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

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# New records of late Quaternary *Bison* from southern Alberta, and comments on significance of Holocene faunal remains

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## ABSTRACT

Recent fieldwork associated with flooding of major river drainages in southern Alberta produced several new records of *Bison*. Specimens reported here range in age from late Pleistocene to late Holocene, and come from localities along Tongue Creek and the Bow River. Cranial measurements are consistent with specimens identified as *Bison antiquus* and *Bison bison*. The finds come from non-archaeological contexts and highlight new collections initiatives at the Royal Alberta Museum, which includes focused collecting of Holocene vertebrates from non-archaeological contexts.

## KEYWORDS

Bow River, Tongue Creek, *Bison*, flooding, radiocarbon dating, palaeontology

## 1. Introduction

Significant flooding along major river drainages in 2013 had broad impacts on late Quaternary deposits throughout southern Alberta. This prompted a series of systematic surveys that targeted the impacted drainages of the Bow River, Highwood River, Kananaskis River, Jumpingpound Creek, and Tongue Creek. These surveys were funded by the Government of Alberta, and assessed impacts to known heritage resources and newly identified localities exposed by flooding (Beaudoin et al. 2016). New faunal records were identified in flood assessment surveys and others were reported by members of the public (e.g., Slade 2013). Here we present some records for remains of bison collected as part of flood-related assessment and/or fieldwork in 2013-2015, and summarize cranial data for specimens from those localities. Additionally, we discuss the potential significance of these records for future studies of morphology and evolution in *Bison*.

All specimens are housed in the Quaternary Palaeontology collections at the Royal Alberta Museum (RAM), and were assigned unique specimen numbers following accessioning protocols used at the RAM (e.g., P16.171.1). Cranial measurements were taken with digital calipers or a measuring tape following Skinner and Kaisen (1947).

The sample for radiocarbon dating was taken at the Royal Alberta Museum, and sample analysis was conducted by Beta Analytic, Inc. Detailed methods for radiocarbon analysis are outlined in laboratory protocols of Beta Analytic, Inc. (www.radiocarbon.com). The calibrated age is based on IntCal13 (Reimer et al. 2013).

## 2. Van Megen bison locality

The Van Megen bison locality was visited by a

palaeontologist and archaeologist in early August of 2013, following initial reporting of the site in July 2013. The locality is on the north side of the Bow River, just south of the Ivor Strong Bridge in Calgary. Exposed remains were eroded out of 1.2 meters of structureless, sandy clay exposed at the surface of a cut bank along the Bow River (Figure 1). Given the stratigraphic position of the remains, we interpret them as representing an individual of late Holocene age.

Remains included left and right scapulae, left and right humeri, left and right radii, left and right ulnae, 22 ribs, nine thoracic vertebrae, one unfused centrum, two sternal fragments, two first phalanges, one second phalanx, one left lunar, one left scaphoid, and one left metacarpal. No cranial fragments were recovered. Given that the anterior limb elements were eroded out of the bank, it seems likely that cranial elements were either washed away or collected prior to our inspection of the site. A sacrum was left in situ, and it is possible that other remains of the hind limbs remain preserved in the bank. All collected materials are curated under specimen number P13.7.1.

