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SUITMA 11



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

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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)



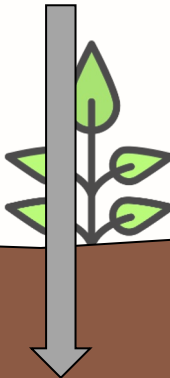
High proportion of the soil
organic carbon stock

CO₂



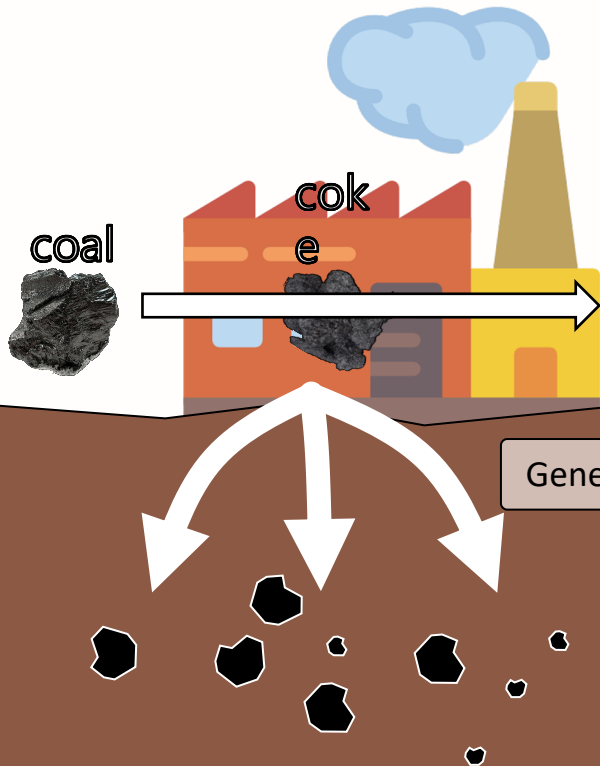
Source?

CO₂



Sink?

