Art. XLI. — *New Species of Merycochœrus in Montana.* Part I. By Earl Douglass.

Description of the Skull of Merycochœrus laticeps n. sp.

While making a collection of vertebrate fossils from the Loup Fork beds of the Lower Madison Valley in Montana, I obtained several parts of mandibles, representing three or four different species, which were doubtfully referred to the genus Merycochœrus. Three of the species were remarkable for the depth of the rami. One, which was more slender than the others, possessed characters which made it probable that it belonged to the same genus; though, measuring beneath the middle lobes of the last molars, the deepest jaw was double the depth of the narrower one. I could not identify any of these with species that had been described.

In the summer of 1899 in some clay bluffs near the village of New Chicago in Granite County, Montana, a nearly complete skull and lower jaw with some other bone fragments were found. The jaw was at once recognized as similar to one of those found in the Madison bluffs. The greater part of the skull was enclosed in a clay nodule. From some of the teeth which were exposed it was supposed to be one of the Oregon species of Merycochœrus; but when cleaned from the matrix it was seen to be very different, possessing many peculiar characters which separate it from those forms. It is more nearly related to the type represented by *Merycochœrus proprius* and *M. rusticus*, between which it is intermediate in size.

Its most striking characteristics are the following:

Skull low, broad behind the orbits, narrowing rapidly toward the front and back. Brain case short, the length behind the post-frontal process being about one-half the distance in front of it. Premaxillaries united in front forming a trough-shaped depression, evidently for the accommodation of a proboscis. Maxillaries deeply concave on the sides of the face—this, with the malo-maxillary ridge which widens outward rapidly toward the zygomatic arch, forming a broad nearly horizontal shelf above the posterior premolars and anterior molars. Larger part of external narial opening nearly between the orbits, but continuing forward in a horizontal slit between the maxillaries. Nasal bones short and ascending, placed far back, the anterior tips being about midway between the inion and incisive border. *Foramen infraorbitale* placed farther back than in any other species. Bending down of the face upon the basicranial axis carried to the extreme, the shape of the posterior basal

part of the skull indicating that the head was carried in a nearly vertical or hanging down position. Back part of zygomatic arch small and simple. Length of the alveolar border twice the distance from the last molar to the occipital condyle. Otic bullæ not inflated. Mandible heavy and very deep in the region of the angle. First lower incisor absent. Jaw nearly as deep as skull exclusive of nasals, and nearly as long as the skull at base.

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Merycochœrus laticeps.
Skull and Mandible, side view, $\times \frac{1}{3}$.

Description of Skull.—The premaxillaries are coössified with the maxillaries. Anteriorly the maxillo-premaxillaries are united for a distance of 5·5^{cm}. Here they form a trough-like depression which becomes broader as it curves gently upward and backward. This widening of the trough is caused by the converging of the ridges from the upper borders of the maxillaries which bound laterally the hori-

zontal wedge-shaped forward projection of the narial opening, and by the conical shape—as seen from the front—of the large convexities in the region of the canines. These convexities have their bases close together in the middle of the incisive alveolar border, make a broad lateral sweep and die out on the face in front of the anterior projection of the malo-maxillary ridge. The first mentioned ridges die out on the anterior inner sides of these convexities a little distance above the alveolar border.

The anterior part of the narial opening begins anteriorly in a rather blunt point, widens gradually as it extends backward and slightly upward for a distance of 3^{cm}, then the sides are nearly parallel and horizontal about the same distance, then it expands and ascends to form the inferior part of the posterior oval opening. This posterior part of the external nares looks forward and slightly upward, thus forming a high angle with the anterior part. Above it is arched over by the short backward sloping nasals. Its lower border is in advance of the orbits, but in front of the bases of the nasals a notch extends back of the orbital border. The vertical height is about 5^{cm}. Between the narial opening and the orbit the tongue of the maxillary curves upward and then backward, apparently ending in a wedge-shaped process between the nasals and the frontals in a plane with the posterior parts of the orbits. The suture separating the frontal and maxillary extends from this point outward and forward and then downward, passing close to the anterior border of the orbit. The skull is a little injured just at the border of the orbit and the orbit is still filled with the matrix so that the lachrymal bone cannot be made out, but it occupies an extremely small space if any in front of the orbit. The malo-maxillary suture continues downward from the orbital border to a line 2·2^{cm} lower than the lower border of the orbit, where it curves forward and downward to near the lower anterior border of the overhanging malo-maxillary ridge. From this place it cannot be traced. The suture where seen is well defined, is complex but forms a quite regular band 3 to 4^{mm} broad. On the roof of the mouth the maxillo-palatine suture appears near the root of the second molar, extends forward and slightly inward to opposite the posterior lobe of *m1*, then transversely across the palate in nearly a straight line. The roof of the mouth is broad and concave. The incisive foramina are confluent, but this is apparently due to the breaking away of the thin median partition, part of the superior portion of which still remains. It now appears as an oval opening, the smaller end being directed backward. Its length is 3^{cm}, and its greatest width 1·5^{cm}.

