ASX Announcement

High Purity Vanadium Pentoxide Produced

Positive benchscale testwork achieves target V_2O_5 flake product quality and exceptional roast leach vanadium extraction

Highlights:

- **High Purity 99.4% Vanadium Pentoxide (V_2O_5)** produced from pre-pilot testwork. Product quality is comparable to standard products from existing global producers.
- Latest roast-leach process testing demonstrates the dual benefits of **pelletising** and **increased roasting temperatures**. Bench scale optimisation tests show a significant improvement in vanadium roast leach extraction compared to the basis applied in the PFS.
- Improved vanadium recovery in the refinery process can potentially deliver an overall improvement in post-tax project **Net Present Value (NPV_8) of US$14.3M for every 1% increase**, assuming a price of US$13/lb.
- The AVL mine standard product is expected to be of outstanding quality by selection of the **APV precipitation process**. This change to the PFS flowsheet has potential to simplify the refinery circuit and lower both capital and operating costs.
- **Pilot scale testwork** is advancing. CMB circuit continuous testing on 4 tonne and 2 x 10 tonne typical mine life material blends are due for completion in early July 2019. Representative concentrate samples will proceed immediately to pilot scale roast-leach and hydrometallurgical refining testwork (Q3 and Q4, 2019).

Australian Vanadium Limited (ASX: AVL, "the Company" or "AVL") is pleased to provide an update on the metallurgical testwork currently underway for The Australian Vanadium Project ("the project") including the production of high purity vanadium pentoxide using methods typical of those planned for the final project.

Managing Director Vincent Algar commented, "With the first production of a producer-peer comparable high-purity product and the significant process improvements identified, our confidence increases further as we continue to improve and derisk the project with each step forward."

28th May 2019

ASX ANNOUNCEMENT

Australian Vanadium Limited

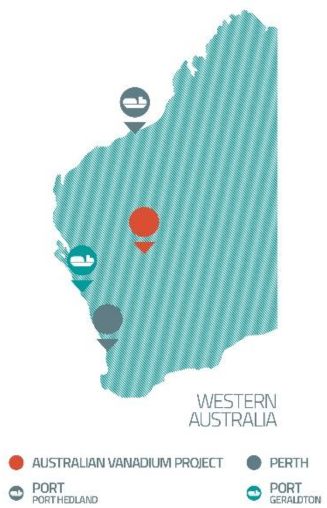
ASX: AVL
FRA: JT7.F
ABN: 90 116 221 740
T: +61 8 9321 5594
F: +61 8 6268 2699
E: info@australianvanadium.com.au
W: australianvanadium.com.au

Address:

Level 1, 85 Havelock Street
West Perth WA 6005

Projects:

The Australian Vanadium Project – Vanadium
Blesberg, South Africa –Feldspar
Nowthanna Hill – Uranium/Vanadium
Coates – Vanadium



Metallurgical Testwork Summary

A benchscale metallurgical testwork program has been undertaken to optimise the refinery flowsheet for the Australian Vanadium Project. Results have identified improvements to the Pre-Feasibility Study (PFS) design and show that higher vanadium recoveries and lower reagent usage can be anticipated in the planned pilot scale testing which will be used to support the finalised DFS design. (See ASX announcement dated 19 December 2018 '*Gabanintha Pre-Feasibility Study and Maiden Ore Reserve*' for details of the PFS).

The standard AVL process commences with physical crushing, milling and magnetic separation of ore to make a concentrated product, followed by a soda ash roast and further refining to produce a high quality V_2O_5 product which constitutes typical alkaline roast leach refining for vanadium processing.

Roasting tests were performed on magnetic concentrate that had been pelletised using a binder. Roasting at optimised temperature and reagent conditions resulted in a vanadium roast leach extraction of 94%, a substantial increase from 88% without pelletising. This compares with the roast vanadium extraction of 87.9% applied in the PFS.

An alternative vanadium production route known as APV (ammonium polyvanadate) was tested on the leachate produced by roasting and generated a final product quality of 99.4% V_2O_5, which was independently verified by an accredited laboratory (see Plate 1). The APV process showed reduced reagent consumption and the potential to eliminate the desilication step required in the AMV (ammonium metavanadate) process which was considered in the PFS.

Plate 1 - AVL's V_2O_5 product (right hand side image of product under microscope)

These encouraging results are guiding the overall design of the refinery circuit and are expected to have positive impacts on the project economics. AVL is currently modifying the refinery pilot testwork scope of work to incorporate the learnings from the benchscale program.

V_2O_5 Production

Hydrometallurgical testing was undertaken on vanadium liquors generated from the optimised salt roast leach tests. These liquors underwent two technically-mature vanadium refining routes, namely the AMV route and the APV route. The AMV route was selected for the PFS, however upon comparing results from the recent testing, it was clear that the APV route had three distinct advantages:

1. Higher V_2O_5 product purity and lower deleterious constituents,
2. Lower reagent consumption, particularly ammonium sulphate and aluminium sulphate , and
3. A desilication step was not required.

Utilising the APV production route, AVL has produced a V_2O_5 product at a purity of 99.4%. An abridged chemical analysis (assay) of the V_2O_5 is presented in Table 1. This is anticipated to be the standard product capable of being produced by the project when in operation. The chemical analysis indicates low levels of minor elements and is comparable with products from the best operating mines and vanadium refineries globally. This assay gives AVL further confidence in the flowsheet and the processing route selected.

Table 1: V_2O_5 powder – chemical analysis

XRF Assay [weight %]												
V_2O_5	Fe	$Na_2O + K_2O$	Si	Al_2O_3	As	CaO	Cr	MgO	Mn	Mo	P	S
99.40	0.01	0.35	BDL	0.002	0.04	0.02	0.10	0.01	BDL	0.01	0.01	0.07

BDL is below detection limit

Since open circuit testing was applied where streams are not recycled, there is opportunity to improve results for all tests during the upcoming refinery pilot testwork. Following the refinery pilot testwork program larger samples will become available to evaluate further V_2O_5 purification, targeting products to service the vanadium redox flow battery and specialty chemical markets.

Improved Roast Leach Parameters

Benchscale tests were undertaken to investigate the effects of roasting and leaching variables on vanadium extraction and to reduce the co-extraction of deleterious elements. The concentrates tested were generated from bench scale testing of diamond core samples considered indicative of oxide, transitional and fresh material types. Variables such as sodium flux type and addition rate, roast temperature and time, particle size, pellet size and quench temperature were investigated. This was achieved by changing one variable at a time whilst controlling the other variables. It was shown that:

1. Soda ash as the sodium flux type performed better than either sodium sulphate alone or for various mixtures of the two. Best results showed 96% vanadium roast leach extraction for soda ash in comparison to 91% when substituting with sodium sulphate.
2. Increasing the roast temperature to 1250°C resulted in an increase in vanadium roast leach extraction, up to 96% with pelletised feed. The base case parameters applied in the PFS were a 87.9% vanadium extraction to leach at a roast temperature of 1150°C.
3. Pelletising with a binder achieved a 3% increase in vanadium extraction whilst reducing the co-extraction of deleterious elements. Pelletising in a large kiln results in additional benefits such as the reduction of dust recycle in the kiln and prevention of slag rings that can be caused by excessive fines.
4. Calcine quench temperatures had a negligible effect on vanadium extraction. Leach tests were performed at 450°C, 250°C and 90°C. This result will be reconfirmed in pilot scale testwork and if validated will have capital and operating cost benefits associated with simplifications to the kiln and leach circuit in the final design.

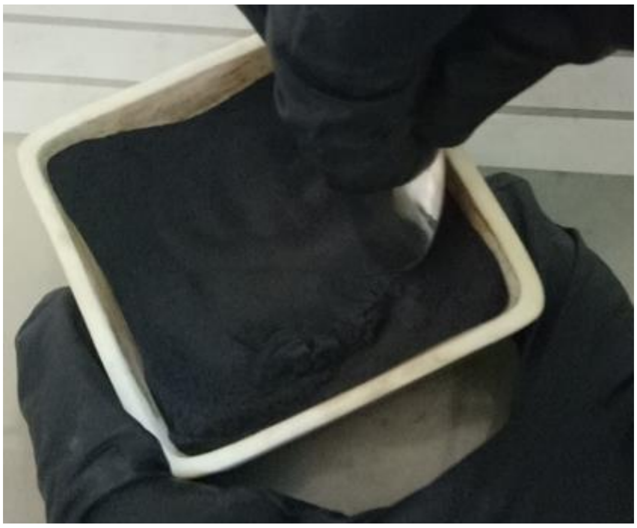



Plate 2 - Magnetic concentrate prior to roasting (left) and post roasting (right)

Project Economics Impact – increased vanadium recovery

Optimisation bench scale testing indicates higher vanadium roast leach extraction than adopted for the PFS. The PFS design was based on a vanadium roast leach extraction of 87.9% and indicative tests have shown extractions as high as 96% for optimised bench conditions. A full refinery circuit vanadium balance and therefore vanadium recovery, will be developed from the pilot testwork program (Q3 and Q4, 2019).

The PFS adopted an 80.4% LOM average vanadium recovery for the refinery circuit. Improved vanadium recovery in the refinery process can potentially deliver an overall improvement in post-tax project Net Present Value (NPV_8) of US$14.3M for every 1% increase, assuming a price of US$13/lb.

AVL's Managing Director, Vincent Algar commented, 'AVL's aim is to become the world's lowest cost vanadium producer and our team is achieving regular breakthoughs to bring the costs down and further improve the project economics. We have a strong focus on seeking to understand our unique mineralisation in detail through the analysis of historical and current drilling programs, test work and studies.

Only by having a thorough understanding of the deposit and process we're working with, will we have the greatest chance of success throughout the mine's life. Having a project design which achieves such a high quality standard product using proven technology, further demonstrates the strength of the Company's processing design and reflects on the quality of our technical team at AVL.'

