

1962

A Description of *Castoroides ohioensis* from Minnesota

Bruce R. Erickson

Follow this and additional works at: <https://digitalcommons.morris.umn.edu/jmas>



Part of the [Zoology Commons](#)

Recommended Citation

Erickson, B. R. (1962). A Description of *Castoroides ohioensis* from Minnesota. *Journal of the Minnesota Academy of Science*, Vol. 30 No.1, 6-13.

Retrieved from <https://digitalcommons.morris.umn.edu/jmas/vol30/iss1/2>

This Article is brought to you for free and open access by the Journals at University of Minnesota Morris Digital Well. It has been accepted for inclusion in Journal of the Minnesota Academy of Science by an authorized editor of University of Minnesota Morris Digital Well. For more information, please contact skulann@morris.umn.edu.

A Description of *Castoroides ohioensis* from Minnesota

BRUCE R. ERICKSON
Science Museum, St. Paul

INTRODUCTION: During the month of July 1938, some remains of a giant beaver, *Castoroides ohioensis*, were uncovered by construction workers on the east slope of the Mississippi River gorge within the city limits of St. Paul. Location of the find, known locally as "Hidden Falls Park," occupies one of the many incipient glens formed along this segment of river valley during post glacial times. Exposures within the glen total approximately 115 feet and consist of Ordovician and Pleistocene deposits. St. Peter sandstone is exposed as base at river level. The top of the St. Peter grades into a series of thin sandy, shaly beds which make up the Glenwood formation. Overlying these beds is Platteville limestone, relatively resistant and characteristically a ledge former. Above the limestone, exposures consist of isolated patches of shale and Pleistocene drift.

The skeleton of the giant rodent appears to have been crushed by collapse of an overhanging Platteville limestone ledge, under which it had been resting. Subsequent weathering of the remaining cliff face and talus resulted in deposition of a calcareous coating on the bone surfaces. We can unquestionably attribute the finely preserved texture of the bone surfaces to this covering, which was of little concern during preparation. Without it, surfaces might very easily have been destroyed by prolonged exposure. A clay matrix surrounding the skeleton also contained numerous remains of *Castor*. It is questionable that their deposition was synchronous with that of the giant beaver.

The discovery was reported to the late Louis H. Powell, then director of the Science Museum, who identified and recovered the major portion of a badly damaged skeleton. The occurrence is documented by Powell (1948).

Most known specimens of *Castoroides ohioensis* are far from complete enough to be called skeletons. Substantial portions of individual skeletons have been preserved in a few instances. Perhaps the most complete of these, and one that has frequently been figured, is the mounted specimen at Earlham College, Richmond, Indiana. Moore (1890, 1893) described this skeleton. It lacks its fore feet and much of the hind feet. The skull is lacking its posterior part and a number of vertebrae are also missing.

The individual to be described in this paper has just recently been mounted by the author. It lacks a good share of the bones; however, regions of the skeleton which are not present or are inadequately represented in the Earlham specimen and in other previous finds are sufficiently preserved to warrant description. These are particularly the feet. Many known elements are also figured and discussed for general reference purposes.

In addition to the afore mentioned description, occurrence of *Castoroides* in Minnesota is noted.

REFERRED MATERIAL: A badly crushed skeleton of a young adult individual of *Castoroides ohioensis* (62-2001) Science Museum, lacking most of the axial skeleton.

LOCATION AND HORIZON: Post glacial talus slope on east side of the Mississippi River Valley within the city limits of St. Paul, (SE $\frac{1}{4}$ Sec. 17 T28N., R23W.) Ramsey County, Minnesota.

DESCRIPTION: *Skull:* The skull of *Castoroides* has been discussed at great length by various authors. Its structural affinities with *Castor* are well known and need little comment here. Because of the extremely fragmentary nature of the present skull, its total length and height are uncertain. Both internal and external contacts are lacking between the anterior third and the middle and posterior third of the skull; therefore, at best, only close approximations have been made in the restored skull (Figs. 1 and 2).

The skull, as preserved, lacks all of its brain case, except a narrow section of the roof from the base of the right zygomatic arch through the approximate center of the parietals and including the base of the left arch. Parts of the basicranium are preserved, including the paired auditory bullae which are much less bulbous than those of *Castor*. The prominent external auditory meatus is located very nearly in the same place as it is in *Castor*. The auditory canal seems to follow a more horizontal path than it does in *Castor*. All occipital components are lacking. The anterior half of each arch is intact; each exhibiting a broad triangular-shaped angular process. The left maxilla is present, insofar as it nearly surrounds the external opening of the infraorbital foramen. The anterior margins of the frontals are preserved. Nasals are wanting. Premaxillaries, as represented, extend backward on the ventral side from the incisors nearly to where they join the maxillaries. A small scrap of premaxillary on the left side of external nares was also found; anteriorly it is strongly rugose.

