SMITHSONIAN MISCELLANEOUS COLLECTIONS

PART OF VOLUME LI

SMITHSONIAN EXPLORATION IN ALASKA IN 1907 IN SEARCH OF PLEISTOCENE FOSSIL VERTEBRATES

WITH THIRTEEN PLATES

BY

CHARLES W. GILMORE

Of the United States National Museum

No. 1807

CITY OF WASHINGTON

PUBLISHED BY THE SMITHSONIAN INSTITUTION

1908

WASHINGTON, D. C.
PRESS OF JUDD & DETWEILER, INC.
1908

SMITHSONIAN EXPLORATION IN ALASKA IN 1907 IN SEARCH OF PLEISTOCENE FOSSIL VERTEBRATES. SECOND EXPEDITION

By CHARLES W. GILMORE

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I. Introduction

Since the discovery of extinct vertebrate remains in Alaska by Otto von Kotzebue, in 1815, while on "A Voyage of Discovery into the South Sea and Beering Straits," much interest has been manifest regarding the occurrence and cause of extinction of the Pleistocene

fauna of this northern country; and, although various expeditions have collected specimens and much has been written concerning them, it was not until 1904, when the first Smithsonian expedition was organized, that the subject was taken up in a systematic manner. This expedition was conducted by Mr. A. G. Maddren, whose report has now been some years before the public.[1] It was planned, at that time, to carry on the exploration for two or more consecutive seasons, but it was not until 1907 that the present writer was detailed to continue the work so well begun three years previous. The report herewith presented gives the results of this second trip, undertaken, as was the first, under a grant made by the Secretary of the Smithsonian Institution at the suggestion of Dr. George P. Merrill, Head Curator, Department of Geology, U. S. National Museum.

The writer's instructions were, in part, as follows:

"You are hereby authorized to proceed to Alaska, on or about May 22, 1907, for the purpose of exploring the regions herein described, with a view to securing remains of large extinct vertebrate animals and investigating the causes which have led to their extinction.

"While it is expected that you will exercise your best judgment in carrying out the details of your itinerary, it is suggested that on leaving the city of Washington you proceed to Seattle, securing at that point the necessary outfit, excepting provisions, and arranging for the services of a competent assistant.

"On leaving Seattle you will go by way of Skagway, Alaska, to White Horse, and thence down the Yukon River to Rampart, where the first stop will be made and the area explored, from which certain bison skulls now in the Museum collections have been obtained. You will then proceed to Fort Gibbon, exploring the territory in the direction of the Nowi River—the so-called "Bone Yard" region—and from this point either by steamer or canoe, to Hall Rapids, investigating the areas on both sides of the Yukon as far as Andreafski.

"Should the explorations so far outlined not yield results warranting your delay, it will then be advisable for you to proceed, provided the season be not too far advanced, by the most expeditious route to Kotzebue Sound, and make similar investigations in the areas drained by the Buckland River.

"Should you at any point discover material of such importance as to justify the making of immediate excavations, you are authorized to undertake such work, though bearing in mind that it may be advisable to first make a reconnaissance of the entire field, leaving the work of actual excavation until the following year. This is a matter, however, which must be left to your discretion.

"It is expected that the explorations herein authorized will probably consume not more than four months of the present year."

[1] Smithsonian Exploration in Alaska in 1904 in Search of Mammoth and Other Fossil Remains. Smithsonian Misc. Coll., vol XLIX, pp. 1–117.

II. Itinerary

In compliance with the above instructions the writer left Washington, D. C., May 22, for Seattle, Washington. At this place a canoe and the necessary camp equipment were purchased and shipped to Rampart, Alaska, where the first active field work was to be done. Some time prior to leaving Washington the services of Mr. Benno Alexander were engaged. His several seasons' experience with various scientific expeditions in the different parts of Alaska made him a very desirable companion and an efficient assistant.

The party consisted of Mr. Alexander and the writer, the plan being, as explained in the instructions, to employ such help from time to time as might be necessary.

On May 30 we took passage on the steamer *Jefferson,* arriving at Skagway, Alaska, June 4. It was learned upon our arrival there that all accommodations on the first boat down the Yukon had been engaged and that it would be best to remain in Skagway until the next boat, which was scheduled to sail from White Horse June 12. On June 10 we left Skagway over the White Pass and Yukon Railroad for White Horse, Northwest Territory, Canada, the terminus of the railway and head of steamboat navigation on the Yukon River. Here passage was secured on the river boat *White Horse,* which sailed June 12 and arrived in Dawson, Yukon Territory, Canada, June 14. This being a transfer point between the upper and lower river boats, we were again delayed because of inadequate accommodations, and it was not until June 22 that we left Dawson on the steamer *Sarah* for Rampart.

The delay at Dawson was profitably spent, however, in examining fossils in the possession of citizens of that place; in making inquiries concerning the occurrence of the fossils found in the Klondike region, and in visiting some of the localities on Bonanza Creek from which many of the specimens examined had been obtained. Scattered remains of Pleistocene mammals are commonly found in the diggings of this region, but the result of diligent inquiry regarding the finding of complete or partial skeletons in the mining operations conducted here were not encouraging. In only one instance were we told of the finding of an accumulation of bones such as would lead one to believe that an entire skeleton or any considerable part of the skeleton of a single individual had ever been found. The single case mentioned was that of the remains of a mammoth (*Elephas primigenius*) disinterred while sinking a shaft on Quartz Creek in March, 1904. The skull and tusks were recovered intact (see pl. VII),

but, according to our informant, although surrounded by a mass of other bones, no attempt had been made to preserve them.

We arrived at Fort Yukon, Alaska, the farthest point north in our journey, at midnight June 23, and Rampart (see pl. 1, fig. 1), the limit of steamer travel, was reached the evening of June 24. While here, the area drained by Little Minook Creek, Junior, where scattered mammal remains had been found, was visited. We were shown a few specimens taken out by miners, but the character of their occurrence here did not justify a continued search; so, after overhauling our camp outfit and laying in a supply of provisions, we loaded our canoe, and on the evening of June 28, left Rampart (see pl. 1, fig. 2) for our trip down the Yukon.[1] For thirty or forty miles below Rampart the Yukon flows between walls of the older rocks with a current of from five to six miles an hour, accelerating somewhat as the rapids are reached, near the lower end of what is known as the Lower Ramparts. The first alluvial deposits encountered of any considerable thickness after passing the rapids were on the right-hand bank some twelve miles above the mouth of the Tanana River. Imbedded in these were myriads of small land shells representing the living forms, *Euconulus trochiformis* Mtg. and *Succinea grosvenori* Lea, as determined by Dr. W. H. Dall. No vertebrate remains were found.

Fort Gibbon, a military post at the junction of the Tanana and Yukon rivers, was reached the evening of June 30. Here inquiry was made regarding localities on the lower river points and particularly relating to the Palisades, better known locally as the "bone yard,"[2] some thirty-five miles below. We were informed that scattered fossil remains were also to be found along the Tanana River and its tributaries; but, as the information was somewhat indefinite as to exact localities, it was decided not to investigate the reports at this time.

The first exposures of the elevated Yukon[3] silts were observed twenty miles below Fort Gibbon, where the bluffs are undermined by the river for a half mile or more, and although a careful examination was made for the presence of vertebrate fossils, none were found either in the face of the cliff or in the talus at its base. This point marks the beginning of the escarpment of which the Palisades, some

[1] The day we left Rampart a small tusk of the mammoth was brought in by some miners from Ray River, a locality from which Pleistocene mammals had not been previously reported.

[2] So named because of the great number of fossil bones found here.

[3] Spurr, J. E.: 18th Ann. Rept. U. S. Geological Survey, pt. III, p. 200.

Fig. 1.--RAMPART, ON YUKON RIVER, WHERE THE CANOE TRIP COMMENCED

Fig. 2.--EXPEDITION ABOUT TO LEAVE RAMPART

fifteen miles farther down, are a part. Covered with a dense vegetation, this level-topped bluff or "plateau terrace," as called by Russell,[1] extends along the left side of the river, only separated from it by a heavily timbered flood-plain at its base. The Palisades were reached July 3, and two days were spent in the studying of this historic locality. Some scattering fossil remains were found, of which a more detailed account will be given later.

The evening of July 5 camp was pitched some five miles below the Palisades, at the mouth of "Wasikakat" River, a small tributary flowing into the Yukon from the south. This stream, which enters the river through a low alluvial flat, was ascended some distance in the expectation of reaching a place where it had dissected the higher silts of the Palisade escarpment, but we were obliged to turn back because of its small size and the consequent difficulty in navigating it.

The mouth of the Nowitna River[2] was reached June 7. Inquiry concerning the occurrence of bones along this stream elicited the information from an intelligent Indian, who visited the headwaters of this stream occasionally on hunting excursions, that he had seen "big horns and other big bones" on the river bars, and a white trapper also told us of having picked up the "shank bone" of some large animal along the stream.

The information was stimulating, for it had been planned before leaving Washington that this stream should constitute one of the principal areas of search. Before leaving Fort Gibbon, three weeks provisions had been purchased in the expectation of the supply being sufficient for us to reach the headwaters of this stream, the length of which, as given by Dall,[3] is one hundred miles. We ascended the stream for nine days, and at the farthest point reached, estimated to be at least one hundred and seventy to one hundred and eighty miles from the Yukon, found it to be a considerable stream still (see pl. VI, fig. 1). It may be explained, however, that in a straight line the distance covered might not be half of this estimate. Trappers who have ascended its entire course estimate its total length as being two hundred and seventy-five to three hundred miles. The Nowitna enters the Yukon from the southwest, about seventy-five miles below the mouth of the Tanana. It rises on the eastern flank of the Kaiyuh Mountains, and we were told its headwaters are con-

[1] Russell, I. C.: Geological Society of America, vol. 1, 1890, p. 146.

[2] By a recent decision of the United States Geographic Board, this stream, which has been successively designated *Nowekaket, Nowikakat,* and *Nowi,* now becomes the *Nowitna.*

[3] Dall, W. H.: Alaska and Its Resources, 1870, pp. 87–282.

nected by portages with those of the Innoko and Kuskokwim rivers. There are no settlers living on this stream, although deserted winter cabins of the lonely trapper were passed several times on our journey. The stream flows by a tortuous, meandering course through a low alluvial valley covered with a dense growth of alder, willow, poplar, birch, and spruce. Its course forms a series of curves alternately sweeping from right to left, the channel being confined between banks of unconsolidated alluvium and silt from twelve to fifteen feet in height. It presents the typical effects of meandering erosion so well described by Maddren[1] in his description of the lower reaches of the Porcupine, *i. e.*, "cutting away the banks on the concave side and depositing the material removed lower down on the opposite side as bars" (see pl. VI, fig. 1). Often the water has cut in under the bank, which extends out over the stream like a great shelf. The trees growing on these undermined banks frequently lean far over and dip their tops in the water before being carried away. Large blocks of the bank, with its superincumbent vegetation, cave off into the stream, where they remain standing half submerged for long periods. Another feature of the undermined banks is the mantle of moss that hangs down from the top like a curtain (see pl. II, fig. 2), as if to hide the destruction the waters have wrought. This blanket is composed of the tenacious and closely woven moss and rootlets which everywhere cover the ground throughout these lowlands.

The banks are not sufficiently high to prevent their overflow by the spring floods, and the quantity of drift materials lodged in the growth on top of the banks indicates the great volume of water that flows down during the spring break up. Lanes through the dense undergrowth indicate recently abandoned watercourses, many of which hold ponds and sloughs. The erosional effects of ice are also seen in the scarred and abraded tree trunks and the deep gouges and gashes along the higher banks.

