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# Large game hunting strategies in Middle Palaeolithic of Southern France: contribution of dental cementum analysis through the study of the Canalettes rockshelter and Lazaret cave sites

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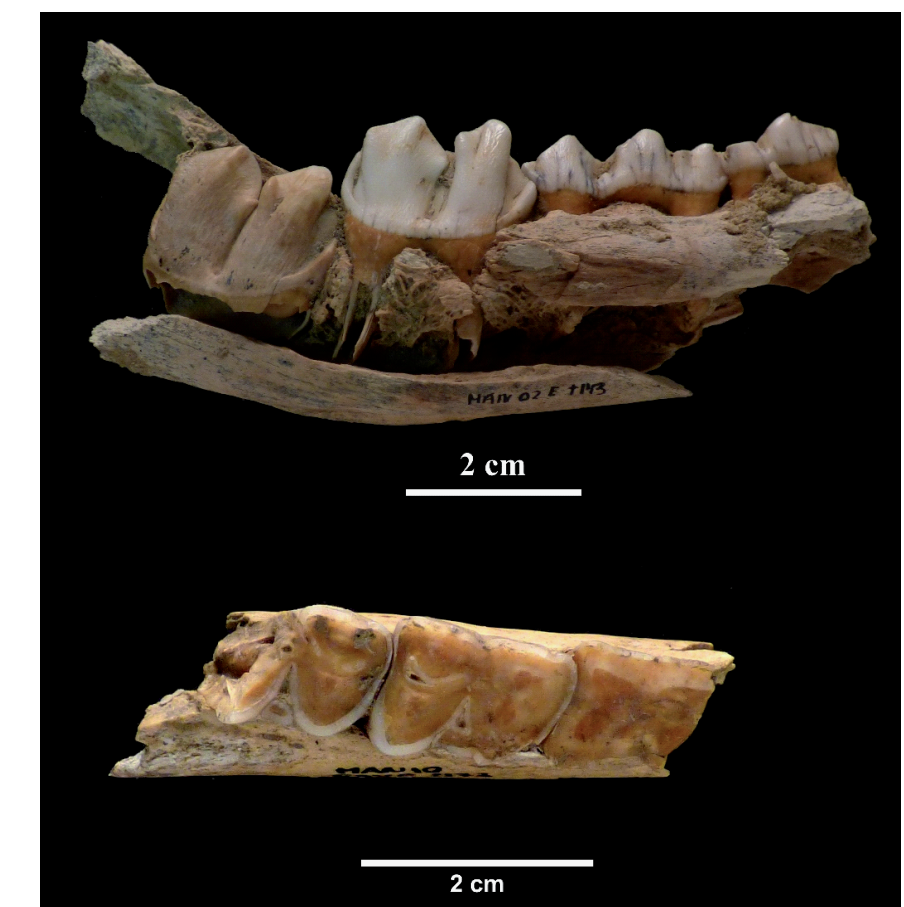
## Introduction

Recent zooarchaeological studies undertaken on several **Middle Palaeolithic** sites [e.g. 1,4,5,7] have questioned previous models implying opportunistic large game exploitation and highlighted more **complex food procurement strategies** (collective vs specialized hunting, meat storage and deferred consumption, etc.). However, this topic research remains limited due to the small number of sites carefully studied as well as the scarcity of high-resolution data. In this perspective, we propose to assess two main parameters: the **demographic composition** of the hunted animal populations and the **seasonality of their acquisition**. Both are critical to address **mobility and settlements patterns** of Neanderthal and pre-Neanderthal communities in Southern France.

## Context

**Lazaret Cave** on the **Mediterranean coast** (Nice, Alpes-Maritimes) and the rockshelter of **Les Canalettes** located in the mid-altitude zone of **Causse du Larzac** (Aveyron) are two archaeological sites from Southern France [8,14,18]. The horizons studied here are respectively the Unit UA29 (MIS 6) and the layer 4 (MIS 5a). **Red deer** (*Cervus elaphus*) and **ibex** (*Capra ibex*) are the main prey at Lazaret Cave, and **horse** (*Equus germanicus*), **red deer** and **large bovines** (*Bos primigenius*, *Bison priscus*) are dominant at Les Canalettes.

