Zn Mineralization and Associated Dolomitization in the Río Mundo Area (Albacete)

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INTRODUCTION

The oldest working brass factory of the Iberian Peninsula is found in the town of Riópar (S of Albacete). The foundries opened in 1773 and utilized zinc from the calamines of nearby mines. These mines are situated close to the birth of the Mundo River, in the Northern edge of the Sierra de Segura.

Geologically the area belongs to the External Prebetic zone of the Betic Mountain Range (Fig. 1). It is characterized by a Mesozoic and Tertiary sedimentary sequence up to 2000 m thick (Vera et al. 2004), part of which appears strongly dolomitized. The present-day geological structure consists of a succession of folds and thrusts, oriented approximately N30E and verging towards the NW. They are affected by dextral strike-slip faults perpendicular to the fold axes. A number of tectonic grabens developed during a later extensional phase (Rodríguez-Estrella, 1978; Azema et al., 1979). An erosive phase occurred after folding and emergence of the region during the Late Miocene.

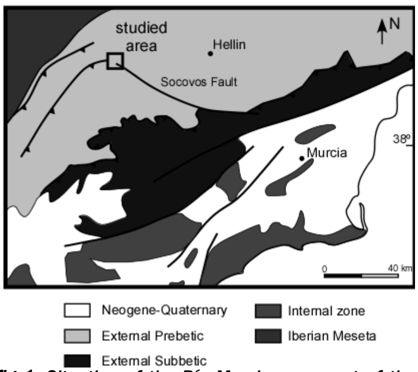

fig 1. Situation of the Río Mundo area, part of the External Prebetic zone.

Although the geodynamic context of the Río Mundo area is broadly known (e.g. Vera et al. 2004), no detailed studies of Zn mineralization and related host rocks have been published. Therefore, we set up a research project to characterize this Zn mineralization and associated dolomitization. Utilising numerical simulations of reactive transport and comparing the Rio Mundo with other similar mineralizations of the Iberian peninsula (e.g. Symons et al. 2009; López-Horgue et al. 2010; Grandia et al. 2003; Gómez-Rivas et al. 2010), we expect to shed light on the genetic controls of the Zn deposits and associated dolomitization. In the present work, we explain a first appraisal of the geological environment and paragenetic succession of the mineral association in the Río Mundo area.

GEOLOGY OF THE RIO MUNDO AREA

The Río Mundo area is basically constituted by sedimentary rocks of Triassic, Jurassic and Cretaceous age. Sandstones and clays of Triassic age mostly appear confined to the valley of the Mundo river, where the Socovos regional fault crosscuts the area. Jurassic limestones and dolostones outcrop predominantly in the northern part of the valley whereas carbonates of Cretaceous age are widespread in the southern part.

Several dolomitization episodes have been distinguished, affecting irregularly Triassic, Jurassic and Cretaceous rocks. However, it is especially pervasive in the southern slopes of the Río Mundo valley, where Zn mineralization is found.

Several Zn-bearing bodies had been mined since 1773. Although sphalerite is the primary mineral, the mining works concentrated on the oxidized parts of the bodies, containing calamines. A first group of ancient works appears next to the Mundo River in the easternmost sector, which comprises San Agustín and Rosita mines. A second group of mineralizations occurs at higher altitudes in the westernmost sector, which includes San Jorge mine. The Zn bodies seem to be aligned along the E-W trending San Jorge fault. The location of Zn occurrences within dolomitized bodies suggests a relationship between mineralizing and dolomitizing fluids and a hydrothermal origin for at least some of the dolomitizing episodes. The position of dolomitized rocks and ore bodies near major faults indicates a possible structural control of fluid circulation.

PARAGENETIC SEQUENCE

During the first field campaign we thoroughly sampled the easternmost mineralizations and host rocks of the Río Mundo area; we also sampled one of the westernmost mines. The thin-polished section study allowed to deduce the paragenetic sequence (Fig. 2). The primary sulfide ore in the Río Mundo area was constituted by sphalerite and marcasite that replaced a dolomitic host rock. Under the microscope, sphalerite shows idiomorphic and zoned crystals of brown-reddish color (Fig. 3A). Their size ranges from a few microns to centimeters that grow disseminated in the host rock and forming alternating bands with dolomite crystals. Marcasite and minor pyrite are still preserved in some occurrences. Textural relationships suggest that they formed contemporaneously or later than sphalerite (growing over it).

The original carbonate host rock appears strongly dolomitized in all sampled mines. The first dolomitizing event produced a light brown fine grained replacive dolomite (RD1). A second generation of dolomite is

palabras clave: Esfalerita, Dolomitización, Prebético Externo. | *key words:* Sphalerite, Dolomitization, External Prebetic.

