Tree Rings In Archaeology, Climatology and Ecology (TRACE 2019)

# Can we use isotopic analyses (δ13C) on archaeological charcoal as paleoenvironnemental proxy for Pleistocene sequences? : Two test methods in the different archeological context of La Combette (Middle Paleolithic) and La Grotte aux Points (Upper Palaeolithic)

***Benjamin AUDIARD***, *Julien MONNEY, Marco PADOVAN, Pierre-Jean TEXIER, Thierry BLASCO, Giovanna BATTIPAGLIA, Isabelle THERY-PARISOT*

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-> Focus on the glacial period

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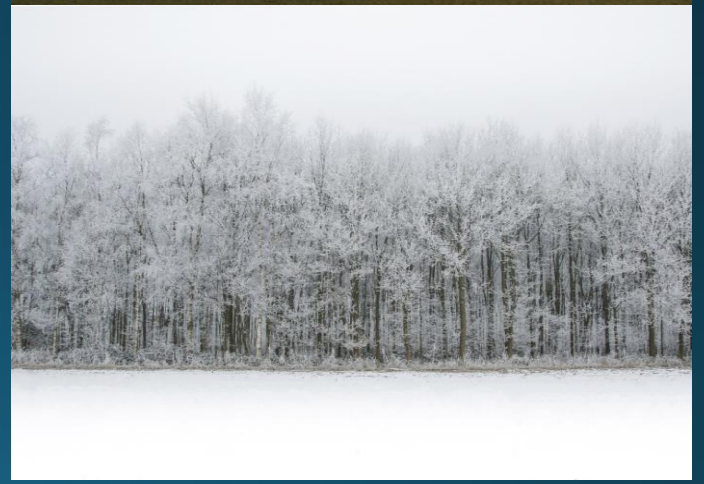

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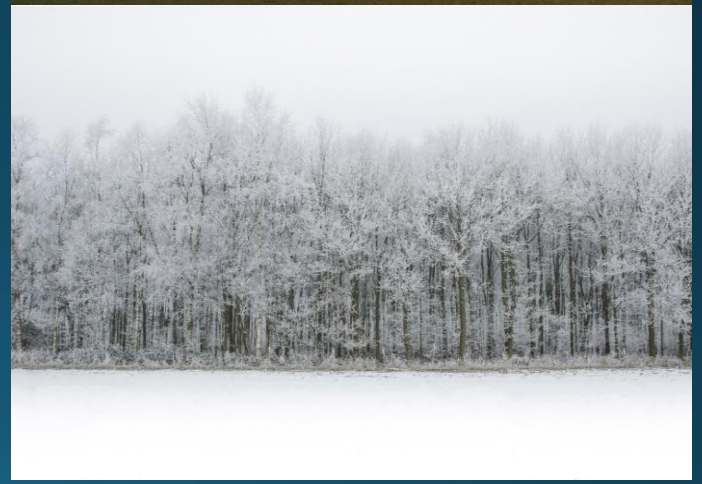

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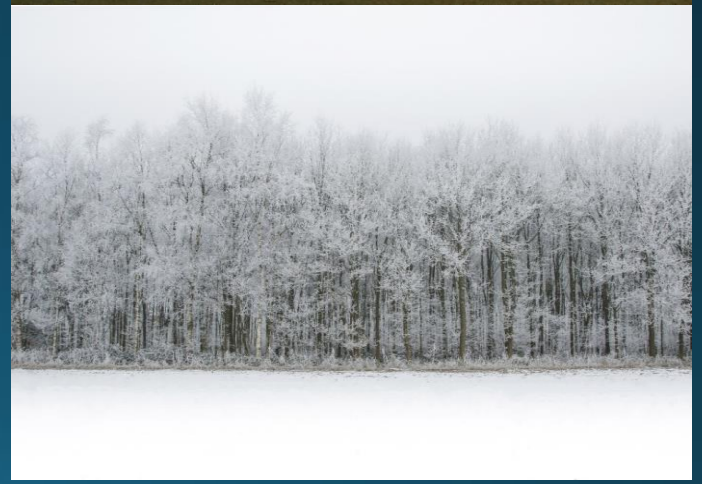

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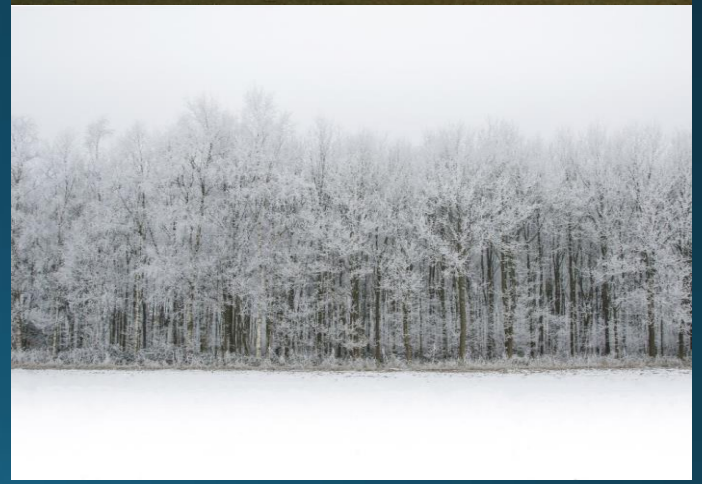

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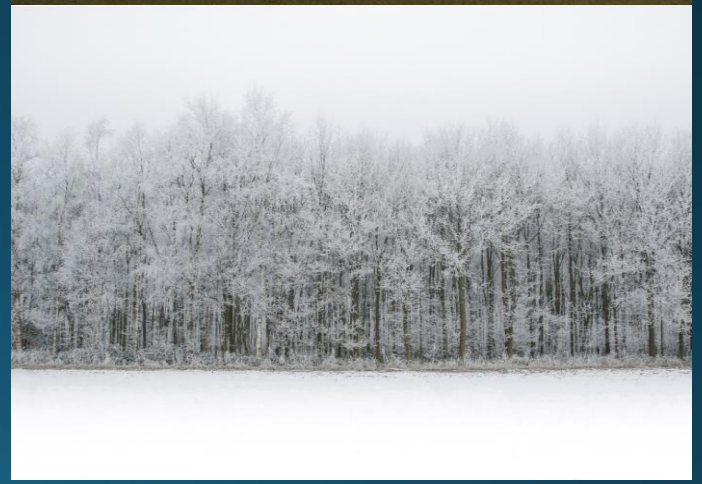

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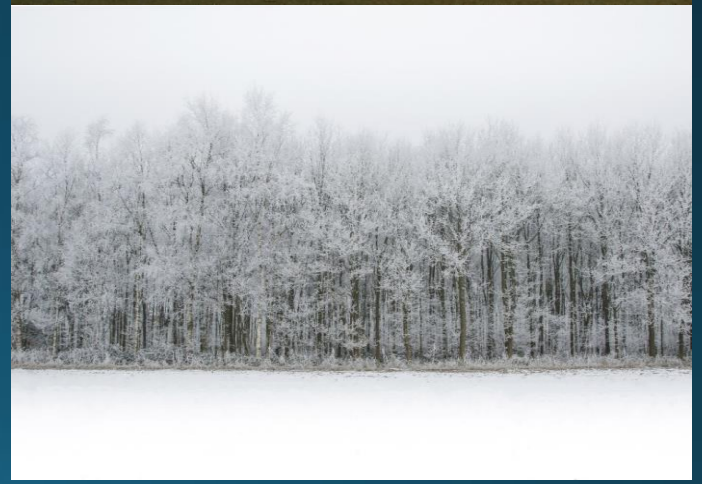

**-> New stronger method : crossing taxinomic and isotopic study from charcoals**

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-> No statistic $\delta^{13}C$ difference between Pinus species from same geographic area (Audiard et al., 2018)

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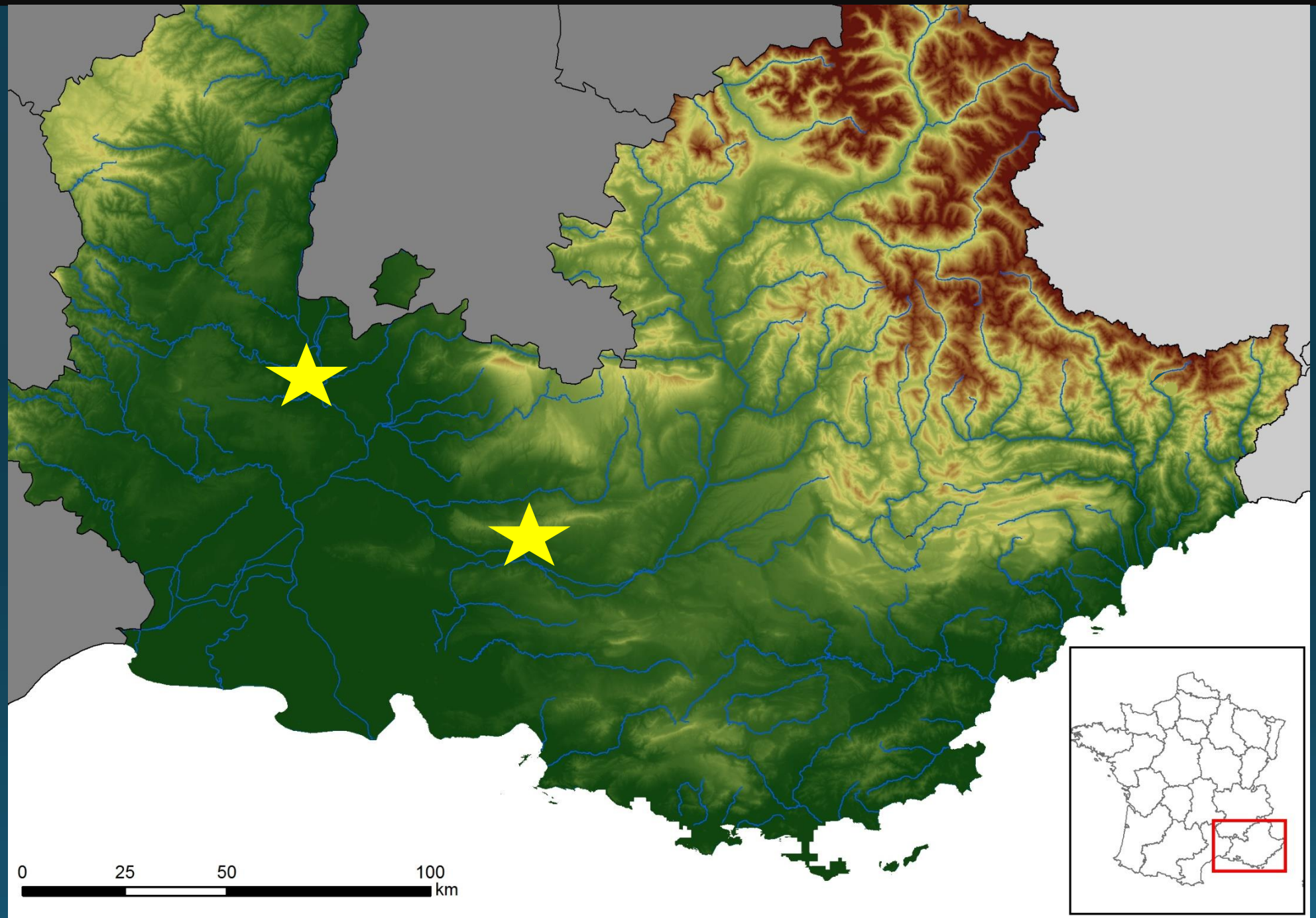
  - Preferential conservation of a charcoal type


0
25
50
100
km

## La Combette

- Mousterian (MIS 4 – MIS3)
- Well preserved stratigraphy (7m)
- Numerous charcoals

0 25 50 100 km

## La Grotte aux points

- Gravettian & Solutrean

(30 to 26 kys & 24 to 22 kys cal BP)

- Complex disturbed stratigraphy
- Sparsely charcoals

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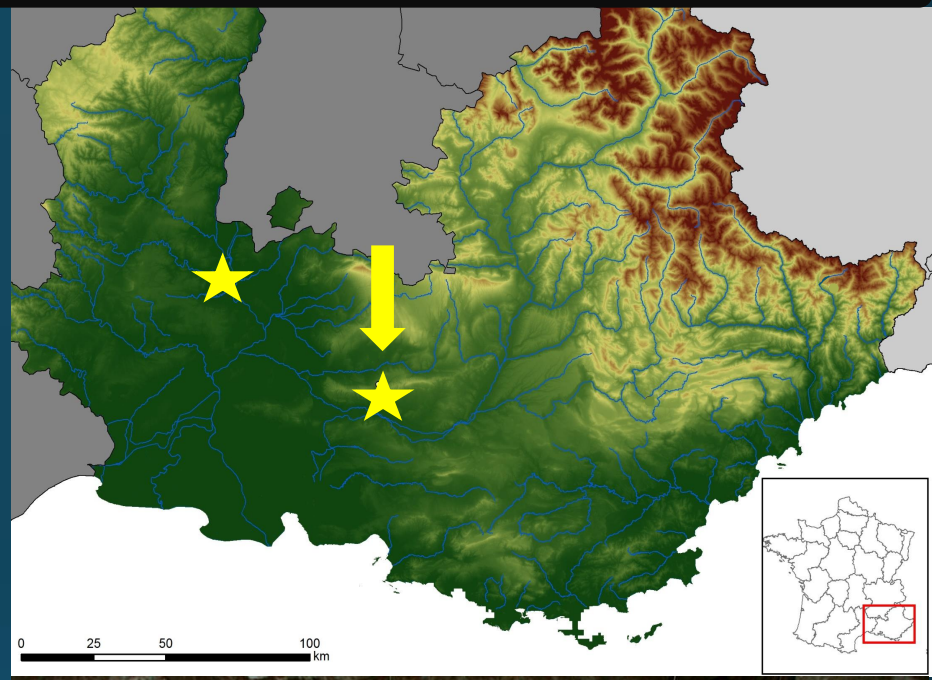
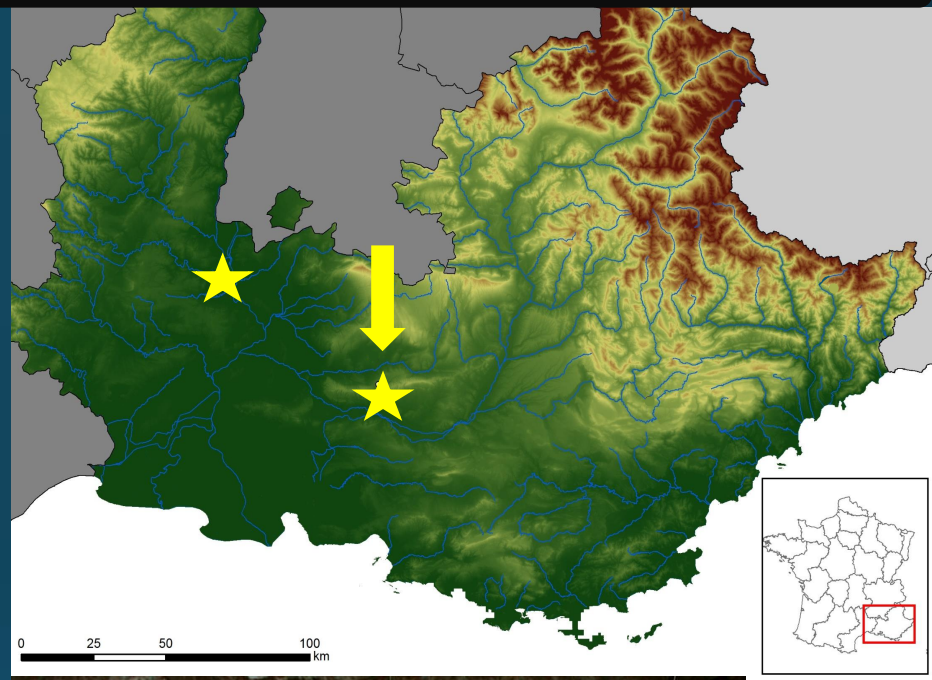
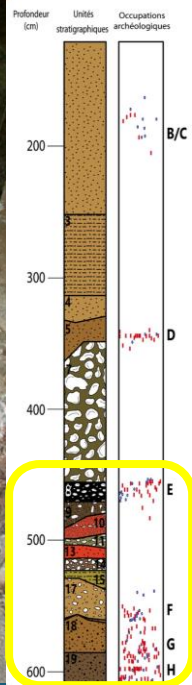



