

CASE STUDY

Wireless initiation – Enabling new mining methods to reduce dilution Musselwhite, Canada

Site Profile

Musselwhite Mine is located on the southern shore of Opapimiskan Lake, approximately 480 km north of Thunder Bay, Ontario, Canada. The mine is 100% owned and operated by Goldcorp Inc. (Goldcorp) and produces 265,000 ounces of gold per annum.

The Situation

The majority of the mining at Musselwhite is completed using a modified Avoca mining method. With this method, each blast is backfilled and waste is removed from the backfilled stope (void pull) to create a void for the next blast.

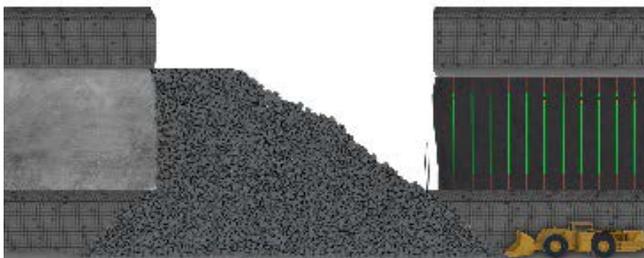


Figure 1 Modified AVOCA filling and void pull activities

As Musselwhite follows the ore body down, the increasing depth, the strike length, and number of lifts have contributed to high levels of stope dilution. Some of this dilution is separable during the mucking cycle, but the net effect is a reduction in productivity and profit.

Orica identified an opportunity to use WebGen™ 100 wireless through the earth initiation technology

(WebGen™). A project was initiated in late 2016 to leave temporary rib pillars (TRP's) that could be recovered using WebGen™.

The TRP concept aimed to improve two key aspects; Safety and Productivity:

- Reduce hazard exposure of operators working adjacent to open holes
- Improve fragmentation through mass blasting
- Reduce mucking and remote bogging time
- Eliminate void pulls (re-handling)
- Reduce dilution

Technical Solutions

The TRP method leaves a section of the orebody stranded in the form of a temporary pillar located at the backfill/ore interface. This pillar is charged with WebGen™ primers. A slot is drilled in the next panel to be mined, highlighted in blue in Figure 2. The entire panel is loaded in one operation with the mass blast primed with i-kon™.

The temporary pillar is designed to hold back the unconsolidated fill or mine waste rock after the stope is mass blasted in a single event and subsequently removed using conventional methods.

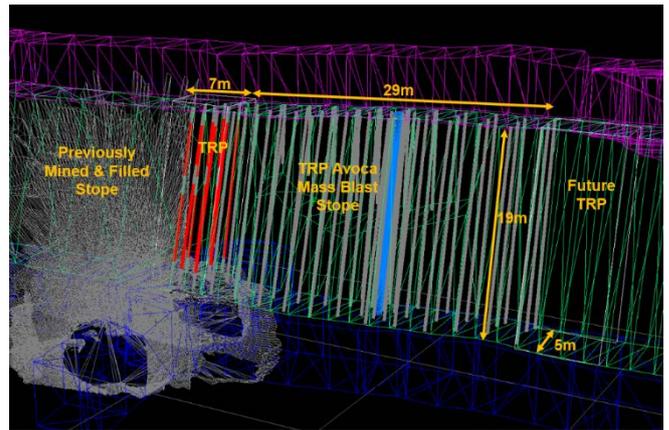


Figure 2 The novel mining method purposely leaves a section of the orebody stranded, in the form of a temporary pillar, charged with WebGen™ primers.

Once the stope has been cleared, the TRP is initiated wirelessly with the WebGen™ 100 system. The TRP is



Wireless initiation – Enabling new mining methods to reduce dilution Musselwhite, Canada

fired in two distinct blasting sequences within the same blasting event and the ore removed.

