

# The Rising Star in the Manganese Battery Space

It seems appropriate having just written on Great Western's recent travails to take a look at the executives that first brought GWG to its initially success before decamping to their new vehicle Star Minerals (CSE: SUV). Nowadays the company is a Saskatoon-based, diversified exploration-stage company, with a primary focus on strategic technology metals. Star Minerals was known as Star Uranium up until October 2013.

In 2013 Star entered into a joint venture on Great Western's rare earth project in Saskatchewan, Hoidas Lake. This we shall discuss briefly a bit further along. Star also holds a gold exploration property in the Seabee gold mining district, diamond properties in the Fort a la Corne region as well as base metal and uranium properties. However the company's direction is now starting to crystallise with a recent deal signaling that Electrolytic Manganese, in a mine to market format, is the mineral the company has decided to pursue.

## **Manganese**

Manganese is a chemical element with symbol Mn and atomic number 25. It is not found as a free element in nature; it is often found in combination with iron, and in many minerals. Manganese is a metal with important industrial metal alloy uses, particularly in stainless steels.

Manganese is the world's twelfth most prevalent mineral and is mined in South Africa, Australia, China, Brazil, Gabon, Ukraine, India and Ghana and Kazakhstan. It is the fourth most traded metal with annual production (in 2011) amounting to an estimated 14 million tonnes. As a direct shipping ore (DSO) it has become in recent years almost the exclusive preserve of mega-producers, and smaller players have

disappeared. One of the largest players has been BHP-Billiton (with mines in Australia and South Africa) while the largest player in North America is probably Grupo Autlan in Mexico. The BHP Manganese assets (amongst others) are shortly going to be cast adrift when the South32 demerger operation is effected.

## **Battery Usage – Covering the Gamut**

We should start by noting that manganese is currently employed in that most prosaic of battery formats, the alkaline battery (think AA or AAA). There is nothing new in that but it does provide a constant demand for manganese and has done for over half a century. It is also one in which little effort goes into the recycling of the manganese metal.

More relevance to Star's move is the application known as the Lithiated Manganese Dioxide (LMD) Battery. The standard mix of LMD used in batteries contains 4% Lithium, 61% manganese and 35% oxygen by atomic weight. The attractions of this format are that LMD has high power output, thermal stability and enhanced safety when compared to other lithium ion battery types. For these reasons LMD batteries are currently being used in the Chevy Volt and Nissan Leaf. Research at the University of Illinois has achieved an advanced prototype battery, using Lithiated Manganese that can be recharged in as little as two minutes (equivalent to filling a gas tank).

Battery consumption of Electrolytic Manganese Dioxide (EMD) has been predicted to be fastest growing segment of manganese production.



## **Electrolytic Manganese**

Manganese scarcely gets a mention in the Canadian markets for several reasons. The main one is that the trade is so dominated by the bulk metal trade that juniors are just not

players (or have not been in recent memory) while a secondary factor is that Canada and the US and peculiarly poorly resourced in this metal so if juniors or majors have dabbled it has tended to be those in Australia that have done so.

Despite this the metal does have relevance to the North American economy with the USA being the largest consumer of EMD globally at 41%. Currently there is no production of electrolytic manganese in North America. For a long while American Manganese was the great white hope for this mineral in North America but never seemed to get escape velocity.

### **The Recent MOU**

In early December 2014, Star Minerals announced the signing of a Memorandum of Understanding with Cooperative Mineral Resources (CMR) of Brainerd, Minnesota and Octopus Technologies (of Vancouver, BC) to cooperate on developing a mine-to-market manganese-based battery technology. This was a key strategic shift designed to take Star into the business of finding, exploring and developing strategic metal deposits for the battery industry. By implication, as with many others in the REE space, it might be seen as a distancing from that over-crowded sector.

CMR is owned 100% by Crow Wing Power, which is a member-owned electric utility, with the cooperative distributing electricity to 37,000 customers in Cass, Crow Wing and Morrison counties in rural Minnesota.

### **The Emily Deposit**

In 2009, CMR began work to advance the development of the Emily Manganese/Iron Ore Project located near Emily, Minnesota on the Cuyuna Iron Range.

Although manganese has been reported at various places in the Emily district, its distribution has not been studied in detail, partly because of the pervasive alteration, partly

because of a relatively thick glacial cover, and also partly because the resource was considered to be an extension of that in the better-known North range.



