HORNED RUMINANTS
of NORTH AMERICA

By CHILDS FRICK

103 Text Figures

BULLETIN
OF
THE AMERICAN MUSEUM OF
NATURAL HISTORY
VOLUME LXIX, 1937

NEW YORK
March 31, 1937
FRONTISPICE. Pronghorns and deer of the American Late Tertiary.
Reconstructions × approximately ½ (a slightly oversize).

Merriam's Pronglet (a)
*Merriamoceros coronatus* (Merriam) (p. 332)
Osborn's Pronghorn (b)
*Osbornoceros osborni*, n.g. and sp. (p. 471)

Three-horned Deer (c)
*Procranioceras skinneri*, n.subg. and sp. (p. 75)

Four-horned Deer (d)
*Sinclairoceros sinclairi*, n.g. and sp. (p. 147)

Further reconstructions, Figs. 1, 2D, 19, 27, 49, 55 and 59
HORNED RUMINANTS
of NORTH AMERICA

BY CHILDS FRICK

103 Text Figures

BULLETIN
OF
THE AMERICAN MUSEUM OF
NATURAL HISTORY
VOLUME LXIX, 1937

NEW YORK
March 31, 1937
FOREWORD

The horn-bearing ruminants of America of historic time—the deer, moose, wapiti and caribou, the mountain goat and sheep, and the pronghorn antelope and bison—have claimed the interest of many besides hunters and naturalists. In this volume are assembled the previously recorded and much new data as to the number, nature and affinities of certain of the widely diverse horned and antlered predecessors of these modern forms. Few in kind, the Recent species comprise a mere remnant of those diversified assemblages of horned and hornless ruminants which existed in America during that portion of the so-called "Age of Mammals" which embraced the Quaternary (Recent and glacio-Pleistocene) and the upper third (Pliocene, Miocene and Late Oligocene) of the immediately preceding and vastly longer Tertiary. The palaeontologist's data consist of remains retrieved from fortuitous burials of the past. The fossilized evidence of the present volume numbers over seven thousand specimens—skulls, partial skulls, jaws, horns and limbs. Though most of the modern horn-bearing forms have been identified from superficial accumulations of relatively recent glacial age, so far only the pronghorn and deer groups have been encountered in the indurated deposits of the older to vastly older Late and Middle Tertiary. In the deposits of glacial time the progenitors of certain of the creatures of today are occasionally encountered in association with peculiarly distinct though broadly allied creatures. The latest of such curious prehistoric forms, even if known in part to early man, must have been extinct long before the arrival of Columbus. In the earlier and far remote Tertiary, the ancestors of our American pronghorn and deer are still masked amid the host of widely diversified Antilocaprids and Cervids of the vanished faunas of that time. The magnificence of the mammalian assemblages of the American past is in strange contrast to the impoverishment of the Recent fauna. While the final disappearance of the rich herds of the Tertiary, of which the genera and species here glimpsed formed a part, may not be charged to the interference of man, the continuance of the surviving creatures of today rests with civilization. Doubtlessly foremost among factors contributing to the destruction of the great assemblages of Tertiary time were changes in topography and climate, accompanied by the shifting of faunas and the ravages of predatory hosts of both the animal and plant worlds.
The evidence described in the present volume represents a particular section of the accumulated collections of fifteen years of exploration of fossiliferous deposits in the states of New Mexico, Colorado, Nebraska, Kansas, Wyoming, Arizona, Texas, Oklahoma, Nevada and California, and in Alaska. It is hoped that these studies on the range of form in the horned ruminants of prehistoric America, in conjunction with the parallel investigations in progress on the extinct American Camelidae, Oreodontidae, Equidae and Carnivora, by making available a wealth of new evidence, may establish a new starting point for the interpretation and tracing-out of the comings and goings of the mammals of the Late Tertiary-Quaternary and the reconstruction and filling-in of portions of the general biological and historical pattern. Knowledge as to the history of mammals and the correlation of faunas and formations is still limited by woeful lack of information as to the kinds, relationships and distribution of the vast multitude of extinct forms. The manner of origin of the individuals of the groups under discussion is yet unknown. Such origin may be found to have been parallel and largely similar for all mammals.

The writer's acknowledgments are due first to the leaders and members of the field parties cited in the ensuing pages in conjunction with the detailed lists of fossil remains, whose painstaking investigations have resulted in so vastly increasing the available data both as to the new and to previously described species. Prominent among these are Joseph Rak, John C. Blick, Charles H. Falkenbach, Morris F. Skinner, Jack Wilson, Ralph Mefferd, John Lynch, Carl Long, William Klaus, Ted Galusha, Peter Kaisen and their associates, and among Professor E. H. Barbour's assistants, C. Bertrand Schultz, Grayson Meade and F. W. Johnson. Sincere thanks are due to the collections' custodian, Floyd Blair, and to Joseph Rooney and associates for their skillful preparation of the material. Acknowledgment also is made to Haakon G. Dehlin for his aid in the details of many of the studies, especially in the inter-comparison of limb elements, preparation of measurement tables and filing of the data¹ for ready reference. Warm appreciation is expressed to Sydney E. Helprin for his assistance in the editing of the manuscript and in the carrying of this with frequent additions safely through the press. The writer is particularly indebted to Dr. William K. Gregory for his critical reading of the text in its original form.