Pilot Study Progress

The pilot testwork program is advancing as planned. The Crushing Milling and Beneficiation (CMB) circuit continuous testing on 1 x 4 tonne and 2 x 10 tonne typical mine life material blends is due for completion in early July 2019.

For further information, please contact:

Vincent Algar, Managing Director

+61 8 9321 5594

About Australian Vanadium

AVL is a resource company focused on vanadium, seeking to offer investors a unique exposure to all aspects of the vanadium value chain – from resource through to steel and energy storage opportunities.

AVL is advancing the development of its world-class Australian Vanadium Project. The Australian Vanadium Project is currently one of the highest-grade vanadium projects being advanced globally with 183.6Mt at 0.76% vanadium pentoxide (V_2O_5), containing a high-grade zone of 96.7Mt at 1% V_2O_5 with an Ore Reserve of 9.82Mt at 1.07% V_2O_5 Proved and 8.42Mt at 1.01% V_2O_5 Probable Resource, reported in compliance with the JORC Code 2012 (see ASX announcement dated 19 December 2018 '*Gabanintha Pre-Feasibility Study and Maiden Ore Reserve*')

AVL has developed a local production capacity for high-purity vanadium electrolyte, which forms a key component of VRFB.

AVL, through its 100%-owned subsidiary VSUN Energy Pty Ltd, is actively marketing VRFB in Australia.

Competent Person Statement – Metallurgical Results

The information in this announcement that relates to Metallurgical Results is based on information compiled by independent consulting metallurgist Brian McNab (CP. B.Sc Extractive Metallurgy), Mr McNab is a Member of AusIMM. Brian McNab is employed by Wood Mining and Metals. Mr McNab has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which is undertaken, to qualify as a Competent Person as defined in the JORC 2012 Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Mr McNab consents to the inclusion in the announcement of the matters based on the information made available to him, in the form and context in which it appears.

Section 1: Sampling Techniques and Data

Criteria	JORC Code Explanation	Commentary
Sampling techniques	Nature and quality of sampling (e.g. cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.	The Australian Vanadium Project deposit was sampled using diamond core and reverse circulation (RC) percussion drilling from surface. During 2019 a further 30 PQ diamond drill holes have been completed to collect metallurgy sample for a plant pilot study. 12 are drilled down-dip of the high-grade zone. These were complimented by an additional 18 PQ diamond drill tails on RC pre-collars, drilling vertically. These holes are measured by hand-held XRF at 50 cm intervals to inform metallurgy characterisation but will not form part of any resource estimation update unless certified laboratory analysis is completed on a cut portion of the drill core. At the time of the latest Mineral Resource estimation (November 2018), a total of 250 RC holes and 20 diamond holes (6 of which are diamond tails) were drilled into the deposit. 59 of the 251 holes were either too far north or east of the main mineralisation trend or excised due to being on another tenancy. One section in the southern part of the deposit (holes GRC0156, GRC0074, GRC0037 and GRC0038) was blocked out and excluded from the resource due to what appeared to be an intrusion which affected the mineralised zones in this area. Of the remaining 191 drillholes, one had geological logging, but no assays and one was excluded due to poor sample return causing poor representation of the mineralised zones. Two diamond holes drilled during 2018 were not part of the resource estimate, as they were drilled into the western wall for geotechnical purposes. The total metres of drilling available for use in the interpretation and grade estimation was 17,530m at the date of the most recent resource estimate. The initial 17 RC drillholes were drilled by Intermin Resources NL (IRC) in 1998. These holes were not used in the 2015 and 2017 estimates due to very long unequal sample lengths and a different grade profile from subsequent drilling. 31 RC drillholes were drilled by Greater Pacific NL in 2000 and the remaining holes for the project were drilled by Australian Vanadium Ltd (Previously Yellow Rock Resources Ltd) between 2007 and 2018. This drilling includes 20 diamond holes (6 of which are diamond tails) and 76 RC holes, for a total of 20,974m drilled. All of the drilling sampled both high and low-grade material and were sampled for assaying of a typical iron ore suite, including vanadium and titanium plus base metals and sulphur.
	Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.	2019 PQ core has not been sampled. Handheld XRF machines being used to take ½ metre measurements on the core have been calibrated using pulps from previous drilling by the Company, for which there are known head assays. 2018 HQ diamond core was half-core sampled at regular intervals (usually one metre) with smaller sample intervals at geological boundaries. 2015 diamond core was quarter-core sampled at regular intervals (usually one metre) and constrained to geological boundaries where appropriate. 2009 HQ diamond core was half-core sampled at regular intervals (one metre) or to geological boundaries. Most of the RC drilling was sampled at one metre intervals, apart from the very earliest programme in 1998. RC samples have been split from the rig for all programs with a cone splitter to obtain 2.5 – 3.5 kg of sample from each metre. Field duplicates were collected for every 40th drill metre to check sample representativity from the drill rig splitter.

Criteria	JORC Code Explanation	Commentary
	Aspects of the determination of mineralisation that are Material to the Public Report.	RC drilling samples were collected at one metre intervals and passed through a cone splitter to obtain a nominal 2-5kg sample at an approximate 10% split ratio. These split samples were collected in pre-numbered calico sample bags. The sample was dried, crushed and pulverised to produce a sub sample (~200g) for laboratory analysis using XRF and total LOI by thermo-gravimetric analysis. Diamond core was drilled predominantly at HQ size for the earlier drilling (2009) and entirely HQ for the 2018 program, with the 2015 and 2019 drilling at PQ3 size. Field duplicates, standards and blanks have been inserted into the sampling stream at a rate of nominally 1:20 for blanks, 1:20 for standards (including internal laboratory), 1:40 for field duplicates, 1:20 for laboratory checks and 1:74 for umpire assays.
Drilling techniques	Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc.) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc.).	Diamond drillholes account for 14% of the drill metres used in the Resource Estimate and comprises HQ and PQ3 sized core. RC drilling (generally 135 mm to 140 mm face-sampling hammer) accounts for the remaining 86% of the drilled metres. Six of the diamond holes have RC pre-collars (GDH911, GDH913 & GDH916, 18GEDH001, 002 and 003), otherwise all holes are drilled from surface. No core orientation data has been recorded in the database. 17 RC holes were drilled during the 2018 program and three HQ diamond tails were drilled on RC pre-collars for resource and geotechnical purposes. The core was not orientated but all diamond holes were logged by OTV and ATV televiewer. Six RC holes from the 2018 campaign are not used in the resource estimate due to results pending at the time of the latest update, and two diamond holes drilled during 2018 were not used as they are for geotechnical purposes and do not intersect the mineralised zones. During 2019 a further 12 PQ diamond holes have been drilled down-dip on the high-grade zone for metallurgical sample, but have not been sampled for assay analysis, and do not form part of any resource estimation. An addition 18 PQ diamond tails on RC pre-collars have been drilled vertically and are expected to contribute to the resource.
Drill sample recovery	Method of recording and assessing core and chip sample recoveries and results assessed.	Diamond core recovery is measured when the core is recovered from the drill string. The length of core in the tray is compared with the expected drilled length and is recorded in the database. For the 2019, 2018 and 2015 drilling, RC chip sample recovery was gauged by how much of the sample was returned from the cone splitter. This was recorded as good, fair, poor or no sample. The older drilling programmes used a different splitter, but still compared and recorded how much sample was returned for the drilled intervals. All of the RC sample bags (non-split portion) from the 2018 programme were weighed as an additional check on recovery. An experienced AVL geologist was present during drilling and any issues noticed were immediately rectified. No significant sample recovery issues were encountered in the RC or PQ drilling in 2019.
	Measures taken to maximize sample recovery and ensure representative nature of the samples.	Core depths are checked against the depth given on the core blocks and rod counts are routinely carried out by the drillers. Recovered core was measured and compared against driller’s blocks. RC chip samples were actively monitored by the geologist whilst drilling. All drillholes are collared with PVC pipe for the first metres, to ensure the hole stays open and clean from debris.

Criteria	JORC Code Explanation	Commentary
	Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	No relationship between sample recovery and grade has been demonstrated. Two shallow diamond drillholes drilled to twin RC holes have been completed to assess sample bias due to preferential loss/gain of fine/coarse material. Geologica Pty Ltd is satisfied that the RC holes have taken a sufficiently representative sample of the mineralisation and minimal loss of fines has occurred in the RC drilling resulting in minimal sample bias.
Logging	Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.	All diamond core and RC chips from holes included in the latest resource estimate were geologically logged. Diamond core was geologically logged using predefined lithological, mineralogical and physical characteristics (such as colour, weathering, fabric, texture) logging codes and the logged intervals were based on lithological intervals. RQD and recoveries were also recorded. Minimal structural measurements were recorded (bedding to core angle measurements) but have not yet been saved to the database. The logging was completed on site by the responsible geologist. All of the drilling was logged onto paper and was transferred to a SQL Server drillhole database using DataShedTM database management software. The database is managed by Mitchell River Group (MRG). The data was checked for accuracy when transferred to ensure that correct information was recorded. Any discrepancies were referred back to field personnel for checking and editing. All core trays were photographed wet and dry. RC chips were logged generally on metre intervals, with the abundance/proportions of specific minerals, material types, lithologies, weathering and colour recorded. Physical hardness for RC holes is estimated by chip recovery and properties (friability, angularity) and in diamond holes by scratch testing. From 2015, drilling also had magnetic susceptibility recorded, with the first nine diamond holes (GDH901-GDH909) having readings taken on the core every 30 cm or so downhole. Holes GDH910 to GDH917 had readings every 50 cm and RC holes GRC0159 to GRC0221 had readings for every one metre green sample bag. 2018 RC drill holes also have magnetic susceptibility data for each one metre of drilling. All resource (vs geotechnical) diamond core and RC samples have been logged to a level of detail to support Mineral Resource estimation to and classification to Measured Mineral Resource at best. Geotechnical logging and OTV/ATV data was collected on three diamond drillholes from the 2018 campaign, by consultant company Dempers and Seymour, adding to an existing dataset of geotechnical logging on 8 of the 2015 diamond drillholes and televiewer data for four of the same drillholes. In addition, during 2018 televiewer data was collected on a further 15 RC drillholes from various drill campaigns at the project. PQ diamond drill holes completed during 2019 have handheld XRF readings per half metre, in addition to KT-10 magnetic susceptibility readings at the same core locations. They are being geologically and geotechnically logged in detail by the site geologists.

