**Bushveld Minerals**

**Right commodity, right asset, right time**

Bushveld’s recently-acquired Vametco operation in South Africa offers direct exposure to vanadium, one of the best performing metals over the last two years with prices surging four-fold from the lows of late 2015. This renaissance was triggered by curtailment of co-product supply, historically the largest source of vanadium. With much of this likely to remain dormant absent a material recovery in iron-ore pricing, and demand proving robust (underpinned by traditional end markets, but with energy-storage increasingly important), we believe primary vanadium producers are best placed to profit from the structural deficit. Vametco already enjoys a market share of 3.5%, and as a low-cost producer with a large, high-grade primary resource base, there is ample opportunity to expand into an increasingly supply-starved market. Vanadium’s recovery drove a six-fold increase in Vametco’s EBITDA in 2017, to US$24m. Assuming a US$30/kg long-term price that is no more than in line with the ten-year average, we estimate EBITDA can double as Bushveld completes a capacity expansion of the business. If vanadium holds its recent gains – prices have spiked to around twice our long-term (from 2020) assumption – these estimates could prove very conservative.

- **Compelling market dynamics:** The global vanadium market has moved into deficit following significant rationalisation of co-product supply on depressed iron-ore prices (iron-ore prices being the key economic driver of iron-vanadium magnetite operations). With global demand from the steel sector, traditionally the most important end market for vanadium, stabilising (and China increasing the intensity of its vanadium use in domestic steel production), this has driven a remarkable turnaround in vanadium pricing from the historic lows of late 2015. Use of vanadium redox flow batteries in energy-storage applications is fast emerging as a source of potential significant demand growth looking forward, and with mothballed co-product supply capacity unlikely to return without a substantial recovery in seaborne-traded iron-ore prices and new sources of primary supply limited, the outlook for vanadium remains positive, in our view.

- **Low-cost, scalable producing asset:** With one of the largest high-grade primary vanadium resource inventories globally, and a low-cost, scalable production base in its 59%-owned Vametco operation in South Africa, we consider Bushveld ideally positioned to profit from this structural market deficit. Vametco’s current capacity of c3,000t equates to >3% of global vanadium supply, and its low-cost structure safeguarded operational-level profitability even through vanadium’s nadir of 2016. Bushveld has initiated a low-capex, internally-fundable expansion programme aimed at growing output to c5,000t pa, which we estimate could lift Vametco-level EBITDA from the US$24m achieved in 2017 to a sustainable level of at least double that figure, conservatively assuming a US$30/kg V price.

- **Attractive valuation:** Our sum-of-the-parts analysis suggests intrinsic fair value at approximately 14p, some 70% above Bushveld’s current share price. We believe this valuation gap will narrow as Bushveld further executes on its expansion plans for Vametco over the next 12 months and, in time, begins drawing up surplus cash generated from the operation. Moreover, we see substantial valuation upside potential on vanadium price (FeV is currently trading around double our US$30/kg long-term (from 2020) assumption), and through further growth initiatives (we believe Vametco provides a solid base from which Bushveld can further develop its other South African vanadium assets and/or participate in industry consolidation).

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Investment case

Focused exposure to compelling commodity class

With its acquisition last year of a majority 59% interest in the Vametco operation in South Africa, Bushveld Minerals has emerged as a focused equity play on vanadium, one of the world’s best performing mineral commodities over the past 12 months.

In the wake of a retreat in seaborne-traded iron ore prices from the highs of the start of this decade, recent years have witnessed a rationalisation of iron-vanadium magnetite ore mining operations (magnetites being a higher-cost source of iron ore than haematite operations), with a consequent fall in co-product sourced vanadium, the dominant source of the world’s vanadium supply. Curtailment of such production in the major production centres of China and South Africa in particular saw global vanadium supply reduced by 7% in 2015, and by a further 8% in 2016.

With demand from the steel industry, the dominant end market for vanadium, recovering in 2017, this tightening of supply pushed vanadium into a structural deficit, and prices have rebounded accordingly – ferrovanadium (FeV) ended 2017 up by more than 70% from its year open price, and up over three-fold from its historic lows of late 2015. Prices have spiked even higher in 2018 to date.

We expect demand from the steel industry to remain robust, particularly from China given recent revisions in that country’s standards for the tensile strength of steel rebar in its domestic construction industry, which is driving an increase in the intensity of vanadium use in Chinese steelmaking. While modest demand growth is also anticipated from the more minor non-alloy end-use markets, it is the utility-scale energy storage market that is emerging as the next most important driver of vanadium demand. Vanadium’s unique combination of properties lend it for use as an agent for storing energy through vanadium redox flow batteries (VRFBs), which have several advantages over alternative technology for large-scale storage of energy generated from renewable sources. Based on projections for the growth of the global energy-storage market, VRFB’s could contribute c20% of total vanadium consumption by 2030 (up from just 2% in 2016).

Large, high-grade resource ideally positioned to exploit market deficit

We believe primary producers are best placed to profit from this robust demand outlook, particularly those able to expand output into the supply gap created by recent curtailments of co-product vanadium, which we consider unlikely to come back on stream without a material and sustained recovery in iron-ore pricing.

Bushveld is strategically positioned in this regard, controlling one of the world’s largest high-grade vanadium resource bases across its portfolio of South African assets. These include the operating Vametco operation, a low-cost primary producer of approximately 2,800t pa of vanadium over recent years, an annual total that currently accounts for over 3% of global vanadium supply.

Vametco’s favourable position on the industry cost curve is a direct result of its grades, which at around 2% V2O5 (in magnetite) are amongst the highest of any primary operations globally (other large-scale deposits typically grade around 1%). This enabled Vametco to remain profitable even through vanadium’s cyclical low, generating operational-level EBITDA of R16m (US$1m) and R48m (US$3m) in 2015 and 2016 respectively. Operational EBITDA rose to R316m (US$24m) in 2017, benefitting from vanadium’s sharp recovery, which more than offset local cost inflation.
**Internally-funded expansion initiative underway**

Since Bushveld acquired its initial interest in the business in Q2 2017, Vametco has initiated a phased expansion aimed at lifting annual vanadium output to over 5,000t. The first, debottlenecking stage of the expansion was completed in H2 2017, increasing operational capacity to just over 3,000t pa. The second phase is underway, with upgrades to the crushing and grinding circuit expected to lift capacity to 3,750t pa by the middle of this year. The final stage of the expansion involves upgrading the kiln feed, discharge equipment and evaporative capacity to raise output to at least 5,000t pa by the end of 2019.

We estimate this phased expansion initiative could see Vametco’s operational EBITDA more than double from 2017 levels assuming a reasonably conservative long-term FeV price of US$30/kg (in-line with the ten-year average price, but below current pricing levels which have spiked to cUS$60/kg). We understand the total capital cost of delivering this expansion (which began in H2 2017) could be around R215m (cUS$18m), which we estimate can be adequately funded from operational cash flow generated by the business.

Vametco’s 26Mt reserve (grading 1.96% V₂O₅ in magnetite 26.8%) would sustain operations at the expanded level for ten years. But with a total resource base of 142Mt (inclusive of reserves), the mine will stay in operation for many multiples of the current reserve life.

Moreover, Bushveld’s adjacent Brits property, a strike extension of the Vametco magnetite seams and on which historical drilling has demonstrated in-magnetite V₂O₅ grades of up to 2.6%, holds potential as a future satellite source of high-grade ore for the operation. The company’s Mokopane project meanwhile offers potential for the future development of a second primary vanadium operation in the same Bushveld Complex – a 2016 prefeasibility study demonstrated the potential for a c9,500t pa operation, with a capital requirement of US$298m, and a mining right application for the project is in final stage of the approval process.

Combined, Vametco and Mokopane give Bushveld control of some 440Mt of high-grade vanadium resources, one of the largest portfolios of open-pittable, primary vanadium resources that we are aware of globally.

![Figure 1: Production and cost profile (next four years forecast)](source: ARC estimates)
**Scope to diversify downstream processing capabilities**

Vametco provides Bushveld with an operational platform to advance further downstream and achieve product diversification as well as direct participation in the growing energy-storage markets. To this end the company has established Bushveld Energy, an 84%-owned subsidiary focussed on promoting and developing the growing market for VRFBs, and specifically their role as a utility-scale energy storage solution in Africa. VRFB’s long-duration storage capacity and life span, scalability and rapid response time makes them well suited for grid-scale energy storage relative to competing technologies such as lithium-ion batteries. This could see VRFBs claim a meaningful share of the forecast US$350bn energy-storage market by 2030.

Bushveld aims to further promote the technology’s use and, ultimately, to become one of Africa’s largest electricity-storage providers by 2020, leveraging its position as an integrated miner and processor of primary vanadium in South Africa (consistent supply of vanadium feedstock material at an economically viable price being the greatest hurdle to widespread commercial take-up of VRFBs given vanadium accounts for 30-40% of their cost).

In conjunction with South Africa’s Industrial Development Corporation (IDC), Bushveld Energy has commenced a feasibility study of the potential for developing a vanadium electrolyte production plant in South Africa to be fed by locally-produced vanadium. Initial results have demonstrated the potential for constructing a scalable facility at an initial capital cost of just US$10m, with significant scope to reduce the latter by locating and integrating the electrolyte plant within Vametco’s existing vanadium processing facility. Bushveld Energy plans to further evaluate the proposed plant’s cost structure over the course of 2018, whilst also undertaking laboratory test work in conjunction with Vametco’s technical team to ascertain the potential quality of electrolyte production using Vametco vanadium feedstock and identifying optimum processing techniques.

Bushveld Energy has brokered an agreement with Eskom for the third-party deployment of a pilot VRFB unit with a peak energy-storage capacity of 450kWh. This is expected to be in operation in H1 CY2018. Moreover, the group is proactively engaging with power utilities in countries in which energy storage programmes are already being developed, and is fostering relationships with potential customers in South Africa whom would benefit from a vanadium-based energy-storage solution.

