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A late Pleistocene steppe bison (*Bison priscus*) partial carcass from Tsiigehtchic, Northwest Territories, Canada

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ABSTRACT

A partial steppe bison (*Bison priscus*) carcass was recovered at Tsiigehtchic, near the confluence of the Arctic Red and Mackenzie Rivers, Northwest Territories, Canada in September of 2007. The carcass includes a complete cranium with horn cores and sheaths, several complete post-cranial elements (many of which have some mummified soft tissue), intestines and a large piece of hide. A piece of metacarpal bone was subsampled and yielded an AMS radiocarbon age of 11,830 ± 45 ^{14}C yr BP (OxA-18549). Mitochondrial DNA sequenced from a hair sample confirms that Tsiigehtchic steppe bison (*Bison priscus*) did not belong to the lineage that eventually gave rise to modern bison (*Bison bison*). This is the first radiocarbon dated *Bison priscus* in the Mackenzie River valley, and to our knowledge, the first reported Pleistocene mammal soft tissue remains from the glaciated regions of northern Canada. Investigation of the recovery site indicates that the steppe bison was released from the permafrost during a landslide within unconsolidated glacial outwash gravel. These data indicate that the lower Mackenzie River valley was ice free and inhabited by steppe bison by ~11,800 ^{14}C years ago. This date is important for the deglacial chronology of the Laurentide Ice Sheet and the opening of the northern portal to the Ice Free Corridor. The presence of steppe bison raises further potential for the discovery of more late Pleistocene fauna, and possibly archaeological evidence, in the region.

1. Introduction

The unglaciated regions of Alaska (USA) and Yukon (Canada) contain some of the most productive Pleistocene vertebrate fossil localities in North America (Guthrie, 1990; Harington, 2003). This area is referred to as "eastern Beringia", the eastern province of the "mammoth-steppe" biome which stretched from England eastward across the entire unglaciated northern hemisphere during Pleistocene cold intervals (Guthrie, 1990). The frigid, arid environment of the mammoth-steppe was a Pleistocene Arctic refugium for the mammoth fauna: the now extinct community of large mammals characterized by woolly mammoths (*Mammuthus primigenius*), steppe bison (*Bison priscus*), and horses (*Equus* sp.). The eastern border of the mammoth-steppe is typically marked by the Richardson and Mackenzie Mountains as suggested by the rarity of Pleistocene vertebrate fossils from the glaciated terrain in the Northwest Territories (Fig. 1). Although a few Pleistocene mammal fossils have been recovered in the western Canadian Arctic east of the Yukon, little is known about the composition or chronology of these communities.

In this paper we add to the limited data on Pleistocene mammals in northern Canada east of the Yukon, by reporting on a recently discovered partial steppe bison (*Bison priscus*) carcass from Tsiigehtchic near the confluence of the Arctic Red and Mackenzie rivers, Northwest Territories (Fig. 1a). To our knowledge this is the first radiocarbon dated Pleistocene mammal with mummified soft tissue discovered in the glaciated region of northern Canada. Data presented in this paper include an accelerator mass spectrometry (AMS) radiocarbon age, preliminary assessment of the carcass, morphometrics, and mitochondrial DNA sequences that confirm the presence of Pleistocene steppe bison in the Mackenzie River valley during the Lateglacial. These data are considered in light of previously discovered Pleistocene fossils in the Northwest Territories, the glacial chronology of the western

