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Radiocarbon Dates on Some Quaternary Mammals and Artifacts from Northern North America

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ABSTRACT. Nine radiocarbon dates on five genera of Quaternary mammals from northern North America are discussed. Of particular interest are: (a) a 29,000-year-old artifact from the Yukon Territory; (b) the first evidence that steppe mammoths (*Mammuthus columbi* or *M. armeniacus*) occupied eastern Beringia during the peak of the Wisconsin glaciation; (c) dates indicating that saiga antelopes (*Saiga tatarica*) and Yukon short-faced bears (*Arctodus simus yukonensis*) occupied the Yukon-Alaska region in mid-Wisconsin time; (d) dates indicating that bison (*Bison* sp.) lived near the arctic coast of the Northwest Territories, and tundra muskoxen (*Ovibos moschatus*) lived in the western Yukon in late postglacial time; and (e) dates suggesting that tundra muskoxen have occupied the central Canadian Arctic Islands for the last 7000 years.

RÉSUMÉ. Neuf datations au radiocarbone sont ici discutées; elles ont été obtenues pour cinq genres de mammifères du Quaternaire des régions septentrionales de l'Amèrique du Nord. Les points particulièrement intéressants sont: (a) un artefact daté à 29,000 ans provenant du Yukon; (b) la première preuve de la présence du mammouth des steppes (*Mammuthus columbi* ou *M. armeniacus*) en Béringie orientale au maximum glaciaire du Wisconsin; (c) des dates indiquant que l'antilope saîga (*Saiga tatarica*) et l'ours à museau court du Yukon (*Arctodus simus yukonensis*) occupèrent le Yukon et l'Alaska à l'époque wisconsinienne moyenne; (d) que le bison (*Bison* sp.) vécut près de la côte arctique des Territoires du Nord-ouest, et que le boeuf musqué de la toundra (*Ovibus moschatus*) habita l'ouest du Yukon à la fin de l'époque postglaciaire; (e) enfin, des dates suggérant la présence du boeuf musqué de la toundra dans les îles de l'Arctique Central canadien pour les derniers 7000 ans.

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INTRODUCTION

During the last few years, several radiocarbon dates have been obtained on remains of Quaternary mammals from the Northwest Territories, Yukon Territory and Alaska (Fig. 1) that are of interest to paleobiologists and archaeologists. In some cases the dates are important because they are the first on certain species from this part of northern North America (e.g. short-faced bear, steppe mammoth, saiga antelope). Others are important because they refer to artifacts (i.e. bones evidently modified by humans), and because they either give an idea of the earliest postglacial penetration of a species into the heart of a formerly glaciated region or they suggest when parts of a species' range, that are now extralimital, were abandoned in late postglacial time (e.g. bison and tundra muskox).

All but one of the dates discussed in detail were obtained from Teledyne Isotopes (Westwood, New Jersey) by the Quaternary Zoology section of the National Museum of Natural Sciences. The method of analysis used by Teledyne Isotopes (I) is that outlined by Berger *et al.* (1964:999) and subsequently

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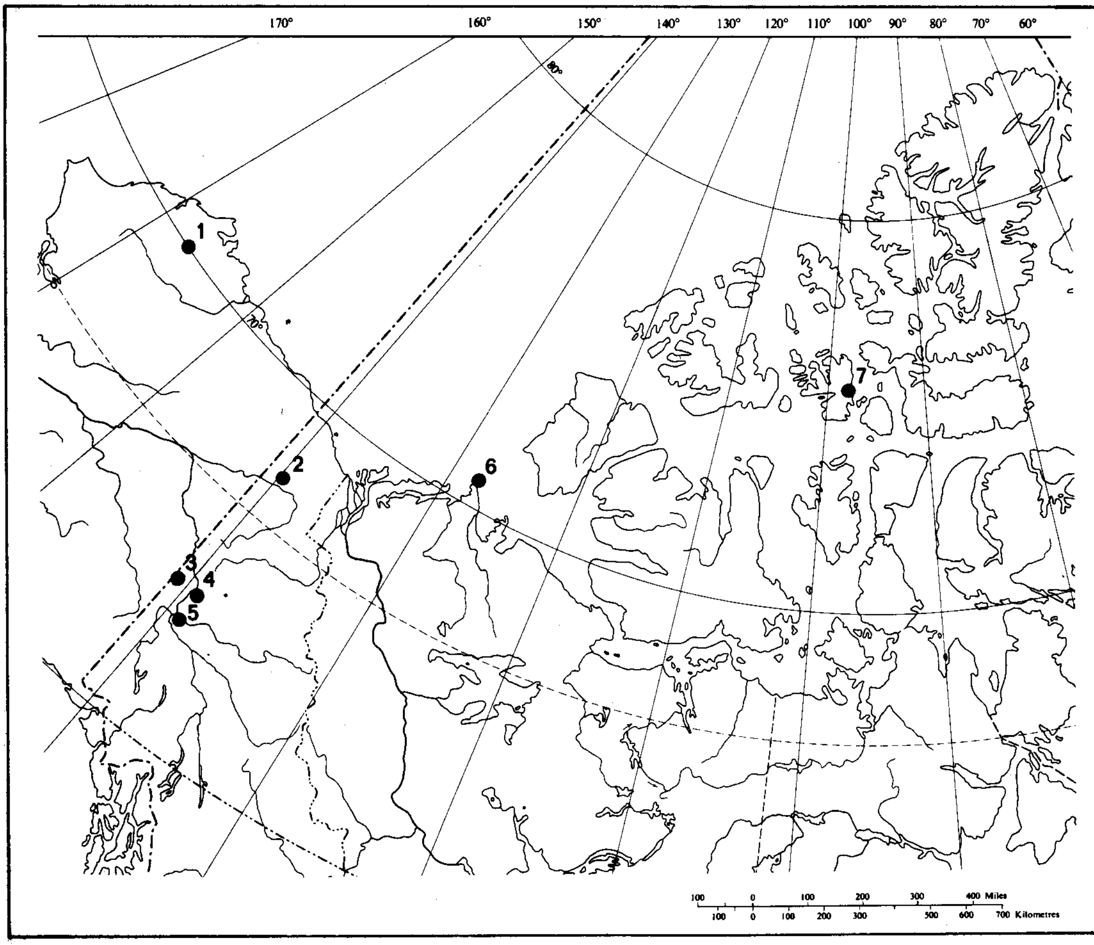

FIG. 1. Localities of radiocarbon-dated specimens described in the text. Key: 1. Usuktuk River, Alaska. 2. Old Crow River (Loc. 3), Yukon Territory. 3. Miller Creek (Sixtymile Loc. 7), Yukon Territory. 4. Dawson area (Locs. 6, 8, 10, 16), Yukon Territory. 5. Brewer Creek (Loc. 1), Yukon Territory. 6. Baillie Islands (eastern shore), Northwest Territories. 7. Goodsir Inlet area, Bathurst Island, Northwest Territories.

modified by C.V. Haynes. The modification involves treating the collagen with a dilute sodium hydroxide solution to remove the possibility of humic acid contamination. The date on the saiga antelope specimen was received from the Geological Survey of Canada Radiocarbon Dating Laboratory (GSC). There, bone is pretreated with hydrochloric acid and sodium hydroxide. More details concerning this laboratory and the techniques used there are provided by Dyck (1967). All nine radiocarbon dates detailed here are bone collagen dates.