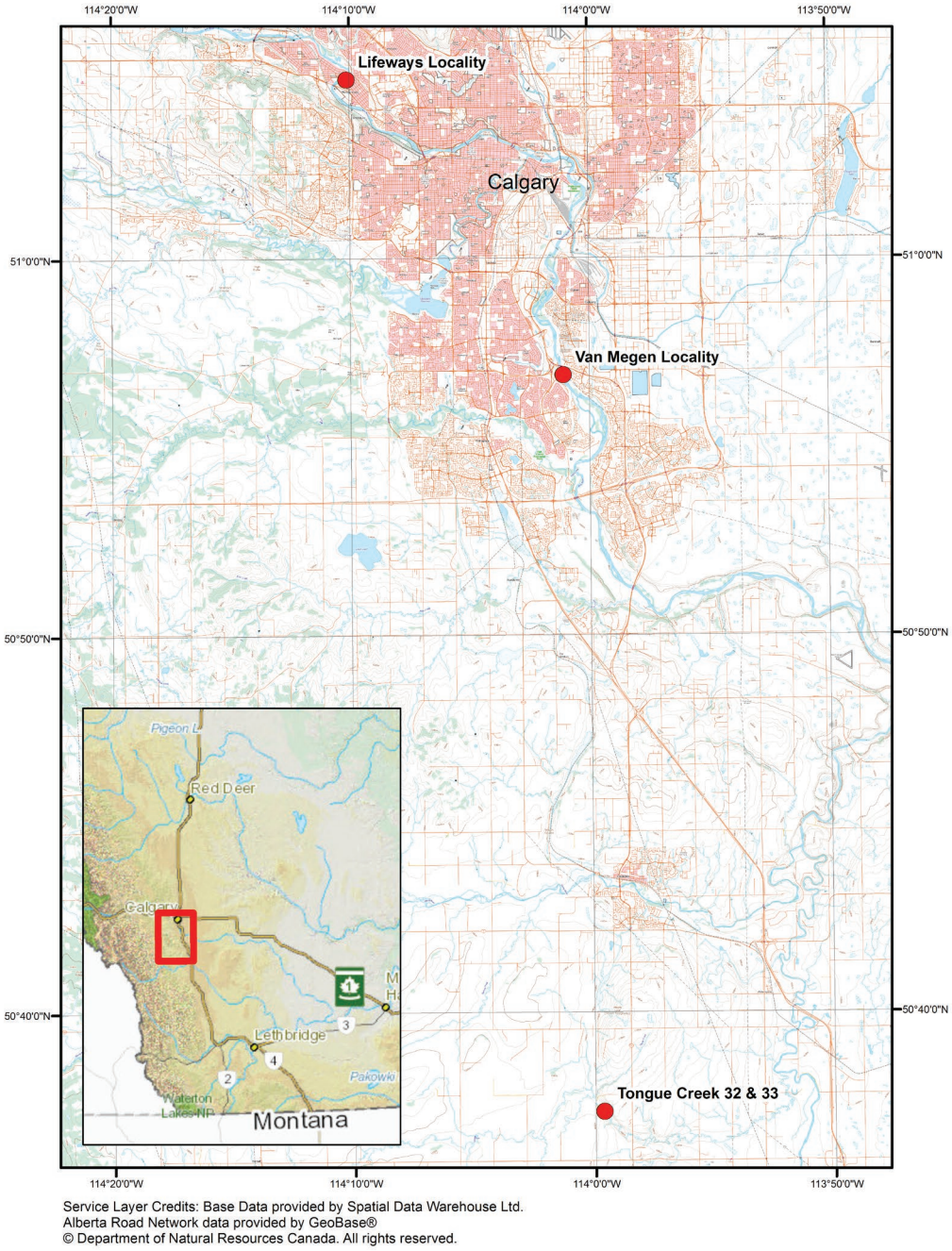


**Figure 1**. Site locations.

## 3. Lifeways bison locality

Following flooding in 2013, Brian Vivian of Lifeways of Canada found and reported a partial bison skull to the Archaeological Survey of Alberta and the Quaternary Palaeontology program at the RAM. The specimen (P13.17.1) was found in basal gravels exposed along the Bow River near Home Road in northwestern Calgary (Figure 1). Because no archaeological evidence was found at the site, the specimen was accessioned into the Quaternary Palaeontology collections at the RAM, although a Borden number was assigned to the specimen (EgPn-762) by the Archaeological Survey as reported in Vivian and Amundsen-Meyer (2015).

The skull consisted of the right horn core and partial cranium, and was situated 468 centimeters below the surface in a stratum dominated by gravels and cobbles. A layer of Mazama Ash is situated above the gravel layer in this area. The skull was firmly embedded in the exposed basal gravels, and was interpreted as being in situ with respect to the gravel unit.

