

**Low  
Cost**

**Abenab  
Vanadium  
Project**

**High  
Grade**

**Near  
Term**

## **TO ACCELERATE THE DEVELOPMENT OF THE ABENAB VANADIUM PROJECT**

**(Stage One 500,000 tpa, Low Cost, High Grade, Near Term Ore Processing Facility)**

This will be achieved by:

1. A fully informed exploration program to identify >3Mt vanadium pentoxide ( $V_2O_5$ ) bearing ore that is economically mineable (Current Resource is 2.8Mt @0.66%  $V_2O_5$ , 2.35% Pb, 0.94% Zn)
2. The development of an efficient 500,000 tpa, low capital & operating cost, mineral processing plant for the production of a high grade 18-21%  $V_2O_5$  concentrate
3. Identification of suitable refining options for third party processing of the concentrate





- ✓ Large tenement holding located in a proven vanadium-rich province
- ✓ Province hosts several historic high-grade vanadium mines
- ✓ Updated maiden JORC (2012) Mineral Resource of 2.8Mt @0.66%  $V_2O_5$ , 2.35% Pb, 0.94% Zn (reported January 2019)
- ✓ Metallurgy is proven for simple low cost gravity separation to produce an exceptionally high-grade vanadium, lead & zinc concentrate of up to 21%  $V_2O_5$ , 14% Zn and 53% Pb
- ✓ Project to benefit from the low capital cost and low operating cost
- ✓ Short development and construction timeframe identified due to modular plant opportunities
- ✓ Namibia is a stable jurisdiction with good infrastructure and a skilled workforce
- ✓ Company is in discussion with existing refineries for the processing of concentrate to extract the greatest value



- Resource definition drilling plan identified to develop the working mine plan
- Detailed engineering study to develop a 500,000 tpa modular concentrator process to produce the high value concentrate of up to 21%  $V_2O_5$ , 14% Zn and 53% Pb using a low capital solution
- Identification of third party downstream toll treatment options with existing low cost refineries or sell concentrate directly to third parties
- Extension drilling to increase LOM and increase existing resource base



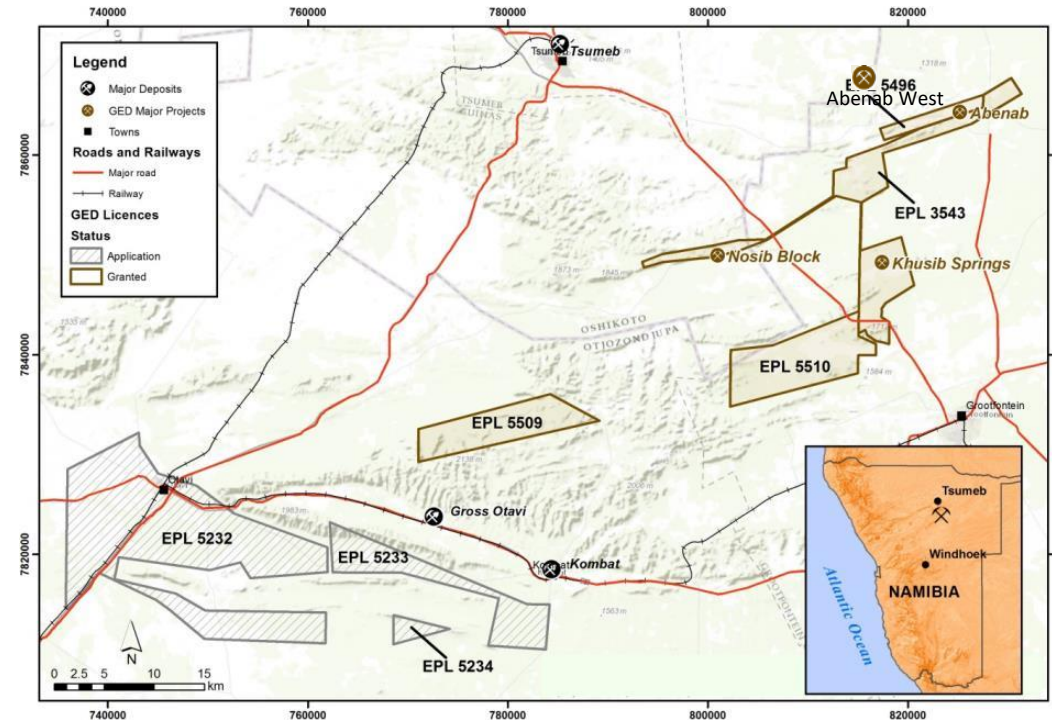
Q1 2019	Q2 2019	Q4 2019	2020
<p>Drilling</p> <p>Metallurgical Testwork</p> <p>Develop Process Flow Sheet Design</p>	<p>Drilling</p> <p>Engineering Scoping Study</p> <p>Mining Concession Approval</p> <p>Environmental Impact Study</p> <p>Social Impact Study</p>	<p>Bankable Feasibility Study (Concentrator)</p> <p>Mine Plan Developed</p> <p>Detailed Engineering Design</p> <p>Plant Construction</p>	<p>Recruitment</p> <p>Mining Commences</p> <p>Production of V<sub>2</sub>O<sub>5</sub>, Pb and Zn Concentrate</p> <p>Supply Concentrate to Refineries</p>