Precise information on the Yukon fossil localities mentioned is provided in records of the Paleobiology Division, National Museums of Canada (NMC).

The purposes of this paper are to: (a) augment the long list of radiocarbon dates on mammalian bone from the Northwest Territories, Yukon Territory and

Alaska (see for example Péwé, 1975, Table 13; Harington, 1977, Tables 5, 6; Harington, 1978:47-51; Matthews, 1979, Fig. 4); (b) describe, provide measurements for and in some cases illustrate the specimens considered; and (c) discuss the significance of the specimens — particularly their geochronological, zoogeographic and paleoenvironmental implications.

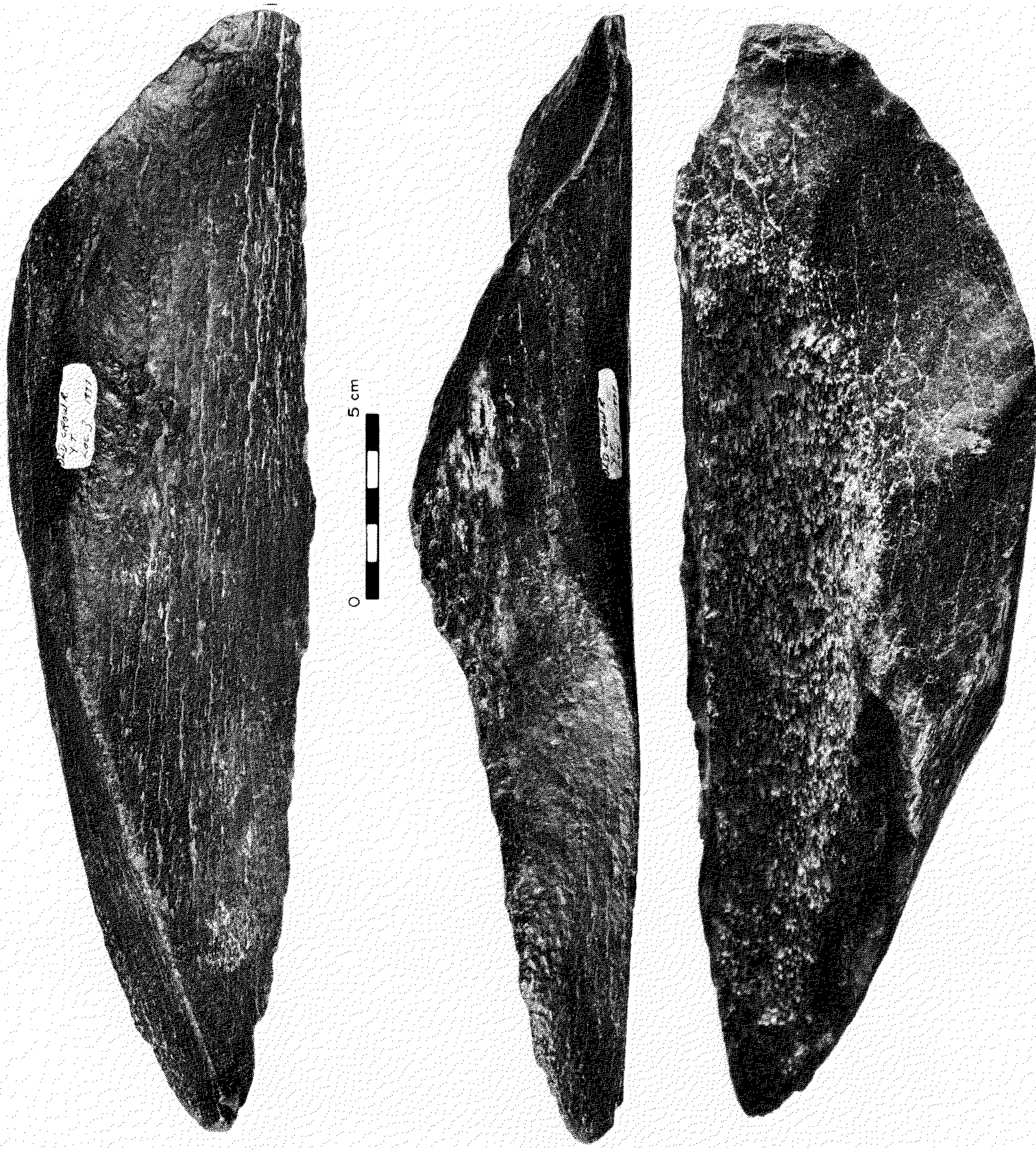

FIG. 2. Three views of a long bone fragment of a mammoth (Proboscidea cf. *Mammuthus* sp.) that was fractured when fresh by man. The point of impact was probably at the blunter end (top). Old Crow River (Loc. 3), Yukon Territory.

RADIOCARBON DATES ON QUATERNARY MAMMAL REMAINS

Homo sp. (man; indirect evidence)

In order to obtain a better idea of the geochronological range of bone evidently broken by man from Yukon Quaternary deposits, two specimens were selected for dating from my 1977 collections made in the Dawson and Old Crow areas. Neither specimen was found *in situ.*

The first, a long bone fragment referred to mammoth (Proboscidea cf. *Mammuthus* sp.) from Old Crow River (Old Crow Loc. 3; M*k* V*l*-3:9; Fig. 1:2) was stained blackish brown on the surface and measured approximately 288 mm long x 77 mm wide up to 32 mm thick along the fracture. The bone was fractured when fresh by man, according to R.E. Morlan (pers. comm. 1980; Morlan, 1980: 99-100, 295, 298). The point of impact was probably at the blunter end (Fig. 2). Broad, smooth spiral fracture surfaces having the same colour as the outer surface were seen distal to the probable point of impact. The specimen yielded a date of 29 300 ± 1200 B.P. (I-11050), which places it near the earliest part of the 25 000 to 29 000 B.P. time range based on three earlier radiocarbon dates on bone artifacts from Old Crow Loc. 14N (M*l* V*l*-1) (Irving and Harington, 1973, Table 1). Some scientists believe the latter dates are unreliable because they were based on bone apatite rather than bone collagen. [Hassan *et al.* (1977:364) give reasons why bone apatite may yield unreliable dates.] This date is important because it is on collagen from a bone that, although not found in place in an ancient human occupation site, was evidently broken when fresh by man before the peak of the last (Wisconsin) glaciation (arbitrarily considered here to cover the period 15 000 to 25 000 B.P.).