On the side of the face is a large depression difficult to define. It is nearly triangular in shape. Above its boundary is the median upper border of the maxillary; behind it is the outward expansion of the posterior part of the maxillary in front of the orbit. Beneath is a broad shelf above the malo-maxillary ridge. The anterior angle of the depression is occupied by a deeper elliptical one, the deepest part of which is above the last premolar and the first molar. These two concavities extending inward on opposite sides of the maxillaries make the face quite thin transversely in this region, being in fact only 2·4^{cm} thick, while the skull at its widest place is 20^{cm}. The malo-maxillary ridge dies out on the anterior border of this depression but expands rapidly posteriorly, thus forming the broad shelf above mentioned which is broadest in front but extends outward and backward toward the zygomatic arch. The infra-orbital foramen is large, is near the inferior posterior border of the oval depression above *m2* and looks forward and outward, opening on the horizontal maxillary platform or shelf.

The nasals are nearly triangular if I make out their posterior borders correctly. They are short, extending upward and forward to form the roof of the external nareil opening. They are convex transversely and longitudinally and are pointed in front. These points are about midway between the incisor and the inion.

The orbits are oval with the larger end upward. The posterior inferior border is nearly straight or a trifle convex, but this may be due to a slight displacement of the post-orbital process of the malar. Only one orbit is preserved.

What I take to be the boundary between the nasals and frontals is a line where the bone is broken. It passes from the posterior angle of the maxillary transversely and somewhat backward to the suture between the nasals.

The frontal appears to meet the malar posterior to the orbit at the median line, where there is a roughening on the narrow isthmus of bone. From the upper posterior border of the orbit the supra-orbital ridges converge rapidly backward and then less rapidly, uniting to form a prominent narrow sagittal crest. The form of this part of the skull back of the nasals and including the upper part of the brain case is almost like that figured in Bettany's paper, "On the Genus Merycochœrus," as *M. temporalis;* but the supra-orbital foramina occupy a different position. In the present species they are above a line uniting the posterior borders of the orbits, are far apart, have no grooves leading into them, and are a little nearer the median line of the skull than the outer border. The tempero-parietal suture extends upward and backward until, beneath the anterior part of the sagittal crest it curves downward and

then upward again, passing just beneath the foramina at the base of the inion. These foramina are not the same on opposite sides of the skull. They are farther forward and farther apart on the right side of the skull and are more uniform in size. On the left side the anterior one is circular and several times larger than the one which is a little behind and beneath it. Just posterior to this smaller foramen the parieto-occipital suture extends upward to the broken sagittal crest. The temporo-occipital extends backward and downward but is lost on the broken border. The ridge near the parieto-squamosal suture extends from the larger foramen above mentioned, downward and forward, at first coinciding with the suture and then running beneath and nearly parallel to it. The brain case on each side of this is broadly concave. The brain case is short antero-posteriorly and slopes downward quite rapidly behind the forehead, though the sagittal crest evidently continued nearly on a level.

