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Investigating the kinship between individuals deposited in exceptional Merovingian multiple burials through aDNA analysis: The case of Hérange burial 41 (Northeast France)

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ABSTRACT

In funerary studies, "multiple burials" that have received several individuals in the same grave at the same time naturally raise questions concerning both the relationship linking the deceased and the cause of their simultaneous death. During the Merovingian period in Northeast France, multiple burials were revealed as highly rare and were consequently considered special burials linked to exceptional dramatic events. To help document the status of the deceased recovered from such special burials, we conducted ancient DNA analyses (mitochondrial and nuclear markers) to investigate the possible maternal kinship between a woman and three immature individuals simultaneously deposited in burial 41 at the Hérange site (Lorraine, France). The genetic data obtained (i) strongly supported a maternal (genetic) kinship between the woman centrally deposited in the burial and the two immatures deposited right beside her but (ii) permitted the exclusion of a genetic link between the woman and the teenager deposited along her legs. Thus, these data support the view that survivors had intimate knowledge of the deceased relationship and buried these individuals in a manner to illustrate their biological connections. As a consequence, if a common cause of death was the presupposition for the special treatment of the deceased recovered from Hérange burial 41, then interpersonal relationship was likely the deciding factor for setting this multiple burial.

1. Introduction

In archaeo-anthropological science, "multiple burials" are defined as the deposit of more than one body in the same grave at the same time (Duday et al., 1990). Generally, the association of several individuals in the same burial naturally raises the question of biological or social relationship between the deceased. Moreover, the contemporaneous deposit of several individuals also raises the question of the cause of their simultaneous death, conducting to consider multiple burials as special burials linked to notable dramatic events, such as interpersonal violence, infectious disease or natural disaster. The exceptional nature of multiple burials is reinforced for periods where the occurrence of such burials is rare. The Merovingian period in Northeast France (developing from 440/450 to 700/710 CE; Legoux et al., 2004) represents such a case, where a large majority of the types of deposits encountered consists of individual burials. In this context, whereas hundreds of individual burials are known, the syntheses recently conducted have enabled the inventory of only six multiple burials (Lefebvre and Lafosse, 2016). These observations naturally raised questions about the exceptional circumstances that led the members of the community to set up such unusual burials.

The archaeological site of Hérange, excavated in 2014 (Lorraine, Grand Est region; Fig. S1), holds a key position in the debate surrounding the interpretation of multiple burials during the Merovingian period since it contains one of these rare multiple burials: burial 41, which was dated through archaeological material to the period 530–640 CE. Hérange site excavations permitted the discovery of different structures dating from the Late Neolithic to the High Middle Ages, with only two isolated burials attributed to the Merovingian period. The first burial (not studied here) contained the remains of a

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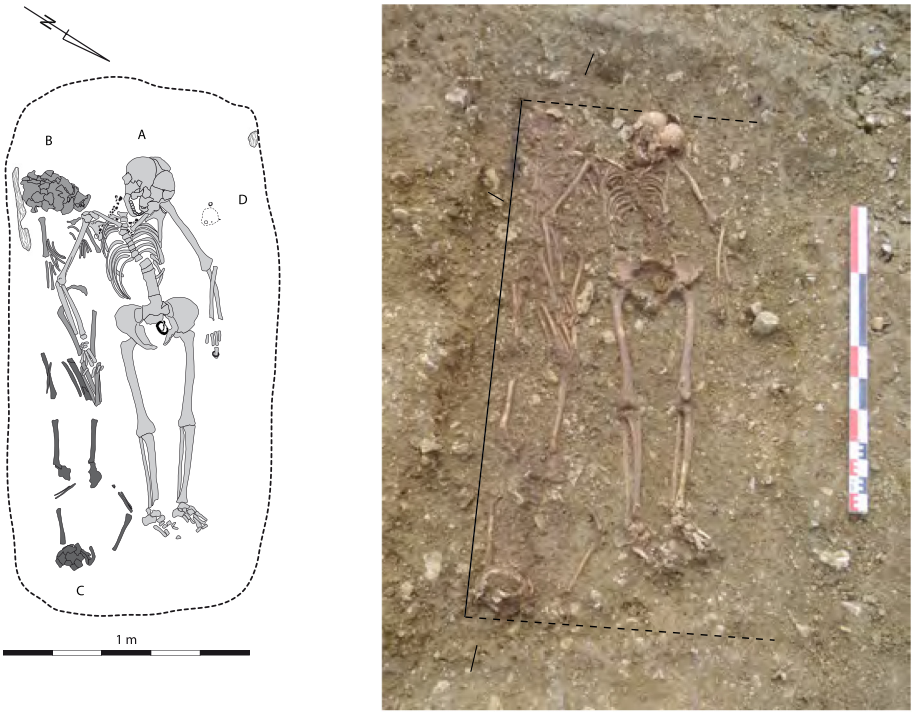

Fig. 1. Picture and illustration of the deceased arrangement in the Hérange Burial 41.