Criteria	JORC Code Explanation	Commentary
	Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc.) photography.	Logging was both qualitative and quantitative in nature, with general lithology information recorded as qualitative and most mineralisation records and geotechnical records being quantitative. Core photos were collected for all diamond drilling.
	The total length and percentage of the relevant intersections logged.	All recovered intervals were geologically logged.
Sub-sampling techniques and sample preparation	If core, whether cut or sawn and whether quarter, half or all core taken.	The 2018 and 2009 HQ diamond core was cut in half and the half core samples were sent to the laboratories for assaying. Sample intervals were marked on the core by the responsible geologist considering lithological and structural features. No core was selected for duplicate analysis. The 2015 PQ diamond core was cut in half and then the right-hand side of the core (facing downhole) was halved again using a powered core saw. Quarter core samples were sent to the laboratories for assaying. Sample intervals were marked on the core by the responsible geologist considering lithological and structural features. No core was selected for duplicate analysis. 20-30% of the total PQ diamond drill holes from 2019 will be sampled, through cutting a wedge from the core. This sample will be available for assay analysis. The portions of core to be sampled are still to be selected.
	If non-core, whether riffled, tube sampled, rotary split, etc. and whether sampled wet or dry.	RC drilling was sampled by use of an automatic cone splitter for the 2018 and 2015 drilling programmes; drilling was generally dry with a few damp samples. Older drilling programmes employed riffle splitters to produce the required sample splits for assaying. One in 40 to 50 RC samples was resampled as field duplicates for QAQC assaying.
	For all sample types, the nature, quality and appropriateness of the sample preparation technique.	The sample preparation techniques employed for the diamond core samples follow standard industry best practice. All samples were crushed by jaw and Boyd crushers and split if required to produce a standardised ~3kg sample for pulverising. The 2015 programme RC chips were split to produce the same sized sample. All samples were pulverised to a nominal 90% passing 75 micron sizing and sub sampled for assaying and LOI determination tests. The remaining pulps are stored at an AVL facility. The sample preparation techniques are of industry standard and are appropriate for the sample types and proposed assaying methods.
	Quality control procedures adopted for all sub-sampling stages to maximize representivity of samples.	Field duplicates, standards and blanks have been inserted into the sampling stream at a rate of nominally 1:20 for blanks, 1:20 for standards (including internal laboratory), 1:40 for field duplicates, 1:20 for laboratory checks and 1:74 for umpire assays. Also, for the recent sampling at BV, 1 in 20 samples were tested to check for pulp grind size.
	Measures taken to ensure that the sampling is representative of the in-situ material collected, including for instance results for field duplicate/second-half sampling.	To ensure the samples collected are representative of the in-situ material, a 140mm diameter RC hammer was used to collect one metre samples and either HQ or PQ3 sized core was taken from the diamond holes. Given that the mineralisation at the Australian Vanadium Project is either massive or disseminated magnetite/martite hosted vanadium, which shows good consistency in interpretation between sections and occurs as percentage values in the samples, Geologica Pty Ltd considers the sample sizes to be representative. Core is not split for duplicates, but RC samples are split at the collection stage to get representative (2-3kg) duplicate samples.

Criteria	JORC Code Explanation	Commentary
		The entire core sample and all the RC chips are crushed and /or mixed before splitting to smaller sub-samples for assaying.
	Whether sample sizes are appropriate to the grain size of the material being sampled.	As all of the variables being tested occur as moderate to high percentage values and generally have very low variances (apart from Cr_2O_3), the chosen sample sizes are deemed appropriate.
Quality of assay data and laboratory tests	The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.	All samples for the Australian Vanadium Project were assayed for the full iron ore suite by XRF (24 elements) and for total LOI by thermo-gravimetric technique. The method used is designed to measure the total amount of each element in the sample. Some 2015 RC samples in the oxide profile were also selected for SATMAGAN analysis that is a measure of the amount of total iron that is present as magnetite (or other magnetic iron spinel phases, such as maghemite or kenomagnetite). SATMAGAN analysis was conducted at Bureau Veritas (BV) Laboratory in early 2018. Analysis results of the relevant portions of the RC holes by Satmagan are pending, but underway. Although the laboratories changed over time for different drilling programmes, the laboratory procedures all appear to be in line with industry standards and appropriate for iron ore deposits, and the commercial laboratories have been industry recognized and certified Samples are dried at 105ºC in gas fired ovens for 18-24 hours before RC samples being split 50:50. One portion is retained for future testing, while the other is then crushed and pulverised. Sub-samples are collected to produce a 66g sample that is used to produce a fused bead for XRF based analysing and reporting. Certified and non-certified Reference Material standards, field duplicates and umpire laboratory analysis are used for quality control. The standards inserted by AVL during the 2015 drill campaign were designed to test the V_2O_5 grades around 1.94%, 0.95% and 0.47%. The internal laboratory standards used have varied grade ranges but do cover these three grades as well. During 2018, three Certified Reference Materials (CRMs) were used by AVL as field standards. These covered the V_2O_5 grade ranges around 0.327%, 0.790% and 1.233%. These CRMs are also certified for other relevant major element and oxide values, including Fe, TiO_2, Al_2O_3, SiO_2, Co, Ni and Cu (amongst others). Most of the laboratory standards used show an apparent underestimation of V_2O_5, with the results plotting below the expected value lines, however the results generally fall within ± 5-10% ranges of the expected values. The other elements show no obvious material bias. Standards used by AVL generally showed good precision, falling within 3-5% of the mean value in any batch. The standards were not certified but compared with the internal laboratory standards (certified) they appear to show good accuracy as well. Field duplicate results from the 2015 drilling all fall within 10% of their original values. The BV laboratory XRF machine calibrations are checked once per shift using calibration beads made using exact weights and they performed repeat analyses of sample pulps at a rate of 1:20 (5% of all samples). The lab repeats compare very closely with the original analysis for all elements. 2019 PQ diamond core is not yet sampled, but any core sampled will be subject to the same process outlined above for previous drill campaigns.

Criteria	JORC Code Explanation	Commentary
	For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.	The geophysical readings taken for the Australian Vanadium Project core and RC samples and recorded in the database were magnetic susceptibility. For the 2009 diamond and 2015 RC and diamond drill campaigns this was undertaken using an RT1 hand magnetic susceptibility meter (CorMaGeo/Fugro) with a sensitivity of 1 x 10^{-5} (dimensionless units). The first nine diamond holes (GDH901 – GDH909) were sampled at approximately 0.3m intervals, the last eight (GDH910 – GDH917) at 0.5m intervals and the RC chip bags for every green bagged sample (one metre). During 2018 and 2019 RC and diamond core has been measured using a KT-10 magnetic susceptibility metre, at 1 x 10^{-3} ssi unit. In addition to the handhold magnetic susceptibility described above the 2019 drilling included downhole magnetic susceptibility. This was taken using a Century Geophysical 9622 Magnetic Susceptibility tool. The 9622 downhole tool sensitivity is 20 x 10^{-5} with a resolution of 10cm 2019 diamond core is being analysed using an Olympus Vanta pXRF with a 20 second read time. The unit has been calibrated using pulp samples with known head assays from previous drill campaigns by the Company. Standard deviations for each element analysed are being recorded and retained. Elements being analysed are: Mg, Al, Si, P, S, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Y, Zr, Nb, Mo, Ag, Cd, Sn, Sb, W, Hg, Pb, Bi, Th, and U. Four completed diamond drillholes were down hole surveyed by acoustic televiewer (GDH911, 912, 914 and 915) as a prequel to geotechnical logging during the 2015 drill campaign. A further six holes from the 2018 campaign have been down hole surveyed using acoustic televiewer and optical televiewer (18GEDH001, 002 and 003 and partial surveys of 18GERC005, 008 and 011) for 627 metres of data. Televiewer data was also collected during 2018 on some of the holes drilled in 2015 and prior. The holes surveyed were GRC0019, 0024, 0168, 0169, 0173, 0178, 0180, 0183, 0200 and Na253, Na258 and Na376 for a further 286.75 m of data. All 12 of the 2019 down dip PQ holes have been televiewer surveyed.
	Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.	QAQC results from both the primary and secondary assay laboratories show no material issues with the main variables of interest for the recent assaying programmes.
Verification of sampling and assaying	The verification of significant intersections by either independent or alternative company personnel.	Diamond drill core photographs have been reviewed for the recorded sample intervals. Geologica Pty Ltd Consultant, Brian Davis, visited the Australian Vanadium Project site and the BV core shed and assay laboratories in September 2015 and on multiple occasions over a 10-year period. Whilst on site, the drillhole collars and remaining RC chip samples were inspected. All of the core was inspected in the BV facilities in Perth and selected sections of drillholes were examined in detail in conjunction with the geological logging and assaying. Resource consultants from Trepanier have visited the company core storage facility in Bayswater and reviewed the core trays for select diamond holes.
	The use of twinned holes.	Two diamond drillholes (GDH915 and GDH917) were drilled to twin the RC drillholes GRC0105 and GRC0162 respectively. The results show excellent reproducibility in both geology and assayed grade for each pair.

