AUSTRALIAN RESEARCH
INDEPENDENT INVESTMENT RESEARCH

Lake Resources NL (ASX: LKE)

July 2019

INDEPENDENT INVESTMENT RESEARCH

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Lake Resources NL (ASX: LKE)

Initiation - July 2019

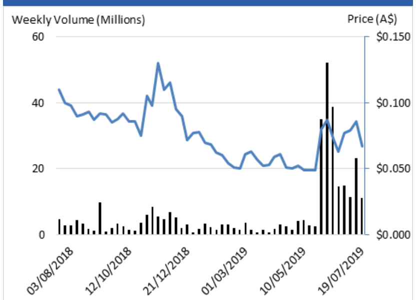
Note: This report is based on information provided by the company as at July 15, 2019.

Investment Profile	
Share Price as at 15 July 2019	A$0.067
12 month L/H ($)	$0.044/0.14
Issued Capital	
Ordinary Shares	478.2 m
Unlisted Options	20.1 m
Including In the Money Options	5.1 m
Fully Diluted	498.2 m
Diluted for in Money Options	483.3 m
Market Capitalisation - Undiluted	A$32.0 m
Market Capitalisation - Diluted for In Money Options	A$32.4 m
Convertible Notes	A$0.66 m
Cash - March 31, 2019	A$0.15 m
June 2019 Placement	A$2.68 m
Cash from Option Conversion - June	A$0.34 m
Notional Cash due on Conversion of In-Money Options	A$0.25 m

Board and Management
Mr Stuart Crow: Non-Executive Chairman
Mr Stephen Promnitz: Managing Director
Mr Nick Lindsay: Non-Executive Director
Ms Sinead Teague: Company Secretary

Major Shareholders	
Lambrecht Investment Fund	5.58%
Mr Stephen Promnitz	3.26%
Acuity Capital	3.18%
Directors and Management	4.18%
Top 20	39.8%

Price Chart



Mark Gordon - Senior Analyst

DISRUPTIVE LITHIUM

Lake Resources ("Lake" or "the Company") is concentrating activities on a number of 100% owned lithium projects in Argentina. The most advanced is the Kachi Lithium Project ("Kachi") which covers the Carachi Pampa salt lake, located some 100 km south of Livent's Hombre Muerto operation.

Lake has defined a large Mineral Resource Estimate ("MRE") of 4.4 Mt lithium carbonate equivalent ("LCE") at a grade of 211 mg/L Li, and is now working towards a Pre-Feasibility Study, due for completion in late 2019. The key to the possible technical and commercial viability is the utilisation of ion exchange technology for the direct extraction of lithium from the brines.

An Engineering Study, undertaken in conjunction with US-based and Silicon Valley backed Lilac Solutions, and using ion exchange technology developed by the same, has been successful and has shown the potential for the extraction of lithium from Kachi brines at a cost of US$2,600/tonne (+-30%), comparable with the lower quartile of operating costs of current evaporative brine operations in South America.

Recoveries of up to 90% have resulted, significantly higher than that for evaporation operations, as well as production of lithium within a few hours of commencement of processing, as compared with up to 24 months for traditional operations. The viability of the process given the altitude and arid conditions at Kachi will be further tested through a pilot plant, due to start operating on site in late 2019.

Ion exchange is a well understood and widely used separation, purification and decontamination process (the orange juice you drink has probably been through an ion exchange filter), however has only recently been looked at for treating lithium brines. It has the potential to be a disruptive technology should it prove viable.

Other brine projects include Cauchari and Olaroz, where the Company has pegged ground on the margins of the salars and adjacent to the world class resources of Orocobre (ASX: ORE), Lithium Americas Corporation (TSX: LAC), Advantage Lithium (TSX: AAL) and Ganfeng - these two salars host Resources totalling ~36 Mt LCE at a grade of ~580 mg/L Li.

The strategy here is to test, through drilling, an interpretation that the aquifers hosting the Resources extend under the alluvial fans and that basin margins are sub-vertical. Initial assay results from a recently completed hole at Cauchari have supported the concept, with these returning values of between 340 to 538 mg/L li (comparable with grades from the neighbouring properties) from a 144 m thick zone from 172 to 316 m. This zone also has low Mg/Li ratios of 2.7 to 3.0 and high brine flows, with detailed sampling now underway. Ongoing drilling success could lead to the estimation of significant Resources at Cauchari and Olaroz, with the drilling rig now to move to Olaroz.

Finally, Lake holds ~80,000 ha over ground with known pegmatite hosted spodumene mineralisation near the capital of the Province of Catamarca. This is early stage, has seen no modern exploration and provides blue sky potential.

KEY POINTS

- **Large MRE and control of the salar at Kachi:** Work by Lake has defined a major brine Resource at Kachi, with significant upside potential - a key point is that Lake controls the salar.
- **Disruptive technology:** Successful commercial implementation of the Lilac Solutions ion exchange technology could be a game changer in the lithium brine business.
- **Transport infrastructure**: Areas are all well served by transport infrastructure.
- **In the right commodity**: Although there are differing demand forecasts for lithium, the fundamentals look strong over the medium to long term with the expected +20% CAGR growth largely in electric vehicle ("EV") battery markets, with Lake ideally situated to take advantage of this.
- **Strong management and committed personnel**: Company personnel, including consultants, have extensive industry experience in varied regions (including Argentina) and commodities. In addition directors hold significant share holdings, and thus will be motivated to producing strong returns for shareholders.
- **Steady activities and news flow**: Ongoing activities including drilling (four holes planned at Olaroz, with the current Cauchari hole recently completed), and the PFS and ion exchange pilot plant at Kachi should provide steady news flow over the next six to 12 months.
- **Value uplift with success:** We see significant upside in the value of Lake, with this to be driven by a positive PFS, successful ion exchange pilot plant and drilling success - the Company has an EV/tonne LCE value significantly lower than peers.

SWOT ANALYSIS

Strengths

- **Large resources with upside at Kachi**: Kachi represents one of the larger South American brine resources by volume and contained lithium, and also has significant upside that could be released through only limited drilling.
- **Results of Lilac Solutions test work:** The possibility to treat the brines through ion exchange processing is a key technical strength, and would mitigate the relatively low grade of the Resource.
- **Proven brine mining destination:** Argentina is a proven brine mining destination where the industry wants to be, and is host to a number of world class deposits, with well developed mining legislation.
- **Transport access:** All projects have ready access to transport infrastructure, and are close to current operations.
- **Experienced people with skin in the game:** Company personnel have significant experience in the resources game, as well as share holdings.

Weaknesses

- **One of many:** Lake 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. A key mitigating/differentiating factor with Lake is the potential for a robust operation at Kachi should the ion exchange processing prove viable.
- **Grade at Kachi:** The lithium grade at Kachi is low compared to existing operations, and thus would be a relatively high cost operation should the ion exchange processing not prove viable. Mitigating this are the results of ion exchange processing to date, with bench scale processing producing a high quality, low impurity product.
- **Marginal holdings at Cauchari-Olaroz:** Given the interpreted geology and size of the holdings (particularly at Cauchari), these may prove to be marginal to develop an operation over. However the results of the recently completed hole at Cauchari are very positive, showing the possibility that the basins are bounded by steeply dipping faults. If this is true, there is the scope for significantly larger volumes of potentially brine mineralised sediments that past interpretations have presented, which could go a significant way to mitigating this. Also, the Company's Olaroz holdings have an area similar to that hosting Ganfeng's/Lithium America's 23.0 Mt LCE Resource at Cauchari - this is the largest published lithium brine Resource globally.

Opportunities

- **Kachi development:** This will hinge on a number of factors, including the upcoming results of the PFS and ion exchange pilot processing, however results to date are largely positive.
- **Asset sales:** Should appreciable Resources be defined or strong drilling results be returned, there may be the potential to sell the Cauchari and/or Olaroz tenements to the neighbouring developers. Dependent upon results, the Company's view is that Cauchari would be the most likely property to be put up for sale, with the potential to look towards a stand alone development of Olaroz should the results of the drilling be positive.
- **Lithium fundamentals:** Despite recent falls in price, these currently look reasonably strong for the foreseeable future, which should facilitate progress and investor interest.

Threats/Risks

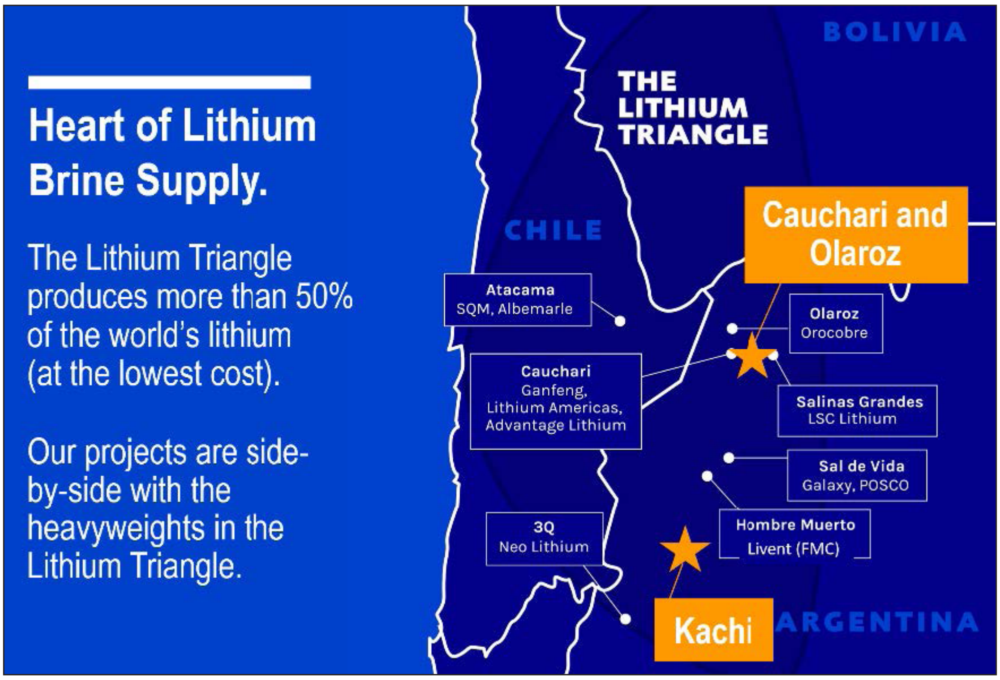
- **Resources, hydrology and processing:** The key technical threat is that the projects do not stack up technically, with possible factors including physical dimensions and hence size of Resources (Olaroz and Cauchari), chemistry, hydrology and processing (Kachi). As mentioned above these factors however are mitigated by the results of work to date.
- **Markets and funding:** These are perennial threats for junior resources companies, and include the effects of the stock and metals markets on the ability to fund juniors. Our view is that Lake will need to raise cash within six months, with our estimate indicating a spend in the order of A$4 million over the same period. In addition we have seen general falls in value of lithium stocks since the beginning of 2019.
- **Politics and sovereign risk:** Although President Macri has introduced much needed reform, including the relaxation of capital controls and floating the Argentinian Peso to attract foreign investment, the economy continues to perform poorly, and there is a risk that the 2019 election could see a change back to a more populist or socialist government, that may work on undoing some of these measures. Argentina has a history of political and social instability (and corruption), and as well the separate provinces perform badly in the Fraser Institute surveys. Mitigating this is that the country is a proven brine producer, with recent entrants including Orocobre showing that projects can be developed - this is the first brine start-up in the past 15 to 20 years.

OVERVIEW

STRATEGY AND PROJECT OVERVIEW

- The Company's main strategy is to explore for, and develop brine hosted lithium (+- potash and boron) mineralisation, for which the salars of the "Lithium Triangle" of Argentina-Chile-Bolivia are a major global producer, supplying some 50% of non-Chinese LCE production in 2018.
- Lake has three 100% owned brine projects in Argentina (Figure 1), and in addition it has a package of tenements hosting known "hard-rock" pegmatite lithium mineral mineralisation.

Figure 1: Maricunga location map



Source: Lake

- The three brine projects are:
  - Kachi, located over the Carachi Pampa salt lake, and for which the Company has the rights to the whole salar - this is the most advanced project, with the Company completing an initial Mineral Resource Estimate ("MRE") of 4.4 Mt LCE at 211 mg/l Li; Kachi also has an Exploration Target, inclusive of the MRE, of 8 to 17 Mt LCE;
  - Cauchari, located over the western flank of Salar de Cauchari, which is host to world class deposits of Orocobre/Advantage Lithium (6.3 Mt LCE @ 475 mg/L Li, with a PFS for 30,000 tpa LCE) and Lithium Americas Corp/Ganfeng (23.0 Mt @ 586 mg/L Li, currently under construction with a planned start up of a 40,000 tpa operation in 2020; and,
  - Olaroz, located over the western flank of Salar de Olaroz, adjacent to the Olaroz operation of Orecobre/Toyota Tsusho, and which has a resource of 6.4 mt LCE at a grade of 690 mg/L Li.
- Kachi is investigating the use of ion exchange as a direct extraction method at Kachi - a partnership has been formed with private US-based Lilac Solutions, with work to date indicating high recoveries at a relatively low cost - the next step will be to install a pilot plant in parallel with the completion of the PFS by the end of 2019.
- Ion exchange lithium extraction, if successful at a commercial scale, has the potential to be a game changer, in that it is rapid, has a high lithium recovery, there is no need for the large evaporation ponds as used in standard brine operations, and brine (with the chemistry only slightly altered) can be pumped back down into the aquifers.
- Lake's strategy at Cauchari and Olaroz is to target areas largely peripheral to the main salar basins and covered by alluvium that however are considered prospective for brine resources - passive seismic surveying by Lake at Cauchari indicates that the salar sediments extend under the fans to the west with the results of drilling confirming this.
- The pegmatite targets (which are south of Kachi, and thus not shown in Figure 1) have seen some historic small scale production and present the potential for discovery using modern exploration methods.