Generation of waste



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



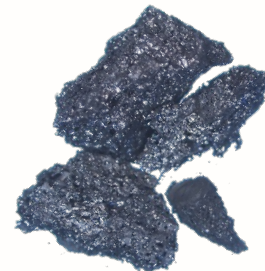
RS



BC



CO

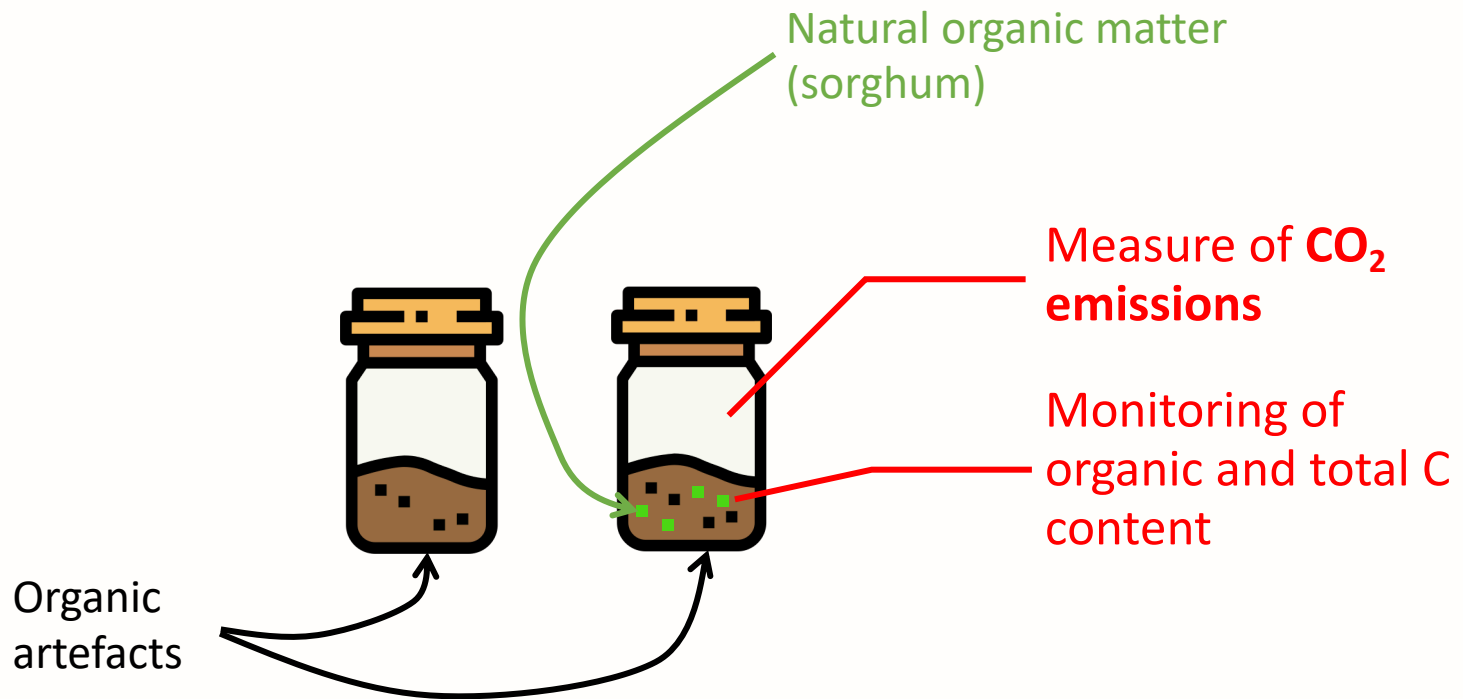


CK

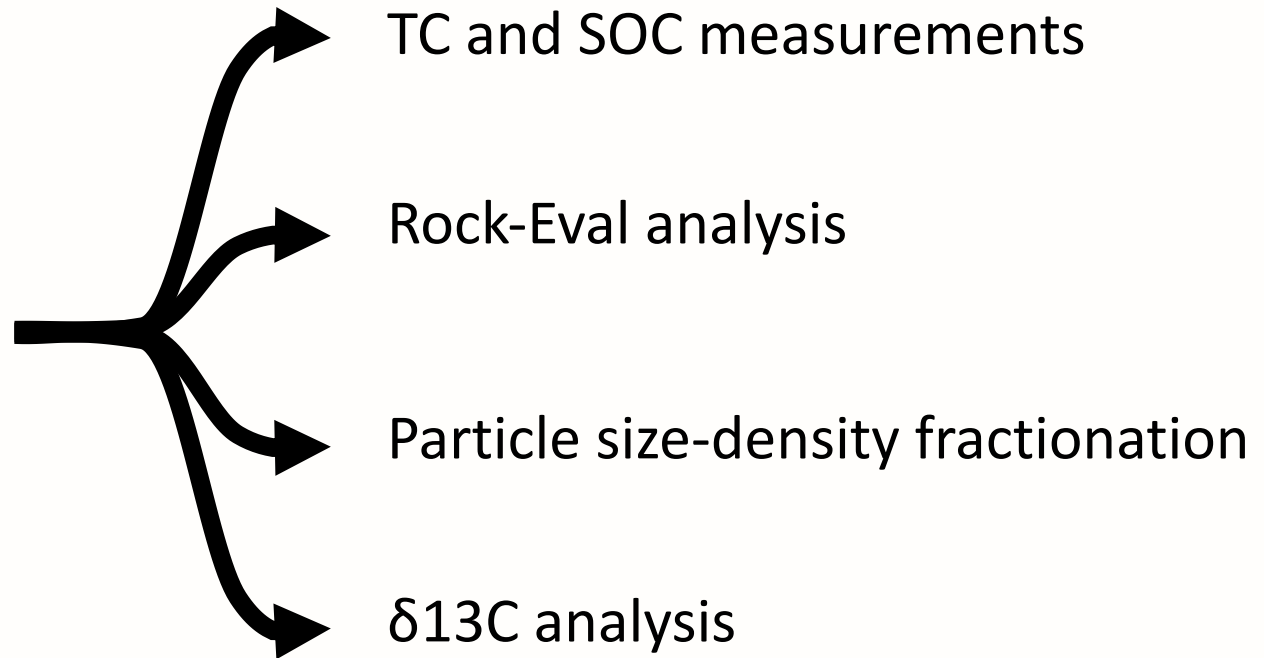
Incubation and monitoring of the mineralization

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.



