

# Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <http://orca.cf.ac.uk/108567/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Chambon, Philippe, Blin, Arnaud, Ramsey, Christopher Bronk, Kromer, Bernd, Bayliss, Alexandra, Beavan, Nancy, Healy, Frances and Whittle, Alasdair 2018. Collecting the dead: temporality and disposal in the Neolithic hypogeum of Les Mournouards II (Marne, France). *Germania* 95 , pp. 93-143. 10.11588/ger.2017.49475 file

Publishers page: <http://dx.doi.org/10.11588/ger.2017.49475>  
<<http://dx.doi.org/10.11588/ger.2017.49475>>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



## Collecting the dead: temporality and disposal in the Neolithic hypogeum of Les Mournouards II (Marne, France)

By Philippe Chambon, Arnaud Blin, Christopher Bronk Ramsey, Bernd Kromer, Alex Bayliss, Nancy Beavan, [Frances Healy](#) and [Alasdair Whittle](#)

*Keywords:* Late Neolithic / [Paris basin](#) / collective burial / hypogea / radiocarbon dating / Bayesian chronological modelling

*Schlagwörter:* Spätneolithikum / Pariser Becken / Kollektivbestattung / Felskammergrab / Radiokarbondatierung / Bayessche Statistik

*Mots-clés:* Néolithique récent / Bassin parisien / sépulture collective / hypogées / datation radiocarbone / approche bayésienne

### **Introduction: collectivities of the dead in the later fourth millennium cal BC**

Several factors may inhibit us from appreciating the specificity of particular mortuary practices. People have a bewildering range of attitudes to death, and practise all manner of disposals of their dead (ARIÈS 1981; BLOCH 1982; BLOCH / PARRY 1982a; 1982b; BARLEY 1995; LEACH 1961; METCALF / HUNTINGDON 1991; PARKER PEARSON 1999). There is often considerable variety within the same broad horizons (BORIĆ 2015, for eastern Europe; CHAMBON 2003, for France and surrounding countries).

Collective burials in western Europe are a case in point. In the early Neolithic LBK of the later sixth millennium cal BC, and in the continuing ‘Danubian’ tradition of the fifth millennium, the dead are often grouped, but in a common space — the burial ground or cemetery — rather than in a shared deposit. Subsequently, a long phase in the later fifth and fourth millennia cal BC, and in some regions extending into the third, can be defined in which collective deposits of the dead became commonplace, often, though not always, associated with monuments such as barrows and cairns of various kinds, and also enclosures. In two recent accounts, these have been seen as principally characterising a period from c. 3500 cal BC onwards (CHAMBON 2003, 316; HARRIS et al. 2013, 65–70), but the start of such practices is definitely earlier, potentially going back to the fifth millennium cal BC in Brittany (BOUJOT / CASSEN 1992; SCARRE et al. 2003; CASSEN 2009; CHAMBON 2003, fig. 9), and to the earlier fourth millennium cal BC in Britain and Ireland, northern Europe and Iberia (WHITTLE et al. 2011; MÜLLER et al. 2014; MISCHKA 2014; EBBESEN 2006; ERIKSEN / ANDERSEN 2014; BALSERA NIETO et al. 2015). The massive use of collective burial, however, constitutes one of the striking features of the late Neolithic in western Europe.

There appears to have been a broad horizon in the second half of the fourth millennium cal BC in which there was a widespread emphasis on collective burial deposits, many of them in their regional contexts on a larger scale than previously witnessed. These varied practices can be contrasted with a renewed emphasis in many parts of western Europe in the third millennium cal BC on single burials, especially in the orbits of the Globular Amphorae and Corded Ware cultures (FURHOLT 2014; SALANOVA / SOHN 2007).

If the principle of collective burial is simple, that is a container that accumulates the deceased, death by death, it does not follow that such mortuary practices were identical across western Europe. There were very diverse outcomes within the collective mode of disposal. Some containers were monumental, but others not; a range of other constructional materials were used as well as the well-known megaliths; and especially the size of burial containers and chambers varied: from 1 m<sup>2</sup> to 100 m<sup>2</sup> or more (CHAMBON 2003). The location of tombs, the numbers of the deceased, the structure of deposits and the character of grave goods are further variables from region to region. So each set of variations on the general theme of collective burial requires close examination.

In the Paris basin of northern France, the late Neolithic horizon of collective burial is mainly characterised by two distinctive types of funerary monuments, the *allées sépulcrales* and the *hypogées* (fig. 1). The *allées sépulcrales* are very similar to the so-called gallery graves in Hesse, and not dissimilar to later TRB monuments including the *Totenhäuser* of the Mittelbe-Saale region; there are also passage graves in Denmark to take into account. All these architectures, containing collective deposits, appear to be contemporary (MÜLLER 2001; SCHULZ PAULSSON 2010; SCHIERHOLD 2014; HOFMANN / ORSCHIEDT 2015, 998–99; SJÖGREN 2015, 1007; PAPE 2016). In the Paris basin, critique of the available radiocarbon dates reduced the construction period of both kinds of tomb to the later fourth millennium cal BC, with some continuation into the early third (CHAMBON / SALANOVA 1996), and joint analysis of all types of data has suggested regional groupings and trajectories (SALANOVA et al. 2011).

The *hypogées* are rock-cut tombs. While some dispersed collective burials, in the Paris basin, may partially or totally correspond to this simple description, one specific area concentrates more than 160 of these tombs: the Côte d'Île-de-France. Dug into the chalk from gentle slopes, they normally include a small corridor, a very short antechamber and a chamber. Passages between each part are usually narrow. The plan of a *hypogée* is quite similar to that of an *allée sépulcrale*, but proportions of chambers differ: more square for *hypogées*, but rectangular for *allées sépulcrales*.

Preventing collapse of the roof may have imposed limitations on *hypogées*. The division of the largest ones into two chambers separated by pillars or a wall of unexcavated chalk, speaks for such a hypothesis. That does not exclude using this partition to distinguish groups of dead. Despite convergences in plan between *hypogées* and *allées sépulcrales*, differences are numerous. The most notable one is the usual grouping of *hypogées* in cemeteries; the Razet (Coizard, Marne) example with 37 located tombs remains the biggest. The dead, in each tomb, do not reach the huge number of individuals often counted in *allées sépulcrales*. Moreover, the use of the *hypogées* is shorter, limited to the second half of the fourth millennium BC; very few have provided material of the Final Neolithic of the earlier third millennium cal BC (LANGRY-FRANÇOIS 2004; RENARD et al. 2014). The geographical concentration of *hypogées* poses important questions. Should we envisage these necropolises as places of convergence for communities dispersed across wide territories, or was there a rapid succession of tombs, each accumulating the dead of the community over a short span of time? Both wide catchments and separate, contemporary social units could also be possible. How then would finer chronological resolution contribute to better understanding of the hypogea phenomenon?

### **The hypogeum of Les Mournouards II**

The distinctive character of hypogea relates also to the history of research. It was the excavation of the example at Les Mournouards II that fully established funerary archaeology in France. This artificial burial cave is cut into the side of a chalk hill at Le Mesnil-sur-Oger, Marne, on the eastern side of the Paris basin (*fig. 2*). Its excavation and publication by André Leroi-Gourhan and colleagues (LEROI-GOURHAN et al. 1962) remain a landmark in French archaeology. With Leroi-Gourhan, spatial recording and analysis, methods already current in Germany and the Netherlands, amounted to palaeoethnology, reconstructing the fine details of ancient behaviour. The analysis defined the gamut of funerary behaviour, including the characteristics of the inhumations, their treatment after decomposition, the deployment of grave goods and the treatment of different subgroups of individuals, weaving them into a history of the monument (CHAMBON / BLIN 2011).

More specifically, the publication was a turning point in the understanding of the collective burials which mark the latter part of the Neolithic (*Néolithique récent*) in the Paris Basin. Les Mournouards II is the best excavated and best understood of the 160 hypogea known in the area so far, since over 90 percent of them were emptied in the late 19th or early 20th century, principally by the Baron de Baye, a local aristocrat (DE BAYE 1880; BAILLOUD 1974; BLIN 2015).

They are often grouped in cemeteries, as at Coizard, noted above. Les Mournouards II was discovered a few metres from Les Mournouards I, another underground tomb excavated in haste a short time before (*fig. 2*); a third tomb had been destroyed long before (COUTIER / BRISSON 1959; BAILLOUD 1974, 272). Other tombs are known 4 km to the north and south, and under 15 km away is the Marais de Saint-Gond, where there is the largest concentration of hypogea: more than 100 in less than 80 km<sup>2</sup>.

The Les Mournouards II tomb consisted of two successive chambers, entered through a creephole from an antechamber, itself reached by an approach passage which could not be excavated. In the course of recording and subsequent analysis it was divided into four zones (*fig. 2*). Human remains, both articulated and disarticulated, representing a MNI (WHITE 1953; POPLIN 1976) of 79 individuals (BLIN 2012: 41), were concentrated in zones I (the inner chamber) and II and IV (the two sides of the outer chamber), with relatively few in zone III (the central passage through the outer chamber; *figs 3–4*). A ceiling height of c. 1.15 m would have severely restricted movement within the tomb.

The resumption of analysis of the anthropological collection of Les Mournouards II is intended to be a complement to the research done in 1962. In the original publication, only the material and skeletons found in place were studied in context. A new estimation of the MNI needed an enumeration of all the bones, including loose bones (BLIN 2012). Another task was updating our understanding of the structure of the buried population, by age and sex. The DSP technique of sex determination, on the coxal bones (MURAIL et al. 2005), provides more reliable results than those obtained in the 1960s. The chosen threshold was 95% certainty. Due to lack of time and without access to the skulls and the mandibles, age estimation of the immature individuals was made from levels of bone maturation (BIRKNER 1980). This choice enabled dividing the individuals into only three age categories: adults, teenagers (15–19 years) and children (under 14 years).

#### *Previous dating and interpretation*

For the original authors, the artefacts placed the monument in the Seine-Oise-Marne (SOM) culture, perhaps its earlier part, with a date towards the end of the third or the start of the second millennium BC (LEROI-GOURHAN et al. 1962, 50, 116, 118). The SOM was then considered as a single, widespread, cultural complex, between the middle Neolithic and the Bronze Age. A previous radiocarbon date (2460–1940 cal BC, at 2 $\sigma$ : REIMER et al. 2013; STUIVER / REIMER

1986) was measured on a bulk sample of alder and pine charcoal ( $3750 \pm 150$  BP; Gsy-114; COURSAGET / LE RUN 1966, 128, 132; LEROI-GOURHAN et al. 1962, 76, 125, 133). There is, however, no indication of the context or contexts of the sample. Subsequently, Philippe CHAMBON and Laure SALANOVA (1996, fig. 9) rejected this date since its context remained unknown. Given these uncertainties, it is not employed in the present models.

The recent revision of cultural and chronological data from the end of Neolithic has led to the splitting of the former Seine-Oise-Marne culture into various entities. In this perspective, according to the reassessment of the grave goods and new dating of hypogea and their cultural context, the use of Les Mournouards corresponds only to *Néolithique récent 2*, currently dated to 3350–3000 cal BC (AUGEREAU et al. 2007; SALANOVA et al. 2011, 82–4; COTTIAUX / SALANOVA, 2014).

