A MIOCENE MAMMALIAN FAUNA FROM SUCKER CREEK, SOUTHEASTERN OREGON

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ABSTRACT

Deposits occurring along Sucker Creek, a tributary of the Snake River, in southeastern Oregon, have yielded a small mammalian fauna which is correlated with the Virgin Valley fauna of Nevada and the Mascall fauna of Oregon, both of Middle Miocene age. The Sucker Creek fauna, though much less complete, closely resembles that from Skull Spring, a locality forty miles to the west. The beds are correlated with the Payette formation of southwestern Idaho and have yielded also a Payette flora. The fauna indicates a semi-humid, forest environment.

INTRODUCTION

This study of a fossil mammalian fauna from the region of Sucker Creek,[1] a tributary of the Snake River in southeastern Oregon, is part of an extensive program of paleontological exploration conducted by the California Institute of Technology in the Great Basin Province of western North America. The collections were made by the summer field parties of 1928 and 1929.

The author wishes to express his thanks to Dr. Chester Stock, under whose direction the study was carried on, for the opportunity to undertake this project and for valuable advice and criticism during the progress of the work. Acknowledgment is made also of the assistance rendered by F.D. Bode and R.W. Wilson.

LOCATION AND NATURE OF THE SUCKER CREEK BEDS

The deposits from which the mammalian materials were obtained occur along the lower course of Sucker Creek, in eastern Malheur County, Oregon. The more important collecting localities occur approximately nine miles north of Rockville, Oregon and approximately five miles west of the Oregon-Idaho border. Location

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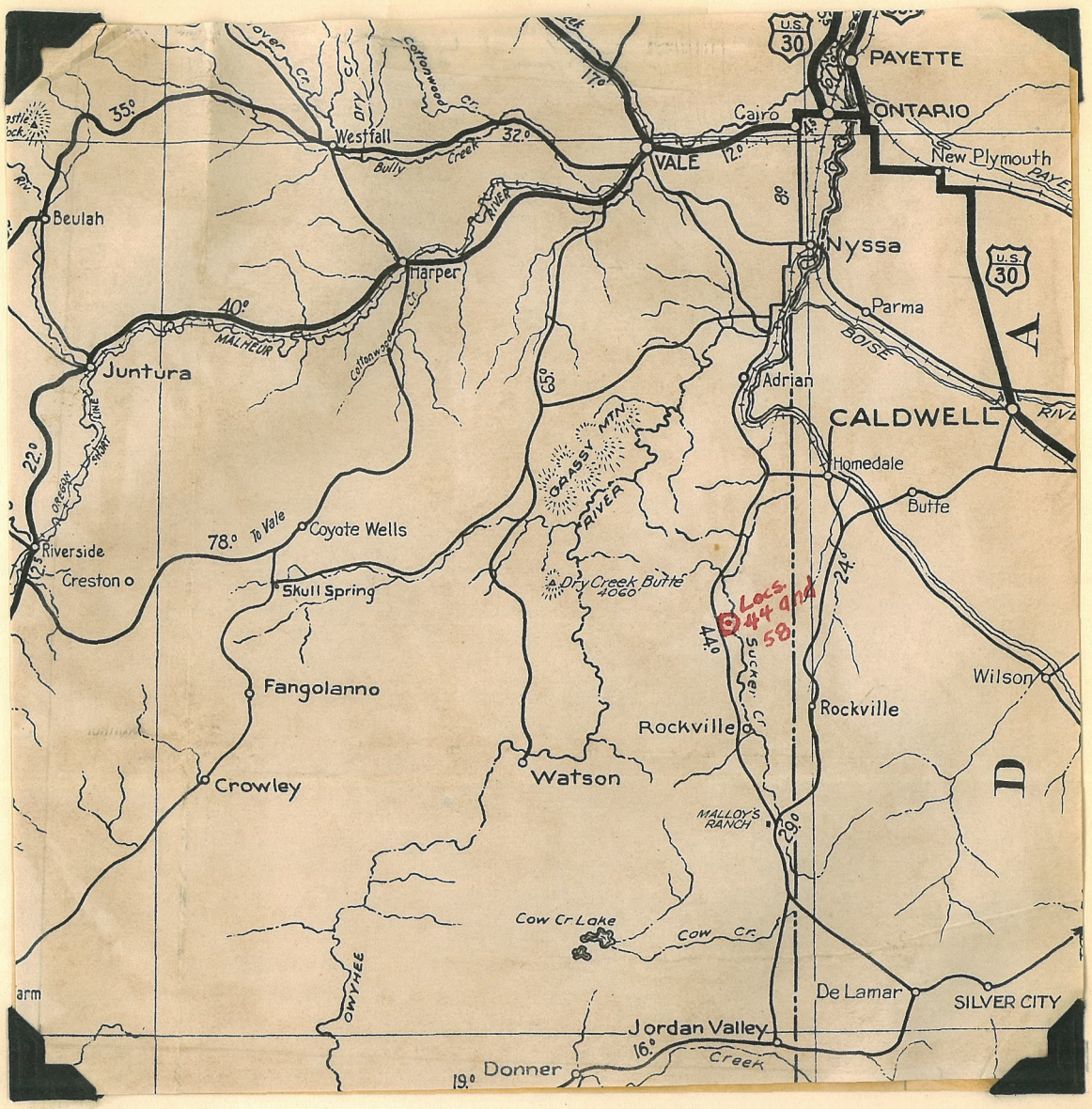
[1] On many maps of the area of southeastern Oregon this creek is called Succor Creek. Since the present spelling of the name is that recorded on recent road maps it is adopted in this paper.