The ultimate goal of the project is to supply electrolytic manganese metal to the steel industry and electrolytic manganese dioxide to the battery industry. CMR has undertaken extensive work including exploration core drilling, bulk sampling at Emily and mineralogical and metallurgical testing at recognized analytical laboratories, and has been successful in producing EMM and EMD from samples taken at Emily.

In May 2013, Barr Engineering of Minneapolis completed a report entitled "Mineral Resource Report on the Emily Manganese Project Minnesota" compiling historic and modern data from the CMR work to produce an historic estimate of manganese mineralization at the Emily deposit. The Barr estimate incorporates drilling results from three separate drilling programs; the first from October 1945 to June 1950, the second in September and October 2011, and the third in October and November 2012 for a total of 20 drill holes totaling 8,861 feet.

Based on the report, the deposit ranges from:

- 4 billion pounds of contained manganese grading at 16.48% Mn at a cut-off grade of 10% Mn
- to 2.2 billion pounds of contained manganese grading at 9.2% Mn at a cut-off grade of 1% Mn

Star and CMR intend to enter into an agreement forming a joint venture to develop the Emily deposit dependent upon proof of the project's technical and economic viability.

### **The Offtakers**

OTI is an energy storage company which has developed a

smaller, lighter battery that significantly reduces the cost of energy storage and is suited for backup/standby power applications and smart grid management systems. OTI is in a strategic partnership with Kemetco Research in building the prototype battery for testing and certification. Kemetco also specializes in extractive metallurgy and chemical processing and has done extensive work for CMR on manganese metallurgy.

The initial focus will be to produce EMD to be sold to OTI in an offtake agreement between OTI and the CMR/Star JV (though terms are yet to be established. OTI has in turn completed and signed a sales distribution agreement, for their storage battery, with a significant global player in this market. The time frame of all this is quite short as CMR and Star intend to complete and sign the JV agreement by the end of February 2015 with OTI and the JV having signed their offtake agreement by the same date. OTI will have provided details of the sales agreement between themselves and the significant distributor by the end of February 2015. Of course with so many parties there is always the potential for slip-up in coordinating the sequence of final deals. Amongst the potential pitfalls are that Kemetco and OTI must come to an agreement on completing the test facility for their battery plant and final terms need to be agreed between Kemetco and the JV to build the test facility to produce EMD.

### **A Few Words of Hoidas Lake**

The Hoidas Lake project in northern Saskatchewan is made up of 14 mineral claims, totaling about 12,490 hectares. The deposit has, according to Star, one of the highest proportions of neodymium (Nd) present in any known rare earth deposit and this element is of particular strategic importance to the permanent magnet industry. The Measured and Indicated resource for Hoidas Lake amounts to around 50,000 tonnes of contained TREE grading at 2.027% by weight.

Back in October 2013 Great Western Minerals signed an option

and joint venture agreement with Star for the Hoidas Lake project, executing on a preliminary deal inked back in June 2013.

Under the terms of the deal, Star was given the option to acquire a 51% stake in the property, separated into two tranches. The first option would give Star a 25% interest, and is contingent on the company completing an NI 43-101 compliant preliminary economic assessment at the project within two years. In March 2014 Star engaged Barr Engineering to complete the required PEA report however this has yet to be released.

The additional option, for the remaining 26%, is dependent on Star finishing a feasibility study during a four year period after exercising the first option.

## **Conclusion**

The management team at Star are undertaking the increasingly common task these days of “turning the supertanker” with a morphing from a Rare Earths company into a manganese (and technology metals) company. At least the Hoidas Lake REE asset is not one that is too advanced or that has had too much effort expended upon it. It can sit in the freezer a bit longer without too much harm being done.

With American Manganese preserved in aspic there was a space for a North American producer of Manganese (particularly Electrolytic Manganese) and Star have clearly decided to move into the space elbowing AMY to the side. Management at Star must also be breathing a sigh of relief at moving into a metal where the metallurgy is an order of magnitude simpler than the REE space they have left behind.

The move on the Emily property ticks the boxes on the torturous path to reestablishing domestic US sources of production in a swathe of strategic metals that have fallen into a state of neglect due to expediency. At least the Star crew will not have to surf the mosh-pit of wannabes that

crowded them out of the Rare Earth space. EMD is a much sparser populated space. The coming month should see some of the technical accords and JVs of the various parties involve start to slot into place and then the Spring should see work on Emily kick up to verify its potential for mining.