Leroi-Gourhan's reconstruction of the burial history was painstaking and detailed. He saw all the individuals buried as fleshed corpses, progressively rearranged inside the tomb in the course of making space for later burials. The first burials would have been placed with their heads to the south-east, resting on chalk-cut ledges in the sides of the chambers; most of the later introductions were laid with the heads to the north-west (LEROI-GOURHAN et al. 1962, 82–3, fig. 55). Skulls were moved towards the walls. While the last burials clearly took place in the outer chamber, he was uncertain whether the inner chamber would have been completely filled before burial began in the outer or whether bodies began to be placed in the outer chamber while the inner one was still in use. There were differences between the zones in the composition and disposition of the human remains and in the artefacts accompanying them. The north-east side of the outer chamber (zone IV) for example, saw more disarticulation than elsewhere, with bones left perpendicular or oblique to the chamber axis.

In his re-interpretation of the original publication, Philippe CHAMBON (2003) saw the funerary processes as involving a greater movement of disarticulated bones rather than of complete corpses and highlighting B3 I, the skeleton of a heavily pregnant woman lying obliquely across the central passage in the outer chamber (fig. 4), as the last interment. He also pointed out that a shortage of skulls in relation to the minimum number of individuals represented meant that skulls had been removed from the tomb.

A wide-ranging reassessment was undertaken by Arnaud BLIN (2011; 2012). Most notably, he

- documented which bones were present in each articulated individual, clarifying that none was complete, although some were almost so (BLIN 2011, 594–5; 2012, 47);
- extended the analysis of the disarticulated bones, establishing that their composition was different in each zone, the bones themselves always being less than would make up the number of individuals represented, and confirming that the bones were unevenly representative of the human skeleton. Zone I, for example, yielded one right scapula and eleven left humeri (BLIN 2012, 44). These observations pointed to the complete or partial removal of skeletons during the use of the tomb;
- recognised eight articulations and 44 pairings between nearby disarticulated bones, 93% of them in a single zone and 88% of the pairings within a single square metre, concluding that the bones had remained close to where they had originally been deposited and that zones I, II and IV functioned almost independently (BLIN 2012, 41);
- established more stratigraphic relations between the articulated individuals than those illustrated or described in the original publication, by close examination of the excavation record (BLIN 2012, fig. 14);
- and reconstructed the history of the tomb as follows: Leroi-Gourhan’s initial placing of skeletons with heads to the south-east against ledges was followed by at least one, and possibly several, emptyings of the tomb, leaving only a few bones from each individual; then, after an interval of perhaps several centuries, the final 29 articulated individuals were introduced, possibly over a fairly short space of time, becoming progressively more displaced the earlier in the sequence they were. He followed Chambon in seeing B3 I as the last of these. The removal of her head, after decomposition, would have been the final act in the use of the monument (BLIN 2012, 46–7).

### **Aims of the dating programme**

The analysis presented here has been carried out as part of the project, *The Times of Their Lives* (see Acknowledgements). The new chronology for Les Mournouards II complements that for the *allée sépulcrale* at Bury, Oise (SALANOVA 2007; SALANOVA et al. 2017).

Previous dating and interpretation left many questions about the chronology of Les Mournouards II, including the following:

- When was the monument built and when did it go out of use?
- Did burial start and end at different times in different zones, in particular did the inner chamber come into use before the outer?

- Did the disarticulated bones include the displaced remains of the earliest burials in the monument?
- What was the duration of burial in the monument, and was there any evidence for one or more hiatus in its use?
- Looking beyond the monument, what could its precise chronology contribute to wider questions (see above) concerning the late Neolithic of the region, especially collective burials (cf. CHAMBON / SALANOVA 1996; SALANOVA et al. 2011)?

These questions serve to define the aims of the dating programme at Les Mournouards II.

### **Radiocarbon dating and sampling**

The new radiocarbon dating programme for Les Mournouards was conceived within the framework of a Bayesian chronological approach (BUCK et al. 1996). This allows the combination of calibrated radiocarbon dates with archaeological prior information using a formal statistical methodology.

An analysis of this kind will fail if the samples dated are not contemporary with their contexts. Sample selection must be rigorous and conform to strict criteria (e.g. BAYLISS et al. 2011, 38–42). At Les Mournouards, articulated bones are ideal material because they must still have been joined by soft tissue when they reached their final position. This means that the relative order of the dated samples should be the same as that of the parent contexts. Furthermore, the identification of sequences of three or four individuals (BLIN 2012, fig. 14) indicated that their stratigraphic relationships could be used to constrain the dates. Unfortunately, the human remains, although excellently preserved, had been extensively consolidated with undocumented substances. This created a problem, because most of the consolidants used during the second half of the 20th century contain extremely old carbons of petrochemical origin, completely depleted in  $^{14}\text{C}$  and hence capable of making radiocarbon dates too old. Radiocarbon laboratories have procedures for dissolving these contaminants, but these may not always be totally successful. A preliminary Fournier Transform-Infrared (FT-IR) analysis identified polyvinyl acetate and cellulose acetate in different bones. To avoid any risk of error, only bones which FT-IR analysis showed to be unconsolidated were sampled. All the dated samples then underwent ultrafiltration in the laboratories. One pair of replicate samples subsequently failed at both the Klaus-Tschira-Archäometrie-Zentrum, Mannheim, and the Oxford Radiocarbon Accelerator Unit due to lack of collagen.

This selection process reduced the number of samples eventually dated to 29, although simulations had previously indicated that a higher total was needed to achieve the highest possible precision. The bones sampled from the articulated burials were those which definitely belonged to the individual in question. Those sampled from among the disarticulated bones were all left humeri, the most numerous bone in this part of the collection (BRÉZILLON 1962, 51; BLIN 2012, fig. 9). It was hoped that the choice of a bone of which each individual has only one would avoid the risk of biasing the result by dating a single individual more than once. It subsequently transpired that 14 of the 29 articulated individuals, including 5 of the 13 dated ones, lacked their left humeri (BLIN 2011, table 8), so that this eventuality was not totally avoided.

## Methods

### *Sample preparation and measurement*

At Mannheim collagen extracted from bone samples was ultrafiltered and freeze-dried (BROWN et al. 1988) before combustion to CO<sub>2</sub> and graphitisation prior to measurement by AMS as described by KROMER et al. (2013). At Oxford all the samples underwent solvent extraction to remove any consolidants, followed by acid-alkali-acid pretreatment, gelatinisation, ultrafiltration and combustion to CO<sub>2</sub> (BROCK et al. 2010, 106–7: pretreatment AF\*). They were then graphitised using methods described by DEE / BRONK RAMSEY (2000) and dated by AMS (BRONK RAMSEY et al. 2004).  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values were measured on the target graphite by AMS (the value being used to calculate the conventional radiocarbon age), and also by Isotope Ratio Mass Spectrometry (IRMS) as described by BROCK et al. (2010, 110). At Mannheim  $\delta^{13}\text{C}$  values were only measured by AMS on the graphite used for dating. These values were again used to calculate the conventional radiocarbon ages, although they can include an element of fractionation introduced during the preparation and measurement of the samples in addition to the natural isotopic composition of the sample. They are thus not suitable for dietary analysis. Sub-samples of the gelatin prepared at MAMS- were therefore analysed for  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  at the Isotrace facility, University of Otago Chemistry Department, by IRMS using methods outlined by BEAVAN ATHFIELD et al. (2008, 3). These measurements are used in the dietary analysis of stable isotopes presented below.

### *Quality control*

Both laboratories have continuous internal quality control procedures. They also take part in international intercomparisons (SCOTT et al. 2007; 2010a; 2010b). For Les Mournouards, consistency in measurement is also confirmed by the results for replicates. The seven pairs of

radiocarbon ages measured on the same bone fragments by Oxford and Mannheim are all statistically consistent at 95% confidence, as are the three replicate pairs of  $\delta^{15}\text{N}$  values (*table 1*; WARD / WILSON 1978). Two of the replicate pairs of IRMS  $\delta^{13}\text{C}$  values are statistically consistent at 95% confidence, with the other pair consistent at 99% confidence. This observed variation is in line with statistical expectation.

### *Chronological modelling*

The new radiocarbon dating programme for Les Mournouards II was designed within the framework of a Bayesian chronological approach (BAYLISS et al. 2007; BAYLISS 2009). At its most simple, Bayesian statistical modelling allows us to account for the fact that all the radiocarbon dates from Les Mournouards are related. They come from the same tomb and randomly sample the period of use of that tomb. We incorporate into the model the information that the tomb was established, continued to be used for a period of time, and was then abandoned (BUCK et al. 1992). We also have strong prior beliefs from the excavated stratigraphic sequences of burials that can be incorporated; all the models for Les Mournouards, for example, incorporate the belief that **the articulated leg bones of B4 I overlay the articulated individual B3 I** and **were** hence placed in the tomb at a later, even if only slightly later, date (*fig. 4*).

The Bayesian chronological modelling has been undertaken using the program OxCal v4.2 (BRONK RAMSEY 2009) and the atmospheric calibration curve for the northern hemisphere published by REIMER et al. (2013). The algorithms used are defined exactly by the brackets and OxCal keywords on the left-hand side of *figs 6–7* and *9–10* (<http://c14.arch.ox.ac.uk/>). The posterior density estimates output by the model are shown in black, with the unconstrained calibrated radiocarbon dates shown in outline. The other distributions correspond to aspects of the model. For example, the distribution *start Zone I articulated* (*fig. 6*) is the posterior density estimate for the time when articulated burials were first placed in Zone I of the tomb. By taking the differences between such parameters, it is possible to estimate the durations of an episode of activity, i.e. the difference between its start and its end (e.g. *duration Zone I articulated*; *fig. 12*) and the intervals between certain events (e.g. *end zone I / end Les Mournouards*; *fig. 12*). In the latter case, these estimates can be partly negative if the order of the dated events is itself uncertain. In the text and tables, the Highest Posterior Density intervals of the posterior density estimates are given *in italics*. **Statistics calculated by OxCal provide guides to the reliability of a model. The individual index of agreement (e.g. ‘MAMS-21794 (A: 109)’; *fig. 6*) expresses the consistency of the prior and posterior distributions; if this falls below 60 the radiocarbon date is regarded as**

inconsistent with the prior information built into the model, probably because of inaccuracy of the information and/or the date. Another index of agreement,  $A_{model}$  (e.g. 'Amodel: 81'; *fig. 6*), is calculated from the individual agreement indices, and indicates whether the model as a whole is likely, given the data. This too has a threshold value of 60.

### *Results and calibration*

The radiocarbon results and associated measurements are listed in *table 1*. All are conventional radiocarbon ages that have been corrected for fractionation (STUIVER / POLACH 1977). The calibrated radiocarbon dates given in *table 1* (at  $2\sigma$ ) have been calibrated by the maximum intercept method (STUIVER / REIMER 1986); in the Bayesian modelling calibration has been undertaken using the probability method (STUIVER / REIMER 1993). Highest posterior density intervals have been rounded outwards to five years. The dates fall on a plateau in the calibration curve in the 33rd to 31st centuries cal BC (*fig. 5*), so that their distributions, even when constrained by the models, are extended and sometimes bimodal. The resulting chronology is thus less precise than it would have been had the dates fallen elsewhere on the curve. A further consequence is that the dataset is flexible when it comes to accommodating various interpretations.

