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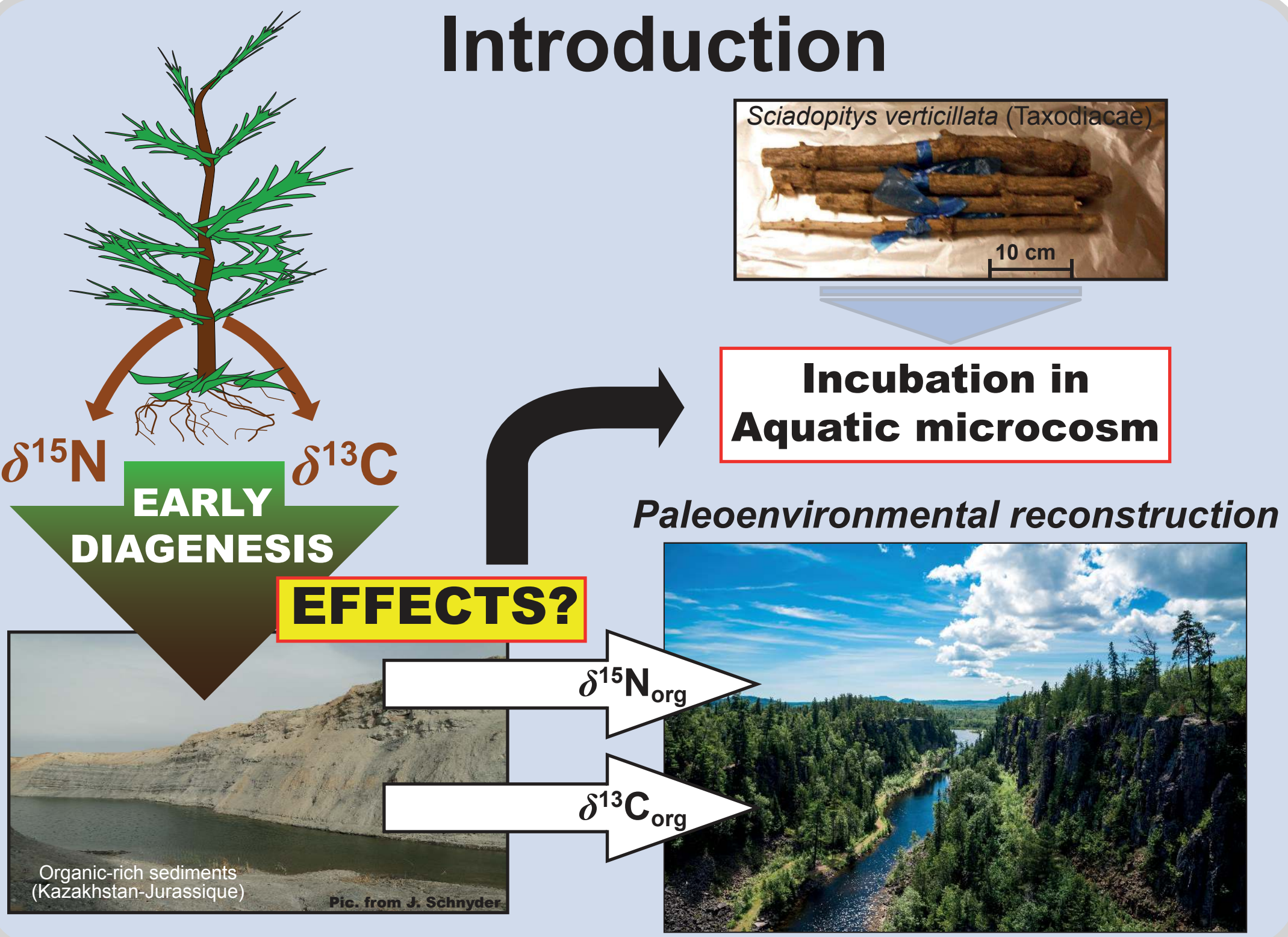
# Effects of early diagenesis on the isotopic signature of wood ( $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ): incubation in aquatic microcosm

Romain Tramoy<sup>1</sup>, Thanh Thuy Nguyen Tu<sup>2</sup>, Véronique Vaury<sup>3</sup>, Mathieu Sebilo<sup>3</sup>, Laurence Millot Cornette<sup>2</sup>, Celine Roose-Amsaleg<sup>2</sup>, Johann Schnyder<sup>1</sup>.

