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Medallion Resources: There's Rare, Unearthly Value In This Hidden Rare Earth Gem

By Ben Kramer-Miller | September 11, 2015

This report should be read in conjunction with my audio interview with CEO Don Lay and Chief Technical Adviser Bill Bird. I suggest you read my article "What the Rare Earth Industry Faces" as well.

1: Overview

Medallion Resources (TSX.V: MDL) (OTCPK: MLLOF) is designing a business based on extracting REEs from the monazite sand found in heavy mineral sands tailings waste. Monazite sand is a rich source of REEs, yet large mineral sands mining companies don't find it worthwhile to extract the REEs themselves because the market is small and specialized (such a pursuit would be akin to BHP pursuing a $50 million project that takes years to develop–it simply won't happen). So it makes perfect sense for small entrepreneurs to come in to do this processing.

Despite this observation, the proposed strategy is uncommon among REE juniors, who are exploring and developing hard rock deposits (most of which are without appeal given current prices). Nevertheless it should be: generally speaking, **the monazite sands strategy is superior to the conventional mining strategies**, and I cite the following reasons for saying this:

- Monazite sand has a very high REE content relative to every single known REE deposit. While grade doesn't correlate exactly with operating costs it is a very good indicator.

- Medallion can be flexible in ways one cannot be when mining a deposit. First, the company can source monazite from several sources. Second, it can locate its processing plant based on the relative ease with which it can comply with regulations, hire qualified workers, easily obtain reagents…etc. Practically speaking, this last point means that it can place its plant in an area where it is easy and cost-effective to comply with radioactive waste disposal regulations (I believe this will be far and away the top deciding factor). Meanwhile, mining companies cannot simply ship raw 1-3% TREO Eq. ore across the world without one or more beneficiation steps, which greatly restrict where they can do their mineral processing. Third, Medallion can scale its project given market conditions when it looks for financing. This last point reveals a source of hidden leverage that is limited when operating a mine.
- The strategy is less expensive to finance than mining projects since it requires no mining or beneficiation. These initial steps are carried out by the supplying parties as a part of their other operations (the monazite ore will be delivered to Medallion as a high grade sand).
- The operations can be expanded very easily because the proposed project is more akin to a chemical plant than a mine. While a mining company can develop a second mine, it will have to go through the entire process (exploration, resource definition, PEA, PFS, FS, advanced engineering and then development). All Medallion has to do is secure an additional monazite sand supply and permit/build the second facility (and there's no reason why it can't be next door working with the same engineers, regulators, construction workers…etc.). This provides incredible optionality that goes well beyond REE-price leverage and that is unique to Medallion's monazite strategy.

While Medallion is not the only company claiming to be pursuing this strategy I believe it has a tremendous advantage over neophyte competitor Pele Mountain given its 3+ year head start. Numerous conversations with CEO Don Lay and Chief Technical Adviser Bill Bird have convinced me that over these years the company has acquired both knowledge and contacts that will be essential to developing the business. Such hurdles can only be overcome with time and effort, regardless of how much money one has at one's disposal. The importance of this can only be factored in when we consider that REE companies in the West understand very little relative to the Chinese, and the development of even what are relatively simple projects come with the added difficulties that come with inexperience.

The company's stock is also relatively inexpensive with a price of just C$0.03/share and 66.4 million shares outstanding. While REE stock prices have lost tremendous value Medallion's valuation is particularly low. I believe this reflects a belief on behalf of REE investors that most of the value left in these stocks is in the optionality value of these companies' deposits. Medallion may not have a deposit (it actually has an early exploration project in Labrador whose optionality value is negligible) yet we will see it's model incorporates other forms of optionality that are arguably greater than that realized by owning in-ground ore. More importantly, the company has an economic project in today's market environment. It also has considerable leverage to higher REE prices, as we will see presently.

The market valuation reflects the fact that investors do not understand the incredible advantage that Medallion has with respect to its peers given these attributes. Once investors realize that Medallion is a front-runner rather than a laggard the stock price will rise to reflect this reality. I will look at a couple of valuation scenarios presently, but it is safe to say that the potential return on an investment today is extraordinary. Note that **most REE companies are trading at valuations that are 5-10 times higher despite the fact that they have relatively high risk projects that don't make sense given current prices**. Even the most valuable companies–Lynas, Ucore and Northern Minerals–are all working on projects whose economics are dubious in today's market environment. There's no reason why Medallion should trade at a discount to virtually all of its peers, yet several justifying a premium valuation for the space.