The eight plates of reconstructions of the Tertiary Cervids, Antilocaprids, Proteroceratids and Quaternary Antilocaprids and Bovids are by Joseph M. Guerry. The restoration of the deciduous "horn-sheaths" of

¹ The method of filing the fossil data is shown in the photograph of Paracosorux wilsoni and Merriamoceros coronatus specimens, Figure 40A, page 371.
the Antilocaprini and "antlers" of the Aletomerycini-Dromomerycini are largely hypothetical as the same are in no case, so far, preserved. The ninety-three text figures of some six hundred and fifty-seven scaled drawings\textsuperscript{1} of horns, crania, dentitions and limb elements have been executed by Hazel de Berard. These drawings are based on camera lucida and pantographic outlines, the specimens appearing in "orthogonal projection." Dimensions which are parallel to the plane of the drawing are in their true size, but dimensions which are at an angle with the plane are more or less foreshortened. (By referring to both the lateral and posterior views in the case of the Merycodontini horn drawings, for example, the true dimensions of a specimen may be readily obtained.) For the sake of uniformity and ease of comparison, elevations of the larger skulls and horns are figured at one-third actual size; the smaller skulls and horns and the great majority of mandibular rami at one-half actual size; the occlusal (and lateral) views of the teeth at natural size, and the limbs at one-half actual size.

The only deviation from these scales is in the case of the comparative unit drawings of crania, Fig. 2, and teeth, Figs. 2B, 67, and one figure of the Bovidae $x \frac{2}{3}$.

All specimens are figured in the line drawings as left-hand, right-hand specimens being reversed so as to appear left. Such specimens are marked "rev." on the figures. The reconstructions of the heads in the flesh are approximately $x \frac{2}{3}$, except the Merycodontini $x \frac{1}{3}$ and the Pleistocene-Recent Cervini $x \frac{1}{3}$.

The dentitions, horns and limbs have been filed for reference arranged on plaster plaques according to the order of their listing in this volume. For convenience, the material is divided between tentative size groups. The dentition size groups do not always synchronize with those of the limbs because of differences in the limb proportions of various genera and families. Tooth wear is indicated by symbols: \( \Lambda \) (adolescent), \( M \) (mature), \( W \) (worn), etc.

For the privilege of reproducing certain important types and other specimens of the literature, the author wishes to acknowledge his appreciation of the courtesy of:

Professor Henry Fairfield Osborn of the American Museum of Natural History, regarding the material described by Cope and Matthew, and the types of

\begin{itemize}
  \item Dromomeryx borealis (Cope, 1878),
  \item Blastomeryx gemmifer Cope, 1874,
  \item Cranioceras unicornis Matthew, 1918, and
  \item Ramoceros (Merycodus) osborni (Matthew, 1904);
\end{itemize}

Doctor Charles W. Gilmore of the U. S. National Museum, in relation to the type of

\begin{itemize}
  \item Cranioceras (Dicrocerus) teres (Cope, 1874);
\end{itemize}

\textsuperscript{1} Where more than one view of the same specimen (or specimens of one catalogue number) occur on the same plate, all are counted as one drawing; where appearing on different plates, they are separately counted. Cross sections are not counted. The six hundred and fifty-seven drawings are representative of five hundred and fifty-two different actual specimens (including sixteen hornless Hypertragulids).
Foreword

Professor William J. Sinclair of Princeton University, the types of
  Drepanomeryx falciformis Sinclair, 1915,
  Dromomeryx whitfordi Sinclair, 1915, and
  Dromomeryx antilopinus Scott, 1893;

Director Thomas Barbour of the Museum of Comparative Zoology, Harvard University, the type of
  Aletomeryx (Blastomeryx) scotti (Matthew, 1924) and the Cosoryx remains of
  the Garman Collection, described by William B. Scott, 1890;

Director Andrey Avinoff of the Carnegie Museum of Pittsburgh, for the loan of the
  Dromomeryx borealis (Cope, 1878), Douglass cotype, and other data;

Director Charles Cadwallader of the Academy of Natural Sciences of Philadelphia, for the use of the
  "Merycodus necatus" remains from South Dakota, studied by Joseph Leidy, 1854;

Director J. D. Figgins of the Colorado Museum of Natural History, for the use of the type of
  Yumaceras figginsi, n.g. and sp., and other remains;

Doctor Mark Francis of the Agricultural and Mechanical College of Texas, for the opportunity of describing
  Prosynthetoceras francisi, n.subg. and sp.;

President Charles E. Bunnell of the University of Alaska in connection with the discoveries of the Alaska College-American Museum Expedition—
  Cervalces alaskensis, n.sp.,
  Saiga ricei, n.sp.,
  Ovis dorski, n.sp., and
  Bos bunnelli, n.sp.;

Doctor Erwin H. Barbour of the Nebraska State Museum, for the privilege of studying the types of
  Barbouromeryx trigonoconeus (Barbour and Schultz, 1934) and
  Proantilocapra platycornea Barbour and Schultz, 1934.