Criteria	JORC Code Explanation	Commentary
	Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.	All primary geological data has been collected using paper logs and transferred into Excel spreadsheets and ultimately a SQL Server Database. The data were checked on import. Assay results were returned from the laboratories as electronic data which were imported directly into the SQL Server database. Survey and collar location data were received as electronic data and imported directly to the SQL database. All of the primary data have been collated and imported into a Microsoft SQL Server relational database, keyed on borehole identifiers and assay sample numbers. The database is managed using DataShed™ database management software. The data was verified as it was entered and checked by the database administrator (MRG) and AVL personnel
	Discuss any adjustment to assay data.	No adjustments or calibrations were made to any assay data, apart from resetting below detection limit values to half positive detection values.
Location of data points	Accuracy and quality of surveys used to locate drillholes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.	The 2019 drill holes have been set out using a real-time Kinematic (RTK) GPS system. At completion of drilling the collar positions were picked up by a professional surveyor with an RTK system. For the 2018 drilling, all collars were set out using a handheld GPS. After drilling they were surveyed using a Trimble RTK GPS system. The base station accuracy on site was improved during the 2015 survey campaign and a global accuracy improvement was applied to all drillholes in the Company database. For the 2015 drilling, all of the collars were set out using a Trimble RTK GPS system. After completion of drilling all new collars were re- surveyed using the same tool. Historical drill holes were surveyed with RTK GPS and DGPS from 2008 to 2015, using the remaining visible collar location positions where necessary. Only five of the early drillholes, drilled prior to 2000 by Intermin, had no obvious collar position when surveyed and a best estimate of their position was used based on planned position data. Downhole surveys were completed for all diamond holes, using gyro surveying equipment, as well as the RC holes drilled in 2015 (from GRC0159). Some RC drillholes from the 2018 campaign do not have gyro survey as the hole closed before the survey could be done. These holes have single shot camera surveys, from which the dip readings were used with an interpreted azimuth (nominal hole setup azimuth). The holes with interpreted azimuth are all less than 120m depth. All other RC holes were given a nominal -60º dip measurement. These older RC holes were almost all 120m or less in depth.
	Specification of the grid system used.	The grid projection used for the Australian Vanadium Project is MGA_GDA94, Zone 50. All reported coordinates are referenced to this grid.

Criteria	JORC Code Explanation	Commentary
	Quality and adequacy of topographic control.	High resolution Digital Elevation Data was captured by Arvista for the Company in June 2018 over the MLA51/878 tenement area using fixed wing aircraft, with survey captured at 12 cm GSD using an UltraCam camera system operated by Aerometrex. The data has been used to create a high-resolution Digital Elevation Model on a grid spacing of 5m x 5m, which is within 20 cm of all surveyed drill collar heights, once the database collar positions were corrected for the improved ground control survey, that was also used in this topography survey. The vertical accuracy that could be achieved with the 12 cm GSD is +/- 0.10 m and the horizontal accuracy is +/- 0.24m. 0.5m contour data has also been generated over the mining lease application. High quality orthophotography was also acquired during the survey at 12cm per pixel for the full lease area, and visual examination of the imagery shows excellent alignment with the drill collar positions. The November 2018 Mineral Resource used this surface for topographic control within the Mining Lease Application area (MLA51/878). For the entire 2017 and July 2018 Mineral Resource estimates, and the November 2018 Mineral Resource estimate outside the MLA area, high resolution Digital Elevation Data was supplied by Landgate. The northern two thirds of the elevation data is derived from ADS80 imagery flown September 2014. The data has a spacing of 5M and is the most accurate available. The southern third is film camera derived 2005 10M grid, resampled to match it with the 2014 DEM. Filtering was applied and height changes are generally within 0.5M. Some height errors in the 2005 data may be +/- 1.5M when measured against AHD but within the whole area of interest any relative errors will mostly be no more than +/- 1M. In 2015 a DGPS survey of hole collars and additional points was taken at conclusion of the drill program. Trepanier compared the elevations the drillholes with the supplied DEM surface and found them to be within 1m accuracy. An improved ground control point has been established at the Australian Vanadium Project by professional surveyors. This accurate ground control point was used during the acquisition of high quality elevation data. As such, a correction to align previous surveys with the improved ground control was applied to all drill collars from pre-2018 in the Company drill database. Collars that were picked up during 2018 were already calibrated against the new ground control. 2019 drill collar locations have been verified with a DGPS in the field (accuracy about 20 cm on the horizontal) with final RTK pick up complete.
Data spacing and distribution	Data spacing for reporting of Exploration Results.	The 2018 RC drilling in Fault Block 17 has infilled areas of 260 m spaced drill lines to about 130m spaced drill lines, with holes on 30 m centres on each line. The closer spaced drilled areas of the deposit now have approximately 80m to 100m spacing by northing and 25m to 30m spacing by easting. Occasionally these spacings are closer for some pairs of drillholes. Outside of the main area of relatively close spaced drilling (approximately 7015400mN to 7016600mN), the drillhole spacing increases to several hundred metres in the northing direction but maintains roughly the same easting separation as the closer spaced drilled area.
	Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.	The degree of geological and grade continuity demonstrated by the data density is sufficient to support the definition of Mineral Resources and the associated classifications applied to the Mineral Resource estimate as defined under the 2012 JORC Code. Variography studies have shown very little variance in the data for most of the estimated variables and primary ranges in the order of several hundred metres.

Criteria	JORC Code Explanation	Commentary
	Whether sample compositing has been applied.	All assay results have been composited to one metre lengths before being used in the Mineral Resource estimate. This was by far the most common sample interval for the diamond drillhole and RC drillhole data.
Orientation of data in relation to geological structure	Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.	The grid rotation is approximately 45º to 50º magnetic to the west, with the holes dipping approximately 60º to the east. The drill fences are arranged along the average strike of the high grade mineralised horizon, which strikes approximately 310º to 315º magnetic south of a line at 7015000mN and approximately 330º magnetic north of that line. The mineralisation is interpreted to be moderate to steeply dipping, approximately tabular, with stratiform bedding striking approximately north-south and dipping to the west. The drilling is exclusively conducted perpendicular to the strike of the main mineralisation trend and dipping approximately 60º to the east, producing approximate true thickness sample intervals through the mineralisation.
	If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	The orientation of drilling with respect to mineralisation is not expected to introduce any sampling bias. Drillholes intersect the mineralisation at an angle of approximately 90 degrees. The 2019 PQ diamond holes are deliberately drilled down dip to maximise the amount of metallurgy sample collected for the pilot study. They are not intended to add material to the resource estimation, or to define geological boundaries, though where further control on geological contacts is intercepted, this will be used to add more resolution to the geological model.
Sample security	The measures taken to ensure sample security.	Samples were collected onsite under supervision of a responsible geologist. The samples were then stored in lidded core trays and closed with straps before being transported by road to the BV core shed in Perth (or other laboratories for the historical data). RC chip samples were transported in bulk bags to the assay laboratory and the remaining green bags are either still at site or stored in Perth. RC and core samples were transported using only registered public transport companies. Sample dispatch sheets were compared against received samples and any discrepancies reported and corrected.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	A review of the sampling techniques and data was completed by Mining Assets Pty Ltd (MASS) and Schwann Consulting Pty Ltd (Schwann) in 2008 and by CSA in 2011. Neither found any material error. AMC also reviewed the data in the course of preparing a Mineral Resource estimate in 2015. The database has been audited and rebuilt by AVL and MRG in 2015. In 2017 geological data was revised after missing lithological data was sourced. Geologica Pty Ltd concludes that the data integrity and consistency of the drillhole database shows sufficient quality to support resource estimation.

Section 2: Reporting of Exploration Results

Criteria	JORC Code Explanation	Commentary
Mineral tenement and land tenure status	Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.	Exploration Prospects are located wholly within Lease P51/2567 and E 51/843. The tenements are 100% owned by Australian Vanadium Ltd. The tenements lie within the Yugunga Nya Native Title Claim (WC1999/046). A Heritage survey was undertaken prior to commencing drilling which only located isolated artefacts but no archaeological sites *per se.* Mining Lease Application MLA51/878 covering most of E 51/1843 and the vanadium project is currently under consideration by the Department of Mines and Petroleum. AVL has no joint venture, environmental, national park or other ownership agreements on the lease area. A Mineral Rights Agreement has been signed with Bryah Resources Ltd for copper and gold exploration on the AVL Gabanintha tenements.
	The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	At the time of reporting, there are no known impediments to obtaining a licence to operate in the area and the tenement is in good standing.
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties.	The Australian Vanadium Project deposit was identified in the 1960's by Mangore P/L and investigated with shallow drilling, surface sampling and mapping. In 1998, Drilling by Intermin Resources confirmed the down dip extent and strike continuation under cover between outcrops of the vanadium bearing horizons. Additional RC and initial diamond drilling was conducted by Greater Pacific NL and then AVL up until 2018. Previous Mineral Resource estimates have been completed for the deposit in 2001 (Mineral Engineering Technical Services Pty Ltd (METS) and Bryan Smith Geosciences Pty Ltd. (BSG)), 2007 (Schwann), 2008 (MASS & Schwann), 2011 (CSA), 2015 (AMC), 2017 (Trepanier) and 2018 (Trepanier).
Geology	Deposit type, geological setting and style of mineralisation.	The Australian Vanadium Project is located approximately 40kms south of Meekatharra in Western Australia and approximately 100kms along strike (north) of the Windimurra Vanadium Mine. The mineralisation is hosted in the same geological unit as Windimurra, which is part of the northern Murchison granite greenstone terrane in the north west Yilgarn Craton. The project lies within the Gabanintha and Porlell Archaean greenstone sequence oriented approximately NW-SE and is adjacent to the Meekatharra greenstone belt. Locally the mineralisation is massive or bands of disseminated vanadiferous titano-magnetite hosted within the gabbro. The mineralised package dips moderately to steeply to the west and is capped by Archaean acid volcanics and metasediments. The footwall is a talc carbonate altered ultramafic unit. The host sequence is disrupted by late stage dolerite and granite dykes and occasional east and northeast - southwest trending faults with apparent minor offsets. The mineralisation ranges in thickness from several metres to up to 20 to 30m in thickness. The oxidized and partially oxidised weathering surface extends 50 to 80m below surface and the magnetite

Criteria	JORC Code Explanation	Commentary
		in the oxide zone is usually altered to Martite.
Drillhole Information	A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drillholes: easting and northing of the drillhole collar elevation or RL (Reduced Level – elevation above sea level in metres) of the drillhole collar dip and azimuth of the hole down hole length and interception depth hole length.	All drill results relevant to the mineral resource updates were disclosed at the time of the resource publication.
Data aggregation methods	In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (e.g. cutting of high grades) and cut-off grades are usually Material and should be stated.	Length weighed averages used for exploration results are reported in spatial context when exploration results are reported. Cutting of high grades was not applied in the reporting of intercepts.
	Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.	There were negligible residual composite lengths, and where present these were excluded from the estimate.
	The assumptions used for any reporting of metal equivalent values should be clearly stated.	No metal equivalent values have been used.

