THE PREHISTORIC SOCIETY
SINCE 1935

INTRODUCTION TO PREHISTORY

METHODS FACTSHEET 1
DATING METHODS

Dating Methods

In order to understand the prehistoric societies whose traces can be seen in the landscape, or excavated, we need to know when they were living, building, hunting, burying, and using and reusing sites and monuments. Without the ability to put actions and events into chronological order and to compare individual site sequences and finds across different regions, archaeologists struggle to achieve a clear understanding of the past.

There are two main types of dating: Relative and Absolute. Relative dating ranges from a straightforward use of succession (simply understanding the order archaeological layers occur in the ground) through to using our understanding of how artefacts have changed over time (based on detailed sequencing items such as a pottery or axes). Absolute dating attempts to date something directly, for instance by using a bone to understand the date that the animal died or, with timber, the date the tree was felled before being used.

Relative Dating

It is usually possible through careful excavation to fully understand the order in which each layer in the ground was laid down. This is called *stratigraphy*. Many sites can be quite complex with rubbish pits, holes for structural timber and graves all cut into the ground, but it usually possible to understand their chronological order. This allows a *stratigraphic matrix* to be drawn up, putting all layers into sequence. Using this enables archaeologists to understand the relative date of all the finds and actions they see taking place within the layers.

Using artefacts for relative dating relies on detailed understanding of how specific types of artefact have changed over time, what form those changes took and when they occurred. This is called *typology*. Artefacts from newly excavated sites or from an archive can be compared to an established typological sequence and so assigned a date range or period. For instance, pottery excavated from a new site can be identified by comparison with a local pottery *reference collection*. Close similarities of shape and clay fabric would allow it to be given the same date. Because pottery was both used and discarded rapidly, and changed in design frequently, it is a very good artefact type for the purpose. It is used extensively in dating throughout all periods when it has been used. Many of these typologies, which were until the mid-twentieth century the only means of dating, have now been cross-dated using absolute techniques such as *radiocarbon dating* and *dendrochronology* (see below). This has refined their accuracy.

There are though some drawbacks which require careful thought when using relative dating. Firstly, artefacts may get moved around in the ground, perhaps through animal or plough disturbance, and become incorporated into deposits younger than they are. This would mean that incorrect phasing would be given to those deposits or features. Secondly, artefacts may be 'curated' or treasured as heirlooms: there are known examples of Palaeolithic handaxes carefully placed in Roman features in Swanscombe, Kent. However, there are very good typologies for pottery, flint artefacts, and stone or metal axes which, with care, provide a reasonably accurate, quick and cheap method of dating finds, deposits and sites.

Absolute Dating

There are many forms of absolute dating. Several forms are quite widely used but a number are more experimental, difficult to apply, dependent on complex equipment and quite expensive. Not every absolute dating method is completely precise. A number of techniques will provide a date range, rather than a simple date, for each sample measured. Depending on the technique, and the period in which the sample comes from, this date range can be quite large, several hundred or even thousands of years, and so it is very important to use the best technique to answer your question. If you want to know the decade in which a hut was built, you need a technique where the date range will be very small. However, if you only want to know roughly in which millennia a gravel layer was deposited by a river, then you will have more options.

Dendrochronology is the most precise form of absolute dating. It uses tree-rings (following the basic principle that (some) trees lay down one ring for every year of growth) to count back into the past. In fact, however, it is the width of each ring caused by annual variations of rainfall and temperature that is the crucial factor. Ring variations produce a distinctive sequence akin to a bar code. Extensive research has created geographically distinct *reference chronologies* of consecutive ring-widths going back over 10,000 years into prehistory. This allows the ring sequences from excavated timber to be cross-matched in search of a date. There are though some drawbacks. First only some species can be used, particularly oak. Second in order to find out precisely to the year when the tree died, the bark is necessary, and this can often fall off the timber. Having some of the sapwood will, however, allow a reasonably good estimate to be made of the age of the tree. Third the timber may not have been used until many years after the tree died or the timber may have been re-used, for instance a post from a hut may be reused in another building. Nevertheless, when circumstances are correct, it can be possible to date an object or structure to a year and even a season. The Neolithic Sweet Track in Somerset is a good example. This is a timber trackway linking two areas of raised ground in the swamps of the Somerset Levels. The wood survived in peat by virtue of waterlogging. Dendrochronological dating indicates it was built over the winter/spring of 3807−3806 BC; an astonishingly precise insight into the Neolithic.

As wood rarely survives on prehistoric sites, except as charcoal, radiocarbon dating is the most widely used form of absolute dating. It was developed in the mid twentieth century and relies on the presence of carbon in all life forms, and the ways in which that carbon decays after death. In fact, it is just the unstable fraction ^{14}C which decays, and this takes place at a known rate. So, the amount of ^{14}C left in, for instance, a bone or seed can be measured against the amount of the two stable forms, ^{12}C and ^{13}C. This allows us to work out the number of years since the animal or plant died. Unlike dendrochronology, however, each radiocarbon date has an error range. When the technique was in its infancy that could be very large; now it has been refined to a few decades in most cases. There are a number of complexities with this method, largely associated with carbon, particularly variations in the amount of ^{14}C present in the atmosphere across time. How an organism takes up carbon is also important: diet plays a large part, as does being aquatic or terrestrial (for instance fish compared to cows).