The second, a right tibia shaft of a bison (*Bison* sp.) from upper Hunker Creek (Dawson Loc. 16; K*l* V*i*-1); Fig. 1:4) was stained pale yellowish brown on the surface and measured approximately 222 mm long x 61 mm wide x up to 13.5 mm thick along the fracture. The bone was fractured when fresh, possibly by man, according to R.E. Morlan (pers. comm. 1980). It displayed complex sets of spiral fractures (Fig. 3). The point of impact of the blow causing the fractures

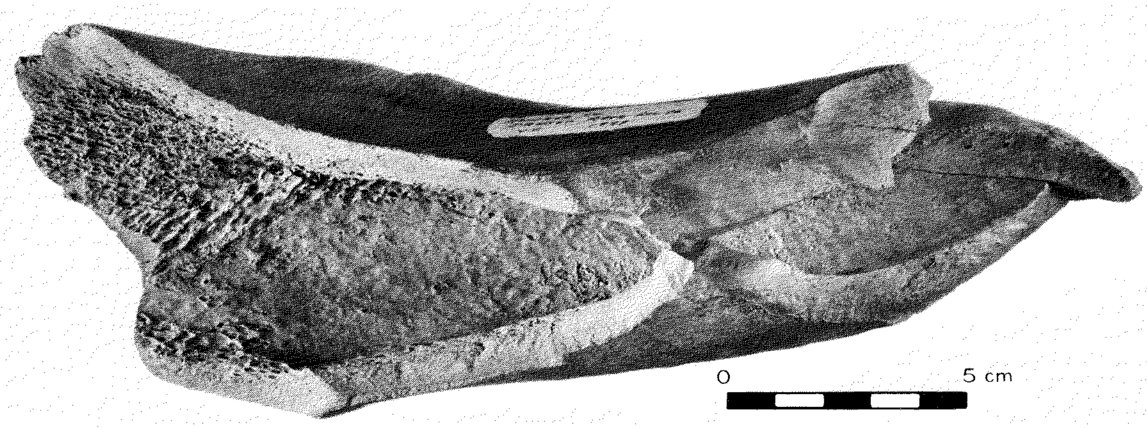

FIG. 3. Right tibia shaft of a bison (*Bison* sp.) from upper Hunker Creek (Dawson Loc. 16), Yukon Territory. Note complex spiral fracture.

could not be clearly defined. The specimen yielded a date of 1465 ± 85 B.P. (I-11051), suggesting that it was derived from a wood bison (*B. bison athabascae*), because another wood bison specimen, including a complete horncore, collected from Quartz Creek (Dawson Loc. 6) had given a date of 1350 ± 95 B.P. (I-5404) (Harington, 1977:855, Fig. 80). Therefore, people may have butchered wood bison in this area as late as about 1300 years ago.

Arctodus simus yukonensis (Yukon short-faced bear)

A partial right humerus of this species was collected in 1979 on lower Hunker Creek, Yukon Territory (Dawson Loc. 10; Fig. 1:4). The fossil lacked the proximal third and was damaged in the medial epicondylar region. As preserved, it was approximately 460 mm long, had a minimum shaft width and depth of 59 mm x 54 mm, and is 43 mm in minimum depth across the articular surface (Fig. 4). Its surface is tan with darker patches. I collected the specimen *in situ* in

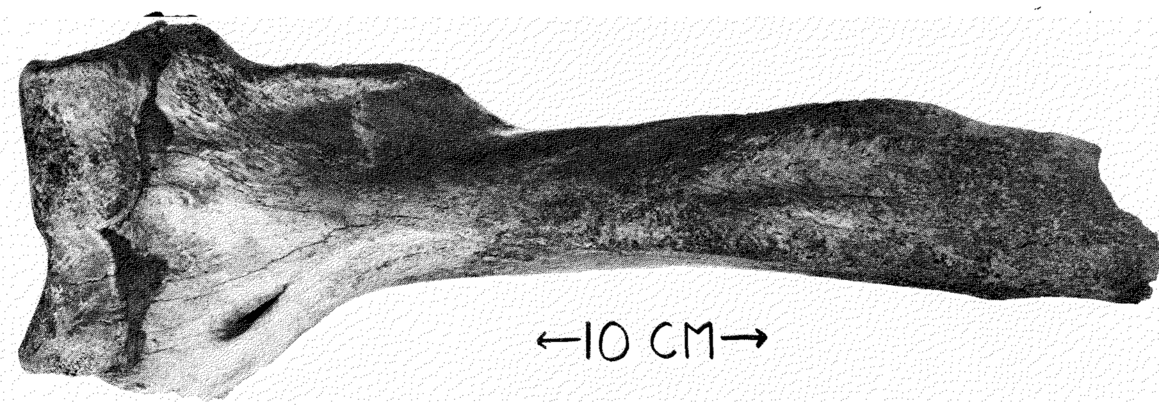

FIG. 4. Anterior view of a right humerus, lacking the proximal end, of a Yukon short-faced bear (*Arctodus simus yukonensis*) from lower Hunker Creek (Dawson Loc. 10), Yukon Territory.

frozen organic silt 30 mm above the surface of the gold-bearing gravel unit. The bone yielded a date of 29 600 ± 1200 B.P. (I-11037).

A map (Harington, 1973, Fig. 2) suggests that this rather lanky, highly carnivorous bear (Kurtén, 1967:50) occupied high, well-drained grasslands from Mexico to Alaska during the Pleistocene. In Canada, *A. simus* is represented by 16 specimens from the Old Crow Basin, Yukon Territory, three specimens [including the largest known cranium, NMC 7438 (Lambe, 1911; Harington and Clulow, 1973, Fig. 5-7)] from the Dawson area, Yukon Territory, and a single specimen from Lebret, Saskatchewan (Harington, 1973). Most of the Yukon fossils are very darkly stained, suggesting a pre-late Wisconsin age, although NMC 7438 could be of late Wisconsin age. The Lebret specimen appears to be of Sangamon interglacial age (Harington, 1977:391).