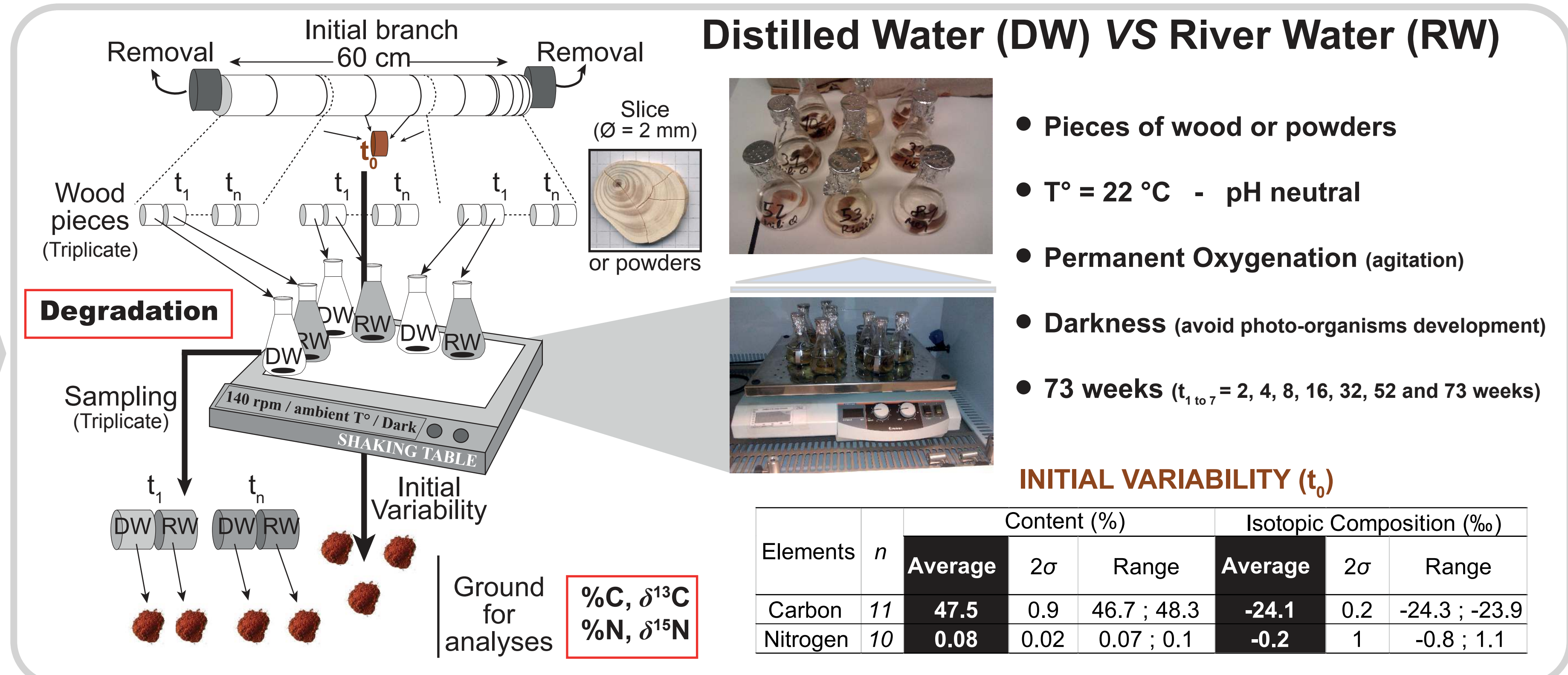
<sup>1</sup>Sorbonne universités, CNRS, UPMC, UMR 7193, ISTEP, France ; <sup>2</sup>Sorbonne universités, CNRS, UPMC, EPHE, UMR 7619, METIS, France ; <sup>3</sup>Sorbonne universités, CNRS, UPMC, INRA, IRD-Paris Diderot-UPEC, UMR7618, IEES, France

