Mineralization of organic artefacts: implication for carbon early dynamics in Technosols

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SUITMA 11

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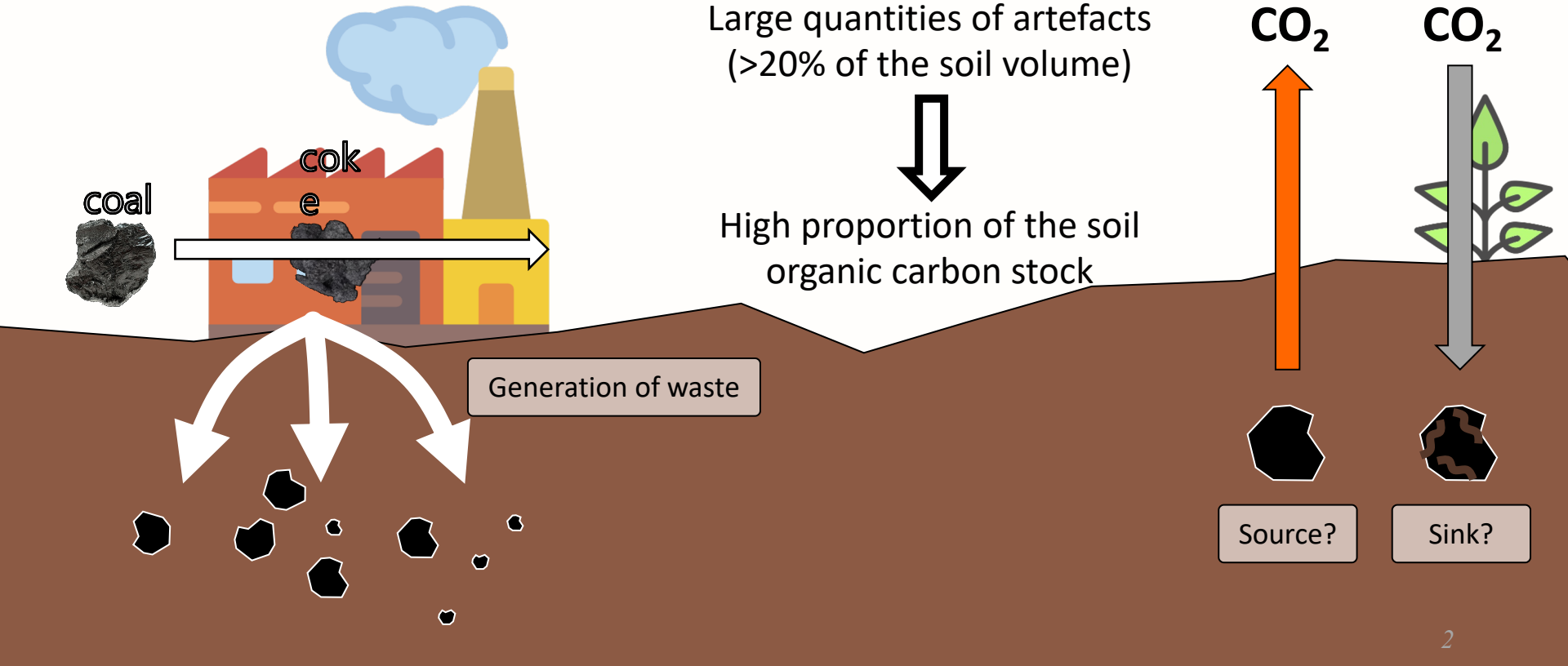
Organic artefacts in the Technosols

= « **artefact** »

Anthropogenic activities, e.g. coking plant

High organic carbon content
(20 to 90% of organic carbon)
+
Large quantities of artefacts
(>20% of the soil volume)

High proportion of the soil organic carbon stock



Selection of the artefacts and one natural organic matter

Artefacts

- **Papermill sludge, PS**
- **Green waste compost, GWC**
- **Biochar, BC**
- **Coal, CO**
- **Coke, CK**

