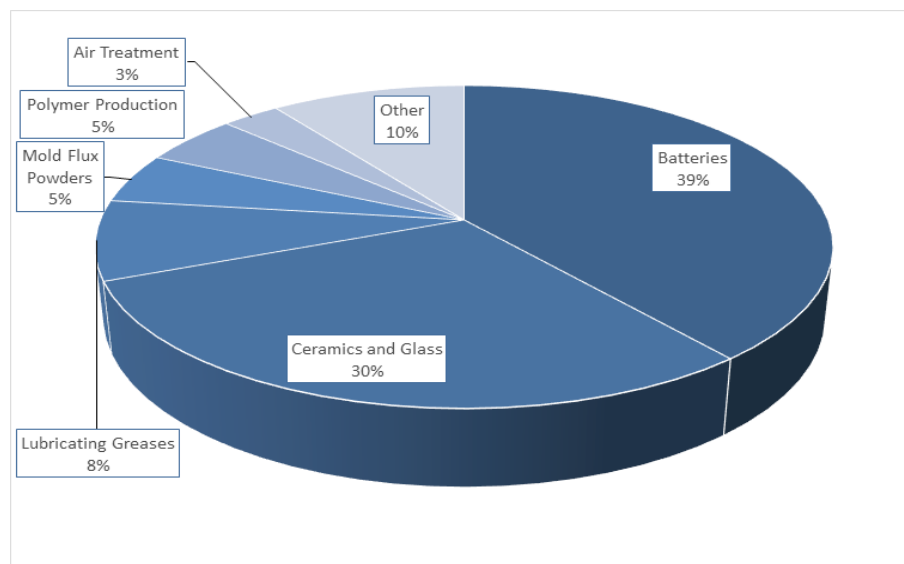
### Lithium Uses and Demand

- ◆ Lithium has a large number of uses, with the most relevant now being in rechargeable batteries (particularly in electric vehicles, "EVs"), which in 2017 made up some 39% of the then annual demand of around 240,000t of lithium carbonate equivalent ("LCE"; Figure 17), which is the form that lithium grades and prices are most commonly quoted in.
- ◆ It has been estimated that a 70kWh Tesla Model S uses 63kg of LCE, hence has an LCE intensity of 0.9kg/kWh - batteries from different manufacturers won't be the same, however will be similar.
- ◆ Recent forecasts by Cannacord and Deutsche Bank have demand reaching between 775,000tpa LEC (DB) and 920,400tpa LCE (Cannacord) by 2025, representing CAGRs of between 15% and 18% from 2017, with this growth predicated on strong growth in the electric vehicle market.



- ◆ More aggressive forecasting by Roskill (9th Lithium Supply & Markets Conference, Montreal, 31st May 2017) has demand growing to between 800,000tpa and 1,600,000tpa LCE by 2026, a growth of between 15% and 23% CAGR, again mainly driven by the growth in the electric vehicle market.
- ◆ Continuing forecast strong growth in the electric vehicle market from 2025 should lead to major increases in demand; for example, a 7% CAGR over 10 years will lead to a doubling of demand by 2035 from 2025 levels; a 10% CAGR will double demand by 2032, with the potential for demand to reach close to 2,000,000 tpa LCE in that period.

**Figure 17: Lithium uses - 2017**



Source: USGS

- ◆ Other growing battery uses include home storage, and the potential for grid scale storage to be used in conjunction with solar and wind power generation.
- ◆ In Australia over the last 18 months we have seen AGL Energy launching a home storage product in Australia in line with Tesla's "Powerwall" announcements, and more recently the construction of a 100MW battery in South Australia by Tesla..
- ◆ The major battery producers are Japan, China and South Korea, with Tesla also now joining the fray.

## Lithium Products

- ◆ Lithium is supplied as, and prices quoted for a number of products, with the most common being lithium carbonate, followed by lithium hydroxide and lithium concentrates.
- ◆ Care has to be used in comparing reported grades, tonnages and expected revenues between companies when they are quoted on different bases.
- ◆ Lithium carbonate ( $\text{Li}_2\text{CO}_3$ ) contains around 18.8% lithium; therefore one tonne of lithium is equivalent to 5.3 tonnes of lithium carbonate.
- ◆ Another compound that is often quoted is lithium oxide –  $\text{Li}_2\text{O}$  – which contains 46.5% lithium, around 2.5 times that of LCE (and in which hard rock concentrate grades are commonly quoted in), with lithium hydroxide ( $\text{LiOH}$ , 29% Li) also being used – conversion factors are shown in Table 6.