16–17-year-old teenager and an 8–10-year-old child. The burial revealed to be heavily eroded and the human remains recovered were very partial, impeding any discussion concerning the chronology and conditions of deposits. The biological analysis of the human remains recovered in the second burial ("burial 41") enabled the demonstration of the combined presence of a woman of approximately 40 years old (**A**) and three immature individuals, including a 4–5-year-old child (**B**), a 14–16-year-old teenager (**C**) and a 2,5–3-month-old infant (**D**) (Lefebvre and Lafosse, 2016) (Fig. 1). Since rare multiple burials described for the Merovingian period in Northeast France mainly contained two or rarely three deceased, the discovery of a burial grouping four individuals reinforced its exceptional nature. The osseous conservation of all remains was mediocre whereas the degree of completeness of the different skeletons was highly variable: from good completeness for the adult, poor for the child and the teenager, to very poor for the infant (with only teeth bud and skull fragments). Intriguingly, great care was observed in the treatment of the dead, as illustrated through a special arrangement of the deceased in the grave (Fig. 1). Indeed, the woman **A** occupied a central position in the grave, with her left arm covering part of the body of child **D,** her right arm covering the torso of child **B** and her right hand covering the legs of children **B** and **C**. Several arguments, such as the close contact or the imbrication of the bones of individuals **A**, **B** and **C**, have attested to the simultaneity of their deposits in the burial (Lefebvre and Lafosse, 2016). If the low number of skeletal elements conserved for infant **D** did not permit to confirm any contact with adult **A**, then the close association of this infant with the adult and his implication in the general arrangement of the deceased in the grave argued for the simultaneous deposit of all four deceased individuals. The exceptional grouping of the deceased recovered from burial 41, combined with the special arrangement of these individuals in the grave, indicated that the death of all four individuals must have occurred in a very short period of time and that all individuals must have been linked by strong social ties. Since burial 41 from Hérange did not show indications of interpersonal violence, the hypothesis of a dramatic event linked to an infectious disease has been retained to explain this exceptional case. All anthropological and archaeological elements gathered for Hérange burial 41 naturally raised the question of the biological relationship between the deceased, i.e., the hypothesis that the woman **A** might have been buried together with her descendants **B**, **C** and **D**, after a mortality crisis in the community.

Parental relationship within burial groups can be addressed through ancient DNA (aDNA) investigations. More generally, the analysis of aDNA can represent a major contribution to the analysis of the funerary practices of ancient human groups. Indeed, the recovery of exploitable DNA from human remains can contribute to (i) document the sex of the deceased (notably for immature remains), (ii) assemble commingled remains or (iii) conduct kinship analyses for individuals grouped in funerary structures or cemetery sectors (see for example Schultes et al., 2000; Keyser-Tracqui et al., 2003; Amory et al., 2007; Haak et al., 2008; Gamba et al., 2011; Keller et al., 2015). The combination of such information with data obtained from anthropological and archaeological analyses can yield a wealth of information about the biological and social aspects of the communities.

Given the questions raised by the exceptional burial 41 from Hérange, aDNA analyses were performed to investigate the possible biological kinship between the woman **A** and immatures **B**, **C** and **D** deposited with great care around her. Thus, we investigated whether the biological relatedness between individuals could explain the grouping and special arrangement of the deceased, representing an exceptional case for the region and the period. The aDNA study involved the analysis of maternal and paternal lineages (mitochondrial and Y chromosome genetic markers), as well as the typing of nuclear short tandem repeats (STRs) of all four individuals.

2. Materials and methods

2.1. Human remains

As aDNA analyses were not anticipated prior to the excavation, the individuals were excavated without specific aDNA care. Consequently, the teeth or bone samples were systematically decontaminated, i.e.,