### **The models**

Another significant limitation is that disarticulated bones were recorded only by 1 m square, so that there is no record of their stratigraphic relationships. Photographs make it clear that, while some underlay the articulated individuals, not all did (e.g. *fig. 3*) and there is also the consideration that the left humeri missing from 14 of the articulated individuals may be among the disarticulated bones, if they were not removed from the tomb. Before any constraint is put on the dates, it should be noted that all the measurements from zone I and all the measurements from zone IV, whether for articulated or disarticulated samples, are statistically consistent (zone I:  $T^*=8.5$ ;  $T^*(5\%)=12.6$ ;  $v=6$ ; zone IV:  $T^*=4.7$ ;  $T^*(5\%)=12.6$ ;  $v=6$ ). Those from zone II are not ( $T^*=28.6$ ;  $T^*(5\%)=18.3$ ;  $v=10$ ; WARD / WILSON 1978).

### *A minimal model*

It seemed best to start with a minimal model which incorporated only the least contestable relationships and then to modify it to explore some of the interpretations proposed over the years. This model is presented first and in detail (*figs 6–7*). It treats the use of the tomb as a single, more-or-less continuous phase of activity, within which the start, end and duration of

each zone (and the articulated and disarticulated burials within each zone) are estimated. The only relationship between zones included is that burial in zone I must have ceased before burial B3 I and the overlying articulated limb B4 I were placed in the central passage of the outer chamber, since the introduction of a corpse into the inner chamber would have entailed disturbance to B3 I, and there is no trace of this; the skeleton was fully articulated and complete but for the head. At least the outer parts of zones II and IV would have remained accessible after B3 I and B4 I were in place (*fig. 4*). Within individual zones, the stratigraphic relations between articulated individuals identified by BLIN (2012, *fig. 14*) are incorporated where it was possible to date the individuals concerned. Weighted means have been taken of replicate measurements before their incorporation in the model.

According to the minimal model, burial in zone I — the inner chamber — would have started in *3360–3215 cal BC (90% probability)* or *3195–3160 cal BC (5% probability; start Zone I; fig. 6)* on the basis of dates for four disarticulated left humeri and for three articulated individuals. The radiocarbon dates are in good agreement with the stratigraphic sequence between C1 X and B1 VII (*fig. 6*). Burial here would have ended in *3320–3310 cal BC (1% probability)* or *3305–3260 cal BC (8% probability)* or *3255–3105 cal BC (86% probability; end Zone I; fig. 6)*. It would have extended over *1–165 years (95% probability; use Zone I; fig. 12 (upper))*. Within this period there was little difference between the chronology of disarticulated and articulated bone; it is only *60% probable* that the individuals from whom the disarticulated bones came began to be placed in the chamber before those who remained more or less intact (*table 4*). Similarly, both seem to have continued to the end of burial in the inner chamber; it is only *40% probable* that the most recent disarticulated humeri in the chamber were older than the most recent articulated individual (*table 4*).

In the central passage of the outer chamber, statistically consistent weighted means for B3 I and the overlying limb B4 I accord with the sequence between the two individuals, and with the premise built into the model that they post-date the last insertion into the inner chamber (*fig. 6*).

In zone II of the outer chamber, burial would have started in *3355–3220 cal BC (90% probability)* or *3195–3160 cal BC (5% probability; start Zone II; fig. 7)*. This is based on dates for seven disarticulated left humeri and on a sequence of three articulated individuals. The radiocarbon dates from these skeletons are in good agreement with this stratigraphic sequence. More humeri were dated from here than from zone I because more untreated examples could be found and

because, after the first round of dating had delivered two slightly surprisingly late results for disarticulated samples (*MAMS-21275*, *OxA-30836*; *fig. 7*), it was decided to check whether there were other similar ones. Here, it is *67% probable* that some of the disarticulated bones were earlier than the articulated individuals, and *75% probable* that disarticulated bones were also the latest in this zone (*table 4*). Burial in zone II would have ended in *3300–3255 cal BC (5% probability)* or *3245–3065 cal BC (90% probability; end Zone II; fig. 7)*, after *1–230 years (95% probability; use Zone II; fig. 12 (upper))*.

In zone IV of the outer chamber only two unconsolidated left humeri could be found. Five dated articulated individuals, however, provided two stratigraphic sequences. In the north-east, a young child, C3 X, underlay an adolescent, C2 I, who seemed to have been crammed flexed into the space between C5 I and **the end of the chamber** (BLIN 2012, 50). Immediately north-west of this pair, the lower body of an adult male, D4 II, underlay the pelvis and upper body of another adult, C4 I, also underlain by the undated adult C5 II (*fig. 4*); archival evidence indicates that the bones of a young child, C5 V at the south-east end of the zone, underlay C5 II, and hence C4 I. These relationships are incorporated into the model. All the radiocarbon dates are in good agreement with this stratigraphic sequence. On this basis, burial in zone IV would have begun in *3350–3215 cal BC (89% probability)* or *3190–3160 cal BC (6% probability; start Zone IV; fig. 7)* and continued until *3300–3260 cal BC (5% probability)* or *3240–3085 cal BC (90% probability; end Zone IV; fig. 7)*. Burials would have been made for *1–205 years (95% probability; use Zone IV; fig. 12 (upper))*. With only two dates for disarticulated bones it is not realistic to consider their chronological relationship with the articulated individuals.

Overall, the monument would have been initiated in *3375–3225 cal BC (89% probability)* or *3200–3165 cal BC (5% probability)* or *3130–3120 cal BC (1% probability; start Les Mournouards II; fig. 6)* and the last burial would have been made in *3295–3250 cal BC (4% probability)* or *3235–3045 (91% probability; end Les Mournouards II; fig. 7)*. The total period of burial was *1–265 years (95% probability; duration Les Mournouards II; fig. 12 (upper))*.

Salient points include these:

- There was almost no perceptible difference between the times at which burials began to be made in zones I, II and IV (*fig. 11 (upper); table 2*).
- Zone I (the inner chamber) however, probably went out of use before the outer chamber (*figs 11–12 (upper); tables 4–5*).

- There were minimal differences between the dates of disarticulated bones and articulated individuals in zone I. In zone II, however, the picture is different. Here, disarticulated bones may have covered a greater span of time than the articulated individuals (*fig. 12* (upper); *table 3*).
- Nowhere is there any hint of an interval between the end of the deposition of disarticulated bone and the start of burial of articulated individuals.
- The last human remains to have been deposited in the tomb seem to have been either B4 I, the articulated leg overlying B3 I in the central passage, or the latest **disarticulated** bones in zone II (*fig. 11* (upper)).

#### *Modelling other interpretations*

Going beyond the relationships incorporated in the minimal model, it is possible to explore different interpretations which have been suggested over the years. The alternative models described below retain the original prior information: that burial in zone I ceased before B3 I and B4 I were placed in the central passage (zone III); that each zone had a separate history, on the evidence of the virtual restriction to each of pairings and articulations; and that there were stratigraphic relationships between some of the articulated individuals. Each then adds a further constraint which affects the model outputs. The posterior density estimates for the start and end of burial at Les Mournouards II from the alternative models are shown in *fig. 8*. They differ not so much in the overall date ranges covered, as in the balances of probability within them.

*Alternative 1. Do the disarticulated bones include the remains of the earliest burials, most of whose remains were cleared out of the tomb?*

This is what would be expected from the progressive displacement and reworking of the burials envisaged by both Leroi-Gourhan and Blin. The latter (BLIN 2012), indeed, has suggested that all the disarticulated bones, regardless of their final stratigraphic positions, pre-date the more or less complete burials. The incompleteness of some of the articulated individuals is an argument against this, unless the bones in question were removed. If, however, the minimal model is modified to place the start of articulated individuals in each zone after the end of disarticulated left humeri in the same zone, overall agreement is good (Amodel: 74; model not shown). This constraint makes the estimates more precise than in the minimal model because the two groups of dates in each zone are made sequential. The overall duration, however, is similar to that

estimated by the minimal model. Even in this reading there could have been continuity between the end of disarticulated remains and the start of articulated ones.

*Alternative 2. What was the chronological relationship between the inner and outer chambers?*

Leroi-Gourhan was uncertain whether the inner chamber was filled before the outer came into use, or whether both chambers were used simultaneously, with the inner filled before the outer, differences in body position and grave goods between the two reflecting two different social groups (LEROI-GOURHAN et al. 1962, 86). The minimal model indicates that burial started in all three zones at more or less the same time, but ceased earlier in zone I, the inner chamber, corresponding to the second of these interpretations (*fig. 11*). If, however, that model is modified to place the start of burial in zones II and IV after the end of burial in zone I, corresponding to the first interpretation, overall agreement is good (Amodel: 76; model not shown). Any interval between the end of burial in zone I and the start of burial in the outer chamber would in this case have amounted to a decade or two. The overall timescale is the same as that of the minimal model, although the durations of the individual chambers are shorter because they are made successive.

The minimal model is safe and uncontentious. The alternatives are both statistically feasible because the shape of the calibration curve for this period (*fig. 5*) gives the data the flexibility of a contortionist. The minimal model and the alternatives cannot all be correct. Indeed, if the first and second alternatives are combined (with both the sequences in different zones between disarticulated and articulated remains and the primacy of zone 1 invoked), the model falls into poor overall agreement (Amodel: 33; model not shown).

*A preferred model?*

In these circumstances, archaeological judgement must be the decider. On any of the proposed interpretations of the burial process, some of the disarticulated humeri should derive from the oldest burials. We suggest a model incorporating the prior information that *some* disarticulated humeri are older than all the articulated individuals in each zone, although others may have been contemporary or later, with the burials in zone III (the central passage) still later than those in zone I (the inner chamber). The model has good overall agreement (Amodel: 72; *figs 9–10*). *Figures 11–12* show key parameters from both the minimal model (upper) and the preferred model (lower).

Following this preferred model, the monument would have been initiated in 3365–3215 cal BC (74% probability) or 3200–3160 cal BC (21% probability; start *Les Mournouards II*; fig. 9). The oldest bones eventually found disarticulated in zone I would have been deposited in 3350–3215 cal BC (74% probability) or 3200–3155 cal BC (21% probability; start *Zone I left humeri*; fig. 9). The first burial to have survived in articulation would have been inserted in 3340–3260 cal BC (29% probability) or 3255–3155 cal BC (66% probability; start *Zone I articulated*; fig. 9). Burial in zone I would have continued for 1–140 years (95% probability; use *Zone 1*; fig. 12 (lower)), until 3325–3310 cal BC (1% probability) or 3295–3260 cal BC (7% probability) or 3245–3110 cal BC (87% probability; end *Zone I*; fig. 9). As in the minimal model, the deposition of disarticulated and articulated bone seems coterminous; it is only 47% probable that left humeri ended earlier than articulated individuals (table 5).