Road map of a part of southeastern Oregon, showing Sucker Creek fossil localities (locs. 44 and 58).

of the beds is shown on the accompanying map.

The beds carrying the fossils consist of fine- to medium-grained pyroclastics, varying from white to green and brown in color. Occurrence of ostracod shells in one sample of the rock indicates deposition of at least part of the sediments in a body of water.

RELATION TO OTHER PALEONTOLOGICAL STUDIES IN THE REGION

In addition to the mammalian remains, the Sucker Creek beds have yielded a Tertiary flora, representative of the Payette stage of southeastern Oregon and southwestern Idaho. The Payette formation, occurring in the region of the lower Snake River, was named by Waldemar Lindgren in 1898. The flora has been described by F.H. Knowlton (1898 and 1902) and more recently by R.W. Chaney (1922). The age of the Payette has been determined chiefly by plant remains. In support of a Miocene age for this plant assemblage Chaney makes the following statement:

"The position of the Payette formation, above basalt lavas, is in accord with the relation of the Miocene Mascall formation to the Columbia lavas in Oregon. Vertebrate remains collected from the Payette formation by Buwalda are referred by him to the Middle or Upper Miocene. There appears, therefore, to be an agreement between the evidence of the flora, the fauna and the stratigraphy in pointing toward the Miocene age of the Payette formation." (1922, p.220)

Approximately forty miles west of the Sucker Creek localities is the Skull Spring occurrence, which has yielded a large and varied mammalian assemblage recently described by C. L. Gazin (1932). Gazin assigns a Middle Miocene age to the fauna, correlating it with the Mascall of north central Oregon and with the Virgin Valley of northwestern Nevada. The sediments carrying the fossils were correlated with the Payette formation.

The significance of the Sucker Creek fauna lies in the fact that it makes possible a clearer understanding of the relationships between the Miocene mammalian stages found in the northern Great Basin region and in the John Day and the Payette stage of southwestern Idaho. Because of its incompleteness the Payette mammalian assemblage up to the present time has furnished no thoroughly satisfactory basis for comparison with similar faunas farther to the west. Future geologic mapping may show that the Sucker Creek beds are an integral part of the Payette formation. That the Sucker Creek beds are directly related in age to the Payette is shown by the flora and such comparisons as can be made between the fossil mammals obtained at Sucker Creek and those from the type section are fully in accord with this view.

SUCKER CREEK FAUNA

While the mammalian collections from Sucker Creek are as yet not so complete as might be desired, nevertheless there is sufficient material to permit certain reasonably trustworthy conclusions. Further collecting in the Sucker Creek region will doubtless give a more complete representation of the fauna which inhabited the region at the time the beds were deposited.

The following is a list of the forms recognized in the present collection:

Carnivora
- Indeterminate fragments

Rodentia
- Sciurid(?), sp.
- Chalicomyid, sp.
- Mylagaulus, cf. laevis Matthew

Proboscidea
- Mastodont, sp.

Perissodactyla
- Hypohippus, sp.
- Parahippus, cf. avus (Marsh)
- Merychippus isonesus (Cope)
- Rhinocerotid, sp.
- Moropus, sp.

Artiodactyla
- Prosthennops(?), sp.
- Ticholeptus(?), sp.
- Dromomeryx borealis (Cope)
- Merycodus, sp.
- Camelid(?), sp.

Environment of Fauna

The material at present available quite evidently is far from a reasonably complete representation of the Miocene mammalian fauna of the region. It should hardly be expected, therefore, that such scanty material could furnish a very clear picture of the environmental conditions that prevailed in the region during the period of deposition of the Sucker Creek sediments. Nevertheless, certain conclusions are suggested by the fauna.

The brachydont ungulates, represented by Hypohippus, Parahippus, Moropus, and Dromomeryx were evidently browsing types and suggest a glade or forest environment, more humid than the semi-arid desert which characterizes the region today. However, the presence of hypsodont grazing forms, as for example Merychippus and Merycodus, may well indicate that extensive grasslands were also available.

