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### ► To cite this version:

Olivia Cheronet, Daniel Fernandes, Iñigo Olalde, Nadin Rohland, Ludovic Soler, et al.. aDNA and kinship in French Atlantic Façade megalithic monuments. Laporte (L.), Large (J-M.) et Nespoulous (L.), Scarre (C.), Herbet-Steimer (T.) dir. Mégaliths of the world., Archaeopress, p.1260-1262, 2022, 978-1-80327-321-1. hal-03904704

**HAL Id: hal-03904704**

<https://univ-rennes.hal.science/hal-03904704v1>

Submitted on 23 Aug 2024

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# Megaliths of the World

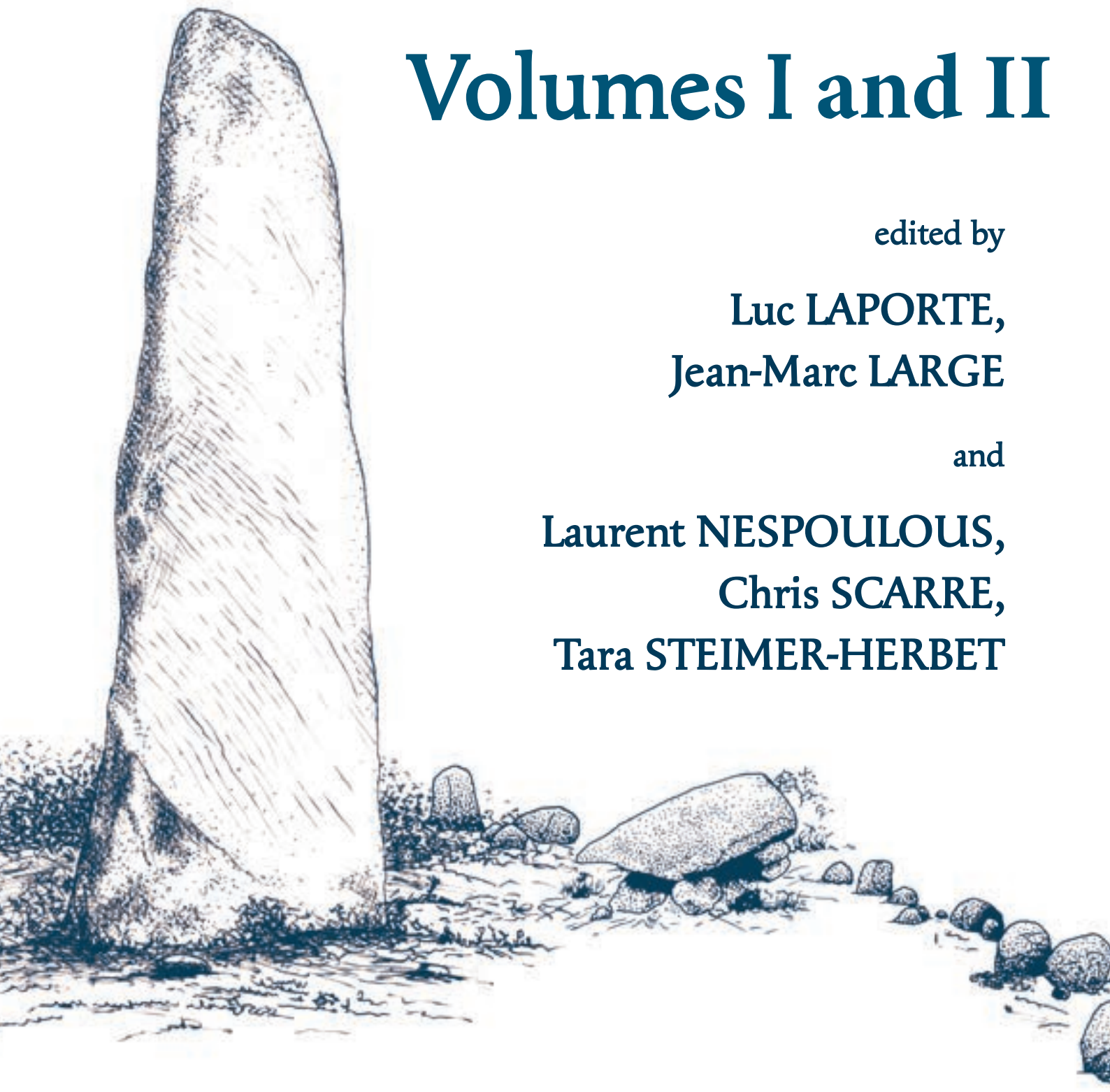
## Volumes I and II

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# aDNA and kinship in French Atlantic façade megalithic monuments

