

# Soil heavy metals contamination in the vicinity of the abandoned Zeïda mine in the Upper Moulouya Basin, Morocco.

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The Zeïda mine represented one of Morocco's largest lead deposits for thirteen years. Mining activities generate a massive amount of waste, which was kept as tailings and exposed to meteoric agents. Multiple physical and chemical analyses were conducted to determine the degree of contamination in a bid to better assess the impact of prior mining activity on the soil ecosystem in the proximity of the abandoned open pit mine. A number of 27 topsoil samples were taken from crop fields at a depth of about 0–20 cm and examined for total Pb, Zn, Cu, Co, Cd, and As concentration levels (aqua regia extraction) using the ICP-MS procedure. When compared to an uncontaminated soil sample taken as a geochemical background reference, the results revealed that soils have moderate to high levels of heavy metals, particularly close to the tailings. Physicochemical parameters (pH, electrical conductivity, total calcium, phosphorus, potassium, and organic matter) findings revealed high alkalinity levels associated with carbonates, differing organic matter content, and electrical conductivity values ranging from 4.12 to 1466 S/cm. The majority of the topsoils studied have a similar mineral content, including carbonates (calcite and dolomite), quartz, orthoclase, and muscovite. Three samples contained lead mineral phases (cerussite and wulfenite) (ZAM17, ZAM18, and ZAM21). The primary clay minerals are illite and kaolinite. To examine the distribution of the studied heavy metals, descriptive and multivariate statistics were used. The results compared to the international standards limits (ISL), show that the soils close to the mine tailings have a high heavy metals content. In Zeïda, concentrations of Pb, Zn, Cu, As, and Cd in soils are typically attributed to anthropogenic sources. Correlation coefficients between As, Cu, and Cd and Pb and Zn indicate that they originate from identical sources and react similarly during transport [1].

[1] Ech-Charef, A., Dekayir, A., Jordán, G., Rouai, M., Chabli, A., Qarbous, A., & El Houfy, F. Z. (2023). Soil heavy metal contamination in the vicinity of the abandoned Zeïda mine in the Upper Moulouya Basin, Morocco. Implications for airborne dust pollution under semi-arid climatic conditions. *Journal of African Earth Sciences*, 198, 104812.

