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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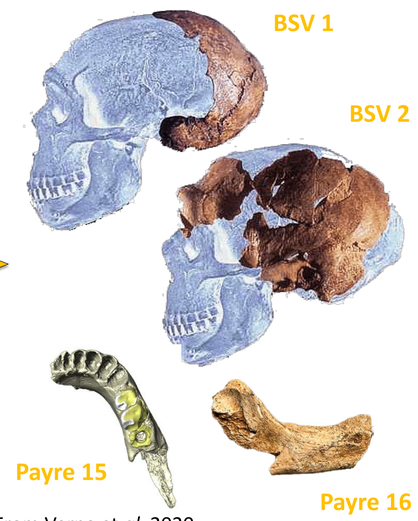
Introduction

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.

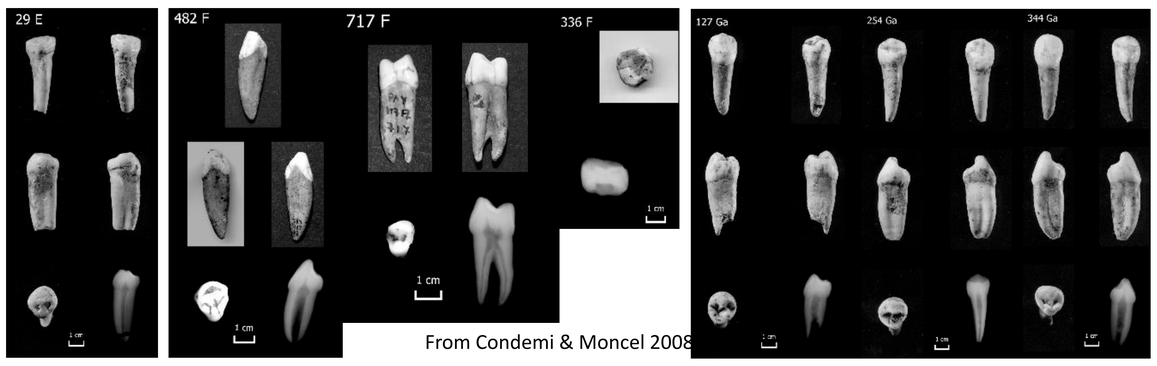


From Verna et *al*. 2020

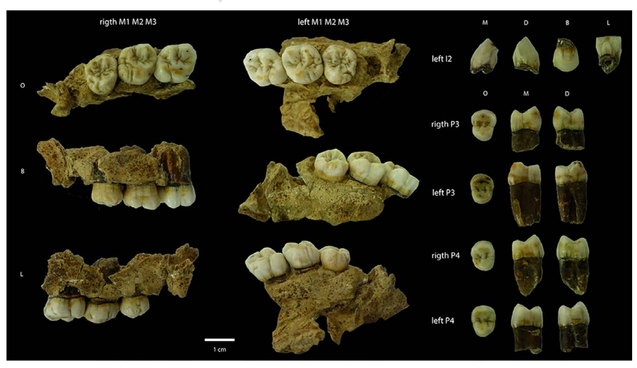
BSV & Payre

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

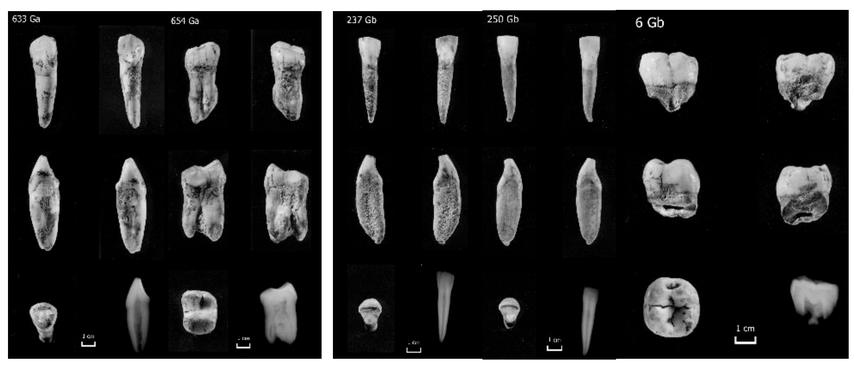
Maxillary teeth of **BSV: right and left** molars are still in the arcades; LI1, RP3, LP3, RP4, LP4 are isolated teeth from the same individual (bottom).



