

# The critical race for lithium production

In the years leading up to production, many lithium juniors will confess to have regularly dreamt of the fantastic offer from one of “the big three” waiting ‘just around the corner’. Those three companies were renowned for gobbling up juniors whenever they needed to scale up production, until one swallowed another at the beginning of 2015, leaving a rather lopsided duo.

Dr Steffen Haber, President of Critical Elements Corp. (TSXV:CRE | OTCQX:CRECF) (“Critical Elements”) since January 2017, joined the company after being CEO of Rockwood Holdings when it was sold to Albermarle for the princely sum of \$6 billion. Rockwood were heavily involved in lithium projects, catalysts, bromine and surface treatments, and now Dr Haber’s experience is helping Critical Elements to more rapidly advance their expansive Rose lithium-tantalum project.

Haber has homed in on the Rose deposit primarily as it represents the safest bet for hitting production quickly and cheaply out of their total of eleven resources. A Preliminary Economic Assessment (PEA) has already been completed and is due to be published shortly, but it, amongst other studies, reveals that the particular crystal structure found at the site is so easy to process that a concentrate grading of 6.6% should result without much effort. This would be an astonishing 20% higher concentration than competing lithium mines. In addition, impurity levels are low, meaning the time to market for this project is rather short indeed.

Critical Elements expects the project to be shipping its high-quality spodumene concentrate by 2020, but it could be as early as 2019. About one-third of the total output will be sold as technical grade spodumene required by the industrial

glass and ceramics market, and the premium attached to technical grade spodumene is higher than even refined lithium carbonate.

But Haber doesn't plan to stop there; he wants to be shipping battery-grade lithium carbonate by 2023, around 600,000 tonnes of which is widely expected to be required globally in 2025. Battery-powered products are going nowhere, are only becoming more culturally entrenched, and have led to the modern gold rush that we see today, as manufacturers rush to source the component parts of our most beloved technologies.

The target for Rose is over 26,000 tonnes per annum of lithium carbonate equivalent, much higher than many competitors, but perhaps the good doctor's experience tells him to aim high. Unsurprisingly, offtake agreements are already appearing; HELM, for instance, are a German sales and distribution company with an equivalent turnover of around \$11 billion and widely recognised in the lithium industry. They will provide not only offtake, but both global sales experience and the workforce with which to shift product, indeed an efficient value-addition.

Looking at Critical Elements, one gets the impression that the rev-counter is thrashing around in the red zone; the clear goal of efficiency-over-all, aside from being rather pleasing, is almost certainly aimed at placing the company in an imminent position to benefit from the current boom before it runs out of steam. Reaching production in the next few years is imperative for any lithium-based company if they are to catch the wave that is Tesla *et al*. Secure and trusting partnerships are emerging every day, and these will be much more difficult indeed to break apart in ten years time.

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# A Key Piece in the Clayton Valley Lithium Patchwork

In the staking frenzy of recent months, little historical ground has gone unturned, and yet Sienna Resources (TSXV: SIE | OTCBB: HBNRF) has still managed to sneak under the skirts of some major players and grab hold of a key piece in the long-established Clayton Valley lithium district. While its early days to draw conclusions specifically on the Sienna territory, here I shall look at the area and its geological and production history to see if the “tealeaves” look as prospective as they seem.

## Clayton Valley

This saline lake in Nevada has become a veritable patchwork of interests as the Lithium boom has fired imaginations. In the beginning there was Albemarle (which operates North America’s only producing Lithium brine deposit here), but surprisingly they had been comfortable enough to have not secured all the available territory with the result that the door was left ajar for a handful of other players to move in and get themselves a foothold.

Clayton Valley is located in Esmeralda County, Nevada, USA approximately 180 km north of Death Valley, CA. Clayton Valley is a closed basin with an area of 1,342 km<sup>2</sup> and a playa surface of 72 km<sup>2</sup>. The basin lies in the eastern rain shadow of the Sierra Nevada and is arid with an annual average precipitation of 13 cm, average evaporation rates of 142 cm/yr and an average temperature of 13°C. The elevation of the valley floor is 1298 m, lower than any of the basins in the region.