Burial in zone II would have begun in 3350–3215 cal BC (74% probability) or 3200–3155 cal BC (21% probability; start *Zone II*; fig. 10); burial in zone IV in 3340–3215 cal BC (73% probability) or 3195–315 cal BC (22% probability; start *Zone IV*; fig. 10). There was no appreciable difference between the start dates of the two zones. In zone II, disarticulated humeri may have ended slightly after articulated individuals.

Zone II remained in use until 3295–3260 cal BC (6% probability) or 3240–3075 cal BC (89% probability; end *Zone II*; fig. 10), over 1–195 years (95% probability; use *zone II*; fig. 12 (lower)). Zone IV remained in use until 3295–3280 cal BC (2% probability) or 3275–3260 cal BC (3% probability) or 3240–3085 cal BC (90% probability; end *Zone IV*; fig. 10), over 1–180 years (95% probability; use *Zone IV*; fig. 12 (lower)). There is no appreciable difference between the start and end dates for the two zones. The use of the tomb as a whole ended in 3295–3255 cal BC (6% probability) or 3240–3065 cal BC (89% probability; end *Les Mournouards II*; fig. 10), 1–100 years (95% probability) after burial had ceased in the inner chamber (end *zone I/end Les Mournouards*; fig. 12 (lower)). The overall span of burial was 1–235 years (95% probability; duration *les Mournouards II*; fig. 12 (lower)), with much of the probability concentrated at the shorter end of the distribution, making a duration of 50 years or so feasible, although one of 200 years or more is not excluded. As in the minimal model, it is impossible to judge whether the final deposits in zone II or B4 I in the central passage were the latest to be placed in the tomb.

Use may have continued rather longer: bones, including the skull of B3 I, one of the latest burials, may have been removed at a later date; the placement of artefacts in the antechamber is

undated; and there may have been later activity in the unexcavated entrance area. It is noteworthy that, except in the model where disarticulated humeri were constrained to finish before the start of articulated individuals, they continue from the start to the end of burial in the monument. This suggests that, rather than a universal intermittent progress from articulation to disarticulation as further burials were made in the tomb, some individuals, regardless of date, may have undergone more radical manipulation than others.

### *The possibility of dietary offsets*

Diet-induced radiocarbon offsets can occur if a dated individual has taken up carbon from a reservoir not in equilibrium with the terrestrial biosphere (LANTING / VAN DER PLICHT 1998). If one of the reservoir sources has an inherent radiocarbon offset — for example, if the dated individual consumed marine fish or freshwater fish from a depleted source — then the bone will take on some proportion of radiocarbon that is not in equilibrium with the atmosphere. This makes the radiocarbon age older than it would be if the individual had consumed a diet consisting of purely terrestrial resources. Such ages, if erroneously calibrated using a purely terrestrial calibration curve, will produce anomalously early radiocarbon dates (BAYLISS et al. 2004).

Given the nature of the monument, there is no direct dietary evidence from Les Mournouards; the scant fauna consisting almost entirely of wild taxa that could have found their own way into the tomb (fox, polecat, dormouse, field mouse, bat and birds of the sparrow family; LEROI-GOURHAN et al. 1962, 123–4). The site lies on free-draining chalk, and so surface water is comparatively rare. Those buried in Les Mournouards, however, could have consumed freshwater fish which would be depleted in  $^{14}\text{C}$  because some of their carbon would have derived from chalk dissolved in the water of rivers and lakes. This possibility is examined by means of a quantitative reconstruction of the diet of the dated individuals.

### *FRUITS source proportional diet modelling*

Diet reconstruction for the Les Mournouards **people** was determined by the Bayesian mixing model FRUITS v2.0 $\beta$  (Food Reconstruction Using Isotopic Transferred Signals; FERNANDES et al. 2014). FRUITS employs the isotopic averages of possible food sources, and allows the user to define isotopic offsets between diet and consumer, as well as the expected weighting and concentration of food sources. Prior information to constrain the calculations of the stable isotope mixing model can also be added. FRUITS then produces estimates of the mean

percentage (and standard deviation) for each of the possible food sources making up the diet for each given consumer.

Weighted means of replicate isotopic values were used in the dietary modelling (*table 1*). The FRUTTS results were produced from two diet proxies ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ), and used the following food source data and assumptions in the model.

The averages and the standard deviation of analytical error from  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  analyses of three possible food sources were used, with the weight and concentration of each of the three diet sources set at 100%. Cereal values come from analyses of archaeobotanical cereals: wheat and barley (n=18; average values: OGRINC / BUDJA 2005) and emmer wheat and naked barley from Ecssegfalva, Hungary (BOGAARD et al. 2013). Data for terrestrial herbivores are from Neolithic herbivore faunal values from the Meuse Basin, Belgium (n=19; BOCHERENS et al. 2007, table 5A). Data for fish (freshwater and anadromous) are from collated European archaeological fish data from previous studies (n=9; BOCHERENS et al. 2007, table 2). The mean values used in the FRUTTS diet proportion modelling and their errors are given in *table 6*.<sup>1</sup>

Mean isotope values and the mean of analytical errors for each food source in *table 6* were then used to run a simple FRUTTS model where the whole diet is considered. The isotopic offsets were  $4.8 \pm 0.2\text{‰}$  for  $\delta^{13}\text{C}$  (FERNANDES et al. 2014) and  $6.0 \pm 0.5\text{‰}$  for  $\delta^{15}\text{N}$  (O'CONNELL et al. 2012).

The FRUTTS modelling at Les Mournouards included prior information that terrestrial herbivores probably provided a higher proportion of dietary protein than freshwater fish (BOCHERENS et al. 2007; MEIKLEJOHN et al. 2014). Work by ARBOGAST / CLAVEL (2007) on early Neolithic sites in the Oise, Aisne and Marne valleys revealed that a range of freshwater fish could be found among local bone assemblages. Further evidence of diets which included local fish can be provided by the stable isotope values of human populations, such as the enriched  $\delta^{15}\text{N}$  values found in Middle Neolithic populations of the Meuse Basin by BOCHERENS et al. (2007, 18).

---

<sup>1</sup> For the future, specifically regional dietary baselines would greatly improve analysis of the effects of diet on radiocarbon age.

In the Les Mournouards population stable isotope values are not indicative of an isotopically enriched dietary protein component such as fish (*fig. 13*). Average adult values ( $\delta^{13}\text{C} = -20.4 \pm 0.4\text{‰}$ ;  $\delta^{15}\text{N} = 8.1 \pm 0.3\text{‰}$ ;  $n=17$ ) differ little from the average values of the 3–7-year-old children ( $\delta^{13}\text{C} = -20.1 \pm 0.2\text{‰}$ ;  $\delta^{15}\text{N} = 8.3 \pm 0.1\text{‰}$ ;  $n=5$ ). These stable isotope profiles have therefore returned FRUITS estimations of negligible percentages of fish ( $1 \pm 1\%$  to  $2 \pm 2\%$ ), with a greater proportion of cereals in the overall diet (*table 7*). One child (MAMS-21805;  $\delta^{15}\text{N} = 9.3 \pm 0.1\text{‰}$ ), which plotted as an outlier in *Fig. 13*, also returns a negligible % fish in its FRUITS estimates (*table 7*).

A different model was used to estimate the diet for the disarticulated femur of a child of under 2 years (A4c; OxA-30836;  $\delta^{13}\text{C} = -20.2 \pm 0.2\text{‰}$ ,  $\delta^{15}\text{N} = 10.1 \pm 0.3\text{‰}$ ). This very young child's  $\delta^{15}\text{N}$  is enriched by  $+2\text{‰}$  over adults, and enriched by  $1.8\text{‰}$  over children of 3–7 years. Considering the age of the infant subject, we assume that the  $\delta^{15}\text{N}$  enrichment is associated with breastfeeding (JAY et al. 2008; FULLER et al. 2006) rather than with fish or other higher protein foods. A second food source for this individual is likely to have been cereal gruels, which are associated with the gradual introduction of solid foods during the weaning transition (FILDES 1986). For this FRUITS model, the stable isotope values for archaeological cereals outlined above was used (*table 6*), and a “breastmilk” isotopic signature was calculated using the average  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  value of the four adult women in the Les Mournouards population ( $\delta^{13}\text{C} = -20.4 \pm 0.2\text{‰}$ ,  $\delta^{15}\text{N} = 8.3 \pm 0.3\text{‰}$ ). The FRUITS isotopic offsets (the consumer's trophic enrichment of the metabolised food) was set at  $1.0 \pm 0.5\text{‰}$  for  $\delta^{13}\text{C}$  and  $3.0 \pm 0.5\text{‰}$  for  $\delta^{15}\text{N}$ , following the enrichment factors noted between mothers and nursing infants in other studies (FULLER et al. 2006; KATZENBERG et al. 1996). This FRUITS model returned a diet estimate for OxA-30836 of  $75.0 \pm 11\%$  breastmilk and  $25.0 \pm 11\%$  cereals.

Two alternative models for the chronology of Les Mournouards which account for the possibility of a freshwater reservoir effect in the samples of human bone were constructed. These were identical in form to the models defined in *figs 6–7* and *9–10*, except that an individual calibration curve that accounts for the proportion of fish in their diet has been constructed for each dated individual.

Unfortunately, no measurements of the freshwater reservoir in the waters of the Marne or surrounding area are currently available, and so we have used a generic offset of  $500 \pm 100$  BP. On the basis of the evidence that is currently available, this is probably a reasonable average of

the marine offset in the North Atlantic (from which any migratory species are likely to derive) and the local freshwater offset in the Marne and its tributaries (cf. KEAVENEY / REIMER 2012; BONSALL et al. 2015). This reservoir is used, offset from the atmospheric calibration data-set (REIMER et al. 2013), and the Mix\_Curves function of OxCal v4.2 (BRONK RAMSEY 2001, amended following JONES / NICHOLLS 2001).

The individual mixed-source calibration curve for each dated **individual** incorporates the aquatic reservoir in the proportion suggested by the dietary estimates provided by the FRUITS model **for** that particular person (*table 7*). So, for example, MAMS-21794 (A2) has been calibrated using a calibration curve including a component of  $2\pm 2\%$  aquatic resources (note that the proportion of any curve is constrained to be 0–100%). The remainder of diet sources will be in equilibrium with the contemporary atmosphere and these have been calibrated using IntCal13 (REIMER et al. 2013). For OxA-30836 the proportion of breastmilk in this individual ( $75.0\pm 11.0\%$ ) has been multiplied by the average proportion of fish in the diets of adult females from Les Mournouards ( $2.0\pm 2.0\%$ ). For the two adult and two adolescent individuals for whom stable isotopic values by IRMS could not be obtained (MAMS -21795, 21799, -21800, -21804), the average proportion of fish in the diets of adult and sub-adult individuals from Les Mournouards (also  $2.0\pm 2.0\%$ ) has been employed.