FINANCIAL POSITION

- We estimate that the Company has ~A$2 million at the end of June, 2019.
- During the period January 1, 2018 to March 31, 2019, Lake raised:
  - A$4.500 million through a placement of 33.33 million shares at A$0.135/share,
  - ~A$1.8 million through the exercise of A$0.10 options - this included A$0.810 million through direct exercise, and ~A$1 million through a financing agreement with US investment firm, Long State Investments ("Long State"),
  - A$0.911 million through the exercise of A$0.05 options; and,
  - A$2.347 million through the issue of convertible notes (terms are discussed later) - one note is part of a facility with the opportunity to raise up to a total of A$5 million, however the Company is in the process of retiring the notes.
- During the same period Lake spent A$6.601 million on exploration and evaluation and A$2.659 million on staff and administration.

KACHI LITHIUM PROJECT - LAKE 100%

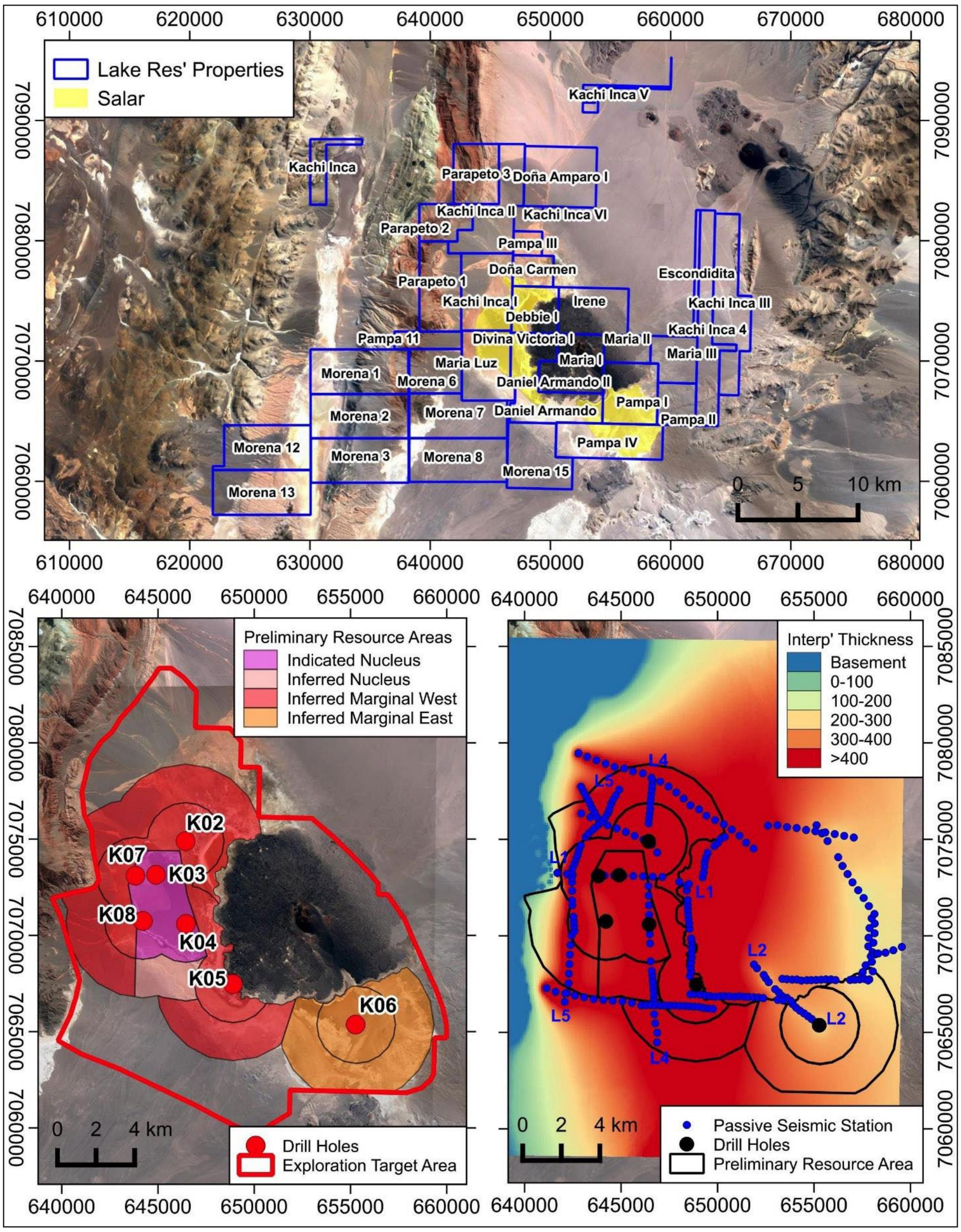
Location and Tenure

- Kachi is located at an elevation of ~3,000 m in Catamarca Province of north-western Argentina (Figure 1).
- The nearest town is Antofagasto de le Sierra (population ~700), located some 45 km to the north, and in the same basin hosting the salar - the town is readily accessible by project access tracks and then "Ruta Provincial" RP43, as is Livent's Hombre Muerto lithium operation, located ~100 km north of Kachi.
- Kachi covers 69,047 ha in 36 consolidated mining leases - the Company has indicated that all are in good standing (Figure 2).

Geology and Mineralisation

- Lithium mineralisation is hosted within saline brines in the Carachi Pampa salt lake, with the brines within clastic sediments and evaporates of the salar - a description of lithium brine deposits is presented later in this note.
- The ~135 km^2 rhomboidal salar has formed in the central part of a closed intra-montane structurally controlled pull-apart basin, with the basin having a drainage area of some 6,800 km^2; ranges adjacent to the basin rise to an elevation of ~5,100 m.
- The bounding ranges are formed from the Ordovician marine turbidite Falda Cienaga Formation, the Permian Pataquia sediments and Eocene volcanics of the Geste Formation.
- A noticeable feature is a Pliocene basaltic volcanic cone overlying part of the salar - this has a NW-SE trending fissure vent (parallel to the main axis of the salar), as well as an apron of air fall basalts covering some 70 km^2.
- Pliocene to Holocene welded ignimbrites and unconsolidated pyroclastics of the Cerro Blanco Pyroclastic Complex are also located in the region, and are interpreted as covering areas of brine bearing Kachi basin sediments.
- Drilling by Lake has shown that the basin infill largely comprises sand dominated unconsolidated sediments with some intercalated silts and clays - little halite has been intersected in drillholes and surficial halite is variable.
- The drilling has also intersected some ignimbrites, however these are limited in thickness and are not found basin wide - they however show up in the seismic surveying completed by Lake as strong reflectors (Figure 3).
- The seismic survey has also shown that the basin sediments possibly extend to a depth of up to 850 m below surface - Lake has only drilled to 405 m.
- The basin fill characterises Kachi as an "immature clastic" salar - these salars are characterised by significant thicknesses of clastic sediments with gypsum dominated evaporite interbeds, with porosity and permeability characterised by primary depositional features, which can be highly variable given the nature of the sediments, and with sediments being found to a depth of many hundreds of metres.

Figure 2: Kachi tenements, drilling pads, resource and exploration target



Source: Lake

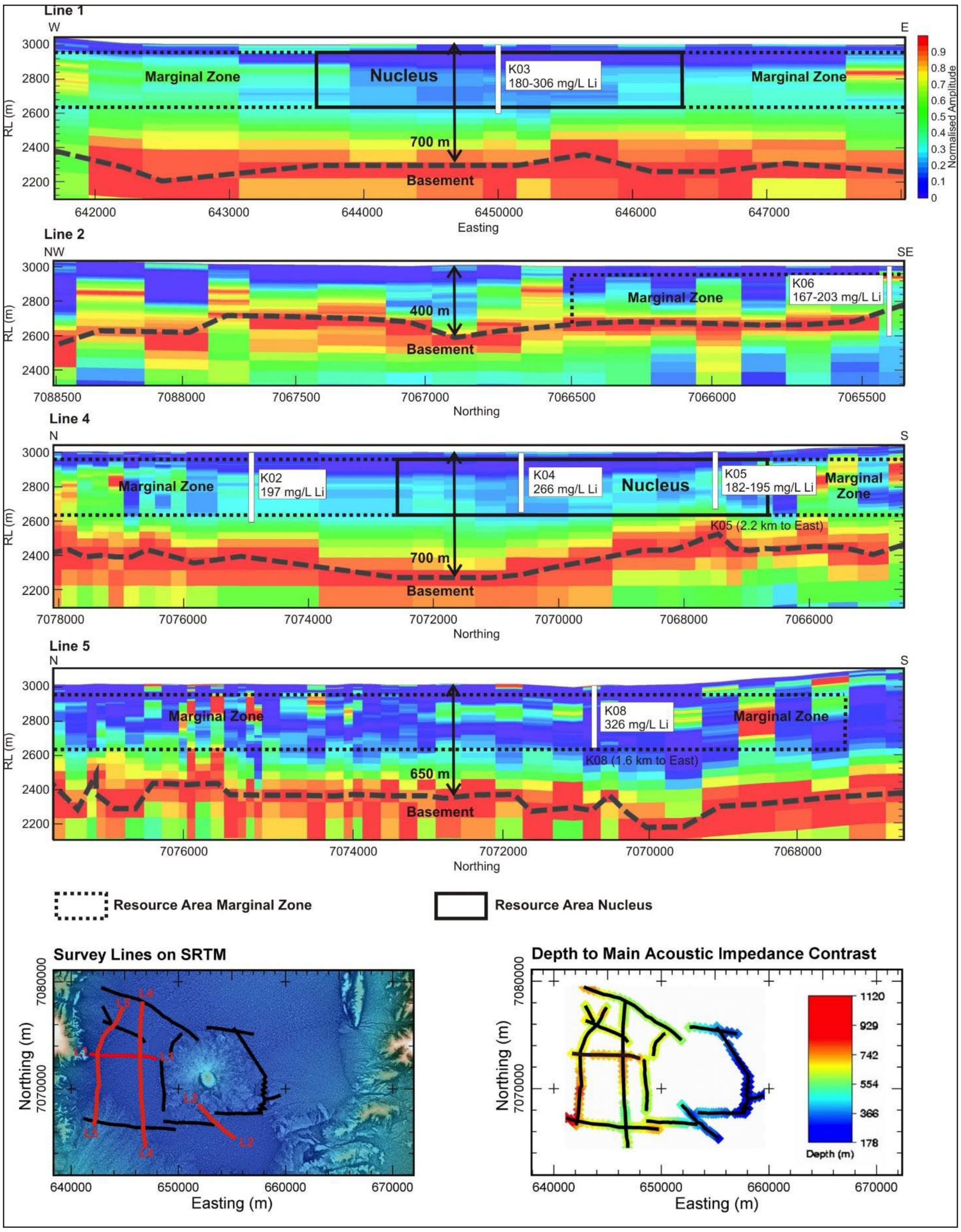
Work By Lake

- Kachi is the Company's most advanced project, with very little work being undertaken by previous operators.
- Work by Lake has included:
  - Initial auger surface sampling (which returned up to 332 mg/L Li),
  - Basin mapping using passive seismic (Figures 2 and 3),
  - Rotary and diamond drilling (3,150 m in seven diamond and eight rotary holes), Figure 2 and Table 1); and,
  - Mineral Resource Estimate and Exploration Target calculation (Tables 2 and 3).
- The Company has also formed an alliance with Lilac Solutions to investigate the use of ion exchange methodology for the direct extraction of lithium from the brines.

Basin Mapping

- Four of the seismic profiles are shown in Figure 3, highlighting the interpreted depth to the basin floor of up to 850 m on LIne 5, however with an average of ~700 m in the main part of the salar to the west of the basaltic cone.
- It is interpreted from the work that the base of the basaltic cone is actually quite shallow, with salar sediments, and hence potentially brines, extending under the volcanic edifice.

Figure 3: Kachi passive seismic sections and plans



Source: Lake

Drilling

- Hole details and results of the drilling are shown in Table 1, with the fifteen holes drilled from seven platforms (Figure 2) between December 2017 and October 2018 - holes were drilled to a maximum depth of 405 m, with an average depth of 210 m.
- As mentioned previously, the drilling largely intersected poorly consolidated sand and gravel dominated clastic sediments, with some intercalated silts and clays - although pumping tests are yet to be undertaken, field hydraulic testing has demonstrated the high permeability of the sandy units.
- This testing has included air lift pumping to obtain brine chemistry samples, which has indicated very high permeabilities of all locations drilled to date.
- As shown in Table 2, Lithium assays vary in a relatively narrow range largely between 150 mg/L Li and 300 mg/L Li (with some outliers); Mg/Li ratios are commonly around 3 to 6, however there is what appears to be a distinct second population with ratios of ~10 to 15.

