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Geogenic Enrichment of PTEs and the " Serpentine Syndrome"(H. Jenny, 1980). A proxy for soil remediation

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Serpentine soils have relatively high concentrations of PTEs (e.g., Co, Cr, Cu, Fe, Ni) but generally low amounts of major nutrients. They often bear a distinctive vegetation, and a frequently-used approach to understanding serpentine ecology and environmental hazard has been the chemical analysis of soils and plants. Long-term studies on aspects of serpentine soils and their vegetation provide results on total concentrations, or on plant-available fractions, of soil elements which counteract ecological conditions. For example, there is evidence of Ni toxicity at Ni-concentration >0.3 mg/L in the soil solution (Johnston and Proctor, 1981).
The serpentine vegetation differs from the conterminous non-serpentine areas, being often endemic, and showing macroscopic physionomical characters such as dwarfism, prostrate outcome, glaucescence and glabrescence, leaves stenosis, root shortening (what Jenny, 1980, called "the serpentine syndrome"). Similarly, at microscopic level cytomorphological characteristics of the roots and variations in biochemical parameters such as LPO and phenols have been recorded in serpentine native vegetation (Giuliani et al., 2008). Light microscopy observations showed depressed mitotic activity in the meristematic zone, and consequent reduced root growth (Gabbrielli et al., 1990)
The metal content of plants growing on serpentine soils at sites with different microclimatic conditions has been examined by several authors (e.g. Bini et al., 1993; Dinelli and Lombini, 1996) .
A preferential Ni distribution in epidermis and sclerenchima has been observed in the stem of Alyssum bertoloni, a well known Ni-accumulator plant (Vergnano Gambi, 1975).
The different tolerance mechanisms responsible for plant adaption to high concentrations of PTEs in serpentine soils can be related to the capacity of plants either to limit metal uptake and translocation or to accumulate metals in non toxic forms. The majority of serpentine species (e.g. Silene italica) tend to limit metal absorption to roots so that leaf concentration is generally low; only a few species (e.g. Alyssum bertoloni) are able to accumulate metals in their shoots and leaves.
The hypothesis that the cell wall could constitute a barrier against the penetration of PTEs inside the plant tissues is supported by metabolic modifications that make possible plant tolerance to very high metal concentrations, and to low levels of essential nutrients such as P, K, N, Ca, Mn.
This vegetation, therefore, is of great interest for the study of resistant mechanisms to PTEs penetration, and therefore could be useful in remediation of metal-contaminated soils.
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