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Background levels of PTEs in terraced agroecosystems of NE Italy: geogenic vs anthropogenic enrichment and phytoremediation perspectives

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This study is part of a research aimed at characterizing soils of terraced landscapes in the Alpine region. Previous contributions concerned pedogenetic aspects, soil distribution model in the terraced landscape, physical and chemical characteristics, and the role of man in the soil evolution. The main objectives of the study were: i) to evaluate the background level and the concentration range of heavy metals in soils of a mountain area in the proximity of the Dolomites natural park (Northern Italy), ii) to ascertain metal distribution and to identify possible contamination of some sites, and the related environmental hazard, with special reference to the pollution of the Dolomites area, which is a unique and delicate ecosystem.
Background levels of trace elements in the soils investigated are consistent with currently recorded trace element concentration of soils from Western Europe. In many of the analysed profiles, trace elements present concentrations decreasing with depth. However, at some sites (Sospirolo, NE of the area, and Sovramonte, NW) trace elements (namely As, Be, Co, Cu, Zn) show contents above the limits if the Italian guidelines for residential areas. At some sites near Sedico (NW) high concentration of Pb, Sn, and Zn are recorded. Nearly all the samples examined present Sn concentrations above the legislation limit for green areas (1 mg/kg). The fact that many elements are concentrated in the A horizon may be related to several factors. Surface horizons are generally enriched in organic matter, which could have a role in adsorbing trace elements. On the other hand, it is possible that heavy metals be accumulated at surface since the past century, when mining activity was operating in a conterminous area. Exploitation, grinding and roasting of minerals could have generated solid particulate added to soil. A third possibility is that metals could have a partial natural (geogenic) origin, and a partial anthropic origin, and the observed stratification could be a result of these two forms of diffused contamination.
It is likely that higher concentration of trace elements could be related to the migration of species released by the mineralised area north of Valbelluna, via riverine transport, in the extreme parts of the valley. Instead, in the central part such metal contamination does not occur, since geomorphological conditions do not enhance river flow through the valley. A second way of contamination could be related to former mine activities north of the Valbelluna, where atmospheric particulate from grinding and roasting of minerals could have been transported by dominant winds, and could have been deposited on the topsoil, contributing to the metal content enrichment in surface horizons.
Yet, given the multiple factors contributing to soil genesis, natural background levels may be extremely variable even in limited areas, and in some cases it is not possible to assess if the presence, or the concentration level, of a metal could be related to natural sources or to recent, or past, human activities.
Phytoremediation could be an environmental friendly technique useful to restore the investigated areas slightly contaminated by PTEs