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INDEPENDENT INVESTMENT RESEARCH

Golden Deeps Limited

(ASX: GED)

February 2020

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INVESTMENT RESEARCH

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Golden Deeps Limited (ASX: GED)

Initiation - February 2020

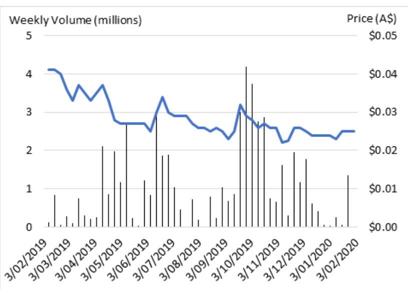
Note: This report is based on information provided by the company as at February 5, 2020

Investment Profile	
Share Price as at Feb 5, 2020	A$0.025
Issued Capital:	
Ordinary Shares	280.6 m
Unlisted Options	8.5 m
Fully Diluted	289.1 m
Market Capitalisation (Undiluted)	A$7.02 m
12 month L/H	A$0.02/$0.047
Cash December 31, 2019	A$0.569 m

Board and Management
Mr Michael Minosora: Chairman
Mr Michael Rodriguez: Director
Mr Michael Norburn: Director
Mr Michael Scivolo: Director
Mr Robert Collins: Director
Mr Johannes Ashipala: Director - Namibia
Mr Scott Mathewson: Executive GM, Operations
Mr Martin Stein: Company Secretary
Mr Martin Bennett: Exploration Manager

Major Shareholders	
Coniston Pty Ltd	19.50%
Kalgoorlie Mine Management	9.02%
Tempio Corporate	5.65%
Board	1.44%
Top 20	65.01%

Share Price Performance



The investment opinion in this report is current as at the date of publication. Investors and advisers should be aware that over time the circumstances of the issuer and/or product may change which may affect our investment opinion.

POTENTIAL SHORT TERM CASH FLOW

Golden Deeps Limited ("Golden Deeps" or "the Company") is set to benefit from a joint venture ("JV") with Hong Kong based Generous Metals Company Limited ("GMC") to develop the 80% owned Abenab Vanadium-Lead-Zinc Project ("the Project"), located in the Otavi Mountain Land of Northern Namibia.

Under the terms of the JV (which covers only that surface mineralised material identified at the time of the agreement), GMC will fund development and operations at the Project, including a comminution and concentration plant (with the size to be determined), which is planned to produce high grade V_2O_5-Pb-Zn concentrates from surface material, including stockpiles and tails, to be sent to China for refining.

Project operating profit will initially be shared between Golden Deeps (50%) and GMC (50%) after recoupment of costs to GMC, with ~5 - 10% then expected to be distributed from Golden Deeps to Coniston Pty Ltd ("Coniston"), the Company's largest shareholder and the holder of a free carried interest in the Project. Following the end of the JV Golden Deeps will be sole operator and own the plant, and will have the ability to treat mineralised material identified subsequent to the signing of the JV on its own account - such material has been identified over a significant area in recent work by Golden Deeps, and thus has the potential to host an appreciable shallow Resource, the estimation of which is underway.

Initial production from the Project is targeted for later in 2020, which is located over historic operations that produced 102,000 t of concentrate grading at 18% V_2O_5, 13% Pb and 42% Zn from 1.85 Mt from 1.85 Mt of ore - Abenab is one of the highest grade and largest known vanadate deposits globally, with the mineralogy including descloisite and willemite.

The nature of the material to be treated under the JV, being free dig, at surface and able to be upgraded to a very high grade V_2O_5-Pb-Zn concentrate by gravity separation and flotation should make Abenab a very low cost project. Also, given that it will be treating historic tails and stockpiles should mean a relatively simple and quick permitting process.

Activities under the JV are currently concentrating on metallurgy, with a 40 t bulk sample being recently sent to China for concentration and refining test work - the Chinese side of the operation, including marketing, is being managed by GMC, with Golden Deeps managing the Namibian operations.

Recent work by the Company has included diamond, RC and auger drilling that has identified mineralised surface material that falls out of the scope of the JV - this drilling also included material within the JV, with the results to be used for an initial Mineral Resource Estimate ("MRE") for the surface mineralised material.

KEY POINTS

- **Funded, low cost project:** Through the JV with GMC, Abenab is fully funded through development and operations, and in our view should be low cost by virtue of the style of mineralisation. One key benefit is that the Project should be relatively insulated from the vagaries of vanadium pricing; in addition it is planned to produce lead and zinc which provide a revenue hedge.
- **Short term to production:** All going well, it is expected that operations could commence later in 2020.
- **Proven mining destination:** Namibia has a well developed mining industry, which provided 47% of the country's total export income in 2017 and contributed 12% of GDP - this is supported by a transparent and tested legal framework.
- **Infrastructure rich**: Namibia has well developed transport and utility infrastructure - this applies to the Project area, which is well served by roads and has access to grid power.
- **Strong management and committed personnel**: Company personnel have extensive relevant experience, including in the commercial and technical aspects of the industry.
- **Geared to operational success**: With an EV of~A$6.4 million and a tight capital structure the Company is well geared to successful development and production.
- **Steady newsflow:** Ongoing work over coming months should lead to steady newsflow for Golden Deeps.

SWOT ANALYSIS

Strengths

- **Potential low operating cost operation:** A successful operation at Abenab should be low cost, by virtue of the targeted mineralisation being largely tails and stockpiles (with low cost free dig earth moving), and amenable to concentration by simple gravity and flotation techniques. In addition the potential to produce a very high grade concentrate should lead to relatively low shipping and refining costs per unit of metal production.
- **Potential low capex operation:** The Project lends itself to low capex crushing and coarse grinding, with downstream processing to be done by a third party. In addition water and grid power is available on site, and the Project is within 40 km of major service towns.
- **No up-front capital due to Golden Deeps:** Under the JV, GMC is responsible for all pre-production and development costs (including building the plant with ownership to ultimately pass to Golden Deeps), although these will be recouped out of future project profits - this limits the requirement for Golden Deeps to raise capital and dilute shareholders, and will result in the Company having a plant on-site that will be able to be used to treat additional material outside of that included in the JV.
- **JV currently limited to feedstocks identified as at the time of the agreement**: New mineralised material that has subsequently been identified by Golden Deeps, such as tailings delineated during recent drilling campaigns may however be included, subject to negotiation, in an extension to the current JV.
- **In-built hedge:** Dependent upon successful metallurgical testwork, the potential to produce vanadium, lead and zinc from the same concentrate provides an in-built revenue hedge.
- **Proven mining destination:** Namibia is a major global producer of base metals, uranium and diamonds. The Government's recognition of the importance of the industry and the need for foreign investment has recently been demonstrated by the scrapping of the requirement that previously disadvantaged Namibians hold 25% of businesses (including mining operations under the National Equitable Economic Empowerment Framework ("NEEEF") Bill. The rationale behind the Government's decision is that similar systems have not worked in other jurisdictions, in deterring direct foreign investment, and concentrating wealth in the hands of just a small part of the groups that these schemes were designed to benefit.

Weaknesses

- **Cash position:** Although the Company has recently raised A$1.15 million, our view is that it will need to go to the market soon to raise additional funds, despite GMC now funding a significant amount of activities. This is made more important by new requirements introduced by ASIC in that companies will be required to have liquid assets to cover at least two quarters of activities based on the expenditure in the quarter being reported, else be able to explain to ASIC how that cash will be raised.

Opportunities

- **Identification of further surface material:** This would provide ready feed should the concentration operation get up and running.
- **Hard rock exploration success:** Although not the focus of current activities, the Company holds an under-explored, tenement package highly prospective for hard frock discoveries in a region that is a significant historical producer of base metals.

Threats/Risks

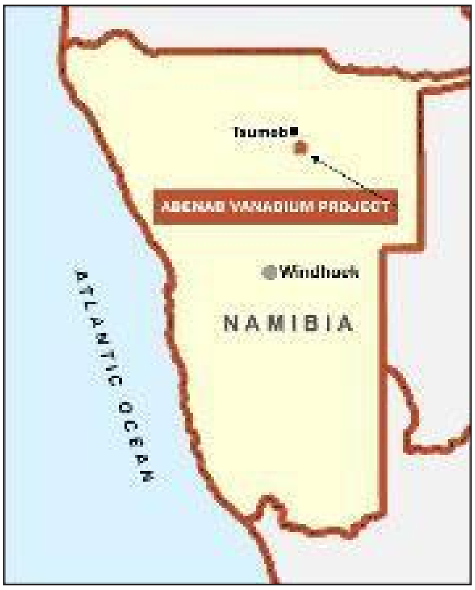
- **Metallurgy:** Although work to date has demonstrated that a high grade concentrate can be produced from the tails, the V_2O_5 grade, at 8.93% is lower than the 18% (as expected from primary mineralisation) targeted under the JV, although there is a trade off between recovery and concentrate grade, and that, under toll treating arrangements, the grade achieved still has a significant cost advantage over the concentrate grades of ~1% for traditional vanadium sources. Further concentration testwork is underway however. Also, results of the refining test work will be crucial, in that the metal recoveries and thus the revenues will be critical to the financial viability of the Project.
- **GMC withdrawal:** The current strategy is predicated upon GMC constructing a plant, which will then be owned by Golden Deeps once the material that comes under the JV is exhausted. A withdrawal by GMC from the JV prior to development will result in Golden Deeps having to look at funding options, however the Company has mentioned that similar parties to GMC have indicated an interest to participate on the same basis as GMC.
- **Equity and metals markets:** Although the junior resource sector is relatively strong at the moment, markets can turn very quickly due to changes in market sentiment or movements in metals prices, impacting the ability of companies to raise equity.