Table 1: Kachi drillhole locations and results

Exploration Hole	Drilling Method	Easting	Northing	Total Depth (m)	Assay Interval (m)	Li (mg/L)	Mg (mg/L)	K (mg/L)
Northern Area								
K07D01	Diamond	643829	7073100	76.25	10-34	157		3330
K03D02	Diamond	644880	7073149	150.5	74 - 92	180	1740	4435
K03R03	Rotary	644898	7073147	242	213 - 237	306	1307	5998
K03R12	Rotary	644885	7073132	400	358 - 400	267	1180	5180
K02D13	Diamond	646432	7074897		60	217	3557	4438
					64 - 108	182	2884	3620
					269 - 298	204	2163	4100
					313 - 343	252	1411	4987
Southern Area								
K06D04	Diamond	655320	7065352	167.5	95 - 113	203	766	3321
K06R05	Rotary	655273	7065354	87	68 - 85	167	1000	3160
K06R06	Rotary	655307	7065374	180	Not Sampled			
K06R07	Rotary	655326	7065362	189	159 – 179	191	1009	961
K06D08	Diamond	655326	7065362	405	69 -70	194	958	3171
					120 - 121	191	873	3199
					165-166	170	880	3650
					205-206	164	894	3590
					258-259	164	888	3560
					354-405	170	877	3670
K05D09	Diamond	648899	7067469	139	62	83	1229	965
					108	222	1325	4360
K05D11	Diamond	648902	7067491	391	157	95	1460	1926
					188	215	919	3596
					224 - 248	175	876	3065
					289	143	1088	2251
					300.5	116	1035	1782
					291 - 334	234	3199	4980
					349 - 391	185	1955	3892
K08R14	Rotary	644218	7070750	364	301 - 361	326	1232	6038
K04R15	Rotary	646454	7070594	350	290 - 350	265	1154	4993

Source: Lake

MRE and Exploration Target

- The MRE and Exploration Target, which were released to the market on November 27, 2019, are shown in Tables 2 and 3, and with outlines of the relevant areas shown in Figure 2.
- Both Indicated and Inferred Resources, which have been calculated from the results of 15 holes have been estimated to a depth of 400 m, with the top of the Resource at 50 m below surface - the top 50 m has been excluded due to dilution by surface waters, and the interpretation that these shallow brines will not be representative of lithium concentrations at greater depths.
- The brines are interpreted as extending beneath lake sediments, pyroclastic sediments and dunes to the south of the outcropping salar, as well as cover to the north and west.
- As mentioned earlier, it is interpreted that brines extend under the basaltic cone, and that seismic surveys indicate that the sediments reach a depth of up to 800 m, therefore highlighting the potential for significant increases in Resources with additional drilling.
- We have noted two distinct populations with regards to Mg/Li ratios - one averaging ~5, and a second with a range of 10 to 15; the Indicated Resources have a range of 3.7 to 4.3, with the bulk of the Resources at the lower end.
- Normally brines with a Mg/Li ratio of over 10 are considered problematic, in that significant extra consumables are required to remove the magnesium from the brines and hence increasing costs.

- This however is not a problem with the planned ion exchange processing, and, if conventional processing were to be used, only a relatively small portion of the Resource has the higher ratios.

Table 2: Kachi MRE

Kachi MRE						
Parameter	**Indicated**		**Inferred**		**Total Resource**	
Area km^2	17.1		158.3		175.4	
Aquifer volume km^3	6		41		47	
Brine volume km^3	0.65		3.2		3.8	
Mean drainable porosity % (Specific yield)	10.9		7.5		7.9	
Element	Li	K	Li	K	Li	K
Weighted mean						
Concentration mg/L	289	5,880	209	4,180	211	4,380
Resource tonnes	188,000	3,500,000	638,000	12,500,000	826,000	16,000,000
LCE Equivalent tonnes	**1,005,000**		**3,394,000**		**4,400,000**	
Potassium Chloride tonnes	**6,705,000**		**24,000,000**		**30,700,000**	

Source: Lake

- The Exploration Target (Table 3 and Figure 2) is inclusive of the MRE, and extends from 25 m below surface to a depth of 400 m, and is largely limited in surface extent by the lease boundaries.
- This again highlights the significant opportunity to expand the MRE with only limited drilling.

Table 3: Kachi Exploration Target

Kachi Exploration Target										
Subarea	**Area km^2**	**Average Thickness m**	**Specific yield %**	**Brine volume MM m^3**	**Li mg/L**	**Li kT**	**LCE kT**	**K mg/L**	**K kT**	**KCl kT**
UPPER RANGE SCENARIO										
High Confidence Western Sector	55.2	375	10%	2,801	310	641	3,412	5,880	16,470	31,457
High Confidence Eastern Sector	16.7	338	10%	873	250	141	752	5,880	5,133	9,804
Moderate Confidence Sector	150.7	350	10%	6,631	310	1,633	8,689	5,880	38,990	74,471
Low Confidence Sector	72.6	321	10%	2,733	310	723	3,849	5,880	16,070	30,694
Total						**3,139**	**16,700**		**76,663**	**146,426**
LOWER RANGE SCENARIO										
High Confidence Western Sector	55.2	375	7%	2,801	210	304	1,618	4,180	6,053	32,204
High Confidence Eastern Sector	16.7	338	7%	873	150	83	442	4,180	1,655	8,803
Moderate Confidence Sector	150.7	350	7%	6,631	210	774	4,120	4,180	15,415	82,009
Low Confidence Sector	72.6	321	7%	2,733	210	343	1,825	4,180	6,828	36,327
Total						**1,480**	**7,878**		**29,951**	**159,342**

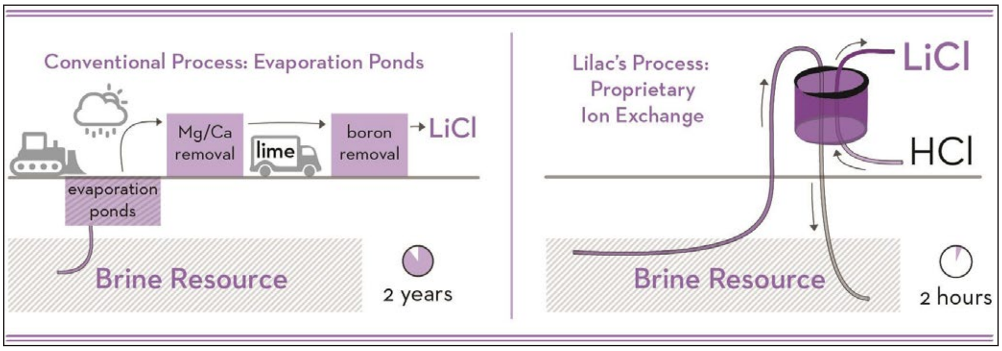
Source: Lake

Processing and Lilac Solutions

- One of the key factors to any future operation at Kachi, given the relatively low grade, is processing.
- To that end the Company looked at a number of processing options, and settled on an ion exchange process developed by US-based firm, Lilac Solutions - a services agreement has been signed with Lilac Solutions, with the engagement announced to the market on September 5, 2018.

- Ion exchange is a well understood process, and is used in a wide range of applications, including water purification and ion separation (refer to section on ion exchange later in this note) - the challenge has been to develop the bead chemistry to limit degradation, and hence maximise bead life to suit the treatment of lithium brines.
- Another facet of the Lilac Solutions process is the development of an ion exchange media that is selective enough to be able to discriminate between Li^+ and Na^+ ions, which have similar chemical behaviours.
- From work to date, including bench scale test work, it would appear that Lilac has achieved these aims for the Kachi brines.
- A schematic comparison of ion exchange and evaporative treatment is shown in Figure 4.

Figure 4: Comparison of evaporative and ion exchange brine treatment



Source: Lilac website

- In May, the Company completed a Phase 1 Engineering Study which demonstrated the following:
  - Lithium concentrations of 30,000 mg/L (and up to 50,000 mg/L) achieved with low impurities after three hours of processing from 300 mg/L brines,
  - Lithium recoveries of 85% - 90%; and,
  - Estimated operating costs to lithium carbonate of US$2,600/tonne (+- 30%) - this is in the lowest quartile for lithium carbonate production from brines.
- The company has mentioned that bench scale processing has been ongoing continuously for around six months, with the original beads still being used, indicating excellent durability, and hence the potential for relatively low costs.

Pre-Feasibility Study and Pilot Plant

- Lake has recently commenced a PFS for a 25,000 tpa operation, which will use the results of the Phase 1 Engineering Study; in parallel the Company is designing and will install a pilot ion exchange plant at Kachi.
- International engineering consulting firm, Hatch, has been appointed to provide engineering and design services for Kachi, including for the pilot plant.
- The PFS is planned to be completed in November, with commencement of pilot processing at around the same time - the plant will be designed to produce ~10 tonnes of lithium carbonate per annum, and will test the suitability of the Lilac Solutions process under the high altitude and arid conditions at Kachi.
- This will also provide the opportunity for optimisation of the ion exchange technology, and given the modular nature of the plant, additional modules could be added as required.
- Other work to be undertaken during the PFS will include pump testing of existing wells - there will be no requirement to drill additional wells for this.
- The Company has estimated that the cost of completing the PFS will be in the order of A$750,000, and that for the design, construction and installation of the pilot plant ~A$2 million.

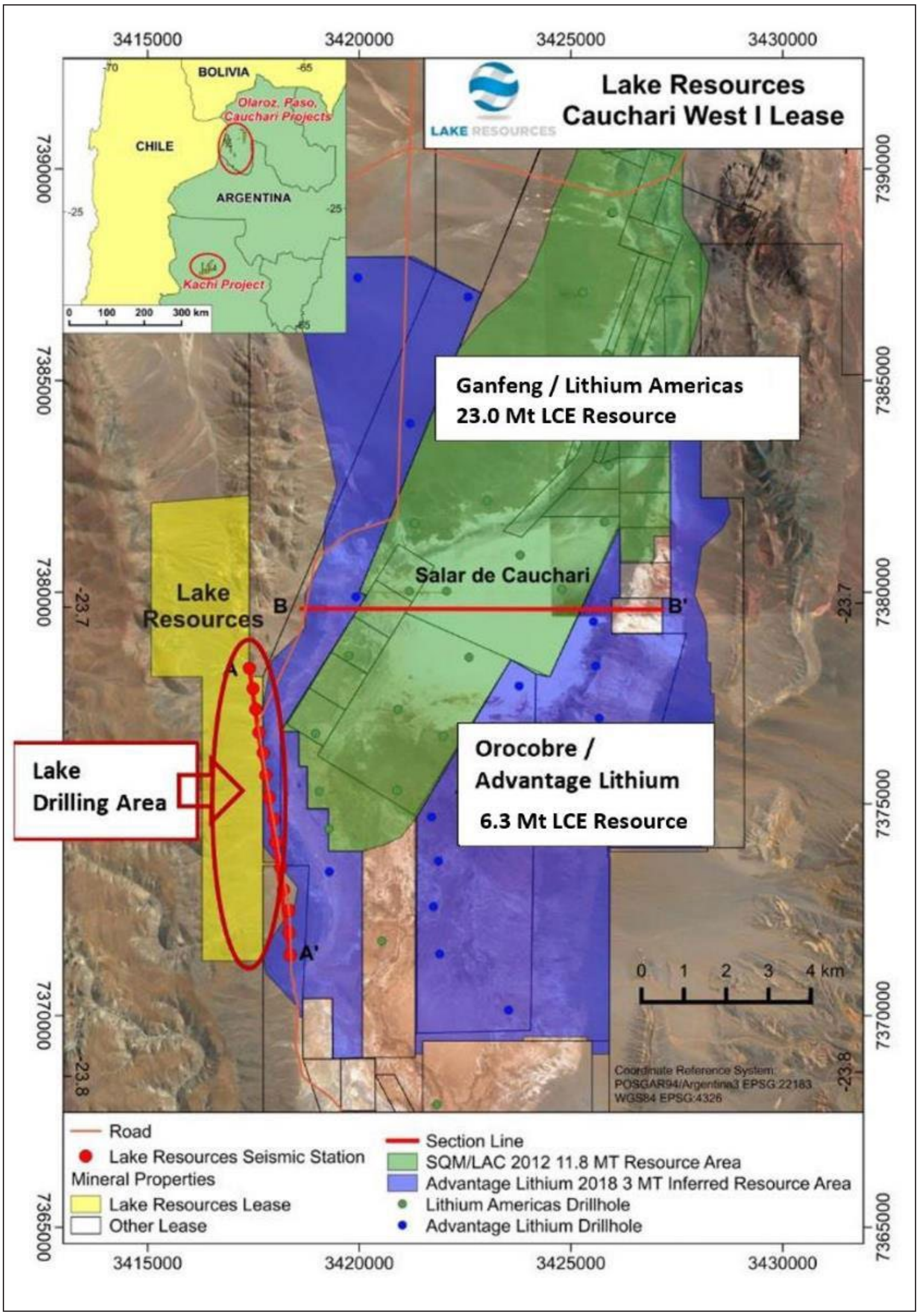
CAUCHARI AND OLAROZ LITHIUM PROJECTS - LAKE 100%

Location and Tenure

- Cauchari is located over the western side of Salar de Cauchari, in Jujuy Province, northwestern Argentina (Figure 5) - Cauchari includes five granted leases for 3,712 ha.

