

Ageing Archaeological Bison by Dental Annuli

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ABSTRACT

A simple histological technique is described for illustrating cementum annuli in the fourth premolar of archaeological bison (*Bison bison*). These annuli are readily identifiable and allow the investigator to age individual animals to within one-half year, thus having an advantage over traditional eruption and wear methods previously used for broad age classification of archaeological bison.

INTRODUCTION

Archaeologists investigating sites in the **plains** region of the United States **are** in need of an accurate and reliable method for ageing bison (*Bison bison*). Frison and Reher (1970), in their investigation of the Glenrock Buffalo Jump, relied upon tooth eruption, replacement, and wear for ageing bison remains. This method is at best somewhat arbitrary and often results in lumping animals into several broad age classes. The accuracy of this method depends upon a known standard and the experience of the investigator. Both physiological and environmental factors can influence the sequence and **wear** of teeth in mammals. Shackleton et al. (1975) recently reported variability in tooth wear among living bison. Investigators working with other ungulates have also reported large discrepancies in assigning age classes based upon tooth wear versus histological examination (Lockard 1972; Gilbert and Stolt 1970; Erickson et al. 1970; Keiss 1969).

Because of the problem with tooth wear ageing techniques, and also since mandibles from archaeological sites are often fragmentary, we have adapted a simple histological technique for use on archaeological bison teeth. **This** method consists of a histological examination of cementum layers in the tooth roots and hence reduces the variability of assigning age classes based on the tooth **wear** method. The utilization of **this** method allows the investigator to accurately age a bison to within one-half year. This technique may be as valuable to the archaeologist as it is to the biologist. The findings of **this** report are not meant to describe any archaeological site in reference to bison population characteristics but rather to describe an accurate and reliable technique for ageing archaeological bison. The mandibles used in the study were from an archaeological excavation in western North Dakota and do not represent anyone time period and therefore no single bison **kill**.

METHODS AND MATERIALS

The fourth premolar (PM₄) from six archaeological bison jaws was used in this investigation. This tooth was selected to correspond with Novakowski's (J965) technique for ageing living bison. However, any permanent tooth could be used if the time of eruption is known. All mandibles were classified as either young adults or adults based on Fuller's (1959) classification of tooth wear. Further analysis of age by measurement of tooth components was not attempted due to the degenerate condition of the mandibles.

The teeth were carefully removed from the mandible and decalcified in 10 percent nitric acid. Decalcification took approximately one week though it may vary somewhat depending upon the tooth. Upon complete decalcification the tooth should appear translucent and soft. Care should be taken to avoid over-decalcification which results in total tooth destruction. Each tooth was placed in slow running water for an hour to remove the nitric acid and any remaining calcium salts. At this point one root was severed from the tooth with a scalpel and split longitudinally. This aids in later penetration of the embedding material and facilitates handling since it is in the root that the cementum annuli occur.

The root was then dehydrated through a series of 24-hour baths of 35, 70, 95, and two 100 percent ethanol solutions. After dehydration the root was placed in two 24-hour toluene baths to insure embedding material penetration. If the root is not completely decalcified or dehydrated it will have an opaque or cloudy appearance and the process must be reversed and repeated from the start.

Roots were impregnated with Paraplast (56-57°C melting point) overnight and embedded the next day. Longitudinal sectioning was done on a microtome at a thickness of 10 microns. Sections were mounted on glass slides using egg albumin and dried overnight on a slide warmer.

The materials were stained by standard histological techniques (Humason 1972). Sections were deparaffinized in two changes of xylol for three minutes each and a solution of carbo-xylol for one minute. The sections were then hydrated through a series of 100, 95, 70, and 35 percent ethanol and finally distilled water. Sections were stained with toluidine blue for two minutes, rinsed in distilled water, and then dehydrated with 90 and 100 percent ethanol. The sections were then passed through carbo-xylol and xylol baths, mounted in Canada balsam and coverslipped.

Toluidine blue is an unstable stain and will fade with time, especially when placed on a slide warmer. Thus the slides should be read within a couple of days after staining. Mayer's hemotoxylin and eosin stain were also used although the results were not as desirable as toluidine blue. The inner layers of cementum did not stain as intensely as the outer layers when hemotoxylin and eosin were used. However, hemotoxylin does give positive results and is good for a permanent slide.

RESULTS AND DISCUSSION

The permanent fourth premolar is one of the last cheek teeth to erupt in bison and does not fully erupt until the animal is between three and four years of age

(Taber 1971). Cementum in this tooth does not begin deposition until the animal is four and a half year old (Novakowski 1965). Prior to this age bison may be successfully aged by tooth eruption and replacement. For each winter that the animal undergoes an opaque, dark-staining layer of cementum is seen under the microscope. Spring and summer cementum appears as a light, translucent band.

We believe that our technique represents a valid technique for ageing archaeological bison because all of the mandibles used represented mature animals and all exhibited cementum annuli. This technique has several advantages over other methods in that it is independent of geographical variability in tooth wear. This method allows the investigator to accurately age bison to within one-half year depending upon the staining quality of the outermost cementum layer. Thus not only can all animals be aged accurately without lumping several age classes together, but the season of death may be determined.

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