**Table 6 :Lithium mineral/compound conversion factors**

Lithium mineral/compound conversion factors						
Species	Formula	Lithium content	Convert to Li	Convert to $\text{Li}_2\text{O}$	Convert to $\text{Li}_2\text{CO}_3$	Convert to $\text{LiOH}$
Lithium	Li	100%	1.000	2.152	5.322	3.451
Lithium Oxide	$\text{Li}_2\text{O}$	46.46%	0.465	1.000	2.473	1.603
Lithium Carbonate	$\text{Li}_2\text{CO}_3$	18.79%	0.188	0.404	1.000	0.648
Lithium Hydroxide	$\text{LiOH}$	28.98%	0.290	0.365	1.542	1.000

Source: IIR analysis

- ◆ Primary hard rock concentrates come in two main products - technical grade, which is used directly in applications such as glass and ceramics, where a high grade (>6.5%  $\text{Li}_2\text{O}$ ), low iron concentrate is required, and chemical grade, which is further refined to lithium

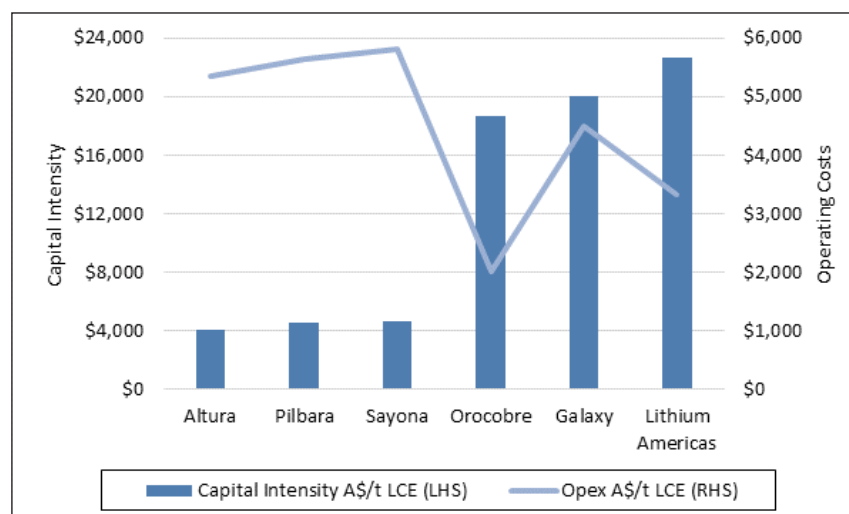
carbonate and lithium oxide for end products such as batteries - specifications for chemical grade concentrates are less demanding than those for the technical grade product.

- ◆ Lithium carbonate products, either processed from hard rock concentrates or directly from brines come in three main specifications, with typical values as follows (source FMC product data sheets), and with these commanding different prices:
  - Industrial grade (+99%  $\text{Li}_2\text{CO}_3$ , 0.60%  $\text{H}_2\text{O}$ , 0.20%  $\text{Na}_2\text{O}$ ) - glass, casting powders and greases.
  - Technical grade (~99.3%  $\text{Li}_2\text{CO}_3$ , 0.60%  $\text{H}_2\text{O}$ , 0.20%  $\text{Na}_2\text{O}$ ) - ceramics, greases and batteries.
  - Battery grade (>99.5%  $\text{Li}_2\text{CO}_3$ , 0.50%  $\text{H}_2\text{O}$ , 0.05%  $\text{Na}_2\text{O}$ ) - high end battery cathode materials.

