Mt Cattlin by night www.galaxylithium.com

The Race is on - Australia's advanced hard rock Lithium Deposits

With the growing global demand for lithium, driven by advancing technology, Australia much like the rest of the world has seen a resurgence in the interest of pegmatite hosted hard rock lithium deposits over the last 24 months. Currently there are no fewer than 40 lithium prospects being explored in Australia with the vast majority currently at the exploration stage either undergoing field sampling or drilling towards defined resources.

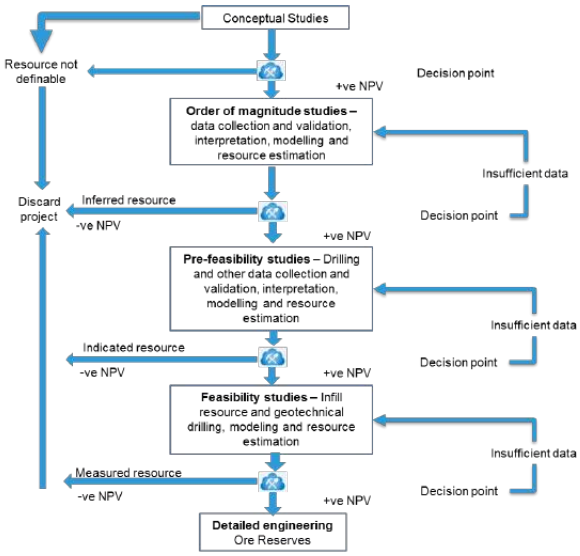
However a select few have stolen a march on the competition. There are currently only four operating assets including the recently restarted Mt Marion and Mt Cattlin, the ever present Greenbushes and just entering the scene a direct shipping (DSO) operation at Wodgina. A further four others are fighting to get into production in 2018, three potentially as early as the first quarter. Table 1 below shows these projects and we would not be surprised to see many more economic studies released during 2018 as lithium continues to be the hot topic on the ASX.

Table 1: List of Peer Projects used in the Analysis

Project	*Company*	*Stage*	*Mining Method*	*Production Start*
Pilgangoora Li-Ta	Pilbara Minerals	Definitive Feasibility	Open Pit	Q1 2018
Pilgangoora Li	Altura Minerals	Definitive Feasibility	Open Pit	Q1 2018
Wodgina	MinRes	DSO Trial Mining	Open Pit	Current
Mt Marion	MinRes/NeoMetals	Operations	Open Pit	Current
Mt Cattlin	Galaxy Resources	Operations	Open Pit	Current
Greenbushes	Talison	Operations	Open Pit	Current
Bald Hill	Tawana Resources	Pre-Feasibility	Open Pit	Q1 2018
Earl Grey	Kidman Resources	Scoping Study	Open Pit	Q3 2018

Not surprisingly in line with this surge The CloudMiner (TCM) software has increasingly been used to model and benchmark more and more tech metal deposits such as lithium but also including graphite, cobalt and nickel on behalf of interested investors. This article is designed to be a quick snapshot of one such research topic we covered for Asian investors which was recently carried out on the Australian hard rock lithium deposits.

The report was based on publicly available information that was available at this time and is in no way meant to be an exhaustive list. While due care has been made to use current data if we have missed anything or you feel another project should be included please feel free to reach out and we will gladly add it to our portfolio analysis info@thecloudminer.com or www.thecloudminer.com.



As part of any project life cycle there are many decision points where a project's technical and economic understanding is assessed prior to advancing. The typical path is laid out in the adjacent figure with many projects proving uneconomic in the conditions of that time, be that the prevailing commodity price or perhaps the current technology available to extract the minerals economically. The continuous rise in the price of lithium has enabled such projects to be re-examined, technical reports to be updated and production to recommence. While new discoveries are being made and proven economic.