2: Management

REE management teams in the West face an incredible challenge of competing with the Chinese, who conscientiously manage a global RE value-chain oligopoly. This oligopoly is more than just the result of a geological accident (even though the Chinese are well-endowed with rich REE-resources. It comes from decades of industrial development, no doubt through countless iterations of trial and error. Few people outside of China have built or operated an REE processing facility, and many of those who have did so decades ago.

Therefore it is critical that any REE management team be armed with as much experience and technical knowledge as possible. Technical Adviser Bill Bird has over a decade experience in the REE space from the industrial side as well as added experience/interest in REEs as an academic. The team of advisers he has chosen is weighted towards scientists with expertise in geology and mineralogy, including specialization in REEs (e.g. Tony Mariano, world-renowned REE mineralogist).

Evidence that the company has built a quality team goes beyond generic "experience" and academic accolades. The company has been developing the monazite sands strategy for more than 3 years, and while this period is peppered with missteps we've seen tremendous progress that has led to a barrage of recent accomplishments that go unacknowledged by the market. These include: (1) the appointment of a company to source monazite in southeast Asia, (2) the production of a REE concentrate at bench-scale starting with the sourced monazite and using techniques that have been proven at commercial scale, and (3) the production of a phosphate by-product that will add a cost-free revenue stream.

3: Strategy

The company's strategy is as follows:

1. Buy monazite sand
2. Extract a RE-concentrate from the monazite sand
3. Sell the RE-concentrate
4. Produce a phosphate by-product and dispose of radioactive waste

Buy Monazite Sand

Medallion Resources isn't mining a deposit–it is buying the tailings of another mine or group of mines. The company hasn't yet picked a source of monazite, although it has appointed a company–GHC Minerals–to source monazite tailings from southeast Asia. When choosing sources the companies will be focused on long-term source security, REE concentration/distribution, and cost.

The most important aspect of choosing a monazite source is supply security: management needs to be sure that the chosen supply sources can last for a long period of time and come with minimal supply disruption risk (e.g. as a result of political tension). It follows that the selection should be located in a relatively stable jurisdiction, and it should have a long life. In the interview Don tells me that the company is looking for sources of monazite tailings primarily from operating mines, and this makes sense given that the monazite stockpile doesn't deplete. Once Medallion has found secure source options it and its partner GHC can look into optimizing magnet metal content or TREO/total ore content.

Regarding REE distribution, monazite is 50-60% REEs. It mostly contains LREEs, with ~65% lanthanum and cerium (borderline waste and waste, respectively) and maybe 20% – 25% praseodymium and neodymium. These two are much more valuable at $53.5/kg and $38/kg for the oxides, and will comprise the bulk of Medallion's revenue. They are also among the most marketable REEs given that

they are essential in neodymium-iron-boron permanent magnets (note that praseodymium can be used as a substitute for neodymium in NdFeB magnets). Dysprosium and terbium–which are added to NdFeB permanent magnets in order to increase their coercivity–will also generate a fair amount of revenue for Medallion (~20%). These materials come in small amounts but have high values. There is almost no production of either element outside of China, meaning that these are at risk of a supply shock more so than the LREEs. It is worth noting, however, that the largest LREE mine in the West–Mountain Pass–is now in care and maintenance, meaning the supply shock effect for LREEs (namely Pr, Nd) would be greater now than it otherwise would have been just a few weeks ago.

The REE distributions of different monazites will vary only slightly, but REE distribution is important considering the potential value of a small increase in the four main elements in Medallion's prospective revenue stream.

To get a general idea of a realistic monazite REE distribution we can look pro forma REE distribution data compiled by the USGS.

REE	Pro forma Distribution
La	24.40 %
Ce	46.55 %
Pr	5.77 %
Nd	18.02 %
Sm	2.37 %
Eu	0.03 %
Gd	1.01 %
Tb	0.10 %
Dy	0.42 %
Y	1.26 %
Er	0.08 %

Regarding the monazite price, the company will be paying a small amount relative to the REE-value of the monazite–let's say 15%. The effective rate rises to ~16.5% when we consider that the company's recovery rate is estimated to be 91%. At current prices this basket has a fully separated value of $12.96/kg., meaning that Medallion should expect to pay **$2.14/kg**. of TREO equivalents.

