

Processing and interpretation of gravity, magnetic and radiometric data of the Neves-Corvo region, Iberian Pyrite Belt, Portugal

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The goal of this work is to contribute to the geological knowledge of the northern sector of the Neves-Corvo mine (Iberian Pyrite Belt, a VMS world class metallogenetic province) through the use of geophysical methods (gravity ground surveys, seismic reflection, EM profiles and airborne magnetic/radiometric – K, U, Th and Total Count), geological and mining mapping and drill-hole data. The Neves-Corvo deposit includes presently 7 massive sulphide ore lenses, 5 of which are being mined (massive+stockwork ores). The expected life-time of the mine is about 15 years and therefore, the discovery of new orebodies is extremely important to extend the mine's life-time. In this study, supported by the EXPLORA/Alentejo2020 project, we performed 3D magnetic and gravimetric modeling/inversion using an updated 3D geological model of the area. This model considers the high resolution stratigraphy of the existing Carboniferous and Devonian geological formations: Mértola Fm. (Baixo Alentejo Flysch Group), Volcano-Sedimentary Complex (VSC) and Phyllite-Quartzite Group (PQ). The available density database has been updated to more than 30 000 measurements and a new magnetic susceptibility database was built from drill-hole and surface rock measurements to assist with the modeling procedure. The 3D geological model has been built using recent drilling results up to 1 500 m deep, surface geological data, 2D legacy seismic reflection data, 2D and 3D seismic reflection data acquired in 2012, and the interpretation of potential-field data. For the latter, the gravimetric ground data, which is a combination of different surveys carried out from the 1970's until the 1990's, has been checked and re-leveled. The preliminary modeling results related with the gravity field show the NW-SE Rosário-Neves-Corvo VSC-PQ antiform and the structural control by NW-SE thrust faults and late E-W, N-S and NE-SW strike-slip faults. Large areas are covered with Mértola Fm. flysch sediments, conditioning the gravity field. In this geological setting, particular gravity anomalies can be associated with the massive ore lenses, with emphasis on the most superficial orebodies (Neves, Graça, Corvo and Zambujal). However, available 1D inverted TEM and seismic reflection data suggest a strong structural imprint on the gravity data. In the NW of Neves-Corvo, several promising gravity anomalies were identified that can be followed in the near future. The magnetic survey shows NW-SE lineaments linked with the basic rocks and jaspers with disseminated magnetite and pyrrhotite that occur in the VSC sequence. No important magnetic anomalies are linked with the Neves-Corvo deposit. At the mine site the existing spot-like magnetic anomaly is directly associated with the mine ore mill and processing plant. Several reflectors are defined by the seismic profiles linked with thrust fault planes and the presence of lithological discontinuities, e.g. ore lenses and volcanic/sediments contacts. The radiometric survey shows a good correlation with the geological mapping. Hydrothermal alteration results in K rich felsic rocks in the Rosário-Neves-Corvo structure and well reflected in radiometric mapping. Geophysics is one of the goals of the EXPLORA project, considering the best geological near mining scenarios. Other vectors are included in the project, like geochemistry and high resolution stratigraphy.