The World's Next High Grade Vanadium Mine

An Interview with Vincent Algar, Managing Director of Australian Vanadium

Mastermines interview with Vincent Algar of Australian Vanadium Limited dated 9th April 2018. Published in English and Chinese Simplified.

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Questions compiled and submitted by David Gillam of Mastermines using questions from both Australian Vanadium Limited investors and Mastermines staff.

Mastermines ask questions that we believe shareholders most wish to ask. Management are not consulted in relation to the format of questions. No consideration is given to the capacity of such questions to be answered and in some cases, there may be legal or regulatory constraints in answering. We use a text-based interview format which allows more considered responses and a less guarded approach to on-the-spot questions. Such a format also suits reporting in additional languages such as Chinese, German etc.

Please Note: Mastermines and/or Mastermines employees are currently invested in Australian Vanadium Limited and therefore have an interest in this stock. In addition, Mastermines are currently engaged as consultants to Australian Vanadium Limited.

Australian Vanadium Limited is listed on the Australian Stock Exchange – ASX:AVL

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David Gillam – Mastermines. How would you personally compare the AVL deposit with the top few vanadium mines in the world?

Vincent Algar – Australian Vanadium. *In my view Gabanintha is highly comparable in size and grade and metallurgical characteristics to other operating mines. Our technical work so far confirms its ability to generate high quality and yield of vanadium concentrate, which is a key feedstock for the chemical processing required to produce high quality vanadium pentoxide for steel and battery use.*

David Gillam – Mastermines. How far advanced are discussions to use Windimurra and how important is Windimurra to AVL success?

Vincent Algar – Australian Vanadium. *We have an open dialogue with Atlantic and the Windimurra team. There are good and long-standing relationships between members of our respective teams. Windimurra has indicated publicly that they must proceed with a review process to re-open the mine and plant. Having use of an operating Windimurra processing plant for Gabanintha concentrate products would be the fastest way for AVL to get Gabanintha into the production of vanadium. However, it's is not the only way, and building our own processing plant is our current primary objective.*

David Gillam – Mastermines. Has AVL had discussions with the large battery manufacturers such as Rongke, Pu Neng and others?

Vincent Algar – Australian Vanadium. *Since the creation of VSUN Energy inside AVL, we have had strong dialogue and relationships with the various players in the VRFB space including Rongke, Pu Neng, Gildemeister, Sumitomo, WattJoule and redT Energy. We have met with all of them and others in Australia and Europe and understand their specific requirements for high quality V_2O_5. We have also developed an intimate understanding of issues around electrolyte with our R&D work at UWA, (University of Western Australia), and with our electrolyte pilot plant. Of all the Australian vanadium companies, we have the best understanding of this area when it comes to integrating vanadium production into the battery markets. Our plan is to use our unique understanding in the development of products from our operation.*

David Gillam – Mastermines. Why do you consider AVL to be the most likely high-grade deposit that's closest to production?

Vincent Algar – Australian Vanadium. *There are many reasons, but our primary reason is the team we are now developing. Daniel Harris (Tech Director), Todd Richardson (PFS Study Manager-internal), and Brian McNab, (External), have specific global vanadium project development experience giving us a team that is the envy of all the other projects in the world, (producing and not producing). This team will attract others of similar quality. Combined with project characteristics that are very comparable to operating mines such as Largo and Bushveld, we will put ourselves in the top position to get Gabanintha into production first.*

David Gillam – Mastermines. Does oxidization present any issues or add to the cost of mining?

Vincent Algar – Australian Vanadium. *It should be noted that unless a glacier recently scoured your deposit (such as Black Rock in Canada), oxidation from weathering is always a factor near surface in deposits globally. At Gabanintha, this oxidation varies from 10m to 50m below surface and its effect is to lower magnetic yield. It does not affect material that becomes less oxidised below these weathering boundaries. It does not remove the vanadium from the ore. The vanadium is in fact, pre-oxidised, so saving the roasting step. The challenge is to develop a simple process to capture these vanadium credits and we will be able to do this in our final circuit. It will not add to the cost of mining, but it requires diligence to understand its distribution and to reduce any reduction of yield while mining any oxide. Blending and mine schedule optimisation are key methods to reduce any potential effects and this is my own personal area of expertise and interest. One I look forward to applying to Gabanintha as we progress our studies.*

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David Gillam – Mastermines. How would you compare the processing path of AVL against the acid leach method considered by some other deposits?

