



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

Guillaume Hostyn, Jean-Marie Côme, Stéphanie Ouvrard, C. Schwartz

► To cite this version:

Guillaume Hostyn, Jean-Marie Côme, Stéphanie Ouvrard, C. Schwartz. Does size matter? Assessing the role of the coarse fraction to overall pollution of anthropized soils. 22. World Congress of Soil Science, Jul 2022, Glasgow, United Kingdom. hal-04233992

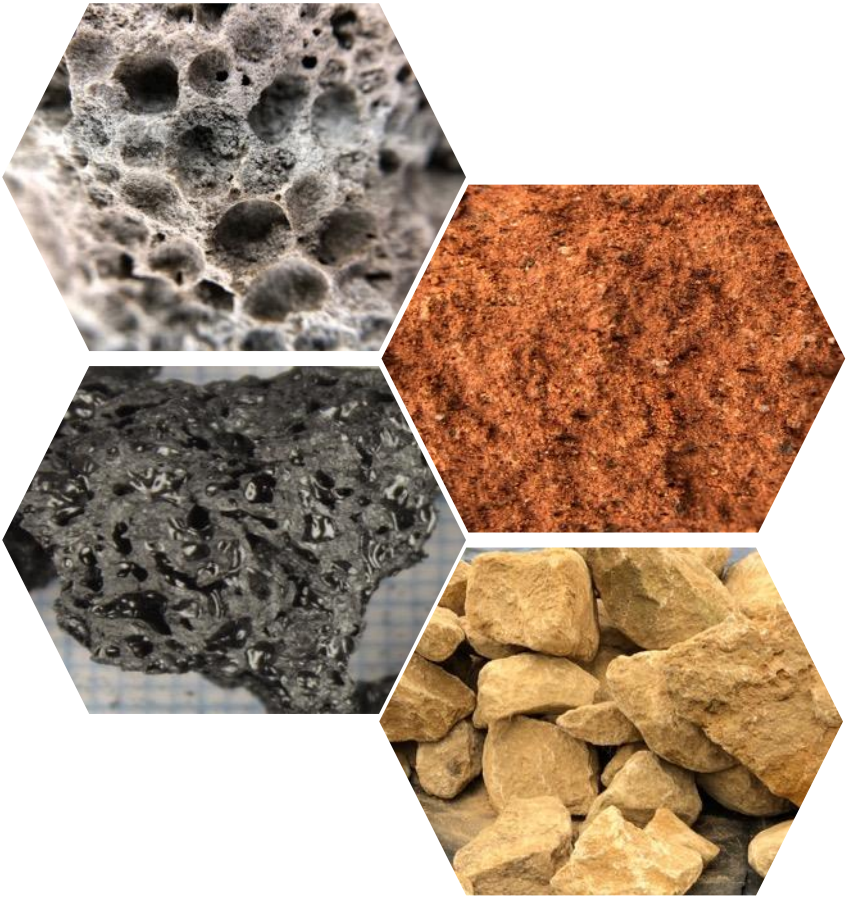
HAL Id: hal-04233992

<https://hal.inrae.fr/hal-04233992>

Submitted on 9 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



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

Guillaume HOSTYN^{1,2}, Jean-Marie CÔME¹, Stéphanie OUVARD² and Christophe SCHWARTZ²

¹ GINGER BURGEAP R&D, F-69425 Lyon, France ; ² Université de Lorraine, INRAE, LSE, F-54000 Nancy, France

