Refining techniques for radiocarbon dating small archaeological bone samples

Fewlass, H.K.

Propositions

Stellingen behorende bij het proefschrift “Refining techniques for radiocarbon dating small archaeological bone samples”, te verdedigen door Helen Fewlass, 24.03.2020, Universiteit Leiden.

1. A reliable chronological framework is crucial for the accurate interpretation of significant events in human prehistory.

2. Direct radiocarbon dates of human remains and important artefacts provide a firm foundation for robust archaeological chronologies.

3. Archaeological artefacts and bones are finite resources and often have strong cultural importance. A balance must be struck between obtaining information via invasive sampling and preserving the object for future generations to appreciate and study. Destructive sampling should therefore be undertaken responsibly with as minimal an impact as possible.

4. Bone pretreatment involves extracting surviving collagen and removing exogenous carbon. As any exogenous carbon will affect the ^{14}C dating result, consideration of all forms of contamination is crucial to the radiocarbon dating process, from the burial context, handling and storage, and during sample pretreatment and measurement.

5. Collagen degrades with the increasing age of a bone, dependent on environmental conditions. The effects of contamination become increasingly problematic as sample sizes decrease. Consequently, pretreating small aliquots of ancient bone is very challenging.

6. The MICADAS gas ion source can be used to obtain accurate and reproducible data from collagen samples containing <100 µg C. The level of precision achieved is lower than measurements of 500-1000 µg C measured in the form of graphite, but can achieve a level of precision useful for archaeological questions. The improved gas ion source of the MICADAS therefore represents an important resource for cases where archaeological sample material is highly limited.

7. Increased accuracy and precision of direct radiocarbon dates and improvements in the international calibration curve >14,000 BP will allow questions about human behaviour and responses to environmental change to be answered at higher resolution.

8. Communication between archaeologists and dating specialists is crucial for effective sampling strategies, increased precision and background stability of AMS measurements (beyond ‘routine’ handling) and the correct interpretation of radiocarbon data.

9. Pretreatment methods and quality assessment information should be published alongside all radiocarbon measurements so the reliability of the data can be assessed by other researchers. In the instances where this is not carried out so it should be required by journal-editors and requested during peer-review.

10. In recent decades, scientific methods including genetic, palaeoproteomic and isotopic analyses and rigorous dating programs have been increasingly applied to archaeological assemblages. Teaching the basic principles and requirements of these scientific tools should be incorporated into undergraduate archaeology degrees to improve general understanding of appropriate applications, methodological requirements and quality assessments, and facilitate closer inter-disciplinary collaborations between field archaeologists and laboratory-based researchers.