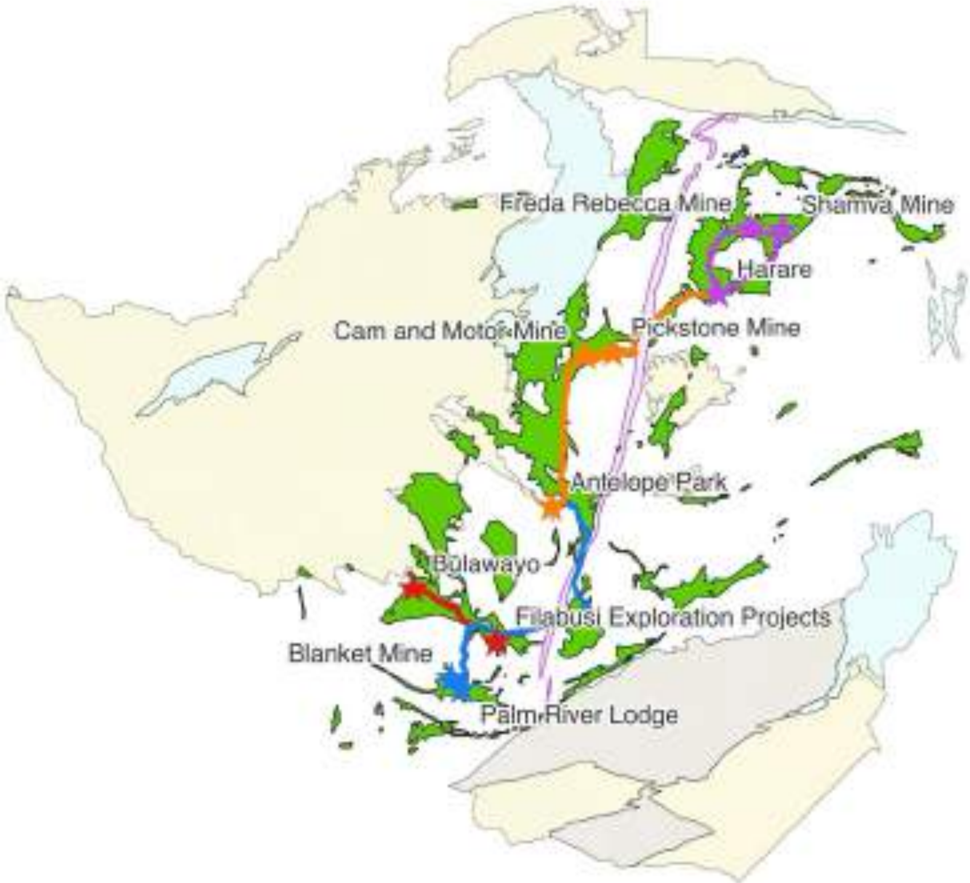
# ZIMBABWE GEOLOGICAL SOCIETY




# *OROGENIC GOLD FIELD TRIP*

## 12th FEBRUARY 2025 to 14TH FEBRUARY 2025


Gayle Hanssen and Brian Mapingere

with contributions

Dale Blair, Godfrey Chagondah, Dave Dube, Moregood Dzimba, Trish Nyrenda and Kerim Sener

# Route

<table>
<tr><th></th><th>Start</th><th>Stop</th><th>Leave</th><th>Arrive</th><th>Minutes</th><th>Distance (km)</th></tr>
<tr><td rowspan="9">DAY 1</td><td>BRONTE HOTEL</td><td>Shamva Mine</td><td>7AM</td><td>8.30AM</td><td>75</td><td>90</td></tr>
<tr><td colspan="6">SHAMVA MINE VISIT</td></tr>
<tr><td></td><td></td><td>8.30 AM</td><td>12.00 PM</td><td></td><td></td></tr>
<tr><td colspan="6">Induction, Overview and preparation for Underground 1 hour<br>Underground Visit - 2.5 hours - including returning and getting ready for departure.</td></tr>
<tr><td>Shamva</td><td>Bindura</td><td>12.00AM</td><td>13.30 AM</td><td>1.5 hour incl lunch</td><td>30</td></tr>
<tr><td colspan="6">FREDA REBECCA MINE VISIT</td></tr>
<tr><td></td><td></td><td>13.30 AM</td><td>16.00 PM</td><td></td><td></td></tr>
<tr><td colspan="6">Induction and Overview 30 mins<br>Pit Visit and Core Yard Visit 2 hours</td></tr>
<tr><td>Bindura</td><td>BRONTE HOTEL</td><td>16.00PM</td><td>17.45 PM</td><td>105</td><td>85</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td rowspan="9">DAY 2</td><td>BRONTE HOTEL</td><td>Pickstone Mine</td><td>7AM</td><td>9.30AM</td><td>2.5 hours</td><td>125</td></tr>
<tr><td colspan="6">PICKSTONE MINE VISIT</td></tr>
<tr><td></td><td></td><td>9.30 AM</td><td>12.00 AM</td><td></td><td></td></tr>
<tr><td colspan="6">Induction and Overview 1 hour<br>Pit and Outcrop visits 1.5 hours</td></tr>
<tr><td>Pickstone Mine</td><td>Cam and Motor Mine</td><td>12.00AM</td><td>13.30 AM</td><td>1.5 hour incl lunch</td><td>30</td></tr>
<tr><td colspan="6">CAM AND MOTOR MINE</td></tr>
<tr><td></td><td></td><td>13.30 AM</td><td>15.30 PM</td><td></td><td></td></tr>
<tr><td colspan="6">Induction and Overview 30 mins<br>Pit Visit and Core Yard Visit 1.5 hours</td></tr>
<tr><td>Cam and Motor Mine</td><td>ANTELOPE PARK</td><td>15.30PM</td><td>18.00 PM</td><td>2.5 hours</td><td>156</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td rowspan="6">DAY 3</td><td>ANTELOPE PARK</td><td>Gwanda</td><td>6AM</td><td>10.30AM</td><td>4.5 hours</td><td>310</td></tr>
<tr><td colspan="6">BLANKET MINE UNDERGROUND VISIT</td></tr>
<tr><td></td><td></td><td>10.30AM</td><td>17.00 PM</td><td></td><td></td></tr>
<tr><td colspan="6">Induction and Prepare for Underground 45 Minutes<br>Underground Visit - 2 hours</td></tr>
<tr><td colspan="6">Returning from Underground and Lunch 1 hour<br>Overview 1 hour - done later due to time underground must be before lunch<br>Core Shed and Farwell - 1 hour</td></tr>
<tr><td>Blanket Mine</td><td>PALM LODGE</td><td>16.30PM</td><td>17.00 PM</td><td>30 mins</td><td>15</td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td rowspan="6">DAY 4</td><td>PALM LODGE</td><td>Filabusi</td><td>8AM</td><td>9.30AM</td><td>1.75 hours</td><td>110</td></tr>
<tr><td colspan="6">FILABUSI EXPLORATION PROJECT</td></tr>
<tr><td></td><td></td><td>9.30 AM</td><td>15.00 AM</td><td></td><td></td></tr>
<tr><td colspan="6">Induction and Overview 1 hour<br>Visits to Outcrops and discussions</td></tr>
<tr><td colspan="6">Lunch<br>Visits to Outcrops and discussions</td></tr>
<tr><td>Filabusi</td><td>TRAVELLERS LODGE</td><td>15.00PM</td><td>16.30 PM</td><td>1.5 hours</td><td>110</td></tr>
</table>

# Table of Contents

# List of Figures

# List of Tables

# List of Photos

# Welcome and Foreword

On behalf of the Geological Society of Zimbabwe if you are visiting for this historic Orogenic Gold Workshop, run by the Society for Economic Geologists, and this associated field trip run by our own Society. We will travel from the northern Bindura Greenstone belt, through the most prolific Midlands Greenstone belt and to the currently biggest producer in the southern Gwanda Greenstone belt and then we will have a taste of a Junior exploration company in the often little known Filabusi Greenstone belt.

On this trip around Zimbabwe, we hope to showcase some of our biggest producers, both historically in the case of Cam and Motor, and currently in the case of Blanket Mine.
We would like to thank the following Mining Houses: Kuvimba, Dallaglio, RioZim, Caledonia and Kavango, all of whom have kindly given permission to visit their operations, and further availed their staff to show us around these geological wonders. We would again like to thank all those contributors mentioned below who have taken time out to prepare the sections for your reference, and we thank them all for their contributions.

Finally – to the team from the Geological Society of Zimbabwe that has helped me put this together – of course Brian, my co-leader and done much of the compliation of this field guide, Melusi Mlambelo who has dealt with the financials and the coordinator and liaison, Kundai Zvinorova.

*Gayle Hanssen, Field Trip Leader.*

# Field Trip Leaders

**Gayle Hanssen** with over 38 years' experience, in Southern and Central Africa, but with a focus on her home country – Zimbabwe. She has been involved in both the Mining and Exploration sectors. During the last 25 years, she has been as a private consultant, specializing in gold, base metals, and now lithium deposits. Gayle was involved in grass roots exploration in the 1990s, which culminated in the discovery of Maligreen mine under 7m of Kalahari sand.

**Brian Mapingere** is a Structural Geology enthusiast with a MSc in Structural Geology and Tectonics from the University of Johannesburg. Over the past few years, Brian has been involved in lithium exploration as well as hard-rock platinum and nickel mining. Brian is also a part-time lecturer at the University of Zimbabwe, and a Geological Society of Zimbabwe Committee member.

**Shamva –** Kerim Sener graduated in the UK After working in gold exploration and mining in Zimbabwe, particularly at Shamva Mine, he completed a PhD at the University of Western Australia in 2004 on orogenic gold systems in the Northern Territory of Australia. He has since been responsible for the discovery of over 3.8Moz gold in eastern Europe. Kerim is Managing Director of AIM-listed Ariana Resources plc and a Non-Executive Chairman of LSE-listed Panther

Metals Limited. Currently he is focused on the development of the Dokwe Mine in southwestern Zimbabwe.

**Freda Rebecca -** Moregood Dzimba is current the Exploration Manager for Kuvimba Mining House Gold Cluster. He has over 30 years of experience in mining and exploration geology in Zimbabwe, Zambia and DRC on Au, Ni, Cu & Co, emeralds and lithium projects. He previously held senior geological management and consultant positions in Mwana Africa Plc, DRC, ASA Resources Plc, Kuvimba Mining House, Landela Mining and Konkola Copper Mines, Zambia. He holds a BSc General degree in Geology & Geography (1992) and a Diploma in General Management (2018).

**Pickstone Peerless –** Godfrey S. Chagondah has 30 years of exploration and mining geology experience in various commodities gained through working with renowned international companies in Zimbabwe and Zambia. His experience is complemented by an MSc in Exploration Geology (Rhodes University) and PhD in Geology (University of Johannesburg) degrees. Godfrey is also a researcher with interests in Precambrian geology and has published peer reviewed papers in internationally recognized journals. Godfrey is a director of Enesia Resources (Pvt) Limited, a geological consulting practice.

**Cam and Motor –** Trish Nyirenda is a geologist with over 10 years' experience specializing in gold and coal deposits. She holds a BSc degree in Geology and Geography from the University of Zimbabwe and currently pursuing an MBA with Unicaf University. Currently Trish is the Senior Geologist at Cam and Motor Min(RioZim), where she is responsible for overseeing grade control. She has previously worked at Hwange Colliery Company Limited as a Production Geologist. She is an active and dedicated member of the Geological Society of Zimbabwe.

**Blanket Mine –** Dave Dube, is the Mineral Resources Manager at Blanket Mine (Caledonia Mining). With 26 years in the mining industry, he leads the team that reached a record 80,000 ounces of gold production in 2022. A 1994 graduate of the University of Zimbabwe with a BSc in Geology and Chemistry, he started at AAM Mines in 1995, spending time in the platinum sector and internationally, before returning to Zimbabwe's gold sector with time at Renco Mine and Golden Valley before his current role at Blanket Mine.

**Filabusi Exploration –** Dale Blair graduated from Rhodes University in 2017 and started his career in gold and lithium exploration. Following on, he spent time at Old Nic being promoted to Resource Geologist, managing the ore reserve portfolio, including GIS and 3D modelling work. Time was then spent with DGL5 as their Technical Services Manager before taking up a similar role in the exploration company Kavango Resources plc, a junior with the Filabusi exploration projects

# 1 Orogenic Gold Deposits – General Overview

## 1.1 Background and ore-fluid source models

Orogenic gold deposits comprise a group of vertically extensive gold-only deposits, which formed from low-salinity ore fluids that were in broad thermal equilibrium with their host rocks at upper and possibly middle crustal levels (Groves, 1993; Groves et al., 1998; Kolb and Meyer, 2002; Kolb et al., 2005, 2015). They are hosted in ancient (Archaean) cratonic blocks as well as Phanerozoic mobile belts (Fig. 1a). All the orogenic gold deposits show similar characteristics: gold deposition is synchronous with late to post regional metamorphism, deposits are located in accretionary settings (Fig. 1b) and associated with hydrothermal addition of K, S, $CO_2$, $H_2O$, Si, and Au (Goldfarb and Groves, 2015). The gold deposits are typically associated with deformed, metamorphosed, altered mid-crustal host rocks, particularly in spatial association with major crustal structures.

The genesis of orogenic gold deposits was reviewed (Goldfarb and Groves 2015) and they suggested a metamorphic source for the ore fluids Groves and Santosh, 2016; Groves et al. 2020; Fig. 1c). In this model, gold-bearing mineralising fluids are sourced from metamorphism of deep-seated supracrustal rocks. This model is supported by most geological observations as reviewed by Goldfarb and Groves (2015).

Archaean orogenic gold deposits are mostly found in greenstones which embrace metavolcanic and metasedimentary rocks (e.g., in the Zimbabwe Craton; Campbell and Pitfield, 1994) whereas Phanerozoic deposits are largely hosted in metasedimentary rocks in fold and thrust belts (e.g., Cox et al., 1991; Hodgson, 1993). Most orogenic deposits are spatially associated with first-order crustal-scale structures, but mineralisation is normally hosted in higher order structures (Groves et al., 1998).

## 1.2 Orogenic gold and geologic time

A review of gold deposition through time (Goldfarb et al., 2001) shows that the major orogenic gold deposition events are bracketed between the Paleoarchaean and Tertiary. The following four mineralisation events are recognised:

The oldest, Meso- to Neoarchaean , 2.8–2.55 Ga deposits representing the most world class deposits occur in cratonic terranes from which a large part of the global resource is sourced. 2.1 – 1.8 Ga deposits mostly occur in West Africa and lastly fewer deposits cluster between 1.8 and 0.6 Ga.

Orogenic gold deposits account for around 110 Moz (2019 statistics) of global annual gold production with Australia, USA, South Africa and Canada being amongst the top producers, although a substantial amount of this gold may be sourced from Cu-Au porphyry and VMS deposits (Phillips, 2023).

When considering Africa, as illustrated below – gold occurs throughout the continent. However, the majority of the Archaean gold is concentrated on the 3 major cratons of Southern Africa – the Tanzanian, Zimbabwean and the Kaapvaal.

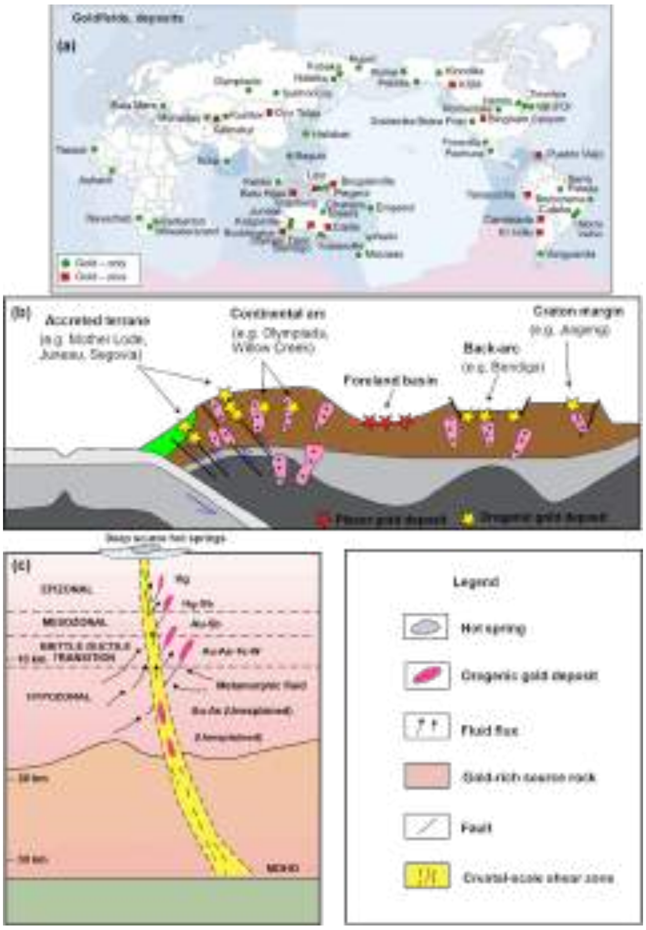



**Figure 1:** *(a) Global distribution of orogenic gold deposits (Phillips, 2023). (b) Cross section showing the distribution of orogenic gold deposits in a convergent plate boundary (modified after Goldfarb and Groves, 2015). (c) Schematic model (Groves et al., 2020) of the supracrustal metamorphic ore-fluid source model for orogenic gold deposits.*

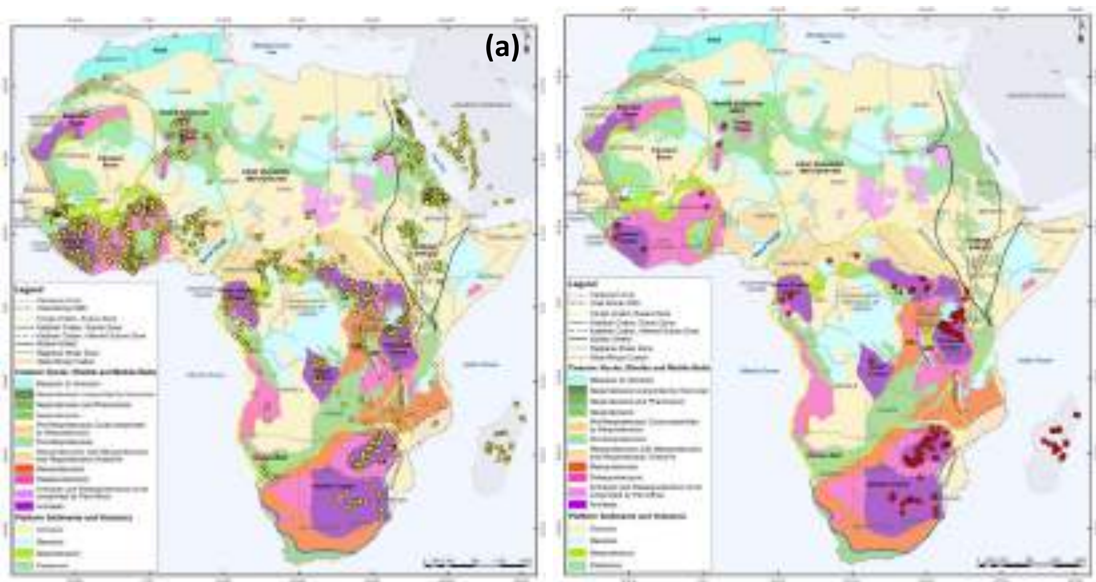



***Figure 2:*** *Map of Africa showing **(a)** all Gold Deposits and **(b)** Archaean Gold Deposits*

*From Mike Robertson SEG Conference 2023, Map Source noted as : Modified from Frost-Killian et al (2016) in Episodes Vol. 39, 35th IGC. Data Source: Modified from International Metallogenic Map of Africa (2002)*

## 1.3 Overview – Zimbabwe geology and orogenic gold deposits

### 1.3.1 Zimbabwe Craton geology

The Zimbabwe Craton (ZC) is bound by 4 orogenic belts: Neoarchaean Limpopo to the south; Neoarchaean and Pan-African Pfunzi and Zambezi to the north, respectively and the Paleoproterozoic Magondi belt to the NW (Fig. 2a). The pre-3.2 Ga gneisses and greenstone remnants of the Sebakwe protocraton (Horstwood et al., 1999) forms the oldest rocks of the craton restricted to the south-central part of the craton, with some exposures in the Midlands greenstone belt (e.g., Harrison, 1970; Robertson, 1976; Fig. 2a). The late Archaean growth of the ZC is characterized by deposition of 2.9-2.8 Ga Lower Bulawayan and 2.7 Ga Upper Bulawayan greenstones, which are unconformably overlain by the 2.65 Ga silisticlastic metasedimentary rocks of the Shamvaian Supergroup (Wilson et al. 1995; Jelsma et al., 2021; Fig. 2b). The 2.7 Ga Upper Bulawayan greenstones are subdivided into the eastern and western successions based on their differences in lithostratigraphy and geochemistry (Wilson, 1979; Fig. 2). Eastern succession consists of largely pillowed and massive tholeiitic basalts and basaltic andesites, whereas the western successions comprises largely calcalkaline intermediate and felsic volcanic and volcanoclastic rocks, less tholeiitic and komatiitic basalts).