g.hostyn@groupeginger.com



Background and Objectives

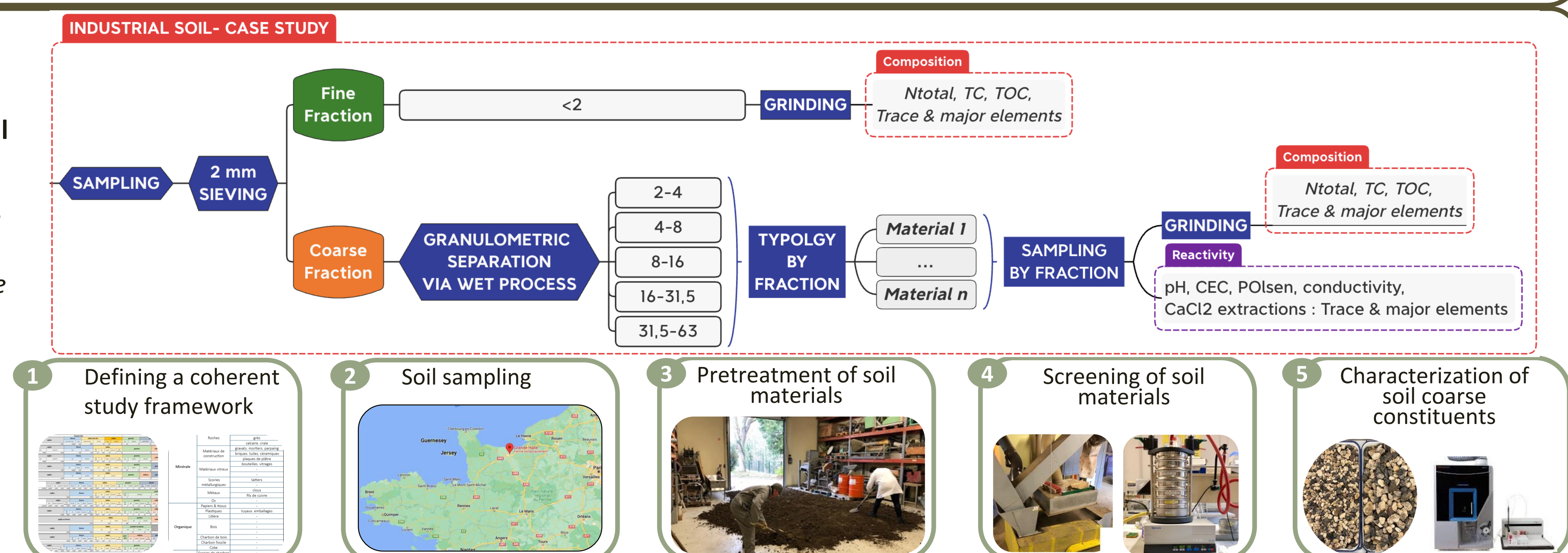
Should the **soil coarse fraction** be considered a key element in the functioning of **highly anthropized soils**, especially regarding risk associated to **contaminants**? **Soil quality diagnosis systematically dismiss it as inert** for not contributing to the soil's nutritional potential or contaminants 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