Plants are in general the most sensitive indicators of environment and the evidence offered by the Payette flora concerning the environmental conditions should be regarded as more dependable than that obtained from the Sucker Creek fauna. Chaney's conclusions as to the environment indicated by the Payette flora accord with the evidence offered by the brachydont, browsing ungulates. He considers the climate to have been similar to that of northern

California and southwestern Oregon today. A forested region of some relief is indicated, with oaks as the dominant form on the slopes, while the lake or stream borders were swampy (Chaney, 1922, pp. 221, 222).

Stage of Evolution of Fauna

Although relatively few forms are sufficiently well represented by fossil material to permit a satisfactory specific identification, the number is nevertheless large enough to permit an age determination. In the light of the known Tertiary faunal stages for western North America the assemblage from Sucker Creek is certainly of Miocene age. Presence of the species Merychippus isonesus, Dromomeryx borealis, and Mylagaulus, cf. laevis found in Middle Miocene faunas elsewhere would seem to suggest a nearly comparable age for the Sucker Creek assemblage. Hypohippus, Parahippus, and Moropus are unfortunately too incomplete for specific determination but may be indicative likewise of this stage.

Relationships of Fauna

The mammalian assemblage most closely related to the Sucker Creek fauna in time and in geographic position is that reported from the region of Skull Spring by Gazin (1932). The close similarity of the two faunas is at once apparent from a comparison of the faunal lists given below:

Sucker Creek	Skull Spring[1]
Carnivora	Carnivora
Indeterminate fragments	Tomarctus, cf. brevirostris Cope
	Euoplocyon (?), sp.
	Canid(?), sp.
	Amphicyon sinapius Matthew
	Amphicyon, cf. frendens Matthew
	cf. Pliocyon medius Matthew
	Hemicyon, n. sp.
	Mustelid, n. sp.
Rodentia	Rodentia
Sciurid(?), sp.	Sciurus malheurensis, n. sp.
	Sciurus tephrus, n. sp.
	Citellus longirostris, n. sp.
	Liodontia alexandrae (Furlong)
Mylagaulus, cf. laevis Matthew	Mylagaulus, cf. laevis Matthew
	Diprionomys(?) oregonensis, n. sp.
Chalicomyid, sp.	
Proboscidea	
Mastodont, sp.	

[1] "Material recently secured from a second Skull Spring locality includes mastodon and tapir in addition to many of the forms listed here." (Gazin, 1932, p. 42)

Sucker Creek	Skull Spring
Perissodactyla	Perissodactyla
Hypohippus, sp.	Hypohippus, sp.
Parahippus, cf. avus (Marsh)	Parahippus, near coloradensis Gidley
Merychippus isonesus (Cope)	Merychippus isonesus (Cope)
Rhinocerotid, sp.	Rhinocerotid, sp.
Moropus, sp.	Chalicothere(?), sp.
Artiodactyla	Artiodactyla
Prosthennops(?), sp.	Platygonus(?), sp.
Ticholeptus(?), sp.	Ticholeptus(?), sp.
Dromomeryx borealis (Cope)	Dromomeryx, near borealis (Cope)
	Blastomeryx(?), sp.
Merycodus, sp.	Merycodus, sp. a
	Merycodus, sp. b
Camelid(?), sp.	

Many of the forms recognized in the Sucker Creek fauna are represented likewise in the Skull Spring assemblage, either by identical or closely related types. It appears entirely possible that the Sucker Creek faunal stage is a near if not a direct chronologic equivalent of that described from Skull Spring, although the deposits in which the former occurs may represent a longer period of accumulation than that recorded by the beds containing the latter horizon. Gazin (1932, p. 44) has pointed out the close resemblance of the Skull Spring fauna to the assemblages known from the Mascall and the Virgin Valley. Like the Skull Spring assemblage that from Sucker Creek shows a slightly greater resemblance to the Virgin Valley fauna than to the Mascall fauna. Similarity of types is also seen when comparison is made with the fauna from the

Pawnee Creek beds of Colorado and with that of the Lower Snake Creek beds of Nebraska.

SYSTEMATIC DESCRIPTION OF MAMMALIAN FAUNA

CARNIVORA

The presence of carnivores in the fauna is indicated by several jaw and limb fragments, but none of this material is complete enough to permit the establishment of family relationships.

RODENTIA

SCIURIDAE

Sciurid(?), sp.

A fragmentary ramus suggests a sciurid type, but this determination is by no means certain. Four quadrate cheek-teeth were apparently present as in the Sciuridae and the ramus is somewhat heavier and more massive than that in modern representatives of that family.

CHALICOMYIDAE

Chalicomyid, sp.

A single tooth fragment suggests the presence of a member of the Chalicomyidae. The specimen unfortunately does not provide a basis for a more definite determination.