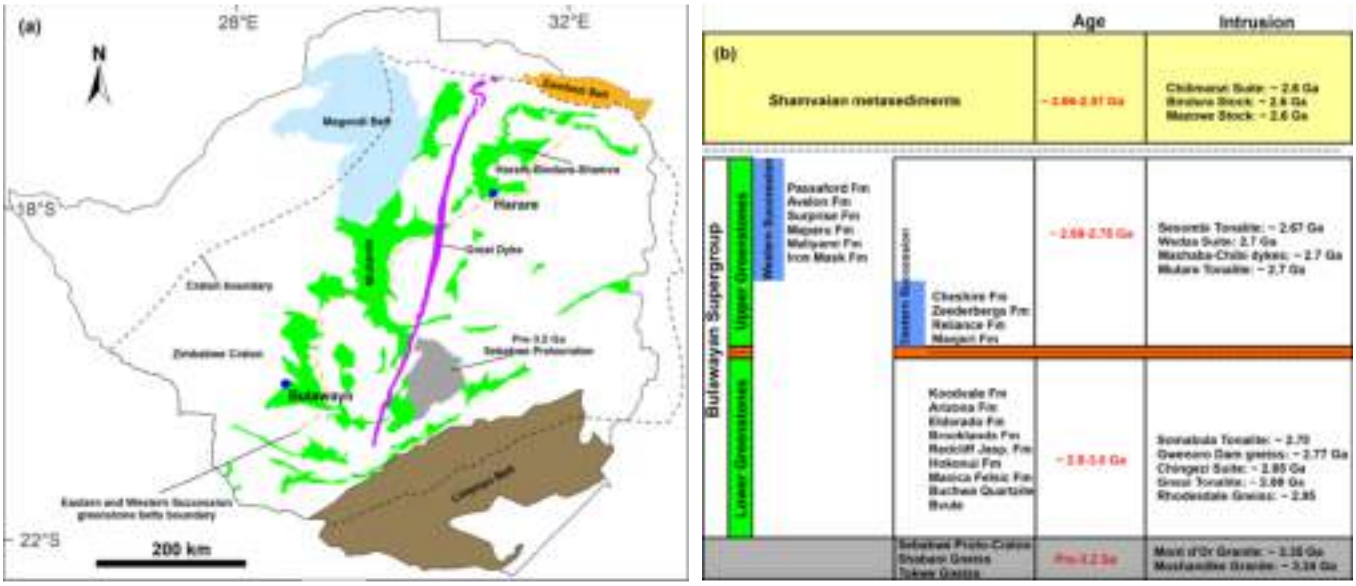



***Figure 3:*** *(a) Simplified map of the ZC modified after Markwitz et al. (2010) and Wilson et al. (1978). (b) Revised stratigraphy of the ZC modified after Jelsma et al. (2021).*

The late Archaean growth stage of the ZC is also characterised by intrusion of tonalitic to granodioritic suites at 2.9 Ga (Chingezi), 2.7 Ga (Sesombi), 2.65 Ga (Wedza) and the wide-spread crust-derived 2.62 Ga Chilimanzi granites which marked the stabilization of the craton (Stagman, 1978; Taylor et al., 1991; Wilson et al., 1978; Wilson et al. 1995; Jelsma et al., 1996; Jelsma et al., 2021; Chagondah et al., 2023). The Sesombi and Wedza suites are regarded as intrusive equivalents of felsic volcanic rocks of the 2.7 Ga Upper Bulawayan, Western Succession greenstone belts (e.g., Hawkesworth et al., 1975; Dougherty-Page, 1994; Wilson et al., 1995). The 2620 Ga Chilimanzi Suite precedes the emplacement of the 2575 Ma Great Dyke (Oberthur et al., 2002).

## 1.3.2 Gold mineralization

Gold is a significant contributor towards Zimbabwe's export earnings, contributing an average of 18%, and approximately 2-3% towards the country's GDP (Barry, 2023). Annual gold production fluctuates around 1 Moz (Chamber of Mines 2022 report), with small-scale miners contributing slightly over 50%. The currently producing major gold mines include Blanket, Freda Rebecca, Eureka, Shamva Gold, How, Pickstone Peerless and Renco.

Orogenic gold in the ZC is largely hosted in greenstone belts and to a less extent granitoids spatially associated with greenstone belts (Campbell and Pitfield, 1994). There are a few occurrences in the Neoarchaean granulites of the Northern Marginal Zone of the Limpopo belt (Renco Mine), Piriwiri Group of the Paleoproterozoic Magondi belt and the Neoproterozoic Umkondo Supergroup. Reported below are only the major deposits, and these are exclusively in the Archaean, with the exception of Renco which is in the Limpopo Mobile belt, which is Neoarchaean, or 2.58 Ga in age.

The most common host rocks include mafic volcanic rocks (Blanket mine), BIFs (Pickstone Peerless mine), clastic metasedimentary rocks (Shamva Gold mine) and other felsic intrusive rocks (Freda Rebecca mine; Groves and Foster, 1991). Most gold deposits show a structural control consistent with formation during deformation. Mineralisation occurs as sulphide-hosted gold in shear zones and shear zone-hosted quartz veins (Campbell and Pitfield, 1994). In addition, gold mineralisation is controlled by folds where mineralisation is observed mostly in the hinge zones as saddle reefs, extensional veins, and sheared limbs.

A review of the timing of gold deposits in the ZC reveals the following three major gold deposition events:

1. A 2.68-2.61 Ga gold-forming event, which was coeval with the age of peak metamorphism recorded in most greenstone belts forming structurally and lithologically controlled deposits throughout the craton.
2. A 2.58 Ga event temporally related to thrusting of the NMZ into the southern margin of the ZC. Gold deposits of this age are located in the NMZ (Renco; Blenkinsop et al. 2004) and southern part of the ZC e.g., the Gwanda greenstone belt where structures related to NMZ thrusting are most pervasive (Campbell and Pitfield, 1994).
3. Lastly, a 2.0 Ga event related to the reactivation of Neoarchaean shears is another possible gold forming event although evidence is still scarce. Examples include shear zone-hosted deposits in the Midlands greenstone belt (Herrington, 1995).

The map below shows the million ounce deposits well distributed throughout the greenstone belts, although interestingly most occurring in the belts west of the Great Dyke. Buried deposits are now being discovered under the tertiary Kalahari Sands, but all pretty close to the margins, and therefore under shallower cover. Although gold is found in the Proterozoic

Belts, nothing close to the million ounce mark has been defined. It can be observed that many of the major deposits are within 5km of the granite – greenstone contacts. The is also a dominance of the major deposits to the west of the Great Dyke (GD). East of the GD only the Bindura greenstone belt is well endowed with larger known deposits.

Some of the gold mines only report productions figures of a few kilograms, with the highest producer Cam and Motor, having produced over 4 Moz, and has been mined to a vertical depth of 1.8 km.

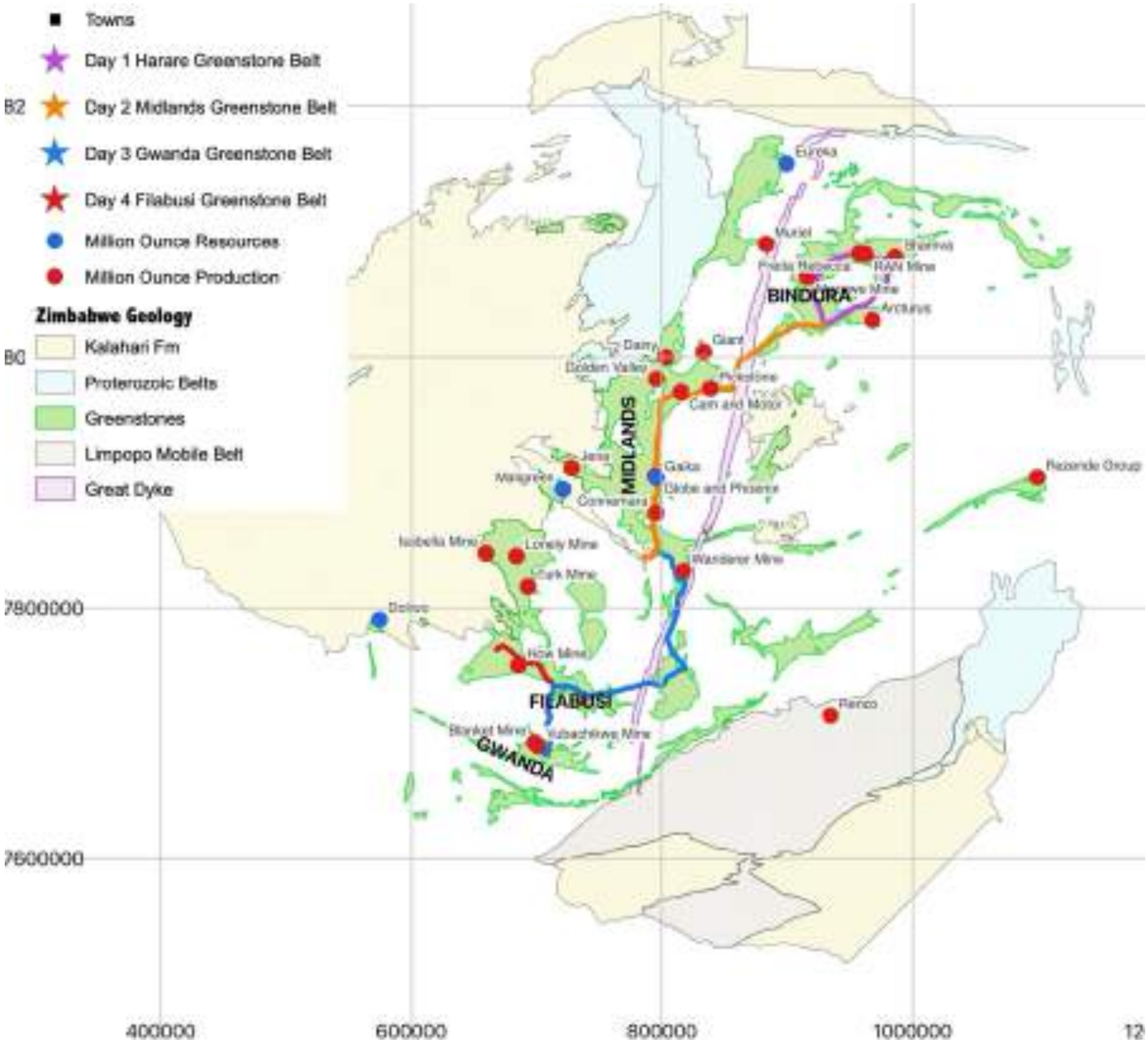



***Figure 4:*** *Million Ounce Deposits in Zimbabwe in relation to the Field Trip*

Blanket Mine, on the field trip has a produced 2 Moz, and has a resource of 1 Moz. Dokwe and Maligreen are unmined resources with current interest.

However, it should be noted that in the last 25 years there has been limited exploration activities and should these be scaled up, particularly in light of the current gold price this map could well show some adjustments.  Zimbabwe has certainly produced more gold than what is currently sitting in publicly declared resources.

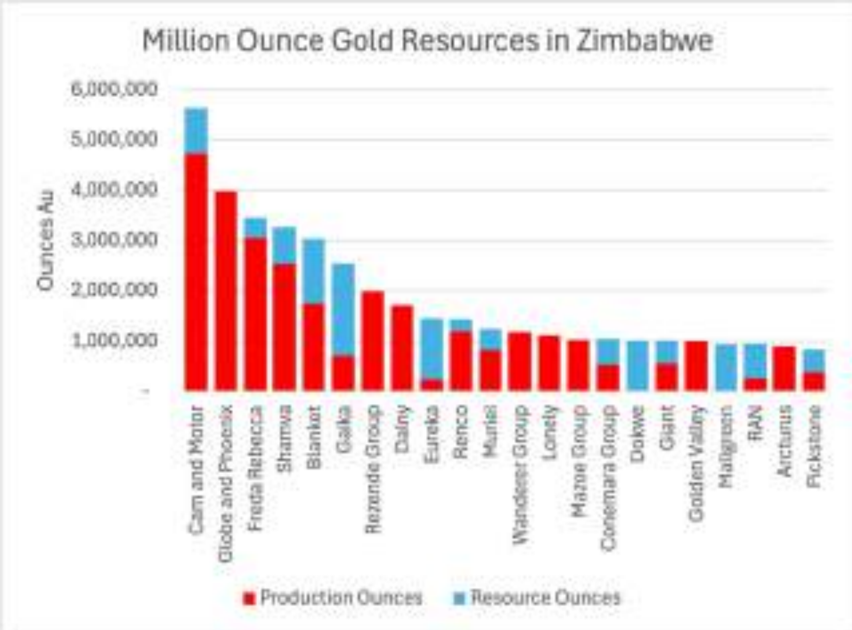



***Figure 5 :*** *Gold Deposits One Million Ounces and Above – Split by Production and Resources*

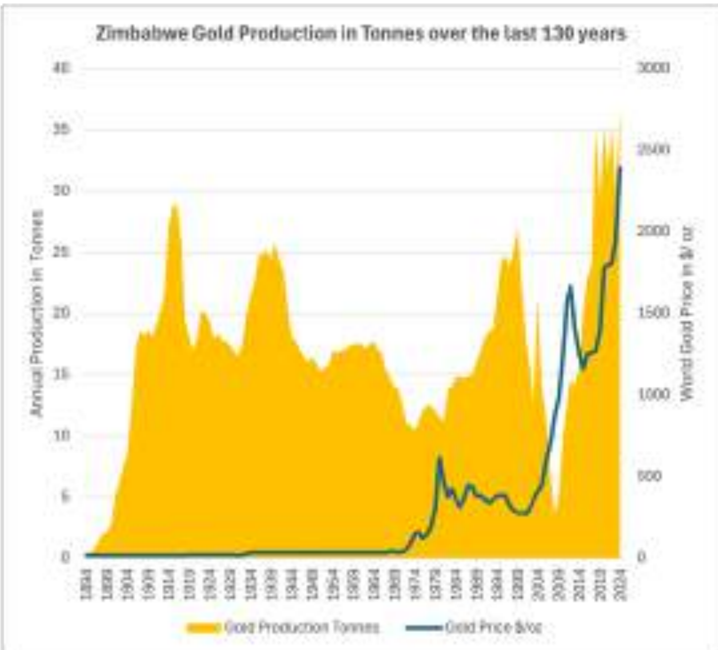



***Figure 6 :*** *Zimbabwe Gold production over the last 125 years.*

# 2 DAY 1 – HARARE GREENSTONE BELT

*Contributions from Kerim Sener and Moregood Dzimba*

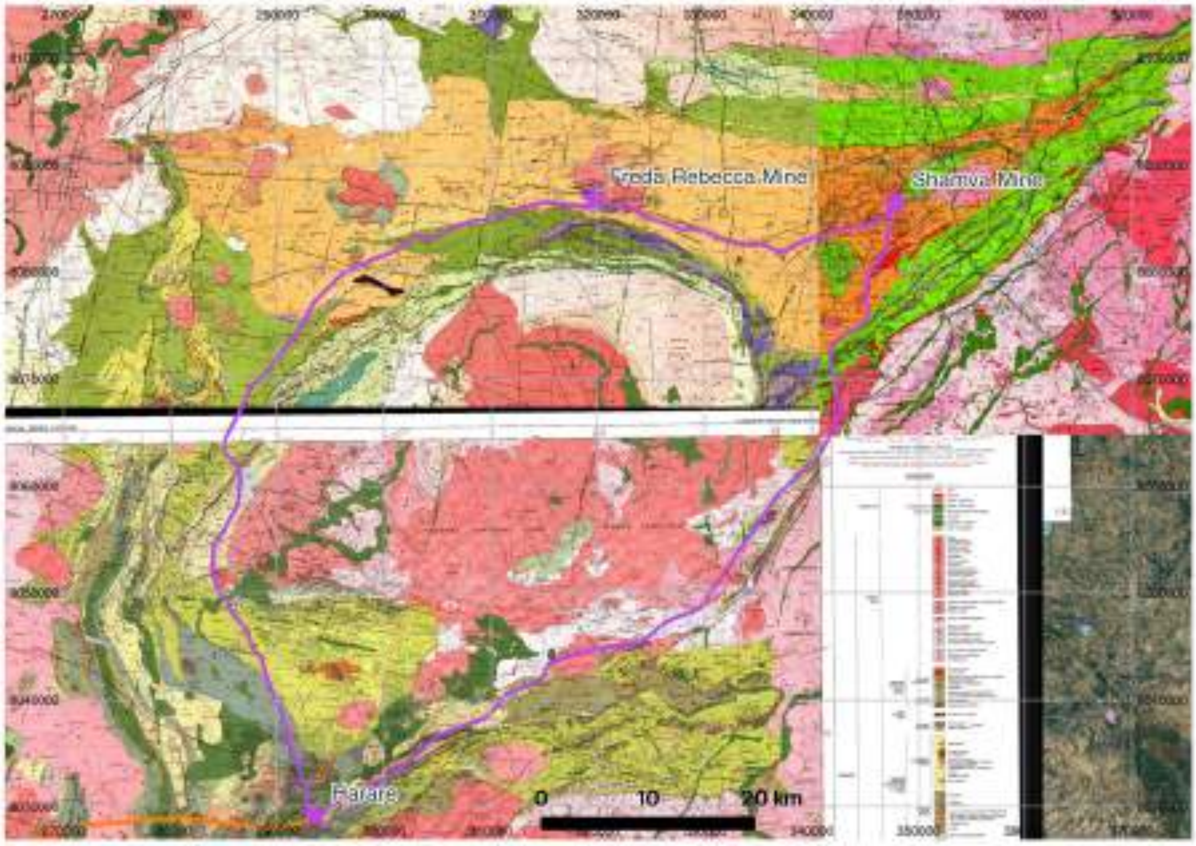



***Figure 7:*** *DAY 1 – Harare- Shamva Mine – Freda Rebecca Mine Route (1:100,000 Geo Maps).*

## 2.1 Overview of the Geology of the Bindura Greenstone Belt

Unlike other greenstone belts in Zimbabwe that are generally attenuated, the Harare-Bindura Shamva (HBS) belt is in the form a 'C' shape, believed to have been caused by the diapiric intrusion of the Chinamhora batholith at the centre of the greenstone belt. (Figure 7). The supracrustal units include quartz-rich volcanoclastic units, tuffs, agglomerates, and felsic and mafic volcanic rocks which have undergone predominantly greenschist facies metamorphism.

Structurally, the Shamva area of the Terrane features ENE-trending shear zones associated with significant gold mineralisation. These shear zones exhibit evidence of brittle and ductile deformation, with fractures and folding contributing to the structural complexity. Intrusions of quartz-feldspar porphyries are observed, along with later dolerite dykes.

In terms of economic geology, the greenstone belt hosts several mineral deposits including some of the largest gold deposits of the country, pegmatite mineral deposits, and nickel. The gold mineralisation in the region is linked to silicified zones, which contain quartz-carbonate-pyrite veins and disseminated pyrite in the main. These mineralised zones are hosted within the volcanic and volcanoclastic units and highlight the significance of structural controls and hydrothermal processes in the formation of the deposits. However, the second visit of the day is to Freda Rebecca Mine, which is associated with the sheared contact of the greenstones with an internal granodiorite.

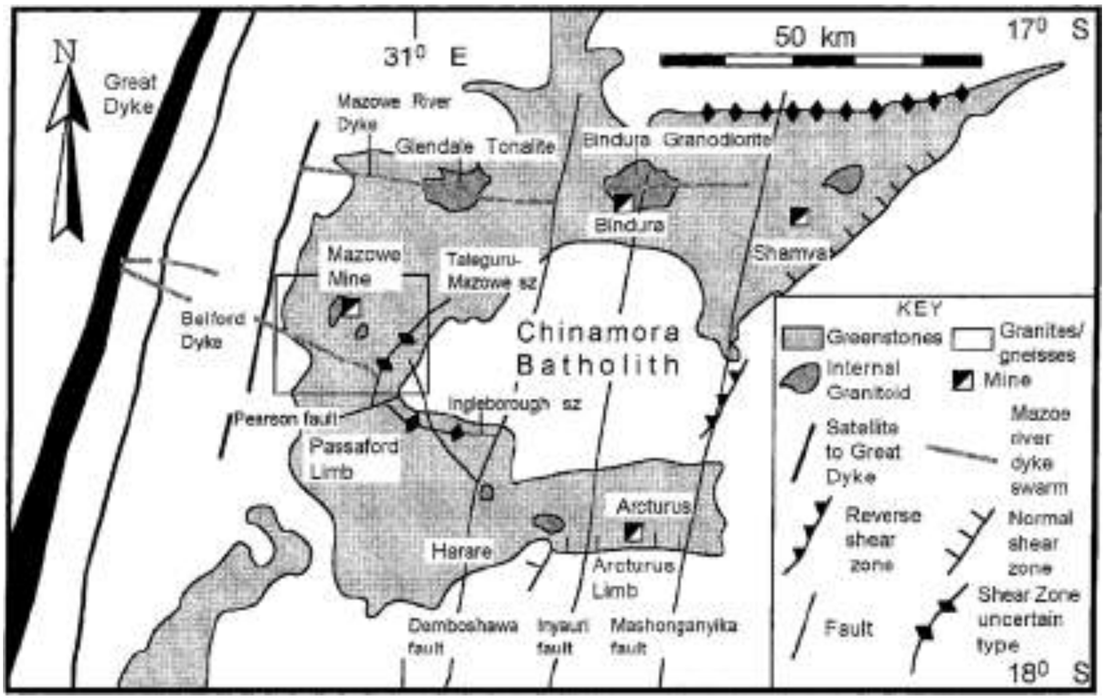



***Figure 8:*** *Outline map of the Harare-Bindura-Shamva Greenstone Belt (Blenkinsop et al., 2000).*

## 2.2 Shamva Mine

### 2.2.1 Overview of Shamva Mine Geology

The >2.5Moz Shamva gold deposit (lat. 17° 19’ 10”S, long. 31° 34’ 09”E; elevation 1,220m) is operated by Kuvimba Mining House; owned by the Zimbabwe Government Mutapa Sovereign Wealth Fund since 2024. As the third most significant historical gold producer in Zimbabwe, operating near continuously for well over a century producing c.2.6Moz of gold from 19.4Mt @ 4.2 g/t Au. Approximately 40.8Mt @ 1.96g/t Au (2.6Moz) remains, suggesting that Shamva may be one of the largest gold resources in Zimbabwe.

