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BULLETIN OF THE UNIVERSITY OF NEBRASKA STATE MUSEUM

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The Geologic History of the Bison in the Great Plains* (*A Preliminary Report*)

C. BERTRAND SCHULTZ AND W. D. FRANKFORTER **

THE GEOLOGIC history of the bison in North America is a subject which has received little attention to date. Osteological rather than geological problems have been the main concern of most writers who have so far published. If the geologic history of the bison is to be learned, it will be necessary to devote more time and effort in the field in determining the age of the deposits in which various specimens have been discovered and in making more extensive collections from deposits of known age. Unfortunately the majority of the type specimens have been surface finds and little attempt has been made to determine their geologic occurrence. Research concerning phylogenetic problems definitely begins in the field. The geologic age of the specimens, types, and referred material must be determined before a phylogenetic line can definitely be established. The problem of individual variation also must not be overlooked.

The present paper has been prepared in order to record some definite observations and information on bison remains collected in the Great Plains with special emphasis on the collections of the University of Nebraska State Museum. The field parties of the

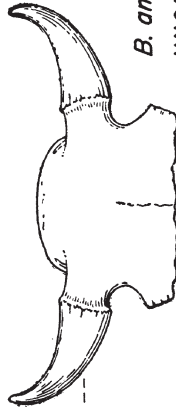
* Presented in part at the December 1945 meeting of the Society of Vertebrate Paleontology held at Pittsburgh, Pennsylvania (Schultz and Frankforter, 1945, p. 1194).

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PERIOD	AGE	FORMATIONS MATERIALS
GLACIAL OR	RECENT	Terrace 1
	WISCONSIN	Cochrane
		Terrace 2
	Mankato	Bignell loess
		Terrace 3
	Iowan	Peorian loess
SANGAMON		
ILLINOIAN	Citellus Zone soil	
	Loveland loess, sand and gravel Pearlette ash	



B. bison
U.N.S.M. 30353



B. antiquus
U.N.S.M. 30323



B. antiquus barbouri
U.N.S.M. 30310

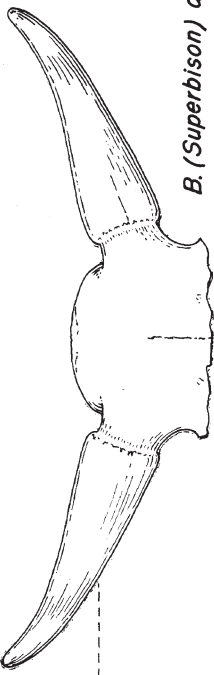
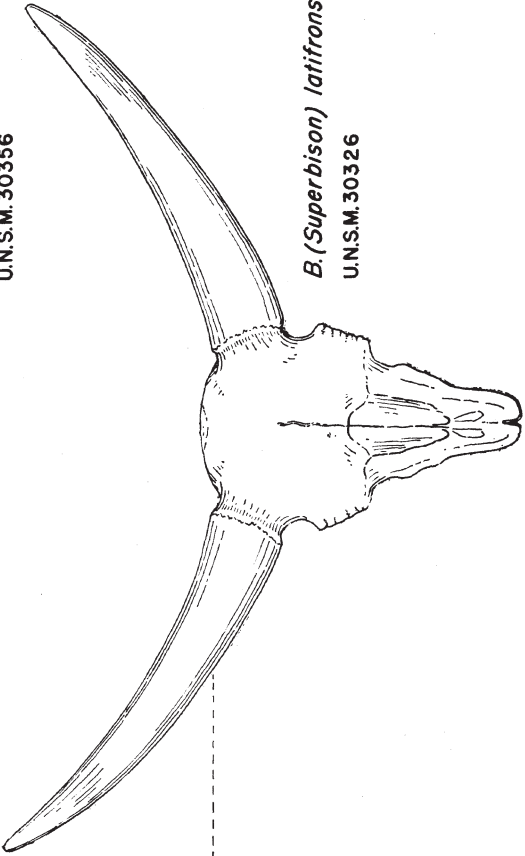
<p style="text-align: center;">PLEISTOCENE</p>		<p>YARMOUTH</p>	<p>Upland clay, silt, sand and marl-peat</p>	 <p><i>B. (Superbison) alleni</i> U.N.S.M. 30356</p>
		<p>KANSAN</p>	<p>Grand Island sand and gravel</p>	 <p><i>B. (Superbison) latifrons</i> U.N.S.M. 30326</p>
		<p>AFTONIAN</p>		
		<p>NEBRASKAN</p>		

Chart I.—Geologic distribution of the bison of the Great Plains. Skulls drawn by N. H. Mohler. x 1/15.