OVERVIEW

STRATEGY AND PROJECT OVERVIEW

- Golden Deeps' key project is the Abenab Vanadium-Lead-Zinc Project ("the Project"), located in northern Namibia, in the historic Grootfontein mining region, which includes historic base metal operations including Tsumeb and Kombat amongst others (Figures 1 to 3).
- The region is also well know for historical production of high grade vanadium concentrates, from the Abenab and Abenab West (Christiana) mines, which were, due to their mineralogy, noted by producing a very high grade V_2O_5 concentrate.
- Abenab was historically one of the world's largest and highest grade deposits of vanadate ore, with the mine producing some 102,000 t of concentrate grading at 18% V_2O_5, 13% Pb and 42% Zn from 1.85 Mt of ore, with Abenab West (historically referred to as Christiana) reportedly producing 74,000 t of concentrate grading at 13% V_2O_5 and 72% Pb.
- Golden Deeps's immediate focus is on the development and mining/processing of mineralised surface materials and tailings dumps, and has partnered with Hong Kong based GMC for this development, which will include the building of a processing plant - there is the potential to produce high grade V_2O_5-Pb-Zn concentrates from this material which it is planned to send to China for refining.
- Given the focus on surface material and the potential to produce high grade concentrates, the Project has the potential to be a low cost and near term producer, with production targeted for 2020 - this will also require only limited permitting and associated activities, again reinforcing the potential for a low cost, near term operation.
- The Abenab trend, which hosts Abenab and Abenab West (and of which Golden Deep holds a strike length of 35 km) contains a number of other prospects, including the historic Nosib Mine; the tenements also contain elements of the Khusib and Pavian trends.
- In addition the Company holds tenure over 30 km of strike length over the Askevold Trend to the south, considered prospective for copper mineralisation.
- Given the focus on Abenab, the Askevold tenements won't be discussed further, nor will the Professor and Waldman Co-Ag projects in Ontario, in which Golden Deeps acquired 70% in early 2018.

Figure 1: Abenab location



Source: Golden Deeps

FINANCIAL POSITION

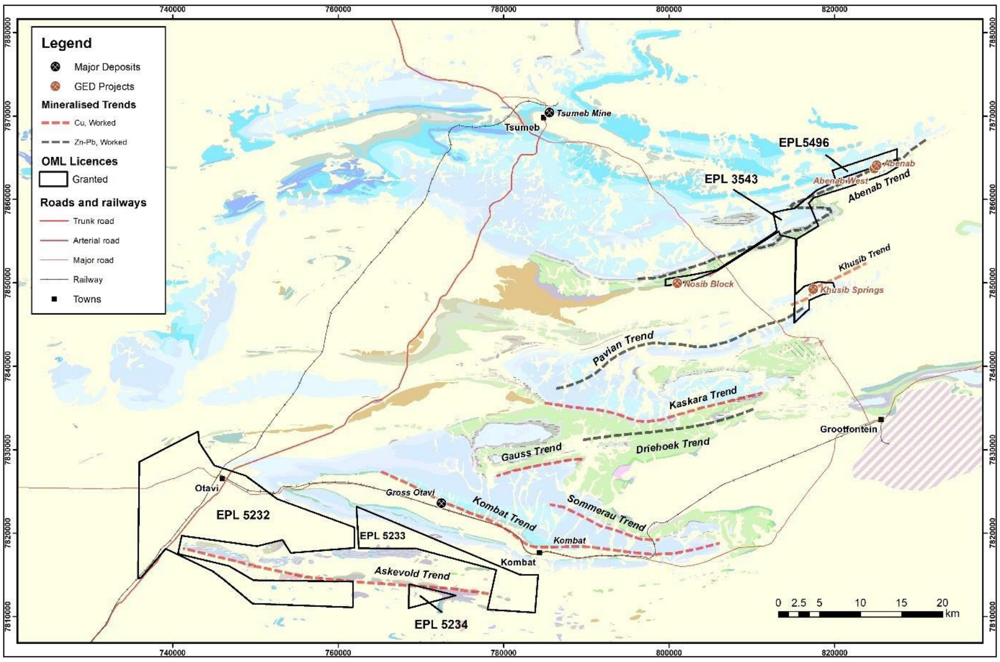
- As of December 31, 2019, the Company had A$0.569 million in cash and no debt.
- In the December 2019 Quarter Golden Deeps raised A$1.150 million (before costs) through the placement of 44.231 million shares at A$0.026/share - this included A$75,000 subscribed for by the Chairman.
- Over the twelve months to September 30, 2019 Company spent A$1.201 million on exploration/evaluation and $1.225 million on administration and wages (as per Appendix 5Bs).

ABENAB VANADIUM-LEAD-ZINC PROJECT, NAMIBIA - GED 80%

Location, Acquisition and Tenure

- The Abenab Vanadium-Lead-Zinc Project comprises two granted exclusive prospecting licences ("EPLs"), located ~30 km north of the town of Grootfontein in northern Namibia (Figures 1 and 2).
- The tenements - EPL3543 and EPL5496 (currently with a combined area of 102 km^2, but reduced to 53.28 km^2 after renewal) cover 30 km strike length of the Abenab Trend and Nosib Block, with both currently in the renewal process.
- The Company also holds tenements over the Askevold Trend to the southwest which includes EPL5232, EPL5233 and EPL5234, for a combined area of 331 km^2 and with all in good standing (Figure 2).
- The tenements are readily accessible by highways and secondary roads, and also with grid power available to site.
- Golden Deeps original acquired the Namibian interests in 2012, through the 100% acquisition of all of the issued capital of two Australian companies, Glendale Asset Pty Ltd ("Glendale") and Jewell Corporation Pty Ltd ("Jewell").
- Glendale holds an 80% interest in Huab Energy (Pty) Ltd ("Huab"), the direct holder of the five tenements currently held through the corporate structure by Golden Deeps; tenements previously held by Jewell (through the Namibian registered subsidiary Oshivela Mining (Pty) Ltd) have subsequently been relinquished.
- The 20% holder of Huab, and hence the tenements, is Coniston Pty Ltd ("Coniston"), the top shareholder in Golden Deeps.
- We note that this holding is a free carried interest, with Coniston being entitled to 20% of the operating profit of any operations within the tenements (this will be 10% under the current GED/GMC JV) - Coniston is not required to pay any expenses of any operation, however monies will be paid out only after recoupment of previous expenditure by GED and pre-production/capital costs by GMC, thus lessening the actual percentage paid.

Figure 2: Tenement locations and geology



Source: Golden Deeps

Generous Metals Joint Venture

- On April 8, 2019, the Company announced that it had entered into a Joint Venture Agreement ("JV") with Hong Kong based trading company Generous Metals Company Limited ("GMC") to produce vanadium (and potentially zinc and lead) products from concentrates sourced from tailings and stockpile materials at the Abenab Project.
- As part of the JV Golden Deeps will provide the tailings and stockpile material (as at the time of the agreement - material subsequently defined is not covered by the agreement) and oversee the Namibian operations, with GMC paying all costs of crushing, concentrating,

shipping and refining the concentrates - this will include pre-production costs, including development studies (and associated activities, including drilling and metallurgical testwork) and the Project capital costs.

- Capital costs will include a planned modular crushing and concentrating plant - although originally stated as 250,000 tpa in releases, this is subject to change with a final decision yet to be made.
- GMC will also oversee the Chinese aspects of the operations, however any decisions made with regards to the JV must be by a unanimous decision between GED and GMC.
- Profits from the operations will be shared equally between the parties - GED's share will be after recoupment of all preproduction and development costs by GMC.
- The JV, which applies to the tailings and stockpiles only, and not to the hard rock mineralisation, is divided into three stages:
  - Stage 1 (which has been completed), included the concentration of a nine tonne parcel of tails and stockpile (by Mintek in South Africa) to a concentrate with an originally targeted grade of 18% V_2O_5, with concentrate samples to be despatched by GMC to China for refining,
  - This work resulted in concentrate grades of up to 8.9% V_2O_5, 30.5% Pb and 8.95% Zn from stockpiles, with 6% V_2O_5 concentrate samples having now been to sent to a number of Chinese refinieries. We note the V_2O_5 grade is under the originally targeted 18%, however a contributing factor in this is the trade off between concentrate grade and recovery,
  - Originally Stage 2 could either involve JV activities to proceed on the basis of the results of Stage 1, else a further parcel of tailings/stockpile be requested to be despatched for testwork, giving GMC a further period to decide on whether to proceed with the JV,
  - Current Stage 2 activities include a further 40 t bulk sample being collected for processing, including concentration and metallurgical testwork - this has been collected and shipped to China; and,
  - Stage 3 involves a decision to proceed with the JV.