Criteria	JORC Code Explanation	Commentary
Relationship between mineralisation widths and intercept lengths	If the geometry of the mineralisation with respect to the drillhole angle is known, its nature should be reported.	Drillholes intersect the mineralisation at an angle of approximately 90 degrees.
Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drillhole collar locations and appropriate sectional views.	See Figures 9, 10, 17 of this release.
Balanced reporting	Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	Comprehensive reporting of drilling details has been provided in the body of this announcement.
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	All meaningful & material exploration data has been reported
Further work	The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling).	Further drilling is planned as to provide bulk sample material for a pilot study with further metallurgical test-work following completion of this Pre-feasibilty study. Extensional resource drilling is under consideration for the additional 8 km of mineralisation that is currently drilled at broad spacing.

Criteria	JORC Code Explanation	Commentary
	Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	The decision as to the necessity for further exploration at the Australian Vanadium Project is pending completion of mining technical studies on the currently available resource.

Section 3: Estimation and Reporting of Mineral Resources

Criteria	JORC Code Explanation	Commentary
Database integrity	Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes.	All the drilling was logged onto paper and has been transferred to a digital form and loaded into a Microsoft SQL Server relational drillhole database using DataShed^{TM} management software. Logging information was reviewed by the responsible geologist and database administrator prior to final load into the database. All assay results were received as digital files, as well as the collar and survey data. These data were transferred directly from the received files into the database. All other data collected for the Australian Vanadium Project were recorded as Excel spreadsheets prior to loading into SQL Server. The data have been periodically checked by AVL personnel, the database administrator as well as the personnel involved in all previous Mineral Resource estimates.
	Data validation procedures used.	The data validation was initially completed by the responsible geologist logging the core and marking up the drillhole for assaying. The paper geological logs were transferred to Excel spreadsheets and compared with the originals for error. Assay dispatch sheets were compared with the record of samples received by the assay laboratories. Normal data validation checks were completed on import to the SQL database. Data has also been checked back against hard copy results and previous mines department reports to verify assays and logging intervals. Both internal (AVL) and external (Schwann, MASS, CSA and AMC) validations were completed when data was loaded into spatial software for geological interpretation and resource estimation. All data have been checked for overlapping intervals, missing samples, FROM values greater than TO values, missing stratigraphy or rock type codes, downhole survey deviations of ±10° in azimuth and ±5° in dip, assay values greater than or less than expected values and several other possible error types. QAQC data and reports have also been checked by the personnel listed above.
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits.	The drill location was inspected by John Tyrrell of AMC in 2015 for the initial 2012 JORC resource estimation. Consulting Geologist Brian Davis of Geologica Pty Ltd has visited all the Australian Vanadium Project drilling sites since 2015 and has been familiar with the Australian Vanadium Project since 2006. The geology, sampling, sample preparation and transport, data collection and storage procedures were all discussed and reviewed with the responsible geologist for the 2015 and 2018 drilling. Visits to the BV laboratory and core shed in Perth were used to add knowledge in the preparation of this Mineral Resource Estimate.

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	If no site visits have been undertaken indicate why this is the case.	N/A
Geological interpretation	Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit.	The Australian Vanadium Project mineralisation lies along strike from the Windimurra Vanadium Mine and the oxidised portion of the high-grade massive magnetite/martite mineralisation outcrops for almost 14km in the company held lease area. Detailed mapping and mineralogical studies have been completed by company personnel and contracted specialists between 2000 and 2015, as well as four separate drilling programmes to test the mineralisation and continuity of the structures. These data and the relatively closely- spaced drilling has led to a good understanding of the mineralisation controls. The mineralisation is hosted within altered gabbros and is easy to visually identify by the magnetite/martite content. The main high-grade unit shows consistent thickness and grade along strike and down dip and has a clearly defined sharp boundary. The lower grade disseminated bands also show good continuity, but their boundaries are occasionally less easy to identify visually as they are more diffuse over a metre or so.
	Nature of the data used and of any assumptions made.	No assumptions are made regarding the input data.
	The effect, if any, of alternative interpretations on Mineral Resource estimation.	Previous interpretations were considered in the current estimation and close comparison with the 2015 resource model was made to see the effect of the new density data and revised geology model. The continuity of the low-grade units, more closely defined from lithology logs is now better understood and the resulting interpretation is more effective as a potential mining model. The near-surface alluvial and transported material has also been more accurately modelled in this estimation. The impact of the current interpretation as compared to the previous interpretation would be a greater volume of low grade mineralisation and a higher overall V_2O_5 grade for that mineralisation in the current estimate.
	The use of geology in guiding and controlling Mineral Resource estimation.	Geological observation has underpinned the resource estimation and geological model. The high grade mineralisation domain has a clear and sharp boundary and has been tightly constrained by the interpreted wireframe shapes. The low grade mineralisation is also constrained within wireframes, which are defined and guided by visual (from core) and grade boundaries from assay results. The low grade mineralisation has been defined as four sub-domains, which strike sub-parallel to the high-grade domain. In addition there is a sub parallel laterite zone and two transported zones above the top of bedrock surface. The resource estimate is constrained by these wireframes. Domains were also coded for oxide, transition and fresh, as well as above and below the alluvial and bedrock surfaces. The extents of the geological model were constrained by fault block boundaries. Geological boundaries were extrapolated to the edges of these fault blocks, as indicated by geological continuity in the logging and the magnetic geophysical data.

Criteria	JORC Code Explanation	Commentary
	The factors affecting continuity both of grade and geology.	Key factors that are likely to affect the continuity of grade are: • The thickness and presence of the high-grade massive magnetite/martite unit, which has been very consistent in both structural continuityand grade continuity. • The low-grade sub-domains are less consistent in their thickness along strike and down dip with more pinching and swelling than for the high-grade domain. • SW-NE oriented faulting occurs at a deposit scale and offsets the main orientation of the mineralisation. These regional faults divide the deposit along strike into kilometer scale blocks. Internally the mineralised blocks show very few signs of structural disturbance at the level of drilling.
Dimensions	The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	The massive magnetite/martite unit strikes approximately 14 km, is stratiform and ranges in thickness from less than 10m to over 20m true thickness. The low grade mineralised units are sub-parallel to the high-grade zone, and also vary in thickness from less than 10m to over 20m. All of the units dip moderately to steeply towards the west, with the exception of two predominantly alluvial units (domains 7and 8) and a laterite unit (domain 6) which are flat lying. All units outcrop at surface, but the low grade units are difficult to locate as they are more weathered and have a less prominent surface expression than the high grade unit. The high- and low-grade units are currently interpreted to have a depth extent of approximately 200m below surface. Mineralisation is currently open along strike and at depth.
Estimation and modelling techniques	The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used.	Grade estimation was completed using ordinary kriging (OK) for the Mineral Resource estimate. Surpac™ software was used to estimate grades for V_2O_5, TiO_2, Fe_2O_3, SiO_2, Al_2O_3, Cr_2O_3, Co, Cu, Ni, S and loss on ignition (LOI) using parameters derived from statistical and variography studies. The majority of the variables estimated have coefficients of variation of significantly less than 1.0, with Cr_2O_3 being the exception. Drillhole spacing varies from approximately 80 m to 100 m along strike by 25 m to 30 m down dip, to 500 m along by 25 m to 30 m down dip. Drillhole sample data was flagged with numeric domain codes unique to each mineralisation domain. Sample data was composited to 1 m downhole length and composites were terminated by a change in domain or oxidation state coding. No grade top cuts were applied to any of the estimated variables as statistical studies showed that there were no extreme outliers present within any of the domain groupings. Grade was estimated into separate mineralisation domains including a high-grade bedrock domain, four low grade bedrock domains and low grade alluvial and laterite domains. Each domain was further subdivided into a fault block, and each fault block was assigned its own orientation ellipse for grade interpolation. Downhole variography and directional variography were performed for all estimated variables for the high-grade domain and the grouped low grade domains. Grade continuity varied from hundreds of metres in the along strike directions to sub-two hundred metres in the down-dip direction although the down-dip limitation is likely related to the extent of drilling to date.