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## 1. Introduction

From the mid 5th millennium BC, the Neolithic people of western France began to build megalithic burial monuments. Numerous individuals were often deposited within single monuments. This practice spread across the continent and megaliths can be encountered in landscapes from Iberia to Scandinavia and beyond. Despite their ubiquity, the question remains of **who were the people selected for burial within megalithic monuments?** As a consequence of the high logistical cost associated with their construction, it could be suggested that these constructions were the resting places of the elite members of the community. Furthermore, individual structures may have been reserved for the remains of individuals from the same groups (i.e., families, lineages or clans).

Recent advances in our ability to obtain and analyse whole genome aDNA data now enable us to shed some light on this question. By obtaining genetic data from the skeletons found in the monuments, it is possible to determine their relatedness. A previous study on megaliths from the British Isles and Scandinavia was able to detect familial relationships between individuals buried in the same monuments (Sánchez-Quinto *et al.* 2019), however a recent study of French megaliths found scarce evidence of kinship within monuments (Rivollat *et al.* 2020). By contrast, extreme levels of inbreeding and kinship between individuals in Irish monuments has led Cassidy *et al.* (2020) to strengthen the suggestion that megalithic monuments were the burial places of the elite.

In this study, we sampled a large number of individuals from three Middle and Late Neolithic megalithic monuments from the French Atlantic façade (Fig. 1). Nine individuals were sampled from Bougon's tumulus F0. This Middle Neolithic structure with <sup>14</sup>C dates ranging from 4700-4000 BCE is one of a group of five tumuli containing the remains of hundreds of individuals. A further 33 individuals were sampled from the Middle Neolithic Champ-



Fig. 1 – Location map of megalithic sites studied.

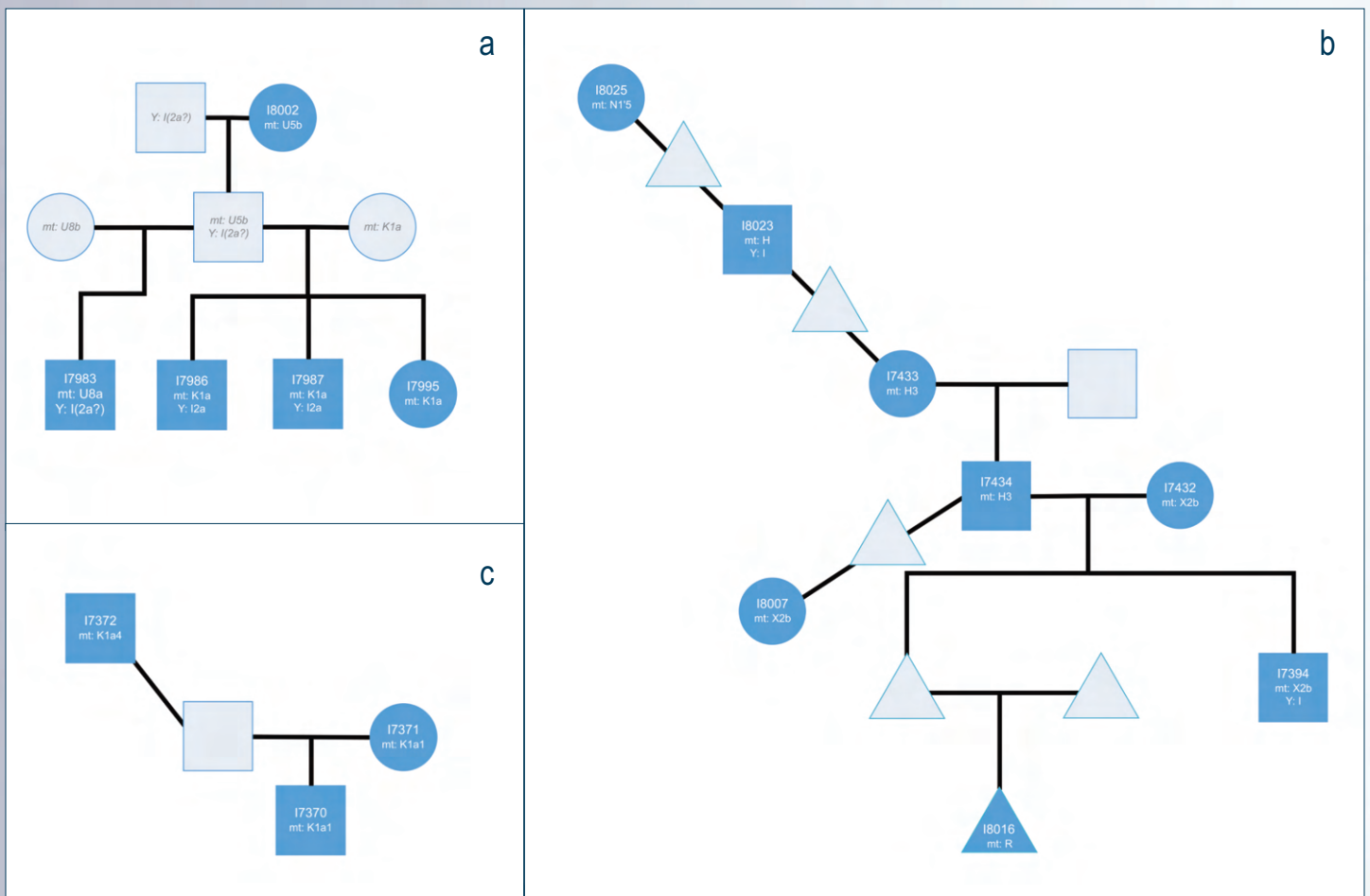
Châlon tumulus B, from each of its two chambers, B1 [dated to 4336-4005 BCE (OxA-9097)] and B2 [3973-3787 BCE (OxA-9595)]. Finally, 22 individuals were sampled from the Late Neolithic monument of the Pierre-Virante in Xanton-Chassenon. Using these samples, we have attempted to identify familial relationships within each of the monuments.