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**Figure 2: Bushveld’s integrated vision**

*Source: Bushveld Minerals*
Commodity diversity retained through AfriTin and Lemur Resources

Though vanadium, and the Vametco operation specifically, is now clearly Bushveld’s core focus, the company retains an element of commodity diversity through its wholly-owned coal subsidiary Lemur Resources and a 17.5% interest in AIM-listed tin project developer AfriTin Mining Ltd. Lemur is advancing the Imaloto thermal coal and integrated power project in southwestern Madagascar, while AfriTin has a portfolio of potentially open-pit tin projects in historic tin-producing areas of southern Africa. AfriTin was spun out of Bushveld last year (with Bushveld retaining a 17.5% stake) as the group increased its focus on vanadium, and we expect management to explore similar routes for realising value from Lemur in the near-medium term.

Undemanding valuation

Our sum-of-the-parts analysis, incorporating risk-weighted NPV estimates for Bushveld’s attributable share of Vametco and Mokopane assuming a conservative US$30/kg V long-term vanadium price from 2020, indicates fair value at approximately 14p per share. This represents around 70% upside to Bushveld’s current share price, a disproportionately wide valuation gap that we believe will narrow as Bushveld further executes on its expansion plans for Vametco over the next 12 months and, in time, begins drawing up dividends of surplus cash generated by the operation.

We see considerable upside to our sum-of-parts valuation on higher vanadium prices, recognising that our conservative long-term FeV price assumption is significantly lower than currently traded prices of around US$60/kg V. We also see scope for upside as Bushveld advances its other South African vanadium assets (we include just 20% of our NPV estimate of Mokopane in our valuation) and further progresses its plans to start downstream processing of vanadium for the VRFB markets. Moreover, we believe Vametco provides a solid base from which Bushveld can further grow in the sector through M&A opportunities.

Upcoming catalysts

► Completion of second phase of Vametco expansion (mid 2018)
► Commissioning of pilot VRFB unit at Eskom (H1 2018)
► Continued development of the Bushveld Energy business (2018 and beyond)
► Completion of final phase of Vametco expansion (by end 2019)
Valuation

Sum-of-the-parts analysis

Given that Vametco is undergoing a period of expansion and that Bushveld also has non-producing assets in its portfolio, we consider a sum-of-the-parts approach to be the most appropriate method of estimating fair value for Bushveld today.

Figure 3 summaries our valuation, which is dominated by our NPV estimate for Vametco. The latter incorporates the operating and cost parameters detailed on pp30-31, which envisages Vametco being expanded over the next two years in line with Bushveld’s announced plans. Using a long-term (from 2020) FeV price assumption of US$30/kg V (see pp13-20 for vanadium market discussion) and a 10% discount rate, we value Bushveld’s attributable share of Vametco (including its net share of cash and liabilities at Vametco, and adjusted for deferred payments to Yellow Dragon and EVRAZ) at US$134m, or 11p per share.

We have similarly included the Mokopane project at NPV, calculated using the operating and cost estimates presented in the January 2016 prefeasibility study of the project, and our US$30/kg vanadium price and 10% discount rate assumptions. Given the significant hurdles to be negotiated before production can ever be realised at this project (not least full feasibility study, securing funding and construction) and uncertainty surrounding timing, we suitably risk-weight our valuation of Mokopane, including just 20% of our project NPV estimate in our sum-of-parts.

Including nominal values of US$20m and US$10m for the earlier-stage Brits vanadium project and the Lemur Resources coal subsidiary respectively and the group’s stake in AfriTin at market value, and adjusting for our estimate of balance sheet items at end-2017, we arrive at a Bushveld risked sum-of-the-parts valuation of US$180m, or 14.3p/share. This represents just over 70% upside to Bushveld’s current share price, affirming our belief that the market is significantly missing the value inherent in the company’s now cash-generating asset portfolio. It is noteworthy that, even were we to ignore the company’s non-producing assets, our estimate of Bushveld’s attributable share of Vametco alone (11p/share, rounded) greatly exceeds its current share price. Moreover, our sum-of-parts attributes no value to Bushveld Energy, which could be a source of future revenue if its ambitions in the VRFB sector are realised.

<table>
<thead>
<tr>
<th></th>
<th>Unrisked US$m</th>
<th>Risk multiple</th>
<th>Risked US$m</th>
<th>GBp/s</th>
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</thead>
<tbody>
<tr>
<td>Vametco (BMN share)</td>
<td>134</td>
<td>1.0x</td>
<td>134</td>
<td>10.6</td>
</tr>
<tr>
<td>Mokopane</td>
<td>191</td>
<td>0.2x</td>
<td>38</td>
<td>3.0</td>
</tr>
<tr>
<td>Brits</td>
<td>20</td>
<td></td>
<td>20</td>
<td>1.6</td>
</tr>
<tr>
<td>AfriTin Mining (17.5%)</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>Lemur Resources</td>
<td>10</td>
<td></td>
<td>10</td>
<td>0.8</td>
</tr>
<tr>
<td>Corporate G&amp;A</td>
<td>-19</td>
<td></td>
<td>-19</td>
<td>-1.5</td>
</tr>
<tr>
<td>EV</td>
<td>337</td>
<td>184</td>
<td>14.7</td>
<td></td>
</tr>
<tr>
<td>BMN-level cash</td>
<td>estimate</td>
<td>3</td>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>Convertible debt</td>
<td>estimate</td>
<td>-7</td>
<td>-7</td>
<td>-0.6</td>
</tr>
<tr>
<td>NAV</td>
<td>333</td>
<td>180</td>
<td>14.3</td>
<td></td>
</tr>
</tbody>
</table>

*Assumes long-term FX rate assumptions of R12.25:US$1 and US$1.40:£1  
Source: ARC estimates
We consider US$30/kg to be a suitably conservative long-term price assumption for vanadium taking into account the supply-demand outlook but also historical pricing trends and the pricing environment for vanadium redox flow battery technology to be widely embraced on a sustainable commercial basis. However, we note that the current market is some way ahead of this, with FeV reportedly currently trading at around US$60/kg.

Figure 4 below illustrates the sensitivity of our Bushveld NAV estimate to vanadium price and the US/ZAR exchange rate (another key determinant of Vametco’s level of profitability).

Figure 5 illustrates the sensitivity of our sum-of-parts NAV estimate to assumed long-term vanadium price and discount rate assumption.

Market peer-group comparable analysis

There are very few ‘pure-play’ publicly-quoted vanadium companies with which to compare Bushveld against. Of those that do exist, by far the highest-profile is TSX-listed Largo Resources (LGO CN), owner of the Maracás Menchen primary vanadium operation in Brazil.

As an established operator (Maracás Menchen commenced production in H2 2014, and has been steadily ramping up since then) with the world’s highest-grade production base, it is unsurprising that Largo commands a premium market rating on the basis of EV/t V₂O₅ equivalent resource (Figure 6). But, as the only other producing company in the peer group, Bushveld looks significantly undervalued, in our view – it is currently trading at a substantial discount to Largo on an EV/t basis (despite Vametco producing ferrovanadium equivalent at low cost rather than an intermediate product, and despite Bushveld having significantly lower debt levels), and broadly in-line with the three non-producing companies (two of which, in addition to being non-cash-flow generating, have significantly lower-grade resource bases than Bushveld).
We would expect Bushveld to upwardly re-rate relative to this peer group as it further executes on its expansion plans for Vametco and demonstrates its cash-flowing credentials over the next year.

*Vanadium producers

Source: Bloomberg, Company data, ARC estimates
Forecasts

Figures 8-12 below summarise our operating and financial forecasts, the latter assuming Vametco is fully consolidated in Bushveld’s P&L from 2018 (we equity account Vametco for 2017). Note that our tabulated 2016 numbers reflect Bushveld’s reported financial statements for the 12 months to 28 February 2017, its previous fiscal year – the company has since moved to a calendar year end.

Bushveld has not yet reported financial results since taking majority control of Vametco, so our forecasts are presented on a ‘best estimates’ basis. The accounting treatment may differ materially (specifically in relation to minorities and dividends). We conservatively assume Vametco only commences cash dividends in 2020 following completion of the capacity expansion programme. Our estimates also assume the convertible bonds are repaid in 2019 – in reality we expect these will be converted, which would lift our estimated 2019 year-end cash balance by £5m.

Given uncertainty over Mokopane’s future development (which has become less core following the acquisition of the long-life Vametco operation and neighbouring Brits property), we do not include any contribution from this project in our forecasts (our sum-of-the-parts valuation assumes Mokopane enters production in 2021).