The crest of the inion is broken but was considerably posterior to the occipital condyles. The wing-like expanses extending to the zygomatic arch were broad and thin. Just above the foramen magnum the occiput is broadly convex; but a short distance above a depression begins on the median line, becomes broader and deeper and then shallower to near the crest of the inion. The ridges that bound this concavity separate it from larger lateral concavities situated farther down. These concavities are bounded above by the wing-like expansions above mentioned and outwardly by the broad convex post-tympanics which appear as large swellings on the sides of the occiput. This post-tympanic with the horizontally expanded portion of the squamosal above and the long posterior flat surface of the post-glenoid encloses a quite large triangular cavity, the post-tympanic and post-glenoid nearly coming in contact below. The meatus auditorius externus evidently did not fill all this space, but the shape cannot be definitely made out on account of the matrix and injury of the bone; but it passes inward and forward a distance of 4^{cm} to connect with the otic bullæ.

As seen from below, the foramen magnum is lenticular in section and its transverse is double its antero-posterior diameter, being respectively $2{\cdot}5^{cm}$ and $1{\cdot}2^{cm}$. With a line joining the incisive border, the lower extremities of the pterygoids and the occipital condyles, this opening forms an angle of about 65°. The occipital condyles are also narrow antero-posteriorly, the diameter being only $1{\cdot}7^{cm}$ in this direction while the transverse diameter is $6{\cdot}1^{cm}$. The anterior articular faces are much deeper and broader than the posterior ones and they are partially

separated by an angle. The anterior faces are separated by an excavation 1·5^{cm} wide while the posterior ones are 3^{cm} apart.

The basi-occipital and basi-sphenoid ascend at a steep angle. This with the upper contour of the skull makes the brain cavity very small. Beneath the forehead the basi-sphenoid bends forward and becomes nearly parallel with it. The basi-sphenoid is angulate for a short distance between the glenoid surfaces.

The paroccipital processes are broken off at about a level with the lower points of the occipital condyles, but they appear to have been much longer. They are broad transversely but rather narrow antero-posteriorly. At the bases they are nearly crescent-shaped in cross-section. The more convex portion faces inward and backward, while the concave area faces forward and outward. The outer portion is a wing-like expansion of the more robust inner part, which slants forward and outward from the occipital condyles, forming with them an angle of 65°. The anterior inner horns or lobes are in a line with the post-glenoids. Just in front of these horns and closely in contact with them at the bases but with their anterior bases higher are the prismatic tympanic bullæ. These bullæ are not inflated but quite long vertically, especially on the anterior inner side, and do not extend much below the posterior bases of the paroccipitals. The shape of these bullæ is nearly that of a quarter of a cylinder terminated by a cone, the angle joining the nearly plane or slightly concave faces being directed outward and backward.

The post-glenoid processes are of moderate length and transverse breadth, are flat behind and moderately convex in front. The outer border slopes outward and upward, dying out on the inferior posterior surface of the zygomatic arch, which slopes upward and backward from the glenoid surface. This surface is slightly concave, being bounded exteriorly by the ridge on the lower outer border of the arch. The glenoid surface is broad transversely (6^{cm}) and uniformly convex antero-posteriorly.

The posterior angle of the zygomatic arch is on a line with the anterior borders of the paroccipital process, and extends upward to the line of the lower border of the orbit.

The malar has four approximately equal sides if the upper is measured along the border of the orbit; though the lower is longer in a straight line. The vertical width below the orbit and the antero-posterior length just below it are nearly the same. The upward extension in front of the orbit is narrower than the post-orbital process.

The palatines and pterygoids extend about 2·9^{cm} back of the last molars. It is only 2^{cm} from the posterior edges of the pterygoids to the anterior faces of the otic bullæ. This

approximation is due to the extreme shortening of the posterior basal elements of the skull so that the post-glenoid and par-occipital processes, the occipital condyles and otic bullæ occupy a comparatively narrow transverse zone.

Between the posterior lobes of the last molars the palato-pterygoid lobes extend downward and backward until they reach a point about on a level with the incisive border and the lower extremities of the occipital condyles. They formed a median trough extending downward and backward from the palate.

