

Fosterville Gold Mine – Transitioning from disseminated sulphide to a high-grade visible gold deposit

Nathan Phillips

Fosterville Gold Mine is a complex structurally controlled disseminated and vein-hosted gold deposit within Ordovician aged turbidite metasediments. Located 20km north east of Bendigo, Fosterville research often draws on the extensive histories of both Bendigo and Ballarat gold mining provinces.

The Fosterville goldfield was discovered in 1894 and within a 10 year gold rush produced 47koz of gold from open pit and minor underground oxide mining. Almost 100 years later, a number of ventures further explored the main gold trends producing 240koz from oxide heap leach production from 1988 to 2003. Towards the end of oxide mining in 2003, Perseverance Corporation conducted a sulphide gold feasibility study and established the BIOX® processing plant to liberate refractory gold from the arsenopyrite / pyrite ores.

Mining at Fosterville has been focussed underground since 2008, with the Phoenix and Harrier systems being the main focus of exploration and development. Both ore systems share similar geological settings, with mineralisation occurring between the Fosterville Anticline and Phoenix Syncline along the Fosterville Fault trend. Mined grade from both orebodies in the years between 2009 and 2014 achieved an average of 4.7g/t Au with production consisting of sulphide ore from surface to an approximately 800m depth below ground.

Fosterville Gold Mine celebrated production of its one millionth ounce of gold based firmly within this history of refractory sulphide gold mining. Compared with other Victorian gold mines, the disseminated nature of the sulphide gold allows for a deposit that exhibits low estimation variance combined with systems and processes established to accurately delineate the controlling structures. The systems in place had been established and worked for the majority of the 1 million produced ounces.

In late 2014 diamond drilling intercepts into the Lower Phoenix system started showing coarse visible gold hosted within quartz carbonate veins. Fosterville had several historic drill intercepts showing visible gold. However, the occurrences were found to be localised and were not reproducible with follow up drilling, so the initial intercept was received with some reservations as to the significance. Drill holes continued to target the Lower Phoenix mineral resource corridor with results continuing

to reveal the presence of a coarse gold orebody, growing in magnitude with each subsequent intercept.

By the end of 2016, Fosterville Gold Mine's Mineral Reserves increased from December 31, 2015 by 66% to 643,000 ounces of gold, with Mineral Reserve grade increasing by 27% to 9.2 g/t Au from 7.3 g/t Au (Fuller et al, 2017). These increases firmly secures Fosterville's position as one of the highest grade gold mines in the world and is on the back of sustained world class drill intercepts including 1,429 g/t Au over 15.15m (Estimated True Width "ETW"

4.97m), including 21,490 g/t Au over 0.6m in hole UDH1817, 12.5m @ 500.7 g/t Au (ETW 4.5m, UDH1501) and 19.0m @ 112.2 g/t Au (ETW* 11.9m, UDH1487).

Data about the new and exciting discovery couldn't be gathered fast enough, however established systems and processes throughout the Geology and Processing departments were not developed to handle a coarse gold environment. Change would be commensurate with the size and scale of the discovery, and new learnings would need to be implemented quickly to keep in front of a mining schedule that was focussed on producing tonnes due to the decreasing sulphide grades.

The challenge was to review and set new standards with regards to handling an orebody that transitioned the very nature of the gold being mined. This involved reviewing all steps in the estimation process including data capture and quality control and quality assurance through to mineral liberation through the mill. Difficulties also involved finding analogous orebodies that consisted of both free milling and refractory ores that were dealing with drill assays that were measured as percentages of gold.

REFERENCES

Fuller T. and Hann I. 2017, Report on the Mineral Resources & Mineral Reserves of The Fosterville Gold Mine, Victoria Australia. Effective date December 31, 2016. Prepared for Kirkland Lake Gold. Available on System for Electronic Document Analysis and Retrieval (SEDAR).