Does size matter? Assessing the role of the coarse fraction to overall pollution of anthropized soils

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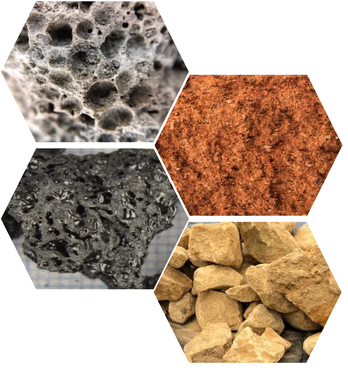

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Background and Objectives

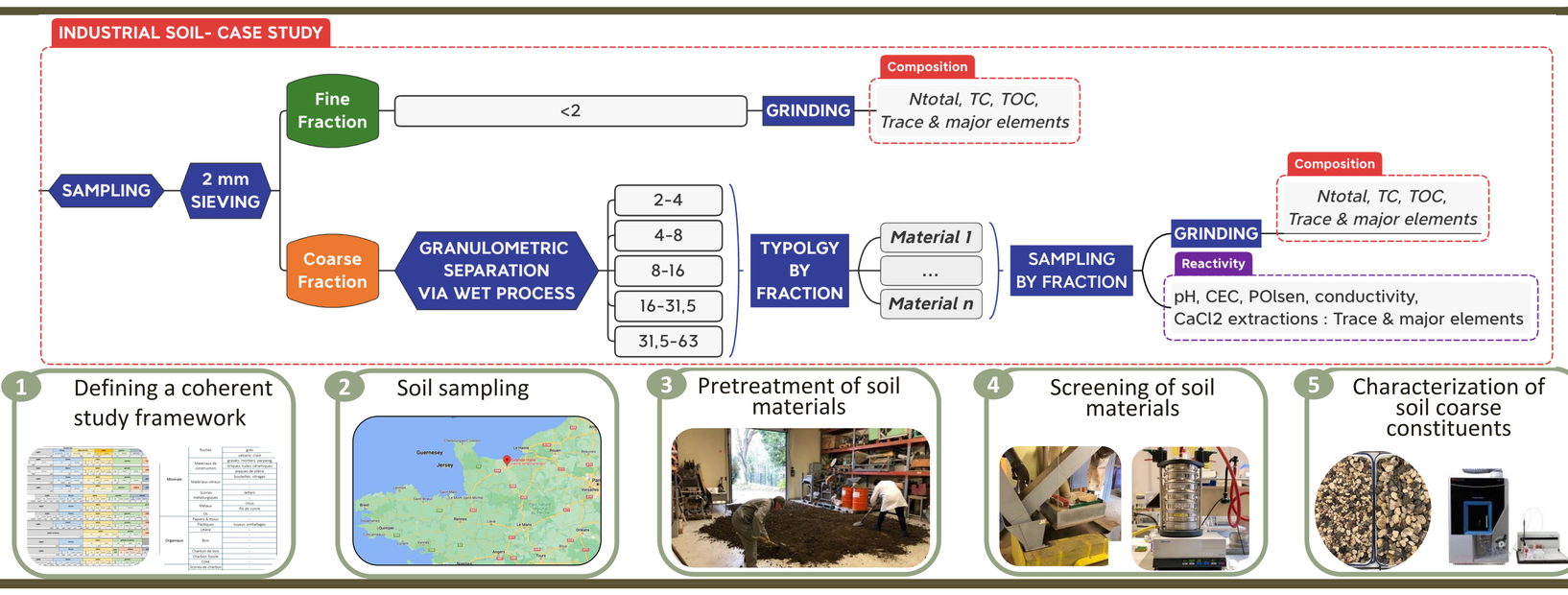
Should the **soil coarse fraction** be considered a key element in the functioning of **highly anthropized soils**, especially regarding risk associated to **contaminants**? **Soil quality diagnosis systematically dismiss it as inert** for not contributing to the soil's nutritional potential or contaminants in the short term. However, in forest context, it can contribute significantly to **the assimilation of essential nutrients by plants**. Yet, insufficient research has been done to understand its influence in terms of physicochemical fertility and contribution to toxicity in the context of highly anthropized soils. In these contexts, **coarse materials** are found in **various quantities and natures** and can constitute in some cases the main source of **pedogenetic evolution** of these systems. This raises the questions of the evolution of the properties of the soil coarse fraction constituents as a function of their size, and the intensity of their contribution to the fertility and toxicity of highly anthropized soils.

