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# Focus at 250 ka within the Neandertal lineage: comparison of teeth from Biache-Saint-Vaast (Pas-de-Calais) and Payre (Ardèche) in France

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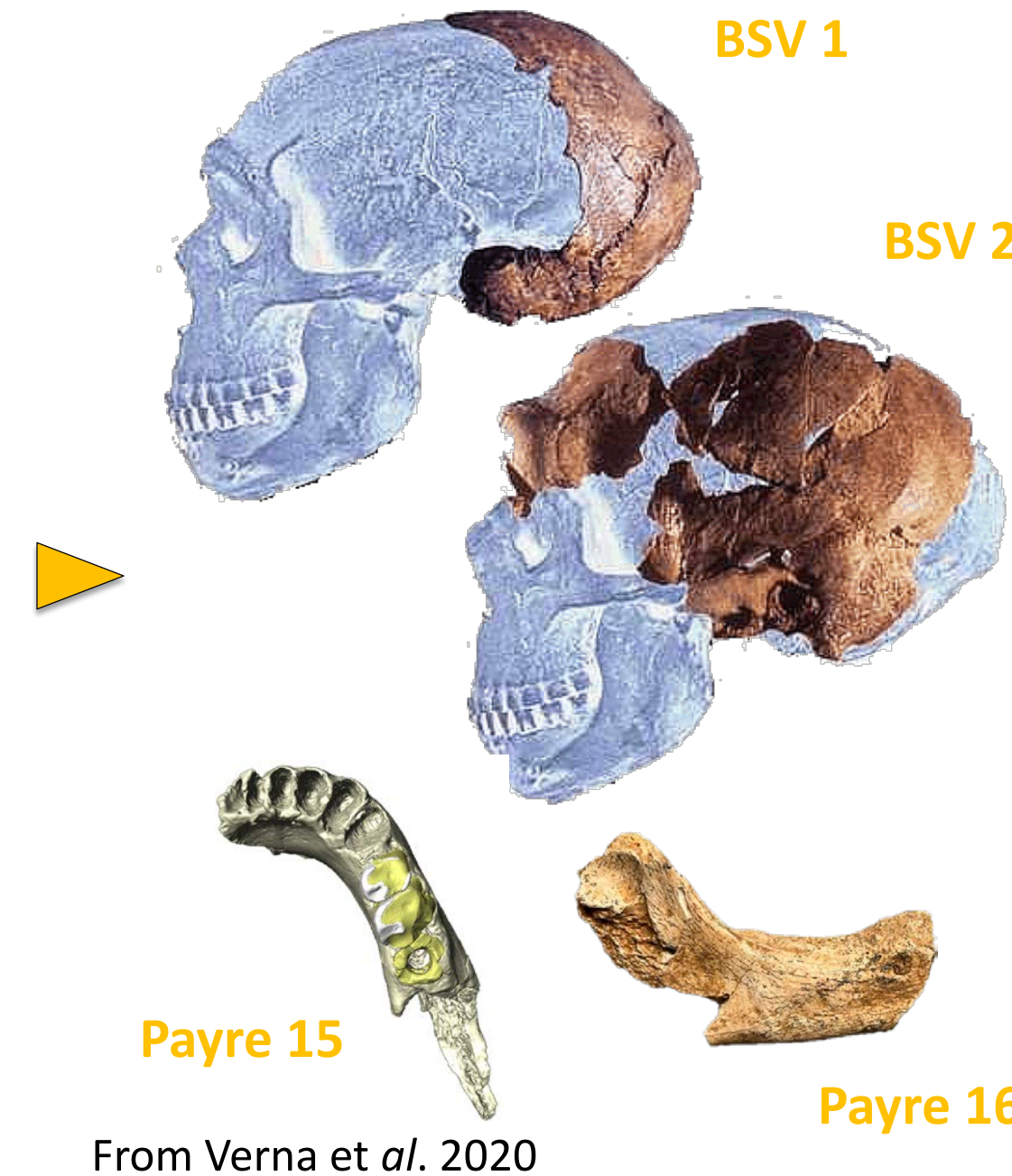
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## Introduction

This paper aims at comparing two contemporary anthropological series from the following French sites: **Biache-Saint-Vaast-BSV** (an open-air site in the North of France) and **Payre** (a rock-shelter in the Rhone valley, south of France). Both have yielded human remains from archaeological levels whose chronological attribution is around **250 ka, i.e. at the time of the emergence of the classic Neandertal form in Europe.**