*Bushveld did not assume majority control of Vametco until end 2017
Source: ARC estimates

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**Figure 8: Summary Vametco operational forecasts and macro assumptions**

<table>
<thead>
<tr>
<th></th>
<th>2017E*</th>
<th>2018E</th>
<th>2019E</th>
<th>2020E</th>
</tr>
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<tbody>
<tr>
<td>Vanadium production</td>
<td>t</td>
<td>2,649</td>
<td>3,680</td>
<td>4,280</td>
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<tr>
<td>V₂O₅ equivalent</td>
<td>t</td>
<td>4,729</td>
<td>6,569</td>
<td>7,641</td>
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<tr>
<td>Vanadium market price</td>
<td>US$/kg V</td>
<td>2,721</td>
<td>3,680</td>
<td>4,280</td>
</tr>
<tr>
<td>Vanadium received price</td>
<td>US$/kg V</td>
<td>30.13</td>
<td>38.80</td>
<td>33.95</td>
</tr>
<tr>
<td>Total cash costs (including royalties)</td>
<td>US$/kg V</td>
<td>20.91</td>
<td>21.99</td>
<td>21.03</td>
</tr>
<tr>
<td>Operating cash margin</td>
<td>%</td>
<td>31%</td>
<td>43%</td>
<td>38%</td>
</tr>
<tr>
<td>All-in costs (including depreciation)</td>
<td>US$/kg V</td>
<td>21.47</td>
<td>23.05</td>
<td>22.53</td>
</tr>
<tr>
<td>All-in margin</td>
<td>%</td>
<td>29%</td>
<td>41%</td>
<td>34%</td>
</tr>
<tr>
<td>GB Sterling</td>
<td>USD:GBP</td>
<td>1.29</td>
<td>1.40</td>
<td>1.40</td>
</tr>
</tbody>
</table>

*Reflects Bushveld’s reported accounts to the 28 February 2016

**Source: ARC estimates**

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**Figure 9: Summary Bushveld Minerals consolidated income statement**

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>102.0</td>
<td>103.8</td>
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<tr>
<td>Cost of sales</td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>(51.1)</td>
<td>(59.0)</td>
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<tr>
<td>Other income</td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Selling &amp; distribution costs</td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>(5.7)</td>
<td>(6.1)</td>
</tr>
<tr>
<td>G&amp;A costs</td>
<td>£m</td>
<td>(1.6)</td>
<td>(1.5)</td>
<td>(5.3)</td>
<td>(5.3)</td>
</tr>
<tr>
<td>Other expenses</td>
<td>£m</td>
<td>0.0</td>
<td>(1.5)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Operating profit</td>
<td>£m</td>
<td>(1.5)</td>
<td>(3.0)</td>
<td>40.5</td>
<td>34.0</td>
</tr>
<tr>
<td>Net finance costs</td>
<td>£m</td>
<td>(0.2)</td>
<td>(0.5)</td>
<td>(1.1)</td>
<td>(0.9)</td>
</tr>
<tr>
<td>Impairments</td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Share of profit/(loss) from associates**</td>
<td>£m</td>
<td>0.0</td>
<td>2.9</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Tax</td>
<td>£m</td>
<td>(1.7)</td>
<td>(8.3)</td>
<td>39.4</td>
<td>33.1</td>
</tr>
<tr>
<td>Net profit/(loss)</td>
<td>£m</td>
<td>(1.7)</td>
<td>(8.3)</td>
<td>23.2</td>
<td>19.8</td>
</tr>
<tr>
<td>Minority interests</td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>(13.1)</td>
<td>(10.2)</td>
</tr>
<tr>
<td>Attributable net profit/(loss)</td>
<td>£m</td>
<td>(1.7)</td>
<td>(8.3)</td>
<td>10.1</td>
<td>9.6</td>
</tr>
</tbody>
</table>

*Reflects Bushveld’s reported accounts to the 28 February 2016

**Source: ARC estimates**

1 March 2018
**Bushveld Minerals**

**Figure 10: Summary Bushveld Minerals consolidated cash flow statement**

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational CF before WC changes</strong></td>
<td>£m</td>
<td>(1.4)</td>
<td>(3.0)</td>
<td>27.1</td>
<td>25.3</td>
</tr>
<tr>
<td><strong>Working capital changes</strong></td>
<td>£m</td>
<td>1.4</td>
<td>(1.9)</td>
<td>(5.5)</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Cash flow from operations</strong></td>
<td>£m</td>
<td>0.0</td>
<td>(4.9)</td>
<td>21.6</td>
<td>26.0</td>
</tr>
<tr>
<td>Capex</td>
<td>£m</td>
<td>(0.0)</td>
<td>(0.5)</td>
<td>(9.3)</td>
<td>(11.8)</td>
</tr>
<tr>
<td>Other</td>
<td>£m</td>
<td>(0.8)</td>
<td>(4.9)</td>
<td>(1.8)</td>
<td>(1.9)</td>
</tr>
<tr>
<td><strong>Cash flow from investing activities</strong></td>
<td>£m</td>
<td>(0.8)</td>
<td>(5.4)</td>
<td>(11.1)</td>
<td>(13.6)</td>
</tr>
<tr>
<td><strong>Equity issue</strong></td>
<td>£m</td>
<td>3.2</td>
<td>1.7</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td><strong>Net borrowings</strong></td>
<td>£m</td>
<td>(2.5)</td>
<td>16.3</td>
<td>0.0</td>
<td>(5.0)</td>
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<tr>
<td><strong>Dividends to minorities</strong></td>
<td>£m</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Other</td>
<td>£m</td>
<td>(0.5)</td>
<td>(1.3)</td>
<td>(0.9)</td>
<td>(0.6)</td>
</tr>
<tr>
<td><strong>Cash flow from financing activities</strong></td>
<td>£m</td>
<td>0.1</td>
<td>16.7</td>
<td>(0.9)</td>
<td>(5.6)</td>
</tr>
<tr>
<td><strong>Increase/(decrease) in cash</strong></td>
<td>£m</td>
<td>(0.7)</td>
<td>6.4</td>
<td>9.6</td>
<td>6.7</td>
</tr>
</tbody>
</table>

*Reflects Bushveld's reported accounts to the 28 February 2016  **Vametco equity accounted in 2017  

Source: ARC estimates

**Figure 11: Summary Bushveld Minerals consolidated balance sheet**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>£m</td>
<td>0.1</td>
<td>6.6</td>
<td>16.2</td>
<td>22.9</td>
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<tr>
<td>P,P&amp;E</td>
<td>£m</td>
<td>0.3</td>
<td>14.1</td>
<td>20.7</td>
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<tr>
<td>Intangible assets</td>
<td>£m</td>
<td>60.2</td>
<td>53.6</td>
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<td>54.7</td>
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<tr>
<td>Other assets</td>
<td>£m</td>
<td>2.5</td>
<td>30.8</td>
<td>32.6</td>
<td>29.4</td>
</tr>
<tr>
<td><strong>Total assets</strong></td>
<td>£m</td>
<td>63.1</td>
<td>105.1</td>
<td>123.7</td>
<td>134.8</td>
</tr>
<tr>
<td>Payables</td>
<td>£m</td>
<td>1.4</td>
<td>17.4</td>
<td>14.6</td>
<td>13.2</td>
</tr>
<tr>
<td>Debt</td>
<td>£m</td>
<td>0.0</td>
<td>15.5</td>
<td>13.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Other liabilities</td>
<td>£m</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total liabilities</strong></td>
<td>£m</td>
<td>1.4</td>
<td>32.9</td>
<td>28.2</td>
<td>21.7</td>
</tr>
<tr>
<td>Shareholders' equity</td>
<td>£m</td>
<td>59.7</td>
<td>61.5</td>
<td>71.8</td>
<td>79.2</td>
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<tr>
<td>Non-controlling interests</td>
<td>£m</td>
<td>2.0</td>
<td>10.7</td>
<td>23.7</td>
<td>33.9</td>
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<tr>
<td>Total equity</td>
<td>£m</td>
<td>61.7</td>
<td>72.2</td>
<td>95.5</td>
<td>113.1</td>
</tr>
<tr>
<td><strong>Total liabilities &amp; equity</strong></td>
<td>£m</td>
<td>63.1</td>
<td>105.1</td>
<td>123.7</td>
<td>134.8</td>
</tr>
</tbody>
</table>

*Reflects Bushveld’s reported accounts to the 28 February 2016  

Source: ARC estimates

**Figure 12: Key financial measurements and ratios**

<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
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<tbody>
<tr>
<td>EBITDA</td>
<td>£m</td>
<td>(1.5)</td>
<td>(3.0)</td>
<td>43.3</td>
<td>38.6</td>
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<tr>
<td>EBITDA margin</td>
<td>%</td>
<td>na</td>
<td>na</td>
<td>42%</td>
<td>37%</td>
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<tr>
<td>EBIT</td>
<td>£m</td>
<td>(1.5)</td>
<td>(7.8)</td>
<td>40.5</td>
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<td>EBIT margin</td>
<td>%</td>
<td>na</td>
<td>na</td>
<td>40%</td>
<td>33%</td>
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<tr>
<td>EPS</td>
<td>GBp</td>
<td>(0.28)</td>
<td>(1.06)</td>
<td>1.14</td>
<td>1.07</td>
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<tr>
<td>Net profit margin</td>
<td>%</td>
<td>na</td>
<td>na</td>
<td>10%</td>
<td>9%</td>
</tr>
<tr>
<td>Free cash flow</td>
<td>£m</td>
<td>(0.8)</td>
<td>(10.3)</td>
<td>10.5</td>
<td>12.3</td>
</tr>
<tr>
<td>Net cash/(debt)</td>
<td>£m</td>
<td>0.1</td>
<td>(8.9)</td>
<td>2.6</td>
<td>14.3</td>
</tr>
<tr>
<td>EV/EBITDA</td>
<td>x</td>
<td>na</td>
<td>na</td>
<td>1.8</td>
<td>2.0</td>
</tr>
<tr>
<td>P/E</td>
<td>x</td>
<td>na</td>
<td>na</td>
<td>7.3</td>
<td>7.8</td>
</tr>
<tr>
<td>FCF yield</td>
<td>%</td>
<td>na</td>
<td>na</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

*Reflects Bushveld’s reported accounts to the 28 February 2016  

Source: ARC estimates
Risks

► Macro factors (e.g. exchange rates and commodity prices) may differ materially from our assumptions, impacting our financial forecasts and valuation.

► Bushveld has yet to report financial results since taking a controlling interest in Vametco, its sole cash-generating asset. The flow of cash and calculation of profit/loss attributable to minority interests may differ materially from our assumed structure.

► As its sole cash-generating asset, Bushveld is highly exposed to the operational performance of Vametco – as is the case with all mining businesses, operating and cost performance may differ materially from company budgets and forecasts owing to unforeseen technical and economic factors.

► Dilution: by our estimates, Vametco’s expansion can be adequately funded through internally-generated cash. However, Bushveld may or may not seek to raise additional equity in the future to fund other, unforeseen initiatives.
Vanadium market overview

With its acquisition of a controlling stake in the Vametco operation in South Africa, Bushveld has evolved into a focused equity play on vanadium, a specialist metal whose high strength-to-weight ratio, resistance to corrosion and favourable electrochemical properties lend it for use in a variety of industrial applications.

