# Assembling the geological complexity to mineral resources classification

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# ABSTRACT

The principle of transparency is an essential grounding in reporting mineral resources and ore reserves. In this sense, disclosing all criteria used for categorizing mineral inventory into confidence classes is of paramount importance in the declaration of mineral inventory. Although, assigning a risk category to a resource may be critical as the reporting codes cannot standardize generical rules of whether a material should be classified as measured, indicated, or inferred. The decisions should account for geological, technical, and operational factors considering the inherent differences between deposits. This lack of objective guidance allows a certain degree of subjectiveness in categorization, especially when quantifying the risk regarding geological interpretation. Its common sense that 3D representation of geological shapes significantly contributes to the overall uncertainty of the metal prediction. The greater the geometrical complexity, the greater the risk of domain misinterpretation. Thus, it is discussed in this work alternatives to assess geological complexity by combining geometrical, geostatistical, and mathematical tools to overcome subjectiveness in decision-making. Firstly, the anisotropic continuity approach uses functions such as variograms to quantitatively analyze the local mineralization continuity. The workflow consists in quantify indicator variogram ranges at different structural domains. The geological complexity is assumed as inversely related to the anisotropy ranges. Another technique consists in applying morphological operations to image scanning. Morphological erosion steps are performed over a grid until the entire domain gets eroded. The process creates contrasting results when applied to simple or complex images, and the shape complexity is assessed by calculating the number of iterations required to erode a grid node. The third approach based on signed distance functions. These are widely used in implicit modeling algorithms and assessments of geological model uncertainty. Multiple realizations of the signed distance functions are simulated to produce equiprobable boundaries of a given domain. Thus, the simulations dispersion provides a direct measure of the interpretation risk due to inherent geometrical complexity. Ultimately, the angular gradient approach has been used to map sudden variations in the model´s directions. According to the angular relations between structural domains, variations in the continuity directions are transformed in gradients from zero to one. Highly deformed regions show greater variability on simulated angular gradients. This study demonstrates the techniques applied to a hypothetical case and then discusses the results for a real structurally complex gold deposit.