**Semi-Automated Fracture Characterization to Optimize Dimension Stone Mining**

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# ABSTRACT

The characterization of structural discontinuities in dimension stone mining is essential to optimize block extraction, maximizing recovery, and enhancing economic viability. In dimension stone mining, the recovery rates are typically very low, while the selling price of high-value rock materials can be extremely high. Therefore, improving recovery can lead to significant economic and environmental benefits. This study investigates the application of high-resolution aerial photogrammetry combined with specialized software to automate the identification, mapping, and characterization of discontinuities within dimension stone operations. Discontinuities are accurately mapped and represented in three-dimensional models, which detail the geometry and orientation of each fracture plane. These models allow for comprehensive analyses of fracture orientations, enabling precise measurement of dip angles, persistence, and other relevant spatial metrics. Results demonstrate the methodology’s ability to precisely identify main structural features, which facilitates extraction planning to optimize block recovery and minimize waste generation. By integrating these analyses, the study explores the potential to reorient quarry fronts based on dominant fracture orientations. This strategy aims to enhance recovery rates by aligning extraction operations with favorable structural configurations, reducing material losses. Additionally, the generation of stereographic projections provides an overview of dominant fracture orientations across the deposit, supporting extraction strategies that improve operational efficiency and block integrity. This methodology not only enhances recovery but also promotes sustainable resource management practices by reducing waste generation and inefficient resource use. While challenges persist, particularly in processing large datasets, the findings highlight the significant potential of this approach to improve both productivity and sustainability in dimensional stone mining. Consequently, this approach not only supports sustainable practices in the dimension stone industry by optimizing the recovery process but also contributes to reducing the environmental impact associated with waste generation and inefficient resource use.