The writer further would express his deep appreciation of the courtesy and kindly cooperation of Doctor Erwin H. Barbour in permitting the description and figuring in these pages of much unique and heretofore unpublished evidence from the unrivaled series of the Nebraska State University Collection.

C. F.

AMERICAN MUSEUM OF NATURAL HISTORY
CONTENTS

FOREWORD ............................................................... v

INTRODUCTION .......................................................... 1

Introductory; five families and thirteen divisions—distribution; Middle and Late Tertiary correlations; characters of American Pecora — crania and “horns” (p. 15), teeth (p. 19) and limbs (p. 23); differentiation and parallelism in deer and pronghorn; “horns,” stages and form; historical; previously named (p. 29) and new genera and subgenera (p. 30); tentative reclassification and keys (pp. 31–39).

FAMILY I.—CERVIDÆ .................................................. 40

Table I. Distribution of genera, subgenera and species. .............. 41

DIVISIONS DROMOMERYCINI AND ALETOMERYCINI .................. 44

DISCUSSION ............................................................... 44

Table II. Mandibular measurements .................................... 52

DIVISION A.—DROMOMERYCINI (Tertiary of North America) ........ 75

Subfamily 1.—Cranioceratinae (Late Tertiary) ....................... 75

1. Cranioceras Matthew and 1a, Procranioceras, new subgenus .... 75

(1) C. unicornis Matthew, genotypic species, Nebr. ............... 82

(1a) C. granti, n.sp., Nebr. ........................................... 84

(2) C. (P.) skinneri, n.subg. and sp., Nebr. ......................... 86

(3) C. (P.) mefferdi, n.sp., and (?) (3a) var., Nebr. .............. 88

(4) C. (P.) dakotensis, n.sp., S. Dak. .............................. 90

(4a) C. (P.) kinseyi, n.sp., Mont. .................................. 91

(5) C. teres (Cope), N. Mex ........................................... 92

(6) C. (P.) pawniensis, n.sp., Colo ................................ 93

(7) C. clarendonensis, n.sp., and (?) var., Tex. .................. 94

(7a) (?) C. texanus (Hay), Tex ................................... 97

Subfamily 2.—Dromomerycinae (Late Tertiary) ..................... 99

II. Rakomeryx, new genus ............................................... 99

(1) R. raki, n.g. and sp., Calif ..................................... 101

(2) R. forakhiatus, n.sp., Calif .................................... 105

(3) R. yeronensis, n.sp., Calif ..................................... 105

(4) R. species, Nev ................................................. 106

(5) R. gazini, n.sp., Oreg ........................................... 106

III. Dromomeryx Douglass and IIIA, Subdromomeryx, new subgenus 109

(1) D. borealis (Cope), genotypic species, Mont .................. 114

(2) D. pawniensis, n.sp., Colo ..................................... 115

(3) D. whitfordi Sinclair, and var., Nebr .......................... 117

(4) S. antilopinus (Scott), Mont .................................. 123

(4a) S. scotti, n.subg. and sp., Nebr ............................... 123

(4b) S. wilsoni, n.sp., Nebr ....................................... 126
Contents

Subfamily 3.—Barbouromerycine (Middle and Late Tertiary) ........................................ 127

iv. Bouromeryx, new subgenus. (Late Tertiary) ................................................................. 130

(1) B. milleri, n. subg. and sp., Nebr. ................................................................. 130
(1a) B. submilleri, n.sp., Nebr. ................................................................. 131
(1aa) (?) B. parvus (Cook), Nebr. ................................................................. 131
(1b) B. nebrascensis, n.sp., Nebr. ................................................................. 131
(1c) B. supernebrascensis, n.sp., Nebr. ................................................................. 131
(1d) (?) B. pseudonebrascensis, n.sp., Nebr. ................................................................. 132

(2) (?) B. americanus (Douglass), Mont. ................................................................. 132
(2a) B. madisonius (Douglass), Mont. ................................................................. 133

(3) B. pawniensis, n.sp., Colo. ................................................................. 133

v. Barbouromeryx, new genus, va, Probarbouromeryx, new subgenus, and vb, Prolobarbourmeryx, new subgenus. (Middle Tertiary) ................................................................. 130
(4) B. trigonocorneus (Barbour and Schultz), genotypic species, Nebr. ................................................................. 134
(5) P. sweeti, n.subg. and sp., Nebr. ................................................................. 135
(6) P. marslandensis, n.subg. and sp., Nebr. ................................................................. 136

Subfamily 4.—Drepanomerycine (Late Tertiary) ................................................................. 137

vi. Drepanomeryx Sinclair and vii, Matthomeryx, new subgenus ................................................................. 137
(1) D. falciformis Sinclair, genotypic species, Nebr. ................................................................. 140
(2) M. matthewi, n.subg. and sp., Nebr. ................................................................. 141

Division B.—ALETOMERYCINI (Tertiary of North America) ................................................................. 142