\*Work published as Tramoy et al. (2017) in *Environmental Chemistry*

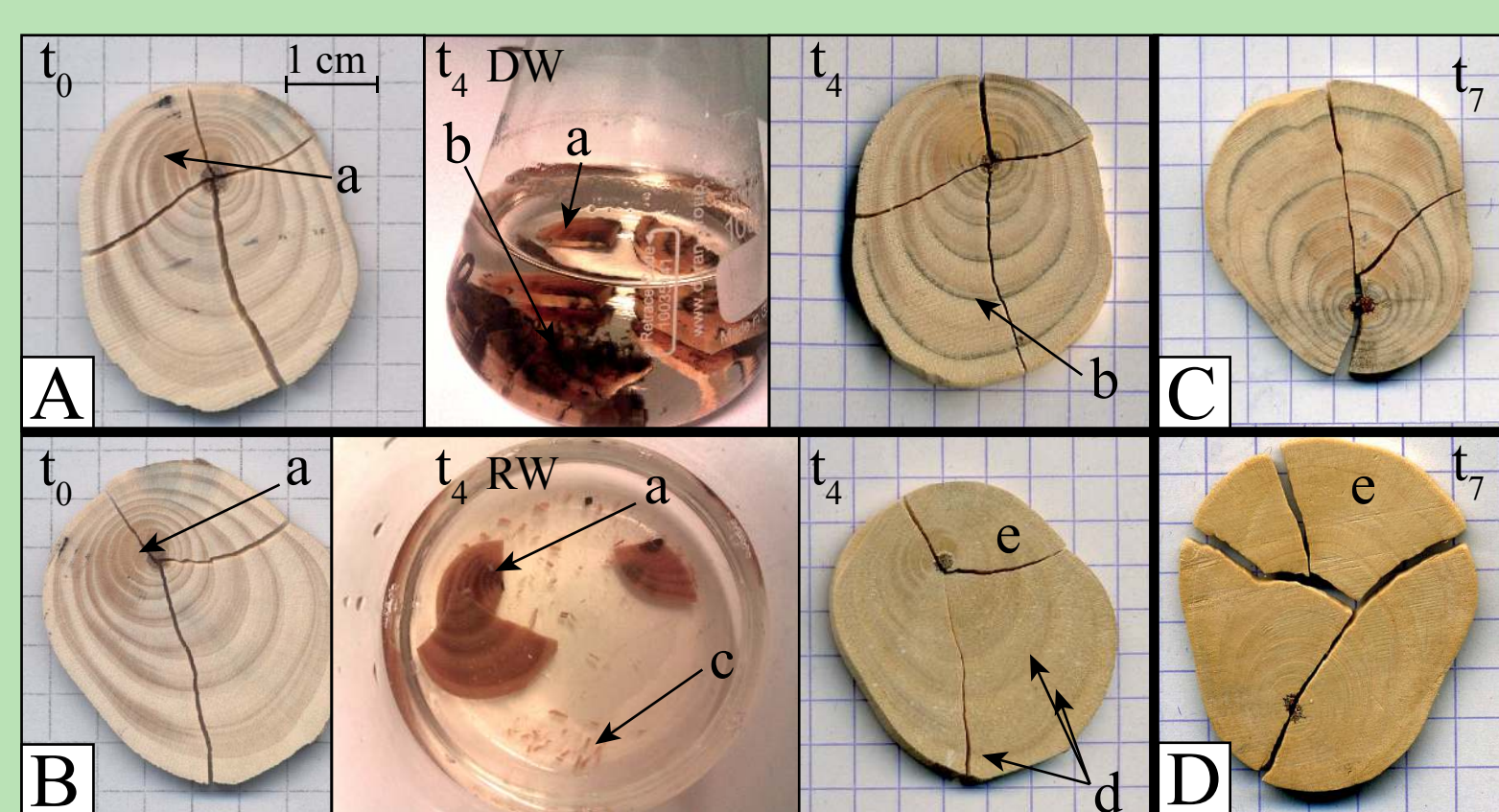
## Introduction



METHOD



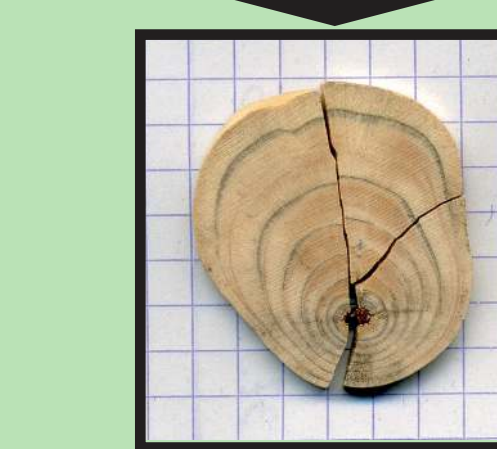
## 1. Observations: Fungi as main decomposers ?



