

# Monitoring study of the mine pond reclamation of Mina Concepción, Iberian Pyrite Belt (Spain)

Tomás Martín-Crespo · Cristina De Ignacio-San José ·  
David Gómez-Ortiz · Silvia Martín-Velázquez ·  
Javier Lillo-Ramos

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**Abstract** Mining of massive (Cu, Pb and Zn) sulphide bodies in the Iberian Pyrite Belt (SW Spain) has generated a great number of abandoned waste deposits such as mine ponds. These represent large accumulations of reactive minerals and subsequently, emission sources of trace elements and formation of acid drainage. Even if they have been restored, monitoring studies are required to evaluate the corrective effects and how they may change over time. This work presents the results of a monitoring study carried out at Mine Concepción mine pond, based on mineralogical (XRD), geochemical (INAA, X-ray fluorescence, ICP-MS) and geophysical (electrical resistivity tomography) techniques. In it, a series of relevant parameters have been well delimited, such as the infilling thickness and its variation and, the position, geometry and absence of water leakages through the base of the mine pond. Additionally, the existence of an internal, remnant flow of acid waters that tends to come out through the pond dyke has been

identified. Chemistry of these waters indicates that oxidation processes affecting the Mina Concepción mine tailings are generating acid drainage waters which could potentially release substantial amounts of trace elements to the river Odiel. Thus, giving that not complete sealing is accomplished by the restoration capping and rainfall water infiltrates into the pond materials, at least the sealing of the dyke through which leakages occur should be revised.

**Keywords** Mine reclamation · Monitoring · Acid mine drainage · Electrical resistivity tomography · Iberian Pyrite Belt · Spain

## Introduction

The Iberian Pyrite Belt is a geological unit of about 250 km length, within the South-Portuguese zone of the Iberian Massif. It is made up of an acid, volcano-sedimentary complex of later Devonian-Carboniferous age, where numerous bodies of massive sulphides were formed in response to hydrothermalism and tectonics related to the Variscan Orogeny (Tornos 2006). Exploitation of these massive (mainly Cu, Pb or Zn) sulphide bodies has generated a great number of structures, cavities and mining waste deposits, such as slag heaps and mine ponds, as a consequence of the extraction and metallurgic processes (Fig. 1). In these mine ponds, watery sludge composed of medium-to-fine-grained material, resulting from grinding and mineral processing (e.g. pyrite, chalcopyrite, arsenopyrite), pile up. They entail both an accumulation and subsequent emission source of trace elements and formation of acid drainage due to oxidation of the sulphides present in the mine tailings, either because they were not sufficiently benefited or due to the existence of a deficient

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T. Martín-Crespo (✉) · C. De Ignacio-San José ·  
D. Gómez-Ortiz · S. Martín-Velázquez · J. Lillo-Ramos  
Department of Biology and Geology, ESCET,  
Universidad Rey Juan Carlos, C/Tulipán s/n,  
28933 Móstoles, Madrid, Spain  
e-mail: tomas.martin@urjc.es

C. De Ignacio-San José  
e-mail: cristina.deignacio@urjc.es

D. Gómez-Ortiz  
e-mail: david.gomez@urjc.es

S. Martín-Velázquez  
e-mail: silvia.martin@urjc.es

J. Lillo-Ramos  
e-mail: javier.lillo@urjc.es