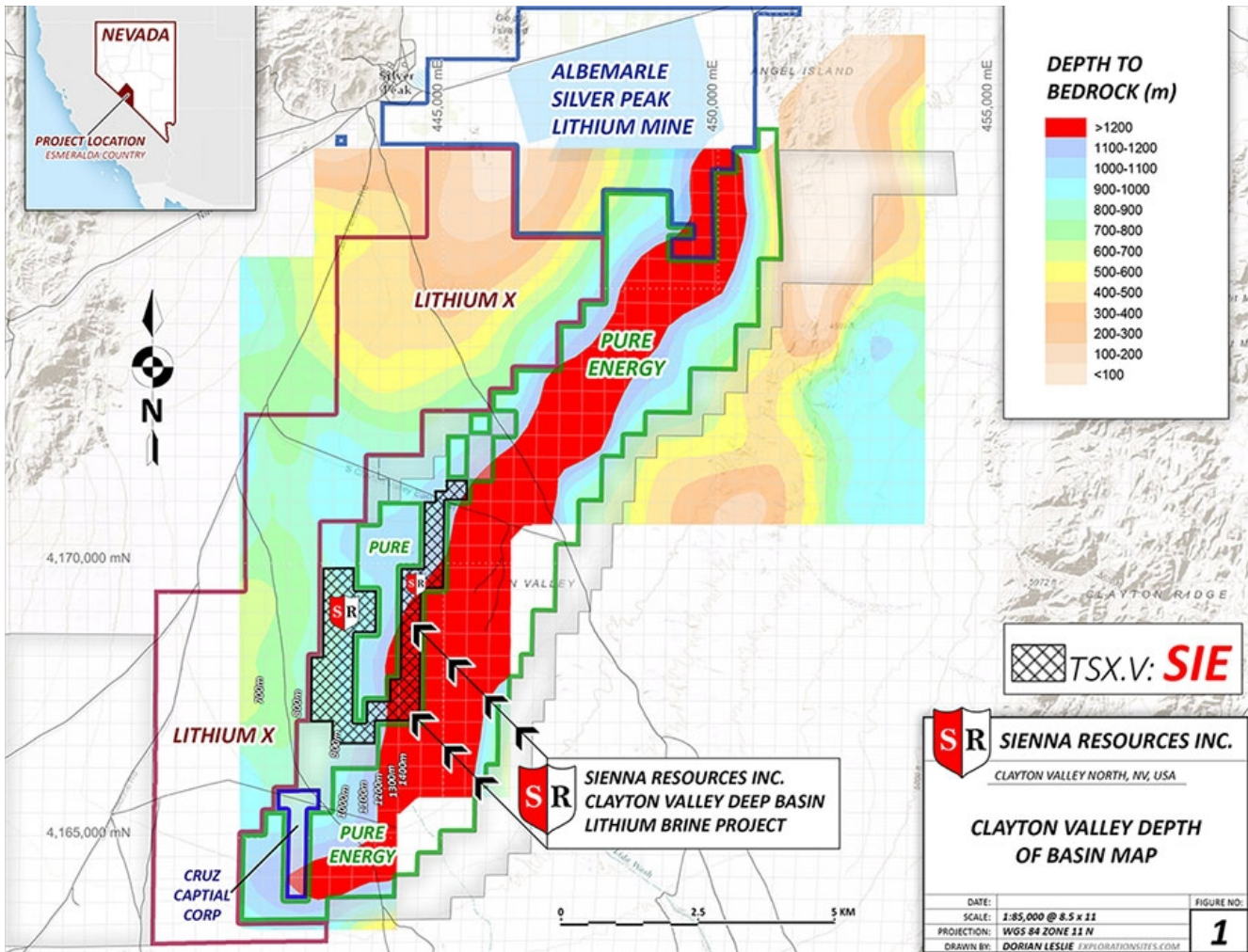
It is located in a closed-basin system with an arid climate. The Li-rich brines are currently being produced from six different aquifers in the playa. The brines have formed from a

complex process involving evaporation, mixing, and halite, and hectorite (dissolution, precipitation, ion exchange and sorption). Climate fluctuations in Clayton Valley over time (at least since ~ 1Ma) have played a role in the preservation of Li in clays (hectorite).

