Metal transfer from the abandoned mining district to the endoreic plain of Touiref (NW Tunisia): solid-phase distribution and availability of metals

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The old mining district of Touiref (1901-1958), which is located in NW Tunisia, has Pb-Zn mineralizations hosted in a carbonated gangue. The mining activity (extraction, processing) generated large amounts of flotation tailings that caused the contamination of the surrounding agricultural lands by Pb, Zn, Cd and As. An endorheic basin, located at 1,5 km downstream the tailings pile collects waters of two watercourses, one of which drains the mining site.

Two cores (I and II) were taken in the outlet of the two rivers until depths of 90 cm and 110 cm, respectively. The sediments of the two cores show similar textures composed by fine sediments at the bottom, medium to coarse sands in the median part and conglomeratic deposits at the top. Physicochemical measurements show that the pH of the sediments are neutral to slightly alkaline (7,76 to 8,26) and the TOC contents (0.17 to 0.72 %), measured on the fine fraction of the sediments (< 63 µm), are higher at the bottom of the cores.

XRD patterns show that the sediments of the two cores are homogeneous and dominated by quartz and calcite, with smaller amounts of clay minerals (smectites).

In core I, the vertical distribution of major and trace (Pb, Zn, Cd, As) elements shows an increase of CaO and trace elements along with a reduction of SiO2 at 50-80 cm depth, whereas in core II, the highest values of these elements are recorded at surface. The calculation of the enrichment factor (EF) in the two cores shows that Pb, Zn, Cd and As concentrations range in the 14-390, 11-496, 4-132 and 1-14 mg.kg-1, respectively. Such values testify the strong contamination of the sediments of the endoreic plain due to hydrous transport

The sequential extraction shows that Pb, Zn and Cd are distributed differently between the various fractions phases of the sediments. Pb is mainly associated with carbonates, while Zn and Cd are mainly associated with carbonates and Fe (oxy) hydroxides and at a lesser degree with sulphides. These results show that the metals are in soluble/available forms and can be easily releasedfrom the sediments to the water.

Key words: Pb-Zn mine, sediments, enrichment factor, contamination, selective sequential chemical extractions, solid phase distribution of metals, NW Tunisia.

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