Shamva mine is hosted by a unique sequence of Lower Shamvaian Group (c.2.67 Ga) sedimentary rocks metamorphosed to upper greenschist facies (Figure 7). Ubiquitously pyritiferous and silicified clastic and volcanoclastic debrites and epiclastic conglomerates occur within a tightly folded <2 km wide stratigraphic unit which extends ENE-WSW over a strike length of 5.5km. The location of the deposit is marked by a pronounced change in topography, with most of the major ore zones developed along the crest of Shamva Hill.

Virtually all the host rocks within the Shamva mine area are enriched in gold to some degree. The mine host rocks are enriched by a factor of 43 relative to the average for Shamvaian metasediments and these are enriched by at least a further 44 times within the ore zones

The intrusion of several syndepositional andesitic-dacitic feldspar porphyries (2,672±12 Ma) in to an unconsolidated volcanosedimentary sequence and coincident generation of a sub-aqueous exhalative system may have caused an anomalous trace element geochemistry within the host rocks. Synsedimentary hydrothermal enrichment of the Shamvaian sedimentary rocks in Cu, Pb, Zn, Mo (±Au?) was a likely prelude to the evolution of this deposit.

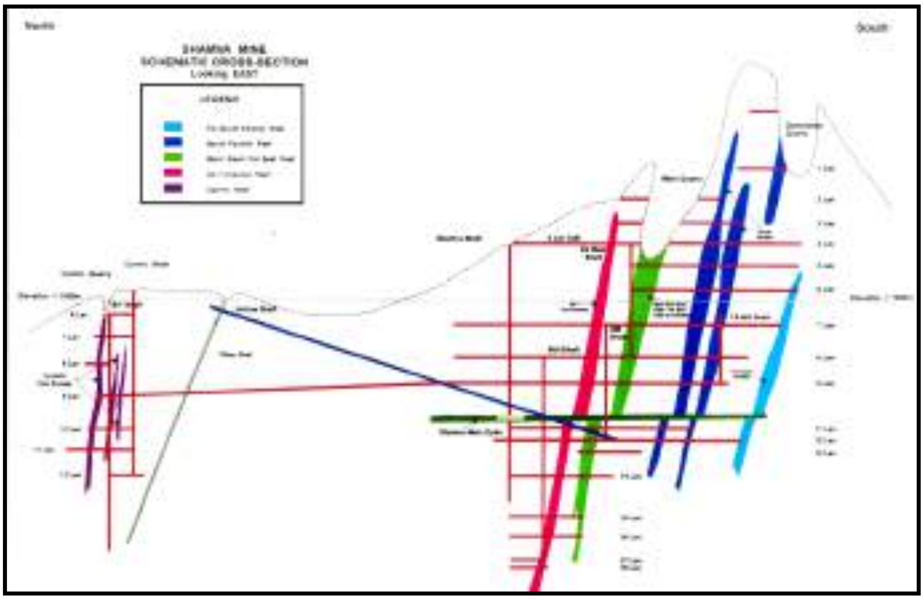


***Figure 9:*** *Schematic cross-section through the Shamva Mine showing the underground workings as at early 2000, showing the distribution of major ore zones along strike and the major areas of stoping.*

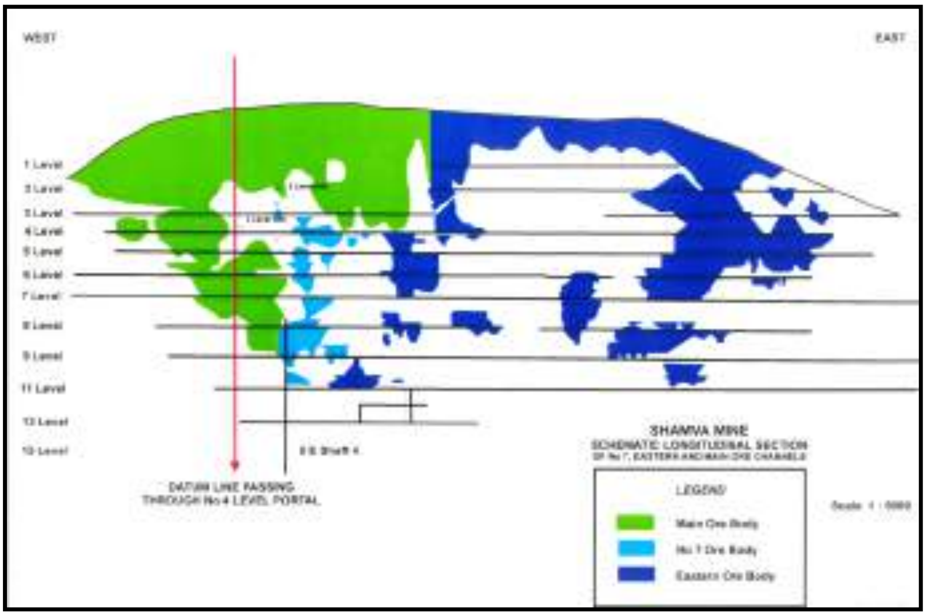



***Figure 10:*** *Long-section through the Shamva Mine showing the underground workings as at early 2000, showing the distribution of major ore zones along strike and the stoped-out areas.*

The structural framework of the deposit is defined by an ENE-WSW trending brittle-ductile transpressional duplex system (Figure 11). This system is c.250-300m wide by c.2.5km long, tapering at both eastern and western ends, forming an attenuated *en échelon* array of dominantly ENE to E trending shears that are, in places, dissected/wrenched apart in a sinistral sense by essentially synchronous but sequentially later NE-trending shears. Large orebodies occur at the intersections of the ENE- and major NE-trending shear zones, and primarily plunge (N)NW at about 75 degrees, but also plunge steeply to the (S)SE in places. Zetamoidal ore zones, developed along attenuated link shears within the thrust-duplex system are characteristic and form sigmoidal structures in cross-section (Table 1).

***Table 1:*** *Characteristics of dominant ore zone types at the Shamva, identifying specific examples where particularly clear.*

| Ore Zone Type | Characteristics | Examples | Frequency |
|---|---|---|---|
| **I-Type** | Inteference ore zones developed at the intersections of ENE and NE trending shears | 9E9, 11E9, 11E5, 13E5, 13E9, 13E6, 13E4 | Common |
| **Z-Type** | Ore zones developed along the attenuated zetamoidal link shears within the ENE duplex | Eastern ore bodies | Common |
| **L-Type** | Linear ore zones developed along the principle NE trending shears | No. 7 trend (e.g. 7E2, 8E5, 11E6) | Common |
| **V-Type** | V-shaped ore zones developed at the intersections of link and drive shears within the ENE duplex | 7E30, 8E30, 8E33, 5E52 | Rare |
| **F-Type** | Fold controlled ore zones | 2E43, 3E43 and parts of the South Parallel | Rare |

Gold mineralisation at Shamva is closely associated with hydrothermal alteration. Key alteration processes include carbonitisation, potassium metasomatism and sulphidation. Sulphide minerals such as pyrite, pyrrhotite and arsenopyrite are dominant, with additional minor occurrences of chalcopyrite and sphalerite. The late-stage pyrite-arsenopyrite assemblage hosts the majority of the gold, which was deposited under conditions of 250–450°C and pressures of 1–3 kbar; studies of the fluid chemistry have indicated that the vein types contained aqueous mixed $H_2O$-$CO_2$ (±$CH_4$) and $CO_2$ (±$CH_4$) rich inclusions (Jelsma *et al.*, 1998).

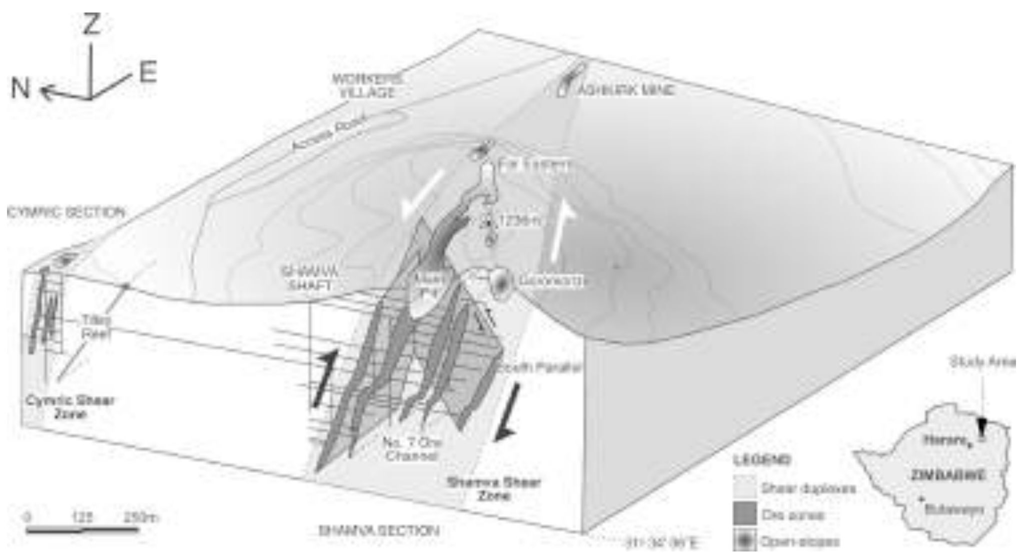



***Figure 11:*** *Interpretative cross section showing the mine deposit and Shamva Shear Zone.*

### 2.2.2 Mineralisation styles

The sub-vertical ore bodies are indistinguishable from the host rocks. Ore-bodies are delineated largely based on soft boundaries i.e., drill assay information. Sulphide mineralisation within the ore bodies consists predominantly of pyrite (> 90%) with minor sphalerite, galena, chalcopyrite, pyrrhotite and arsenopyrite. Gold is found in contact with the sulphides, often in fractures, and varies significantly in grain size with visible gold commonly intersected in development and underground drilling. The widest stopes are 50m.

### 2.2.3 Stop 1: Underground visit

Underground visit (level to be decided) exposes the above-described different mineralisation styles, the associated sulphide minerals as well as appreciating grade control practices.

### 2.2.4 Stop 2: Drill core

A visit to the core yard to look at exploration drill core to understand the host rocks, mineralization styles and alteration. The picture below shows some of the drill core with various geological structures.


***Photo 1:*** *Photo showing metasediments with carbonate filled veinlets, porphyritic texture and coarse-grained pyrite from Surface Exploration Drilling core.*

## 2.3 Freda Rebecca Mine

### 2.3.1 Local geology

Freda Rebecca gold mine (FRGM) was a fairly recent Zimbabwean discovery in the 1980s, and has subsequently held its position as the largest gold producer in Zimbabwe almost continuously for the last 30 years. It is located in the south-western margin of the dioritic-granodioritic Bindura pluton, which intruded the 2.65 Ga Shamvaian metasedimentary rocks of the belt (Campbell and Pitfield, 1994; Fig. 12).

The Bindura pluton comprises two discrete intrusions (Vinyu, 1994): (1) the relatively older Rebecca diorite exposed on the south-western part and (2) the more extensive younger Bindura granodiorite. Near the Freda Rebecca mine, the Bindura pluton shows evidence of extensive potassium-metasomatism and hydrothermal alteration. Both the 2.65 Ga Shamvaian metasedimentary rocks and ca. 2.6 Ga Bindura pluton (Jelsma et al., 1996) are crosscut by the Mashonaland dolerite dikes. The locality coincides with the central part of the broadly ENE-trending synclinal axis, the major structure of the central part of the HBS.

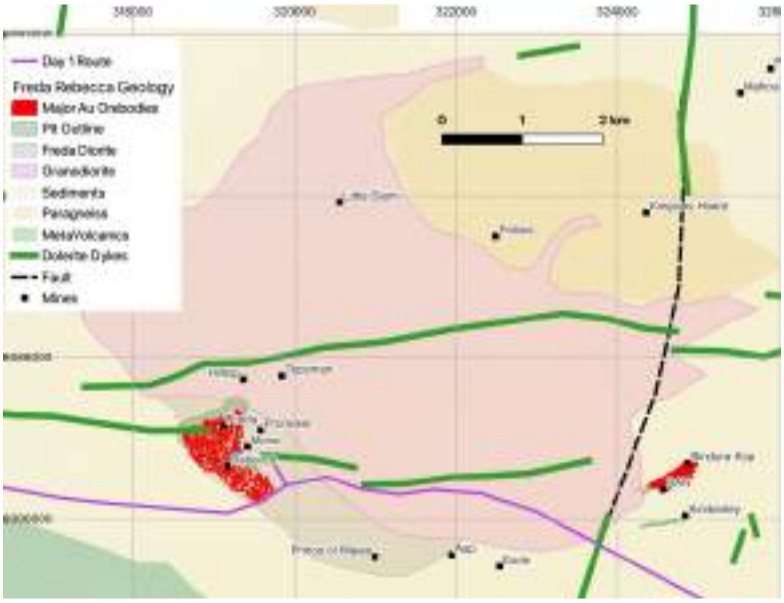



***Figure 12:*** *Geological map around Freda Rebecca and RAN Gold Mines*

### 2.3.2 Lithologies

The three main lithologies within the Freda Rebecca Mine environs are the Shamvaian metasediments, the metadiorite, (locally referred to as the diorite), and the Bindura granodiorite.

The metasediments are volcanoclastic siliceous rocks which are preserved as arkoses and greywackes. They are dark brown to dark greyish rocks with primary sedimentary structure preserved e.g. graded bedding and cross-bedding. Compositionally the metasediments are highly siliceous with more than 90% silica composition.

The metadiorite is reported as having a compositional range between a diorite and that of a monzodiorite. Where altered, it has a high chlorite content which gives the rock a distinctive green colour. When sheared, the rock displays a marked increase in biotite content and it develops a penetrative fabric within the shear zone, giving the rock a gneissic appearance. The diorite occurs as a kidney/lobate shaped body on the South Western flank of the Bindura granodiorite stock. It is locally termed the Prince of Wales Diorite. The metadiorite hosts the bulk of the mineralisation associated with the mining operations at Freda Rebecca Mine. To the South East of Freda Rebecca, the diorite also hosts the old Phoenix Prince Mine.

The Bindura granodiorite is a leucocratic and porphyritic rock with large prismatic plagioclase phenocrysts. The rock is associated with numerous mesocratic hornblende-biotite rich xenoliths. Where the granodiorite is sheared, there is a marked increase in biotite content. The under formed equivalent of the rock has hornblende and biotite occurring in equal amounts with the former occasionally predominant. The granodiorite was intruded in phases as evidenced by compositionally zoned feldspar phenocrysts.

### 2.3.3 Structure, gold mineralization and alteration

Gold mineralization at Freda Rebecca mine is hosted in two major shear zones (Campbell and Pitfield, 1994; Klemm and Kräutner, 2000): (1) moderately SW-dipping (30-40°) Rebecca, with a dextral normal sense of shear and (2) the shallowly S-dipping Freda shear zones, which has a sinistral reverse sense of shear. The two shear zones are characterized by variable widths and merge at depth (elevation ca. 300 m) to the SW and flatten at a depth of ca. 850 m and continue into the Shamvaian metasedimentary rocks (Figs. 13 and 14).

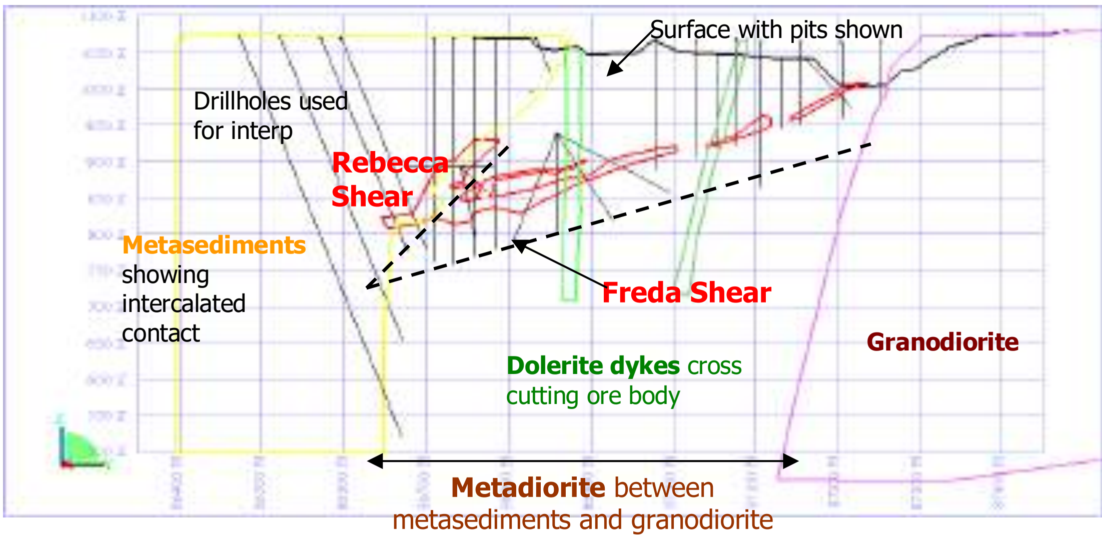



***Figure 13:*** *Schematic section showing the Freda and Rebecca shear*

Individual shear zones are made up of anastomosing subshears, ranging between 0.2 to 10m and enclose lithons of undeformed granodiorite. Gold occurs in the altered zones enclosed in the shear zones with gold content of around 1-15 g/t although lower contents of 0.1-1.5 g/t are more extensive in the altered rock units (Klemm and Kräutner, 2000). Gold content is normally proportional to the extent of alteration in the shear zones with extensively altered parts of the shear zones have relatively higher gold content. These mineralised shears only extend to a maximum of 25m into the Shamvaian metaediments.

The commonly observed alteration types include chloritization, carbonatization, silicification and sulphide mineralization. Sulphide minerals in the altered zones are generally macroscopic and include arsenopyrite, pyrite, chalcopyrite and pyrrhotite (Klemm and Kräutner, 2000).

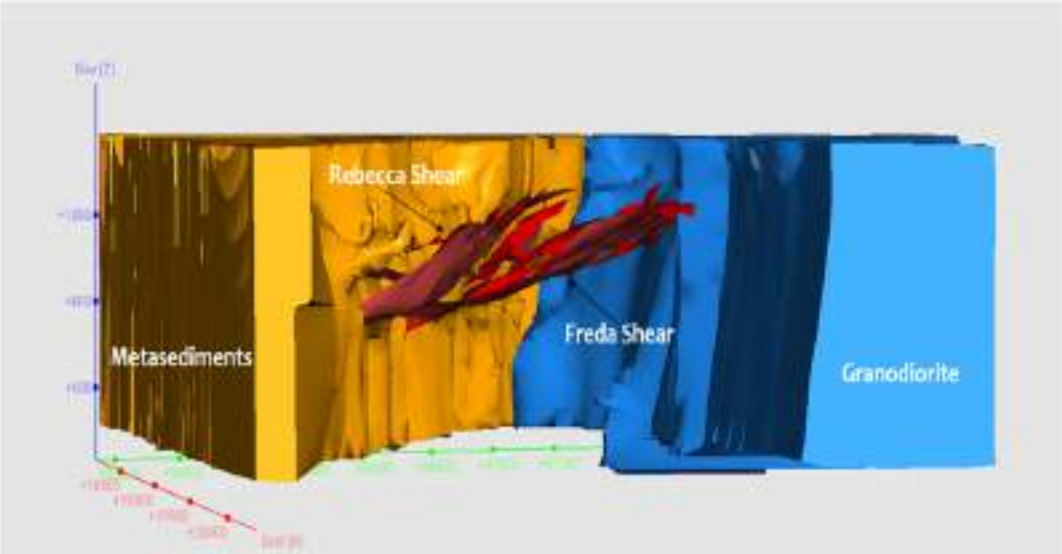



***Figure 14:*** *3D view of Local Geology extracted from leapfrog.*

### 2.3.4 Stop 1: Open pit

The Open pit operations at FRGM are occurring in the upper levels of the Freda and Rebecca shear zones. Mineralisation is structurally controlled, with the gold being associated with shear and fault zones . The structures include mineralised faults, joint sets and quartz veins whose average thickness is ranges from 1 cm to 2 m. The structures tend to crosscut defined open pit benches in various directions with some falling into the waste benches. The structures are particularly common on the upper levels of the open pit coupled with weathered and oxidised host rock before the main orebody is intercepted. The cut-off grade for the pit is 0.7 g/t.