## Lithium Supply

- ◆ There are two main sources of lithium – brine deposits and hard rock spodumene deposits.
- ◆ Production from brine deposits involves the extraction by pumping of lithium rich brines in salt lakes, followed by concentration by evaporation in evaporation ponds. From this, the concentrated solutions are processed to end products, including lithium carbonate and lithium hydroxide.
- ◆ Common by- or co-products include potassium and boron salts, which can significantly improve the economics of brine operations.
- ◆ Key points that affect potential brine operations include lithium content, magnesium content (this is relatively expensive to remove, with a rule of thumb stating that the ratio of Mg to Li in brines must be below 10:1 for a brine deposit to be economical) and evaporation and rainfall rates – high evaporation rates result in lower costs as smaller ponds and shorter residence times are required.
- ◆ Spodumene (which is a lithium pyroxene –  $\text{LiAl}(\text{SiO}_3)_2$  - and other silicate mineral (including petalite and lepidolite) deposits are commonly hosted in pegmatites, and are mined by conventional hard rock open cut mining, followed by crushing and grinding, and extraction using a mixture of gravity, heavy media separation, magnetic separation and flotation to produce a concentrate, largely comprised of the lithium-bearing silicates, but also commonly containing quartz and feldspar.
- ◆ Both premium technical grade and the lower value chemical grade concentrates are often produced from the same hard rock deposit, dependent upon customers' requirements. A common by-product is tantalite and other tantalum minerals. The concentrate is then further treated to produce  $\beta$ -spodumene for downstream uses.
- ◆ Brine operations are characterised by high initial capital costs, long lead times for full production, whereas hard rock operations are marked by relatively low capital costs, short lead times but relatively high operating costs to lithium carbonate, when the estimated conversion costs of US\$2,500/tonne are added to the cost of producing a concentrate.
- ◆ This is shown in Figure 18, with figures taken from development studies for the various operations - note that we have added the estimated concentrate to lithium carbonate conversion cost to the operating costs for the three hard rock developers, Pilbara, Altura and Sayona.

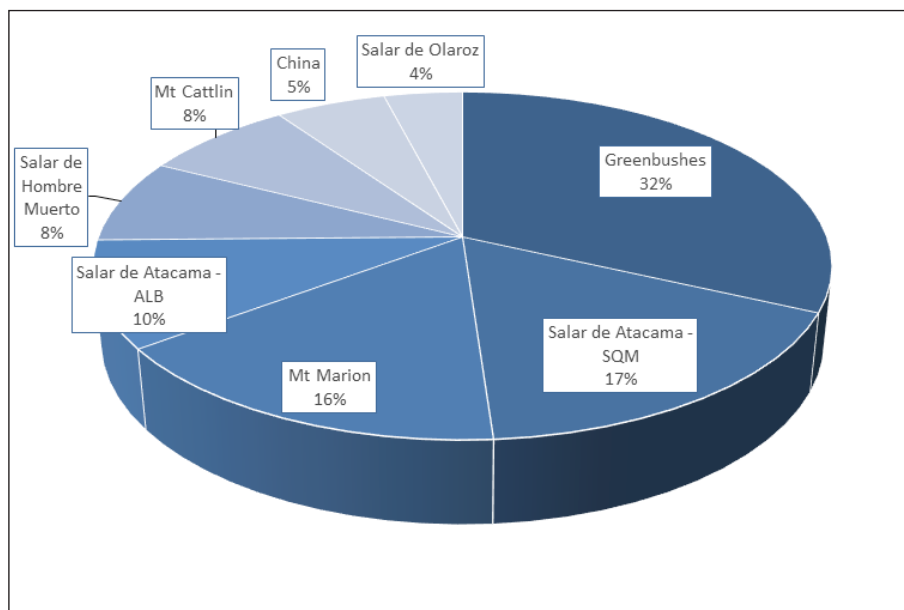
**Figure 18: Cost profiles of hard rock and brine operations**



Source: IIR analysis

- ◆ Figure 19 shows a breakdown of 2017 mine production of ~300,000t LCE - what this shows is that production outside of China is highly concentrated, with only a few major operations, largely controlled by a few major producers.

