A SPECIMEN OF THE EXTINCT MUSK-OX, *SYMBOS CAVIFRONS* (LEIDY) FROM NORTH LIBERTY, INDIANA.

MARCUS WARD LYON, JR., South Bend.

In the museum of the Northern Indiana Historical Society, South Bend, is a well preserved posterior portion of a skull of the extinct musk-ox *Symbos cavifrons* (Leidy). For having my attention called to this specimen and for the opportunity of examining it I am indebted to Dr. H. T. Montgomery, of South Bend, to whom my thanks are due. As remains of musk-oxen are not frequently found in Indiana and as the specimen is in a collection where it might escape the observations of naturalists, it seems desirable to call attention to it and describe and illustrate it in order that it may be compared with other specimens of the same species.

The other Indiana specimens of this species of musk-ox as recorded by Dr. O. P. Hay in his article "The Pleistocene Period and its Vertebrata", 36th Annual Report of the Department of Geology and Natural Resources of Indiana, are a very complete skull from Hebron, Porter County; and more fragmentary ones from an unknown locality in Randolph County; from Walesboro, Bartholomew County; and Bear Lake, Newton County.

The specimen here described and illustrated was found in excavating a ditch in the southwest corner of St. Joseph County, three and one-half miles west of North Liberty, on the estate of D. W. Place, Section 35, township 36 N., Range 1, west of second principal meridian, in 1924. That is, it was found in the Kankakee Valley and was probably laid down in the bottom of the old Pleistocene Kankakee Lake. Essentially all of the facial portion of the skull is lacking save for a portion of the right zygoma and a portion of the left orbit. The left horn core is particularly well preserved and it is doubtful if more than 25 mm. of its tip are lacking. Scarcely any wear is noticeable on the specimen and judging from the sand that fell off as I examined it, it had evidently been deposited in sandy material. The exostosis between the horn cores is less extensive than it is in the case of the Hebron specimen as figured by Doctor Hay, probably due to the anterior portion having been broken away in the North Liberty skull. The exostosis is quite irregular not only as regards texture but also as regards its general surface. At the base of the left horn core there is a well defined shallow depression measuring 55 mm. antero-posteriorly and 35 mm. laterally. The pterygoid processes are well preserved, projecting from the base of the skull 60 mm. and having a width of 35 mm. The air cells of the frontal sinus under the anterior portion of the exostosis are well defined and do not appear to extend into the horn cores themselves as happens in many of the other Bovidae. The general appearance of the fragment and the relationships of its various parts are shown in figure 1.

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The age of the specimen is unquestionably the same as that of the one found at Hebron and stated by Hay to be late Wisconsin Pleistocene, and like the Hebron animal the present one was probably living at the foot of the glacier which left the Valparaiso moraine.

The North Liberty specimen gives the following measurement expressed in millimeters. The figures in parentheses are the corresponding measurements of the Hebron skull as published by Hay. The Hebron skull appears to be slightly larger than the North Liberty skull, though the latter had apparently slightly longer horns.

MEASUREMENTS.

Height of rear of skull from upper edge of foramen magnum to top of exostosis	160	
Height of rear of skull from lower surface of occipital condyles to top of exostosis, median plane	200	(223)
Width of skull at external auditory canals	190	(191)
Maximum width of cranium	205	
Width between outer edges of articular surface of occipital condyles	150	(118)
Width of skull at hinder edge of temporal fossae	135	(134)
Width of hinder end of basioccipital eminence	73	(82)
Greatest width of posterior nares	50	(58)
Paroccipital width	195	
Length of horn core from center of skull on top to estimated tip along outer convexity	435	
Length of horn core from elevated inner edge to estimated tip along outer convexity	405	(380)
Antero-posterior diameter of horn core at base	100	(118)
Supero-inferior diameter of horn core at base	70	
Circumference of horn core at base	270	
Antero-posterior length of exostosis (probably defective anteriorly)	185	
Width of exostosis at center	110	
Greatest depth of concavity between horn cores	25	(36)
Tip of horn core to sagittal plane (estimated)	250	(262)
Other surface of right zygomatic process to median line of skull	105	(112)
Height of temporal fosse at middle	65	

