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Diversified forest ecosystems can grow on industrial waste residues: evidence from a multiproxy approach

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Smelter activities in the Lorraine region (North-East France) have lead to the creation of flotation ponds that were used to eliminate wastes, mainly slag. After industrial decline, some of these flotation ponds were colonized by vegetation and evolved to forest ecosystems.
One of these old flotation ponds, situated in Pompey, close to Nancy (North-East France), was studied by collecting information on several physico-chemical and biological indicators. The main objective was to understand the biological functioning of this system, whose soil can be classified as a pure Technosol, characterised by a very complex stratified profile created by successive slag deposits.
Soil is characterized by its apparent heterogeneity, but also its high agronomic fertility and particularly high metal contents. Holorganic horizons can vary from one to several centimetres. Macrofauna is characterized by a very low abundance of earthworms and a dominance of millipedes. Furthermore, whereas earthworms do accumulate metals, this is not the case for millipedes. Mesofauna is typical of a temperate forest system, dominated by Collembola. Soil organo-mineral associations showed a high proportion of faecal pellets from Oribatid mites, Isopods and Diplopods. Furthermore, Mn, which is highly associated to metals (especially Zn and Pb) seems to play an important role in organo-mineral associations, including bacteria. An organic fraction is also directly associated to Calcium, Pb and Cu. Vegetation presents a high diversity, with more than 70 species, with very low metal transfer to plants. Results from soil respirometry are typical from temperate forest ecosystems.
All this information has been combined to propose a model for the biochemical functioning of a such Technosol.