EDISON

Lepidico

Piloting its way through

Refining commerciality

Metals & mining

Although an abundant lithium-bearing mineral, lepidolite has hitherto been overlooked as there has been no commercial process by which to process it economically (unlike spodumene). Central to Lepidico is its disruptive (patent pending) L-Max metallurgical technology that recovers lithium from micas (eg lepidolite), and therefore holds out the prospect of creating a new source of lithium supply. Lepidico has completed mini-plant trials on its L-Max process at a processing rate of 1kg/hour and a pre-feasibility study (PFS) on the development of a 3.6t/hour Phase 1 demonstration plant. It is developing a 15kg/hour pilot plant in part to mitigate scale-up risk, while simultaneously completing a full FS on a 7t/hour plant ahead of a final investment decision in mid-2019.

Year end	Total revenues (A$m)	Reported PBT* (A$m)	Cash from operations (A$m)	Net (debt)/cash (A$m)	Capex (A$m)
6/17	0.1	(5.4)	(3.6)	3.3	(0.9)
6/18	0.2	(7.2)	(3.0)	4.9	(3.1)
6/19e	0.0	(3.7)	(1.1)	21.2	(30.1)
6/20e	16.7	(4.3)	0.8	(16.8)	(38.8)

Note: *PBT and EPS are normalised, excluding amortisation of acquired intangibles and exceptional items.

Scaling up by degrees

L-Max uses readily available mainstream chemicals and a PFS completed by Minmet Services in 2017 estimated C1 cash costs of production of lithium carbonate as close to zero (net of by-products) using this method. To date, Lepidico has conducted large-scale laboratory tests that have shown the L-Max technology to operate continuously and stably over a long period of time. The PFS assumed a small-scale, commercial L-Max plant processing a lithium mica concentrate at a rate of 3.6 tonnes per hour (tph) to produce c 3,000tpa of battery-grade lithium carbonate and a suite of commercially important by-products. Having received the results of the PFS for the Phase 1 L-Max Plant, Lepidico's strategic imperative is now the development of a 15kg/hour pilot plant to reduce scale-up risk and provide a demonstration facility for prospective financiers, while simultaneously completing a full FS on a 7t/hour Phase 1 plant before proceeding to full commercial scale (c 4–5x the size).

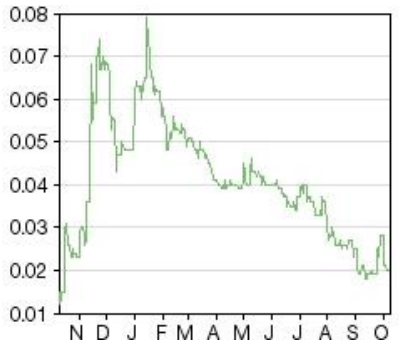
Valuation: 109% premium at 3.98c per share

Our valuation of Lepidico is substantially based on the unit operating costs of the 3.6t/hour plant (on which the PFS was conducted) and our updated estimate of capex (see Exhibit 9). On the basis of this assumption, we estimate that execution of the 7t/hour Phase 1 plant will result in free cash flow to Lepidico of A$52.0m per year once steady-state production has been achieved. Assuming US$30m (A$42.4m) of equity financing at the prevailing share price, this implies a valuation for Lepidico of A$0.0398/share (vs A$0.0202 for the 3.6t/hour plant a year ago), rising to A$0.0530 in FY22, based solely on discounting our estimate of (maximum potential) future dividends to shareholders at a rate of 10% per year (fully diluted), ie no value is ascribed to the development of the Phase 2 plant or other development options.

9 October 2018

Price	**A$0.019**
Market cap	**A$64m**
	A$1.4135/US$
Net cash (A$m) at end June 2018	4.9
Shares in issue	3,356.2m
Free float	68%
Code	LPD
Primary exchange	ASX
Secondary exchange	N/A

Share price performance



%	1m	3m	12m
Abs	(4.8)	(50.0)	89.6
Rel (local)	(4.2)	(48.9)	76.1
52-week high/low		A$0.1	A$0.0

Business description

Lepidico provides exposure to a portfolio of lithium assets via its wholly owned properties, JVs and IP in Australia, Canada and Europe. Uniquely, it has successfully produced lithium carbonate from non-traditional hard rock lithium-bearing minerals using its registered L-Max process technology.

Next events

Feasibility study	Q1 CY19
Permits & approvals	Mid-2018 to mid-2019
Final investment decision	Mid-2019

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Edison profile page

Investment summary

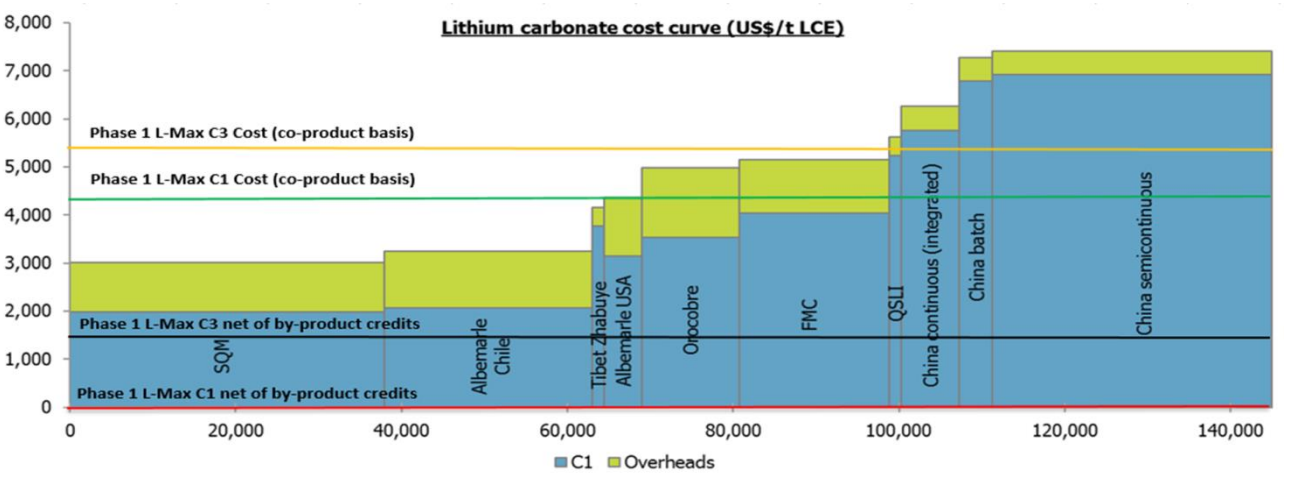
Company description: Alternative lithium

Lepidico is an ASX-listed lithium exploration and development company that provides exposure to a portfolio of lithium exploration assets through its ownership of a unique lithium mica processing technology, L-Max, as well as its wholly owned properties, joint ventures (JVs) and intellectual property (IP) licence agreements in Australia, Canada and Europe. The L-Max process is a disruptive technology that presents the opportunity to create a competitive (see Exhibit 1, below) third source of lithium supply, namely lithium bearing micas such as lepidolite and zinnwaldite. Although a number of lithium-bearing micas are known around the world, these minerals have typically been overlooked as a source of lithium as there has been no commercial process available to economically extract the contained lithium to produce lithium carbonate or lithium hydroxide. Lepidico's strategic objective is to become a sustainable lithium producer over the next two years.

Valuation: 109% premium to current share price

Having received the results of the PFS for the Phase 1 L-Max Plant in 2017, Lepidico has stated that its key business imperative is the development of a pilot plant in April 2019 to minimise scale-up risk and the simultaneous advancement of the project to FS status. The PFS estimates C1 cash costs for the production of lithium carbonate via the L-Max process as close to zero net of by-products (including, among other things, sulphate of potash (SOP), sodium silicate, tantalum and sodium sulphate).

Exhibit 1: Estimated lithium carbonate cost curve (co-product basis)



Source: Roskill, Lepidico

We estimate that development of a 7tph Phase 1 plant according to the operational parameters contained within the PFS will result in free cash flow to Lepidico of A$52.0m per year once steady-state production at the Phase 1 L-Max plant has been achieved. Discounted at a rate of 10% per year over 10 years, steady-state free cash flow of A$52.0m has a net present value of A$319.6m. This reduces to A$218.3m to account for steady state not being achieved until FY23 and A$173.3m (A$0.0516 per existing share) once intervening cash-flows (including central costs etc) and initial capex is taken into account. Ultimately, however, our detailed valuation is derived from the discounting of future, real, maximum potential dividends to shareholders and thus depends, in part, on the degree and price of any future equity financing of Phase 1 capex. In our base case, we assume US$30m (A$42.4m) of equity financing at the prevailing share price of A$0.019/share, in

which case our ultimate valuation of Lepidico shares is A$0.0398 at the start of FY19 (cf A$0.0202 for the 3.6t/hour plant a year ago), rising to A$0.0530 in FY22.