Project cash flow structure

- Given both the JV with GMC, and the Coniston 20% free carried interest, our view is that the following cashflows will eventuate from a successfully developed Project:
  - Pre-production, development and operating costs to be provided to the JV by GMC - production costs will include toll treatment, with, given the expected high grade of the concentrate, should result in a relatively low cost per unit of metal produced,
  - Revenues will be remitted to the JV,
  - GMC will recoup project pre-production and development costs incurred by them,
  - GMC will recoup operating costs on an ongoing basis, and will receive 50% of the operating profits on an ongoing basis,
  - GED will be paid 50% of operating profits on an ongoing basis,
  - From this GED will pay Coniston 20% (or 10% of the total operating profits, which is a variation on the 20% of total operating profits that would be expected under the tenement ownership structure) less recoupment of prior costs incurred by GED.
- As such, the final split will be GMC - 50%, GED - 40% plus recoupment of previous costs from Coniston, and Coniston - 10% less previously incurred costs due to GED.

Historical Work

- The most significant work historically comprised the open cut and underground mining of the vanadium ore, with 1.85 Mt @ 1.05% V_2O_5 being mined from both open cut and underground operations at Abenab from 1921 until 1947 - this was undertaken by the South West Africa Company, primarily for the lead and zinc, with the mine closure being due to water ingress and decreasing grades.
- Open cut operations were undertaken to a depth of 60 m, with the underground workings extending to 215 m (Figure 4); both open cut and underground operations were also carried out at the nearby Abenab West mine.
- Subsequent workers included Tsumeb Corporation, Anglo-American, the Japanese International Cooperation Agency ("JICA"), and most recently, the ASX listed Avonlea Minerals (ASX: AVZ).

- Work by Avonlea included drilling (nine holes for 2,597 m), preliminary metallurgical testwork and MRE/Exploration target calculations - the latter activities are explained more fully in the relevant sections below.

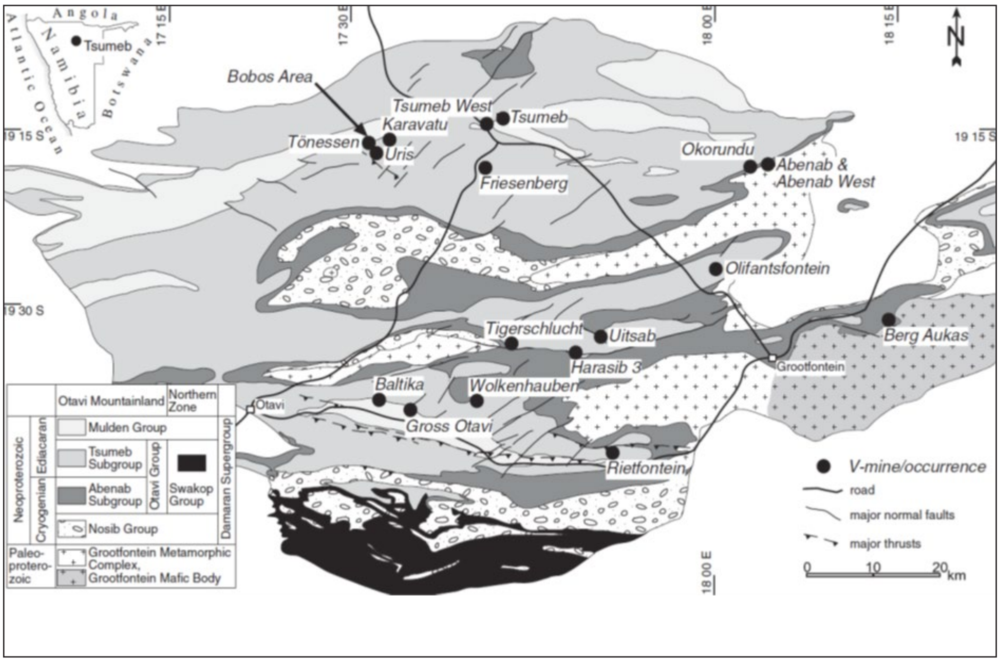
Work by Golden Deeps

- Although the Company has carried out significant relatively early stage exploration work over the highly prospective tenement package since the 2012 acquisition, we will largely concentrate our discussion on the vanadium focus over the past two or so years, with rising vanadium prices being the catalyst for the current activities.
- A lack of funds (particularly during the 2011 - 2016 downturn) prevented the undertaking of comprehensive programmes, including drilling, over much of the tenement package.
- The last two years however have seen an acceleration in activities over Abenab and Abenab West; this initially concentrated on assessing the hard rock potential, however the focus has now moved to the surface material, including tails, stockpiles and primary material readily accessible in the walls of the open pit.
- Key activities are listed below, and where applicable are discussed in detail in the relevant sections later in this report:
  - Completion of a comprehensive geological review, resulting in an upgraded Inferred MRE,
  - Surface geochemical sampling,
  - RC and diamond drilling (28 holes), auger drilling (120 holes) and backhoe pitting (71 pits),
  - Under the GMC JV, collection and concentration of an initial eight tonne bulk sample of surface material, with 6% V_2O_5 concentrate samples being produced from this and sent out to refineries for evaluation,
  - Collection and shipment to China of a 40 t bulk sample for additional testwork; and,
  - Ongoing process design work.

Regional and Deposit Geology

- The Project is hosted in shelf facies carbonates of the Otavi Group, which forms a 2 km to 4 km thick succession deposited over a period of ~200 My from ~770 Ma to ~580 Ma, with deposition flanking troughs developed by the rifting of the Adamastor Ocean.
- These units were subsequently deformed during the ~580 Ma to 550 Ma Damaran Orogeny, resulting in generally east-west trending, steeply dipping stratigraphy (Figure 3).

Figure 3: Otavi Mountainland geology and key vanadium occurrences



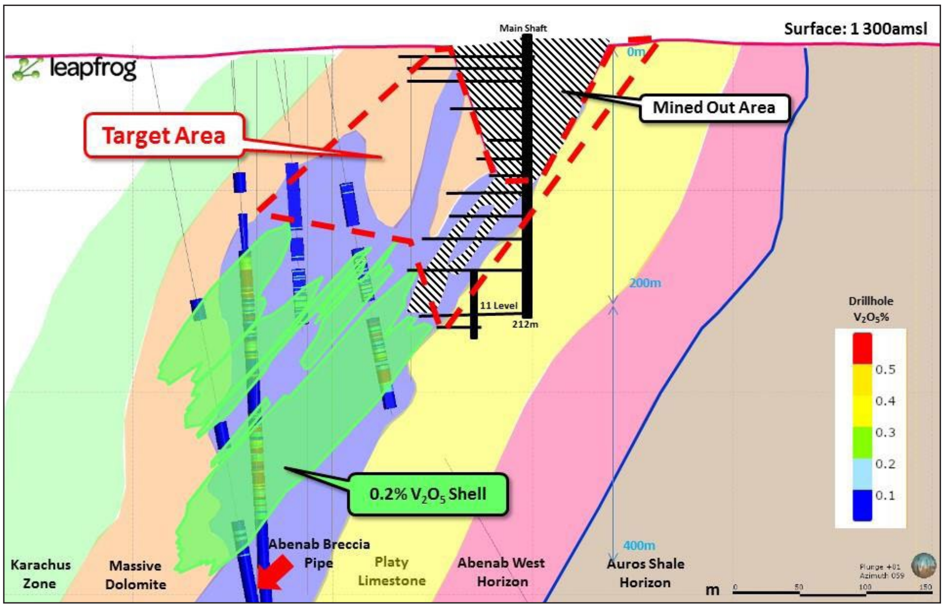
Source: Boni et al, Economic Geology v102, pp.441-469

- The Otavi Group, which is a unit within the broader Damara Supergroup, comprises the Abenab and Tsumeb Subgroups, and form the Otavi Mountainland, which is a Neoproterozoic inlier within broad areas of Paleozoic to Mesozoic Karoo Supergroup cover

- there is evidence that large areas of the Damaran units within the Otavi Mountainland were never covered by units of the Karoo Supergroup.

