BARBERTON GOLD MINES
OPERATIONS AT SA'S OLDEST GOLD MINE
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OVERVIEW OF PRESENTATION

• Overview and history of Barberton Mines

• Current mining methods

• Further exploration potential
OVERVIEW OF BARBERTON GOLD MINES
OVERVIEW OF BARBERTON MINES (‘BML’)

• Mining started in 1886 at Sheba Mines – oldest operating mine
• Currently BML have three operations i.e. Sheba, New Consort and Fairview
• BML treat about 24,000 ore tons per month at about 11g/t
• BML also have a Tailings Retreatment Plant (90,000t/m)
• Combined gold production per month is 290kg
• Each operation have a treatment plant with a centralised BIOX® plant
• BML is the biggest employer in the Barberton area
LOCALITY OF BARBERTON MINES
This is where it all started. After this discovery a company was floated and the first shares were sold at £1 and it increased to £120
Edwin Bray Adit when it started – Oldest photo of this adit available
EDWIN BRAY ADIT IN PROGRESS
EDWIN BRAY ADIT IN PRODUCTION
EDWIN BRAY ADIT STILL IN USE
EDWIN BRAY ADIT STILL IN USE

Edwin Bray Adit still in use - 127 years later
SHEBA MINE - ZK VERTICAL SHAFT

Sheba Mine – SK vertical shaft – Today (110 years old)
Very early days of Fairview, on top of the mountain
FAIRVIEW – MAIN ADIT

Fairview Main Adit being used today
NEW CONSORT – 1 LEVEL

Early days at New Consort No1 level entrance
NEW CONSORT - MAIN ADIT

New Consort Main Adit today ± 60 years old
BIOX® PLANT

BIOX® Plant
CURRENT MINING METHODS
CURRENT MINING METHODS

• **Mechanised Mining** – Cut and fill (90%)
  - Breast & Updip

• **Open Stoping** – Conventional Mining (10%)

• **Shrinkage Mining** (0%)
**CURRENT MINING METHOD**

- **Mechanised Mining** – Cut and fill (90%)
  - Waste from your infrastructure development is hauled back into stope for fill (Ramp system and Access cross cut which is then fan lifted)
  - 55% of reef tons removed equates to waste tonnage requirement for waste fill (Development meters required)
  - Mining sequence
    - Blasting stope face and support
    - Loading reef
    - Waste filling
    - Compacting
    - Cement capping
CURRENT MINING METHOD

Simplified section view of stoping/mining layout

- STEEP OREBODY
- TRACKLESS RAMP SYSTEM
- START OF RAMP SYSTEM
- LEVEL SPACING 40m
- TRACKBOUND HLGE
- SHAFT SYSTEM
- FIRST CUT THROUGH OREBODY
- -9deg FAN LIFT XCUT
CURRENT MINING METHOD

Simplified plan view of stoping/mining layout

 CONNECTING REEF DR TO ESTABLISH 1st STOPING PLATFORM AND THROUGH VENTILATION

ORE PASS

TRACKLESS RAMP SYSTEM

- 9deg FAN LIFT XCUT

STEEP OREBODY

TRACKBOUND HLGE

SHAFT SYSTEM
CURRENT MINING METHOD

Close up section of floor support in 1st cut

1.5m SHEPPARD CROOKS FOR LOCAL SUPPORT

15m LONG ANCHORS

4.5m ANCHORS INTO S/W 1m APART ON STRIKE

6m ANCHORS

STEEL ROPE + WELDED MESH MAT CONSTRUCTION ON FW COVERED WITH 1m CONCRETE SLAB/PLUG
Close up section of floor support in 1st cut.
CURRENT MINING METHOD

Close up plan view of floor support in 1st cut

4.5m ANCHORS INTO S/WALL OF THE STOPE WITH STEEL
LOOPS OR BRACKETS THROUGH WHICH ROPE IS THREADED

16 – 20mm STEEL ROPE WEAVED THROUGH ALL THE
“LOOPS” AND THEN COVERED WITH WELDED
DIAMOND MESH AND A 1m CONCRETE SLAB ON TOP
OF THIS
Close up plan view of floor support in 1st cut
CURRENT MINING METHOD