Museum have constantly been building up the bison collections since 1928. The first large collection was made in 1932 at the Scottsbluff Bison Quarry (Barbour and Schultz, 1932, pp. 283-6) which is located in the base of a late Pleistocene terrace.

Bison first appeared in the Great Plains before the middle of the Pleistocene. Remains have been recorded from several localities in Nebraska from Grand Island gravels (Lugn, 1934, p. 345; 1935, pp. 103-19; 1939, p. 856; Schultz, 1934, pp. 390-2) which probably are of late Kansan or early Yarmouth age. The first bison to reach the plains region were truly giants and were the size of *Bison (Superbison) latifrons* (Harlan) from Big Bone Lick, Kentucky. The four following specimens of note are from the Grand Island gravels of Nebraska: (1) A portion of horncore (U.N.S.M. No. 30324)¹ from near Giltner in Hamilton County; (2) a right horncore (U.N.S.M. No. 30359) including the complete tip end from alluvial gravels (probably Grand Island) of Hitchcock County; (3) an incomplete skull with horncores (H. Mus. No. 4710, cast U.N.S.M. No. 30326, the holotype of "*B. angularis* Figgins," figured in Chart I of this paper, anterior portion restored) from near Sutton, Clay County; and (4) an incomplete skull with horncores (C.M.N.H. No. 1187, the holotype of "*B. rotundus* Figgins") from near Dorchester in Saline County. The present writers refer the four above-mentioned specimens to the same species, *B. (Superbison) latifrons* (Harlan). No small species have been recorded from the Grand Island gravels in Nebraska. At Big Bone Lick, the holotype of a smaller species of bison, *B. antiquus* Leidy, was also found but the fossil-bearing deposits at this locality cannot be attributed to one single age.² The latter species undoubtedly came from one of the later deposits of that area.

Another specimen from Nebraska which should be commented upon is the holotype of *B. (Superbison) ferox* Marsh. This species appears to be synonymous with *B. (Superbison) latifrons*. It was thought earlier by the writers (Schultz and Frankforter, 1945, p. 1194) that *B. (Superbison) ferox* was a smaller species than *B.*

¹ U.N.S.M.=University of Nebraska State Museum; other abbreviations: A.N.S.P.=Academy of Natural Sciences of Philadelphia, C.M.N.H.=Colorado Museum of Natural History, H. Mus.=Hastings Museum (House of Yesterday), Hastings, Nebraska, Y.P.M.=Yale Peabody Museum.

It will be noted that new permanent file numbers for University of Nebraska State Museum specimens are used for the first time in this paper. Heretofore, a number prefixed to a date was used in publications. This latter number, however, was assigned in the field and is now considered to be a field number. Henceforth, the permanent file numbers will be used.

² The senior writer visited Big Bone Lick in 1941 in order to study the geological evidence in the vicinity where the bones had been collected.

(*Superbison*) *latifrons* but size and other characteristics of the horncores of the holotypes are similar if not indistinguishable. Unfortunately, the holotype of *B. (Superbison) ferox* is so incomplete that definite comparisons are extremely difficult. The exact location of the discovery of this latter specimen has been variously reported. In order to reach conclusions as to geologic and geographic occurrences of this form, it seems advisable to review some of the evidence.

The holotype of *B. (Superbison) ferox* (Y.P.M. No. 10910) is recorded in the Yale Peabody Museum catalogue as having been found along the Niobrara River of Nebraska in 1870. O. P. Hay (1924, p. 199) also indicates that it was found along the Niobrara River by Eli Whitney (a grandson of the inventor) the same year. Richard S. Lull (1913, p. 2) states, however, that the Yale Expedition of 1870, which collected the specimen, did not reach the Niobrara River but went only as far as the "Loup Fork of the Platte" which is in the area of the present Middle Loup in Hooker and Cherry counties. A study of all available information concerning both the Pleistocene collecting localities along the Niobrara and along the Middle Loup, indicates that there is little if any opportunity to collect from fossiliferous deposits other than those of late Kansan (Grand Island formation in part) or Yarmouth (upper Grand Island and Upland formation). The color and preservation of Marsh's specimen are similar to those of fossilized remains from University of Nebraska State Museum quarries in the Middle Loup area. It is probable, therefore, that the holotype of *B. (Superbison) ferox* came from deposits of late Kansan or early Yarmouth age. An unusually large distal end of a radius-ulna (U.N.S.M. No. 30360) of a bison from the Pleistocene deposits along the Middle Loup River in Hooker County is definite evidence of a large species in the area where Marsh is supposed to have collected his specimen.