## La Combette (COMB)

- Sampling area:
  - Lower sequence -> Cross section L/M13
  - Upper sequence -> entire site surface



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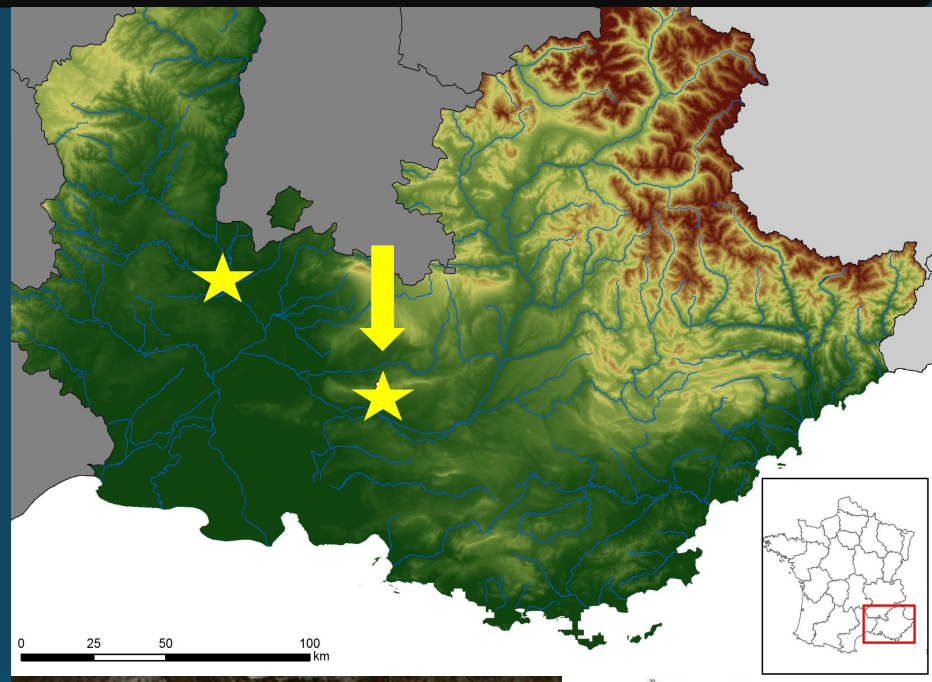
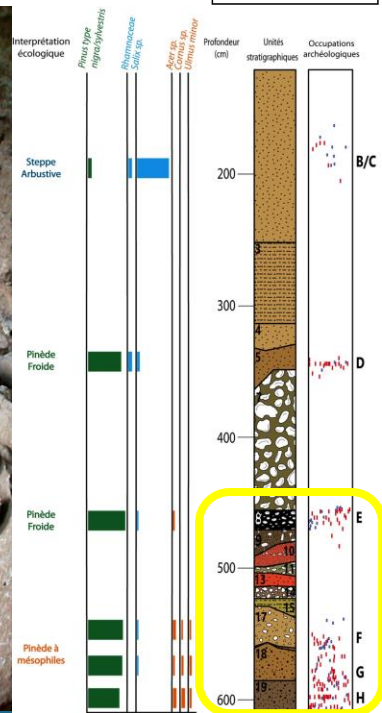
  (I. Théry-Parisot)
  - Pinewood and Riparian forest
  - or Riparian forest with few pine



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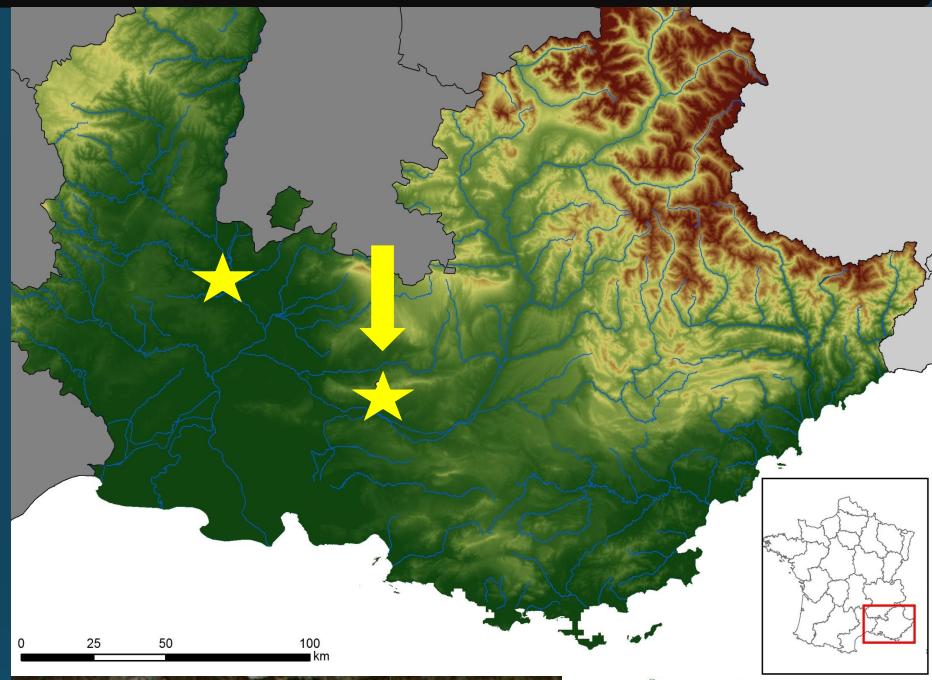
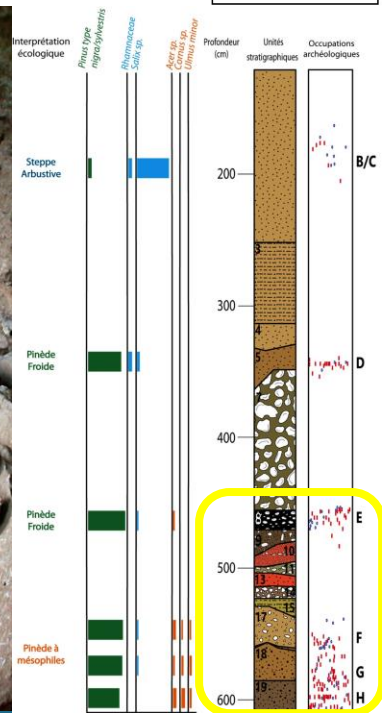
- Supplementary data:
  - Palynology
  - Microstratigraphy
  - Microfauna and fauna



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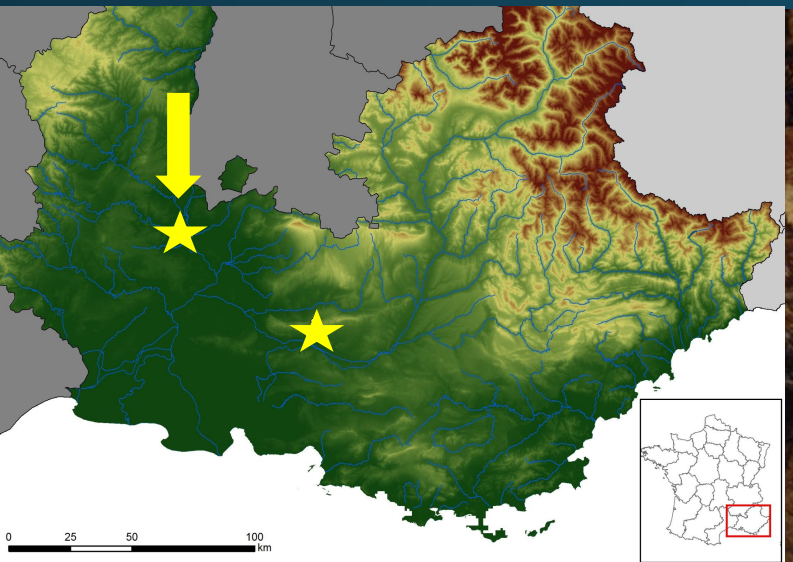


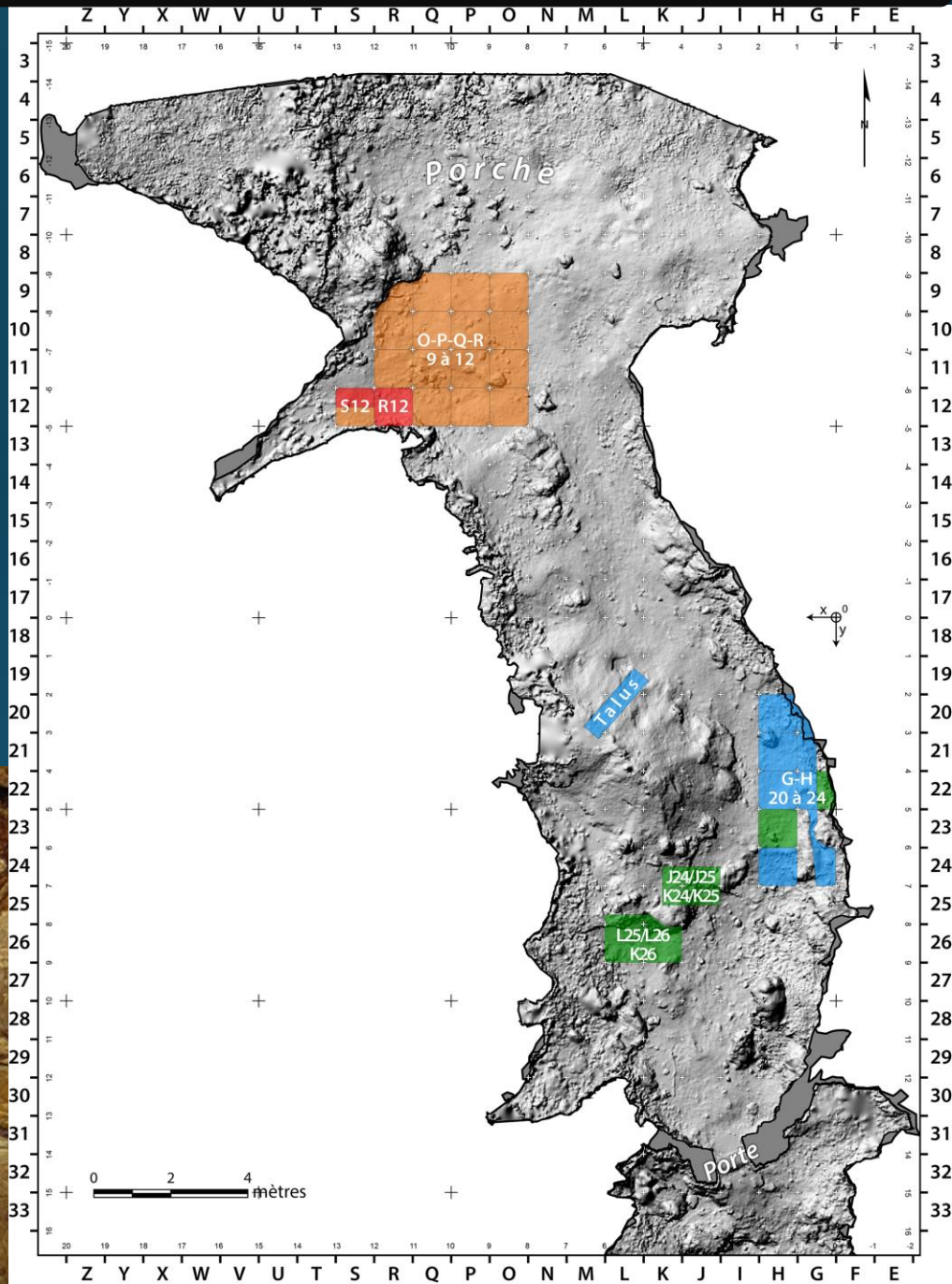

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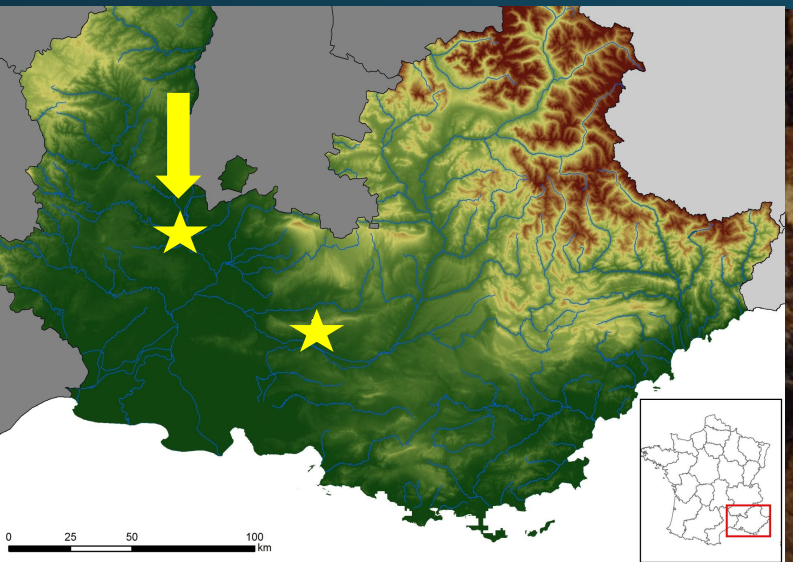


