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Adaptation of caprinae husbandry in contrast environments

during Bronze Age : osteological and stable isotope analysis in coastal versus mountain site

Juliette Knockaert¹ / Marie Balasse¹ / Albane Burens² / Laurent Carozza² / Pierre Campmajo³ / Jean-Denis Vigne¹

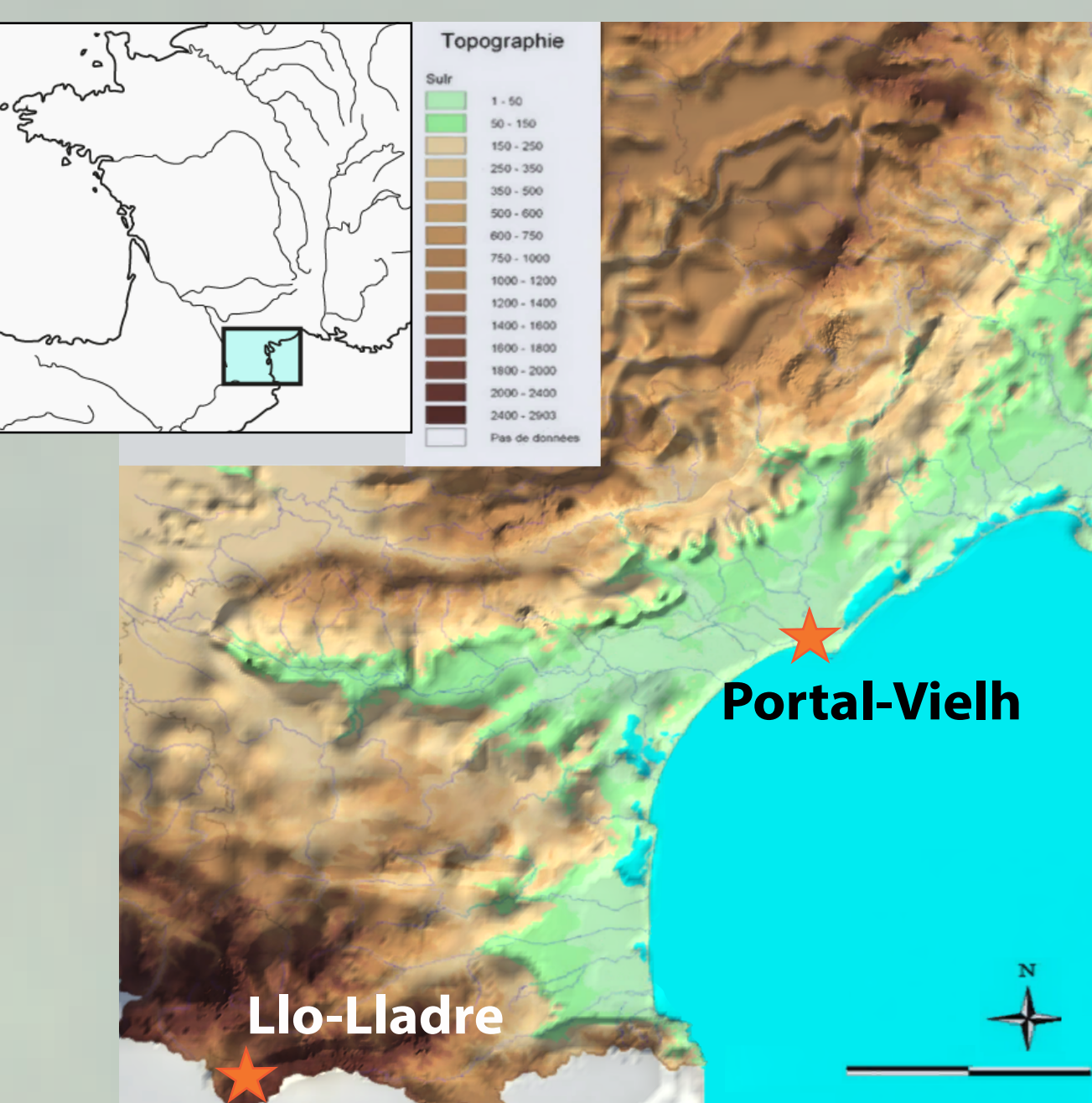
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The occidental Languedoc (Southeastern France) shows an important diversity of vegetal environments and relief (from the Mediterranean seashore to the Pyrenees mountains). It is a privileged area to apprehend the question of pastoral mobility. The first indicators of pastoral activities in the Pyrenees mountains appear during early Neolithic and increase substantially during Bronze Age. Zooarchaeological and isotopic analysis of caprinae tooth enamel from a mountain and a coastal Bronze Age sites allow to investigate the husbandry strategies and adaptations to mountains environments.

