



## **Determination of regional soil geochemical baselines for heavy metals in areas impacted by mining wastes**

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The mining activities has lead to the occurrence of several abandoned sites across the northern part of Chile. These abandoned sites are contaminated with heavy metals, which have led to large amounts of toxic contaminants being released into the sourroundings. In Chile guidelines values of heavy metals in soils has not been established yet, and to determine if a soil has been polluted is important to known the heavy metals baseline value. The objectives of this study were to characterize soils in a zone impacted by mine wastes and to determine the geochemical baseline of heavy metals. A systematic sampling was conducted on the target site to determine the physical and chemical composition of mine wastes and soil material. The sampling consisted of taking 400 soil samples at 0–20 cm depths in a 20,000 square-kilometer area. The samples were analysed for total heavy metal concentrations, pH, redox potential, and conductivity. Geochemical baseline concentrations of heavy metals were estimated following the upper-whisker limit method. The pH, conductivity, and redox potential of soils were 6.32-9.39, 0.10 - 43.2 mS/cm, and 114.1- 333.5 mV, respectively. Heavy metal concentration ranged from 6,182.7 to 101,110.8 mg Fe kg<sup>-1</sup>, 213.3 to 7,283.4 mg Mn kg<sup>-1</sup>, 18.2 to 543.4 mg Cu kg<sup>-1</sup>, 8.32 to 302.6 mg V kg<sup>-1</sup>, 1.10 to 236.7 mg Co kg<sup>-1</sup>, 14.3 to 232.7 mg Zn kg<sup>-1</sup>, 4.89 to 150.1 mg Cr kg<sup>-1</sup>, 22.8 to 136.5 mg Ni kg<sup>-1</sup>, 2.77 to 83.59 mg Pb kg<sup>-1</sup>, 4.13 to 80.68 mg As kg<sup>-1</sup>, 12.2 to 58.5 mg Sb kg<sup>-1</sup>, 6.5 to 29.6 mg Sn kg<sup>-1</sup>, 0.05 to 25.23 mg Cd kg<sup>-1</sup>, 0.21 to 12.21 mg Mo kg<sup>-1</sup>, and 0.01 to 11.99 mg Hg kg<sup>-1</sup>. The estimated geochemical baseline concentrations of Fe, Mn, Cu, V, Co, Zn, Cr, Ni, Pb, As, Sb, Sn, Cd, Mo, Hg, were 79,958, 1,625, 283.4, 302.2, 28.1, 173.2, 72.5, 139.1, 58.2, 55.7, 67.1, 36.6, 35.1, 10.8, 1.5 mg kg<sup>-1</sup>, respectively. The concentrations of Co, Mn, Hg, Cr, Cu, As, Pb, Zn, and Mo in topsoils showed high variability and exceeded the baseline values in sites closer to the abandoned mine sites. It is concluded that the baseline values were useful to assess whether soils are contaminated. It is necessary to estimate baseline values for heavy metals in other areas of northern part of Chile in order to facilitate the identification of soils polluted with heavy metals. The database used here is part of an ongoing regional soil geochemical mapping programme.