Mandible: The mandible is massive and resembles that of *Castor* in over-all shape and proportions. The most striking difference is found in the relative size of the incisor. Comparison shows the mandible of *Castoroides* to be roughly twice as large as *Castor*; whereas, its incisor is fully three times as large. Actual length of the mandible in the present specimen is not uncertain, as was the case with the length of the skull, although sizable areas of both halves of the lower jaw are missing. The mandible is compared with that of a fully grown individual (Figs. 3 and 4). The mandible is wedge

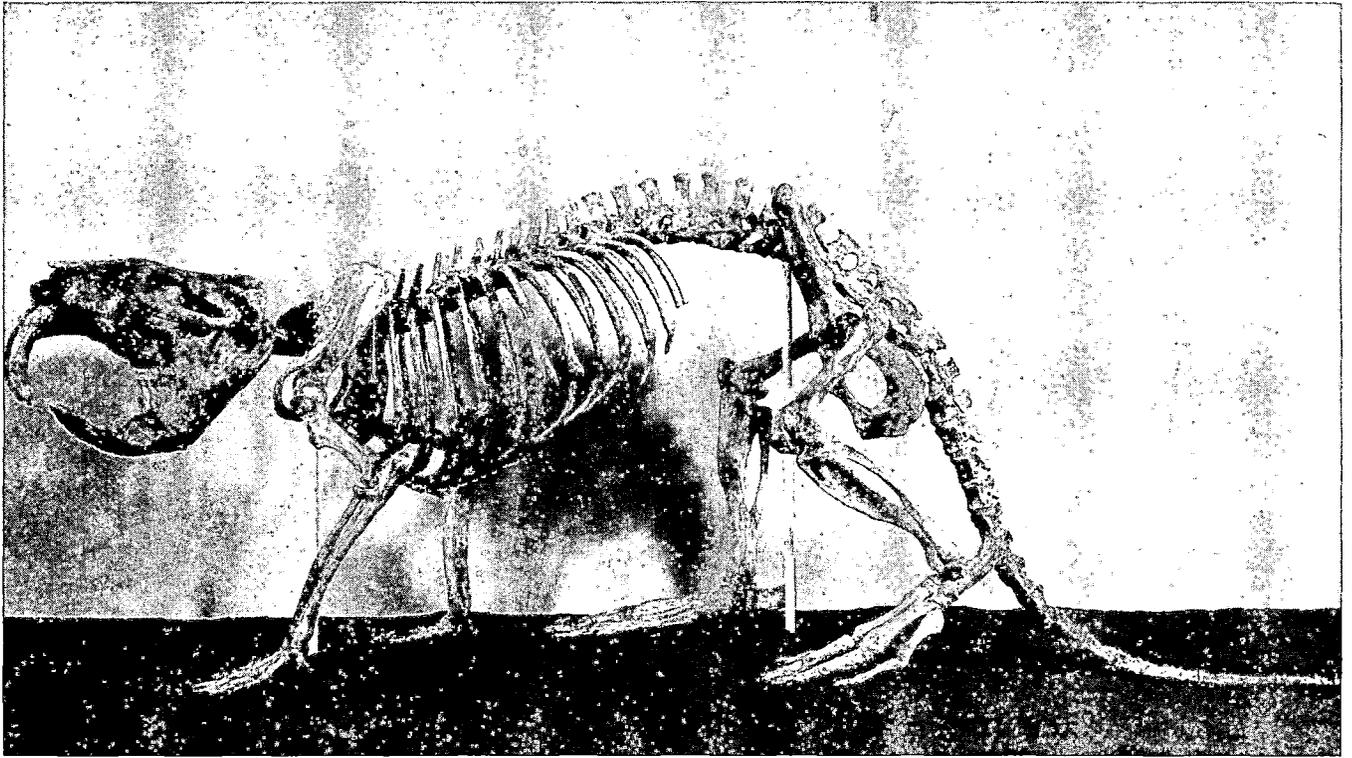


PLATE 1. Mounted skeleton of *Castoroides ohioensis* Sci. Mus. No. 62-2001.

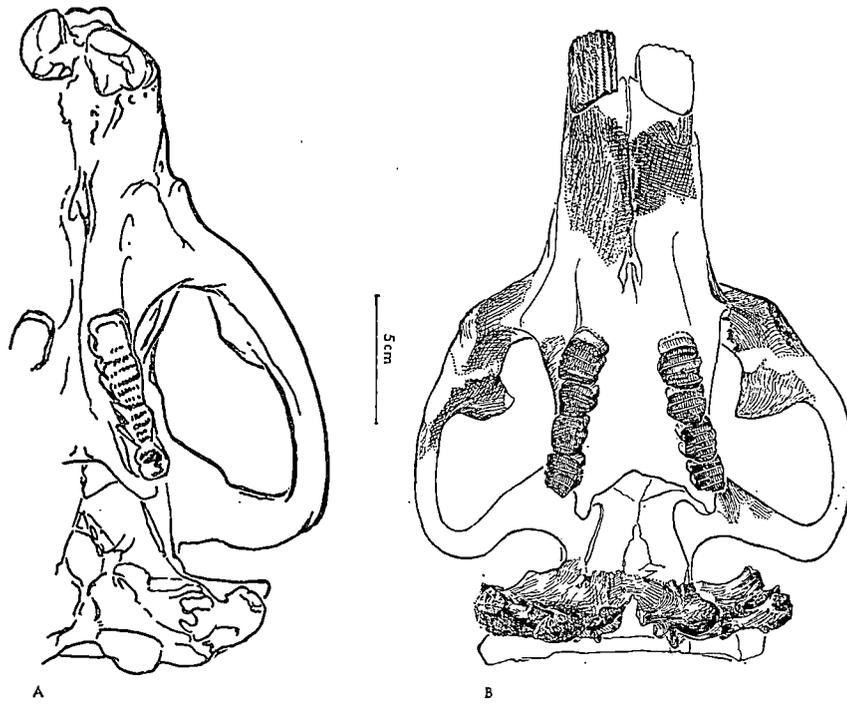


FIGURE 1: A. Ventral view of Clyde skull (cast) Sci. Mus. No. 38-2000X; B. Ventral view of skull. Referred specimen, Sci. Mus. No. 62-2001.