Archaeological contexts and herding strategies

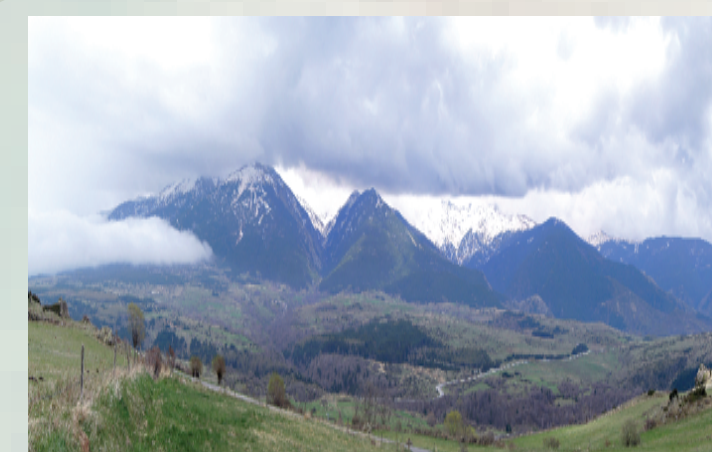
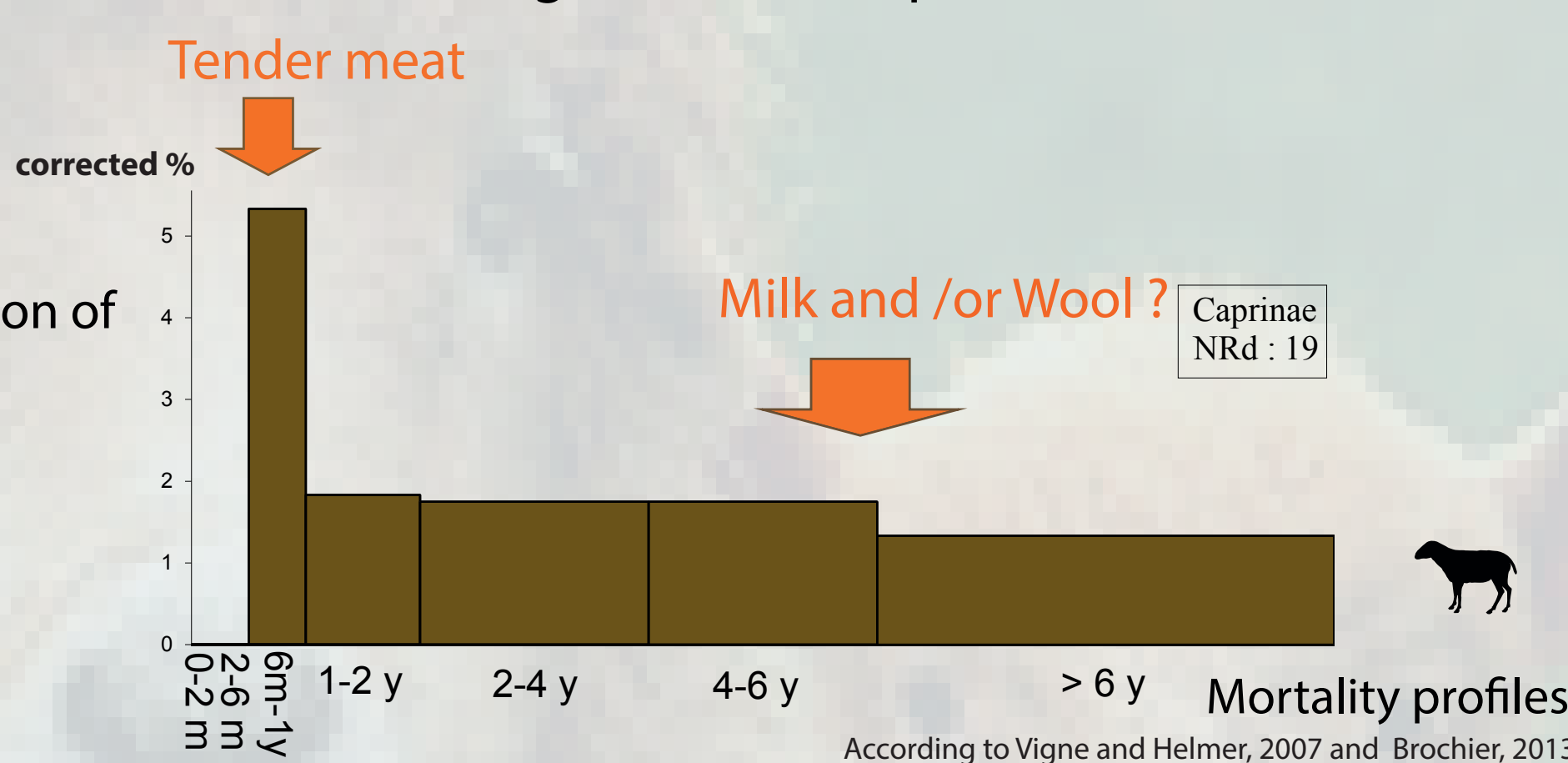