MYLAGAULIDAE

Mylagaulus Cope 1878

Mylagaulus, cf. laevis Matthew

A single mylagaulid tooth, No. 1042 C.I.T. Coll. Vert. Pale., an upper fourth premolar, is practically identical in size and in structure with specimens from Skull Spring referred by Gazin (1932, pp. 69-71) to Mylagaulus cf. laevis Matthew. There are five enamel lakes on the occlusal surface, although there may have been six or seven present originally. The anterior lake is bifurcate and appears to have been formed by the union of two lakes. The postero-external lake is bifurcate posteriorly and appears also to be the result of the union of two lakes. The external lake is quite small and elliptical while the others are elongate anteroposteriorly.

PROBOSCIDEA

Mastodont, sp.

Fragments of teeth and incomplete limb elements are recognized as belonging to a mastodont type, but the specimens are not sufficiently complete to permit a more detailed determination.

PERISSODACTYLA

EQUIDAE

Hypohippus Leidy 1858

Hypohippus, sp.

Two fragments of upper cheek-teeth are referred to the genus Hypohippus. One specimen, No. 1048 C.I.T. Coll. Vert. Pale., represents the posterior portion of an upper cheek-tooth, broken away immediately in front of the metaloph. The tooth is unworn and appears to have possessed a crown of less height than in H. osborni Gidley (1907, pp. 930-931; and Osborn, H.F., 1918, p. 207). The metaloph joins the ectoloph at a point slightly in front of the mesostyle, as in H. equinus (Scott, W.B., 1894, pp. 94-122; and Osborn, H.F., 1918, pp. 203, 206), while in H. osborni the union takes place almost opposite the mesostyle. The metaloph is compressed anteroposteriorly. The hypostyle consists of two short transverse ridges enclosing a small basin with a small tubercle at its inner end. A similar development of the hypostyle is seen in teeth of Hypohippus from Skull Spring. The relatively great anterposterior distance across the metacone would appear to indicate that the tooth was proportionately longer from front to rear than in H. osborni, in which respect a greater approach is made to H. equinus. The mesostyle rises gently from the concavity of the outer wall of the metacone and there is no abrupt cingulum-like ridge at the base of the metacone. The enamel surface is smooth.

The second specimen, No. 1043 C.I.T. Coll. Vert. Pale., is an anterior portion of the outer wall of the ectoloph of an upper cheek-tooth. The mesostyle rises as an abrupt ridge and a sharp cingulum-like ridge is present at the base of the outer paracone wall. The surface of the enamel is smooth except for minute horizontal striations. The anteroposterior distance across the paracone also indicates a tooth somewhat longer from front to rear than in H. osborni.

No. 1048 appears to resemble more nearly teeth of H. equinus than of H. osborni. The specimen resembles however a tooth referred to Hypohippus, near osborni from Virgin Valley, figured by Merriam (1911, p. 256, fig. 25). It likewise resembles a tooth of Hypohippus from Skull Spring (No. 344 C.I.T. Coll. Vert. Pale.).

Measurements (in millimeters)

	No. 1043	No. 1048	No. 344 (Skull Spring)
Anteroposterior distance across paracone	15.9		14.6
Anteroposterior distance across metacone		12.3	12.2
Transverse width meso-style to hypostyle		19.0	21.1

Parahippus Leidy 1858

Parahippus, cf. avus (Marsh)

A single fragmentary upper molar (M3?), No. 1044 C.I.T. Coll. Vert. Pale., and a number of lower cheek-teeth, Nos. 442 to 445 inclusive, 1045, and 1046 C.I.T. Coll. Vert. Pale., show a strong resemblance to comparable teeth of Parahippus avus (Marsh) (Osborn, 1918, pp. 87,88) from the Mascall formation of north central Oregon.

In the upper tooth fragment the crown is worn down to the base and the posterior portion has been broken away, but enough remains to permit a measurement of the anteroposterior diameter and to show the character of the anterior half of the tooth. At this late stage of wear the crochet makes a strong connection with the protoconule, closing the prefossette. The protoconule in cross-section is as large as the protocone. The external wall of the paracone shows a faint median rib and a small deposit of cement is present at its base. The tooth agrees well in size and in character of crown with that of a referred specimen of P. avus figured by Osborn (1918, Pl. 9, fig. 4).

The lower teeth are brachydont and are featured by very strong external cingula and by the presence of cement in the valleys. No. 1046, $M\overline{3}$, exhibits a very heavy deposit of cement but possesses only a faint cingulum. A very low cingular cuspule

is present at the base of the external median valley in all of the specimens. Two specimens show tiny cuspules at the bases of the interior valleys, attached to the walls of the metaconid and metastylid. The external faces of the teeth exhibit rather regular parallel horizontal striae. One specimen, No. 445, is unique in possessing a prominent buttress on the anterior wall of the protoconid and a separate style in the center of the anterior interior valley. The entostylid is a well-developed pillar, rising from the posterior cingulum. Its summit in a little-worn tooth is somewhat lower than that of the entoconid. The metaconid and metastylid are separated by a groove which is distinct for a distance extending about half-way to the base of the crown. The metaconid, when worn, sends a long narrow projection into the anterior interior valley. The floors of the interior valleys are situated somewhat above the base of the crown. The valleys are rather shallow in vertical depth and become reduced by wear to mere notches. The external valley, on the other hand, extends well into the tooth even when the crown is worn to the base.