The company will also have to pay to have the monazite sand shipped. I estimate that this will cost ~$800/t or $1.70/kg. of TREO, bringing the total cost of monazite to **$3.84/kg**. of TREO. This assumes shipment by boat from SE Asia and then by truck to the plant which will be in the central part of North America. However, this shipping cost estimate may be excessive given the company's flexibility to locate its processing facility near a rail line (rail is much cheaper than truck). I have to believe that minimizing shipping costs is on the agenda, and I wouldn't be shocked to see the figure come down by 50% or more. However for now I'll use the assumed $800/t. and recalculate again at a 10% discount ($720/t = $1.53/kg of TREO) given this likelihood, giving us an estimate of $3.67/kg. per kg. of TREO.

Extract REEs From the Monazite Sand

As I've emphasized Medallion has an enormous advantage in that it doesn't have to mine. This eliminates costly pre-mine development, permitting, and mining equipment expenses. Furthermore, since the company is buying sand it doesn't need to crush ore prior to leaching. Finally, it doesn't have to beneficiate the ore since it is already high grade. So Medallion investors can fast-forward through

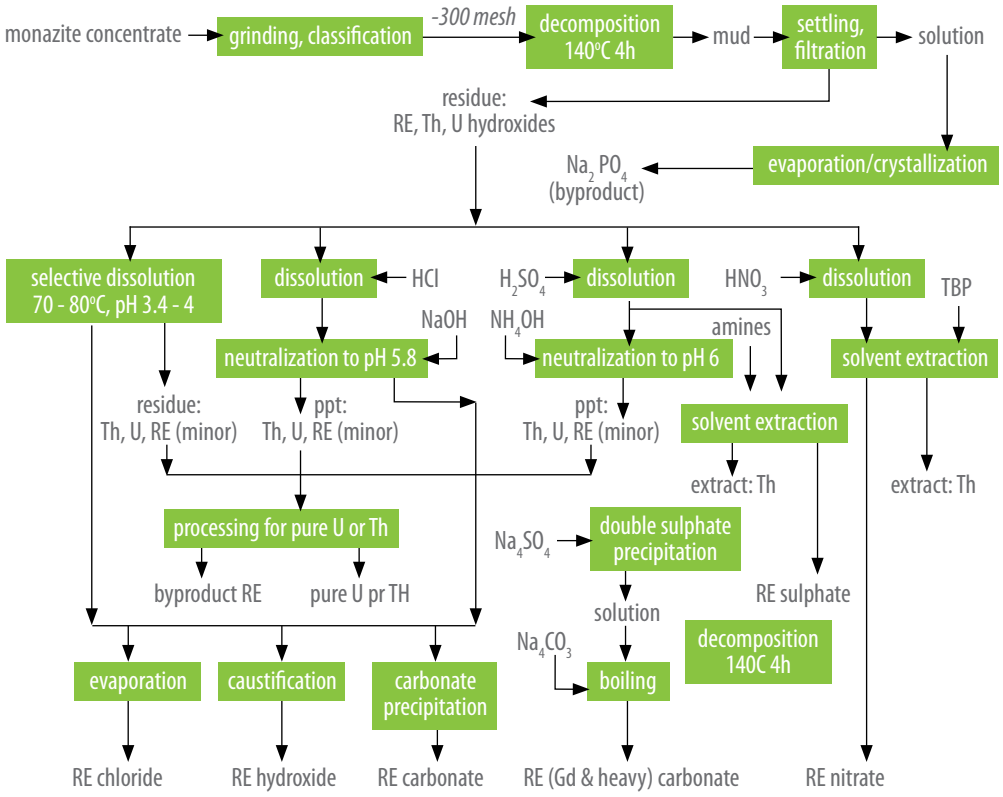
the drill-blast-haul-crush-beneficiate part of the process and start from there, namely at leaching. The REEs will be extracted from monazite sand using technology that has existed and been used to economically extract REEs since the 1950's. The process is **alkaline digestion**, which basically means that the company will take the monazite and dissolve it in sodium hydroxide (NaOH) at an elevated temperature (~140 degrees Celsius). Monazite is a REE phosphate (REE-PO4) (with REE being a rare earth element (or yttrium) with some thorium substitution (about 5% of the time)), and when alkaline digestion occurs the REE/Th ions are dissolved in the alkaline solution while sodium phosphate is precipitated. From here it can easily be removed, and by introducing lime a calcium phosphate animal feed product can be produced that is worth ~$400/tonne.