## Methods

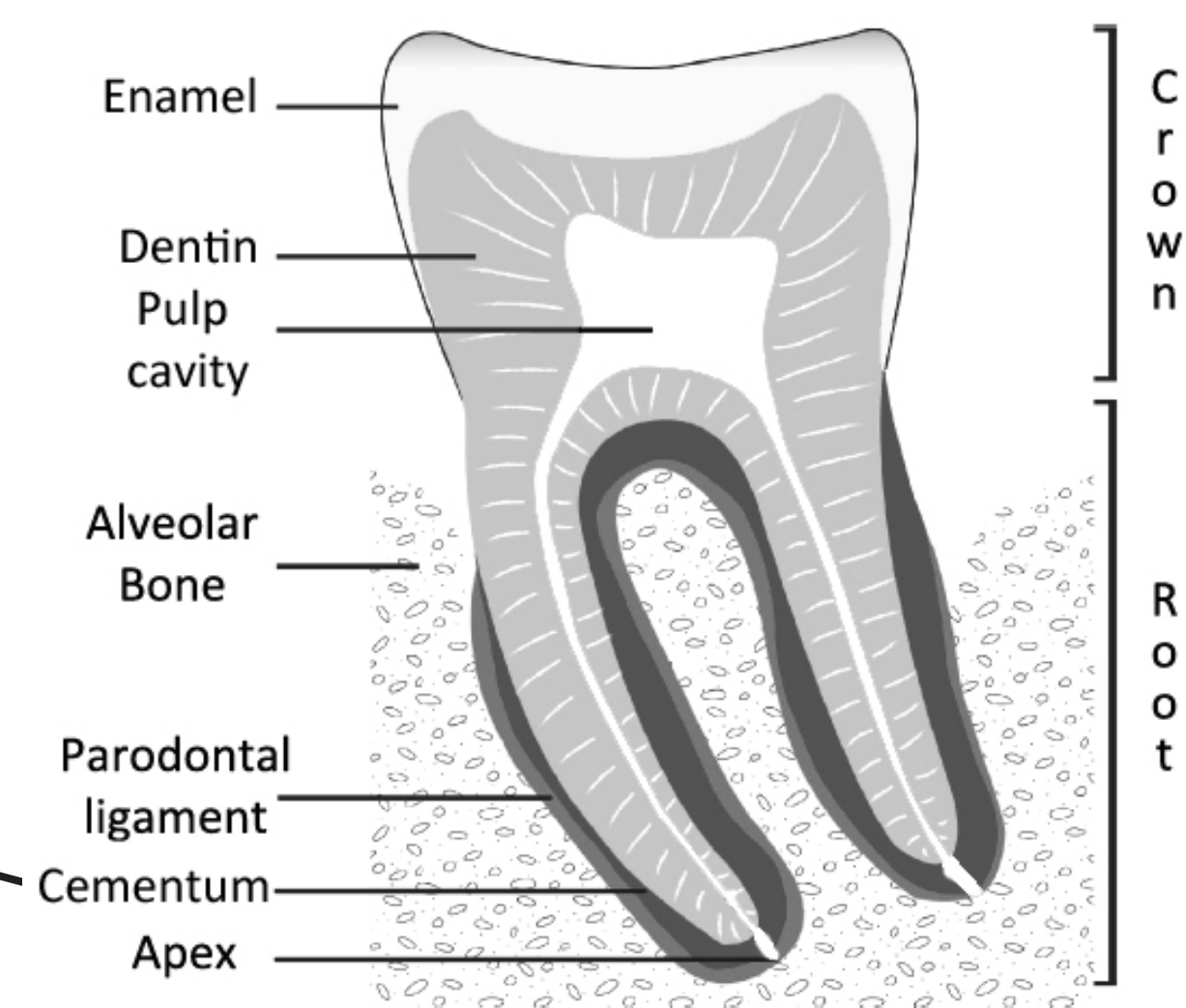
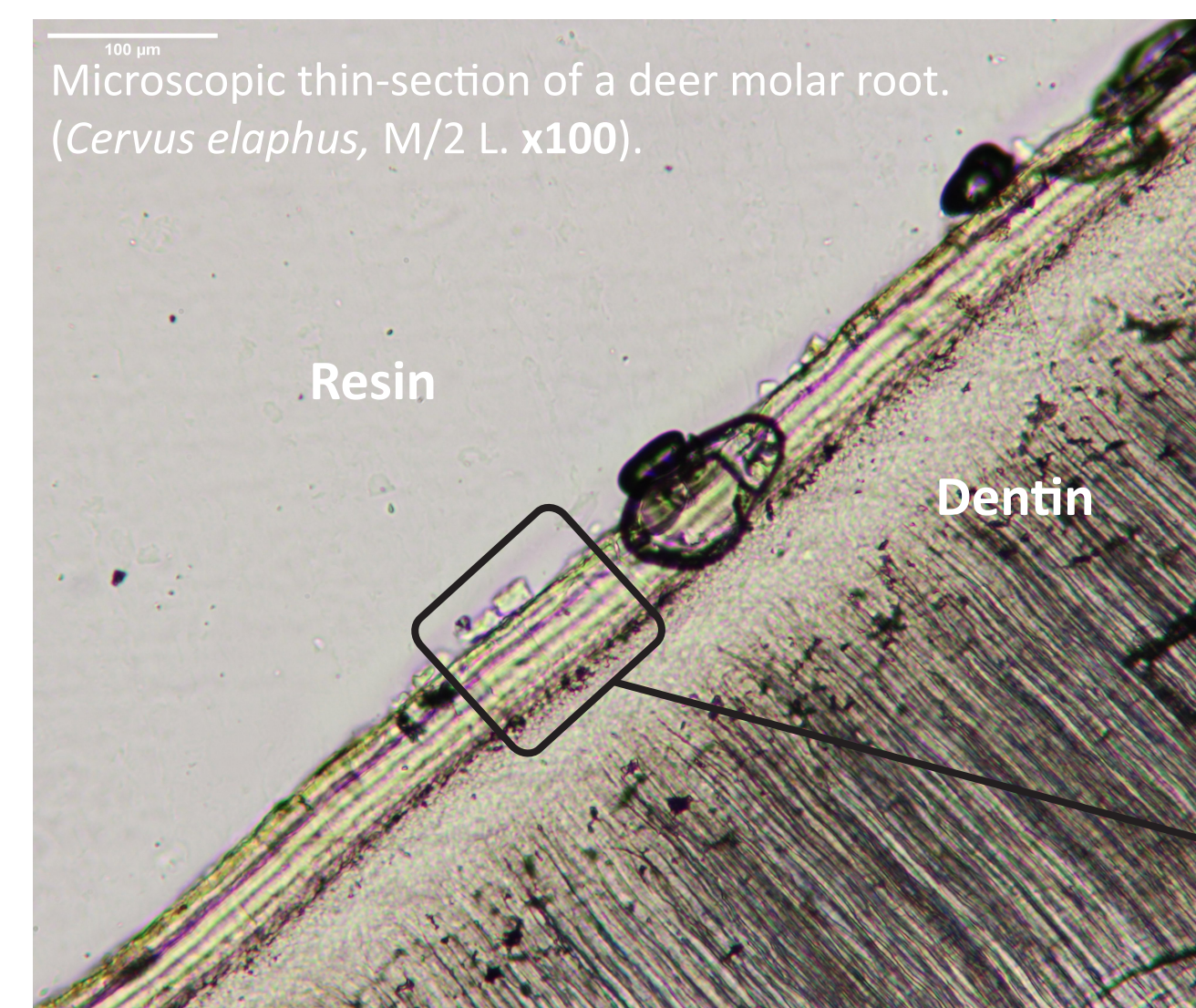


The analysis is based on **traditional methods of age and season at death estimation** (i.e. tooth eruption and wear) and **cementochronology** (biological age and season of death for adults) [2,3,6,10,12,13, 15,16].

