



Back on the horse: Recent developments in archaeological and palaeontological research in Alberta

ARCHAEOLOGICAL SURVEY OF ALBERTA

OCCASIONAL PAPER NO. 36

An AMS radiocarbon age for the pathological vertebra of a bison from near Pibroch, north central Alberta

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ABSTRACT

For a number of years, the Royal Alberta Museum displayed a seventh cervical bison vertebra from north central Alberta that exhibited a severe pathology resulting from a humanly inflicted wound. We make a detailed description of this specimen and the embedded projectile point fragment that caused the pathology to form. The vertebra was sampled and yielded an Oxford Radiocarbon Accelerator Unit date of 1702 ± 25 ¹⁴C yr BP, with a calibrated 2σ (95.4%) range of AD 255 to AD 401.

KEYWORDS

AMS, radiocarbon, bison, pathology, wound, archaeology

1. Introduction

In the summer of 1987, Mr. Bill Vaughn collected an unusual specimen from a location described as 4 miles (6.4 kilometres) west of Pibroch, a hamlet just to the north of Westlock, Alberta (Figure 1). The specimen (P.89.3.1) was donated to the Quaternary palaeontology program of what was then the Provincial Museum of Alberta (today the Royal Alberta Museum). It is not known if the vertebra came from an archaeological site, or if it occurred naturally as an isolated find. This remarkable specimen has not been described in detail, and its age was unknown. We illustrate the specimen here, make inferences about the wound and healing that followed, and report the radiocarbon age of the vertebra.

2. Description and analysis

The Pibroch specimen is the seventh cervical vertebra from a bison, made unusual by the fact that the right lateral portion of the vertebra was normal, but the left side of the vertebra had been badly deformed with a

pathology. The pathology consisted of a massive osseous growth affecting the left transverse process. Embedded in the deformed process area was the mid-section of a quartzite projectile point. Photographs of the specimen are presented in Figure 2 (a and b). A Computerized Tomography (CT) scan image of the vertebra (Figure 2c), shows the projectile point fragment and its orientation more clearly. Figure 3a presents a clear view of the distal (tip) and proximal portions of the projectile point fragment, while Figure 3b is a CT scan image oriented so that the projectile point can be seen in cross-section.

This wound to the C7 vertebra was created by a shot inflicted to the neck of the bison, perhaps originally intended for the heart and lung kill zone located between the sternum and thoracic vertebrae and the forelimb and the scapula. The current orientation of the blade fragment is obliquely angled up and rearward, but this is unlikely to be the angle that the projectile trajectory would have followed. The left transverse process was

