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Well Logging as a Tool for Detailed Subsurface Characterization and Mineralization Analysis in the Tapira Mining Complex (MG), Brazil.

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Introduction

Well logging plays a crucial role in mining as they provide efficient, detailed and cost-effective rock data for the exploration and characterization of mineral deposits. Geophysical data makes it possible to delineate mineralized horizons and calculate the volume and quality of deposits, providing valuable support for mine planning and decision making. Although the collection of drill cores provides accurate data, it is not always possible due to high costs and operational constraints. Geophysical logging fills this gap by providing an indirect but extensive view of the subsurface in places where drill cores are not available.

Method

The application of geophysical logging, in particular bulk density and natural gamma tools, made it possible to obtain continuous profiles from three drill holes in the Tapira Mining Complex (CMT), to identify the phosphate and titanium mineralization zones and to differentiate the weathering horizons based on their mechanical properties. The geophysical data were correlated with petrographic and lithogeochemical analyzes, providing a detailed insight into the composition and structure of the weathering horizons. This integrated approach is essential to understand the formation and evolution processes of the weathering mantle and to identify zones of economic interest in the CMT.

Results and Conclusions

Phosphate ore was identified in the basal isalterite horizon and was characterized by density values close to 2.5 g/cm3, reaching values above 3.0 g/cm3 due to the apatite-rich levels. The natural gamma profile was useful to separate the alteration horizons as it showed low values in highly leached areas and high values in the lower horizons due to dissolution and precipitation of mobile chemical elements. The macroscopic and petrographic description of the drill cores allowed the detailed study of the structures and textures of bebedourites and carbonatites as well as the generations of phlogopite-picrite, and carbonatite veins. It is concluded that the integration of these techniques was effective for the characterization of the CMT horizons and provided a detailed understanding of the lithological variations and their properties.