

Are Technosols developing on former steel industry settling pond comparable to natural soils?

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Pedogenesis of soils developing on human-made substrates is of interest because of the increase of soil anthropisation. Little knowledge is available on these technosols and a better understanding of their evolution is needed and of the fate of the potentially polluting materials they contain. Parent material origin may strongly influence their formation and functioning and the governing processes have to be elucidated. They may be specific or similar to those occurring in natural soils. Our objective is the investigation of a technosol developing on a former settling pond of the steel industry.

This pond (Pompey, Northeast of France) was formed after settling of sludge generated by wet cleaning of blast-furnace smokes [1]. Probably abandoned in the mid-20th century, it has been colonized by vegetation and covered by a diversified forest. The soil is composed of contrasted layers. A 20 cm organic layer has developed at the surface [2, 3]. Twelve samples were collected in the first two meters which are under root influence. Elemental composition and agronomic parameters were determined. Mineralogy was studied by combined techniques. Organic matter was extracted and analyzed by GC-MS. Specific surface area, solid density, bulk density and water retention curve were measured.

Elemental composition was dominated by Fe, Mn, Ca and Si and revealed very high contents of heavy metals, up to several percents for Pb and Zn. The soil was slightly alkaline (5-30 % carbonate). Cation exchange capacity was quite high (24-83 cmol⁺ kg⁻¹). Mineralogy was characterized by poorly crystalline phases mainly aluminosilicates, Fe and Mn hydroxides and oxides, Ca carbonates and sulfates. Organic carbon content ranged from 0.5 to 10.5 % at the surface. Organic matter was found of natural origin at the surface and from anthropogenic sources in the deeper layers. Bulk density was lower than 0.5 g cm⁻³. Porosity represented more than 80 % of soil volume and specific surface area was between 50 and 300 m² g⁻¹. Water retention capacity was high.

The presence of short order range minerals and its physical characteristics make this Technosol comparable to volcanic soils. But unlike volcanic soils, the high carbonate content leads to an alkaline pH. Such observations, also made on other soils formed on industrial wastes [4], may show that Technosols could have properties that rarely coexist in nature. Analogy with volcanic and carbonated soils functioning may suggest favourable conditions to organic matter and metal stabilization but arises the question of the evolution of these young and reactive soils.

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