Resources and Reserves

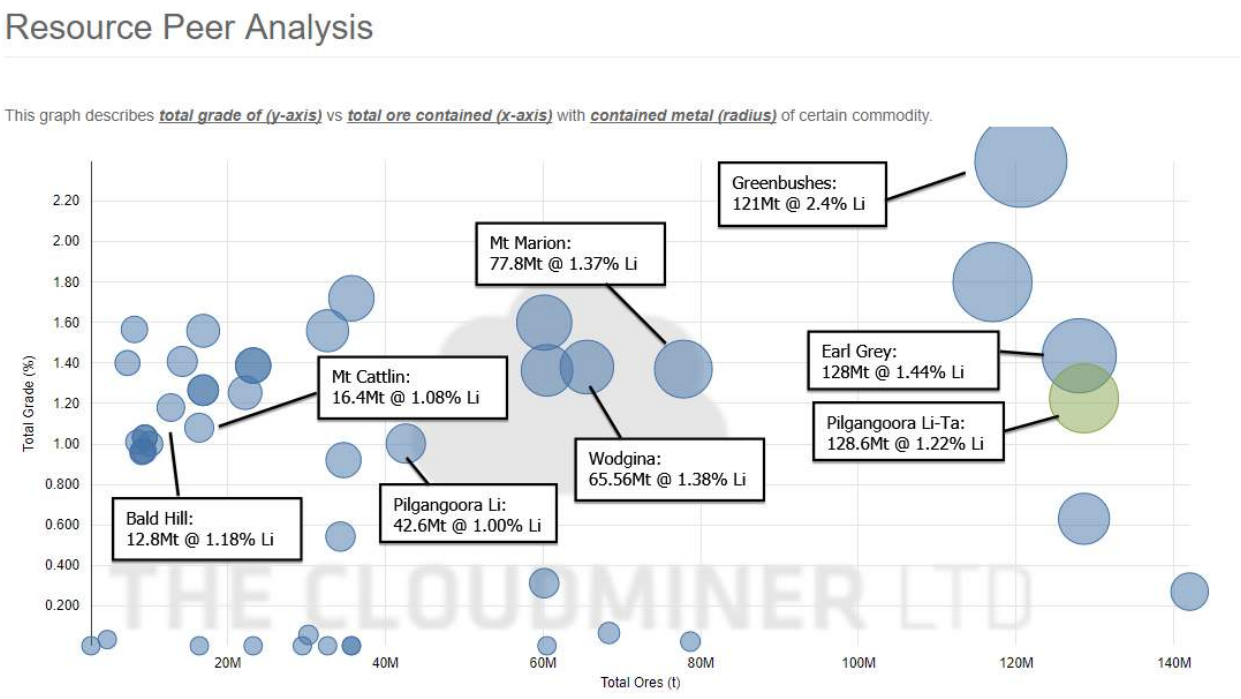
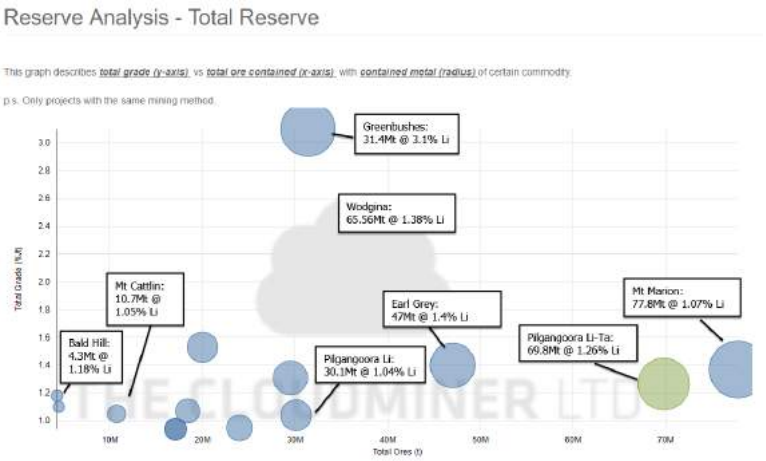
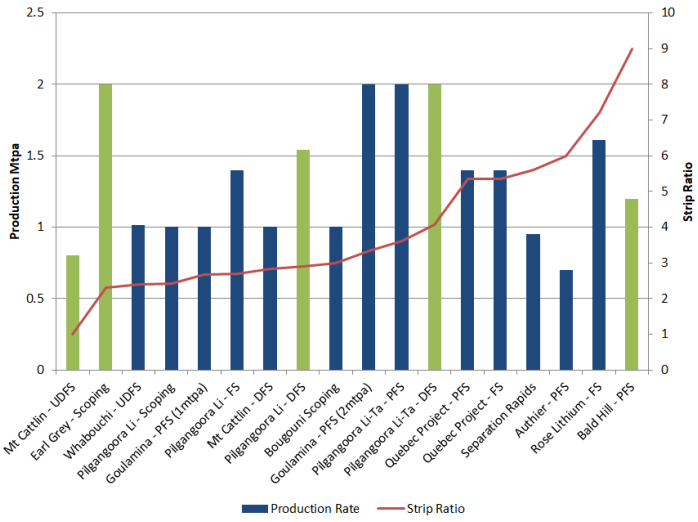


Figure 2 above and Figure 3 adjacent illustrate the scale of the projects currently present in Australia. Figure 2 demonstrates the Resource peer while Figure 3 focus' on their corresponding reserves. In the background are the other prominent global pegmatite deposits which remain unlabeled. Australia boasts three of the largest hard rock deposits namely the Pilgangoora Li-Ta Deposit, Earl Grey Li Project and Greenbushes which has been in operations since 1983 for lithium but was mining tin from as early as 1888 - one of the longest operating mines in Western Australia.