Sensitivities and risks: As mitigated as reasonably possible

In qualitative terms, the principal risks to which Lepidico is immediately exposed include geographical/sovereign, geological, metallurgical/technological, engineering, financing, legal and management. In general terms, these may be summarised as execution risk, which is management's ability to bring the Phase 1 L-Max project to account within the required technical parameters. Owing to its unique technology, however, the balance of these risks is unlike those in the mainstream mining industry. For example, process chemistry risk has been significantly mitigated by continuous mini-plant trials, while scale-up risk is being mitigated via a series of intermediate initiatives prior to the development of the Phase 1 plant (see page 19 for details). At the same time, management risk is mitigated by the track record of the management team (see pages 19-20). Once in production, however, these risks will abate and others, such as commercial, commodity price, foreign exchange and global economic risks, will become relatively more significant.

Financials: Funded to a final investment decision

Lepidico had A$4.9m in cash at 30 June 2018, since which time it will have been in receipt of A$8.2m (gross) from the proceeds of its (heavily oversubscribed) 1 for 7 renounceable rights offer at 1.9c per share, announced on 3 September 2018. The estimated cost of the pilot plant capex is A$3.0m plus a further A$1.5m in operating costs. Simultaneously, the estimated cost of the L-Max FS is US$5m (A$6.6m), of which A$4.0m has already been spent. Assuming a positive investment decision in mid-2019 (depending, among other things, on the performance of the pilot plant and sourcing suitable purchasers of its product), we presume Lepidico will raise an additional US$30m (A$42.4m) in equity in FY19 to fund the capex of its Phase 1 L-Max plant. This will leave it with a relatively conservative net debt fu nding requirement of A$16.8m in FY20, equating to a gearing (net debt/equity) ratio of 26.3% and a leverage (net debt/[net debt+equity]) ratio of 20.8%.

Company description: Unique lithium technology

Lepidico is an ASX-listed lithium exploration and development company that provides exposure to a portfolio of lithium exploration assets through its ownership of the rights to a unique lithium ore processing technology, L-Max, as well as its wholly owned properties, JVs and IP licence agreements in Australia, Canada and Europe. Unlike its 'peers', it is uniquely differentiated in having successfully produced lithium carbonate and a suite of by-products from non-traditional, hard rock, lithium-bearing minerals such as lepidolite and zinnwaldite using its patent-pending L-Max process technology.

History

Lepidico was formed via the A$10m acquisition of the private, Belmont-based lithium explorer Lepidico by listed vehicle Platypus Minerals, on 16 March 2016. Platypus secured underwriting from advisory and venture capitalists GTT Ventures for a A$3.5m rights issue to finance the acquisition, while shareholders in Lepidico received 750m ordinary shares in Platypus at A$0.010/share. On 25 November 2016, the company's shareholders voted in favour of changing its name to Lepidico and this became effective from 30 November 2016.

On 10 October 2017, Lepidico forged a strategic, commercial relationship with Galaxy Resources whereby the latter agreed to subscribe for a 12% strategic shareholding in Lepidico via a private placement of 291.8m shares at a price of A$0.01/share to raise A$2.9m. Galaxy is an international lithium company, listed in Australia, with a market capitalisation of A$1,010.7m. It owns and operates the James Bay lithium pegmatite project in Quebec and the Mt Cattlin mine at Ravensthorpe in Western Australia, which is producing a spodumene and tantalum concentrate. It is also advancing plans to develop the Sal de Vida lithium and potash brine project in the lithium triangle in Argentina (where 60% of global lithium production is sourced). As such, it has been described as the biggest of the non-Big 3 lithium producers. Given its existing contacts and relationships, Galaxy is assisting Lepidico with future business and growth opportunities, including evaluating potential synergies with its Mt Cattlin mine and James Bay projects, as well as accessing additional mica feedstock sources for processing via L-Max. As a result of its investment, it also has a representative on Lepidico's board. At the same time as the Galaxy investment, Lepidico also offered existing shareholders the opportunity to invest alongside Galaxy on the same financial terms, via a 1 for 6 partially underwritten renounceable entitlement offer (effectively a rights issue) at A$0.01/share to raise up to an additional c A$4m.

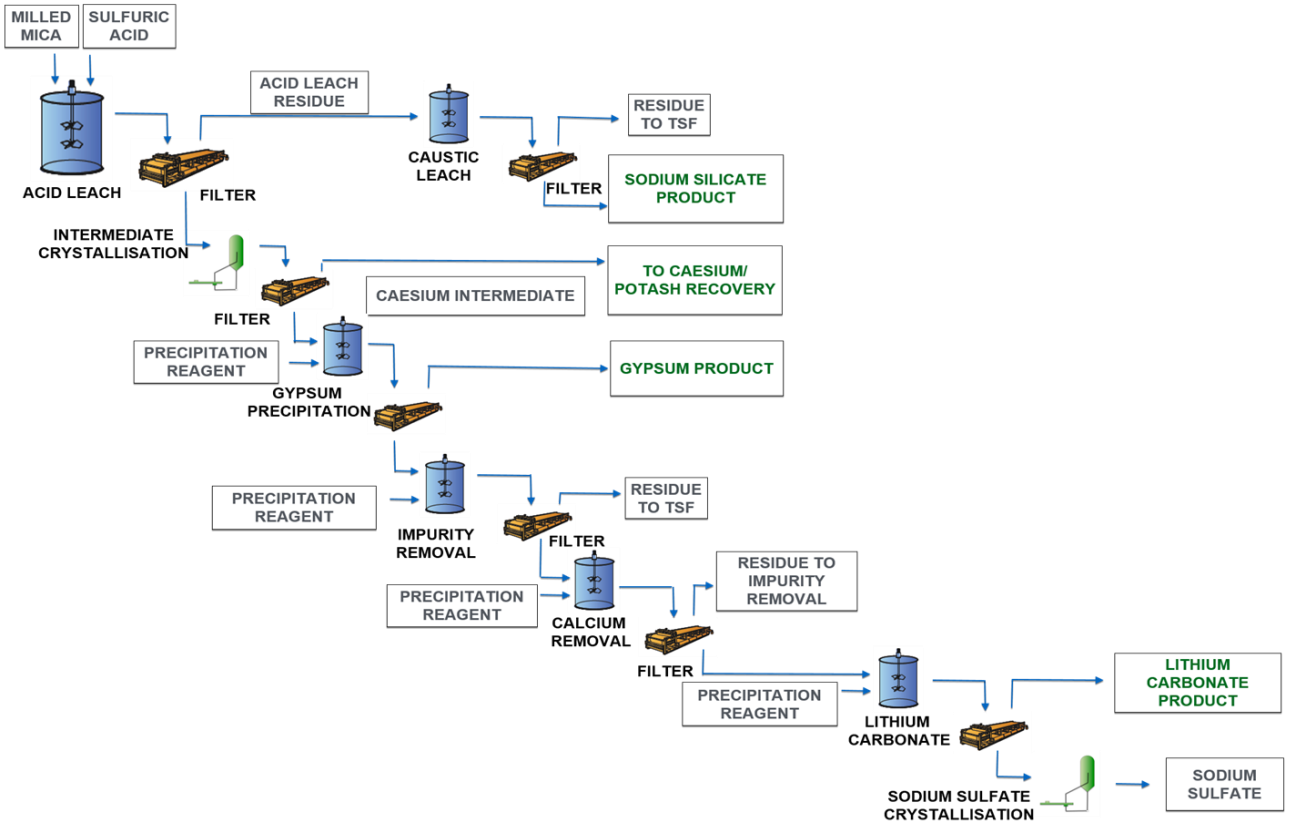
Lepidico's original intention was to complete a full feasibility on a 3.6t/hour Phase 1 L-Max plant by the end of 2017 then seek permitting and approvals for the subsequent six months before making a final investment decision on the plant in mid-2018. Lycopodium duly completed its engineering specification of the plant in December 2017. While the major equipment to be used was industry standard, however, since it had never been employed for its L-Max specified purpose before, no guarantees could be provided regarding the amount of throughput and output that it could support, which variously ranged from 1,500 to 3,000t of lithium carbonate per year. In view of this, Lepidico then embarked on an additional six-month period of exhaustive testwork to precisely clarify the matter before proceeding with the completion of the FS. In addition, it has determined to develop a 15kg/hour pilot plant as an intermediate stage to development the full Phase 1 plant to minimise scale-up risk, which has been financed by a 1 for 7 renounceable rights offer to raise A$8.2m, which has recently closed heavily oversubscribed. As a result, the pilot plant and FS are both now expected to conclude in H1 CY19, after which Lepidico will make a final investment decision on developing the Phase 1 plant in mid-2019.

Technology

Central to Lepidico is its L-Max technology. L-Max is a hydrometallurgical process that uses readily available mainstream chemicals (eg sulphuric acid, lime and limestone) to extract and recover lithium from lithium-containing micas. Lithium micas are abundant across the world, but are not typically treated owing to their having a lower lithium content than spodumene and conventional roast processing not affording the production of by-products (see below).

In basic terms, concentration of the micas ahead of the L-Max process occurs via simple rougher flotation at a fine grind size. Testwork, completed on various mica samples, has resulted in recoveries in percentages in the high 80s to low 90s. The mica concentrate is then treated with sulphuric acid to dissolve the metallic ion salts and filtered to separate silicate by-products and to remove waste. The leach liquor is then subjected to a series of impurity removal and precipitation steps at different pH levels (sequentially, via the addition of limestone and lime) to produce a >99.8% Li_2CO_3 product that is typically sold to end users on three- to five-year contracts. A schematic representation of the L-Max process is provided in the flowsheet below.