## 2. Methods and results

DNA samples were taken from petrous bones or teeth. These were then extracted and Next Generation Sequencing libraries were prepared following standard aDNA protocols, followed by a human DNA enrichment procedure and next generation sequencing. After a preliminary assessment of the data to remove samples with insufficient quality or

visible modern contamination, they were subjected to a first set of relatedness analyses (Kennett *et al.* 2017). Relatedness was then re-analysed using a more sensitive method in the case of low-coverage aDNA data (Fernandes *et al.* 2017).

We obtained successful data for nine individuals from Bougon F0 (100% success rate), 21 from Xanton-Chassenon (95% success rate) and 19 from Champ-Châlon (56% success rate). The first set of relatedness analyses uncovered familial relationships in each of these three sites. The second, more sensitive, method confirmed these relationships. By combining this information with the detected mitochondrial and Y-chromosome haplogroups, we constructed the hypothetical pedigrees presented in **Figure 2**.



**Fig. 2** – Hypothetical pedigrees of individuals sampled: (a) at Bougon F0 (Deux-Sèvres), and (b-c) at Champ-Châlon B (Charente-Maritime).

### **3. Discussion**

The genomic analyses presented here have revealed the presence of multiple generations from the same family in these three Neolithic megaliths. In addition to the previously published work by Sánchez-Quinto *et al.* (2019), this strengthens the argument that these structures were built to house the remains of specific lineages. Nevertheless, in the three studied structures we also found numerous individuals with no apparent familial ties. This may be the result of the presence of genuine non-relatives, or a sign of the limits of the methods presently available to us.

Interestingly, patterns were slightly different in the Xanton-Chassenon monument which, unlike the other two sites sampled, is from the Late Neolithic. In contrast to the two Middle Neolithic structures, where over 50% of individuals sampled showed some level of kinship, only 2 out of 21 individuals were found to be related in the later monument. Whether this is a site-specific pattern or a wider cultural trend associated with the Late Neolithic

remains open to speculation and requires <sup>14</sup>C date confirmation. Champ-Châlon offered an interesting case with many individuals represented, found in two distinct burial chambers. However, the two family groups identified were spread across both chambers, suggesting the greater importance of the monument than the structures within, or intermarriages between families/groups.

These analyses are preliminary. Although the pedigrees presented are possible, they are not the only way to explain the relationships uncovered. The relationships here are the most cautious and do not include events of inbreeding, which may well have taken place. Precise radiocarbon dating of the related individuals may help further refine these patterns. Furthermore, the sites of Bougon and Champ-Châlon contain a number of other funerary structures, which, if sampled, may reveal further levels of complexity in the familial relationships of their residents.