



Research paper

Late Famennian (latest Strunian) palynomorph assemblages and their role in the Neves Formation depositional environment—The Neves-Corvo mine case study (Iberian Pyrite Belt, Portugal)



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ABSTRACT

This research examines palynomorph assemblages preserved in sediments of the Iberian Pyrite Belt (IPB) that host the Neves-Corvo massive sulfide deposit and its importance for mineral exploration. The sediments belong to the Neves Formation, characterized by black shales and minor occurrences of siltstones and cherts, indicative of reduced environmental conditions, favorable to sulfide deposition in a hydrothermal context dominated by submarine felsic volcanism and graben structures. Analysis was performed in barren drill holes (e.g., Monte Novo), as opposed to productive sectors with massive sulfide mineralization and/or stockwork vein networks (e.g., Lombador, Corvo and Semblana deposits) and favorable sectors like Algaré. The recovered palynological assemblages are assigned to the LN Miospore Biozone, indicating a Late Famennian (latest Strunian) age. Several characteristic species of this age are identified, such as *Retispora lepidophyta* and *Verrucosiporites nitidus* in close association with *Densosporites spitbergensis*, *Dictyotriletes fimbriatus*, *Retusotriletes cf. incohatus*, *Retusotriletes crassus*, *Vallatisporites* spp. (including *V. pusillites*, and *V. verrucosus*). Despite some palynomorphs showing signs of breakage, folding, and indistinctness, no significant preservation or diversity differences were noted between barren and mineralized areas. The high abundance of marine phytoplankton in all studied black shales indicates ecologically stressed setting, dominated by dysoxic to anoxic conditions in a distal marine setting with active felsic volcanism and hydrothermal mineralizing events during Late Famennian time. This geologic context correlates with other IPB deposits and the global latest Devonian anoxic Hangenberg event.

1. Introduction

The Iberian Pyrite Belt (IPB, SW Portugal and Spain), stands as one of the most significant global mining provinces, widely known for its considerable metal concentrations in volcanogenic massive sulfides (VMS) ore deposits (Barriga et al., 1997; Almodóvar et al., 2019). Among these deposits, the giant Neves-Corvo deposit (NC) located in the south-eastern extension of the Rosário-Neves-Corvo NW-SE-trending antiform structure (Barriga et al., 1997; Carvalho, 1991; Leca, 1983; Relvas et al., 2006; Oliveira et al., 2013b; Pereira et al., 2021; Relvas et al., 2006), is particularly noteworthy and represented by a VMS cluster comprising 7 massive ore lenses. The mineralization is hosted by felsic volcanic rocks (Barriga et al., 1997; Carvalho et al., 1999; Relvas et al., 2006; Albardeiro et al., 2020, 2023) and sediments of the Neves Formation, which includes black shales, black cherts, and minor siltstones dated to

the Late Famennian age (latest Strunian, Late Devonian) (Oliveira et al., 2004; Pereira et al., 2008, 2021).

Local correlation within different Neves-Corvo mine sectors and a direct correlation with felsic volcanic rocks was performed. The Guedelhinhas-Lançadoiras-Algaré geological deep section (2000 m depth, Pereira et al., 2023) located in the Neves-Corvo NW region and supported by sedimentary rock dating (palynology) and felsic volcanic rocks dating (U/Pb isotope analysis on zircon grains), forms the basis for an accurate geological and structural model, aiding in the correlation between the Neves-Corvo mine sector and the surrounding areas.

A crucial geological transition, the Devonian-Carboniferous Boundary (DCB), marks a biotic turnover associated with the anoxic Hangenberg event (e.g., Kaiser, 2005; Kaiser et al., 2006, 2016). This event is characterized by both biotic and lithological/geochemical changes. Despite its well-documented nature, there is no consensus on the

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