



Vulnerability of soils towards mining operations in gold-bearing sands in Chile

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The contamination levels in handicraft mining, despite less production and processing less equipment, have high repercussions upon the environment in many cases. High-grade ore extraction, flotation, gravity concentration, acid leaching cementation and mercury amalgamation are the main metallurgical technologies employed. Gold recovery involving milling and amalgamation appears to be the most contamination source of mercury.

This research work is only a starting point for carrying out a risk probability mapping of pollutants of the gold bearing sands. In southern Chile, with a mild and rainy climate, high levels of pollutants have been detected in some gold placer deposits. The handicraft gold-bearing sands studied are located in X Region of “Los Lagos” in southern Chile. A great quantity of existing secondary deposits in the X Region is located in the coastal mountain range. The lithological units that are found in this range correspond with metamorphic rocks of a Paleozoic crystalline base that present an auriferous content liberated from the successive erosive processes suffered. Metasedimentary and metavolcanic rocks also make up part of this range, but their auriferous load is much smaller.

The methodology used in the characterization of the associated mineralization consists of testing samples with a grain size distribution, statistical parameter analysis and mineralogical analysis using a petrographic microscope, XRD and SEM/EDX. The chemical composition was determined by means of XRF and micro-chemical analysis.

The major concentrations of heavy minerals are located in areas of dynamic river energy. In the studied samples, more than 75 % of the heavy minerals were distributed among grain sizes corresponding to thin sand (0.25-0.05 mm) with good grain selection. The main minerals present in the selected analysed samples were gold, zircon, olivine, ilmenite, hornblende, hematite, garnet, chromite, augite, epidote, etc. The main heavy metals found were mercury, lead, cadmium, chromium, zinc, cobalt, copper, platinum, gold, indium, tellurium, etc., and as well some traces of cerium, praseodymium, gadolinium, neodymium, samarium and lanthanum. The recurring presence of Pb, sulphur and Hg, among others, in mineral species like galena and cinnabar reveal accumulation indices, a product of the contaminating action of human beings. This is notable since no records exist of natural deposits of these minerals that can justify their presence, and records were utilized from semi-industrial exploitations for the extraction of gold where Hg is utilized in the amalgamation processes.