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Land contamination and soil evolution in abandoned mine areas (Italy)

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In Italy ore research and exploitation are nearly exhausted since the end of the last century, leaving on the land a huge amount of mine waste, therefore provoking evident environmental damage including landscape, vegetation and the food chain, and a potential threat to human health.
The increasing environmental consciousness of general population compelled Public Administrators to set down effective legislation acts on this subject (e.g. D.L. 152/2006), and more generally on environmental contamination.
In this work we present the results of a survey carried out at several mixed sulphides mine sites in Italy, exploited for at least a millennium, and closed in the ‘60s of the last century.
Biogeochemical analyses carried out on 50 soil profiles (mostly Entisols and Inceptisols) and vegetation in the proximal and distal areas of ore exploitation show metal concentrations overcoming legislation limits on average (Cu up to 3160 mg kg-1 , Pb up to 23600 mg kg-1, Zn up to 1588 mg kg-1, Fe up to 52,30 %). Ni, Cr and Mn concentrations, instead, are generally below the reference levels.
Metal concentrations in native vegetation of the examined areas are moderately to highly elevated. Significant amounts of Cu, Pb, Zn in roots of Plantago major and Silene dioica, in leaves of Taraxacum officinale, and Salix spp, have been recorded. Essential elements, in particular, present Translocation Coefficients (TC) >1, with Mn>Zn>Cu>Fe. Toxic elements (Cd, Cr, Pb), instead, present TC<1, suggesting a synergic/antagonist effect to occur among metals and plants, according to their role in mineral nutrition.
The results obtained suggest the abandoned mine sites to represent actual natural aboratories where to experiment new opportunities for restoration of anthropogenically contaminated areas, and to study new pedogenetic trends from these peculiar parent materials. Moreover, the examined plants are genetically adapted to naturally metal-enriched soils, and therefore may be utilized in phytoremediation of contaminated sites. Furthermore, the institution of natural parks in these areas could enhance their educational and scientific value, contributing in the meantime to general population amusement and recreation.
Finally, it is the occasion for soil scientists to submit to the scientific community new classification proposals of this new kind of soils.

Key-words: mine waste, heavy metals, accumulator plants, phytoremediation, soil genesis, soil classification