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Critical aspects in the estimation of Mineral Resources for Narrow Tabular PGM Deposits

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PGM deposits occur in a number of deposit styles with the bulk of Southern African production being sourced from layered igneous complexes. The focuses of this paper are the critical aspects of the estimation of narrow tabular PGM deposits of the Bushveld Complex (Merensky Reef and UG2 Chromitite Layer) and Great Dyke (Main Sulphide Zone). The characteristics that make these deposits unique are the incredible continuity of geology and grade within the layered complexes, the mineralisation is not constrained to a single lithology and the mineralisation includes the PGM, Au, Cu, Ni and Cr in various proportions. The economic mineralisation is typically a subset of the geological mineralisation. The economics of these deposits is reliant on the exploitation of all of the precious and base metals.

The estimation of the Mineral Resources of these deposits requires attention to the same sampling and exploration details as other metalliferous projects e.g. sampling, geochemistry, QA/QC, density, estimation techniques etc. However, the first critical aspect in the estimation is the determination of the probable "cut". Because the mineralisation is often distributed over a number of lithologies and additionally parts of the distribution are sub economic, the identification of the "cut" that would be potentially mined is the typical first step as illustrated in Figure 1. The device used is a horizontal bar chart of the grade (or multi-element composite), presented next to the geological log, showing the grade distribution. This technique is commonly known as a grade histogram.
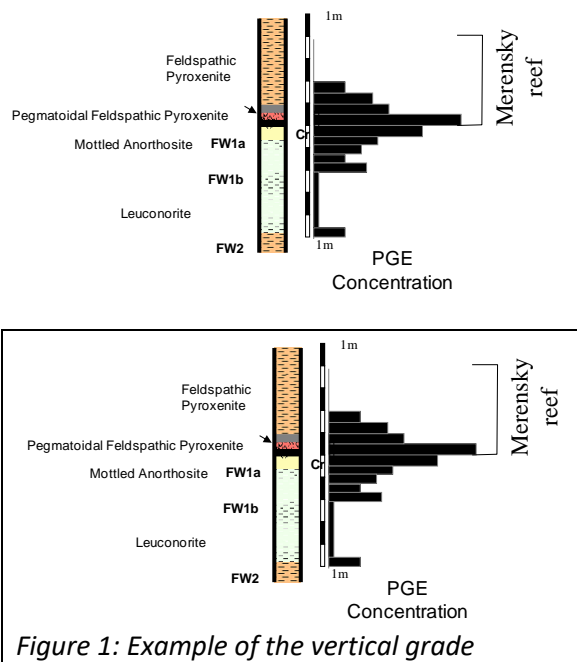

Figure 1: Example of the vertical grade

distribution (histogram) of the Merensky Reef The "cut" is generally referenced to a marker within the package such as the top or bottom chromitite for the Merensky Reef or the sulphide peak for the MSZ. The position of the best cut relative to the identified marker may change in different parts of the deposit. It is critical to understand this component and consider domaining for the optimal resource estimation strategy. The determination of the best cut is an iterative process which is considered important prior to consideration of any other work. This requires the application of scientific, engineering and economic aspects to the modelling process at an early stage.

Subsequently, the selection of the estimation methodology appropriate to that specific deposit whether using it is Ordinary Kriging, Lognormal Kriging, Inverse distance weighted or even a weighted average, is required. The thesis of this paper is that without the appropriate determination of the "cut", the subsequent modelling could result in a poor estimate. The corollary to this is that with appropriate "cut" determination and domaining, a good estimate can be assured that would be not materially different if other estimation techniques had been used.