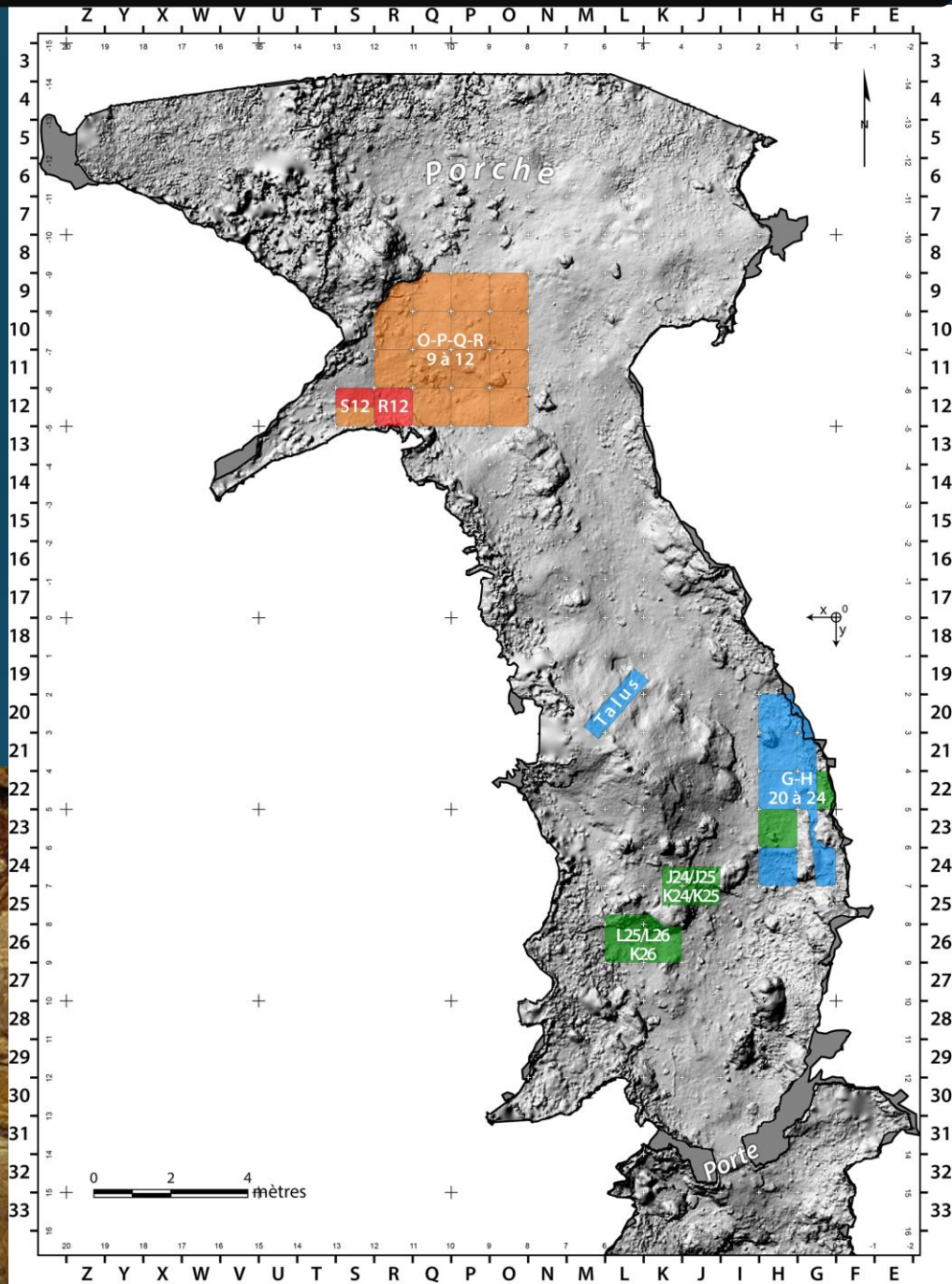

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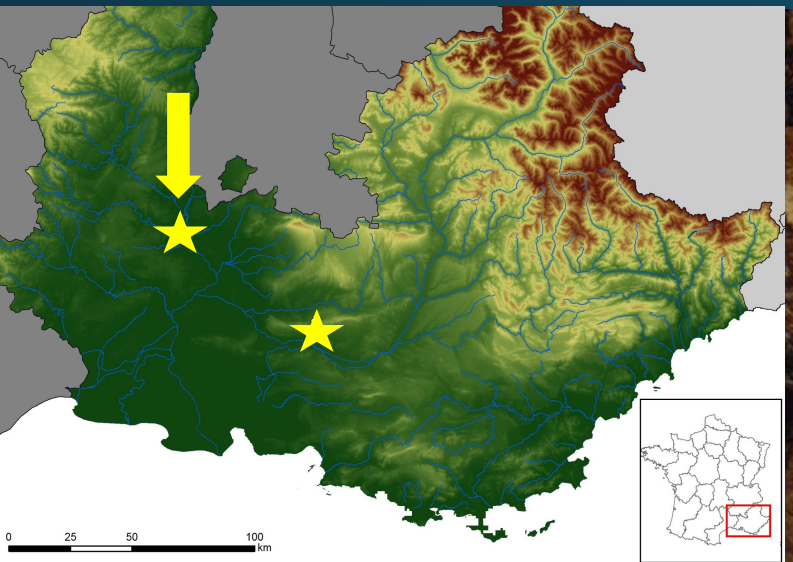


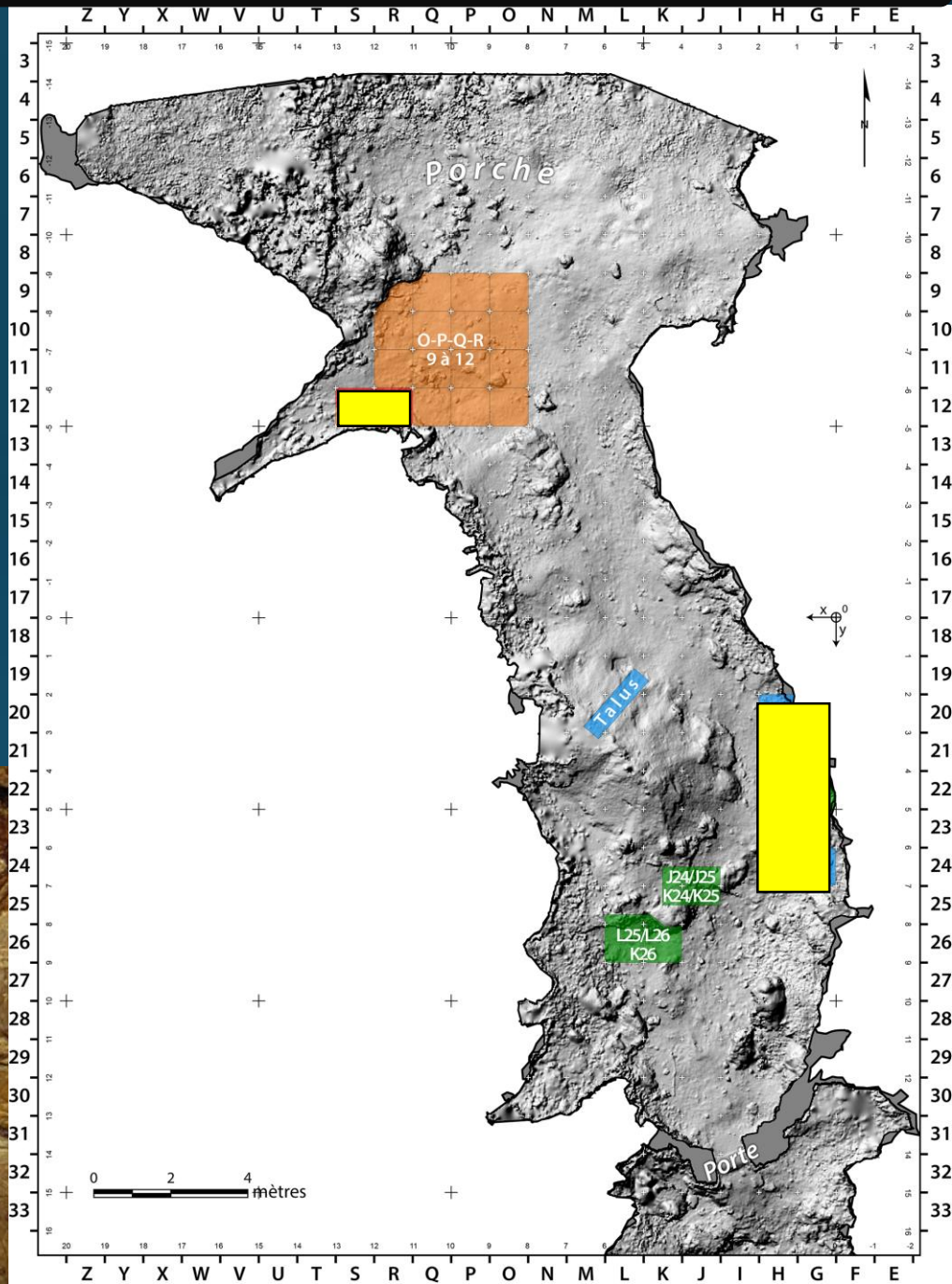

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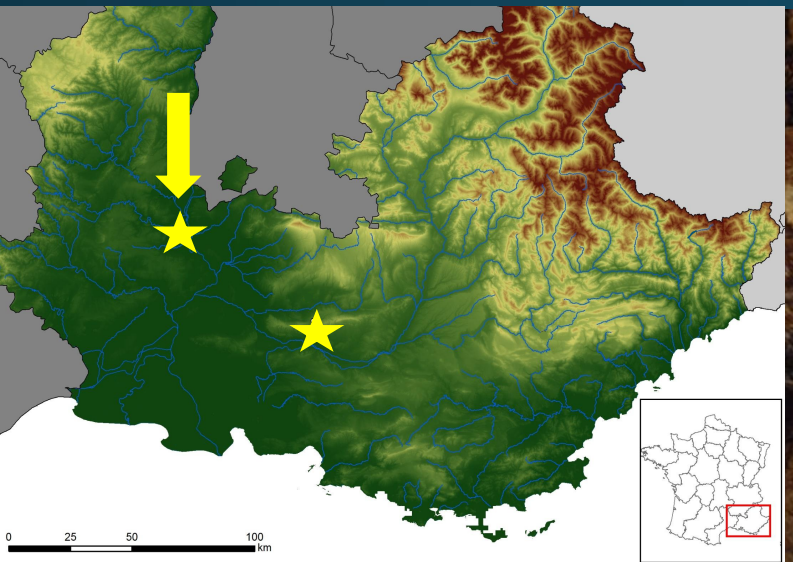