This radiocarbon date is significant because it is the first on this species from northern North America, and because it indicates that short-faced bears had reached the Alaska-Yukon region from southern North America by mid-Wisconsin time. Perhaps the extinction of *A. simus* toward the close of the

Wisconsin glaciation was partly because of the earlier extinction of its large herbivorous prey and partly because of increased competition with brown bears (*Ursus arctos*) (Kurtén and Anderson, 1974:4).

Mammuthus columbi or *M. armeniacus* (steppe mammoth)

In 1975, a partial mandible of a mammoth with a complete, well-worn right third molar (RM_3) (NMC 29270) was collected by J. Lacross at Quartz Creek, Yukon Territory (Dawson Loc. 8; Fig. 1:4). It lacks most of the right ascending ramus, and the posterior half of the left ramus. Part of the socket for LM_3 and some tips of its roots were preserved. Fourteen (only the roots of the anteriormost plate remain) of an estimated total of 16 enamel plates of RM_3 are worn (Fig. 5). In degree of wear on the occlusal surface, the tooth best matches

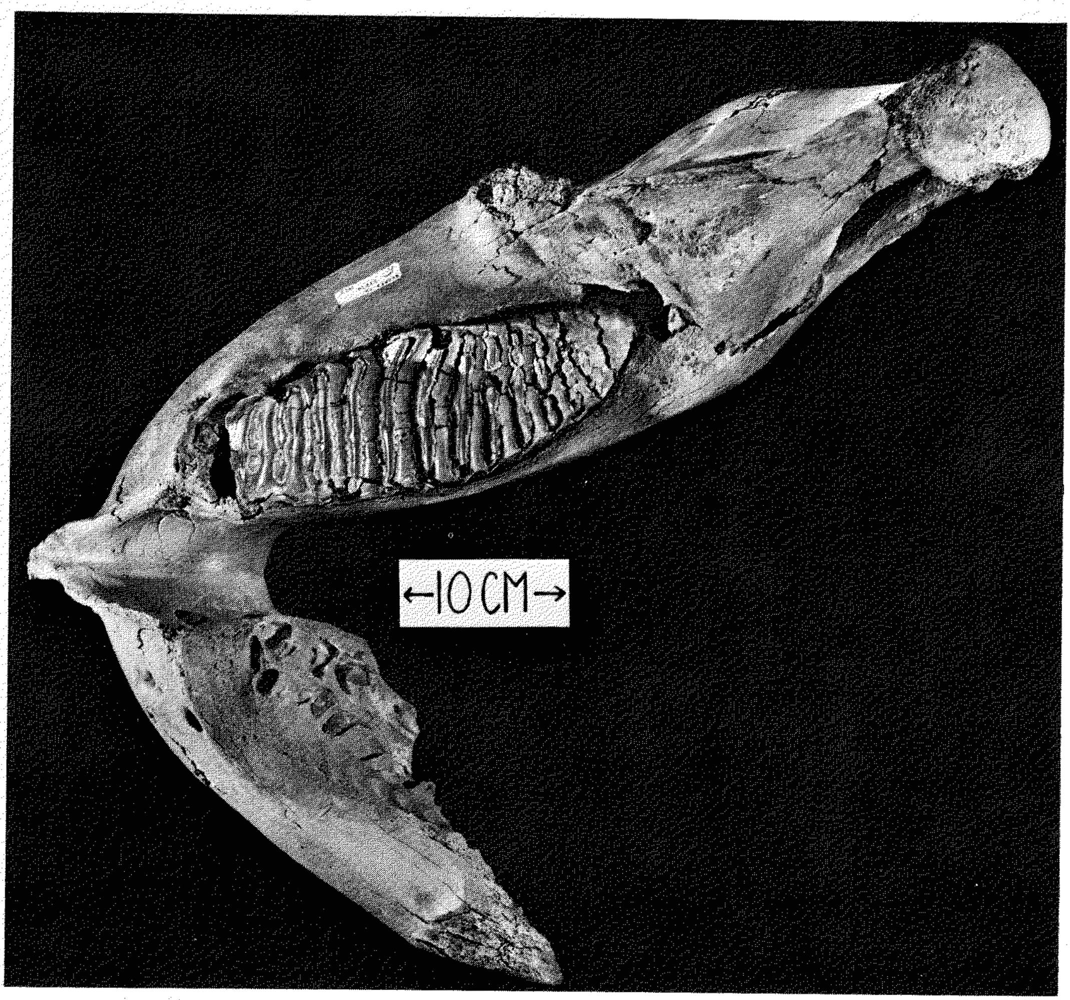

FIG. 5. Occlusal view of a partial mandible with third molar (RM_3) of a steppe mammoth (*Mammuthus columbi* or *Mammuthus armeniacus*; NMC 29270) from Quartz Creek (Dawson Loc. 8), Yukon Territory.

Table 1. Measurements of a Pleistocene steppe mammoth (*Mammuthus columbi* or *M. armeniacus*) M_3 from the Dawson area, Yukon Territory compared to those of Eurasian steppe mammoths (*M. armeniacus*) and woolly mammoths (*M. primigenius*)

Specimens	Measurements (mm)*						
	1	2	3	4	5	6	7
Mammuthus columbi or *M. armeniacus* NMC 29270 Dawson Loc. 8, Y.T.	16e	265.0e	94.8	—	5.0	2.2	—
*Mammuthus armeniacus*** (Maglio, 1973, Table 31)							
M(σ)	18.3(2.0)	298.2(32.8)	87.6(11.5)	139.8(17.9)	6.3(0.6)	2.3(0.3)	165.9(21.9)
OR	15.0-21.0	236.0-340.0	70.3-113.0	96.0-160.0	5.0-7.2	1.8-3.0	133.2-206.6
N	15	14	21	21	22	20	16
Mammuthus primigenius (Maglio, 1973, Table 32)							
M(σ)	21.8(1.9)	267.4(44.1)	87.6(10.9)	137.8(20.9)	8.5(1.1)	1.5(0.3)	159.7(10.8)
OR	20.0-25.0	207.0-320.2	65.0-100.0	123.0-184.1	6.8-10.2	1.3-2.0	137.8-189.2
N	5	5	8	8	8	8	8

*Measurements follow Maglio (1973).
1. Plate (lamella) number. 2. Length. 3. Width. 4. Height. 5. Lamellar frequency (number of plate-cement units in a 100 mm interval). 6. Enamel thickness (average). 7. Hypsodonty index (H/W x 100).
M = mean. σ = standard deviation (not included where fewer than 4 specimens are in the sample). OR = observed range. N = number in sample. e = estimated.
**Data on Eurasian steppe mammoths are used, as comparable data on North American steppe mammoths (*M. columbi*) have not been published.