**Figure 15:** Area of Pit to be visited at Freda Rebecca Gold Mine

# 3 DAY 2 – MIDLANDS GREENSTONE BELT

*Contributions from Godfrey S Chagondah and Trish Nyrenda*


***Figure 16:*** *DAY 2 – Midlands Greenstone Belt – Pickstone and Cam and Motor Mines (1:100,000 Geo Maps).*

## 3.1 Regional Geology

The Midlands Greenstone Belt (MGB) is traditionally the largest in size and has produced the 2 largest gold producers in Zimbabwe's history – Globe and Phoenix and Cam and Motor. It comprises a volcano-sedimentary pile of ca. 2.70 Ga Upper Bulawayan Supergroup capped by ca. 2.65 Ga Shamvaian Supergroup (Wilson et al., 1995; Hofmann et al., 2004). The greenstone sequence overlies a basement of ca. 3.5 Ga Rhodesdale gneisses. The greenstone experienced regional deformation and low-grade metamorphism. Deformation is indicated by development of anticlinal and synclinal structures, N- to NNE-trending crustal scale-scale shear zones and their associated splays (Fig. 17).

MGB is characterized by first-order linear-curve linear zones of crustal- to lithospheric-scale faults and shear zones that generally lack economic gold deposits (e.g., Herrington, 1995), a phenomenon echoed in global studies (e.g., Goldfarb et al., 2005; Groves et al., 2018). Second-order interconnecting faults and shear zones may have been important conduits or pathways for hydrothermal fluids and metals (e.g., Dalny, Brompton Mines). Thus, gold deposits in the MGB are orogenic (e.g., Goldfarb et al., 2005; Groves et al., 2018) and are structurally controlled (Campbell and Pitfield, 1994; Herrington, 1995; Nutt et al., 1998). Gold mineralization is epigenetic and is associated with altered rock domains and is focused on shear zones and dilatant structures.

Jogs coincide with large-scale anticlinal structures (e.g., Kadoma anticline: Venice mine), a major association with orogenic gold deposits (e.g., Groves et al., 2018). Fe-rich metavolcanic rocks and ironstones provided favourable chemical traps for gold mineralization across the MGB (e.g., Nutt et al., 1998). Carbonatization prior and during hydrothermal activity gives host rocks a light-grey colour, which is associated with gold mineralization in places.

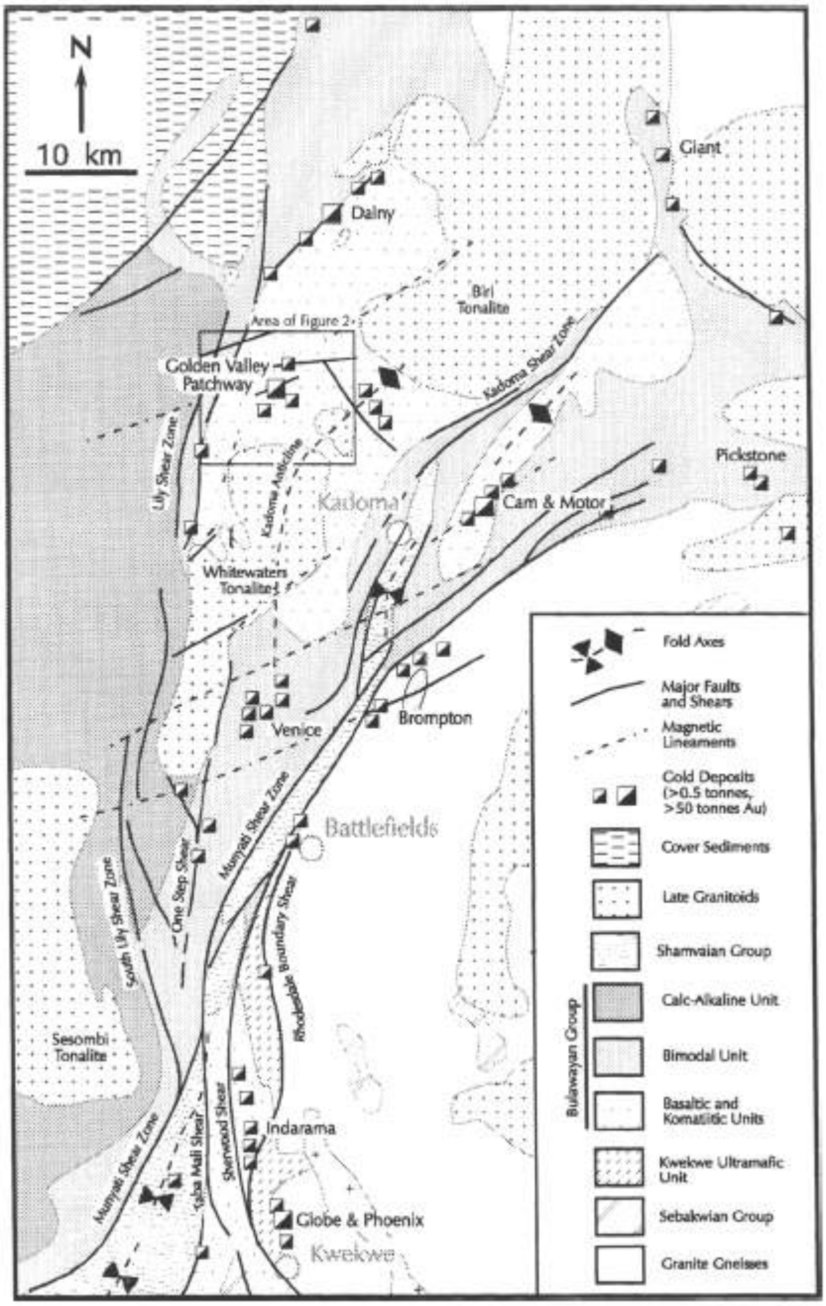



***Figure 17:*** *Geological map and distribution of gold deposits in the Midlands Greenstone Belt, Zimbabwe (Herrington, 1995).*

## 3.2 Pickstone Mine

### 3.2.1 Geology of the Pickstone Mine and Environs

The simplified geology of the Pickstone Peerless Mine comprises a volcano-sedimentary pile of basaltic, ironstone and carbonate rocks underlying ancient basement gneisses (Fig. 18). The volcano-sedimentary pile was deposited in an Archaean Sea in cycles of volcanic activity (basalts) and periods of volcanic quiescency associated with chemical sedimentation of BIF and carbonate rocks. The presence of early life is indicated by deposition of graphitic shale due to microbial activities (e.g., Agangi et al., 2024). The greenstone experienced effects of regional deformation (e.g., folding, shearing and fracturing) and low-grade metamorphism indicated by chlorite-biotite-hornblende mineral assemblages in meta-volcanic host rocks. Elevated and economic gold mineralization is focused on Fe-rich, high strain dilatant and altered domains within the host rocks. Mineralization occurs as parallel reefs of similar strike but variable width.

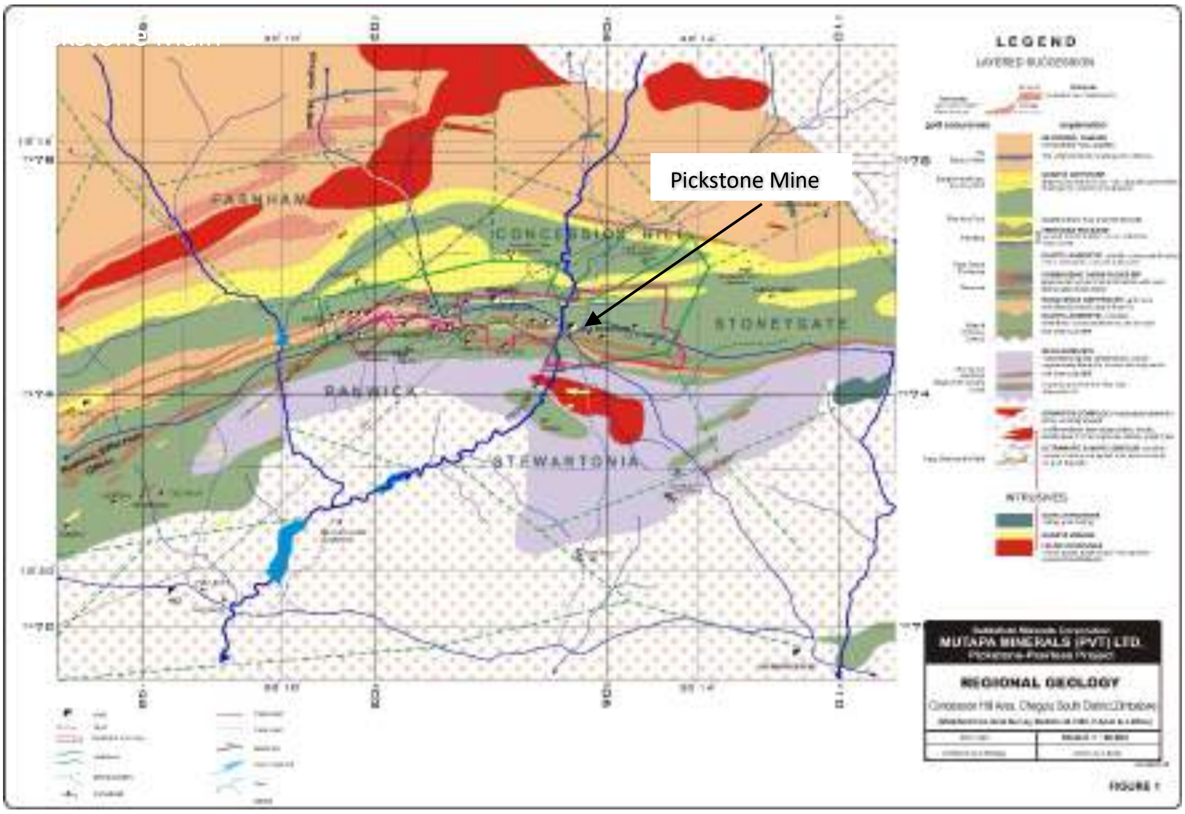



***Figure 18:*** *Local geology in the environs of Pickstone Peerless Mine, Midlands Greenstone Belt (modified after Amm and Wiles, 1952).*

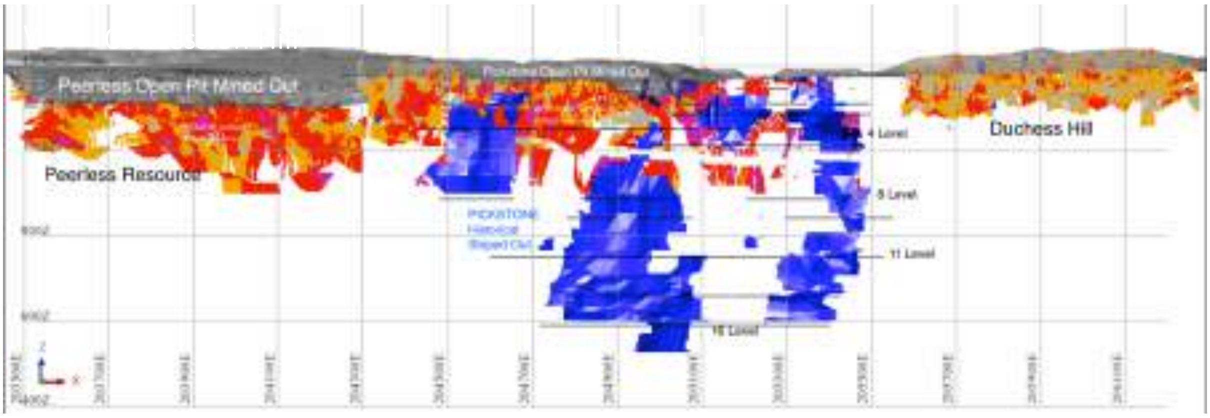



***Figure 19:*** *Longitudinal projection looking north showing distribution of Pickstone Peerless Mine sections*

## 3.2.2 Distribution of ore bodies

Gold mineralization occurs within BIF and jaspilite ironstone, dolomite, chlorite schist and graphitic shale rock types.

BIF and jaspilite ironstone is the main host rock at Duchess, Pickstone Main and Concession orebodies (Figure 20), where elevated gold values are associated with fractured, carbonated, and silicified jaspilite + magnetite ironstone domains.

Peerless is solely hosted in dolomite.

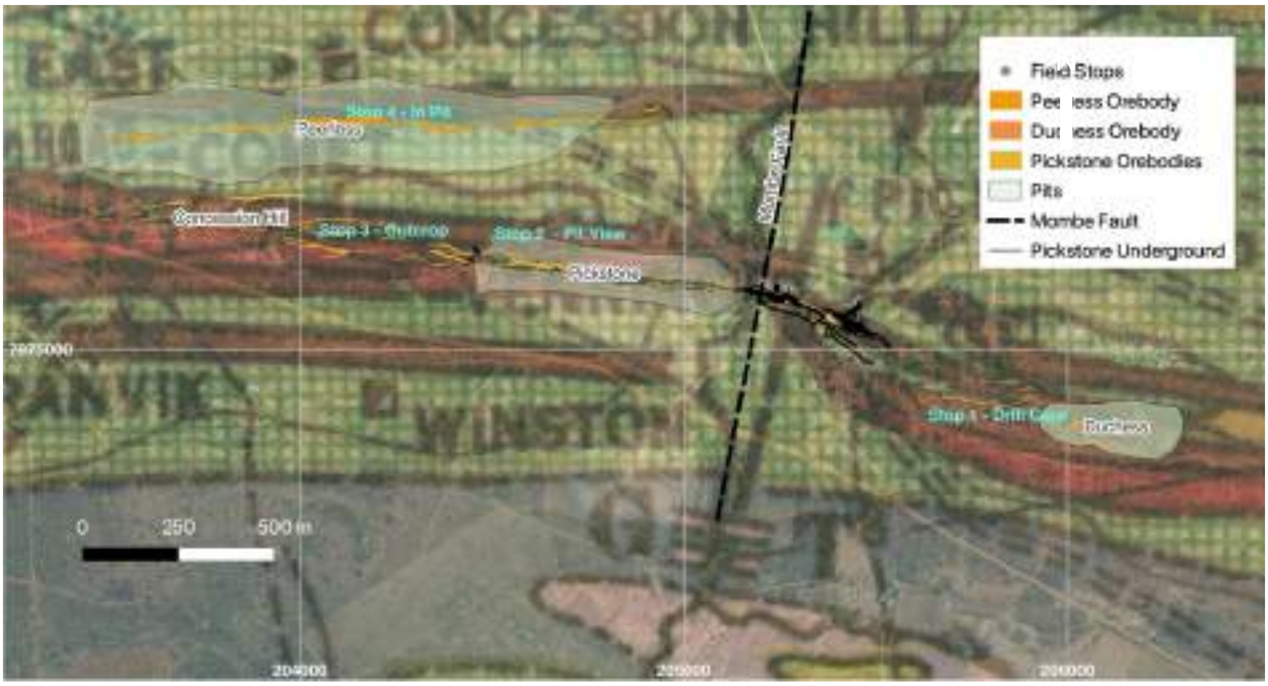



***Figure 20:*** *Plan view showing distribution of Pickstone Peerless Mine ore bodies.*

Sheared zones within the metabasalt (chlorite schist) host narrow (typically < 0.5 m) to stringer sized quartz-carbonate veinlets. Mineralization occurs between Peerless and Pickstone Main trends.

Across all sections of Pickstone Peerless Mine, mineralization manifests as discontinuous, *en-echelon* lenticular bodies, which swell and pinch on strike and depth.

### 3.2.3 Stop 1: Duchess Hill – drill core

The Duchess Hill orebody occurs in the eastern-most part of the Pickstone structural trend. Typical hostrocks, deformation structures and mineralisation styles observed in the Duchess Hill orebody are shown in Photo 1 below.

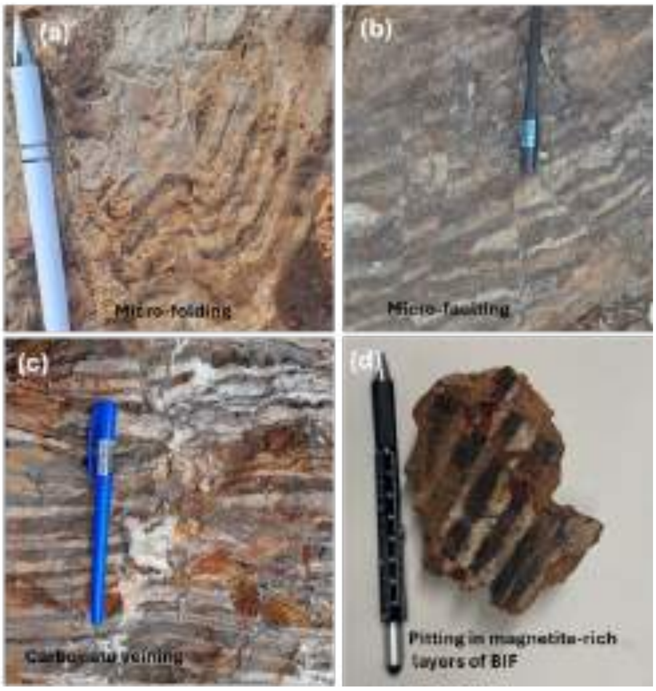



***Photo 2:*** *BIF – Typical Duchess Hill Orebody Exposures*

Gold is hosted in ca. 40 m thick oxide facies BIF, steeply N-dipping at (85°) enclosed by strongly chlorite schist. Deformation is mostly brittle indicated by fracturing, micro-folding and brecciation. Alteration types include silicification, carbonation and sulphidization (Photo 2c and 3). Gold is hosted in carbonated, magnetite + jaspilite ironstone (Photo 2c, d). Sulphide minerals include pyrite and rare arsenopyrite and chalcopyrite. Mineralisation styles include disseminated, vein, and massive bodies associated with discordant quartz-carbonate veins fracture fill (Photo 2c) and sulphide replacement in Fe-rich (magnetite + jaspilite) domains (Photo 2d).

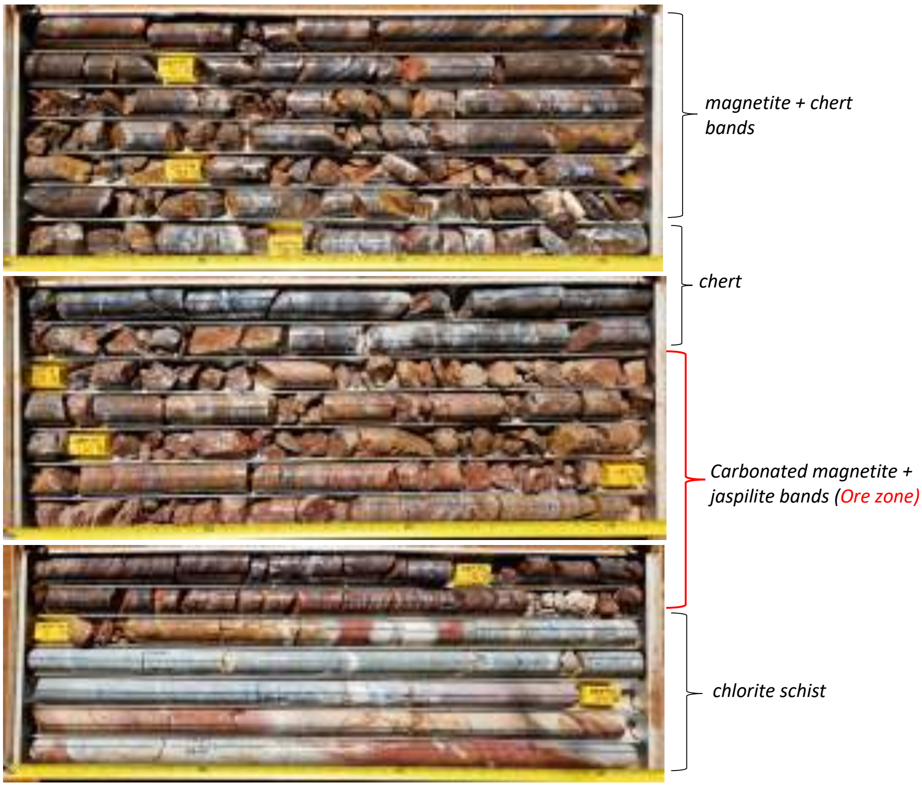



***Photo 3:*** *Duchess Hill core (PKUG_DCHS_05) showing different rock types. Ore zone is associated with fractured and carbonated magnetite-jaspilite ironstone.*

### 3.2.4 Stop 2: Pickstone Main

- View open pit and western most exposure of Pickstone Main near Concession shaft.

