
ARTICLES

ENVIRONMENTAL POLLUTION BY STERILE MINERS IN A TOURIST AREA UNDER DEVELOPMENT, SIERRA MINERA DE CARTAGENA-LA UNION (SOUTHEAST OF SPAIN)

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This research analyses the situation of waste dumps and ponds in the Mining area of Cartagena-La Unión, as of areas of potential risk for the health of their population and the nearby areas, as well as for tourists. It takes as a reference the concentration of heavy metals detected in the samples of wind-mobilized material from the mining metallurgical waste ponds.

Mining activities are responsible for one of the most persistent sources of heavy metal pollution since the storage of mining wastes usually takes up large surface areas. These wastes are formed by a muddy mixture of finely crushed rocks with a high metal content and remains of chemical compounds used during the mineral crushing and washing. Therefore, their characteristics are very different to the ones of the soil itself. For this reason, these mining wastes are very prone to erosion, especially in areas where there are heavy rains (Jacob y Otte, 2004; Gieré *et al.*, 2003). Thus, these wastes may release metals for hundreds of years after the end of mining activities (Gundersen *et al.*, 2001). On the other hand, one of the most important causes of water pollution is acid drainage due to the oxidation of minerals with sulphur, such as pyrites (Sainz *et al.*, 2003; Grande *et al.*, 2005).

Mining in the Sierra de Cartagena-La Unión went on for 2500 years. Phoenicians, Carthaginians and Romans exploited these mines. However, the current mining landscape is the result of the mining exploitation over the last century and a half, and it is divided into two different stages with different landscape and environmental impacts (Vilar y Egea Bruno, 1994). The first stage (approx. 1850-1950), was based in underground exploitation, with accumulation of sterile materials in dumps that today show up in small ochre and reddish landforms. In the second stage, (approx. 1950-1990), exploitation was opencast, which led to a greater environmental impact, with landforms being inverted in some areas due to the accumulation of sterile materials. In both stages, there was also an accumulation of mud in large ponds, due to the mineral washing process.

It has been estimated that the number of deposits in the mining area (García, 2004) amounts to 2,351. The largest ones are the 89 “floating mud ponds or lagoons” that empty their water in watercourses, as well as the 32 “sterile waste ponds”. There are not any dams for mining wastes, so there is a continuous direct leaching into riverbeds due to water erosion. Furthermore, there is another inevitable pollution factor in the mining area: wind erosion. Most of these ponds have a bare surface without any vegetation. This facilitates the erosion and production of dust, which is lifted into the air, increasing the concentration of suspended particles. These particles frequently have harmful effects on the population due to their high metal content.

In 2007, the inland population of the so called Sierra Minera was over 23,000 inhabitants divided into 7 main areas: three of them belonging to the municipality of La Unión and four of them to the municipality of Cartagena. But the area affected by the mining wastes —including those transported by water erosion and those by wind erosion— covers a much larger population, comprising a total area of approximately 400 km². 15 kms to the north of the tourist area of the Mar Menor is located, with a resident population of 100,000 inhabitants which reaches 400,000 during summer months. 10 kms to the south, the municipality of Cartagena, with a population of 210,000 inhabitants is located. From a demographic point of view, this area is, therefore, one of the most dynamic regions of the Iberian Peninsula.

Since the mining ceased, the total population has gone up 90,000 inhabitants (a 39% increase) in the whole area. The town of Los Alcázares has tripled its population and those of San Javier and San Pedro have doubled theirs. The mining town of La Unión and the town of Cartagena are the only places registering a relative increase, which can be regarded as ‘low’ for this area.

This population increase, which has mainly taken place in the last few years, and especially in the tourist resorts around the Mar Menor lagoon, is not likely to stop. So, if this growing rate continues, the resident population within a 25 km radius, may reach 400,000 inhabitants in the next 10 years and come closer to 1,000,000 during the months of July and August.

The composition analysis of the heavy metals found in the mining metallurgical waste ponds showed that the predominant elements are lead (Pb) and especially zinc (Zn). Other elements were also detected, such as copper (Cu), aluminium (Al), chromium (Cr), strontium (Sr), barium (Ba), rubidium (Rb), iron (Fe), arsenic (As) and cadmium (Cd) compounds, most of them in an oxidized form, such as ferric oxide (Fe₃O₃), sulphur trioxide (SO₃), silica dioxide (SiO₂), as well as the magnesium and manganese oxides to name but some.

The Spanish Cancer Mortality Municipal Atlas (CNE 2007) shows that environmental factors explain much better than family predisposition or healthy or unhealthy practices, the pattern distribution of certain types of cancer. This publication reveals a significant increase in the incidence of two types of cancer in the Sierra Minera municipalities compared to the rest of the Region: lung cancer, with an associated risk which oscillates between 1.10 and 1.30 in the towns of Cartagena and La Unión, respectively, as opposed to the 0.8 region average; and the pleura cancer, with an associated risk which oscillates

between 1.10 and 1.50 in La Unión and Cartagena respectively, as opposed to the 0.7 region average.

The direct relation between the concentrations of heavy metals mobilized by wind erosion, which have been analysed in this research, and the incidence of these types of cancer in the mining district cannot be established on the basis of the present data. However, the coincidence is, to say the least, alarming and would be advisable a rigorous epidemiological study.

Considering the importance of the tourist resources of the Sierra Minera area, it would seem necessary to carry out a study on the environmental conditions of this area and the potential risk to health of the heavy metal concentrations which can be transmitted to the atmosphere by wind erosion from the waste ponds. This is especially so during the months of maximum tourist activity, which coincide with those of highest concentration of heavy metals in the atmosphere produced by the wind erosion of mining wastes.

