Chapter XX

Time matters: Chronology in the European Mesolithic

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Introduction

Eric Wolf (1982) famously criticised the notion that non-European cultures were 'people without history' until brought into the European sphere of influence, first through colonisation and then through globalisation. The same might be said for the Mesolithic period. Its long timescale of many millennia, during which there appear to have been only relatively small changes – for example, in the types of stone, bone and antler tools used and in the animals hunted and plants gathered – combine to give the impression of a timeless society, waiting for the Neolithic to happen so that history could finally get kick-started. The small changes that are seen in the Mesolithic have often been understood primarily in terms of reaction to environmental change rather than as the outcome of sociocultural processes, encapsulated by Richard Bradley's oft-cited quote: 'successful farmers have social relations with one another, while hunter-gatherers have ecological relations with hazelnuts' (Bradley 1984, 11). Ceramics tend to record finer-scale temporal change but are absent across much, though not all (Jordan and Zvelebil 2009), of Mesolithic Europe, and changes in Mesolithic stone tool assemblages only provide large time blocks, usually comprising some variation on 'Early', 'Middle' and 'Late', with some regions (e.g., Britain, Ireland, Iberia) being further reduced to only Early and Late. Of course, issues could and should be taken with this overly simplistic characterization; higher typo-chronological resolution is available for southern Scandinavia, for example (Vang Petersen 1984). Nevertheless, the extended time-block approach is still implicit in many of our narratives, not least because large timescales *are* difficult to deal with in ways that can get at the detail of finer-scale events, particularly given the preservation and recovery vagaries imposed by the archaeological record (cf. Elliot and Griffiths 2018). This chapter discusses some recent advances in time-keeping for the Mesolithic, highlighting its importance in providing more historical accounts of the prehistoric past, in which process can be investigated, and explanatory frameworks implying cause and effect more properly evaluated. Equally, several problems and issues are raised, some surmountable with further research effort, and others that may be more intractable.

The question of 'when' – Revolutions in time-keeping

Radiocarbon (^{14}C) dating has undergone a series of 'revolutions' since its inception in the late 1940s, itself constituting the first revolution, since it provided the hitherto unprecedented ability to directly measure the age of organic remains (Libby et al. 1949). The second involved the realization that ^{14}C and true calendric years are not fully equivalent, and, more importantly, that the two diverge from one another to varying degrees at different times in the past and that, in general, the effect is cumulative (Renfrew 1973; Stuiver and Suess 1966). Thus, within the timeframe for this paper (9700 – 6000/3800 cal BC), ^{14}C years are more divergent for the early Holocene than for the mid- and late Holocene. This extends the timeframe for much of the Mesolithic, and particularly the Early Mesolithic. Perhaps ironically considering the above discussion, the effect is to make the pace of Mesolithic change seem even slower. The third revolution, the advent of AMS (Accelerator Mass Spectrometry) ^{14}C dating (Nelson et al. 1977), was more of an advance in instrumentation (to the extent that Bayliss [2009] does not consider it a revolution), but extremely important nevertheless. It permitted the measurement of far smaller samples, thereby both preserving rare specimens, as well as greatly extending the range of dateable materials. Most importantly, this promoted use of single entity, short-lived samples that could be more closely placed in secure archaeological contexts, and were often themselves the subject of direct interest (e.g., human remains, artefacts and ecofacts). Table X.1 provides a list of the main materials used in AMS ^{14}C dating and their advantages and disadvantages. With any material (unless itself of direct interest, as may be the case with human remains), context is crucial, particularly with charcoal which may be natural, residual, and/or subject to 'old wood' effects. Reservoir effects are an especially important issue for the Mesolithic, given the widespread high consumption of marine and/or freshwater resources across much of Europe (Schulting 2015; 2021). This, alongside other issues including species identifications (for wood and fauna), detailed contextual information, and quality control criteria, make it more important than ever to publish ^{14}C dates together with the necessary associated meta-data (Wood 2015).

