



# A drill-hole, geological and geophysical data-based 3D model for target generation in Neves-Corvo mine region, Portugal

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## Abstract

The Neves-Corvo world class Iberian Pyrite Belt volcanogenic massive sulphide (VMS) deposit located in southern Portugal, constitutes an important Cu–Zn–Pb active mine. Seven deposits are currently known, among which the Lombador deposit alone has estimated 150 Mt of massive sulphides. The life-time of the mine is dependent on the discovery of new exploration targets and it is vital to have accurate 3D geological models, not only to guide drilling campaigns but also to drive a winning/new strategy, which in the past has led to Semblana and Monte Branco discoveries: geophysical inversion and modelling. Furthermore, 3D geological models can contribute to the understanding of the tectonic and stratigraphic evolution of the region. Therefore, the goal of this study is to produce a realistic 3D geological model of the Neves-Corvo region, as only one model is presently publicly available: the PROMINE model, which includes the study area of this work and extends from Aljustrel to the border with Spain. Lundin Mining has also produced two unpublished, confidential models in 2007 and 2017. The latest Lundin model incorporates the same geophysical data used in this work (2D and 3D seismic reflection and time-domain electromagnetic (TEM) ground loop data) and approximately 7500 surface and underground drill-holes. The model presented in this research has much more detail than the 2012 PROMINE model in the Neves-Corvo region and uses an updated and revised drill-hole database with approximately 8000 drill-holes, revised geological cross-sections built from surface geology and drill-hole logs, new geological outcrop data, petrophysical and reprocessed geophysical data, and is therefore more detailed and accurate than any of the previous models, in particular the 2007 and PROMINE models. Land gravimetric and aeromagnetic data are also available in the study area but were not directly used to build the geological model but rather to investigate and check the model produced. Modelling was performed with industry standard software and the 3D curves resulting from the geological/geophysical interpretation were interpolated using different approaches to respect the hard data (interpretation lines and drill-holes). The resulting 3D stratigraphic surfaces required strong manual editing to respect the interpretation, due to the presence of folds, thrusts and tectonic nappes in the study area. The surfaces were afterwards tied to the drill-holes, resulting in a 3D model with great accuracy and detail in the near mining area and covering a larger area than previously available 3D geological models. The model has three major stratigraphic layers: the Mértola Flysch Formation and the Volcano-Sedimentary Complex (VSC), overlying the Phyllite-Quartzite Formation basement, and also the known VMS deposits (underlying the top of the Lower VSC) geometries according to drill-hole data. In the central part of the study area, where more drill-holes are available, the top of the Lower VSC sequence surface was also built. This approach will contribute to a better exploration drill-hole planning and the generation of new targets for exploration.

**Keywords** 3D geological modelling · Neves-Corvo mine · Drill-holes · Time-domain electromagnetic data · Seismic reflection data · Bouguer anomaly · Total-field magnetic intensity

## Introduction

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

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