Natural OM → **Roots and shoots of sorghum, RS**

PS

GWC

RS

BC

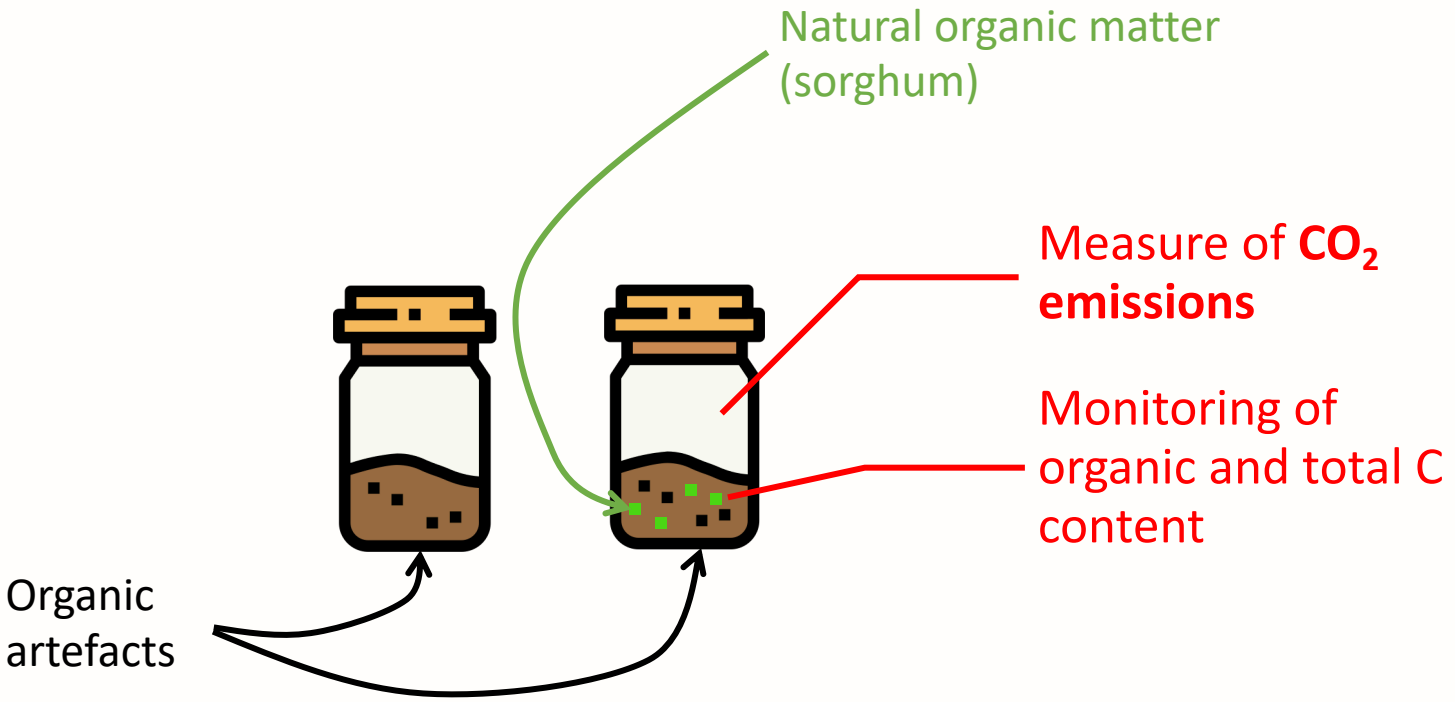
CO

CK

Incubation and monitoring of the mineralization

Preparation of "artificial soils" containing a mixture of minerals (kaolinite and quartz), organic artifacts and/or natural organic matter.

These "artificial soils" were inoculated with a microbial inoculum obtained from an agricultural soil.