Cementum is one of three mineralized tissues composing the tooth, with enamel and dentin.

It is deposited as alternating pairs of bands, according to the annual cycle and throughout the tooth's life :

- a fast growth deposit during the **warm season**;
- a low one in the **cold season**.



## Material & Samples

The study of the material focused on **red deer**, **large bovines** and **ibex**.

**Lazaret**: 13 teeth of deer and 4 of ibex selected, i.e. 30 and 9 thin-sections respectively.

**Canalettes**: 33 teeth of deer, 1 of bovines, 1 ibex and 1 roe deer, i.e. 47 sections, including the samples made by previous studies (H. Martin [personal communication], M. Hassani [11]).

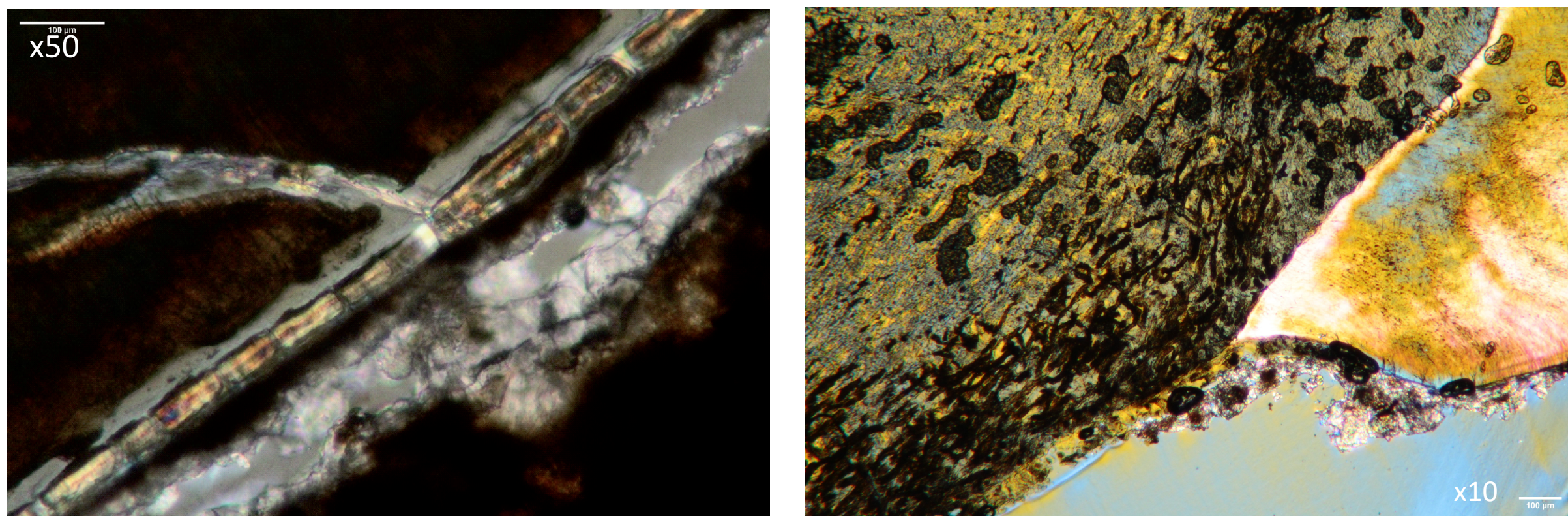
Levels	Lazaret UA29				Canalettes I.4			
	Cervus elaphus		Capra ibex		Cervus elaphus		Bos/Bison	
Cohorts	NISP teeth	MNIc	NISP teeth	MNIc	NISP teeth	MNIc	NISP teeth	MNIc
Juveniles	30	10	7	3	22	7	9	4
Prime adults	57	17	28	6	77	21	13	4
Old adults	18	5	6	2	9	3	0	0
Total	105	32	41	11	108	31	22	8
Total teeth	282	55			241		51	

## Limitations

The success of the analysis in cementochronology depend on the preservation state of the inner structures and tissues of the teeth. Important **taphonomic damages** have been observed in the samples.