### VISUAL ASPECTS

**Distilled Water (DW)**      **River Water (RW)**

- Dark color
- Growth-rings braun-reddish
- Color uniformisation
- Mottled & Spongy traits
- Whitish-yellow coloration

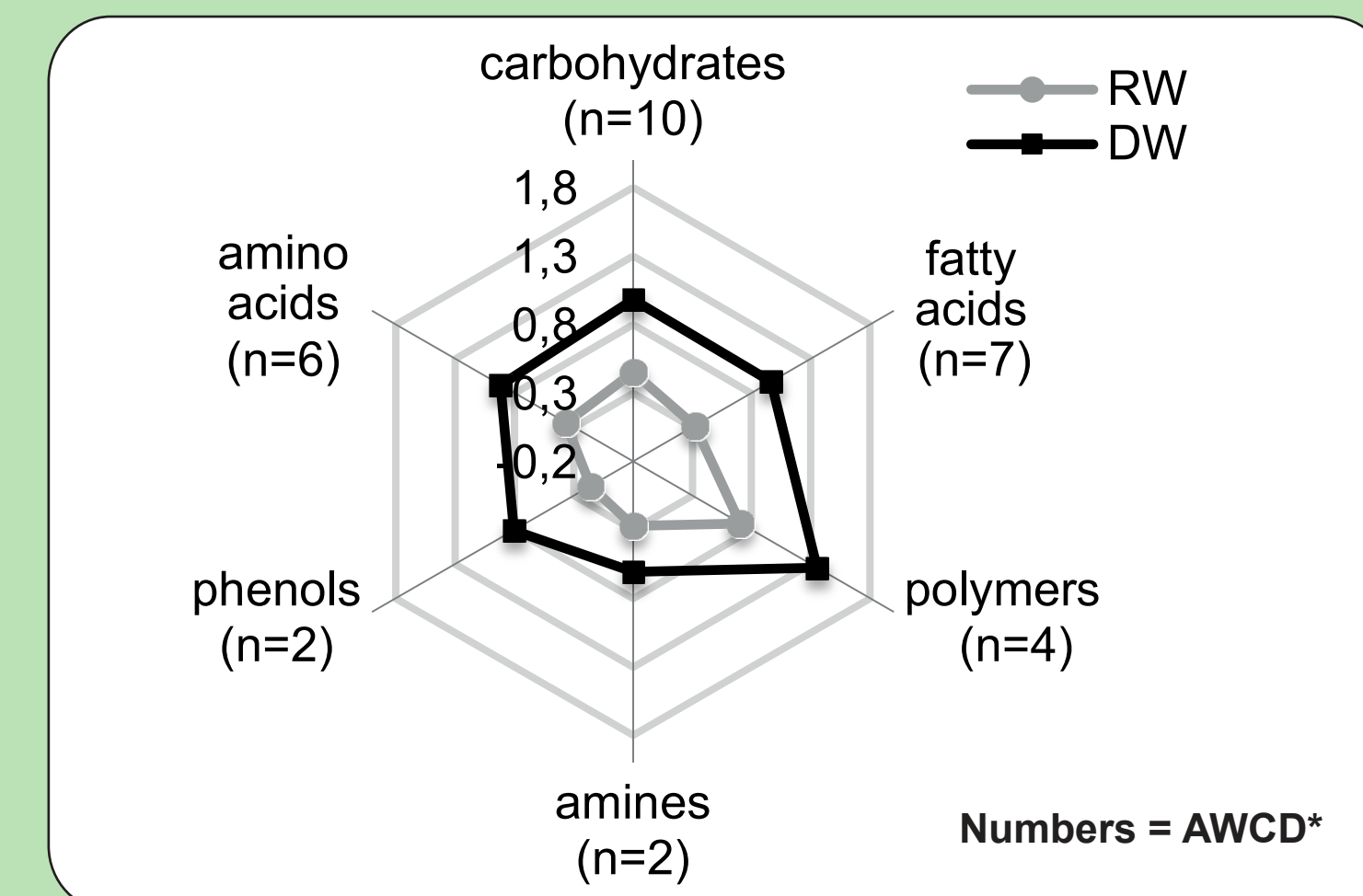


► Degrading Cellulose

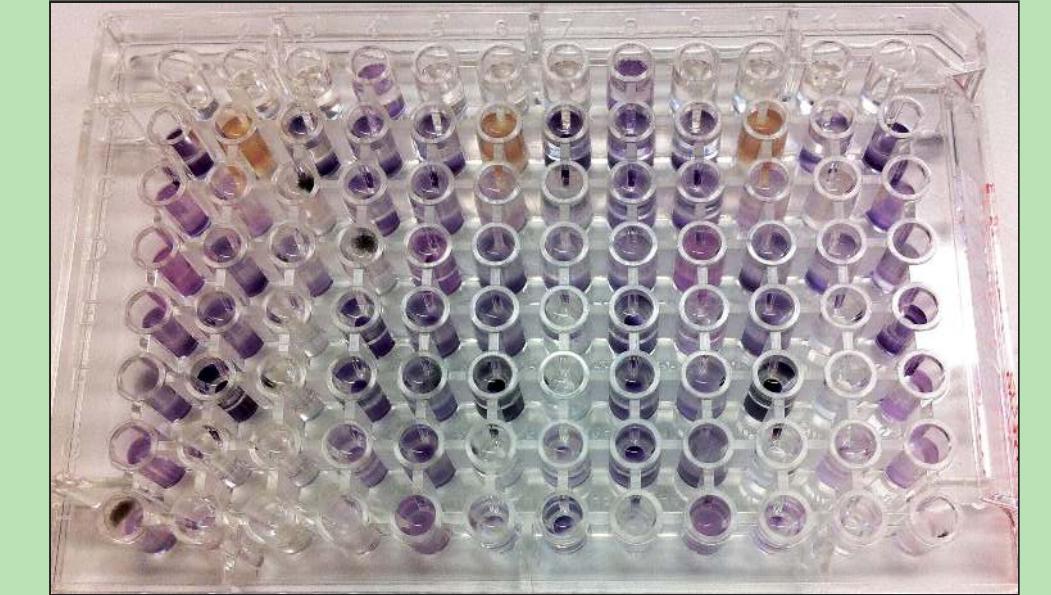
► Degrading Lignin/Cellulose

## 2. Microflora in powders

Functional diversity of the bacterial communities using Method BiologECO (Garland & Mills 1991)



Picture of a BiologECO plate after incubation



\*AWCD (Average Well Colour Development): Index showing the development of microorganisms on different tested substrates. It corresponds to the bacterial activity and diversity in the study environment (Zak et al., 1994; Zhao et al., 2013).