**Exploration: Abenab and Nosib Trend**



# Background: Project Location

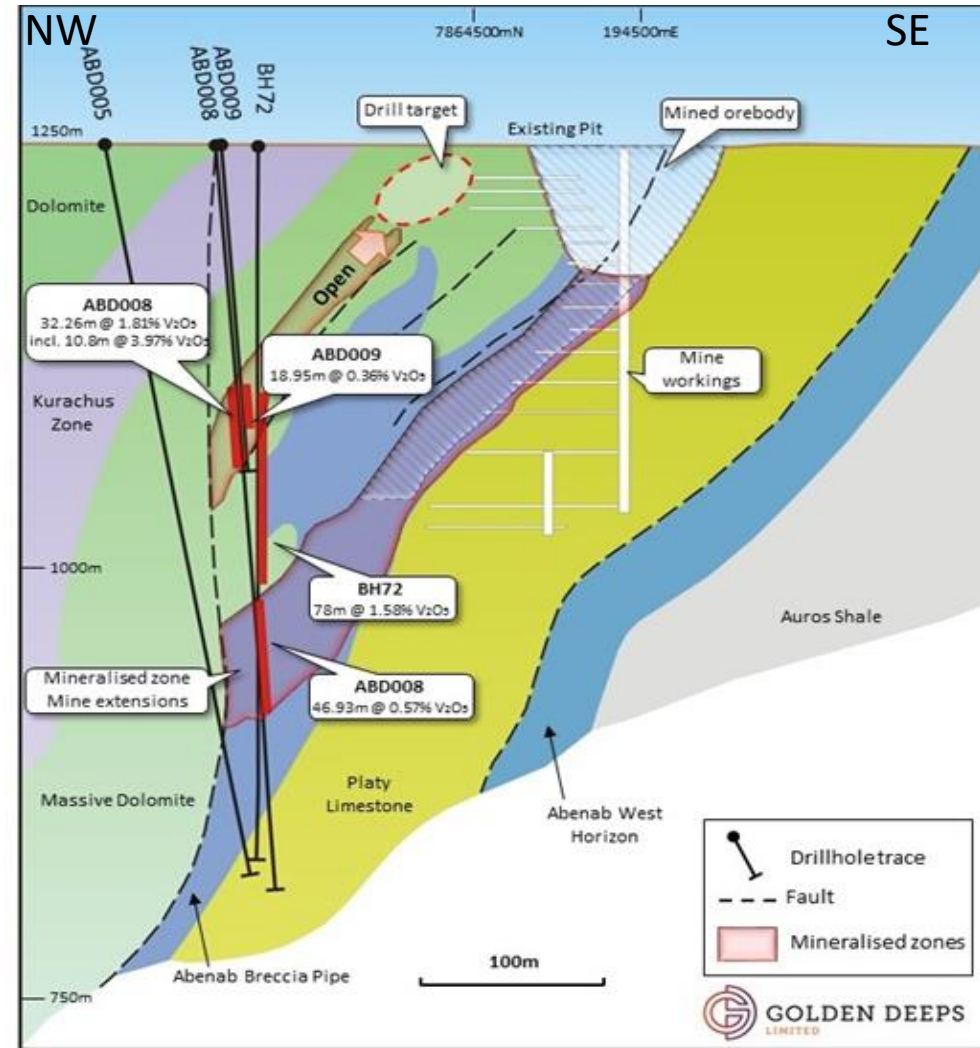
- Located in the mineral-rich Otavi Mountain Land in northern Namibia
- GED controls all key mines and prospects along a 40km long lithological and structural trend
- Four granted EPLs and three pending EPL applications
- 562km<sup>2</sup> of highly prospective ground for vanadium, copper, lead and zinc
- Historic Vanadium mines located in the EPLs:
  - Abenab (102,000 T concentrate @18% V<sub>2</sub>O<sub>5</sub>, 13% Zn, 42% Pb)
  - Abenab West (74,000 T concentrate @13% V<sub>2</sub>O<sub>5</sub>, 72% Pb)