The fourth (or third, *sensu* Bayliss) and most recent revolution involves modelling of radiocarbon determinations within a Bayesian framework (Bronk Ramsey 2009; Buck et al. 1996). Bayesian models in radiocarbon dating take two basic forms. The use of 'informative' priors refers to the availability of an independent source of evidence for a sequence of events, usually involving site stratigraphy. This can constrain the ordering of events represented by a series of radiocarbon dates, thus potentially greatly reducing their individual uncertainty (as reflected in the error terms associated with each date, and in their translation into 'real' years through calibration) as well as that of the sequence as a whole. The use of ‘uninformative’ priors refers to the grouping of a series of dates based on some archaeologically-defined (or rather, archaeologist-defined) criteria, with no inherent ordering of the dates. Examples include non-superimposed graves in a cemetery, or even scattered human bone from a particular context or site (e.g., the Mesolithic human remains from Aveline’s Hole; Schulting et al. 2019); a certain class of artefact sharing stylistic traits (e.g., British antler ‘mattocks’; Tolan-Smith and Bonsall 1999; though see Elliott 2015, who argues for their redefinition as T-shaped axes); or sites containing a certain class of artefact (e.g., rod microliths in Britain; Griffiths 2014).

Table X.1. Materials commonly used in the dating of Mesolithic (and other) sites.

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Timely impacts – Bayesian modelling

To date, the strongest impacts of Bayesian modelling in European prehistory have, arguably, been seen in the Neolithic (cf. Bayliss 2009). The most sustained treatments have come through the fruitful collaboration of Alastair Whittle and Alex Bayliss with their numerous colleagues. This work has transformed our understanding, first of earlier Neolithic Britain (Bayliss and Whittle 2007; Whittle et al. 2011), and then Europe (Whittle 2018), bringing generational timescales within reach for the construction and use of mortuary monuments and causewayed enclosures. Bayesian models are now being widely applied elsewhere across Europe, though again most often for Neolithic and later periods. This is not to say that these new developments have entirely bypassed the European Mesolithic. On the contrary, major impacts have arisen from the abovementioned advances in radiometric dating and its interpretation on understanding specific sites and artefact classes; other examples are discussed below.

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One outcome of the massive increase in ^{14}C dating over the last decades is the so-called ‘dates as data’ approach, in which summed probability distributions of radiocarbon dates are taken as a proxy for population dynamics. Again, an initial focus in these studies in a European context involved tracing the impact of Neolithisation, with the Mesolithic usually acting as little more than a foil against which the subsequent dramatic demographic increase seen with the onset of the Neolithic could be emphasised (e.g., Collard et al. 2009; McLaughlin et al. 2016; Timpson et al. 2014). Some serious problems with an overly literal interpretation of this approach have been noted, involving changes in both past and recent human behaviour. Neolithic practices tend to involve greatly increased levels of deposition – arguably regardless of any putative increase in population – and to enhanced visibility on the landscape, thus providing more targets for ^{14}C dating. At the same time, the appearance of the Neolithic is high on most research agendas, such that additional effort is expended both in locating sites, and in applying ^{14}C dating to recovered materials, at a rate far exceeding that for the Mesolithic (e.g., Crombé and Robinson 2014; Torfing 2015). That said, there does seem to be a real phenomenon here that is being captured, and increasingly sophisticated methods are being developed that will no doubt continue to be applied, and to be controversial (Contreras and Meadows 2014; Timpson et al. 2015). A more recent development involves the use of kernel density estimates (KDE) as a complement or alternative to Bayesian modelling (Bronk Ramsey 2017; McLaughlin 2019).