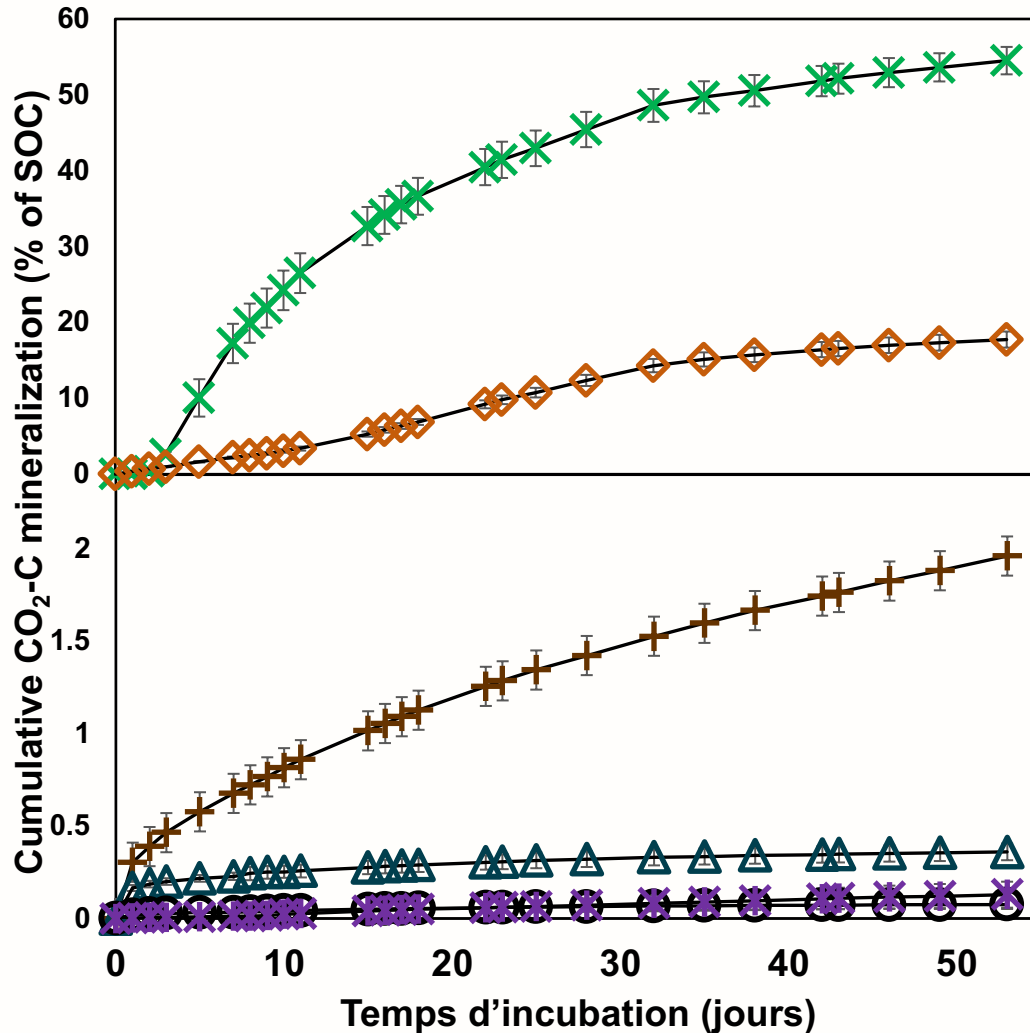
Fine description of the soils through analysis after the incubation



