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Euro Manganese Inc.

Manganese: the Cinderella battery mineral

The coming boom in battery demand has thrust a range of previously obscure minerals into the spotlight. Lithium, the one non-negotiable ingredient of all economically viable vehicle batteries, continues to take centre stage.

A sample of high purity manganese metal, an essential raw material for most electric vehicle batteries.

Other cathode materials such as cobalt and nickel, and anode materials such as spherical graphite, are all attracting investor attention, with junior projects springing up to meet demand forecasts. But manganese, a key ingredient on some of the most commercially suitable battery chemistries, has remained the Cinderella battery mineral through all of this.

On the face of it, the lack of investor interest is easy to understand. Manganese ore is abundant and cheap, with production well placed to grow to meet any shortfall in demand.

"Manganese is the forgotten battery metal," Andrew Zemek, special advisor at CPM Group, told Mining Journal.

"Why is it overlooked? Because it's too cheap."

In fact, it is the very cheapness and abundance of manganese ore that makes manganese so appealing to battery makers. Car manufacturers can choose from a wide array of competing cathode chemistries, all with their own drawbacks and advantages. Not all these chemistries contain manganese, but around half of new projects are based on manganese chemistries.

The reason for this is that manganese offers battery makers a good way to reduce or eliminate the use of cobalt, perhaps the most problematic metal given that it is expensive, volatile, and mostly mined in the Democratic Republic of Congo, where producers have struggled for years with traceability and transparency of supply.
"There is a tug of war between cobalt and manganese," Zemek says. "From an engineering point of view, cobalt is

the ideal product. But it has two drawbacks. One problem is where it comes from, and the other one is its price."
If you look at the price history, manganese is an innocent baby, cobalt is a big bully."

But if battery makers are banking on the price stability of manganese, they may be in for a shock. "There is a deficit brewing in [high purity] manganese," Zemek says. "Global production would need to grow more than 10 times to satisfy demand. It's plentiful, it's everywhere, it's cheap, but the lack of the high-purity product could derail every other battery project. We want to believe in the invisible hand [of the market], but it's not quite happening," Zemek warns.

"The announced capacities do not satisfy demand."

So battery makers are starting to wake up to the fact that despite the seeming abundance of manganese, sourcing this material at the required purity, and at the required environmental standards, is about to get very difficult.

"This small and obscure corner of the market is facing an emerging challenge," Zemek says." Demand is set to rise by 42% per year over the next five years, and 36% over the next 10 years."

The key to the manganese paradox, that it is both abundant and hard for cathode makers to source, is that rechargeable battery-grade material needs to be of an extremely high purity, and in particularly to have almost no selenium. Battery makers can source the element as a high-purity sulphate suitable for direct inclusion in cathodes, or as a high-purity metal used as a feedstock for their own sulphate production. This means that high-purity manganese, which makes up some some 0.5% of the total market by volume, can support very different price trends compared with the lower-grade material that goes to steel making, agriculture, and primary (ie, non-rechargeable) battery cells.

Supply of high-purity manganese is currently highly concentrated, with almost all supply coming from China. And even within China, this market is getting more concentrated. Since 2021, control of high-purity manganese production has been consolidated by a producer's cartel, dubbed the "manganese innovation alliance".
But even if supplies from China are ample to meet battery production projections, and that is a big if, that may not be

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Euro Manganese CEO, Matt James

enough for automotive markets. As pressure increases on manufacturers to meet stringent ESG standards, opaquely sourced manganese from the Chinese commodity markets could prove a headache. So buyers are starting to have to look at other origins to source their manganese from. And there is currently a worrying shortage of new projects to meet this demand. One junior looking to meet the growing shortfall is Element 25, which is developing the Butcherbird project in Australia.

The company is currently working to produce high-purity manganese sulphate from production there. And South Africa's Manganese Metal Company, which already supplies high-purity selenium free metal as a feedstock for battery applications, is moving to cut out the middle man with planned high-purity manganese sulphate production.

Matt James, chief executive of Euro Manganese, sees non-Chinese supply as key to helping automative manufacturers meet their ESG commitments. James took the helm of Euro Manganese in 2021 and the company is working to develop the Chvaletice asset in the Czech Republic.

"The customers are looking for a very green raw material, so the whole value chain has to be clean and green," James told Mining Journal. "What customers are looking for is a life-cycle assessment that demonstrates that traceability and sustainability." James says that these demands are unlikely to be met by existing battery manganese supply. "Where the Chinese are likely to struggle will be traceability," James said. "Chinese supply comes from ore mined mostly in Africa, to traders, and then through to processors. Also, we don't feel the Chinese environmental standards will be up to what customers are looking for."

Illustration of the future state of the Chvaletice Manganese Project site after it is restored to productive community use.

Chvaletice is the most advanced non-Chinese battery-grade manganese project in the world, and the only advanced European project. In January 2022 the company received US$6.7 million in funding from the EBRD. It is working to complete a demonstration plant that will allow it to deliver tonnes of samples to customers for certification, the key step before locking in the offtake agreements that will allow construction on the project to move ahead. Chvaletice plans to produce high purity sulphate and metal from manganese oxide tailings from a mine that was decommissioned in the 1970s.

"The funding from the EBRD is an endorsement of our ESG credentials. From an environmental perspective we're recycling old tailings, which makes this really a remediation project, as much as a mining project," James aid. "The manganese in the tailings is of a lower grade than standard ore, but it is a carbonate mineral. That means you can upgrade it without a high-temperature process, unlike the majority of manganese supply, which are oxide ores."

James reported ready interest from customers, who feel the need to lock in manganese supplies before the rapid ramp up of European battery processing.

"Historically the customers have been more focused on lithium, nickel and cobalt. There's a sense now they're turning their attention to manganese. The perception has been that there's plenty of manganese, but where the bottle neck is in the high purity processing capacity."

George Donne, vice president of business development at Giyani, which is developing a high grade manganese asset in Botswana, also reported high consumer interest in the planned production. "We're speaking to a lot of non-Chinese cathode and precursor companies. They see the need in the future to diversify away from China," Donne said.

"They need to understand not just the current market but the future. Compared to lithium, there's almost nothing coming up in manganese. It's a huge, huge challenge. [...] You can't sit back and wait, or all the supply will be gone. All the non-Chinese producers will be sold out."

As with other battery grade manganese juniors, Giyani is basing its value proposition not on the supply of manganese ore as a feedstock, but on their ability to upgrade it to the specifications required by consumers.

"It's the plant that's the value. We're a miner, but we're a chemical and processing company," Donne said.

But the tiny number of new projects in the high-purity space will have to work fast to capture growing demand. With a slew of new battery projects in Europe and the US slated to come online from 2023 onwards, the race is now on for manganese juniors to get their material into the cathodes.

But the tiny number of new projects in the high purity space will have to work fast to capture growing demand, particularly as they will need to produce sulphate in the tonnages needed. This schedule is going to be hard to hit, Zemek says. "If they were going to be ready to meet the demand on time, they should be much more advanced," he warns.

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