Vincent Algar – Australian Vanadium. *Our ability to process conventionally, (sodium salt roast, hydrous leach), is a major factor in developing Gabanintha. This is the process which is most widely used in high grade TVM, (Titanium Vanadium Magnetite,) deposits, (roughly above 0.6% V_2O_5 ore grade), and the only one being used in the world's current producing vanadium mines, (excluding by-product vanadium).*

Many of the parameters are well understood and use well tested off-the-shelf technology. The high ore and concentrate grades at Gabanintha point to this being the best process for us to use. Many of the new projects fall into the low and very-low grade categories hence require a different approach. These projects have chosen the experimental hydrometallurgical options, (high temp acid leach), often to try and recover revenue streams from iron and titanium. So far none of these have ever been commercialised on low grade TVM deposits anywhere in the world. Subsequently. long delays and teething problems are expected and will occur. Due to the extra engineering and complex chemistry, (particularly acid management), these new projects have estimated capital costs nearly double the standard process. AVL is very pleased to have the team and the deposit to develop a conventional vanadium project.

David Gillam – Mastermines. Why is AVL able to use a roast and aqueous leach while others are forced to acid leach?

Vincent Algar – Australian Vanadium. *The basic reason is our concentrate grade, mass yield, very low silica and coarse grind size which make it conducive to this process. (see my previous answer).*

David Gillam – Mastermines. Are you able to estimate a production cost range for AVL's V_2O_5 and how would it compare to the few largest operating mines in the world?

Vincent Algar – Australian Vanadium. *Our benchmarks are Largo's, (TSX:LGO), Brazilian operations and Bushveld's, (AIM:BMN), South African operation. These are currently producing at around US$3.5-US$4 per pound V_2O_5 (C1 Cost). This is our current objective and we believe it can be achieved.*

David Gillam – Mastermines. How important is silica content in processing and where does AVL stand?

Vincent Algar – Australian Vanadium. *Silica and alumina must be kept low in any processing. In the roast method low silica improves roasting yields and efficiency. Our concentrate studies have shown we can easily produce material that will be around 1-1.5% SiO_2 and therefore an excellent roast result can be expected.*

David Gillam – Mastermines. How important is iron content in processing and where does AVL stand?

Vincent Algar – Australian Vanadium. *The iron contains the vanadium credits, so the higher the grade of the iron in the concentrate the more vanadium it can carry. We currently have iron grades in the high 50%. Our target is to maximise this by blending from the orebody.*

David Gillam – Mastermines. How important is grain size in processing and where does AVL stand?

Vincent Algar – Australian Vanadium. *When using the roasting method, a coarser grind is preferable to avoid problems with particles that are too fine in the kiln. Gabanintha has excellent coarse grind characteristics. Additionally, fine grinding costs a lot of energy, and our comminution work to date has shown we have to expend only modest energies to liberate our best concentrate. This is another huge advantage Gabanintha has. High energy costs have large implications on capital and operating costs.*

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David Gillam – Mastermines. When do you realistically expect the PFS to be complete.

Vincent Algar – Australian Vanadium. *Our team is in place and we are working on final aspects of the circuit design. The next three months will be dedicated to this process and our current plan expects this to be done by the end of June. Obviously getting it right is more important, so if we take a bit longer it will be because we want to nail down the optimal design.*

David Gillam – Mastermines. China is obviously on the agenda. Where else is AVL focused on in search of the right partners to help progress the project?

Vincent Algar – Australian Vanadium. *Chinese steel producers, battery producers and large intermediaries are all on the hunt for long term vanadium. New mines are the obvious choice. The same is true of European and U.S players. Through our various existing relationships and new marketing efforts we will seek to understand the landscape and advance discussions in the coming months. Our intention is to put MOU's in place followed by detailed offtake agreements when the project reaches DFS stage next year.*

David Gillam – Mastermines. Are you confident you have the right skill-sets available to progress to mine as efficiently as possible?

Vincent Algar – Australian Vanadium. *Absolutely. See Question 4.*

David Gillam – Mastermines. How important do you see the VSUN Energy side of the business and what can we expect for the rest of 2018?

Vincent Algar – Australian Vanadium. *Much of the interest we have in the commodity and company is centred around its use as a battery metal. Of great assistance is AVL and VSUN's knowledge of how the VRFB, (vanadium redox flow battery), market works, which target customers and opportunities fit best, and our relationship with battery makers. Our aim of vertical integration is still part of our strategy. We believe this is a significant value-add for investors and offers AVL as a unique investment in the green-tech space.*

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