Fast and slow science and the Palaeolithic dating game

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Accurate and precise dating is critical to our ordering of human fossils and the Palaeolithic behavioural record. Only with such secure dating can we understand the sequence of human evolution and dispersals across the old and new worlds, and the behavioural innovations that constitute the major changes within the Palaeolithic; we are then able to view these in the context of the remarkably unstable climatic conditions that characterise the Pleistocene. For the last 50 000 years of the Upper Pleistocene (the latter part of the Middle Palaeolithic and the Upper Palaeolithic), radiocarbon dating—these days almost entirely undertaken with accelerator mass spectrometry (AMS)—forms the most accurate and precise, and hence preferred, chronometric method. The above paper by Kuzmin (2019) reflects a recurring question in relation to this method—what kind of bone sample should produce the most accurate dates: those on general collagen or those on a specific single amino acid extracted from that collagen? The debate relates to whether the latter should be adopted, on the basis that, as this amino acid derives only from bone, the technique effectively eliminates any contamination that would affect the accuracy of the determined ages.

When the AMS radiocarbon dating of bone collagen was being developed in the 1980s, the amount of bone required for the process was too large to facilitate the dating of valuable fossils. This situation soon changed as chemical pre-treatment methods reduced the necessary sample size. Similarly, although it was possible in the 1990s to extract single amino acids, the amount of bone required precluded the use of this particular method on all but the largest of herbivore bones. Now, in turn, radiocarbon dating based on single amino-acid samples has come to represent the next generation of radiocarbon dating. The questions that Kuzmin poses about dating based on single amino acids are: is it accurate? Is it a suitably reliable replacement for 'generic' collagen dating? And, should we discard the dates produced by other methods? There are several issues here that should concern us. First, I have ethical reservations about the ease with which the finite number of Palaeolithic human remains known to us are repeatedly re-drilled and re-dated whenever a new pre-treatment method becomes available. Why run straight to the hominin fossils when techniques should surely be tested extensively on the far more abundant animal remains first? I am concerned that, in the name of dating, the surfaces of a number of these, usually very small and precious, remains increasingly resemble a pocked lunar surface. My ethical concerns about this high-profile Palaeolithic 'dating game' result from the focus on (decontextualised) human remains and the limited research agendas around them. As Kuzmin correctly implies, these too often seem to be 'how old is this human sample, and might it be found to be older than the last

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age estimation?' This 'older-is-better' mindset suggests that while methods have improved in leaps and bounds, laboratory mentalities have changed little since the 'KBS Tuff controversy' of the 1970s—of direct relevance to the (then) earliest fossils of the genus *Homo*—pitched the new (and in hindsight, erroneous) potassium-argon dating method against (the correct) biostratigraphy of pigs as the best method for dating the KBS volcanic tuff at Olduvai (Lewin 1997).

All applicable dating methods—and arguably as many as possible—should be used to understand site formation and taphonomy. Only by so doing can we attain reliable ages for the human and other materials at these sites. A problem arises when these methods are instead applied narrowly to date the presence of humans in a given region, asking little more than 'how old?' and giving insufficient attention to the many complexities that excavators, sedimentologists, taphonomists and other specialists routinely recognise. In the current research climate, where big grants and big headlines dominate an increasingly aggressive and competitive field, machine-driven 'fast science' is a sure route to competitive fitness, rather than the painstaking and long-term methods such as fieldwork, ethnoarchaeology, zooarchaeology and artefact analysis that can be all too easily caricatured as slow and low-profile (Cunningham & MacEachern 2016; Lyons & Casey 2016).

The focus of this latest iteration of the debate are the new dates produced by Higham *et al.* for the Mid Upper Palaeolithic burials at Sungir, Russia (Marom *et al.* 2012; Reynolds *et al.* 2017). First off, it is important to remember that burial was not the default funerary practice for most of the Palaeolithic; notwithstanding, the Sungir burials are sufficiently iconic as to warrant particular attention. The human bones from Sungir have been dated several times over the last two decades (first by Pettitt & Bader 2000), and Kuzmin makes a number of pertinent observations about the latest round of dating. For example, where dating discrepancies arise, these are often disregarded, such as the dating of the animal samples from Sungir, which have potential relevance for the dating of the human bone. Kuzmin is also correct to stress that Higham's team imply that older dates are better. This, perhaps, is true, at least in some cases, although to my knowledge the Oxford laboratory has not made any statement about whether its pre-treatment process will always result in older dates (i.e. whether there is a systematic age underestimation in previous methods). A clear statement on this question would help Palaeolithic archaeologists to understand the methods and their strengths and weaknesses more fully. Elsewhere, I have expressed similar concerns that the Bayesian modelling of radiocarbon dates can similarly 'drag back' age estimations for dated samples to make them appear older (Pettitt & Zilhão 2015). In broad terms, Kuzmin is correct to question whether the fast dating game is as straightforward as it appears.

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