### **Other Pieces of the Patchwork**

As mentioned the Clayton Valley is home to the only lithium brine producing operation in North America (Albemarle's Silver Peak Mine). Lithium X is also in the scrum and so is an entity called Cruz Capital Corp. Pure Energy Minerals, which owns the Clayton Valley South project, has recently released an inferred resource of 816,000 tons of lithium carbonate equivalent on the Clayton Valley South project. According to the Pure Energy's website, "Geophysics shows that the same brine-bearing formations encountered during drilling appear to extend to much greater depths within the basin."

When we compared the zone to a patchwork quilt we are not exaggerating as the map below shows.



## Some Back History

Of all the locations in North America for Lithium prospectivity the Clayton Valley has the new buzzword “closeology” going for it. The Foote Mineral Company began extracting lithium from below the floor of Clayton Valley in 1966. The mine then ended up in the hands of the German group Chemetall, which was then rolled into Rockwood, which most recently became Albemarle after a takeover. Its evaporation pans are shown below:



The company speaks of its production numbers in cagey terms blending together its output from this site with its Chilean production. However, the site is clearly important. The fact that it has received Department of Energy grants in the past for production expansion clearly shows that the *Powers That Be* in Washington have a desire to keep a US source of Lithium production going.

### **Sienna's Deal**

In late May, Sienna announced that it had acquired what it termed the "Clayton Valley Deep Basin Lithium Brine Project". This project is located directly between and bordering Pure Energy Minerals Limited and Lithium X Energy Corp. The "Clayton Valley Deep Basin Lithium Brine Project" is located in parts of the deepest sections of the valley. Sienna's concession wraps around that of Pure Energy.

The company's attitude is that as saline brines are higher density than fresh or brackish water they therefore tend to

sink. Based on this, management is optimistic regarding this project as its concession is located in the deeper sections of this basin. Work so far on the territory is scanty but management plans to commence operations on this new project shortly.

## **Geology**

It is useful to look at the geology of the whole saline lake. A USGS report note that the basement consists of late Neoproterozoic to Ordovician carbonate and clastic rocks that were deposited along the ancient western passive margin of North America. The basin is bounded to the east by a steep normal fault system toward which basin strata thicken. Tuffaceous lacustrine facies (termed the Esmeralda Formation) deposited during the Late Miocene or Pliocene, contain up to 1300 ppm Li and average 100 ppm Li. Late Miocene or Pliocene felsic tuffs and rhyolites along the basin's eastern flank have Li concentrations reported to be as high as 228 ppm, however, the highest Li concentrations in these volcanic rocks is actually an order of magnitude less (~22 ppm). Multiple wetting and drying periods during the Pleistocene resulted in the formation of alternating lacustrine deposits, salt beds, and Li-rich brines. Hectorite in the playa sediments contains from 350-1171 ppm Li. Prior to development of the brine resource by Albemarle's predecessors, a salt flat and brine pool existed in the north part of the basin, but groundwater pumping has eliminated the surface brine pool.

## **Conclusion**

Sienna look like they have managed to buy the "last ticket to ride" on the Clayton Valley Express. As historical (and present) Lithium producing districts in North America go, this is the one to go for. Now it's a case of getting down to some work on the concession and seeing if it can match or exceed what Pure Energy have managed to achieve here.

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# Lithium in Australia – the Tortoise Takes Flight

For decades, Chile ruled the roost as the world's largest producer of lithium with a few scattered mines in other places augmenting the supply. When the **Lithium Boom** broke out at the end of the last decade, it looked like Latin America's leading position would be cemented with Argentina (and Bolivia) added to the supply mix. The *salares*, or saline lakes (which in some cases are dry anyway), looked like the easiest sources of lithium from the processing point of view and also from the capex angle.



Australia in contrast had a few projects, but they were all hard-rock lithium and the capex bills were eye-watering. With only a few projects, globally, needed to satisfy expected demand the Australian projects looked like they were destined to remain in the slow lane until global demand had absorbed the onset of the production from *salares*.