The bars on the lower part of the stream are low and frequently covered with stranded trees and other drift materials, but on the upper reaches where the bends are more abrupt, they are fairly clear of drift and furnish a good path for the "trackers." On some of the upper river bars the interstratified sands and gravels have been piled in great heaps nearly as high as the inclosing banks. In ascending the stream, the first two days good progress was made with the paddle against the clear but sluggish current, but on the third day, to facilitate our movements against the rapidly increasing current, a

[1] Maddren, A. G.: Smithsonian Misc. Coll., vol. XLIX, No. 1584, 1905, pp. 9–11.

Fig. 1.--CHARACTERISTIC CUT BANKS OF THE LOW FLOOD-PLAINS DEPOSITS OF THE NOWITNA RIVER

Fig. 2.--CUT BANKS ON THE YUKAKAKAT RIVER, SHOWING THE CHARACTERISTIC CURTAIN OF MOSS AND TURF

"cache" was made of all articles in the outfit not absolutely needed. Many times, in order to get over the swift places, "tracking" was resorted to, and a little later it was nearly all tracking and wading, as we alternately crossed from bar to bar at the bends in the river. Nearly every bar searched yielded something—either fragments or one or more complete elements of skeletons representing the mammoth, horse, bison, and other extinct forms.

The first of the older series of rocks encountered was some seventy to seventy-five miles above the mouth, where the stream has cut the end of a low-lying ridge on the right bank. This outcrop is composed of a mass of badly shattered schistose rock. Some fifteen miles farther up, the river again touches the end of a spur of this same ridge, exposing rocks of a similar nature.

Elevated beds of silt of perhaps fifty feet in height were observed twice in the ascent, but appeared local in character, and no fossils were found in them.

The ridge paralleling the right bank extended along the river to the most distant point reached by us and as far beyond as the eye could reach. It rises above the level of the stream from three hundred to five hundred feet, and is covered with a dense growth of trees.

The "Suletna,"[1] the first important tributary, enters the Nowitna from the west ninety miles above its mouth.

The ascent of the stream was continued until July 16, when an inventory of the remaining supplies showed only enough provisions to last until we should reach the Yukon again. On this account we were obliged to turn back. While the specimens found at the farthest point reached were not more abundant or better preserved than those collected farther downstream, it was hoped we could reach the very headwaters, to learn, if possible, the source of all the scattered bones found along its course, and it was with reluctance that we abandoned the search.

The Yukon was reached on the 19th of July, and "Mouse Point," a small trading post, the same day. After a short stop here our journey was continued to Kokrines, an Indian settlement where the Northern Commercial Company maintains a trading post. Some little time was spent here in overhauling our outfit, laying in supplies, packing fossils for shipment, etc.

An exposure of elevated silts on the right bank of the Yukon, some three miles above Melozi, a United States telegraph station, was

[1] The name by which this tributary is known to the Indians and trappers of this region.

the next area visited. Here members of the Tenth United States Infantry had unearthed the almost complete jaws of a mammoth shown the writer while at Fort Gibbon. On our visit, however, nothing was found.

We had been told by Indians, who are in a position to be best informed concerning these out-of-the-way places, that large bones were to be found on the Yukakakat River,[1] a tributary entering the Yukon some seventeen miles above the settlement of Louden.

The mouth of the Yukakakat was reached on July 23. The exploration of the stream occupied the best part of a week, but was without especial incident. The farthest point reached was estimated to be ninety miles from the mouth, and although the current on the upper reaches was swift, it was free from serious rapids and usually had along its shores bars sufficiently broad to give good "tracking."

The sluggish current of the first few miles of its meandering course flows through a low alluvial flat, heavily wooded and very similar in character to that part of the Nowitna. Farther up, however, the course of the stream is flanked by low ranges of hills which gradually converge and thus confine its wanderings to a shorter radius. On either side of the stream back of the low hills mountains were observed rising from one to two thousand feet in elevation.

In many places the growth on the banks was very sparse, and consisted principally of scattering clumps of alders, willow, and birch interspersed with a few stunted spruce trees. Here and there back from these low banks were many shallow lakes that furnish splendid breeding grounds for the geese and ducks which abound there On the uppermost part of the stream reached by us the shores were more heavily timbered and there were long straight stretches of river flowing between banks from ten to twelve feet in height, which in most cases were covered with undergrowth and a tall luxuriant growth of grass extending nearly down to the water's edge. At the bends the undermining of the concave side presented features similar to those observed on the Nowitna River.

The first elevated silts of any importance observed were some sixty miles upstream from the Yukon, where the river makes a right-angled bend. At a comparatively recent date the river at this point has changed its course, and at the time of our visit was not cutting the bluffs (see pl. III). It could undermine them only at an extremely high stage of water. These cliffs have almost perpendicular faces and are from eighty to one hundred feet in height, com-

[1] This stream appears to be known in Alaska as the *Yukakakat*, although Dall has indicated it on a map compiled by him in 1875 as the *Soonkakat*.

EXPOSURE OF ELEVATED SILTS ON THE YUKAKAKAT RIVER, 60 MILES FROM ITS MOUTH

posed mostly of fine light-colored, unstratified silts. Some sixty feet down from the top is a layer of coarse gravel conformable with the silt, which may represent the Palisade conglomerate of Spurr.[1]

This terrace at irregular intervals has been dissected somewhat by the drainage from above (see pl. III). In many places along the cut banks of the stream the silt was underlaid by a stratum of rather fine reddish-colored gravel. A section of these flood-plain deposits, when no complications occur, presents the following divisions in their natural order and approximate thickness:

Layer of peat	18 inches to 2 feet
Layer of fine silt	8 feet to 10 feet
Fine reddish gravel	4 feet to —

Dall[2] noted the occurrence of a similar fine reddish gravel in the deposits of Eschscholtz Bay.

A few scattered bones were collected on the bars below the deposits of elevated silts just described, but although continued search was made for two days upstream from this point, no fossils were found. Even though no indication of vertebrate remains were seen in the silts, the writer is inclined to the opinion that the few fragmentary specimens picked up on the bars below may have been washed out of these bluffs and carried downstream by the river during a flood stage. This idea is strengthened somewhat from the fact that no mammal remains were found in the lower cut banks or alluvial deposits of either this stream or the Nowitna, although persistent and continued search was made, and from our own experience and that of others we do know they occur in the elevated lacustral phase of the silts.

The absence of fossil evidence on the last two days of our ascent and the fact that little had been found previously showed that this stream did not cut an extensive deposit of Pleistocene mammal remains, and it appeared to be a waste of time to continue our search; so we returned by the same route we had ascended, reaching the Yukon on July 30.

A short distance above Louden we met Mr. R. A. Motschman, who, being thoroughly familiar with the region, told us of several localities where fossils had been found. The most important of these was an exposure on the Klalishkakat River, a locality visited by Mr. Arthur J. Collier, of the U. S. Geological Survey, some five years previous. At the time of Mr. Collier's visit a large tusk was

[1] Spurr, J. E.: 18th Ann. Rept. U. S. Geological Survey, 1896–97, p. 190.

[2] 17th Ann. Rept. U. S. Geological Survey, pt. 1, 1895–96, p. 852.

protruding from the bank, a picture of which is shown on plate II, fig. 2, in Mr. Maddren's account of his trip in 1904.

This small stream enters a branch of the Yukon from the south three miles below the settlement of Louden. At the time of our visit there was a high stage of water, and it was with some difficulty that we made the comparatively short distance upstream to the point where the river cuts the elevated silts. That portion of the bluff where Collier had photographed the tusk in place had been undermined and washed away. Scattered fragments of fossil ivory found by us on the bars below probably tell the story of its disappearance. A few fragmentary bones were found, some imbedded in the undisturbed silt and others in the talus at its base.

Eight miles below Louden, on the right bank of the Yukon, occurs a typical exposure of the Yukon silts. The bluffs extend for a distance of perhaps two miles and present faces from two hundred to two hundred fifty feet in height, equal to those of the Palisade escarpment, which they resemble in all their stratigraphic detail. Mr. Motschman told us of finding fossils here, but not even a fragment was secured at the time of our visit.

Here, it was observed that the wind is quite a factor in the erosion of these bluffs. The fine silt dries rapidly, and as it commences to sift down the precipitous face it is caught by the currents of air and carried away. From a distance this silt-laden air, as it poured up over the crest of the bluff, reminded one of an ever-ascending volume of smoke. In places large drifts had accumulated like so much wind-drifted snow.

Nulato, an important Indian village, was reached on August 2, and Kaltag on August 5. Here the Government telegraph line that extends down the river leaves the bank of the Yukon, ascends Kaltag River to near its head, crosses the divide to Unalaklik River, and descends that stream to Norton Sound, a total distance of one hundred miles.

Inquiry here concerning localities on the Kaltag River failed to elicit information of enough importance to warrant investigation; so canoe travel was resumed to Anvik, some two hundred miles below Nulato. Many stops were made to examine silt deposits, but in only two places were fossils found. Some five or six miles above Hall's Rapids, on the right bank, bones of the mammoth and bison were collected at the foot of the silt bluffs, and again above the old station of Greyling, some twenty-five miles above Anvik, where the silts are exposed for two or three miles by the cutting of the river. Here, during the summer of 1907, a fine pair of lower jaws of *Elephas* were picked up by Mr. W. C. Chase, of Anvik, and pre-

sented by him through the writer to the Smithsonian Institution. The Rev. J. W. Chapman, of the same place, also had specimens in his possession from this locality.

It was planned before reaching Anvik to explore the area drained by the Anvik River, as some years previous, while visiting this place, Mr. A. H. Brooks, of the U. S. Geological Survey, had been shown fossils by the Indians said to have been collected along the banks of this stream. Inquiry here among both the white and native inhabitants, many of whom are thoroughly familiar with the river and the country drained by it, developed the fact that, so far as they knew, no fossils had ever been found in the region. Nevertheless, we ascended this stream some distance to fully satisfy ourselves as to the conditions prevailing there, but nothing in the nature of a fossil vertebrate was found. It appears quite probable that the specimens shown Mr. Brooks came from the deposits near Greyling.

Upon our return to Anvik we were delayed some few days by continued rains from resuming our journey down the Yukon. At Holy Cross, a Catholic mission, fifty miles below Anvik, we were told of the occurrence of large bones in the banks of one of the sloughs leading to the portage to the Kuskokwim River. Difficulty in securing the services of a competent guide deterred us from making an investigation of this locality, which was some distance off from the Yukon.

Russian Mission was reached August 25, and Andreafski, where our canoe trip ended, on August 29. The almost incessant rains, accompanied by winds, during the last ten days of canoe travel were the most annoying feature of the whole trip. On several occasions it became necessary to go ashore and wait for the wind to abate, for fear of being swamped by the high waves encountered.

In the two months spent upon the Yukon and its tributaries, after leaving Rampart, we traveled by canoe alone nearly fourteen hundred miles.

At Andreafski passage was secured on the river boat *D. R. Campbell*, for St. Michael, which was reached September 1.

Here it was learned fossils were occasionally found on the mainland shore across the bay, and this area was investigated, but no success was met with.

Nome was reached by the local steamer *Yale* on September 7.

The autumn season being too far advanced to undertake an exploration of the Eschscholtz Bay and Buckland River localities, we took passage on the ocean steamer *Northwestern* from Nome September 20, and Seattle, Washington, was reached on September 29.

We were not successful in finding that which was most desired, a fairly complete skeleton of a mammoth, but the expedition was by no means barren of results, as will be noted later.

III. Occurrence of Fossils

The scattered remains of Pleistocene animals occur throughout the unglaciated region of Alaska and adjacent Canadian territory in three quite distinct deposits: First, in the black muck accumulated in gulches and the valleys of the smaller streams; second, in the fine elevated clays of the *Yukon silts* and *Kowak clays;* and, third, in the more recent fluvial and alluvial deposits. The specimens as found have been disinterred either through the erosive agency of the streams or by the work of the miner in the operations conducted in search of gold.

Although so generally distributed, there have been reported, so far as known to the writer, but two well-authenticated occurrences of accumulations of bones under such conditions as to suggest an original entombment. While the writer was shown bones protruding from the face of the undisturbed beds in the Klondike region (see pl. IV, fig. 1), and in other instances collected specimens actually imbedded in the elevated silts along the Yukon River, they were in all cases disarticulated and scattered, and there was no evidence of an association of any of the parts found.