The upper molar of the Sucker Creek Parahippus differs from the comparable teeth of P. near coloradensis Gidley from Skull Spring (Gazin, 1932, pp. 77, 78, fig. 10a, b) in having the prefossette closed and the protoconule equal to the protocone in a late stage of wear. In the Skull Spring specimens (Nos. 345 and 347

C.I.T. Coll. Vert. Pale.) the protoconule is never so large in cross-section as the protocone and the separation of the crochet from the protoconule persists to the base of the tooth. The lower teeth of the Sucker Creek form also show advance over the Skull Spring type in greater height of crown, slightly larger size, and in the presence of cement. Moreover, in the teeth from the Sucker Creek deposits a heavy, continuous, external cingulum is present and the surface is marked with regular horizontal striations, while in the specimen from Skull Spring only a faint cingulum occurs at the anterior and posterior ends and the enamel surface is irregularly rugose in a vertical direction.

Lower teeth of P. brevidens (Marsh) in the collections of the California Institute from the Merychippus zone of the Coalinga region, California, do not have a strong external cingulum and are of somewhat smaller size. The lower teeth of P. crenidens (Scott) (Osborn, 1918, pp. 90-92) are apparently slightly smaller in anteroposterior diameter and the metaconid does not project into the anterior interior valley as in P. avus. In P. pawniensis Gidley (1907; and Osborn, 1918, pp. 92,93) the metaconid and metastylid are not so distinctly separated as in the Sucker Creek form.

Measurements of teeth (in millimeters)

	Anteroposterior Diameter	Greatest Transverse Diameter (at base)	Height of Hypoconid	
Lower molar or premolar, No. 442	19.5	15.6	12.2	(slightly worn)
Lower molar or premolar, No. 443	20.0	14.6	11.1	"
Lower molar or premolar, No. 444	19.3	13.1	12.4	"
Lower molar or premolar, No. 445	20.6	15.5	11.8	"
$p\overline{2}$, No. 1045	19.9	13.0	9.6	(half-worn)
$M\overline{3}$, No. 1046	21.5	11.6	12.4	(unworn)
$M\underline{3}$, No. 1044	a16.6	20.9		
$M\overline{3}$ of Type (Yale Mus. No. 11281)*	17	22		

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a, approximate

*Osborn, 1918, p. 87.

Merychippus Leidy 1857

Merychippus isonesus (Cope)

Material referred to this species consists, in addition to a few limb elements, of a number of isolated upper and lower cheek-teeth and a mandible bearing well-worn teeth with the right ramus broken away behind $M\overline{1}$ and the left ramus broken away behind $M\overline{3}$.

The upper teeth have moderately long, curved crowns and are heavily cementdd. The parastyle and mesostyle are prominent, the mesostyle especially so on the premolars. In teeth but slightly worn, the paracone and metacone stand relatively high above the general level of the occlusal surface. The fossettes are wide and open to the anterior and posterior ends of the tooth in unworn specimens, but become completely closed in a very early stage of wear. A pli-caballin, pli-protoconule, and a pli-hypostyle are usually present, though not always developed to the same degree in each specimen. The protocone and hypocone are sub-equal in size and round-oval in shape, the hypocone being slightly more flattened than the protocone. Both protoone and hypocone are discrete cusps during the first stages of wear, with spurs projecting toward the protoconule and metaconule respectively. The hypocone connects with the metaconule in an early stage of wear, while the protocone remains distinct until the tooth is a little more than half-worn.

As the teeth advance in stage of wear the fossettes become narrower, while the transverse width of the paracone and metacone increases and the enamel foldings of the fossettes tend to disappear. The height of the paracone and metacone above the general level of the occlusal surface decreases. The protocone becomes rounder in cross-section and the prominence of the projecting spur is decreased. The isthmus connecting the hypocone and metaconule, at first narrow, becomes almost as wide as the hypocone itself at a stage of wear when the protocone joins the protoconule. In very advanced wear the protocone and hypocone coalesce, converting the post-protoconal valley into a small enamel-enclosed lake.

The teeth from Sucker Creek are somewhat shorter-crowned and slightly less curved than teeth of Merychippus californicus Merriam in the collections of the California Institute from the Merychippus zone of the Coalinga region. Furthermore, the protocone in M. isonesus does not project quite so far inward beyond the hypocone as it does in the species M. californicus.

The lower cheek-teeth are moderately long-crowned and heavily cemented. The V-shaped groove separating the metaconid and metastylid extends to the base of the tooth-crown. The entostylid is well-developed and is supported by a pillar which rises from a cingulum at the posterior base of the tooth. In a well-worn tooth the valleys on the lingual side are reduced to shallow notches and eventually disappear

entirely, while the external median valley remains deep to the base of the crown.