Exhibit 2: Schematic representation of the L-Max process



Source: Lepidico

While the chemistry of the L-Max process is novel from an industrial perspective, it uses only common reagents and standard equipment. The process is conducted at atmospheric pressure and at temperatures that do not exceed 110°C. It produces little or no residue and the tailings are benign.

Products and by-products

Significantly, in addition to lithium carbonate, the L-Max process can also produce a suite of valuable by-products, including sodium silicate (water glass) or other silica compounds, SOP, tantalum or tin (if present) concentrate and sodium sulphate. There is also potential to recover both

caesium and rubidium into a formate solution. Caesium, in particular, is a high-value product and is in demand as a component of drilling completion fluids in the oil and gas industries. Sodium sulphate and gypsum are present in the process residue. Finally, when the leach residue is reacted with caustic soda, it produces sodium silicate solution, which has a multiplicity of industrial uses, including as a bulking agent, an additive to paints, adhesives (eg wallpaper paste), corrugated cardboard and fillers, as a fire retardant and as a precursor to precipitated silica in tyres.

Caesium and rubidium

Lepidico is pursuing commercial alternatives in relation to a caesium brine by-product sourced from lepidolite. Further testwork is planned with the objective of producing a marketable-quality caesium brine, while also refining the associated process circuit. Note that no value was attributed to caesium products in the Phase 1 L-Max PFS.

S-Max

During Q418, Lepidico lodged a provisional patent application for an additional hydrometallurgical process, S-Max, developed in close collaboration with Strategic Metallurgy, the inventor of the L-Max process. S-Max produces an amorphous silica from concentrates sourced from a range of mica minerals, including lithium micas. The purified amorphous silica may be sold directly or used as a feed to produce a variety of other marketable silica products.

S-Max employs three stages of processing, namely grinding, sulphuric acid leaching at atmospheric pressure and differential classification and flotation streams. All equipment is industry standard and common-use reagents are employed. Importantly, S-Max can be integrated with Lepidico's proprietary L-Max process. When lithium-bearing mica concentrates are treated, the S-Max leach liquor can feed directly into the first impurity removal stage of the L-Max process. Furthermore, the leach liquor from non-lithium-bearing micas including muscovite and biotite may be treated to produce valuable by-products including SOP fertiliser.

Since lodging the provisional patent application for S-Max in May, in collaboration with Strategic Metallurgy, Lepidico has been evaluating alternate uses for amorphous silica generated from the L-Max leach residue. Testwork has indicated that this silica residue is suitable for use in concrete as a supplementary cementitious material (SCM). When added to ordinary Portland cement (OPC) and water the SCM reacts (with the excess calcium hydroxide generated by the OPC reaction with water) to yield additional cementitious material. This is a valuable attribute of the residue as substitution of OPC with L-Max silica residue could reduce concrete production costs and increase its strength for equivalent OPC additions.

Tests conducted by Strategic Metallurgy resulted in a significant increase in concrete compressive strength of up to 30% when the L-Max residue replaced 10% of the OPC and after curing for approximately 20 days. Subsequent tests by Boral, conducted according to ASTM C1240 standard specification for silica fume used in cementitious mixtures, resulted in strength increases ranging from 4–11% versus the baseline 100% OPC sample after curing for just seven days. Compressive strength increases with curing time and further testwork is planned.

Production of amorphous silica from the planned Phase 1 L-Max Plant will simplify the process flowsheet versus the PFS, which assumed the production of sodium silicate. The associated operating cost and capital cost savings are expected to be offset by lower revenue and are planned to be incorporated into the current FS. A market study has commenced for the sale of amorphous silica from the Phase 1 Plant and the company is pursuing commercial alternatives in this regard. Once in operation the research and development of alternative higher-value silica products may also be considered.

Land reclamation residue product

Following receipt of favourable geochemical, geotechnical and material characterisation testwork, Lepidico has committed to a three-month research collaboration with the Department of Earth & Environmental Sciences at the University of Waterloo in Ontario and Knight Piésold, commencing in September 2018. The purpose of the project is to characterise samples of the blended residue streams from the L-Max process and assess this material for use as a by-product in land reclamation applications. The objective is to validate the L-Max residue as a simple, rapid and cost-effective material to assist in the environmental reclamation of city landfill sites.

The Phase 1 Plant FS continues to contemplate the development of a residue storage facility (RSF). However, assuming the land reclamation reside project is successful, the need to have a dedicated RSF on site may be eliminated, thereby making the Phase 1 Plant a 'zero-waste' facility, and result in further capital and operating cost savings.

Business model

So far, Lepidico has conducted large-scale laboratory tests at a feed rate of 1–2kg per hour that have shown the L-Max technology operates continuously and stably over a protracted period of time. As such, Lepidico's strategic imperative in proving the L-Max concept is now to scale the process up to (first) a pilot plant, processing at approximately 15kg/hour to minimise scale-up risk while simultaneously completing a feasibility on a 7tph demonstration plant – the so-called Phase 1 plant – to produce 5,000tpa lithium carbonate. Ordinarily, such a plant would seek only to prove that it could operate from a technical perspective. In this particular case, however, the company is confident it will also operate from a commercial perspective.

Although the process chemistry has proved itself to be robust in continuous mini-plant trials, inevitably a period of time will be required to optimise the operation of the process (eg flow rates, leach times etc). Thereafter, however, a number of alternatives exist by which Lepidico may commercialise its technology at full scale.

Integration

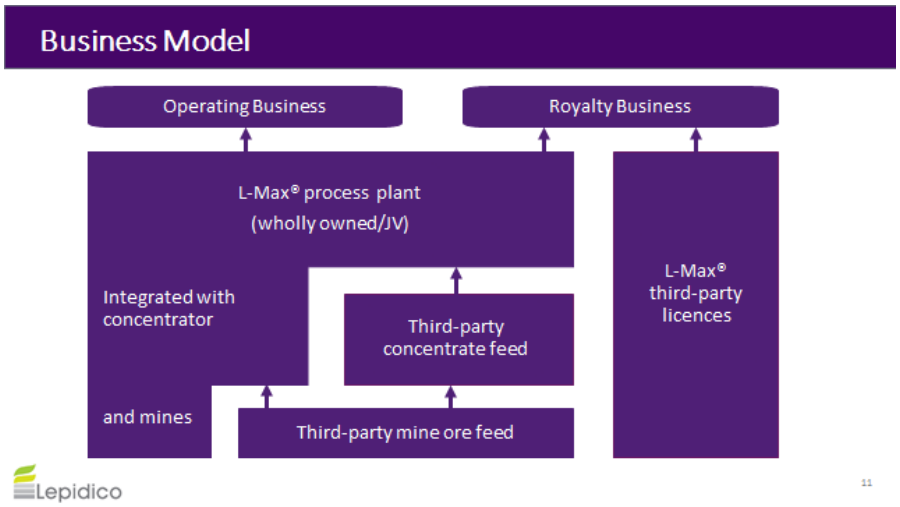
Lepidico's favoured route to commercialisation is to leverage its technology to acquire control of quality lithium mica assets to form an integrated lithium producer (see Exhibit 3). Currently, Lepidico has agreements over a number of prospective lithium mica exploration assets (see the Geological assets section, below) with aggregate resources in excess of 1.6Mt. Assuming 70% of this resource is convertible into reserves, these resources should be capable of supporting a Phase 1 plant for over nine years at an extraction rate of 116.1ktpa, which is sufficient to produce 5ktpa of lithium carbonate product. Self-evidently, additions to these resources will extend the lifetime for which the Phase 1 plant can be supported. In the meantime, Lepidico is only around six months from completing a FS then potentially as little as two years from profitable production.

Licensing

Lepidico has also licensed its technology to other companies. Alignment of interests with licensees and the preservation of the reputation of its IP is supported by Lepidico having the right to review all technical data relating to a project prior to finalising a licence.

A schematic representation of Lepidico's business model options is as follows.

Exhibit 3: Lepidico business model



Source: Lepidico

Lithium supply

Sources of lithium

The two main sources of lithium are hard rock spodumene deposits and salar brines. Historically, commercial lithium production has been derived from hard rock mineral ore sources such as spodumene. Recently, however, the development of salar brines from South America has expanded rapidly.

Global supply of lithium carbonate equivalent is estimated to be around 230ktpa, of which production of lithium via spodumene is c 80ktpa, primarily from pegmatites in Western Australia (of which Greenbushes is the largest and highest grade) and from some Chinese, Chilean and Argentinian sources. Output is dominated by six operations owned by four major companies (representing 91% of total market share): Albemarle, SQM, FMC and Sichuan Tianqi Lithium.

While almost none of the lithium used in consumer batteries is completely recycled, the recycling of lithium has also grown notably since Japan opened its first lithium-ion battery recycling plant in 1992. Facilities in Belgium, Germany, Japan, the US and Canada can all now process batteries for their lithium content.