Subfamily 5.—Yumaceratine. (Late Tertiary) ................................................................. 142

viii. Yumaceras, new genus ................................................................. 142
(1) Y. figginsi, n.g. and sp., and (1a and b) sp., Colo. ................................................................. 143
(2) Y. falkenbachii, n.sp., Okla., and (2a) var., Tex. ................................................................. 144

Subfamily 6.—Aletomerycine. (Middle and early Late Tertiary) ................................................................. 147

ix. Aletomeryx Lull and x, Sinclairomeryx, new genus ................................................................. 156
(1) A. gracilis Lull, genotypic species, Nebr. ................................................................. 156
(1a) A. marshi (Lull), Nebr. ................................................................. 159
(1b) A. gracilis, var., Nebr. ................................................................. 160
(1c) A. scotti (Matthew), Nebr. ................................................................. 161
(2) A. lugni, n.sp., Nebr. ................................................................. 161
(3) A. marslandensis, n.sp., and (3a) (?) var., Nebr. ................................................................. 162
(4) S. sinclari, n.g. and sp., Nebr. ................................................................. 164
(4a) (?) S. riparius (Matthew), and var., Nebr. ................................................................. 165
(5) S. tedi, n.sp., Nebr. ................................................................. 168

Dromomerycine and Aletomerycine Limb Elements ................................................................. 169

Table iii. Limb measurements ................................................................. 172
Contents

Division C.—Cervini [Latest Tertiary and Quaternary of North (and South) America] ........................................... 189

Table iv. Metacarpal length relative to skull length ........................................... 190

(a) (?) Uppermost Tertiary, California .................................................................. 191

Subfamily 7.—Cervinae ................................................................................. 191

xi. Procoileus, new subgenus ......................................................................... 191

(1) P. edensis, n. subg. and sp., S. Calif ................................................... 191

(b) Pleistocene of North America .................................................................. 196

Subfamily 7.—Cervinae (cont.) .................................................................. 196

xii. Cervus Linneus ................................................................................... 199

(1) C. lascruzensis, n.sp., N. Mex ......................................................... 199

(2) C. aquanqa, n.sp., S. Calif .................................................................. 200

Subfamily 8.—Odocoileinae ........................................................................ 196

xiii. Odocoileus Rafinesque ........................................................................ 200

(1) O. sheridanus, n.sp., and (1a) var., Nebr ...................................... 200

(2) O. cascensis, n.sp., and (2a, b) vars., Calif .................................. 201

(3) O. cooki, n.sp., Nebr ........................................................................ 202

Subfamilies 9–9a.—Alcinae–Rangiferinae .................................................................. 196

xiv. Cervinae Scott ..................................................................................... 203

(1) C. alaskensis, n.sp., Alaska; (2) C. borealis Bensley, Ontario; (3) C. roosevelti Hay, Iowa; (4) C. scotti (Lydekker), genotypic species, N. J ............................................ 203

xv, Alces Gray and XVI, Rangifer Hamilton Smith ............................................. 196

(c) Quaternary of South America .................................................................. 205

Subfamilies 8–9a.—Odocoileinae and (?) Rangiferinae (cont.) ............. 205

xvii, Pudu Gray and xviii, Hippocamelus Leuckart ..................................... 205

xviiiA. Blastocerus Wagner, Ecuador ................................................................. 205

(1) B. blicki, n.sp .................................................................................... 209

xix. Pseudoedocoileus Spillmann, Ecuador ......................................................... 205

(2, 3) P. gracilis Spillmann, and var ................................................................ 209

(4) P. saline, n.sp .................................................................................... 213

Table v. Limb measurements (P. gracilis Spillman, ref.) .................................. 214

Division D.—Blastomerycini (Middle Tertiary and Late Tertiary of North America) ........................................... 215

Table vi. Mandibular measurements ................................................................. 227

xx. Longirostromeryx, new genus ................................................................. 230

(1) L. wellesi (Matthew), S. Dak .............................................................. 230
Contents

(2) L. merriami, n.g. and sp., and vars. A and B, Nebr... 230
(2a) L. serpentes, n.sp., Nebr......................... 232
(3) L. novomexicanus, n.sp., N. Mex.................... 233
(4) L. clarenidonensis, n.sp., Tex..................... 233
(4a) (?) L. vigoratus (Hay), Tex........................ 234
(5) (?) L. blicki, n.sp., N. Mex........................ 234

xxi. Blastomeryx Cope.................................. 237
(6) B. elegans Matthew and Cook, Nebr................. 237
(7) B. mefferdi, n.sp., Nebr............................ 238
(8) B. gemmifer Cope, genotypic species, Colo........ 238
(8a) B. g. medius (Matthew); (8aa) var., Nebr.... 239
(8b) B. g. valentinensis, n.subsp.; (8bb) (?) var. A, Nebr. 241
(8c) B. gemmifer var., Mont............................ 241
(9) B. mollis Merriam, Nev............................. 242
(10) B. francesca, n.sp., N. Mex........................ 242
(11) B. franciscita, n.sp., N. Mex..................... 242