A tightening of the supply base over recent years coupled with resilient demand from traditional metallurgical applications and the emergence of energy-storage applications as a potentially highly significant future source of demand has opened a structural deficit in the vanadium market, triggering a striking recovery in prices for vanadium products over the past 18-24 months from the multi-year lows of late 2015 to early 2016. With this deficit showing no obvious sign of receding in the near to medium term, we believe pricing is set to remain buoyant.

Figure 13: Vanadium 10-year price history (FeV basis)

Vanadium 101

Most vanadium is recovered from magnetite and titanomagnetite ores, either as the primary product (17% of global supply in 2016 according to Vanitec) or more commonly as a co-product with iron processed for steel production (73%). It can also be recovered as a secondary product (accounting for the 10% balance of supply in 2016) from fly ash, petroleum residues, alumina slag, and from the recycling of spent catalysts used for some crude oil refining.

The two main traded vanadium products are vanadium pentoxide ($V_2O_5$) concentrate and ferrovanadium (FeV). $V_2O_5$ is the most common intermediate product from treatment of magnetite iron ores, vanadium-bearing slags and secondary materials, and can be used directly by some non-metallurgical applications and in the production of vanadium chemicals. It is also the starting material for production of FeV, the vanadium alloy used as a strengthening/hardening agent in manufacturing of high-strength steel (vanadium’s dominant end use).

Vanadium is not an exchange-traded commodity, pricing instead negotiated by contract between supplier and customer (often through an intermediary trader). Indicative market pricing data is published by commodities market intelligence.
organisations such as Metal Bulletin. Vanadium pentoxide prices are quoted by US Dollar per pound of $V_2O_5$ concentrate (generally on an FOB basis), while ferrovanadium prices are quoted by US Dollar per kilogram of contained V (with a range of prescribed minimum V levels, e.g. 50% and 80%).

Supply

Vanadium supply is dominated by three countries, China (accounting for 57% of 2016 global output of c76,000t), Russia (11%) and South Africa (10%).

South Africa has historically been the largest producer of primary vanadium, and has also been a significant supplier of co-product sourced material. Its output has fallen sharply in recent years with the closure of the EVRAZ Highveld Steel and Vanadium’s operations (a major supplier of co-product vanadium). Vametco and Glencore’s Rhovan operation are now South Africa’s only active vanadium producers. Together with a reduction in Chinese co-product output, this has driven a material decline in global vanadium supply in recent years (c15% year-on-year reduction in 2016).

Figure 14: Global vanadium production 2011-17e

Historic dominance of co-production driving supply constraints

An unusual feature of the vanadium market relative to other commodity sub-sectors is that the main consumer – the steel industry – is also indirectly the largest producer, with over two-thirds of global supply of vanadium co-produced from slag generated through the processing of magnetite iron ores in steelmaking. As such, the health of the iron-ore and steel industry has a direct impact on vanadium supply.

Though magnetite ores represent the highest-cost source of iron (owing to their typically low Fe grades), the co-produced vanadium is inexpensive relative to primary and secondary source, as the costs are borne by the primary iron production (which in turn are absorbed by the steel mill in an integrated operation). Most vanadium feedstock supply in China is co-product from steel plants that process the low-grade vanadium-bearing magnetite ores prevalent domestically, producing steel and a vanadium slag (which is then further processed using similar techniques to those employed in primary vanadium production).
Co-product sourced vanadium supply has become significantly constrained over recent time owing to the following factors:

► The high cost of mining and processing low-grade magnetite ores relative to the cost of importing higher-quality (and, in recent times, increasingly low-cost) seaborne-traded haematite ore;

► The high running costs of the complex steel plants that are necessary to extract titanium and vanadium from magnetite ores, which struggle to compete with the simpler blast furnace operations that process haematite iron ores;

► No leverage on steel prices owing to the small share of global steel production that the high-cost vanadium and titanium-bearing magnetite ore-processing steel plants have.

Magnetite iron-ore processing steel plants have thus come under significant economic pressure, with several curtailing or suspending production, and some resorting to blending their ore feeds with cheaper and higher quality haematite ores that contain no vanadium. The consequence has been a significant reduction in global co-product supply of vanadium.

Primary vanadium production on the other hand accounts for a much smaller share of total global supply (less than 20%), and the development of any new potential primary supply source of scale would likely require elevated vanadium prices to be sustained. Even then, there are few projects globally that we are aware of that have the requisite vanadium grades to prove economically viable across a cycle. Consistently high vanadium prices could incentivise the production of vanadium from alternative lower-grade sources such as sedimentary rock hosted deposits in China, though environmental concerns over such operations would, we believe, limit their impact on global supply.
Secondary production of vanadium lies at the marginal end of the industry cost curve, and could thus increase in scale should elevated vanadium prices persist. However, we do not envisage secondary supply to materially increase, as it is highly exposed to fluctuations in market pricing and to the availability of raw materials such as boiler ashes and slags and spent catalysts and residues.

*N.B. V₂O₅ price has more than doubled since this chart was drafted.*

Source: Vanitec, TTP Squared
Demand

The steel industry, and in particular that part focused on the manufacture of high-strength construction steel such as rebar, is by far the dominant end user of vanadium, accounting for over 90% of global consumption of the metal.

Unsurprisingly given its position in the global steel industry, China is the largest market, accounting for over 40% of global consumption. This share is anticipated to rise going forward, more as a function of the country’s increasing intensity of vanadium use in its steel industry rather than any significant outright growth of its steel output – China has been upwardly revising domestic standards for the minimum permissible tensile strength of steel rebar products used domestically, which should result in more vanadium additive being used in steel produced for domestic consumption. This could result in a c30% increase in Chinese vanadium demand according to estimates by the China Iron and Steel Research Institute.

China is increasing its intensity of vanadium use in steel production

Unsurprisingly given its position in the global steel industry, China is the largest market, accounting for over 40% of global consumption. This share is anticipated to rise going forward, more as a function of the country’s increasing intensity of vanadium use in its steel industry rather than any significant outright growth of its steel output – China has been upwardly revising domestic standards for the minimum permissible tensile strength of steel rebar products used domestically, which should result in more vanadium additive being used in steel produced for domestic consumption. This could result in a c30% increase in Chinese vanadium demand according to estimates by the China Iron and Steel Research Institute.

Figure 18: Global vanadium consumption 2011-17e

Source: Vanitec

Figure 19: Intensity of vanadium use in Chinese rebar is rising

Source: Vanitec
Other notable end uses of vanadium include: application as an additive in non-ferrous alloys (e.g. titanium-aluminium); a catalyst for production of maleic anhydride, sulphuric acid and petroleum cracking; and various chemical applications.

![Figure 20: Vanadium consumption by end-use application](source)

VRFBs application as a utility-level energy storage solution is emerging as a potentially significant new driver of demand.

The latter includes production of vanadium electrolyte for use in vanadium redox-flow batteries (VRFBs), vanadium’s solubility and ability to exist in different oxidation states making it ideally suited for such large-scale, durable energy-storage solutions. VRFB technology is already being used commercially, albeit at a limited scale, but we believe its adoption is set to rise owing to an increasing global shift towards renewable energy (which needs stored) and the many advantages VRFB’s have for utility-level storage over more established battery technologies such as lithium-ion. These include being non-combustible, readily scalable, and, most crucially, providing fast response times and near unlimited recharging and discharging capacity (resulting in a much longer working life and therefore lower overall cost across the life cycle).

![Figure 21: Vanadium electrolyte’s role in the redox flow battery](source)
The energy-storage market could thus emerge as potentially the most significant driver of vanadium demand over the longer term. If realised, energy sector experts’ projections for growth of the energy-storage market could see VRFBs’ share of vanadium consumption growing from the current 2-3% to potentially up to around 20% by 2030.

Outlook

The structural deficit that has emerged in the vanadium market over recent times is reflected in the metal’s exceptionally strong price performance in 2017, with FeV prices increasing by more than 50% across the year and closing at over US$40/kg. As of the end of January 2018, FeV was trading even higher still, at around US$60/kg. We believe pricing will remain robust in the near to medium term, as we simply do not see the iron-ore price rising to the extent that much of the mothballed vanadium-magnetite-ore fed steel operations will come back on stream, which will continue to limit co-product vanadium supply (historically the cornerstone of global vanadium output). Primary output meanwhile will, we believe, continue to be constrained by the geological scarcity of deposits with the requisite scale and grade to be economic at long-term historic average vanadium prices.

On the demand side, we do not necessarily envisage any substantial increase in global steel production rates near term, but we do see potential for a continuing increase in the intensity of vanadium utilisation in the production of high-strength steels (particularly in China, which is coming from a lower base relative to the West).

The energy-storage sector is an emerging demand centre that has much potential, but is in its infancy. VRFBs have many obvious benefits over alternative energy-storage technology for utility-scale use, and we therefore believe there is considerable scope for growth in commercial use.

Since 2017, the use of vanadium in energy storage has grown significantly, particularly with the announcement and start of production for very large VRFBs in China. This includes a 200MW/800MWh system by Rongke Power in Dalian, announced in 2016, and a 100MW/500MWh system by Pu Neng in Hubei Province, announced in 2017. These projects are a result of Chinese Government policy to support the technology through deployment of at least 100MW scale VRFBs. The impact on vanadium demand could be significant – just one such 800MWh VRFB facility would consume c4,400t of vanadium, equivalent to over 5% of current global supply.