Abenab Vanadium Project showing GED tenements and historic mines



- Updated geological model generated by consulting group Shango Solutions incorporates additional historic data
- Updated JORC 2012 Inferred Mineral Resource of 2.8Mt @0.66% V<sub>2</sub>O<sub>5</sub>, 2.35% Pb, 0.94% Zn reported
- Abenab cross section demonstrates down dip continuity of orebody from the existing open pit
- Potential for extensions to vanadium mineralisation adjacent to open pit and underground workings
- Abenab mineralisation occurs as descloizite [(Pb,Zn)<sub>2</sub>VO<sub>4</sub>(OH)] and vanadinite [Pb<sub>5</sub>(VO<sub>4</sub>)<sub>3</sub>Cl] rather than the more common vanadium bearing titanomagnetite minerals in magmatic deposits
- Standard crushing and gravity separation of ore allows high-grade concentrate to be extracted up to 21% V<sub>2</sub>O<sub>5</sub>, 14% Zn and 53% Pb with low processing costs



# Minerology – Higher Grade & Recovery

COMPARISON	ABENAB ORE	TYPICAL VANADIUM SOURCE
Ore Type	Descloizite	Titano-magnetite
Concentrate	18-21% V <sub>2</sub> O <sub>5</sub>	1-3% V <sub>2</sub> O <sub>5</sub>
Crushing & Concentrating	Crushing circuit with gravity separation	Crushing, grind & regrind required to support effective magnetic separation
Concentrator Capital and Operating Cost	Low, due to simplicity of the gravity separation process and higher grade concentrate produced	High, represents ~35% of total plant operating cost attributable to the multi stage grinding, magnetic separation, roasting circuit and reagents
Refinery Process	Smaller & less complex downstream processing plant required due to higher grade of concentrate and ore type (low energy & reagent use)	Downstream processing (salt roast/leach) is typically larger & more complex due to pyro & hydro metallurgical processes required and process reagent losses to waste.
Refinery Capital & Operating Cost	Lower, due to higher V <sub>2</sub> O <sub>5</sub> /T concentrate and ability to treat through chemical based refineries.	High – due to energy intensive multi stage hydro & pyro met processes required.
Byproducts	Pb & Zn recoverable	Low grade Iron Ore and TiO <sub>2</sub>