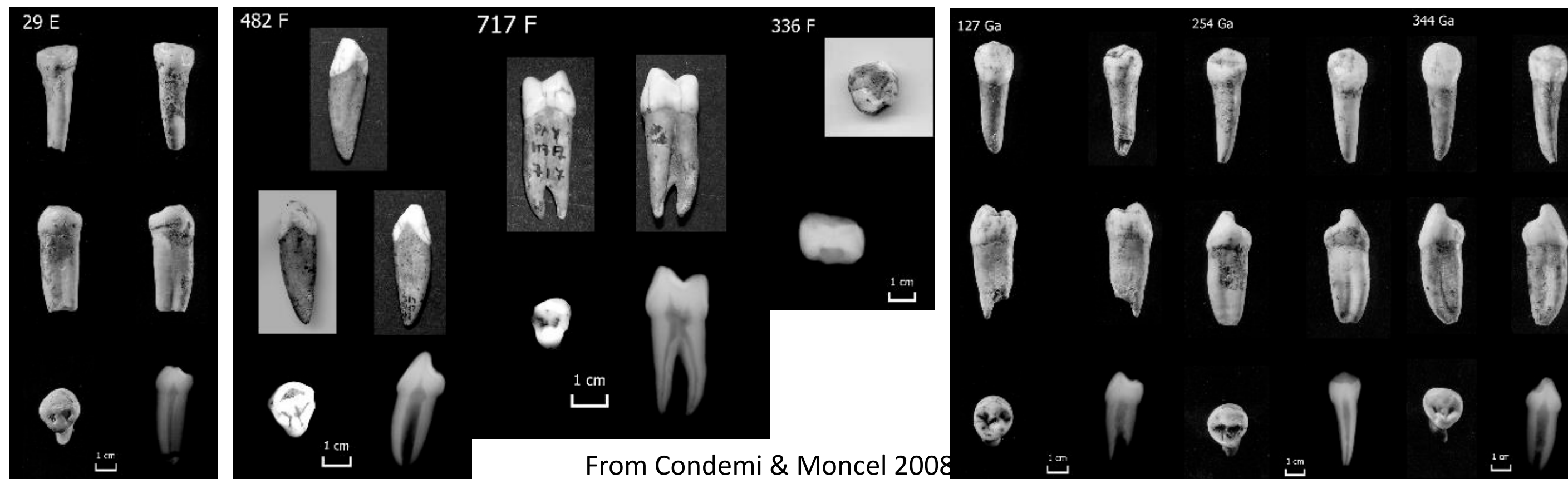
At **BSV**, skull fragments from 2 individuals and 11 maxillary teeth from a single individual were discovered. At **Payre**, 2 parietal fragments probably from the same individual, 10 lower & 3 upper teeth and 2 fragmentary mandibles were unearthed. We have concentrated on the study of teeth, the most abundant and least studied material to date. Only **UP3 and UM2** are represented at **both sites**, enabling direct comparisons.



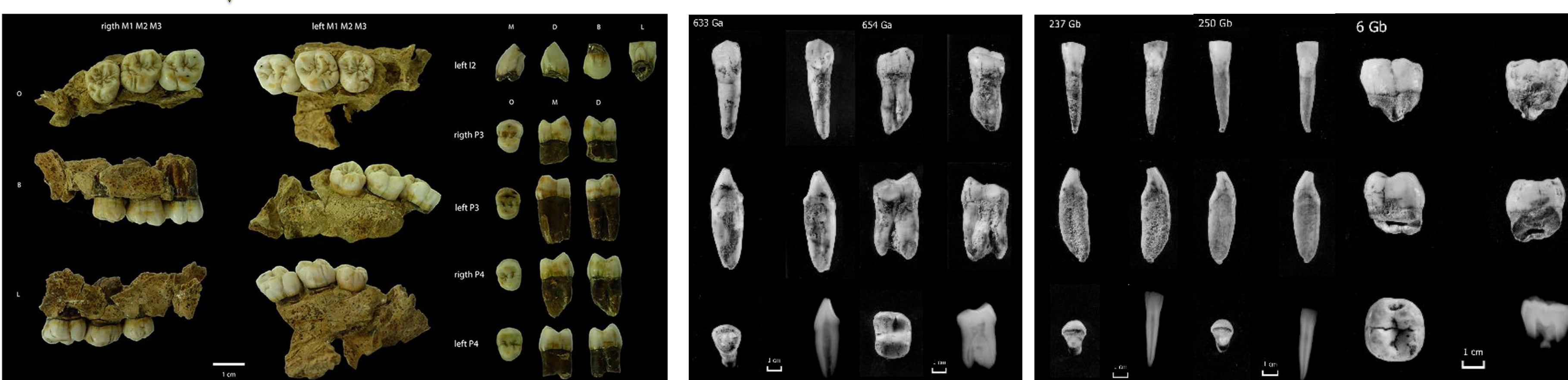
From Verna et al. 2020

## BSV & Payre

Isolated teeth from **Payre** (right) by archaeological level (E, F, Ga, Gb - from left to right).