The posterior density estimates for the start and end of burial at Les Mournouards II from the minimal and preferred models, and their alternative variants which allow for the possibility of a small component of fish in the diet of the dated human individuals are shown in *fig. 14*. Again, these estimates differ not so much in the overall date range covered, as in the balances of probability within them. The estimated dates for when burial began in Les Mournouards II vary only slightly, with the medians of the distribution varying by only a decade or two. The estimated dates for when burial ended in Les Mournouards II are more sensitive to the presence of even small amounts of fish in the diet, with medians of the distributions varying by 50 or 60 years towards earlier endings (and consequently shorter durations).<sup>2</sup>

All the models presented broadly agree in placing the use of Les Mournouards II somewhere between *c.* 3350 cal BC and *c.* 3100 cal BC (the probability that it was in use before or after these dates is relatively low in all readings; *figs 8 and 14*). It is improbable that the tomb was used for

---

<sup>2</sup>This is counter-intuitive since accounting for the presence of freshwater reservoir effects in calibration, should make the resultant dates *later*. The shape of the calibration curve in this case, however, counteracts this effect as the revised calibrated dates are more compatible with a shorter history for the monument.

burial throughout this period (*fig. 12*), with the balance of probability in the preferred model favouring a shorter duration of a century or less. Our understanding of which generations within this period used the tomb is, however, is dependent on the model selected.

### Other hypogea in the Paris basin

There are so few radiocarbon dates available for other hypogea in the Paris basin that any interpretation must be tentative. They are listed in *table 8* and shown in *fig. 15* together with estimates for the start and end of Les Mournouards from the preferred model (*figs 9–10*). Four were measured on bulk samples: bone for Les Gouttes d'Or (Gif-2619; *fig. 15*) and for a sample dated soon after the excavation at Mont Aimé II (Ly-5345; *fig. 15*); and charcoal for Saran 7 (Ly-5244; *fig. 15*) and L'Homme Mort (Gif-360; *fig. 15*). All these samples could thus have included material of mixed ages.

Three are recently measured dates on single-entity samples, two for humeri from the base of the burial deposit in each chamber of Mont Aimé II (GrN-28995, -28996; *fig. 15*; DONAT et al. 2014), and one for carbonised residue on the interior of a *Néolithique récent* vessel from one of the tombs excavated by the Baron de Baye in the Marais de Saint Gond (Ly-5345; *fig. 15*; RENARD et al. 2014). Pending new modern excavations, these are at the moment the best dated contexts for *hypogées* apart from Les Mournouards II. Sepulchral behaviours in le Mont-Amé II remain unpublished but grave goods indicate short use; even if the context of the de Baye excavations is poorly documented, the remains correspond more or less to the date of the associated pot, which has to be regarded as contemporary with grave use.

These three, taken together with the estimates for Les Mournouards, point to a currency in the mid to late fourth millennium cal BC, the two dates from Mont Aimé II falling in the second quarter of that millennium (GrN-28995, -29996; *fig. 15*). The four later dates extend to the end of the third millennium cal BC. They are suspect because they were measured on bulk samples. The sample from Saran 7 (Ly-5244; *fig. 15*) came from the access passage and may thus relate to activity at or after the end of the use of the tomb. That from L'Homme-Mort came from between two burial layers, which might suggest two episodes of use. The precise context of Ly-5345 from Mont Aimé II is unclear; the artefacts from the tomb belong entirely to the *Néolithique récent* (DONAT et al. 2014, 410). The context of Gif-2169 from Les Gouttes d'Or is unknown. It is noteworthy, however, that the excavators envisaged two phases of burial at this tomb, the blocked antechamber being opened up and used for burial after the main chamber had

been sealed for some time (CHERTIER et al. 1994, 38). If this was the case, all or part of the sample for Gif-2169 may have derived from this second use. There are so few radiocarbon dates from hypogea that grave goods provide the best indication of chronology for most of them. All the hypogea contain material from *Néolithique récent* 2, and none, or hardly any, continue to be used into the *Néolithique final* 1 (BLIN 2011, 223–5).

### Discussion

The results of chronological modelling expand and modify existing hypotheses concerning the functioning of the tomb. The concurrent use of all parts, together with their relative autonomy, evidenced by the virtual absence of anatomical links between them, reinforce the notion of different social groups of some kind as proposed by LEROI-GOURHAN (LEROI-GOURHAN et al. 1962, 86) and developed by BLIN (2012, 52).

Following the dating programme, we may conclude that:

- The use of the tomb use was continuous and relatively brief (up to 265 years and perhaps less than 100 years);
- the unbalanced composition of the disarticulated bones (BLIN 2012, fig. 9) shows that large parts of some skeletons were removed;
- the disarticulated bones cannot all derive from an earlier stage than the articulated individuals. The limitations of the record, despite the excellence of the excavation, make it impossible to distinguish between disarticulated bones left behind during the substantial removal of some skeletons and those displaced during the later manipulation of burials from those skeletons which remained articulated, although incomplete, at the time of excavation;
- all the bones of the more recently buried individuals probably remained in the tomb after decomposition, except, probably, for some skulls.

Can the history of Les Mournouards II be applied to all the hypogea in the Marne? Here, the very standardised character of hypogea, especially their dimensions, prompts the thought that a double hypogeum is indeed the equivalent of two hypogea; two groups, related in some way, shared the same space without mingling their dead. The short use-life of hypogea has often been emphasised; unlike *allées sépulcrales*, they were only rarely used in the *Néolithique final*. The minimum number of 79 individuals represented at Les Mournouards II are at the upper end of the (inexact) estimates for the other hypogea. This suggests very short durations in practically all

cases. Such an hypothesis leaves open the possibility that small clusters of hypogea may correspond to the successive tombs of a single social group or community.

The duration of the hypogeum phenomenon remains confined to the *Néolithique récent 2* (SALANOVA et al. 2011), but there is no indication that it occupies the whole of that period; it is rather a matter of a few centuries, as suggested also by the typology of the material culture found in the tombs. Even if they were used successively, the concentration of hypogea in the Côte d'Île-de-France seems too important simply to correspond to the communities in the immediate area of the monuments. This concentration could be linked to a catchment extending beyond the local area, with the Côte d'Île-de-France thus appearing as a place with special funerary associations.

How then do these results contribute to better understanding of both the wider and site-specific questions already raised? At one level, Les Mournouards II is just another collective burial, which collects deceased people in line with local mortality, within the wider phenomenon characteristic of western Europe after c. 3500 cal BC. But literally at another level, one major dimension of the hypogeum of Les Mournouards II, and of all its comparable neighbours, is that it was underground. This serves to fracture any simple overall categorisation of a single collective burial practice. Divided into different funerary spaces and marked by differences in grave goods (LEROI-GOURHAN et al. 1962; BLIN 2012), the tomb accommodated several social groups who chose to differentiate themselves in death; collectivity here does not signify uniformity.

There is also the question of the relative brevity of the use of the tomb, in immediate proximity to comparable structures, and in a region with a striking density of similar constructions. A number of factors may be relevant. First, it seems significant to try to relate these mortuary practices to their wider settlement and landscape context. It is fair to say that the settlement record of the *Néolithique récent* is patchy at best (BOSTYN et al. 2011; COTTIAUX / SALANOVA 2014); but despite a very imperfect record, we could risk the generalisation that settlement was probably dispersed. Writing on the Lugbara of Uganda and Zaire, John MIDDLETON (1982, 134) commented that 'it is reported for many peoples living in small settlements at a low density that one is hardly aware of death', but that seems unlikely to apply here, given the numbers of hypogea and *allées sépulcrales*, and perhaps there were increasing concerns in the Paris basin and widely elsewhere in the later fourth millennium cal BC about land and numbers of people. Drawing on a better documented region, though some distance to the north, it has been argued,

on the basis of pollen diagrams and monument trajectories, that the second half of the fourth millennium cal BC in northern Germany was a time of agricultural intensification (HINZ et al. 2012; HINZ 2014, fig. 1), and perhaps something of the same applied in the Paris basin and elsewhere at this time. Now it was commonplace in processual archaeology to apply generalised ideas, such as the Saxe-Goldstein Hypothesis 8, about the links between formal disposal areas, scarce or vital resources and the existence of corporate descent groups (reviewed in MORRIS 1991), or the notion of territorial markers (RENFREW 1979). It could be that something of both ideas could be applied to the situation of the hypogea in the later fourth millennium cal BC. On the basis of that rather universal logic, such numbers of tombs with varying but probably in some sense corporate groups buried in them could speak strongly to concern over resources and land.

But here we should emphasise differences between the circumstances of the generally dispersed *allées sépulcrales* and the concentrated hypogea, since the character and placing of tombs may relate to how the land round about was perceived. In the case of the hypogea, there is a strong sense of connectivity at multiple levels: within a tomb like Les Mournouards II, within local cemeteries, and within the Côte d'Île-de-France concentration of tombs as a whole. Apart from the shorter use of *hypogées* compared to *allées sépulcrales*, differences remain in the concentration in cemeteries and in the underground nature of the *hypogées*. How far that reflects real difference is a difficult question, since the chalk of Champagne makes it possible to carve out elaborate underground spaces, in a way impracticable in the subsoils elsewhere in the Paris basin. On the other hand, the plans of *allées sépulcrales* are not categorically different; they always have an access ramp to the partially dug-in structure, an antechamber and an elongated main funerary chamber. Differences in architecture are to some extent a matter of degree. By contrast, the differences in location and concentration are absolute.

It is obvious that the chalk of the Côte d'Île-de-France gave a good opportunity for this kind of construction. However such a concentration implies that communities moved outside their daily surroundings to set up a tomb and then to bury the dead. That means another perception of territory, if compared to the more dispersed pattern of *allées sépulcrales*. Mobility has also to be questioned. Even without a large-scale organisation, groups that shared the same location for their dead — the same cemetery but also the same natural barrier that is the Côte d'Île-de-France — must have had a strong consciousness of belonging to the same community.

Further grasping the origins, life histories and relationships of individuals, chamber by chamber, and tomb by tomb, would require an ambitious programme of isotopic, discrete trait and aDNA analyses in the future. It is not a given that the mortuary population within Les Mournouards II was entirely local, and the possible groupings within it could be read in several ways. They are presumably intimately linked, but whether lineage segments, local alliances or some kind of bilateral descent group is obviously hard to call. It can be noted, however, that bilateral groups often appear to dissipate more quickly than in other descent systems, over only three to four generations (FOXHALL 1995; FORBES 2007, 136–41), and that at least would be compatible with a shorter rather than longer chronology for the uses of Les Mournouards II and other hypogea in the Paris basin.

Further, but at a general level of speculative interpretation that could apply to both *hypogées* and *allées sépulcrales*, the numbers of dead assembled over a potentially short span of generations could also be seen as a celebration of the unity and the cohesion of the community, essential for the tenure of place, and conversely as a counter to the fear of dispersal of the assets of the community, which are recurrent features of funerary rites in many cultures observed by anthropologists (BLOCH / PARRY 1982B, 18–21; BLOCH 1982, 212–13, 218–19; METCALF / HUNTINGDON 1991, 108). If the relative uniformity in death emphasises that the destiny of the dead is mainly equal, the *hypogées* bring out some slight differences between both kinds of tombs. In Les Mournouards II specifically, there is clear evidence for differentiation between males and females, with dead women placed mainly on the left side of the tomb and associated with what are considered to be less individual grave goods (BLIN 2015: 590–592). Is it just coincidence that the last near-complete corpse in the central passage, B3 I, was that of a heavily pregnant woman? A triangle of women, birth and death marked and perhaps determined the end of the use of the tomb. It must be correlated, in some way, with what is pure or impure regarding the afterlife, and its part in the maintenance of community in the 34th and 33rd centuries cal BC.