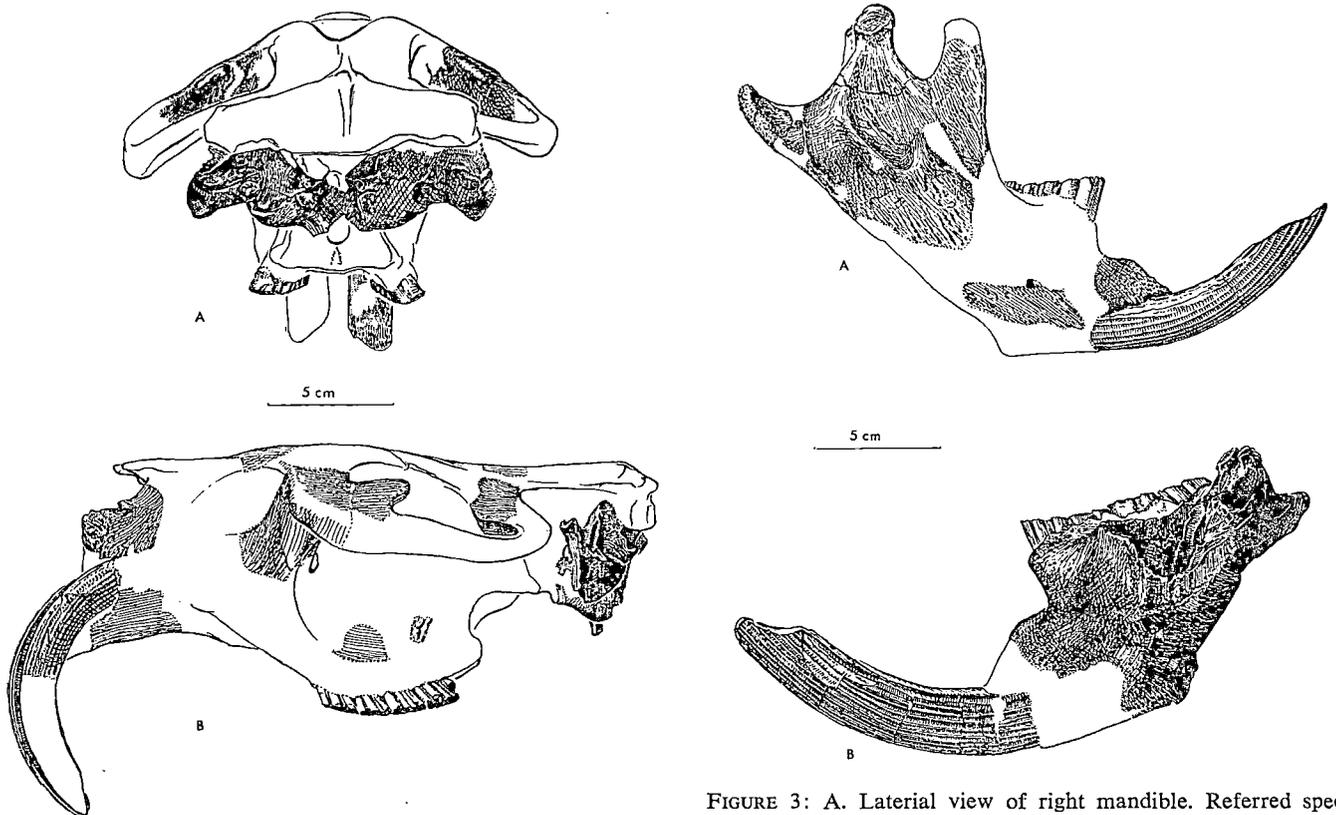


FIGURE 2: A. Posterior view of skull; B. Lateral view of skull.

FIGURE 3: A. Lateral view of right mandible. Referred specimen, Sci. Mus. No. 62-2001; B. Lateral view of left mandible. U. of M. No. 3728.

shaped, as viewed from above. It has a well developed symphysis which joins the two halves of the lower jaw from the incisor base nearly to the level of the second molar in the younger specimen (A and B, Fig. 4). It appears to reach the level of the third molar in the more mature form (C, Fig. 4). The ramus is broad and relatively flat on its medial surface. The lateral surface's most outstanding feature is a prominent depression for the insertion of the masseter.

Dentition: Grinding teeth have the formula p m 1/1, m 3/3. All are present except the last lower left molar. Having very little remaining contact with the rest of the skull, the upper grinding teeth may or may not be entirely accurate in their relationship to the restored skull. Upper dentition of other skulls of *Castoroides* examined, namely, skull (P 12290) Chicago Natural History Museum and a cast of Clyde skull (38-2000X) Science Museum show that the distance between internal leading edges of the premolars (right and left) is slightly greater than one might expect; however, when matched with the lower jaw, the bite seems to be reasonably correct. It is further noted that in a comparison of mature and old individuals of *Castor*, younger individuals have,

as above, a wider space between premolars. Grinding teeth are curved similarly to oversized incisors when observed within the maxilla and are thereby directed backward as they emerge from the skull. The situation in the mandible is reversed, and teeth are aimed forward. Grinding teeth, when viewed in cross-section, consist of quantities of dentine encircled by compressed ridges of well cemented enamel (Fig. 4).