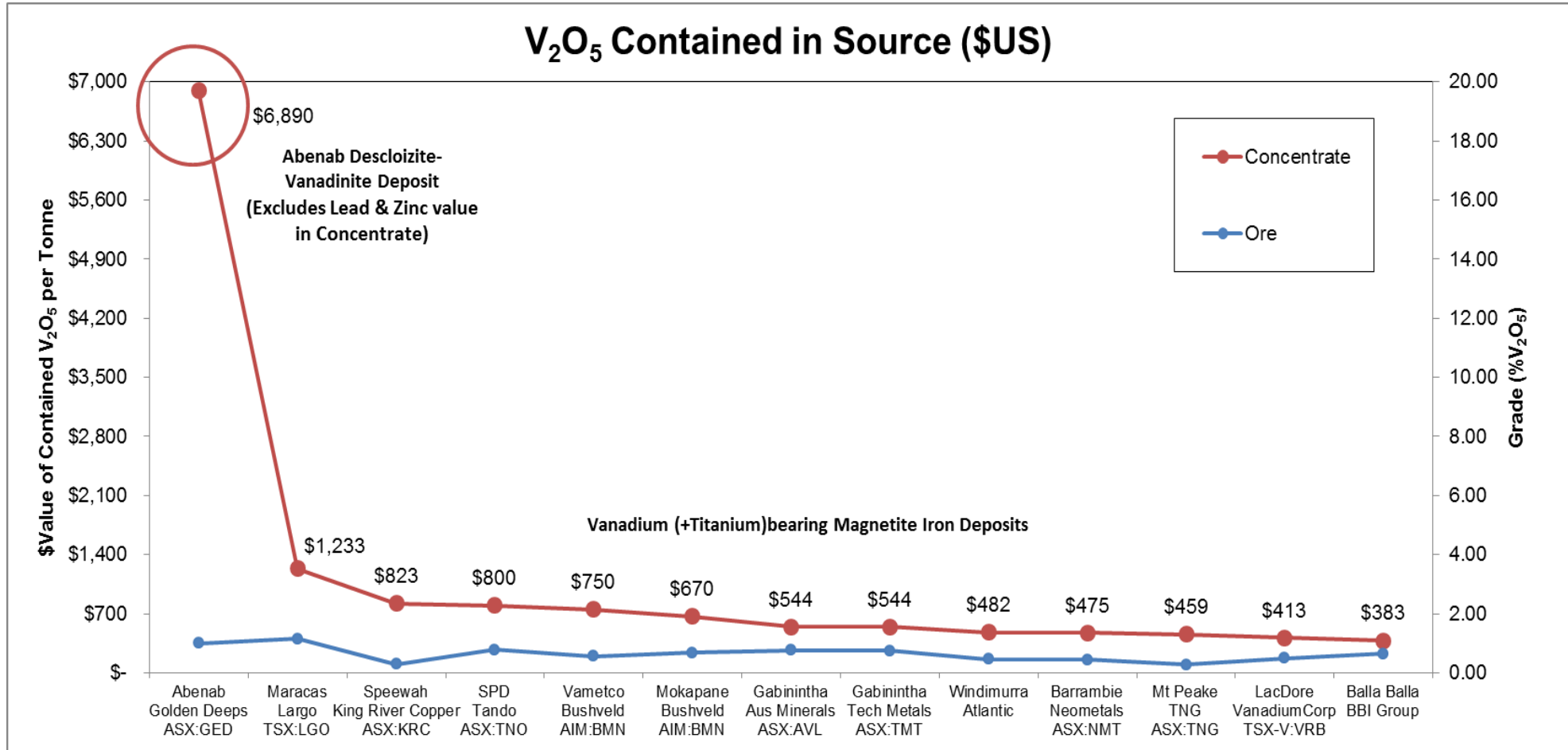
## Concentrator Process

- Gravity Separation with water
- 500,000 tpa ore throughput with modular design to enable ease of construction & ramp up
- High recovery through recycle & multi stage separation producing a high grade product up to 21%  $V_2O_5$ , 14% Zn and 53% Pb
- Commercially known, tested and available technology already in use within the mineral processing industry
- Low CAPEX & OPEX compared with titano-magnetite concentration



Clear Visual Separation of Vanadium  
Bearing mineral from Gangue

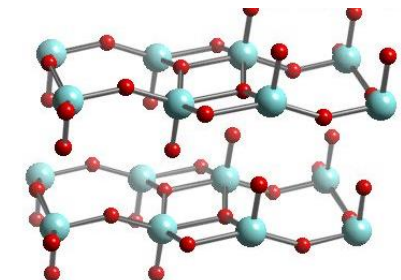
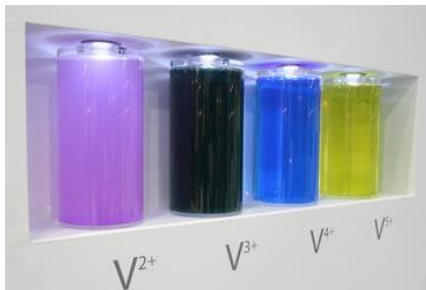
## Comparison between Mine Grade and Concentrate Grades



*Vanadium resource company peer comparison depicting resource and concentrate grades (Price basis: \$US38.3/kg V<sub>2</sub>O<sub>5</sub>)*

# Refining Process: Options for Processing

Processing Option	PROs	CONs
Alkaline Leach	<ul style="list-style-type: none"> <li>Commercial applications currently available in the minerals processing industry</li> <li>Pb &amp; Zn recoverable as usable OH by-product</li> </ul>	<ul style="list-style-type: none"> <li>Competent Ph balance is required to maximise recovery</li> </ul>
Acid Leach	<ul style="list-style-type: none"> <li>Commercial applications currently available in the minerals processing industry</li> <li>Stoichiometry suggests a simple flowsheet</li> </ul>	<ul style="list-style-type: none"> <li>Complex mix of acids required</li> <li>Phase destruction of V, Pb&amp;Zn possible</li> </ul>
Ammonium Salt Leach	<ul style="list-style-type: none"> <li>Stoichiometric study suggests a simple process flowsheet</li> <li>Less processing may be required due to early AMV production</li> </ul>	<ul style="list-style-type: none"> <li>Not a common process</li> <li>Required ammonium salt not yet known</li> <li>Impact on Pb&amp;Zn recoverability not yet known</li> </ul>
Salt Roast & Water Leach	<ul style="list-style-type: none"> <li>Proven commercial process</li> <li>Simple water leach recovery post roast</li> <li>Traditional, well known &amp; understood process, (typically for titano-magnetite ores)</li> </ul>	<ul style="list-style-type: none"> <li>Higher Opex &amp; Capex due to hydro &amp; pyro met processes &amp; energy required</li> <li>May require a downgrade of concentrate to maximise recovery.</li> <li>Impact on Pb&amp;Zn recoverability unknown</li> </ul>