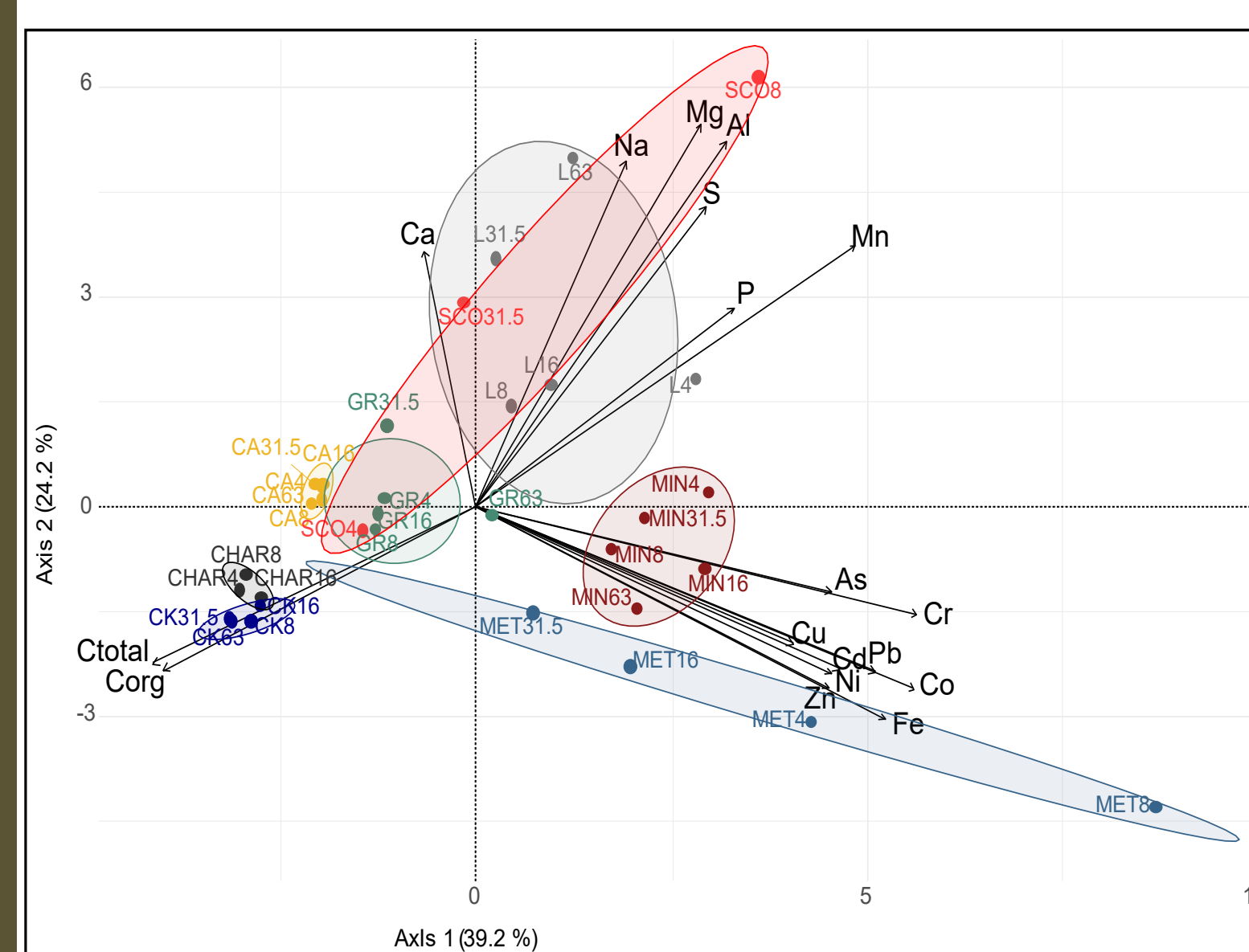
Constituents of the coarse fraction of an industrial soil