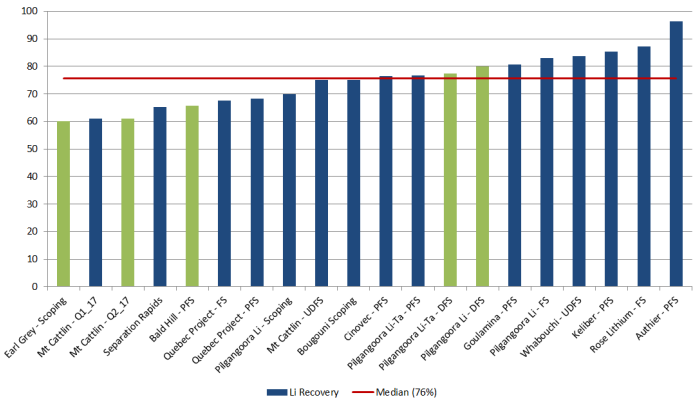
Mine Planning

Each of the focal projects are currently operating or planning to operate with an open pit mining method. Recent restarts at Wodgina and Mt Cattlin held an advantage with existing infrastructure remaining in tact post being placed on care of maintenance. The Wodgina project, currently operated by MinRes, is a previously producing Tantalum mine but saw the first direct shipping ore (DSO) shipped last quarter having been extracted directly from the existing tailings and running 1% Li. MinRes will continue to produce DSO shipped ore direct from their tailings resource which equates to ~twenty Mt, while they further explore the potential held in their in-situ pegmatites.



The Bald Hill deposit has the highest strip ratio with the waste to ore being 9:1 and proposes to mine 1.2 Mtpa. The next nearest is the Pilgangoora Li-Ta deposit which proposes to produce 2 Mtpa of ore with a life of mine waste to ore ratio of 4.07. This sits just in the upper half of the peers. The Pilgangoora Li Deposit comes next and has a strip ratio of 2.9 and plans for an annual production rate of 1.54 Mtpa but Mt Cattlin's 0.8 ratio for waste to ore quoted in the updated feasibility study has the best performing ratio of all the peers while planning a production rate of 1 Mtpa followed closely by the Earl Grey deposit at 2.3 tonnes of waste per ore tonne and a production rate of 2 Mtpa.

Metallurgy



One of the most important aspects to focus on in the pegmatites is the mica content. It is the key contaminant and is very difficult to separate. Mica by its very nature is a mono-clinic sheet mineral which rapidly expands as the rock is broken apart. It is light and therefore easily transported as the mica sheets flake, causing the mineral to fill open cavities within the processing circuit machinery. This in turn causes a reduction in both the processing efficiency and recovery. Since recommencing production Mt Cattlin has posted recoveries of around 61% for both Q1 and Q2 2017, some what below the anticipated recoveries of 75% reported in the Updated Feasibility Study. Earl Grey remains conservative and predicts recovery around 60% while Bald Hill is predicting similar recoveries of 65.8%, Pilgangoora Li-Ta predicts 77.5% and recoveries of 80% are predicted at Altura's Pilgangoora deposit. The Median across all hard rock studies included in the analysis was ~76% with the North American Deposit predicting the most optimistic recoveries.

Aside from Wodgina's DSO ore each of the mines is planning to produce a spodumene concentrate for sale with the typical concentrate grade being 6% Li2O. Mt Cattlin this year has so far been able to produce concentrates with a 5.38% and then in Q2 a 5.77% Li2O grade. Again a reflection of the difficulty presented in the metallurgy.

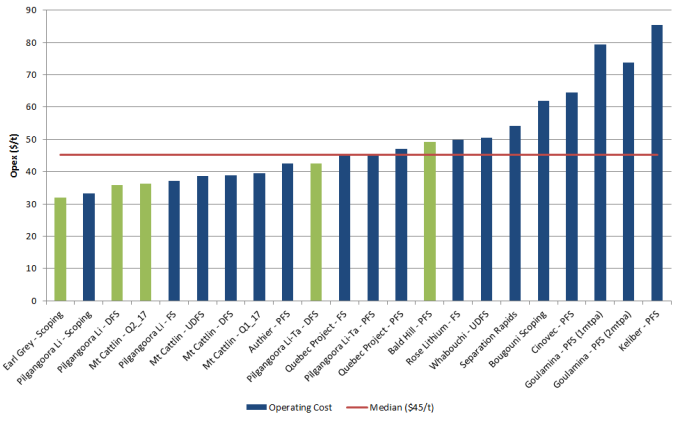
For reference and by request the amount of concentrate tonnes produced is calculated in the following way:

$$Spodumene\ Concentrate\ tonnes = \frac{(Ore\ processed\ \times\ feed\ grade\ \times\ recovery)}{Concentrate\ Grade}$$