Subfamily 11.—Parablastomerycinæ—(A) Late Tertiary. . . . . 217
xxii. Parablastomeryx, new genus.................................... 243
(12) 'P. gregorii, n.g. and sp., Nebr............... 234
(13) (?) P. galushi, n.sp., Nebr..................... 244

xxiii. Pseudoparablastomeryx, new subgenus.................. 244
(14) P. (P.) scotti, n.subg. and sp., Nebr........... 244
Limb Elements (for measurements, see Table IX, pp. 448—451) . 245

Subfamily 10.—Longirostromerycinæ (cont.)—(B) Middle Tertiary. . . . . . 251
xxiii. Macheromeryx Matthew, Lower Miocene, Nebr........ 251
(1) M. tragulus Matthew, genotypic species, Nebr........ 254

Subfamily 11.—Parablastomerycinæ (cont.)—(B) Middle Tertiary. . . . . . 251
xxiv. Problastomeryx, new subgenus.............................. 251
(2) P. ocottii (Matthew), Wyo............................ 255
(2a) P. species, Nebr.................................... 256
(3) P. primus (Matthew), subgenotypic species, S. Dak### 256
xxv. Pseudoblastomeryx, new subgenus.................... 251
(4) P. falkenbachii, n.subg. and sp., Wyo.............. 257
(5) P. advena (Matthew), and (5a) smaller var., S. Dak... 258
(6) P. schultzi, n.sp., Nebr............................. 259
(7) (?) P. marna, n.sp., Nebr............................ 260
Limb Elements (for measurements, see Table IX, pp. 448—451) . 260
FAMILY II.—ANTILOCAPRIDÆ ........................................ 267
  Table vii. Distribution of genera, subgenera and species. 268
DIVISIONS MERYCODONTINI AND ANTILOCAPRINI. ............ 267
DIVISION A.— MERYCODONTINI (Late Tertiary of North America) .... 271
  SECTION I.—DISCUSSION ......................................... 271
  Introductory; characters; problem of the “horns”; distribution;
subfamilies, genera and subgenera as viewed in the “horns” (p. 290);
mandibles and dentitions (p. 313); limbs (p. 316); forty-seven species,
subspecies, vars. and types (p. 317).
SECTION II.—“Horns” ............................................ 323
SUBFAMILIES. MERYCODONTINI (Late Tertiary of North America) .... 271
  SECTION I.—DISCUSSION ......................................... 271
  Introductory; characters; problem of the “horns”; distribution;
subfamilies, genera and subgenera as viewed in the “horns” (p. 290);
mandibles and dentitions (p. 313); limbs (p. 316); forty-seven species,
subspecies, vars. and types (p. 317).
  SECTION II.—“Horns” ............................................ 323

Subfamily 1.—Ramocerotina ........................................ 271
  I. Ramoceros, new genus. ........................................ 233
    (1) R. ramosus (Cope), N. Mex. ................................ 233
    (2) R. ramosus quadratus, n.subsp., N. Mex. .................. 237
    (3) R. osborni (Matthew), genotypic species, Colo. ........... 238
    (4) R. hitchcockensis, n.sp., Nebr. ......................... 239
  I A. Paramoceros, new subgenus. ................................ 239
    (5) R. (P.) marthæ, n.sp., N. Mex. ............................ 239
    (6) R. (P.) howarde, n.sp., and (?)var., Nebr. ............... 239
    (7) R. (P.) kansanus, n.sp., Kans. ......................... 239
    (8) R. (P.) palmutus, n.sp., N. Mex. ......................... 239
    (9) R. (P.) brevicornis, n.subg. and sp., Calif. .......... 239

  I B. Merriamoceros, new subgenus. .............................. 272
    (10) R. (M.) coronatus (Merriam), subgenotypic sp., Calif. 272

Subfamily 2.—Cosorycina .......................................... 271
  II, Cosoryx Leidy and II A, Subcosoryx, new subgenus .......... 234
    (1) C. (S.) cerroensis, n.subg. and sp., N. Mex. .......... 234
    (2) C. ilfonsensis, n.sp., N. Mex. ............................ 234
    (3) C. furcutus Leidy, genotypic species, Nebr. ............ 234
    (4) C. furcutus sternbergi, n.subsp., Kans. ................. 234
    (5) C. furcutus, var. or subsp., S. Dak. .......... 234
      [(5a) Merycodus necatus Leidy, S. Dak.]. .... 234
    (6) C. furcutus mooki, n.subsp., Mont. ...................... 234
      (6a) (?)C. agilis Douglass, and (6b) (?)C. var., Mont. 234
    (7) C. furcutus, var. or subsp., Colo. ...................... 234

  II B, Paracosoryx, and II C, Subparacosoryx, new subgenera ..... 234
    (8) C. (P.) alticornis, n.sp., and (8a) (?)var. or C. species,
        Calif. .................................................... 234
    (9) C. (P.) furlongi, n.sp., Calif. ......................... 234
    (10) C. (P.) species, Calif. ................................. 234
xiv