The dissolved Th (with small amounts of uranium) then needs to be removed, and so hydrogen chloride is added in order to precipitate the Th/U. Depending on the final desired REE concentrate product the remaining REE chloride solution can be further treated. Medallion likely intends to market a REE-carbonate concentrate, as this is the standard intermediate feedstock product of separation companies with which management has spoken. Therefore, I suspect that the current plan is to precipitate the REEs by adding sodium carbonate (Na2CO3).

The process is nothing new: in fact, a more generalized version of this process is illustrated in a flow-sheet found in the canonical Extractive Metallurgy of Rare Earths (Gupta and Khrishnamurthy, 2005).

Monazite Processing by Alkali Treatment

Generalized flow diagram for solvent extraction of REE, Th and U from monazite using ALKALINE decomposition (140°C) followed by separate treatments for insoluble precipitates by CCl (left leg) and NaOH solutes by nitric acid (right leg), where phosphate content of monazite is recovered as a byproduct of trisodium phosphate (Gupta and Krishnamurthy 2005).



Processing monazite should cost ~$3/kg. given estimated costs for labor, reagents, power, and SG&A. I've added a 10% contingency to get $3.30/kg. We should note that the most recent testwork has been more focused on making the process work than on optimizing it, and there are places where the company may be able to reduce costs. For instance, Bill mentions that Medallion might be able to cut reagent costs by recycling them. Since reagents should account for nearly half of the total operating costs, there may be significant room for savings.

Cerium Removal

Cerium's value has fallen so dramatically since the 2010/11 peak that it has essentially become a waste product: it costs more to extract and process than what it is worth on the market. Cerium also happens to be relatively easy to separate early from the other REEs. If the company takes the extra effort to remove cerium from its REE concentrate its basket value will rise considerably. Ce removal can easily be achieved through oxidation of Ce(III) to Ce(IV) and then selective precipitation (Gupta and Krishnamurthy). We don't have an opex estimate for this process, although it is considerably simpler and probably cheaper than solvent extraction, meaning that this extra effort could be extremely worthwhile. Note that since the company has not publicly addressed this issue (even though it is obvious that it will) I will not consider Ce removal in my economic scenarios.

Lanthanum removal is another option, although this is a less attractive proposition than cerium removal based on every major metric (metal value, ease of extraction, concentrate volume reduction…etc.). This doesn't mean it isn't an attractive proposition.

Sell a REE Concentrate

The final step is selling an REE concentrate to a separation company, or to have the refining company carry out the separation on a tolling basis. Given that the bulk of Medallion's revenues will presumably come from the most marketable REEs (Pr, Nd, Tb, Dy) the difference between the two should be relatively negligible, since no tremendous marketing effort will have to be made by the selling party.

As Don indicates in the interview, Medallion is exploring potential business relations with companies that are capable of separating REEs using solvent extraction, the primary technology used in separating out REEs. It is also exploring cheaper alternatives, although none of these has been developed to the point where they have sufficiently proven quantifiable inputs for Medallion's low-risk model. It is worth noting that if any of these companies develops a substantially cheaper separation process that Medallion is a potential beneficiary, since it should be able to realize more for its concentrate relative to its fully separated REO-equivalent value.

Separation pricing is a complicated issue for a couple of reasons. First, LREE separation is cheaper than HREE separation (Y is classified here with the HREEs). Based on informal inputs from a few sources I'm assuming that separation costs $4/kg. for La-Nd and $8/kg. for the rest of the REEs/Sc/Y. Second, the economics of separating individual elements varies, and an SX company is going to value a concentrate from Medallion or from any other company based on the value of separating each individual product. This means, for instance, that it is going to value a concentrate with a significant cerium component lower than the same concentrate minus the cerium–even though the cerium has market value–because separation costs more than this market value.