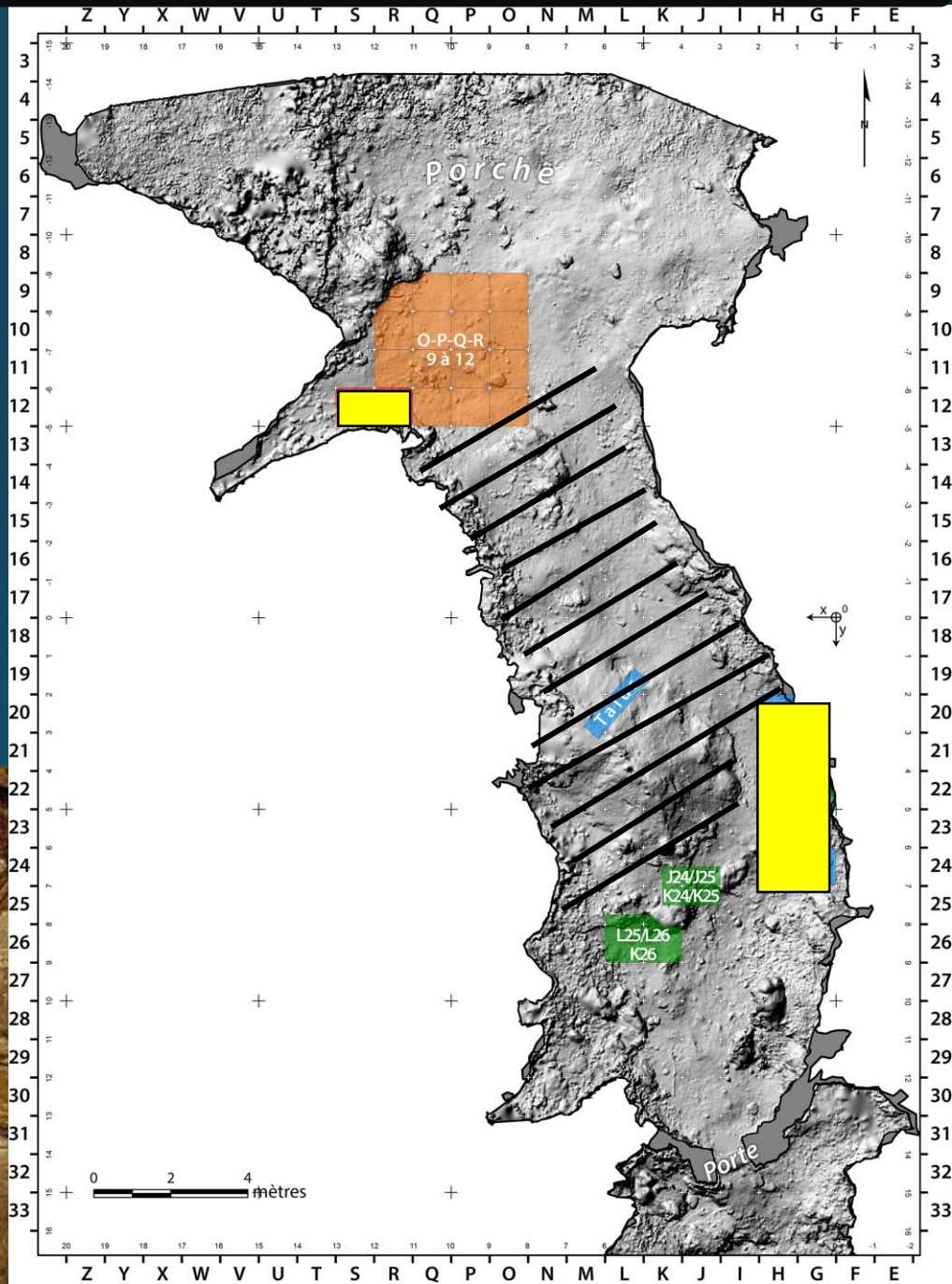

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- Sampling area:
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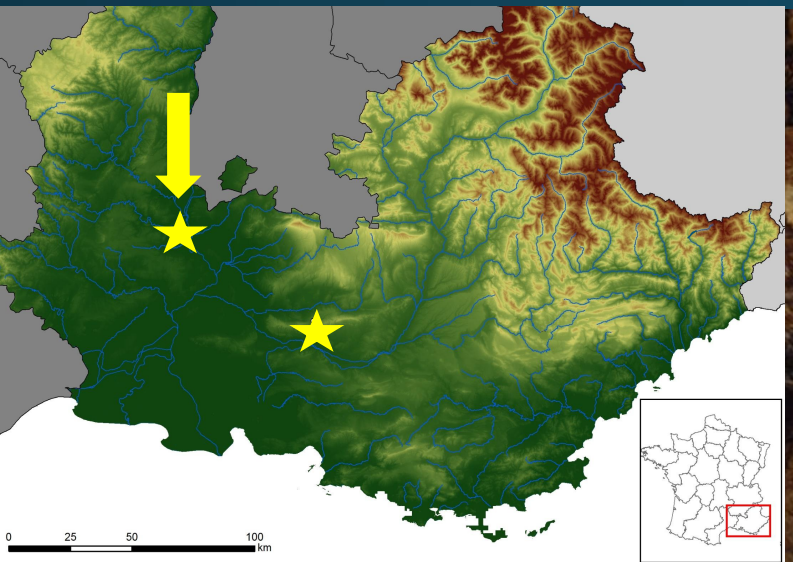


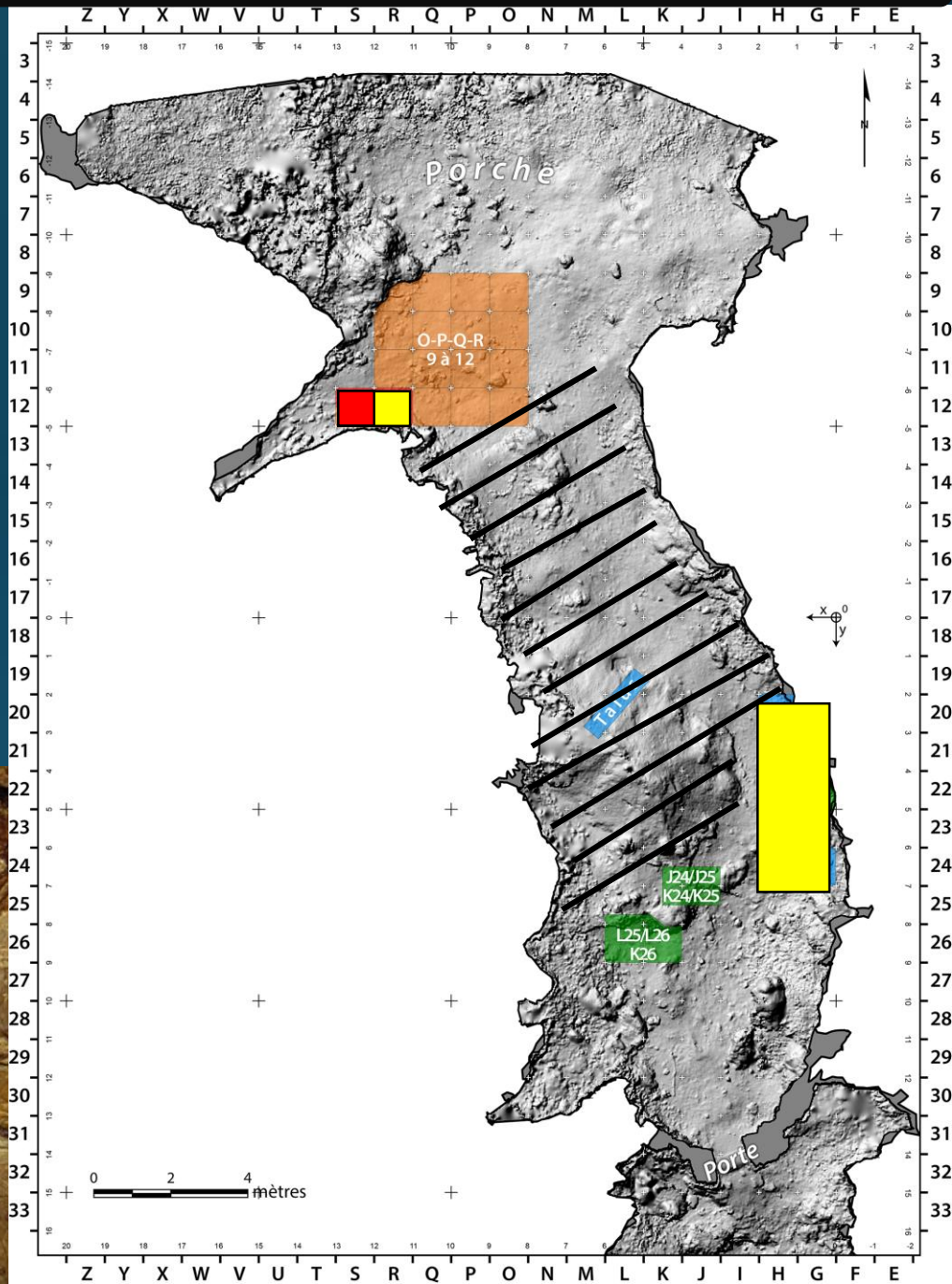

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- Sampling area:
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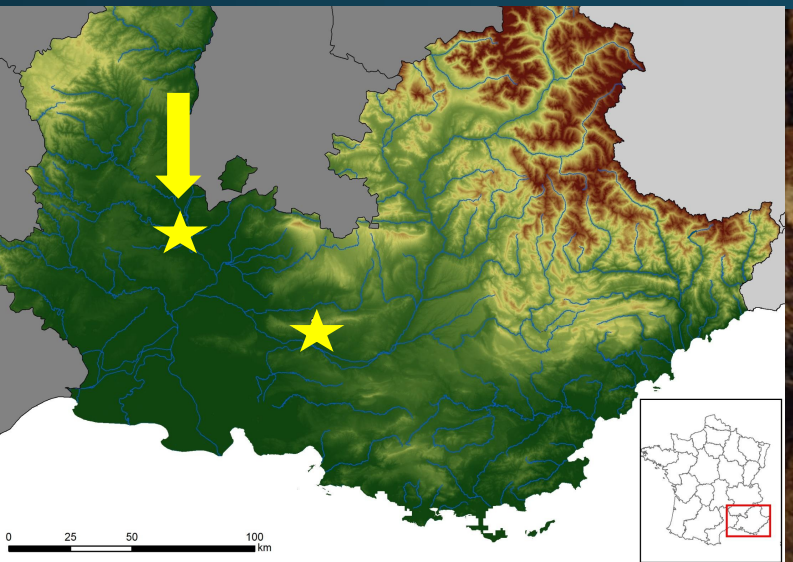
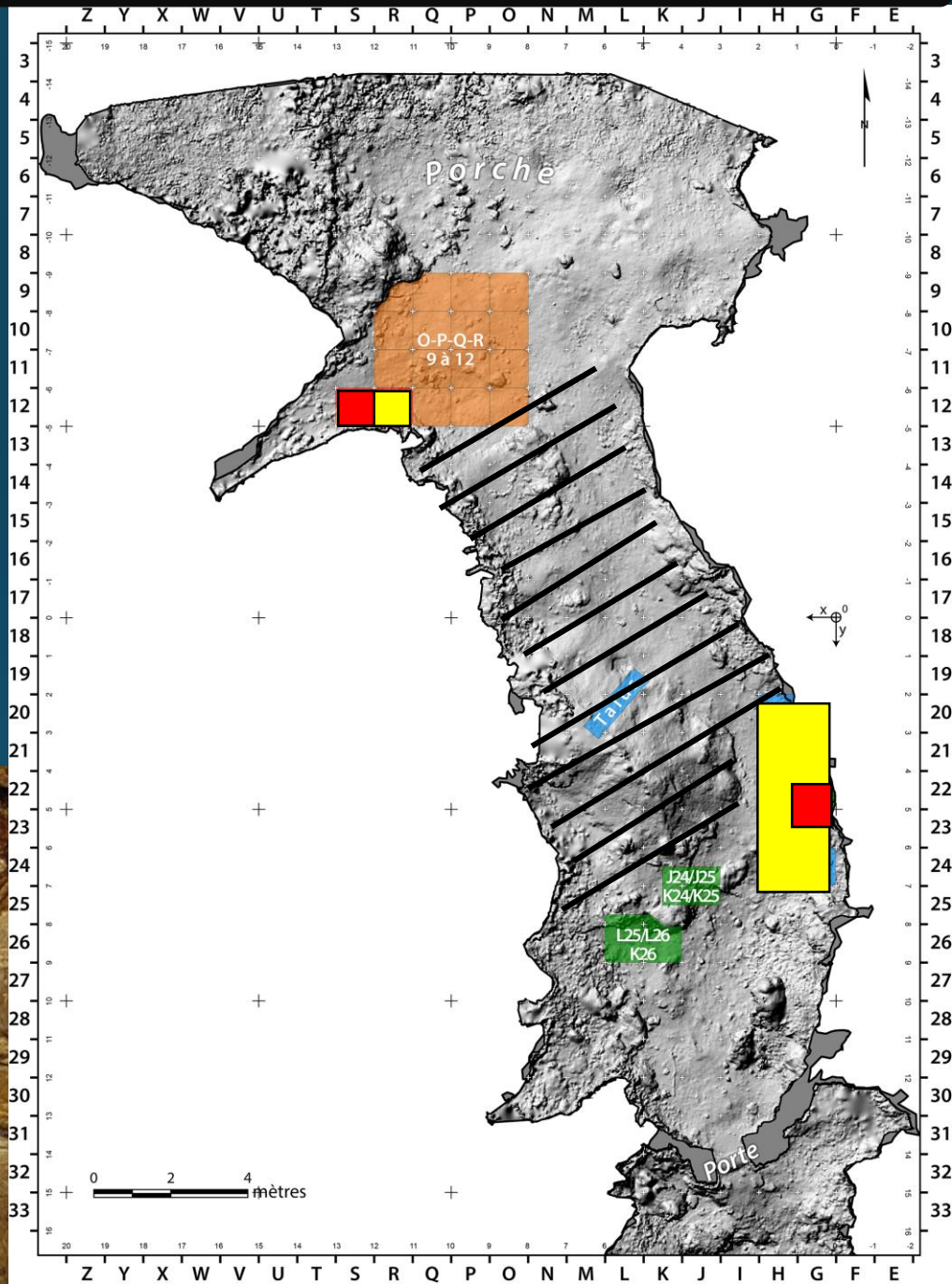
  - G22; well preserved stratigraphy



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## La Grotte aux points (PTS)

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- Subsampling (Pinus sp.)

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| • Charcoal pooling (≈5)<br>-> According to the stratigraphy | • Individual charcoal : S12<br>• Charcoal pooling (2 to 5) : G22 |