## **SHANGO SOLUTIONS**

A highly respected exploration and mining consultancy that has worked on more than 800 projects over a 14 year period. Established in 2004 in Northcliff, Johannesburg, Shango is committed to creating value through provision of technical excellence and innovation, from concept to solution. Now recognised as an industry leader in geological mapping within Africa, their extensive networks and affiliations have helped them develop many unique databases within the African minerals scene.

Shango Solutions has been engaged to conduct a comprehensive geological and target generation study using newly acquired historic exploration data in developing a revised geological interpretation and 3D model, that will be used to generate future drill testing targets. The new drill data will form the basis of an updated mineral resource update.

## **MINTEK**

South Africa's national mineral research organisation and it is one of the world's leading technology organisations specialising in mineral processing, extractive metallurgy and related areas. Working closely with industry and other R&D institutions, MINTEK provides service testwork, process development and optimisation, consulting and innovative products to clients worldwide.

Mintek has been engaged to undertake a comprehensive metallurgical study in developing an optimised concentrator process flow sheet and vanadium refinery processing options.



## Segoelele

### **SEGOELELE PROCESS AND ADVISORY SERVICES**

Provides leading edge engineering solutions, outsourced operations, maintenance services, designs and supply of equipment to the minerals processing industry.

SEGOELELE has been engaged to develop the scoping study for the detailed engineering design and construction of the crushing circuit and concentrator plant.



### **INSTITUTE OF PROCESS ENGINEERING, Chinese Academy of Sciences**

Founded in 1958, for over half a century the institute has extended the research fields from chemical metallurgy to process engineering, involving energy chemical engineering, biochemical engineering, material chemical engineering, resources and environment engineering areas.

IPE has been engaged to develop alternative process flowsheet options for downstream processing of the concentrate.



### **THE CHINA ENFI ENGINEERING CO. LTD**

Established in 1953, China ENFI is now considered one of the world leaders in project integration, new energy industry and resource development.

ENFI has been engaged to develop downstream processing flowsheet options and the engineering design for the Refinery Process.

## **Overview**

This presentation has been prepared by Golden Deeps Ltd (“GED”) as a summary of the company’s exploration and development activities, with particular reference to the Abenab V-Pb-Zn Project in Namibia.

## **No Offer of Securities**

The presentation is not, and should not, be considered as an offer or invitation to subscribe for, or purchase any securities in GED, or as an inducement to make an offer or invitation with respect to those securities. No agreement to subscribe for securities in GED will be entered into on the basis of this presentation.

## **Forward Looking Statements**

This presentation contains certain forward looking statements which have not been based solely on historical facts but, rather, on GED’s current expectations about future events and on a number of assumptions which are subject to significant uncertainties and contingencies many of which are outside the control of GED and its directors, officers and advisers.

## **Reliance on Third Party Information**

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## **Competent Person Declaration**

The information in this announcement that relates to Exploration Targets and Exploration Results is based on information compiled by Mr. Martin Bennett. Mr Bennett is an employee of Golden Deeps Limited and is a member of the Australian Institute of Geoscientists. Mr Bennett has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the ‘Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves’. Mr Bennett consents to the inclusion in the report of the matters based on their information in the form and context in which it appears.



## Resource Estimate

The resource estimate stated in this presentation was compiled by Mr Manie Swart of Shango Solutions and announced to the ASX on January 31, 2019. Mr Swart is a Member of the South African Council for Natural Scientific Professions and a full-time employee of Shango Solutions. Mr Swart has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity that is being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. The announcement is available for download from the GED website (<http://goldendeeps.com/investors.php>).

Mr Martin Bennett, a consultant to GED and who is a member of the Australasian Institute of Mining and Metallurgy, has reviewed the information provided in this presentation and considers that it is an accurate representation of the data and studies for the Abenab Project. Mr Bennett has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'.

## Historical Exploration Results

Exploration Results for drilling, metallurgical testwork and other exploration at the Abenab Mine stated in this presentation have previously been reported by Avonlea Minerals Limited (Avonlea, now AVZ Minerals Ltd). The relevant public announcements made by Avonlea are available for download from the ASX website ([www.asx.com.au](http://www.asx.com.au)) under the code AVZ.