Maxillary teeth of **BSV**: right and left molars are still in the arcades; L1, RP3, LP3, RP4, LP4 are isolated teeth from the same individual (bottom).



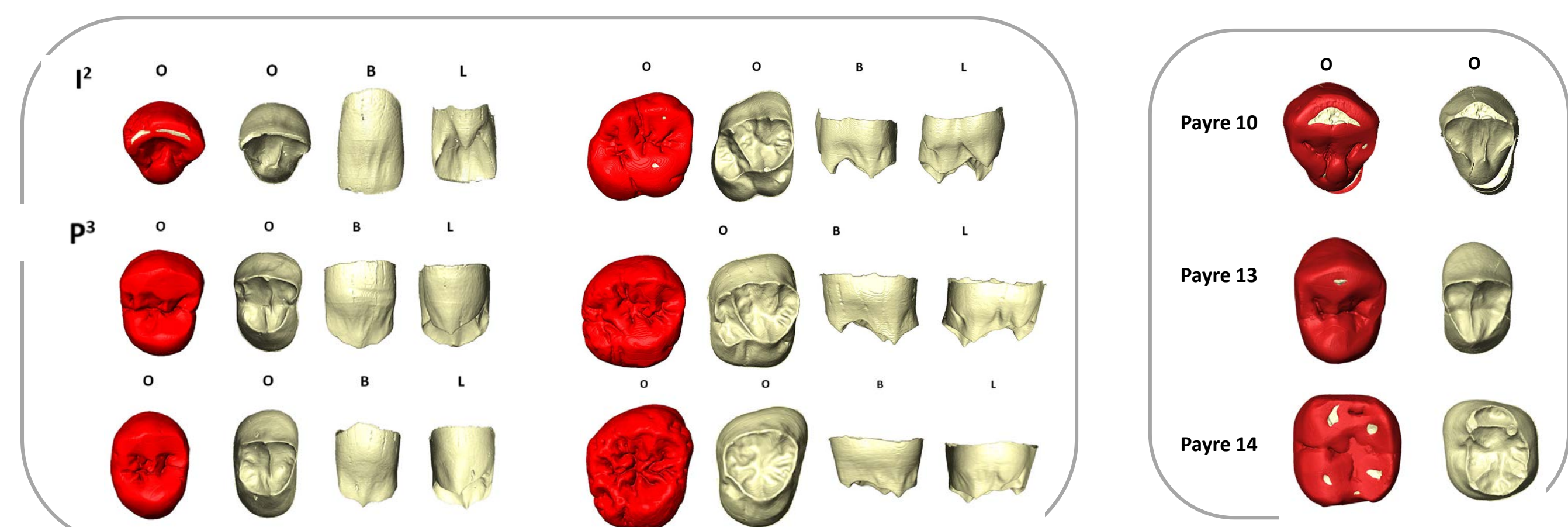
The **BSV** teeth, From Martín-Francés et al. 2022

Top, from left to right: LLP4 (Payre 9), URC (Payre 10), URP3 (Payre 13), LLM2 (Payre 14), LLP4 (Payre 6), LRP3 (Payre 4), LLP3 (Payre 8); Bottom, from left to right: LRC (Payre 11), ULM2 (Payre 12), LLI2 (Payre 2), LLI1 (Payre 3), LLM1 (Payre 1).

**Material:** the comparative sample consists of **teeth (N > 200 in total)** from **Middle Pleistocene populations, Neandertals and Homo sapiens** (see Martín-Francés et al. 2022). **High-resolution  $\mu$ CT scanning** of the fossil and modern material was performed at the *Muséum national d'Histoire naturelle*, France (AST-RX Platform) and at CENIEH, Spain.

**Methods:** **3D virtual segmentation of the dental tissues** (enamel, dentine and pulp) was performed in Amira (6.3.0, FEI Inc.); **Metric analyses** comprised mesio-distal (MD) and bucco-lingual (BL) diameters, crown index (CI) and total computed crown base area (TCBA); For the characterisation of the **enamel (OES) morphological traits** we employed the modified version of the **ASUDAS** (Turner et al. 1991) by Martínón-Torres et al. (2012). For the **Geometric morphometric (GM)** analyses of the EDJ of the premolars, we placed one landmark on each of the dentine horn tips (protocone/-id and metacone/-id) and 49 semilandmarks along the marginal ridges. We performed **weighted between-group principal component analysis (bgPCA)**.