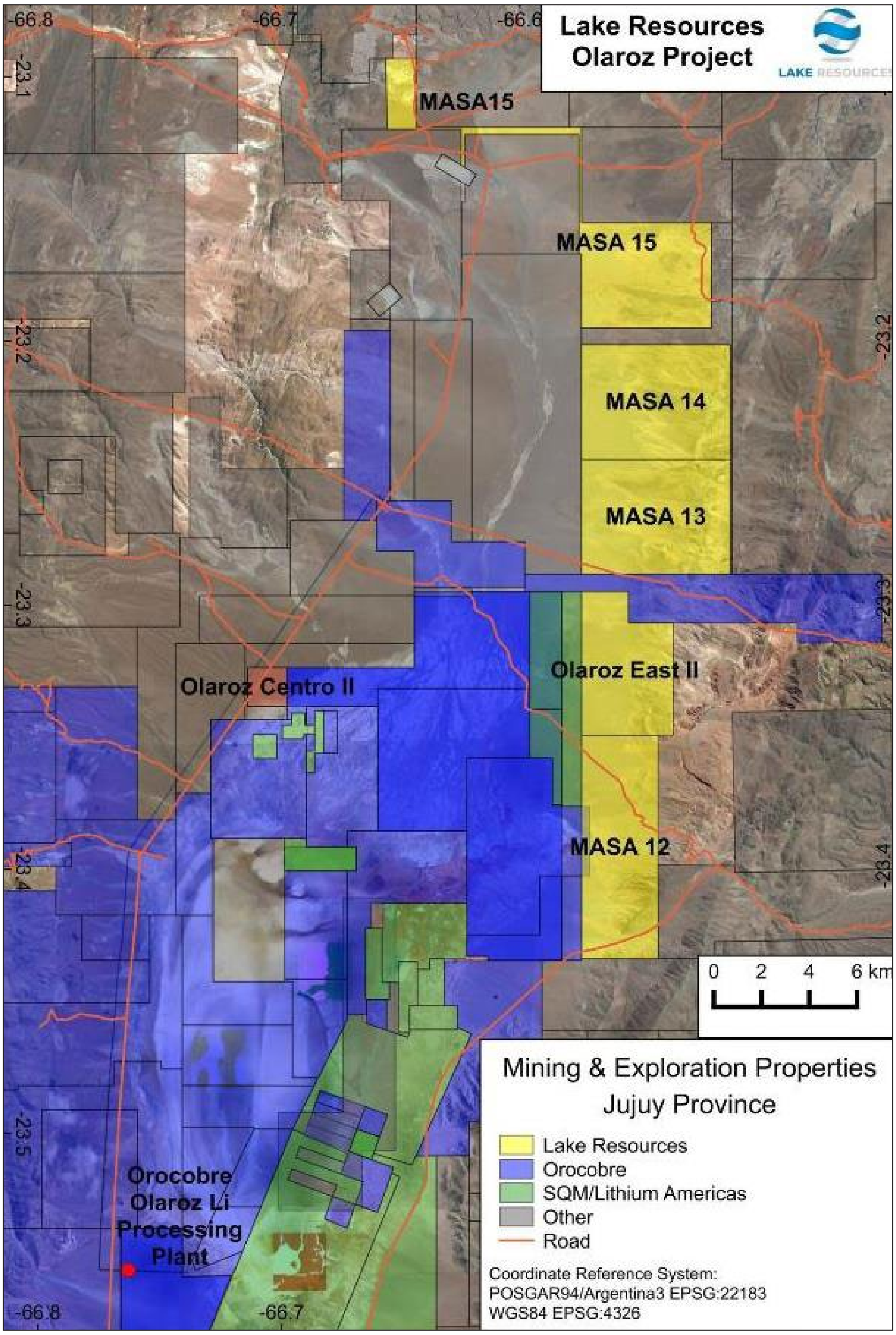
- The Cauchari leases are adjacent to those that host to the world class deposits of Orocobre/ Advantage Lithium (6.3 Mt LCE @ 475 mg/L Li, with a PFS for 30,000 tpa LCE) and Lithium Americas Corp/Ganfeng (23.0 Mt @ 586 mg/L Li), currently under construction with a planned start up of a 40,000 tpa LCE operation in 2020.
- Olaroz is located over the eastern side of Salar de Olaroz, some 60 km NNE of the Cauchari tenements - this includes five granted tenements and one application for 14,241 ha, and is located immediately to the east of the Olaroz operation of Orocobre/Toyota Tsusho (Figure 6).
- The region is well served by transport infrastructure including "Ruta Nacional" RN51 and RN52; the provincial capital of Jujuy (population ~300,000) is approximately 220 km via RN52 and RN9 from the drainage divide between Salar de Olaroz and Salar de Cauchari.

Figure 5: Cauchari tenements and location



Source: Lake

Figure 6: Olaroz tenements



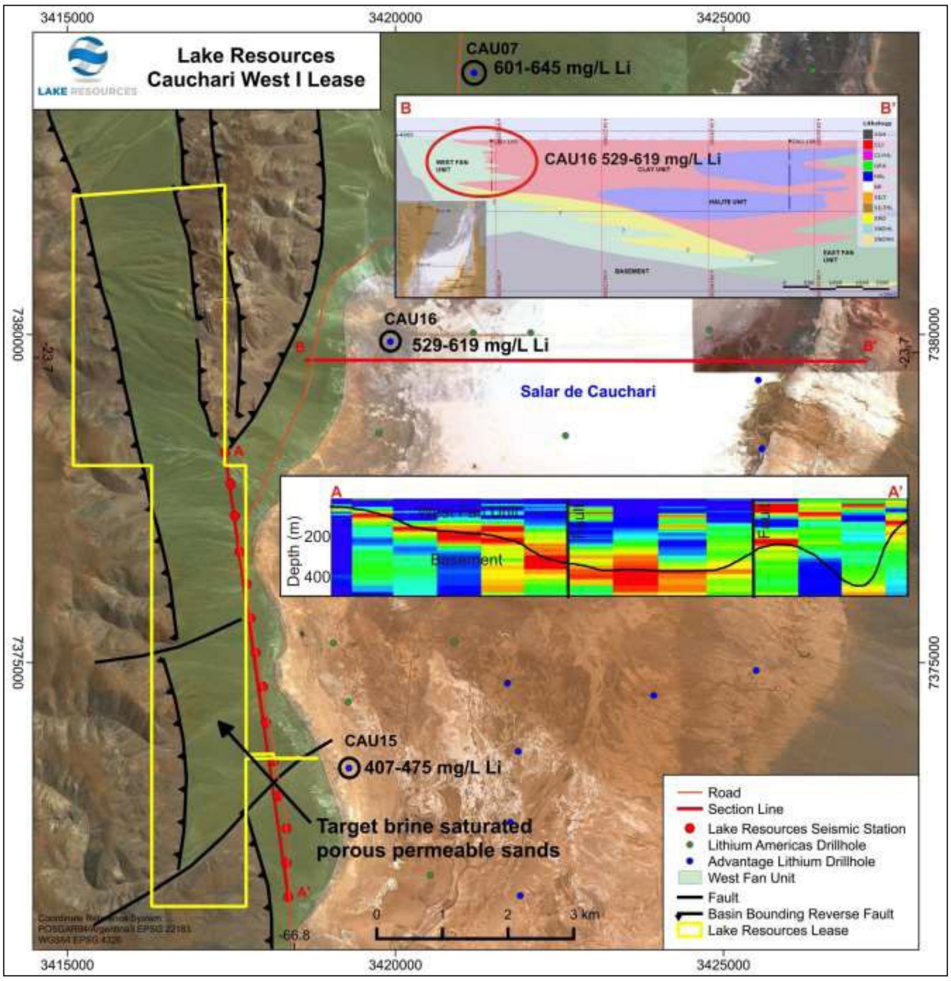
Source: Lake

Geology and Mineralisation

- As at Kachi, Lake is targeting lithium brine mineralisation at both Olaroz and Cauchari - in this case it is interpreted extensions of the resource bearing aquifers extend under flanking alluvial fan cover, areas that have not been traditionally targetted.
- Historic interpretations have assume a "dish" shape for the salars with gently sloping sides, however they are more likely to be bounded by steeply dipping reverse or normal faults - the interpretation at Cauchari is that the western side of the basin is bounded by a steeply west dipping reverse fault (Figure 7), and that the aquifer that hosts the mineralisation in the salar extends westward under the fans.
- These structures may also be conduits for lithium bearing fluids related to the volcanism in the region.

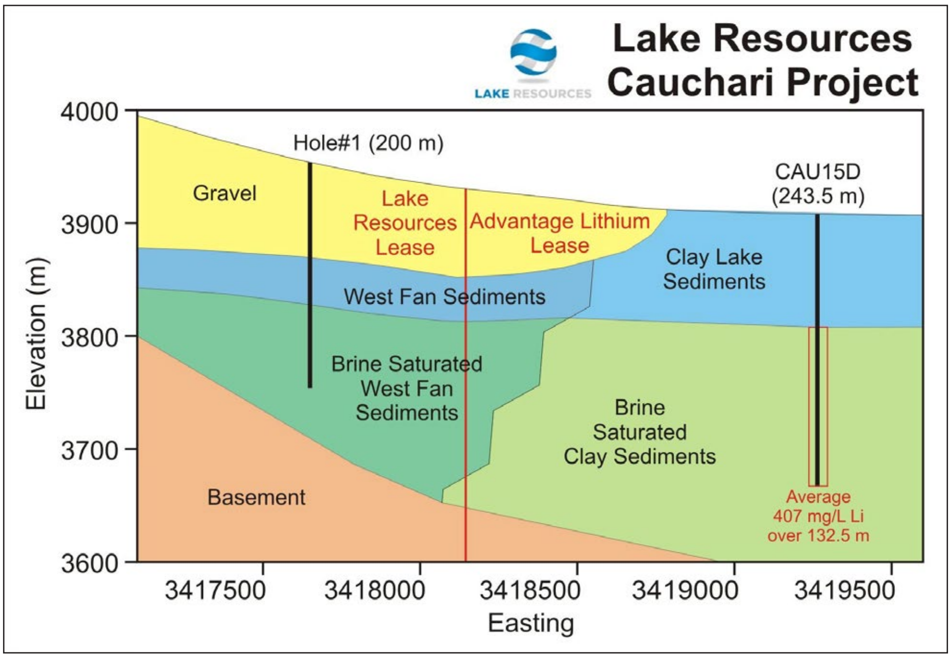
- Even if the margin is relatively gently dipping, there is still the potential for the fan facies to extend south from the section of Advantage Lithium hole CAU16 (top inset in Figure 7) to the CAU15D east-west section.
- A passive seismic profile completed by Lake highlights a ~300 m deep embayment in the region of the CAU16D section, with the interpreted geology on this line shown in Figure 8.

Figure 7: Cauchari tenements, interpreted basin structure and seismic section



Source: Lake

Figure 8: Interpreted geological cross section and Advantage Lithium drillhole CAU15D

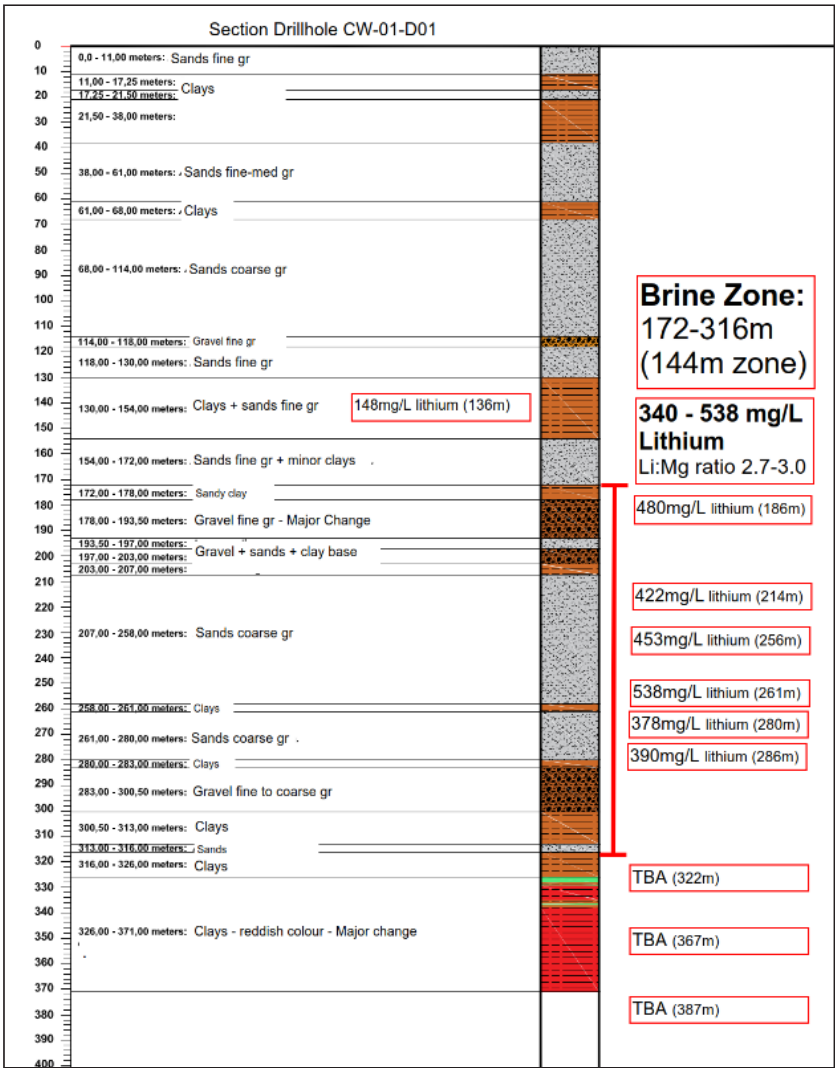


Source: Lake

Current and Planned Work by Lake

- The work by Lake at Cauchari and Olaroz is largely proof of concept in testing the basin edge model as presented above.
- No work has as yet been undertaken at Olaroz, with access at Cauchari only being granted in early 2018.
- Initial work at Cauchari included the passive seismic survey, which highlighted the embayment in the vicinity of the Advantage Lithium hole CAU15 section (Figure 7), and which is currently being tested by drilling.
- Although drilling commenced in the September quarter, there were issues, including high fluid pressures amongst others, that led to the abandonment of the first two holes.
- The Company has recently successfully completed hole CW-01-D01, which was terminated in clay-rich horizons at 460 m, which extended from 326 m.
- The hole intersected a 114 m section hosting multiple lithium brine zones from 172 m to 316 m, with initial assays returning values of 340 to 538 mg/L lithium, with low Mg/Li ratios of 2.7 to 3.0 - the brines were largely hosted in sands and gravels (Figure 9); some brines were also intersected in clays from 356 m to 386 m.
- The grade and thickness of the brines is similar to that in Advantage's hole CAU015; also, with basement yet to be intersected at 460 m depth, the depth to the bottom of the basin is significantly deeper than that shown in Figure 8 (and indicated in the seismic profile shown in Figure 7), thus supporting the interpretation that the basins are steep sided.
- Detailed sampling is now underway, with this to be followed by analysis, casing and geophysics.