Fine description of the soils through analysis after the incubation

TC and SOC measurements

Rock-Eval analysis

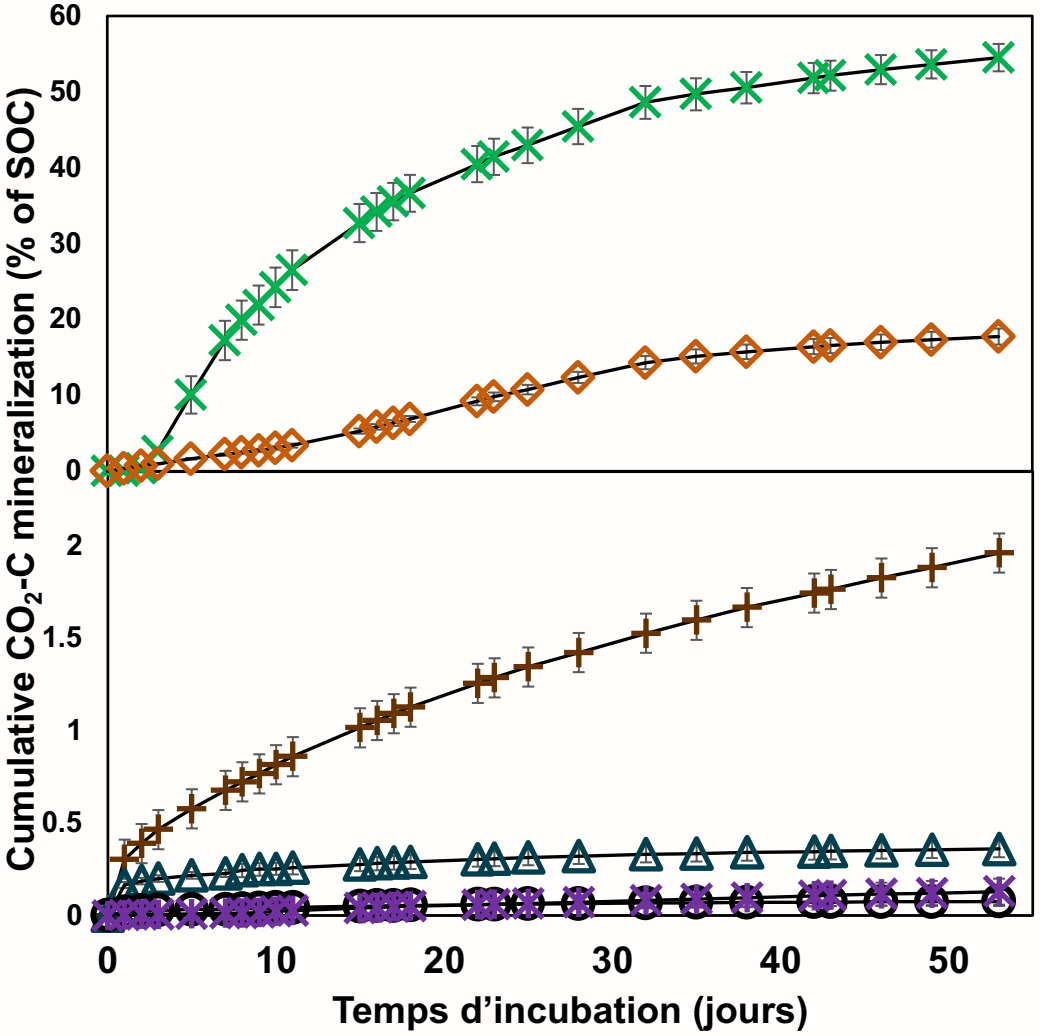
Particle size-density fractionation

δ13C analysis

Objectives:

- Have a fine description and understanding of the mineralization potentials of artefacts
- Observe how artefacts interact with natural organic matters

