

https://dspace.org/

Research report into the use of portable x-ray fluorescence technology at Styldrift I Mine; Western Bushveld Complex; South Africa: Identification of small-scale mineralization variation of Merensky Reef facies types using handheld XRF analyzer and statistical correlation analyses between platinum group elements and base metals for the purpose of underground stope cut optimization

Moodley, Yusavia

2017

http://hdl.handle.net/10539/23617

Moodley, Yusavia (2017) Research report into the use of portable x-ray fluorescence technology at Styldrift I Mine; Western Bushveld Complex; South Africa, University of the Witwatersrand, Johannesburg, <http://hdl.handle.net/10539/23617>

Downloaded from a DSpace repository. https://dspace.org/

Abstract

The Merensky Reef vertical grade distribution is highly variable within Styldrift I Mine. The variable nature of the Merensky Reef mineralisation necessitates regular and timeous updating of the planned mining cut with sampling information so that the optimum can be applied during mining operations. The current geochemical assay analysis that is used for the analysis of platinum group elements (PGEs) has been proven to be accurate and precise however it is expensive with long turn-around times from the laboratory. Portable X-ray fluorescence (pXRF) technology has been tested as an alternative to measure the platinum group element content along the Merensky Reef. pXRF technology cannot accurately measure PGE content directly. Copper and nickel are detectable by the pXRF analyser and, like PGEs, copper and nickel mineralisation peaks along Merensky Reef horizon. Copper and nickel were therefore tested as potential pathfinder elements to target PGE mineralisation along the Merensky Unit. The testing of the pXRF analyser was undertaken by analysing the accuracy of the results it produces as well as determining if a regression between copper/nickel to PGE content is possible along the Merensky Unit. The pXRF did not produce results of adequate accuracy as a consistent significant bias was detected with pXRF results which were consistently lower than laboratory results. Calibration of the pXRF using site specific samples was not sufficient to overcome the bias. Regressions from copper/nickel to PGEs were tested for the Merensky Footwall which could be isolated as a single data population. Significant outliers exist that do not fit the regression analysis due to the inconsistent PGE modes of occurrence along the Merensky Unit. Application of the pXRF to the study area therefore does not meet the required conditions. An underground trial of the pXRF has indicated that peaks in pXRF copper and nickel results often, but not always, coincide with peaks in PGE mineralisation. The pXRF can therefore be used as a low confidence indicator of PGE mineralisation however the user must be aware of the limitations of the instrument. pXRF analysis cannot be used reliably therefore geochemical assay analysis remains the most reliable method to analyse PGE content at Styldrift I Mine.