As is so often the case the best-founded assumptions in the



mining world frequently fall victim to circumstances. In the case of lithium the first off the rank was the Talison Greenbushes deposit in Australia which rapidly attracted a bidder and was taken out by a Chinese group with half later on-sold to a member of the Lithium "club". Then, less fortuitously the Galaxy Resources mine in Western Australia also kicked off. A plan that we didn't like in the first place of processing in China and mining in Australia ran into problems and Galaxy went from first mover to stuck, figuratively speaking, in quicksand. The more it struggled the more it went down. Recently we have seen a major corporate action at Neometals and progress is being made by Lithium Australia (formerly Cobre Montana).

In this piece shall look at how the Australian tortoise has managed to overhaul the Latin American hare in the race to Lithium production.

### **Talison – First Mover Advantage**

The key thing to note with this property is that when Talison Lithium picked it up it was already a mothballed lithium mine with a history of past production. As we have often said there is nothing like a past producer to give a wannabe miner a jump on the competition. And so this property did, with a Chinese group, Chengdu Tianqi making a successful bid of CAD\$848mn for Talison (with 49% later on-sold to Rockwood) in late 2012.

### **Galaxy Resources – First to Stumble**

Galaxy Resources wholly owns the Mt Cattlin spodumene project in Western Australia. At full capacity, ore could be processed at a rate of one million tpa with lithium oxide concentrate production of 137,000 tpa and 56,000 lbs per annum of contained tantalum ( $TA_2O_5$ ).

Galaxy was mining ore at Mt Cattlin which was processed on site to produce a spodumene concentrate and a tantalum by-

product which was then sent on to China. However, in July 2012, Galaxy advised that it would halt its operations at Mt Cattlin to focus on production at the Jiangsu Lithium Carbonate plant. Then in mid-2014 the company agreed to sell the Chinese plant to a Chinese company and this closed in April of this year. Now perversely it is focusing on a *salar* in Argentina.

When we first wrote on this company in 2010, it had a market cap of AUD\$200mn and now it's down to \$33mn. Meanwhile the mine Mt Cattlin mine sits there unused and its lithium and tantalum unmined.

## **Neometals**

I have followed the fortunes of Mt Marion since late last decade. The company (then known as Reed Resources) took a more studied approach to getting its project into position to tempt a potential partner than Galaxy did. The slow and steady approach paid off recently with another Chinese buyer, Jiangxi Ganfeng Lithium, coming down with a case of "resource envy" and making an attractive offer to Neometals to get into the driving seat at Mt Marion.

The Mount Marion lithium project was originally added to the Neometals portfolio in September 2009. It is one of Australia's largest high-grade lithium spodumene occurrences and is located some 40km south of Kalgoorlie in the Goldfields region of Western Australia. The resource totals 14.8 million tonnes @1.3% Li<sub>2</sub>O. The resource is open along strike and down dip.

In July, Neometals and its partner, Mineral Resources Limited (ASX: MIN) entered into a conditional Memorandum of Understanding with the aforementioned Ganfeng group with regard to Neometal's 70% held subsidiary, RIM (the other 30% being held by Mineral Resources).

Ganfeng is acquiring an initial 25% shareholding in RIM by way of share sale and equity subscription leaving Neometals with 45% of RIM, and MIN with 30% of RIM. MinRes and Ganfeng will be granted options by Neometals which allows them to increase their respective shareholdings in RIM to 43.1% by around Q4 of 2016 by way of share purchase from Neometals. If these options are fully exercised, Neometals will be left holding 13.8% of RIM.

Ganfeng will have a long-term offtake for 100% of the spodumene produced from the Mt Marion at benchmarked market prices subject to an agreed price floor. Under the agreement, from Year 4 onwards RIM reserves the right to take 51% of the total production if greater commercial benefit can be derived from such product

Ganfeng is paying out US\$25mn for 25% putting a valuation of US\$100mn on the project at that point in time. This is rather impressive considering that ground has not even been broken. The valuation metric for the exercise of the options Ganfeng holds to acquire further shares in RIM from is US\$1.5mn per 1%, putting a valuation of US\$150mn on the project.

Neometals can rightly be pleased with this outcome as it gets to have its cake and eat it too. The cash coming in now potentially enables its other (Titanium/Vanadium) project at Barrambie.