Contrasted mineralization of artefacts

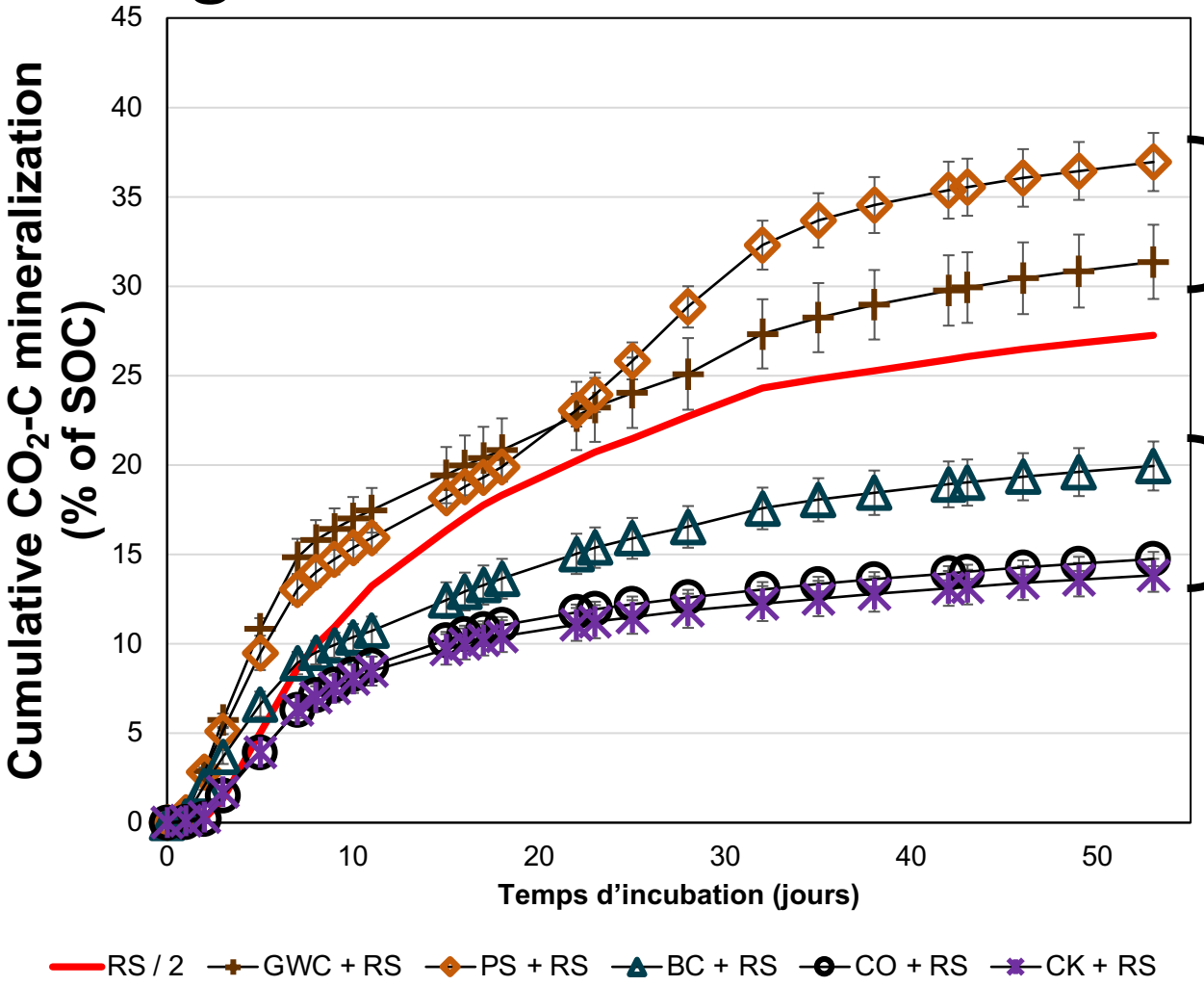


Roots and shoots of sorghum

RS >> PS >> GWC >> BC > CO ≈ CK

Mean residence time of around 100 years!

Enhancement or protection of natural organic matter mineralization?



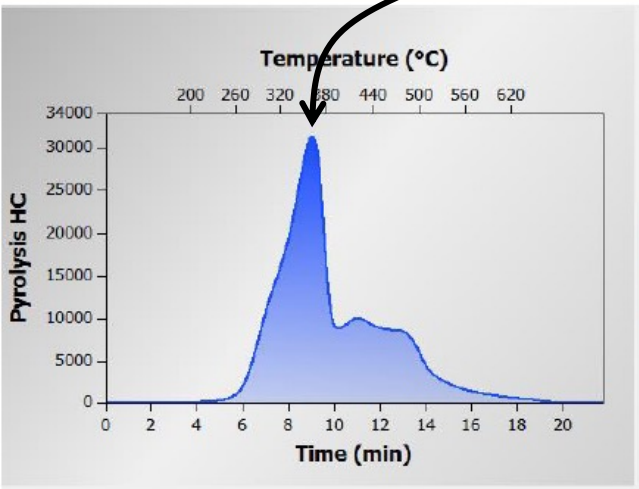
Over-mineralization with soils containing **compost** or **paper-mill sludge**