Spodumene

Hard rock spodumene deposits typically occur in lithium rich pegmatites as colourless to yellowish, purplish or lilac kunzite or yellowish-green or emerald-green hiddenite crystals. The largest concentrations are found in granitic pegmatites (granite-like igneous rocks composed of quartz, feldspar and mica). The most important of these minerals are spodumene, which is a pyroxene mineral ($LiAl(SiO_3)_2$ or, alternatively, Li_2O, $Al_2O_3.4SiO_2$) and petalite (Li_2O, $Al_2O_3.8SiO_2$). Sources include Afghanistan, Australia, Brazil, Madagascar, Pakistan, Quebec, North Carolina and California. Associated minerals include quartz, albite, petalite, eucryptite, beryl and lepidolite (the focus of the L-Max process).

Theoretically, spodumene contains 8.03% Li_2O and is usually recovered through conventional open-pit mining methods and beneficiated via gravity techniques, whereby the ore is concentrated from a 1–2% Li_2O ore grade to a c 6–7% Li_2O concentrate grade (ie 75–87% spodumene).

Pre-flotation treatment (ie cleaning) followed by oleic (fatty) acid or soap flotation and de-sliming is one well-established recovery method for spodumene concentration. Alternatively, spodumene may be agitated with anionic collectors, followed by flotation. Oleic acids and soaps tend to produce a superior recovery in neutral and slightly alkaline pulps, while napthanic acids and sulphonated castor oil etc tend to work better in an acid pulp.

To convert it to globally traded lithium carbonate, the concentrate is heated to over 1,100°C in a rotary kiln, before being crushed and treated with sulphuric acid. The resulting solution is first neutralised with limestone then treated with soda ash (sodium carbonate) to produce a lithium carbonate solution. Next, this solution is evaporated prior to the addition of more soda ash to precipitate lithium carbonate.

Lithium brines

Lithium brine deposits are formed via the leaching of volcanic rocks in basin depositional environments. Salar brines can be described as underground reservoirs that contain high concentrations of dissolved Group 1 metal salts, such as lithium, potassium and sodium, and are generally found below the surface of dried lakebeds (particularly in South America).

Lithium is extracted from brines via a process that involves pumping the brine from the sediment basin and then concentrating it via solar evaporation over a number of months or even years. Potassium is often harvested first from early ponds, while later ponds have increasingly high concentrations of lithium. When the lithium chloride in the evaporation ponds reaches an optimum concentration, the solution is pumped to a recovery plant where filtering removes any unwanted boron and/or magnesium. Purification then occurs via solvent extraction, absorption and ionic exchange with sodium carbonate (soda ash) to precipitate refined lithium carbonate (Li_2CO_3). Alternatively, lithium chloride is a convenient intermediate salt from which to directly produce lithium hydroxide. Finally, excess residual brines are then pumped back into the salar. Since salar brines naturally occur at high altitudes and in areas of low rainfall, solar evaporation is a very efficient method for precipitating salts and it has been estimated that the cost of extracting lithium from such sources may be half of that from hard rock sources.

Advantages of spodumene processing

Notwithstanding their typically higher cost structure, pegmatite-based projects benefit from being quicker to move into production than brines, which may have a lead time of 1.5–3 years from the start of commercial extraction, depending on evaporation rates. Another key advantage of lithium production from hard rock deposits is the purity of the lithium carbonate produced. While the battery industry requires a minimum purity of at least 99.5% lithium carbonate, the composition of the remaining 0.5% is important and commercial penalties are often imposed for lithium carbonate containing enhanced levels of deleterious elements, such as iron, magnesium, etc.

Disadvantages of spodumene processing

In contrast with salar brine sources (see above), recovery of lithium from hard rock deposits, such as spodumene, requires a wide range of hydro-metallurgical processes. Pegmatite ores containing spodumene always contain other minerals such as mica, feldspar and quartz and iron and other silicates that have a tendency to concentrate with the spodumene. Problems associated with spodumene recovery therefore include the degree to which weathering has occurred and the presence of associated gangue minerals. Weathered mineral surfaces must be thoroughly cleaned before selective flotation. In addition, weathering and surface oxidation of the rocks may also give rise to alteration products that interfere with the flotation process. Gangue minerals may interfere with selective flotation, as well as consuming process reagents.

Lepidolite as an alternative source of lithium to spodumene

Lepidolite is a lilac-grey or rose-coloured member of the mica group of minerals with the formula $K(Li,Al)_3(Al,Si,Rb)_4O_{10}(F,OH)_2$. It is a phyllosilicate mineral and a member of the polylithionite-trilithionite series. Compared to spodumene's 8.03%, lepidolite theoretically contains 7.70% Li_2O. Despite being an abundant lithium-bearing mineral, it is a secondary source of the metal, with only a few, small-scale producers in the western world exploiting lepidolite for use in the ceramics industry. Otherwise, it is also produced in China as a precursor to the production of lithium, albeit via a commercially inefficient roasting process. Consequently, there has been little or no global exploration for lithium-bearing micas, with the result that the best potential assets remain un-investigated, even at surface. Notable occurrences have been reported in Brazil, the Ural Mountains, California, Manitoba (the Tanco mine, an underground caesium and tantalum mine, owned and operated by Cabot Corporation, which is the world's largest producer of caesium), Madagascar, the Iberian Peninsula and Zimbabwe.

Zinnwaldite

Zinnwaldite was first described in 1845 in Zinnwald (Cinovec) on the German-Czech border and is a silicate mineral also in the mica group. Chemically, it may be described as potassium lithium iron aluminium silicate hydroxide fluoride with formula $KLiFeAl(AlSi_3)O_{10}(OH,F)_2$. It occurs in greisens, pegmatite and quartz veins often associated with tin ore deposits and is commonly associated with topaz, cassiterite, wolframite, lepidolite, spodumene, beryl, tourmaline and fluorite. Compared to spodumene's 8.03% and lepidolite's 7.70%, zinnwaldite theoretically contains 3.42% Li_2O.

Other

Other sources of lithium, to which Lepidico's L-Max technology may prove to be applicable, include amblygonite (7.4% Li_2O).

Development and milestones

L-Max PFS

On 27 February 2017, Lepidico announced the results of the Phase 1 plant PFS from lead consultant Minmet. The study confirmed the viability of constructing a strategically located Phase 1 L-Max plant at Kenora in Ontario, processing lithium-mica concentrates purchased from third-party suppliers. The study assumed a small-scale, commercial L-Max plant processing a lithium-mica concentrate feed at a rate of 3.6tph to produce approximately 3,000tpa of battery-grade lithium carbonate and a suite of commercially important by-products.

Under the auspices of the PFS, a lepidolite sample containing approximately 40% mica and 2.2% Li_2O (ie approximately 28.6% of the theoretical maximum) was subject to a series of batch tests to assess the amenability of the run of mine mineralisation for lithium extraction and recovery by L-Max. The sample processed was from one specific source (Separation Rapids, see page 15, below) with moderate caesium and tantalum grades. Flotation of the sample achieved a consistent lithium recovery to concentrate of 96% and produced a high-grade mica concentrate containing 4.5% Li_2O that was used as feed to the L-Max process testwork. Ultimately, a 99.88% Li_2CO_3 product was achieved. Individual metallurgical recoveries, by compound, were as follows:

Exhibit 4: L-Max product recoveries

	Element				
	Lithium	Potassium	Silica	Caesium	Tantalum
L-Max feed grade (%)	2.10	6.77	23.10	0.05	0.03
Recovery to product (%)	94	85	85	81	70

Source: Lepidico

Given the positive outcome of the PFS, Lepidico has committed to undertaking a FS. The PFS results have also enabled planning parameters for the FS to be further developed and refined.

L-Max plant location

A key requirement of the PFS was not only to minimise the costs of consumables (including logistics), but also to maximise the value of by-products. This twin requirement had the effect of disqualifying Australia as a potential site for the Phase 1 plant and instead directed the focus of the investigation towards the Great Lakes in North America, mainland Europe and Japan, all of which hosted large sulphur/sulphuric acid production capacity (typically associated with copper and nickel smelting) as well as a deep market for silicates.

After investigating all three geographical areas, Kenora, in Ontario, was initially identified as a potential site for a plant, not least owing to its proximity to the Separation Rapids deposit (owned by Avalon Advanced Materials). In addition, the town has excellent transport connections to other parts of North America, with the Canadian Pacific Railway passing though it and the port of Thunder Bay on Lake Superior being 489km to the east with access to the St Lawrence Seaway. For the purposes of the PFS therefore, the site chosen for the L-Max plant was a vacant industrial site in Kenora and it was assumed that the L-Max plant would receive concentrates from at least two operations and potentially from the deposit at Separation Rapids (located 80km to the north) where suitable mineralisation had also been identified, tested and found to be amenable to the L-Max process. The PFS duly demonstrated that lithium-bearing mica could be economically transported to Kenora from existing overseas lepidolite mining operations.

