MINING AND METALLURGICAL HERITAGE FROM SE SPAIN: THE CASE OF THE MAZARRÓN PB-(AG)-ZN MINING DISTRICT

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Mazarrón is one of the mining districts related to the 160 km long Almería Cartagena Volcanic Belt (e.g., Oyarzun et al., 1995). This coastal Miocene belt comprises a variety of volcanic series including calc-alkaline, high-K calc-alkaline, and shoshonitic rocks. In Mazarrón, volcanic activity gave rise to high-K calc-alkaline andesites, dacites and rhyodacites of Tortonian to Messinian age, that were emplaced as subvolcanic domes and ashfall deposits (tuffs). The Mazarrón basin was infilled during the Tortonian-Messinian and Pliocene by marine sediments comprising marls, sandstones, conglomerates, and coquina limestones. The Mazarrón Pb-(Ag)-Zn mining district (Fig. 1) is located close to the town of Mazarrón, only 4 km away from the Mediterranean coast in SE Spain. The mining area shares many geologic and environmental features with other districts from SE Spain such as La Unión (e.g., Robles-Arenas et al., 2006) or Rodalquilar (e.g., Oyarzun et al., 2008).

Different from other better documented mining districts from SE Spain, the information on Mazarrón is both scarce and scattered. We know that at San Cristóbal – Perules mining was mostly underground and that shafts and galleries reached ~ 500 m of depth (Arana, 2007), whereas for Pedreras Viejas the only available information concerns the old Roman works (pits and trenches) (Martínez Alcalde, 2005). However, the existence of a shaft collar (Mazarronera mine; Martínez Alcalde, 2005) indicates that underground mining must have taken place at Pedreras Viejas in relatively modern times (late 19th early 20th Century). Four different mineral processing procedures were used at the district: 1. Calcination of alunite-rich altered rocks to obtain alum, a potassium aluminium sulphate ($KAl(SO_4)_2$-$12H_2O$). Alum was extracted in Roman time and reached peak production during the 15th to 16th centuries (Manteca Martínez et al., 2005). From 1774 onwards, mineral processing activity focused on the alum waste: the so-called *almagres* (Ayuntamiento de Mazarrón, 2008), a deep red coloured material rich in iron oxides, metals (Pb-Zn), and

Fig. 1: The San Cristóbal - Perules mining site (Mazarrón District).

metalloids (As). 2. Gravity concentration of galena using jigs. 3. Reverberatory smelting of galena rich ore to obtain lead metal, which must have started in 1886 when two large furnaces were installed at San Cristóbal – Perules (Agüera Martínez et al., 1993). 4. It was not until 1951 (and up to 1963) that zinc was selectively extracted from the Mazarrón ores (Manteca Martínez et al., 2005). If something characterizes both San Cristóbal – Perules and Pedreras Viejas (Fig. 2) is the colourful aspect of the area affected by the mining-metallurgical works. These sectors are characterized by the chaotic piling of metal and metalloid rich tailings and other mining wastes, with colours that range from purple to red and yellow, thus revealing the importance of oxidation processes, either natural- or human-induced, or a combination of both (Fig. 2). 3 Mt of ore at 10% Pb and 150 g t^{-1} Ag were extracted between 1920 and 1941, whereas a decline is observed for the period 1951-1962, when only 1 Mt of ore at 3% Pb, 5% Zn and 115 g t^{-1} Ag was extracted.

From the visitor perspective, the abandoned mining buildings are all in very poor conservation conditions and pose a risk to visitors. Besides, it is not only the ruinous state of the buildings, but the widespread presence of heavy metal-rich mine wastes that poses a final risk in the area. Anthropic soils and wastes from the site are not only Pb-Zn rich, but also have high contents of As.

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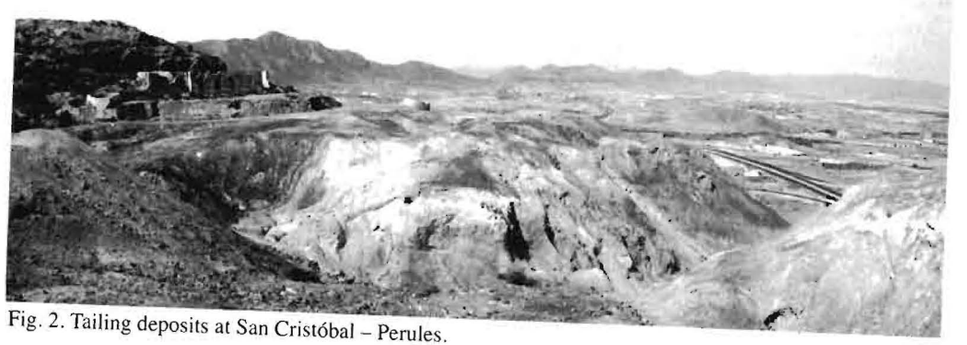

Fig. 2. Tailing deposits at San Cristóbal – Perules.