Aims

1. **Identifying, describing, and characterizing the constituents of highly anthropized soils' coarse fraction**
2. **Evaluating the reactivity of coarse constituents regarding their fertile and toxic properties**
3. **Assessing the role of the coarse fraction to overall pollution of anthropized soils**

Material and Methods

- The constituents of the coarse fraction of an industrial soil are **firstly identified, described and characterized via a conventional soil analysis approach**
- In a **second phase**, the **fertility/toxicity** of these constituents are evaluated via a **modification of standardized soil analysis techniques** *(techniques initially developed for soil particles whose max dimensions do not exceed 2 mm)*
- The proposed evolution principle is as follows :
  - **Whatever** the **grain size** or the **nature of material**, the **ratio** between the **surface** of a sample and the **volume** of the solution **must be kept constant**



Results & Discussion

Constituents of the coarse fraction of an industrial soil

Categories	2-4 mm	4-8 mm	8-16 mm	16-31.5 mm	31.5-63 mm
Limestone 60 %					
Metallurgic Slag 24 %					
Metallic elements 3,5 %					
Granits 3,2 %					
Iron ore 2,1 %					
Fossil coal 2,1 %					
Unidentified Slag 1,6 %					
Coke 1,2 %					

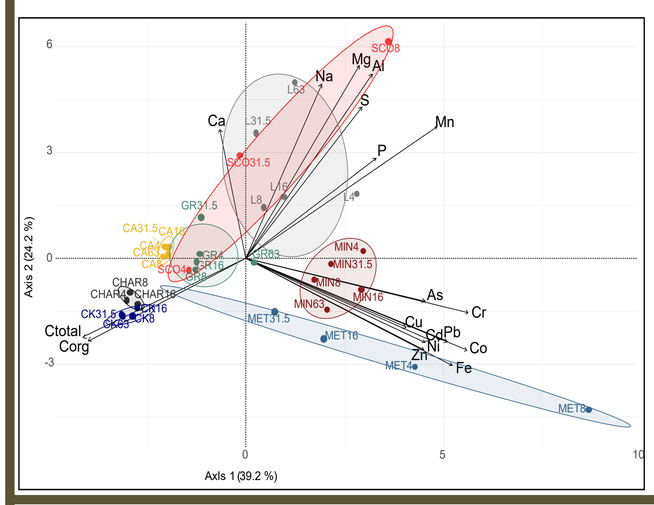
- **39%** of the mass of the coarse fraction is **exogenous** (natural or manufactured)
- The materials are **consistent** with the **underlying soil-geological substrate** of the site and the **past industrial activity**
- **Slags, granites** and **metallic elements** display strong a **morphological heterogeneity**

Overall chemical composition of the coarse constituents of an industrial soil

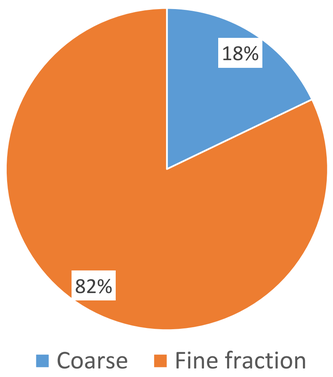
✓ **Slags, granites** and **metallic elements** display strong a **morphological** and **compositional heterogeneity**