The left upper incisor is missing two inches of tip. The cross-section at this brake shows a sub-prismatic form. The entire outer margin of the tooth is covered with enamel bearing diagnostic longitudinal grooves. The right incisor is complete. Lined up with its counter part in the mandible, the respective tips form one-half of an inverted V which characterizes the peculiar cutting edges of the incisors. The lower left incisor lacks the whole of its enamel surface.

Vertebral column: The only vertebrae preserved in any detail are caudals. These are numbers 1, 3, 4, 7, 9 through 12, 16 through 18 and two of the more distal ones—probably 21 and 22. It is estimated that the tail contained in the neighborhood of 24 vertebrae, which is close to general average estimate. Extremities of the neural spines, as well as the lateral processes, are not present in any of the caudals, and in most instances the epiphyses are unattached. No chevron bones were found.

The same approximate section of tail mentioned above has been described and aptly figured by Moore (1890), so no further mention will be made here.

Of the sacrum only the centrum and left transverse process of the first vertebra remain.

The last three lumbar are present in badly crushed condition. Also fragments of what may belong to the first, third and fifth dorsals are all that were recovered of the remainder of the backbone.

Moore (1893), in his description found the axis coossified with the third cervical, forming a solid piece. He speculates as to the possibility of this fusion being an exception. He further hinted at its being diagnostic of the species. Upon consideration of several specimens of *Castor* and the mounted skeleton (P 12118) in the Chicago Natural History Museum, in which similar ankylosis exists between axis and third cervical, the present skeleton was restored exhibiting the consolidation. The four posterior cervicals were fashioned after *Castor*.

Ribs: Ribs of the right side are more fragmentary than those of the left. The only recognizable pieces on the right side are believed to be the complete third rib and head end of the first. The left flank is somewhat better, containing ribs X and XI, both complete, and major portions of VI and VII, less their extremities. Proximal ends of ribs I, IV and V are also preserved. In the mounted specimen at hand the rib cage appears to be less expanded than it is in *Castor*. Like *Castor*, there are fourteen ribs. The first is heavy, very short and straight. They gradually lengthen posteriorly and become curved similarly to the modern beaver. Flattening is apparent on posterior surfaces of the longer ribs. Numbers X and XI are quite round in cross-section and the tubercle is much reduced.

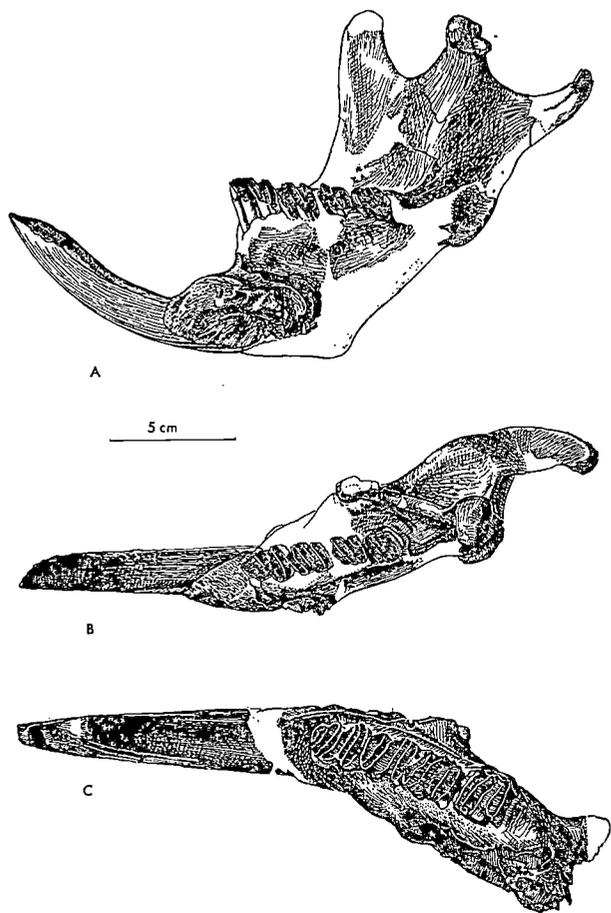


FIGURE 4: A. Medial view of right mandible. Referred specimen, Sci. Mus. No. 62-2001; B. Dorsal view of right mandible. Referred specimen, Sci. Mus. No. 62-2001; C. Dorsal view of left mandible. U. of M. No. 3728.

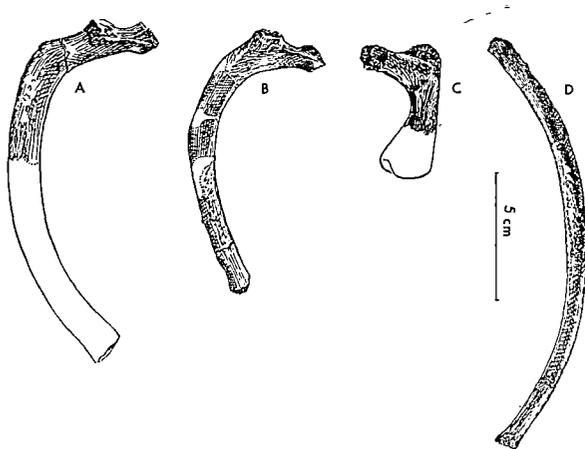


FIGURE 5: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Anterior view of fifth right rib; B. Anterior view of third right rib; C. Anterior view of first left rib; D. Anterior view of tenth left rib.