Cranial measurements are close to other skulls of bison identified as *Bison antiquus* (Table 1) although some fall outside published ranges in Skinner and Kaisen (1947). Because of the stratigraphic context below Mazama Ash and the large size of the specimen, a radiocarbon date was obtained on the specimen. AMS radiocarbon analysis (Beta-372155; $\delta^{13}C$ = -18.5) on bone collagen produced a radiocarbon age of 10840±50 $^{14}C$ years BP (10,815 to 10,745 BC; 12,765 to 12,695 cal yr BP), an age consistent with other remains from early post-Last Glacial Maximum (LGM) gravel deposits along the Bow River (e.g., Churcher 1968, 1975; Wilson and Churcher 1978, 1984; Wilson 1996; Wilson et al. 2008).

**Table 1**. Cranial measurements for Lifeways Bison Locality specimen

| Measurement | P13.17.1 (mm) | Range for *Bison antiquus* (mm) |
|---|---|---|
| Core length on upper curve | 233 (right) | 220-344 |
| Core length on lower curve | 273 (right) | 280-395 |
| Vertical core diameter | 116 (right) | 90-108 |
| Core circumference at base | 367 (right) | 290-358 |
| Transverse core diameter at right angle to long axis | 113 (right) | 92-122 |

## 4. Tongue Creek bison Localities

Localities T32 and T33 on Tongue Creek produced large vertebrate remains (Figure 1). These sites were identified during an assessment conducted by Lisa Bohach of Stantec Consulting Ltd. (Bohach 2016). Remains from T32 included an isolated bison skull (P16.171.1; Figure 2a). The skull was found eroded out of a bank, but is likely associated with bones situated at the interface of the lower boundary of a 60 centimeter layer of silt and an underlying gravel layer (Bohach 2016). Remains from T33 consisted of a skull (P16.172.1; Figure 2b), cranial fragments (P16.172.2, P16.172.5), a left dentary (P16.172.3) and several post-cranial elements (left metacarpal, P16.172.4; left unciform, P16.172.6; left cuneiform, P16.172.7, left lunar, P16.172.8). Remains from T33 came from a paleosol (about 40 cm below the surface) and a slump block (Bohach 2016). Cranial measurements are presented in Table 2. Skull measurements are consistent with identification of *Bison bison*. Collectively, the stratigraphic position of the specimens and the identification are indicative of mid to late Holocene age.

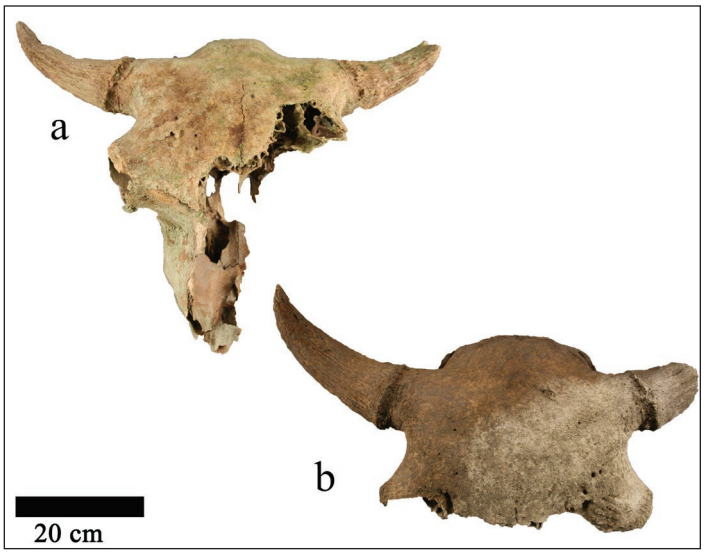


**Figure 2**. Skulls of *Bison bison* from flood assessment studies along Tongue Creek. (a) P16.171.1, locality T32; (b) P16.172.1, locality T33.