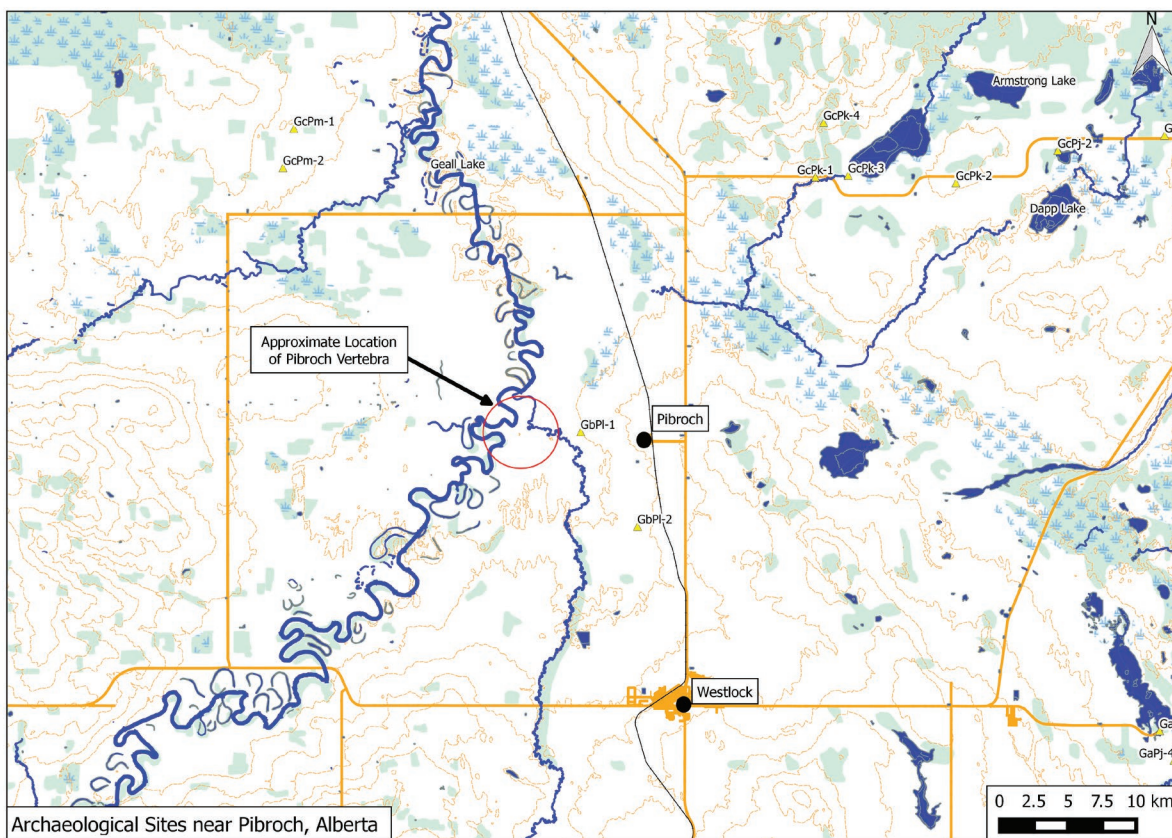


Figure 1. Approximate location of the Pibroch vertebra find spot, and nearby archaeological sites.