#### *Future possibilities*

The short use-life of the Marne hypogea has often been asserted; unlike *allées sépulcrales*, they are only exceptionally used in the *Néolithique final* (VANDER LINDEN / SALANOVA 2004). The number of individuals buried at Les Mournouards is among the largest of the estimates (which do not exceed a few dozen people) for other hypogea, which could indicate short use-lives in practically all cases. Such a hypothesis leaves open the possibility that small clusters of these monuments at places like les Mournouards may consist of the successive tombs of the same

group, whereas real cemeteries like Razet at Coizard could mix this kind of continuity with the convergence of separate communities in the same place. The overall duration of the hypogeum phenomenon remains unknown. It is confined to the *Néolithique récent*, but there is no evidence that it spans this whole period; that this was a particular historical episode or horizon seems to us likely, but it will be for future research to establish that more firmly. To define who is involved it appears essential to compare populations within a same cluster or cemetery in terms of age and sex composition, activities, genetic links and kinship rules. Continuity and discontinuity in the use of the tombs and of the cemeteries are key points for future investigations. The dating of a whole cemetery should be a priority, but the nature of the archives and modern realities (the distribution of hypogea in the Côte d'Île-de-France coincides with the cultivation of vines for the production of champagne) make this unlikely in the short term. It will also be for future research to refine and calibrate but also differentiate with much greater precision the claim made here that large collectivities of the dead were a widespread and significant feature of the later fourth millennium cal BC.

### Acknowledgements

Laure Salanova (CNRS-UMR 8646) had the beautiful idea to date Les Mournouards II. Phil Parkes and Panagiota Manti (Department of Archaeology and Conservation, Cardiff University) kindly undertook FT-IR analysis of the samples. Anne-Sophie Marçais (MAE, Université de Paris Ouest La Défense, Nanterre) identified some of the samples. Kirsty Harding helped with the figures. The collection was deposited in 2015 at the state storage building in Chalons-en-Champagne, under the responsibility of the Service Régional de l'Archéologie du Grand Est. Dating and modelling were carried out as part of *The Times of Their Lives* (www.totl.eu), funded by an Advanced Investigator Grant (295412) from the European Research Council, and led by Alasdair Whittle and Alex Bayliss.

### Bibliography

ARBOGAST / CLAVEL 2007

R.-M. ARBOGAST / B. CLAVEL, Fish exploitation from Early Neolithic sites in northern France: the first data. In: H. Hüster-Plogmann (ed.), *The role of fish in ancient time. Proceedings of the 13th meeting of The ICAZ Fish Remains Working Group in October 4th–9th, Basel/August 2005* (Rahden 2007) 85–9.

ARIÈS 1981

P. ARIÈS, *The hour of our death* (London 1981).

AUGEREAU et al. 2007

A. AUGEREAU / P. BRUNET / L. COSTA / R. COTTIAUX / E. IHUEL / F. LANGRY-FRANÇOIS / P. MAGNE / A. MAINGAUD / N. MALLET / R. MARTINEAU / B. MILL / L.-A. MILLET-RICHARD / A. POLLONI / C. RENARD / G. RICHARD / L. SALANOVA / A. SAMZUN / I. SIDERA / M. SOHN, Le Néolithique récent dans le Centre Nord de la France (3400/3300-2800/2700 av. J.-C.): l'avenir du Seine-Oise-Marne en question. In: J. Évin (ed.), *Un siècle de construction du discours scientifique en Préhistoire. Actes du XXVI<sup>e</sup> Congrès préhistorique de France (Paris 2007)* 165–84.

BAILLOUD 1974

G. BAILLOUD, *Le Néolithique dans le Bassin Parisien* (second edition) (Paris 1974).

BAILLOUD / BREZILLON 1968

G. BAILLOUD, / M. BREZILLON, L'hyogée de L'Homme-Mort à Tinquex (Marne). *Bulletin de la Société Préhistorique Française* 65 (1968) 479–504.

BALSERA NIETO et al. 2015

V. BALSERA NIETO / J. BERNABEU AUBAN / M. COSTA CARAMÉ / P. DIAZ-DEL-RIO / L. GARCIA SANJUAN / S. PARDO GORDO, The radiocarbon chronology of southern Spain's late prehistory (5600–1000 cal BC): a comparative review. *Oxford Journal of Archaeology* 34 (2015) 139–56.

BARLEY 1995

N. BARLEY, *Dancing on the grave: encounters with death* (London 1995).

BAYLISS 2009

A. BAYLISS, Rolling out revolution: using radiocarbon dating in archaeology. *Radiocarbon* 51 (2009) 123–47.

BAYLISS et al. 2007

A. BAYLISS, C. BRONK RAMSEY / J. VAN DER PLICHT / A. WHITTLE, Bradshaw and Bayes: towards a timetable for the Neolithic. *Cambridge Journal of Archaeology* 17.1, supplement (2007) 1–28.

BAYLISS et al. 2004

A. BAYLISS / E. SHEPHERD POPESCU / N. BEAVAN-ATHFIELD / C. BRONK RAMSEY / G.T. COOK / A. LOCKER, The potential significance of dietary offsets for the interpretation of radiocarbon dates: an archaeologically significant example from medieval Norwich. *Journal of Archaeological Science* 31 (2004) 563–75.

BAYLISS et al. 2011

A. BAYLISS / J. VAN DER PLICHT / C. BRONK RAMSEY / G. MCCORMAC, F. HEALY / A. WHITTLE, Towards generational time-scales: the quantitative interpretation of archaeological chronologies. In: A. Whittle / F. Healy / A. Bayliss, *Gathering time: dating the Early Neolithic enclosures of southern Britain and Ireland* (Oxford 2011) 16–60.

BEAVAN ATHFIELD et al. 2008

N. BEAVAN ATHFIELD / R.C. GREEN / J. CRAIG / B. MCFADGEN / S. BICKLER, Influence of marine sources on <sup>14</sup>C ages: isotopic data from Watom Island, Papua New Guinea, inhumations and pig teeth in light of new dietary standards. *Journal of the Royal Society of New Zealand* 38 (2008) 1–23.

BIRKNER 1980

R. BIRKNER, *L'image radiologique typique du squelette* (Paris 1980).

BLIN 2011

A. BLIN, *La gestion des sépultures collectives du Bassin Parisien à la fin du Néolithique*. Unpublished PhD thesis, Université de Paris Ouest Nanterre la Défense (2011).

BLIN 2012

ID., Une nouvelle analyse de l'hypogée néolithique des Mournouards II au Mesnil-sur-Oger (Marne). *Revue Archéologique de l'Est* 61 (2012) 35–54.

BLIN 2015

ID., Mortuary practices as evidence of social organization in the Neolithic hypogea of the Paris basin. *European Journal of Archaeology* 18 (2015) 580–98.

BLOCH 1982

M. BLOCH, Death, women and power. In: M. Bloch / J. Parry (eds), *Death and the regeneration of life* (Cambridge 1982) 211–230.

BLOCH / PARRY 1982a

M. BLOCH / J. PARRY (eds), *Death and the regeneration of life* (Cambridge 1982).

BLOCH / PARRY 1982b

M. BLOCH / J. PARRY, Introduction: death and the regeneration of life. In: M. Bloch / J. Parry (eds), *Death and the regeneration of life* (Cambridge 1982) 1–44.

BOCHERENS et al. 2007

H. BOCHERENS / C. POLET / M. TOUSSAINT, Palaeodiet of Mesolithic and Neolithic populations of Meuse Basin (Belgium): evidence from stable isotopes. *Journal of Archaeological Science* 34 (2007) 10–27.

BOGAARD et al. 2013

A. BOGAARD / R. FRASER / T. H. E. HEATON / M. WALLACE / P. VAIGLOVA / M. CHARLES / G. JONES / R.P. EVERSLED / A.K. STYRING / N.H. ANDERSEN / R.-M. ARBOGAST / L. BARTOSIEWICZ / A. GARDEISEN / M. KANSTRUP / U. MAIER / E. MARINOVA / L. NINOV / M. SCHÄFER / E. STEPHAN, Crop manuring and intensive land management by Europe's first farmers. *Proceedings of the National Academy of Sciences* 110 (2013) 12589–94.

BONSALL et al. 2015

C. BONSALL / R. VASIĆ / A. BORONEANȚ / M. ROKSANDIĆ / A. SOFICARU / K. MCSWEENEY / A. EVATT / Ü. AGURAIUJA / C. PICKARD / V. DIMITRIJEVIĆ / T. HIGHAM / D. HAMILTON / G. COOK, New AMS <sup>14</sup>C dates for human remains from Stone Age sites in the Iron Gates reach of the Danube, south-east Europe. *Radiocarbon* 57 (2015) 33–46.

BORIĆ 2015

D. BORIĆ, Mortuary practices, bodies and persons in the Neolithic and Early-Middle Copper Age of southeast Europe. In: C. Fowler / J. Harding / D. Hofmann (eds), *The Oxford Handbook of Neolithic Europe* (Oxford 2015) 927–57.

BOSTYN et al. 2011

F. BOSTYN / E. MARTIAL / I. PRAUD, Le Néolithique du nord de la France dans son contexte européen: habitat et économie aux 4<sup>e</sup> et 3<sup>e</sup> millénaires avant notre ère. *Revue Archéologique de Picardie*, numéro special 28 (2011).

BOUJOT / CASSEN 1992

C. BOUJOT / S. CASSEN, Le développement des premières architectures funéraires monumentales en France occidentale. Actes du 17<sup>e</sup> colloque interrégional sur le Néolithique, Vannes 1990. Supplément n° 5 de la *Revue Archéologique de l'Ouest* (1992) 195–211.

BREZILLON 1962

M. BREZILLON, Démographie. In: A. Leroi-Gourhan / G. Bailloud / G. Brézillon, 'L'hypogée II des Mournouards (Mesnil-sur-Oger, Marne)'. *Gallia Préhistoire* 5 (1962) 50–63.

BROCK et al. 2010

F. BROCK / T. HIGHAM / P. DITCHFIELD / C. BRONK RAMSEY, Current pretreatment methods for AMS radiocarbon dating at the Oxford Radiocarbon Accelerator Unit (ORAU). *Radiocarbon* 52 (2010) 103–12.