In a subsequent trade-off study, however, the decision to locate the plant at Kenora was superseded by one to locate the plant at Sudbury (also in Ontario). Situated to the north of Lake Huron, Sudbury has a population of c 160,000 and is a former global centre of the nickel mining industry. As mining has decreased in relative importance, Sudbury's economy has diversified to establish itself as a major centre of finance, business, tourism, healthcare, education, government and science & technology research. Currently, c 80% of Sudbury's labour force is employed in services and 20% in manufacturing. Nevertheless, c 6,000 people remain employed by the mining industry and Vale remains the largest single employer in the town. In addition, there are some 350 mining supply and service companies, including a number of public and private firms pursuing research and development in new mining technologies such as the Mining Innovation Rehabilitation & Applied Research Corporation (MIRARCO), the Northern Centre for Advanced Technology (NORCAT) and the Centre for Excellence in Mining Innovation (CEMI).

The trade-off study between Kenora and Sudbury was completed in July 2017. Suitable enclosed facilities serviced by power, gas and road within established industrial parks close to the rail network were identified for lease at both locations. However, management reported that, when compared to Kenora, Sudbury may provide substantial operating cost savings and greater access to mining and processing services, including sulphuric acid (one of the most important cost components in the L-Max process).

Full FS

Lepidico is completing a full FS for the Phase 1 L-Max plant. The study is being conducted to a Class 3 level of cost-estimate accuracy. In contrast to the PFS, the FS will assume the L-Max plant

will receive mica concentrates of a suitable lithium grade and quality from mines that it operates as well as from third-party sources performing the mining and concentrating processes on a commercial, arm's length basis. Although, the L-Max plant could process concentrate from one source, it is likely that multiple sources will be contemplated in the study to guarantee the security of feed.

Three additional sources of value will also be investigated:

- The conversion of lithium carbonate to lithium hydroxide.
- The potential value of producing rubidium in formate brine (to which no value is currently attributed).
- The recovery of sodium sulphate and gypsum as saleable by-products.

As announced in July 2018, final design and engineering work for the Phase 1 L-Max plant has commenced based on an expanded nominal throughput rate of approximately 7tph of concentrate feed, capable of producing approximately 5,000tpa of lithium carbonate (cf 2,500–3,000tpa lithium carbonate in the PFS). Lepidico has a target of completing the FS in Q1 CY19. To achieve this milestone, the engineering aspects of the study will need to be completed in December 2018 and the capex and opex estimates no later than March 2019, when a first draft of the report will be produced.

De-risking scaling up

The path from batch testwork to commercial operation incorporates several development milestones. For example, the construction of a commercially viable demonstration plant (ie Phase 1 L-Max) prior to a full-scale commercial operation (Phase 2 L-Max) is a critical step in reducing project risk and optimising the process. In this case, however, and given the novel and unconventional nature of the L-Max technology, Lepidico has also opted to construct an intermediate stage 15kg/hour pilot plant as well. The rationalisation for the pilot plant is to reduce the risk of scale-up to this size of a commercial plant from the mini-plant trial conducted in 2017 (the incremental scale up factor to the Phase 1 plant then being c 467x, rather than 7,000x otherwise). In addition, the pilot plant will provide material for product development and evaluation purposes with prospective strategic/offtake partners for the Phase 1 L-Max plant project.

Strategic Metallurgy has completed the process design for a nominal 15kg/hour pilot plant at a capital cost of c A$3m, including engineering and contingency. Operating costs are expected to total a further A$1.5m. Pilot plant equipment will be similar to that used in the Phase 1 plant design, although on a smaller scale. The pilot plant has a six-month development timetable, which is planned to be implemented in parallel with the closing stages of Phase 1 plant project FS and will be funded via the proceeds of the A$8.2m (gross) September 2018 entitlements offer. It is anticipated that the pilot plant will be commissioned in April 2019 with a ramp-up of two to three days before being run for approximately one month to confirm the design performance of the major component parts of the plant in a continuous process at the higher throughput rate. Assuming this step of the testing process is successfully implemented, a final investment decision on the larger 7t/hour plant is anticipated in mid-2019.

Beyond the pilot plant, the Phase 1 plant equipment will represent a smaller version of the equipment selected for use in a larger Phase 2 plant (anticipated production capacity of 15,000–25,000tpa lithium carbonate). Consequently, equipment selection for the Phase 1 plant has been made to ensure it is suited for use in a commercial L-Max plant, which will further minimise the scale-up risk of using equipment that is unsuited to larger throughputs.

Proprietary processes, patent protection and the law

Lepidico submitted an international patent application for the L-Max Process under the Patent Cooperation Treaty administered by the World Intellectual Property Organisation in October 2015. Australian Innovation Patent 2016101526 was filed as a divisional application of the international patent application for the L-Max process. This includes a rigorous 'preliminary' examination of the process described and claimed, based on internationally accepted criteria for patentability (the examination being conducted in this case by the Australian Patent Office as an International Searching and Examining Authority). As a result of this examination, it was acknowledged in the International Preliminary Report on Patentability that the L-Max process as described and claimed in the international application was 'novel, inventive, industry applicable and patentable'. As a result, on 8 February 2017, Lepidico announced that its L-Max process (the subject of International Patent Application PCT/AU2015/000608) was granted a Certification Report of Innovation Patent (number 2016101526) in Australia, with formal report advised for receipt the following day. While the conclusions of the International Preliminary Report on Patentability are not ultimately binding, they do represent a guide for patent offices before which national and/or regional phase patent applications from the international application may proceed.

Subsequently, in 2017 the company proceeded with the national and regional phase of patent applications in the main jurisdictions in which L-Max may operate in the future. As part of this process, requests for examination have been filed under the international patent applications for the L-Max process in Europe, the US and Japan and routine interactions have occurred with patent offices from various jurisdictions where applications have been made. This regional phase of the patent process is expected to continue into 2019.

Geological assets

Lepidico's exploration strategy is to identify and secure lithium mica deposits that are capable of providing material quantities of quality L-Max feed to Sudbury or elsewhere, located in stable, mining friendly jurisdictions and close to critical infrastructure, including power, water and transport.

Lepidico's exploration assets have hitherto included options over the Lemare and the Royal projects (both in Quebec), an ore access agreement with Grupo Mota over the Alvarrões Lepidolite Mine in Portugal, farm-in agreements with Pioneer Resources over the PEG 9 lepidolite prospect and with Maximus Resources over the Moriarty lithium project (both in Western Australia), ownership of the Euriowie amblygonite project near Broken Hill in New South Wales and an agreement with Crusader Resources regarding the potential deployment of L-Max in Portugal and Brazil.

After a strategic review during the June 2018 quarter, management concluded that Lemare (spodumene) is no longer a strategic fit for the company and that results from PEG 9 and Moriarty do not justify further work by the company because it is unlikely these projects will meet Lepidico's criteria as prospective sources of lithium mica mineralisation. As a result, Alvarrões in Portugal is the main focus of the company's exploration activities. In parallel, ongoing evaluation of lithium mica projects continues both in Australia and globally.

A map of Lepidico's geological assets, including potential sites for Phase 1 and/or Phase 2 L-Max plants is as follows:

Exhibit 5: Map of assets in which Lepidico has an interest including potential L-Max plant locations

Source: Lepidico

Alvarrões

The Alvarrões Lepidolite mine is owned and operated by Grupo Mota, which produces approximately 20,000tpa of lithium minerals from the mine, predominantly lepidolite for the ceramics industry. The Alvarrões mining concession is approximately 634ha and encompasses most of the known lithium pegmatites that crop out along the north-eastern slopes of the Serra da Estrela mountains.

Although the area has a long-established history of open pit extraction of hard-rock lithium ores, to date the potential for a large-scale mining operation focused on the production of chemicals for the lithium-battery market remains undeveloped. Nevertheless, the dense concentration and strike continuity of the pegmatites provide excellent potential for the delineation of a significant deposit.

Under the terms of its agreement with Grupo Mota, Lepidico undertook development expenditure of at least €250,000 over an 18-month exclusive period on Alvarrões with the goal of defining a JORC-compliant mineral resource of >1Mt at a grade of 1.5% Li_2O. In return, Lepidico had an exclusive/pre-emptive right for three years in which to effect a commercial relationship with Grupo Mota regarding the supply of ore/concentrate from Alvarrões to Lepidico and/or the right for Lepidico to develop and operate a lithium mica mining and concentration project there.

On 7 December 2017 Lepidico met the initial terms of its obligations under its agreement with Grupo Mota by announcing a maiden resource at Alvarrões of 1.6Mt at a grade of 1.2% Li_2O, containing 18,500t Li_2O, or 45,747t lithium carbonate equivalent, which is capable of substantially supporting a Phase 1 plant for 10 years and contributing materially to a Phase 2 plant.

Since then, Lepidico has designed a reverse circulation and diamond core drill programme to increase the data density and test the extension of the mineralisation to the north and west of the deposit. The work will be undertaken following the development of the permitting schedule and has the objective of upgrading the mineral resource within Blocks 1 and 2 from the inferred category

into the measured and indicated categories and establishing the resource potential of all pegmatite sills across Block 3.

In the meantime, flotation testwork on Alvarrões pegmatite mineralisation during the March 2018 quarter successfully generated separate feldspar and quartz concentrates, in addition to a quality lithium mica concentrate suitable for Phase 1 plant feed. Aside from the additional revenue potential, the large increase in product mass means that co-disposal of only relatively small quantities of plant fines with mine waste will be generated, thereby negating the requirement for a tailing storage facility. Advantages of this development include a significantly reduced footprint at Alvarrões along with the option to employ modular concentrator technology, reduced capital and operating costs and maximisation of the mineral potential of the pegmatite.