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



55 % ← Roots and shoots of sorghum

18 %

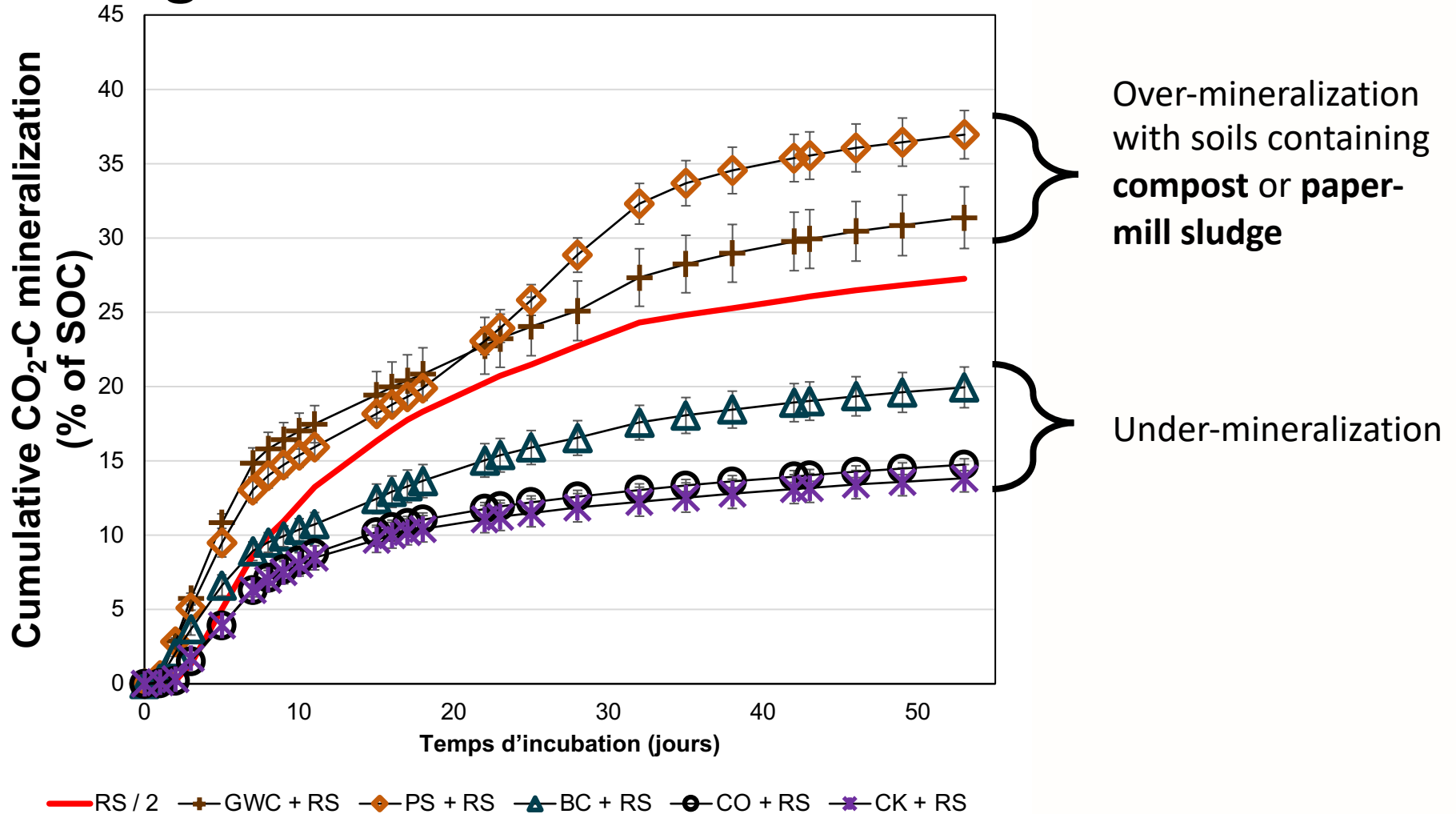
RS >> PS >> GWC >> BC > CO
 ≈ CK

2 %

< 0,5 %

Mean residence time of around 100 years!