Diligent inquiry was made among miners, trappers, and other residents of Alaska, met along the route traveled, concerning what they knew of the occurrence of fossil specimens. While nearly all were familiar with the fragmental and scattered parts, very little information was elicited of an accumulation of bones that would lead one to believe a skeleton or even a part of a skeleton had ever been found together in any one place.

While the scattered depositions occur as separate bones, skulls, teeth, tusks, horns, etc., throughout the formations mentioned, the condition of the specimens found varies greatly. Some are in such a good state of preservation they certainly could not have traveled far from the original place of interment, while on the other hand many bones are broken, abraded, and water-worn, and show unmistakable evidence of having been carried considerable distances. Bones representing these several phases were often found commingled and occupying relatively the same positions, whether it be in the muck, on a river bar, or imbedded in the undisturbed silt deposits.

Fig. 1.--TUSK OF ELEPHAS PROTRUDING FROM THE FACE OF THE UNDISTURBED MUCK IN FOX GULCH, BONANZA CREEK

Fig. 2.--SKULLS OF ELEPHAS PRIMIGENIUS AND BISON FROM THE MUCK OF FOX GULCH, BONANZA CREEK, NEAR DAWSON, YUKON TERRITORY, CANADA

The best-preserved specimens coming under the observation of the writer were those seen at Fox Gulch, on Bonanza Creek, in Yukon Territory, Canada, some twelve miles distant from the city of Dawson. On account of the excellent state of preservation of many of the specimens found here and the fact that they occur in what may be considered as an approach to a primary deposition, a somewhat detailed description of this locality will be given.

Bonanza Creek Localities

Bonanza Creek empties into the Klondike River about a mile and a quarter above Dawson. The valley is trough-like in character and follows a sinuous line bending from right to left. The present valley, according to McConnell,[1] has been cut down through the floor of an older valley. At irregular intervals the sides of the valley have been dissected by gulches. Magnet and Fox Gulches (see pl. IX (X)), on the left-hand side, are the most important from the standpoint of vertebrate fossils. Gold has been found in both, and at the time of our visit hydraulic operations were being carried on here by the Yukon Consolidated Gold Fields Company. In the prosecution of this work the content of the entire gulch to bed-rock was being sluiced down (see pl. VI, fig. 2), the talus spreading out fan-like into the creek bed below.

In the talus from Magnet Gulch representative parts of the mammoth, horse, bison, and moose were picked up.

At Fox Gulch we were shown many fine skulls and other skeletal parts of *Elephas, Bison, Equus,* and *Alce*. On the bank near the working face was a complete skull of the mammoth beside two bison skulls, recently uncovered (see pl. IV, fig. 2), and protruding from the face of the undisturbed muck was a large tusk (see pl. IV, fig. 1) and the skull of another bison. These had been uncovered the morning of our visit.

Fox Gulch is a short, deep gulch that has been cut down through the quartz drift and "White Channel" deposits and deep into the present bed-rock. The bed-rock is covered with a thin layer of rather coarse gravel on top of which is a thick layer of muck (see fig. 1). The gold occurs in the gravel underlying this muck, and in order to reach it the mass of superincumbent material is washed down by the powerful streams of water from the nozzles of the "jacks."

[1] McConnell, R. G.: Preliminary Report on the Klondike Gold Fields, Yukon District, Canada. Geol. Surv. Canada, No. 687, 1900, p. 21.

The working face as we saw it varied from twenty to forty feet in height. It is in the bottom part of the muck that the fossils are found. Those seen in place were from twelve to eighteen inches above the layer of gravel, and upon inquiry it was learned that all of the specimens taken out here had come from approximately the same horizon.

The muck and gravel, which rest unconformably upon the underlying rocks, is solidly frozen, but thaws rapidly under the heat of the summer sun, and large pieces were continually dropping during our examination of the face. This thawed material emitted the disagreeable odor of decomposing organic matter, a phenomenon observed by many others, particularly Dall,[1] who attributed it to

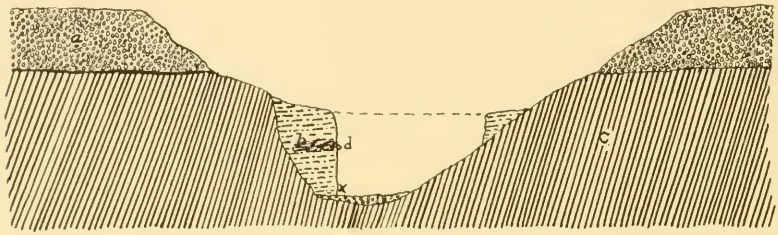

FIG. 1.—Cross-section of Fox Gulch, Bonanza Creek, Yukon Territory, Canada. *a*. "White channel" gravels and quartz drift; *b*. Muck; *c*. Bed rock; *d*. Layer of logs, limbs, etc.; *x*. Level where fossils occur.

decaying animal flesh or to dung of the mammoth or other herbivorous animals. The present writer agrees with Mr. Maddren,[2] who attributes it to the gases from decaying vegetable matter, of which the deposits are largely composed.

Interbedded with the muck in Fox Gulch was a layer of wood, represented by many fair-sized sticks (see (*d*), fig. 1), their ends in many instances being much rounded and water-worn.

Many of the fossils found here were beautifully preserved. For example, several of the bison skulls had the external horn, the entire dentition, and the frail, delicate bones of the anterior portion of the face remaining intact. The conditions are unusual, for, as a rule, only the horn cores and the heavier and stronger parts are found, and it is upon such fragmentary specimens that the descriptions of most of the extinct species of bison of this continent are based. Stranger still, however, is the fact that here no parts of these animals are found articulated or even so associated that skeletons might be assembled. All of the material is dismembered and scattered.

[1] Dall, W. H.: 17th Ann. Rept. U. S. Geol. Surv., pt. 1, 1895–96, p. 853.
[2] Maddren, A. G.: Loc. cit., pp. 64–65.

The preservation of the horn sheaths, as in the cases of the bison skulls, and the completeness of many of the skulls and other elements show they have not been subjected to the rough usage incident to their removal from one place to another; nor after death could they have long lain on top of the ground exposed to the vicissitudes of the elements. The external horn would in such case be the first to disappear, as all know who have visited our western plains and have noted the almost total disappearance of the horn sheaths from the buffalo skulls scattered about. Their destruction, even in a dry climate, has been accomplished in a comparatively few years.

Little Minook Creek Junior

This small stream enters Big Minook Creek from the right some six miles distant from the town of Rampart. Here, as in the Klondike region, the fossils occur in the lower part of the muck, which covers everything from two to twenty-five feet in depth. Specimens would be uncovered here only through the agency of mining, as the volume of water in the creek is not sufficient to cut away the banks.

While sinking a shaft on claim No. 21, operated by Messrs. Bowen and Coole, a skull of *Bison crassicornis* (No. 5727, U. S. National Museum) associated with bones of *Elephas* was taken out twenty feet below the surface.

Some years previous to our visit, we were told, the tusks of a large "*mastodon*" (*mammoth*) were found in a shaft sunk on a claim above No. 21.

Little Minook Creek

This creek is also a tributary of Big Minook Creek, and here, as in other localities, the fossils found occur in the lower layers of the muck.

In the vertebrate fossil collection of the U. S. National Museum is a portion of the skull of *Bison alleni* (No. 2383, see plate XI) from this locality having the entire horn sheaths preserved.

Mr. J. B. Duncan, of Rampart, presented to the Smithsonian Institution, through the writer, a skull of *Bison crassicornis* (No. 5726, U. S. National Museum, see plate X) from one of the claims on this creek, and Mr. C. B. Allen, of the same place, presented the Institution with the calcaneum of *Elephas* from claim No. 1.

Palisades

The Palisades, or "Bone Yard," on the left bank of the Yukon, thirty-five miles below Fort Gibbon (see pl. V, fig. 1), has long been

famous as a locality for vertebrate remains. This escarpment has been described by Russell,[1] Spurr,[2] and later by Collier[3] and Maddren.[4]

The bluff region extends for a mile or more down and around an almost right-angled bend in the left-hand channel of the river (see fig. 2). The bluffs, from one hundred and fifty to two hundred feet in height, and solidly frozen, are composed principally of an extremely fine silt, greenish gray in color and showing no traces of stratification. Their almost perpendicular faces are being continually undermined (see pl. v, fig. 2) by the swift current causing large masses to break off, many times with a startling report and subsequent splash, as they fall into the water below. Often during the two days' stay here the report sounded so like the firing of a gun that we were startled by the sharpness of it.

Near the lower end of these exposures the bluffs have been elevated somewhat, exposing the gravels which underlie them. These last have been called by Spurr the Palisades conglomerate, and it has been suggested they may be of Pliocene age. The top of the bluffs extend back from the river as a level, densely wooded tableland. In several places small watercourses have dissected this table, forming deep gorges. Near their mouths, where they enter the Yukon, their levels are but little elevated above its high-water stage.

At the up-river end of the bluffs we found numerous bones of the mammoth in the débris from a recent slide, and a short distance farther down (2 on map fig. 2) the scattered elements of a bison were found securely imbedded in a huge block of silt not long since displaced from its original position higher in the face of the cliff. The sacrum, part of the pelvis, two dorsals, rib, and scapula were the parts recovered. The scapula (shoulder-blade) was quite complete (see fig. 4), which, on account of its frail nature, appeared rather remarkable, the heavier and stronger bones being broken and abraded before their interment here.

The small streams mentioned previously as dissecting the bluffs were followed inland for considerable distances, and although their banks in many places presented very clean-cut exposures of the silt, no evidence of the presence of fossil remains was found. However,

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[1] Russell, I. C.: Notes on Surface Geology of Alaska. Bull. Geol. Soc. Am., vol. 1, 1890, p. 122.

[2] Spurr, J. E.: Geology of the Yukon Gold District. 18th Ann. Rept. U. S. Geol. Surv., pt. 3, 1898, pp. 200–221.

[3] Collier, A. J.: Bull. No. 218, U. S. Geol. Surv., 1903, pp. 18 and 43.

[4] Maddren, A. G.: Loc. cit., pp. 17–18.

Fig. 1.--PALISADES ON THE YUKON RIVER, 35 MILES BELOW FORT GIBBON, VIEWED FROM A DISTANCE UP THE RIVER

Fig. 2.--ELEVATED SILT BLUFFS AT THE PALISADES, SHOWING BLOCKS OF FROZEN SILTS AS THEY ARE UNDERMINED AND SUBSIDE INTO THE RIVER

among the débris of driftwood and other vegetable material accumulated at their mouths many disassociated bones were recovered (see (+), fig. 2). The concentrating action of the water in carrying away the fine silt and leaving the heavier objects behind would account for their abundance here.

In drifting down along the base of the cliffs in the canoe, the skull of an *Ovibos* sp. nov. (No. 5728, U. S. National Museum) was found on a narrow shelf just above the point (3 on map, see fig. 2) where the underlying gravels first appear. That the skull came

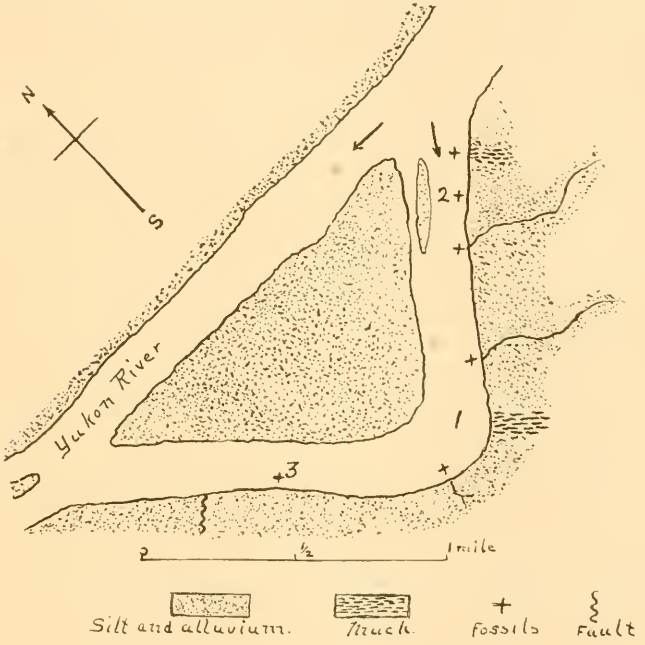


Fig. 2.—Sketch Map in Vicinity of "Palisades."

