

A matter of time: dating a Worcester City Museum ca115,000 year old *Bison* bone by molluscs contained within it.

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Introduction

Dr Kirsty Penkman is an analytical chemist at the University of York. A wide-range of dating techniques are employed by Quaternary scientists of which the developing field of Amino acid racemisation of mollusc shell and opercula is producing an impressive chronological framework. Specialists can apply the evidence of their own particular expertise, whether it be for example hominid evolution or faunal turnover, to this framework. In two major contributions (Penkman *et al.*, 2011; 2013), which also detail dating methodologies, a dependable chronological framework for the British Quaternary has been constructed. These papers also explain why Dr Penkman prefers to work with opercula rather than shells of *Bithynia*, a genus of aquatic gastropod molluscs that does not occur in cold climate stadia. One notable streamlining achievement of this work is that the great prairie fauna represented at Isleworth (Coope & Angus, 1975) has now been pushed back in time closer to the Ipswichian interglacial; this makes perfect sense in relation to trends in increasing climatic continentality implied by megafaunal change and turnover at that time.

Discussion

In the 1970s and 1980s I examined Quaternary vertebrate remains in most of the bigger regional museums. In December 1977 I arranged with Mr Maurice Fendall, who then had responsibility for the collections, to view the Quaternary vertebrate material stored at Worcester City Museum. Through the efforts of Hugh Strickland and William Symonds in particular and following the cutting of the Birmingham to Gloucester Railway Line after 1836, the fossil collections at Worcester Museum rivalled the best in the country and the museum was often cited as a significant repository (Symonds, 1861a, 1861b; Waddington Ingram, 1879).

When I visited the museum in 1977 I found that the bulk of the Quaternary vertebrate material was undated but provenanced and also that historically important material dating from 1830-1835 was represented. These items extend back to the origins of the museum itself which was established during 1833. Seven specimens were labelled 'Eckington' of which most could be referred to the open herb-dominated landscape genus *Bison*. One of these bearing the accession number W140 was a left humerus and when picked up shed a few particles of silt and a couple of *Bithynia* opercula. Mr Fendall allowed me to remove these which were tubed for the purposes of ongoing research; when I set them aside I had no idea they might yield key data 40 years later!

I maintain a large dataset of Avon Valley Quaternary molluscs tied to biotopes (Whitehead, 1989) which I hope to publish in due course. With this in mind and knowing the critical importance of some assemblages I engaged with Dr Penkman regarding opercula dates which might prove to be of interest to the wider community. I also mentioned that opercula from a Worcester City Museum *Bison* humerus having been *ex situ* for *circa* 180 years might prove a challenge. Dr Penkman generously accepted that challenge, analysing one *Bithynia* operculum and on 14 August 2017 advised me that some of the amino acid concentrations were so low that they were of little use. Despite that she was ultimately able to correlate the operculum elegantly (and therefore the *Bison*) with marine oxygen isotope stage (MIS) 5, likely to be late in MIS 5e the Ipswichian Interglacial, although importantly a later MIS 5 substage cannot be ruled out. This throws up other complex questions which will require time and further research to address.

Conclusion

The overwhelming probability is that this *Bison* bone and most, if not all, of the other Worcester City Museum Quaternary vertebrate specimens labelled 'Eckington' originate from Eckington Railway cutting (SO949417) on the old Birmingham and Gloucester Railway Line (Keen & Bridgland 1986). This site has also yielded *Hippopotamus* which is confirmatory for interglacials. Modern technology has therefore established the age and provenance of a museum specimen *circa* 115000 years old which if nothing else must confirm the merits of both museums and technology! The find site is now known as Eckington Railway Cutting Site of Special Scientific Interest.

Acknowledgements

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