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The impact of former mining activity in the vicinity of an old mercury mine (Vallalta, Northern Italy)

Claudio Bini (1), Laura Maleci (2), and Mohammad Wahsha (3)

(1) University of Venice, Environmental Sciences, Venice, Italy (bini@unive.it), (2) University of Florence, Biology, Florence, Italy (maleci@unifi.it), (3) Jordan University, Marine Science, Aqaba, Jordan (M.Wahsha@ju.edu.jo)

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Bini C. (1), Maleci L. (2), Wahsha M. (3)
(1)– Dept. of Environmental Sciences, Ca' Foscari University, Venice (Italy).
(2)– Dept. of Biology, University of Florence (Italy).
(3)– Marine Science Station, The University of Jordan, Aqaba branch, Aqaba (Jordan).
Exploitation of ore minerals (native mercury, cinnabar, chalcopyrite, sphalerite) from the old mine of Vallalta (Belluno, North- East Italy) has determined serious environmental impacts, including acidic water (AMD), soils and sediments. A survey carried out in recent years has highlighted the extent of contamination by heavy metals, and particularly mercury, in soils and plants of the area surrounding the mine. In the examined samples, the soils MIS1 and MIS 2 (Verrucano Formation), present metal concentrations generally below the attention levels, with the exception of Hg; conversely, the soils MIS 3 and MIS 4 (Quartz Porphyrite Formation) are seriously contaminated with Cu, Pb, Zn, and slightly contaminated by Hg. Ni and Cr, conversely, are below attention limits. The levels of Ni, Cr, Mn, Pb, Zn, are generally within the normal ranges reported in literature. Mn and Zn concentrations, moreover, are below the phytotoxic levels; conversely, more than 50% of the examined samples present Cu concentrations >20 mg kg-1, and 25% of these samples have concentrations higher than the phytotoxic level (40 mg kg-1). Fe concentrations overcome normal values in 65% of the examined samples; it is likely due to high Fe concentration in the parent material. Considering metal concentrations in selected plants growing on mine waste, any specimen presents toxicity symptoms. Fe concentrations overcome normal values (30-300 mg kg-1) in most samples. Mercury presents generally higher levels in comparison to normal values (0.005-0.02 mg kg-1), as expected, due to Hg-mineralization of the area. In particular, Chaerophyllum hirsutum presents high Hg concentration both in roots and in the aerial parts (8 mg kg-1), close to hyperaccumulator plants (10 mg kg-1). Three clusters of translocation factor are evident:
1. TF<0.5: Cr, Pb. Owing to their toxic character, they are found mostly in roots;
2. TF≈0.5-1: Cu, Zn, Fe. Easily translocated from soil to roots and leaves.
3. TF>1: Hg, Mn. Most mobile, at least in Stellaria and Chaerophyllum.
The soils investigated present generally low metal concentrations, with the exception of Hg, due to parent material composition; hence, the anthropic impact is reduced. Soil contamination, therefore, is strictly limited to mine waste. Among the investigated plants, Chaerophyllum is signaled, firstly in this work, to present Hg accumulation in leaves; hence, it seems to be suitable for phytoremediation of Hg-contaminated sites.