Sternum: The single sternal element preserved is the presternum (Fig. 6). Its anterior border has been damaged and all articular areas are missing. The anterior end, at least, seems to be somewhat more massive than it is in *Castor*. The bone narrows toward its center to about one-half of its estimated maximum width of 45 mm. Posteriorly, it expands laterally and dorsally; its thickest point being at the center of the base. Four remaining segments have been simulated in plaster, making the total length of the sternum about 150 mm. It seems reasonable that the number of sternal elements in *Castoroides* should coincide with that of *Castor*.

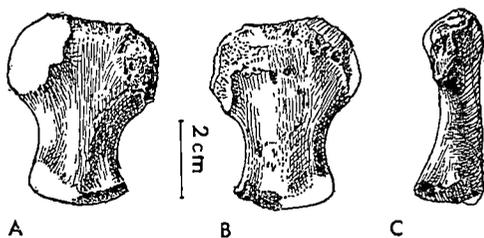


FIGURE 6: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Dorsal view of presternum; B. Ventral view of presternum; C. Lateral view of presternum.

Scapula: Little was recovered of either scapula. The left is worthy of mention only insofar as the neck of the scapula and base of the spine which divides the lateral face are preserved. The acromion process, as seen in a second specimen (P 12118) in the Chicago Natural History Museum, is unlike *Castor*. Its length is relatively shorter and its lateral border compressed.

Clavicle: The left clavicle is preserved in its entirety (Fig. 7) while its mate lacks all but a small piece from the scapular end. The shaft is smoothly curved as it projects upward and laterally, changing to a posterior direction near its lateral extremity to meet the acromion process of the scapula. The medial end becomes much inflated as it approaches the presternum. It resembles that of *Castor*, but has notably more curvature.

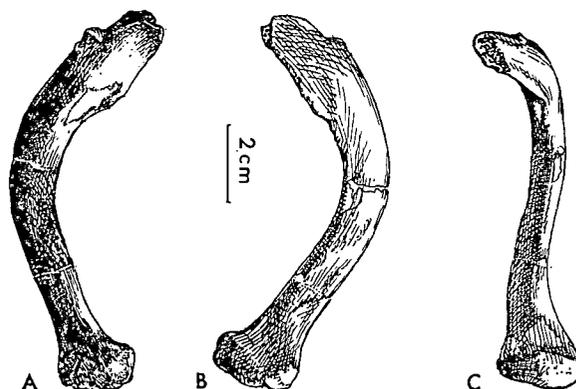


FIGURE 7: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Posterior view of left clavicle; B. Anterior view of left clavicle; C. Dorsal view of left clavicle.

Humerus: Both humeri are essentially complete and uncrushed. Very little difference, other than size, is found between the humeri of *Castoroides* and *Castor*. Relative length in the former is somewhat shorter, however. Its most salient feature is a strong deltoid process on its antero-lateral surface.

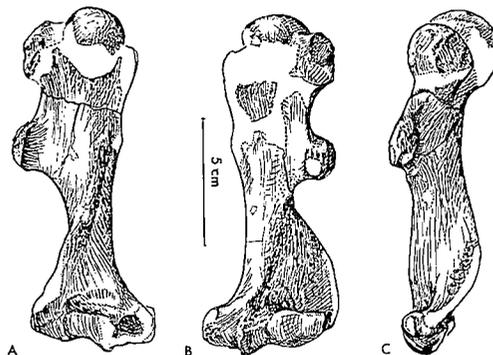


FIGURE 8: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Posterior view of left humerus; B. Anterior view of left humerus; C. Lateral view of left humerus.

Radius-ulna: The left radius is missing a small part of shaft center. Its relationship to the ulna presents no problem, however, as the semilunar and radial notches, including the coronoid process, are preserved. The two bones match quite nicely along their common curvature. Distally the radius is intact, exhibiting the complete epiphysis. The olecranon is missing from the ulna, as is its inferior extremity. *Castoroides* possesses a relatively longer forearm than *Castor*. The radius and ulna of the giant form are the only long bones in which the relative length exceeds that of the latter.

Manus and Pes: Perhaps the most important bit of enlightenment which this report can lend concerns the feet.

The forefoot of the present specimen, as preserved, resembles that of *Castor* in great detail (Fig. 10). It is relatively shorter in *Castoroides* with relation to limb bones. Total interpreted length is 162 mm.