1. Where section was taken, shown in Fig. 3; 2. Bison bones (Fig. 5); 3. Musk ox skull, No. 5728, U. S. National Museum.

down from the cliff above there can be no doubt, for it lay on a pile of talus accumulated since the last high stage of water. The high-water marks were still plainly evident on either side and above the heaps of detritus. Moreover, the cranial and other cavities of the skull were filled with the fine silt composing the bluff. This skull was in fairly good condition, having, beside two of the molars, some of the bones of the anterior part of the face in a good state of preservation. The worn and abraded appearance of most of the fossils here indicates that they are drift and not in a place of primary entombment.

Maddren[1] makes the observation, "There is a little ice on top of these bluffs, but nothing like the extensive development exposed in the Old Crow Basin." Ice was also observed here by the writer, which on first sight appeared to represent the typical ice-bed deposits of many other localities. Upon closer examination, however, it was found to be a superficial layer on the face of the exposure and not a continuous ice-sheet interstratified with the muck and humus. The formation of this layer of superficial ice appears to be of interest and it may explain the presence of apparent ice-beds in some other places. Moreover, it does show that caution should be exercised in pronouncing all ice on the face of a cliff as being a section of a continuous bed.

At (1) on the map (fig. 2), a deep depression or basin in the top of the silt has been filled with alluvium and mucky material. The brow of the escarpment here, three or four hundred feet back from the edge of the stream, was estimated to be one hundred and fifty to one hundred and seventy-five feet above the level of the river. The Yukon, having cut laterally into the center of this basin, has left the remaining muck resting on a slope of silt inclined toward the river (see cross-section, fig. 3). By the undermining of the face of the cliff, one block after another of this frozen muck has broken away from its original position in the face of the escarpment and moved riverward. In most instances this movement has been so gradual that the blocks retain their upright positions and carry with them the superincumbent turf and vegetation undisturbed. The thawing of their faces and subsequent wasting away has allowed the turf to bend down without breaking, thus affording protection against further disintegration. The final destruction of the blocks, as they eventually fall into the stream (where several were seen half submerged), has resulted in leaving a basin-like area of an acre or more in extent devoid of its former covering of from thirty to forty feet of muck, except that here and there are masses recently detached from the walls of the basin. The inclosing walls or faces of the basin are perpendicular and from twenty to thirty feet in height. From three to four feet below the top of the walls was a layer of ice. Upon first sight it had every indication of being a section of a continuous bed. Some of the detached blocks standing in the center of the basin showed ice on both front and back faces. The top of this ice was straight, but the lower margins were irregular when not covered by the detritus at the foot. The face of the ice was also irregularly melted, due to the more exposed position of some parts.

[1]Maddren: Loc. cit., p. 18.

Upon ascending to the top of the escarpment at the point most remote from the river, it was found that a mass of frozen muck, estimated to be two hundred feet long and fifteen to twenty feet in thickness, with a vertical face of twenty to thirty feet, had moved outward at its center for fully fifty feet, but had not yet become detached at its ends. The crevasse formed by this displacement was filled by water to such a depth that the bottom could not be found with a long pole. Back of the crevasse, in the surface of the bluff, were numerous parallel cracks varying from six to eighteen inches in width and many feet in length. These had water standing in them nearly to the top of the ground. The conditions observed here appeared to the writer to explain the presence of the ice on the

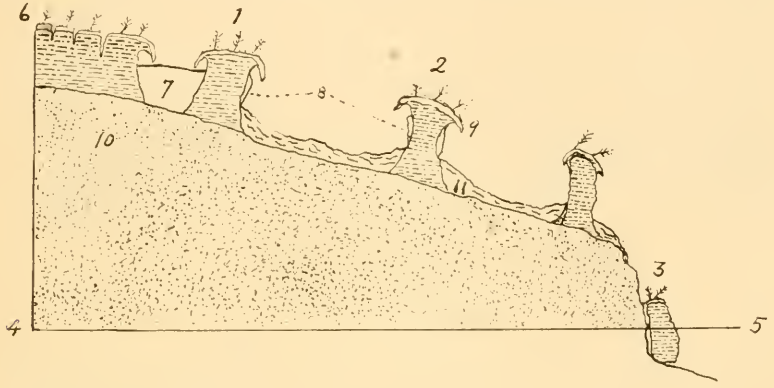


FIG. 3.—Cross-section of "Palisades" Escarpment, showing Formation of Superficial Ice.

1–2–3. Blocks of frozen silt; 4–5. Water level of the Yukon; 4–6. 150–170 feet; 7. Crevasse filled with water; 8. Ice on faces; 9. Overhanging turf; 10. Lacustrian silts; 11. Detritus (thawed muck).

faces below. With the advent of winter, assisted by the already frozen ground, the water in the crevasses becomes frozen solid. A subsequent outward movement of the blocks would leave the ice clinging to the face of either the cliff, or the block, or both, and under the influence of the rays of the summer sun would rapidly smooth the broken and ragged edges. On the faces of blocks 1 and 2 (see fig. 3) such layers of ice were observed, and where protected by the wet mantle of overhanging turf and moss were thawing very slowly. In places the ice was so thin the writer with a few strokes of his pick was able to penetrate it and into the frozen muck wall behind. Sections of the ice, protected by curtains of turf and falling débris, would persist for considerable periods. In places it had melted away, leaving its mould in the face of the cliff.

Under the influence of the summer sun the blocks were gradually disintegrating. Large pieces were continually falling as thawing progressed, and all along the bases of the face and around the blocks were small piles of talus of the mucky material.

The same pungent, disagreeable odor of decaying organic matter was noticed here as in the deposits of Bonanza and Minook creeks. The stench was so strong it could be easily detected on the river a considerable distance away. In many places on the wet muck banks a rusty red fungus-like plant grew in extensive patches.

The writer does not wish to be understood that the observations recorded here apply to all ice deposits, but as a local phase it may explain the occurrence of many so-called "ice-beds." It may also help to explain the position of the mammoth found frozen in the cliff along the Berezovka River in Siberia in 1901. From the position in which the carcass was found it would appear as though he had fallen into a crevasse from which there was no escape. The description[1] of the locality is not so unlike the conditions observed here.

Nowitna River

The exploration of this stream added but little information concerning the occurrence or derivation of the fossils found along its course.

After the first day of our ascent of this stream nearly every bar yielded some fossil evidence, either in the shape of a tooth, limb bone, vertebra, or scattered fragments. The specimens found were in various stages of preservation; many broken, others entire, some badly water-worn, and a few as perfect as the day they performed their functions in the skeleton itself. Some elements, which on account of their frail nature should by the very character of their structure have been broken and abraded, were found complete.

In examining the bars we soon came to know that the up-river ends, where the materials composing them were coarsest, was the most favorable part for finding the scattered bones. The remains without exception were all found below the high-water level of the flood stages of the river, and were without question brought down from some source or sources of deposition, either by the water itself or by floating ice.

A close examination was made of the low-cut banks and elevated silts, but not in a single instance were fossils actually found in place.

The conditions on this stream differed somewhat from those found

[1] Herz, O. F.: Frozen Mammoth in Siberia. Ann. Rept. Smithsonian Inst., 1903, pp. 611–625.

Fig. 1.--TYPICAL SANDBAR ON THE NOWITNA RIVER, 180 MILES FROM ITS MOUTH

Fig.2 .--LOOKING UP FOX GULCH, BONANZA CREEK, NEAR DAWSON, CANADA

Sluice box in the center, and the muck filling of the gulch not yet sluiced out may be seen in the background on the right

by Mr. Maddren on the Porcupine and Old Crow rivers, from the fact the fossils did not become more abundant on the bars as we went upstream. On some bars many fossils would be found, while others would yield only a single specimen. The varying degrees of preservation exhibited by the specimens points to the conclusion that the source of supply is diverse and not one large deposit. The writer is inclined to the opinion that the fossils found on the bars have been washed out of the silt banks along the stream and transported to their present resting places largely by the action of the water.

The finding of abundant remains on the bars of a stream that is cutting elevated silts does not necessarily lead to the conclusion that all of the specimens found there have come from the headwaters of that stream, for we know that scattered bones occur in the silt deposits, and it appears that the bones brought down from far upstream may be augmented in numbers by those washed out of the silts along its course.

The following list gives the fauna of this area as represented by the scattered bones collected:

Elephas primigenius.
Bison.
Equus.
Ursus.
Alce.
Castor.

Yukakakat River

Although fewer fossils were collected along this stream, the prevailing conditions as to their occurrence were found to be similar in most respects to those observed on the Nowitna River.

The following forms were recognized:

Elephas primigenius.
Bison.

Klalishkakat River

A locality on this stream some three miles inland from the Yukon was visited. Here the bluffs present nearly perpendicular faces from sixty to eighty feet in height, the lower parts of which are composed of reddish cross-bedded gravels, varying from fine to very coarse and unconformable with the overlying silt. The silt shows no traces of stratification and is solidly frozen. Back from the bluff is a level tableland, bordered on all sides, except that adjacent to the river, by low hills. It was at this locality that Mr. Collier in 1902

photographed a tusk protruding from the face a few feet below the top of the escarpment.

The bases of the bluffs are washed by the stream, and during stages of high water are undermined, causing large masses to break off. The tusk seen by Collier five years previous had disappeared, but a recent slide had exposed the distal end of a femur of *Elephas* in place about three feet above the underlying stratum of gravel. Other broken fragments were found in the loose clay of the talus along the foot of the bluffs. The silt varies in thickness from thirty to thirty-five feet, and broken and abraded fossil remains occur, scattered throughout. The conditions here are not favorable for the securing of good specimens. Bones of *Elephas* and *Bison* were collected.

Discussion

After a review of the conditions prevailing in localities where fossils have been found in Alaska and contiguous territory, the writer feels inclined to dissent somewhat from the views expressed by Maddren regarding the most promising collecting grounds.

Mr. Maddren[1] has advanced the opinion in the following statement that the old lake shores offer the greatest inducements:

"That the fluvio-glacial Pleistocene lakes of Alaska were subject to annual winter freezing, at least at various stages of their existence, there appears no doubt, because scattered apparently indiscriminately through the clays, at varying depths and considerable distances from the former shore lines of these basins, are some mammal remains. Their positions can only be accounted for by supposing they were carried out on the waters of the lakes from the adjacent shores or tributary streams by ice during spring breakups and freshets, there to be dropped by its melting to their present positions interbedded in the silts. There appears no other logical way of explaining the presence of these bones in the lacustrine areas." . . .

"The main point is that the remains occur in the silts as scattered depositions.

"The animals from which they were derived probably died about the shores of these lakes, and it is these Pleistocene lake shores we must examine carefully if we are to obtain anything like complete remains of the mammals inhabiting the region at that time."

There appears to be one objection to this hypothesis as applied to these fine-silt deposits. If the great number of isolated mammalian bones scattered through it were carried out from the shores and tributary streams by ice, it is hard to understand how they could be

[1] Maddren, A. G.: Smithsonian Misc. Coll., vol. XLIX, No. 1584, 1905, p. 26.

selected for distribution in deposits from which all other large fragments of detrital materials are absent.