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 %					

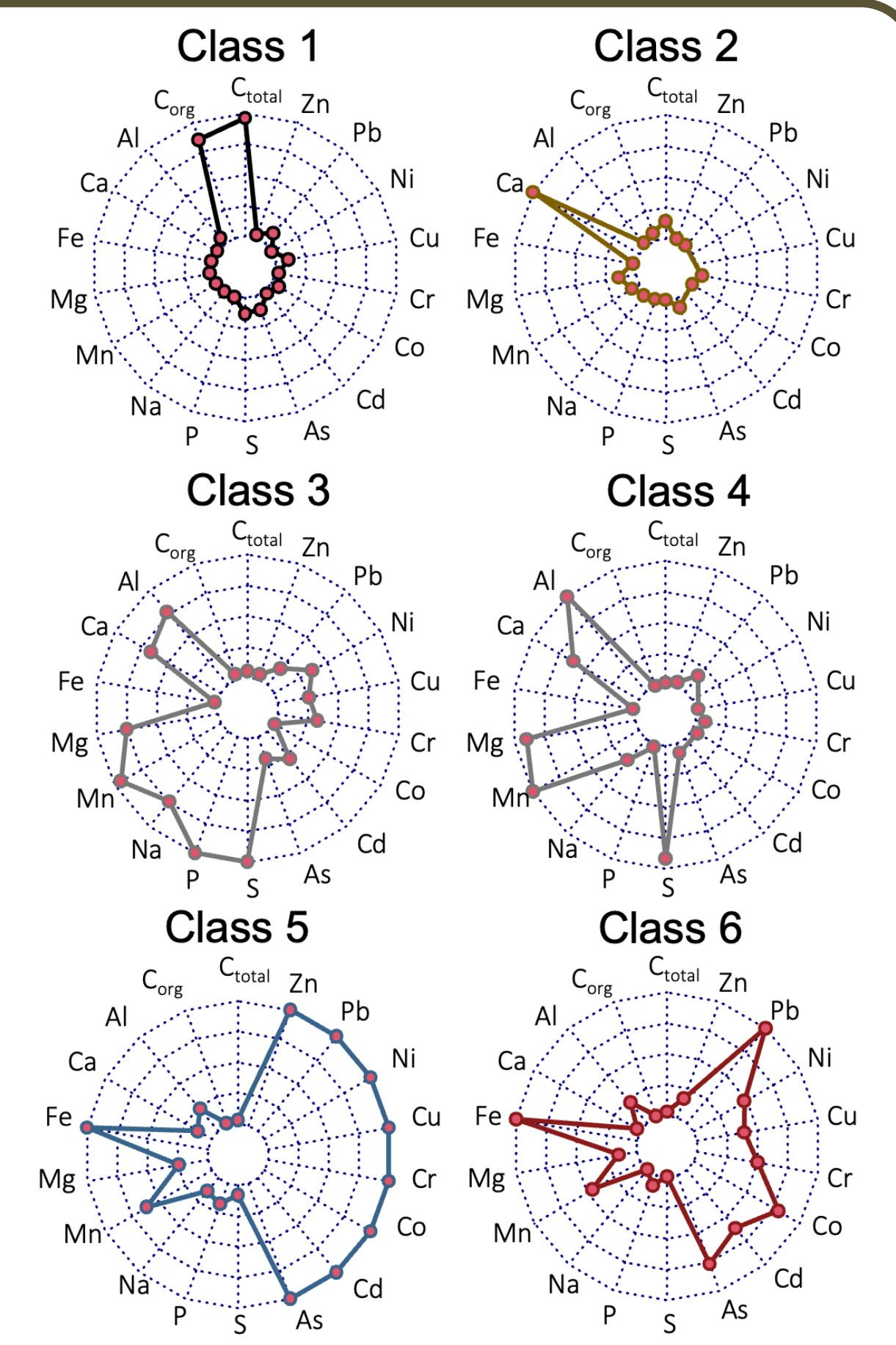
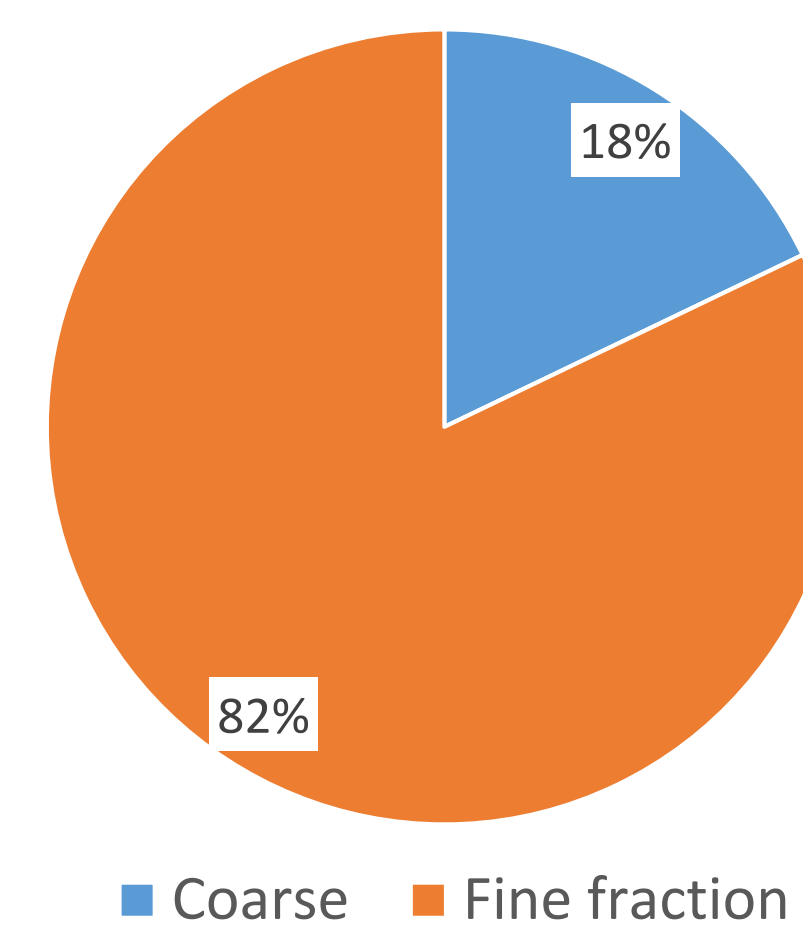
- 39%** of the mass of the coarse fraction is **exogenous** (natural or manufactured)
- The materials are **consistent** with the **underlying soil-geological substrate** of the site and the **past industrial activity**
- Slags, granites and metallic elements** display strong a **morphological heterogeneity**