Laws' (1966, Fig. 6, Table 4) age group XXVI for African elephants (*Loxodonta africana*) — or those estimated to be about 50 years old. Therefore, the mammoth was old when it died. The most significant measurements of the tooth (Table 1), which I consider to be plate number, lamellar frequency and enamel thickness, show that NMC 29270 is best referred to a steppe mammoth — either an American steppe mammoth (*M. columbi*) or a Eurasian steppe mammoth (*M. armeniacus* = *M. trogontherii*) (Table 1). Unfortunately, there is no authoritative published study explaining how teeth of American steppe mammoths differ from those of the Eurasian species, and either or both could have reached eastern Beringia. The confusion of nomenclature in the later North American mammoths is succinctly stated by Maglio (1973:62). NMC 29270 yielded a date of 29 190 ± 400 B.P. (I-10971), indicating that some steppe mammoths occupied eastern Beringia during the peak of the Wisconsin glaciation along with the more abundant woolly mammoth (*M. primigenius*). This is the first radiocarbon date on a steppe mammoth from eastern Beringia.

American steppe mammoths reached heights of about 3.5 m at the shoulder, and seem to have been adapted mainly to cool grasslands with some shrub or scattered trees (Harington *et al.*, 1974:300). Apparently *M. columbi* was common in the southern regions of western Canada during the last (Sangamon) interglacial. A date of 12 000 ± 200 B.P. (S-246) on *M. columbi* bone from a skeleton preserved at Kyle indicates that this species lived in southern Saskatchewan toward the close of the Wisconsin glaciation (Harington and Shackleton, 1978:1281). The species could have reached eastern Beringia from the south by a route east of the Rocky Mountains ("western corridor") or possibly through the interior of British Columbia (Harington *et al.*, 1974:302).

Eurasian steppe mammoths exceeded all other mammoths in size, reaching heights of about 4.5 m at the shoulder (Kurtén, 1968:136). They ranged from Spain to northeastern Siberia (Chukotka), and were characteristic of Eurasian middle Pleistocene faunas (Kahlke, 1973:2). Presumably this species could have entered eastern Beringia from western Beringia (unglaciated eastern Siberia) during the Mindel (= ?Kansan) glaciation or early in the Riss (=Illinoian) glaciation via the Bering Isthmus (land exposed in the Bering Strait region due to a drop in worldwide sea level).

Bison sp. (bison)

A most intriguing date is that on a partial right bison hornsheath (NMC 17505) collected by V. Rampton and J.G. Fyles on the eastern shore of Baillie Islands, Northwest Territories in 1969. It is referred to *Bison* sp., and appeared to be similar in size and shape (e.g. tip curved backward) to specimens of *B. crassicornis* from Yukon Pleistocene deposits. I examined and measured a similar specimen in 1973 that had been collected on the beach at Pauline Cove, Yukon Territory — another offshore island about 400 km west of Baillie Islands. NMC 17505 was iron-stained and, as preserved, was 425 mm long x about 85 mm in diameter at a point some 200 mm from its tip. The specimen yielded a date of 1810 ± 90 B.P. (I-5407).

Two other specimens referred to *Bison* sp., a right humerus (NMC 17503) and a right mandible with teeth (RP_3-RM_3) were collected at the same locality. I hope to visit this site in order to: (a) collect bison specimens identifiable to species; (b) attempt to confirm this relatively late date for survival of bison so far north. The records from Baillie Islands are the northermost (70°35′N) for bison in Canada.

Saiga tatarica (saiga antelope)

Saiga antelope remains are usually considered to be extremely rare in North America, therefore it is worth knowing that nine specimens have been recorded (six from central Alaska, two from northern Alaska and one from Baillie Islands, Northwest Territories). From a stratigraphic viewpoint, Péwé (1975:93) considers that most of the Alaskan saiga fossils are probably of Wisconsin age, but that a few may date to the penultimate (Illinoian) glaciation.

A deeply stained right horncore with partial frontal region of *S. tatarica* (USGS M1422; Table 2, Fig. 6) collected by Dana C. Linck on the Usuktuk River (Fig. 1:1) some 150 km south of Barrow, Alaska in 1978 yielded a date of 37 000 ± 990 B.P. (GSC-3050). The date suggests that saigas occupied northern Alaska during the mid-Wisconsin, perhaps having migrated there from Siberia when a land connection existed in early Wisconsin time, if indeed they had not crossed the Bering Isthmus earlier, during the Illinoian glaciation. The date appears to be the first direct date on a saiga fossil.

This specimen lends credence to a suggested late Pleistocene migration of saigas eastward across the Bering Isthmus to northwestern Canada via the Arctic Slope of Alaska (Fig. 7). Saiga antelope remains seem to be useful paleoenvironmental indicators suggesting the presence of steppe-like vegetation, generally low, flattish terrain, rather arid climatic conditions and, above all, shallow snow cover (Sher, 1968:1259; Harington, 1979:35).

Ovibos moschatus (tundra muskox)

Four radiocarbon dates on tundra muskox specimens lie within postglacial time (the last 10 000 years). A posterior cranial fragment of an adult male collected by K. Djukastein prior to 1967 at Brewer Creek, Yukon Territory (Brewer Creek Loc. 1; Table 3, Figs. 1:5; 8) yielded a date of 2830 ± 100 B.P. (I-3568). The specimen, which is in Mr. Djukastein's possession, was found beneath about 30 cm of black muck.

A more complete cranium with left hornsheath of an old male (NMC 36137; Table 3, Figs. 1:3; 9) collected by W. Yaremcio in 1978 at Miller Creek, Yukon Territory (Sixtymile Loc. 7) yielded a date of 3280 ± 90 B.P. (I-10985). No trace of lingual styles are seen on the upper molars, a feature that commonly separates the Canadian Arctic Islands subspecies (*O. m. wardi*) from the mainland subspecies (*O. m. moschatus*). However, the fact that the cranium represents an old individual may militate against the preservation of this character. Peaty material lodged in the bone cavities suggests that the specimen was preserved in a bog deposit near the surface at this site.