Contents

<table>
<thead>
<tr>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(11) C. (P.) loxocerus (Furlong), Nev..........................</td>
</tr>
<tr>
<td>(11a) (?)C. (P.) nevadensis (Merriam), Nev..................</td>
</tr>
<tr>
<td>(11b) C. (P.) var., Nev...................................</td>
</tr>
<tr>
<td>(12) (?)C. (P.) species (Gazin), Oreg........................</td>
</tr>
<tr>
<td>(13) C. (P.) wilsoni, n.subg. and sp., Nebr..................</td>
</tr>
<tr>
<td>(14) C. (S.) savaronis, n.subg. and sp., Nebr................</td>
</tr>
<tr>
<td>(14a) C. (P.) sabulonis (Matthew and Cook), Nebr............</td>
</tr>
<tr>
<td>(15) C. (P.) dawesensis, n.sp., Nebr........................</td>
</tr>
<tr>
<td>(16) C. (P.) species, Nebr..................................</td>
</tr>
<tr>
<td>III. Meryceros, new genus.....................................</td>
</tr>
<tr>
<td>(1) M. major, n.sp., N. Mex..................................</td>
</tr>
<tr>
<td>(2) M. crucensis, n.sp., N. Mex................................</td>
</tr>
<tr>
<td>(3) M. nenzelensis, n.sp., Nebr................................</td>
</tr>
<tr>
<td>(4) M. warreni (Leidy), genotypic species; (4b) var., Nebr.</td>
</tr>
<tr>
<td>(4a) M. warreni johnsoni, n.subsp.; (4a',a&quot;) vars., Nebr...</td>
</tr>
<tr>
<td>(5) M. warreni, var. or subsp., Colo..........................</td>
</tr>
<tr>
<td>(6) M. foraki, n.sp., Calif....................................</td>
</tr>
<tr>
<td>(7) M. hookei (Furlong), Nev................................</td>
</tr>
<tr>
<td>IIIA. Submeryceros, new subgenus................................</td>
</tr>
<tr>
<td>(8) M. (S.) crucianus, n.subg. and sp., N. Mex................</td>
</tr>
<tr>
<td>(9) (?)S. minor, n.sp., N. Mex................................</td>
</tr>
<tr>
<td>(9a) (?)S. minor serpentinus, n.subsp., Nebr...............</td>
</tr>
<tr>
<td>(9b) (?)S. minor pauniensis, n.subsp., Colo................</td>
</tr>
<tr>
<td>(10) (?)S. minimus, n.sp., N. Mex..............................</td>
</tr>
</tbody>
</table>

SECTION III.—DENTITIONS AND MANDIBULAR RAMI......................... 372

Statement........................................................................ 372

Table viii. Mandibular measurements...................................... 384

Dentitions from:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) New Mexico...............................</td>
<td>391</td>
</tr>
<tr>
<td>(2) Colorado..................................</td>
<td>406</td>
</tr>
<tr>
<td>(3A) South Dakota............................</td>
<td>408</td>
</tr>
<tr>
<td>(3B) Kansas....................................</td>
<td>410</td>
</tr>
<tr>
<td>(3C) Montana..................................</td>
<td>411</td>
</tr>
<tr>
<td>(4) Nebraska..................................</td>
<td>412</td>
</tr>
<tr>
<td>(4A) Brown and Cherry Counties, p. 413; (4B) Sioux County.</td>
<td>428</td>
</tr>
<tr>
<td>(4C) Hitchcock County and (4B) Dawes County..............</td>
<td>434</td>
</tr>
<tr>
<td>(5) California...............................</td>
<td>435</td>
</tr>
<tr>
<td>(5A) Barstow..................................</td>
<td>435</td>
</tr>
<tr>
<td>(5B) Ricardo..................................</td>
<td>444</td>
</tr>
<tr>
<td>(6) Nevada and Oregon......................</td>
<td>445</td>
</tr>
</tbody>
</table>

SECTION IV.—LIMB ELEMENTS............................................ 447

Table ix. Limb measurements (Merycodontini and Blastomerycini) 448
Contents

DIVISION B.—ANTILOCAPRINI (Late Tertiary and Quaternary of North America). ................................................................. 469
Table x. Mandibular measurements ........................................ 488

(A) LATE TERTIARY ............................................................ 469
Subfamily 3.—Iltingocerotinae ............................................. 469
iv. Osbornoceros, new genus .............................................. 490
  (1) O. osborni, n.g. and sp., N. Mex. ................................. 490
v. Iltingoceros Merriam ..................................................... 491
  (1) I. alexandrae Merriam, genotypic species, Nev. ............ 491
    (1a) I. schizoceras Merriam, Nev. .............................. 493
va. Sphenophalos Merriam ............................................... 493
  (1) S. nevadanus Merriam, genotypic species, Nev. ............ 494
    (1a) S. species Merriam, Stock and Moody, Oreg. ............ 494
Subfamily 4.—Pliocerotinae .............................................. 469
vi. Plioceros, new genus .................................................. 494
  (1) P. blicki, n.g. and sp., N. Mex. ................................. 495
  (2) P. flabairi, n.sp., Nebr. ........................................ 496
    (2a) P. dehlini, n.sp., Nebr. ................................... 497
    (2b-c) (?)P. vars., Nebr. and Kans. ......................... 497
  (3) P. species, and (3a) smaller var., Oreg. ................. 498
  (4) P. species, and vars. A and B, Nev. ....................... 498
Subfamily 5.—Stockocerotinae (Tertiary Section) .................. 469
vii. Texoceros, new genus .............................................. 500
  (1) T. guymonensis, n.g. and sp., Okla. ......................... 501
    (1a) T. texanus (Hesse), Tex. ................................ 505
    (1b) (?)T. minores, n.sp., Okla. .............................. 506
  (2) (?)T. vaughani, n.sp., Colo. ................................ 506
  (3) (?)T. species, Ariz. ........................................... 507
  (4) (?)T. altidens (Matthew), Nebr. ............................ 507
  (5) (?)T. edensis, n.sp., and (5a) var. A, Calif. .......... 508
Subfamily 6.—Antilocaprinæ (Tertiary Section) ...................... 469
viii. Proantilocapra Barbour and Schultz ........................... 510
  (1) P. platycornea Barbour and Schultz, genotypic sp., Nebr. 510
Limb Elements .................................................................. 513
Table xi. Limb measurements ............................................ 511