Routine application of AMS ^{14}C dating has arguably made the single greatest impact in Mesolithic studies. Large numbers of human remains have been directly dated, firstly allowing the confirmation or rejection of human material assigned to the period on stratigraphic or other grounds (e.g., Schulting 2013), or the identification of material as Mesolithic that had previously been identified as later or earlier (e.g., Di Maida et al. 2019). More importantly, it has permitted the assessment of earlier claims of diachronic trends, such as the notion that large cemeteries only emerged in the Late Mesolithic, and mainly along the Atlantic façade and in the western Baltic (e.g., Chapman et al. 1981; Clark and Neely 1987; Mithen 1994). But work by one of us and colleagues has clearly demonstrated that groupings of burials at various scales occur throughout the Mesolithic (Meiklejohn et al. 2009; 2016). This finding is particularly important in rejecting past narratives that often saw simple evolutionary trends towards greater social 'complexity' as presaging the Neolithic (cf. Brinch Petersen and Meiklejohn 2007). At the same time, it raises new questions regarding the interpretation of cemeteries (Schulting 2016). The coastal connection can also be questioned, though – with a few notable exceptions, such as Aveline's Hole – most large burial sites are closely associated with water, whether near-coastal (e.g., Téviec and Hoëdic in Brittany; Vedbæk in Denmark; Skateholm in southern Sweden) riverine (e.g., sites along the Muge and Sado Rivers in Portugal; the Dnieper Rapids, Ukraine; and the Danube of the Iron Gates Gorges, Serbia/Romania) or lacustrine (e.g., Yuzhniy Oleniy Ostrov, Karelia, NW Russia; Zvejnieki, Latvia).

The concomitant aquatic focus of Mesolithic human diets presents an issue in terms of the accuracy of ^{14}C determinations on human skeletal remains, due to both marine and freshwater reservoir effects (MRE/FRE). Of the two, correcting for the MRE is more straightforward, as the proportion of marine foods in human diets can usually be estimated using either stable carbon isotope ($\delta^{13}C$) values alone or in combination with stable nitrogen isotope ($\delta^{15}N$) values. The ocean has a global reservoir offset of ca. 500 years (Heaton et al. 2020), so that, for example, stable isotope values estimating a contribution of ca. 50 ± 10% marine foods would entail an MRE correction of ca. 200 to 300 years. Local departures from this global average (termed ΔR) can be taken into account where appropriate (http://calib.org/marine/; Reimer and Reimer 2001). These are particularly evident in estuarine fjords and tidal river valleys, raising a problem for sites in Scandinavia and central Portugal, with reservoir offsets potentially varying considerably over time and space even within the same fjord or valley (e.g., Heier-Nielsen et al. 1995; Soares and Dias 2006). Note that there is a substantial loss of precision that is cumulative when there are multiple sources of uncertainty (including estimates of the dietary contribution of marine/freshwater resources and the size of the reservoir offset). This is particularly the case with the new Marine20 calibration curve, in which a different method is used in the calculation of the reservoir effect, recognising greater uncertainty than previously (Heaton et al. 2020).

Freshwater systems are highly variable, both in how they differ from terrestrial systems in $\delta^{13}C$ (e.g., Dufour et al. 1999), and in the extent or even presence of a reservoir offset (Keaveney and Reimer 2012); hence they are more complex to deal with. Lanting and van der Plicht (1996) raised the issue in the 1990s, noting discrepancies between ^{14}C determinations and known ages for named medieval nobility, suggesting that this could be due to either marine or freshwater reservoir effects, distinguishable through their $\delta^{13}C$ values. They further noted that comparable or higher offsets were likely to apply to humans from the Swifterbant culture, then seen as Neolithic, but the Early and Middle phases of which are now classed as a Mesolithic culture with pottery, akin to the Ertebølle (e.g., Meiklejohn et al. 2015 and sources cited therein). Not long thereafter, Cook et al. (2001) found discrepancies of 300-500 ^{14}C years between determinations on Mesolithic human remains from the Iron Gates Gorge of the Danube, and dates on indisputably associated terrestrial fauna in the form of bone projectile points found embedded in human skeletons. Comparable effects have since been found at other sites, including Zvejnieki on Lake Burtnieks, Latvia (Meadows et al. 2016) and Yuzhniy Oleniy Ostrov, Karelia (Schulting et al. 2022). On the other hand, paired dating of two Late Mesolithic individuals from Lithuania found no significant FRE (Piličiauskas and Heron 2015). Highly variable, but potentially very large reservoir effects have been documented in modern river systems in the Netherlands, northern Germany and Denmark, affecting dates on food crusts on Mesolithic pottery (Boudin et

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[1] https://academic.oup.com/pages/authoring/books/author-reuse-and-self-archiving