

Managing Sample Distribution in Strongly Deformed Orebodies: Development of a Spatial Adherence Analysis Tool

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Diamond drilling is a key mechanism for subsurface geological investigation, essential for determining the geometry, thickness, grades, and other characteristics of mineralized bodies. The spatial distribution of samples resulting from drilling has significant implications for geological modeling and resource estimation, consequently impacting the entire subsequent chain in the mining sector. In this context, the spatial adherence of drill holes to the planned trajectory is directly related to the reliability of the mineralized body geometry and grade distribution, especially in the case of highly deformed bodies. Given the frequent deviation of drill holes, particularly the longer ones, and the industry's lack of tools to analyze spatial adherence in real time for route correction, this study proposes a semi-automated methodology for such monitoring. The research presents the implementation and results of the method at the Cuiabá mine, a world-class orogenic gold deposit in operation since 1984 and currently at 1,600 meters depth. Hosted in the Archean Rio das Velhas Greenstone Belt, the deposit is located in the Quadrilátero Ferrífero, Minas Gerais, one of Brazil's main metallogenic provinces. Due to the folded geometry of the orebody, which has undergone multiple deformation phases, rigorous monitoring of drilling adherence and sample distribution involves systematic comparisons between planned and executed holes. The results highlight impacts on orebody thickness and metal recovery, as well as parameters such as the distance between hole endpoints, distance between intercepts within the orebody, between collars, and comparisons of dip and azimuth in the holes. Generated on a monthly basis, the results demonstrated great effectiveness in improving the accuracy of sampling distribution across the deposit. Moreover, they enabled advances in the mineral exploration of a deposit that has been in operation for 42 years, as well as in its surrounding areas, while highlighting a high potential for application in other localities.