



Geophysical investigation of the down-dip extension of the Lombador massive sulphide deposit, Neves-Corvo, Portugal

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Abstract

The 150 Mt Lombador massive sulphide deposit is one of the seven known deposits of the Neves-Corvo mine. The deposit dips approximately 30°–35° to the NE and is open down dip, with current exploitation reaching down at 1 km depth. To investigate the possible downwards continuation of the deposit, a 1D constrained inversion of time-domain electromagnetic (TEM) ground loop data was conducted, followed by 3D electromagnetic (EM) forward modeling and a constrained 3D gravimetric inversion over the same area. To perform the EM and gravity modeling/inversion, a 3D geologic model was built using a density database comprising of approximately 300 drill-holes, and an electrical conductivity database with measurements from resistivity surveys and 1D inversion of the TEM data. The EM modeling shows that the Neves Formation shales are a regional conductive layer extending down to approximately 1.6 km depth in the Lombador area. This layer, often topped by massive sulphides, has an average density of 2.83 g/cm³, whereas stockwork and massive sulphide reach on average 3.1 g/cm³ and 4.5 g/cm³, respectively. The 3D constrained gravity inversion results do not support the hypothesis of the presence of massive sulphides located in the down-dip direction of the Lombador deposit in the immediate vicinity of the known deposit. The lack of spatial resolution of the gravity grid, the study area limited size and the lack of information from within the basement suggest further studies are required to confirm the presence and amount of stockwork mineralization down-dip the Lombador deposit inside the Neves-Formation or the Phyllite-Quartzite basement.

Keywords Neves-corvo mine · 3D electromagnetic forward modeling · 3D gravity inversion · 2D seismic reflection · Massive sulphides · Lombador deposit · Stockwork mineralization

Introduction

The Neves-Corvo mine, located in the Iberian Pyrite Belt in southern Portugal (Fig. 1) is a world-class volcanogenic massive sulphides (VMS) deposit and the largest operating

mine in the country. Seven massive sulphide bodies have been discovered up to date (Fig. 1), of which two remain open at depth. The tier-one, 150 Mt Lombador deposit is one of these two deposits, with the present exploitation depth of about 1 km below the surface. The lens dips approximately at 30°–35° to NE, and a few sparse underground drill-holes recently drilled do not show the presence of stockwork mineralization below the current exploration depth of 1 km. Therefore, to investigate the Lombador down-dip extension of the mineralization, a 1D constrained inversion of time-domain ground loop electromagnetic data (TEM) followed by 3D electromagnetic (EM) forward modeling and the 3D inversion of land gravity data has been carried out in a coincident area. This approach of using combined electrical/EM/gravity methods and geological data has led in the past to the discovery of several of the currently known deposits (e.g. Marques et al. 2019).

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