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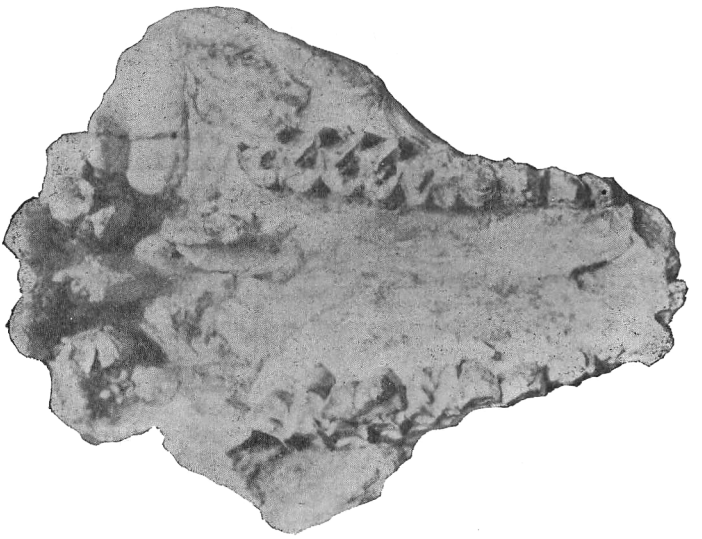

Merycochœrus laticeps.
Skull, view of under side, nearly $\times \frac{2}{3}$.

Lower Jaw.—The rami were not coössified at the symphysis, and in the present specimen they are slightly spread apart. The anterior border is concave downward and nearly uniformly convex transversely. The *foramen mentale* is beneath *pm 3*, as is also the angle of the chin. At this angle a small process projects downward. Back of this the lower border of the ramus curves slightly upward and then downward to a point beneath the posterior part of *m 3*. At this point it is twice the depth of the shallower part under *m 1*. Back of this the posterior border ascends with a steep curve to a point 4·5^{cm} below the top of the condyle, where it ascends nearly vertically to the condyle, forming a low angle (about 25°) with the continuation

of the posterior border. The posterior border is slightly raised laterally. The condyle is not quite so broad transversely as the glenoid surface with which it articulated and is more narrowly convex antero-posteriorly. The masseteric fossa descends only a short distance—to a line connecting the base of the lobe of *m 3* and the posterior angle above mentioned. The bone is injured in the region of the coronoid process so its form cannot be made out. A broad convexity begins at the posterior part of *m 3*, extends forward and downward to the anterior lower border of the ramus, branches at the mental foramen and continues to the alveolar border at *pm 2*, thus leaving a depression under *pms 3 and 4* amd *ms 1 and 2*. The length of the dental series is two-thirds the length of the jaw.

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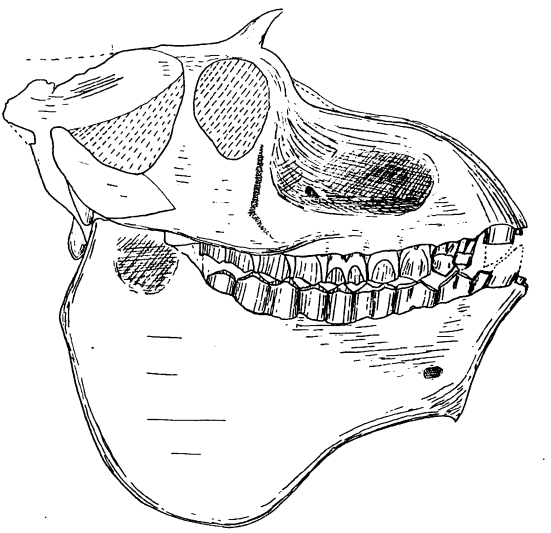

Merycochœrus laticeps.

Skull with jaw, × ½.

The mandible is too far ahead on account of slight forward displacement of post-glenoid process.

Dentition.—Superior: The crowns of the incisors and canines are not preserved. The upper incisors were small, quite close together and in a transverse row. The roots of the first and second are laterally compressed. They were nearly the same size, but the third was a little larger. In cross-section the roots of the canines are three-sided with rounded angles, the posterior side being the broadest: *Pm 1* is com-

pressed longitudinally, is inserted diagonally by two roots, and the posterior part overlaps *pm 2* outwardly. *Pm 2* is considerably worn, but there is still a shallow oblique enamel lake near the posterior margin. *Pm 3* has a longitudinal lake with two pits, near the inner border of the tooth. *Pm 4* is like the corresponding tooth in *Merychyus elegans*. The posterior lobe on the last molar is not developed as in the *Merycochœrus proprius;* though the posterior horn of the posterior external crescent is convex behind, it is narrower and extends much more outward than in that species. The premolars and molars are all longer than in *M. proprius*. This is due in part, but I think not wholly, to less amount of wear.