Portal-Vielh

- On the seashore, at 25 m asl
- Late Bronze Age II and III (2760 ± 30 BP 810-670 cal BC)
- Open field and enclosed during the last occupation (LBA IIIb)

• NISP Caprinae : 20%

Mortality profile indicates an exploitation of all livestock resources. Absence of young animals could be a taphonomical bias.

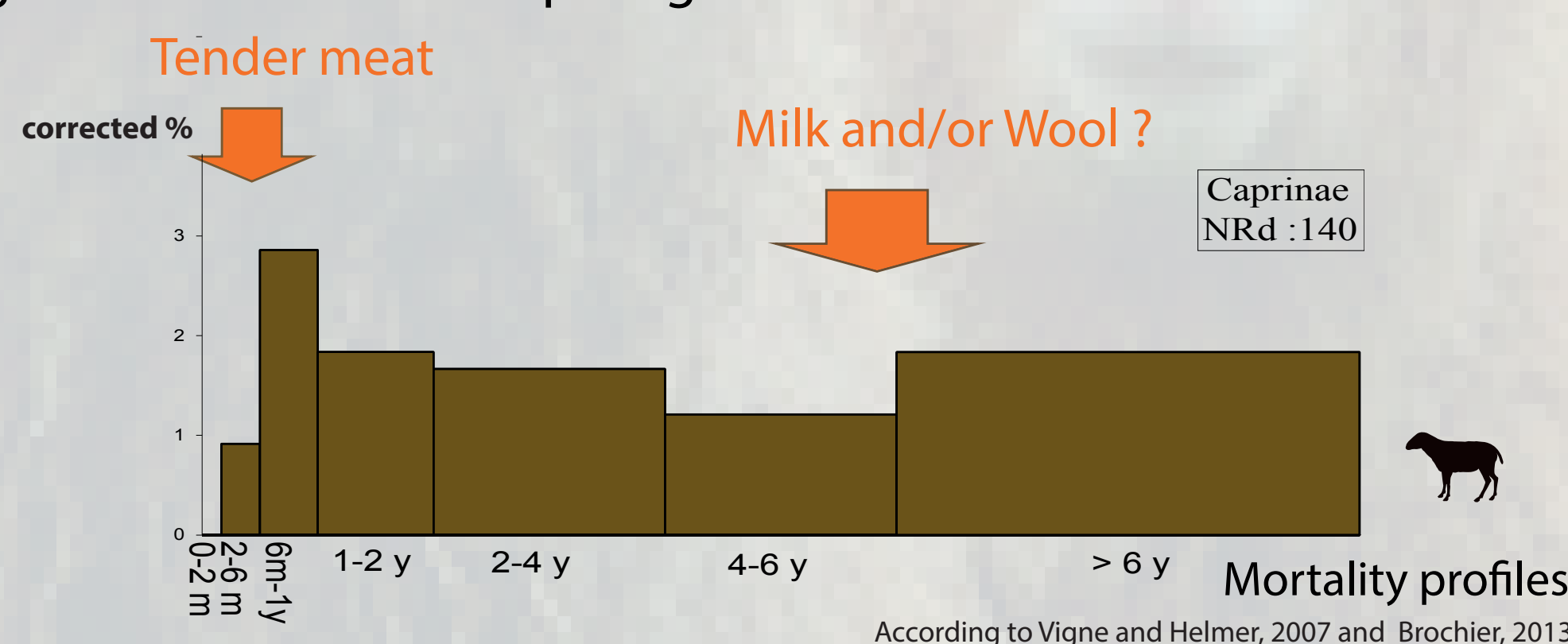


Llo-Lladre

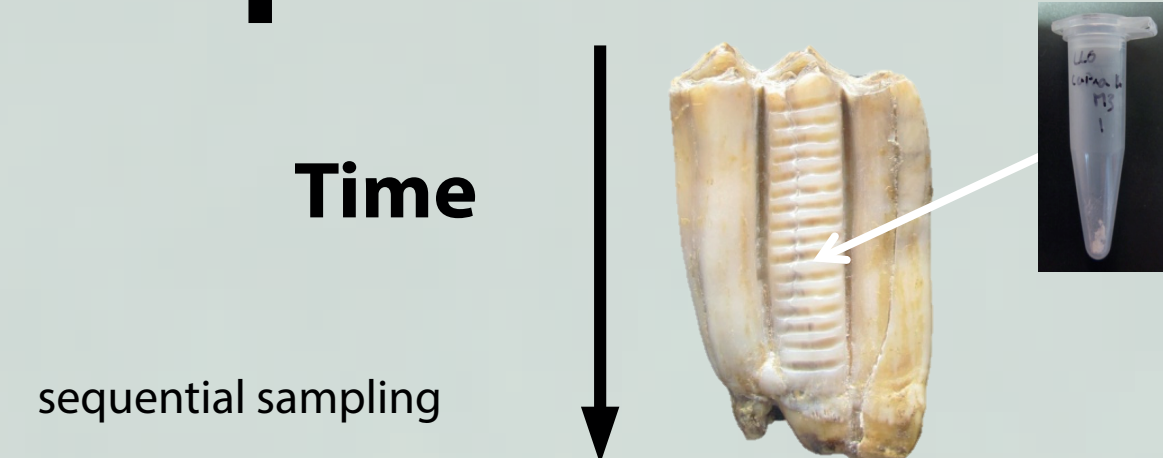
- Pyrénées-Orientales at 1630 m asl
- Middle/Late Bronze Age I (3070 ± 35 BP 1424-1261 cal BC)
- Open field on a rocky spur surrounded by high mountains with Alpine grasslands

• NISP Caprinae : 47%

Mortality profile indicates an exploitation of all livestock resources.