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Criteria	JORC Code Explanation	Commentary
	The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data.	Prior to 2017, there had been five Mineral Resource estimates for the Gabanintha deposit. The first, in 2001 was a polygonal sectional estimate completed by METS & BSG. The subsequent models by Schwann (2007), MASS & Schwann (2008) and CSA (2011) are kriged estimates. AMC (2015) reviewed the geological interpretation of the most recent previous model (CSA 2011), but used a new interpretation based on additional new drilling for the 2015 estimate. In 2017 a complete review of the geological data, weathering profiles, magnetic intensity and topographic data as well as incorporation of additional density data and more accurate modelling techniques resulted in a re-interpreted mineral resource. No mining has occurred to date at the Australian Vanadium Project, so there are no production records. Additional infill drilling and a single extensional diamond core holes have resulted in minor adjustments to the interpretation.
	The assumptions made regarding recovery of by-products.	Test work conducted by the company in 2015 identified the presence of sulphide hosted cobalt, nickel and copper, specifically partitioned into the silicate phases of the massive titaniferous vanadiferous iron oxides which make up the vanadium mineralization at the Australian Vanadium Project. Subsequent test work has shown the ability to recover a sulphide flotation concentrate containing between 3.8 % and 6.3% of combined base metals treating the non-magnetic tailings produced as a result of the magnetic separation of a vanadium iron concentrate from fresh massive magnetite. Further work is underway to evaluate the economic value of the concentrate by-product. See ASX Announcements dated 22 May 2018 and 5 July 2018.
	Estimation of deleterious elements or other non-grade variables of economic significance (e.g. sulphur for acid mine drainage characterization).	Estimates were undertaken for Fe_2O_3, SiO_2, TiO_2, Al_2O_3, and LOI, which are non-commodity variables, but are useful for determining recoveries and metallurgical performance of the treated material. Estimated Fe_2O_3% grades were converted to Fe% grades in the block model for reporting (Fe% = Fe_2O_3/1.4297). Estimates were also undertaken for Cr_2O_3 which is a potential deleterious element. The estimated Cr_2O_3% grades were converted to Cr ppm grades (Cr ppm = (Cr_2O_3*10000)/1.4615).

Criteria	JORC Code Explanation	Commentary
	In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed. Any assumptions behind modelling of selective mining units.	The Australian Vanadium Project block model uses a parent cell size of 40 m in northing, 10 m in easting and 5 m in RL. This corresponds to approximately half the distance between drillholes in the northing and easting directions and matches an assumed mining bench height in the RL direction. Accurate volume representation of the interpretation was achieved. Grade was estimated into parent cells, with all sub-cells receiving the same grade as their relevant parent cell. Search ellipse dimensions and directions were adjusted for each fault block. Three search passes were used for each estimate in each domain. The first search was 120m and allowed a minimum of 8 composites and a maximum of 24 composites. For the second pass, the first pass search ranges were expanded by 2 times. The third pass search ellipse dimensions were extended to a large distance to allow remaining unfilled blocks to be estimated. A limit of 5 composites from a single drillhole was permitted on each pass. In domains of limited data, these parameters were adjusted appropriately. No selective mining units were considered in this estimate apart from an assumed five metre bench height for open pit mining. Model block sizes were determined primarily by drillhole spacing and statistical analysis of the effect of changing block sizes on the final estimates.
	Any assumptions about correlation between variables.	All elements within a domain used the same sample selection routine for block grade estimation. No co-kriging was performed at the Australian Vanadium Project, but correlation studies on the composite data showed very good correlation (0.8 or above) between most variables, apart from Cr which has a correlation coefficient of 0.65 with V_2O_5.
	Description of how the geological interpretation was used to control the resource estimates.	The geological interpretation is used to define the mineralisation, oxidation/transition/fresh and alluvial domains. All of the domains are used as hard boundaries to select sample populations for variography and grade estimation.
	Discussion of basis for using or not using grade cutting or capping.	Analysis showed that none of the domains had statistical outlier values that required top-cut values to be applied.
	The process of validation, the checking process used, the comparison of model data to drillhole data, and use of reconciliation data if available.	Validation of the block model consisted of: • Volumetric comparison of the mineralisation wireframes to the blockmodel volumes. • Visual comparison of estimated grades against composite grades. • Comparison of block model grades to the input data using swathe plots. As no mining has taken place at the Australian Vanadium Project there is no reconciliation data .
Moisture	Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	All mineralisation tonnages are estimated on a dry basis. The moisture content in mineralisation is considered very low.

Criteria	JORC Code Explanation	Commentary
Cut-off parameters	The basis of the adopted cut-off grade(s) or quality parameters applied.	A nominal 0.4% V_2O_5 wireframed cut off for low grade and a nominal 0.7% V_2O_5 wireframed cut off for high grade has been used to report the Mineral Resource at the Australian Vanadium Project. Consideration of previous estimates, as well as the current mining, metallurgical and pricing assumptions, suggest that the currently interpreted mineralised material has a reasonable prospect for eventual economic extraction at these cut off grades.
Mining factors or assumptions	Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.	AVL completed a mining Scoping Study in October 2016 for the Australian Vanadium Project. The primary mining scenario being considered is conventional open pit mining. Based on initial concept study work and the nearby presence of a similar project (Windimurra mine site), the Gabanintha deposit is amenable to economic extraction by open-pit mining methods. The vanadium bearing massive magnetite horizons at the Australian Vanadium Project are of significant width compared to similar deposit types. Test work has indicated excellent vanadium recovery from conventional processing methods. Preliminary economics, reviewed in a public release on 26 September by the Company, supported a robust case for an economic operation. In September 2018, AVL released a base case PFS which included key assumptions supporting a planned open pit vanadium mining operation at the Australian Vanadium Project. This release contains details of mining factors and assumptions . Section 4 of this JORC Table 1 contains details of the assumptions that are also included in the body of this report in Table 1

Criteria	JORC Code Explanation	Commentary
Metallurgical factors or assumptions	The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	Metallurgical studies have focused on bench-scale comminution and magnetic separation test work on 24 contiguous drill core intervals from the high-grade vanadium domain. These samples included 10 off from the "fresh" rock zone, 9 off from the zone defined as "transitional" and 5 off from the near surface oxidised horizon, "oxide".

Metallurgical Sample	Drillhole origin	From (m)	To (m)	Interval (m)	Mass (kg)
1 Fr	GDH903	191	199	8	33
2 Fr	GDH903	199	209	10	47
3 Fr	GDH903	209	215.2	6.2	25
4 Fr	GDH911	98.9	105.5	6.6	59
5 Fr	GDH911	108	113.2	5.2	54
6 Fr	GDH912	124	129	5	52
7 Fr	GDH912	129	134.2	5.2	54
8 Fr	GDH912	134.3	141	6.7	69
9 Fr	GDH914	108	114	6	58
10 Fr	GDH914	114	121	7	75
11 Tr	GDH902	98	105.8	7.8	34
12 Tr	GDH902	105.8	111.1	5.3	31
13 Tr	GDH902	111.1	117.1	6	27
14 Tr	GDH911	105.5	108	2.5	27
15 Tr	GDH913	127.9	133.2	5.3	26
16 Tr	GDH913	133.2	140	6.8	47
17 Tr	GDH913	140	145.2	5.2	45
18 Tr	GDH916	132	139	7	32
19 Tr	GDH916	139	151.3	12.3	101
20 Ox	GDH901	38	45	7	29
21 Ox	GDH901	45	54	9	44
22 Ox	GDH915	12	18	6	44
23 Ox	GDH915	18	23	5	35
24 Ox	GDH917	14.1	21.1	7	44

The comminution test work has included SMC, Bond ball mill work index and Bond abrasion index testing.

Bench-scale magnetic separation test work has included Davis tube testing (1500 gauss) and a customised staged separation using a hand held rare earth magnetic rod (2600 gauss at surface). 21 element XRF and LOI analysis has been carried out on the magnetic and non-magnetic products and selected magnetic concentrates underwent QXRD to determine the contained minerals and or QEMScan analysis to gain an understanding of the mineral associations, grains size, locking and liberation.

Criteria	JORC Code Explanation	Commentary
		Some preliminary sulphide concentrate recovery testing has been undertaken on selected 25kg fresh samples and a 90kg fresh composite sample. These samples were ground to a P_{80} of 106 µm and underwent wet magnetic separation using a low intensity (1500 Gauss) magnetic separation drum. The non-magnetic stream was dried, sub split and provided feed for sulphide flotation testwork. The flotation testing has been carried out at benchscale using a scheme of typical sulphide flotation reagents. Rougher, scavenger and cleaner flotation has been tested with one concentrate (test BC 4113/2) reground prior to cleaning. The preliminary metallurgical investigation has demonstrated: - The oxide, transitional and fresh materials are similar in comminution behavior and exhibit a moderate rock competency and ball milling energy demand. - The abrasiveness is considered low to moderate. - A positive and predictable response to magnetic separation can be demonstrated from the fresh and transitional material within the high-grade domain. The majority of vanadium exists within magnetic minerals which when separated at a grind size P_{80} of approximately 106 µm, generates a consistently high V_2O_5 grade, low silica and low alumina grade concentrate. - Oxidised material responds to magnetic separation, albeit at lower vanadium recovery and concentrate quality. At this stage of metallurgical understanding a primary mill grinding to P_{80} 75 to 106 µm and application of magnetic drum separation is considered a reasonable flowsheet to produce a vanadium rich concentrate (approximately 1.4% V_2O_5) from material classified as oxide, transitional and fresh within the high-grade domain. Benchscale roast leach optimisation testwork has been undertaken on three samples using magnetic concentrates derived from fresh composites 1, 3-10, transitional composite 11 and oxide composite 24. Vanadium roast leach extractions greater than 90% and up to 96% have been achieved for all samples under optimised conditions (pelletised feed of P_{80} 75 to 106 µm size with 10% above stoichiometric soda ash addition, roasted for over 1 hour at 1250°C). Preliminary benchscale tests have also been completed to demonstrate an ammonium polyvanadate precipitation process is capable of producing a 99.4% V_2O_5 product. These results are being used to develop a scope of work for pilot scale testing planned for Q3 and Q4 2019. Given the indicated quality of the concentrate and the preliminary benchscale roast, leach, and V_2O_5 product generation testwork results, it is reasonable to assume that production of a saleable V_2O_5 product would be achieved via a traditional roast, leach and ammonium polyvanadate (APV) precipitation flowsheet path. A pilot scale testwork program (>24 tonnes of diamond drill core) is underway aimed at validating the flowsheet and finalising engineering design criteria.