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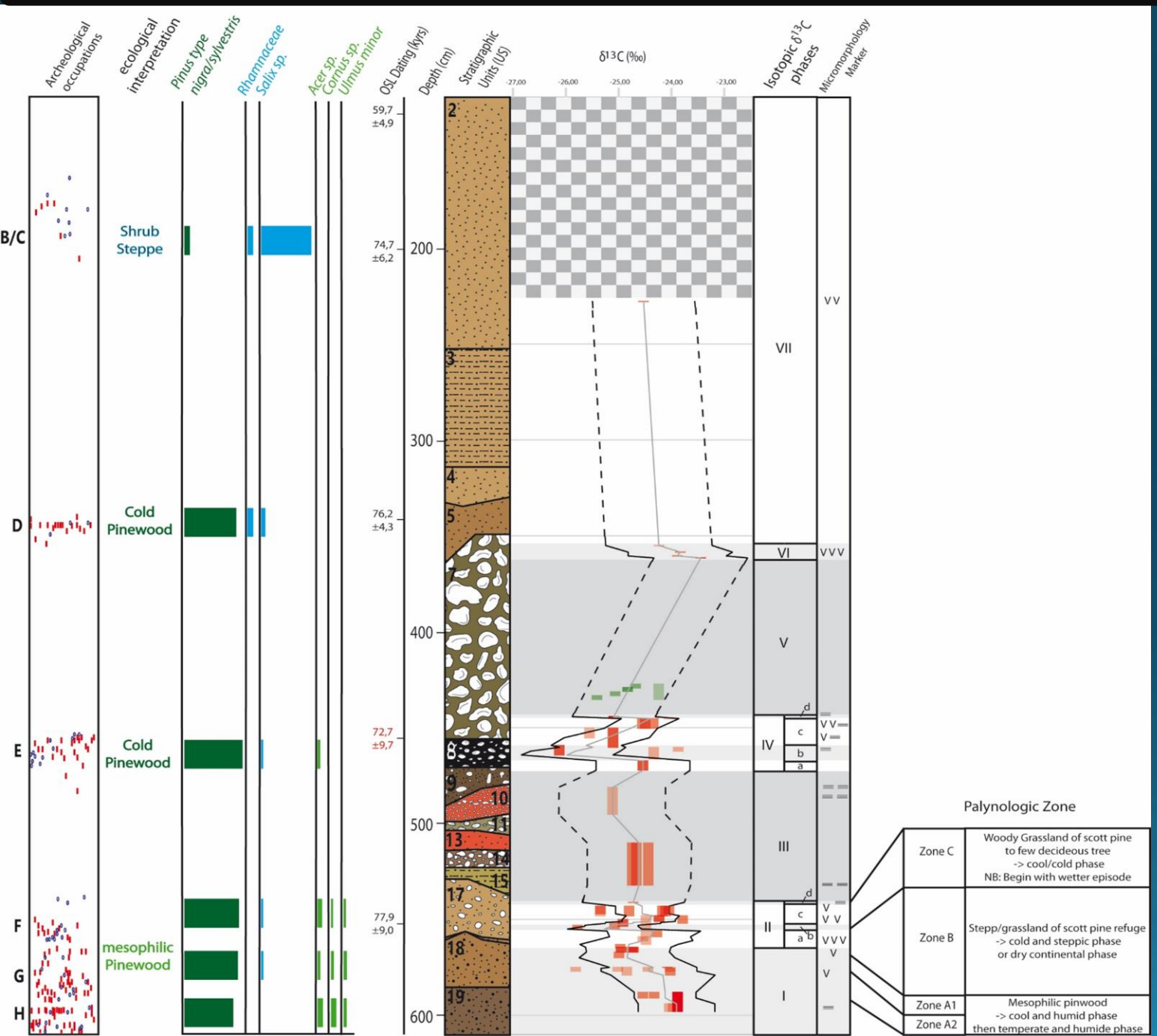
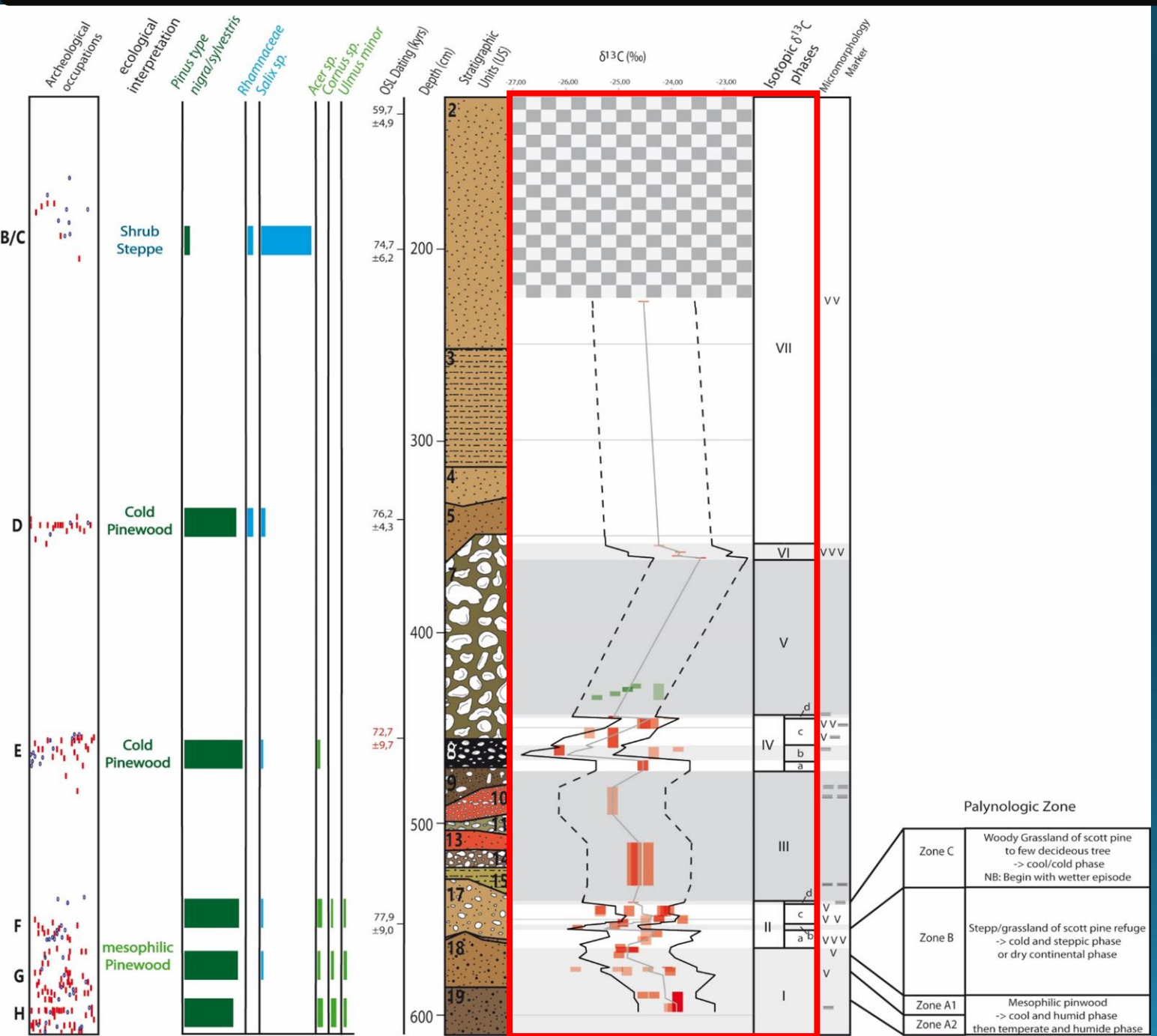
| • $\delta^{13}C$ weighted average with marge of error (based on a normal variability of the $\delta^{13}C$) | • Study $\delta^{13}C$ group with 3D projection |




-> (Audiard & al., in press)

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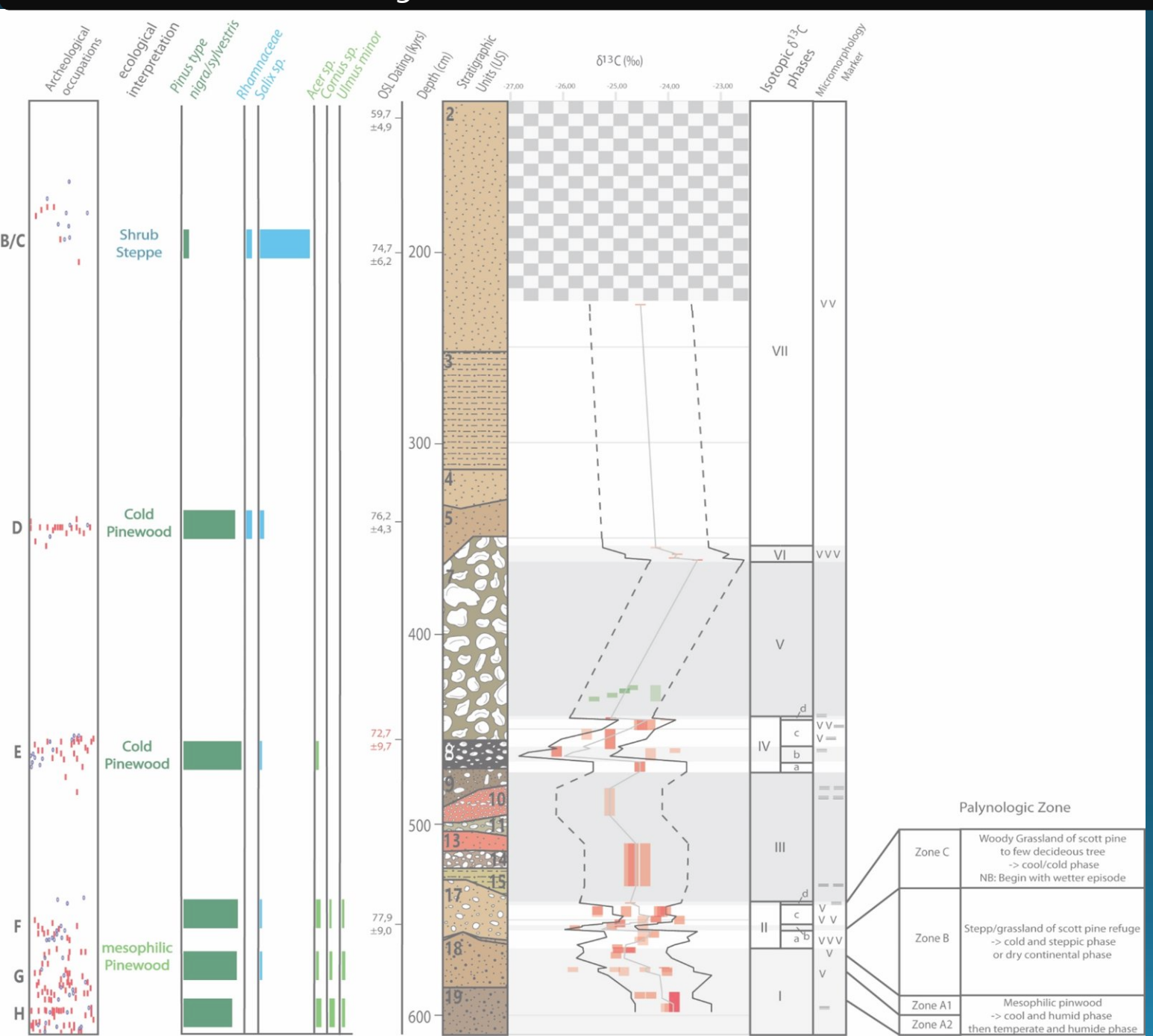


- Correlation between isotopic signal and other paleoenvironmental proxies (NB: Temperature negativly correlated)

-> Complementarity of the signals

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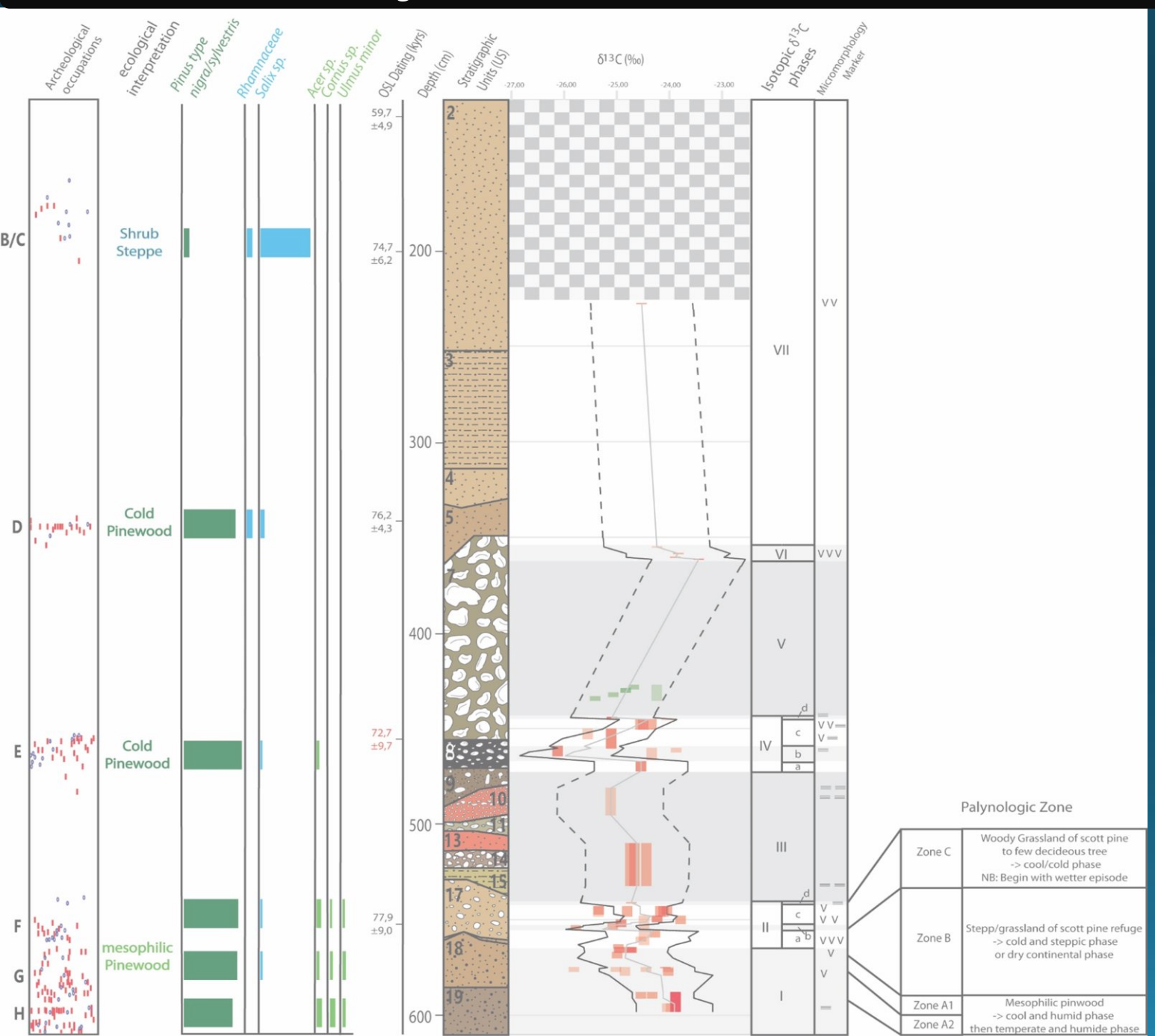


- Correlation between isotopic signal and other paleoenvironmental proxies (NB: Temperature negativly correlated)