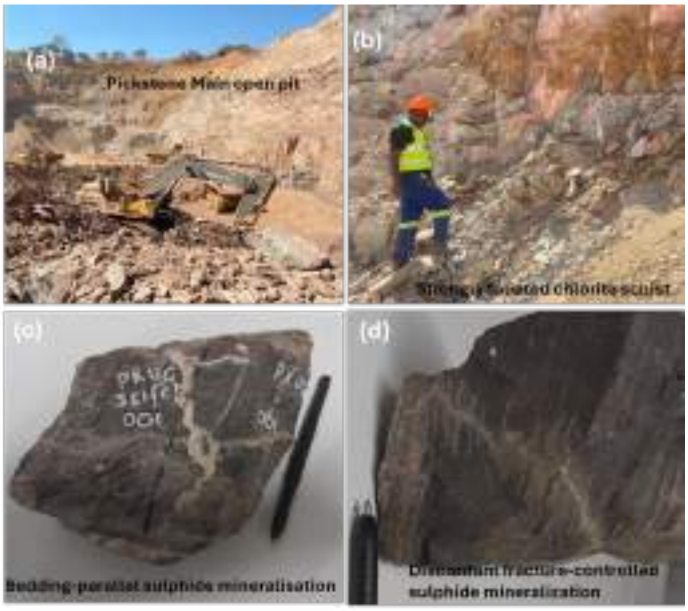



***Photo 4:*** *Pickstone Main Orebody Exposures*

### 3.2.5 Stop 3: Concession Hill

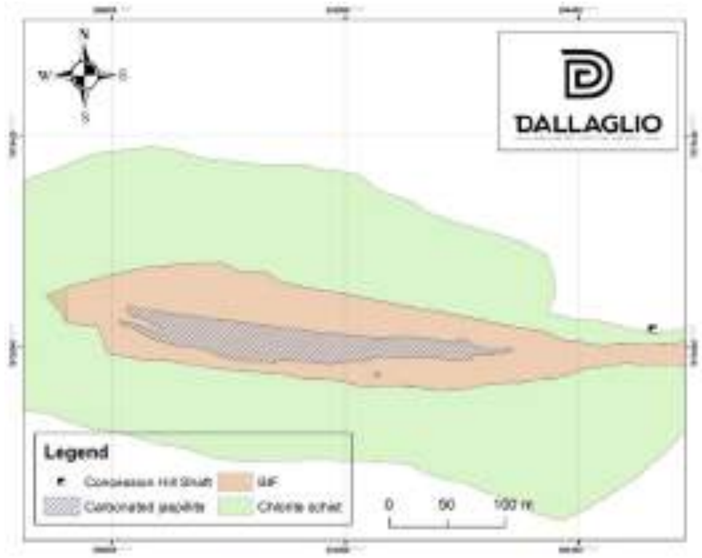



***Figure 21:*** *Simplified geology map of the Concession Hill prospect showing different ironstone rock types and enclosing chlorite schist.*

The Concession Hill orebody is the western-most part of the Pickstone structural trend. It is hosted in a ca. 40 m thick oxide facies BIF, steeply dipping @ 85° N sandwiched by strongly foliated chlorite schist. In turn BIF hosts jaspilite ironstone (Fig. 21). Deformation is mostly brittle indicated by fracturing, micro-folding and brecciation (Photos 5 & 6). Silicification, carbonation and sulphidization are the commonly observed alteration types (Photos 5b & 6). Gold mineralisation is associated with (1) strongly carbonated jaspilite (Photo 5b) and (2) carbonated chlorite schist. Mineralization manifests as discontinuous, en-echelon lenticular bodies, which pinch on strike and depth. Sulphide minerals are mainly pyrite and minor arsenopyrite, chalcopyrite impregnations. Mineralization styles include disseminated, vein, and massive bodies, associated with discordant quartz-carbonate veins fracture fill (Photo 5a) and sulphide replacement in Fe-rich (jaspilite & magnetite) domains.

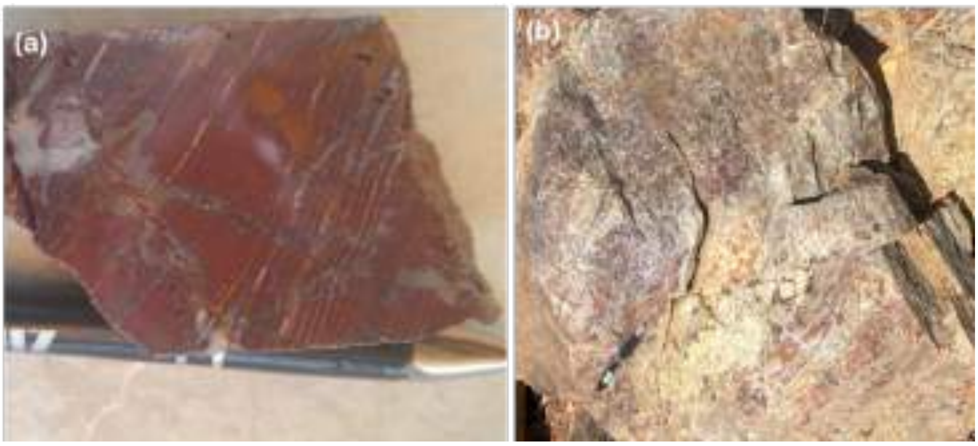



***Photo 5:*** *Core slab showing fractures truncating primary bedding and lamination in jaspilite, and (b) outcrop photography displaying bleached cream-grey, brecciated and strongly carbonated jaspilite at Concession Hill.*


***Photo 6:*** *Concession Hill core (CNS_S_17) showing different intensities of hydrothermal (carbonate and minor silicification) alteration within jaspilite and chlorite schist. Alteration in chlorite schist is sympathetic to foliation.*

### 3.2.6 Stop 4: Peerless

The Peerless orebody is hosted in dolomite or silicious magnesian limestone. Graphitic (black) shale occurs on the hanging of dolomite. The dominant sulphide mineralization is arsenopyrite.

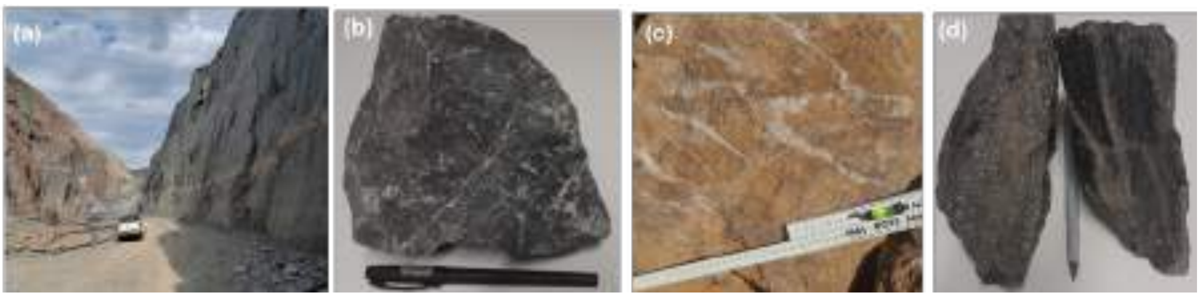


***Photo 7:*** *Peerless (a) Open pit looking West, (b and c) network of quartz-carbonate vein(lets) within carbonate host rock, and (d) mineralized and poorly unmineralized graphitic slate which occur on the hanging wall of Peerless ore body.*

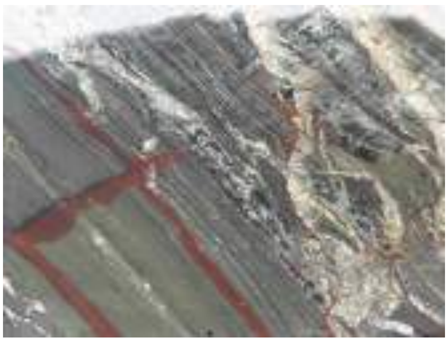


***Photo 8:*** *Cut Core through Mineralised Dolomitic Siltstone Peerless Deposit*

## 3.3 Cam and Motor Mine

### 3.3.1 Introduction

RioZim Limited owns the Cam and Motor Mine, approximately 25km west of the Pickstone Mine on the same greenstone belt. This is the largest historical gold producer in Zimbabwe, with 4.7Moz of gold produced over a 100 years period. Underground mining reached a depth of 1800m and at time a lower cut of 8 g/t was applied.

Presently, RioZim Limited operates an open pit mining on top of the historical workings with payable grades. Resource drilling has defined a mineable orebody to 200m depth on the two major reefs: Cam and Motor lodes. The downstream processing, floatation, biox, carbon in leach and elution have been established and in production. With the existing facility the maximum production is approximately 120 kg of gold per month with siignificant antimony as by product.

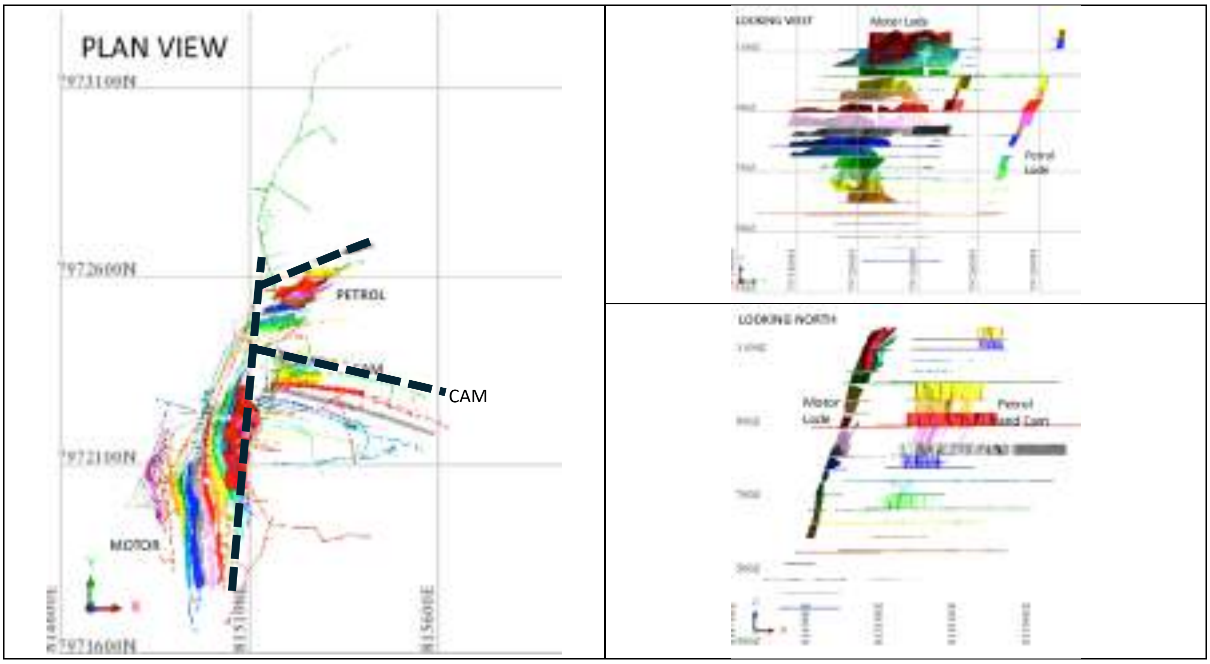



***Figure 22:*** *Various views of top 900m of Cam and Motor development*

**It should be noted that this data is digitised from old level plans, and is incomplete. Final depth of mine would be elevation -700m. Stope information is also considered incomplete, as it is believed to be stoped out. The underground workings are now flooded.*

### 3.3.2 Local Geology

The Cam and Motor project is in the Midlands Greenstone Belt, roughly 25km west of Pickstone Mine. Both are situated in the north of the almost 200km long greenstone belt, with Cam being situated where the greenstones swing from a NS orientation to a NE-SW strike.

The deposit shows typical characteristics of a mesothermal, dominantly metavolcanic and metasediment-hosted gold deposit formed under low-temperature greenschist-facies. The alteration assemblages ae dominated by carbonate and sericite. Gold mineralisation is associated with sulphides, including high concentrations of arsenopyrite with pyrite albeit, not pyrrhotite. Gold is locked in the arsenopyrite causing the ore to be refractory in nature. Molybdenite is also a commonly occurring sulphide phase.

A couple of the host rocks appeared to be more amphibolitic and porphyritic in their textural appearance. All of these may have been volcanic or could even have been sill-like intrusive, and a few rocks are more diorites/dacitic in compositions. No obvious quartz-bearing acid volcanics were observed in the project area except in places they occur as narrow intrusive phases cutting across the sedimentary and mafic volcanic successions.

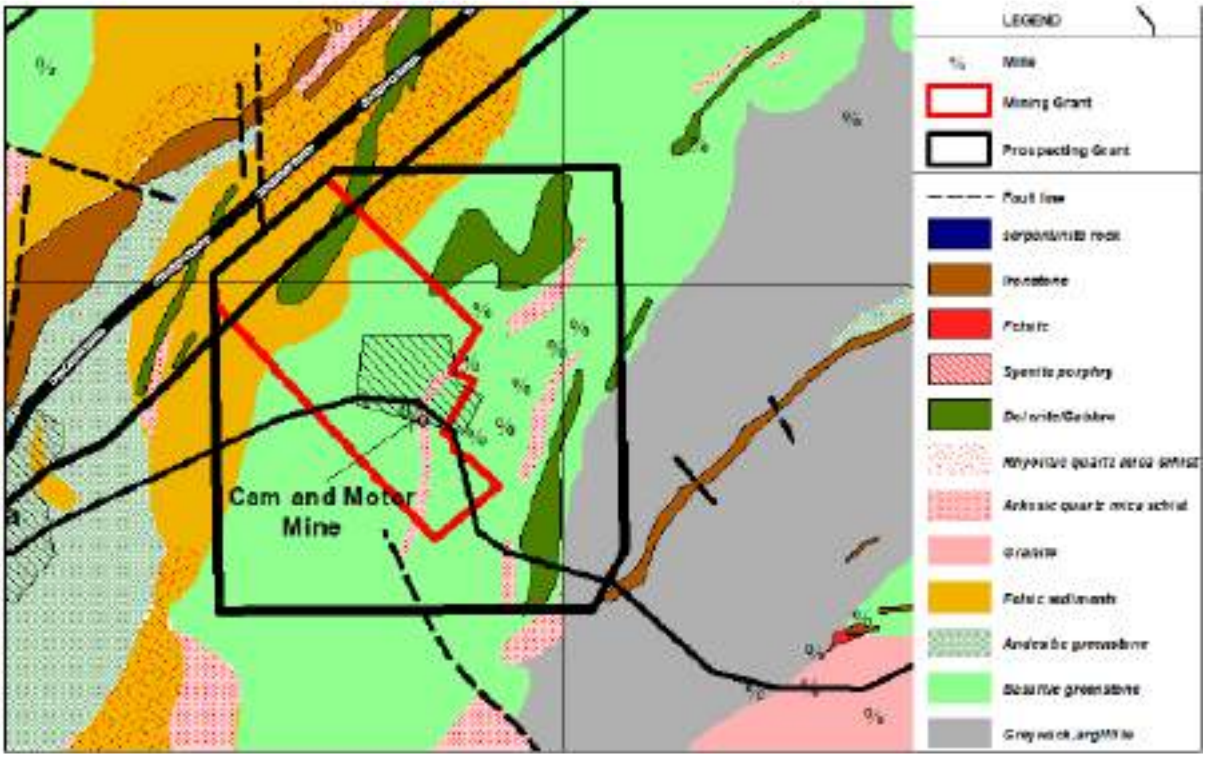



***Figure 23:*** *Local geology map of the area around Cam and Motor Mine.*

## 3.3.3 Structural Geology

The main structure associated with gold mineralisation is the evolution of the Kadoma/Eiffel flats fold system, with shears and faults. The term Eiffel flats anticline or fold in this report has been referred to Kadoma anticline or fold pair where it passes through the Eiffel flats. It therefore means that the Eiffel flats fold is part of the Kadoma fold which has been noted to have pairs of anticline-syncline on both opposing limbs.

The contact between the sediments and greenstones is host to the Cam and Motor shear zone. It is suggested that the fracture pattern in the vicinity of Cam and Motor Mine is due to the intersection of the drag fold and first deformation structure with the fold resulting from the third deformation. The Motor group of fractures were possibly initiated as shears during the first deformation and these fractures were refolded along with the drag fold by the third deformation. Such re-folding would initiate stress in the vicinity of the culmination of the drag fold.

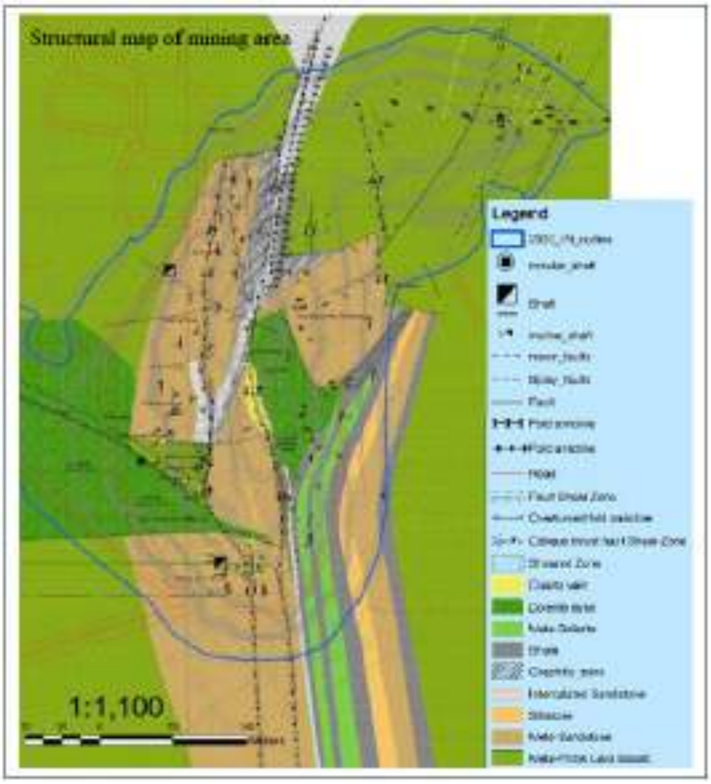



***Figure 24:*** *Structural map of the area around Cam and Motor Mine.*

## 3.3.4 Stop 1: Cam and Motor pit viewpoint

***Photo 9:*** *Cam and Motor pit viewpoint, (view from NW of Motor reef – indicated with red star).*

#### 3.3.4.1 Orebody/Reefs

The Motor orebody strikes north-south dipping steeply (70°) to the west, with a total length of 440 m and a width of 12-18 m. The Cam Orebody strikes east-west strike dipping steeply ( 70°) towards south with a total length is 200 m. Mining in both orebodies is currently at a depth of 80-85 m from the surface. The Motor pit is characterized by black shales on the southern and northern tip of the orebody, sandstone intercalations with shales, basaltic rocks. Dolerite dykes cut across in the southern and central part of the Motor pit, depicting possible sinistral displacement. The ore bodies are oxidized near the surface, then enter a mixed sulphide/oxide (transitional) zone before they get into the sulphide zone. Mapping revealed the east-west gold bearing structures across the Motor pit while the Cam pit is characterized by NS structure known as the JN structure. It was reported that where the lodes diverge and coalescence, it was usually marked by low strain domain zone (not sheared) and a relatively un-mineralized rock. Mineralization along the orebody is confined to the andesitic lavas and greywacke, pillow lava and other sediments (shales and arkose). The Cam fracture lies entirely in the greenstones and at depth it encroaches into the Motor sediments and later entirely into sediments at 40$^{th}$ level.