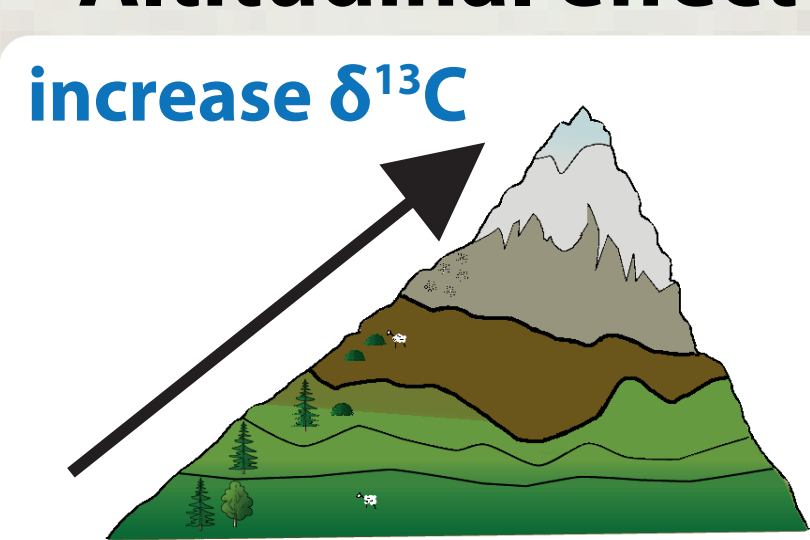
Stable isotope method



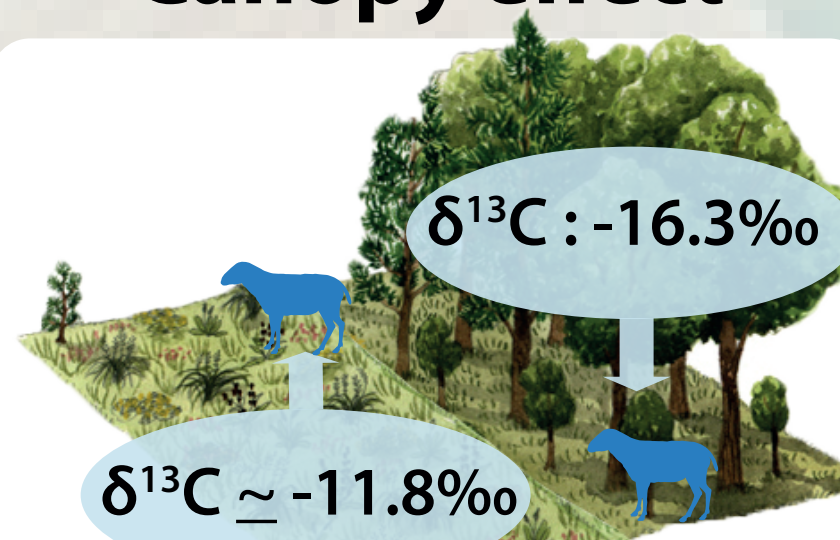
Caprinae isotopic history ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$) was investigated through enamel sequential sampling of lower second (N=2) and third (N=10) molars. Enamel was treated for bioapatite extraction as described in Balasse *et al.* (2002) and analyses were performed in a Delta V Advantage IRMS interfaced to a Kiel IV device.