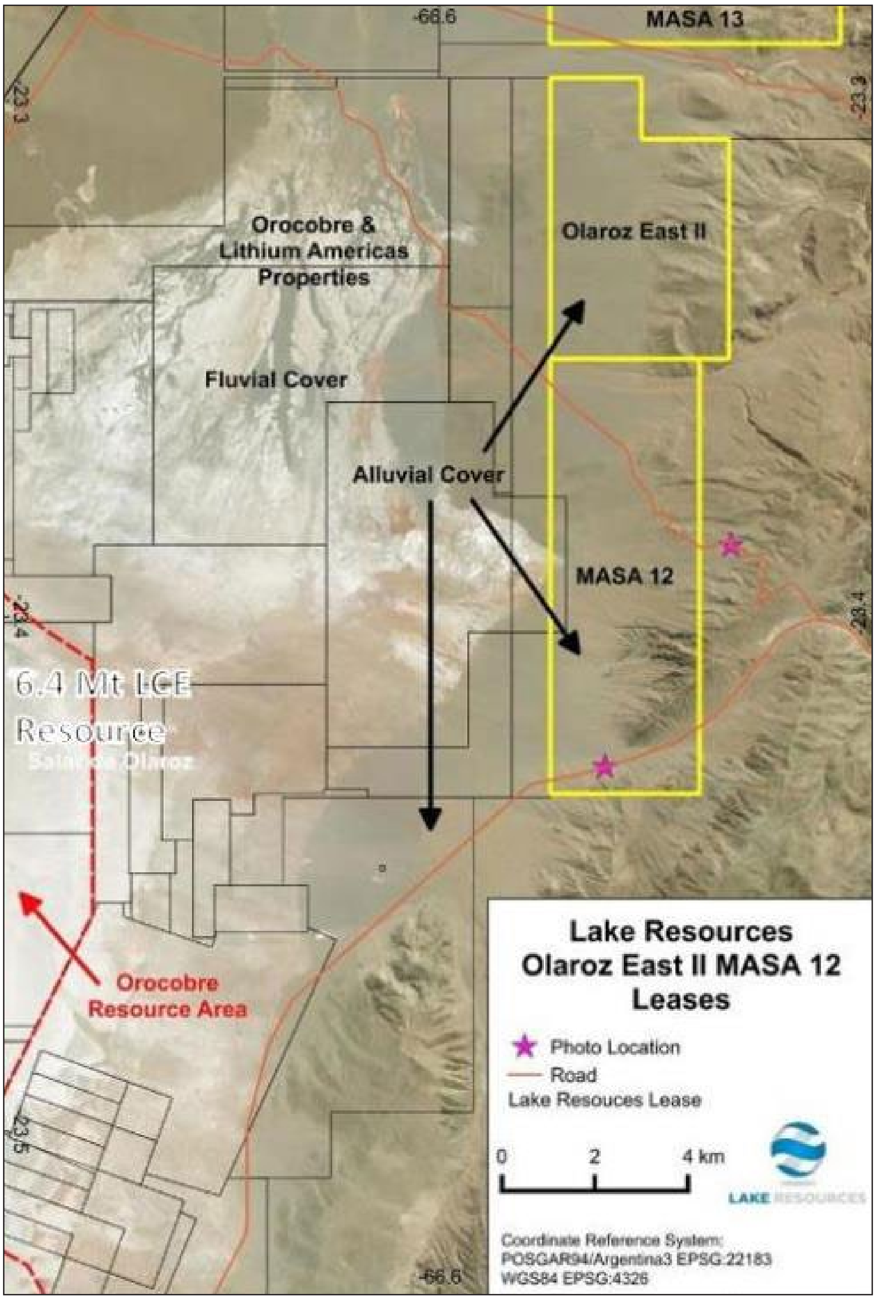
Figure 9: Part log - hole CW-01-D01



Source: Lake

- The rig will now be moved to the southern Olaroz tenements, to test the extension of salar sediments and brines under the alluvial fans (Figure 10).

Figure 10: Southern Olaroz tenements



Source: Lake

- Olaroz and Cauchari are considered to be mixed salars, with halitecores and surrounding clastic sediments; they are flanked by permeable fans, with fluid inflows into the basin.
- The basins were originally formed by Late Cretaceous to Eocene (~70 Ma to 30 Ma) extension through back-arc rifting, which was followed by compression.
- Basement rocks include Ordovician to Cretaceous marine sediments, which were succeeded by continental sediments in the Eocene; younger units are dominated by volcanics from the Andean stratovolcanoes.

CATAMARCA PEGMATITE PROJECT - LAKE 100%

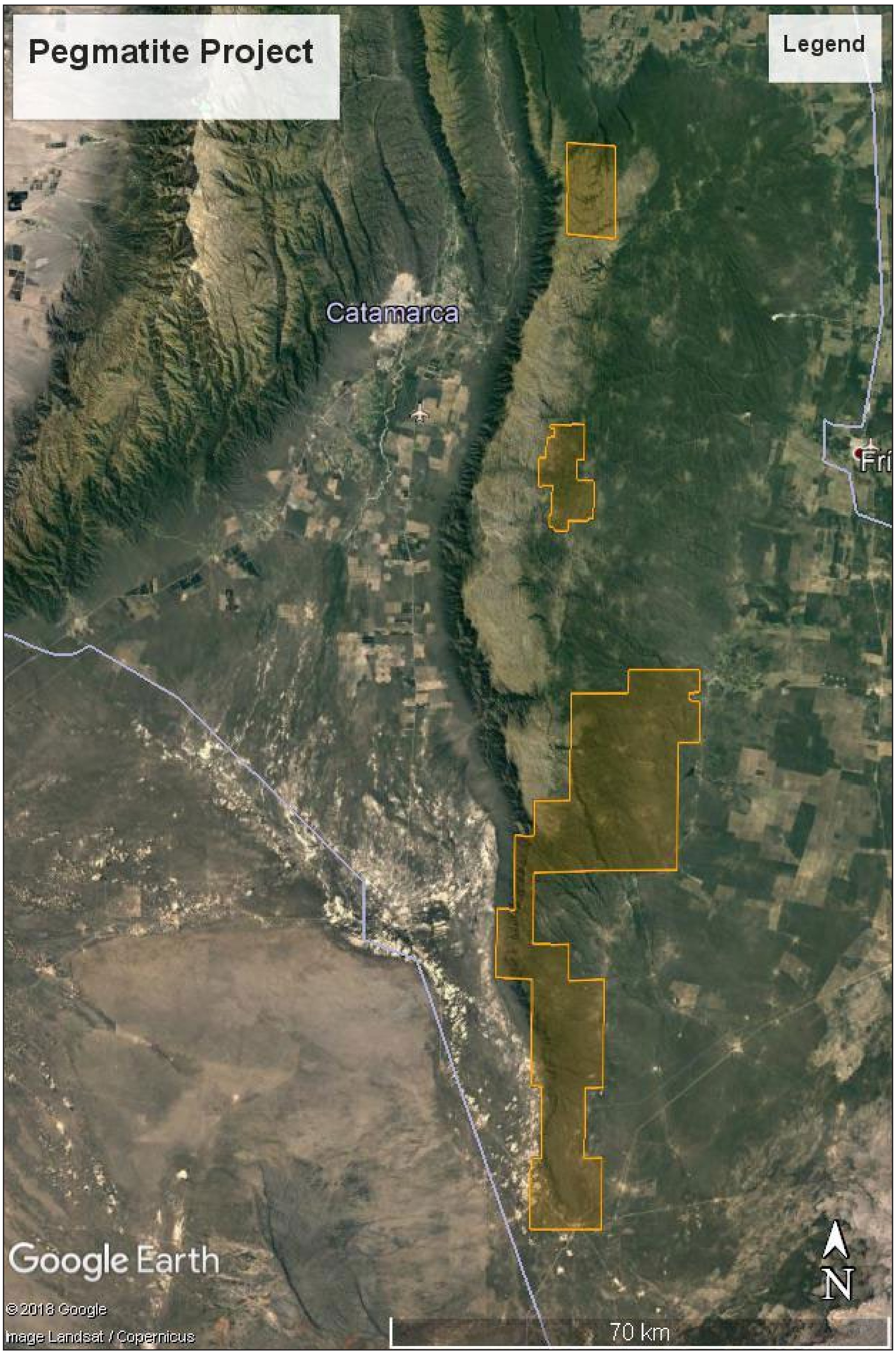
Location and Tenure

- Catamarca comprises ~80,000 ha of tenements along a 150 km long north-south strike of prospective stratigraphy in the Acasti Ranges, to the east and south of San Fernando del Valle de Catamarca (population ~340,000), the capital of Catamarca Province (Figure 11).
- Lake initially entered into an option agreement with local company Petra Energy S.A. in February 2017 to acquire 72,000 ha under the following terms:

- 4 million LKE shares for a 4 month option period, with 1 million shares on signing and 3 million shares within 60 days, extendable to 6 months with a payment of a further 1 million LKE shares. (50% voluntarily escrowed for 6 months). Due diligence and initial exploration to be undertaken at LKE cost; and,
- 15 million LKE shares on execution of the option, paid in two tranches, with 7.5 million shares upon execution and 7.5 million shares once 65% of the areas are granted for exploration (which may be simultaneously). (50% voluntarily escrowed for 6 months).

- The option was exercised in the September quarter 2018 following positive results from due diligence fieldwork, with the area subsequently enlarged to ~80,000 ha.

Figure 11: Catamarca pegmatite tenements



Source: Lake

Background

- The Ancasti Range had been historically known for pegmatite mineralisation, with some small scale operations - the prospectivity was further highlighted by work by Latin Resources (ASX: LRS), which returned up to 7.1% Li_2O from grab samples from historic mine workings.

- Mapping by a local technical team recognised swarms of outcropping pegmatites, with work by Lake personnel supporting this, in some cases this recognised spodumene crystals up to 70 cm long.
- The area has seen only little modern exploration, and thus is a prime target for modern exploration methods.

PEER GROUP ANALYSIS

- Table 4 presents largely ASX and TSX listed companies with interests in brine projects in the Americas.
- The majority of the projects are located in Argentina, with the exception of Clayton Valley (Nevada) and Salar de Maricunga (Chile).
- In our table we have sorted the companies by enterprise value ("EV"), which is calculated from undiluted market capitalisation + debt – cash to give an indicative value for the relevant companies' projects.
- Using the EV we have calculated the EV/tonne of the company's share of contained LCE resources that can be used as a comparison between companies – however care should be used when using this figure, which we consider as indicative only, and will vary according to a number of factors.
- We have not ascribed any value for other projects that the companies may have in their portfolios - this is particularly pertinent in the case of Galaxy, which, in our view, would have most value ascribed to the Mt Cattlin spodumene operation in Western Australia, and thus this distorts the value of the brine mineralisation as presented below.
- We have however not included Livent, partly because we could not source the details of the Fenix Resource and also that Fenix is just one component of a broader vertically integrated lithium business.

Table 4: Lake peer group comparison

Lake peer group comparison								
Company	**Code**	**Key Project**	**EV (A$m)**	**LCE (mt)**	**Li Grade (mg/l)**	**Ultimate Ownership**	**EV/t LCE (A$)**	**Stage**
Argosy Minerals	AGY.ASX	Rincon	$83	0.25	325	90.0%	$372	Pilot Plant
Orocobre	ORE.ASX	Salar Olaroz	$515	6.81	690	66.5%	$114	Producer
Galaxy	GXY.ASX	Sal de Vida	$501	4.69	732	100.0%	$107	FS Completed
Pure Energy	PE.TSXV	Clayton Valley	$15	0.22	123	100.0%	$67	PEA Completed
Lithium Power	LPI.ASX	Maricunga	$68	2.15	1,160	51.0%	$62	DFS Completed
Lithium Americas	LAC.TSX	Cauchari-Olaroz	$526	23.07	585	62.5%	$36	Construction
Bearing Lithium	BRZ.TSXV	Salar Maricunga	$12	2.15	1,160	17.7%	$30	DFS Completed
Millenial Lithium	ML.TSXV	Pastos Grandes	$78	4.92	427	100.0%	$16	PEA Completed
Advantage Lithium	AAL.TSXV	Cauchari	$58	6.30	475	75.0%	$12	PEA Completed
Lake Resources	LKE.ASX	Kachi	$32	4.40	211	100.0%	$7	Resource
Neo Lithium	NLC.TSXV	Tres Quebrados	$33	6.92	605	100.0%	$5	PFS completed, pilot ponds and plant
Galan Lithium	GLN.ASX	Candelas	$23	N/A	N/A	100.0%	N/A	Exploration
Wealth Minerals	WML.TSXV	Various	$59	N/A	N/A	100.0%	N/A	Exploration

Source: IRESS, Company reports

- There is a general increase in EV/tonne LCE with advance in project stage and increasing grade, however we do note a few anomalies, particularly Argosy at the high end and Neo Lithium and Lake Resources at the low end.
- In our view this provides upside for Lake - part of the reason for the low value may be the grade, however a positive PFS and ion exchange pilot testwork should overcome this and realise further value in the Company.
- The size of the Resource (4.4 Mt LCE) compares vary favourably with others in the region.

- A critical factor to be considered is the metallurgical recovery of lithium – figures given above are commonly in-situ resources, and not recoverable resources, with recovery factors being highly variable between different projects and within salars - this will have a significant effect on recoverable resources, thus affecting the relative valuations.
- Again, with the Lilac Solutions processing, Lake has a potential significant advantage here.
- Another idea of value can be gained from transactions - Table 3 presents a number of recent transactions in both the brine and hard rock spaces announced from 2017 to 2019 - these include asset sales, mergers and takeovers.
- This highlights the break between prices paid for the two asset stages - producing and non-producing and also the relatively high value of the Salar de Hombre Muerto transaction when compared with other brine transactions.

Table 5: Lithium transactions

Lithium transactions								
Project	**Type**	**Vendor**	**Buyer**	**Price**	**% of asset**	**LCE in Transaction**	**Value per t LCE**	**Status**
Wodgina	Pegmatite	MinRes	Albermarle	A$1,580 m	50%	3,750 kt	$421	Operating
Mt Marion	Pegmatite	Neometals	Ganfeng	A$104 m	13.80%	281 kt	$370	Operating
Mt Holland	Pegmatite	Kidman	Wesfarmers	A$739 m	50%	3,505 kt	$211	Resource
Salar de Hombre Muerto	Brine	Galaxy	POSCO	A$370 m	100%	2,540 kt	$146	Resource
Salar de Los Angeles	Brine	Lithium X	Nextview	$265.00	100%	2,050 kt	$129	Resource
Cauchari-Olaroz	Brine	SQM	Ganfeng	A$200 m*	37.5%	2,554 kt	$78	Resource
Mt Holland	Pegmatite	Kidman	SQM	A$150 m	50%	2,279 kt	$66	Resource
PPG	Brine	LSC	Pluspetrol	A$110 m	100%	5,770	$19	Resource

Source: IRESS, Company reports. *Cauchari-Olaroz transaction includes initial US87.5 million and conditional US$50 million payments - no allowance is included for loan of US$100 million to LAC.