Ironically prolonged elevated vanadium prices could constrain growth in VRFB use, as, unlike lithium in the context of lithium-ion batteries, vanadium electrolyte feedstock is the major component in the overall cost of producing a VRFB unit. Another critical issue for VRFB developers is security of supply of vanadium feedstock of requisite quality – most of the world’s vanadium supply is targeted at the steel industry, which is relatively agnostic to vanadium quality. Currently installed global capacity to produce high-quality vanadium feedstock materials is thus limited.
We consider US$30/kg V to be a suitably conservative long-term FeV price assumption

Putting all these considerations together, we suggest US$30/kg V is a suitably conservative long-term ferrovanadium price assumption to be using for equity valuation purposes. This is significantly lower than current market pricing of around US$60/kg (and we taper our pricing assumptions down to this long-term deck over the next two years accordingly). However, our long-term price assumption is broadly in line with the ten-year average FeV price.

But one must be mindful that the vanadium market can be highly volatile over a relatively short period of time, as illustrated over the past two years, when the FeV price has ranged from a low of just over US$13/kg at the start of 2016 to currently traded levels of over US$60kg.
Company overview

History and evolution

Bushveld listed on London’s AIM market in March 2012 through an IPO at 20p per share (giving the company an opening market capitalisation of £57m), raising £5.5m to advance its Bushveld iron-ore and Mokopane tin projects in South Africa.

Later that year the company diversified its asset base with an initial £0.4m investment (for 3%) in ASX-listed Lemur Resources, owner of the Imaloto thermal coal project in Madagascar. It increased its holding in Lemur to over 50% majority control in 2013 following partial take-up of a A$19m all-share takeover offer, and took full ownership in 2015 following a A$0.06/share cash offer to remaining minority shareholders (the latter offer valuing Lemur at A$11m).

In 2013 Bushveld expanded its tin portfolio with the acquisition of a 50% interest in the Marble Hall project in South Africa’s Limpopo Province, and established Greenhill Resources, a wholly-owned dedicated tin subsidiary. Greenhill acquired more tin assets in 2017 with the purchase of significant stake in the Uis tin project in Namibia, and was eventually spun out from as a standalone AIM-quoted company called AfriTin Mining (ATM LN) in November 2017, allowing Bushveld to focus fully on its core vanadium business.

Vanadium began to emerge as the company’s key commodity of interest in late 2013, when the Bushveld Vanadium subsidiary was established to focus on the vanadium potential of its South African properties. A prefeasibility study of the Mokopane vanadium project was completed in early 2014, and in 2015 Bushveld Vanadium expanded its South African vanadium footprint with the acquisition from Sable Metals and Minerals of three greenfield properties in the North West province, close to the then EVRAZ-owned Vametco operations.

In May 2016 Bushveld announced it had agreed to acquire EVRAZ’s 79% interest in Strategic Minerals Corporation (SMC), the 75% owner of Vametco. The US$16.5m deal was completed in April 2016, marking Bushveld’s transition from vanadium project developer to producer. While that transaction was progressing, Bushveld also acquired for US$0.6m the neighbouring Brits property, significantly increasing its overall vanadium resource potential.

The company’s vanadium evolution progressed further in January 2016 with the establishment of Bushveld Energy, an 84%-owned subsidiary focused on developing and promoting the role of vanadium in the growing global energy storage market through its application in vanadium redox flow batteries.

Finances and capital structure

Bushveld acquired its interest in Vametco in a leveraged buy-in via special purpose vehicle Bushveld Vametco, the latter initially owned 45% by Bushveld Minerals and 55% by a separate group called Yellow Dragon Holdings (Bushveld subsequently acquired Yellow Dragon’s share – see pp23-24). The US$16.5m purchase price was met through a US$11m bridge loan, a US$3m prepayment facility (subsequently rolled in to an US$11m working capital debt facility at the Bushveld Vametco level – see below) and US$2.5m through equity (funded by Bushveld Minerals and Yellow Dragon).
Bushveld’s last-reported cash position was £0.1m at 31 August 2017, the mid-point of its then fiscal year (the company has since moved to calendar year reporting). Since then the company has bolstered its working capital position through the issue of £8m in convertible bonds to UK-based specialist investment group Atlas Capital Group and its US joint venture partner Atlas Special Opportunities. The bonds carry a coupon of 7.5% pa and have a maturity date of two years from issuance (the first £4.5m tranche was issued in September 2017, the second £3.5m tranche was issued in November 2017). The bonds are convertible into new Bushveld shares at a price equal to the company’s five-day weighted average share price determined over the ten trading days immediately prior to receipt of the conversion notice.

Atlas has agreed to convert no more than 25% of the bonds in any three-month period until 30 September 2018, and to not short sell and/or borrow any Bushveld shares at any point over the two years from first issuance. To date, Atlas has converted £3m of the £8m total.

Bushveld also has available a US$11m working capital facility provided by specialist minerals and metals trader Wogen Resources Ltd (the exclusive marketer of Vametco’s Nitrovan product globally, other than in Japan and Taiwan). At any point in time the amount drawn under the facility must be backed fully by two-thirds of the value of the Vametco inventory that it is financing.

After accounting for the Atlas convertible and our estimate of cash outflows over October to December (including the net cash component of acquiring Yellow Dragon’s interest in Vametco), we estimate Bushveld’s unrestricted cash position at the plc level at end 2017 was approximately £2m. We estimate its debt position at approximately £13.5m (comprising the Atlas convertible bonds less amounts converted to date, and the US$11m Wogen facility, which we assume is fully drawn).

The above figures reflect our estimates of the net debt position at Bushveld Minerals topco, as distinct from our estimates for the consolidated group as presented in figures 9-11 – timing and mechanism of flow of cash up from Vametco has yet to be determined (our estimates conservatively assume cash dividends are paid by Vametco from 2020).

We estimate there was further cash of £4-5m within Vametco at end 2017 (for a consolidated group cash total of £6-7m). There is no external debt in Vametco.

<table>
<thead>
<tr>
<th>Figure 23: Estimated net debt position at end-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
</tr>
<tr>
<td>Atlas convertible bonds</td>
</tr>
<tr>
<td>Drawn Wogen working capital facility</td>
</tr>
<tr>
<td>Net debt</td>
</tr>
</tbody>
</table>

Source: ARC estimates

We estimate there was c£5m of cash within the Vametco business at end 2017, in addition to c£2m at the Bushveld Minerals plc level.
Vametco

Vametco is an integrated primary vanadium operation located near the town of Brits on the Eastern Limb of the Bushveld Minerals Complex in northern South Africa (Figure 25). Comprising a primary vanadium open-pit mine and a processing plant producing a proprietary ferrovanadium-equivalent product, Vametco is situated adjacent to Bushveld’s Brits vanadium project, which could serve as a future alternative source of near-surface ore feed for the operation.

Ownership history

The mine has been in operation since the late 1960s when it was established by then owner Union Carbide of the US. The latter was acquired by Strategic Minerals Corp (SMC), also of the US, in 1986 and renamed Vametco Minerals Corp (VMC). It remained a wholly-owned US-registered subsidiary of SMC until 2006 when it was converted into South African-incorporated entity Vametco Holdings (Pty) Ltd, held 75% by SMC and 25% (in the process of rising to 26%) by a ‘Black Economic Empowerment’ (BEE) strategic partner.

Russian steel group EVRAZ acquired a 78.8% controlling stake in SMC in 2007, becoming the majority owner of Vametco. The 21.2% balancing interest in SMC is held by Japanese industrial conglomerate Sojitz.

Bushveld acquisition

Bushveld obtained an initial effective 26% interest in Vametco in April 2017 through the joint acquisition with Yellow Dragon of EVRAZ’s entire 78.8% stake in SMC for US$16.5m. Vametco had become a non-core asset for EVRAZ, the group having elected to withdraw from South Africa after its larger Highveld steel and vanadium operations entered administration.

The transaction was affected through Bushveld Vametco, a special purpose vehicle at that time owned 45% by Bushveld and 55% by Yellow Dragon. Bushveld Vametco financed the acquisition through: US$1.7m in cash exclusivity fee payments to EVRAZ.
(US$0.5m on 30 March 2016, US$0.5m on 13 May 2016 and US$0.6m on 22 July 2016); a bridge loan facility of US$11.0m from Barak Fund SPC Ltd (subsequently repaid); a US$3.0m prepayment facility from Wogen Resources Ltd (since replaced by a larger, US$11m working capital facility) related to a sales and marketing agreement with the latter; and a further US$0.8m cash contribution from Bushveld Vametco.

Figure 26: Vametco ownership history

In December 2017 Bushveld acquired Yellow Dragon’s 55% stake in Bushveld Vametco, increasing its ownership in SMC to 78.8% and thus its underlying equity interest in Vametco to 59%. The consideration comprised an upfront US$11.1m payment satisfied US$4.5m in cash (less previous fees owed from Yellow Dragon) and US$6.6m in new Bushveld shares (54.8m shares at 9.06p per share).

Additionally, Bushveld will make three deferred payments, two of US$0.6m each following publication of Vametco’s accounts for the years ended 31 December 2018 and 2019, and one calculated by reference to Vametco’s EBITDA for the year ended 31 December 2020.

Figure 27: Bushveld’s staged buy-in to Vametco

<table>
<thead>
<tr>
<th>Date</th>
<th>Transaction</th>
<th>Consideration</th>
<th>Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 2017</td>
<td>BVL (45% BMN, 55% Yellow Dragon) acquires EVRAZ’s 78.8% stake in SMC</td>
<td>US$16.5m upfront</td>
<td>▪ US$11.0m bridge loan (repaid)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US$5m deferred</td>
<td>▪ US$3.0m debt facility with Wogen</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ US$2.5m BMN/Yellow Dragon cash</td>
</tr>
<tr>
<td>Nov 2017</td>
<td>BMN acquires Yellow Dragon’s 55% stake in BVL</td>
<td>US$11.1m upfront</td>
<td>▪ US$6.6m in BMN shares (at 9p/s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ US$4.5m in cash</td>
</tr>
<tr>
<td>2019</td>
<td>Deferred Yellow Dragon payment</td>
<td>US$0.6m fixed</td>
<td>Cash</td>
</tr>
<tr>
<td>2020</td>
<td>Deferred Yellow Dragon payment</td>
<td>US$0.6m fixed</td>
<td>Cash</td>
</tr>
<tr>
<td>2021</td>
<td>Deferred Yellow Dragon payment</td>
<td>4.5x Vametco 2020 EBITDA x 5.91%</td>
<td>Cash</td>
</tr>
</tbody>
</table>

Source: Bushveld Minerals news releases
Geology and resources

Vanadium mineralisation in the region occurs within titaniferous magnetite-rich layers within the Rustenburg Suite in the upper zone of the Bushveld Igneous Complex. The magnetite layers are typically concordant, continuous along strike and down-dip, but can vary considerably in thickness and grade (of magnetite, vanadium and titanium).