These issues have required extensive research into how to *calibrate* the raw measurement that comes back from the laboratory, and convert them into calendar years. When calibrated into a date range a great many archaeological questions can be tackled. Archaeologists generally want to know as much as possible about their site; initially understanding simple phasing – when was the site first used, for how long was it used, when was it abandoned? Then more particular questions might be asked – for instance, with a site like Stonehenge, answers to much more specific questions will be needed. When were all the earthworks built, and in what order? When were the different stones erected? Were all the burials made at the same time, or did they take place regularly over several centuries? With complex sites that have a number of radiocarbon dates it is now possible to use statistical methods, particularly the *Bayesian* system, to refine the date ranges. This provides a more precise chronology and enables a clearer picture of events in the past to be reconstructed.

Other forms of absolute dating include Luminescence Dating, which can be very useful for dating sedimentary layers, particularly in Palaeolithic sequences. A detailed guide on this and other forms of Absolute Dating can be found on the Historic England website: https://historicengland.org.uk/images-books/publications/

Further Reading

Baillie, M. 1995. *A Slice Through Time: Dendrochronology and Precision Dating*. London: Routledge

Bowman, S. 1990. *Radiocarbon Dating (Interpreting the Past)*. London: British Museum

Renfrew, C. & Bahn, P. 2016. *Archaeology: Theories, Methods and Practice*. London: Thames and Hudson

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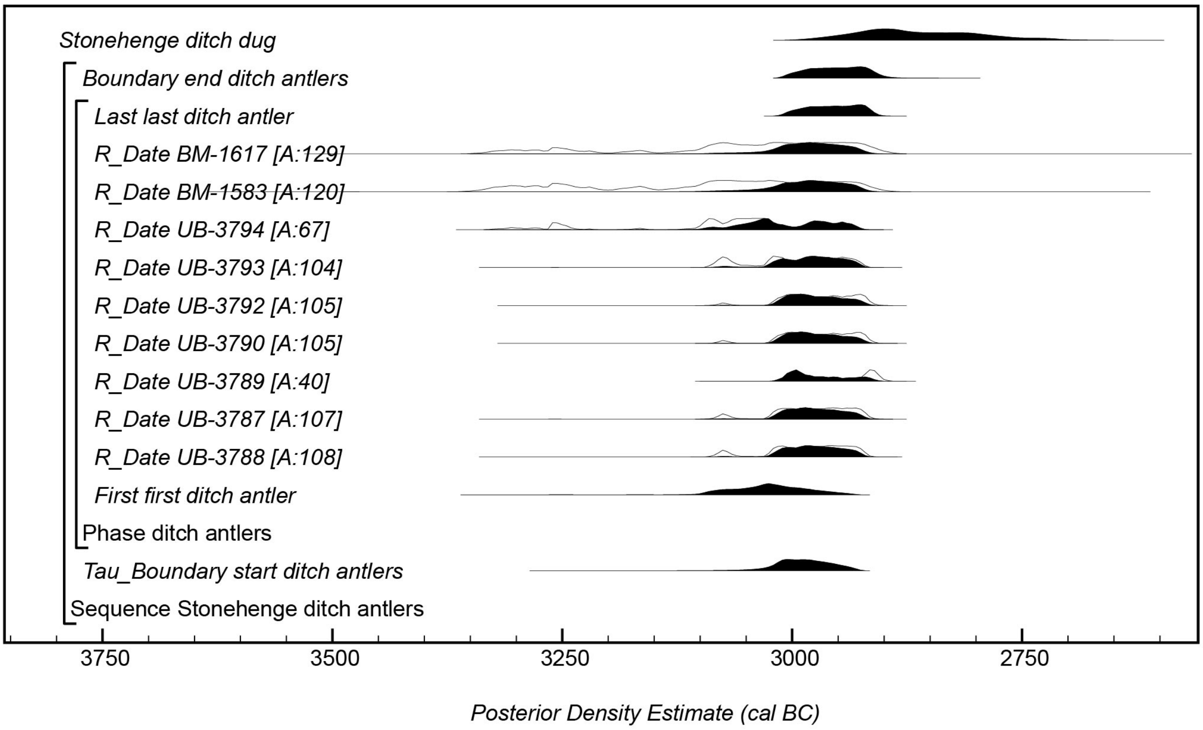

A plot of the radiocarbon dates obtained from antlers left in the Stonehenge ditch. It shows how the often wide error range of the method (raw dates in outline) can be refined by close examination of the stratigraphic sequence and dates contained within it, allowing tighter date ranges to be identified. Thus the probability here is that ditch at Stonehenge was dug between approximately 3000 and 2900 cal BC

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