The left manus of the present specimen offers a greater number of elements for description than does the right. Bones of the left foot are represented as follows: the

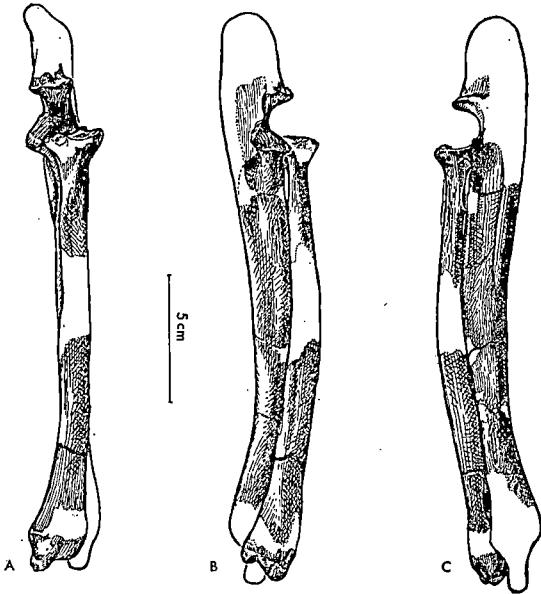


FIGURE 9: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Anterior view of left radius-ulna; B. Medial view of left radius-ulna; C. Lateral view of left radius-ulna.

scaphoid; pisiform; hamate; metacarpals I and IV; the proximal end of II; first phalanx of the first digit; first, second and third phalanges of the second and third digits; the first and second phalanges of the fourth digit; and the first phalanx of the fifth digit. Of the right fore-foot, only the pisiform and half a dozen fragmentary phalanges were found.

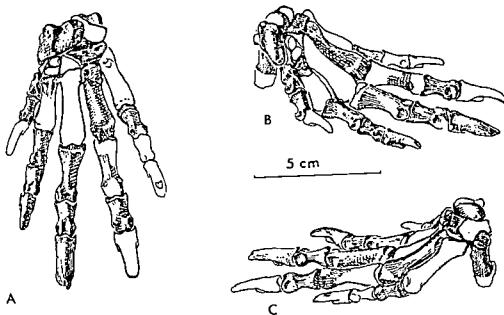


FIGURE 10: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Dorsal view of left fore foot; B. Medial view of left fore foot; C. Lateral view of left fore foot.

As preserved, the carpals agree in arrangement with *Castor*. Articulation between the scaphoid and the radius is also in agreement with *Castor*; however, a slight difference in morphology of the scaphoid bone is noted (Fig. 11). It is at once apparent that the medial face of this element in *Castor* bears two well-developed articular areas which accommodate a sesamoid bone, the radial. Corresponding areas are not provided in this specimen of *Castoroides*, indicating the absence of the radial. Lack of this element may well be accountable to immature development. The cuneiform is missing; however, close inspection of articular surfaces on the *Castor*-like pisiform and hamate, and the general configuration of the scaphoid, indicate close structural resemblance with that of the

modern beaver. The first metacarpal probably articulated with the greater multangular alone. Only the proximal end of the second metacarpal remains, but its articulations must have been much like those of *Castor*. Metacarpal number IV joins the base of the hamate and evidently articulated with both the third and fifth metacarpal in the manner of *Castor*. All phalanges are mere enlargements of those seen in *Castor*.

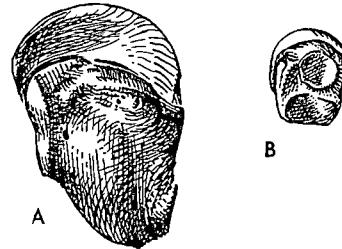


FIGURE 11: A. Medial view of left scaphoid. Referred specimen, Sci. Mus. No. 62-2001; B. Medial view of left scaphoid of *Castor canadensis*. X 1½.

With regard to the hind feet, the left, being the most complete, lacks the distal end of the calcaneum, intermediate cuneiform, first metatarsal, distal extremities of II, III, IV, and V, second phalanx of the first digit, first and second phalanges of the second digit, proximal end of the first and entire third phalanx of the third digit, as well as first, second, and third phalanges of the fifth digit.

The pes is almost identical to that of *Castor*, insofar as it is preserved; therefore it was felt that missing bones could reasonably be restored after this form. Distal phalanges of the second and fifth digits were thus completed. No sesamoids were found and were excluded from the restoration.

Total restored length of the pes is 287 mm., this is relatively less than that of *Castor*.

Tarsals are arranged precisely the same as they are in *Castor* (Fig. 12). Except for size, little difference can be

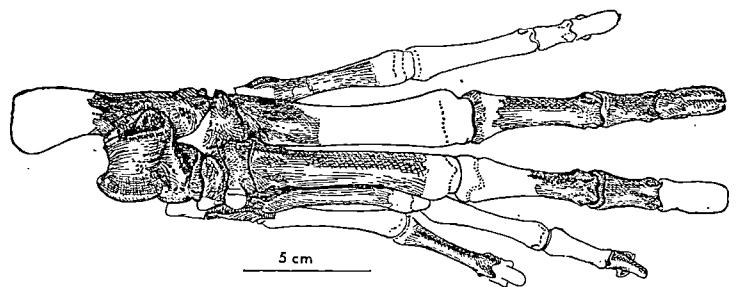


FIGURE 12: *Castoroides ohioensis* dorsal view of left hind foot. Referred specimen, Sci. Mus. No. 62-2001.

found in the calcaneus and astragalus between the two forms. Distally, the calcaneus articulates with the cuboid and the astragalus with the navicular. Three cuneiforms are present; the small intermediate, in the right foot and the other two in the left foot. Lateral and intermediate cuneiforms articulate, as in *Castor*, with the base of the navicular. The medial cuneiform's base is provided with a notch for sole attachment of the first metatarsal. The

second metatarsal, as Moore (1890) observed, is a slender bone curving inwardly and extending further both anteriorly and posteriorly than metatarsal number I. Its primary articulation is with the intermediate cuneiform at its upper end, and it joins the medial edge of metatarsal III to a lesser degree. Numbers III and IV are the larger metatarsals; IV being the thickest and longest of the two. It contacts the whole base of the cuboid and lateral contact on the head of number III. It is completely free of the lateral cuneiform and does not lap over, as it does in *Castor*, to join the base of the lateral cuneiform. Number V is almost identical to its homologue in *Castor*, except with respect to size. Both articulate in like manner. The only structural difference observed is an outward turning of the flange below its proximal articulation point in *Castoroides*, whereas in *Castor* the flange tends to turn inward or roll under. About half of the phalanges are lacking, and as already pointed out, they were restored after *Castor*.