Close up plan view of floor support in 1st cut
CURRENT MINING METHOD

Stoping cycles

1. DRILL & BLAST REEF
   DRILL & BLAST 3m CUT
   (UPDIP OR BREAST)
   CEMENT CAP

2. CLEANING – REMOVE BROKEN ORE
   CLEAN OUT ORE WITH LHD VIA FAN LIFT XCUT
   CEMENT CAP
CURRENT MINING METHOD

Stoping cycles

3. DRILL & BLAST FAN XCUT + WASTE FILL

DRILL & BLAST FAN XCUT

FILL WITH WASTE TO CREATE NEW FLOOR AND ROADWAY IN FAN XCUT

CEMENT CAP

4. COMPACT WASTE & CREATE NEW CEMENT CAP BEFORE BLASTING CYCLE RESTART

NEW CEMENT CAP AFTER COMPACTION

CEMENT CAP

AFTER THIS CYCLE 1 STARTS AGAIN
CURRENT MINING METHOD

Section along strike of stope showing Breast mining & Updip mining
FALL OF GROUND MEASURES

• **Mechanised Mining** – Cut and fill (90%)
  - Because the back areas are filled with waste the overall stability of the stopes are good
  - At Fairview we are mining at about 1800m below surface and have not seen any seismic related activities
  - Only the current stope face area is exposed – reducing FOG risk
  - No back areas. This also helps with ventilation conditions and reduces fire risk
  - Both sidewalls are supported with sheppard crook roofbolts
  - In stopes wider than 4m, the stope face (hanging wall) are supported with the 40t, 15m long pre-stressed anchors
MRC ORE BODY AND EXPLORATION POTENTIAL
BARBERTON MINES - FAIRVIEW

• The MRC is the second richest orebody in the world

• Current life of orebody is 26 years, which greatly exceeds the BML life of mine

• There is a realistic potential for MRC to continue at depth
### The top 10 highest grade underground gold operations

<table>
<thead>
<tr>
<th>Mine</th>
<th>Country</th>
<th>Major Owner</th>
<th>Au grade, g/t</th>
<th>Ore Reserves, 000' tonnes*</th>
<th>Contained Au, 000'ozt</th>
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<tbody>
<tr>
<td>Fire Creek</td>
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<td>Klondex Mines</td>
<td>44.1</td>
<td>170</td>
<td>172</td>
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<tr>
<td>Macassa (South Mine)</td>
<td>Canada</td>
<td>Kirkland Lake Gold</td>
<td>22.2</td>
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*Ore reserves are Proven + Probable, except Kedrovka, where A + B categories calculated.*

Data retrieved from the IntelligenceMine database - Published in MINING.COM on 16 July 2015
BARBERTON MINES - FAIRVIEW

The top 10 highest grade underground gold operations (What the table should look like in reality)

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BARBERTON MINES - FAIRVIEW

MRC Orebody

Active mining @ 32.8 koz/annum

Indicated Resource
780 koz @ 34.3 g/t
26 years life of mine
Exploration Potential at BML

- Unique geology
- Amira Project Study by University of Western Australia
- Current UJ study
Metamorphic devolatilisation

- Transition from greenschist to amphibolite facies triggers process of devolatilisation

- $\text{H}_2\text{O-CO}_2\text{-H}_2\text{S}$ fluids are released from mineral crystal structures and these fluids can transport gold to favourable depositional sites

- Adequate amounts of gold can be dissolve if enough cubic kilometres of appropriate rocks undergo metamorphism
Metamorphic devolatilisation

- At higher pressure (and T) gold solubility is higher

- When pressure is released, $\text{H}_2\text{S}$ (the ligand that makes gold soluble) is driven off, resulting in gold precipitation

- Pressure shadows, which can form during faulting and folding, create spaces effectively sucking the fluid into these spaces and releasing pressure, resulting in gold precipitation
Calculated volume of source rock required to form a deposit containing a given amount of gold
Barberton Greenstone Belt contains 1600 cubic km source rock.

![Graph showing relationship between ounces of gold and cubic kilometers of source rock.](image-url)
BARBERTON MINES

Geological map
Amira Project – 3D model
Amira Project – including geological features
Amira Project – high potential areas
Semi-mechanised Stoping
Waste Filling
Up-dip drilling
BARBERTON MINES

Up-dip drilling
Breast Mining – Waste Fill
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Breast – Face Drilling
Compacting – prior to cement cap
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Sweeping – Between Reef and Waste Pile