Puzzling out the past

Robert Hedges

Archaeological verification

In piecing together our ancestors' habits, corroborating lines of evidence are vital if we are to be confident that the emerging jigsaw reveals the true picture.

We have been hearing a lot of the word 'verification' lately, and although in the international arena it has now been replaced by more primitive tests, it has set me thinking about how verification operates in my own field of archaeological science. As with other historical sciences — such as cosmology, geology or evolutionary biology — our methods are based on well-understood physics and chemistry; but our evidence of what happened is fragmentary, and what remains may be altered out of all recognition.

Archaeology suffers further difficulties in its reconstruction of the past, for here human behaviour is central and so we must engage, somehow, with the mental world of our forebears. As human mentality can encompass the most sophisticated acts (of deception, for example), it is not always satisfactory to rely on the present to explain the past, or to attempt to interpret behavioural evidence in a purely rational way. In short, we need to be able to verify the methods by which we collect and interpret evidence.

When working on a jigsaw or crossword puzzle, we can be confident that the piece, or word, is correct if it gives both a precise 'fit' in the local space and is consistent with the emerging global pattern. This view also applies to verification in research, highlighting the latent tautology of fitting pieces together mainly on the basis of their global sense.

This danger has been demonstrated more than once in the dating of archaeological events, especially when using a new method. The history of radiocarbon dating provides an interesting perspective. This technique measures the time elapsed since the death of an organism; that is, since it lost its metabolic connection with the source of radioactive carbon — the atmosphere. But such a date must still be connected to human activity. For example, carved ivory excavated from an Anglo-Saxon site could turn out to be from much older mammoth bone; subtler differences in age or usage may not be so obvious.

The precision of the local 'fit' is also crucial, and this includes wholesale assumptions, the past validity of which cannot be checked directly. Verification of radiocarbon dates is possible, however, on materials of absolutely known age, such as large pieces of wood in which annual rings can be counted. In such instances, consistent discrepancies have been found, and as well as allowing radiocarbon dating to be calibrated, these examples are now seen as testament to changes in the solar magnetic field and in terrestrial carbon cycles (such as ocean circulation).

The problems of verification become more acute when dating events that are so far in the past (beyond 50,000 years) that all of the radioactive carbon has decayed. Many of the methods available depend on the past environment, such as the accumulating effects of local radioactivity, but are forced to assume a homogeneous history for the sample. Whenever possible, corroboration through the use of multiple dating methods gives much-needed confidence to the 'fit'. For example, the dating of Neanderthal flints in Kebara Cave, Israel, by thermoluminescence gave similar ages to those estimated by electron spin resonance for animal teeth in the same strata. In another instance, controversy over the proposed 1.9-million-year age of the KBS volcanic tuff in Kenya was resolved when results from potassium–argon and fission-track methods were compared.

The bones of our ancestors, like our own, are made from the very atoms that they ate. In particular, they record the isotopic composition of the diet, albeit with some metabolic twists, and from this we are learning to infer, very roughly, the contribution of marine food, and of animal versus plant protein, to the diet. Much of this is founded on laboratory animal models, but estimates can be verified by examining living populations, even though the promiscuity of modern dietary habits, and the problems of sampling, make this an imperfect solution.

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My colleagues and I recently had an opportunity to deliver a 'two-dimensional fit' in the verification of evidence on how our ancestors fed themselves. Between Serbia and Romania, the River Danube flows through a limestone gorge, and on its banks are archaeological sites of human settlements. How important were freshwater fish to people in this region? The scattering of fish bones is only a clue. The human bones indeed contain an increased abundance of the heavy isotope of nitrogen, as would be expected for aquatic food webs, but this is not evidence enough to be sure of a fishy diet. Is there another clue that will corroborate the hypothesis?

The clincher comes from radiocarbon dating. The site contains human burials with, in several cases, spear points of animal bone still fatally embedded in the skeleton. However, the dates measured for the humans are apparently several centuries older than those for the spears. This discrepancy is neatly accounted for if they consumed a substantial quantity of fish. This is because, as the Danube flows through the gorge, it dissolves geological-aged limestone, whose (very old) carbonate carbon is fixed and passed up through the aquatic food chain to human bone collagen. The bones of fish-eaters would therefore contain less radioactive carbon than those of the animals from which the spears were made — who would have grazed on terrestrial carbon sources.

Rarely can we be as confident as with the double fit provided here. Answering these questions usually requires patience and discipline to ensure that bringing the past to light is not a matter of two shaky steps forward and one slipped step back. ■

Robert Hedges is at the Research Laboratory for Archaeology, University of Oxford, 6 Keble Road, Oxford OX1 3QJ, UK.

FURTHER READING

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