Phosphate By-Product & Radioactive Waste

The company will be producing a phosphate by-product. Phosphate makes up ~25-30% of monazite or roughly a third of the REE content. The product is worth ~$400/tonne, and the company will be producing 1,170 tonnes in the 3,500 tonne of REO scenario, and 3,330 tonnes in the 10,000 tonne REE scenario.

The company will also be producing radioactive waste: mostly thorium with small amounts of uranium and radium. The company has not yet worked out the details, however management has decided to place its processing facility in central North America where there is a lot of uranium production and oil and gas processing that deals with such waste streams, meaning that there is preexisting infrastructure

and policies in place that minimize the risk that Medallion won't be able to dispose of its radioactive waste safely and efficiently. Ideally Medallion can sell its waste stream to a company that can extract the uranium (a marketable product), thereby offsetting the cost of thorium disposal.

4: Project Size

Medallion's team has put forward a project size of 10,000 tonnes of TREO output per year (includes Ce, La). However the lousy market coupled with the project's flexibility means that management is likely considering a smaller–3,000 – 4,000 TREO output per year–project. Fortunately, this is not a big deal: the Medallion project is one that is relatively easy to scale up or down in response to changing market conditions. While smaller projects will generally have less attractive economics they will also attract financiers given that they require less capital. This is something that will be worked out between Medallion and its potential financiers. Since a small project is economical, and since the resource market is so lousy I am assuming that only the smaller project is viable at current prices from a practical standpoint. However, should the market recover, even just a little (I assume +30% after a 95% decline) both project sizes demonstrate robust economics, and financiers would be more willing to support the larger project.

5: Project Valuation

Despite the fact that REE prices are down I believe that Medallion's proposed project is economic. On the following table I've compiled current pricing data for the more common REE-oxides in order to arrive at a basket value for a typical monazite-derived concentrate. This figure (D13) was arrived at by multiplying each component's market value (column 'B') by its portion in Medallion's basket (column C), and then summing each element's contribution to the basket price (column D).

The REO market values (column E) and their respective contributions to Medallion's concentrate (column F) were recalculated from the perspective of a separation company, meaning that if a component's value is lower than the cost to separate it, then we assume that it adds negative value to the concentrate (i.e. is effectively waste).

REE	$/kg.	Distribution	ConValue/kg	RefinVal/Kg	RefinConValue
La	$2.05	24.40%	$0.50	$(1.95)	$(0.48)
Ce	$1.88	46.55%	$0.88	$(2.12)	$(0.99)
Pr	$53.50	5.77%	$3.08	$49.50	$2.85
Nd	$38.00	18.02%	$6.85	$34.00	$6.13
Sm	$1.95	2.37%	$0.05	$(6.05)	$(0.14)
Eu	$160.00	0.03%	$0.04	$152.00	$0.04
Gd	$16.90	1.01%	$0.17	$8.90	$0.09
Tb	$400.00	0.10%	$0.41	$392.00	$0.40
Dy	$210.00	0.42%	$0.89	$202.00	$0.86
Y	$4.90	1.26%	$0.06	$(3.10)	$(0.04)
Er	$38.30	0.08%	$0.03	$30.30	$0.02
Total		**100.00%**	**$12.96**		**$8.75**

The following table is the same in every way except I increased REO prices by 30% across the board. Note that below columns B-F have been shifted one letter over (e.g. data from B is now in C).

REE	$/kg	Distribution	ConValue/kg	RefinVal/kg	RefinConValue
La	$2.67	24.40%	$0.65	$(1.34)	$(0.33)
Ce	$2.44	46.55%	$1.14	$(1.56)	$(0.72)
Pr	$69.55	5.77%	$4.01	$65.55	$3.78
Nd	$49.40	18.02%	$8.90	$45.40	$8.18
Sm	$2.54	2.37%	$0.06	$(5.47)	$(0.13)
Eu	$208.00	0.03%	$0.05	$204.00	$0.05
Gd	$21.97	1.01%	$0.22	$17.97	$0.18
Tb	$520.00	0.10%	$0.53	$516.00	$0.53
Dy	$273.00	0.42%	$1.16	$269.00	$1.14
Y	$6.37	1.26%	$0.08	$2.37	$0.03
Er	$49.79	0.08%	$0.04	$45.79	$0.04
Total		**100.00%**	**$16.84**		**$12.75**

I have devised three scenarios that will help us better understand the project's valuation. The first assumes current prices, 3,500 tonnes of TREO Eq. production per year. The second two both assume that prices rise 30%: one assumes 3,500 tonnes of TREO Eq. production, and the other assumes 10,000 tonnes.