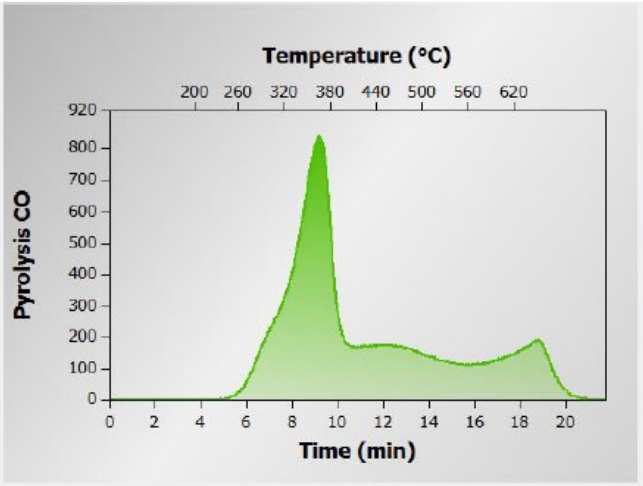
Under-mineralization

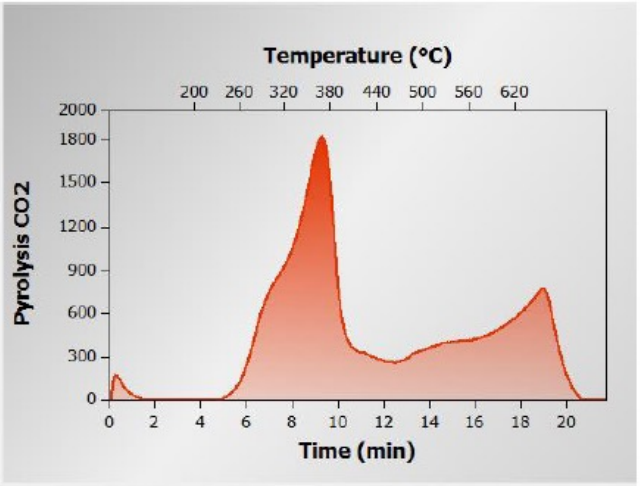
Contrasted Rock-Eval parameters

Papermill sludge, PS

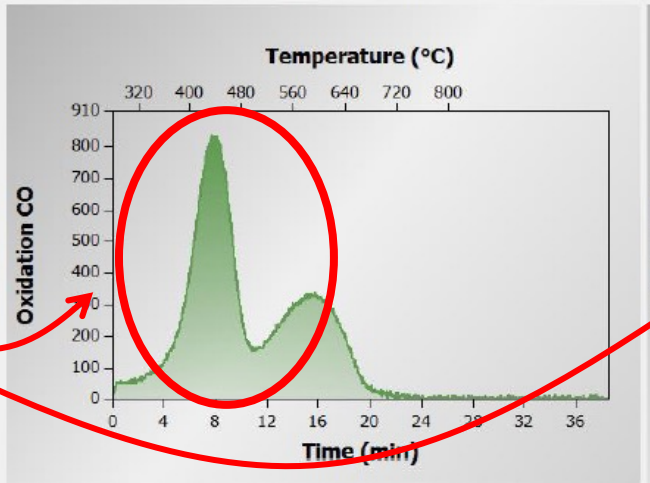
Peak of release at 360 °C

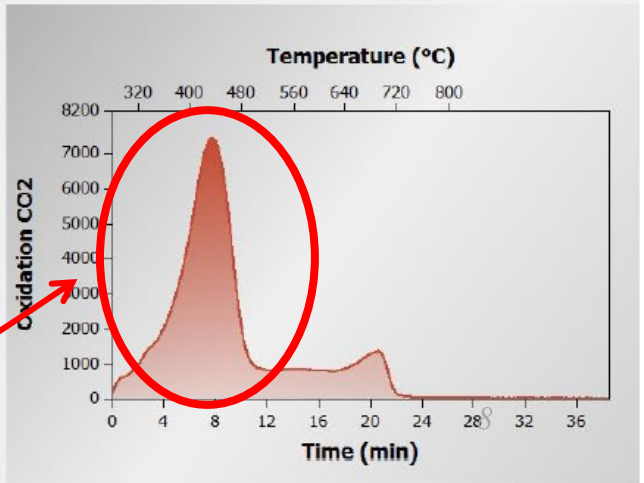






Few gaz releases in early oxidation phase

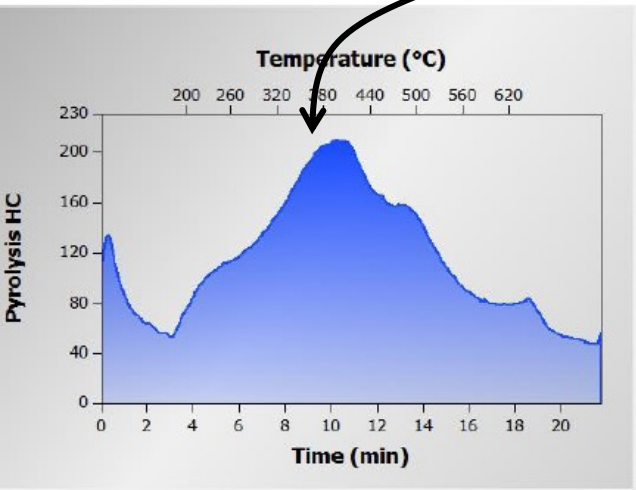


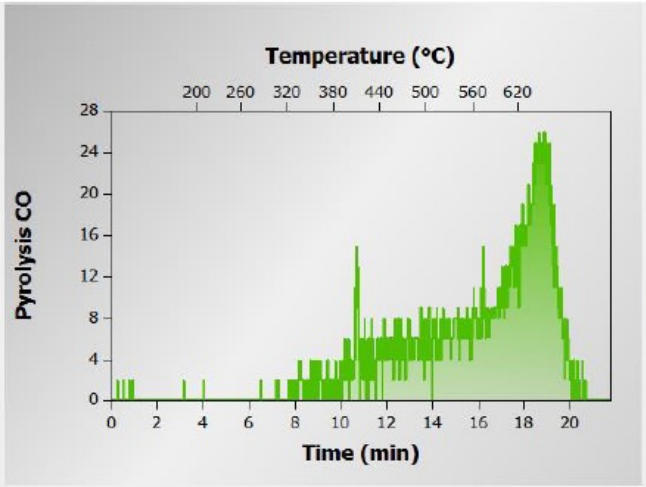


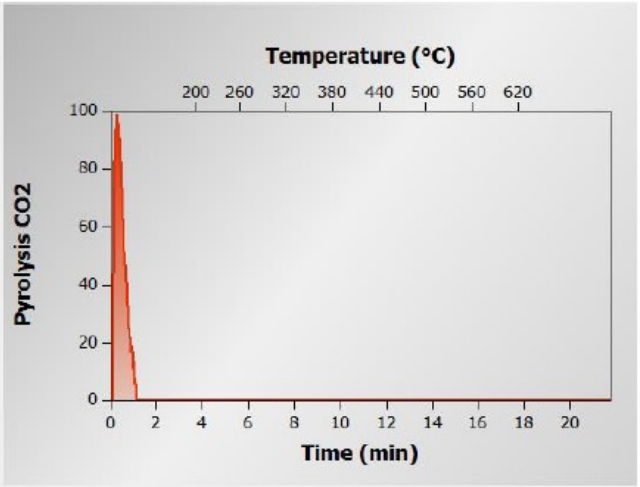
Contrasted Rock-Eval parameters

Coke, CK

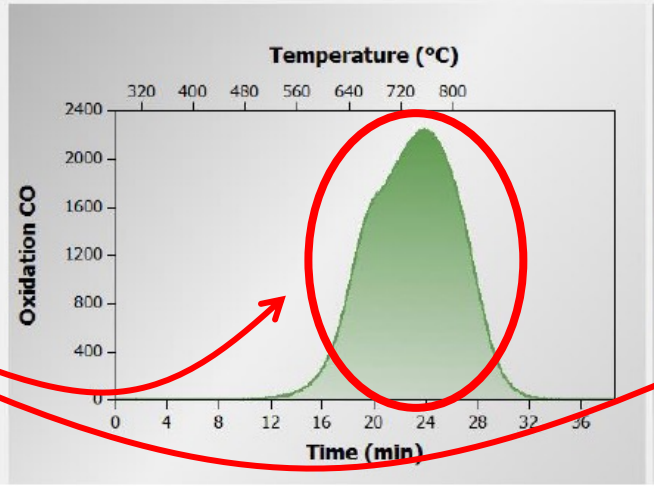
Peak of release at 400 °C