The University of Nebraska State Museum recently acquired a partial skull with horncores (U.N.S.M. No. 30361) of *B. (Superbison) latifrons* from John Newsom of Scott City, Kansas. This specimen came from gravels which are believed to be equivalent to the Grand Island of Nebraska.

Upland deposits of Yarmouth age recently have yielded specimens of bison the size of *B. (Superbison) alleni* Marsh. Two partial skulls with horncores (U.N.S.M. No. 30356,³ figured in Chart I

³ Donated by John and Philip Bartek, Weston, Nebraska.

of this paper, and a specimen at the Assumption High School, Dwight, Nebraska) have been found 30 miles north of Lincoln near Weston in Saunders County, Nebraska. One of the specimens (U.N.S.M. No. 30358, cast of the Dwight example)⁴ is almost identical with the holotype of *B. (Superbison) alleni*. Evidence points to the fact that the two Saunders County specimens came from Upland deposits. *Bison (Superbison) chaneyi* Cook from Texas appears to be synonymous with *B. (Superbison) alleni* and is not considered to be a valid species in this paper.

Only a few specimens of fossil bison are available from the "Citellus faunal zone." These specimens are considerably smaller than the *Bison (Superbison)* forms of the middle Pleistocene and have characters which correspond more to the species of *Bison* from the late Pleistocene. The restored specimen (U.N.S.M. No. 30310) figured in Chart I of this paper came from the "Citellus faunal zone" directly above the buried Loveland soil south of Gothenburg, Dawson County, Nebraska. A second skull (U.N.S.M. No. 30357) from near Broken Bow, Custer County, Nebraska, has similar characters and gives a better indication of size than the Dawson County example. The Custer County skull, however, has questionable geologic data so the writers have used the Dawson County specimen for illustration and as the holotype of a new subspecies. The bison remains from the "Citellus faunal zone" do not seem to be referable to any described form of *Bison* but ten-

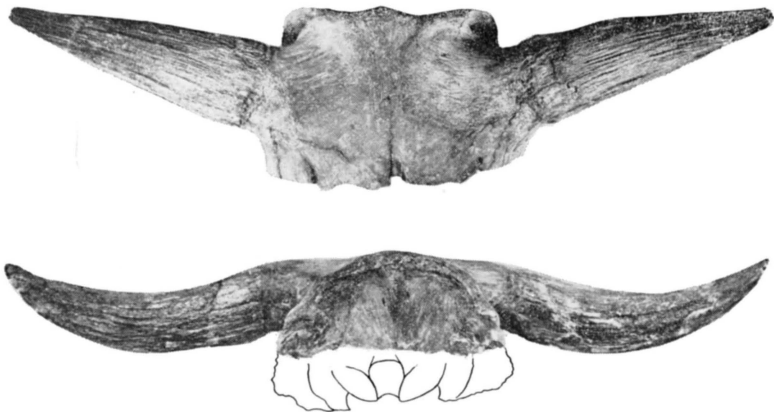


Fig. I.—Dorsal and rear views of holotype of *Bison antiquus barbouri*, new subspecies. No. 30310, The University of Nebraska State Museum. x 1/10.

⁴ Original loaned through the kindness of Father W. Michalicka, Assumption High School, Dwight, Nebraska.

tatively are considered to belong to a new subspecies of *B. antiquus*, the nearest affinity. The subspecies is larger and more massive than the bison from later Pleistocene deposits in the Great Plains and definitely smaller than the Middle Pleistocene forms.

The name *B. antiquus barbouri*⁵ is here proposed for the new subspecies.

Bison antiquus barbouri, new subspecies

Holotype.—Partial skull with horncores, U.N.S.M. No. 30310.

Locality.—Da-10,⁶ center of sec. 22, T.10 N., R.25 W., on west side of "Devils Gap," 9 mi. south and 2½ mi. west of Gothenburg, Dawson County, Nebraska.

Horizon.—*Citellus* soil zone between Loveland and Peorian loesses, Late Pleistocene.

Measurements—	<i>Bison antiquus</i> <i>barbouri</i> subsp. nov. HOLOTYPE U.N.S.M. No. 30310	<i>Bison</i> <i>antiquus</i> Leidy HOLOTYPE A.N.S.P.
Base of horncore		
Vertical diameter	100	102
Transverse diameter	123	122
Circumference	345	364
Length of horncore		
Along upper curve	355	((270)) ⁷
Along lower curve	400	((340))
Width between tips of horncores	(1030) ⁸	

A great many specimens of fossil bison have been collected from Terrace 2 or its equivalent throughout the Great Plains. Recently a classification was proposed (Bryan, K., 1941; Schultz and Stout, 1945) for the late Pleistocene into which these terrace deposits can be placed. It is recognized that terraces along separate drainage patterns may be correlated and data has been accumulated which supports this belief.

