Introduction

Locality
Kimberley Mines - De Beers to KEM-JV
Wesselton Kimberlite Geometry
Slusher Drift Block Cave Mining
Challenges
Draw Control and Grade Control Strategy
Control Measures
Geological Impact on Value Chain
Conclusion
Kimberley Mines - De Beers to KEM-JV

- **1869**: Bultfontein mine discovered
- **1870**: Dutoitspan mine discovered
- **1871**: De Beers & Kimberley (Big Hole) mines discovered
- **1888**: De Beers Consolidated Mines is formed
- **1890**: Wesselton mine discovered
- **1890**: Underground closure by De Beers
- **2005**: Surface ops continued
- **2007**: Block caving implemented
- **2010**: Under De Beers care and maintenance
- **2016**: Petra Diamonds acquisition completed
- **2018**: Petra Diamonds demerger
- **2018**: Kimberley Ekapa Mining-JV formed between Petra and Ekapa Minerals
Wesselton Kimberlite Geometry
## Slusher Drift Block Cave Mining

<table>
<thead>
<tr>
<th>MINING METHOD</th>
<th>BLOCK CAVE (BC)</th>
<th>SUB LEVEL CAVING</th>
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<td>W/COSTS</td>
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<tr>
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<td>↑</td>
<td>↓</td>
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<tr>
<td>TONNAGE RATE</td>
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<tr>
<td>% EXTRACTION</td>
<td>80%</td>
<td>60%</td>
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<tr>
<td>CAPITAL</td>
<td>↑</td>
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<tr>
<td>DRAW CONTROL</td>
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<th>BC METHOD</th>
<th>SLUSHER DRIFT BC</th>
<th>MECHANIZED BC</th>
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Mine Method Context

• Commencement Date - 1993

• Why?
  • Smaller drawpoints - Minimize mud rush risk
  • More DP’s over footprint

• Success!
  • Relative low cost compared to mechanized
  • 88% of design mined
  • Minimum dilution
  • No mud rush related incidents
Slusher Drift Block Cave Mining (Practice)
Current Status
Challenges

Profitability is minimized

LOM is minimized

1) Isolated DP’s are mined

2) Isolated caving rate intensify

3) Rat holes/chimneys are created with excessive isolated draw

4) Localized/surface Waste ingress increase

5) Easy flowing Fines increase

6) Influential geological variables introduced to value chain increase

7) Mining value chain throughput (value per hour/shift/etc.) potential is minimized.

8) DP’s neglected by draw

9) Regional caving rates are delayed

10) Increase in secondary blasting requirements

11) Stress on regional infrastructure buildup

12) Increase in expenses

13) Infrastructure damage increase

14) Drift repair requirements increase

15) Various risk potential increase (mud rush/push, water influx, financial, labor accident/fatality)

16) Loss in DP’s

17) DP loss rate exceed DP reclaim/repair rate drift repair

18) Water ingress to cave

19) Poor adherence motivation

Poor adherence motivation

Weak Draw Control Compliance

Influential geological variables introduced to value chain increase

I9) Mining value chain throughput (value per hour/shift/etc.) potential is minimized.

20) Poor adherence motivation

Profitability is minimized

Kimberley Ekapa Mining Joint Venture

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# Grade Control Strategy

<table>
<thead>
<tr>
<th>Aim to Achieve</th>
<th>Reasons</th>
<th>How to Achieve</th>
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<tr>
<td>Equal draw over block cave footprint</td>
<td>• Min Waste</td>
<td>• 100% Draw compliance</td>
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<tr>
<td></td>
<td>• Min Fines</td>
<td>• Maximum DP’s availability</td>
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<tr>
<td></td>
<td>• Max Grade</td>
<td>• Optimize drift repair resources</td>
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<tr>
<td></td>
<td>• Optimum Fragmentation</td>
<td>• Optimize hang-ups action resources</td>
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<tr>
<td></td>
<td>• Manage Water</td>
<td>• Control free flowing fines draw points</td>
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<tr>
<td>Maximum throughput</td>
<td>• Reduce variable cost</td>
<td>• Minimize dilution, fines and water</td>
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<tr>
<td></td>
<td>• Increase revenue</td>
<td>• Streamline the mining value chain at minimum expenses</td>
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<td>• Higher $/ct</td>
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## Draw Control Meetings

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<th>Comp.</th>
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<th>Fines</th>
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</table>
Dilution Report Procedure

Planning According to Strip

Data Capturing

Volume measurements

Microscope VE

100% waste

Split sample

-1mm

-2.36mm

-6.7mm

+10mm

-20mm

Dilution %

MCF

Draw Control

Coarse

Mid to Fines

Lava (waste)

Kimberlite (ore)

Middle to Fines (Sample)

Rough spherical brakeage surface

Smother, flat brakeage surface

Xenoliths (Internal waste inclusions)

Amygdales

Lava (Waste)
Influential Geological Factors

**Waste**

- Value dilution
- Equipment wear and tear
- Density related
- Data context

**Fines**

- Rise in fines to ultra-fines
- Slimes volumes
- Early diamond liberation
- Value dilution

**Impact:**

- Dust/Ventilation
- Data context
- Clogging and segregation
- Throughput
Controls

- Draw control compliance
- Drift repair
- Fragmentation actioning
- Fines Management
- Waste Management
- Dewatering

LOM

Profitability
Value Chain Reaction

Funnel Flow

- Fine material in motion
- Stagnant coarse material
- Segregated material

Mass Flow

- Intermixed material, all in motion
Conclusion

• Open to abuse in preferential drawing of:
  • Closer draw points (DP’s)
  • Free flowing fines draw points

• Adherence to draw control plan is vital

• With proper management of fines and dilution, throughput can be improved and thus optimize profitability for the operation
References


Thank you