From Condemi & Moncel 2008



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

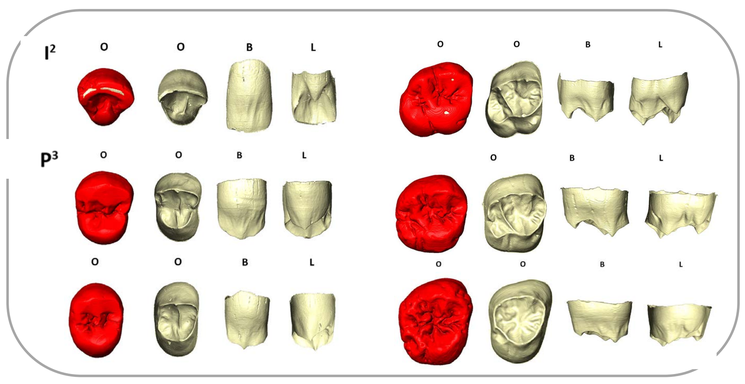


Top, from left to right: LLP4 (**Payre 9**), URC (**Payre 10**), URP3 (**Payre 13**), LLM2 (**Payre 14**), LLP4 (**Payre 6**), LRP3 (**Payre 4**), LLP3 (**Payre 8**); Bottom, from left to right: LRC (**Payre 11**), ULM2 (**Payre 12**), LLI2 (**Payre 2**), LLI1 (**Payre 3**), LLM1 (**Payre 1**).

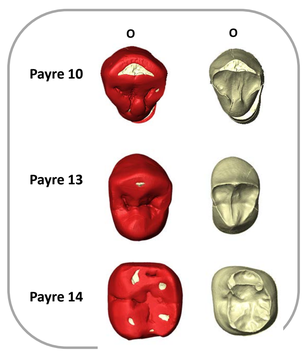
Material: the comparative sample consists of **teeth (N > 200 in total) from Middle Pleistocene populations, Neandertals and *Homo sapiens*** *(see* Martín-Francés et *al*. 2022). **High-resolution µCT scanning** of the fossil and modern material was performed at the *Muséum national d'Histoire naturelle*,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



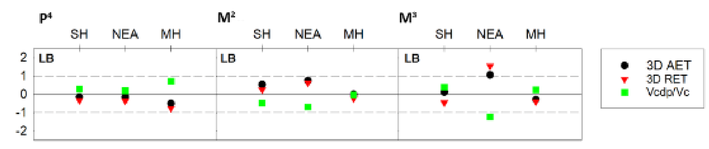
BSV teeth: views of the occlusal faces at OES and EDJ (left) and buccal and lingual surfaces at the EDJ (right), *not at scale*, from Martín-Francés et *al*. 2022



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).

2 Intermediate pattern of the enamel thickness

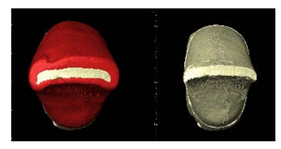


BSV teeth show a **unique combination** of thin (premolars) and thick (molars) enamelled dentition.

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.

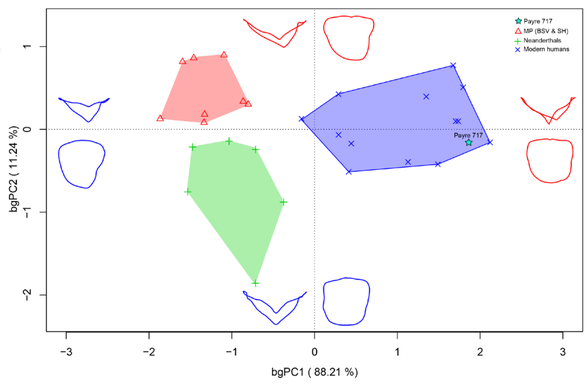
3 Some peculiarities among the Payre teeth

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.



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.**

Acknowledgements

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References

Condemi S., Moncel M.-H. 2008. Les restes humains, in Le site de Payre (dir. Moncel), mémoire 46, SPF, p.131-151 / **Martín-Francés L. et *al*. 2022.** Middle Pleistocene Hominin teeth from Biache-Saint-Vaast (France). *Archaeological and Anthropological Sciences* / **Turner C.G. et *al*. 1991.** Scoring procedures for key morphological traits of the permanent dentition: the Arizona State University dental anthropology system. In: Kelley M, Larsen C (eds) Advances in dental anthropology. Wiley-Liss, New York, p. 13-31 / **Martinón-Torres M. et *al*. 2012.** Morphological description and comparison of the dental remains from Atapuerca-Sima de los Huesos site (Spain). *Journal of Human Evolution* 62: 7–58 / **Verna C. et *al*. 2020**. The Middle Pleistocene Hominin Mandible from Payre (Ardèche, France), *Journal of Human Evolution* 144: 102775