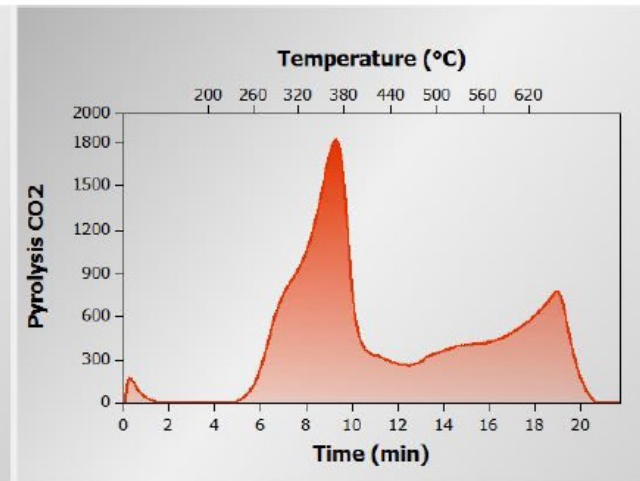
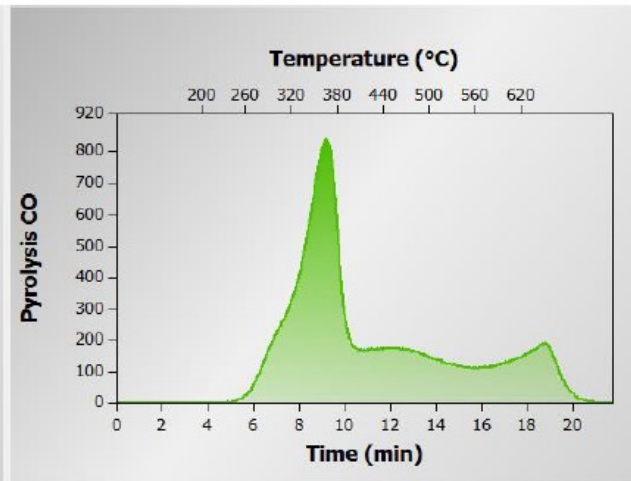
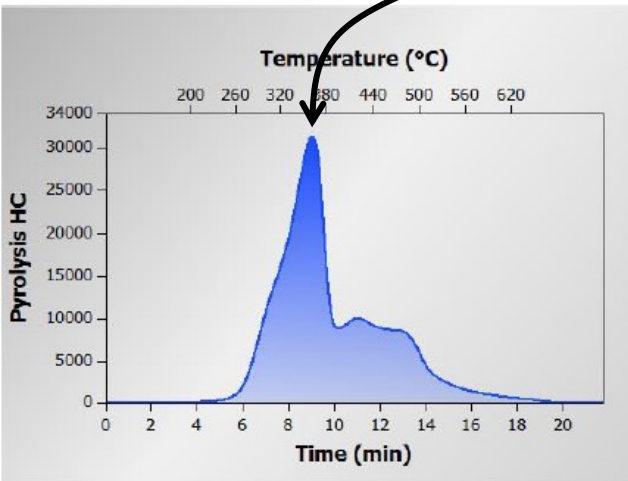
Enhancement or protection of natural organic matter mineralization?



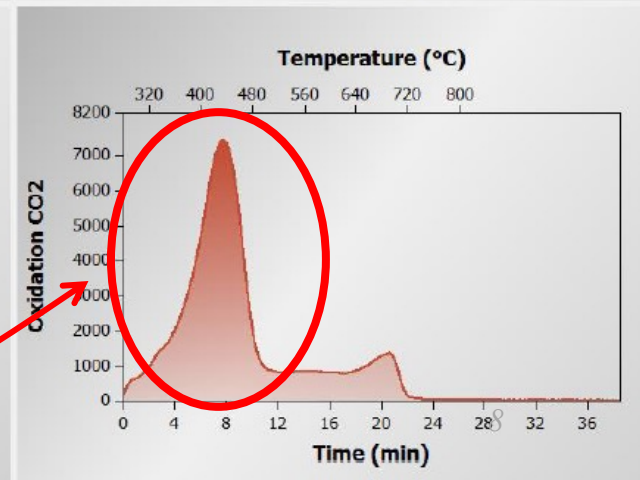
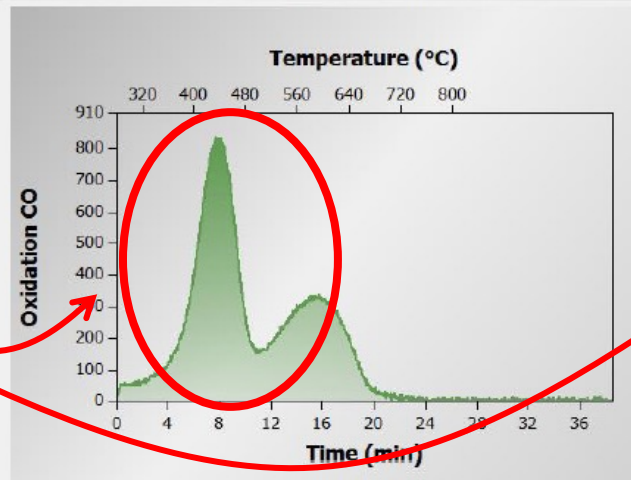
Contrasted Rock-Eval parameters