Separation Rapids

Separation Rapids is a large LCT-type complex pegmatite owned by Avalon Advanced Materials and situated approximately 70km north of Kenora in NW Ontario. Although the prospect already contains an NI 43-101-compliant petalite resource (which was the subject of a PEA announcement in September 2016), it also contains significant but, as yet, unquantified and un-investigated lepidolite resource potential.

Samples from outcropping lepidolite-rich sub-zones to the east of the main Separation Rapids petalite resource were provided to Lepidico for laboratory bench tests using L-Max as part of the Phase 1 plant PFS. Excellent results were achieved (including the production of battery grade lithium carbonate of 99.88% purity, versus a minimum industry requirement of 99.5%, see page 9) and Avalon and Lepidico subsequently entered into a non-binding letter of intent, according to which Avalon will sell a minimum of 15,000tpa of lepidolite concentrate, produced as a by-product from its demonstration-scale pilot petalite flotation plant at Kenora, to Lepidico for processing at its planned Phase 1 commercial lithium carbonate production facility.

In April 2017, Avalon undertook a 2,000m drilling programme at Separation Rapids with the aim of:

- quantifying the lithium mineralisation in the resource model associated with lepidolite and other lithium micas vs the lithium mineralisation associated with petalite;
- expanding the existing mineral resource of lithium (petalite) pegmatite mineralisation;
- testing an undrilled target area 1km west of the known resource where a showing of petalite pegmatite sampled by Avalon in 1997 was reported as having yielded 1.56% Li_2O across 8.9m; and
- collecting geotechnical data for groundwater studies and mine planning in advance of permitting for site development.

In July 2017, Avalon issued a news release highlighting the results of its spring diamond drilling campaign at Separation Rapids, which, in addition to its petalite resource, extended the lepidolite zones and confirmed that high-grade lepidolite mineralisation comprises approximately 20% of the known lithium resources with additional blue-sky expansion potential. Self-evidently, this development materially enhances the lepidolite potential of the prospect and confirms it as another potential high-quality source of lithium mica for LPD's Phase 1 L-Max plant.

Youanmi

During the June 2018 quarter, Lepidico evaluated the lepidolite prospectivity of ground held by Venus Metals Corporation in the Murchison District of Western Australia, approximately 20km southwest of the historical Youanmi gold mine and 560km north-northeast of Perth. The property encompasses 4km of strike of a lepidolite-bearing pegmatite belt within which lepidolite is often the only, or dominant, lithium mineral species. Subsequent to the end of the quarter Lepidico entered into a farm-in agreement with Venus to explore for lithium mica and phosphate minerals on its

Youanmi tenements in return for an up to 80% interest in the lithium rights over exploration licence E57/983.

On 31 August, Lepidico announced it had started drilling three priority lepidolite targets at Youanmi. Mapping indicates the lepidolite pegmatites occur in clusters of up to 300x100m, with individual pegmatites ranging in thickness from 0.1–5.0m in outcrop. Over much of the area, the pegmatites are sub-cropping with indications of possible continuity under cover. Field observations indicate that the lepidolite content is often 5–10%, with up to 30% in certain zones.

A reverse circulation drilling programme of c 1,000 m has been initiated to test for the presence of thicker, lepidolite-rich pegmatites at three initial target areas. Drilling has now started at the northern Target 1 where an outcropping pegmatite has been mapped over more than 300m. All four holes drilled to date have intersected this pegmatite at around 10m vertical depth, confirming strike continuity over 200m and an average true thickness of 4–5m. Drilling will continue along strike while step-out holes will test for continuity at depth.

Mt Cattlin

Although it has no beneficial ownership rights over Mt Cattlin, as a result of its collaboration with Galaxy during Q318 Lepidico produced battery-grade lithium carbonate grading 99.8% using its L-Max process technology from a tailings stream sourced from Galaxy's spodumene operations there. A standard suite of L-Max by-products was also generated from the programme, which was jointly commissioned by Galaxy and Lepidico.

Hydrometallurgical batch tests were also completed on a secondary, tailings float sample sourced from the Mt Cattlin dense media separation plant. The sample was subjected to leaching under standard L-Max conditions and produced a flotation concentrate grading over 4.0% Li_2O with lithium recovery to concentrate of 96.6%. Higher extractions are expected by undertaking an optimisation programme to achieve rates similar those in tests conducted on other lithium mica samples, which realised over 98% extraction. The leach liquor from the test was then subjected to the usual L-Max downstream process flowsheet in a series of batch tests and found lithium losses in the post-leach L-Max process to be no more than 4%, with total recovery from flotation concentrate to final product of over 90%.

Further collaborative testwork with Galaxy specific to Mt Cattlin will be considered once the current plant upgrade at the operation is complete and samples from the expanded plant can be sourced.

Valuation assumptions

We have valued Lepidico based on developing a 7t/hour Phase 1 plant operating at parameters similar to those estimated in its 2017 PFS. Implicitly, it assumes the L-Max plant will purchase mica concentrates of a suitable lithium grade and quality from a third party on a 'free on board' (FOB) basis at the mine gate.

Prices

Our pricing assumptions for the products produced by the L-Max process are essentially those used by Lepidico in its PFS and are shown below, with the exception of the fact that we have recently increased our long-term lithium carbonate price to US$12,000/t from an erstwhile (albeit relatively conservative) US$8,000/t to reflect its recent consistent strength in the price above US$10,000/t since at least mid-2016. According to one of the world's largest lithium producers, Orocobre, lithium carbonate prices increased to US$13,653/t (FOB) during the June quarter and it expects the market to remain in deficit into the foreseeable future and at least into CY22. Variations from this base case assumption are considered in Exhibit 12.

Exhibit 6: Product and by-product price assumptions

Product	Price (US$/t unless otherwise indicated)	Previous*
Lithium carbonate	US$12,000/t	US$8,000/t
Sulphate of potash	US$600/t	US$600/t
Sodium silicate	US$689/t	US$689/t
Caesium	US$15,000/t	US$15,000/t
Gypsum	US$10/t	US$10/t
Tantalum	US$120/kg	US$120/kg

Source: Lepidico. Note: *See our initiation note, Masterful metallurgy, published on 4 July 2017.

Opex

The majority (>90%) of the operating costs have been estimated from the PFS on first principles based on quoted pricing:

Exhibit 7: Major consumables' unit costs and consumption rates

Reagent	Consumable consumption rate (kg/t of concentrate processed)*	Estimated cost of consumable FOB (US$/t)*
Sulphuric acid (93%)	1,054	60
Limestone and hydrated lime	706	38/120
Sodium carbonate	143	239
Caustic soda (50% solution)	614	207
Formic acid	13	600
Natural gas	GJ7.6/t	US$3.38/GJ

Source: Lepidico. Note: *Unless otherwise indicated.

Of the consumable costs, 67% relates to sulphuric acid and caustic soda (for the production of sodium silicate). Other processing costs include personnel, maintenance parts and laboratory analytical services.

Exhibit 8: Estimated unit operating costs (current prices)

Item	Estimated unit operating costs (US$ per tonne concentrate processed)	Previous*
Concentrate purchased	385	350
Concentrate transport	4	4
Inbound consumable logistics	144	144
Consumables (FOB)	286	286
Other processing costs	186	186
Sales, marketing and outbound logistics	55	55
General and administrative	104	104
Total unit costs	**1,165**	**1,130**

Source: Lepidico. Note: *See our initiation note, Masterful metallurgy, published on 4 July 2017. Totals may not add up owing to rounding.

The lithium-mica concentrate purchase price of US$385/t is based on the forecast price for spodumene, which is US$550/t (source: Roskill), adjusted for the lower grade of the lepidolite concentrate (4.5% Li_2O vs 6% for a typical spodumene concentrate). This does not account for the lower capital and operating costs associated with a lepidolite concentrator compared to a spodumene one, which could result in a further discount being applied. This also compares with quotes solicited to deliver lepidolite to Kenora from an existing European mine, which were found to be below the US$350/t used in the PFS (including transport).

Capex

Our internal estimate of scaled-up capital costs is based upon Lepidico's PFS estimates, which were prepared in consultation with an independent cost-estimating firm (Professional Cost Consultants) and based on a comprehensive equipment list, with pricing obtained from up to three vendors:

Exhibit 9: Capex estimate (US$m)*

	September 2018 (Edison)		July 2017 (PFS)	
Item	Estimate (US$m)	Percent of total (%)	Estimate (US$m)	Percent of total (%)
FS and owner's costs	5.0	8.3	5.0	12.2
L-Max plant direct costs	27.1	45.2	16.2	39.4
L-Max plant services	12.0	20.0	4.6	11.2
Infrastructure	0.0	0.0	2.6	6.3
Indirect costs	6.7	11.2	6.7	16.3
Contingency (20%)	9.2	15.3	6.0	14.6
Total	**60.0**	**100.0**	**41.1**	**100.0**

Source: Lepidico, Edison Investment Research. Note: *Excludes pilot plant capex and opex estimates.

The infrastructure scope has been mitigated owing to the plant's urban location with ready access to power, water, natural gas and transport infrastructure.

