Ore Geology Reviews 142 (2022) 104719

Contents lists available at ScienceDirect

Ore Geology Reviews

journal homepage: www.elsevier.com/locate/oregeorev

The influence of variable anisotropic search parameters on implicitly-modelled volumes and estimated contained metal in a structurally-complex gold deposit

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ARTICLE INFO

Keywords:
Implicit Modelling
Structural Analysis
Resource Estimation
Birimian
Gold

ABSTRACT

Modelling and subsequent estimation of an orebody are necessary for the financial assessment of exploration and mining projects. Potentially exploitable resources are increasingly deep and structurally complex, necessitating better-constrained geological models. Where these prospects and deposits occur in a structurally-complex terrane, it is best-practice to undertake a rigorous structural analysis and to incorporate this into the resultant 3D model. A review of a random selection of Competent Person reports, on projects situated in the Birimian of West Africa, indicates that there is little to no structural analysis incorporated into the great majority of their underlying 3D models, despite their situation in a structurally-complex terrane. A sub-suite of data from a Birimian-style Au deposit was subjected to numerous modelling iterations wherein several parameters were systematically and incrementally applied across a series of implicit models. This produced a range of mineralized volumes, which vary significantly from the geometry of the ground-truthed volume that has been established by pit mapping, structural analysis, mining and ongoing reconciliation. Comparison of these varying parameters and their resultant volumes to the ground-truthed volume demonstrates volume inflation of 18% to 40%. This volume inflation is also reflected in contained Au ounces, which were determined for a sub-suite of the implicit models. Notable outliers reflect parameters that produce shapes that are similar to subvertical, tabular mineralized zones, which is a geometry that repeatedly appears in MRE reports on structurally-complex Au - and other precious metal - deposits and prospects. Such geometries are produced by explicit modelling using cross-sections, very often with the erroneous cognitive bias of connecting grade intervals at high angles between drillholes. Exaggerated continuity, interconnectivity and an inflation of volume in these simplistic mineralized zones translate into an overestimation of contained Au ounces, which is reflected in historical surveys of mine development and reconciliation.

1. Introduction

Initiation and continuation of mining operations require large amounts of capital expenditure. To minimize the risks inherent in these ventures, companies and investors are required to prepare formal reports that present Mineral Resource Estimations (MREs), Pre-Feasibility Studies (PFS) and Feasibility Studies (FS; see Dowd, 1994; Sinclair and Valee, 1994; Vallée, 2000; Weatherstone, 2008). These rely on an appropriate level of geoscientific knowledge and confidence in the underlying data and its interpretation, as well as the application of engineering and commercial factors. Long-term mine planning and cash-flow forward modelling, which are based on block models derived from these 3D models, are crucial for mining operations (Fig. 1; e.g. Koushavand and Askari-Nasab, 2010).

To achieve a standardized set of classifications, representative bodies from Australia, Canada, South Africa, the USA and the UK have developed international reporting standards for mineral resources and reserves on various stock exchanges, such as the Canadian CIM guidelines, the Australian Joint Ore Reserves Committee Code (JORC 2012) and the South African Code for the Reporting of Mineral Resources and Mineral Reserves (SAMREC). These guidelines provide the minimum standards and recommendations for public reporting of Exploration Results,

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https://doi.org/10.1016/j.oregeorev.2022.104719
Received 28 July 2021; Received in revised form 11 January 2022; Accepted 17 January 2022
Available online 21 January 2022
0169-1368/