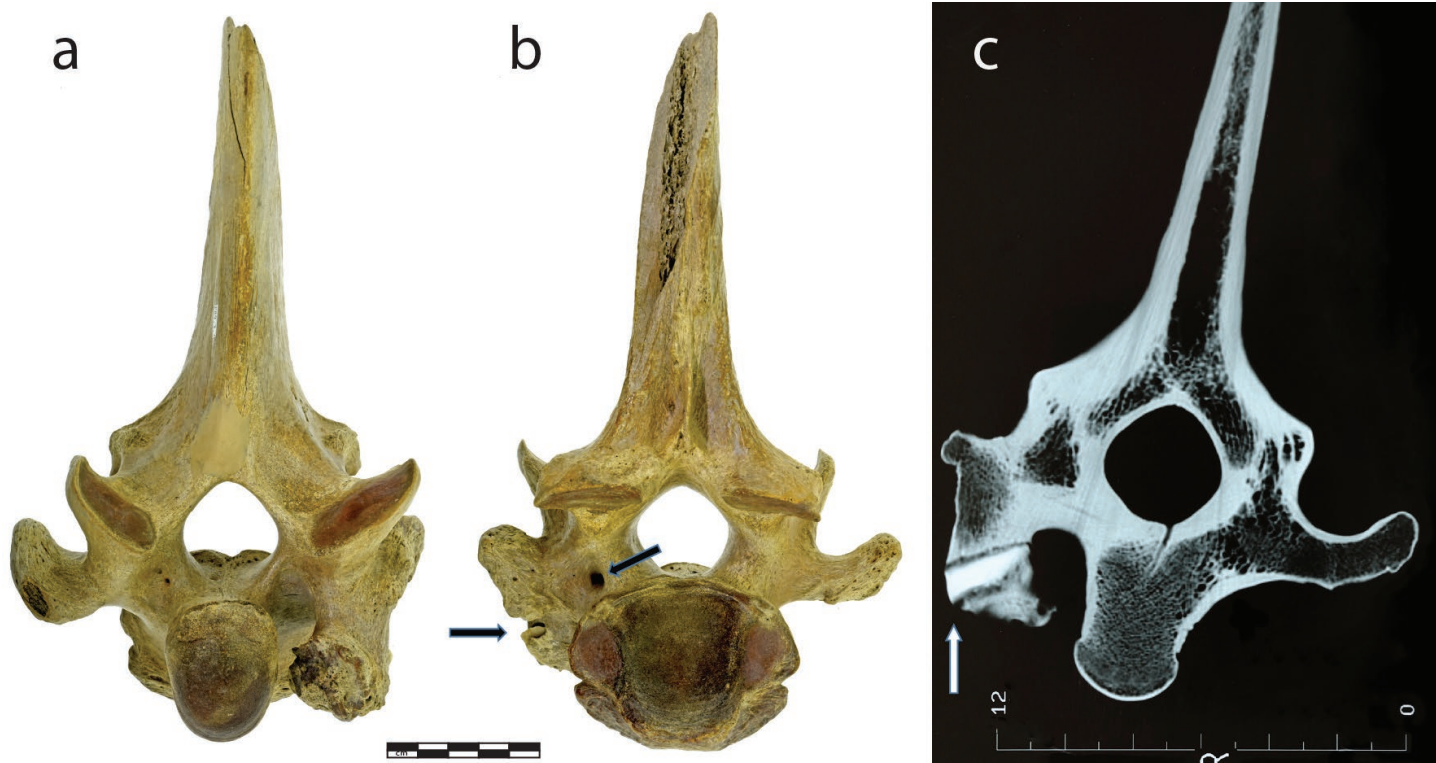


Figure 2. a) Anterior view of the Pibroch vertebra, with the pathological transverse process to the right of the vertebral body; b) posterior view of the Pibroch vertebra, with the pathological transverse process to the left of the vertebral body: the arrow to left indicates point fragment, while the arrow to right indicates a fossa, perhaps a foramen, on the vertebra's left pedicle; c) a CT scan image showing the projectile point embedded with the pathological bone, as indicated by the arrow.



Figure 3. a) Oblique ventral image of the Pibroch vertebra, allowing a view of the proximal and distal portions of the projectile point fragment in the bone mass; b) CT scan image oriented so that the projectile point fragment is visible in cross-section.

broken, and it could be that the projectile struck the left transverse process and deflected downward. In that case, the original angle of penetration for the projectile point would have been from somewhat above or in the same plane as the unfortunate animal. With respect to the latter alternative, we must bear in mind that the shaft of a dart will flex when delivered with an atlatl (particularly as it leaves the atlatl), such that a horizontally thrown dart could be bending downward at impact. The hunter attacking the animal may have been above it, either because of elevated terrain or because the animal itself was down. It is also possible that the wound was inflicted laterally in such a way that the hafted projectile swung forward, breaking the left transverse process, after which bone fragments and the broken projectile point sagged downward and remained near the vertebra; ossification would then have followed.

The proximal portion (base) of the embedded point fragment is missing and appears to have snapped off at the distal margin of a shoulder on one side, carrying through to the blade edge distal to a shoulder or notch on the opposite blade edge. At its most proximal edge, the point is 5.4 millimetres thick. The approximate dimensions of the embedded fragment are provided in Figure 4. The tip of the projectile point is also missing from the embedded fragment. There is a fossa (perhaps a foramen) on the vertebra's left pedicle (midway between the neural arch and the pathological area) that is not mirrored on the opposite

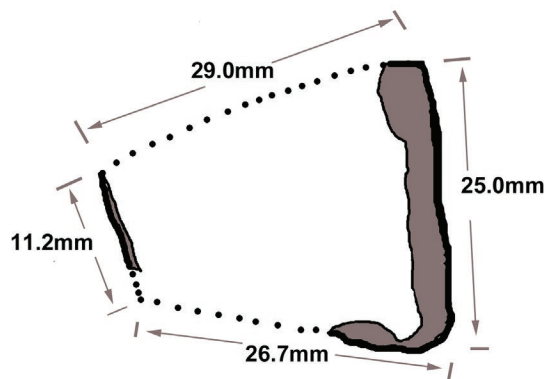


Figure 4. Approximate dimensions of the embedded projectile point in the Pibroch C7 vertebra.

pedicle, but there is no indication that this unusual feature is connected with the wound (see arrow in Figure 2b). Frison (2004:112) described a similar wound, in that case to the centrum of a mature female bison's thoracic vertebra, inflicted with a Yonkee projectile point. There is a projectile point fragment embedded in the centrum of a vertebra from the Stelzer site (39DW242) in South Dakota, a very large campsite contemporaneous with several nearby Sonota burial mounds (Figure 5; Graham 2014).

Despite the severity of the injury, this bison survived the attack. The subsequent, compensatory healing created



Figure 5. A projectile point embedded in the centrum of a vertebra from the Stelzer site (39DW242), a Sonota campsite in South Dakota, of similar age to the Pibroch specimen.

an osseous mass in place of the normal lateral process. A bony callus of this size would likely have taken years to form around the injury site. The right pre-zygapophyseal articular process (facet) has a pronounced curvature and is 1 centimetre (22.5%) narrower than the left, and comparably flat, facet—the wound may have caused this bison to favor one side when turning its neck.

3. Radiocarbon age

Because the projectile point fragment was relatively broad, it seemed important to determine the precise age of the specimen, in case it might reflect an Early Prehistoric Period occurrence. Accordingly, we extracted a bone sample suitable for AMS dating that returned a date of 1702 ± 25 ^{14}C years BP, with a calibrated 2σ (95.4%) range of AD 255 to AD 401 (OxA-27088; calibration with IntCal13, Reimer et al. 2013). As is evident in Figure 6, the intercept for this radiocarbon date strikes a relative plateau in the calibration curve, creating a comparatively broad date range (calibrated in IntCal13, Reimer et al. 2013). As such, the vertebra falls late in the Middle Prehistoric Period, prior to the transition to the Late Prehistoric Period. The $\delta^{13}\text{C}$ value was -20.37 , consistent with northern Plains results for bison (e.g., Chisholm et al. 1986; Graham 2014).