BRONK RAMSEY 2001

- C. BRONK RAMSEY, Development of the radiocarbon calibration program. *Radiocarbon* 43 (2001) 355–63.
- BRONK RAMSEY 2009  
 ID., Bayesian analysis of radiocarbon dates. *Radiocarbon* 51 (2009) 337–60.
- BRONK RAMSEY et al. 2004  
 C. Bronk Ramsey / T. Higham / P. Leach, Towards high-precision AMS: progress and limitations. *Radiocarbon* 46 (2004) 17–24.
- BROWN et al. 1988  
 T.A. BROWN / D.E. / NELSON / J.S. VOGEL / J.R. SOUTHON, Improved collagen extraction by modified Longin method. *Radiocarbon* 30 (1988) 171–7.
- BUCK et al. 1992  
 C.E. BUCK / C.D. LITTON / A.F.M. SMITH, Calibration of radiocarbon results pertaining to related archaeological events. *Journal of Archaeological Science* 19 (1992) 497–512.
- BUCK et al. 1996  
 C.E. BUCK / W.G. CAVANAGH / C.D. LITTON, Bayesian approach to interpreting archaeological data (Chichester 1996).
- CASSEN 2009  
 S. CASSEN (ed.), *Autour de la Table. Explorations archéologiques et discours savants sur une architecture néolithique restaurée à Locmariaquer, Morbihan (Table des Marchands et Grand Menhir)* (Nantes 2009).
- CHAMBON 2003  
 P. CHAMBON, Les morts dans les sépultures collectives néolithiques en France: du cadavre aux restes ultimes. *XXVe Supplément à Gallia Préhistoire* (Paris 2003).
- CHAMBON / BLIN 2011  
 P. CHAMBON / A. BLIN, Gérard Bailloud, co-fondateur de “l’archéologie de la mort”. *Bulletin de la Société Préhistorique Française* 108 (2011) 541–4.
- CHAMBON / SALANOVA 1996  
 P. CHAMBON / L. SALANOVA, Chronologie des sépultures du III<sup>ème</sup> millénaire dans le bassin de la Seine. *Bulletin de la Société Préhistorique Française* 93 (1996) 103–18.
- CHERTRIER et al. 1994  
 B. CHERTIER / C. BOUTTIER-NICOLARDOT / J.-P. BOUTTIER-NICOLARDOT / avec la collaboration de C. MASSET, L’hypogée néolithique de Loisy-en-Brie (Marne, lieu-dit les Gouttes d’Or). *Préhistoire et Protohistoire en Champagne-Ardenne* 1 (1994) 23–64.
- COTTIAUX / SALANOVA 2014

- R. COTTIAUX / L. SALANOVA (eds), *La fin du IV<sup>e</sup> millénaire dans le bassin parisien: le Néolithique récent entre Seine, Oise et Marne (3500–2900 avant notre ère)*. *Revue Archéologique de L'Est* 34<sup>e</sup> supplément & *Revue Archéologique de L'Île-de-France* 1<sup>e</sup> supplément (2014).
- COURSAGET / LE RUN 1966  
 J. COURSAGET / J. LE RUN, Gif-sur-Yvette natural radiocarbon measurements I. *Radiocarbon* 8 (1966) 128–41.
- COUTIER / BRISSON 1959  
 A. COUTIER / P. BRISSON, Fouille d'une grotte-sépulture au Mesnil-sur-Oger (Marne). *Bulletin de la Société Préhistorique Française* 56 (1959) 709–14.
- CRUBEZY / MAZIERE 1991  
 E. CRUBEZY / G. MAZIERE, L'hypogée II du Mont-Aimé à Val-des-Marais (Marne). Note préliminaire. In: *Actes du 15<sup>e</sup> Colloque Interrégional sur le Néolithique, Châlons-sur-Marne les 22 et 23 octobre 1988* (Voipreux 1991) 117–136.
- DEE / BRONK RAMSEY 2000  
 M. DEE / C. BRONK RAMSEY, Refinement of graphite target production at ORAU. *Nuclear Instruments and Methods in Physics Research B* 172 (2000) 449–53.
- DE BAYE 1880  
 J. DE BAYE, *L'archéologie préhistorique* (Paris 1880).
- DONAT et al. 2014  
 R. DONAT / M. SOHN / F. LANGRY-FRANÇOIS / A. POLLONI / A. MAINGAUD / G. MAZIERE / É. CRUBEZY, Le mobilier de l'hypogée du Mont-Aimé au Val-des-Marais (Marne) dans son cadre régional: nouvelles données. In: R. Cottiaux / L. Salanova (eds), *La fin du IV<sup>e</sup> millénaire dans le Bassin Parisien. Le Néolithique récent entre Seine, Oise et Marne (3500–2900 avant notre ère)* (*Revue Archéologique de l'Est* 34<sup>e</sup> supplément, *Revue Archéologique d'Île-de-France* 1<sup>er</sup> supplément 2014) 389–410.
- DELIBRIAS et al. 1970  
 G. DELIBRIAS / M.-T. GUILLIER / J. LABEYRIE, GIF natural radiocarbon measurements V. *Radiocarbon* 12 (1970) 421–43.
- DELIBRIAS et al. 1982  
 ID., GIF natural radiocarbon measurements IX. *Radiocarbon* 24 (1982) 291–343.
- EBBESEN 2006  
 K. EBBESEN, *Danske dysser/Danish dolmens* (København 2006).
- ERIKSEN / ANDERSEN 2014

- P. ERIKSEN / N.H. ANDERSEN, *Stendysser: arkitektur og funktion* (Aarhus 2014).
- FERNANDES et al. 2014
- R. FERNANDES / A.R. MILLARD / M. BRABEC / M.-J. NADEAU / P. GROOTES, Food Reconstruction Using Isotopic Transferred Signals (FRUITS): a Bayesian model for diet reconstruction. *PLoS ONE* 9 (2) (2014), e87436. doi:10.1371/journal.pone.0087436.
- FILDES 1986
- V.A. FILDES, *Breasts, bottles and babies; a history of infant feeding* (Edinburgh 1986).
- FORBES 2007
- H. FORBES, *Meaning and identity in a Greek landscape: an archaeological ethnography* (Cambridge 2007).
- FOXHALL 1995
- L. FOXHALL, Monumental ambitions: the significance of posterity. In: N. Spencer (ed.), *Time, tradition and society in Greek archaeology: bridging the 'great divide'* (London 1995) 132–49.
- FULLER et al. 2006
- B.T. FULLER / J.L. FULLER / D.A. HARRIS / R.E.M. HEDGES, Detection of breastfeeding and weaning in modern human infants with carbon and nitrogen stable isotope ratios. *American Journal of Physical Anthropology* 129 (2006) 279–93.
- FURHOLT 2014
- M. FURHOLT, Upending a 'totality': re-evaluating Corded Ware variability in Late Neolithic Europe. *Proceedings of the Prehistoric Society* 80 (2014) 67–86.
- GODELIER 1996
- M. GODELIER, *L'énigme du don* (Paris 1996).
- HARRIS et al. 2013
- O.J.T. HARRIS / K. REBAY-SALISBURY / J. ROBB / M.L. STIG SØRENSEN, The body in its social context. In: J. Robb / O.J.T. Harris (eds), *The body in history: Europe from the Palaeolithic to the future* (Cambridge 2013) 65–97.
- HINZ 2014
- M. HINZ, Same but different? Neolithic economic and cultural change in northern Germany. In: M. Furholt / M. Hinz / D. Mischka / G. Noble / D. Olausson (eds), *Landscapes, histories and societies in the northern European Neolithic* (Bonn 2014) 207–18.
- HINZ et al. 2012

- M. HINZ / I. FEESER / K.-J. SJÖGREN, Demography and the intensity of cultural activities: an evaluation of Funnel Beaker societies (4200–2800 cal BC). *Journal of Archaeological Science* 39 (2012) 3331–40.
- HOFMANN / ORSCHIEDT 2015
- D. HOFMANN / J. ORSCHIEDT, Mortuary practices, bodies, and persons in central Europe. In: C. Fowler / J. Harding / D. Hofmann (eds), *The Oxford Handbook of Neolithic Europe* (Oxford 2015) 987–1004.
- JAY et al. 2008
- M. JAY / B.T. FULLER / M.P. RICHARDS / C.J. KNÜSEL / S.S. KING, Iron Age breastfeeding practices in Britain: isotopic evidence from Wetwang Slack, East Yorkshire. *American Journal of Physical Anthropology* 136 (2008) 327–37.
- JONES / NICHOLLS 2001
- M. JONES / G. NICHOLLS, Reservoir offset models for radiocarbon calibration. *Radiocarbon* 43 (2001) 119–24.
- KATZENBERG et al. 1996
- M.A. KATZENBERG / D.A. HERRING / S.R. SAUNDERS, Weaning and infant mortality: evaluating the skeletal evidence. *Yearbook of Physical Anthropology* 39 (1996) 177–99.
- KEAVENEY / REIMER 2012
- E.M. KEAVENEY / P.J. REIMER, Understanding the variability in freshwater radiocarbon offsets. *Journal of Archaeological Science* 39 (2012) 1306–16.
- KROMER et al. 2013
- B. KROMER / S. LINDAUER / H.-A. SYNAL / L. WACKER, MAMS – A New AMS Facility at the Curt-Engelhorn-Centre for Archaeometry, Mannheim, Germany. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms* 294 (2013) 11–13.
- LANGRY-FRANÇOIS 2004
- F. LANGRY-FRANÇOIS, Le mobilier lithique des sépultures en hypogée du département de la Marne. *Anthropologica et Præhistorica* 115 (2004) 91–102.
- LANTING / VAN DER PLICHT 1998
- J.N. LANTING / J. VAN DER PLICHT, Reservoir effects and apparent <sup>14</sup>C ages. *Journal of Irish Archaeology* 9 (1998) 151–65.
- LEACH 1961
- E. LEACH, Two essays concerning the symbolic representation of time. In: E. Leach, *Rethinking anthropology* (London 1961) 124–43.

LEROI-GOURHAN et al. 1962

A. LEROI-GOURHAN / G. BAILLOUD / G. BREZILLON, L'hypogée II des Mournouards (Mesnil-sur-Oger, Marne). *Gallia Préhistoire* 5 (1962) 23–133.

MEIKLEJOHN et al. 2014

C. MEIKLEJOHN / R. MILLER / M. TOUSSAINT, Radiocarbon dating of Mesolithic human remains in Belgium and Luxembourg. *Mesolithic Miscellany* 22 (2014) 10–39.

METCALF / HUNTINGDON 1991

P. METCALF / R. HUNTINGDON, Celebrations of death: the anthropology of mortuary ritual (second edition). (Cambridge 1991).

MIDDLETON 1982

J. MIDDLETON, Lugbara death. In: M. Bloch / J. Parry (eds), *Death and the regeneration of life* (Cambridge 1982) 134–54.

MISCHKA 2014

D. MISCHKA, Flintbek and the absolute chronology of megalithic graves in the Funnel Beaker North Group. In: M. Furholt / M. Hinz / D. Mischka / G. Noble / D. Olausson (eds), *Landscapes, histories and societies in the northern European Neolithic* (Bonn 2014) 125–43.

MOOK 1986

W.G. MOOK, Business meeting: recommendations/resolutions adopted by the Twelfth International Radiocarbon Conference. *Radiocarbon* 28 (1986) 799.

MORRIS 1991

I. MORRIS, The archaeology of ancestors: the Saxe-Goldstein hypothesis revisited. *Cambridge Archaeological Journal* 1 (1991) 147–69.

MÜLLER 2001

J. MÜLLER, *Soziochronologische Studien zum Jung- und Spätneolithikum im Mittelleb-Saale-Gebiet (4100–2700 v. Chr.)* (Rahden 2001)

MÜLLER et al. 2014

J. MÜLLER / H. DIBBERN / F. HAGE, Non-megalithic mounds beneath megaliths: a new perspective on monumentality in north central Europe. In: M. Furholt / M. Hinz / D. Mischka / G. Noble / D. Olausson (eds), *Landscapes, histories and societies in the northern European Neolithic* (Bonn 2014) 171–82.