$\delta^{18}\text{O}$ is linked to ingested water, so indirectly meteoric water. It records seasonal variation of precipitation. $\delta^{13}\text{C}$ is linked to diet = C3 Plants on this area whose values maybe influenced by :

Altitudinal effect



Canopy effect

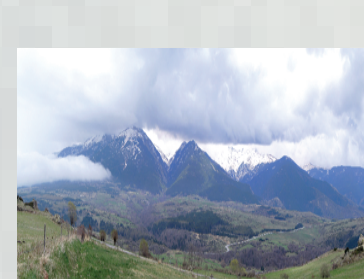
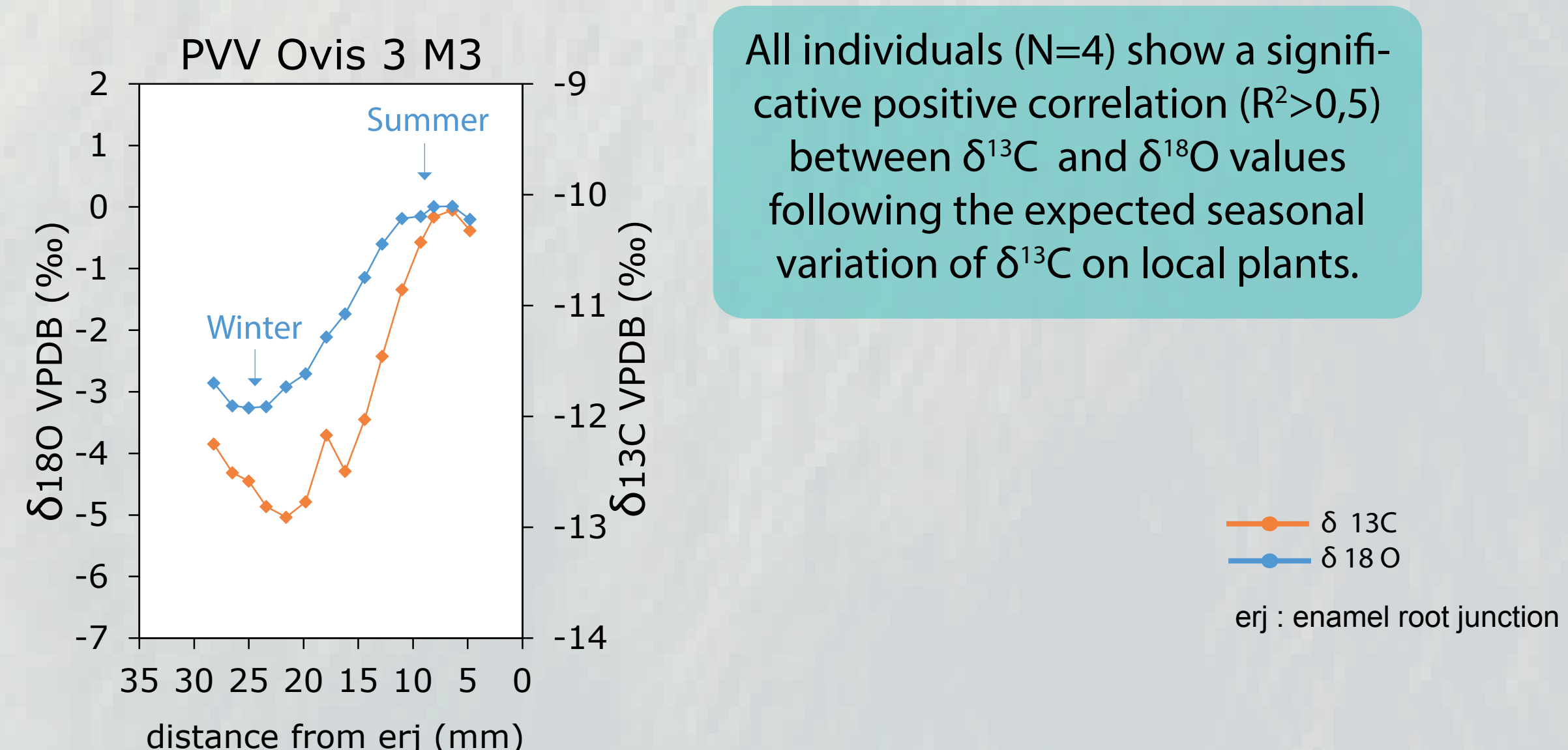


