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Massive sulfide exploration models of the Iberian Pyrite Belt Neves Corvo mine region, based in a 3D geological, geophysical and geochemical ProMine study

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The Iberian Pyrite Belt (IPB) hosts one of the largest concentrations of massive sulfides in the Earth's crust. This highly productive VMS belt contains more than 85 massive sulfide deposits, totalling an estimate of 1600 Mt of massive ore and about 250 Mt of stockwork ore (Leistel et al., 1998; Oliveira et al., 2005; Tornos, 2006). Included in the South Portuguese Zone the IPB is represented by the Phyllite [U+2010] Quartzite Group (PQG) composed of shales and quartzites of late Devonian age followed by the Volcanic [U+2010] Sedimentary Complex (VSC) a submarine succession of sediments and felsic and basic volcanic rocks (late Famennian-late Viséan age). Above the IPB a turbidite sedimentary unit occurs being represented by the Baixo Alentejo Flysch Group (BAFG). The ore deposits are hosted by felsic volcanic rocks and sediments that are dominant in the lower part of the VSC succession. The Neves Corvo (ProMine, EU FP7) project area is focused on the Neves Corvo deposit, an active copper mine. The project area is located between the Messejana Fault and the Portuguese/Spanish border which has been selected for the 3D geological and geophysical modelling study, based on high exploration potential of the Neves Corvo area (Oliveira et al. 2006, Relvas et al. 2006, Pereira et al. 2008, Rosa et al. 2008, Matos et al. 2011, Oliveira et al. 2013). In this study existing LNEG and AGC geological, geophysical and geochemistry databases were considered. New surveys were done: i) - A physical volcanology and palynostratigraphic age data study and log of the Cotovio drill-hole core (1,888 m, drilled by AGC). ii) - Interpretation of 280 km of Squid TEM performed by AGC. Based on the TEM data, significant conductors have been identified related with: shallow conductive cover, graphitic shale, black shale and sulphide mineralizations. The most important TEM conductors are related with the Neves Corvo massive sulphides lenses (1-10 Ω m). iii) - Ground and residual gravimetry studies including superficial directional derivatives to obtain the various directions of the late-Variscan faults, the main overthrusts and lithological structures. iv) - Detailed palynological sediment dating; v) - A seismic survey was conducted in the vicinities of the Neves Corvo mine totalling 82 km of profiles with target depth of over 10 km.

A 3D regional model has been constructed for the selected IPB area using GoCAD, integrating the most critical information of the follow geological units: the lower unit BAFG Mértola Formation, the VSC, the Neves Corvo ores and the PQG. It incorporated surface regional geological maps, 168 drill-hole geological logs throughout the area, structural and tectonic data, former seismic sections, where available, and a digital terrain model. Chemical data from 42 selected drill-holes in order to outline in 3D the Cu distribution in the area. The results have already indicated new important guidelines for VHMS exploration and new regional correlations with the Neves Corvo mining area. The 3D modelling study was essential to the detail understanding of the complex IPB geological structures observed in the south of Portugal.