- The Otavi Group is the host to a number of sulphide and non-sulphide base metal deposits, with sulphide deposits divided into main types, namely the Berg Aukus-type (Zn-Pb>Cu) and the Tsumeb-type (Pb>Cu>Zn).
- It is generally interpreted that primary mineralisation was largely formed syntectonically by orogenic fluids generated during the Damaran orogeny; in addition synsedimentary stratabound mineralisation has also been identified, with an example being Berg Aukas.
- Non-sulphide Zn-Pb mineralisation, which includes Abenab, is interpreted as being formed by replacement of the sulphide mineralisation by weathering processing, including karst dissolution and fill, and associated collapse brecciation; the majority are proximal to sulphide mineralisation.
- Primary mineralisation at Abenab is hosted in a number of shoots within a steeply plunging breccia pipe - the pipe is at the sheared contact between a massive dolomite and platy limestone (Figure 4)

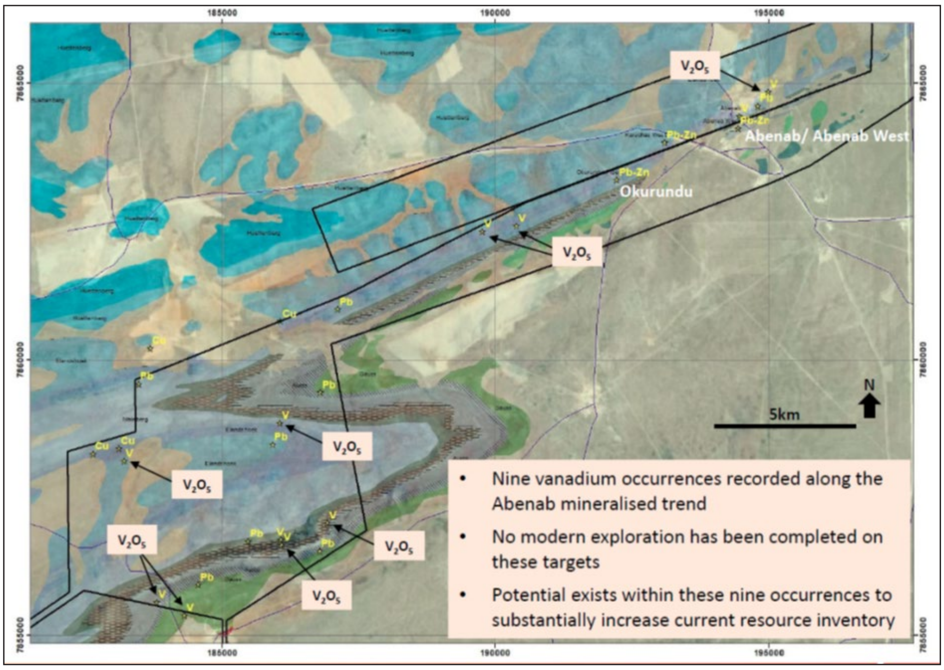
Figure 4: Abenab cross section, looking east



Source: Golden Deeps

- A number of other occurrences have been recognised along this contact, including a number of breccia pipes - targets are shown in Figure 5.

Figure 5: Abenab area vanadium targets



Source: Golden Deeps

- Other targets include Nosib, a historical mine located some 27 km west of Abenab (Figure 2) - we note that the Company's current focus is on the tailings and surface material at Abenab, however we have included this information to highlight the exploration upside.

Mineral Resources and Drilling

- The Abenab Project comprises three main Resource components - surface stockpiles (ROM pads), tailings and hard rock mineralisation - each component has had either Exploration Targets or Mineral Resource Estimates calculated at different times - these are presented in Table 1.
- We have included the Avonlea 2012 Exploration Targets for the tailings and stockpiles to present a history of recent estimations over the Project - the Company plans to upgrade these to MREs in the near term, as discussed below.
- It needs to be noted that the areas of surface samples for which Avonlea reported Exploration Targets is significantly smaller than that elucidated from the recent auger drilling as discussed later.
- Golden Deeps' 2018 JORC-2012 compliant MRE for the primary mineralisation was undertaken following a comprehensive review of previous work and the geology by Shango Solutions ("Shango") - no additional drilling was undertaken by Golden Deeps' on top of that used by Avonlea in the 2012 JORC-2004 compliant estimation.
- The subsequent 2019 MRE was estimated using a lower cutoff grade, with the 0.2% V_2O_5 figure considered to be more suitable than a 0.5% V_2O_5 cutoff for an open pit operation.

Table 1: MRE and Exploration Target summary

MRE and Exploration Target summary								
Coy	**Date**	**Component**	**Confidence**	**Tonnage**	**V_2O_5%**	**Pb%**	**Zn%**	**Cutoff/Notes**
AVZ	19/6/2012	ROM Pad	Target, JORC 2004	100kt - 130kt	0.8% - 1.5%	N/A	N/A	To be upgraded to an MRE by GED
AVZ	19/6/2012	Tails Dam 1	Target, JORC 2004	80kt - 100kt	0.25% - 0.35%	1.3% - 2.0%	1.5% - 2.5%	Considerably smaller area than that outlined by recent GED work, to be upgraded to an MRE
AVZ	1/8/2012	Primary	Inferred, JORC 2004	854,700	1.25%	2.96%	1.30%	0.5% V_2O_5
GED	11/10/2018	Primary	Inferred, JORC 2012	1.12 Mt	1.28%	3.05%	1.25%	0.5% V_2O_5
GED	31/1/2019	Primary	Inferred, JORC 2012	2.8 Mt	0.66%	2.35%	0.94%	0.2% V_2O_5

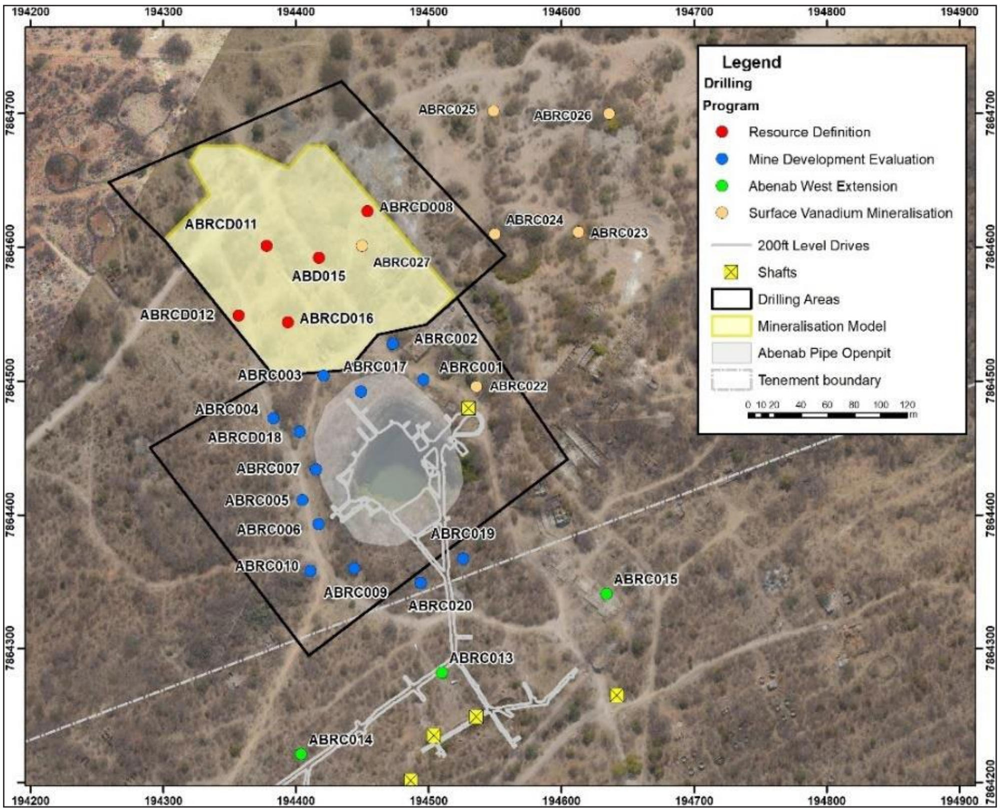
Source: Golden Deeps, Avonlea

Diamond and Reverse Circulation Drilling

- During 2019 the Company drilled 28 diamond and reverse circulation ("RC") holes around Abenab, with collars shown in Figure 6 - the purpose of this was four-fold:
  - A Resource definition programme, designed to infill and extend the current hard rock Resource,
  - A mine development evaluation programme, testing targets along strike from the current Resource and around the pit - this area had seen no surface drilling as historically underground drilling had been used,
  - Test for shallow surface mineralisation, including backfill, stockpiles and tails; and,
  - Test for extensions to the Abenab West mineralisation.
- A number of holes intersected significant mineralisation.
- These included ABRCD011, a diamond hole with an RC precollar, which was one of the five Resource definition holes drilled into the primary mineralisation:
  - 23 m @ 1.34% V_2O_5, 3.33% Pb, 1.25% Zn from 167 m (including 1 m @ 7.84% V_2O_5, 19.0% Pb, 6.52% Zn from 186 m),
  - 16 m @ 0.56% V_2O_5, 1.30% Pb, 0.53% Zn from 274 m; and,
  - 15 m @ 0.29% V_2O_5, 0.65% Pb, 0.32% Zn from 292 m.
- Overall the hole intersected a cumulative of 90 m of mineralisation above the MRE cut-off grade of 0.2% V_2O_5.
- Other results from the Resource definition drilling included (with the Company reporting that the drilling confirmed the Resource model):

- 64.18 m at 0.90% V_2O_5, 2.01% Pb, 0.65% Zn from 207m in hole ABD015; and,
- 3m @ 0.62% V_2O_5 from surface in hole ABRCD016.