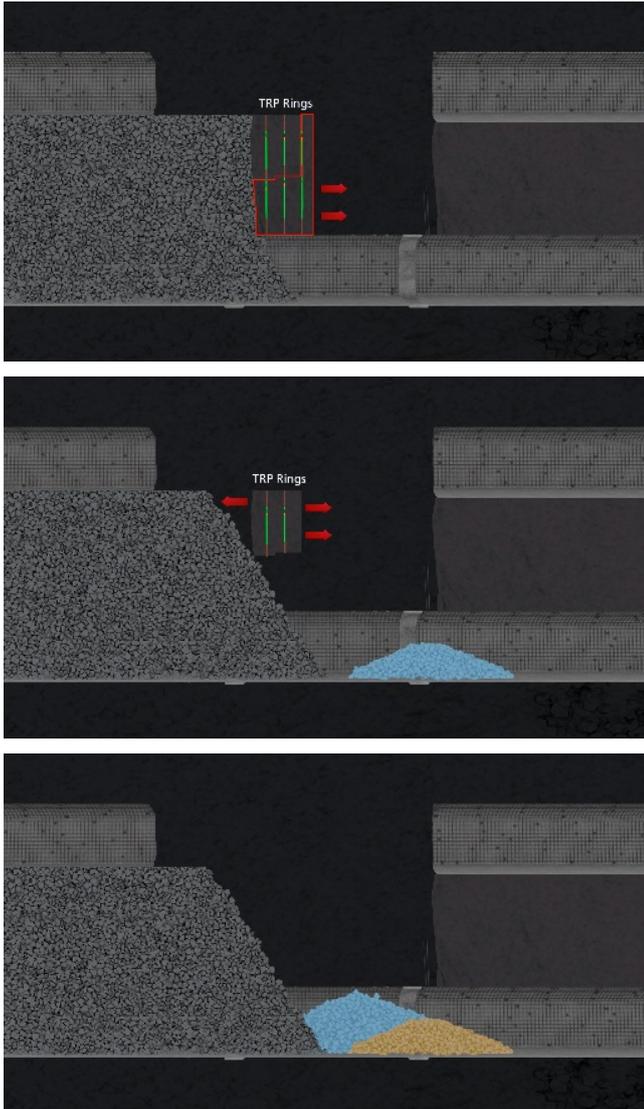


Figure 3 Firing sequence of the TRP rings occurring in one single event

The Result

Several key benefits have been validated by the customer, including:

1. **Improved Safety** - The new mining method has led to significant safety improvements as the operators do not have to work adjacent to the open stope.
2. **Increased Productivity** - Prior to this new method, the mine would fill the previous open stope with waste rock prior to blasting the next block. This re-handling of waste consumed valuable assets and resources that could be moving ore to the mill.
3. **Improved Ore Recovery** - A measurable improvement in the conditions of the stope walls has also been achieved leading to the reduction of waste dilution

The selected stope for the trial was not conventional for the mine. Dilution recorded was well above historical averages. The metrics selected to measure performance were, the overall stope cycle time, in days, the daily scoop productivity, in tonnes per day (TPD), and the overall stope dilution.

TRP Case Study Blast	
Days mucked	33% Reduction
Avg. TPD	27% Improvement
Dilution	93% Reduction

Table 1 Summary of key production metrics for the case study blast

Updated TRP Results

Since the case study blast, Musselwhite has implemented the TRP method in several areas of the mine where excessive dilution is being experienced. On average a 34% reduction in dilution has been observed in these TRP mining fronts.

Overall Summary	
Days mucked	20% Reduction
Avg. TPD	14% Improvement
Dilution	34% Reduction

Figure 4 Summary of key production metrics for TRP blasts after and including case study

CASE STUDY

Wireless initiation – Enabling new mining methods to reduce dilution Musselwhite, Canada

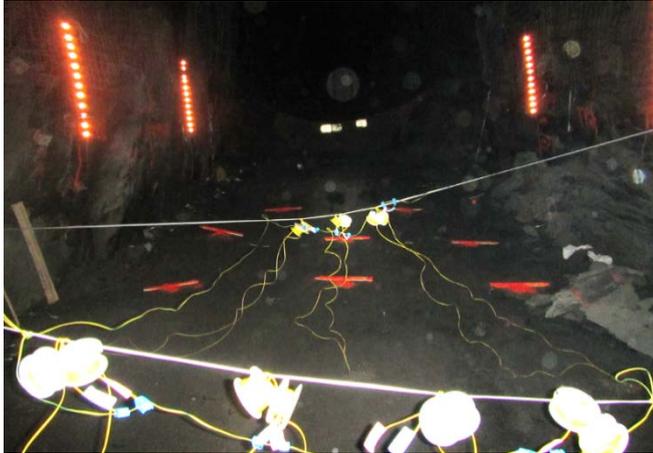


Figure 5 Looking back at the loaded wireless blast from the conventional wired mass blast. The red lighting indicates the position of the TRP loaded with WebGen™ primers

The WebGen™ system has proven itself as an enabler to modify an existing mining method utilized at Musselwhite and provide substantial improvements in safety, productivity and cost reduction.

Based on the success of the TRP method, two other mining methods have been successfully evaluated, including a Temporary Uphole Rib Pillar to improve recovery; and a Reverse Throw Retreat to improve ore recovery. Enhancements to other drill and blast geometries and mining methods utilized at Musselwhite are currently being explored.

Acknowledgements

Orica would like to recognize Steve Piercey, Orica's Senior Underground Blasting Specialist along with Bill Grace, Holly Robinson and the entire Musselwhite team for their relentless drive towards excellence. This achievement would not have been possible without collaboration and support from the customer, led by Musselwhite Mine General Manager, Peter Gula.

Disclaimer

© 2018 Orica Group. All rights reserved. All information contained in this document is provided for informational purposes only and is subject to change without notice. Since the Orica Group cannot anticipate or control the conditions under which this information and its products

may be used, each user should review the information in the specific context of the intended application. To the maximum extent permitted by law, the Orica Group specifically disclaims all warranties express or implied in law, including accuracy, non infringement, and implied warranties of merchantability or fitness for a particular purpose. The Orica Group specifically disclaims, and will not be responsible for, any liability or damages resulting from the use or reliance upon the information in this document.

The word Orica and the Ring device are trademarks of the Orica Group.