For example the Pilgangoora Li-Ta deposit is planning to feed the mill up to 2 Mtpa at an average feed grade of 1.26%. The recoveries are expected to be 77.5%, as mentioned above and they are planning to sell a spodumene concentrate with a grade of 6% Li2O. The reported concentrates to be sold per annum are 314,000 tonnes, if in a perfect scenario a steady state is achieved the annual concentrate tonnes would be 325,500 tonnes per annum.

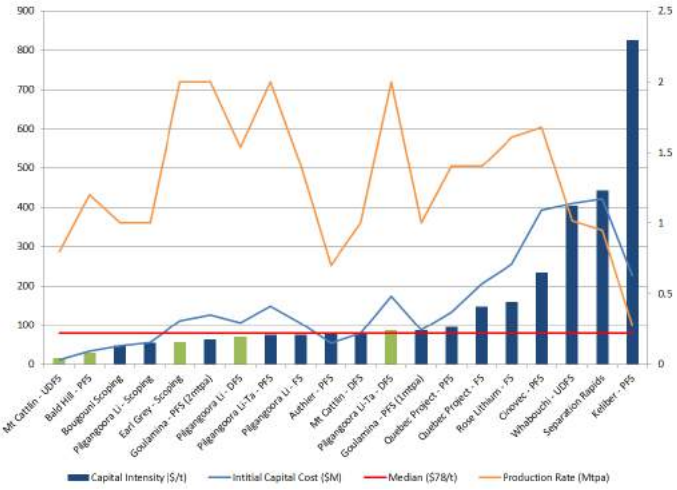
$$325{,}500\ tpa\ = \frac{2{,}000{,}000 \times 1.26\%\ \times 77.5\%}{6\%}$$

Operating and Capital Costs



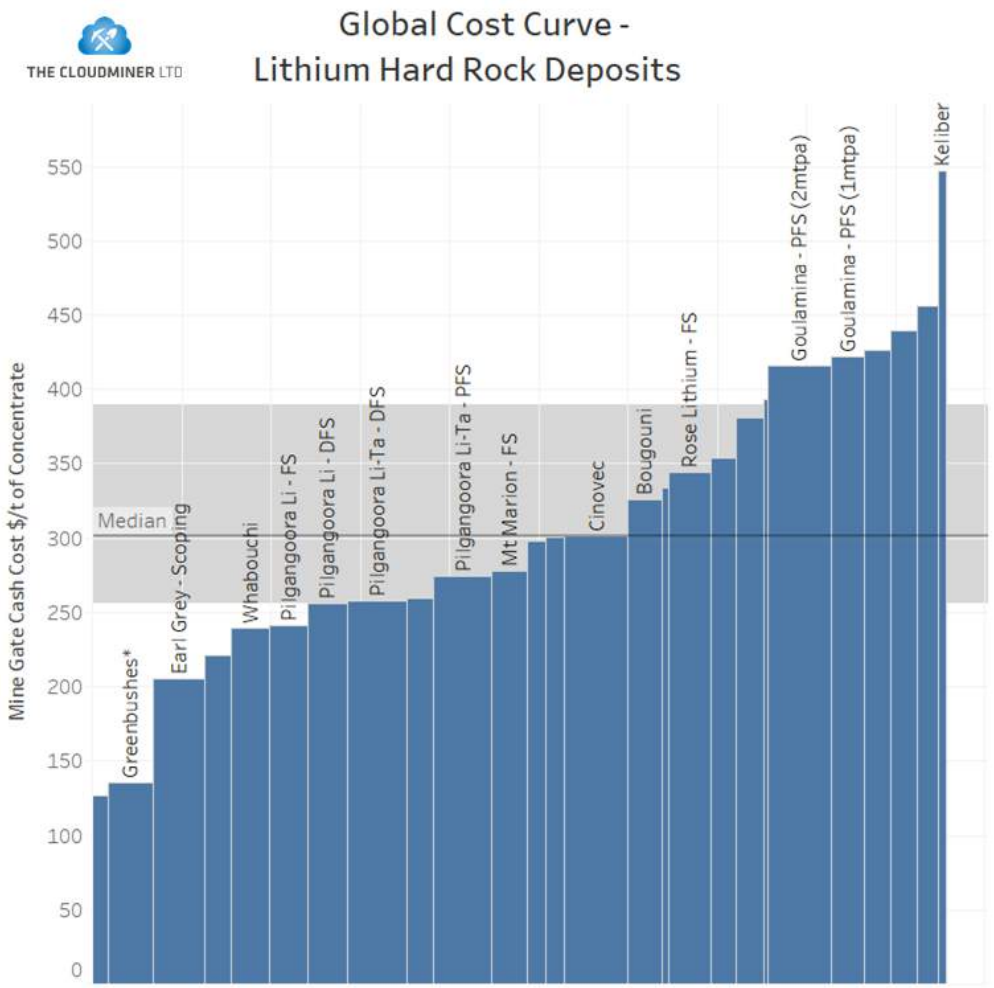
Typically the Australian Deposits rank more favorably than their global counterparts with all but Bald Hill coming in under the median operating cost of US$45/t of ore. Mt Cattlin's Q2 results showed very positive operating costs posted, coming in at US$36.33/t. Both Kidman's Earl Grey and Altura's Pilgangoora Lithium deposits post the lowest operating cost per tonne of ore milled with the Earl Grey Scoping study predicting US$32/t +-30% while the more robust DFS results at Altura predicts US$35.83/t. Current exchange rates help create a more favorable operating environments for Australian miners who then sell their products in US$.