Papermill sludge, PS

Peak of release at 360 °C



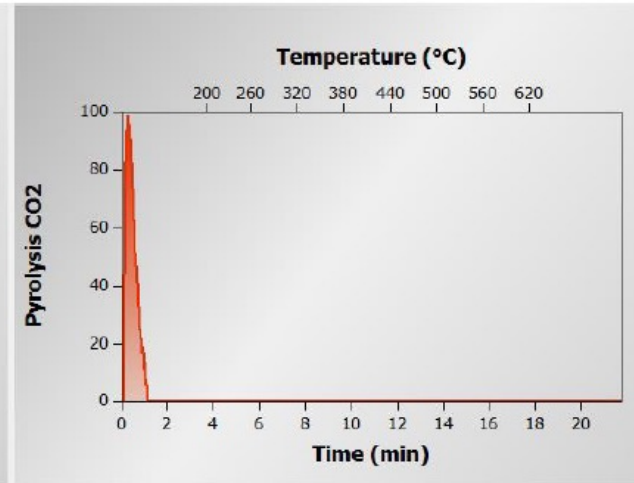
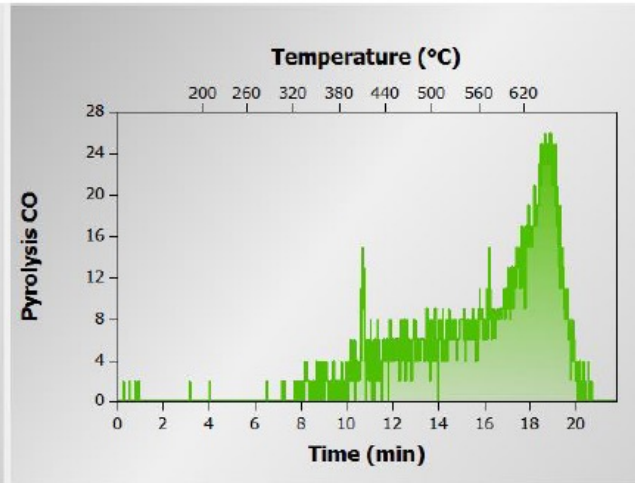
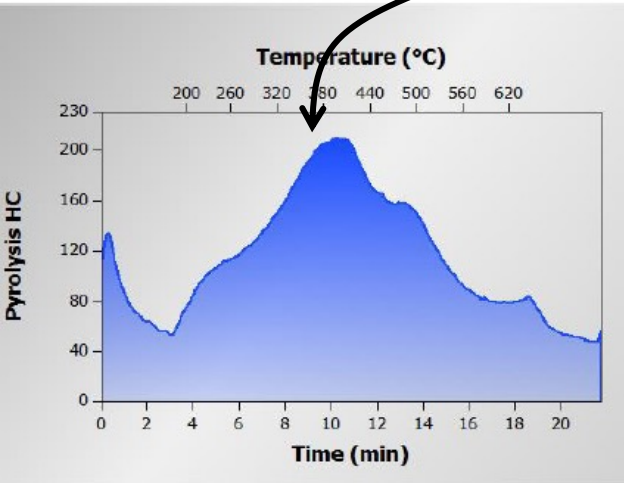
Few gas releases in early oxidation phase



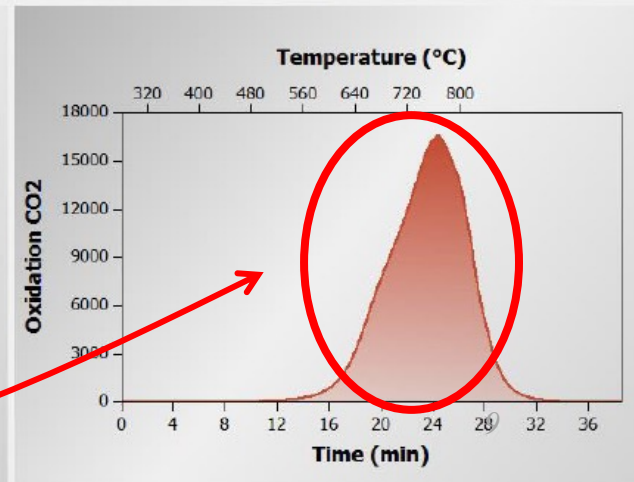
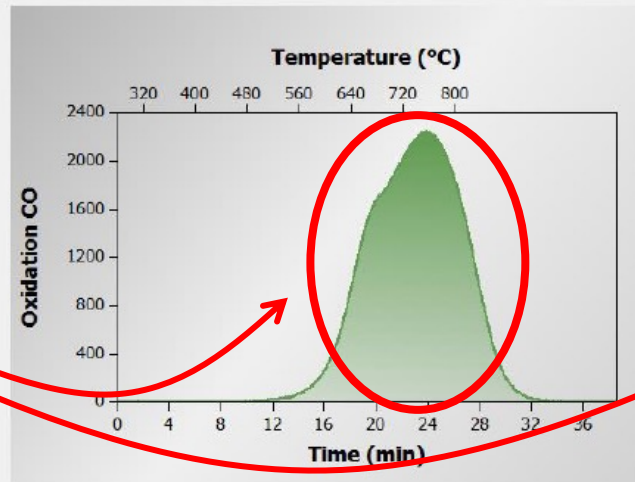
Contrasted Rock-Eval parameters