**Figure 19: Lithium producers by production share 2017**



Source: Company reports and presentations, USGS

- ◆ Both FMC and SQM operate brine operations in the Altiplano of Chile and Argentina – another company operating there is Orocobre (ASX:ORE), which is currently ramping up production at its Olaroz Project.
- ◆ The largest single producer is the Greenbushes Mine in Western Australia, which is a hard rock spodumene producer and a joint venture between Albemarle (49%, NYSE:ALB) and Sichuan Tianqi Lithium (51%).
- ◆ Albemarle is the largest single producer globally (with ~27% of production), with, in addition to its 49% share in Greenbushes, has the 100% owned Salar de Atacama Project in Chile and the Silver Peak brine operation in Nevada.
- ◆ Greenbushes currently produces some 90,000tpa of LCE, however has an aggressive expansion programme in place, including the construction of an LiOH plant at Kwinana; this is just one of a number of planned expansions or new spodumene projects in Western Australia.
- ◆ Announced new operations and expansions (both for hard rock and brine operations) have the potential to increase supply to over 1,000,000 tpa LCE by 2022, however Cannaccord are of the view that realistically this could be around 700,000 tpa LCE, due to development and funding delays; in addition any capacity increases will rely on market developments and also a wish to keep prices relatively strong.
- ◆ There is the potential for rapid increases in supply to lead to surpluses in the medium term, however with growing demand a number of forecasters see the market returning to deficit by 2025.
- ◆ One issue that is being addressed is downstream spodumene conversion capacity - this was estimated at ~110,000 tpa LCE in 2017, which was only able to treat ~50% of the hard rock mine production.
- ◆ A number of the Australian operators are now looking at integrated operations, with one, Tianqi, already starting construction of a 48,000 tpa LiOH (~74,000 tpa LCE), A\$700 million plant in Kwinana, WA; other operators looking at options include Mineral Resources (ASX:MIN) to treat concentrate from Wodgina, and Kidman Resources (ASX:KDR)/SQM, to treat planned production from the Earl Grey project.
- ◆ We have seen the Argentinean Government recently apply a temporary special export duty to finished products as a fiscal repair measure - this duty is at a rate of ARS3 for every US\$1 in exports.
- ◆ At current spot rates (USD:ARS40), this implies a duty of 7.5%, however this will lessen with the expected continuing depreciation of the ARS, and, in combination of being a short term measure (although this could change), should have only a relatively minor effect on project economics and company valuations.

## Lithium Pricing

- ◆ Like most specialty metals, pricing is opaque and set by direct negotiation between producer and customer - pricing is also dependent upon the type and relative quality of the product.
- ◆ Another difficulty involves the plethora of lithium products, however prices trend to track each other.
- ◆ Prices have increased significantly over since late 2015, with Chinese spot battery grade lithium carbonate prices reaching over US\$20,000/tonne CFR in 2017 - this follows on from prices staying around US\$5,000 - US\$6,000/tonne in the preceding few years.
- ◆ These price rises have also been evident in the South American brine producers – according to the TRU Group these averaged around US\$4,500/tonne in 2014 (with battery grade product at a premium of US\$500-US\$1,000/tonne) and have increased steadily since - Orocobre reported receiving US\$13,642/tonne LCE in the June 2018 Quarter.
- ◆ Galaxy has reported increasing spodumene prices, with those for 4Q17 being US\$868/tonne and 1H18 being US\$940/tonne; in FY17 the Mt Marion operation was on a fixed price contract of US\$750/tonne of 6% concentrate, with this subsequently being changed to six-monthly price resets, with the current price being US\$840/tonne.
- ◆ However, with increasing supply, a number of parties are forecasting prices to fall from late this year until 2023 (with some slight falls already reported) with a recovery thereafter; forecast lows in the order of US\$650 - US\$700/tonne 6% spodumene concentrate however are still significantly higher than prices of a few years ago, and are broadly equivalent to LCE prices of US\$9,000 - US\$9,500/tonne

## Where to From Here?

- ◆ The consensus seems to be that demand will rise to around 750,000tpa LCE to 1,000,000tpa LCE by 2025, however this is dependent upon the uptake of electric vehicles, which is the major unknown in the forecasting - some forecasters see demand of up to 1,600,000tpa LCE by 2025.
- ◆ There is then the potential to a further doubling of demand from 2025 to 2035, with this possibly reaching close to 2,000,000 tpa LCE in that period.
- ◆ As mentioned earlier, in the shorter term however, with planned expansions of existing operations and new startups having the potential to bring an extra 700,000tpa LCE into the market over the next five years we could see a supply surplus in the early 2020s with some weakness in price, however these prices will still be significantly above those of a few years ago.
- ◆ There may be price support due to stockpiling and a higher incentive pricing required to guarantee longer term supply, resulting in a price correction rather than a collapse.
- ◆ Our view is that we will continue to see strong demand increases and relatively strong prices going forward, and thus there will be room for new players in the market particular in view of the longer term market fundamentals.

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