A comparison of the lower cheek-teeth of M. isonesus with those of M. californicus reveals the following differences:

(1) In M. isonesus the crowns are shorter and the convexity of the external walls of the protoconid and hypoconid is more prominent than in M. californicus.

(2) The anterior horn of the hypoconid loph joins the posterior horn of the protoconid loph at a later stage of wear in M. isonesus than in M. californicus.

(3) In the lower premolars of M. isonesus the anterior horn of the hypoconid loph usually joins the posterior horn of the protoconid loph immediately adjacent to the metaconid-metastylid column or may join directly with the metastylid, producing a very deep external median valley. In M. californicus, on the other hand, the union is usually established about half-way between the external and internal sides of the tooth, producing a much shallower external median valley.

(4) The antero-external ridge on the protoconid of M. isonesus is weak, while it is prominent in M. californicus.

The differences noted under (1) appear to be constant, whereas those indicated (2), (3), and (4) are evidently subject to variation and are not always trustworthy characters of value in distinguishing these two species.

The lower canines on the incomplete mandibular specimen, No. 1059 C.I.T. Coll. Vert. Pale., are small

and incisiform and are placed immediately adjacent to $I\overline{3}$. The size of the alveolus for $I\overline{3}$ indicates that this tooth was somewhat larger than the canine.

Included in the collection of teeth referred to M. isonesus are several specimens showing slight differences from the rest of the group. The protocone in No. 437 is more elongate than in typical specimens and does not join the protoconule until a late stage of wear has been reached. The hypocone is connected with the metaconule by a much broader isthmus than is found at a corresponding stage of wear in the remaining teeth. This tooth may represent a progressive variant of the typical M. isonesus. Two additional specimens, an $M\overline{2}$, No. 1123, and a $P\overline{2}$, No. 1124, show a noteworthy shortness of crown.

The milk teeth of M. isonesus in this collection are brachydont and devoid of cement. The specimens resemble comparable teeth referred to M. isonesus in the California Institute collections from Skull Spring.

Measurements of teeth (in millimeters)

	Antero-posterior diameter	Greatest transverse diameter (exclusive of cement)	Height of crown of unworn specimens
P2, No. 1049	21.6	15.8	
P3, No. 1050	20.0	19.5	
P4, No. 1051	18.9	19.6	
M2, No. 1053	18.5	17.6	
M3, No. 1054	17.6	17.5	a20.0
M3, No. 437	21.5	20.8	
P2, No. 1057	18.4	8.8	
P3, No. 1057	18.3	11.0	
P3 or P4, No. 1052	19.5	a10.0	
M1, No. 1055	19.5	a 7.8	a30.0
M2, No. 1056	a18.5	a 7.2	a30.0
M3, No. 1058	a22.7	a 7.0	
P2-M3, No. 1059	106.4		
Dp2, No. 441	23.4	13.9	
Dp3, No. 439	19.4	16.6	
Dp4, No. 440	19.7	14.8	
Dp2, No. 1047	a22.5	12.1	

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a, approximate

RHINOCEROTIDAE

Rhinocerotid, sp.

Fragments of teeth and of limb elements indicate the presence of a rhinoceratid in the fauna, but a generic determination of the form is not possible on the basis of available material. The tooth fragments suggest a type with hypsodont dentition.

CHALICOTHERIIDAE

Moropus Marsh 1877

Moropus, sp.

Chalicotheres are represented in this collection by a single tooth, a right M2, No. 1060 C.I.T. Coll. Vert. Pale., which agrees in size and character of crown with the description and illustrations of teeth of Moropus given by Holland and Peterson (1914). The tooth is unworn and well-preserved. It is semi-quadrate in shape, with the parastyle placed farther forward than the antero-internal corner of the tooth. The ectoloph is sharply inflected, having a W-shape, with prominent parastyle and mesostyle. A faint rib is present on the outer wall of the paracone. The outer walls of the paracone and metacone slant inward at an angle of approximately forty-five degrees. The crest of the ectoloph is sharp. A small, sharp tubercle is attached to the inner wall of the paracone. The protocone is

isolated, the protoloph being cut through by the anterior exit of the valley between protocone and paracone. A short, sharp crest curves inward and forward from the summit of the protocone. A low, sharp crest extending inward from the metacone ends in the hypocone. A deep V-shaped valley extends forward from the posterior end of the tooth between hypocone and metacone. Between hypocone and protocone there is another exit of the protocone-paracone valley. A heavy cingulum is present at the anterior end of the tooth; a short cingulum extends backward from the protocone; a slight posterior cingulum is present; and a faint cingulum occurs at the base of the ectoloph. The inner side of the tooth is supported on a large root, elliptical in cross-section, while the parastyle and mesostyle are each supported by smaller roots.