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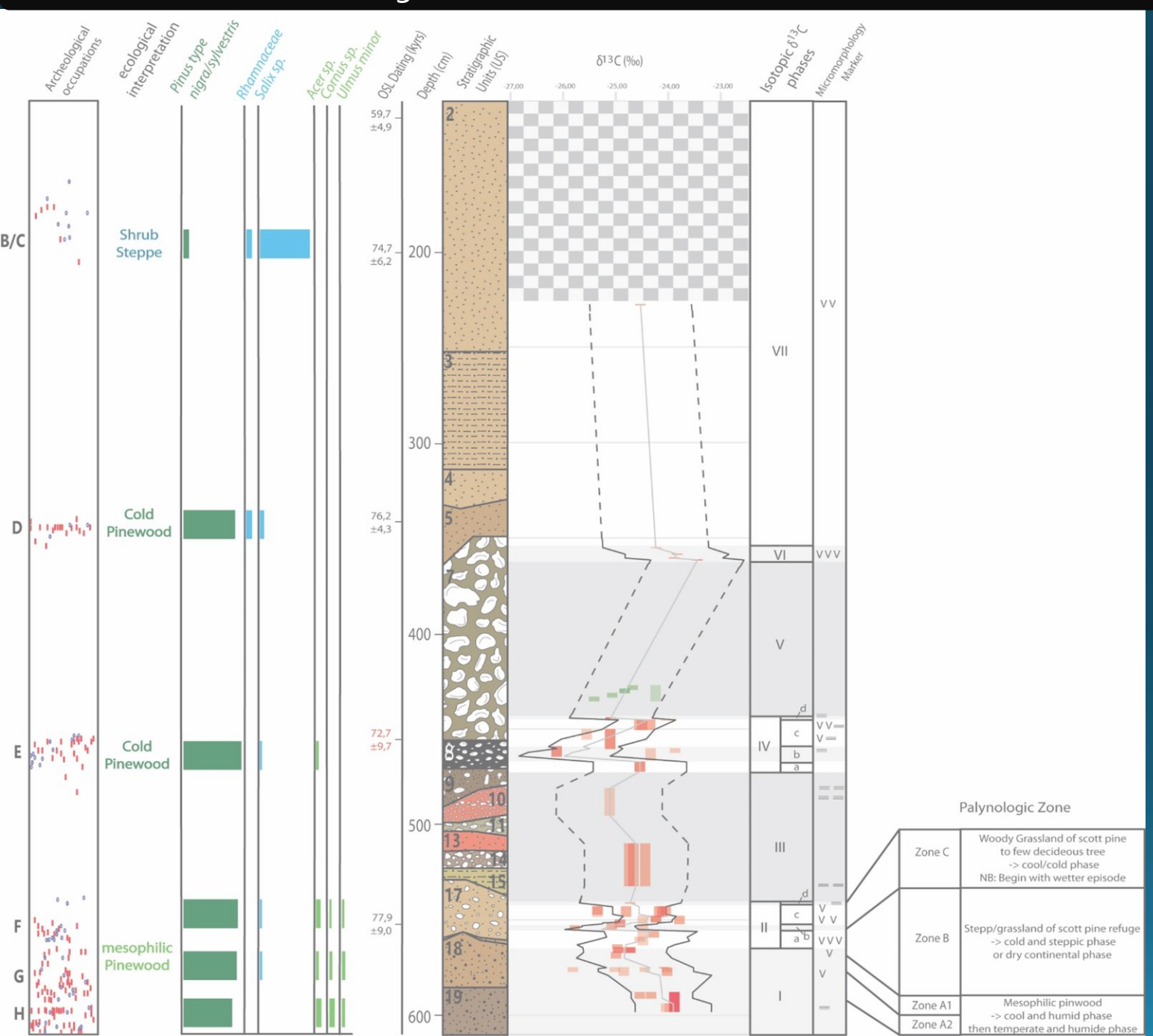
- Higher resolution of the $\delta^{13}C$ than taxonomic analyses charcoal

  -> Complementarity of the signals

-> (Audiard & al., in press)




- Correlation between isotopic signal and other paleoenvironmental proxies (NB: Temperature negativly correlated)

  -> Complementarity of the signals

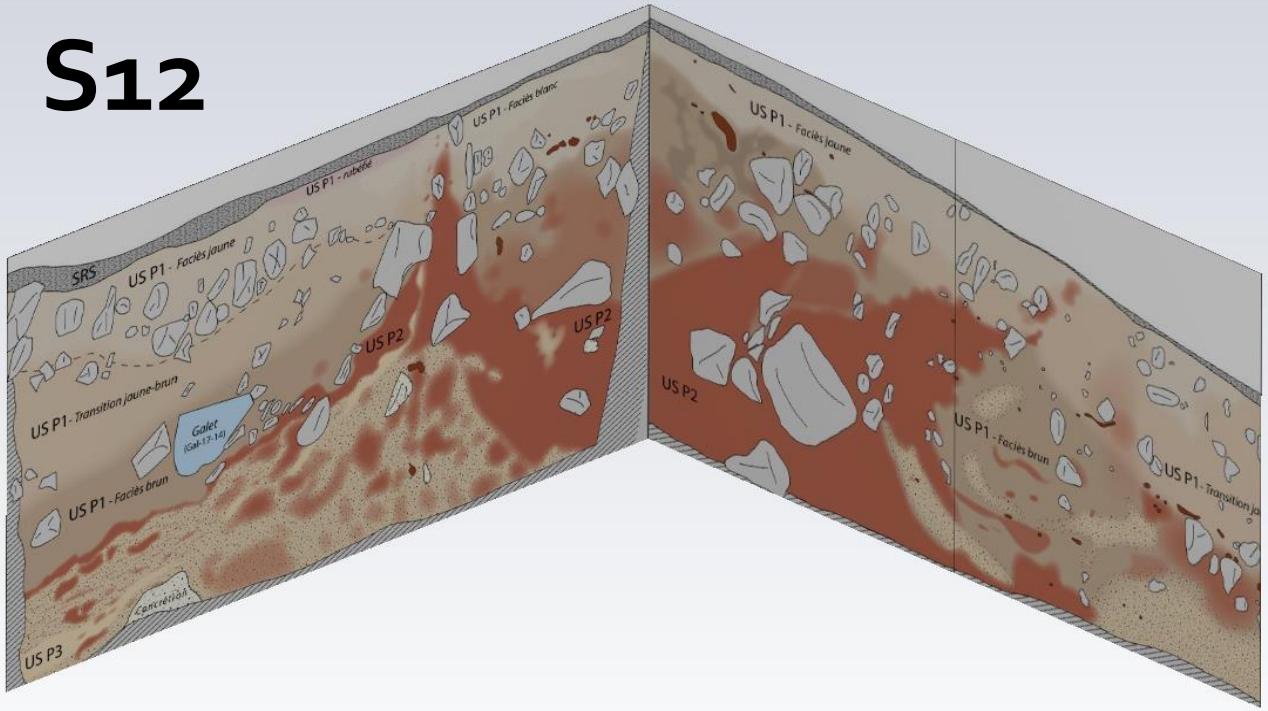
- Higher resolution of the $\delta^{13}C$ than taxonomic analyses charcoal

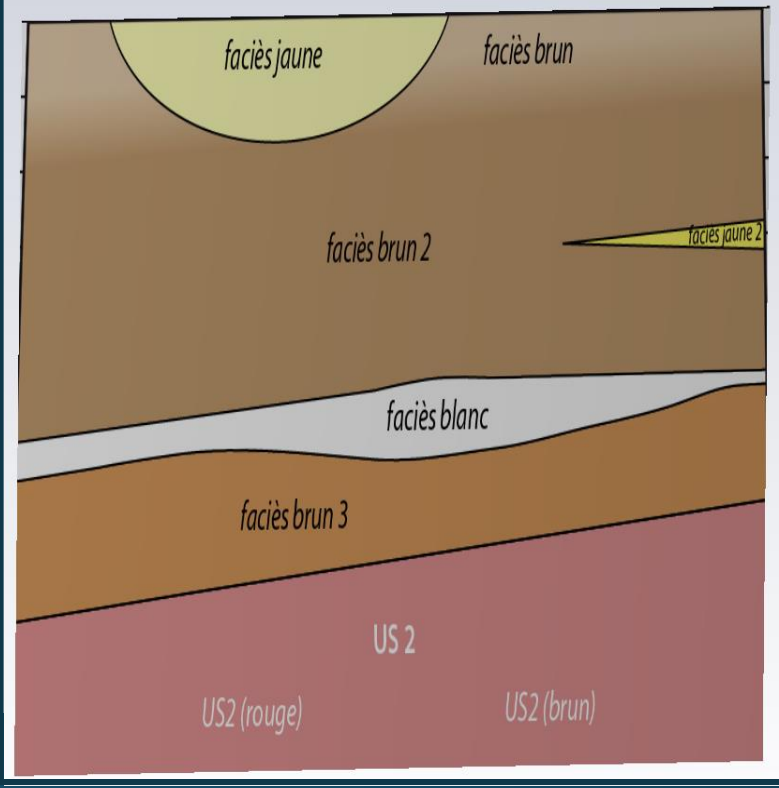
  -> Complementarity of the signals

- Occupation during most favorable periods

-> (Audiard & al., in press)

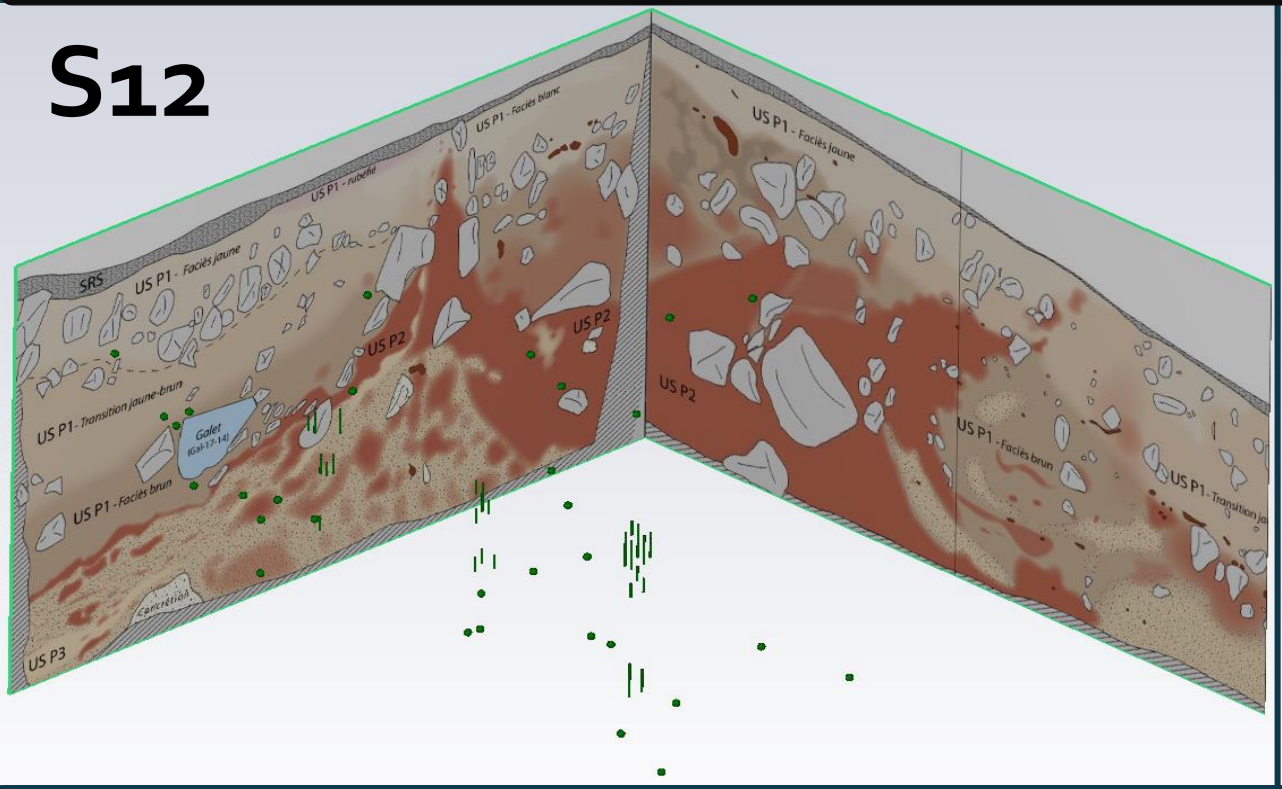
# S12

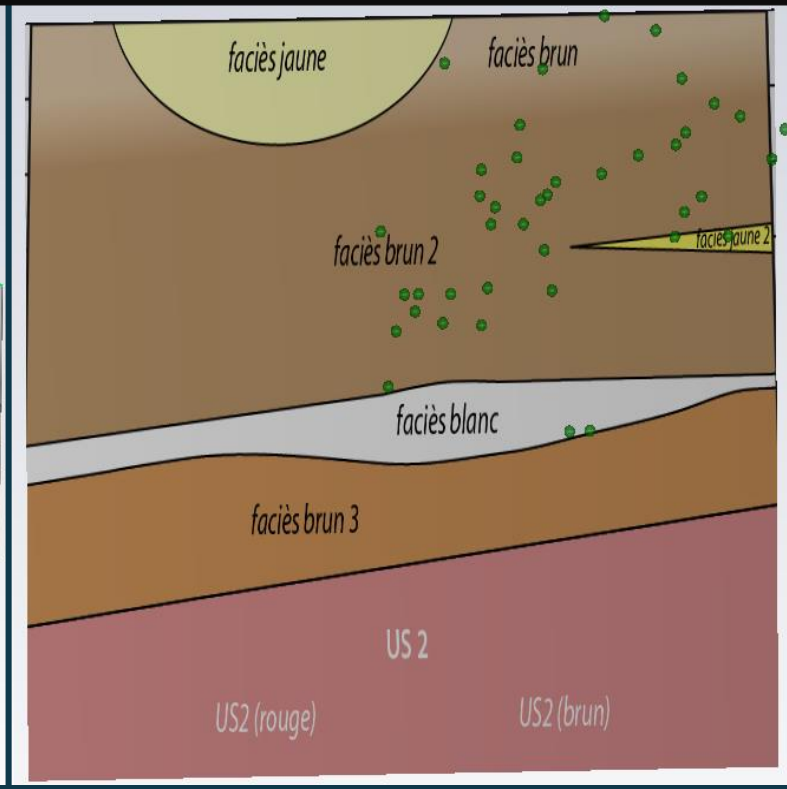

US P1 - Faciès blanc
US P1 - Faciès jaune
US P1 - rubéfié
SRS
US P1 - Faciès jaune
US P2
US P2
US P1 - Transition jaune-brun
Galet
(Gal-17-14)
US P1 - Faciès brun
Concrétion
US P3
US P2
US P1 - Faciès jaune
US P1 - Faciès brun
US P1 - Transition ja


faciès jaune
faciès brun
faciès brun 2
faciès jaune 2
faciès blanc
faciès brun 3
US 2
US2 (rouge)
US2 (brun)