It might be explained, however, on the supposition that the bones have been carried out from muck deposits in which there is no heavy detrital material. In that event many of these deposits might be considered older than are the silts; or, the presence of interbedded layers of lignite at the "Palisades" and in the silts of Cooleen basin (which would indicate a local drainage or elevation of these beds at one time) might furnish the necessary conditions for the accumulation of animal remains, followed by subsidence and further deposition.

Up to this time the best-preserved remains have been found in the deposits of muck accumulated in gulches and the valleys of the smaller streams. Typical examples of the occurrence of this muck may be seen on Little Minook Creek, near Rampart, Alaska, and Bonanza and other creeks, near Dawson, in Canadian territory. Only a single skull of bison with the horn sheaths preserved is recorded as coming from the silt, while they are of common occurrence in the muck. Their presence here may be accounted for on the supposition that the animals became mired in the bogs before they became solidly frozen as they are now. This naturally raises the question: If mired down in such a place, why is it that the remains should be so universally scattered? The writer suggests that they may have been separated by the creeping of the muck or peat—a phenomenon familiar to all students of deposits of this nature. By such creeping the muck may have moved considerable distances, particularly where the floor is inclined, as in many of the gulches. From the fact that most of the bones occur in the lower layers of the muck, no matter what the depth of the deposits may be, it is apparent that their specific gravity has caused them to sink to their present resting places. Thus it would not be necessary for the extermination of the fauna to have taken place at one time, as might be inferred by their occurrence at one level.

It was from the muck forty-two feet below the surface that the skull and tusks, surrounded by other bones of the skeleton of *Elephas primigenius* shown in plate VII, was obtained. Mr. A. H. Brooks, of the U. S. Geological Survey, tells me of seeing a portion of a skeleton of *Elephas* from Woodchopper Creek, Alaska, probably taken from a similar deposit.

The two instances just cited undoubtedly represent places of primary entombment, and the manner of their occurrence appears to approximate the conditions found in the bogs and swamps in the

Eastern States, from which many of the best skeletons of the *Mastodon* have been obtained.

From the evidence reviewed the writer believes that the deposits of muck represent the most likely places from which to secure remains of this extinct fauna.

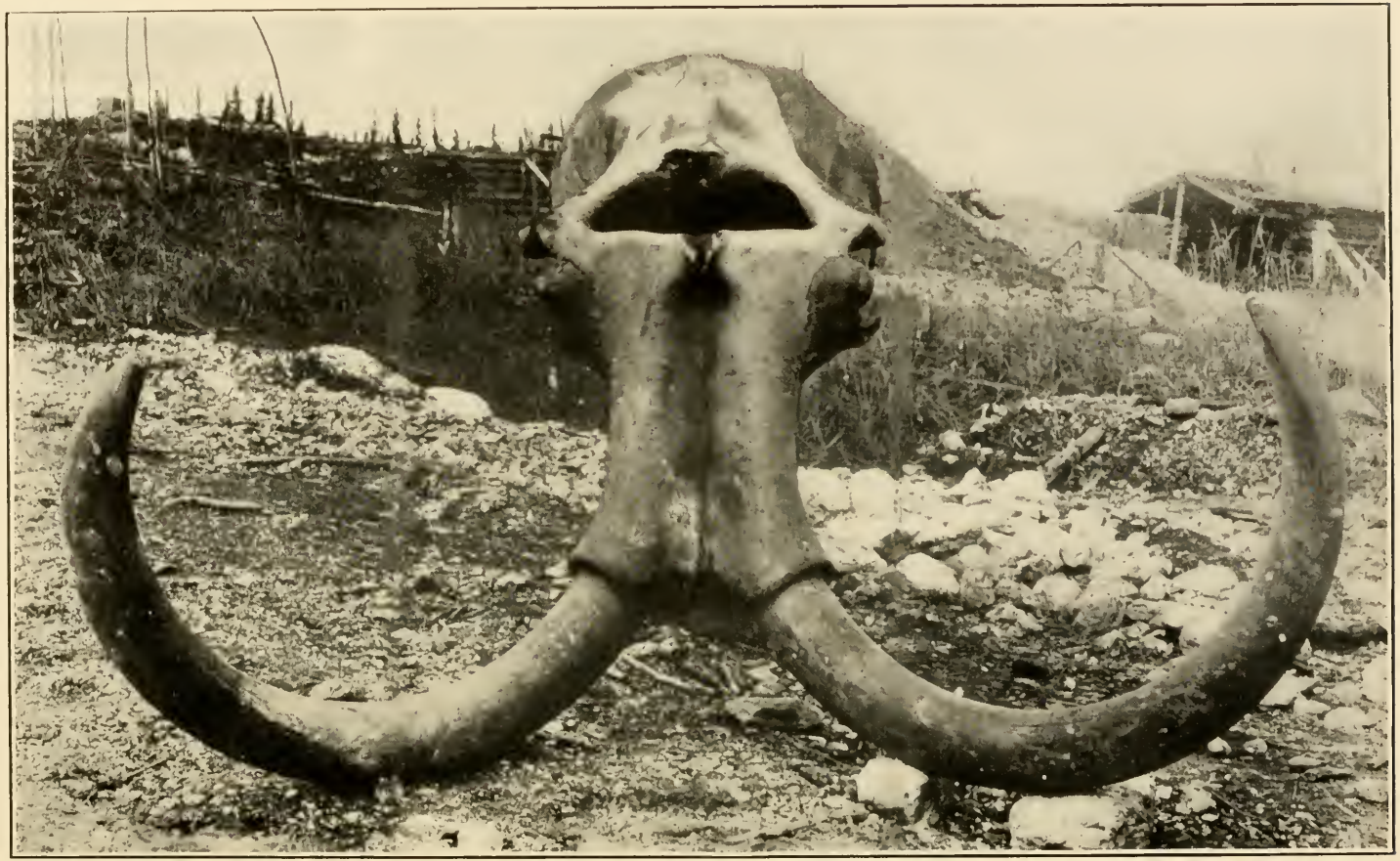
The writer takes this opportunity to express his appreciation for the assistance given him by Mr. A. H. Brooks and Mr. A. G. Maddren, of the U. S. Geological Survey. Many services were rendered by residents of Alaska along the route traveled, and favors were extended by agents and officials of the Northern Commercial Company. Mr. J. B. Duncan, of Rampart; Mr. Frank Haslund, of Kokrines, and Mr. Frederick, of Andreafski, were especially kind in many ways. My thanks are also due Mr. J. W. Gidley of the National Museum, for help in the identification of specimens.

IV. The Pleistocene Fauna of Alaska.

Although a number of species have been described from the Pleistocene deposits of Alaska, they have for the most part been based on fragmentary, and therefore rather unsatisfactory, specimens. In many cases the principal osteological and dental characters are not known, and on that account it is not always possible to compare them intelligently with related forms.

Only a few of the large number of localities where fossils have been found furnish well-defined specimens, capable of specific determination, and while these vertebrates are interesting from the standpoint of their general geographical distribution, they are of comparatively little aid in the interpretation of the local deposits. The forms have been entombed under such exceptional conditions as to raise some question regarding the exact age of the deposits in which they are many times found, although they could not have antedated Pleistocene time. A glance at the list of determinable species is sufficient to show at once that they represent a typical Pleistocene fauna, some of which, as the moose, caribou, musk-ox, sheep, bear, and beaver, have persisted down to the present day.

To aid the student, there is given here a list of the various genera and species thus far reported as occurring in Alaska, followed by a brief review of each, with a reference to the original description; the condition and present location of the type specimen (if known, and when based upon fossil remains) upon which these were founded, and in some cases figures of representative specimens from Alaska. Some additional information has been derived from a study of specimens in the vertebrate paleontological collection of the



SKULL AND TUSKS OF ELEPHAS PRIMIGENIUS FOUND 42 FEET BELOW THE SURFACE, IN THE MUCK, ON QUARTZ CREEK, NEAR DAWSON, YUKON TERRITORY, CANADA, IN MARCH, 1904

U. S. National Museum, collected in Alaska by Lieutenant Hooper, Dr. W. H. Dall, E. W. Nelson, L. M. Turner, A. G. Maddren, and others.

ELEPHAS PRIMIGENIUS Blumenbach

THE NORTHERN MAMMOTH

Elephas primigenius BLUMENBACH, Handb. Naturg., 1st French ed., vol. II. 1803, p. 407.

DESCRIPTION.—"Jaw broad and rounded; profile in front of tooth row almost vertical; enamel folds narrow and compressed; rather more than two folds to the inch, or twenty-four in ten inches; enamel itself thin."[1]

REMARKS.—This species is, geographically, the most widely distributed of extinct elephants. It has been reported as ranging from Florida, Texas, and Mexico on the south and northward into Canada and Alaska. It is also found in Great Britain and nearly all Europe and northern Asia.

Its remains are particularly abundant in parts of Alaska and Siberia. As yet no complete specimens have been found in Alaska, although several good skulls and nearly all parts of the skeleton are known from scattered but well preserved bones. Neither have specimens been found in the flesh, as is so often reported through the columns of the newspapers and even by some of the magazines.

The size of the mammoth has been so grossly overestimated by the general public that a few comparisons may help to correct some of these false impressions. The largest mounted specimen known is the skeleton in the collection of the Chicago Academy of Sciences, obtained in 1878 from Spokane County, in the State of Washington. The height of this animal when alive has been estimated to be thirteen feet. The African elephant "Jumbo" was eleven feet high, and there have been other elephants recorded as measuring twelve feet in height; so, as this would indicate, there is not so much difference in size between the mammoth and living elephants as is often supposed.

Mr. Lucas says:

"Tusks offer convenient terms of comparison, and those of a fully grown mammoth are from eight to ten feet in length, those of the famous St. Petersburg specimen and those of the huge specimen in

[1] Lucas, F. A.: Systematic Paleontology of the Pleistocene Deposits of Maryland. Maryland Geol. Surv., December, 1906, p. 163.

The above characters are given by Mr. F. A. Lucas as distinguishing this species from all other elephants.

Chicago measuring respectively nine feet three inches and nine feet eight inches. . . . Compared with these we have the big tusk that used to stand on Fulton Street, New York, just an inch under nine feet long and weighing one hundred eighty-four pounds."

In a footnote[1] he gives the measurement of the left tusk of an African elephant that is ten feet three and one-half inches in length along the outer curve, twenty-four and one-quarter inches in circumference, and weighing two hundred and thirty-nine pounds.

The longest tusk reported from Alaska is twelve feet ten inches in length. During the summer of 1907 the writer measured a tusk at Fort Gibbon that was ten feet seven inches long and the greatest circumference was twenty-one inches. This specimen was broken at both ends.

The tusks belonging to the skull shown in plate VII are seven feet six inches in length.

The tusks of the mammoth, as a rule, were more curved and of greater length than of the living forms, although there is a great variety of shapes and sizes.

Economic Importance of Mammoth Ivory.—It appears that the mammoth remains found in Alaska are not in as fresh a state of preservation as those found in Siberia, where for a good many years their tusks have constituted an important article of export. Dr. Middendorf, who visited Siberia about the year 1840, estimated the annual output of this fossil ivory to be one hundred and ten thousand pounds and representing at least one hundred individuals.[2] From their great abundance, Dr. R. Lydekker[3] has suggested that tusks were probably developed in both sexes.

It is seldom, if at all, that tusks are found in Alaska sufficiently well preserved to compete on the market with those of the African and Indian elephant, as is the case with the Siberian ivory; usually they are found to be discolored and either badly checked or exfoliated. A curio dealer in Nome, however, told the writer, "A few years ago a man would not take a tusk as a gift, but of late the best ones had acquired a commercial value, being cut into curios for the tourist trade."

In the "curio" stores at Skagway we were shown some of the articles manufactured for the trade from this ivory, consisting of

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[1] Lucas, F. A.: Annual Report Smithsonian Institution, 1899, p. 355.

[2] This estimate appears rather low, as the average tusk would hardly weigh two hundred and fifty pounds, or five hundred pounds for the pair, which would give over two hundred individuals.