CAPITAL STRUCTURE

- Lake currently has 478.3 million ordinary shares and 20.1 million unlisted options on issue.
- 5.052 million A$0.05 options are in the money, with the potential to bring in A$252,604 if exercised.
- The top shareholder at 5.58% is the Lambrecht Investment Group; directors directly and indirectly hold 4.18% of the Company.
- The Company has ~2,060 shareholders, with the top 20 holding 39.8%.
- The Company also has 2,905,000 convertible notes outstanding as detailed in Table 6 - our analysis indicated that at current share prices redeeming of the notes would result in the issue of approximately 11 million shares - Lake is now undertaking a programme of retiring the notes.

Table 6: Convertible note terms

Convertible note terms		
Issued	**21/12/2018**	**28/2/2019**
Holders	Sophisticated Investors	North American Investor
Term	18 Months	18 months
Interest Rate	15%	15%
Interest Payments	Quarterly in arrears in cash or shares - shares to be priced at 95% of the VWAP for the preceeding 10 trading days	Compounded monthly, paid quarterly in arrears in cash
Face Value	A$0.10	A$1.00
Number Originally Issued	9,900,000	1,820,500
Initial Amount Raised (before costs)	A$990,000	A$1,820,500
Number Redeemed/Retired/Added	7,400,000	1,415,500
Number Outstanding	2,500,000	405,000
Value Outstanding	A$250,000 plus interest	A$405,000
Other Raisings	N/A	Potential for up to a total of A$5 million in two note issues - second to be between A$500,000 and A$3.345 million, with a 12 month maturity
Conversion	At holders election, otherwise at maturity. Outstanding amounts (including interest) converted at 80% of the VWAP of the shares for the 10 trading days prior to conversion	At holders election, and at 90% of three VWAPs of the shares selected by the investor for the 20 trading days prior to conversion
Conversion and Other Restrictions	Not within six months of issue, or when the conversion price is less than A$0.10 or greater than A$0.30	No shorting of Lake securities by investor or affiliates
Options	N/A	5,555,555 options at A$0.08, expiring on 28 Feb, 2022 for initial investment, options for 2nd issue dependent upon issue amount

Source: Lake.

BOARD AND MANAGEMENT

- **Mr Stuart Crow – Non-Executive Chairman:** Stuart has global experience in financial services, corporate finance, investor relations, international markets, salary packaging and stock broking. Stuart is passionate about assisting emerging listed companies to attract investors and capital and has owned and operated his own businesses.
- **Mr Stephen Promnitz – Managing Director:** Stephen has considerable technical and commercial experience in Argentina, a geologist fluent in Spanish, and a history of exploring, funding and developing projects. Mr Promnitz has previously been CEO and 2IC of mid-tier listed mineral explorers and producers (Kingsgate Consolidated, Indochine Mining), in corporate finance roles with investment banks (Citi, Westpac) and held technical, corporate and management roles with major mining companies (Rio Tinto/CRA, Western Mining).
- **Mr Nick Lindsay – Non-Executive Director:** Dr Nick Lindsay has over 25 years' experience in Argentina, Chile and Peru in technical and commercial roles in the resources sector with major and mid-tier companies, as well as start-ups.

  Nick has an BSc (Hons) degree in Geology, a PhD in Metallurgy and Materials Engineering as well as an MBA. A fluent Spanish speaker, he has successfully taken companies in South America, such as Laguna Resources which he led as Managing Director, from inception to listing, development and subsequent acquisition.

  Mr Lindsay is currently CEO of Manuka Resources Ltd, an unlisted company, having previously held the position of President – Chilean Operations for Kingsgate Consolidated Ltd and is a member of the AusIMM and the AIG.
- **Ms Sinead Teague – Company Secretary:** Ms Teague is a governance and compliance professional at the Automic Group, with over ten years of company secretarial experience across a range of industries and ASX listed companies. Ms Teague is an associate member of the Governance Institute.

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 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 (Li_2CO_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 – Li_2O – which contains 46.5% lithium, around 2.5 times that of LCE, with lithium hydroxide (LiOH, 29% Li) also being used – conversion factors are shown in Table 7.

Table 7 :Lithium mineral/compound conversion factors

Lithium mineral/compound conversion factors						
Species	Formula	Lithium content	Convert to Li	Convert to Li_2O	Convert to Li_2CO_3	Convert to LiOH
Lithium	Li	100%	1.000	2.152	5.322	3.451
Lithium Oxide	Li_2O	46.46%	0.465	1.000	2.473	1.603
Lithium Carbonate	Li_2CO_3	18.79%	0.188	0.404	1.000	0.648
Lithium Hydroxide	LiOH	28.98%	0.290	0.365	1.542	1.000

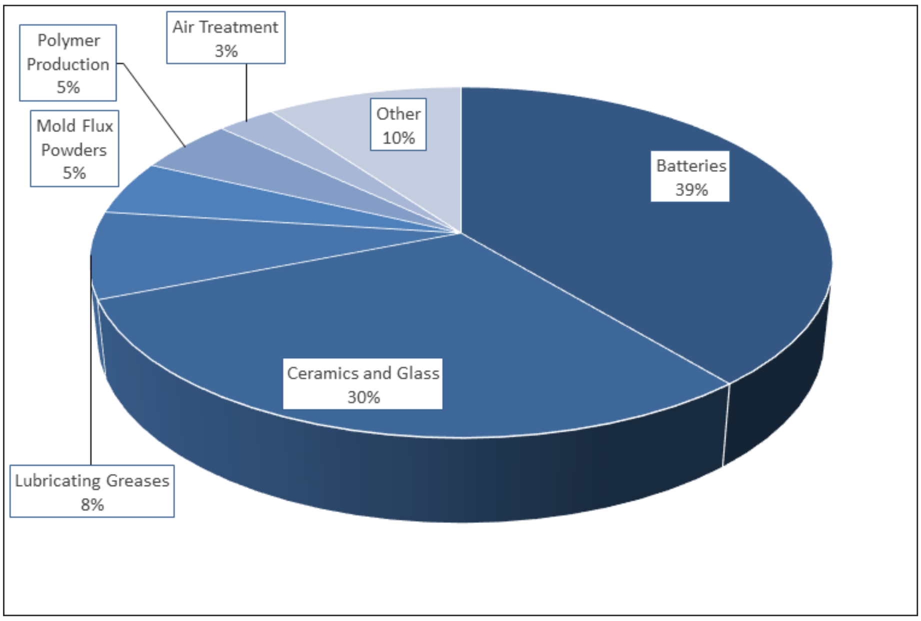
Source: IIR analysis

- Our figures and discussions in the following sections are based on LCE - where necessary we have converted figures from other compounds using the ratios in Table 7.
- Lithium products come in three main specifications, with typical values as follows, and with these commanding different prices:
  - Industrial grade (+96% Li, 0.70% H_2O, 0.50% Na_2O) - glass, casting powders and greases.
  - Technical grade (~99.3% Li, 0.60% H_2O, 0.20% Na_2O) - ceramics, greases and batteries.
  - Battery grade (>99.5% Li, 0.50% H_2O, 0.05% Na_2O) - high end battery cathode materials

Lithium Uses and Demand

- Lithium has a large number of uses, with the most relevant now being in rechargeable batteries, which in 2016, according to the USGS made up some 39% of the then annual demand of over 175,000 t of lithium carbonate equivalent ("LCE"), which is the form that lithium grades and prices are most commonly quoted in.
- Figure 12 presents the USGS's breakdown by application in 2016 - we note that the battery demand here differs from that provided by Roskill and SQM, which estimated battery demand (electronics plus EVs) was ~50% of total demand in 2016, rising to 60% in 2018.

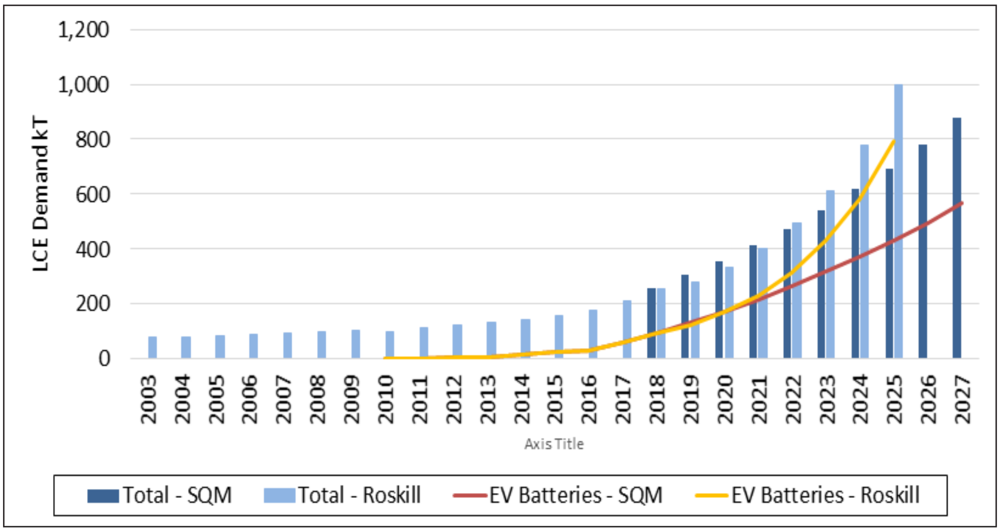
Figure 12: Lithium uses - 2017



Source: USGS

- Demand forecasts also vary quite widely between different parties, with this depending largely on the expected take-up in electric vehicles.
- Figure 13 presents a comparison of recent forecasts by Roskill (as presented in a Livent presentation) and SQM (as presented in a Millenial Lithium presentation) - historic data and non-EV forecasts are similar, however the difference in total future demand is strongly driven by assumptions as to EV demand.

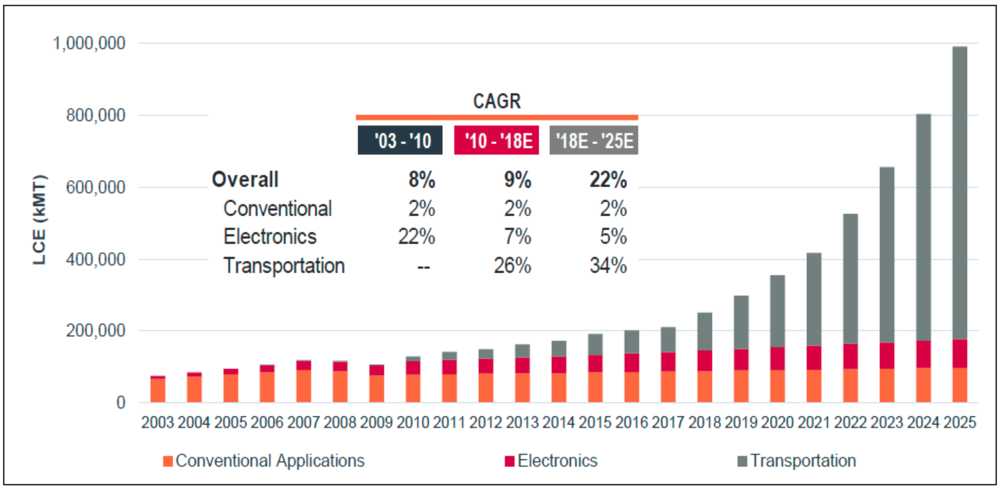
Figure 13: Forecast LCE demand comparison



Source: Adapted from Roskill (Livent presentation) and SQM (Millenial presentation)

- The Roskill forecasts uses an EV CAGR of ~34% to 2025, whereas the SQM forecast has a CAGR of 24% out to the same date - these result in significant differences in the forecast demand, with that for Roskill close to 1,000 ktpa LCE and SQM ~700 ktpa LCE.
- The demand forecasts for non-EV applications are however reasonably similar, increasing to around 200,000 tpa LCE by 2025.
- Figure 14 presents the detailed Roskill forecasts as used in Figure 13 - this highlights a forecast overall 22% CAGR from 2018 to 2015, resulting in demand of ~1,000 kt LCE by 2025, largely driven by electric vehicles (31% CAGR); this also shows the slowing in growth rate in consumer electronics as this market matures.
- 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 few years we have seen AGL Energy launching a home storage product in Australia in line with Tesla's "Powerwall" announcements. The major battery producers are Japan, China and South Korea, with Tesla also now joining the fray.

Figure 14: Roskill LCE demand forecast



Source: Roskill, in Livent presentation

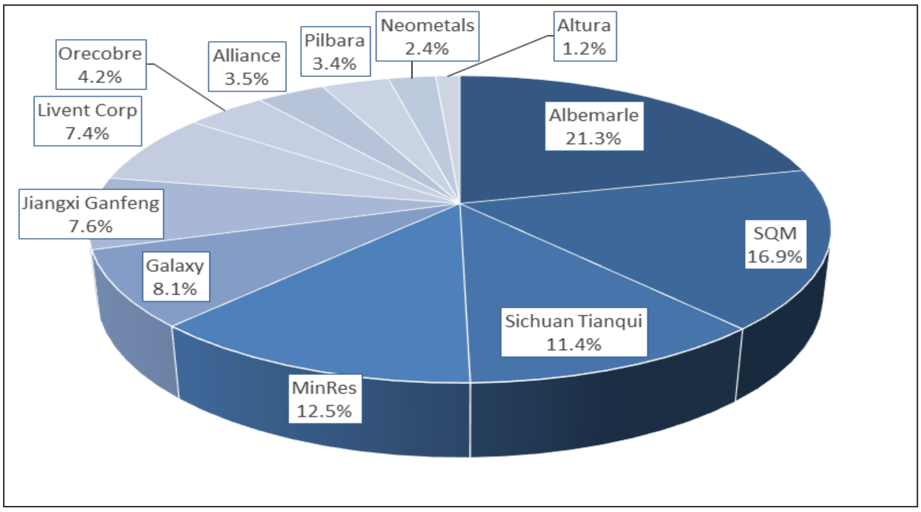
- It needs to be noted that the EV market is still relatively immature - it will take some time for clear trends to develop, which may also lead to some difficulties in getting projects financed, as well as some delaying of projects, including conversion facilities
- One example of is Toyoto Tsusho's (Orocobre's partner at Olaroz) decision to delay any decision to increase supply for at least two years, so as a clear direction in the EV market may be seen.