### **Lithium Australia (LIT.ax) – Novel Mineralogy**

I have written on this stock before (under its old name) but only as it pertains to its Czech Lithium/Tin deposit, which it owns through a complicated arrangement with European Metals (ASX:EMH). I had not had cause though to look at its Australian lithium efforts. These are much more early stage than the other names mentioned here but are worth mentioning because they involve the extraction of lithium from mica.

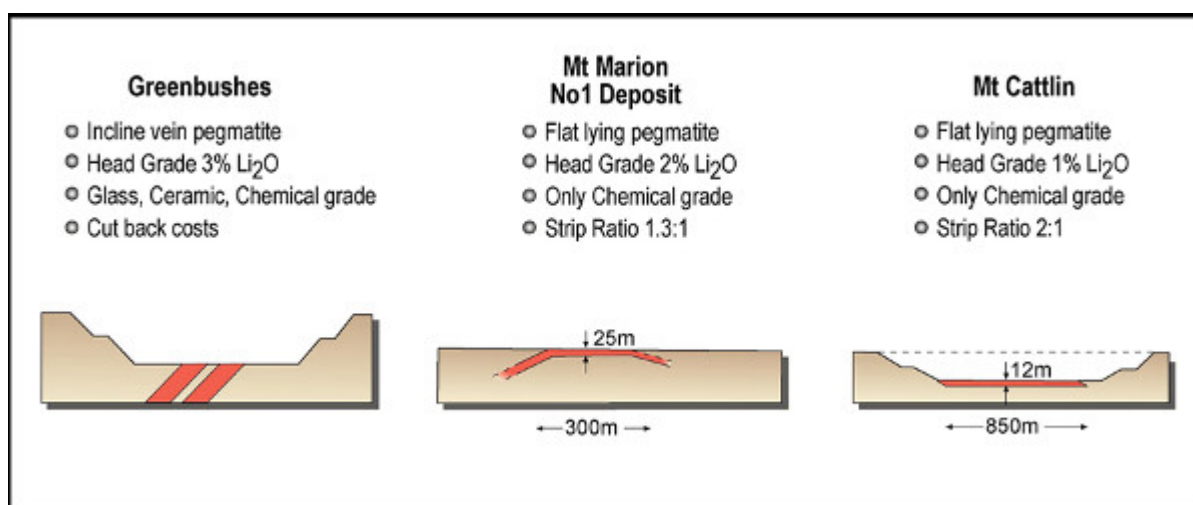
This project is part of what is known as the Coolgardie Rare

Metals Venture which is 80% held by Lithium Australia and with Focus Minerals Limited holding the residual 20%. It focuses on areas of pegmatites 15 km south of the long-established mining town of Coolgardie. The main effort thus far has been on a site known as Lepidolite Hill. Waste dumps from prior mining at Lepidolite Hill comprise around 400,000 tonnes of lepidolite-rich material. Recent proof-of-concept processing by LIT, under the aegis of its alliance with Strategic Metallurgy, has produced battery-grade Lithium carbonate from that material. It's too early as yet to add this to the tortoise-turned-hare category but history has shown not to underestimate the speed at which Australian lithium wannabes can move. Certainly having such large waste dumps at its disposal potentially speeds things up.

### Some Comparisons

The comparative cross-sections below are illuminating. Talison has the most problematical property logistically but is compensated with a good grade. Mt Marion has the advantage of a minimal strip ratio and a grade that is double Galaxy's. Strip ratios for the Mt Marion deposits range from 1:1 to 2:1.

Other differences of note are:



### Conclusion

With Western Australia leaping ahead of Latin America in the

lithium race one should not forget that there is progress in the high Andes. Most particularly the Olaroz "mine" of Orocobre (ORE.ax) and the Rincon development of the resources hedge fund Sentient are both moving forward and will make their contribution to global lithium output. While there has not been any actual "Argentine" factor (regulatory-wise) to the delays in the *salares* moving forward the fact that the country has been seen as a poor-risk mining wise has not helped lesser players with their financing efforts. Therefore if the Kirchner regime had not had such a bad press over the last decade then the lesser players might be up there with Orocobre in the ranks of ready-to-go rather than just cooling their heels waiting for the political planets to align.

If there is a theme to all this it's that Chinese companies are going for the "devil they know" in Western Australia while having shown little to no interest whatsoever in the "easier" *salares* deposits in South America.