These dates — the first direct dates on tundra muskox bone from the Yukon — indicate that the species lived in tundra-like surroundings in the western Yukon

Table 2. Comparative measurements of Usuktuk River specimen with other Pleistocene and Recent adult male saiga (*Saiga tatarica*) crania

Specimens	Measurements (mm)*					
	1	2	3	4	5	6
USGS M1422 Usuktuk R., Alaska	29.2	29.4	105.0	35.8	32.6	125.0⁺(130.0e)
Pleistocene, North America						
M(σ)	28.8(3.4)	26.5(2.5)	108.6(10.3)	34.9(2.9)	30.1(3.7)	129.7⁺
OR	25.2-33.9	24.0-30.0	98.0-125.0	31.4-39.5	26.2-35.5	108.0⁺-149.0⁺
N	4	4	4	4	4	3
Pleistocene, USSR						
M(σ)	29.5(1.3)	26.9(1.3)	103.4(5.9)	35.8(2.5)	31.6(2.9)	148.5(16.6)
OR	28.1-32.0	24.9-28.8	93.0-114.0	32.5-41.1	27.0-36.8	122.0-164.0
N	8	8	7	8	8	4
Recent, USSR AND Zoos						
M(σ)	27.5(2.0)	26.5(1.7)	98.8(5.5)	33.2(2.3)	29.0(1.3)	128.7
OR	24.2-30.3	23.7-28.6	93.0-106.0	31.2-36.7	27.6-30.5	100.0-172.0
N	8	8	4	4	4	3

*1. Anteroposterior diameter of horncore pedicel. 2. Mediolateral diameter of horncore pedicel. 3. Circumference of horncore at burr. 4. Anteroposterior diameter of horncore at burr. 5. Mediolateral diameter of horncore at burr. 6. Length of horncore, burr to tip along anterior surface. M = mean. σ = standard deviation (not included where fewer than 4 specimens are in the sample). OR = observed range. N = number in sample. e = estimated.

until about 3000 years ago. Evidently, about this time, *Ovibos* also died out in the northern Yukon and Siberia. However, the last tundra muskoxen native to Alaska are believed to have been killed west of Barrow about 1858 or 1865 (Harington, 1970:4-6).

A right horncore of a female with an attached portion of the right side of the braincase (NMC 34511; Table 3, Fig. 1:7) was collected by R. Popko and D.R. Gray in 1976 approximately 16 km west of Goodsir Inlet on Bathurst Island, Northwest Territories. It was deeply iron-stained, apparently having been washed into a creek bed from sediments nearby. The specimen yielded a date of

FIG. 6. **Right side view of a right horncore with attached cranial bone of a saiga antelope (*Saiga tatarica*; USGS M1422) from Usuktuk River, Alaska.**

6725 ± 130 B.P. (I-10919). Much of Bathurst Island was ice-free some 9000 years ago (Blake, 1964:5; 1974:237), and evidence suggests that both marine mammals (Harington, 1975:249, Fig. 1) and muskoxen had reached the area about 7000 years ago. Muskoxen could have occupied Bathurst Island continually from about 7000 B.P. to the present time, as indicated by a date of 2950 ± 90 B.P. (I-9996) on a right mandible with teeth (RP_2-RM_3) of *O. moschatus*. The teeth