Coke, CK

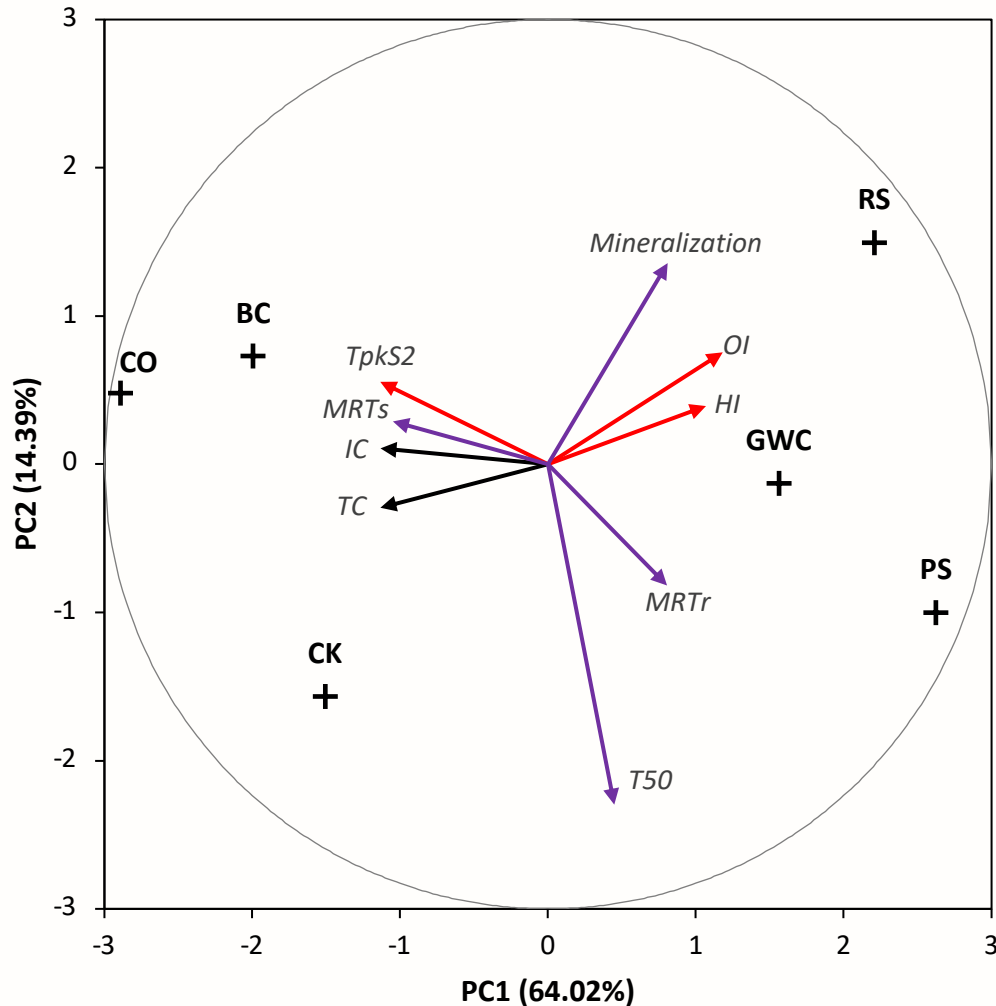
Peak of release at 400 °C



Many gas 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! 😊