Similarly the Australian projects rank favorably on a $/t to produce for capital intensity with only the Pilgangoora Li-Ta DFS results coming in just above the median of $79/t. Mt Cattlin not surprisingly performed the best due to the existing infrastructure and restart nature followed closely by Bald Hill, Earl Grey and then Pilgangoora Li sits just below the median on $69.5/t .



Cash Costs

In order to factor in all the uncertainties another way of looking at the costs to operate would be to look at the cost associated with producing a tonne of concentrate. This would then factor in the majority of the key issues we have previously reviewed for example the feed tonnes, grade and the anticipated recoveries as well as the concentrate grade. The Pilgangoora Li-Ta project is projected to produce on average 314,000 tonnes of spodumene grading 6% Li2O per annum at a mine production cash cost of US$258/t of concentrate. Obviously where there are issues with any one of the key drivers the concentrate tonnes decrease and in direct relation the cash costs increase. For example Mt Cattlin's Updated DFS study planned for a production of 104,000t per annum at a net production cash cost of US$298/t. However the current last two quarters realised cash costs sit at US$393/t in Q1 and US$334/t in Q2, 2017. Similarly Mt Marion predicted production of 200,000 tpa at a Cash cost of US$278/t, however the last recorded cash cost was US$456/t for 115,000 tonnes of spodumene produced.



The two Pilgangoora deposits sit below the median of the current peers which equates to US$300/t however similar to the recently producing peers there may well be a teething period as they tackle similar problems with grade, recoveries and unknown unknown's. Kidman's cash cost of US$205/t is the nearest competitor to Greenbushes and with the conservative recoveries anticipated would look promising should their operating costs at the mine hold true.

Conclusion

On face value when compared purely against their hard rock peers Australian pegmatite deposits appear to hold an advantage in terms of the cost to operate and the capital required to bring them into production. Aided somewhat by the prevailing exchange rate at the time. However the recoveries are lower especially the actual realised recoveries as reported at Mt Cattlin. The race is clearly on to bring these projects into production in 2018 and with Bald Hill and Earl grey hot on the heels of the two more advanced Pilgangoora deposits it will be interesting to see who else emerges between now and Q1 2018 as other potential operators.

About The CloudMiner Limited

The CloudMiner Limited is a cloud based financial modelling suite with in built data analytics and visualization. The platform has been engineered for sharing project analysis between industry professionals and financiers having been built and perfected over the past 5 years by industry professional's with a passion for cloud computing, big data and machine learning.

While TCM can be used to model and benchmark key attributes of any mining project in order to quickly screen and rank investment targets we also assist users to better understand what is being reported and while it is not intended to replace a thorough due diligence processes carried out by reputable qualified professional's we do present the right questions to ask during such a process.

Over the last two years here at TCM we have built circa 2000 economic models within the cloud based software. Each model is unique to the project in question and is available upon request, while the key data points are made available for bench-marking across the platform for all users as seen here in the images.

We are always happy to include new projects either as data points for bench-marking or built as fully functioning models available for downloading and sharing through the cloud either on a one to one basis or with our ever expanding user base.

With every passing day and every new project our software gets smarter, our data broader and our analytics sharper.