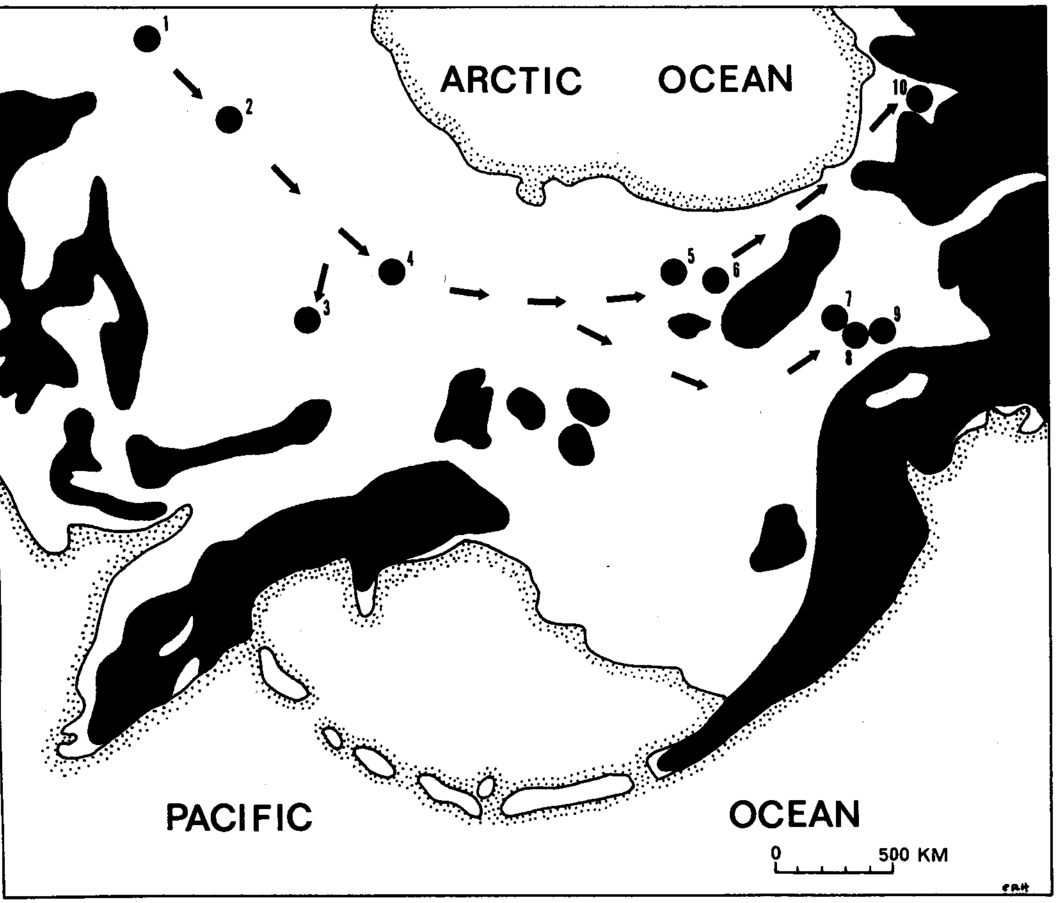

FIG. 7. Generalized map of Beringia during the peak of the last (Würm/Wisconsin) glaciation showing localities of saiga (*Saiga tatarica*) fossils (black dots). Arrows indicate possible lowland routes used by saigas moving from western Beringia to eastern Beringia via the broad exposed plains of the Bering Isthmus (right of centre). The shoreline arbitrarily follows the -180 m isobath. Glaciated areas are shown in black, ocean shorelines are stippled and land is white. Map modified from Hopkins (1972), and Harington (1979, Figure 12). *Saiga* fossil localities: 1. Near Kayaga Lak, Lena Delta, USSR (Sher, 1968). 2. Bolshoi Lyakhov Island, New Siberian Islands, USSR (Sher, 1968). 3. Near Kolymskaya, Kolyma River, USSR (Sher, 1968). 4. Ayon Island, Chukotka, USSR (Agadjanian, 1979). 5. Kuk River, Alaska (Harington, 1979). 6. Usuktuk River, Alaska (this paper). 7. Lillian Creek near Livengood, Alaska (Frick, 1937). 8. Cripple Creek near Fairbanks, Alaska (Harington, 1979); Gold Hill near Fairbanks, Alaska (Harington, 1979); Gilmore Creek near Fairbanks, Alaska (Frick, 1937); Goldstream Creek near Fairbanks, Alaska (Harington, 1979). 9. Banner Creek near Big Delta, Alaska (Harington, 1979). 10. Baillie Islands, Northwest Territories (Harington, 1971).

FIG. 8. Dorsal view of posterior cranial fragment of a tundra muskox (*Ovibos moschatus*) from Brewer Creek (Loc. 1), Yukon Territory.

were well worn, so the specimen represented an adult. The mandible (Table 4, Figs. 1:7; 10) was collected from a peat hummock by J.S. Tener in 1973. The locality is approximately the same as that of NMC 34511.

Perhaps muskoxen survived the Wisconsin glaciation in a refugium on western Banks Island and spread thence to the remainder of the Canadian Arctic Islands and Greenland. Dates of > 34 000 B.P. (S-288) (Maher, 1968:261) on a metapodial from Bernard River, and 10 660 ± 170 B.P. (GSC-240) (Dyck *et al.*, 1965:15) on peat containing a pelvic bone (NMC 11337) from Thesiger Bay indicate that tundra muskoxen occupied western Banks Island in late Wisconsin time and earlier.

Table 3. Measurements of postglacial tundra muskox (*Ovibos moschatus*) crania from the Yukon Territory and the Northwest Territories

	Specimens		
Measurements (mm)*	NMC 36137, Sixtymile Loc. 7, Y.T., ♂	Uncatalogued, Brewer Creek Loc. 1, Y.T., ♂	NMC 34511, Bathurst I., N.W.T., ♀
1	212.7	203.8	55.3
2	82.0	—	37.0
3	170.0	—	90.0
4	310.0	—	170.0
5	155.3	154.0	—
6	339.0	—	—
7	138.9	145.0	—
8	126.0	—	—
9	90.3	—	—
10	115.6	—	—
11	30.0	—	—
12	32.6	—	—
13	197.0	—	—
14	74.2	—	—
15	60.8	—	—
16	163.8	—	—
17	146.5	—	—
18	90.7	—	—
19	74.0	—	—
20	99.0	—	—
21	290.3	—	—
22	231.6	—	—
23	440.0a	—	—
24	368.0	—	—
25	690.0e	—	—

*1. Anteroposterior diameter of horncore at base (maximum). 2. Dorsoventral diameter of horncore (proximal). 3. Length of horncore on lower curve (ridge to tip). 4. Length of horncore on upper curve (middle of horncore base to tip). 5. Width of cranium at constriction between horncores and orbits. 6. Minimum width between horncore tips. 7. Width of cranium at constriction above nuchal crest. 8. Height from dorsal margin of foramen magnum to midline on dorsal surface of cranium. 9. Height from dorsal margin of foramen magnum to top of nuchal crest. 10. Height from ventral margin of foramen magnum to top of nuchal crest. 11. Height of foramen magnum. 12. Width of foramen magnum. 13. Maximum width of cranium above auditory meatus. 14. Basioccipital width (across posterolateral margins). 15. Minimum width of basioccipital. 16. Minimum width across posterior zygomatic process. 17. Alveolar length (P^2-M^3). 18. Alveolar length (M^1-M^3). 19. Palatal breadth at P^2 (inside). 20. Palatal breadth at M^3. 21. Width across posterior of orbits. 22. Width across anterior of orbits at notch. 23. Length from nuchal crest to anterior of nasals. 24. Length from lower lip of foramen magnum to anterior alveolar margin of P^2. 25. Hornspread (tip to tip measurement of hornsheaths, estimated from the half measurement). a = approximate, e = estimated.

CONCLUSION

A collagen date of approximately 29 000 B.P. on a mammoth long bone, evidently fractured when fresh by man, supports earlier evidence based on bone apatite dates that people occupied the Old Crow Basin of the northern Yukon between about 25 000 and 29 000 years ago.

Yukon short-faced bears occupied the Dawson area of the Yukon during the mid-Wisconsin about 30,000 years ago. These large, cursorial, highly carnivorous bears evidently died out in North America toward the close of the last glaciation.