## 5. Discussion and conclusion

Remains of bison are common in archaeological and palaeontological contexts in Alberta, particularly from localities that post-date the LGM. The earliest of these post-LGM records have received considerable attention in the literature, particularly as a proxy for understanding the movements of humans and other animals across deglaciating landscapes (e.g., Wilson 1996, Heintzman et al. 2016). Despite the ubiquity of remains in late Quaternary deposits, the published literature likely under-represents the actual breadth and scope of the record of *Bison*. Holocene records of bison not associated with archaeological sites are not commonly reported in the literature, possibly due to a lack of concerted collecting of those records.

A greater collecting focus on Holocene remains from non-archaeological contexts has begun in recent years, specifically as part of the collections growth of the

**Table 2**. Measurements (in mm) of Bison bison from T32 (P. 16.171.1) and T33 (P16.172.1). Measurements follow Skinner and Kaisen (1947).

| Measurement (mm) | P16.171.1 | P16.172.1 | Range for male *Bison bison* (Skinner and Kaisen, 1947) |
|---|---|---|---|
| Spread of horn cores | 600* | - | 485–662 |
| Spread of horns outside curve | 610 | - | 534–687 |
| Core length on upper curve | 180 (right) | 207 (right) | 140–250 |
| Length of core on lower curve | 200 (right) | 280 (right) | 170–313 |
| Length, tip of core to upper base at burr. | 165 (right) | 180 (right) | 135–210 |
| Vertical diameter of core | 89.52 (right); 77.03* (left) | 83 (right); 83 (left) | 64–91 |
| Circumference of core at base | 256 (right); 245* (left) | 291 (right); 275* (left) | 208–279 |
| Greatest width at auditory openings | 256.36 | - | 222–275 |
| Width of condyles | 127.46 | 124.19 | 113–135 |
| Depth, occipital crest to top of foramen magnum | 84.02 | 94.10 | - |
| Depth, occipital crest to lower border of foramen magnum | 122.55 | 135.85 | 139–163 |
| Transverse diameter of core at right angle to long axis | 80.39 (right); 77.05 (left) | 89.70 (right); 86.95 (left) | 68–95 |
| Width between base of horn cores | 308.10 | 311 | - |
| Width of cranium between horn-cores and eye orbits | 268.48 | 275.78 | 242–290 |
| Greatest post-orbital width | - | 336.15 | 271–343 |
| M1 – M3 alveolar length | 80.06 (right) | - | 82–98 |

Quaternary Palaeontology program at the RAM. For bison in particular, there is considerable interest in understanding population dynamics in historic times (e.g., Freese et al. 2007). Additionally, rapidly developing analytical techniques are opening new research directions. In particular, the growth of studies focused on the extraction of ancient deoxyribonucleic acid (aDNA) is permitting greater insight into the history of population-level dynamics of extinct and extant mammals (e.g., Wilson et al. 2008, Heintzman et al. 2016). In Alberta, the response of mammals to deglaciation and the subsequent development of the modern biota can be explored in new ways as a result of methodological advances. Research growth in this area in Alberta will require awareness and availability of specimens that span the Holocene from both archaeological and palaeontological contexts.

In summary, flood-related assessment provided an opportunity to identify new Quaternary palaeontological localities and recover historic resources from sedimentary deposits along the Bow River and Tongue Creek. The specimens reported here represent distinct snapshots of bison from late Quaternary times, including the latest Pleistocene and mid to late Holocene. Some additional localities containing bison were identified as part of the Flood Impact Assessment program (e.g., Wilson 2015), but we restricted this report only to specimens that are fully accessioned at present.

We advocate for the continued collection and publication of Holocene records such as those reported here. The greater the breadth of the known record, the more detailed research questions that can be considered, particularly relating to population level changes occurring throughout the structuring of the modern biota in Alberta. Although Holocene faunal dynamics have not received the same amount of attention as the Pleistocene, there is a growing research focus on more recent time, particularly as it relates to understanding responses to climate change and conservation palaeobiology (e.g., Hadly et al. 2004, Dietl and Flessa 2011).

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