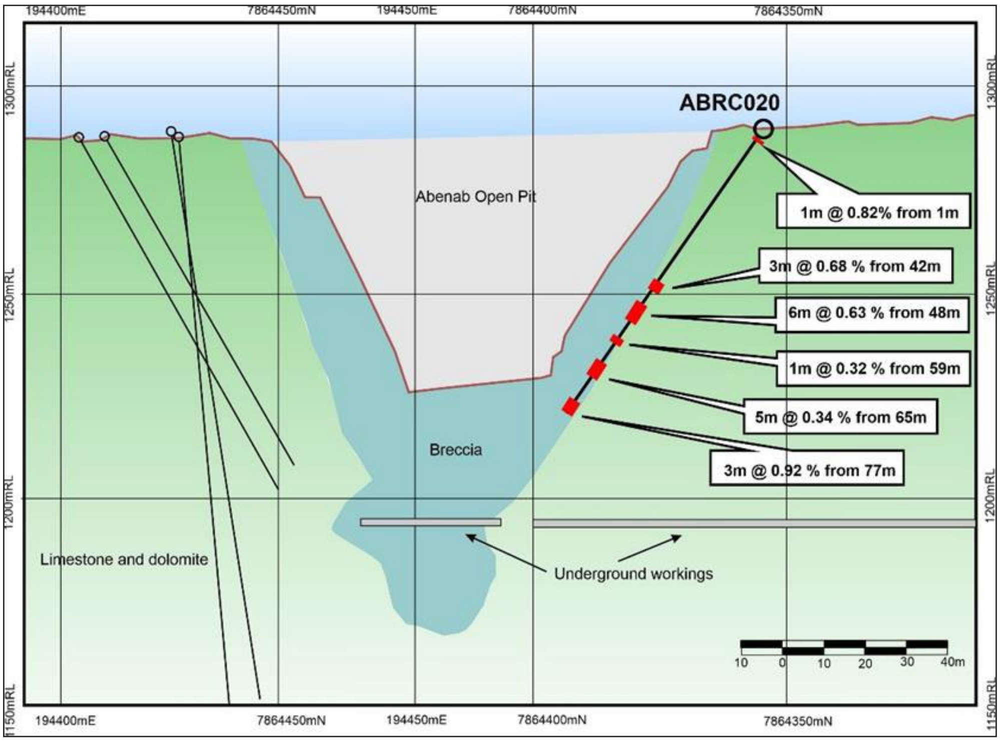
Figure 6: RC and diamond collars



Source: Golden Deeps

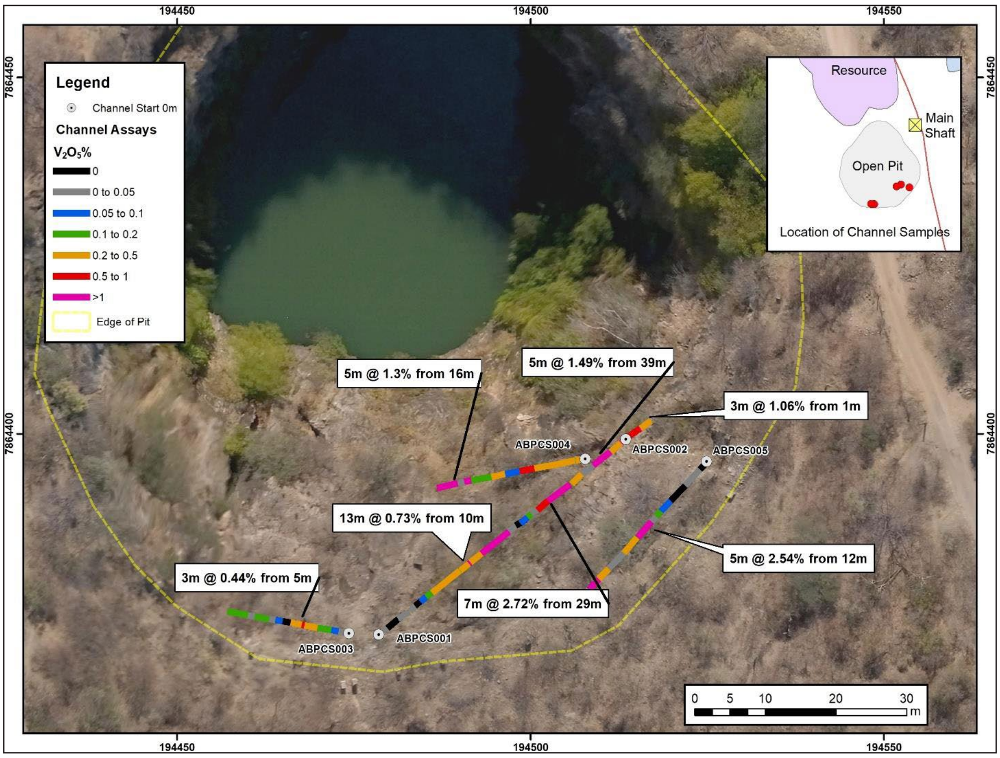
- Results were reported from two holes, ABRC019 and ABRC020, from the mine development evaluation drilling - as shown in Figure 7 hole ABRC020 intersection six intervals in the limestone forming the footwall to the southern up-dip extension of the mineralised breccia pipe; likewise hole ABRC019 intersected six such intervals - this work has been supported by rock chip sampling along the pit walls as shown in Figure 8.
- This material is typical calcite-descloiste fracture fill within limestone.

Figure 7: Section through hole ABRC020, looking NE



Source: Golden Deeps

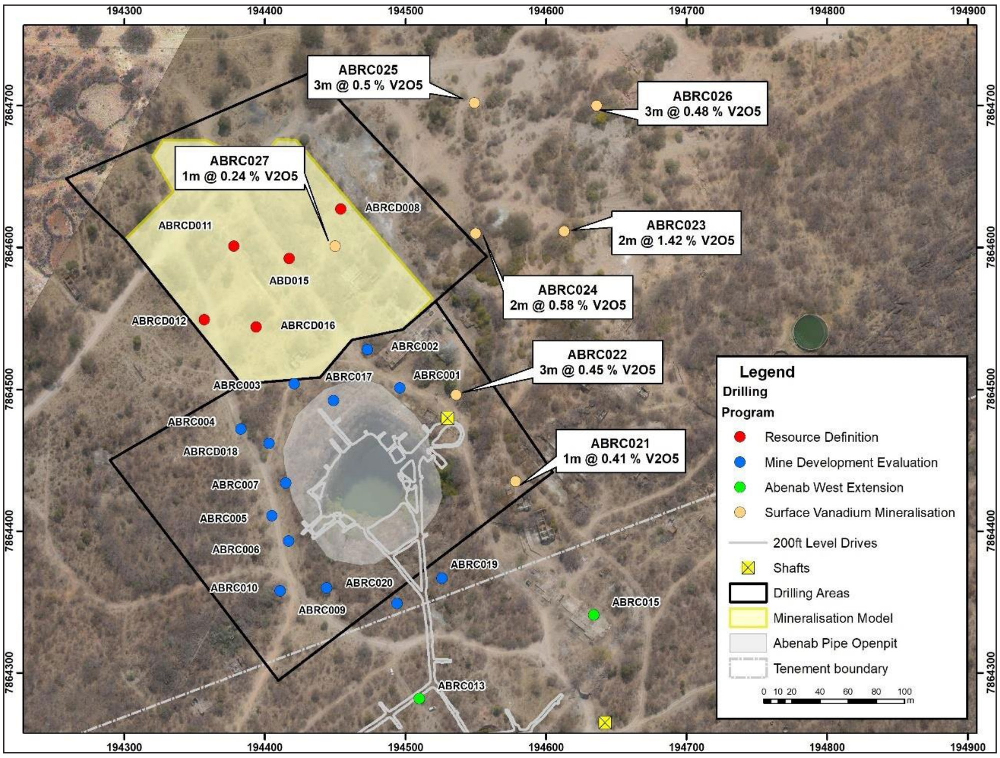
Figure 8: Results - pit wall channel sampling



Source: Golden Deeps

- Figure 9 shows the results from the RC holes that tested for near surface mineralisation - as can be seen all holes intersected thin (up to 3 m thick) mineralised material from surface.