The most recurrent are:

- **Physical and chemical alterations** (cracks, peeling, leaching, staining), cf. below on the left ;
- **Microbial focal destructions** (bacterial or fungal attacks), cf. right image.



In the case of Lazaret Cave, most of the specimens show various alteration types but 95% allow the estimation of age and 67% the seasonality.

The Canalettes teeth are **heavily impacted by microbial destructions**. Indications of age were provided by 40% of teeth and the season of death by only 22% of them.

Preliminary results indicate that prehistoric groups exploited their **immediate environment**, targeting **female and juvenile herds**, but favoring **higher-yielding adults**. Residential mobility seems reduced, favoring a **logistical use of the territory** to procure specific resources not always available nearby. Lithic studies and data from spatial analyzes (fireplaces, dump areas) also suggest a long term occupation of the sites.

In a symmetrical ways, the sites seem to have had the **same fonction** but in distinct seasons and environments. Canalettes could be a **summer base camp** and the Lazaret a **winter camp-site**. In both cases, mobility patterns are similar, characterized by a long term occupation and the exploitation of main and secondary herd preys available in the surroundings.

## Results

### Demography

The deer mortality profiles are dominated by the **prime adults** and **young individuals**.

Ibex and large bovines are represented by few individuals but while the ibex group composition is similar to the deer, the bovines have the same proportion of young and adults.