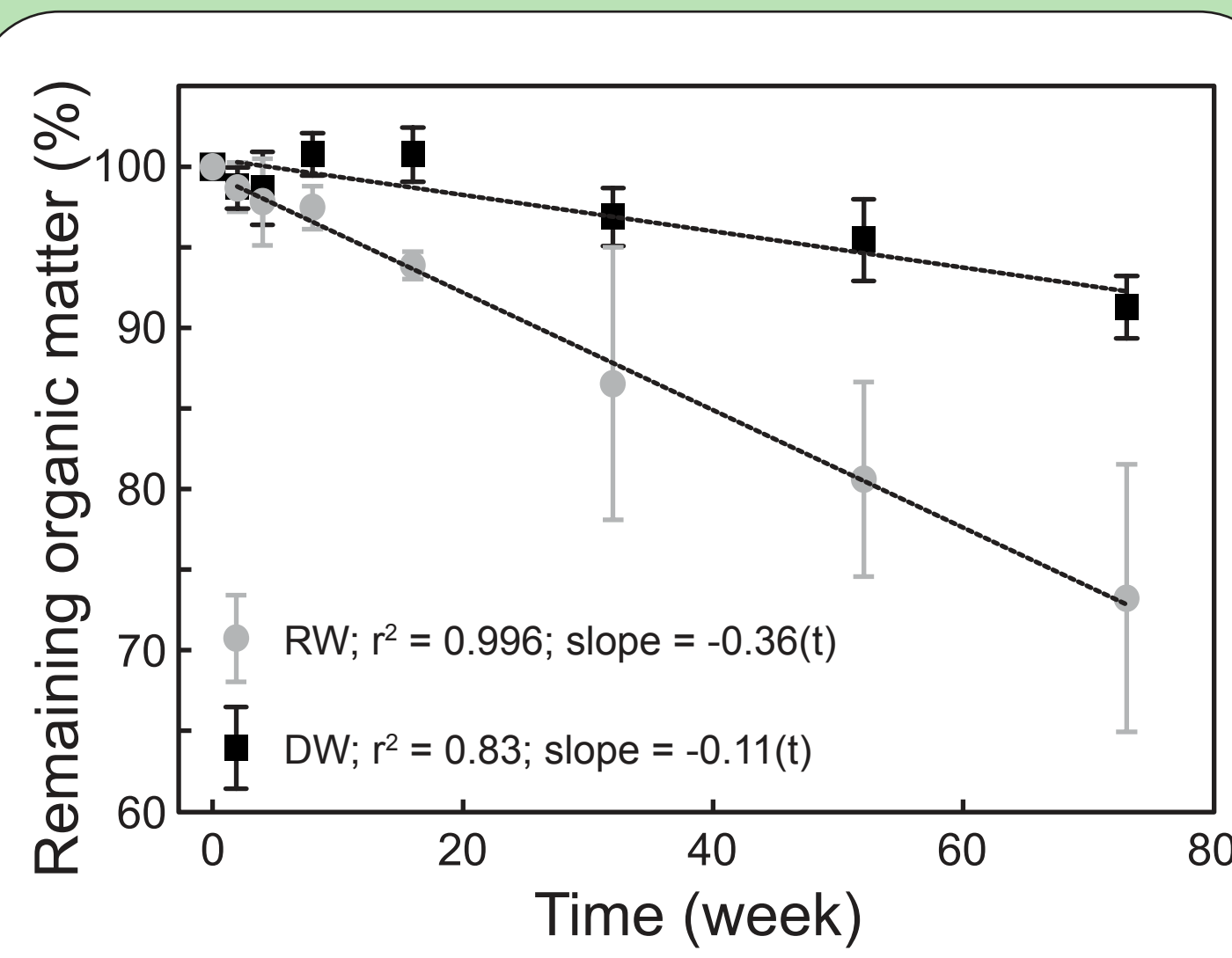
Average bacterial activity (AWCD\*):

**Distilled Water (DW)**  
0,98±0,03

**River Water (RW)**  
0,41±0,09

Similar community structure, but twice higher activity in DW than in RW...

## 3. Degradation state



Mass loss of wood pieces vs time

Error bars correspond to standard deviation of triplicate  
100 % corresponds to the initial state ( $t_0$ )