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), sulphate content and evaporation and rainfall rates – high evaporation rates results in lower costs as smaller ponds and shorter residence times are required.
- Brine deposits are further detailed in the section below.
- Spodumene (which is a lithium pyroxene – $LiAl(SiO_3)_2$) 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 spodumene, but also commonly containing quartz and feldspar.
- Two spodumene concentrate qualities are often produced from the same deposit – a premium technical grade ("TG") concentrate and a chemical grade ("CG") concentrate, dependent upon customers' requirements. A common by-product is tantalite and other tantalum minerals. The concentrate is then further treated to produce ß-spodumene for ceramics, and lithium carbonate and lithium hydroxide for other applications.
- TG concentrates, which are largely used in glass and ceramics applications, particularly in low thermal shock ceramics, require low iron contents (maximum of 0.2% Fe_2O_3, but significantly lower is preferred), and with LiO_2 grades of at least 6.5%. Specifications for CG concentrate, as used in battery applications, are less strict, with concomitant lower prices.
- Figures 15 and 16 show a breakdown of supply from non-Chinese producers and operations - what this shows is that production outside of China is reasonably concentrated, with only a few companies providing the bulk of supply in the business - note that is some cases accurate production figures are hard to source.

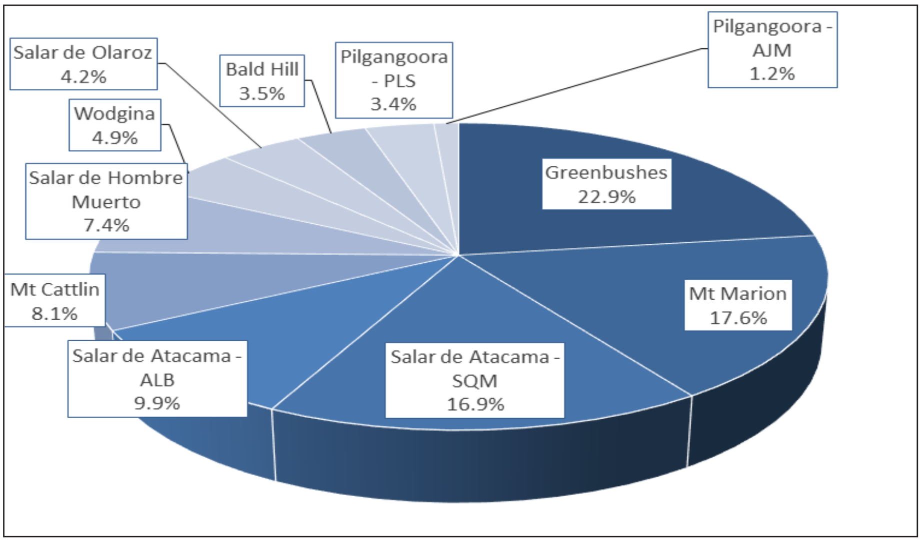
- However what needs to be noted is that a number of the hard rock operations are in the start up phase with first production in 2018, and hence production from these is expected to increase - this includes the Pilgangoora operations of both Pilbara and Altura, Alliance's Bald Hill Operation and Mineral Resources'/Albemarle's planned Wodgina operations.
- These graphs are based on LCE - we have converted reported sales from other sources (DSO, spodumene concentrates and lithium hydroxide) to LCE.

Figure 15: Lithium production by company 2018



Source: Company reports

Figure 16: Lithium production by deposit 2018



Source: Company reports

- Livent, Albemarle and SQM have operated brine operations in the Altiplano of Chile and Argentina for many years – a recent entrant there is Orocobre, which is currently ramping up production at its Olaroz Project in Argentina.
- 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%) and Sichuan Tianqui Lithium (51%) - Until recently Greenbushes provided some 78% of global spodumene concentrates, with the balance made up largely by Chinese producers, however this is changing with the recent Australian start-ups and as of the end of 2018 Greenbushes provided some 50% of non-Chinese hard rock supply.
- Albemarle also produces from a number of brine operations in the US and Chile, which, when added to its holding in Talison, makes it the world's largest single mine supplier of lithium with ~21% of market share.
- Greenbushes produces some 65,000 tpa of LCE, however is looking at expansions, including an LiOH plant at Kwinana, to increase production to 180,000 tpa of LCE by the end of 2022 - this LiOH plant is just one of a number of conversion plants planned or under construction in Western Australia.

- Recent developments in the hard rock space have seen the restart of Galaxy's Mt. Cattlin operation and the ramp up of the Mt. Marion operation, owned by 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") - Neometals is selling its stake in the operation, with closure expected very soon.
- Both operations are in Western Australia, with Mt. Cattlin planning to produce up to 137,000 tpa and Mt. Marion up to 400,000 tpa of spodumene concentrate - this is equivalent to ~ 20,000 tpa and 65,000 tpa LCE respectively.
- In the brine space near term production is expected to increase from Orocobre's Olaroz operation in Argentina with this ramping up from the current ~13,000 tpa LCE to 42,500 tpa LCE by 2025.
- The status and quantum of planned expansion projects in the Salar de Atacama in Chile is more opaque, with the Chilean Government recently rejecting part of Albemarle's plans to boost output on environmental grounds and also flagging restrictions on water extraction from the southern areas of the salar.
- Albemarle had been developing a production process that would use significantly less water, however this reportedly has been put on hold, with some conjecture that the process was not working as expected, and also a reason for the Chilean Government's rejection of the expansion plans is that it wanted more details on the process.
- Our analysis indicates that planned (or flagged) start-ups and expansions have the potential to increase supply to ~950 ktpa LCE by 2022, however this will be dependent upon demand - the forecasts discussed earlier see demand increasing only to around 500 ktpa by this date, and thus we would not expect all of these to come to fruition.
- Some planned hard rock expansions may also be stymied by a lack of conversion facilities.

Lithium Pricing

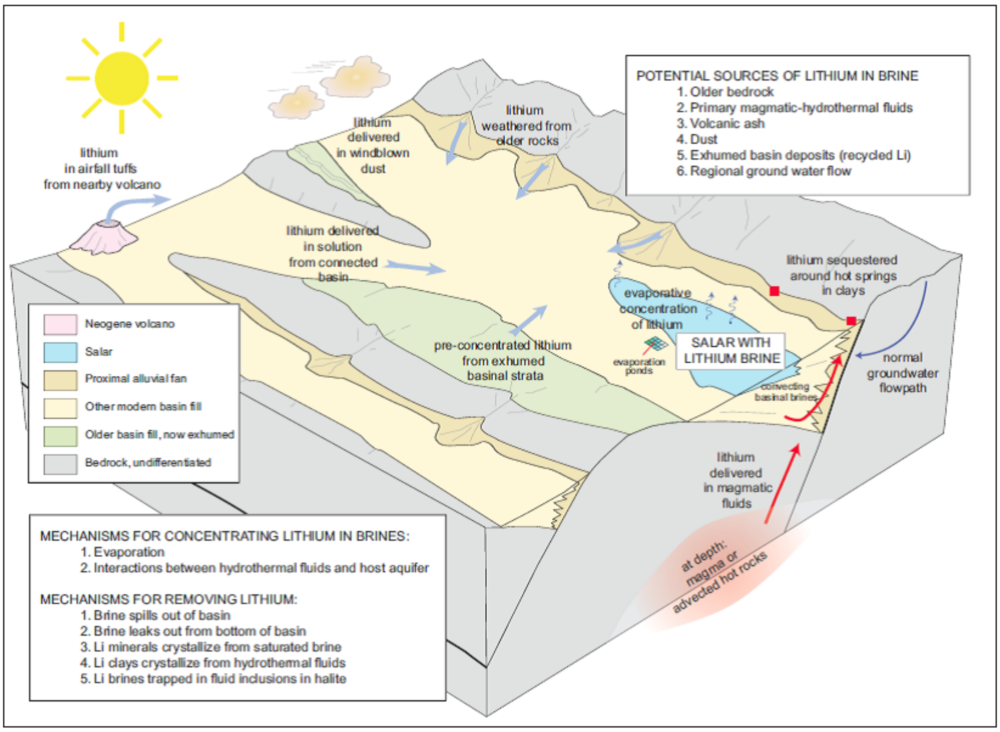
- Like most specialty metals, pricing is opaque and set by direct negotiation between producer and customer - pricing is also dependent upon the type and relative quality of the product.
- Another difficulty involves the plethora of lithium products, however prices trend to track each other.
- Prices have increased significantly since late 2015, with Chinese spot battery grade lithium carbonate prices reaching over US$20,000/tonne CFR in 2018, following on from prices staying around US$5,000 - US$6,000/tonne in the preceding few years.
- These price rises were also 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 to US$1,000/tonne), reached ~US$15,000/tonne in the September quarter, 2018 however have now retreated to around US$10,000/tonne as presented in Company financial reports.
- Orocobre has seen a fall in price from US$10,587/tonne LCE in the December 2018 quarter to US$9,457/tonne in the March 2019 quarter.
- Recently announced spodumene concentrate contract prices include US$905/tonne for 6.0% Li_2O product from Galaxy's Mt. Cattlin operation - this is equivalent to US$6,000/tonne LCE.
- Spodumene concentrate prices however vary according to grade and levels of contaminants; these largely track that of lithium carbonate, albeit at a significant discount on an LCE basis due to the requirement for further processing, with this generally having a cost of between US$2,500 and US$3,500/tonne LCE.
- Recent falls in prices may have been largely due to some oversupply, with a number of new operations coming on stream, and with a slower than expected increase in conversion capacity (for the spodumene producers).
- Falls have been more exaggerated in China, with falls in the rest of the world pricing being subdued; this is a similar case to the rises in prices, with this being exaggerated for Chinese pricing.
- We see prices of lithium carbonate continuing to trade at around US$10,000 tonne and higher over the longer term as the industry settles down and demand and supply reach a balance.

BACKGROUND – LITHIUM BRINE DEPOSITS

General Characteristics and Geology

- Salars can be classified according to "mature" and "immature" end members.
- "Immature clastic" salars are characterised by significant thicknesses of clastic sediments with gypsum dominated evaporite interbeds, with porosity and permeability characterised by primary depositional features, which can be highly variable given the nature of the sediments.
- The clastic controlled characteristics can extend to several hundred metres depth – the recent drilling by Lake at Kachi has demonstrated this with drilling intersecting porous, lithium brine rich sediments down to at least 400 m depth.
- "Mature halite" salars are characterised by high permeability at shallow levels, however this decreases rapidly with increase in depth due to salt recrystallising and sealing fractures – in these salars exploitable resources are limited to shallow depths, generally down to around 50m.
- The immature salars are commonly found at higher and wetter elevations, with the mature type at lower and more arid elevations; however some salars exhibit both styles, with Salar de Hombre Muerto being a prime example - the western basin is a mature system, with the eastern (including Candelas) being an immature system.
- A number of factors are essential in the formation of lithium rich, potentially exploitable saline brines:
  - Arid climate – low rainfall,
  - High evaporation rates,
  - Closed basin, with ongoing tectonic subsidence,
  - Suitable lithium source rocks: and,
  - Thick aquifers with permissive porosity and permeability to allow efficient extraction of the brines.
- Ongoing hydrothermal activity is also considered important for a number of reasons, including enhancing leaching of lithium from source rocks amongst others.

Figure 17: Diagrammatic representation of a lithium-bearing salar



Source: Lithium Brines: A Global Perspective (Munk et al)

- A magnesium to lithium ratio of under 9:1 or 10:1 is also considered essential, given that magnesium is a deleterious element, and incurs additional operating costs in removal.
- High potassium grades are considered positive, as potassium salts can be produced as a by-product; other potential by-products include boron.

- High lithium grades and high evaporation rates generally help operating and capital costs, in that relatively smaller evaporation ponds and shorter residence times are required to concentrate the brines to the specifications required by the downstream processing plants.
- Table 8 presents characteristics of a number of different salars - note that the brine chemistry figures presented are representative only - there is variation in these figures across the different salars, and also due to the reporting of different cutoff grades
- Other factors that affect the viability of a lithium brine operation include access to infrastructure and the operating jurisdiction – again Salar de Hombre Muerto is located favourably with respect to these parameters.