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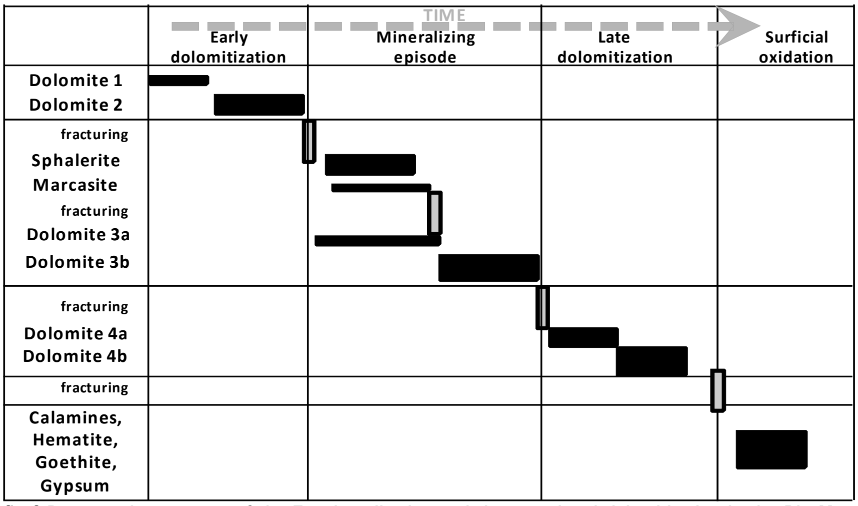

fig 2.Paragenetic sequence of the Zn-mineralization and the associated dolomitization in the Rio Mundo

observed in thin section as a idiomorphic replacive dolomite (RD2) preserving dark nuclei formed by abundant solid inclusions corresponding to RD1. Some relicts of the limestones primary textures can be observed.

A third generation of dolomite is observed filling fractures affecting the previous brown replacive dolomite (RD1 and RD2). These fracture cement forms idiomorfic zoned dolomite crystals (Fig. 3) and contain abundant inclusions of iron oxides (dolomite 3a). It is overgrown by a clear markedly zoned dolomite cement, which sometimes has a saddle texture (dolomite 3b). Sphalerite appears to grow on top of dolomite 3a in some veins but both sphalerite and dolomite are also replaced by dolomite 3a and 3b in other veins.

A fourth dolomitization event took place after fracturing. Clear white dolomite cement crystals (dolomite 4a; Fig. 3B) overgrow dolomite 3b and fill fractures crosscutting the pre-existing saddle dolomite, sulfides and replacive dolomite host rock. A later recrystallization event must have occurred, as saddle dolomite crystals and fracture-filling rombohedrons appear to be in optical continuity under cross polarized light in the petrographic microscope (dolomite 4b).

At least a later fracturing episode took place, causing the formation of dolomitic cataclasites, with no further mineral neoformation. This suggests the absence of fluid circulation along fractures at this stage.

The primary sulfides have been strongly oxidized in the most surficial parts of the mines to calamines (smithsonite has been seen under the microscope with globular growth) and iron oxides, hematite and goethite. Iron oxides, basically hematite and goethite, are also ubiquitous minerals that resulted from the oxidation of primary sulfides. Gypsum is found as centimetric crystals filling fractures and secondary porosity.

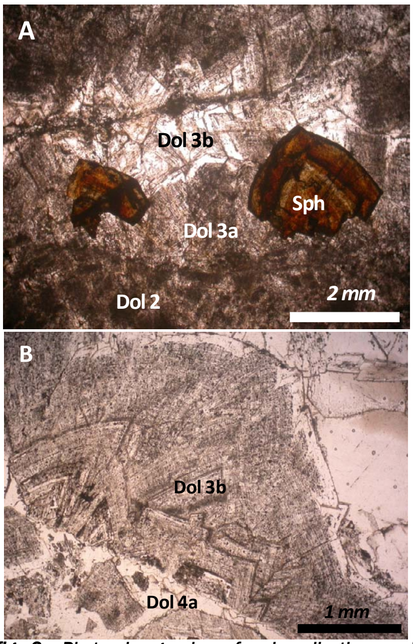

fig 3. Photomicrographs of mineralization and dolomitization of Río Mundo under transmitted light.

CONCLUSIONS

The mineralization of the Río Mundo area was originally mainly constituted by sphalerite and marcasite. Nevertheless, these minerals appear strongly oxidized to calamines and iron oxides/hydroxides. The ore is hosted by a brown fine grained dolomitic rock of Mesozoic age, but other contemporaneous and later dolomitizing events are widespread in the area. The mineralization is composed of several bodies that outcrop aligned following the strike of the San Jorge fault. From the textures observed and the geologic characteristics of the host rock, the Zn-mineralization of the Río Mundo may be classified as of Mississippi Valley type.

AKNOWLEDGEMENTS

This study is financed by the Spanish Ministerio de Economía y Competitividad, through project CGL2011-26488.

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