Figure 9: Results - surface mineralisation RC drilling

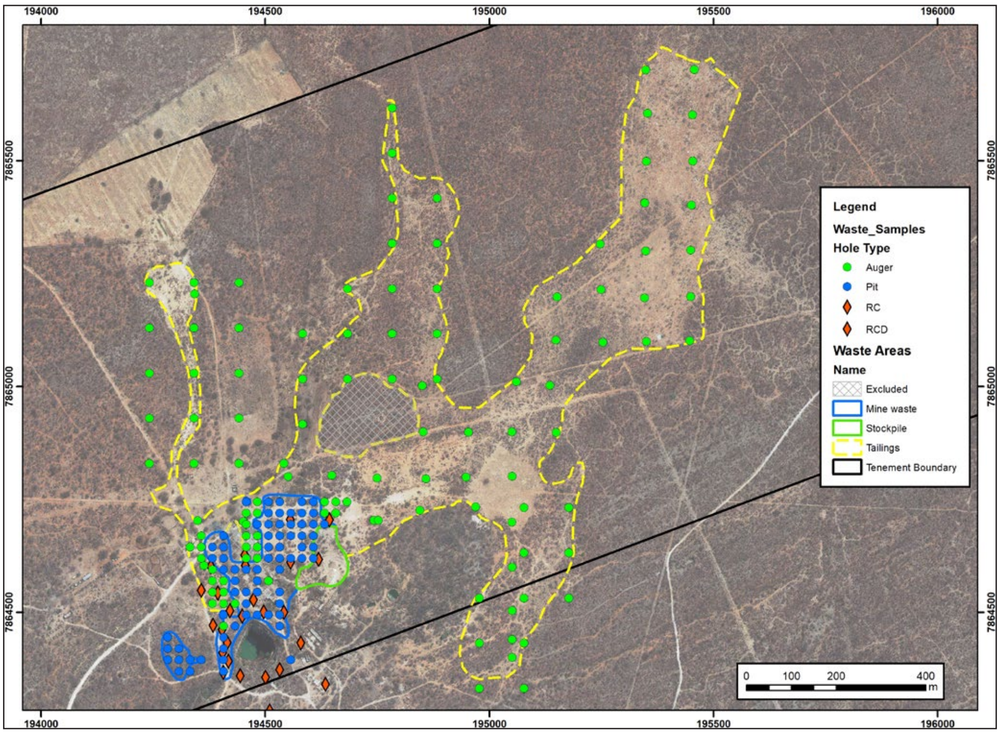


Source: Golden Deeps

Auger Drilling and Pit Sampling

- Following on from the RC drilling, the Company undertook a two phase auger and pit sampling programme to define the quantum and types of the surface mineralisation - the collar and pit locations and interpreted extents of mineralised material are shown in Figure 10.

Figure 10: Drillhole and pit collars, interpreted mineralisaed surface material area



Source: Golden Deeps

- This work included 120 power auger holes on a 100 m x 100 m grid spacing, with tails intersections averaging a grade of 0.42% V_2O_5, 1.53% Pb and 1.25% Zn, with maximum values of 1.81% V_2O_5, 5.44% Pb and 9.67% Zn
- The tailings have an average thickness of ~0.5 m, however are up to 2.5 thick in places.
- A backhoe was used to dig 71 pits on a spacing of 25 m x 25 m, with depths generally in the order of 1 m to 2 m; in the majority of cases the Company has stated that the pits did not penetrate to the base of the material being tested, which is up to 4 m thick in areas.
- The pit material had an average grade of 0.41% V_2O_5, 0.91% Pb and 1.33% Zn, with maximum values of 1.20% V_2O_5, 4.33% Pb and 3.15% Zn.
- It is now planned to undertake a surface Lidar survey to update the current DTM (which is considered inaccurate), and to drill the stockpiles using an Odex drill, which is a specialised RC technique to drill loose material without sample contamination.
- This information, as well as that from the drilling and pitting will be used to generate an initial JORC-2012 compliant Resource for the surface material.

Mineralogy and Metallurgy

- The key to the success of the Project is successful metallurgy, with the potential to provide very high grade vanadium plus Pb/Zn concentrates by simple comminution and gravity plus possible flotation concentration; however in our view the ultimate key to a viable operation will lie in the ability to refine the concentrate with viable metallurgical recoveries, to produce vanadium, lead and zinc products.
- In regards to concentration, Abenab differs significantly from other potential vanadium developers - these are largely looking at developing vanadiferous titano-magnetite mineralisation, which have primary grades in the order of 0.5% to 1.0% V_2O_5, however with concentrate upgrades generally in the order of 1.5 x head grade.
- Differences between the different deposit styles are presented in Table 2.
- We have not included here other deposit styles where vanadium would largely be produced as a by-product - this includes a number of graphite projects and the vanadiferous/kerogen rich sediments as found in the Julia Creek region of Queensland.

Table 2: Vanadium deposit metallurgical comparisons

Vanadium deposit metallurgical comparisons		
Comparison	**Abenab Ore**	**Typical Vanadium Source**
Ore Type	Descloizite	Titano-magnetite
Concentrate	Up to 30 x head grade, to a maximum grade of ~20% V_2O_5. Potential recoveries to concentrate of ~80%.	Generally around 1.5 x head grade. One of the highest upgrades globally is Largo Resources' Maracas Menchen operation in Brazil, with a Reserve head grade of 1.15% V_2O_5 and a concentrate grade of 3.20% V_2O_5.
Crushing and Concentrating	Crushing circuit with gravity separation	Crushing, grind & regrind required to support effective magnetic separation
Concentrator CAPEX & OPEX	Very low due to simplicity of the gravity separation process and higher grade concentrate produced	High, can represent up to 40% of total plant operating cost attributable to the multi stage grinding, magnetic separation, roasting circuit and reagents
Refinery Process	Concentrate to be refined by third party contract refineries - final process yet to be determined	Downstream processing (salt roast / leach) is typically complex due to pyro & hydro metallurgical processes required and process reagent losses to waste
Refinery CAPEX & OPEX	Capex not applicable – using 3rd party refinery	High, due to energy intensive multi stage hydro & Pyro met processes required
By - products	Pb & Zn recoverable, percentage recovery to be determined by current work	Iron oxide and TiO_2

Source: Adapted from Golden Deeps. Where applicable figures verified by IIR

Concentration

- The ability to produce a high grade concentrate is by virtue of the mineralogy, largely comprised of base metal vanadates and zinc silicates, which are weathering products of the original base metal sulfides.
- The main minerals, with theoretical metal contents, include:
  - Descloisite - $PbZn(VO_4)(OH)$ - 16.2% Zn, 51.2% Pb and 22.4% V_2O_5,
  - Mottramite (which forms a solid solution with descloisite) - $PbCu(VO_4)(OH)$ - 51.5% Pb, 15.8% Cu and 22.5% V_2O_5
  - Vanadinite - $Pb_5(VO_4).3Cl$ - 82.4% Pb and 7.2% V_2O_5; and,
  - Willemite - Zn_2SiO_4 - 58.7% Zn.
- Being able to successfully separate these species can result in very high grade vanadium, lead, zinc and copper concentrates, as evidenced by the reported historic concentrate grades as presented below (and mentioned earlier):
  - Abenab - 18% V_2O_5, 13% Pb and 42% Zn; and,
  - Abenab West - 13% V_2O_5 and 72% Pb.
- A key factor in the potential to produce a high grade concentrate is the high specific gravity of most ore minerals when compared with the typical carbonate gangue minerals; for example descloisite has an SG of 5.5 - 6.2, mottramite 5.9 and willemite 3.9 - 4.2 - this results in the mineralisation being amenable to gravity processing.
- The ability to upgrade was demonstrated by the historical operations - this reportedly produced 102,000 t of concentrate grading at 18% V_2O_5 from 1.85 Mt of ore grading at 1.05% V_2O_5 - these figures also suggest a recovery to concentrate of 80%.
- Limited testwork has been undertaken on various elements of the site by both Avonlea and Golden Deeps - these are summarised in Table 3.
- What the work to date has demonstrated is the ability to produce a high grade, probably largely descloisite (judging from the metal ratios) concentrate from the ROM pad and mineralised drill core, recreating, and in some cases, improving on the average grade of the concentrate produced during the historic operation.
- The initial testwork by Golden Deeps on the tails however has produced a lower grade concentrate (albeit with a very high V_2O_5 upgrade factor), although the metal ratios possibly indicate that the mineralised portion of the concentrate is largely descloisite, however potentially with considerable gangue, with incomplete liberation in the processing.
- As mentioned previously the concentration also needs to take into account recovery, with there generally being an inverse relationship between recovery to the concentrate and grade of the concentrate.

- None the less, concentrate grades of 6% V_2O_5 (as in the refining samples should result in a very low contract/toll treatment cost per unit of metal produced for any operation.
- Also, our view is that the relative upgrade factor for Zn indicates that the material tested may have a significant Willemite component.
- The Company, as mentioned previously, has now sent a 40 t bulk sample to China for further testwork as part of Stage 2 of the GMC JV - in addition a separate one tonne sample of willemite has been shipped for testwork.