Overall chemical composition of the coarse constituents of an industrial soil

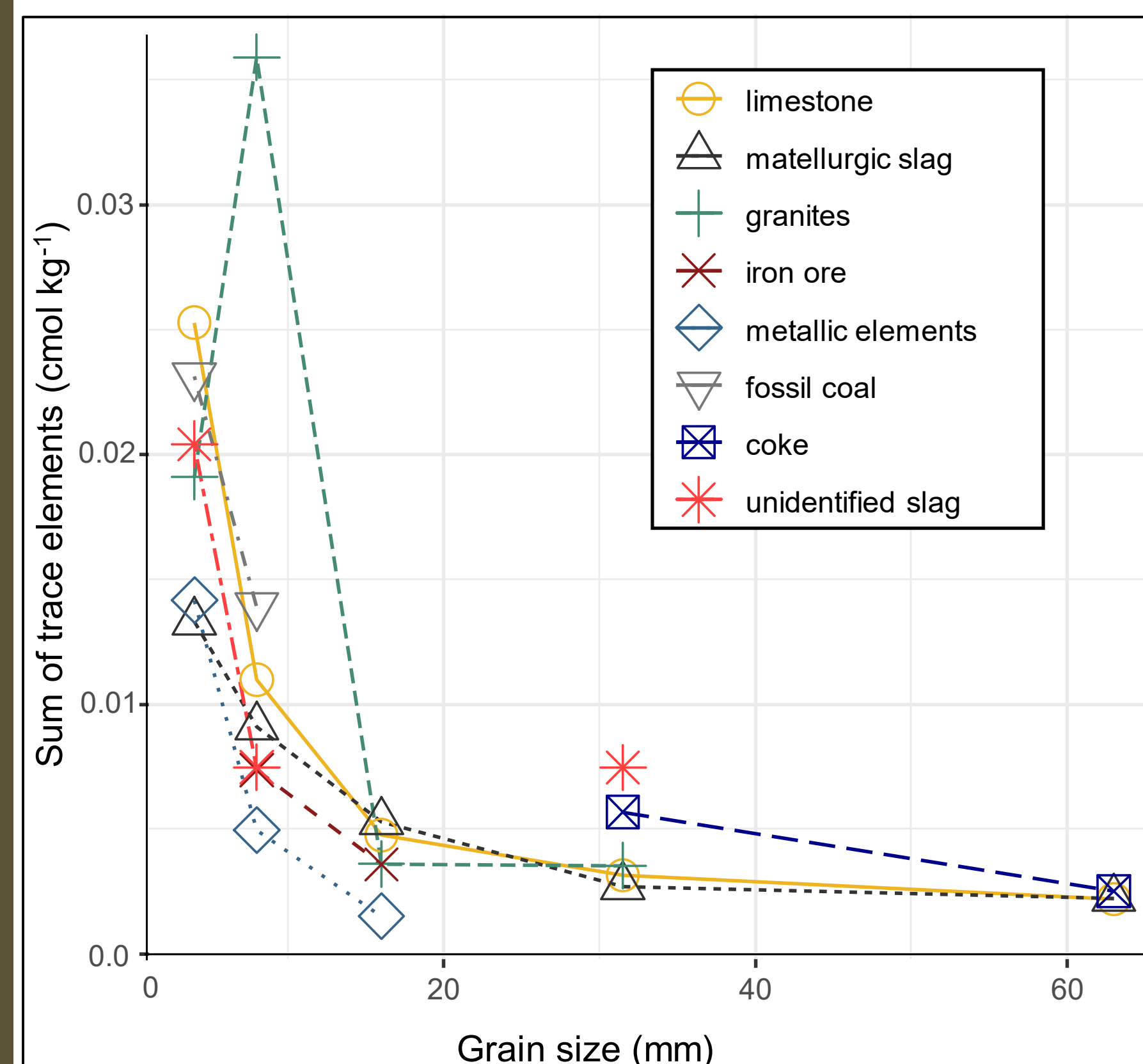
- ✓ **Slags, granites and metallic elements** display strong a **morphological and compositional heterogeneity**
- ✓ **Iron ore and metallic elements** are the main stock of trace elements
- ✓ **18 % of total trace elements** is contained in the coarse fraction