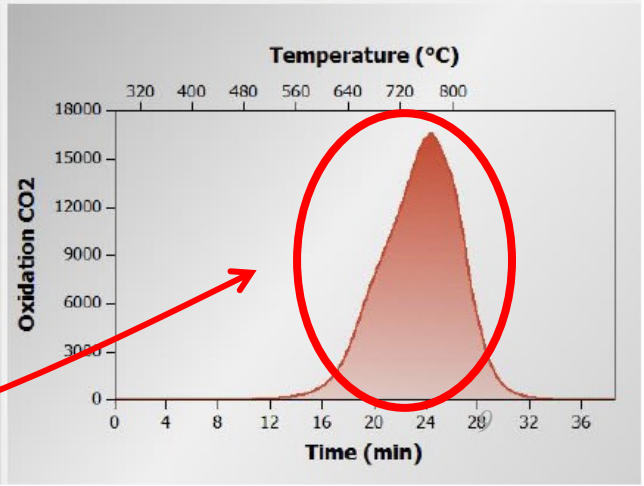




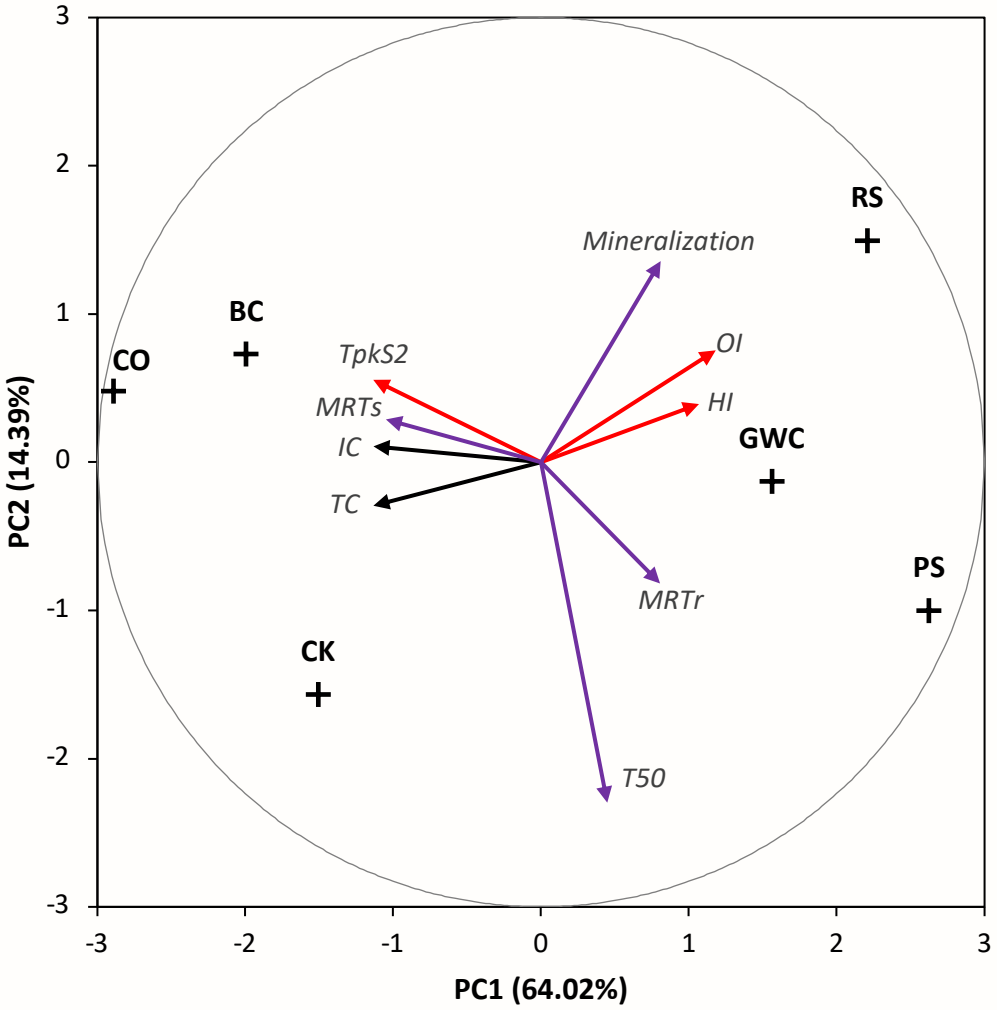


Many gaz releases in **late** oxidation phase





PCA of mineralization and Rock-Eval parameters



Purple arrows are related to mineralization kinetics parameters.

Red arrows are related to thermal degradation resistance and chemical composition (from Rock-Eval analysis).

Mineralization potential is correlated with artefact chemical composition parameters such as O/C and H/C ratios.

Carbon early dynamics of Technosols

- Low degradation rates for most of the artefacts tested, comparable to the most stable organic matter of natural soils
- The most recalcitrant organic artefacts **reduce the mineralization of the natural organic matters.**
- Low degradation potential is directly linked to the chemical composition of artefacts

➔**Technosols with organic artefacts might more behave as a carbon sink**

To go further…

- What role have mineral artefacts?
- How is natural organic matter protected by the coal related artefacts?
- Is recalcitrance the main C sequestration mechanisms in Technosols?

Thank you for your attention! ☺