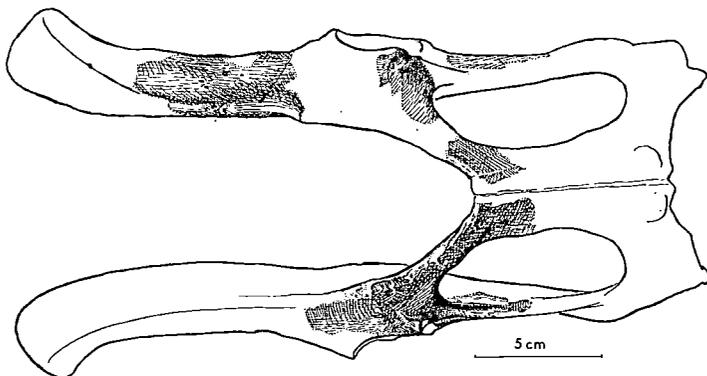


FIGURE 13: *Castoroides ohioensis*. Ventral view of pelvis. Referred specimen, Sci. Mus. No. 62-2001.

Pelvis: Only remnants of the pelvis remain (Fig. 13). The pubic symphysis and pubis, including the ventral rim of the acetabulum, are preserved on the right side. A section from the middle of the left ilium also remains. It is known from other specimens that the pelvis resembles that of *Castor* to a great extent; although, it is relatively shorter in relation to body length.

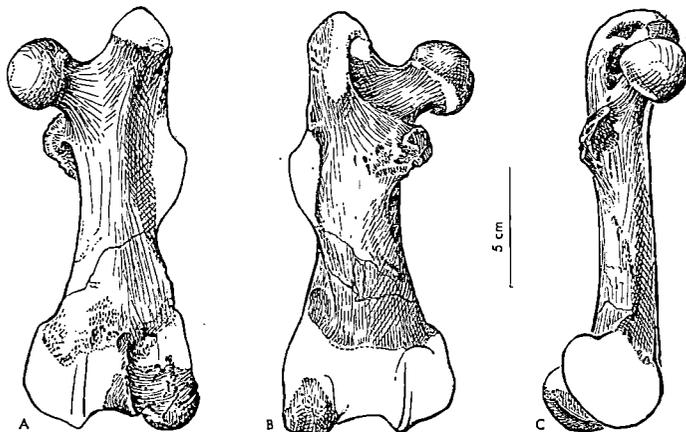


FIGURE 14: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Anterior view of left femur; B. Posterior view of left femur; C. Medial view of left femur.

Femur: The hue of the bone surfaces of the femora is typical of most of the skeleton. The bone is smooth and gives a greasy appearance of just having been stripped of its flesh. In general appearance it is not greatly unlike that which is encountered in much of the White River mammalian material.

The left femur lacks, at its lower end, the right hand condyle. It is also deficient the third trochanter and a portion of the greater tuberosity. Its total length is readily discernible at 168 mm. This is proportionately less than in the modern beaver. Other differences arise in location of the third trochanter. It is much nearer the head end of the shaft than that of *Castor*. There is a greater constriction immediately below the base of the third trochanter in *Castoroides*.

Patella: The patella is well-preserved in an uncrushed condition. This element is basically a copy of its homologue in *Castor* (Fig. 15). It is slightly more elongate and the overall articular area on the posterior surface is somewhat less than in *Castor*. The prominent depression found in *Castor* on the anterior face of the apex, for the attachment of the ligamentum patellae, is not nearly as well defined in *Castoroides*.

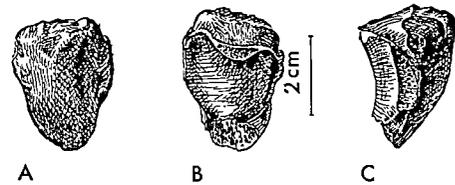


FIGURE 15: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Anterior view of left patella; B. Posterior view of left patella; C. Medial view of left patella.

Tibia-fibula: The tibia as represented, lacks its entire proximal epiphysis and lower quarter of the shaft. The very tip of the lower end is present, exhibiting a medial malleolus. Lateral malleolus and a scrap of bone from the shaft are all that remain of the fibula. A distinguishing

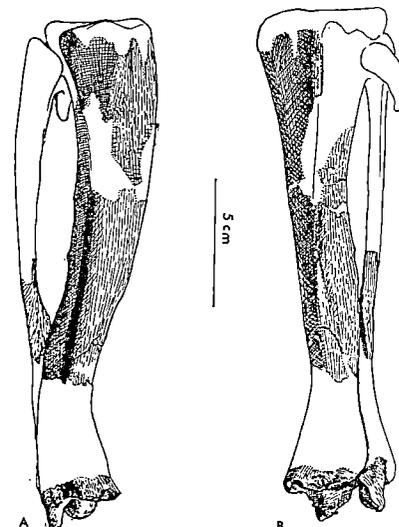


FIGURE 16: *Castoroides ohioensis*. Referred specimen, Sci. Mus. No. 62-2001. A. Medial view of left tibia-fibula; B. Anterior view of left tibia-fibula.

feature is the extent of tibia-fibula fusion. It is over one-third the bone length.