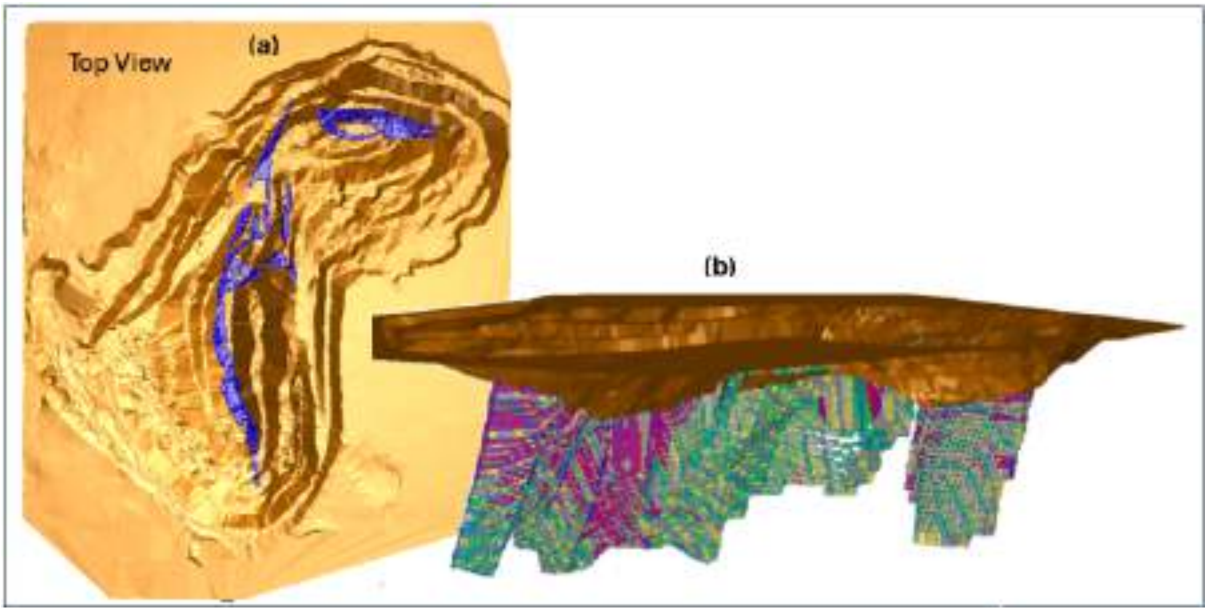



***Figure 25:*** *Cam and Motor orebody view from top(a) and view from the East(b).*

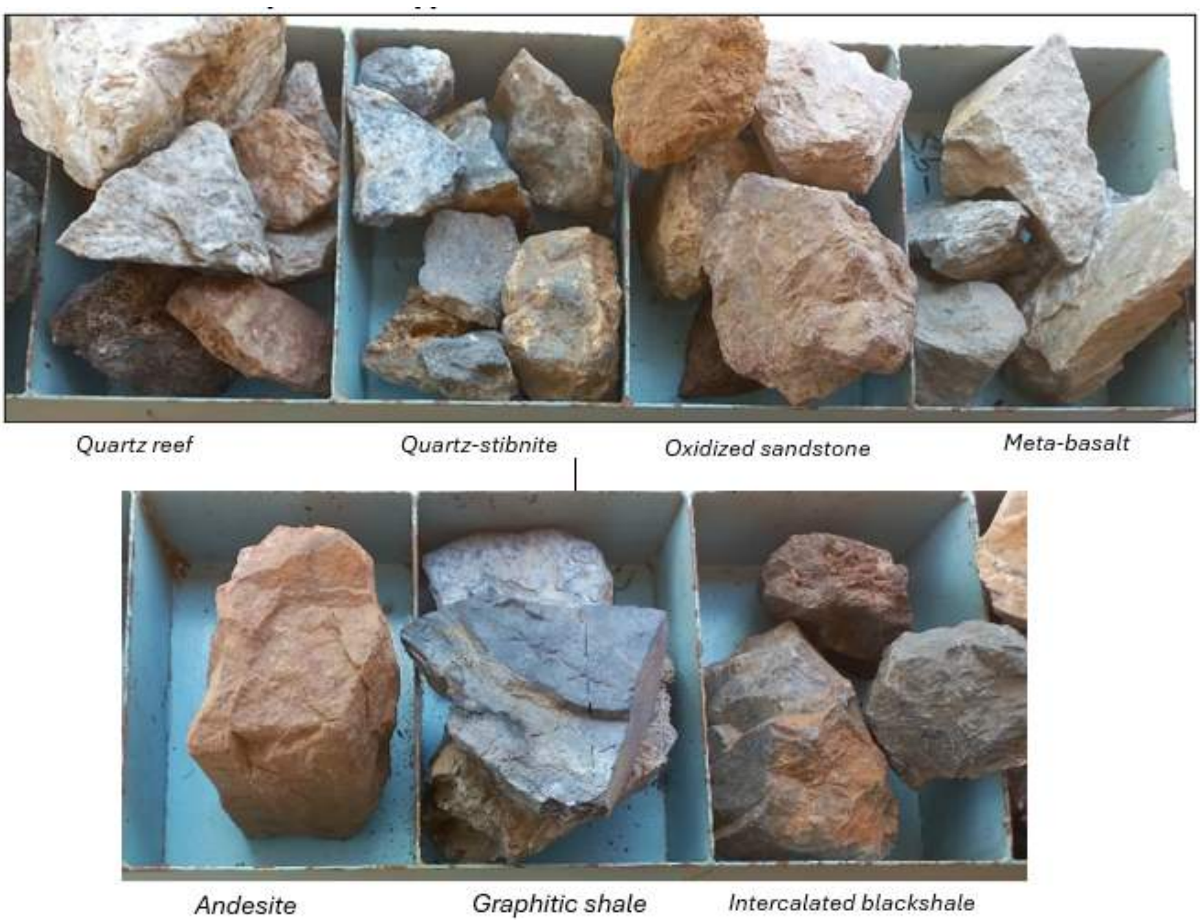



***Photo 10:*** *Typical Cam and Motor lithologies.*

### 3.3.5 Stop 2: B2 Stockpile (CamOre)

**Host rocks:** Predominantly metabasalt veined with quartz, dipping @70 degrees towards the South. A couple of rocks appear to be more amphibolitic and porphyritic in their textural appearance.

**Deformation:** Shear deformation indicated by sigma structures, and elongated quartz ribbons/bands, (Figure 3b). Primary structures-faults, fractures also common.

**Alteration:** Sericitisation, carbonisation and silicification are seen to be of mainly veining type. Chlorite is present associated with replaced mafic minerals.

**Gold mineralization:** These include the alteration assemblage (carbonate-sericite), the presence of high concentrations of arsenopyrite and pyrite without pyrrhotite which is typical of low-temperature greenschist-facies-type mineralization.

**Sulphide minerals:** mainly pyrite, arsenopyrite and minor amounts of stibnite.

**Mineralization styles:** disseminated, vein, and massive bodies, lenses of laminated quartz

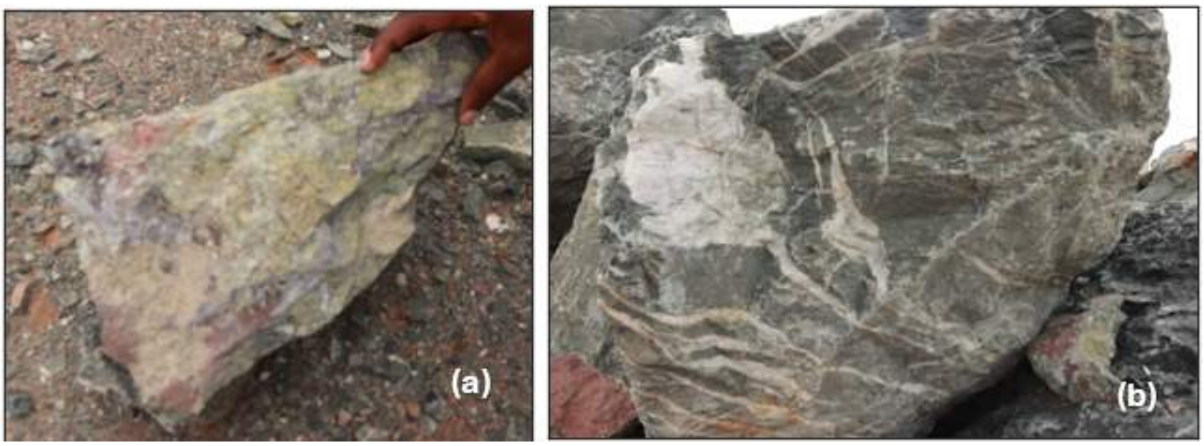



***Photo 11:*** *(a) Metabasalt showing sericitisation and quartz veining, (b) displaying ductile regime deformation structures on the ore from Cam Pit.*

### 3.3.6 Stop 3: Motor pit

**Host rocks:** Metasediments (black shales, sandstones, greywackes, arkoses) and metavolcanics.

**Deformation:** Brittle structures indicated by faults, fractures, and brecciation.

**Alteration:** Silicification, carbonisation, sericitisation.

**Gold mineralization:** Associated with metasediments and metavolcanics, quartz veins
**Sulphide minerals:** Mainly pyrite, arsenopyrite, stibnite and minor chalcopyrite.
**Mineralization styles:** Disseminated, vein, and massive bodies.
Interesting mineralization and primary structures can be seen on some of the drillholes cores on site.

# 4 DAY 3 – GWANDA GREENSTONE BELT

*Contributions from Dave Dube*

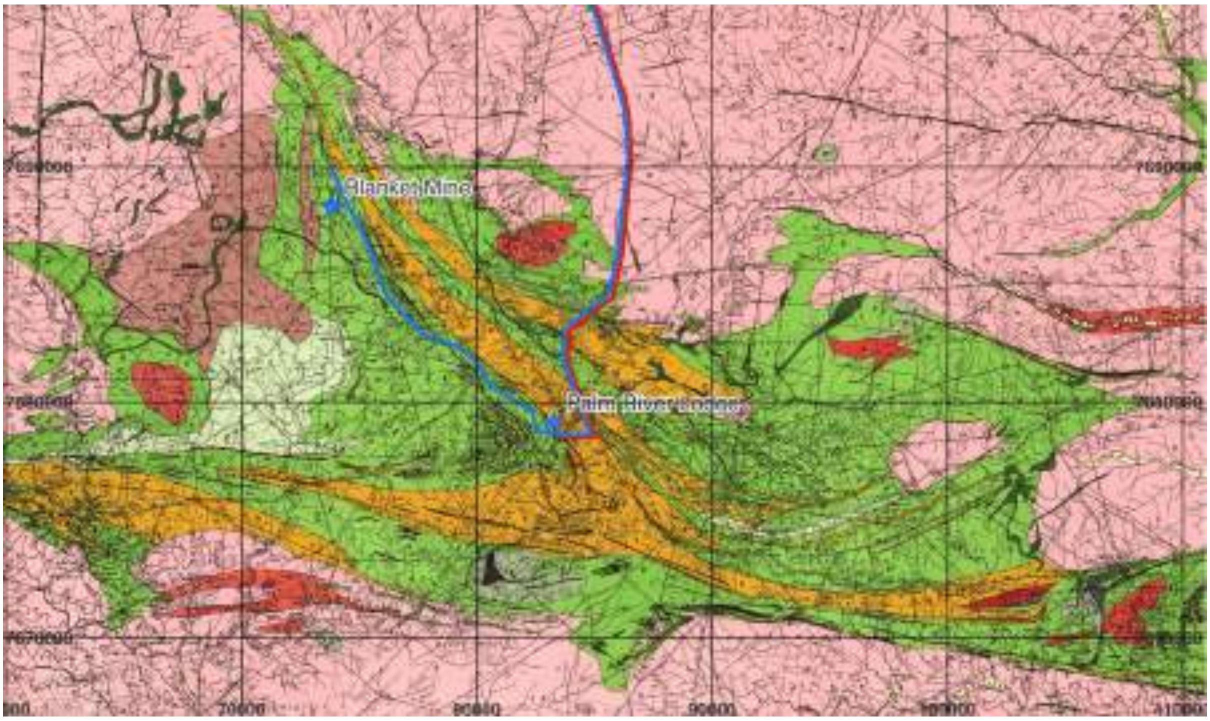



***Figure 26:*** *DAY 3 – Gwanda Greenstone Belt – Blanket Mine (1:100,000 Geo Maps)*

## 4.1 Geology of the Gwanda Greenstone Belt

The Gwanda Greenstone Belt is highly prospective in terms of gold mineralisation potential. It is ranked second in Zimbabwe after the Midlands Greenstone Belt. It had a recorded gold production history of more than 114 tonnes by end of 1991. Its considerable economic importance not only stems from the fact that this belt produces more that 10% of Zimbabwe annual output, but also unusually high gold output per unit area (112–114 Kg Au/km$^2$). At one point it was host to 268 operational gold mines (Tyndale-Biscoe, SRGS Bulletin 36). Mineral occurrence can be grouped into 5 clusters Shown in Figure 27 below.

Of considerable importance is the NW cluster, (historically known as the Sabiwa cluster) today is Blanket Mine - situated approximately 15 kilometres west of the town of Gwanda. Ore bodies in this area are primarily shear hosted with quartz-carbonate fracture fill veins, associated with both Banded Iron Formation (BIF) and basaltic greenstone, reflecting a diverse mineralization landscape. Ongoing studies indicate considerable gold potential within the BIF Reef, alongside a complex shear system.

Despite high exploration potential, the presence of thick overburden has posed challenges to resource evaluation, necessitating the integration of advanced geophysical methods for effective exploration. The mineralization is characterized by disseminated sulphides and quartz vein lodes, with various alteration styles identified, underscoring the area's geological significance not only for economic output but also for advancing geological research and understanding metamorphic processes essential for future exploration initiatives.

The broader geology in the vicinity of Blanket Mine area is noteworthy for its sequence of massive and pillowed metabasalts intermixed with volcaniclastic rocks, mainly pillow breccia and tuffs. Additionally, these sequences are interspersed with distinctive argillaceous sulphide layers, sometimes referred to as "black markers," as observed in underground mine workings (Fuchter, 1990).

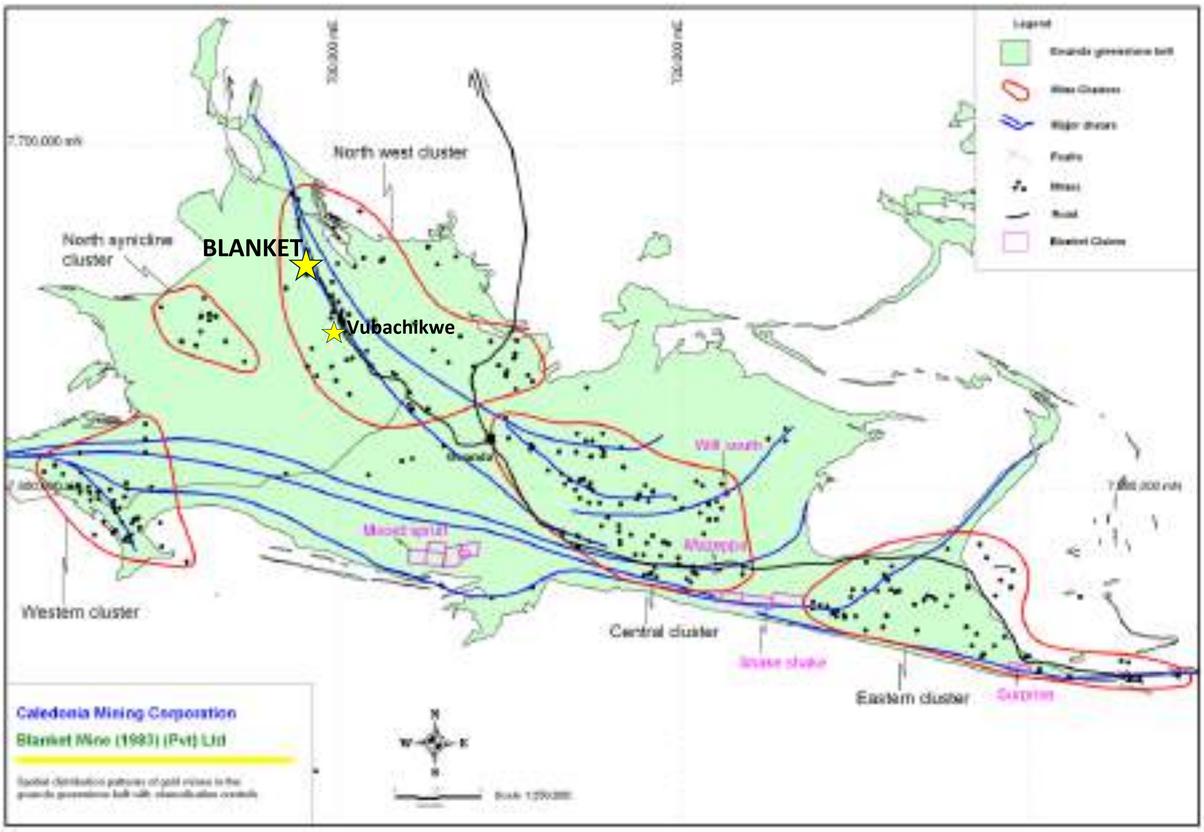



***Figure 27:*** *Spatial distribution of Mining Camps in the Gwanda Greenstone Belt.*

## 4.2 Blanket mine local geology and mineralisation

Blanket Mine, located in the Northwest Mining Camp (Fig. 27), is renowned for its rich gold deposits and unique geological features. The local geology (Fig. 28, including stratigraphic column), consists of a basal Felsic Unit, which is not mineralised. This is generally on this lithology that the tailings disposal sites are located. There is an interpreted thrust contact, and unconformably overlying this unit is the Ultramafic Succession that include the BIF hosting the eastern dormant cluster and the ore bodies of the nearby Vubachikwe complex. Studies by Fuchter (1990) and Master et al. (1989) identified BIFs with distinctive mineralization patterns, including angular clasts of carbonatized and sulfurized iron transitioning outwards to bedded arsenopyrite. This is parallel system evident in the eastern and footwall side of the Blanket mine main orebodies with traces of outcropping BIF faulted and displace along the entire strike from Sabiwa shaft to beyond Smiler.

The active Blanket ore bodies are found in the overlying stratigraphic unit – the Mafics. An andesitic unit caps this whole stratigraphy. A late regional dolerite sill cuts the entire sequence from Vubachikwe through Blanket to Smiler.

Gold mineralisation at Blanket Mine complex is epigenetic and associated with hydrothermal system structures. It is associated with a later regionally developed deformation zone characterized by areas of high strain wrapping around relatively undeformed remnants of the original basaltic flows. It is within the higher strain regime that the wider of the ore bodies are located.

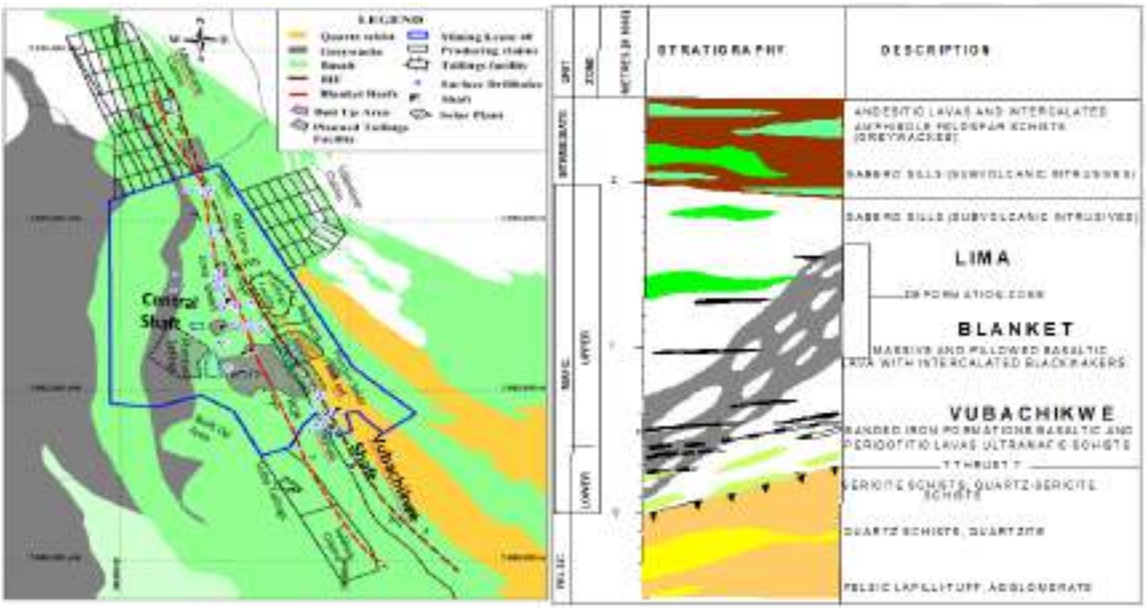



***Figure 28:*** *The geology and stratigraphy of Blanket Mine.*

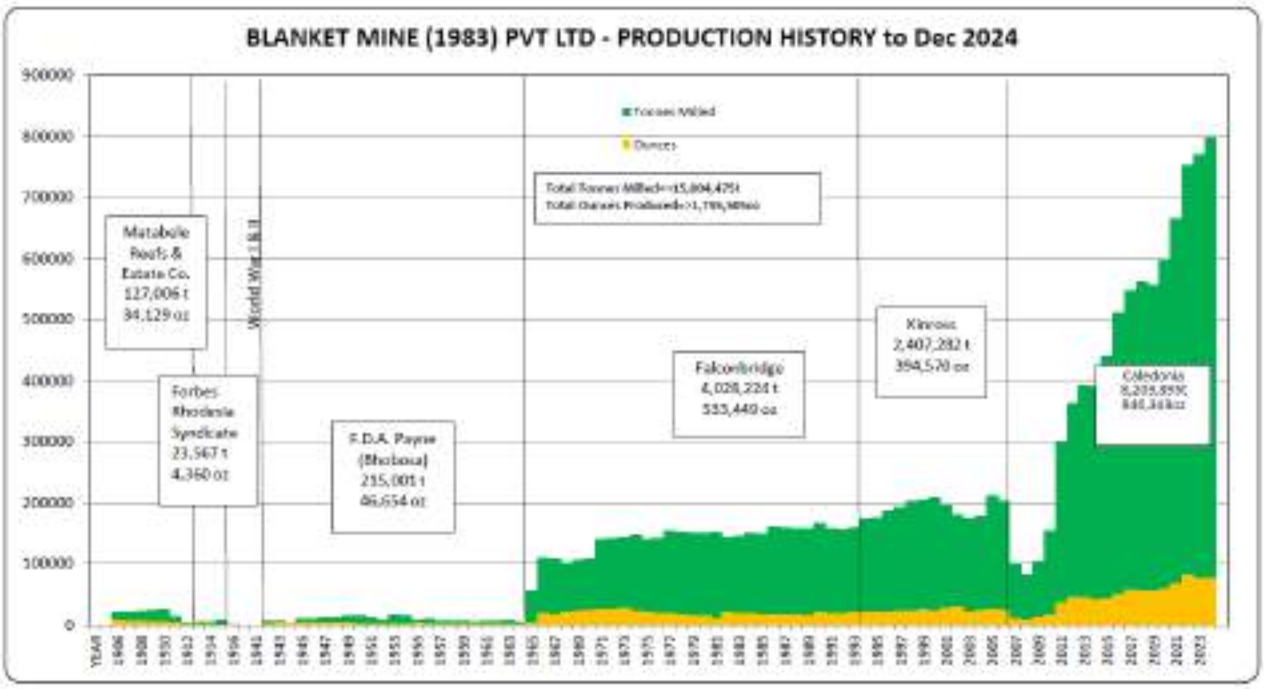



***Figure 29:*** *Blanket Mine Annual Production over the last Century*

### 4.2.1 Blanket Production

Blanket Mine has in the last decade considerably increased their gold production. (Fig. 29) This has been largely attributed to a robust exploration programme that defined considerable underground resources and allowed the investment in a deep vertical shaft, raising the gold production to be among the top in Zimbabwe currently.

