Professional Zooarchaeology Group (PZG) Minutes

Stable Isotopes and DNA, Research Laboratory for Archaeology and the History of Art, University of Oxford, 19th January 2008

Scientific approaches (e.g. stable isotopes, DNA and radiocarbon dating) are becoming key research tools in zooarchaeology but these methods are not equally accessible to all individuals working in the field, the limiting factors being high cost and access to expertise and equipment. On Saturday 19th January, we were welcomed by to the Research Laboratory for Archaeology and the History of Art (RLAHA), University of Oxford, to learn more about the potential of scientific techniques but also to hear about the avenues through which we might all access their use.

Our host for the day, Julie Hamilton, began the programme with a talk about the work she does on carbon and nitrogen isotopes (isotopes are different forms of the same element – they have a different atomic mass due to variations in the number of neutrons). We were introduced to the principles of isotopic fractionation – the physical and chemical processes (such as photosynthesis, evaporation and location) that lead to the partial separation of isotopes – and the signatures that fractionation produces. In archaeological studies, carbon and nitrogen isotopes are used to inform on environmental conditions and, in particular, human/animal diet. Essentially, the food that an individual eats becomes incorporated into that individual's body tissues, leaving a signature of the food consumed. If collagen is extracted from these tissues it is possible to infer what foods were eaten at the time the collagen was formed. For instance, it is possible to distinguish between the consumption of C3 and C4 plants (although this is not such an issue for Britain where there are few C4 plants) and foods from marine and terrestrial sources. It is also possible to determine how much of the protein being consumed was of animal origin – nitrogen stable isotope ratios increase up the food chain. In archaeological studies we are usually restricted to sampling hard skeletal tissues (bones and teeth). Because these tissues have fairly slow rates of turnover they can provide only broad indications of diet: dentine has a very slow turnover and so reflects childhood diet; cortical bone will reflect the last 10 years of diet and cancellous bone the last 5 years; if hair has survived this can provide information about short term variation. Julie finished her paper by providing a wealth of examples showing how profitable the study of carbon and nitrogen isotopes can be.

The second paper, given by Jane Evans from the NERC Isotope Geosciences Laboratory (NIGL), continued with the theme of isotopes, this time looking at strontium and oxygen – both used to indicate migration and movement. Strontium ratios (the radiogenic ^{87}Sr to stable ^{86}Sr) broadly reflect the geology on which an individual lived, the isotopic signature being taken into human/animal tissues through the consumption of plants grown in the soil. Oxygen isotopes reflect climatic variation from poles to equator, the heavy isotopes rain out first, so as you move towards the poles the isotopes become increasingly lighter. Oxygen isotope variation is well mapped in Britain and can be used as an indicator of latitude. For archaeological studies it is unwise to sample bone for strontium and oxygen analyses because bone usually takes on the signature of the soil in which it is buried. Dental enamel, on the other hand, is less susceptible to diagenetic change, preserving the isotopic signature acquired when the tooth mineralised. Using a case-study, looking at animals from the Anglo-Saxon sites of Empingham II and Ketton (Rutland), Dr Evans explain the benefits and problems of these types of analyses – further details of this work can be found in:

Evans, J. A., Tatham, S., Chenery, S. R. and Chenery, C. A. 2007 'Anglo-Saxon animal husbandry techniques revealed though isotope and chemical variations in cattle teeth' *Applied Geochemistry* **9**, 1994-2005.

If you are interested in undertaking isotopic analysis, it is possible to apply for support from NIGL – more information can be found here http://www.bgs.ac.uk/nigl/HowToApply.htm

Jaco Weinstock, from the University of Southampton gave the third paper on ancient DNA and the taxonomy, biogeography and extinction of horses in North America. Jaco was able to demonstrate how an integrated programme of traditional zooarchaeology (in particular metrics), DNA analysis and AMS dating can provide a new perspective on the question of horse evolution. A summary of his work can be found at:

http://biology.plosjournals.org/perlserv/?request=get-document&doi=10.1371%2Fjournal.pbio.0030241&ct=1

Finally, Tom Higham from the RLAHA, gave a talk about the Oxford Radiocarbon Accelerator Unit and the work that has been done there over the last few years. He provided a wide range of examples demonstrating how far radiocarbon dating, in particular AMS dating, has come - it is now possible to gain reliable results from very small samples of organic material. Tom presented a number of examples of re-dating studies that have provided far more logical dates than were provided by earlier dating methods. Should anyone wish to utilise the Oxford Radiocarbon Accelerator Unit's services it is possible to apply to the NERC radiocarbon dating facility for support. Because this facility is funded by NERC, the principal applicant does need to be from an academic institution – if you're not in an academic institution, don't despair, you could always collaborate with someone in the PZG who is. Further details of the application process can be found here http://www.c14.org.uk/embed.php?File=

Our thanks go to the speakers and to Julie and the staff at the RLAHA for organising/hosting such an informative day.

Minutes contributed by Naomi Sykes

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