Criteria	JORC Code Explanation	Commentary
Environmental factors or assumptions	Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfield project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	Waste rock dumps have been designed as part of the mining studies and the tailings are planned to be deposited in a conventional manner and to be contained within one of the waste dumps as an integrated waste landform. Studies have been completed on flora, fauna, hydrology, hydrogeology, soil characterisation and waste disposal. Further work is required to quantify the potential impact for some aspects, particularly for subterranean fauna. However, the Project is not likely to have highly significant environmental impacts that are of public interest. The approvals process will include referral and assessment by the EPA but is not expected to be subject to a Public Environmental Review. Refer to Section 4 of this document for more details of environmental work completed.
Bulk density	Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.	Bulk density determinations (using the Archimedes' method) were made on samples from 15 diamond drillholes. Bulk density data from 313 direct core measurements were used to determine average densities for each of the mineralisation and oxide/transition/fresh domains. Bulk Density was estimated for HG, LG, Alluvial and waste material in Core taken to represent the main lithological units.
	The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc.), moisture and differences between rock and alteration zones within the deposit.	The water immersion method was used for direct core measurements. All 313 of the latest measurements have been done using sealed core, the previous 97 measurements were not wrapped. AMC's observation of the core indicates that observable porosity was not likely to be significant.

<table>
<tr><th>Criteria</th><th>JORC Code Explanation</th><th>Commentary</th></tr>
<tr><td></td><td>Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.</td><td>The average dry bulk density values for at the Australian Vanadium Project are:
<table>
<tr><th>Domain</th><th>Oxidation State</th><th>Bulk Density</th></tr>
<tr><td>10 (high grade)</td><td>Oxide</td><td>3.39</td></tr>
<tr><td>10 (high grade)</td><td>Transition</td><td>3.71</td></tr>
<tr><td>10 (high grade)</td><td>Fresh</td><td>3.67</td></tr>
<tr><td>2-8 (low grade)</td><td>Oxide</td><td>2.13</td></tr>
<tr><td>2-8 (low grade)</td><td>Transition</td><td>2.20</td></tr>
<tr><td>2-8 (low grade)</td><td>Fresh</td><td>2.62</td></tr>
<tr><td>Alluvial</td><td>Oxide</td><td>2.63</td></tr>
<tr><td>(waste)</td><td>Oxide</td><td>2.02</td></tr>
<tr><td>(waste)</td><td>Fresh</td><td>2.45</td></tr>
</table>
All values are in t/m^3.

Regressions used to determine bulk density based on iron content are as follows:
• Oxide: BD = (0.0344 x Fe_2O_3 %) + 0.9707
• Transition: BD = (0.0472 x Fe_2O_3 %) + 0.3701
• Fresh: BD = (0.0325 x Fe_2O_3 %) + 1.4716
The bulk density used for reporting of the Australian Vanadium Project Mineral Resource is based on the regression as it provides a more reliable local estimated bulk density.</td></tr>
<tr><td>Classification</td><td>The basis for the classification of the Mineral Resources into varying confidence categories.</td><td>Classification is based upon continuity of geology, mineralisation and grade, consideration of drillhole and density data spacing and quality, variography and estimation statistics (number of samples used and estimation pass).
The current classification is considered valid for the global resource and applicable for the nominated grade cut-offs.</td></tr>
<tr><td></td><td>Whether appropriate account has been taken of all relevant factors (i.e. relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data).</td><td>At the Australian Vanadium Project, the central portion of the deposit is well drilled for a vanadium deposit, having a drillhole spacing from a nominal 80 m to 100 m x 25 m to 30 m in northing and easting. The lower confidence areas of the deposithave drillhole spacings ranging up to 500 m x 25 m to 30 m in northing and easting directions.
In general, the estimate has been classified as Measured Mineral Resource in an area restricted to the fresh portion of the high-grade domain where the drillhole spacings are less than 80 to 100m in northing. Indicated Mineral Resource material is generally restricted to the oxide high grade and oxide and fresh low grade in the same area of relatively closely spaced drilling. Inferred Mineral Resource has been restricted to any other material within the interpreted mineralisation wireframe volumes.</td></tr>
</table>

Criteria	JORC Code Explanation	Commentary
	Whether the result appropriately reflects the Competent Person's view of the deposit.	Geologica Pty Ltd and Trepanier Pty Ltd believe that the classification appropriately reflects their confidence in the grade estimates and robustness of the interpretations.
Audits or reviews	The results of any audits or reviews of Mineral Resource estimates.	The current Mineral Resource estimate has not been audited.
Discussion of Relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.	The resource classification represents the relative confidence in the resource estimate as determined by the Competent Persons. Issues contributing to or detracting from that confidence are discussed above. No quantitative approach has been conducted to determine the relative accuracy of the resource estimate. The Ordinary Kriged estimate is considered to be a global estimate with no further adjustments for Selective Mining Unit (SMU) dimensions. No production data is available for comparison to the estimate. The local accuracy of the resource is adequate for the use of the model in the mining studies. Further investigation into bulk density determination as well as infill drilling will be required to further raise the level of resource in the Inferred mineral resources category.
	The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used.	These levels of confidence and accuracy relate to the global estimates of grade and tonnes for the deposit.
	These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	There has been no production from the Australian Vanadium Project deposit to date.

Section 4: Estimation and Reporting of Ore Reserves

Criteria	JORC Code Explanation	Commentary
Mineral Resource estimate for conversion to Ore Reserves	Description of the Mineral Resource estimate used as a basis for the conversion to an Ore Reserve. Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.	The most recent Mineral Resource estimate was declared on 28 November 2018 and has been used in the PFS. Refer to the ASX release of 28 November 2018 for material assumptions and further information. The Measured and Indicated Resources from Section 3 have been used as the basis for conversion to the Ore Reserve. The Mineral Resources are inclusive of the Ore Reserve.
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits. If no site visits have been undertaken indicate why this is the case.	No site visit was undertaken by the Competent Person. There are no current facilities at the project site.
Study status	The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves. The Code requires that a study to at least Pre-Feasibility Study level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.	A Pre-Feasibility Study has been prepared.
Cut-off parameters	The basis of the cut-off grade(s) or quality parameters applied.	The break-even cut-off grade has been calculated based on the pit optimisation inputs. The basis for calculation of cut-off is: $$Cut\ off\ grade = \frac{(process + overhead\ cost) \times (1 + Mining\ Dilution(\%))}{Payable\ Vanadium\ Price \times Process\ Recovery\ (\%)}$$ Cut-off grades have been calculated as 0.40% V_2O_5 for oxide ore, 0.18% V_2O_5 for transitional and 0.18% V_2O_5 for fresh. The selected cut-off grade of 0.8% V_2O_5 is higher than the calculated values as metallurgical testing suggests unpredictable recoveries below this chosen value.

Criteria	JORC Code Explanation	Commentary
Mining factors or assumptions	The method and assumptions used as reported in the Pre-Feasibility or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design). The choice, nature and appropriateness of the selected mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc. The assumptions made regarding geotechnical parameters (eg pit slopes, stope sizes, etc), grade control and pre-production drilling. The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate). The mining dilution factors used. The mining recovery factors used. Any minimum mining widths used. The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion. The infrastructure requirements of the selected mining methods.	The Mineral Resources have been optimised using Whittle software followed by detailed final pit design. The Ore Reserve is the Measured and Indicated Resources within the pit design, after allowing for ore loss and mining dilution. In selecting the optimised pit shell used for pit designs the conservative pit shell with a revenue factor of 0.675 was selected. The mining method selected is open pit, selective mining of ore and waste on nominal 2.5 m benches using a backhoe excavator. Pit ramps are designed at a 10% gradient and 23 m wide, except for lower pit levels where the ramp reduces to 18 m wide and then 15 m. A Pre-Feasibility Study level geotechnical study has been completed by Dempers and Seymour. The pit design parameters from this study have been used for the pit design and the overall pit slope angle was estimated for the preceding pit optimisations. Grade control will be based on additional RC drilling, pit mapping and sampling from production drilling where necessary. A RC drilling pattern of 12.5 m along strike and 6.25 m across strike pattern has been allowed for. Mining dilution was estimated to be 5%, at zero grade. This was based on consideration of the width, continuity and orientation of the orebody and the planned mining method. Ore recovery of 95% has been estimated to allow for losses from blasting and grade control. A minimum mining width was set at 20 m. Inferred Resources within the pit design make up 21% of the total Mineral Resources and have not been considered for Ore Reserve estimates. Infrastructure required for the open pit mining operation includes mining contractor workshop, heavy equipment washpad, mining offices, water storage dam, ROM pad, fuel and explosives storage.

Criteria	JORC Code Explanation	Commentary
Metallurgical factors or assumptions	The metallurgical process proposed and the appropriateness of that process to the style of mineralisation. Whether the metallurgical process is well-tested technology or novel in nature. The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied. Any assumptions or allowances made for deleterious elements. The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole. For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications?	The metallurgical process proposed includes beneficiation and refining of the vanadium product and an additional sulphide flotation circuit for base metals recovery, as discussed in Section 3. Metallurgical processes proposed are all well-tested technology and appropriate for the styles of mineralisation. Extensive benchscale metallurgical testwork has been undertaken under the direction of Wood Mining and Metals, as detailed in Section 3 and included: • Comminution • Magnetic separation • Sulphide flotation • Roast leaching of concentrate • Desilication, ammonium meta and ammonium polyvanadate precipitation • Deammoniation Metallurgical domaining has been categorised into weathering stages including oxide, transitional and primary mineralisation with and without recoverable base metals, as defined in the Mineral Resource models. Metallurgical recoveries for the concentrator have been determined from testwork and indicate vanadium recoveries of 44% for oxides, variable with depth up to 87.8% for transitional and variable with grade from 76.7% to an expected maximum of 96% for primary material. Base metals recovery to a sulphide concentrate has been based on benchscale testwork outcomes up to a primary flotation concentrate and an assumed 90% cleaner flotation recovery. Vanadium recovery in the refinery flowsheet ranges from 79.7% (oxide concentrate) to 80.6% (fresh concentrate) and is based on operating benchmarks and experience from other similar flowsheets and is supported by preliminary benchscale roast leach testwork. Recoveries for the Ore Reserves were applied according to the recovery equations. Deleterious elements are discussed in Section 3. Not applicable.