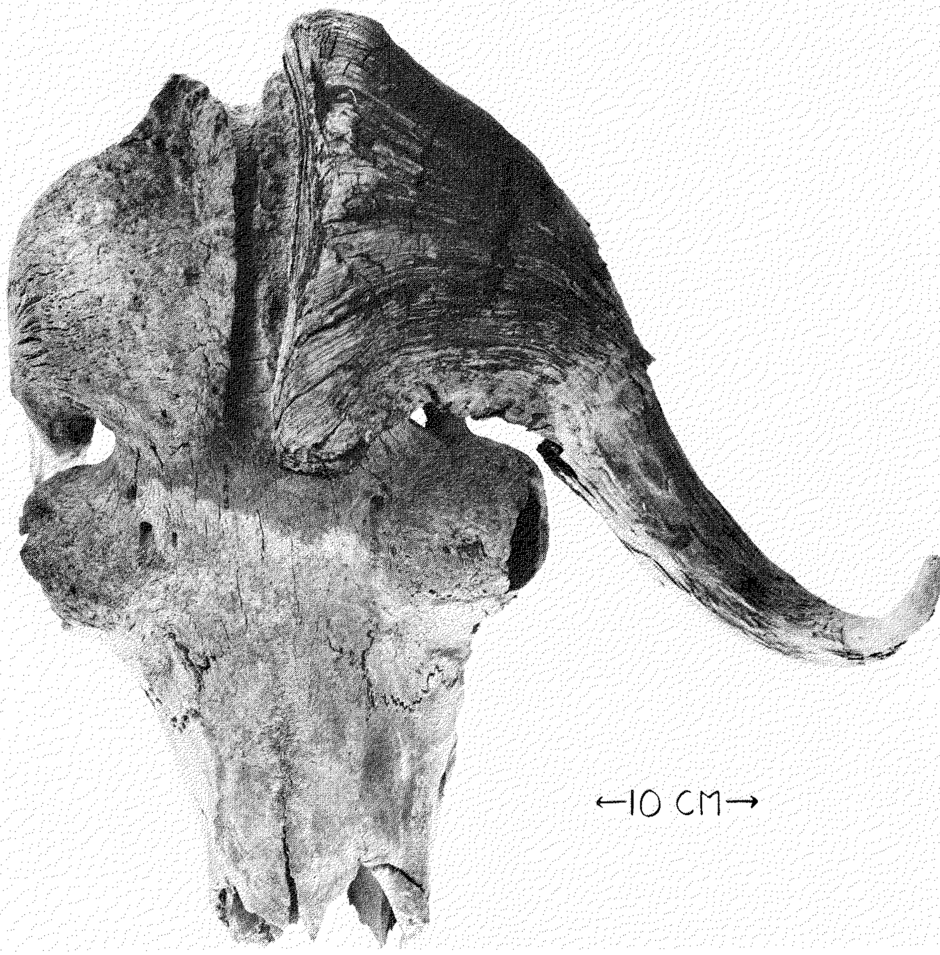

FIG. 9. Dorsal view of cranium with left hornsheath of a tundra muskox (*Ovibos moschatus*; NMC 36137) from Miller Creek (Sixtymile Loc. 7), Yukon Territory.

Although remains of steppe mammoths have been described previously from the Yukon (e.g. Harington, 1977:567-577), the first radiocarbon-dated specimen, from the Dawson area of the Yukon, indicates that some steppe mammoths occupied eastern Beringia during the peak of the Wisconsin glaciation about 20 000 years ago.

Bison occupied the Baillie Islands area of the Northwest Territories about 2000 years ago. This is the northernmost locality in Canada from which bison remains have been recorded. Their remains have also been found on Herschel Island, Yukon Territory, approximately 400 km west of Baillie Islands.

The first direct date on a saiga antelope fossil indicates that the species was present in northern Alaska during the mid-Wisconsin about 37 000 years ago.

Table 4. Measurements of a postglacial tundra muskox (*Ovibos moschatus*) mandible from Bathurst Island, Northwest Territories.

Specimen	Measurements (mm)*							
	1	2	3	4	5	6	7	8
Uncatalogued Bathurst I., N.W.T.	141.2	66.6	26.7	16.3	46.7	25.4	59.6	28.0

*1. Alveolar length P_2-M_3. 2. Minimum length from anterior of P_2 alveolus to posterior of mental foramen. 3. Depth of mandible at shallowest point on diastema. 4. Width of mandible at shallowest point on diastema. 5. Depth of mandible below centre of M_3. 8. Width of mandible at centre of M_3.

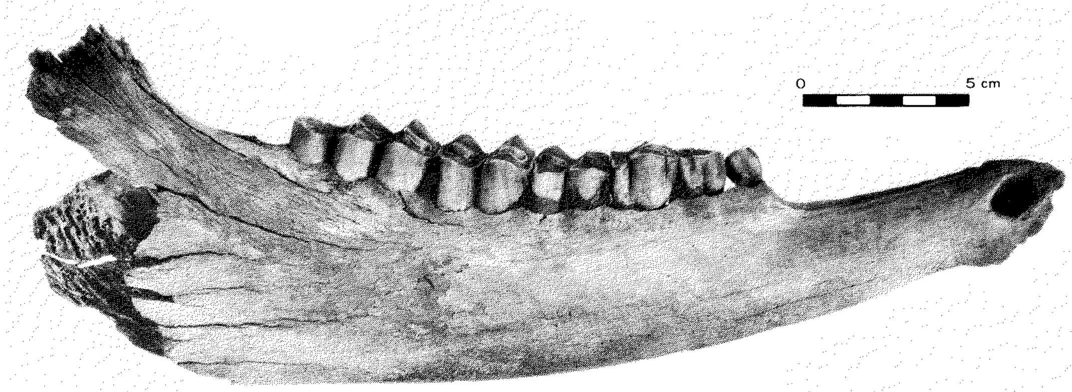

FIG. 10. **Right side view of a right mandible lacking the ascending ramus and with cheek teeth (RP_2-RM_3) of a tundra muskox (*Ovibos moschatus*) from the Goodsir Inlet area, Bathurst Island,** Northwest Territories.

Probably steppe-like vegetation and rather arid climatic conditions, including shallow winter snow cover, prevailed in the region then.

Herds of tundra muskoxen had reached central Bathurst Island nearly 7000 years ago, and seem to have remained in that region from then until the present time. Radiocarbon dates on partial skulls from Brewer Creek and Miller Creek suggest that tundra muskoxen survived in the Yukon Territory until about 3000 years ago.

Although radiocarbon dates indicate that large-horned bison (*Bison crassicornis*), horses (*Equus* sp.), woolly mammoths (*Mammuthus primigenius*) and steppe mammoths (*Mammuthus columbi* and/or *Mammuthus armeniacus*), caribou (*Rangifer tarandus*), camels (*Camelops hesternus*), helmeted and Sargent's muskoxen (*Symbos cavifrons* and *Boötherium sargenti;* probably the latter is the female of the former), Dall sheep (*Ovis ?dalli*) and American lions (*Panthera leo atrox*) lived in eastern Beringia during the peak of the last glaciation (see references at end of Introduction), questions remain as to the overall geochronological ranges of these and other species. Some examples follow. There are no dates on American badger (*Taxidea taxus*), American mastodon (*Mammut americanum*), giant beaver (*Castoroides ohioensis*), or Jefferson's ground sloth (*Megalonyx jeffersonii*) fossils.

When did they first reach eastern Beringia from the south, and when did they die out in the former region? Did wapiti (*Cervus elaphus*) occupy eastern Beringia during the peak of the last glaciation? So far, radiocarbon dates suggest that they were most abundant toward the close of the last glaciation and in postglacial time (Harington, 1980:181). There are no radiocarbon dates on moose (*Alces alces*) from eastern Beringia. Did they live in eastern Beringia during the peak of the Wisconsin glaciation? Surely tundra muskoxen (*Ovibos moschatus*) lived there then, but, as yet, there are no radiocarbon dates to prove it. An effort should be made to fill such gaps in the geochronological record of Quaternary mammals in northern North America.

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