Stable isotope results



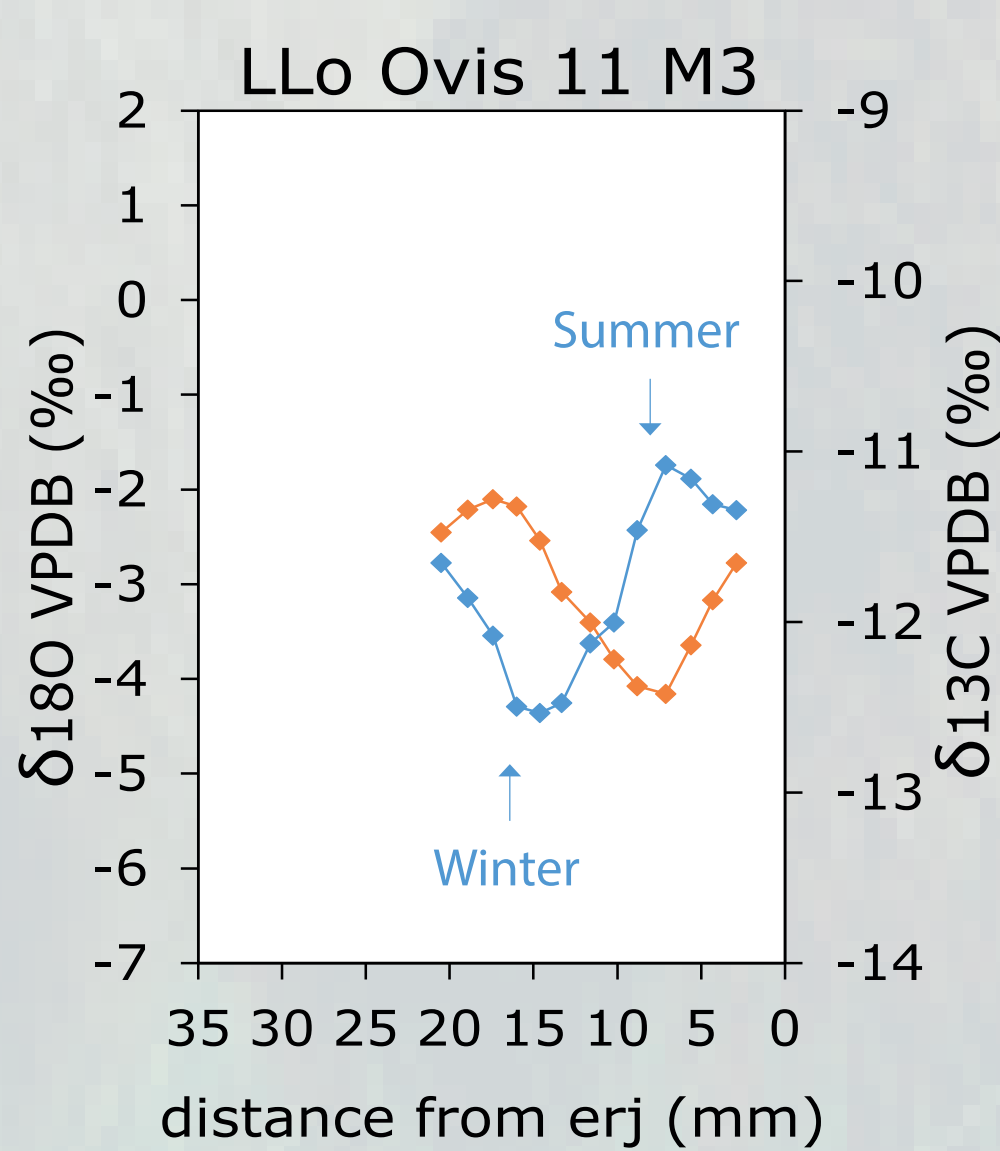
Type 1 : Portal-Vielh

$\delta^{18}\text{O}$ & $\delta^{13}\text{C}$ positive correlation



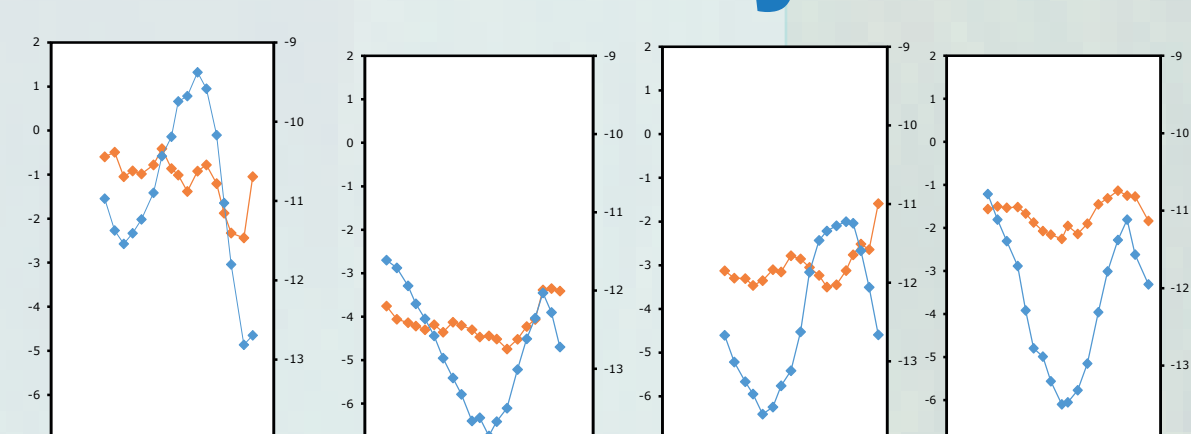
Type 2 : Llo-Lladre

$\delta^{18}\text{O}$ & $\delta^{13}\text{C}$ negative correlation



and

diversity...



Others individuals present an important diversity of profiles (different from type 1 and Type 2)

- $\delta^{18}\text{O}$ values follow seasonal cycle of temperature in both sites.
- $\delta^{13}\text{C}$ values reflect consumption of C₃ plants from open area (around 11.8 ‰) without significant difference on mean values between both sites.

Conclusions and perspectives

- Mortality profiles reveal an exploitation of all livestock resources and no specific strategy to respond to mountain environment constraints of Llo.
- No evidence of canopy effect ($\delta^{13}\text{C}$ values > -12.7 ‰).
- Two opposite isotopic profiles : Portal-Vielh (Coastal site) vs Llo (Mountain site) ➡ The difference could be linked to different husbandry strategies.
- Important variability of isotopic profiles among the individuals in Llo ➡ Diversity of husbandry strategies in mountain context ?