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LABORATORY EXPERIMENT ON UNDISTURBED MESOCOSMS: THE LEACHING OF HEAVY METALS FROM CONTAMINATED SOIL

D. ABU EL KHAIR, C. FERRÉ, R. COMOLLI

University of Milano-Bicocca - Department of Earth and Environmental Sciences, Milan, ITALY

One of the most important ecosystem services provided by soil is its ability to slow down and mitigate the percolation of pollutants, of natural or anthropogenic origin, into aquifers, a function of great importance for maintaining good groundwater quality.
This study is part of the PNRR project (Biodiversity Future Center, Spoke 5: Urban Biodiversity) and aims to assess the leaching of heavy metals (Cr, Cu, Ni, Pb, and Zn) under controlled laboratory conditions.
The experiment used undisturbed soil columns (mesocosms) of Ap and Bw horizons of a Dystric Cambisol, with bulk densities of 1.07 and 1.68 g/cm³ respectively, constructed manually by assembling PVC tubes (diameter 14 cm) to create 40 cm long cylinders with a 5 cm drainage layer. Both horizons are characterized by a strong acidic reaction (pH 4.7 and 5.3 respectively), a good content of organic C (Ap: 2.34%; Bw: 1.07%), and a silt loam texture. They also have a high content of heavy metals (topsoil - Cu: 161 ppm; Pb: 214 ppm; subsoil - Cu: 64 ppm; Pb: 45 ppm).
In order to evaluate the leaching of metals under controlled conditions, an extreme meteorological event for the Milan Region (150 mm of precipitation in one day) was simulated, stressing the system while maintaining a constant head of 10 mm and collecting the percolated water every hour.
Preliminary data show that water infiltrates relatively easily into the topsoil (9.8 mm/h), leaching a small fraction of the exchangeable and soluble fraction of metals present in the Ap horizon (Cr: 1.17%; Cu: 1.10%; Ni: 1.55%; Pb: 0.09%; Zn: 0.18%). In the subsoil, however, water tends to infiltrate much more slowly (0.4 mm/h).
The results were used as a basis for a long-term monitoring period (6 months), during which the leaching of heavy metals was assessed in both the topsoil and subsoil, replicating a spring-summer precipitation cycle.

Keywords: Pollutants, Percolation, Soil columns, Undisturbed soil, Water