Table 3: Beneficiation test work summary

Beneficiation test work summary						
Sample	**V_2O_5**	**Zn**	**Pb**	**Cu**	**Pb + Zn + Cu + V_2O_5**	**Recovery**
Historic operations						
Head	1.05%					
Produced Con	18%					~80%
Upgrade Factor	17.14					
AVZ	**3/8/2012**	**ROM**				
Composite Head	3.90%	3.10%	9.90%	0.20%	17.10%	
WT1 Conc	21.10%	14.70%	53.70%	1.00%	90.50%	~58%
WT2 Conc	20.80%	14.70%	52.90%	0.90%	89.30%	~58%
Upgrade Factor	5.33	4.74	5.34	4.50	5.22	
AVZ	**7/19/2012**	**Drill Core**				
Composite Head	1.90%	1.70%	4.50%	0.08%	8.18%	
Concentrate	17.40%	12.10%	41.50%	0.60%	71.60%	73.40%
Upgrade Factor	9.16	7.12	9.22	7.50	8.75	
GED	**8/22/2019**	**Tails**				
Composite Head	0.30%	1.14%	1.29%		2.73%	
Concentrate	8.93%	8.95%	30.54%		48.42%	Not disclosed
Upgrade Factor	29.77	7.85	23.67		17.74	

Source: Golden Deeps

- The initial eight tonne sample was treated through being crushed and ground to -1 mm, with the best concentrates being obtained through a circuit comprised of three rougher and three scavenger gravity stages - these included spirals, shaking tables and Falcon concentrators.
- The circuit included a desliming hydro-cyclone - this removed 40% of the mass as slimes, with only 6% loss of the vanadium to the rejects; subsequent treatment of the rejects through a Falcon centrifuge recovered 50% of this vanadium.
- The Company however has not released overall metal recoveries for this testwork.

Refining

- Our research has resulted in little information on the refining of the resulting concentrate, however with this the focus of ongoing work by the JV.
- It is expected that hydrometallurgical processing will be the expected treatment route, that being said Table 4, as included in a Company presentation presents a list of processing options, and the pros and cons of these.

Table 4: Potential refining options

Potential refining options		
Refining Option	**Pros**	**Cons**
Alkaline Leach	– Commercial applications currently available in the minerals processing industry – Pb & Zn recoverable as usable OH by-product	– Competent Ph balance is required to maximise recovery
Acid Leach	– Commercial applications currently available in the minerals processing industry – Stoichiometry suggests a simple flowsheet	– Complex mix of acids required – Phase destruction of V, Pb & Zn possible – Presence of carbonate gangue would result in high acid consumption (IIR comment)
Ammonium Salt Leach	– Stoichiometric study suggests a simple process flowsheet – Less processing may be required due to early AMV production	– Not a common process – Required ammonium salt not yet known – Impact on Pb & Zn recoverability not yet known
Salt Roast & Water Leach	– Proven commercial process – Simple water leach recovery post roast – Traditional, well known & understood process, (typically for titano-magnetite ores)	– Higher Opex & Capex due to hydro & pyro met processes & energy required – May require a downgrade of concentrate to maximise recovery. – Impact on Pb & Zn recoverability unknown

Source: Golden Deeps - this information has not been verified by IIR

Current and Planned Activities

- Activities are now concentrated on working towards the planned commencement of activities in 2020 for the Project (which is being funded by GMC).
- Ultimately the course of activities will depend upon the results of the metallurgical testwork and whether GMC decides to proceed with the JV.
- Near term and current activities include:
  - Refining testwork from the initial bulk concentrate is underway, with results expected in Q1, 2020,
  - Concentration and refining testwork on the 40 t sample is expected to commence shortly, and is expected to take two to three months to complete; and,
  - Lidar topography surveying to update the current inaccurate DTM and Odex drilling of the surface stockpiles - these will be included with the results of recent drilling in the preparation of an initial MRE for the surface material.
  - Potential additional diamond drilling to further define the remaining mineralisation in the south wall of the open pit.

PEERS

- Given the unique nature of the Project, Golden Deeps has no clear peers.
- We would not include it as part of the vanadium developers, given the style of mineralisation and the expected relatively small scale of the Project when compared to the titano-magnetite focussed companies.

CAPITAL STRUCTURE

- Golden Deeps currently has 280.6 million shares and 8.50 million unlisted options on issue.
- All of the options are out of the money, with exercise prices of A$0.15 and A$0.20, and an expiry date of September 1, 2020.
- The top 20 hold 65.01%, with insiders holding 1.44%; the largest shareholder is Coniston Pty Ltd, with 19.50% of the issued shares, with Kalgoorlie Mine Management Pty Ltd being the second largest, with 9.02%. Both of these entities are beneficially held by the same person.
- The Company has over 600 shareholders.

BOARD AND MANAGEMENT

- **Mr Michael Minosora – Chairman:** Michael Minosora has extensive experience with a number of ASX listed industrial and mining companies. He has been Managing Partner of Ernst & Young, Managing Director of advisory firm Azure Capital Limited, Chief Financial Officer of Fortescue Metals Group and Managing Director of Atlantic Limited. He holds a Bachelor of Business; a Masters of Business Administration and is a graduate of the Executive Management Program of the North Western University, Kellogg School of Business, Chicago.
- **Mr Michael Rodriguez - Director:** Michael Rodriguez has over 30 years' experience in the design, construction,commissioning, operation and management of hydrometallurgical and pyrometallurgical plants across Australia, Turkey, Europe and the Americas. He is a qualified metallurgist with a strong background in project construction, mechanical completion and site handover to operations.
- **Mr Michael Norburn - Director:** Michael Norburn graduated from the University of Birmingham with an honours degree in engineering and has worked for over twenty six years in the resource industry in Australia, the Middle East and Africa.
- **Mr Michael Scivolo - Director:** Michael Scivolo has extensive experience in the fields of accounting and taxation in both corporate and non-corporate entities. He is a Director of Sabre Resources Ltd, and Metals Australia Ltd.
- **Mr Robert Collins - Director:** Robert Collins has extensive experience in the fields of accounting and taxation in both corporate and non-corporate entities, and owned a large West Perth accounting practice serving the corporate sector. He is currently a Director of Metals Australia Ltd, and Sabre Resources Ltd.

- **Mr Johannes Ashipala - Director of Namibian Companies:** Co-founder and Executive Director of Natura Energy, a Namibian company dedicated to sponsoring and developing power projects in Southern Africa. Natura Energy has developed the USD 340 million Arandis Power Hybrid heavy fuel oil and solar PV initiative in Namibia. Consults and is a director of foreign companies investing in Namibia, and is extensively involved in the mining sector.
- **Mr Scott Matthewson - Executive General Manager - Operations:** Scott has over 25 years of experience in senior operational, technical and leadership roles in the metals,mining and mineral processing sectors with a focus on operations, mining, process engineering and business improvement. He has a passion for safety and fostering a caring culture across the business.

  Prior to joining Golden Deeps, Scott was the EGM of Global Mining and Production for an international mineral sands producer where he was responsible for all mining & production operations and the development of future growth and expansion opportunities. Prior to this, he was Technical Director within the Corporate Finance sector responsible for raising capital for new mining operations in Australia and Internationally. Across his career, Scott has also held senior positions with Rio Tinto, Alcoa World Alumina and Atlantic Vanadium.

  Scott holds a Bachelor of Chemical Engineering from Curtin University and a MBA from the University of Southern Queensland where he majored in OHS and Corporate Finance. He also holds an Unrestricted WA Quarry Manager Certification.
- **Mr Martin Stein - Company Secretary:** Martin is a finance and governance professional, and has previously held senior positions with PricewaterhouseCoopers LLP and Anvil Mining Limited. Martin has held the office of Company Secretary with several other ASX listed companies.
- **Mr Martin Bennett - Exploration Manager:** Exploration Manager with 30 years resource industry experience. Mr. Bennett was previously Exploration Manager at BCI Minerals, and has held senior roles at KGL Resources, Endeavour Mining and La Mancha Resources. He has exploration experience in Australia and Africa.

VANADIUM AND VRFBs

Background

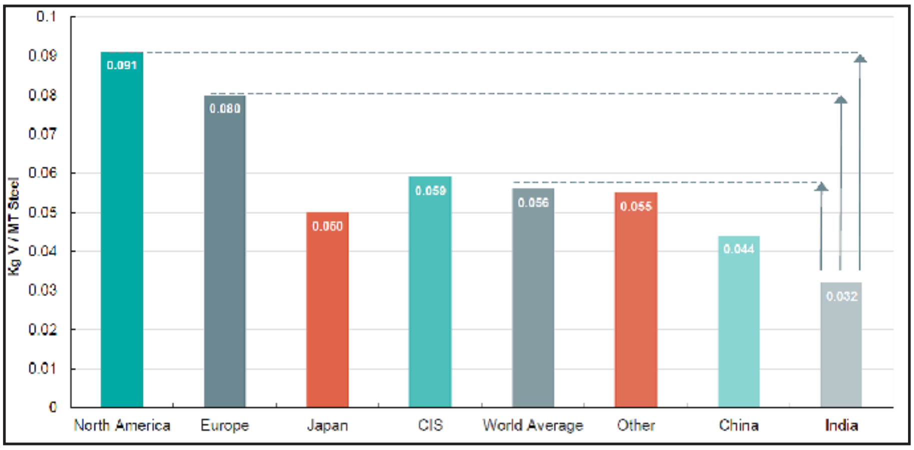
- The main use of vanadium is as a steel additive in high-strength steel, which accounts for about 92% of the current global demand of ~90,000 t of vanadium metal (equivalent to ~160,000 t V_2O_5, with the oxide containing 56% V).
- Other uses include chemicals, catalysts and in batteries - vanadium is produced as two main products – FeV for steel-making and V_2O_5 for chemical and battery applications.
- Global production was reportedly ~73,000 t in 2018, with the largest source being as a by-product from slag produced from the smelting of titaniferous magnetite ores for steelmaking – it is estimated that this accounts for ~73% of total supply, with 17% being derived from mining as a primary product and the remainder from secondary sources, including oil residues and fly ash.
- Supply is concentrated, with over 90% of vanadium products produced in South Africa, China, Russia and Brazil.
- New developments include Largo Resources Maracas Project in Brazil, which is now in full production, and exceeding the planned output of 9,200 t of V_2O_5 per year, with a planned FeV plant to be added at a later date.
- Demand has outstripped supply since 2010, with successive drawdowns on inventory; part of this has been due to industry rationalisation and environmental constraints in China, with this now resulting in the inventories being depleted and hence a recent increase in prices after falling for over 10 years (Figure 8).
- However, as Figure 8 also shows there has been a retracement of this most recent rise in prices, which highlights the volatile nature of vanadium pricing at times.