(b) PLEISTOCENE ............................................................ 521
Subfamily 5.—Stockocerotinae (cont.) ................................ 521
ix. Stockoceros, new subgenus .......................................... 526
  (1) S. conklingi (Stock), subgenotypic species, N. Mex. .... 526
  (2) S. onusrosagris (Roosevelt and Burden), Ariz. ......... 527
FAMILY III.—BOVIDÆ (Quaternary of North America) .......... 539

DIVISIONS ANTILOPINI, OVINI AND BOVINI ................. 539

Table XII. Metacarpal length relative to skull length . 541

DIVISION A.—ANTILOPINI .............................. 543

Subfamily 1.—Antilopinæ ................................ 543

1. Neotragocerus Matthew and Cook ................. 543
   (1) N. improvisus Matthew and Cook, genotypic species, Nebr. (horizon in question) . 544
   (2) (?)N. lindgreni Merriam, Idaho . 544

II. Oreamnos Rafinesque .......................... 545
   (1a-c) O. montanus, vars., Wash. and Calif. . 545

III. Saiga Gray ................................ 546
   (1) S. ricei, n.sp., Alaska . 547

DIVISION B.—OVINI ........................................ 548

Subfamily 2.—Euceratherinæ ................................ 548

iv, Euceratherium Furlong and Sinclair, and v, Preptoceras Furlong. . 548
   [(a) Aftonius Hay and (b) Taurotragus ref. Gidley] . 548

Species from California:
   (1) E. collinum Furlong and Sinclair, genotypic species. 550
      (1a) E. (P.) collinum (Furlong) . 550
   (2) E. collinum, ref. Sinclair . 551
   (3) E. collinum, ref. Stock . 551
   (4) E. species, ref. Stock-Furlong . 551
   (5) E. (P.) species, ref. ........................ 551
Species from other localities:  

(6) (?)E. (P.) mayfieldi (Troxell), Tex.  
(7) (?)E. (A.) calvini (Hay), Iowa.  
(8) (?)E. (T.) americanum (Gidley), Md.  
(8a) (?)E. americanum, ref. Gazin, Ill.  
(9) E. collinum morrisi Schults and Howard, N. Mex.  
(9a) (?)E. (P.) sinclairi neomexicana (Schults and Howard), N. Mex.  
(10) (?)E. (P.) cf. sinclairi, ref. Freudenberg, Mexico.  

Subfamily 3.—Ovine.  

vi. Ovis Linnaeus.  
(1) O. dalli kaiseni, n.subsp., Alaska.  
(2) O. dorshi, n.sp., Alaska.  

Subfamily 4.—Ovibovine.  

vii. Ovibos Blainville.  
(1) O. moschatus (Zimmerman), genotypic species, Recent and fossil.  
(2) O. appalachicolaus Rhoads, Pa.  
(3) (?)O. zuniensis (Gidley), N. Mex.  
(4) O. yukonensis Gidley, Alaska.  
(4a) O. proximus Bensley, Ontario.  
(5) (?)O. giganteus, n.sp., Alaska.  

viii. Symbos Osgood.  
(1) S. cavifrons (Leidy), Indian Terr.; (1a–e) vars., Ind., Nebr., Ill. and Mo.; and (1cc) S. convexifrons Barbour, Nebr.  
(2) S. tyrrelli Osgood, genotypic species, Yukon Terr.  

ix. Bovitherium Leidy.  
(1) B. bombifrons (Harlan), genotypic species, Ky., and (1a–b) vars., Pa. and Nebr.  
(2) B. sargenti Gidley, Mich.  
(3) B. nivicolens Hay, Alaska.  

Division C.—Bovini.  

Subfamily 5.—Bovine.  

x. Bos Linnaeus (= Poephagus Gray).  
(1) B. (P.) bunnelli, n.sp., Alaska.  