[3] Lydekker, R.: Annual Report Smithsonian Institution, 1899 (pp. 361–366). p. 362.

sawed sections polished for paper-weights, on which were etched representative scenes and animals of Alaska. The life restoration of the mammoth with its long hair and curved tusks appeared to be a favorite subject. In one instance a miniature of the mammoth had been carved from it. This carving and etching is done by the Indians and Eskimo, many of whom become quite adept at this line of work. Similar objects were observed in the curio stores at Nome. The Skagway dealers obtain most of their tusks from the Klondike region, while the Nome dealers procure the ivory used by them from the Eschscholtz Bay, Buckland, and Kobuk River localities.

In 1854 Sir John Richardson said:

"Eskimos are in the habit of employing the soundest tusks for the formation of various utensils; and the American fossil ivory has for at least a century, and for a longer period of unknown duration, been an article of traffic with the Tchutche of the opposite shores of Beering Straits; so that we can venture upon no calculation of the multitudes of mammoths which have found graves in several icy cemeteries of the American coast of Beering Sea."

Dr. W. H. Dall[1] tells of obtaining "in 1880 a deep ladle as large as a child's head, carved, handle and all, out of a solid tusk of mammoth ivory by those people," referring here to the Eskimo.

The writer also saw pieces of tusks fashioned into sled runners, having holes at intervals by which they were lashed to the wooden framework above. On the Yukon it was observed the Indians sometimes used sections of tusks as weights for sinking their salmon nets.

An account of this fossil ivory would not be complete without a mention of the blue phosphate of iron sometimes formed by the decomposition of the tusks and used by the Alaskan Eskimo as a pigment.

Sir John Richardson was the first to make note, in 1854, of this phosphate[2] (Vivianite) occurring between the plates of the exfoliated tusks. The writer saw this blue stain on many of the tusks examined by him, and it was particularly noticeable on those just recently removed from the ground. The same iron phosphate was found in the metacarpal bones of the bison collected on the Nowitna River.

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[1] Dall, W. H.: Seventeenth Annual Report, U. S. Geol. Surv., pt. 1, p. 857.

[2] In this connection it is interesting to quote from Warren's report on *Mastodon giganteus:* "On burning the bone, the ash which remains is of a beautiful blue color, owing to the presence of phosphate of iron, which appears to have been formed from the iron which had penetrated into the bone from the marl surrounding the skeleton."

ELEPHAS COLUMBI Falconer

Elephas columbi FALCONER, H., 1857, Quart. Jour. Geol. Soc. of London, XII, p. 319.

The only reported occurrence of *E. columbi* is given by Dall,[1] who mentions that tusks, teeth, and bones of *E. primigenius* and *E. columbi* were collected by Wossnessenski near Topanika Creek, Norton Sound. We quite agree with Maddren[2] that "the identification needs verification before it is assigned to Alaska."

MAMMUT AMERICANUM (Kerr)

THE AMERICAN MASTODON

Elephas americanum, KERR, R., 1792 Anim. Kingdom, p. 116.

DESCRIPTION.—It may be readily distinguished from *Elephas primigenius* by the character of the teeth, which bear simple tent-like ridges (see plate VIII). By its low massive build and shape of the skull and the tooth characters just reviewed, it may be told apart from the mammoth by the most casual observer.

REMARKS.—This animal also has a wide distribution. Its remains have been found from New York to Florida and west to Texas and Washington. It extended north into Canada, and recently two teeth have been found in the Klondike region near Dawson. The writer refers here to a Mastodon molar secured by Dr. T. W. Tyrrell on Gold Run Creek in 1902, and through him presented to Mr. W. H. Osgood,[3] of the U. S. Biological Survey, and now in the vertebrate paleontological collection of the U. S. National Museum (see pl. VIII, fig. 1). A second occurrence of this species in this region was noted by the writer in the summer of 1907—a tooth collected during the spring of 1906 on Sulphur Creek, near Dawson (see map, plate IX), and now in the possession of Mr. Joseph Nichlas, of that city. This specimen is reproduced here from a photograph (pl. VIII, fig. 2). It is of interest to note the occurrence of the mastodon in this region and in both places associated with remains of the mammoth.

In 1904 Mr. M. T. Obalski[4] mentions the occurrence of the mas-

[1] Dall, W. H.: Seventeenth Annual Report U. S. Geological Survey, 1896, p. 856.

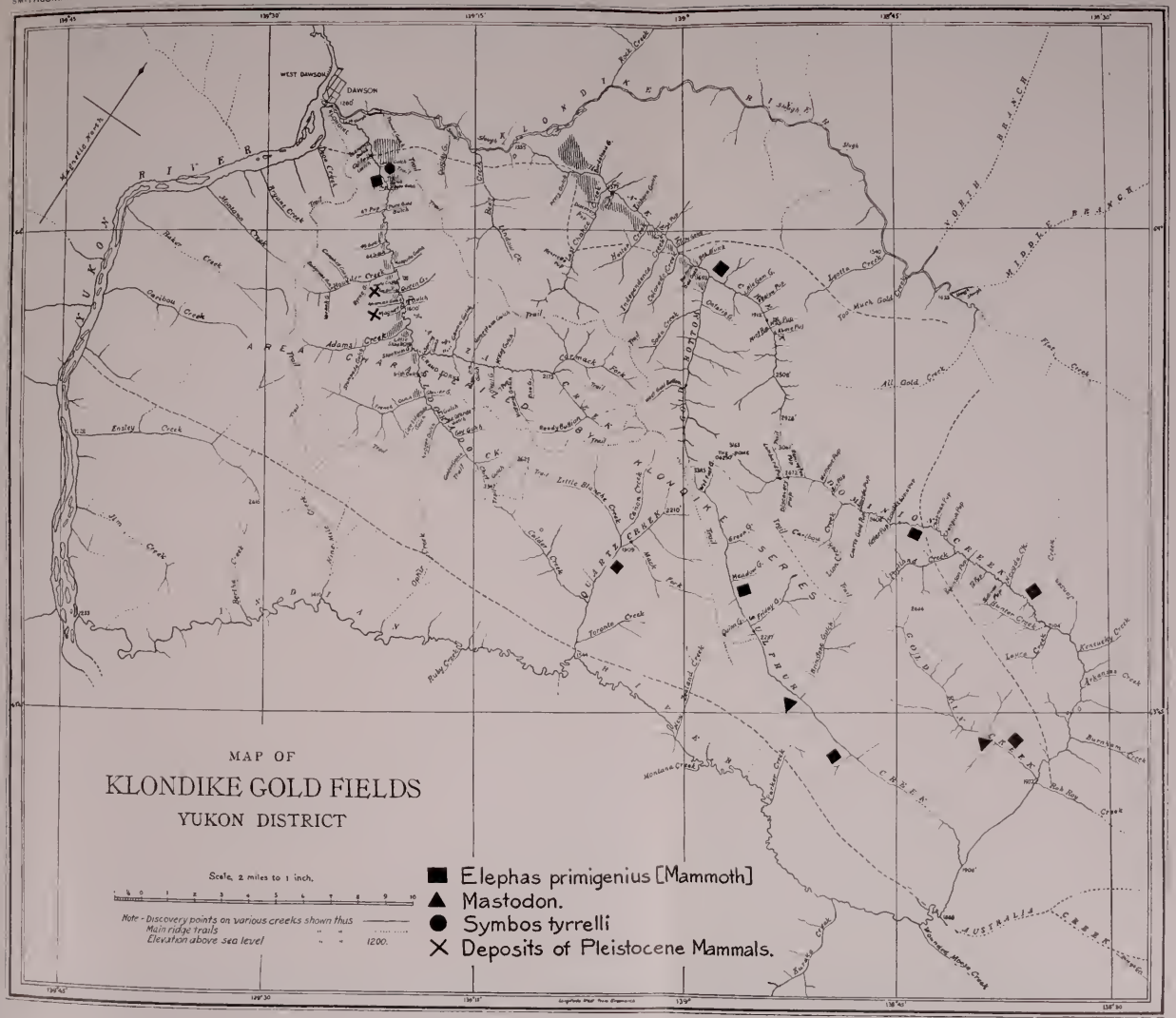
[2] Maddren, A. G.: Smith. Misc. Coll., vol. XLIX, No. 1584, 1905, p. 7.

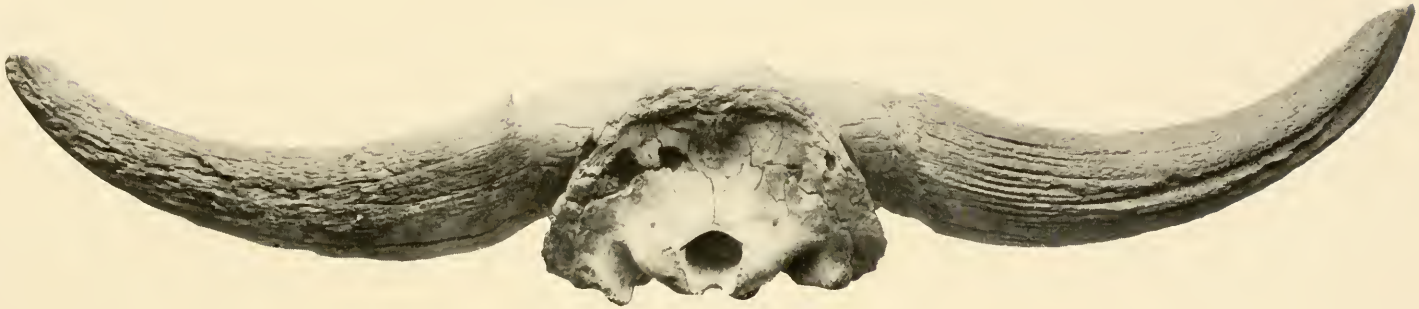
[3] Osgood, W. H.: Proc. Biol. Soc. of Washington, November, 1905, vol. XVIII.

[4] Obalski, M. T.: Les grandes Fossiles dans le Yukon et l'Alaska. Bull. de la Musée d'Hist. Nat., Paris, 1904, No. 5, pp. 214–217.

Fig. 1.--UPPER MOLAR OF MASTODON (No. 5102, U. S. National Museum) FOUND ON GOLD RUN CREEK, NEAR DAWSON, YUKON TERRITORY, CANADA, IN 1902
About 2/5 natural size

Fig. 2.--MOLAR OF MASTODON FOUND ON SULPHUR CREEK, NEAR DAWSON, YUKON TERRITORY, CANADA, IN 1906
In the possession of Mr. Joseph Nichlas, of the city of Dawson. About ½ natural size


MAP OF
KLONDIKE GOLD FIELDS
YUKON DISTRICT
Scale, 2 miles to 1 inch.
Note - Discovery points on various creeks shown thus
Main ridge trails
Elevation above sea level
1200.
Elephas primigenius [Mammoth]
Mastodon.
Symbos tyrrelli
Deposits of Pleistocene Mammals.
WEST DAWSON
DAWSON
YUKON RIVER
KLONDIKE RIVER
HUNKER CREEK
BONANZA CREEK
ELDORADO CREEK
GOLD RUN CREEK
QUARTZ CREEK
GOLD BOTTOM CREEK
AUSTRALIA CREEK
EUREKA CREEK
ADAMS CREEK
CARIBOU CREEK
ENSLEY CREEK
MONTANA CREEK
HUNKER CREEK AREA
BONANZA CREEK AREA
ELDORADO CREEK AREA
GOLD RUN CREEK AREA
QUARTZ CREEK AREA
AUSTRALIA CREEK AREA
EUREKA CREEK AREA
NORTH BRANCH
MIDDLE BRANCH



BISON CRASSICORNIS Richardson

(Cat. No. 5726, U. S. National Museum.) Posterior view of cranium from Little Minook Creek, near Rampart, Alaska
Greatest width 46½ inches

todon in the placer gravels of the Klondike region. Maddren[1] attributes this to an error. While it may have been an error in this particular instance, it is likely to be a very common one, for throughout this entire region all of the tusks, teeth, and big bones are usually referred to by the people as those of the mastodon.