Sustaining capital has been estimated at US$1.9m pa (previously US$1.1m pa), which is largely attributable to residue disposal. A closure cost of US$1.7m has been included to provide for removal of the plant at the end of the project's life.

The accuracy of the original PFS estimate was -20% to +30%.

Valuation

On the basis of the assumptions set out above, our forecast Lepidico's annual income statement is approximately as follows, once steady-state production at the Phase 1 L-Max has been achieved (see below):

Exhibit 10: Edison estimate of Lepidico free cash flow once steady-state Phase 1 achieved

	Australian dollars
Revenue	138,207,900
Costs	65,188,135
Gross profit	73,019,765
Depreciation	(9,220,921)
General & administrative costs	(3,146,290)
Operating profit	60,652,554
Net finance income	0
Loss before income tax	60,652,554
Income tax expense	15,163,139
Marginal tax rate (%)	25.0
Profit from continuing operations	45,489,416
Sustaining capex	(2,695,073)
Free cash flow	52,015,264

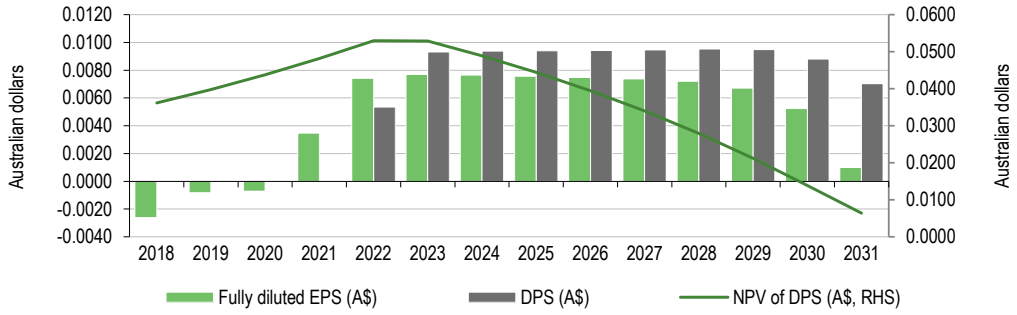
Source: Edison Investment Research

Discounted at a rate of 10% per year over 10 years, steady-state free cash flow of A$52.0m pa (cf A$28.1m previously for the 3.6t/hour plant) has a net present value of A$319.6m (A$172.4m previously). This reduces to A$218.3m (A$117.1m previously) to account for steady state not being achieved until FY23 and A$173.3m (previously A$66.6m) once intervening cash flows (including central costs etc) and initial capex are taken into account.

Ultimately, however, our detailed valuation is derived from the discounting of future, real, maximum potential dividends to shareholders and thus depends, in part, on the degree and price of any future equity financing of Phase 1 capex. In our base case, we assume US$30m (A$42.4m) of equity financing via the issue of an additional 2.2bn shares at the prevailing share price of A$0.019 later in the current financial year to finance the start of Phase 1 capex in the second half of calendar year 2019 (FY20). This is relatively conservative in terms of implied future gearing/leverage and consequent debt/strategic partner-sourced funding requirements (see Exhibit 16); however, we

believe it is justified on the grounds that prudent gearing/leverage ratios are appropriate in relation to the funding of a specific, specialist, novel and unique technology. In this case, our ultimate valuation of Lepidico shares is A$0.0398 (cf A$0.0202 previously) at the start of FY19 (1 July 2018), rising to A$0.0530 in FY22, when the first dividend is potentially payable to shareholders, as shown below:

Exhibit 11: Edison estimate of future Lepidico EPS and (maximum potential) DPS



Source: Edison Investment Research

Risks and sensitivities

In qualitative terms, the principal risks to which Lepidico is immediately exposed include geographical/sovereign, geological, metallurgical/technological, engineering, financing, legal and management. In general terms, these may be summarised as execution risk, ie management's ability to bring the Phase 1 L-Max project to account within the required technical parameters. Owing to its unique technology, however, the balance of these risks is unlike those in the mainstream mining industry:

- Lepidico's exposure to sovereign risk may be separated into sovereign risk relating to its mining/exploration activities and sovereign risk relating to the potential location of its plant. In terms of its plant, Lepidico has the option to site its plant almost anywhere in the world, although it has narrowed this down to (probably) Sudbury in the Great Lakes area of North America, which exposes it to little more discretionary sovereign risk than the average, multi-national manufacturing organisation. In terms of its mining/exploration sovereign risk, Lepidico has made a conscious decision to focus on stable, mining-friendly jurisdictions close to critical infrastructure, owing to its unique lepidolite processing technology, which therefore gives it the ability to select geological assets in a minimally competitive environment.
- As a result of the above, Lepidico's exposure to geological risk is also greatly reduced in that it is not critical for it to control the production of lepidolite ore feedstock (notwithstanding its integrated business model).
- Metallurgical/technological risk is mitigated by Lepidico's ongoing programme of testing and technological studies. Thus far, Lepidico has conducted large-scale laboratory tests at a feed rate of up to 3kg per hour, which have shown the L-Max technology operates continuously and stably over a protracted period of time. As a result, its immediate strategic imperative now is to scale the process up to 15kg/hour pilot plant before then scaling it up to c 7tph in its Phase 1 commercial demonstration plant.
- Similarly, the path from batch testwork to full-scale operation incorporates several development milestones to mitigate engineering risk, such as the construction of (first) a pilot plant and (then) a commercially viable demonstration plant, before embarking on a full-scale commercial operation. Pilot plant equipment will be similar to that used in the Phase 1 plant design albeit on a smaller scale, while the equipment selected for the Phase 1 plant will be a smaller version of

the equipment used in the larger Phase 2 plant and will be made with the specific intention of minimising scale-up risk.

- Legal risk. Lepidico holds International Patent Application PCT/AU2015/000608 and a granted Australian Innovation Patent (2016101526) in relation to the L-Max process. In the preliminary part of this process, the Australian Patent Office (as an International Searching and Examining Authority) found that the L-Max process as described and claimed in the international application was 'novel, inventive, industry applicable and patentable'. While the conclusions of the International Preliminary Report on Patentability are not ultimately binding, they do represent a guide for patent offices before which national and/or regional phase patent applications from the international application may proceed. Since then, the company has begun national and regional patent applications in the main jurisdictions in which L-Max may operate in the future. As part of this, requests for examination have been filed under the international patent applications for the L-Max process in Europe, the US and Japan and routine interactions have occurred with patent offices from various jurisdictions where applications have been made.
- Management risk is similarly mitigated by the track record of its senior managers and board members. The chairman, Gary Johnson, has over 30 years of experience in the industry, including as the managing director of LionOre. The managing director Joe Walsh has over 25 years of experience, including as general manager (corporate development) of PanAust, in which role he was instrumental in the evolution of the company from an explorer to a >US$2bn, ASX 100, multi-mine copper and gold company.

Once in production, the above risks will typically abate and others, such as commercial, commodity price, foreign exchange and global economic risks, will become relatively more significant. On the one hand, for example, third-party estimates suggest the lithium market will need to grow from c 230kt per year in 2017 to c 3Mtpa to accommodate electric vehicle penetration of the car market of c 14% globally and 30% in Europe by 2025. This might be regarded as an 'opportunity' or an 'upside risk'. Conversely, other commentators forecast a market of only c 420kt by 2025. At the same time, although spent lithium ion batteries (LIBs) are processed to recover cobalt and other base metals, almost none of the lithium used in consumer batteries is completely recycled. Varying compositions of batteries for different applications require the development of suitable recycling processes to recover metals from all types of LIBs. However, there is also every chance of this becoming a reality in coming years, especially if the market takes off to the extent suggested above. Self-evidently, the extent to which either of these scenarios prove to be true will express itself as changes in the lithium price. In quantitative terms, our valuation of Lepidico is sensitive to lithium price assumptions to the following extent:

Exhibit 12: Lepidico valuation sensitivity to lithium carbonate price

Lithium carbonate price (US$/t)	4,000	6,000	8,000	10,000	12,000	14,000	16,000	18,000	20,000
Change vs base case (%)	**-66.7**	**-50.0**	**-33.3**	**-16.7**	**u/c**	**+16.7**	**+33.3**	**+50.0**	**+66.7**
Valuation (A$/share)	0.0017	0.0115	0.0209	0.0304	0.0398	0.0492	0.0587	0.0680	0.0773
Change vs base case (%)	-95.7	-71.1	-47.5	-23.6	u/c	+23.6	+47.5	+70.9	+94.2

Source: Edison Investment Research

Within this context, readers should note that, according to one of the world's largest lithium producers, Orocobre, lithium carbonate prices increased to US$13,653/t (FOB) during the June quarter; it expects the market to remain in deficit into the foreseeable future and at least into CY22.