I didn't bother putting together assumptions for a lower price environment: despite the fact that the project is economic in the current market environment it is highly sensitive to REE prices, meaning that a small decline could put the project on hold. I will factor in a zero-valuation scenario when valuing the company below.

	Scenario 1	Scenario 2	Scenario 3
Basket Value (kg)	$8.75	$12.75	$12.75
Costs:			
Monazite (kg)	$(3.75)	$(4.39)	$(4.39)
Processing (kg)	$(3.30)	$(3.30)	$(3.30)
OCF/kg.	$1.70	$5.06	$5.06
OCF	$5,950,000.00	$17,710,000.00	$50,600,000.00
Phosphate			
$/tonne	$400.00	$400.00	$400.00
Volume (tonnes)	1170	1170	3330
Phosphate OCF	$468,000.00	$468,000.00	$1,332,000.00
Total	**$6,418,000.00**	**$18,178,000.00**	**$51,932,000.00**
Initial Capex	$(20,000,000.00)	$(20,000,000.00)	$(50,000,000.00)
Project Life (years)	25	25	25
Discount Rate	10%	10%	10%
Pre-tax NPV	$38,256,442.84	$145,002,433.45	$421,388,842.23
IRR	32%	91%	104%

We should note that there are additional sources of revenue not factored into this model. The primary one is Ce removal. Ce costs the separation company $1/kg. to remove because its value is so low relative to that of separation via solvent extraction. Ce can more easily be removed using selective oxidation, and since such a large portion of the modeled RE-concentrate consists of Ce (almost half) this makes sense. So, for instance, if Medallion could remove Ce for just $1/kg. cheaper it would save a whopping $4.7 million and grow its OCF in scenario #1 by nearly 80%.

Smaller, yet meaningful improvements could include:

- Reagent recycling: I estimate reagent costs to be ~$1.30/kg. TREO Eq. on reagents (sodium carbonate, hydrochloric acid…etc.). If the company can reduce reagent consumption via recycling (a hypothesis that hasn't yet been tested) then it can reduce its operating costs.
- Lanthanum removal: Lanthanum is another waste product that costs more to separate from a concentrate than it is worth. Medallion could find a way to remove it from the concentrate that is cheaper than sending it to the SX facility.

6: Risks

We've seen that the monazite strategy is less risky than competing strategies for many reasons. Nevertheless, Medallion faces many challenges going forward.

Financing: The company is going to have a difficult time raising pre-development funds given weakness in the resource space. Furthermore, any capital raise at or near the current valuation is going to be highly dilutive. The company will need to raise money for a prefeasibility study (or equivalent), a pilot plant, and a full feasibility study (equivalent).

REE Pricing: Prices remain in a cyclical bear market. While the recent Mountain Pass shutdown could catalyze prices higher I'm concerned that overcapacity and economic weakness could continue to pressure them. The good news is that Medallion's costs will be among the lowest in the industry, but even this isn't necessarily enough to ensure the project's viability.

Concentrate Value: Note that this is different from REE-values, since the concentrate value is a function of both REE-prices and separation costs. Separation costs could rise if REE-prices rise (a good scenario but Medallion's leverage is diminished) or if input costs rise. Medallion is probably well shielded from the latter scenario given the recent deflationary tendencies in commodities–especially REE-prices.