## 1 Neandertal-like morphological traits



**BSV teeth:** views of the occlusal faces at OES and EDJ (left) and buccal and lingual surfaces at the EDJ (right), *not at scale*, from Martín-Francés et al. 2022

**Payre teeth:** views of the occlusal faces at OES and EDJ, *not at scale*

In the **BSV** specimens, at the OES and EDJ, mostly typical Neandertal traits are observed. For examples, on premolars: **a continuous transverse crest, both buccal and lingual essential crests bifurcated (ULP3), an interrupted transverse crest and a distal accessory ridge (URP3).** Typical Neandertal traits are also observed in the **Payre** teeth: **a well-developed tuberculum dentale and marginal ridges on the upper right canine (Payre 10), a continuous transverse crest on the right P3 (Payre 13); a continuous mid-trigonid crest with a deep and pit-like anterior fovea on the lower left M2 (Payre 14).**

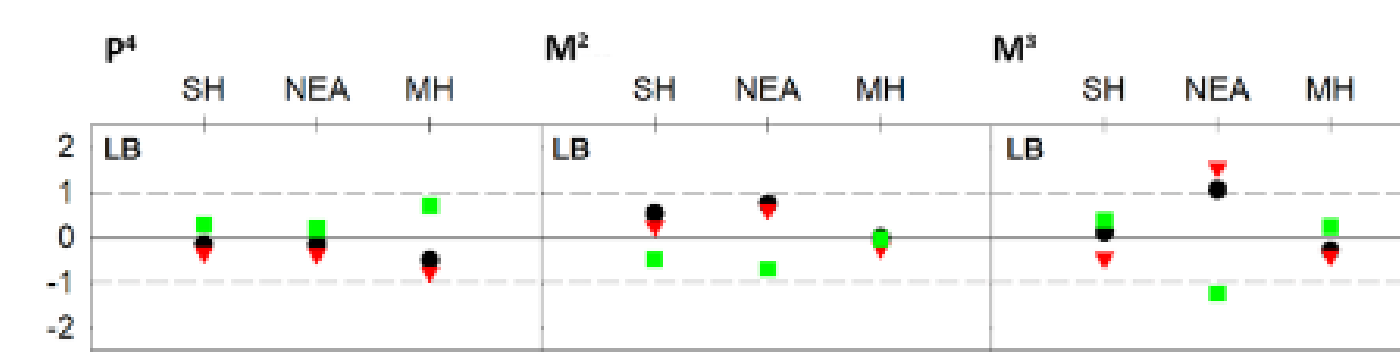
## Conclusions

Our results show that the BSV and Payre fossils, dated at around 250 ka, are part of Middle Pleistocene hominins variation. Concerning the enamel and dentine morphology, **the teeth exhibit the typical Neandertal pattern. However, concerning the ET, they show an intermediate pattern.** The two incisors from Payre are well outside the range of Neandertals as well as UP3 in the GM analysis. **As expressed in the mandible, teeth from Payre are not completely Neandertal. The ones from BSV, even contemporary to Payre, seem more derived.**

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## 2 Intermediate pattern of the enamel thickness

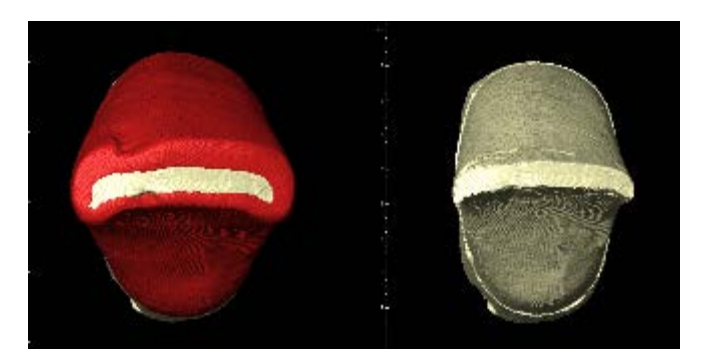


**BSV teeth show a unique combination of thin (premolars) and thick (molars) enamelled dentition.**

For the LP3 of **Payre**, the results are **intermediate** between the low values of Neandertals and the high values of modern humans. For LP4, the AET, RET and percentage of dentine **align this it with the Sima de los Huesos and modern humans.**

