



## **Acid sulphate alteration at the Lagoa Salgada, Aljustrel and São Domingos VMS deposits, Iberian Pyrite Belt, Portugal: mineral exploration guidelines**

João Xavier Matos (1), Fernando J.A.S. Barriga (2), and Jorge M.R.S. Relvas (2)

(1) Laboratório Nacional de Energia e Geologia, I.P. (Portuguese Geological Survey), Unidade de Recursos Minerais e Geofísica, Aljustrel, Portugal (joao.matos@lneg.pt), (2) Instituto Dom Luiz, Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal

A detailed study was performed at the Lagoa Salgada, Aljustrel (Algaes and São João orebodies) and São Domingos VMS deposits, located in the Portuguese part of the Iberian Pyrite Belt. The research was based on extensive mapping and drill hole logging of the ore-hosting geological units, structural and stratigraphic settings, outcropping mineralization, and hydrothermal and supergene alteration zonation. At the Aljustrel mine, a near surface mine gallery was additionally studied. The research methods used include sample optical inspection under the microscope and mineral identification and mineral chemistry studies based on EPMA, PIMA II (Portable Infrared Mineral Analyzer), and XRD analyses. The PIMA VIEW software was used, following the principles and procedures described by Horsfall (1999). The analytical work was run at the laboratories of both LNEG and Faculty of Sciences of the University of Lisbon.

The acid sulphate alteration was characterized and correlated with the supergene kaolinite-halloysite alteration observed. The supergene alteration decreases with depth and distance to the massive sulphide orebodies. Nevertheless, the primary volcanic textures of their host rocks are often partially preserved, despite the common replacement of hydrothermal phyllosilicates by clays. Regardless of the intensity of kaolinization, several different alunite vein generations were recognized, as follows: I) deformed, syn-tectonic veins, sub-parallel to the main cleavage and to shear zones; IIa) deformed veins, oblique to cleavage, usually with ptygmatic folding; IIb) sub-horizontal vein networks; III) sub-vertical veins associated with late strike-slip faults. The vein-filling mineral assemblage includes alunite, natroalunite, minamiite, natrojarosite, jarosite and wavellite. The alunite veins occur commonly associated with the gossans, but can also occur below the oxidation level, cutting the orebodies, in direct contact with massive sulphides. Jarosite veins of stages I, IIa and III are relatively scarce and occur only in the supergene alteration settings. The occurrence of Al-bearing sulphates is consistent with low temperature circulation of very acidic and oxidizing fluids, under both syn/late-Variscan, and Alpine tectonic regimes.

The occurrence of alunite veins and strong kaolinization of volcanic rocks and gossans observed at the Lagoa Salgada, Algaes, São João and São Domingos deposits are considered an useful exploration guide both for outcropping, and for near surface massive sulphide targets (e.g. Lagoa Salgada hidden deposit, bellow Cenozoic sediments). At least the first stage of the sulphate veins should predate the kaolinite-halloysite supergene alteration, interpreted as certainly hypogenic, probably syn-tectonic. Evidences supporting this model include: i) the occurrence of alunite veins in deep, non-oxidized horizons, in poorly kaolinized volcanic rocks observed at S. Domingos and Lagoa Salgada; ii) the strong deformation and structural control of the stage I alunite veins, which occur parallel to the cleavage S1 and are locally affected by the subsequent S2 cleavage. The evolution of the morphology and distribution of the veins from stage I to stage IIb (formation of vein networks) suggest significant fluid pressure control, and is consistent with a progressive deformation model for their build-up history. Acknowledgement: publication supported by FCT- project UID/GEO/50019/2019 - Instituto Dom Luiz and EXPLORA/Op.ALT20-03-0145-FEDER-000025 Project, funded by Alentejo2020/Portugal2020+European Regional Development Fund/ERDF.