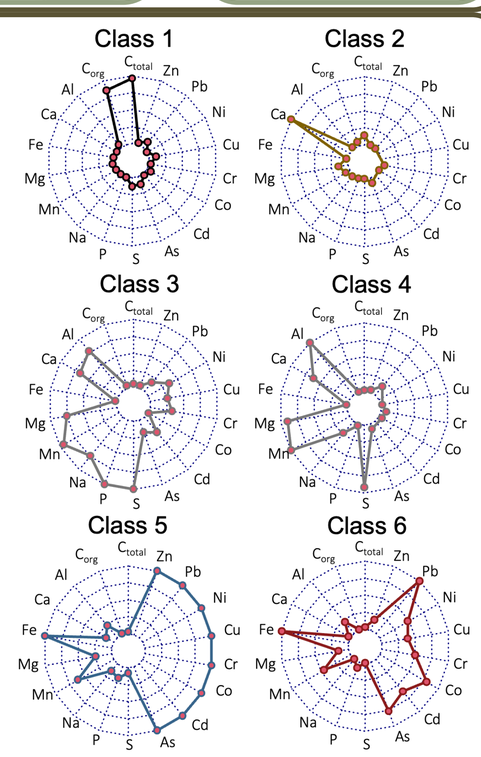
✓ **Iron ore** and **metallic elements** are the main stock of **trace elements**

✓ **18 % of total trace elements is contained in the coarse fraction**

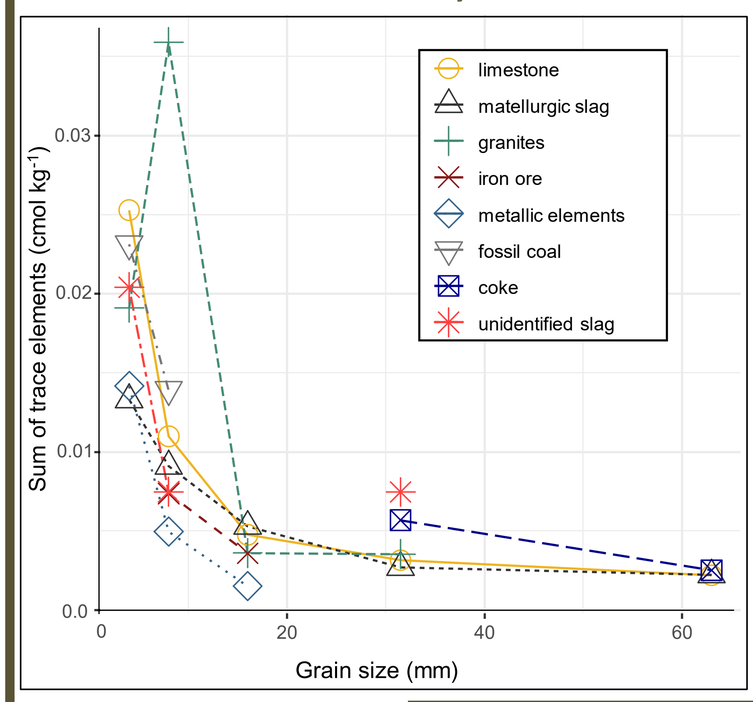


Distribution of total trace elements between fine and coarse fractions (%)

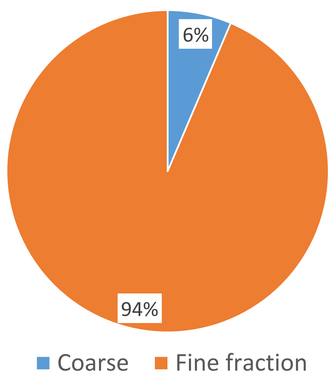




Release of trace elements by the constituents of the coarse fraction of an industrial soil



Distribution of total trace elements extractable by a $CaCl_2$ solution between the fine and coarse fractions (%)



✓ Coarse constituents release very little trace elements in comparison with the fine fraction

✓ They exhibit nevertheless a small reactivity, tackling the idea of their inert character

Conclusions

- Implementation of a **coherent** and **efficient** approach to study **soil coarse fractions**
- **Coarse fractions are not inert** and **contribute** in a limited way to the **release of trace elements**
- **Coarse fractions** must therefore be **reintegrated** into our **approaches** to assessing the **quality of highly anthropized soils** and be integrated in the evaluation of **other soil functions** (*e.g.* carbon storage)

Perspectives

- To carry out **more thorough mineralogical characterizations** (XRD, XRF)
- To **complete the database** created with **other types of materials** constitutive of the coarse fraction of the highly anthropized soils
- To use these materials as **substrates** for **plant growth trials**