Locally at the Vametco property, the magnetite layers strike in an east-west direction for 3.3km and dip northwards at an average of 19 degrees. Three main seams are present – the Upper, Intermediate and Lower. The Lower seam has been the main focus of production activities to date, as it is generally thicker (average thickness of c26m, compared with c11m for the Upper and Intermediate seams) and higher grade (c2.0% V$_2$O$_5$ contained in magnetite versus c1.7-1.8% in the Upper and Intermediate seams).

Following its acquisition of an initial interest in Vametco in April 2017, Bushveld's geologists, in conjunction with Vametco’s management team, undertook a full review of the previously published mineral resource and reserve estimates with a view to improving the operation's grade control.

The review identified erroneous assay data for some historic drill holes, with vanadium values inconsistent with those reported from mining of the same areas. The erroneous assay values were discarded from the database, which was then re-modelled resulting in a revised JORC Code compliant resource and reserve estimated by independent consultant MSA Group as detailed in Figure 29.

The revised reserve calculation (effective date 6 October 2017) displays lower average vanadium grades (though still high by global standards), but these are considered by Bushveld to be more in line with realised vanadium grades of the concentrate fed into the process plant’s kiln, and thus should facilitate better grade control and thus process optimisation going forward.
**Figure 29: Resources and reserves**

<table>
<thead>
<tr>
<th>Category</th>
<th>Tonnage</th>
<th>Magnetite</th>
<th>$V_2O_5$ grade</th>
<th>$V_2O_5$ content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured &amp; Indicated</td>
<td>61.5</td>
<td>27.23</td>
<td>2.01</td>
<td>336.6</td>
</tr>
<tr>
<td>Inferred</td>
<td>80.9</td>
<td>31.12</td>
<td>1.92</td>
<td>479.6</td>
</tr>
<tr>
<td><strong>Total Resources</strong></td>
<td>142.3</td>
<td>27.47</td>
<td>1.96</td>
<td>816.2</td>
</tr>
<tr>
<td>Proven reserves</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Probable reserves</td>
<td>26.1</td>
<td>26.79</td>
<td>1.96</td>
<td>137.2</td>
</tr>
<tr>
<td><strong>Total Reserves</strong></td>
<td>26.1</td>
<td>26.79</td>
<td>1.96</td>
<td>137.2</td>
</tr>
</tbody>
</table>

*As at 6/10/17, calculated at cut-off grade of 0.16% $V_2O_5$ in magnetite  

Source: Bushveld Minerals

**Mining operations**

The Vametco mine employs conventional open-pit bench mining methods to exploit well-defined vanadium-bearing ore seams that strike 3.5km in an east-west orientation and dip at 19° to the north.

By our estimates existing ore reserves would be sufficient to maintain production at current rates (c3,000t pa V) for around 17 years. However, Bushveld has plans to lift output to around 5,000t pa V through a staged expansion over the next two years (see pp29-30), which we estimate would require mining rates to increase to around 5Mt pa (c2.5Mt pa ore and c2.5Mt pa waste for a 1:1 strip ratio). This would reduce the mine life to around 10 years based on current reserves, but we note the potential of the significant inferred resource base at Vametco to be upgraded to indicated status, and ultimately converted to mineable reserves. Furthermore, the adjacent Brits property represents another source of potential future ore supply (p32).

We therefore fully expect Vametco to run at management’s targeted expanded production level for at least another 20 years, and likely much longer than that.

*As at 6/10/17, calculated at cut-off grade of 0.16% $V_2O_5$ in magnetite  

Source: Bushveld Minerals

Source: Bushveld Minerals

**Figure 30: The Vametco open-pit mine has many years of resources**

*Source: ARC*
Processing facility

The Vametco processing facility employs a conventional salt roast and leaching process to produce a modified vanadium oxide (MVO) product (Figure 31). A final processing stage is then incorporated to convert the MVO to a unique, trademarked vanadium carbon nitride product called Nitrovan.

Run-of-mine (ROM) ore is first fed into a primary, secondary and tertiary crushing circuit, with the crushed material then heading to the mill for grinding. Ground particles exiting the mill next undergo magnetic separation to produce a concentrated magnetite material running at an average grade of around 2% V$_2$O$_5$.

The magnetite concentrate is then roasted with sodium salts in a kiln at temperatures of approximately 1,200°C to produce water-soluble sodium vanadate. The latter is next converted into ammonium metavanadate (AMV) through a leaching and purification process (the roasted vanadium concentrate is dissolved in water and then subject to vanadium purification and precipitation through the addition of ammonium sulphate before drying and calcining in a rotary kiln). Dried AMV is then reduced to modified vanadium oxide (MVO) feedstock.

The MVO is finally briquetted and fed into an induction shaft furnace in a nitrogen-rich environment to produce the saleable Nitrovan product. It can also be used as a feedstock to produce standard ferrovanadium.

**Figure 31: The Vametco processing plant flowsheet**

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*Vametco employs a conventional vanadium processing circuit, modified to produce Nitrovan*

Source: Bushveld Minerals
Product marketing

Nitrovan is a trademarked vanadium nitrate micro-alloying product that can be a more efficient steel-strengthening additive than standard ferrovanadium. This can allow steelmakers to use less vanadium in high-strength low-alloy construction steels, reducing their vanadium raw-material input costs by up to 40%.

Wogen Resources has exclusive rights to market Vametco’s Nitrovan product globally, other than in Japan and Taiwan – Nitrovan is marketed in these two territories by Sojitz, Bushveld’s minority partner in SMC.

Production history

The Vametco processing facility can treat both vanadium-bearing magnetite ore and slag material. Mining rates have historically been adjusted according to the availability of vanadium-bearing slag – a constraint in supply of the latter from mid-2016 prompted mined throughput to be maximised, yielding more consistent magnetite-based output of the operation’s trademark Nitrovan vanadium nitride product in recent times.

CY2016 output totalled just over 2,800t, up from just over 2,400t in 2015. Partly driven by this 16% increase in volumes, cash production costs (excluding royalties, selling costs and G&A) came down to US$12.9/kg V in CY2016, from US$14.6/kg V in CY2015.

Production rates in CY2017 were a little below those achieved in CY2016, the company taking advantage of the higher vanadium price environment to undertake remedial and upgrade work on the plant. Output totalled 2,649t accordingly, with sales slightly higher at 2,721t. Cash production costs increased to US$16.6/kg V however, owing mainly to strengthening of the South African Rand (the local operating currency).
Expansion project

Since its acquisition of EVRAZ’s interest in the business in April 2017, Bushveld has initiated expansion activities given the now focus on magnetite ore feed rather than slag material. An initial R9m (<US$1m) de-bottlenecking initiative was implemented involving an upgrade of the screening and magnetic separation capacity in the concentrate section of the process plant to allow the mill to run at optimal feed rates without compromising concentrate quality (high SiO₂ levels in the kiln feed results in higher raw material consumption as well as lower recovery in the roasting stage). This was completed during the Q3 2017, lifting overall production capacity to an annualised run-rate of just over 3,000t V (in the form of Nitrovan).
The group is now pursuing a further staged expansion to lift output to an ultimate rate of around 5,000t pa by the end of 2019. The next phase involves further debottlenecking the concentrator through upgrades to the crushing circuit and the installation of an additional ball mill, and is expected to result in an achievable production rate of 3,750t pa by mid-2018. Already underway, this phase has been budgeted at R32m (US$3m).

The final stage of the expansion involves upgrading the kiln feed and discharge equipment to enable it to operate at its maximum rated mechanical capacity, plus a complimentary expansion of the process circuit’s evaporative capacity to cope with the increased production volumes. Budgeted at R173m (US$14m), this phase is targeted for completion by the end of 2019, from which point the overall operation should be capable of sustaining annualised vanadium output of approximately 5,000t, depending on head grade.

On the mining side, waste stripping will be increased in the near term while vanadium prices are strong, ensuring sufficient ore is available at all times for the expanded processing capacity, even in the event of a future weakening of prices.

**ARC forecasts**

We have modelled Vametco going forward based on Bushveld’s plans to expand output to 5,000t pa from the end of 2019. Our cash flow model incorporates operating and cost assumptions derived from data included in the recent Competent Persons’ Report on the asset complied by independent technical consultant MSA Group, and public guidance published by Bushveld. Our key assumptions are summarised in Figure 35 below.