The bison material from Terrace 2 has been assigned by various authors to *B. antiquus* and numerous other species. This form has been found associated with cultural remains of early man in many parts of the Great Plains. The specimen (U.N.S.M. No. 30323) figured in Chart I of this paper (also figured, Schultz and Eiseley, 1935, pl. 9, and Barbour and Schultz, 1936, fig. 204) is from the Scottsbluff Bison Quarry from a fossiliferous zone in T²

⁵ Named in honor of Erwin H. Barbour, Director Emeritus of the University of Nebraska State Museum.

⁶ New locality system using county abbreviations of two letters prefixed to locality numbers, adopted January, 1945 by Division of Paleontology, University of Nebraska State Museum.

⁷ (()) = estimated.

⁸ () = approximate.

(Schultz and Stout, 1945). Yuma points were found *in situ* associated with the bison material (Barbour and Schultz, 1932, pp. 283-6). Near Canadian in Lipscomb County, Texas, a series of over twenty skulls with associated skeletal material has been collected by field parties of the University of Nebraska State Museum. Numerous Folsom artifacts were found associated with the Lipscomb fossils (Schultz, 1943, pp. 242-9). These two collections afford a fine opportunity to compare the bison associated with Folsom and Yuma artifacts. A quantitative study of this material is at present in progress at the University of Nebraska. From observations thus far made there is little if any difference in size or characters between the bison associated with the two types of artifacts mentioned above. Unfortunately most of the available material of bison of this type, including the Colorado Museum of Natural History and the American Museum of Natural History collections, is in a very poor state of preservation. Much crushing is in evidence.

A large collection of bison from more recent terraces is being accumulated. An effort is being made to secure large numbers of specimens from each locality reported. For example, from deposits along Humbug Creek, northwest of Pilger, Stanton County, Nebraska, over fifty partial skulls⁹ (skull U.N.S.M. No. 30353 figured in Chart I of this paper) including complete horncores and numerous individual cores are in the University of Nebraska State Museum collections. All of this is an effort to bring together examples of bison in sufficient numbers from restricted horizons to form a valid basis for conclusions on range of variation in bison.

In conclusion the writers wish to state that evidence at hand indicates that there has been a gradual diminution in the size of the bison since the first migrants arrived in the Great Plains during Kansan time. The giant forms apparently had attained their maximum size before reaching the plains region, probably in Asia. It would appear that the bison of central United States are in one phylogenetic line, with perhaps a specialized line or two branching off in the late Pleistocene. The truly giant forms appear to be restricted to horizons of Kansan and Yarmouth age. These large species are considered as belonging to the subgenus *Superbison* Frick (1937, p. 567). There is a definite break between these and the later forms but this appears to be due to the fact that no reported remains of bison have been found in deposits definitely

⁹ Obtained through the courtesy of Otto Klima and Walter Chase, Pilger, Nebraska.

attributed to the Illinoian. In other words there is a "missing link" in the phylogenetic line at this time but when specimens are found they probably will be intermediate forms between those known from deposits of Yarmouth and Sangamon ages.

There is considerable variation in size, curvature, and direction of horncores in associated material. This variation has been taken into consideration in the present report. Quantitative studies are now in progress to determine more definitely this variation. It will be necessary to collect much more fossil bison material from known geological horizons before phylogenetic relationships can be well established between the numerous species. Bison remains eventually may become some of the most important "index fossils" of the Pleistocene of the Great Plains since it appears that diminution in size was rapid enough to cause specific differences in succeeding faunal zones.

The writers are indebted to the following persons: Carl O. Dunbar of Yale Peabody Museum for providing casts of the types of *Bison (Superbison) alleni* and *B. (S.) ferox*; the Nebraska State Geological Survey, through E. C. Reed, for stratigraphic information concerning various Pleistocene deposits which have yielded fossil bison remains; Herbert Waite of the United States Geological Survey for geological data; Charles H. Falkenbach and Morris Skinner of the Frick Laboratory, American Museum of Natural History, for information and helpful suggestions; Childs Frick and the late Charles H. Morrill for financial support of the project, and Iona May of the University of Nebraska State Museum for editorial assistance.

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