



## **Geophysical investigations in support to elaboration of a mining plan in a Marble mine in the Campos do Jordão region, SP**

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### **Abstract**

Small Scale Mining (SSM) is responsible for practically all the production of non-metallic mineral substances in the world and it represents around 70% of mining in Brazil. The SSMS are characterized by the high level of informality associated with the predatory exploration techniques, use of equipment with low technological level, limited financial resources and lack of investments in research focused on geological characterization. The high level of geological uncertainty increases the risk of investments in SSM projects. Additionally, the lack of geological information contributes to the low productivity, leads to an increase in production costs and maximizes the generation of waste resulting from exploratory activity, besides to increased environmental impact. The geological characterization of the deposit should guide the process of mineral extraction. The application of geophysical methods in mineral exploration consists of a resource that optimize the production. In this research, the geophysical methods Resistivity, Capacitive Resistivity, Ground Penetrating Radar (GPR) and Time Domain Electromagnetic (TDEM) were used to characterize a deposit of ornamental rocks (marble) in a Small Scale Mining located in the Campos do Jordão region, São Paulo state, Brazil. Resistivity data were acquired from electrical profiles and vertical electrical sounding techniques. The geoelectric models permitted to locate marble packages, as well as fracture zones. The TDEM soundings permitted to investigate up to hundreds of meters deep. GPR profiles were acquired in the area around the quarry and on benches in front of the mine in order to investigate the occurrence of structural discontinuities inside massive blocks. At the mining front, the 3D GPR models permitted to evaluate the distribution of structural discontinuities inside the marble blocks. Lithological informations from boreholes were provided by the mining company and they were used to aid the interpretation of geophysical results. The integration of geophysical results and geological information permitted to the mapping of marble packages in the subsurface up to tens of meters deep. Micromine software was used to develop a 3D geological model and a conceptual model of pit. The conceptual pit model estimated the extraction of 2.344.525 tons of marble. The geological and pit models permitted to infer reserve and analyze the economic potential of the deposit. The results demonstrate how the investment in geophysical research can help in the modernization process of SSMS and contribute to making them more efficient and sustainable enterprises.