**Figure 35: Cash flow modelling assumptions**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mined resource</td>
<td>Mt</td>
<td>69</td>
</tr>
<tr>
<td>Magnetics</td>
<td>%</td>
<td>26.79</td>
</tr>
<tr>
<td>$\text{V}_2\text{O}_5$ grade of magnetics</td>
<td>%</td>
<td>1.96</td>
</tr>
<tr>
<td>Steady-state (from 2020) ore throughput</td>
<td>Mt pa</td>
<td>2.5</td>
</tr>
<tr>
<td>Life of mine (LoM)</td>
<td>years</td>
<td>28</td>
</tr>
<tr>
<td>Strip ratio</td>
<td>t ore: t waste</td>
<td>1.1</td>
</tr>
<tr>
<td>Concentrator recovery</td>
<td>%</td>
<td>92</td>
</tr>
<tr>
<td>Salt roast recovery</td>
<td>%</td>
<td>75</td>
</tr>
<tr>
<td>Nitrovan plant recovery</td>
<td>%</td>
<td>97</td>
</tr>
<tr>
<td>Steady-state $\text{V}_2\text{O}_5$ production (in Nitrovan)</td>
<td>t</td>
<td>5,000</td>
</tr>
<tr>
<td>$\text{V}_2\text{O}_5$ equivalent</td>
<td>t</td>
<td>8,926</td>
</tr>
<tr>
<td>Long-term (from 2020) FeV price assumption</td>
<td>US$/kg V</td>
<td>30</td>
</tr>
<tr>
<td>LoM average C1 cash operating costs</td>
<td>US$/kg</td>
<td>17.2</td>
</tr>
<tr>
<td>LoM average total costs (incl marketing fees and royalties)</td>
<td>US$/kg</td>
<td>19.8</td>
</tr>
<tr>
<td>Expansion capex (from 2017)</td>
<td>Rm</td>
<td>215</td>
</tr>
<tr>
<td>Sustaining capex</td>
<td>Rm pa</td>
<td>35</td>
</tr>
<tr>
<td>Currency rate</td>
<td>ZAR:USD</td>
<td>12.25</td>
</tr>
<tr>
<td>Corporate tax rate</td>
<td>%</td>
<td>28</td>
</tr>
</tbody>
</table>

*Source: ARC estimates*
The chart in Figure 36 summarises our forecast production and cost profile for the next five years (note that we model a 27-year mine life in total, assuming the current mineral reserve is increased through conversion of a portion of the substantial existing resource base – we believe there is sufficient resource potential for the mine life to be extended beyond even that).

Our model is in real 2018 terms, assuming a constant currency rate of R1.25 to US$.1. On this basis, we envisage total cash costs (including royalties and marketing fees) declining somewhat from our estimated 2017 level of over US$21/kg V to a sustainable level of under US$20/kg V once the expansion is complete by 2020, benefiting from economies of scale given the significant fixed component of the cost base. At our conservative long-term (from 2020) FeV price assumption of US$30/kg V (which we discount slightly in converting to assumed received Nitrovan product price), we estimate that the operation could thus sustain an operating profit margin of over 30%.

We estimate an operational margin of >30% can be sustained post expansion.

Figure 36: Production and cost profile (next four years forecast)

Source: ARC estimates
Other vanadium projects

Brits

The Brits vanadium project comprises several properties adjacent to Vametco for which Bushveld has prospecting rights are in place and a mining right under application.

As at Vametco, high-grade vanadium mineralisation occurs in several magnetite layers and outcrops at surface – it is an along-strike continuation of that deposit and as such offers potential to extend the Vametco operation’s life and/or to provide an alternative source of cheaper, near-surface ore to the plant in the near term. Resources and reserves clearly need to be properly drill-defined, but historical drilling shows in-magnetite grades of up to 2.6% V$_2$O$_5$, which compares favourably against Vametco’s resource grades.

Bushveld is in the process of securing regulatory approval for the change of ownership of the assets following the acquisition from Sable Metals & Mining Ltd, a South African-based resources company. Upon receipt of these approvals it will commence resource-definition work.

<table>
<thead>
<tr>
<th>Property</th>
<th>Mineral Rights</th>
<th>BMN stake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion 3 of Uitvalgrond 431 JQ</td>
<td>Prospecting right for vanadium (application to include iron ore and rutile granted but not yet executed)</td>
<td>65%</td>
</tr>
<tr>
<td>Portion 2 of Uitvalgrond 431 JQ, Syferfontein 430 JQ</td>
<td>Mining right application</td>
<td>100%</td>
</tr>
<tr>
<td>Remainder of Doornpoort 295 JR</td>
<td>Prospecting right for vanadium, iron ore and rutile</td>
<td>74%</td>
</tr>
</tbody>
</table>

Source: Bushveld Minerals

Drilling has indicated >2% V$_2$O$_5$ (in-magnetite) grade potential at Brits

Figure 37: Brits project minerals rights status

Figure 38: The three Brits properties lie adjacent to Vametco

Source: Bushveld Minerals
Mokopane

Bushveld holds a 64% interest in the Mokopane vanadium project, a collection of five properties under prospecting licence located on the central portion of the northern limb of the Bushveld Complex in the Mokopane District of Limpopo Province, approximately 65km west of Polokwane.

The Mokopane project comprises five properties of interest – Vogelstruisfontein (765 LR), Vriesland (781 LR), Vliegekraal (783 LR), Schoonoord (786 LR) and Bellevue (808 LR) – on which Bushveld has the right to explore for iron ore and titanium in addition to vanadium. A Mining Right application was lodged in March 2015 and is currently being processed by South Africa’s Department of Minerals Resources.

Bushveld received environmental authorisation for the project in September 2016. The next step in the mining right application process is the approval of the company’s mine works programme and social and labour plan.

Geology and resources

Mokopane comprises three adjacent and parallel magnetite layers (the Main Magnetite Layer, the Main Magnetite Hanging Wall Layer and the AB Zone) striking 5.5km in a north-south orientation and dipping 18-22° to the west.

Drilling to date has defined JORC compliant resources totalling 297Mt across the three layers, with grades ranging from 1.5% to 2% \( \text{V}_2\text{O}_5 \) in magnetite.
Development progress to date

A prefeasibility study was completed in January 2016 to evaluate the potential for mining the Main Magnetite Layer resource (comprising 52Mt of the total project resources, with average in-magnetite grades of 1.6-1.8% V$_2$O$_5$) and developing a primary salt roast and leach processing facility to produce >99% purity V$_2$O$_5$.

The base case scenario envisaged a 1Mtpa run-of-mine operation (exploiting a 27Mt reserve) producing 9,525tpa of high-purity V$_2$O$_5$ product, with operating costs estimated at US$2.72/lb V$_2$O$_5$ produced (or US$6/kg V). The capital expenditure requirement across the development and construction years was estimated at US$298m, and the study yielded a post-tax IRR and NPV$_{10\%}$ of 20% and US$259m respectively, using a long-term V$_2$O$_5$ flake price of US$7.50/lb (US$16.53/kg).

The PFS results provided Bushveld with sufficient confidence to advance the project further, which will include the progression of a definitive feasibility study. Given the subsequent acquisition of a controlling interest in the operating Vametco asset, Mokopane has understandably moved down the pecking order in Bushveld’s project portfolio. Nevertheless, the company continues to evaluate means of developing the project in the most cost-efficient manner, including the potential for introducing a strategic partner at an appropriate point.
Bushveld Energy

Bushveld Energy is an 84%-owned subsidiary of Bushveld Minerals that was established in January 2016 to develop, participate in and promote the market for VRFBs as a utility-scale energy storage solution in Africa. The 16% balance of ownership in Bushveld Energy is held by the subsidiary’s co-founder and managing director Mikhail Nikomarov, an African energy expert whom previously spent several years with global management consultant McKinsey & Co advising governments, utilities and manufacturers on policy and growth strategies in the energy sector.

Background and opportunity

The subsidiary company’s goal is to become one of Africa’s largest electricity-storage providers, leveraging parent Bushveld Minerals’ position as an integrated miner and processor of primary vanadium in South Africa.

Though they currently account for a very small proportion of vanadium consumption today, Bushveld believes that energy markets present a significant demand growth opportunity going forward given the applicability of VRFBs as a potential utility-scale energy-storage solution. Based on its analysis of various market forecasts, Bushveld estimates that the energy-storage market could exceed US$350bn in size by 2030, and that VRFBs could claim a meaningful share of this owing to several inherent advantages over other battery technologies, including:

- **Durability:** VRFBs can be charged and discharged repeatedly many thousand times over, giving the battery a much longer potential lifespan (over 20 years) relative to other battery technologies. Such a lifespan closely matches that of many of the renewable energy-generation technologies, such as solar photovoltaic. Moreover, VRFBs have capacity for 100% depth of discharge without any performance degradation.

- **Scalability:** VRFBs can store large quantities of energy, making the technology well-suited for use on a grid-level scale

- **Fast response times:** Owing to the liquid state of the electrolyte, VRFBs can respond extremely quickly (<70ms), a prerequisite for a battery’s applicability for grid use

- **Safety:** Distinct from other battery technologies, VRFBs have water-based chemistry and are neither flammable nor toxic

- **Recyclability:** of the vanadium (and/or reusability of vanadium electrolyte) upon system decommissioning, making VRFB one of the most environmentally sustainable battery technologies

The emerging vanadium electrolyte market is currently dominated by China, with c90% of global capacity (smaller facilities exist in Europe, and batch production in other regions of the world). Perhaps the greatest hurdle to the widespread commercial adoption of VRFB technology is security of supply of low-cost vanadium feedstock. As an integrated primary vanadium miner and processor in a stable jurisdiction through its controlling interest in the low-cost and scalable Vametco operation in South Africa, Bushveld is uniquely positioned to address this challenge.

Strategy

Bushveld Energy has been working alongside South Africa’s IDC to study both the potential market for VRFB in Africa and to evaluate the technical and economic viability of developing a vanadium electrolyte production plant in South Africa,
potentially within the Vametco processing facility. Meanwhile, the group also participates in global energy storage industry platforms, including a leading role in the Energy Storage Committee of Vanitec, a technical/scientific community of participants in the vanadium industry that promotes global education in, and use of, the commodity.

**Progress to date**

Last year Bushveld Energy, in conjunction with the IDC, completed a market study on VRFB demand that concluded that electrolyte demand is growing globally and could peak in 2025-2030 at 1200-1800MWh (or 40-60 Ml) per annum. Moreover, the study indicated the potential for Bushveld to supply at least an initial 5-10Ml of this demand, supporting the supply of an initial 200MWh pa in energy storage capacity in Africa.

Bushveld and the IDC are also progressing a technical and economic study on the potential of developing a vanadium electrolyte production facility in South Africa. Initial results have indicated that a scalable plant could produce electrolyte at globally competitive cost levels. Based on an initial annual production capacity of 200MWh (with potential for expansion to 400MWh), the initial capital requirement was estimated at just R130m (US10m).