### Macroscopic vs microscopic

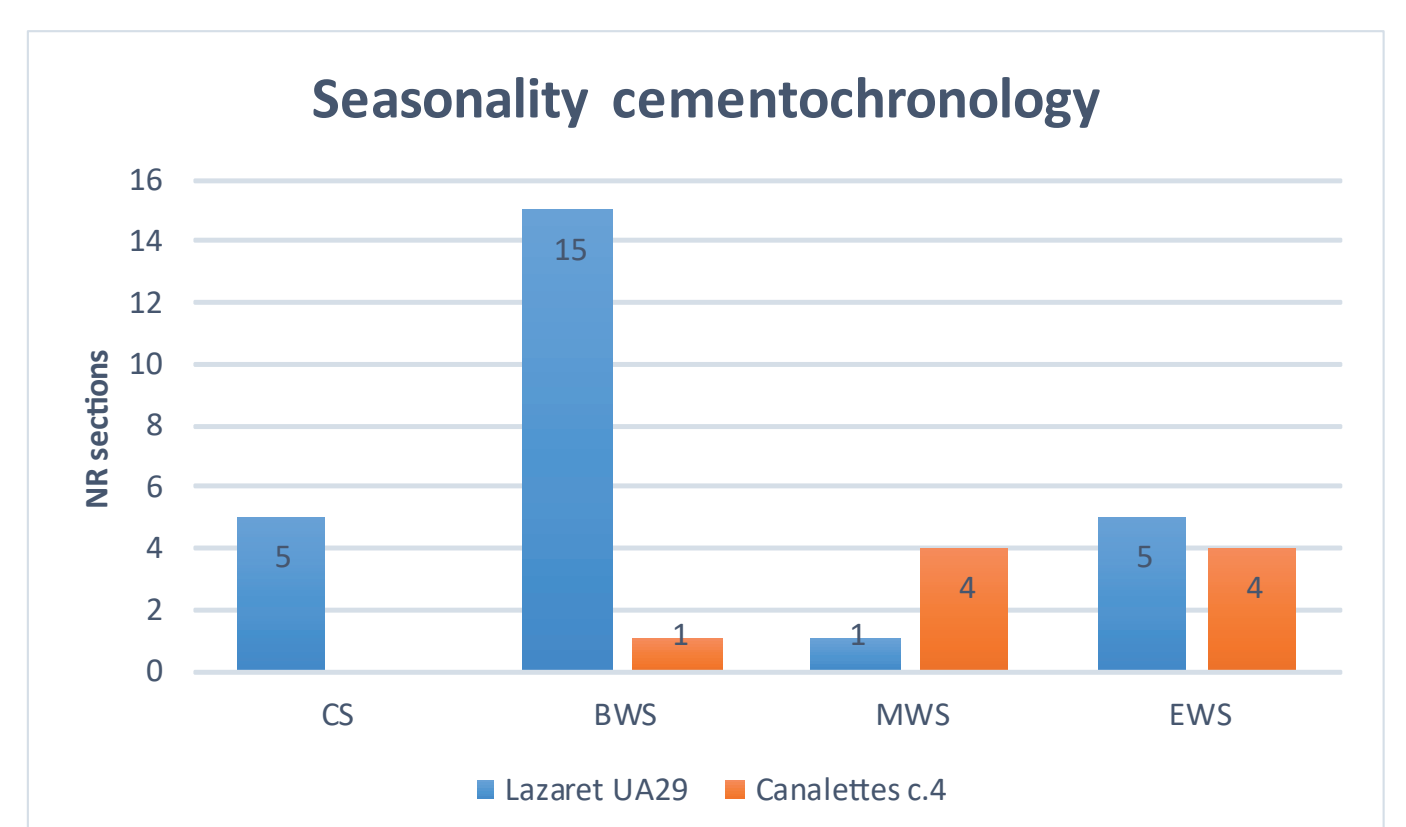
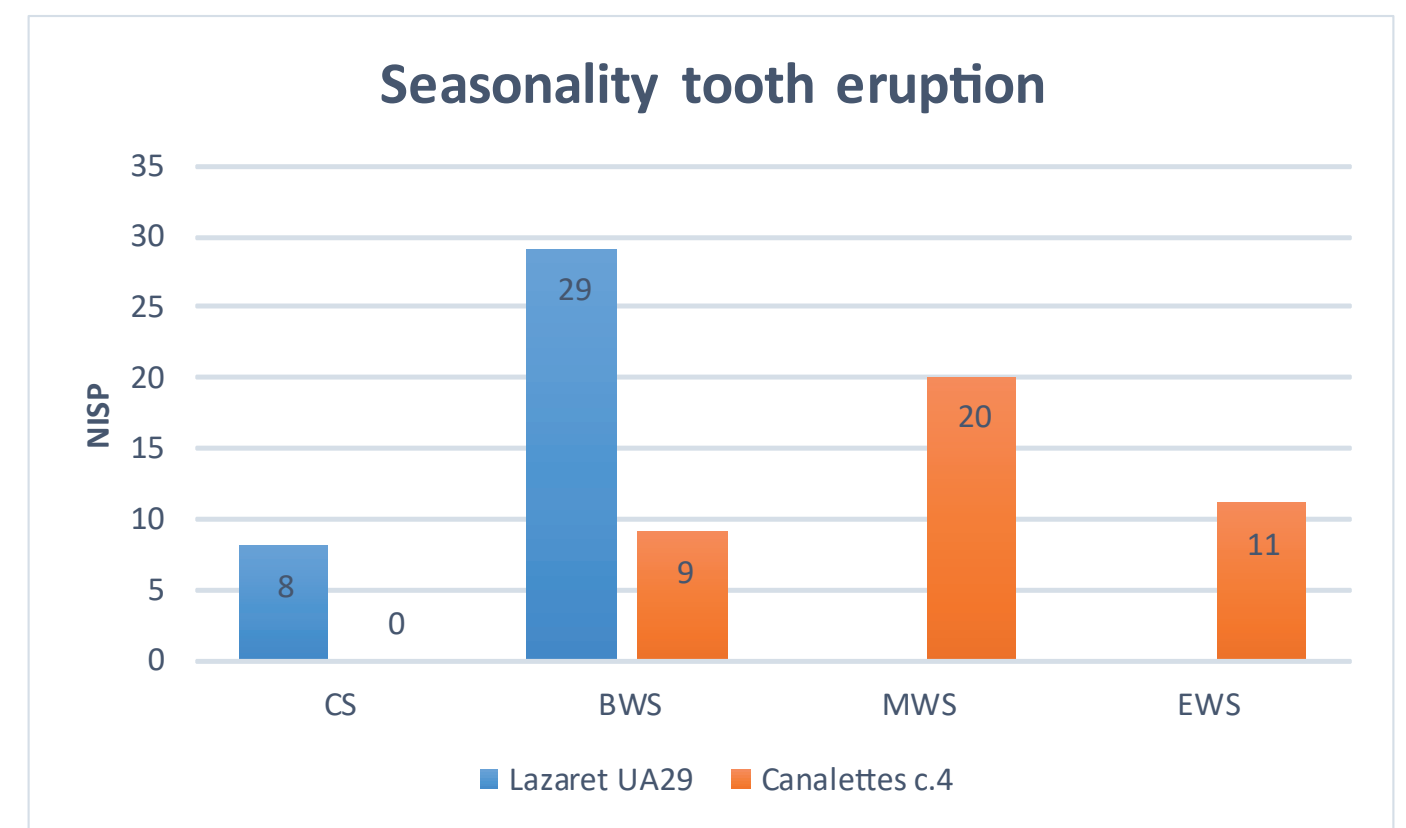
When samples give positive results, the comparison between the tooth wear and cementochronology observations shows 61% of agreement. The macroscopic methods over-estimated the age of death in 27% of the cases and only 8% are underestimated.