So far as the writer knows, there have been no authentic cases recorded of the occurrence of mastodon in Alaska. From the fact that its remains do occur in the Klondike region, there appears no logical reason why it should not be found in Alaskan territory as well. It is on that account that the brief review is appended here.

Through the kindness of Mr. R. G. McConnell, of the Canadian Geological Survey, the writer is enabled to present a map (see plate IX) of the Klondike district on which has been indicated the localities where mastodon and mammoth remains have been found. With three exceptions, the localities indicated are based upon specimens seen by the writer.

EQUUS sp. undet.

Scattered remains of *Equus* are commonly associated with the other Pleistocene fossils found in Alaska. These bones have been considered by various authorities as representing the extinct species *Equus fossilis* and *E. fraternus,* and by some referred to the living form *E. caballus.* On account of the very fragmentary nature of the specimens upon which these determinations have been made, in all cases the identifications are open to question, and until better material is found the species should be considered undeterminable.

Remains of horses have been found in the following localities:

Eschscholtz Bay, Seward Peninsula, on the Kobuk and Buckland Rivers; "Palisades," on the Yukon; Nowitna River, Old Crow River, and in many places in the Klondike district.

BISON CRASSICORNIS Richardson

Bison crassicornis RICHARDSON, Zoöl. Voy. of H. M. S. *Herald,* 1852–54, pp. 40–60, pls. IX, XI, fig. 6; pl. XII, figs. 1–4; pl. XIII, figs. 1–2, pl. XV, figs. 1–4.

TYPE.—Poorly preserved skull in the British Museum, from Eschscholtz Bay, Alaska.

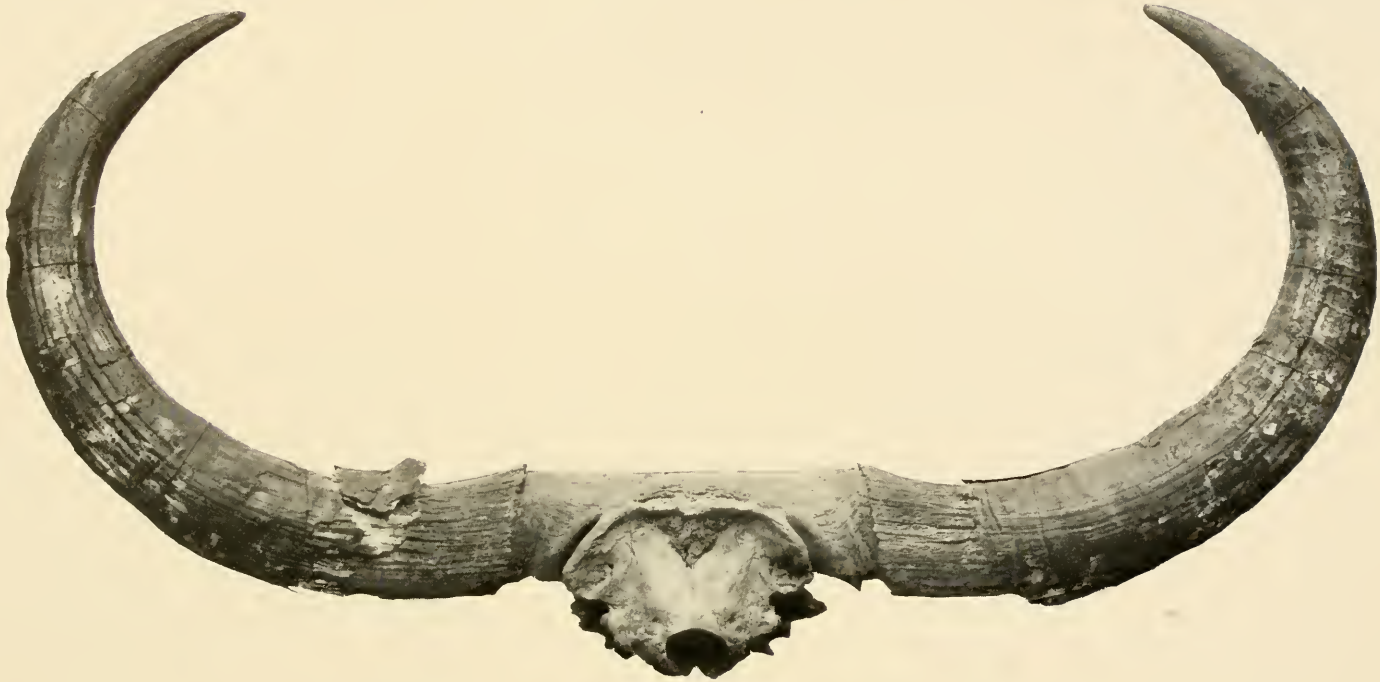
DESCRIPTION.—"Horns long; length of horn core along upper curve very much greater than circumference at base; horn cores slightly flattened on superior face; transverse diameter much greater than vertical; curve of horn regular, the tip not abruptly reflected nor pointing decidedly backward; horn cores raking decidedly backward."

[1] Maddren, A. G.: Smithsonian Misc. Coll., vol. XLIX, No. 1584, 1905, p. 7.

Remarks.—This species heretofore has not been known outside of Alaska, but, as might have been anticipated, skulls of this species were observed at Fox Gulch, Bonanza Creek, Yukon Territory, Canada, by the writer during the summer of 1907. In the foreground of plate IV, fig. 1, may be seen a portion of the skull and horn cores

Fig. 4.—Scapula of *Bison crassicornis* (?) (Cat. No. 5941) from "Palisades," on the Yukon River. (See 2, Fig. 2.) Greatest length, 22½ inches.

of this species. Remains of *B. crassicornis* have been collected from the following localities: On the tundra back of Point Barrow, Elephant Point, Eschscholtz Bay, Little Minook Creek, Little Minook Creek Junior, and Bonanza Creek, Yukon Territory, Canada.



BISON ALLENI Marsh

(Cat. No. 2383, U. S. National Museum.) Posterior view of cranium, with horn sheaths preserved, from Little Minook Creek, near Rampart, Alaska
Greatest width 45 inches

This is the largest of the extinct bisons found in the deposits of this region, and a scapula (see fig. 4) collected by the writer at the "Palisades" on the Yukon River may, on account of its size, pertain to this species. Plate x represents a typical skull of this form collected on Little Minook Creek and presented to the Smithsonian Institution through the writer by Mr. J. B. Duncan, of Rampart, Alaska.

BISON ALLENI Marsh

Bison alleni Marsh, Amer. Jour. of Science, vol. xiv, 1877, p. 252.

Type.—Horn core, No. 911, Museum of Yale College, New Haven, Connecticut, from Blue River, near Manhattan, Kansas.

Description.[1]—"Horn cores long, slender, much curved, slightly flattened above at base; transverse diameter considerably greater than vertical; length along upper curve much greater than circumference at base. *Bison alleni* is distinguished from *B. crassicornis* by the much greater curvature of the horn cores, these being also more flattened and more elliptical in section in *crassicornis*.

Remarks.—This species is represented in the U. S. National Museum paleontological collection, by a skull, No. 2383, from Little Minook Creek, near Rampart, Alaska.[2] It (see pl. xi) was found in the frozen muck twenty-five feet below the surface, and is of more than usual interest on account of the excellent state of preservation of the horn sheaths and from its being the first of this species found in Alaska. This species is also reported as occurring in Idaho.

A skull of *B. alleni* from the Porcupine River is now in the Grand Rapids Museum, of Grand Rapids, Michigan.

BISON OCCIDENTALIS Lucas

Bison occidentalis Lucas, *Science*, November 11, 1898, p. 678.

Type.—Portion of skull with horn cores, No. 4157, U. S. National Museum, from Fort Yukon, Alaska, collected by Sir John Richardson.

Description.—"Horn cores moderate; circumference at base equal to or slightly greater than length along upper curve; subcircular in section, regularly curved upward and backward."

[1] The descriptions of the *Bison* from Alaska is taken from Mr. F. A. Lucas' article, "The Fossil Bison of North America." Proc. U. S. National Museum, vol. xx, 1899, pp. 755–771.

[2] This specimen was presented to the Museum by Messrs. McLain and Ballou, of Rampart, through the efforts of Gen. Timothy Wilcox, U. S. A., of Washington, D. C.

Remarks.—A second specimen, No. 2643 (see pl. XII), in the U. S. National Museum collections, was collected by Mr. A. G. Maddren on the Old Crow River in 1904. A fairly complete skeleton[1] of this species from Gove County, Kansas, is now in the University of Kansas Museum. This species has also been reported as occurring on the Tatlo River and St. Michaels, Alaska. The writer doubts very much the authenticity of this last locality. Mr. Lucas says: "It is the species most nearly resembling the existing bison, with which it was probably for a time contemporaneous." In that event *B. crassicornis* was also a contemporary, as the writer recognized skulls of *B. occidentalis* and *B. crassicornis* at Fox Gulch, on Bonanza Creek, coming from the same layers in the deposits there.

BISON PRISCUS (?)

A skull collected at Eschscholtz Bay, Alaska, was provisionally referred[2] to this species by Sir John Richardson. In a more recent paper,[3] however, Mr. F. A. Lucas has considered this specimen (No. 24,589, British Museum) as representing an immature individual or "spike horn" of *B. crassicornis*.

Horn cores collected by Maddren on the Old Crow River and by the writer at the "Palisades" on the Yukon River appear to resemble the figure (see pl. XIII, fig. 3) given by Richardson in his report.

SYMBOS TYRRELLI Osgood

Scaphoceros tyrrelli Osgood, Smithsonian Miscellaneous Collections, vol. XLVIII, No. 1585, 1995, pp. 173–183, pl. XXXVII, fig. 2; pl. XXXVIII, fig. 2; pl. XXXIX, fig. 1; pl. XL, fig. 2.

Symbos tyrrelli Osgood.

Type.—Fairly complete skull, No. 2555, U. S. National Museum, from Lovett Gulch, Bonanza Creek, Klondike District, Yukon Territory, Canada (see map, plate IX).

Description—*Generic characters.*[4]—"Similar to *Ovibos*, but horn cores much smaller, less compressed at base, and more divergent at tips; crown of skull between bases of horn cores surmounted by a prominent exostosis with an anterior bounding rim and a deep median excavation; orbits much less produced laterally than in

[1] Stewart, Alban: Kansas University Quart., July, 1897, Sec. A, pp. 127–135. Described as *B. antiquus*, but referred later by Lucas to *B. occidentalis*.

[2] Richardson, Sir John: Zoölogy of Voyage of H. M. S. *Herald*, 1852–54, pl. VII, fig. 1, p. 34.

[3] Lucas, F. A.: The Fossil Bison of North America. Proc. U. S. Nat. Mus., vol. XXI, 1899, p. 762.

[4] Generic and specific characters as given by Osgood.

BISON OCCIDENTALIS Lucas

(Cat. No. 2643, U. S. National Museum.) Posterior view of cranium from Old Crow River, Canada
Greatest width 33 + inches

Ovibos; facial part of skull nearly as wide as cranial; basioccipital without a high median ridge; teeth very large and relatively broad; m^1 and m^2 quadrate in transverse view."

SPECIFIC CHARACTERS.—"Size smaller than in *S. cavifrons* (Leidy); horn cores much smaller and shorter; exostosis less extensive, but more deeply excavated; depth of brain case and surmounting bony mass decidedly less."

REMARKS.—The only reported occurrence of this species in Alaska is a horn core, No. 2378, U. S. National Museum, presented by Rev. J. W. Chapman through Dr. Arthur Hollick. The label with the horn gives the locality as Anvik, on the Yukon River, but it is unlikely the specimen was collected in the immediate vicinity of that place. It is more probable that it comes from some of the silt deposits along the Yukon twenty-five or thirty miles above Anvik.

