

## Occurrence and Distribution of Metal(oid)s in Soils near an Abandoned Lead Smelter

M<sup>a</sup>. Carmen Hidalgo<sup>1</sup>, Julián Martínez<sup>2</sup>, Javier Rey<sup>1</sup>, Unai Cortada<sup>1</sup>

<sup>1</sup>University of Jaen, Department of Geology, Higher Polytechnic School of Linares, Avenida de la Universidad s/n, 23700 Linares, Spain, [chidalgo@ujaen.es](mailto:chidalgo@ujaen.es), [jrey@ujaen.es](mailto:jrey@ujaen.es), [ucortada@ujaen.es](mailto:ucortada@ujaen.es)

<sup>2</sup>University of Jaen, Department of Mechanical and Mining Engineering, Higher Polytechnic School of Linares, Avenida de la Universidad s/n, 23700 Linares, Spain, [jmartine@ujaen.es](mailto:jmartine@ujaen.es)

### Abstract

The slags of the abandoned smelter of La Cruz (Linares mining district, Spain) present very high concentrations of As (300 mg/kg), Cu (4200 mg/kg), Pb (22900 mg/kg), and Zn (51300 mg/kg). The smelting dump lacks of any restoration process, it is affected by erosion, and generates alkaline leachates (pH 8-9) of sodium-sulphate type, with dissolved As ranging from 40 to 100 mg/L.

Due to the pollution risk of this smelting site, we have studied the occurrence and distribution of metal(oid)s in the vicinity of the smelter, analyzing the total contents in 50 soil samples uniformly distributed over a 3 km<sup>2</sup> area. Nine of the 33 analyzed elements presented a high to very high enrichment factor (Ag, As, Bi, Cd, Cu, Pb, Sb, Tl and Zn), and they reached average contents that largely exceed the environmental quality standards for soils. In the case of Pb and Tl values, all the collected samples have contents higher than the maximum allowable concentrations established by the regional government.

In general, there is a preferential distribution of the metal(oid)s coincident with the direction of the prevailing winds to NE of the smelter, and with a maximum range of 500 meters. However, the maximum As contents (up to 1920 mg/kg) have been detected at the south of the slag dump, in a sector receiving its leachates. The highest values for Cd (180 mg/kg) and Tl (65 mg/kg) also appeared in soils very close to the smelting slag, near a drainage channel at the foot of the dump.

These polluted soils affect both a residential zone and an olive grove located in the study area. These activities are incompatible with the current state of the soils, taking into account the elevated metal contents that still persist in this zone.

**Key words** Arsenic, soil contamination, lead smelter