Operations: We cannot stress the extent to which Medallion's project has been de-risked from an operations standpoint both on a relative basis and in general. First, we've seen how the company can avoid several steps to which mining companies will have to devote a substantial amount of time and capital with no guarantee of success. Mining, more generally, is risky given that while you could think you have a good understanding of the geology you may not (think Midway Gold). Monazite is a mineral with highly predictable attributes (and Medallion's contracts will guarantee that any monazite it buys meets certain specifications, no doubt in part complying with metallurgical standards that minimize uncertainties with respect to REE-distribution and deleterious material composition (e.g. minimize Th-content)). Second, the monazite strategy utilizes only technologies that have been proven at scale and that are being used today. Third, Medallion will likely be able to recruit experienced individuals for select positions. Fourth, even for those without direct experience REEs and uranium have similar metallurgy, meaning that those metallurgists in central North America from the uranium industry should be qualified to operate the plant. We have to note, however, that there are going to be operational uncertainties with any start-up operation, and that cash-flow figures during the first several quarters could be disappointing when we compare them with estimates.

Medallion Doesn't Actually Own REEs: This is really just a perceived risk but it is worth discussing. Investors might mistakenly believe that just because Medallion doesn't own a deposit of REEs that it is missing out on leverage. After all the cost of monazite rises if the contained REE-prices rise, and in a price spike we could see a mineral sands company demand a larger percentage of the REE value, especially since Medallion's failure to comply could open the door for a competitor willing to accept a smaller margin. Nevertheless we've seen that the company has tremendous leverage if prices rise even a modest 30%. We will see that there are other ways for the company to leverage a stronger REE-market (some are unique to Medallion). We have also seen that the attractiveness of the business at first glance masks the underlying difficulties that face newcomers, meaning that any prospective competitors are likely years away from being able to enter the market. Where there is risk regarding this is that REEs and REE-bearing minerals are considered strategic resources by governments, meaning that we could see monazite export restrictions (we already have these in India and Brazil) that directly impact Medallion, whose strategy is to export monazite from one or more of the few countries that have a lot of it. Even then there is monazite in several countries, including the United States.

Monazite Sources

Countries with 50,000+ tonnes

7: Company Valuation

Investors need to consider three factors when valuing a company such as Medallion. The first is the project's valuation, which I calculated to be $38 million at today's prices. The NEV/NPV ratio is going to vary widely with each trade in Medallion's stock since it trades with such a wide bid/ask on a percentage basis, but it is roughly 5%. The second consideration consists of the intangible factors: project optionality and the potential for expansion once the first plant is up and running. Finally, we need to figure out the risk that the stock is worthless. This is an "all or nothing" bet, meaning there's no reasonable scenario in which Medallion can be a viable business and be worth less than it is today, so all scenarios that aren't successes will be valued at zero.

If we assume today's REE prices, then Medallion's project has a pre-tax NPV (10%) of $38.3 million. We would like to be highly confident in this figure but admittedly have to be presumptuous with some of our inputs since we don't really know what things will cost until the company actually pays for them. Still, several inputs were conservative. Meanwhile, there are ways in which the company can improve

its margins. With that in mind, and given the other project advantages discussed above, a 5% NEV/NPV multiple is too low. If this were a project focused on a more common resource such a low-risk project in the development stage would be at least trade at half of its project's NPV. Given that this is the rare earths space and that there is a presumed "opacity discount," I'm using a 25% multiple, or $9.6 million (C$12.7 million).

Regarding the project's optionality, let's first take a step back to observe that virtually all of the real value in the REE-junior sector is in this optionality. The mining projects are generally uneconomic as a group considering the precipitous decline in REE-prices. Consider that most of these companies saw their largest two products–lanthanum and cerium–become waste (for HREE investors yttrium is also likely a waste product at $4.90/kg.). But because REEs are so critical–especially in the West–there is a firm belief among remaining investors that prices will rebound.

Given the fact that in recent years no market has suffered as large a decline as the REE-sector, and given its criticality, we believe the presence of discounted optionality is a legitimate reason to bet on the REE-space. However, the real potential is misunderstood: the market has mistakenly placed its bets on mining companies to get this leverage. Investors assume that if REE-mines have stable costs and if REE-prices rise that they will get a leverage that is correlated to the project's costs (which are, at this point, only hypothetical). Based on companies' various economic assessments, if we take prices meaningfully higher from here these projects are worth hundreds of millions, if not billions of dollars vs. today's valuations of $10-$20 million. Assuming these guys do what they say they can there is incredible leverage here.

However, these companies simply don't have the leverage that Medallion does, although it isn't immediately apparent. We will note four sources of "optionality" or financial benefits from a rising REE-price.