Bushveld believes there is scope to reduce capex by locating the electrolyte plant within its existing Vametco facility – in conjunction with more detailed costing of the proposed development, Bushveld plans to further evaluate the potential quality of electrolyte produced from Vametco feedstock through laboratory test work in conjunction with Vametco’s operational team. Given that vanadium feedstock is by far the main cost driver of developing VRFB capacity (upwards of 70% of the total cost of a VRFB unit), Vametco’s position as a low-cost, local supplier of primary vanadium in our view provides Bushveld with a natural competitive advantage to commercially advance VRFB technology in South Africa and the wider Africa region.

Meanwhile, Bushveld Energy continues to engage with numerous private and public organisations over the potential to supply vanadium feedstock and/or electrolyte from Vametco. To date this has included discussions with various VRFB manufacturers to better understand their future vanadium requirements, and engagement with power utilities, developers of renewable energy projects, and potential private customers in South Africa with power consumption patterns suited to VRFB use.

And in November 2017, the group brokered an agreement whereby VRFB manufacturer UniEnergy Technologies (UET) will deploy a pilot VRFB unit to South African national power utility Eskom to allow the latter to test the technology’s performance under various conditions over a period of 18 months. Expected to be commissioned during H1 2018, the 20-foot single container unit will be the first utility-scale VRFB to be deployed in South Africa, with a peak energy storage capacity of 450kWh. Eskom, the IDC and Bushveld Energy will jointly facilitate access to the battery for other independent power producers, energy-storage developers, policymakers and capital providers as part of a wider educational push on the technology, and at the end of the 18-month test period the system will be redeployed to a commercial site within South Africa.
Non-vanadium assets

Lemur Resources (thermal coal)

Lemur Resources Ltd is a wholly owned subsidiary of Bushveld that is focused on advancing the Imaloto thermal coal project in southwestern Madagascar.

Imaloto has a 136Mt JORC-compliant mineral resource, of which 92Mt is in the measured category. A 2014 economic evaluation demonstrated the potential for a US$36m project NPV (at a 10% discount rate) for a stand-alone 1.5Mtpa coal operation, with an initial capex requirement of US$12m. However, the group is now pursuing an expanded scope for the project, which is focused on the integration of a 60MW coal-fired power plant with more than 200km of transmission line to be developed in parallel with the mine. If realised, this would establish the enterprise as one of Madagascar’s leading independent power producers.

Lemur has signed an MoU with Sinohydro, a subsidiary of PowerChina for the development of the power plant, and in November 2017 it executed a binding Power Purchase Agreement (PPA) with the Madagascar state-owned utility Jirôsy Rano Malagasy (JIRAMA). The latter is for a period of 30 years (commencing post construction in 2021), and provides for an initial 10MW of capacity, which is expected to increase over time in accordance with JIRAMA’s requirements.

Lemur holds one of only three coal exploitation mining rights in Madagascar, and its key focus for 2018 is to obtain a concession for the power project as well as completing a definitive feasibility study and social environmental impact assessment of the project.

Although the integrated Imaloto mine and power project appears to be gaining considerable momentum, given Bushveld’s increasing focus on vanadium we would not be surprised to see the company look to give Lemur independence. This could be via a spin out as was the case with Bushveld’s tin interests (see below), or via a straight trade sale of the business.

AfriTin Mining (tin)

Bushveld holds a 17.5% interest in AfriTin Mining Ltd, an AIM-quoted (ATM LN) tin-focused company that Bushveld spun out to shareholders in November 2017. Its strategy is to capitalise on the tin market’s compelling supply/demand fundamentals through building a sizeable tin resource inventory and achieving small-scale production in the near term and that can be scaled up over time as the company develops. The company is led by CEO Anthony Viljoen, founder of the business in its previous guise as Greenhills Resources and a non-executive director of Bushveld.

AfriTin’s project portfolio contains a number of potentially open-pittable tin deposits in regions of Africa known for historic production of the metal. Its flagship asset is an interest in the past-producing Uis tin property in Namibia, host to what was once the world’s largest tin mine. Uis has an historic (non JORC compliant) resource of 73 Mt grading 0.136% Sn, and the project areas are fully permitted. In South Africa, AfriTin owns the Mokopane and Marble Hall brownfield projects.
Board and Senior Management

Ian Watson – Non-Executive Chairman

Ian Watson is a qualified mining engineer with over 45 years’ experience in the mining industry, starting with Goldfields South Africa. Mr Watson served as mine manager of Northam Platinum Ltd in 1986 where he led the start-up of the Northam Platinum mine, ultimately bringing the mine into production in 1992. He became managing director of Northam Platinum in 1998, serving in that role until 2002. Other past directorships include, chief executive officer of Platmin Ltd, non-executive director of International Ferro Metals Ltd and independent non-executive director of Shaft Sinkers Holdings plc.

Fortune Mojapelo – Chief Executive Officer

Fortune Mojapelo is mining sector entrepreneur with a strong track record in resource exploration and development. He is a co-founder and director of VM Investment (Pty) Ltd, a principal investments and advisory company focusing on developing mining projects in Africa. Mr Mojapelo has played a leading role in the origination, establishment and project development of several junior mining companies in Africa, including New Kush Exploration and Mining (gold), Greenhills Resources (tin), Bushveld Resources Ltd (iron ore), New Horizon Minerals (iron ore), Bushveld Platinum Ltd (PGMs) and Eagle Resources Ltd (uranium). He has been CEO of Bushveld Minerals since the company’s inception. Mr Mojapelo’s corporate career started at McKinsey & Co, where as a strategy consultant he worked on advising clients in several industries on corporate strategy and organizational development.

Geoff Sproule – Finance Director

Geoff Sproule is a chartered accountant with more than 40 years’ experience in various financial management roles. He is a former partner of auditing firm Deloitte and Touche, South Africa. Mr Sproule’s other directorships include the property related J H Issacs group of companies.

Anthony Viljoen – Non-Executive Director

Anthony Viljoen is a mining entrepreneur and founding shareholder and director of VM Investment Company (Pty) Ltd, a principal investments and advisory company with a leaning towards minerals exploration. In addition to his non-executive position on the board of Bushveld Minerals, Mr Viljoen is CEO of AfriTin Mining Ltd, a focused tin project developer that was spun out of Bushveld in November 2017. Previously Mr Viljoen has been responsible for the establishment and development of a number of junior mining companies across Africa, including New Kush Exploration and Mining (gold), Coal of Madagascar (coal), Greenhills Resources (tin) and Eagle Uranium (uranium). Prior to entering the mining industry, Mr Viljoen spent several years working in investment banking, including stints with Deutsche Bank, Barclays Capital and Loita Capital Partners.

Jeremy Friedlander – Non-Executive Director

A qualified attorney, Jeremy Friedlander started his career with Old Mutual as a legal advisor before establishing in 1993 McCreedy Friedlander, which went on to become one of the premier property in South Africa and negotiated with an association with
Savills. In 1998 he listed McCreedy Friedlander as part of a financial services group on the JSE and shortly afterwards relocated to London. In the United Kingdom, Jeremy has been involved in a number of property transactions. More recently Jeremy was a director of Onslo Resources (Oil and Gas). He is business development director of a number of Avana Companies involved in Uranium, Coal, Gold and Gas and industrial minerals.

*Malcolm Curror – CEO Bushveld Vametco and Vametco Holdings*

Malcolm Curror has been Chief Executive of Vametco since April 2011. He has over 22 years’ experience in primary vanadium mining and processing, and is a former General Works Manager for Xstrata Vanadium’s Rhovan integrated vanadium operations in South Africa. Prior to joining Vametco, Mr Curror also held a range of other senior management positions within Xstrata, including Production Manager and Operations Manager at Rhovan, Vantech and Lydenburg.

*Mikhail Nikomarov – CEO Bushveld Energy*

Mikhail Nikomarov is co-founder of and minority shareholder in Bushveld Energy. He has strategic and operational experience across four continents and eight African countries. Prior to founding Bushveld Energy, Mr Nikomarov spent over six years with McKinsey & Co in Moscow and Johannesburg, advising national governments, utilities and manufacturers on energy strategy and policy. During this time he published work on national competitiveness and trade, and co-authored McKinsey & Co’s 2015 ‘Brighter Africa’ report on the African power sector. Mr Nikomarov has also worked in the banking sector in the US, and has a deep knowledge of mid-cap company funding. He holds an MBA from INSEAD from France, an Economics Diploma from the London School of Economics in the UK, and two BA degrees (History and in Economics) from the University of Massachusetts in the US. Mr Nikomarov currently chairs the Energy Storage Committee of Vanitec.

*Bill Chipane – Head of Corporate Development*

Bill Chipane has been a corporate finance advisor to Bushveld since January 2016. He currently also holds various management and director positions with other subsidiary companies within the group. A qualified chartered accountant, Mr Chipane was previously M&A director with Société Générale’s London-based metals and mining M&A business, responsible for the European, Indian and Southern African regions. Prior to that, he worked for ABN AMRO Investment Banking London (subsequently the Royal Bank of Scotland) in the metals and mining team. His formative experience in mining corporate finance was with the base-metals corporate finance team of Anglo American.

*Prince Nyati – CEO Lemur Holdings*

Prince Nyati has over 15 years’ experience in the energy and mining sectors, with a focus on project development and M&A. He has worked in several countries including Zambia, South Africa, India, Singapore and the US, for companies including Shell, Total, Eskom, Tata Power and Oreport. As Group Head of Tata Power, Mr Nyati evaluated over 100 coal assets and over 50 power opportunities across 30 countries. He served on the boards of Cennergi and the Tsitsikamma and Amakhala wind projects. Mr Nyati has also led the development of infrastructure projects in sub-Saharan Africa and has helped facilitate transactions worth approximately US$1.5bn in Zambia and South Africa.
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