CASTOROIDES IN MINNESOTA: Previous occurrences: The first account of *Castoroides ohioensis* in Minnesota is a paper by Winchell (1879). The specimen described consists of a single bone, the greater portion of left mandible of a very large individual, containing the four grinding teeth and a fine incisor (B, Fig. 3) and (C, Fig. 4). Except for an indication of the base of the anterior border the ramus is missing. Total length of the jaw must have been close to 285 mm. Winchell refers this specimen to the "Terrace" epoch of the last glacial period. The creature probably inhabited the Mississippi Valley about the same time as the present specimen.

New Occurrence: Until recently, the specimen herein described was the only other record of *Castoroides* from Minnesota. In 1958, during the excavation of a sump pit near Wells, Minnesota, a 2-inch segment of what is believed to be a part of a lower incisor of *Castoroides ohioensis* was discovered. Unfortunately, the present whereabouts of the specimen is unknown to the author; therefore, a figure and measurements are not possible. The specimen is most likely that of *Castoroides* as the enameled surface is preserved, exhibiting the longitudinal grooves. As recalled, the specimen was intermediate in size—between the two previous finds. It was found in glacial drift occupying a broad flat valley which drains Freeborn Lake. The specimen was five feet below the surface in a wet sand on the farm of Ordis Jacobson (NW ¼, NE ¼, Sec. 33, T104N, R23W), Freeborn County, Minnesota.

SUMMARY: The above description of a new specimen of *Castoroides ohioensis* supplements previous finds, especially in a consideration of the feet. As preserved, the feet are found to bear strong morphological similarity to the feet of *Castor canadensis*, with only slight differences. Proportionately, the two animals are quite different. The extinct form is relatively shorter-legged, with the noted exception of the forearm.

Little can be said about distribution of the giant beaver in Minnesota. It is interesting to note, however, that the two earlier occurrences are approximately equivalent in age. The Minneapolis specimen (3728) University of Minnesota (Acc. 1074) Science Museum and the St. Paul specimen (62-2001) Science Museum are definitely post glacial, as they are associated with meltwater features of

the Mississippi River development within the Twin Cities region. The age of third specimen is a bit more doubtful, but indications are that its deposition occurred around the time of the last retreat of the ice front.

Acknowledgment: The author wishes to express his sincere thanks to Mr. Alex Oja for his many fine illustrations.

LITERATURE CITED

- BAKER, F. C. 1920. The life of the Pleistocene. *Bull. Univ. of Ill.* 17:41.
- BAKER, F. C. 1930. A new record of *Castoroides ohioensis* from Illinois. *Science (NS)*. 71:1841:389.
- BARBOUR, E. H. 1931. The giant beaver, *Castoroides*, and the common beaver, *Castor*, in Nebraska. *Neb. State Mus. Bull.* 20. 1:171-186.
- CAHN, A. R. 1929. Information concerning *Castoroides*. *Science (NS)*. 70:1826:635.
- CAHN, A. R. 1932. Records and distribution of the fossil beaver, *Castoroides ohioensis*. *Jour. of Mamm.* 13: 229-241.
- CAHN, A. R. 1936. Further notes on the giant beaver. *Jour. of Mamm.* 17:66-67.
- COUES, E. and J. A. Allen. 1877. Monograph of Amer. Rodentia. *V. S. G. S.* II:423-426.
- FOSTER, J. W. 1838. Description of *Castoroides ohioensis*. *2nd Rept. Geol. Ohio.* 80-83.
- HAY, O. P. 1914. The Pleistocene Mammals of Iowa. *Iowa Geol. Surv. Ann. Rep.* 456-468.
- MOORE, J. 1890A. Concerning a skeleton of the great fossil beaver. *Jour. Cincinnati Soc. Nat. Hist.* 13:138.
- MOORE, J. 1890B. Concerning some portions of *Castoroides* not heretofore known. *Proc. Amer. Assoc. Adv. Sci.* 39:265.
- MOORE, J. 1893. The recently found *Castoroides* in Randolph County, Indiana. *Amer. Geol.* 12:66-74.
- POWELL, L. H. 1948. The Giant Beaver *Castoroides* in Minnesota. *Science Bull No. 2.* Science Mus., St. Paul Inst.
- SIMPSON, G. G. 1930. Rodent Giants. *Nat. Hist.* 30:3: 305-313.
- WILSON, R. 1949. Early Tertiary rodents of N.A. *IV Publ. of Carnegie Inst.* Wash. 584:67-164.
- WINCHELL, N. H. 1879. *Castoroides ohioensis*, Foster. *8th Ann. Rept. Minn. Geol. Nat. Hist. Sur.* 181-183.
- WOOD, A. E. 1955. A revised classification of the rodents. *Jour. of Mammalogy.* 36:2:165-187.