The Sucker Creek specimen is about half the size of the corresponding tooth in Moropus elatus of the Lower Miocene of Nebraska, the most completely known species of that genus (Holland and Peterson, 1914). Moropus(?), sp. from Virgin Valley (Merriam, 1911) apparently approaches M. elatus in size, as does also the Skull Spring Chalicothere(?) (Gazin, 1930). The Sucker Creek form may be determined ultimately as a type specifically distinct from both the Virgin Valley and the Skull Spring forms.

Measurements (in millimeters)

	Moropus, sp. No. 1060 C.I.T.	M. elatus* No. 2103 Car. Mus.
M2, anteroposterior diameter	25.4	56.0
M2, transverse diameter	21.0	41.0

*Holland and Peterson, 1914, p. 247.

ARTIODACTYLA

DICOTYLIDAE

Prosthennops Gidley 1904

Prosthennops(?), sp.

A suilline third lower molar, No. 1061, rooted in a lower jaw fragment which bears also the fangs of M2, is provisionally referred to Prosthennops, since that appears to be the most common genus of Miocene peccary. The tooth has four principal conical cusps arranged in rectangular pattern, with anteroposterior dimension of the rectangle slightly greater than the transverse diameter. There is, in addition, a posteriorly rounded heel about one- third as long as the entire tooth, bearing six smaller cusps. The anterior pair of the four principal cusps is higher and somewhat stouter than the posterior pair. The two pairs of cusps are separated by a prominent transverse valley which is higher in the middle than on either side. On the heel, four of the six cusps are arranged in a diamond-shape whose long axis is transverse to the long axis of the tooth. The remaining two cusps

are much smaller and are placed on either side of the posterior heel cusp.

Measurements (in millimeters)

$M\overline{3}$, No. 1061, anteroposterior diameter	17.5
$M\overline{3}$, No. 1061, transverse diameter	10.0

OREODONTIDAE

Ticholeptus Cope 1878

Ticholeptus(?), sp.

Identification of the oreodont material is very unsatisfactory because very little of it exhibits good diagnostic characters. The remains consist of isolated teeth and jaw fragments bearing teeth. The specimen which is perhaps the most diagnostic is a symphyseal fragment of a right ramus, No. 1062 C.I.T. Coll. Vert. Pale., showing an incomplete $P\overline{4}$, well-preserved $P\overline{3}$ and $P\overline{2}$, the stump of a large caniniform $P\overline{1}$, and alveoli for a canine and three incisors arranged almost in a straight line transversely across the front of the jaw. Since $P\overline{4}$ has its diagnostic part broken away, $P\overline{3}$ is the only tooth which shows any characters that might be useful in identifying the specimen. This tooth is almost identical with an isolated $P\overline{3}$ from Skull Spring (No. 387 C.I.T. Coll. Vert. Pale.). Both teeth closely resemble $P\overline{3}$ of Ticholeptus as figured by Loomis (1924, p. 11), except that the posterior basin in the Skull Spring and Sucker Creek specimens is open

postero-internally, while Loomis' illustration shows the posterior basin entirely closed. The only recognizable difference between the specimens from Sucker Creek and Skull Spring is that the one from the former locality has a double posterior intermediate crest, while the tooth from Skull Spring has only a single crest.

The symphysis in No. 1062 is deep and descends steeply to the ventral surface of the ramus, which curves down sharply at the point where it meets the symphysis, directly below $P\overline{3}$. The ramus is quite deep.

An isolated $P\overline{3}$, No. 1063 C.I.T. Coll. Vert. Pale., closely resembles that of Ticholeptus as illustrated by Loomis, in having the posterior basin inclosed. However, in the posterior basin of the Sucker Creek specimen there are two cuspules which apparently coalesce to form a posterior intermediate crest parallel to the median crest, while in Loomis' figure the posterior intermediate crest runs from the primary cusp postero-internally across the posterior basin. In $P\overline{3}$ of Metoreodon the posterior intermediate crest is parallel to the median crest (Loomis, 1924, p.11), but the anterior basin is also completely inclosed.

The remaining oreodont material shows no diagnostic characters. One specimen, No. 1064, is a mandibular fragment with $M\overline{2}$ and $M\overline{3}$ in fairly complete preservation. The teeth were evidently sub-hypsodont. $M\overline{3}$ has a long prominent third lobe which runs back

postero-externally from the postero-internal corner of the second lobe. The surface of the tooth is slightly rugose near the base and the inner wall is broadly convex antero-posteriorly. If internal styles or pillars were present on the teeth, they have disappeared at this stage of wear. Anterior cingula and cingular shelves occur between the outer lobes. The ramus is quite deep and in size is commensurate with the symphyseal fragment described above.