SYMBOS CAVIFRONS (Leidy)

Hay[1] cites the occurrence of *O.*[2] *cavifrons* in Alaska, due to the fact that he includes Richardson's indeterminate species, *Ovibos maximus,* under this head.

This species, therefore, is not known to occur in Alaska.

OVIBOS MAXIMUS Richardson

Ovibos maximus RICHARDSON, Zoöl. Voy. of H. M. S. *Herald,* 1852–54, pp. 25–28, pl. XI, figs. 2, 3, and 4.

TYPE.—An imperfect cervical vertebra, the axis or *dentata* (No. $\frac{9}{2}$, Haslar Museum), from Eschscholtz Bay, Alaska.

REMARKS.—From the very fragmentary nature of the type this species appears indeterminable.

OVIBOS MOSCHATUS (?) Zimmerman

This is a recent species found at present in northern North America and Greenland. At present this animal is not known to range west of the McKenzie River, but Pleistocene remains which have not been distinguished from this species are found in Alaska. As in the case of other remains referred to living species, more complete material may show an extinct species separable from the living form.

This appears more probable since a skull, collected by the writer at the Palisades, on the Yukon, in 1907, is being described by Mr. J. W. Gidley as the type of a new species, and it may be that all the remains formerly considered *O. moschatus* should be referred to this species.

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[1] Hay, O. P.: Bulletin No. 179, U. S. Geological Survey, p. 688.

[2] Osgood now includes *Ovibos cavifrons* under *Symbos.*

Buckland, because of the preservation of a horn sheath on a skull of *Ovibos* submitted to him from Eschscholtz Bay, considered it of recent origin, but now that *Bison* (see pl. x) skulls are known distinct from living species having the horn thus preserved, this argument would apply equally to the case in question.

OVIS, sp. undet.

A list of species occurring in the Eschscholtz Bay deposits is given by Seeman in his "Narrative of the Voyage of H. M. S. *Herald* in 1853, in which *Ovis montana* is mentioned as being found there.

This list was compiled from a report[1] made by Sir John Richardson, but a careful perusal of his report failed to reveal any mention of fossil remains, although he does describe the recent skeleton of *Ovis montana*.

It is probably by mistake that this species was included in Seeman's list, although sheep remains will undoubtedly be found, as Mr. W. H. Osgood, of the U. S. Biological Survey, has fragmentary remains of *Ovis* in his possession from the Klondike district, Yukon Territory, Canada. At present, however, the writer does not know of an authentic record of their occurrence in Alaska.

ALCE, sp. undet.

Like *Rangifer*, scattered remains of the moose are known from several widely separated localities in Alaska and adjacent territory. These bones have usually been referred to as representing the living form *Alce americanus*, but it appears the identifications have been based upon such scanty material that the assignment to this species is open to question. When better specimens are known, characters of sufficient importance to distinguish it from the living species will probably be found.

Remains of *Alce* are known from the deposits of Eschscholtz Bay, on the Old Crow and Nowitna rivers, and fragmentary antlers were found in the muck of Magnet and Fox gulches on Bonanza Creek near Dawson.

RANGIFER, sp. undet.

Fragmentary remains representative of this genus are commonly found with the bones of other Pleistocene animals in Alaska. These scattered and fragmentary parts have been referred by various writers to the living species, *R. caribou* and *R. tarandus*. It appears

[1] Zoölogical Voyage of H. M. S. *Herald*, 1852–54.

more likely, however, if referable at all to a living form, it would be *R. articos,* the barren-ground caribou and now living in these regions.

As mentioned by Richardson, Zoölogy of the Voyage of H. M. S. *Herald,* 1854, p. 20, fragmentary remains have been found at Eschscholtz Bay, and the writer collected fragments of antlers on Little Minook Creek Junior and on the Nowitna River.

So far, remains have not been found sufficiently complete upon which an accurate specific determination could be based.

URSUS, sp. undet.

The finding of a scapula and astragulus of *Ursus* associated with the remains of other Pleistocene animals on the Nowitna River during the summer of 1907 verifies a former record of the occurrence of the bear in the Pleistocene of Alaska.

The scapula, although incomplete, indicates an animal about the size of the black bear (*Ursus americanus*), an inhabitant of these regions at the present time.

Bones[1] of *Ursus* have also been found associated with mammoth remains in a cave on St. Paul Island of the Pribilof group.

CASTOR, sp. undet.

Among the vertebrate remains collected on the Nowitna River in 1907 were the left pelvic bones (No. 5942, U. S. National Museum) of a beaver. This appears to be the first occurrence recorded of the finding of bones of *Castor,* although Mr. E. W. Nelson,[2] who visited Eschscholtz Bay in 1881 with the U. S. S. *Corwin,* observed a beaver's nest imbedded in the cliffs at that place, and noted that many of the sticks composing it had been gnawed and others still retained the tooth-marks made by that animal.

The remains found, however, are too fragmentary to admit of specific determination.

Summary

From the preceding review of the extinct vertebrates reported as occurring in the Pleistocene deposits of Alaska, it will be seen that the identification of several of the forms has been based upon such scanty and fragmentary material that their determination is

[1] These remains, collected by the party with Dr. D. S. Jordan in 1897, are now in the paleontological collection of the U. S. National Museum.

[2] Maddren, A. G.: Smithsonian Misc. Coll., vol. XLIX, No. 1584, 1905, pp. 112–113.

open to question. This observation is particularly applicable to those so long regarded as being identical with living species. The writer believes that when more perfect material is available it will be found, probably in all instances, to be quite distinct from the living forms. That this is in some instances the case is shown by the discovery this past summer of a skull of *Ovibos* sufficiently complete to show characters of enough importance to warrant its separation from the living form *O. moschatus,* to which nearly all musk-ox material found in this region previously had been referred.

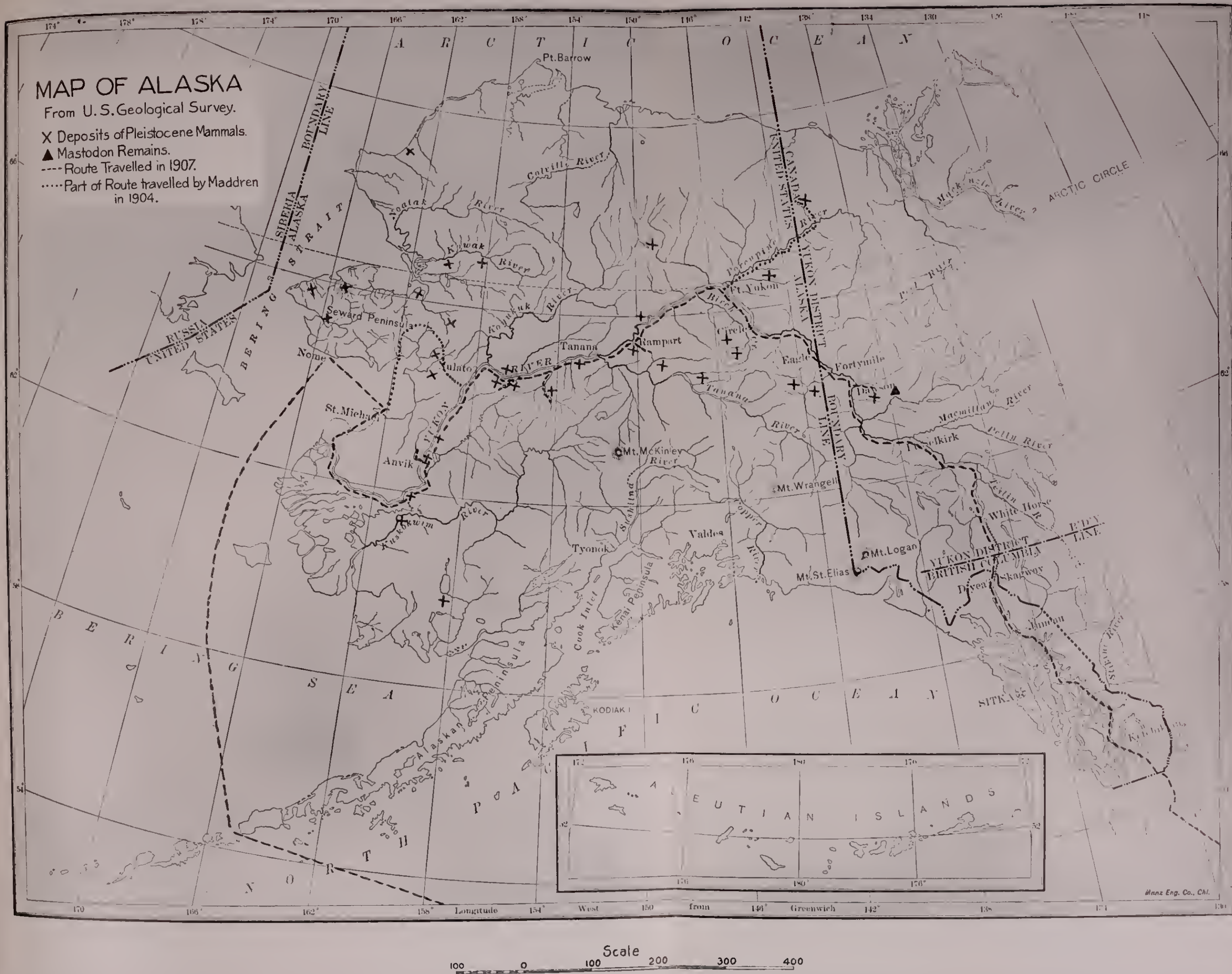
More persistent collecting, aided by improved methods, will undoubtedly increase the faunal list and widen the geographical distribution of the known forms.

Now that *Mastodon* and *Ovis* remains have been found in Canadian territory and at a comparatively short distance from the international boundary, there appears no logical reason why both of these animals should not have lived in Alaska at one time.

While in some cases we are unable to adequately define many of the species, still a very good idea of the fauna as a whole is obtained. Its close relationships in many instances with living animals furnishes an interesting link in the development of mammalian life of this continent.

The following list, based upon material sufficiently complete for fairly accurate determinations, represents the Pleistocene fauna of Alaska as we know it today:

Elephas primigenius Blumenbach.
Equus, sp. undet.
Alce, sp. undet.
Rangifer, sp. undet.
Ovibos, sp. nov.
Symbos tyrrelli Osgood.
Bison crassicornis Richardson.
Bison occidentalis Lucas.
Bison alleni Marsh.
Ursus, sp. undet.
Castor, sp. undet.


MAP OF ALASKA
From U. S. Geological Survey.
X Deposits of Pleistocene Mammals.
▲ Mastodon Remains.
----Route Travelled in 1907.
·····Part of Route travelled by Maddren in 1904.
ARCTIC OCEAN
BERING SEA
PACIFIC OCEAN
NORTH
BERING STRAIT
SIBERIA
ALASKA
BOUNDARY LINE
RUSSIA
UNITED STATES
CANADA
UNITED STATES
YUKON DISTRICT
ALASKA
BOUNDARY LINE
YUKON DISTRICT
BRITISH COLUMBIA
ARCTIC CIRCLE
Pt. Barrow
Colville River
Noatak River
Kowak River
Koyukuk River
Porcupine River
Pt. Yukon
Birch
Seward Peninsula
Nome
St. Michael
Nulato
Tanana
Rampart
Circle
Eagle
Fortymile
Dawson
Tanana River
YUKON RIVER
Anvik
Kuskokwim River
Mt. McKinley
Mt. Wrangell
Copper River
Valdes
Tyonok
Cook Inlet
Kenai Peninsula
Mt. Logan
Mt. St. Elias
Selkirk
Macmillan River
Pelly River
White Horse
Dyea
Skagway
Juneau
SITKA
KODIAK I.
Alaskan Peninsula
ALEUTIAN ISLANDS
Longitude West from Greenwich
Scale
100 0 100 200 300 400