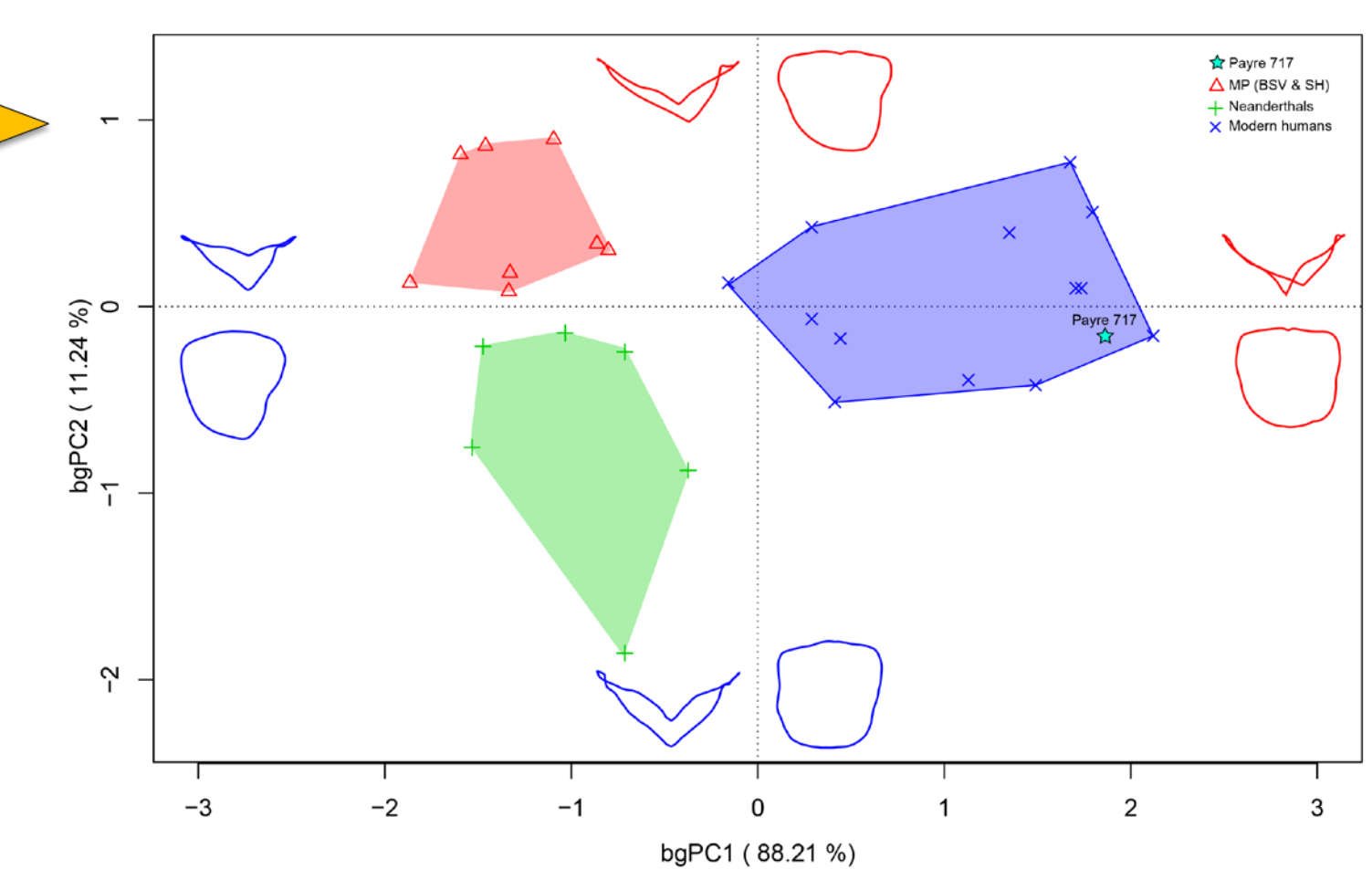
## 3 Some peculiarities among the Payre teeth

Regarding the morphological traits of **lower incisors (Payre 2&3)**, both display a **simpler configuration than the typical Neandertal patterns:** weak convexity of the labial surface, no expression of tuberculum dentale and only a faint shovel shape. It's far from the Neandertal condition as well as the one observed on BSV.



**Payre 2 (LRI2):** occlusal faces at OES and EDJ, *not at scale*

**GM analysis shows that the UP3 (Payre 13) is characterized by a quadrangular EDJ rim and the lingual cusp slightly displaced mesially.** On the contrary, the BSV, Sima de los Huesos and Neandertals are characterized by a more compressed mesio-distal diameter and the lingual and buccal horns at EDJ are centered.



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