Another mandibular fragment, No. 1065, represents a young individual. $M\underline{1}$ is but slightly worn and $M\underline{2}$ is only partially erupted. The teeth are smaller and apparently less hypsodont than in No. 1064, described above, and the ramus is only a little more than half as deep. The teeth have a prominent mesostylid and entostylid. The parts bearing the parastylid are incomplete, but it apparently was not prominent. Faint median ribs are present on the inner crescents. There is an anterior cingulum and an external median cuspule.

Measurements (in millimeters)

	No. 1062	No. 1064	No. 1065
$P\underline{1}$–$P\underline{4}$, anteroposterior distance	50.0		
Depth of ramus below $P\underline{4}$	34.8		
$M\underline{1}$, anteroposterior diameter			14.7
$M\underline{1}$, transverse diameter			9.5
$M\underline{2}$, anteroposterior diameter		16.5	17.1
$M\underline{2}$, transverse diameter		11.7	9.3
$M\underline{3}$, anteroposterior diameter		30.0	
$M\underline{3}$, transverse diameter		11.8	
Depth of ramus below $M\underline{2}$		40.3	26.3

CERVIDAE

Dromomeryx Douglass 1909

Dromomeryx borealis (Cope)

Remains of Dromomeryx consist of teeth and fragmentary limb elements. $P\overline{3}$, $M\overline{1}$(?), $M\overline{2}$, $M\overline{3}$ (with third lobe missing), P3, P4, and M2 are represented in a good state of preservation. The specimens agree rather closely with the illustrations of the teeth of D. borealis shown by Douglass (1909, Pls. 62, 63). The teeth are brachydont, tending toward hypsodonty. The "Paleomeryx fold" is well-developed on the lower molars. $P\overline{3}$, No. 1069, has a small anteroposterior crest in the posterior basin near the inner side, separating off a small part of the basin; $M\overline{1}$(?), No. 1070, has a small cingulum at the postero-internal corner and only a small external median tubercle; $M\overline{2}$, No. 1071, has only a faint indication of a posterior cingulum; the posterior end of the postero-internal crescent of $M\overline{3}$, No. 1072, hooks sharply outward where the missing third lobe was attached; in P4, No. 1067, the anterior border is slightly concave instead of convex. While the above differences have been noted between the Sucker Creek specimens and the comparable teeth of D. borealis figured by Douglass, the essential agreement between the types from southeastern Oregon and Montana appears to justify identification of the Sucker Creek form as D. borealis. The minor differences are apparently within the range of variation of the species.

Measurements(in millimeters)

	Anteroposterior Diameter	Transverse Diameter
P3, No. 1066	16.3	14.6
P4, No. 1067	14.0	17.2
M2, No. 1068	22.2	20.5
p3, No. 1069	16.6	7.6
M1(?), No. 1070	a20.5	13.0
M2, No. 1071	21.8	13.5
M3, No. 1072		15.5

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a, approximate

ANTILOCAPRIDAE

Merycodus Leidy 1854

Merycodus, sp.

A horn fragment, No. 1073 C.I.T. Coll. Vert. Pale., and a lower jaw fragment, No. 1074 C.I.T. Coll. Vert. Pale., bearing an unworn molar, possibly M1, constitute the merycodont remains in the collection from Sucker Creek. One of the two tines of the horn is complete; the other is broken off at the point of bifurcation. The base of the beam is not present, but the length of the remaining part in proportion to the length of the tine indicates that the horn was long-beamed rather than short-beamed. In this respect, the specimen resembles Merycodus furcatus Leidy.

The beam flattens toward the fork and has a triangular cross-section just below the bifurcation, with the apex of the triangle on the side of the missing tine. From the size of the cross-section of the base of the missing tine, one would judge that it was the smaller of the two.

The tooth is hypsodont and has the typical merycodont structure, consisting of two columns set obliquely in the jaw, the anterior column rotated slightly more to the rear than the posterior column. The posterior end of the anterior column projects inward considerably beyond the anterior end of the posterior column. The inner walls of the two inner crests have median ribs running up to the apices of the crests. An accessory pillar is present at the posterior end of each inner crest and the anterior crest has in addition an anterior accessory pillar. A small pillar-like median cusp is present between the two external lobes. The tooth resembles that in Merycodus(?), sp. a from Skull Spring (Gazin, 1932), except that it has no trace of an anterior fold or vertical projection of the cingulum.

Measurements (in millimeters)

Length of tine above bifurcation	50.1
Length of beam below bifurcation (incomplete)	58.5
$M\overline{1}$(?), anteroposterior diameter	8.3
$M\overline{1}$(?), transverse diameter	4.6
Depth of lower jaw below $M\overline{1}$(?)	13.6

CAMELIDAE

Camelid(?), sp.

A number of foot and limb elements, including an unciform with a fragment of the co-ossified vestigial fifth digit, a patella, and a pisiform, are clearly too large to be referred to artiodactyla already recorded in the Sucker Creek fauna. Structural resemblances suggest a relationship with the camels. In size these specimens may represent Alticamelus or Megatylopus.

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