First, Medallion will obviously benefit as REE-prices rise, although the benefit is dampened somewhat by the floating cost of monazite. The dampening effect is minimal however: if REE-prices rise just 30% from here the project's NPV grows nearly 4-fold.

Second, as REE prices rise Medallion's project is more likely to succeed, meaning that it makes sense for the market to ascribe a higher NEV/NPV multiple. This is a function of market sentiment so it is difficult to predict. I am assuming 40%, which is low for a project such as Medallion's.

Third, the probability that Medallion will develop the larger project grows as REE-prices rise: the economics of the project improve so financiers feel more comfortable lending them money and more eager to own the options and warrants that will be tacked on as a bonus. If management pursues the 10,000 tpa. project–which would be preferable given its higher NPV and IRR with respect to the 3,500 tpa. project–the value of the project grows 11-fold. This is a source of optionality that is largely unavailable to mining companies, who are restricted in their production by constricting geologic, infrastructural, and permitting factors.

Before discussing the fourth source of optionality let's look at the incredible value potential we've just revealed. If we increase the NEV/NPV multiple to 40%, increase REE-prices 30%, and grow the project to 10,000 tpa. the project is worth $168 million. This is hardly an unlikely scenario given everything we've just seen, yet even if we ascribe just a 5% probability to it we get $8.4 million in value

Finally, if the company is able to successfully develop its first facility it will be well positioned to develop more of them. Given the advantages of the monazite sands strategy it is feasible that Medallion could set up several of these facilities over time (the company has showed preference for horizontal vs. vertical integration). As this happens the market could easily grow to consider Medallion as the preeminent North American REE producer. Needless to say that this is a very long-term goal, and despite the relatively clear path to such a scenario we have to consider it as low-probability given everything mentioned above plus timeline risk.

But market perception is everything. Keep in mind that many investors are convinced that another company–Ucore–can achieve something similar with respect to the REE-separation technology it is pursuing, and the market has ascribed a whopping $43 million valuation on this stock given this conviction (of which I'm highly skeptical) (note that, like with most other projects Ucore's Bokan is well under water with price assumptions at a sizable multiple to current levels,). I'm not saying that Medallion should be worth $43 million, but it is worth pointing out how the market's perception of who the "winners" are can have a tremendous impact on valuations.

If we assign a 40% probability of failure (0 valuation), a 49% of the base case assuming an NEV/NPV multiple of 25% ($4.7 million in valuation), a 5% probability for each of scenarios 2 and 3 assuming an NEV/NPV multiple of 40% ($2.9 million and $8.4 million in respective valuations) and a 1% probability of the company developing 3 10,000 tpa. facilities using a 60% NEV/NPV multiple and valuations in scenario 3 ($7.6 million), then we get an estimated valuation of **$23.6 million, or $0.355/share (C$31.1 million, or C$0.469/share)**.

8: Investment Thesis

It is rare to see a company trade at such a low valuation despite the fact that its project is so attractive. The projected returns are staggering for investors who purchase shares at or near today's price. We believe that these projections aren't outlandish and that they can be realized as the market re-rates Medallion shares. This re-rating doesn't require any fundamental improvements to the story as I present it above, but rather a reevaluation of Medallion on the part of REE investors as the most advanced and knowledgeable company developing the simplest, least inexpensive project.

The attractiveness of the project–the sum of all of the advantages stated above–is a function of its simplicity, and the project's simplicity is a product of management's acute understanding of the REE-industry. After all, we've seen that there has been an enormous amount of planning that has gone into this strategy as it exists today, and we can conclude that right now what is so valuable about Medallion is something most REE-companies lack, which is intellectual capital. It is this intellectual capital, more so than anything else, that has convinced me that the sizable returns discussed above are well within reach.

We can make all of these points with respect to Medallion Resources in spite of the relentless bear market we've seen in REE-prices. Prices are unsustainable at these levels since the vast majority of the industry is uneconomical. Yet this market reality doesn't change the fact that there is very little REE-production outside of China. Furthermore, there is virtually no dysprosium or terbium production outside of China. All of these factors combine to create a strong fundamental bull case for REEs, along with the real possibility for a shortage to develop, especially outside of China. By extension the bullish factors that will drive REE prices higher longer term also serve to strengthen the bull case for Medallion Resources.

I own shares of Medallion Resources.

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