Table 8: Characteristics of South American salars

Characteristics of South American salars						
	Salar de Hombre Muerto	**Salar de Maricunga**	**Salar de Atacama**	**Salar de Centenario**	**Salar de Olaroz**	**Salar de Cauchari**
Country	Argentina	Chile	Chile	Argentina	Argentina	Argentina
Owner	Lake/Galaxy/ Livent/POSCO	LPI/MSB/Li3	SQM/ALB	LPI/Eramet	Orocobre/ Lithium Americas	Orocobre/ Lithium Americas
Lithium (g/l)	0.74	1.25	1.84	0.56	0.69	0.59
Potassium (g/l)	7.40	8.97	22.63	5.11	5.73	4.85
Magnesium (g/l)	1.02	8.28	11.74	3.26	1.86	1.42
Mg/Li	1.40	6.63	6.40	5.87	2.40	2.43
K/Li	9.95	7.18	12.33	9.20	8.30	8.30
K/Mg	7.26	1.08	1.93	1.57	3.46	3.58
Altitude (m)	4000	3800	2300	3900	3900	3900
Rainfall (mm/yr)	100	125	15	100	100	100
Evaporation (mm/yr)	2710	2400	3200	2600	2600	2600

Source: Various company reports and presentations

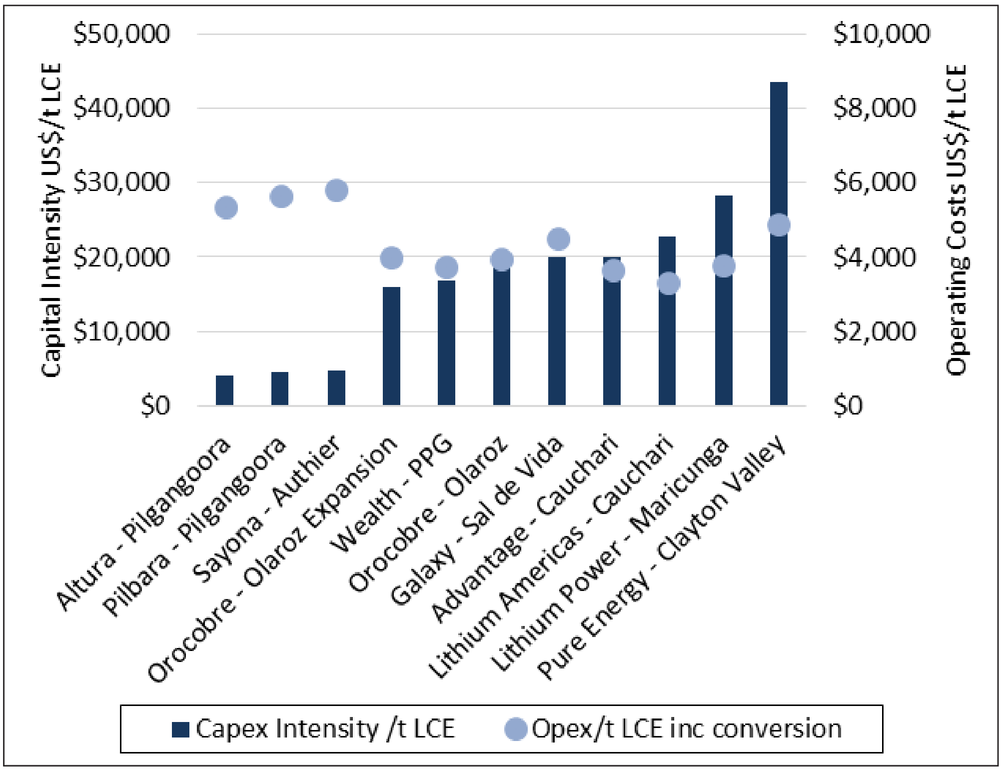
Resource and Reserve Estimation

- Given the fluid nature of the mineralisation Resource estimation techniques are different for brines than for hard rock deposits.
- They are a function of the volume and the "effective" porosity of the aquifer, and the grade of the brines, with the latter usually presented in mg/l.
- Effective porosity ("P_e") is the interconnected porosity of the host unit, and in most cases, except in the case of well sorted sands, will be less than total porosity ("P_t") - there will usually be an element of porosity due to pore spaces that are not interconnected with others.
- Another factor that needs to be taken into account is the specific yield, or drainable porosity ("S_y"); there is also retained porosity ("S_r"), which is that element of the effective porosity that cannot be removed by gravity draining or pumping.
- The relative proportions of S_y and S_r will commonly depend upon the grainsize of the sediments - in the case of fine grained sediments $S_r >> S_y$, and in the case of coarser sediments $S_y >> S_r$ - this is mainly due to adsorption on the surface of the grains and capillary forces - S_y is important when defining Reserves.
- The relationships can be described by the equation $P_e = S_y + S_r$.
- As an example, drainable porosities for Galaxy's Sal de Vida project, on which the MRE was based on, ranged from 2% for clays, through 10% for sands and silty sands and to 15% for travertine, tuff and dacitic gravel.
- There will be differences in porosity and permeability depending on the salar types - immature salars may have higher porosities but lower permeabilities when compared to the mature salars, with, at shallow levels, the permeability in halite zones being controlled by highly permeable fractures.
- Permeabilities in halite zones will also be isotropic, whereas that in clastic sediments (as found in immature salars) will tend to be anisotropic.

Costs, Mining, and Treatment

- Mining and treatment of lithium brine deposits is relatively simple, and results in generally low operating costs when compared to hard rock lithium operations (Figure 18).
- This presents figures from recent development studies that we have analysed; the average operating cost for South American brines is US$3,900/tonne LCE, and that for hard rock operations (including conversion costs) is US$5,600/tonne LCE - Orecobre reported operating costs of US$4,193/tonne in the March 2019 quarter (however not including the 4 pesos per dollar short term export tax as announced by the President, Mr Macri, in September 2018).
- Given the results to date, the Lilac Solutions ion exchange process compares well with the other brine operations, with the published operating cost figure of US$2,600/tonne (+- 30%)
- Conversion costs associated with converting spodumene concentrates to downstream products are in the order of US$2,500 to US$3,500 per tonne, and hence affect the LCE equivalent price of the concentrates as mentioned earlier.
- What this does show are the high margins for a brine business producing lithium carbonate and other downstream products – hard rock operations commonly produce and sell only concentrate, which can be discounted by up to 60% on an LCE basis compared to the downstream products to allow for the processing costs.
- Capital costs however are relatively high for brine operations, and there can be a longer ramp up to production than in a hard rock mine - our analysis of the results of development studies indicates expected capital cost intensities of US$21,000/annual LCE tonne for brine projects and US$4,400/annual LCE tonne for hard rock operations.

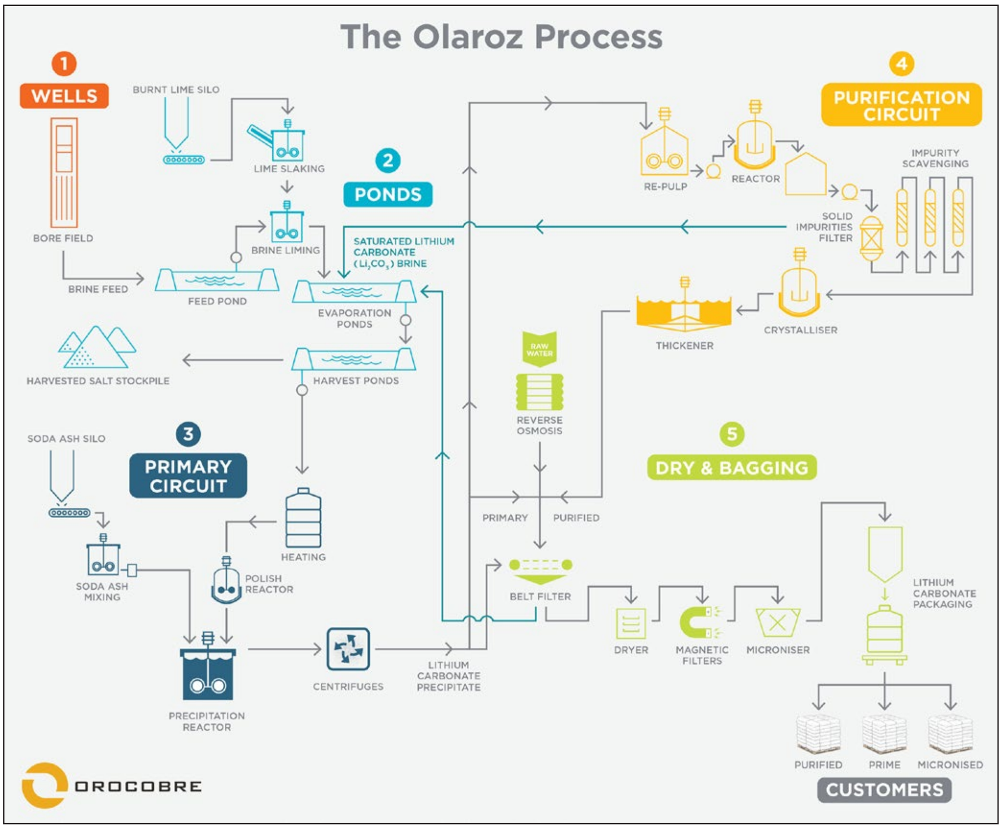
Figure 18: Indicative lithium cost curve



Source: LPI

- Treatment has traditionally involved the harvesting of brines from wells or trenches, with the lithium content in the brine upgraded through evaporation in a series of evaporation ponds - the requirement for the evaporation ponds, which can cover many square kilometres is part of the reason for the relatively high capital cost for operations (Figure 19).

Figure 19: Typical evaporative brine treatment



Source: Orocobre website

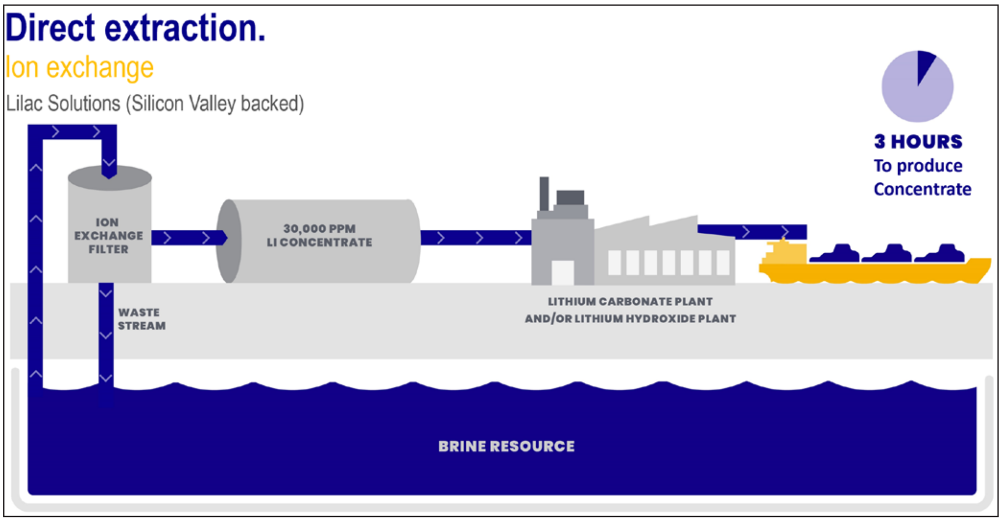
- As mentioned earlier recoverable resources are commonly significantly lower than in-situ resources, with brine recovery factors commonly in the order of 20-70%.
- The evaporation process, which can take up to 12-18 months to complete (exclusive of any issues encountered during ramp-up) and can include up to 10 stages, results in the progressive precipitation of various salts from the brines.
- The first salt to precipitate is usually halite (NaCl), commonly followed by sylvite (KCl) and then more magnesium rich species.
- The aim of the evaporation process is to increase the lithium grade to at least ~1-2% or above, at which point the brine is treated to produce the end products including lithium carbonate and lithium hydroxide.
- Treatment may include the addition of reagents, including soda ash to remove magnesium – depending on the magnesium to lithium ratio this can significantly increase operating costs.

Ion Exchange Treatment

- Companies are now starting to look at ion exchange processing of brines to extract lithium - one such process is that developed by Lilac Solutions, as mentioned earlier.
- One reason that this has not been looked at historically is that most current plants were constructed over 20 years ago, with the primary product being potassium, and with lithium as a by-product, where evaporation was a suitable treatment process.
- Difficulties in the original start-up of Orocobre's Olaroz operation, the only new plant built in the past 15 to 20 years, has highlighted the requirement for new technology to enable more efficient processing to extract the lithium.
- Ion exchange is a well developed and commonly used separation, purification and decontamination process in which liquids are passed over resins or other media (commonly small, highly porous polymer beads with a large surface area) which trap some ions whilst releasing others, hence the term "ion exchange".
- In the case of a lithium brine, the brine would be passed over beads formulated to trap the lithium ions; this would then be washed with hydrochloric acid (in the case of Lilac's process), with the lithium ions exchanging for the hydrogen ions in the acid, and thus releasing a lithium chloride solution - this is shown graphically in Figure 20.
- This LiCl solution is low in deleterious elements.

- Following stages are largely water purification processes to remove the lithium from the LiCl solution, and can include reverse osmosis, solvent extraction or further ion exchange amongst others; this is then followed by conversion to the required end products.
- It needs to be remembered that lithium is only a minor component of the brines, so it makes sense to remove the lithium from the other components rather than removing the other components.
- One of the challenges however with extracting lithium from NaCl rich saline brines by ion exchange is the similar chemical behaviour of Na^+ and Li^+ ions - this has required the development of a very selective exchange media, which is the key to the Lilac Solutions process.

Figure 20: Schematic diagram of the Lilac ion exchange process



Source: Lilac website

- Potential benefits of ion exchange processing include:
  - Capital costs potentially lower than those for other brine operations,
  - Readily scalable (modular equipment),
  - Operating costs at the lower end of those for traditional evaporation methods,
  - Short treatment time - around 2 hours instead of 1 to 2 years at steady state production,
  - High recoveries of up to 90%, when compared to evaporation processing with recoveries averaging around 50%,
  - The brines, with chemistry only slightly altered, can be pumped back down into the aquifer,
  - Consistent lithium concentrate product quality, which is valuable in downstream processing into different chemicals,
  - Environmentally "friendly", without the need for large areas of evaporation ponds and the ability to return brines to the aquifer - this should also help in permitting projects.
- The main risks are to do with the beads, including scaling, and physical and chemical degradation - beads are expensive to replace.
- The main purpose of a pilot plant is to ascertain the behaviour of the beads with the particular brines, and hence to give estimates on replacement and descaling requirements.
- However, as has been mentioned previously, Lilac Solutions successfully ran a six month bench scale test on Kachi brine, with there being no requirement to change the beads.

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