At the same time, our valuation of Lepidico is sensitive to by-product price assumptions (see Exhibit 6) to the following extent:

Exhibit 13: Lepidico valuation sensitivity to by-product prices

Change vs base case (%)	-50.0	-25.0	u/c	+25.0	+50.0
Valuation (A$/share)	0.0227	0.0311	0.0398	0.0483	0.0569
Change vs base case (%)	-43.0	-21.9	u/c	+21.4	+43.0

Source: Edison Investment Research

Similarly, it is sensitive to costs and the discount rate as follows:

Exhibit 14: Lepidico valuation sensitivity to operating cash costs*

Change vs base case (%)	-20.0	-10.0	u/c	+10.0	+20.0
Valuation (A$/share)	0.0487	0.0442	0.0398	0.0354	0.0309
Change vs base case (%)	+22.4	+11.1	u/c	-11.1	-22.4

Source: Edison Investment Research. Note: *See Exhibit 8.

Exhibit 15: Lepidico valuation sensitivity to the discount rate

Discount rate (%)	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Valuation (A$/share)	0.0872	0.0579	0.0398	0.0282	0.0206	0.0707	0.0117

Source: Edison Investment Research

Financials

Lepidico had A$4.9m in cash as at 30 June 2018. Since then it will have been in receipt of A$8.2m (gross) from the proceeds of its (heavily oversubscribed) 1 for 7 renounceable rights offer at 1.9c per share, announced on 3 September 2018. Its intention is to apply the net funds raised from the offer as follows:

- build and operate a 15kg/hour L-Max pilot plant
- L-Max product development
- exploration activities
- complete a scoping study for a full-scale L-Max plant
- working capital

The estimated cost of the pilot plant capex is A$3.0m plus a further A$1.5m in operating costs. Simultaneously, the estimated cost of the L-Max FS is US$5m (A$6.6m), of which A$4.0m has been spent already.

Central to our valuation is an assumption that Lepidico raises US$30m in FY18 to fund the development of the Phase 1 plant. To the extent that it actually raises more or less than this sum, our valuation is sensitive to the degree of future equity financing to the following extent:

Exhibit 16: Lepidico valuation sensitivity to degree of future (gross) equity funding

Estimated future equity funding (US$m)	0.0	10.0	20.0	30.0	42.6
Estimated future equity funding (A$m)	0.0	14.1	28.3	42.4	60.2
Edison valuation (A$/share)	0.0564	0.0490	0.0437	0.0398	0.0361
Maximum debt funding requirement (A$m)	(58.9)	(44.1)	(30.2)	(16.8)	0.0
Maximum gearing* (%)	-267.3	-120.0	-59.5	-26.3	0.0
Maximum leverage** (%)	-72.8	-54.5	-37.3	-20.8	0.0

Source: Edison Investment Research. Note: *Defined as (net debt/equity); **defined as (net debt/[net debt+equity]).

Exhibit 17: Financial summary

Accounts: IFRS, Yr end: June, AUD: Thousands		2015A	2016A	2017A	2018A	2019E	2020E
Total revenues		9	116	127	171	0	16,720
Cost of sales		0	0	0	0	2,120	(11,330)
Gross profit		9	116	127	171	2,120	5,390
SG&A (expenses)		(455)	(617)	(912)	(5,284)	(3,146)	(3,146)
Other income/(expense)		0	0	0	0	0	0
Exceptionals and adjustments	Exceptionals	(16)	(415)	(878)	(2,171)	0	0
Depreciation and amortisation		(5)	(6)	(6)	(6)	(2,745)	(6,625)
Reported EBIT		(467)	(923)	(1,670)	(7,290)	(3,771)	(4,381)
Finance income/(expense)		(18)	(5)	128	70	24	106
Other income/(expense)		(559)	(448)	(3,815)	0	0	0
Exceptionals and adjustments	Exceptionals	0	(888)	0	0	0	0
Reported PBT		(1,044)	(2,263)	(5,357)	(7,220)	(3,746)	(4,275)
Income tax expense (includes exceptionals)		0	0	0	0	0	0
Reported net income		(1,044)	(2,263)	(5,357)	(7,220)	(3,746)	(4,275)
Basic average number of shares, m		178	465	1,802	2,624	4,245	5,588
Basic EPS		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Balance sheet							
Property, plant and equipment		9	4	8	27	27,404	59,581
Goodwill		0	0	0	0	0	0
Intangible assets		0	16,204	16,698	19,027	19,027	19,027
Other non-current assets		1,485	715	1,620	730	730	730
Total non-current assets		1,494	16,922	18,326	19,783	47,161	79,338
Cash and equivalents		53	650	3,307	4,860	21,157	21,157
Inventories		0	0	0	0	0	1,393
Trade and other receivables		4	3,886	706	712	1,043	1,374
Other current assets		0	0	0	0	0	0
Total current assets		57	4,537	4,013	5,572	22,200	23,924
Non-current loans and borrowings		0	0	0	0	0	37,985
Other non-current liabilities		0	0	0	0	0	0
Total non-current liabilities		0	0	0	0	0	37,985
Trade and other payables		105	614	1,663	804	997	1,190
Current loans and borrowings		115	0	0	0	0	0
Other current liabilities		40	33	46	51	51	51
Total current liabilities		260	647	1,709	856	1,048	1,241
Equity attributable to company		1,292	20,812	20,630	24,500	68,312	64,037
Non-controlling interest		0	0	0	0	0	0
Cashflow statement							
Profit for the year		(1,044)	(2,263)	(5,357)	(7,220)	(3,746)	(4,275)
Taxation expenses		0	0	0	0	0	0
Depreciation and amortisation		5	6	6	6	2,745	6,625
Share based payments		450	40	1,736	2,138	0	0
Other adjustments		(451)	1,036	(162)	2,066	0	0
Movements in working capital		(10)	132	133	(28)	(139)	(1,532)
Interest paid / received		0	0	0	0	0	0
Income taxes paid		0	0	0	0	0	0
Cash from operations (CFO)		(1,050)	(1,049)	(3,644)	(3,038)	(1,140)	817
Capex		(9)	(63)	(861)	(3,057)	(30,122)	(38,802)
Acquisitions & disposals net		0	32	122	110	0	0
Other investing activities		(563)	(80)	0	0	0	0
Cash used in investing activities (CFIA)		(572)	(111)	(739)	(2,947)	(30,122)	(38,802)
Net proceeds from issue of shares		1,505	1,872	7,040	7,555	47,559	0
Movements in debt		100	(115)	0	0	0	37,985
Other financing activities		0	0	0	0	0	0
Cash from financing activities (CFF)		1,605	1,757	7,040	7,555	47,559	37,985
Increase/(decrease) in cash and equivalents		(18)	597	2,657	1,570	16,297	0
Currency translation differences and other		0	0	0	(17)	0	0
Cash and equivalents at end of period		53	650	3,307	4,860	21,157	21,157
Net (debt) cash		(61)	650	3,307	4,860	21,157	(16,828)
Movement in net (debt) cash over period		(61)	711	2,657	1,553	16,297	(37,985)

Source: Company sources, Edison Investment Research

Contact details	Revenue by geography
Level 1, 254 Railway Parade West Leederville Western Australia 6007 Australia +61 (08)9363 7800 www.lepidico.com	N/A

Management team

Chairman: Gary Johnson	Managing director: Julian 'Joe' Walsh
With over 30 years' experience in the mining industry as a metallurgist, manager, owner, director and managing director, Gary possesses broad technical and practical experience of the workings and strategies of successful mining companies. He is a member of the Australasian Institute of Mining and Metallurgy and the Australian Institute of Company Directors. Other directorships include Strategic Metallurgy, Antipa Minerals and St Georges Platinum & Base Metals.	Joe is a resources industry executive and mining engineer with over 25 years' experience working in both mining companies and investment banks. Within the industry, he was, among other things, PanAust's general manager, corporate development, and was instrumental in the evolution of the company from an explorer in 2004 to a >US$2bn, ASX 100, multi-mine copper and gold company. He also has extensive equity market experience and has been involved with the technical and economic evaluation of many mining assets and companies around the world.
Exploration director: Tom Dukovcic	**General manager (business development): Gavin Becker**
With over 25 years' experience in exploration and development, Tom brings valuable geological, exploration and corporate management experience and skills to the board of Lepidico. He has worked in remote and inhospitable regions throughout Australia, including the Yilgarn, Kimberley, central Australia and north-east Queensland and internationally in South-East Asia and Brazil. During this time he has been directly involved with the management of gold and copper discoveries in Australia and gold in Brazil. He is a member of the Australian Institute of Geoscientists and a member of the Australian Institute of Company Directors.	Gavin is a metallurgist with 40 years' industry experience. During that time he has worked in a variety of roles, including senior operational, R&D, FS and consulting roles on gold, uranium, base metal and specialty metal projects and/or operations. He holds a bachelor of science (Eng) degree from Imperial College, London, and completed his MBA at Bond University. He is a fellow of the Australasian Institute of Mining and Metallurgy and is an associate of the Royal School of Mines (UK).

Principal shareholders	(%)
Strategic Metallurgy	12.08
Galaxy Resources	11.64
Wythenshawe	2.38
BACCHUS CAP	2.08
Lycopodium Minerals	1.79
Perth Capital	1.60
Netwealth Investments Ltd/Australia	1.44

Companies named in this report

Lepidico, Galaxy, Grupo Mota, Albemarle, SQM, FMC, Sichuan Tianqi Lithium, Pioneer Resources, Venus Metals Corp, Maximus Resources, Avalon Advanced Materials, Crusader Resources, PanAust.