**Distilled Water (DW)**

**River Water (RW)**

► -10 %

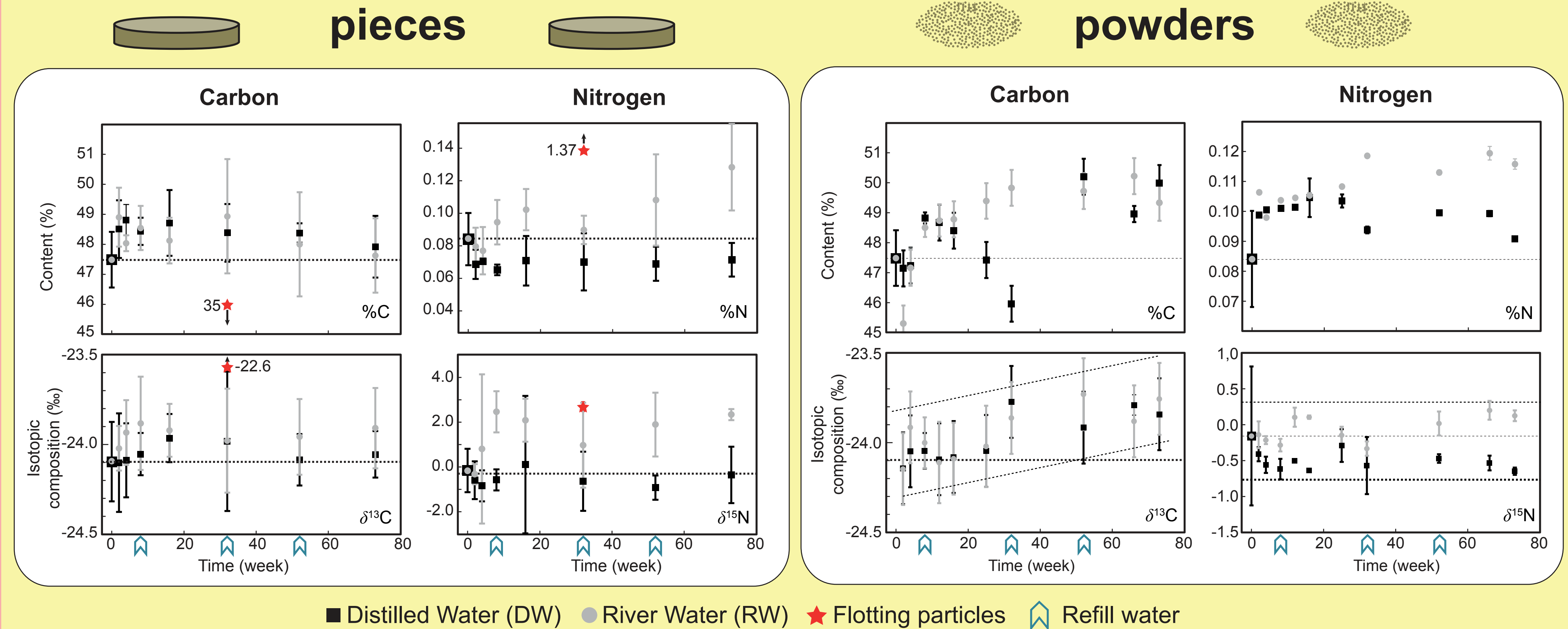
► -30 %

• **Leaching** of labile constituents (monoses, amino-acids...)

• **Biotic degradation** by (micro-)organisms like fungi

**Bacteria are NOT the main decomposers**  
**Fungi are the main decomposers**

## 4. Effects on the isotopic signature of wood



**CARBON DYNAMIC**

- Pieces: Low variability in  $\delta^{13}\text{C}$  and in  $\%C$** 
  - Low amount of material affected by degradation when compared to the bulk carbon pool.
  - Loss of  $^{13}\text{C}$ -depleted compounds (cf. floating particles; tannins, lignin, other non-polar compounds; Melillo et al., 1989)
- Powders: complex dynamic**
  - Key-role of respiration leading to  $^{13}\text{C}$ -enrichment ?

**NITROGEN DYNAMIC**

- Similar between pieces and powders**
- Nitrogen gain in pieces in RW +  $^{15}\text{N}$ -enrichment**
  - Incorporation of exogenous nitrogen into the wood (nitrates from water ?) thanks to fungi activity. Higher  $\text{NO}_3\text{-}\delta^{15}\text{N}$  supports this hypothesis. **N accumulation according to Melillo et al. (1989)**
- Nitrogen loss in pieces in DW +  $^{15}\text{N}$ -depletion**
  - Amino-acids and proteins ( $^{15}\text{N}$ -enriched) consumption by fungi, which exports nitrogen from the wood through mycellium.

In both type of water, **mycellium** of fungi likely constitute a **nitrogen transport network** and their activity may proceed toward isotopic uniformisation of a system (e.g. wood-fungi-water) as long as nitrogen is maintained in the bulk system

## Conclusions

►  $\delta^{13}\text{C}$  values of organic matter has lower variability than  $\delta^{15}\text{N}$  values, which confirms its interest as a **source and environment indicator**

► Without invalidating the use of  $\delta^{15}\text{N}_{\text{org}}$  as a paleoenvironmental marker, this study shows that **early diagenesis leads to the integration of isotopic compositions from multiple environmental origins** that should be addressed when interpreting  $\delta^{15}\text{N}_{\text{org}}$  in soils and sediments

## Références

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