Age Cementum/wear	Lazaret	Canalettes
Agreement	9	8
Lower	7	
Upper	1	1
Total	17	9

### Seasonality

At the Lazaret Cave, both methods show an acquisition of prey throughout the year, particularly in the **cold season (CS)**, during a large period which includes the **beginning of the warm season (BWS)** and the **end (EWS)** (cementochronology).

It is the opposite at Les Canalettes, with animals killed throughout all the **warm season**, especially during the **mid-warm season (MWS)**, i.e. in summer (dental eruption).



## Analizis

The mortality profiles correspond to a **"catastrophic"** pattern in the ternary diagrams and represent a living population type **«Juvenile>Prime>Old»**.

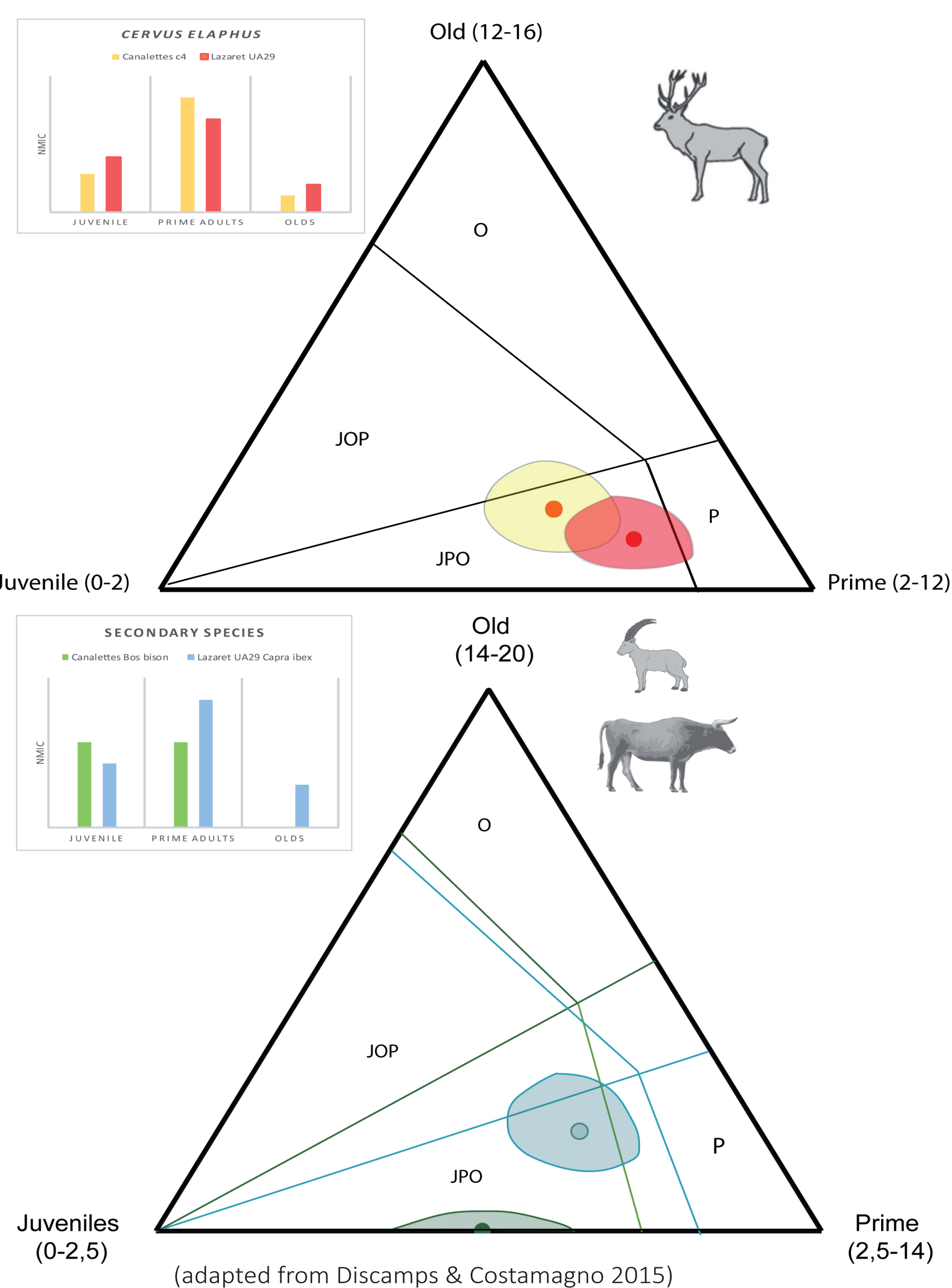
The cementum data indicate a majority of ages **slightly younger** than those estimated with dental wear. Individuals initially placed in the oldest adult class (>12 years) were found to be heavily over-estimated for the deer. Taking this parameter into account, the composition of the deer groups seems to mainly focused on the **"prime adults"** range.

The composition of deer (young et prime adults) reflects structures of herds of females and fawns.

Represented by few individuals, results for ibex and large bovines could suggest punctual killings from **herds of femelles with calves**.

At both sites, prey acquisition seems to have occurred during a **long period** (several months) or recurrent visits, during the **cold season** at Lazaret Cave and **warm season** at Les Canalettes.

Prehistoric human groups seem to have performed a **regular predation** on small groups of ungulates available nearby the sites.



## Discussion

The main differences are found on the seasonality of occupation. In the Canalettes rockshelter, a relative **temperate period** allows access to the medium mountain environment of the Causse and the **exploitation of the highlands**, not accessible in winter or glacial periods.

On the contrary, Lazaret Cave occupation occurs during the **cold season**. The site is located in a favorable climatic region which played a role of **climatic refuge** for animal populations during glacial periods [9,17].

## Conclusion

Such a **combination of traditional and cutting-edge methods for studying dental remains** allows us to obtain reliable and relevant new data about **demography and seasonality** that shed light to the issue of animal resource **procurement and human mobility** during the **Middle Palaeolithic in Southern France**.

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