There is too little of the projectile point to infer what type it might have been, but contemporaneous projectile styles are consistent with the embedded fragment (see the example in Figure 7). Fully formed Besant and Sonota-era points, such as we see at sites like Muhlbach and Smith-Swainson in Alberta or Stelzer in South Dakota, have broad blades consistent with what we see in the Pibroch specimen (Graham 2014). Taltheilei points in this age range would also be capable of yielding a point mid-section

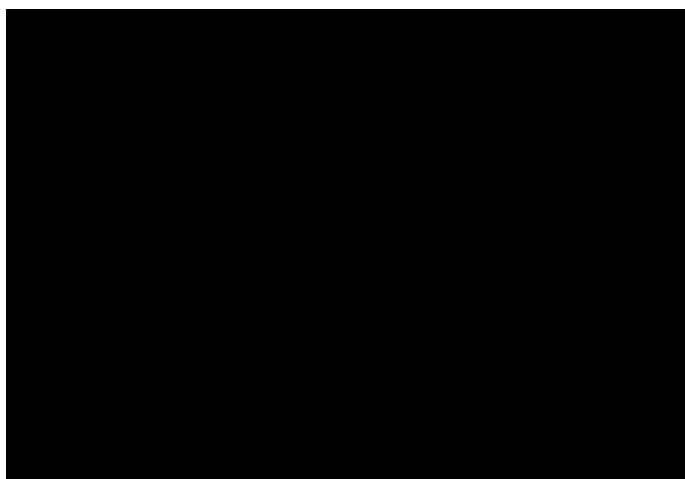


Figure 6. Calibration curve values for OxA-27088, the AMS radiocarbon age for the Pibroch vertebra.

of the dimensions evident in the Pibroch specimen; such points do occur in the Parkland-southern Boreal Forest region. It would seem unlikely that the projectile point involved Avonlea weaponry. The inferred neck width and the thickness of the fragment are consistent with atlatl or spearthrower technology, or even thrusting spear use, rather than bow and arrow technology.



Figure 7. a) A white quartzite projectile point from the Smith-Swainson site, central Alberta; b) oblique lateral view of the embedded Pibroch projectile point in cross-section.

4. Conclusions

The Pibroch find involved the seventh cervical vertebra from a bison that had been severely wounded by a quartzite dart tip most likely delivered from an atlatl or spearthrower; despite severe deformation of the vertebra, the animal survived the attack, with subsequent healing resulting in a massive bony callus that would take some time to form. The Pibroch vertebra entered the Royal Alberta Museum as a single specimen, and it is not known if it came from an archaeological site (suggesting that the animal was later successfully hunted), or if it comprises an isolated discovery following from the subsequent natural death of the bison. The vertebra has been dated (OxA-27088) to 1702 ± 25 ^{14}C yr BP (AD 255 to AD 401).

Brink (2008:156-159) describes at some length the measures many northern Plains First Nations ancestors took to ensure that bison did not escape from a communal kill - primarily so that escaping bison could not affect future hunting strategies of the same type by communicating it to other bison. Of course, a previously hazed animal might well be reluctant to be maneuvered in such a way for a second time. Whether a communal hunting strategy could have been involved here is also unknown, but however the Pibroch animal came to be wounded, it was clearly “one that got away.”

Projectile points embedded in bones are relatively rare, and instances where animals were wounded but survived an attack are much rarer still. This rarity perhaps inhibits systematic reporting (other than anecdotal references). Nevertheless, we do see value in providing documentation of such instances, and encourage their reporting. Systematic descriptions would enhance the potential for assessing the seasonal or migratory behavior of animals such as bison, and with sufficient sample sizes, can help achieve better understandings of intended target areas employed in dispatching prey animals (e.g., Heizer 1968; Losey and Yang 2007; Nikolsky and Pitulko 2013:4194).

5. Acknowledgments

We thank Jack Brink, Curator of Archaeology and Christopher Jass, Curator of Quaternary Palaeontology, at the Royal Alberta Museum for access to the Pibroch specimen and its accession record. We are also grateful to Iain Birchall, Director of Oncologic Imaging at the Cross Cancer Institute, for the CT scan imagery of the vertebra, which was undertaken in the early morning hours when the equipment was not otherwise in use. Ives acknowledges Landrex Distinguished Professor funding from the

University of Alberta that supported the AMS dating at the Oxford Radiocarbon Accelerator Unit.

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