MURAIL et al. 2005

P. MURAIL / J. BRUZEK / F. HOUËT / E. CUNHA, DSP: a tool for probabilistic sex diagnosis using worldwide variability in hip-bone measurements. *Bulletins et Mémoires*

de la Société d'Anthropologie de Paris 17 (2005) 161–76.

O'CONNELL et al. 2012

T.C. O'CONNELL / C.J. KNEALE / N. TASEVSKA / G.G.C. KUHNLE, The diet-body offset in human nitrogen isotopic values: a controlled dietary study. *American Journal of Physical Anthropology* 149 (2012) 426–34.

OGRINC / BUDJA 2005

N. OGRINC / T.M. BUDJA, Paleodietary reconstruction of a Neolithic population in Slovenia: a stable isotope approach. *Chemical Geology* 218 (2005) 103–16.

PAPE 2016

E. PAPE, Shared ideology of death? The architectural elements and the uses of the late Neolithic gallery graves of Western Germany and the Paris basin. Unpublished PhD, Nanterre & Heidelberg Universities (2016).

PARKER PEARSON 1999

M. PARKER PEARSON, *The archaeology of death and burial* (Stroud 1999).

POPLIN 1976

F. POPLIN, À propos du nombre de restes et du nombre d'individus dans les échantillons d'ossements. *Cahiers du Centre de Recherches Préhistoriques* 5 (1976) 61–76.

REIMER et al. 2013

P.J. REIMER / E. BARD / A. BAYLISS / J.W. BECK / P. BLACKWELL / C. BRONK RAMSEY / C.E. BUCK / H. CHENG / R.L. EDWARDS / M. FRIEDRICH / P.M. GROOTES / T.P. GUILDERSON / H. HAFLIDASON / I. HAJDAS / C. HATTÉ / T.J. HEATON / D.L. HOFFMANN / A.G. HOGG / K.A. HUGHEN / K.F. KAISER / B. KROMER / S.W. MANNING / M. NIU / R.W. REIMER / D.A. RICHARDS / E.M. SCOTT / J.R. SOUTHON / R.A. STAFF / C.S.M. TURNEY / J. VAN DER PLICHT, IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. *Radiocarbon* 55, 2013, 1869–87.

RENARD et al. 2014

C. RENARD / A. POLLONI / M. SOHN / E. IHUEL / F. LANGRY-FRANCOIS / P. MAGNE / A. MAINGAUD / R. MARTINEAU / L. SALANOVA, La collection du Baron Joseph de Baye au Musée d'Archéologie Nationale. In: R. Cottiaux / L. Salanova (eds), *La fin du IVe millénaire dans le Bassin Parisien. Le Néolithique récent entre Seine, Oise et Marne (3500–2900 avant notre ère)*, *Revue Archéologique de l'Est* 34e supplément; Paris: *Revue Archéologique d'Île-de-France* 1er supplément (2014) 313–71.

RENFREW 1979

C. RENFREW, *Investigations in Orkney* (London 1979).

SALANOVA 2007

L. SALANOVA (ed.), Allée sépulcrale de Saint-Claude à Bury (Oise). Rapport sur les opérations de fouille 2001–2007 (Amiens 2007).

SALANOVA et al. 2011

L. SALANOVA / P. BRUNET / R. COTTIAUX / T. HAMON / F. LANGRY-FRANÇOIS / R. MARTINEAU / A. POLLONI / C. RENARD / M. SOHN, Du Néolithique récent à l'Âge du Bronze dans le Centre-Nord de la France: les étapes de l'évolution chrono-culturelle. In: F. Bostyn / E. Martial / I. Praud (eds), *Le Néolithique du Nord de la France dans son contexte européen : habitat et économie aux 4e et 3e millénaires avant notre ère*, Actes du 29<sup>ème</sup> colloque interrégional sur le Néolithique, Villeneuve d'Ascq, 2–3 oct. 2009, *Revue Archéologique de Picardie* 1/2 (2011) 77–101.

SALANOVA et al. 2017

L. SALANOVA / P. CHAMBON / J.-G. PARIAT / A.-S. MARÇAIS / F. VALENTIN, From one ritual to another: the long-term sequence from the Bury gallery grave (northern France, 4<sup>th</sup>–2<sup>nd</sup> millennia BC). *Antiquity* 91 (2017) 57–73.

SALANOVA / SOHN 2007

L. SALANOVA / M. SOHN, Mobilier funéraire et modes de différenciation des morts à la fin du Néolithique en Europe occidentale. In: L. Baray / P. Brun / A. Testart (eds), *Pratiques funéraires et sociétés : nouvelles approches en archéologie et en anthropologie sociale* (Dijon 2007) 77–90.

SCARRE et al. 2003

C. SCARRE / L. LAPORTE / R. JOUSSAUME, Long mounds and megalithic origins in western France: recent excavations at Prissé-la-Charrière. *Proceedings of the Prehistoric Society* 69 (2003) 235–51.

SCHIERHOLD 2014

K. SCHIERHOLD, Landscape between cultures: Westphalia between 4100 and 2700 BC. In: M. Furholt / M. Hinz / D. Mischka / G. Noble / D. Olausson (eds), *Landscapes, histories and societies in the northern European Neolithic* (Bonn 2014) 145–54.

SCHULZ PAULSSON 2010

B. SCHULZ PAULSSON, Scandinavian models: radiocarbon dates and the origin and spreading of passage graves in Sweden and Denmark. *Radiocarbon* 52 (2010) 1002–17.

SCOTT et al. 2007

- E.M. SCOTT / G.T. COOK / P. NAYSMITH / C. BRYANT / D. O'DONNELL, A report on Phase 1 of the 5th International Radiocarbon Intercomparison (VIRI). *Radiocarbon* 49 (2007) 409–26.
- SCOTT et al. 2010a
- E.M. SCOTT / G.T. COOK / P. NAYSMITH, A report on Phase 2 of the Fifth International Radiocarbon Intercomparison (VIRI). *Radiocarbon* 52 (2010) 846–58.
- SCOTT et al. 2010b
- ID., The Fifth Radiocarbon Intercomparison (VIRI): an assessment of laboratory performance in Stage 3. *Radiocarbon* 52 (2010) 859–65.
- SJÖGREN 2015
- K.-G. SJÖGREN, Mortuary practices, bodies, and persons in northern Europe. In: C. Fowler / J. Harding / D. Hofmann (eds), *The Oxford Handbook of Neolithic Europe* (Oxford 2015) 1005–22.
- STUIVER / POLACH 1977
- M. STUIVER / H.A. POLACH, Reporting of <sup>14</sup>C data. *Radiocarbon* 19 (1977) 355–63.
- STUIVER / REIMER 1986
- M. STUIVER / P.J. REIMER, A computer program for radiocarbon age calculation. *Radiocarbon* 28, (1986) 1022–30.
- STUIVER / REIMER 1993
- ID., Extended <sup>14</sup>C data base and revised CALIB 3.0 <sup>14</sup>C age calibration program. *Radiocarbon* 35 (1993) 215–30.
- VANDER LINDEN / SALANOVA 2004
- M. VANDER LINDEN / L. SALANOVA (eds), *Le troisième millénaire dans le nord de la France et en Belgique* (Paris 2004).
- WARD / WILSON 1978
- G.K. WARD / S.R. WILSON, Procedures for comparing and combining radiocarbon age determinations: a critique. *Archaeometry* 20 (1978) 19–31.
- WHITE 1953
- T.E. WHITE, A method of calculating the dietary percentage of various food animals utilized by Aboriginal peoples. *American Antiquity* 8 (1953) 396–8.
- WHITTLE et al. 2011
- A. WHITTLE / F. HEALY / A. BAYLISS, *Gathering time: dating the Early Neolithic enclosures of southern Britain and Ireland* (Oxford 2011).

**Abstract: Collecting the dead: temporality and disposal in the Neolithic hypogeum of Les Mournouards II (Marne, France)**

Why were large collectivities of the dead a widespread feature of the later fourth millennium cal BC in western Europe? The hypogeum or artificial cave of Les Mournouards II in the Marne region, northern France, where remains of 79 people were deposited in two chambers, is used to address this and related questions. Bayesian modelling of 29 newly obtained radiocarbon dates places the construction of the tomb in the 34th or 33rd centuries cal BC, with a use-life which could be as little as 100 years. The results indicate that the two chambers were used concurrently, distinctions between them being attributable to their use by different social groupings, as hypothesised by the excavator, André Leroi-Gourhan. The probably short life of this tomb suggests that clusters of hypogea in general could reflect the use of successive tombs by the same groups. The character of the tomb is discussed in general terms of anxieties about land and numbers of people, threats of dispersal and the maintenance of community. Diversity within collective burial practices in the Paris basin is examined, and a series of specific differences between hypogea and *allées sépulcrales* are examined.

**Zusammenfassung:**

**Résumé: La gestion des morts: temporalité et organisation dans l'hypogée néolithique des Mournouards II (Marne, France)**

Pourquoi les communautés d'Europe de l'ouest à la fin du IV<sup>e</sup> millénaire rassemblent-elles leurs morts au sein de sépultures collectives ? Cette question est analysée sous le prisme de l'hypogée (ou grotte artificielle) des Mournouards II (Marne, France) où 79 individus ont été inhumés dans deux chambres. La modélisation bayésienne de 29 nouvelles dates place la construction de la tombe durant le 34<sup>e</sup> ou le 33<sup>e</sup> siècle avant J.-C., avec une durée d'utilisation qui n'excède peut-être pas 100 ans. Les deux chambres ont été utilisées conjointement, l'utilisation par deux groupes sociaux expliquant les différences, comme l'avait déjà envisagé le fouilleur, André Leroi-Gourhan. La probable courte durée de la tombe suggère que les petits groupes d'hypogées peuvent correspondre à des usages successifs par les mêmes groupes. Par l'affirmation de la cohésion du groupe dans la mort, la tombe collective peut apparaître comme une réponse à la crainte d'une dispersion liée à un accroissement de la taille de la communauté. Enfin la diversité des pratiques funéraires dans le Bassin parisien est examinée, et les spécificités des hypogées en regard des allées sépulcrales sont soulignées.

Addresses of the authors:

Philippe Chambon  
CNRS-UMR 7206,  
Éco-anthropologie et Ethnobiologie,  
Musée de l'Homme,  
Paris, France

Arnaud Blin  
Ministère de la Culture  
Service regional de l'archéologie  
Lyon, France

Christopher Bronk Ramsey  
Oxford Radiocarbon Accelerator Unit  
Oxford, UK

Bernd Kromer  
Klaus-Tschira-Archäometrie-Zentrum  
Mannheim, Germany

Alex Bayliss  
Historic England  
London, UK  
and  
Biological and Environmental Sciences  
University of Stirling  
Stirling, UK

Nancy Beavan  
Frances Healy  
Alasdair Whittle  
Department of Archaeology and Conservation  
Cardiff University  
Cardiff, UK