Relationships. As pointed out by Dr. Wilfred H. Osgood (in 1905 volume 48, page 177 of Smithsonian Miscellaneous Collections) *Symbos cavifrons* is more nearly related to the existing genus of true Musk-Oxen, *Ovibos* than to any other animal. He calls attention to certain characters which might indicate *Symbos* to be an ancestral form of *Ovibos.* The prominent exostosis between the horn cores and its evident covering with horn during life would indicate that in respect to its horns at least *Symbos* was a more highly specialized animal than *Ovibos.* Both are probably distinct offshoots of the same line. The presence or absence of extension of the frontal sinus into the horn cores may have some taxonomic value. The presence or absence of such air passages in the horn

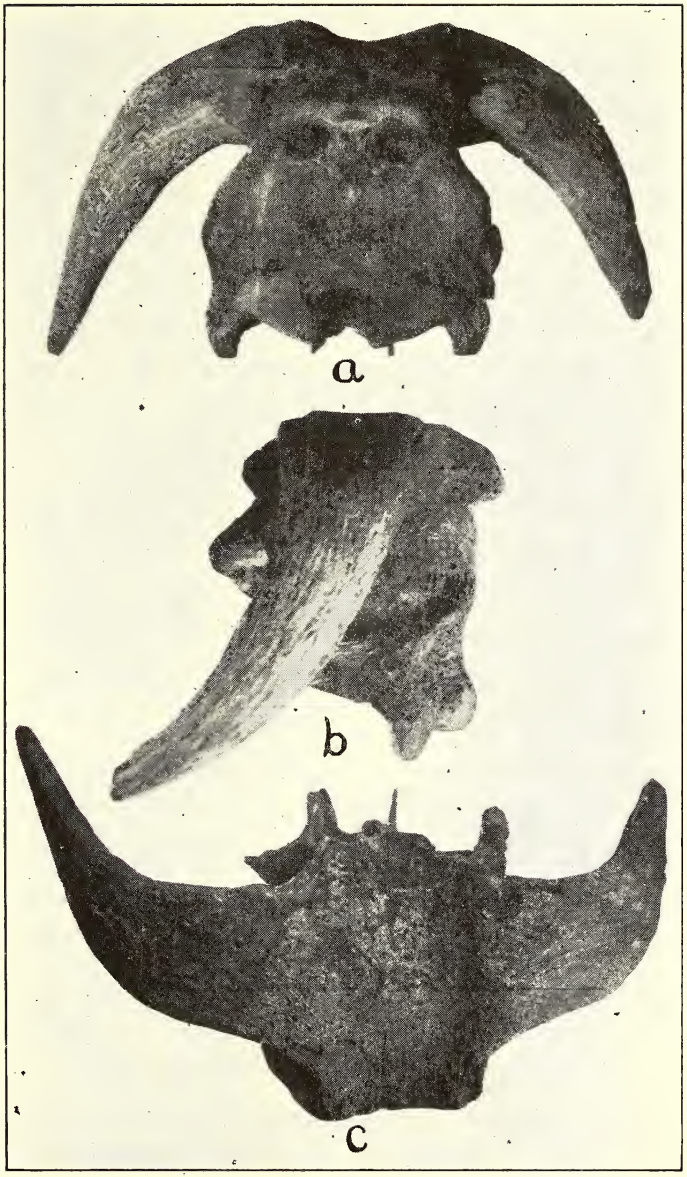

Fig. 1—(a) Posterior view of skull of *Symbos cavifrons* (Leidy); (b) left lateral view of skull. Facial portion of skull is lacking. Note the downward and forward slope of the horn core, the well marked temporal fossa and the conspicuous paroccipital process extending below the level of the condyle; (c) dorsal view of skull. It shows particularly well the roughened exostosis between the horn cores and that it extended farther back posteriorly than the main portion of the cranium and as far or farther anteriorly than the extant portion of the skull.

cores could probably be ascertained by roentgenograms of the horn cores without injuring the specimens. A roentgenogram of the present specimen of *Symbos* shows the core to be solid. I regret there are not available for roentenography specimens of *Ovibos, Bison* and of the Ovinae. Remains of true Musk-Oxen, *Ovibos* are much rarer in Indiana than those of *Symbos*. Doctor Hay records but a single specimen from Indiana, a portion of a skull unearthed near Richmond.