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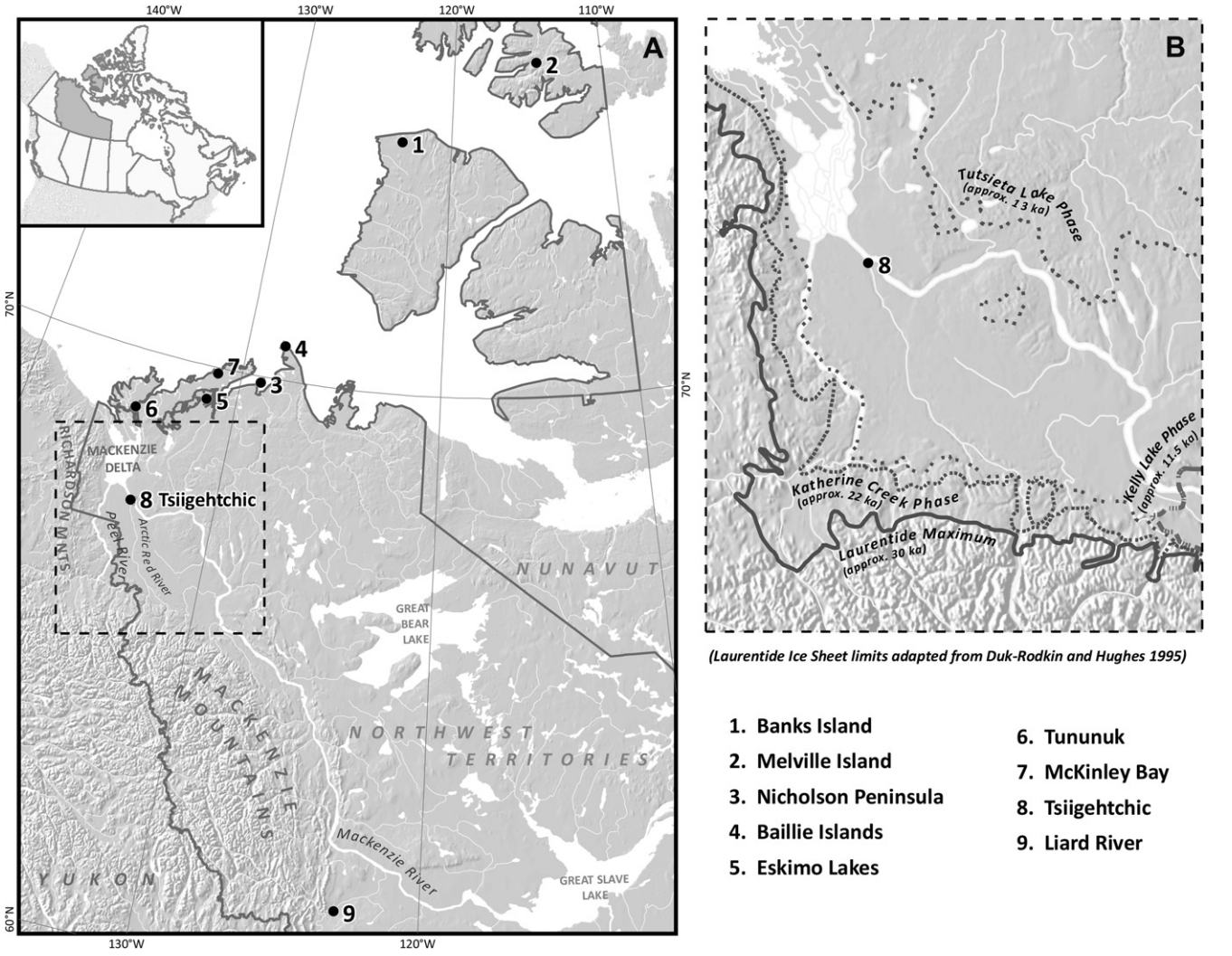

Fig. 1. (A) Map of the lower Mackenzie River valley, Northwest Territories, including location of Tsiigehtchic and other Pleistocene fossil localities; (B) location of Tsiigehtchic in relation to Laurentide Ice Sheet limits after Duk-Rodkin and Hughes (1995).

Canadian Arctic and the northern opening of the "Ice Free Corridor" (IFC) as a mid-continental dispersal route between the Cordilleran and Laurentide Ice Sheets during deglaciation.

2. Regional setting

2.1. Pleistocene fauna of the Northwest Territories

In comparison to the adjacent unglaciated regions of the Yukon, few Pleistocene mammal fossils have been recovered from the Northwest Territories (Harington, 2003; Fig. 1a). The rarity of previous Pleistocene fossil discoveries in the region highlights the significance of the Tsiigehtchic bison for our knowledge of late Pleistocene mammal biogeography. Rare Pleistocene fossils include those recovered from the Mackenzie Delta and Beaufort Coastlands on the mainland, the islands off the Beaufort Sea coast near the Mackenzie Delta (e.g., Summer, Richard's, Garry and Baillie Islands), and Banks and Melville Islands (Harington, 1990). Few Pleistocene fossil vertebrates have been recovered *in situ* or radiocarbon dated, thus often making their stratigraphic and palaeoenvironmental significance difficult to resolve. Until now, the Mackenzie River valley has remained virtually unknown in terms of Pleistocene mammals.

The presence of steppe bison in the Northwest Territories prior to the last glaciation is established by a radiocarbon date of 55,500 ± 3100 ^{14}C yr BP (OxA-1163; Canadian Museum of Nature (CMN) 21096) on a specimen from the Eskimo Lakes area of the Tuktoyaktuk peninsula (Shapiro et al., 2004; Fig. 1a). Gordon (1970) reports an undated *Bison antiquus* (cf. *B. priscus*) cranium from the Liard River (Prince of Wales Northern Heritage Center, NWT 984.80.1), further south along the Mackenzie River valley. Harington (2005) reports woolly mammoth specimens from northwestern Banks (CMN 38655) and southwestern Melville Islands (CMN 11833) dating to 20,700 ± 270 ^{14}C yr BP (TO-2355) and ~21,000 ^{14}C yr BP (21,000 ± 320, GSC-1760; 21,600 ± 230, GSC-1760-2), respectively. Harington (2005) suggests that these represent animals that moved northwest from the Mackenzie Delta region during the Last Glacial Maximum (LGM). The presence of woolly mammoth during the LGM in the Mackenzie Delta is confirmed by a date of 19,440 ± 290 ^{14}C yr BP (I-8578) on a bone recovered from Tununuk (Rampton, 1988; Harington, 2003). Another woolly mammoth recovered from Nicholson Peninsula dates to 34,000 yr BP (Burns, 2001). The presence of saiga antelope (*Saiga tatarica*) on the Baillie Islands (NMC 12090) dated to 14,920 ± 160 ^{14}C yr BP (ETH-3898) provides evidence for a hyperarid environment on the northeastern extremity of Beringia