### 4.2.2 Orebody Characteristics

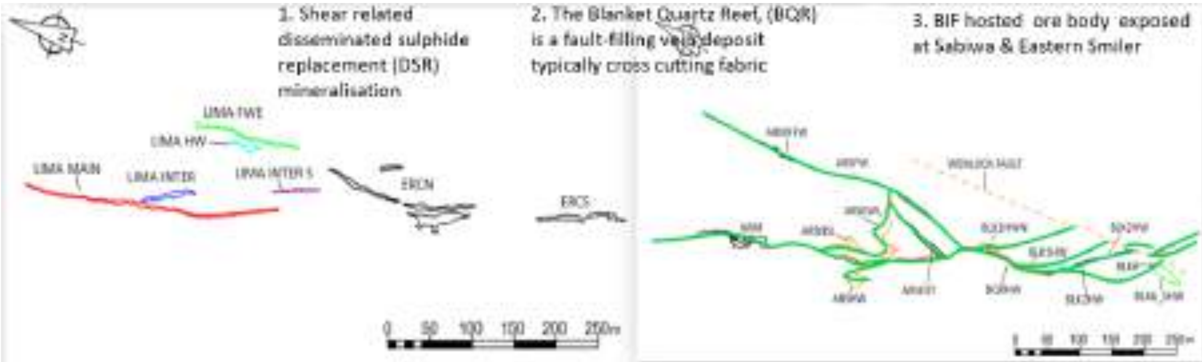



***Figure 30:*** *Spatial location of orebodies at Blanket Mine*

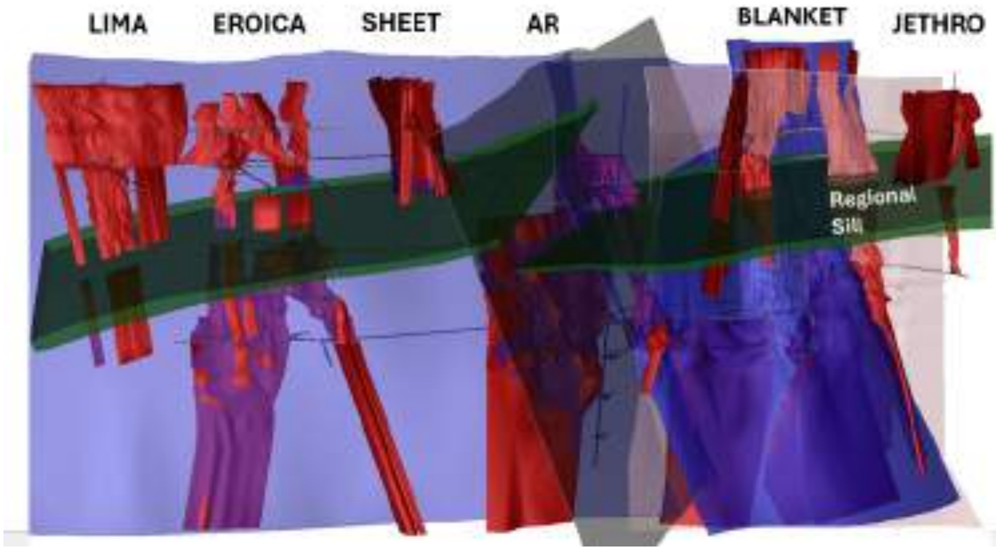



***Figure 31:*** *3D view of Blanket Mine Orebodies*

As illustrated above, there are various styles of mineralisation at Blanket Mine:

**Deformation Zone Hosted Disseminated Sulphides Replacement (DSR) Auriferous Ore:** This primary ore type shares similarities with mineralization found at the nearby Lima Mine (Fuchter, 1990). It is characterized by disseminated gold within a sheared and silicified metabasalt host rock. The gold is primarily associated with arsenopyrite, with minor pyrrhotite and pyrite also present but composition varies with ore bodies ore characterisation. The ore grades are highest at the core and progressively decreases towards the margins of the orebody. Encasement in biotite-rich alteration zones is a common feature, although the extent of this alteration can vary (Fuchter, 1990).

**Quartz Vein Lode (QV) Ore :** This characterises Blanket Quartz Reef (BQR) and represents mineralization consisting of quartz-carbonate veins within the fracture filled host rock.

**BIF Ore:** This is hosted at nearby nearby Vubachikwe, Sabiwa and Eastern Smiler deposits.

Additionally, these mineralised sequences are interspersed with distinctive argillaceous sulphidic layers, sometimes referred to as "black markers," as observed in underground mine workings (Fuchter, 1990). It's important to note that while the Blanket Mine currently focuses on DSR and QV ores, the presence of Banded Iron Formations (BIFs) has also been documented within the area (reference source for BIFs in Blanket Mine area). These BIFs are characterized by angular clasts of iron formations that have undergone carbonatization and sulfidation at their core, transitioning outwards into an irregular zone of bedded arsenopyrite ore (Master et al., 1989; Fuchter, 1990). The presence of BIFs suggests the potential for further exploration into different ore types within the Blanket Mine area

**Mineralization Patterns:**
Mineralization is closely related to the shear zones and is often accompanied by arsenopyrite, pyrrhotite and pyrite. The ore is primarily free milling with minimal refractory characteristics, around 50% free Au.

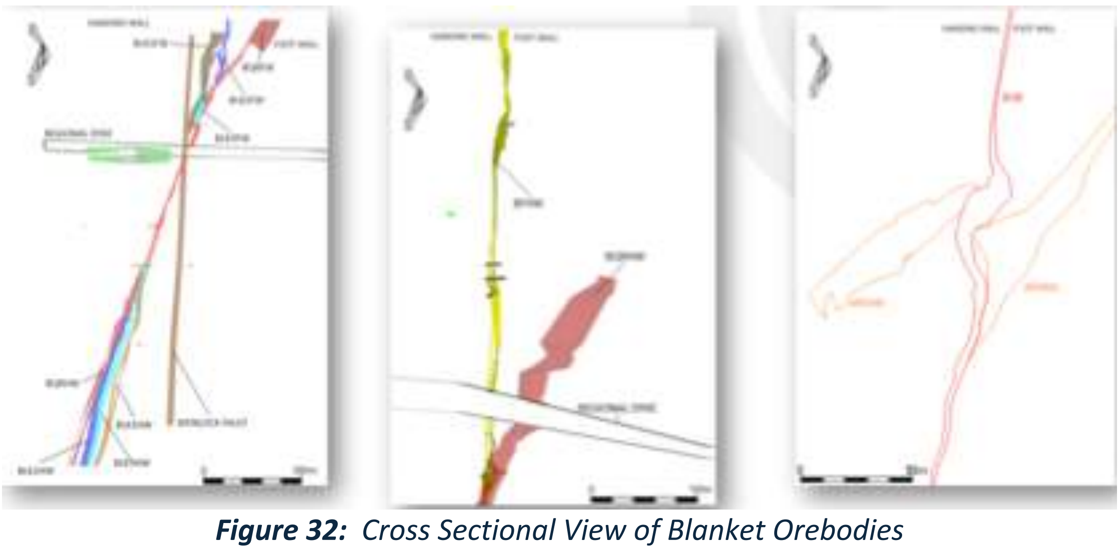


***Figure 32:*** *Cross Sectional View of Blanket Orebodies*

## 4.2.3 Underground orebody exposures

Various types and degrees of alterations are observed in the ore bodies. The alteration package occurs in sheared bands and stringers of mm-cm scale that pinch and swell in an anastomosing fashion sympathetic to the 340/65 foliation which is the general strike.

The major alterations styles are:
**Biotization:** the pervasive brownish bands that impart the distinct fabric to the mineralized zone.
**Chlorite:** the greenish bands
**Silicification:** stringers are the mineralizing channels clear like water in colour.
**Carbonation:** gives the bleaching aspect. Carbonation within the ore body may be obscured but using acid on all lithologies may detect it. Outside the mineralized zone, it manifests itself as stringers, veinlets or bands intercalated with meta-basalt parallel to foliation.

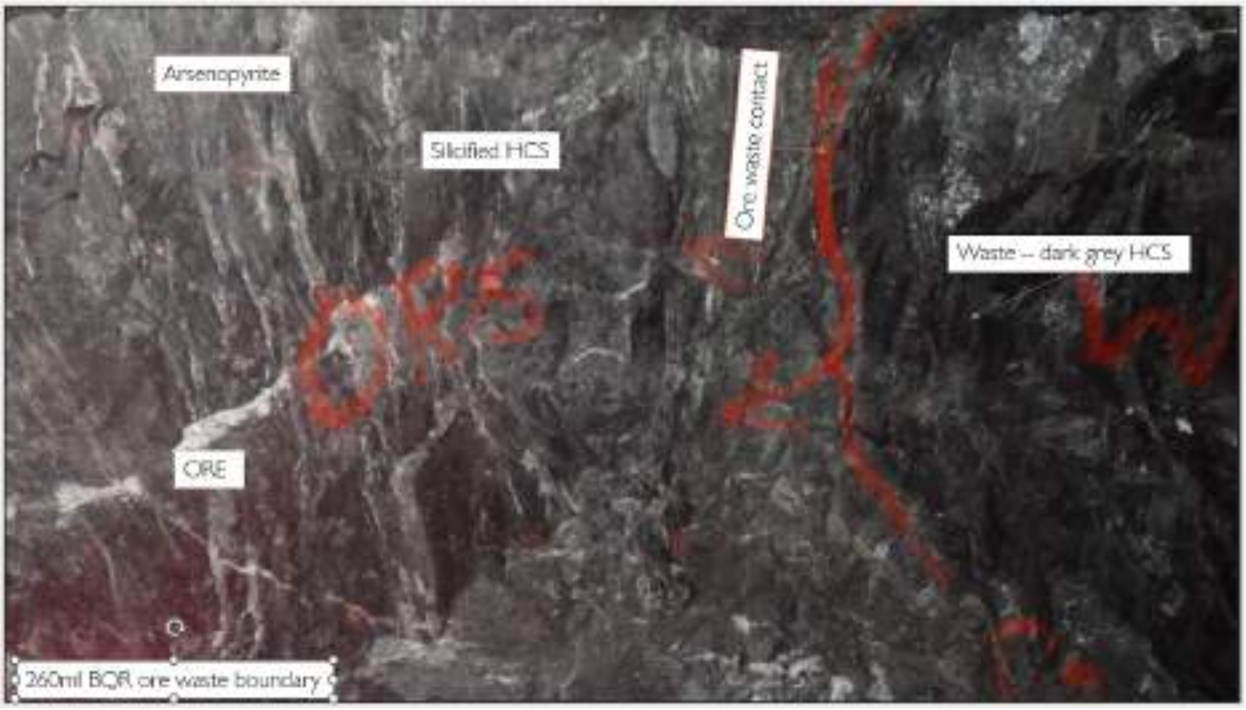



***Photo 12:** Photo of 260 BQR Orebody showing Ore-Waste Boundary*

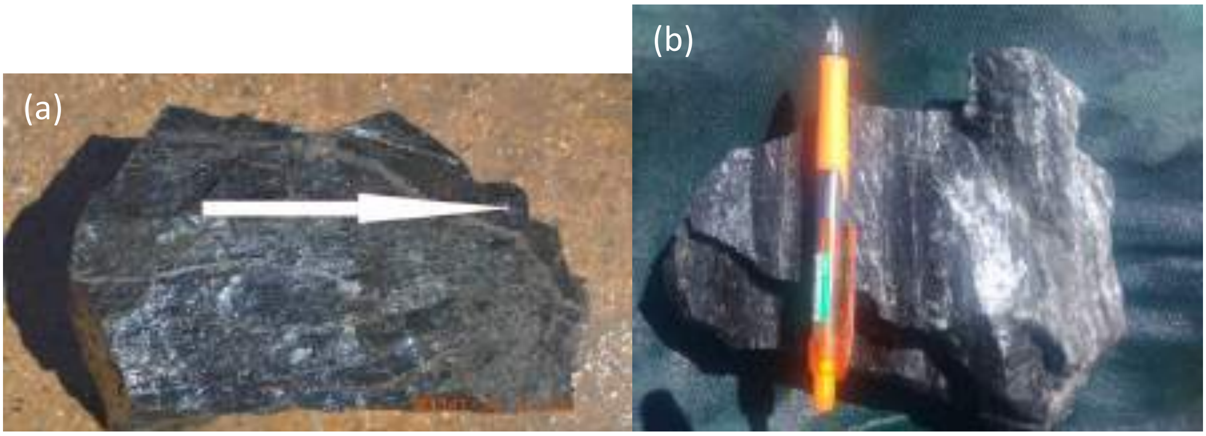



***Photo 13:** Mineralisation styles at Blanket Mine (a) ARM Orebody – 600 Level (b) Specimen showing silicification and Arsenopyrite.*

# 5 DAY 4 – FILABUSI GREENSTONE BELT

*Contributions from Dale Blair*

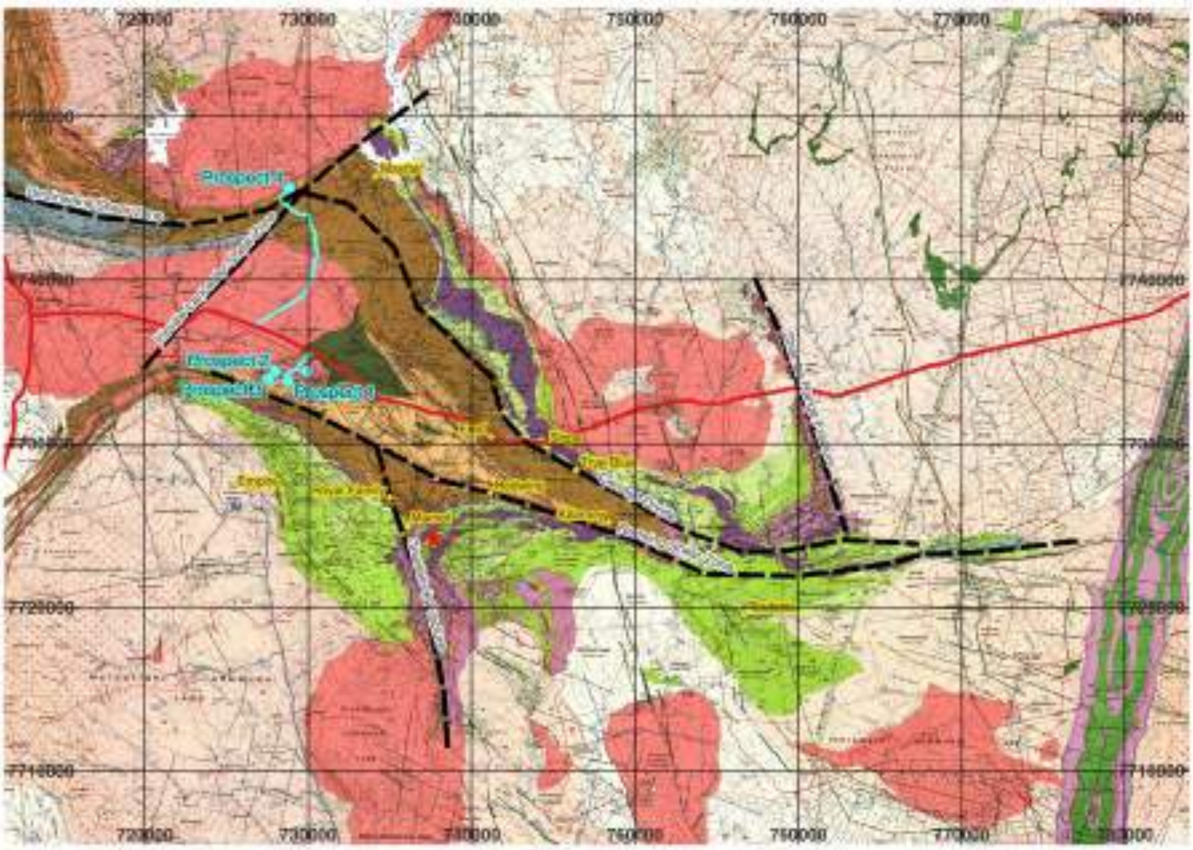


***Figure 33:*** *DAY 4 – Filabusi Greenstone Belt – Exploration stops (1:100,000 Geo Maps)*

## 5.1 Regional Geology

The Filabusi greenstone belt is one of the lesser known greenstones in Zimbabwe and forms the easternmost extension of the large and more well known Bulawayo greenstone belt to the north. It has a maximum length of 55km and width of 20km, with the Bulawayan formations forming a major syncline. Generally the major shear zones are related to this strike and the major mines are again proximal to these major structures. To the east it is bounded by the Great Dyke, as seen above in the far right. There is evidence of an abundance of ultramafic rocks in this greenstone, and previously asbestos was a major mineral produce. The Phurombuzi Complex is a locally differentiated ultramafic intrusive in the south was the host for much of this production.

When considering the gold production, two of the formations have the most production. That is the mafic metavolcanic of the Upper Bulawayan Swart-Spruit Formation (dark brown in the map above) and the older Lower Bulawayan bimodal metavolcanics of the Eldorado Formation (green). Similarly to the Gwanda Belt, the gold mines can be “grouped”, with the central area around Fred Mine being the productive area within the greenstone for gold. Nickel and Lithium have also been produced from this greenstone belt.

## 5.2 Local Geology

Two areas where Kavango Resource are actively exploring will be visited, with the first area being close to the western contact and the synclinal axis. This is known as the Bill's Luck Group and is a cluster of mine covering almost all of the Balmoral Granite Stock, and some immediately adjacent to it. The auriferous reefs are commonly associated with scheelite, with molybdenite being a widespread accessory.

The final stop will be in the north of the greenstone, proximal to the Irisvale-Lancaster Shear zone. (Prospect 4).

## 5.3 Area 1 – Balmoral Granite Stock

The figure below, published on Kavango's website illustrates the drilling and proximity of the 3 Prospects (1 to 3).

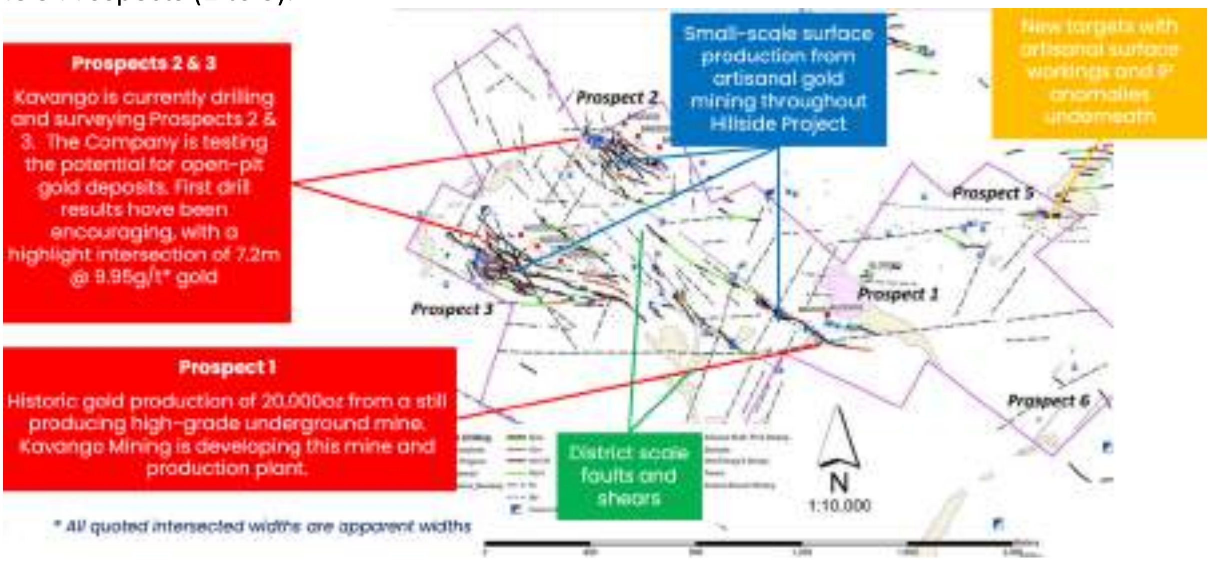



*Figure 34: Location and Information Map of Kavango Balmoral Projects*

### 5.3.1 Stop 1 – Prospect 1

The prospect is in fact located on a known ancient working, where a collapse had preserved evidence prior to the re-opening of the mine in the 1930s. Evidence of the use of fire to shatter quartz reef was clearly recorded.

