GOLD AND PLATINUM-GROUP ELEMENT CONTAINING MINERALS - REFLECTIONS ON THE RELIABILITY OF OBSERVATIONS

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The textural settings of gold and platinum-group minerals (PGM) in different ores, the grain sizes of these valuable minerals, and variations in the modal proportions of different phases are important factors for the evaluation of such ores. Variations of these parameters are not only studied because they affect beneficiation, but also because they reflect changes in the intrinsic conditions under which the ores formed or equilibrated. In order to come to meaningful genetical interpretations, it is of paramount importance to evaluate the statistical reliability of mineralogical observations and to assess to what degree apparent differences may be due to chance.

In this presentation, data sets on gold grains from the Witwatersrand basin (N = 1340), as well as PGM from the UG-2 chromitite layer of the Bushveld Complex (N = 3444) and from a massive Ni-Cu sulphide ore body at Uitkomst (N = 1161) are used to evaluate the relationship between number of observations and the inherent errors of evaluating sizes, textural settings, and modal proportions of these minerals. In addition, PGM compositions are used to evaluate the relationship between number of analyses and the possibility to safely detect systematic differences of the same PGM between different chromitite layers in the Bushveld Complex.

Because of the log-normal size distributions of the grains evaluated and systematic size differences between mineral species, reporting mineralogical proportions based on number of grains is misleading and must be avoided. It is demonstrated that even large data sets with several hundred documented grains may be insufficient to achieve reasonable statistical security for deductions about mineralogical differences
in PGM assemblages. In addition, "snuggets" (i.e., unusually large grains of a mineral species) have a pronounced effect on estimating modal proportions, which leads to an overestimation of the reliability of data if too few grains are considered.

The evaluation of laurite analyses from different chromitite layers of the Bushveld Complex demonstrates that the detection of systematic differences may require in access of 150 analyses per layer.

It appears that many mineralogical descriptions of gold and PGE ores may be based on insufficiently large data sets and therefore limit the reliability of genetic interpretations. Only very large data sets afford the possibility to evaluate to what degree conclusions on compositional differences, or differences in mineralogy and textural settings, are an over-interpretation or not.