Demand Drivers

Steelmaking

- The current key demand driver is as an additive in steel – demand for vanadium closely follows the production of steel. This includes two factors – firstly the natural organic growth in steel production and secondly increasing vanadium intensity in steel with the move to lighter weight and higher strength steels – the addition of just 0.2% vanadium to steel increases steel strength by up to 100% and reduces the weight of steel required in relevant applications by up to 30%.
- This second factor is particularly relevant in China, where there is increasing vanadium intensity in rebar due to changes in building standards (with new regulations set to become effective in November 2018), partly following on from the 2008 earthquake - there is still a fair way to go with this and thus significant potential growth in use in this application, however this has the potential to increase Chinese vanadium consumption by up to 50% (15,000 tpa).
- Roskill estimate that, although steel production will only grow at 1% CAGR over coming years, the increasing intensity of vanadium in steel along with other end uses will result in a long term demand growth of 3.45% CAGR from ~100,000 tpa V in 2015 to 131,000 tpa contained V in 2025, with the forecast supply deficits now being seen.
- Figure 10 shows the relative vanadium intensities in rebar between various jurisdictions.

Figure 10: Vanadium steelmaking intensity

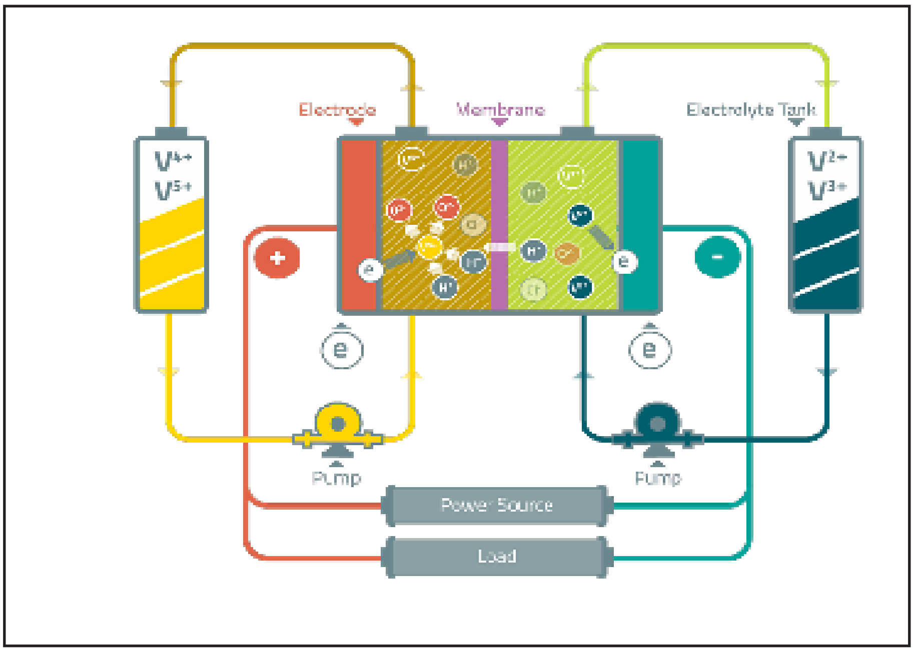


Source: Australian Vanadium

Energy Storage – VRFB's and Li-Ion Batteries

- The blue sky in demand, and the potentially disruptive technology is in grid scale battery usage - the key here will be the adoption of vanadium redox flow batteries ("VRFBs") that have the capacity for multi-megawatt scale storage - this makes them useful for grid scale applications, including grid balancing and storing energy from variable output sources, including wind turbines and solar cells.
- The batteries are inherently simple (Figure 11), relying on the changing redox state of vanadium to store and then supply power.
- Other attributes of these batteries include:
  - Scalability
  - Long lifespan – up to 20 years
  - Up to a 1 year charge retention
  - 100% discharge without damage, and,
  - Only one element – V in various oxidation states – in electrolyte.
- There are widely differing forecasts on the growth in VRFB's, however some commentators see the potential for VRFBs to provide up to 30% of the growing energy storage market, with some forecasting an additional demand of 300,000 t of vanadium over coming years to meet this need.

Figure 11: VRFB schematic



Source: Australian Vanadium

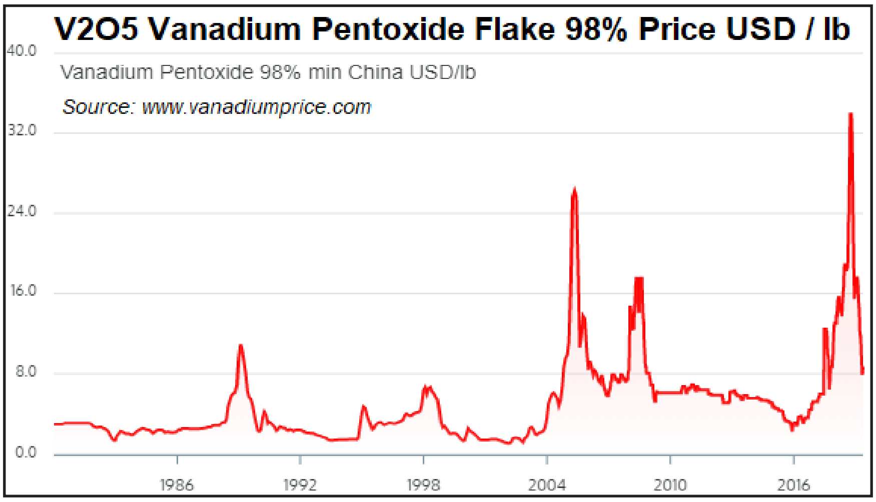
- There are a number of active VRFB developments globally at the moment, reportedly with the largest being the development of a 200MW/800MWh battery in Dalian, China, which reportedly uses 6,950 tonnes of V_2O_5, at an intensity of 8.7t/MWh; we have also seen documentation for other batteries with a usage intensity of 7.25t of V (12.94t of V_2O_5) per MWh of capacity.
- Other recent developments include a US$200 million, 15MW/60MWh facility by Sumitomo on the Japanese island of Hokkaido.
- Development of VRFBs has been partly hamstrung by the lack of a suitable battery grade V_2O_5 supply – batteries require a higher purity product than that used in steelmaking, and hence arises the opportunity for manufacturers of high purity material.
- Some forecasts see the Australian energy storage market reaching 3,000 MWh by 2030 – should the VRFB penetration reach an estimated 30% of the market this will result in the requirement of 900 MWh of VRFB capacity over the same period.
- Australia is an ideal market for fringe-of-grid and off-grid storage facilities given the extended power networks and large off-grid areas, thus potentially providing a domestic market for any V_2O_5 producers.
- Assuming a capital intensity of A$1,000,000/MWh, this equates to a A$900 million market, and using an average V_2O_5 intensity of ~10t/MWh (this intensity will vary depending upon the battery producer), this results in a potential domestic demand for an additional 9,000 t of V_2O_5 by 2030.
- There is also significant forecast demand (~1/3 of that for VRFB's) for vanadium in Li-ion batteries.

Pricing

- Figure 12 highlights the recent price spike to over US$30/kg (US$14 - US$14.50/lb) largely due to de-stocking of inventories over recent years and supply constraints due to rationalisation of the iron ore industry in China (with vanadium being a major by-product) along with environmental constraints leading to a sharp decline in production
- This however also shows the subsequent retracement in prices - this had fallen to around US$9/lb in July 2019.
- The 30 year average price has been US$11/kg V_2O_5, with the inflation adjusted mean since 2004 being ~US$16/kg.
- The market is not particularly transparent, and also prices do not correlate with steel production even though this is the key demand driver.
- As mentioned earlier wide acceptance of VRFBs may go some way to breaking the price "spike-collapse" pattern over recent times, due to the requirement for a consistent supply of high purity V_2O_5 for the electrolyte.

- However, there is a Catch 22 here, with the consistently higher prices for V_2O_5 required to get new projects funded and up and running leading to batteries being comparatively expensive, and hence inhibiting demand.
- As a final point, given the potential very low operating and capital costs and being funded (should GMC continue with the JV), Abenab is largely insulated from the effects of the spike/crash price behaviour.

Figure 12: V_2O_5 price chart



Source: Stockhouse.com, extracted October 30, 2019

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