The mine is reported to have produced 558kg of gold and was mined down to 3 level. The shaft has recently been re-habilitated, and mining has commenced. The grades were reported very high – averaging around 8-9g/t. Although in a granitic host, the mineraliseation is associated with sheared felsic volcanic rocks. The reefs are reportedly under 1m wide, but thicken at junctions with branch reefs, particularly as the shears pass into the schists from the granite. Kavango has confirmed mineralisation by 3 diamond holes.

*Figure 35: Balmoral Granite with associated mines and field visit sites*

### 5.3.2 Stop 2 – Prospect 3

This prospect is heavily worked by artisanal miners. Further, Kavango has drilled 3 exploratory holes over a strike of 200m, see the figure below.

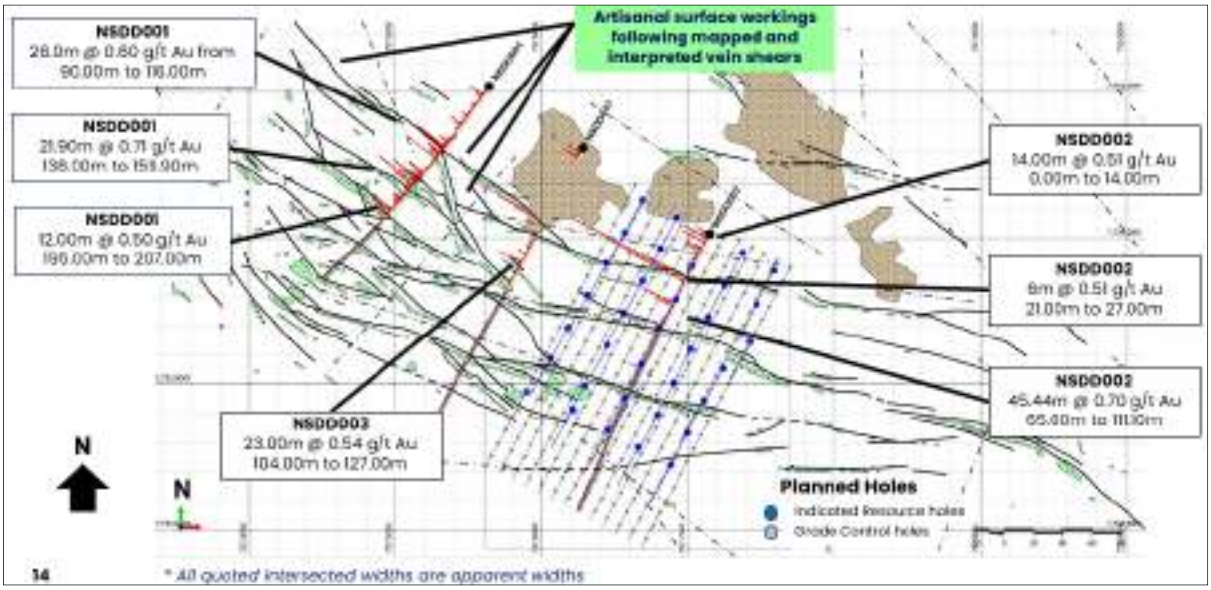



***Figure 36:*** *Vein mapping based on Artisanal workings and drilling.*

A mineralised zone of 800 x 200m has been defined by this geological work and geophysical surveys. The mineralised zone contains multiple zones of fairly low grade mineralisation, ranging in width from 1 to 8m in width and grading between 1 and 3g/t Au. The anastomosing vein set is believed to be in contaminated granitic margin and is currently being investigated for a low grade open pit potential. The map above illustrates the vein sets and the drilled holes, and indicates the difficulty of drilling this type of structure. The artisanal miners are predominantly mining the high grade core of these veins.

### 5.3.3 Stop 3 – Prospect 4

The final stop is on the northerly contact zone of the greenstone belt. This is mapped as being a mylonitised zone associated with the Irisvale-Lancaster shear zone.

***Photo 14:*** *Parallel Quartz veins, approximately 5m apart.*

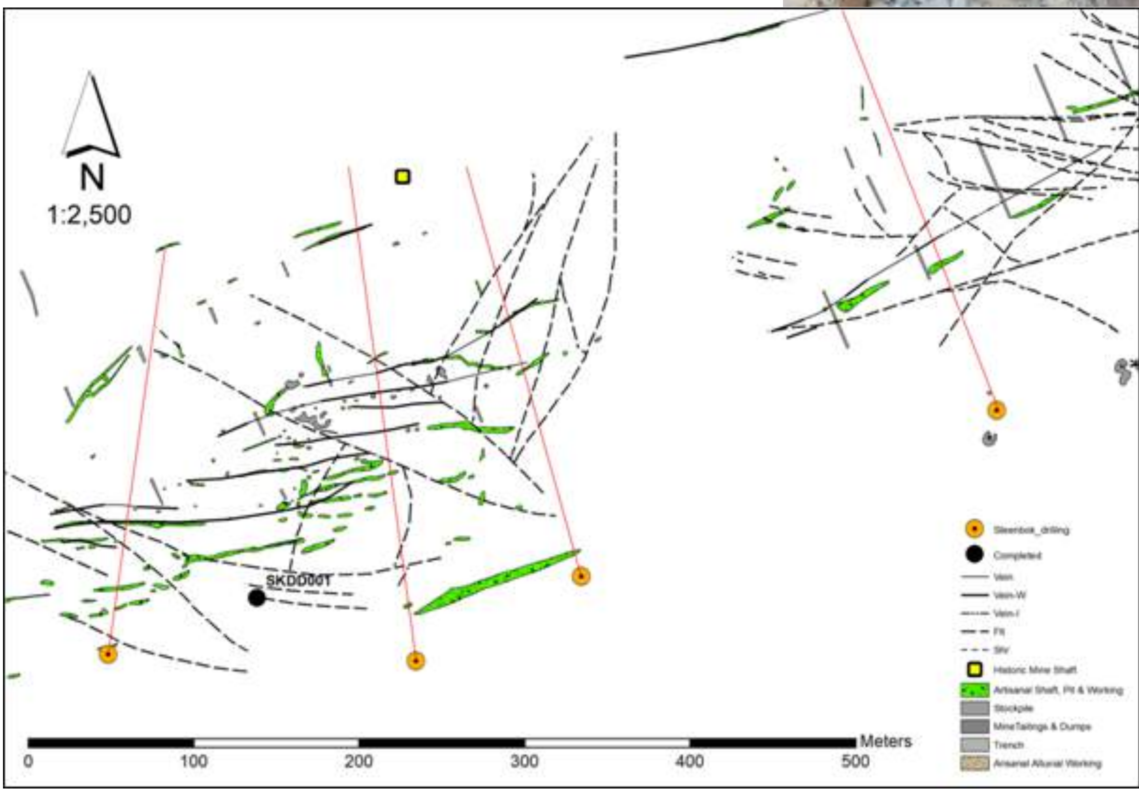



***Figure 37:*** *Map of Prospect 4 showing structural features together with artisanal workings, completed borehole and proposed boreholes*

Again, there is considerable artisanal activity.  Surface mapping has indicated the presence of at least 8 quartz filled shear zones.  Drilling of a single hole returned amazing grades of 29g/t over 2.5m.    Geochemical surveys have returned  phenomenally high gold grades

Therefore, the plan is to drill further holes to confirm and define the continuity of the gold mineralisation.

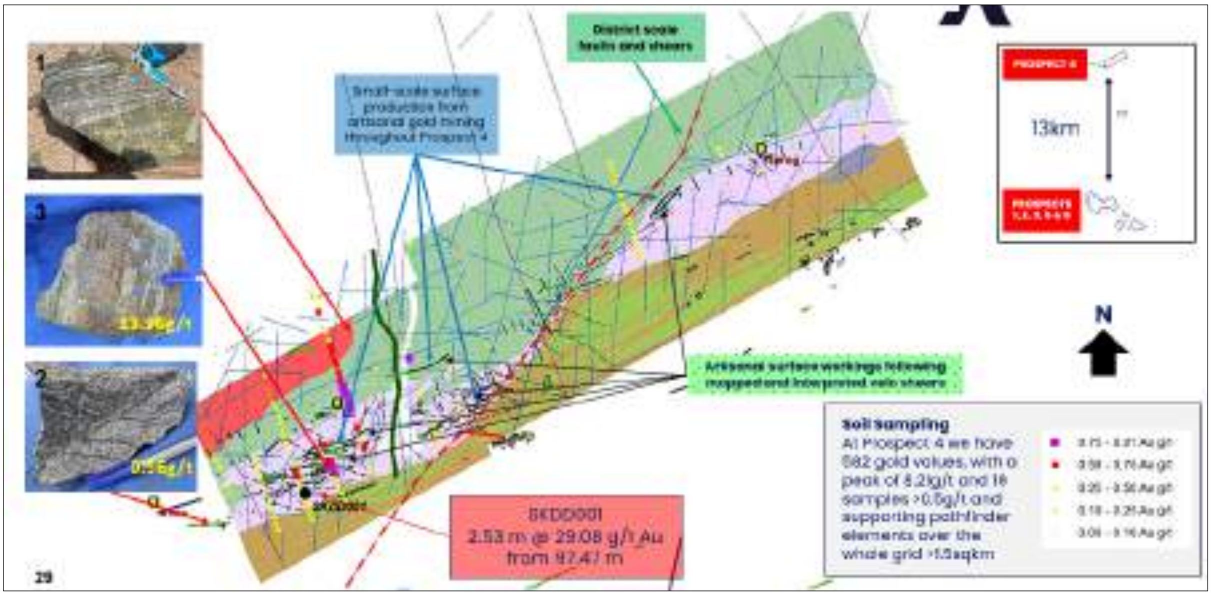



***Figure 38:** Map of Prospect 4 showing structures, soil sampling and grab sampling*

# 6 References


Agangi, A., Hofmann, A., Echigo,T., Bolhar, R., Araoka, D., Mashoene,V., Ndhlovu, L.T., Takahashi, R. and Manalo, P., 2024. The use of combined C-Mg isotope compositions of carbonates from orogenic Sb-Au deposits as a tracer of fluid interaction with sea-floor altered crust. Chemical Geology 673, 122442.

Baglow, N., 1998. The Geology of the Filabusi Greenstone Belt and surrounding granite terrane. Zimbabwe Geological Survey Bulletin No. 91.

Bartholomew, D. S. 1990. Gold Deposits of Zimbabwe. Zimbabwe Geological Survey. Mineral Resources Series No. 23

Blenkinsop, T.G., Oberthür, T. and Mapeto, O., 2000. Gold mineralization in the Mazowe area, Harare-Bindura-Shamva greenstone belt, Zimbabwe: Tectonic controls on mineralization. Mineralium Deposita 35, 126–137.

Bowen, D.J. 1979. Gold Mines of Rhodesia. 1890-1980. Marden Printer, Salisbury, Zimbabwe.

Campbell, S.D.G. and Pitfield, P.E.J., 1994. Structural controls of gold mineralisation in the Zimbabwe Craton – exploration guidelines. Zimbabwe Geological Survey Bulletin, 101. Foster, R.P. et al. 1986. Shamva gold mine, Zimbabwe: a product of calc-alkaline-linked exhalative, volcaniclastic and epiclastic sedimentation in the Late Archean. In: Turbidite-hosted gold deposits, Geological Society of Canada Special Paper 32, 41-66.

Campbell, S.D.G., and Pitfield, P.E.J., 1994. Structural controls of gold mineralization in the Zimbabwe Craton – Exploration guidelines. Zimbabwe Geological Survey Bulletin No. 101.

Chagondah, G.S., Hofmann, A. Elburg, M.A., Laccheri, L.M., Kramers, J.D. and Wilson, A.H., 2023. Petrogenesis of potassic granite suites along the southern margin of the Zimbabwe Craton. South African Journal of Geology 126. 1-28.

Cox, S.F., Wall, V.J., Etheridge, M.A. and Potter, T.F., 1991. Deformational and metamorphic processes in the formation of mesothermal vein-hosted gold deposits-examples from the Lachlan Fold Belt in central Victoria, Australia. Ore Geology Reviews 6, 391-423.

Dougherty-Page, J.S., 1994. The evolution of the Archaean continental crust of northern Zimbabwe, Ph.D. thesis, Open University, Milton Keynes, England.

Goldfarb, R.J. and Groves, D.I., 2015. Orogenic gold: common or evolving fluid and metal sources through time. Lithos 233:2-26.

Goldfarb, R.J., Baker, T., Dube, B., Groves, D.I., Hart, C.J.R. and Gosselin, P., 2005. Distribution, character, and genesis of gold deposits in metamorphic terranes. Economic Geology 100th Anniversary, 407–450.

Goldfarb, R.J., Groves, D.I. and Gardoll, S., 2001. Orogenic gold and geologic time; a global synthesis. Ore Geology Reviews 18, 1-75.

Groves, D.I. and Santosh, M., 2016. The giant Jiaodong gold province: the key to a unified model for orogenic gold deposits? Geoscience Frontiers 7, 409-418.

Groves, D.I., 1993. The crustal continuum model for late-Archaean lode gold deposits of the Yilgarn block, Western Australia. Mineralium Deposita 28, 366-374.

Groves, D.I., Goldfarb, R.J., Gebre-Mariam, M., Hagemann, S.G. and Robert, F., 1998. Orogenic gold deposits: a proposed classification in the context of their crustal distribution and relationship to other gold deposit types. Ore Geology Reviews 13, 7-27.

Groves, D.I., Santosh, M., Deng, J., Wang, Q.F., Yang, L.Q. and Zhang, L., 2020. A holistic model for the origin of orogenic gold deposits and its implications for exploration. Mineralium Deposita 55, 275-292.

Groves, D.I., Santosh, M., Goldfarb, R.J. and Zhang, L ., 2018. Structural geometry of orogenic gold deposits: implications for exploration of world-class and giant deposits. Geoscience Frontiers 9, 1163–1177.

Fuchter, W. A. H, 1990. The Geology and Gold Mineralisation of the Northwestern Mining Camp, Gwanda Greenstone Belt, Zimbabwe. PhD Dissertation, Queens University, Canada.

Hanssen, M. G. 2006. Preliminary Gold Resource Estimation. Mwana Africa Company Files

Harrison, N. M., 1970, The geology of the country around Que Que. Rhodesia Geological Survey Bulletin 67, 125.

Hawkesworth, C.J., Moorbath, S., O'Nions, R.K. and Wilson, J.F., 1975. Age relationships between greenstone belts and "granites" in the Rhodesian Archaean craton. Earth and Planetary Science Letters 25, 251-262.

Herrington, R.J., 1995. Late Archaean structure and gold mineralization in the Kadoma region of the Midlands greenstone belt, Zimbabwe. In Coward, M.E. and Ries, A.C. (editors), 1995. Early Precambrian Processes, Geological Society Special Publication No. 95, 173-191.

Hodgson, 1993. Mesothermal lode-gold deposits. In: Kirkham, R.V., Sinclair, W.D., Thorpe, R.I. and Duke, J.M., (editors). Mineral Deposit Modeling. Geological Association of Canada Special Paper 40, 635–678.

Hofmann, A., Dirks, P.H.G.M. and Jelsma, H.A., 2004. Clastic sedimentation in a late Archaean accretionary terrain, Midlands greenstone belt, Zimbabwe. Precambrian Research 129, 47-69.

Horstwood, M.S.A., Nesbitt, R.W., Noble, S.R. and Wilson, J.F., 1999. U-Pb zircon evidence for an extensive early Archean craton in Zimbabwe: a reassessment of the timing of craton formation, stabilisation, and growth. Geology 27, 707-710.

Jelsma, H.A., Huizenga J.M. and Touret J.L.R., 1998. Fluids and epigenetic gold mineralisation at Shamva Mine, Zimbabwe: a combined structural and fluid inclusion study. Journal of African Earth Sciences 27, 55-70.

Jelsma, H.A., Nesbitt, R.W. and Fanning, C.M., 2021. Exploring our current understanding of the geological evolution and mineral endowment of the Zimbabwe Craton. South African Journal of Geology 124, 279-310.

Jelsma, H.A., Vinyu, M.L., Valbracht, P.J., Davies, G.R., Wijbrans, J.R. and Verdurmen, E.A.T., 1996. Constraints on Archaean crustal evolution of the Zimbabwe Craton: A U-Pb zircon, Sm-Nd and Pb-Pb whole rock isotope study. Contributions to Mineralogy and Petrology 124, 55-70.

Jelsma, H.A., van der Beek, P.A., Vinyu, M.L. (1993). Tectonic evolution of the Bindura-Shamva greenstone belt (northern Zimbabwe): progressive deformation around diapiric batholiths. Journal of Structural Geology, 15.2, 163-176.

Kalbskopf, S. 2002. The Economic Geology of the Country around Bindura. . Zimbabwe Geological Survey Bulletin No. 97.

Klemm, D. and Kräutner, H., 2000. Hydrothermal alteration and associated mineralization in the Freda-Rebecca gold deposit – Bindura District, Zimbabwe. Mineralium Deposita 35, 90–108.

Kolb, J. and Meyer, M.F., 2002. Fluid inclusion record of the hypozonal orogenic Renco gold deposit (Zimbabwe) during the retrograde P–T evolution. Contrib. Mineralogy and Petrology 143, 495-509.

Kolb, J., Dziggel, A. and Bagas, L., 2015. Hypozonal lode gold deposits: a genetic concept based on a review of the new consort, renco, hutti, hira buddini, navachab, nevoria and the granites deposits. Precambrian Research 262, 20-44.

Kolb, J., Sindern, S., Kisters, A.F.M., Meyer, F., Hoernes, S. and Schneider, J., 2005. Timing of Uralian orogenic gold mineralization at Kochkar in the evolution of the East Uralian granite gneiss terrane. Mineralium Deposita 40, 473-491.

Markwitz, V., Maier, W.D., González-Álvarez, I., McCuaig, T.C. and Porwal, A., 2010. Magmatic nickel sulfide mineralization in Zimbabwe: Review of deposits and development of exploration criteria for prospectivity analysis. Ore Geology Reviews 38, 139-155.

Nutt, T.H.C, Oberthur, T., Saager, R.,and Tomschi, H.P., 1998. The Geology, Mineralogy, and Geochemistry of the Broomstock Gold Deposit, KweKwe Greenstone Belt, Zimbabwe; some implications for Gold mineralization in Jaspilite Iron Formations. Mineralogy and Petrology 39, 145-162.

Oberthür, T., Davis, D.W., Blenkinsop, T.G. and Höhndorf, A., 2002. Precise U-Pb mineral ages, Rb-Sr and Sm-Nd systematics for the Great Dyke, Zimbabwe-constraints on late Archean events in the Zimbabwe craton and Limpopo belt. Precambrian Research 113, 293-305.

Phillips, N., 2023. Formation of gold deposits. Economic Geology 118, 257-258.

Ramsay, J.G. 1989. Emplacement kinematics of a granite diapir: the Chihamora botholith. Zimbabwe Journal of Geology 11. No. ½ 191-202.

Robertson, I.D.M., 1976. The Geology of the Country around Battlefields. Rhodesia Geological Survey Bulletin, 76.

Rohwe, M. Bloy, P. and Nicholls, C. (2015). Freda Rebecca Gold Mine 2015 Estimate. Company Files

Şener, A.K., 2024. The world-class Shamva gold deposit, NE Zimbabwe. Peer-reviewed abstract presented at SEG 2024 Conference: Sustainable Mineral Exploration and Development.

Şener, A.K., Groves, D.I. and Moles, C.M.E., 2000. Towards an integrated geological model for the development of the enigmatic late-Archaean Shamva gold deposit, NE Zimbabwe. Society of Economic Geologists, Gold in 2000 Companion Volume.

Stagman, J.G., 1978. An Outline of the Geological History of Rhodesia. Rhodesia Geological Survey Bulletin 80, 21-24.

Tyndale-Biscoe, R. 1940. The Geology of the Country around Gwanda. Southern Rhodesia Geological Survey. Bulletin 36

Stidolph, P.A., 1977. The geology of the country around Shamva. Rhodesia Geological Survey Bulletin 78.

Wilson, J.F., 1979. A preliminary reappraisal of the Rhodesian basement complex. In: Anhaeusser, C.R., Foster, R.P. and Stretton, T. (editors). A Symposium on Mineral Deposits and Transportation and Deposition of Metals. Geological Society of South Africa Special Publication 5, 1-23.

Wilson, J.F., Bickle, M.J., Hawkesworth, C.J., Martin, A., Nisbet, E.G. and Orpen, J.L., 1978. Granite-greenstone terrains of the Rhodesian Archaean Craton. Nature 271, 23-27.

Wilson, J.F., Nesbitt, R.W. and Fanning, C.M., 1995. Zircon geochronology of Archaean felsic sequences in the Zimbabwe craton: A revision of greenstone stratigraphy and a model for crustal growth. In: Coward, M.P. and Ries, A.C., (editors). Early Precambrian Processes. Geological Society Special Publication 95, 109-126.