# G22

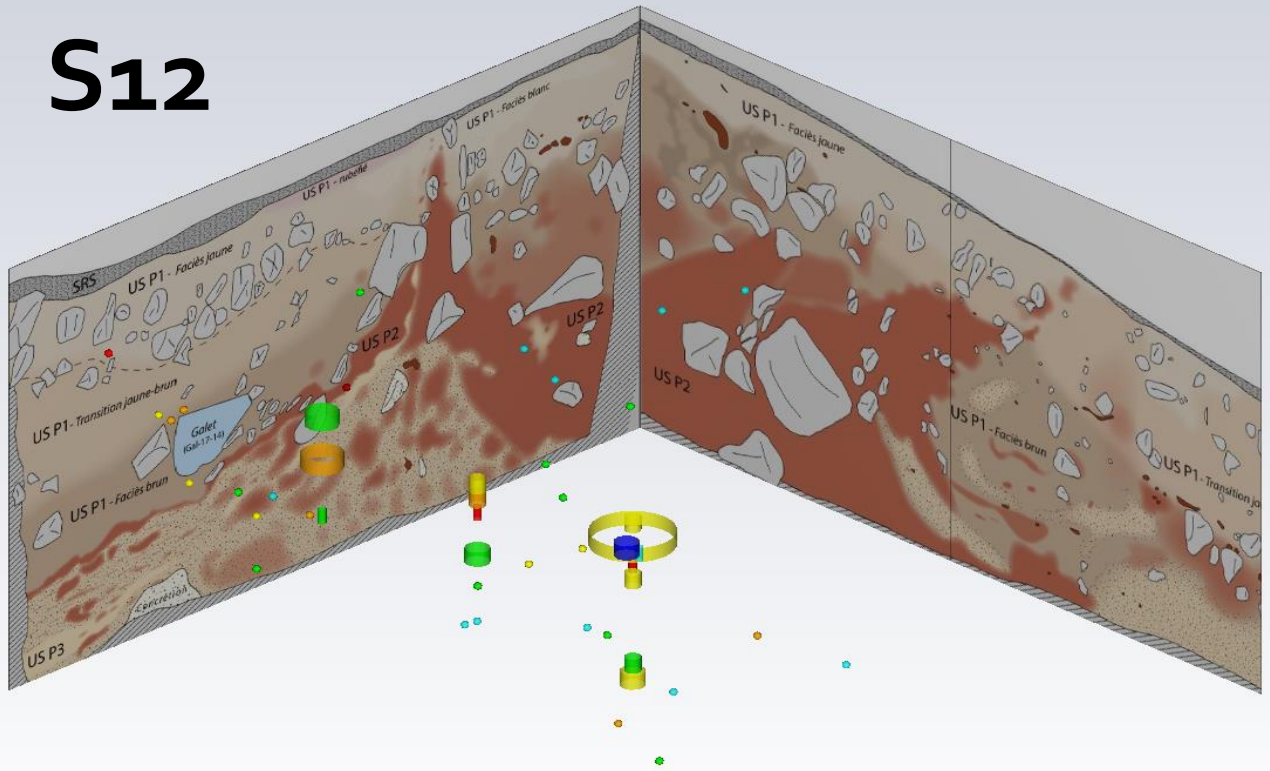
# S12

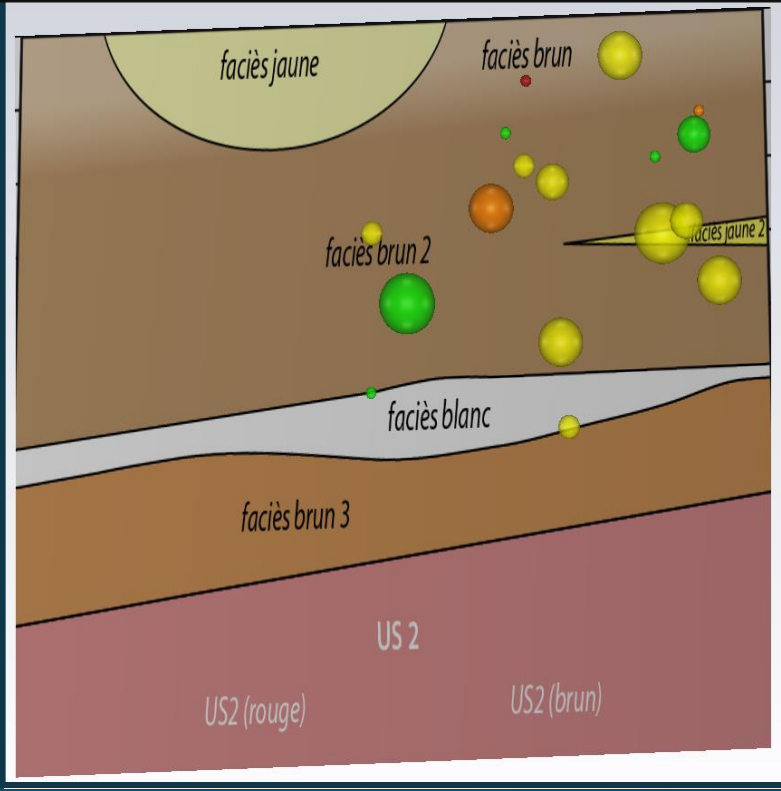

US P1 - Faciès blanc
US P1 - Faciès jaune
US P1 - ruissellé
SRS
US P1 - Faciès jaune
US P2
US P2
US P1 - Transition jaune-brun
Galet
(Gal-17-14)
US P1 - Faciès brun
Cendres
US P3
US P2
US P1 - Faciès jaune
US P1 - Faciès brun
US P1 - Transition ja


faciès jaune
faciès brun
faciès brun 2
faciès jaune 2
faciès blanc
faciès brun 3
US 2
US2 (rouge)
US2 (brun)

# G22

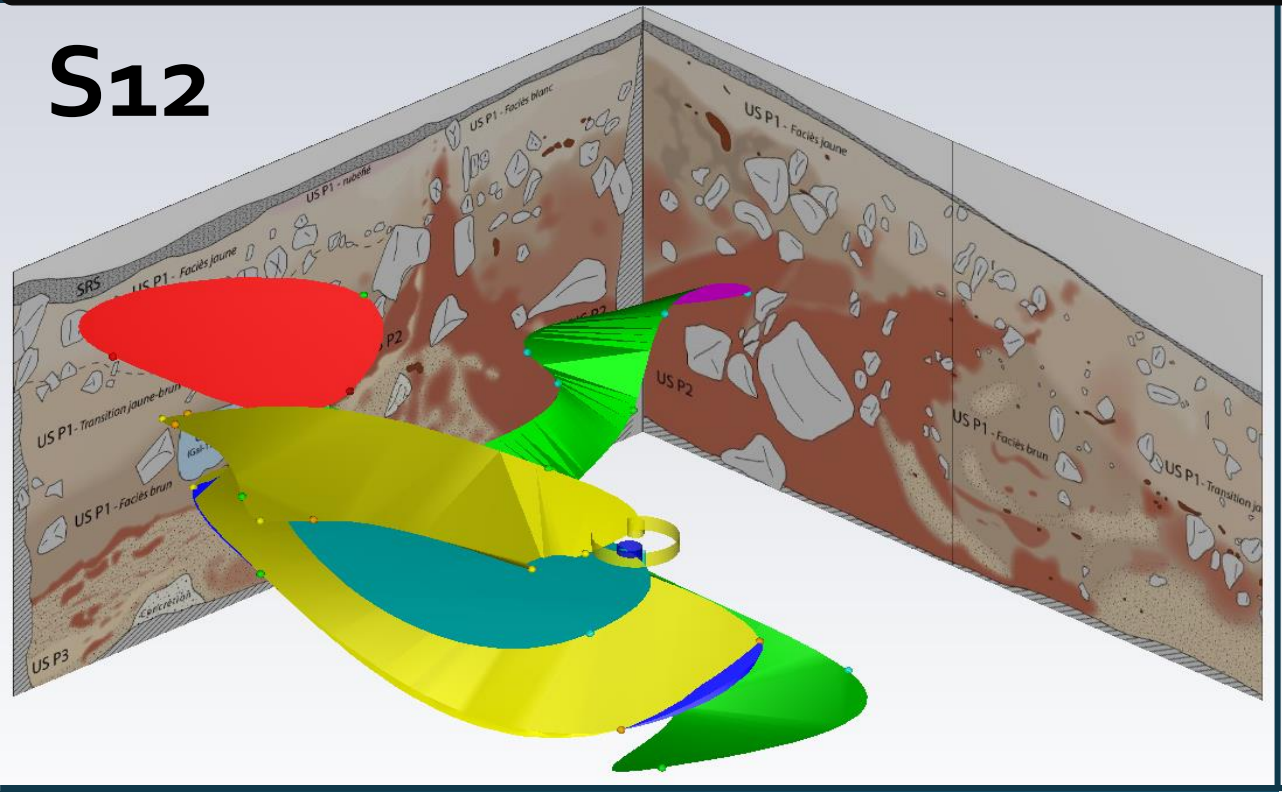
# S12

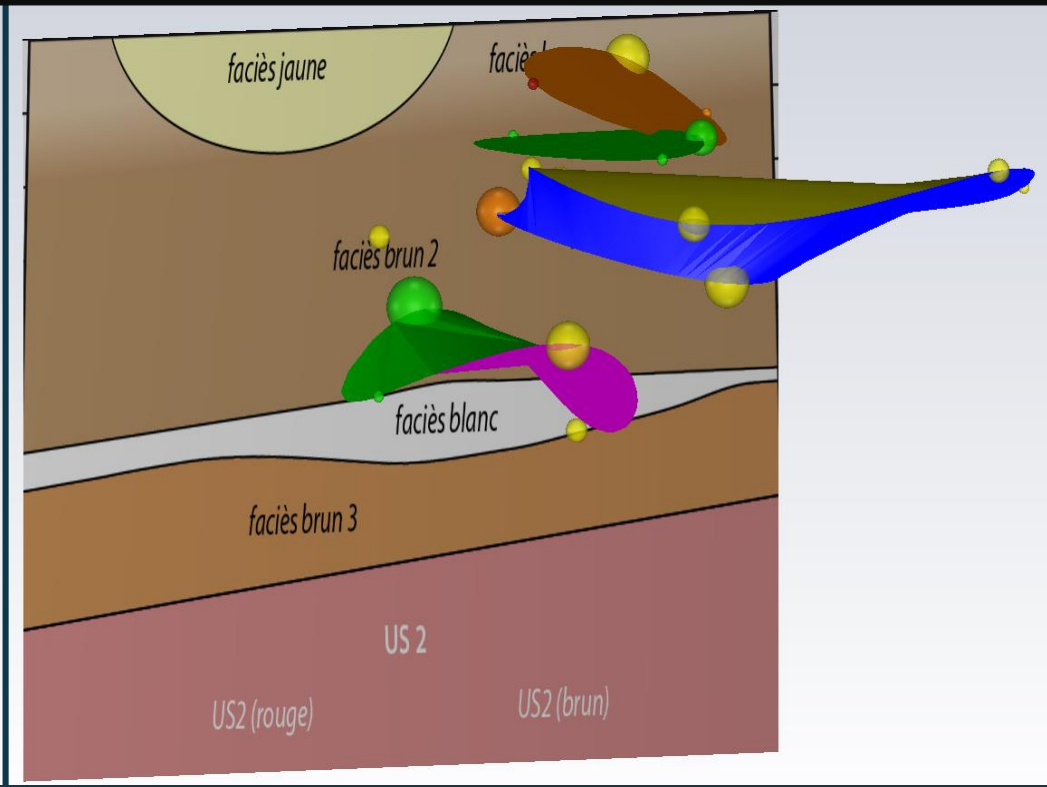


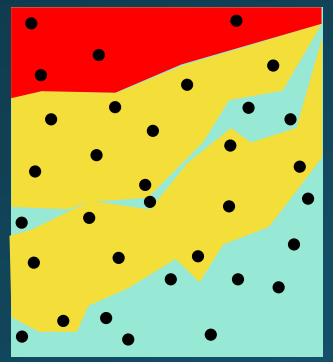

# G22

-22,5 à -23,00 ‰
-23,0 à -23,50 ‰
-23,5 à -24,00 ‰
-24,0 à -24,50‰
-24,5 à -25,00 ‰
-25,0 à -25,50 ‰
-25,5 à -26,00 ‰
-26,0 à -27,00 ‰

