Blast movement monitors or polypipe?

A cost-benefit study of BMMs vs BVIs at White Foil gold mine, Western Australia

Presented at the **AusIMM Tenth International Mining Geology Conference 2017 / Hobart, Tasmania, 20-22 September 2017**

By **Marcelle Watson, Senior Mine Geologist, Evolution Mining, Kalgoorlie, WA**

About White Foil gold mine

An Evolution Mining property, While Foil gold mine is located 35 km east of Kalgoorlie, Western Australia

- A low-grade open pit gold deposit
- Utilizes conventional drill and blast, and load and haul methods
- Managing ore quality is a high priority
- Stringent ore movement monitoring and polygon adjustment
- Blasting displaces ore and waste boundaries up to 10 m from *in situ* position
- Blasts are conducted on 10 m benches in dry areas of the pit while 5 m benches are designed where there is dynamic water
    - Optimized flitch heights are:
        - 10 m bench: Heave only (top flitch), Second (3.5 m), Third (3.5 m) and Fourth (3 m)
        - 5 m bench: Heave + 1 m (top flitch), Second (4 m)

This Study[1]

Quantifies profit and loss for polypipe (BVIs) and BMT's Blast Movement Monitors (BMMs) across eight blasts

1. Summary of Watson, M. E., Blast Movement Monitors or Polypipe? A study into cost-effective blast movement monitoring at White Foil gold mine, https://blastmovement.com/wp-content/uploads/2017/10/Cost-effective-blast-movement-monitoring-White-Foil-gold-mine.pdf

Study compares BMMs and polypipe (BVIs)

- 8 blasts monitored: 3 blasts in a 10 m mining bench and 5 blasts in a 5 m mining bench
- Polypipe holes were drill 5 m and 9 m deep in the 5 m and 10 m benches respectively
- BMM placement in shots
    - 5 m shots: 2 BMM per hole installed at 1.5 m and 3.8 m from the surface (targeting mid-flitch)
    - 10 m shots: 3 BMM per hole installed at 2.5 m, 5 m and 7.5 m from the surface (targeting flitch boundaries)
- Survey picked up the locations of BMM and polypipe holes before blasting
- Geology personnel detected the BMMs using the BMT detector equipment
- Survey also located and registered the locations of the polypipes found after each blast. After each flitch was excavated, any polypipes that were located were surveyed again

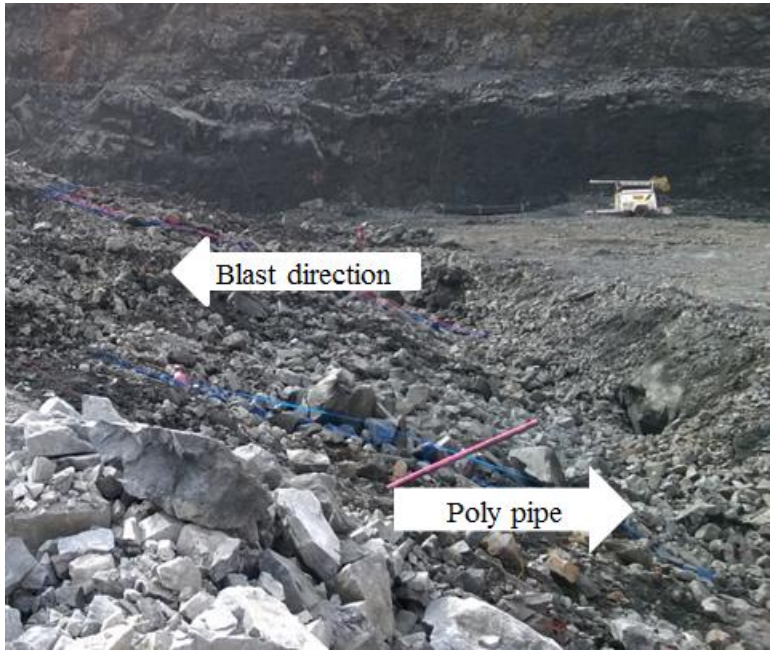
Recovery and detection comparison

Polypipe: poor surveyed recovery

- 5m benches - 53% BVIs recovery surveyed on the heave, 0% for second flitch
- 10m benches – 91% recovery on the heave, 18% for second flitch, 36% on third, 9% on the fourth
- Some BVIs clearly moved contrary to designed firing direction and ore movement direction

BMMs: good detection rate and **more accurate post-blast ore/waste contacts**

- 5m benches – 97% recovery
- 10m benches – 88% recovery



Polypipe moved in the opposite direction to ground movement in some blasts.

