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Enhancing Iron Ore Delineation through Ground Geophysics on Near-Surface Deposits

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Introduction

Geophysics plays an important role in mineral exploration, offering valuable support for reducing drilling risks, guiding target definition, and improving understanding of orebody geometry.

This work presents two case studies involving the use of ground geophysical methods: one aimed at characterizing a colluvial deposit in an inactive iron mine, and another focused on estimating the thickness of an iron-rich layer in a tailing reservoir. In both cases, the materials studied have high iron content, representing opportunities to increase production without the need to develop new mining fronts.

Method and/or Theory

The studies combined electrical and seismic geophysical techniques. The results were cross validated with drilling and chemical analyses, which helped refine the acquisition parameters. Electrical resistivity tomography (ERT) was applied using dipole-dipole and Schlumberger arrays, with electrode spacing ranging from 2.5 to 5 meters, depending on the site conditions. Seismic data were acquired using the Horizontal-to-Vertical Spectral Ratio (HVSR) and Multichannel Analysis of Surface Waves (MASW) methods.

Results and Conclusions

The results demonstrated that geophysical methods are effective in delineating iron-rich surface materials such as colluvial deposits and tailings reservoir geometry. Despite the natural variability of these deposits, the geophysical profiles showed strong agreement with borehole descriptions and chemical data. The use of geophysics proved to be a practical and cost-effective approach, allowing for broader area coverage and reducing the need for extensive drilling campaigns.