

# Mineralogy and geochemistry of Zimapan, Mexico mine tailings

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## Abstract

Mining for silver, lead, zinc, and copper in Zimapan, Hidalgo State, Mexico has been ongoing since 1576. Unsecured tailings heaps and associated acid mine drainage have presented tremendous problems to revegetation, water quality, and dust emission control in the Zimapan area. Objectives of the preliminary study of the mine tailings are (1) determine mineralogy and elemental composition of the tailings in order to identify acid-producing minerals and identify heavy metals at risk for release in acidic conditions, and (2) to determine the balance between potential acidity and potential alkalinity to determine if the current concentration of carbonates is sufficient to mitigate acid-producing sulfide minerals and (3) to determine readily extractable heavy metals that may be readily released due to the presence of organic acids produced by vegetation. Representative mine tailings have been sampled from a site located north of the town of Zimapan. Mineralogical characterization has been conducted with X-ray diffraction (XRD) and electron microscopes (SEM and TEM). Potential acidity and potential alkalinity trials have been conducted by hydrochloric acid and hydrogen peroxide dissolution methods, respectively. Readily extractable metals have been determined by DTPA extraction of the samples. Neutron Activation Analysis (NAA) has been utilized to determine total elemental composition. XRD and SEM analyses have confirmed the presence of pyrite and arsenopyrite, indicating a potential for acid mine drainage. Calcite has been confirmed to have a significant presence by XRD and potential alkalinity trials, with some samples containing as much as 26% calcite. Other minerals identified in the tailings include wollastonite, gypsum, quartz, pyrite, mica, talc, amphiboles, and feldspars. DTPA extractions revealed that potentially toxic elements Zn, Cu and Pb were readily extractable from the samples, indicating possible release in the presence of vegetation. Potential acidity results are pending. Future study will explore the constraints to vegetation that these tailings present.