Maximizing ore yield at White Foil gold mine

Potential revenue loss through ore loss for the 8 blasts totaled A$664 978

Dilution

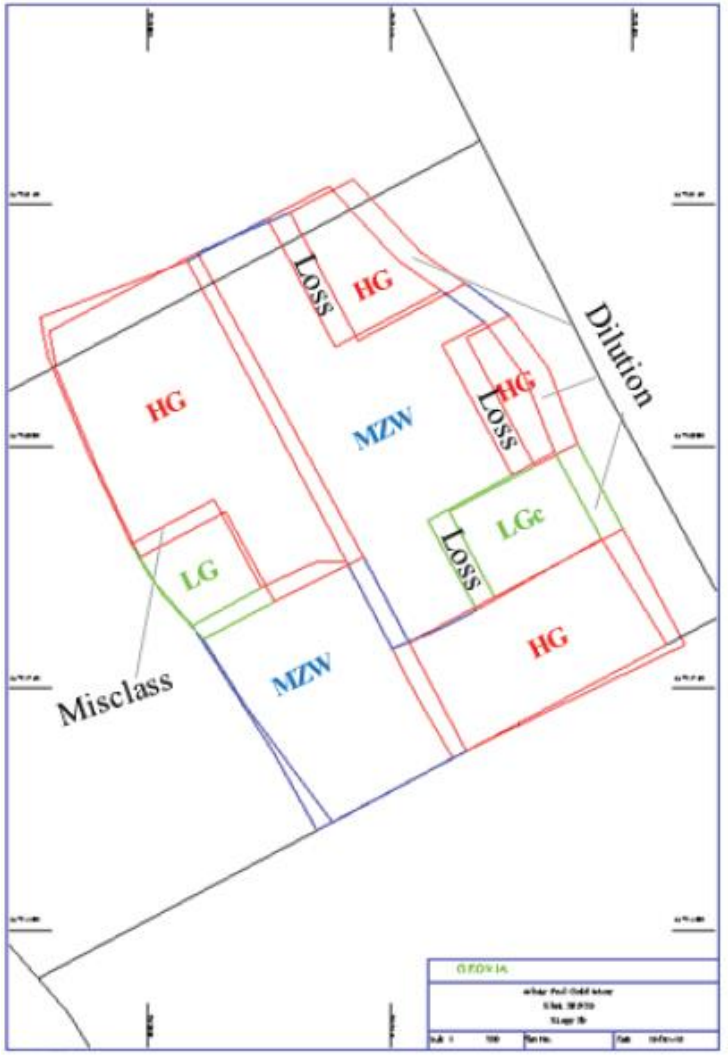
- Waste prevented from going to the mill totalled 7610 t (as 0 grade), avoiding $180,000[1] in processing costs

Misclassification

- High-grade misclassified as LG was minor; prevented 420 t @ 1.57 g/t Au (avg)
- Low-grade misclassified as high grade prevention was 2030 t @ 0.82 g/t Au

Ore loss

- Potential ore loss using BVIs vs BMMs was 9850 t @ 1.47 g/t Au
- Revenue lost by using BVIs would have been $664,978[2]



Polypipe and BMM ore block comparison illustrating areas of ore loss, dilution and misclassification in one blast.

1. Calculated using a processing cost of $23.60
2. Calculated by a gold price of A$1,450

BMMs resulted in better grade control and increased value recovery

- Polypipe/BVI data resulted in inaccurate post-blast ore block boundaries
  - Polypipe had a poor recovery rate of 32% compared with 92% for BMMs

- **BMM System added A$665,000 recovered value across 8 blasts**
  - Recovered an additional 9,852 tonnes of ore (avoided ore loss)
  - Average per-blast savings estimated at A$83,125
  - BMM system payback in 2-3 blasts

Definitions

Ore loss occurs when material containing grade (ore) is incorrectly sent to a waste dump
- When a cost is given for Ore Loss, it is the sale value of the metal (gold, copper) recovered from this ore (i.e. ore tonnes x grade x recovery rate x metal price)

Dilution occurs when waste is unintentionally with material containing ore and sent to the mill
- When a cost is given for Dilution, it is the cost of processing the waste material through the mill

Misclassification occurs when material containing grade (ore) is sent to an incorrect downstream location (i.e. a stockpile); for example, sending high grade material to a low grade stockpile