Inferior: There is no trace of a first incisor. The second and third are laterally compressed at the roots, and are 2^{mm} apart. They were about the size of upper incisors one and two. *I 3* is set obliquely close to the canine on its anterior inner side and a little more anteriorly than *I 2*. The canine is small, but a cross-section at the root is nearly the same in form as the upper canine. *Pm 1* is much larger than the lower canine. It has a longitudinal groove on the outside of the root. The *crowns* of the above teeth are not preserved. *Pm 2* is more oblique than in *M. proprius* or *M. rusticus*, being closely crowded between *pms 1 and 3*. *Pm 3* is porportionally narrower posteriorly than in the former species, judging by Leidy's figure. In *pm 4* the posterior fossa is more oblique, opening on the posterior inner angle instead of on the posterior border.

Measurements.

SKULL.

	M.
Length of skull from incisive border to posterior of occipital condyles	·245
Length from incisive border to back of pterygoids	·185
Length from incisive border to front of otic bullæ	·203
Width of skull at glenoid articulation	·200
Width at middle of last molars	·180
Width at third premolars	·080
Width at canines	·057
Width of palate between last molars	·063
Distance from anterior tips of nasals to incisive border, measured in a straight line	·166
From tips of nasals to crest of inion, about	·150 to ·160
Distance from front of orbit to incisive border	·135
From front of orbit to back of occiput	·150
Diameter of orbit, antero-posterior	·038
Diameter of orbit, vertical	·045

	M.
Width of top of skull above orbits	·118
External nares, greatest width	·044
External nares, greatest length	·112
Length of three upper incisors	·015
Length of dental series from front of canine	·153
Length of molar-premolar series	·136
Length of premolar series	·056
Length of molar series	·080
Width of last molar	·030

LOWER JAW.

	M.
Length of jaw, greatest	·235
Depth at chin	·057
Depth under m 1	·053
Depth under back part of m 2	·063
Depth under last lobe of m 3	·109
Length of inferior dental series	·157
Length of molar-premolar series	·150
Length of premolar series	.058
Length of molar series	·092
Space occupied by i 2 and 3	·008
Width of canine at alveolus, transverse	·009
Length of canine antero-posterior	·0065
Width of pm 1	·011
Length of pm 1 antero-posterior	·014
Length of pm 2	·014
Width of pm 2	·006
Length of pm 3	·017
Width of pm 3	·0095
Length of pm 4	·0185
Width of pm 4	·012
Length of m 3	·044
Width of m 3	·0165
Length of foramen mentale	·008
Width of foramen mentale	·005

From the parts of *Merycochœrus proprius* that have been described *M. laticeps* differs in the lateral aspect of the maxillaries; the smaller size and, apparently, the more transverse position of the incisors and incisive border; the absence of a space between *pms 1* and *2;* the more hypsodont character of the teeth; the more posterior position of the infra-orbital foramen; the smaller size and different shape of the small posterior lobe on the last upper molar; and the different shape of the mandible, especially its greater posterior depth.

M. rusticus approaches more nearly to the present species in the facial concavities, in the size and position of the incisors,

and the trough-like shape of the maxillo-premaxillaries above; the crowding together of *pms 1* and *2;* and possibly in the posterior deepening of the mandible. But, as will be seen by comparing the present descriptions with Leidy's figures and descriptions, the face and anterior border are quite different in the two species. In *M. rusticus* the anterior part of the face as viewed from the side rises more abruptly for a short distance and then more gradually backward. The form of the concavity on the side of the face is different; the infra-orbital foramen and the anterior inferior root of the zygomatic arch are farther forward; the latter also is higher as is also the lower border of the malar. The space between the upper canine and first premolar is greater and *pm 1* does not overlap *pm 2.* The mental foramen is longer and the chin is less concave, the protuberance at the chin is larger and longer, and the anterior inferior border of the jaw is more nearly straight. *M. rusticus* is smaller than *M. laticeps.*