Criteria	JORC Code Explanation	Commentary
Environmen-tal	The status of studies of potential environmental impacts of the mining and processing operation. Details of waste rock characterisation and the consideration of potential sites, status of design options considered and, where applicable, the status of approvals for process residue storage and waste dumps should be reported.	Environmental studies have been completed by AQ2. This included studies into: • Flora. • Fauna. • Surface Hydrology. • Sub-surface Hydrology. • Soil, Waste Rock and Groundwater analysis. All potential environmental and social impacts associated with the Project have been considered and no issue has been identified that cannot be mitigated or managed to an acceptable degree. Further work is required to quantify the potential impact for some aspects, particularly for subterranean fauna. The approvals process will include referral and assessment by the EPA but is not expected to be subject to a Public Environmental Review. Waste geochemistry investigations have been undertaken by interpretation of the geological database indicating that none of the waste rock samples tested were potentially acid generating. Management of surface runoff and seepage from the waste dumps and pit walls during operation will need to be managed and final waste dumps capped with suitable materials to minimise water infiltration.
Infrastructure	The existence of appropriate infrastructure: availability of land for plant development, power, water, transportation (particularly for bulk commodities), labour, accommodation; or the ease with which the infrastructure can be provided, or accessed.	The Sandstone to Meekatharra Road passes close to the mine lease area, however an access road will be constructed from the Northern Highway to the west to the operational area. This road will give access to Meekatharra, which is approximately 55 km away. Power will be generated on site using a gas fired power station using gas from a new gas pipeline. Water will be sourced from onsite pit dewatering and water supply bores. The mining lease is sufficiently extensive to accommodate all the required infrastructure. A communications tower and related equipment will be installed on site for phone and data communications. Accommodation will be constructed on site adjacent to the Project.

Criteria	JORC Code Explanation	Commentary
Costs	The derivation of, or assumptions made, regarding projected capital costs in the study. The methodology used to estimate operating costs. Allowances made for the content of deleterious elements. The source of exchange rates used in the study. Derivation of transportation charges. The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc. The allowances made for royalties payable, both Government and private.	Capital costs for the plant and most of the rest of the infrastructure were estimated by Wood Mining and Metals. Mining capital costs for heavy equipment workshop and washpad will be part of the mining contract and have been estimated from a contractor quotation. Mining operating costs have been based on contractor rates for similar projects in Western Australia and a quotation from a mining contractor that broadly supported the benchmarked mining costs. The average mining costs are \$3.50/t mined. General and administration costs were estimated based on experience with similar projects and make up \$2.24 /t of ore feed. Processing costs have been estimated based on the plant design and detailed costings derived by Wood Mining and Metals. Not applicable For mining optimisation and design, the exchange rate used was AUD:USD 0.74. The exchange rate used in financial modeling was AUD:USD 0.72. The exchange rate used for capex and opex derivation was set on 8th November 2018 at AUD:USD 0.728, AUD:EUR 0.637 and AUD:GBP 0.555. The exchange rates were sourced from publicly available data produced by banks. The transport cost related to haulage of the product to the port of Fremantle has been estimated by Wood Mining and Metals. This has been estimated based on a rate A\$50t of V_2O_5 product sold FOB Fremantle. Backhaul rates after delivery of consumables to site have been assumed. Processing and refining costs have been derived by Wood Mining and Metals based on their design of the processing plant and refinery. The royalty paid to the West Australian government will be 2.5% of revenue.

Criteria	JORC Code Explanation	Commentary
Revenue factors	The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc. The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and co-products.	Revenue for pit optimisation assumes a V_2O_5 sale price of US$8/lb. This is based on a FOB price for the V_2O_5 flake product. The sales price used for base case financial analysis was US$8.67/lb V_2O_5. A table of alternative prices is calculated and presented as upside sensitivity, given the conservative long-term price selected. Revenues from Cobalt, Nickel and Copper are based on LME prices for 13 September 2018 of AUD 84.01/kg, A$ 16.57/kg and A$ 7.95/kg respectively. A 65% payability has been assumed for these base metals that make up approximately 1.3% of the total revenue. The cyclical nature of the vanadium market is illustrated in 6 of the report summary above. Imbalances in supply have driven prices up above US$30/lb twice during this time, and there was a prolonged period where prices hovered around US$5/lb from 2012 to 2017. However, the average price for the 15-year period was well above this, at US$8.67/lb in 2018 adjusted numbers.

Criteria	JORC Code Explanation	Commentary
Market assessment	The demand, supply and stock situation for the particular commodity, consumption trends and factors likely to affect supply and demand into the future. A customer and competitor analysis along with the identification of likely market windows for the product. Price and volume forecasts and the basis for these forecasts. For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.	The market for Vanadium Pentoxide is substantially based on its use in steel alloys and now also in batteries. In the last few years the vanadium price slumped to below US$5/lb leading to cutbacks in production. The price has now recovered, reaching over US$30/lb in November 2018. Reasons for the price rise are based on continued low supply from reduced capacity and recent increase in demand from China. Demand for vanadium has outstripped supply since mid-2015, corresponding to Evraz Group's Highveld Steel and Vanadium's (South Africa) closure. In late 2015, Chinese stone coal producers began to shut down due to Chinese environmental regulations, further reducing supply. Since then, supply and demand have not been in balance. In 2017, there was approximately 8,000 MTV of demand that was not met by production, or the approximate yearly output of one and a half plants the size of AVL's proposed Australian Vanadium Project. Vanadium Redox Flow Battery (VRFB) technology uptake could have a large impact on medium to long term vanadium demand. If VRFBs capture even a small piece of the renewable energy storage demand, it could require thousands of MTV that are not currently available. A market assessment analysis has been completed internally with information supplied by Daniel Harris (Technical Director AVL). Vanadium products include various oxides of Vanadium, that are converted to Ferro Vanadium or Vanadium Carbo-Nitride products for use in steelmaking. Refined Vanadium pentoxide, V_2O_5 produced as a powder is supplied as a chemical, and can be used in the production of vanadium electrolyte solutions for VRFB.
Economic	The inputs to the economic analysis to produce the net present value (NPV) in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc. NPV ranges and sensitivity to variations in the significant assumptions and inputs.	The December 2018 Pre-Feasibility Study includes the revenue and cost inputs discussed above and cash flows were discounted by an 8% rate. The post-tax NPV 8% of the project using the long-term historical pricing was estimated to be US$125M. The mine life is significant but the current benign outlook for inflation does not justify an allowance for inflation. Sensitivity analysis has been completed based on different product price, other revenue related items such as grade and metallurgical recovery and costs. The project is most sensitive to the product price, metallurgical recovery, the mining cost and the processing cost, in decreasing order.

Criteria	JORC Code Explanation	Commentary
Social	The status of agreements with key stakeholders and matters leading to social licence to operate.	The proposed Project will be located within mining lease application M 51/878, which is currently pending, due to native title processes. The native title claimant is the Yugunga-Nya Native Title Claim Group. A draft mining agreement between AVL and the Yugunga-Nya Native Title Claim Group was prepared in November 2017. A standard Heritage agreement is in place with the Yugunga-Nya Native Title Claim Group. No land use agreements are in place with other local landowners but good relations are maintained.
Other	To the extent relevant, the impact of the following on the project and/or on the estimation and classification of the Ore Reserves: Any identified material naturally occurring risks. The status of material legal agreements and marketing arrangements. The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary Government approvals will be received within the timeframes anticipated in the Pre-Feasibility or Feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a third party on which extraction of the reserve is contingent.	No material naturally occurring risks have been identified. No material legal or marketing agreements have been entered into. The Mining Lease Application MLA51/878 over the tenement that contains the Ore Reserves has not yet been granted. . Application for the mining approval has not started but there are no impediments expected to this process. The timeframes for assessment of an environmental assessment proposal vary depending on the level of assessment set by the Environmental Protection Authority (EPA), the amount of consultation undertaken prior to referral and how quickly the proponent can compile the information required by the EPA

Criteria	JORC Code Explanation	Commentary
Classification	The basis for the classification of the Ore Reserves into varying confidence categories. Whether the result appropriately reflects the Competent Person’s view of the deposit. The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).	Measured Resources have been converted to Proved Reserves. Indicated Resources have been converted to Probable Reserves. The estimated Ore Reserves are, in the opinion of the Competent Person, appropriate for these deposits. Not applicable
Audits or reviews	The results of any audits or reviews of Ore Reserve estimates.	No audits have been undertaken.

Criteria	JORC Code Explanation	Commentary
Discussion of relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate. The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. Accuracy and confidence discussions should extend to specific discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for which there are remaining areas of uncertainty at the current study stage. It is recognised that this may not be possible or appropriate in all circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	The Ore Reserve estimate have been completed to Pre-Feasibility Study with ±25 confidence. The Ore Reserve is a global estimate in line with the Mineral Resource Statement The AVL management and board has extensive experience in managing VTM sources and vanadium operations allowing comparison of operation of other plants in South Africa, Australia, USA and Russia to be drawn upon during the study process.