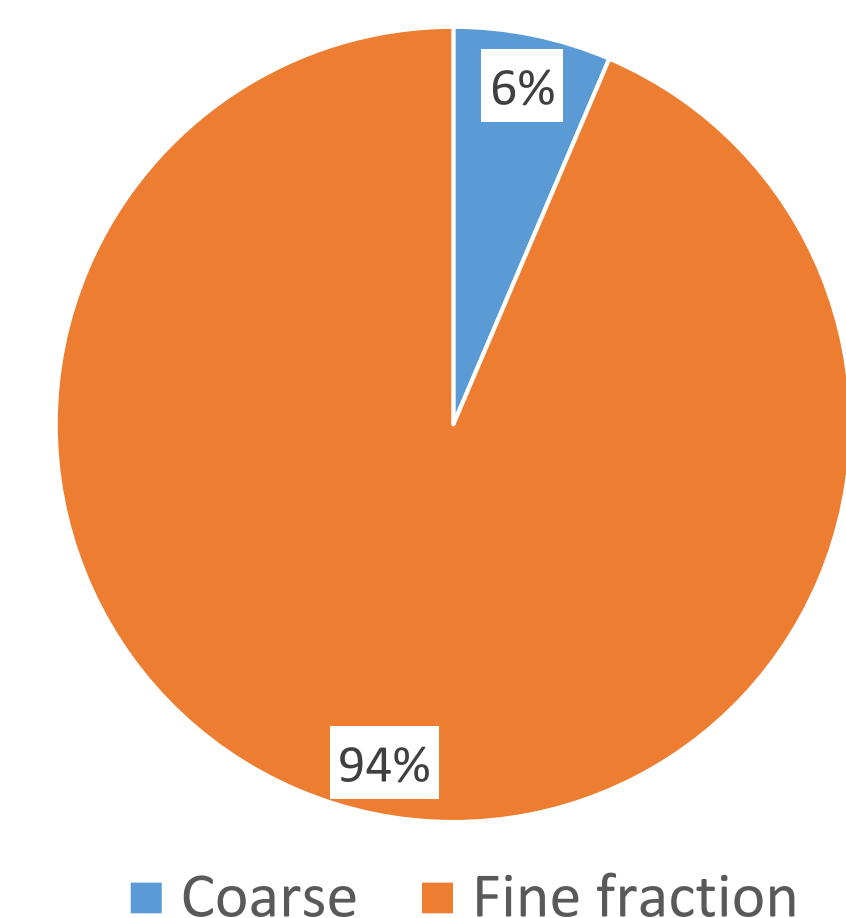
Distribution of total trace elements between fine and coarse fractions (%)



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



Distribution of total trace elements extractable by a CaCl₂ 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**