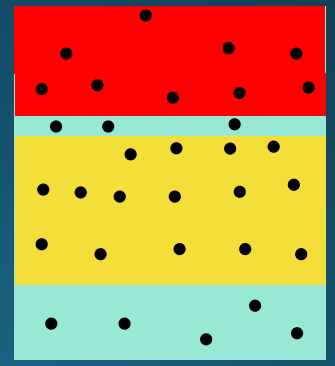


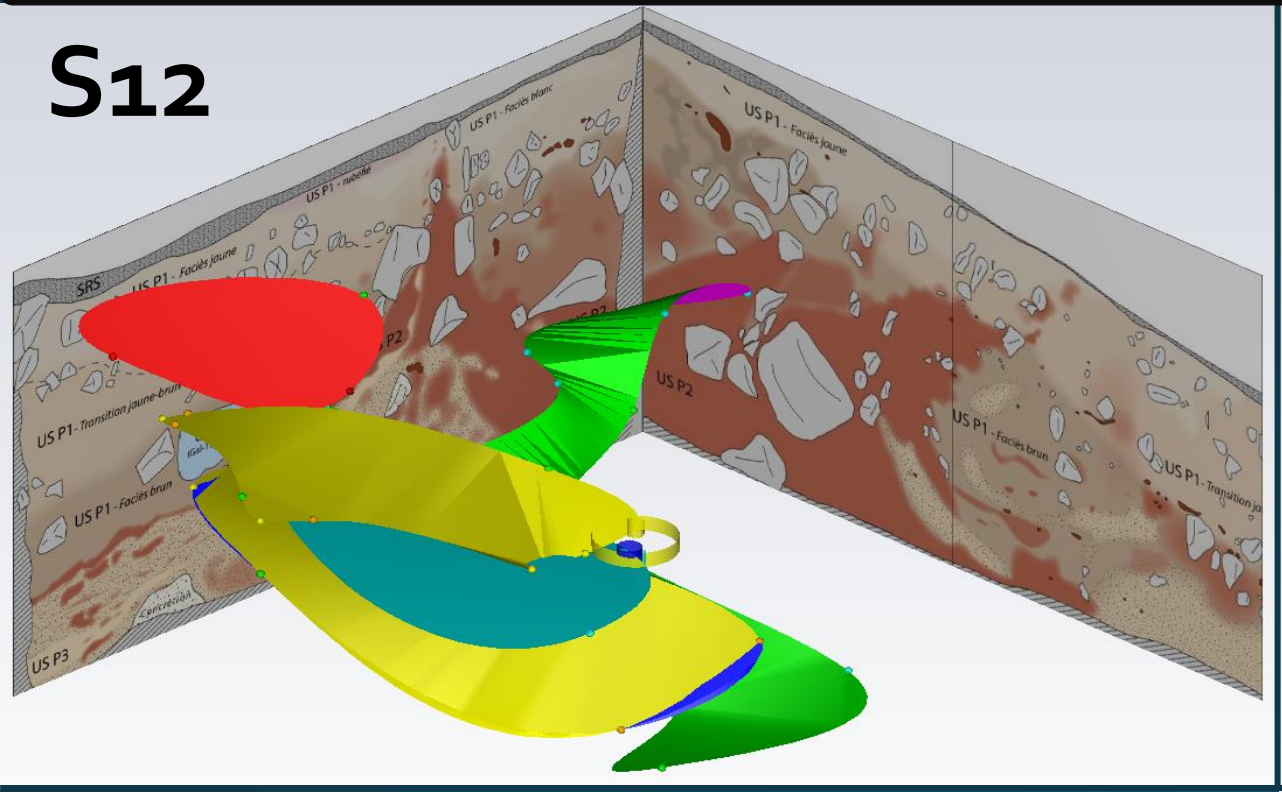

-> $\delta^{13}C$ groupe individualisation

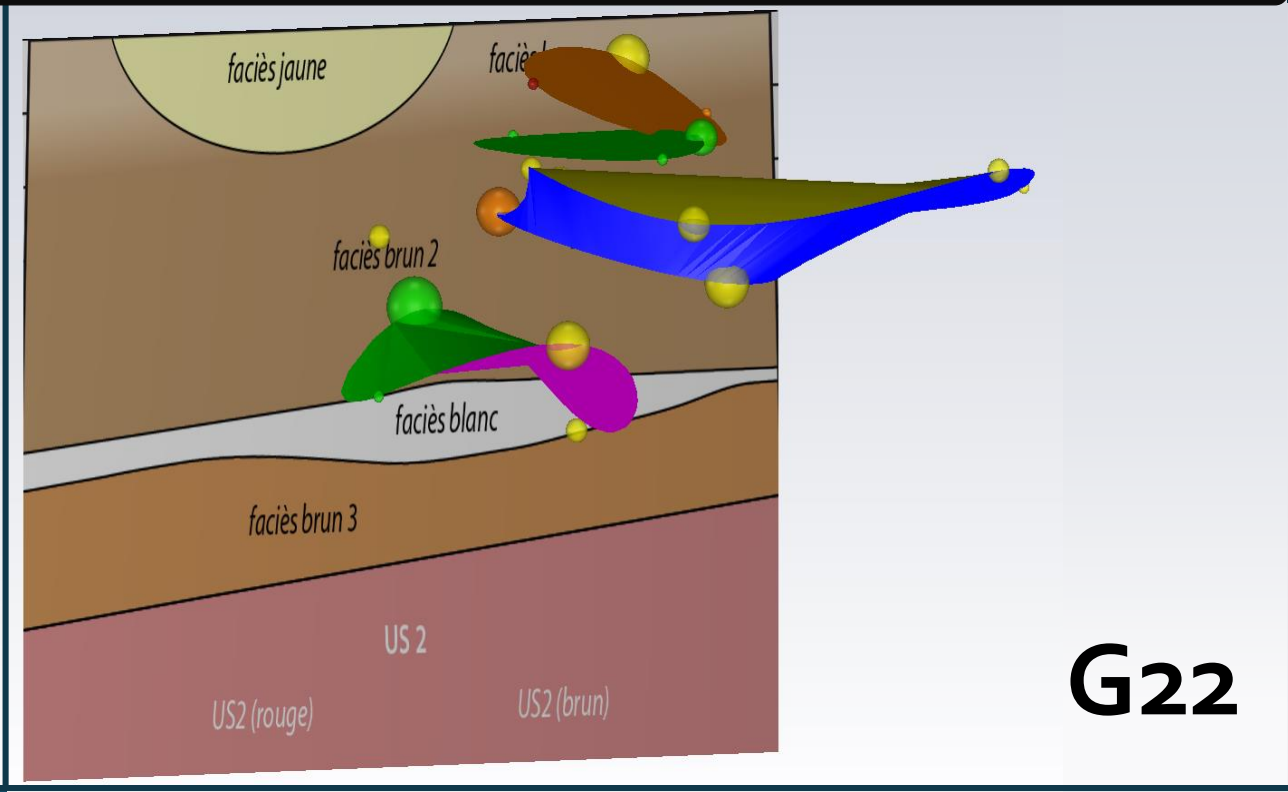


S12



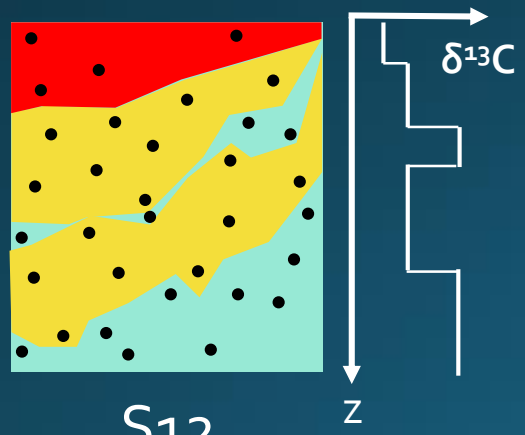
G22

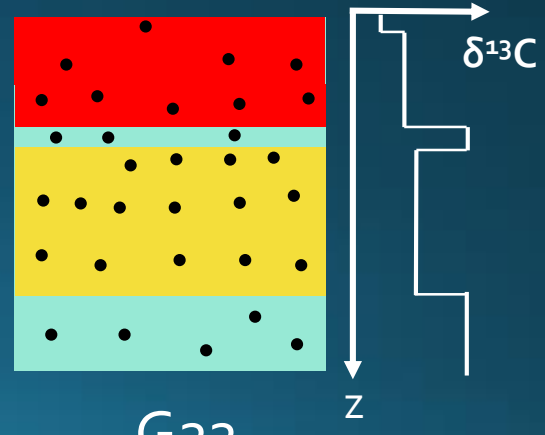


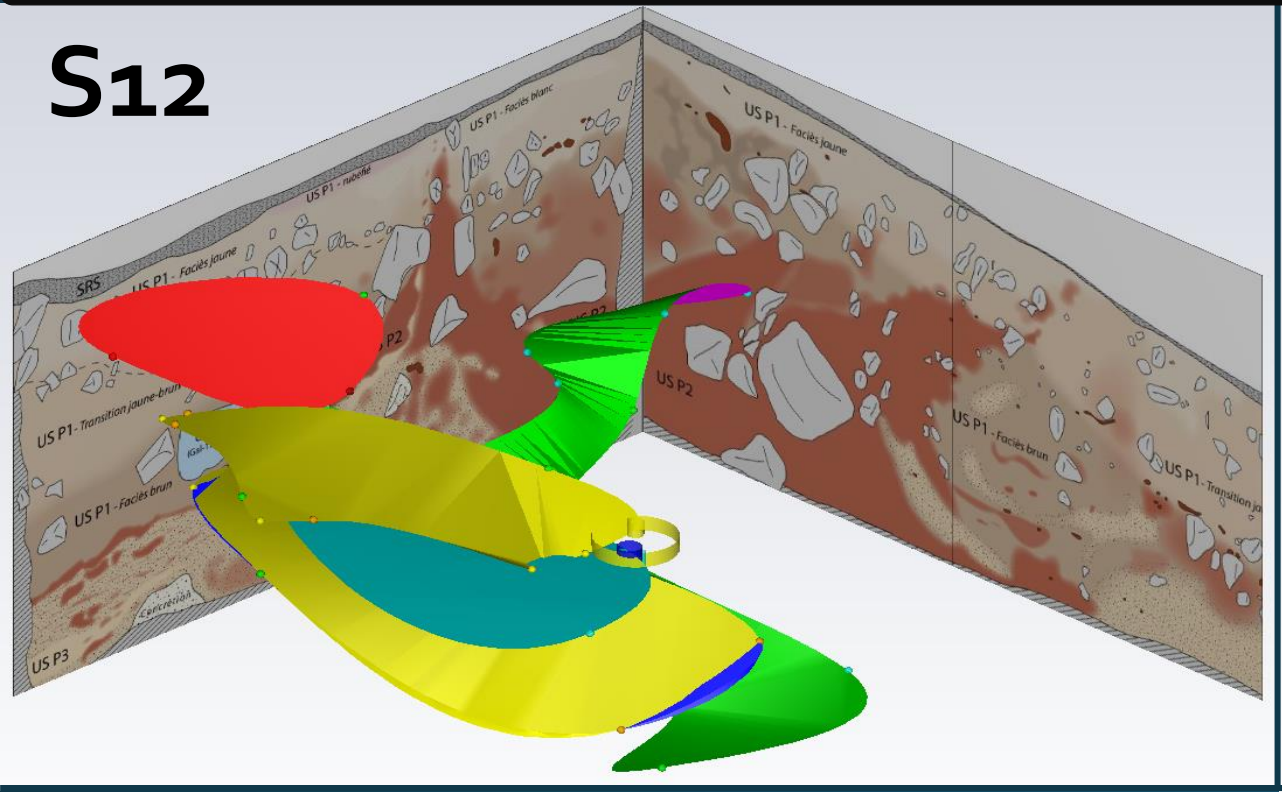



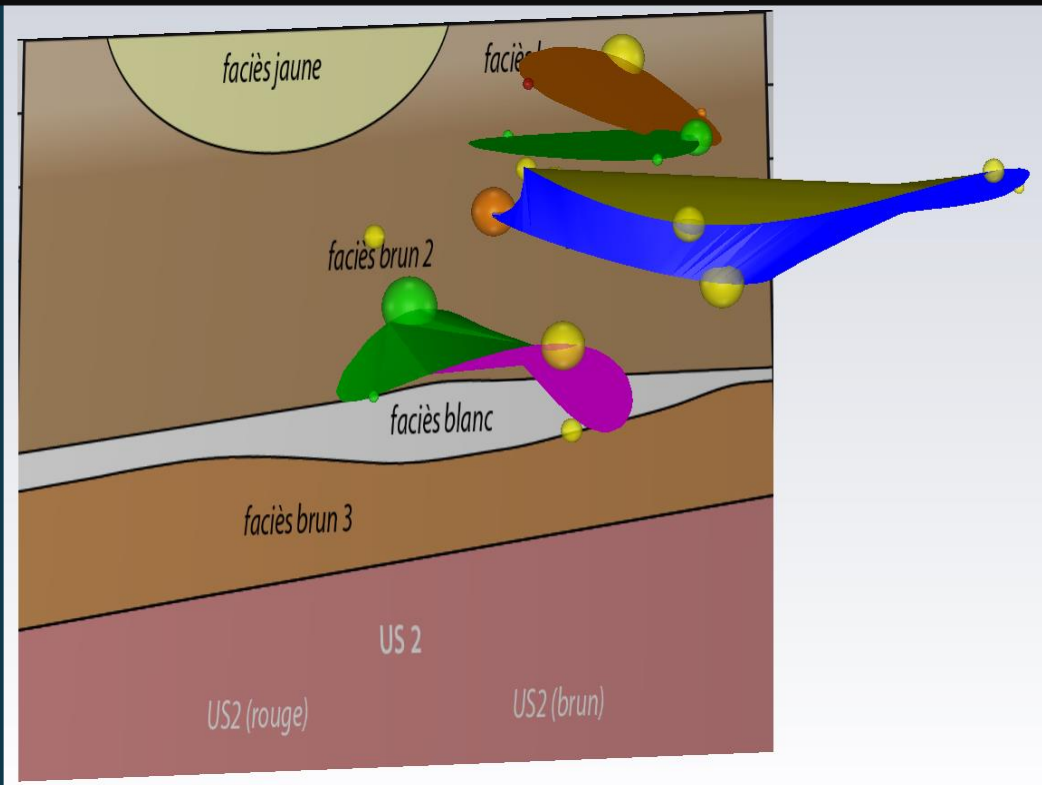

-> $\delta^{13}C$ groupe individualisation

-> Calcul of a mean pattern $\delta^{13}C$ signal





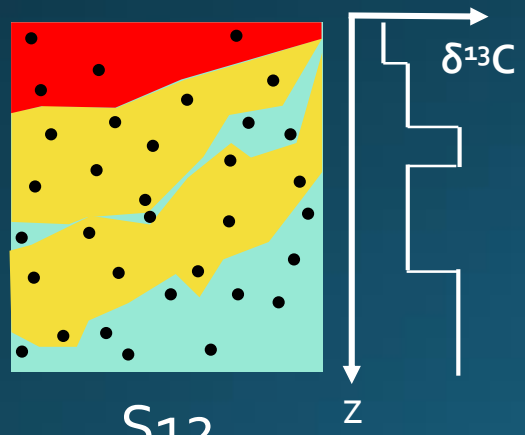

-> $\delta^{13}C$ groupe individualisation

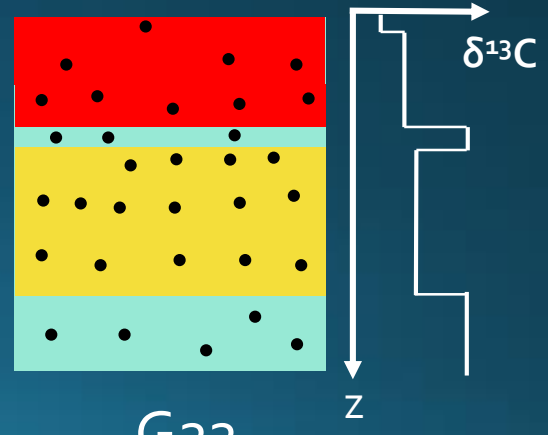
-> Calcul of a mean pattern $\delta^{13}C$ signal

-> Statistic comparaison between the two signal

Nonparametric ANOVA

P-value > 0,05



- « Isotopic signal» Challenge
  - Study of a mean low frequency signal of isolated charcoals
  - Representativity of high frequency variability in the $\delta^{13}C$ signal
  - Representativity of intra & inter individu variability in the $\delta^{13}C$ signal
  - Impact of the atmospheric $\delta^{13}C$ and $CO_2$ concentration
  - Plant adaptation to climate
- « Anthracologic » Challenge
  - Impact of the Carbonisation on the isotopic signal
  - Taxonomic identification to genus level (*Pinus* type *sylvestris/nigra*)
- « Sampling and taphonomic » Challenge
  - Fragmentation process: size, mass, number
  - Questions on the certainty of the stratigraphic position
  - Exogenous carbon contamination
  - Preferential conservation of a charcoal type

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## ❑ « Anthracologic » Challenge

- Impact of the Carbonisation on the isotopic signal
- Taxonomic identification to genus level (*Pinus* type *sylvestris/nigra*)

## ❑ « Sampling and taphonomic » Challenge

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Thank you for your attention
GDR 3544
Sciences du Bois