

Complex Stope Blasting while Collapsing Crown Pillars

Laverton, Western Australia

Site Profile

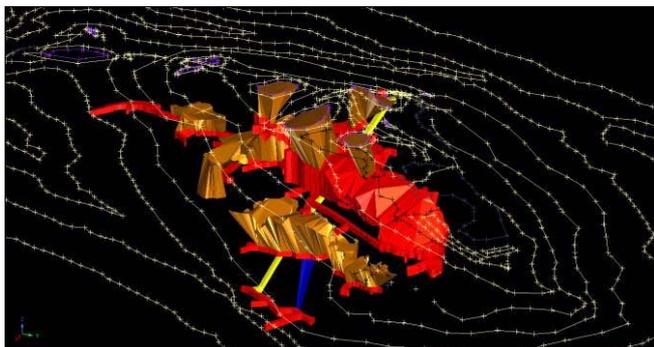
Crescent Gold's mining operations are based around the town of Laverton in the Northern Goldfields region of Western Australia. They run multiple pits ranging from 2km to 170km from the town.

Mary Mac Hill is located approximately 2km to the south west of Laverton and hosts a comprehensive network of underground workings dating back to the 1800's and last worked in the 1960's. With the current gold price, it became viable to re work Mary Mac Hill as an open pit operation.

The Situation

A comprehensive probe drilling program was commissioned to confirm the void model and various consultants were engaged to develop a suitable methodology and schedule.

A 3D void model was created (above) and showed that the initial crown pillar at the 507 RL did not have enough cover to meet the 2:1 ratio required by the contractor's standard operating procedure for working near voids. Various external consultants had been advising Crescent Gold on the approach required to drop the first crown pillar into the large open stope. The initial methodology and execution of the design did not provide a satisfactory result.

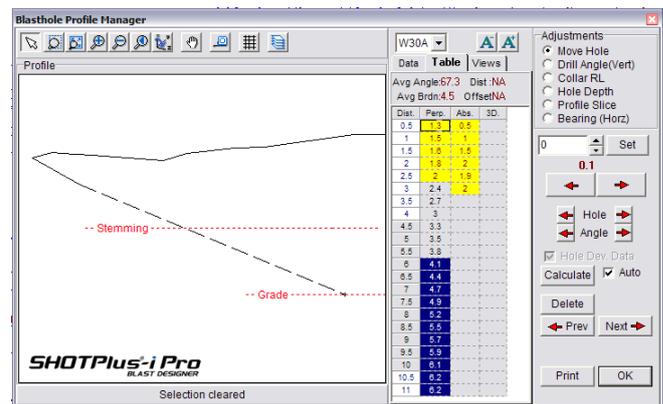


Orica were asked to provide a solution that would see the first crown pillar blasted in a safe and efficient manner, complying with vibration and airblast overpressure limits.

A Blast Quality Service (BQS) was provided encompassing design, on bench quality control, as drilled, as loaded and as fired data, to minimize the risk of an exceedence. With the successful firing of the first crown pillar OMS were then involved heavily from the onset to develop and execute a similar solution for the second crown pillar firing at the 485 RL.

Technical Solutions

As the crown pillar had been drilled to a previous design, Orica conducted a full risk assessment and requested that a complete down-hole survey be conducted. These results were then uploaded into Orica's SHOTPlus™-i Pro blast design software.



During the risk assessment process stemming and minimum burden criteria were identified as control measures. Stemming would be no less than 4 meters and minimum burden no less than 2m. Any holes that fell outside these criteria were not to be loaded. Both toe and collar burdens were checked and a loading design was created.

The drill design adopted was similar to a long hole open stop pattern, with hole diameters ranging from

89mm to 115mm and were anywhere from 3m to 24m long, with several breaking through into the void below.

The shot required comprehensive quality control to deliver precise gas bag placement and toe stemming.



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253 sub horizontal holes, up to 24m long were loaded with Fortis™ Advantage 1.2 (1.2 g/cc) bulk product and i-kon™ programmable delay detonators.

The loading and firing was supervised by Orica personnel to ensure the shot was loaded to design; any areas where this could not happen were adjusted to stay within the parameters of the risk assessment. A total of 22,527kg of Fortis™ Advantage™ 12 (1.2 g/cc) was pumped; all holes were double primed using a total of 485 i-kon™ detonators.

The Result

The shot was fired using the i-kon™ SURBS (Surface Remote Blasting System) on the edge of the 1.4km exclusion zone. The crown pillar fractured but remained in place. The shot was monitored in 2 locations – in the town and on the town boundary. The readings were 118.7 dB(L) and 118.5 dB(L) respectively – both below the agreed limit of 120 dB(L). Although initial plans were for the pillar to drop, it remaining in place meant that grade control could be followed whilst mining continued around it.



As the Mary Mac pit deepened, Orica were requested to assist with design, loading and firing the second Crown Pillar at the 485 RL. Due to mine planning, this shot was a much more conventional design incorporating a Vertical Crater Retreat slot that fired into the void below with the surround holes firing towards the free face created.

As all holes were vertical, 17,145kg of Fortan™ Advantage 11 (1.1 g/cc) was used in conjunction with 262 i-kon™ programmable delay detonators. The 20m shot fired successfully filling the stope below enabling mining to commence immediately.



Testimonial

"Mary Mac Hill presented Crescent Gold with by far one of our most challenging deposits to date with a complex network of underground drives and stopes really testing the limits of Crescent Gold's technical expertise and experience level. The project was also subject to careful public scrutiny and restrictive blasting parameters due to its close proximity to the local community in Laverton. Orica were very successful in helping us mitigate our risk of noise exceedence and blasting overpressure concerns even having inherited an already drilled out mass blast which was quite different from the way they would have approached the problem. They were keen to impart a lot of their technical expertise onto both Crescent Gold and their contractors, schooling them in overpressure control, underground blast design principles and i-kon™ firing equipment and procedures. Orica's professional conduct, seamless synergy with our working groups, depth of their research and their attention to detail meant that we were quick to engage their help at the commencement of the second crown pillar blast. Involving them from the initial design phase proved to be much more successful than engaging them part way through. I



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would have no hesitation contracting Orica for any further technical blasting projects and look forward to a long and healthy relationship between our two companies.”

Tim Mullen – Planning Engineer, Crescent Gold

Acknowledgements

Orica wish to acknowledge support of Crescent Gold and Mining and Civil Australia, for what was definitely a team effort.



Mary Mac Hill prior to Crown pillar blasting.

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