Table xiii. Horn-core measurements.  
(1) S. latifrons (Harlan), Ky.  
(1x) B. antiquus Leidy, Ky.  
(2a–g) (?)S. or B. species, Fla., Ga., S. C., Pa., Mass., N. Y. and Miss.  
(3) S. species, Ohio.  
(3x) B. sylvestris Hay, Ohio.  
(3x–1) B. species, Ind.
(4) *S.* species, Idaho .............................................. 581  
(4x) *B.* species, Iowa ............................................. 582  
(5) *S.* alleni (Marsh), Kans. ........................................ 582  
(5a) *S.* crampianus (Cope), Kans. .................................. 582  
(5b) *S.* regius (Hay), Kans. ......................................... 582  
(5x) *B.* species of Williston's mount, Kans. ........................ 583  
(5x-1) *B.* kansensis McClung, Kans. ................................. 583  
(5x-2) *S.* alleni (Marsh), Kans. ..................................... 583  
(5x-3) *S.* crampianus (Cope), Kans. ................................ 583  
(5x-4) *S.* regius (Hay), Kans. ....................................... 583  
(5x-5) *B.* species of Williston's mount, Kans. ........................ 583  
(5x-6) *B.* kansensis McClung, Kans. .................................. 583  
(5x-7) *S.* alleni (Marsh), Kans. ..................................... 583  
(5x-8) *S.* crampianus (Cope), Kans. ................................ 583  
(5x-9) *S.* regius (Hay), Kans. ....................................... 583  
(5x-10) *B.* species of Williston's mount, Kans. ...................... 583  
(6) *S.* species, Nebr. .............................................. 583  
(6a) *S.* angularis (Figgins), Nebr. .................................. 584  
(6b) *S.* rotundus (Figgins), Nebr. ................................... 584  
(6x) *B.* species, Nebr. .............................................. 584  
(7) *B.* taylori Hay and Cook, N. Mex .................................. 585  
(7x-1) *B.* oliverhayi Figgins, N. Mex ................................. 585  
(8) *S.* species, Tex. .............................................. 585  
(8a) *S.* occidentalis Lucas, Alaska ................................... 589  
(8b) *S.* alaskensis (Rhoads), Alaska ................................ 592  
(11) *S.* crassicornis (Richardson), Alaska ............................ 589  
(11a) *S.* occidentalis (Lucas), Alaska ............................... 591  
(11b) *S.* alaskensis (Rhoads), Alaska ............................... 592  
(12) *B.* bison (Linné), genotypic species .............................. 592  
(x-1) *B.* b. intermedia Stirton, genotypic species, Nebr. ............... 593  
(x-2) *B.* b. arizonica (Blake), Ariz. ................................ 587  
(x-3) *B.* b. californicus Rhoads, Calif. ............................... 588  
(x-4) *B.* b. species (Condon), Oreg. ................................ 588  
(x-5) *B.* b. species, Mexico .......................................... 589  
(x-6) *B.* b. athabascae Rhoads (Woodland form), Canada ............... 593  
(x-7) *B.* b. pennsylvanicus Shoemaker, Pa. .......................... 593  

FAMILY IV.—PROTOCERATIDÆ .............................................. 595  
Table xiv. Distribution of genera, subgenera and species ............. 597  
DIVISION.—PROTOCERATINI ............................................... 595  
Subfamily 1.—Synthetoceratina (Late Tertiary) .......................... 602  
i. *Synthetoceras* Stirton ............................................. 602  
(1) *S.* tricornatus Stirton, genotypic species, Tex. ................... 603  
(1a) (?) *S.* rileyi, n.sp., Tex. .................................... 605  
ii. *Prosynthetoceras*, new subgenus .................................. 602  
(2) *P.* francisci, n.subg. and sp., Tex. ................................ 605  
(3) *P.* siouxiensis, n.sp., Nebr. ..................................... 607  
(3a) *P.* siouxiensis dawesensis, n.subsp., Nebr. ........................ 607  
Subfamily 2.—Syndyoceratinae (Middle Tertiary) ........................ 607  
iii. *Syndyoceras* Barbour (Lower Miocene) ............................ 607  
(1) *S.* cooki Barbour, genotypic species, Nebr. ........................ 608
Contents

PAGE
Subfamily 3.—Protoceratinae (Middle and Late Tertiary)........... 608
iv. *Paratoceras*, new genus (Late Tertiary).......................... 608
   (1) *P. macadamsi*, n.g. and sp., Tex.......................... 609
v. *Protoceras* Marsh and *Calops* Marsh (Middle Tertiary—Upper Oligocene, S. Dak.)........... 609
   (1) *P. celer* Marsh, genotypic species....................... 610
   (2) *P. comptus* Marsh........................................... 613
   (4) *P. (C.) cristatus* Marsh..................................... 613
   (5) *P. (C.) consors* Marsh........................................ 613
vi. *Pseudoprotoceras* Cook (Middle Tertiary—Lower Oligocene).... 614
   (6) *P. longinaris* Cook, Nebr................................. 614
Table xv. Limb measurements........................................ 614

FAMILY V.—HYPERTRAGULIDÆ............................................. 619
Table xvi. Distribution of genera, subgenera and species.......... 618
DIVISIONS LEPTOMERYCINI, HYPERTRAGULINI AND HYPISODONTINI (Middle Tertiary).......................... 619
DISCUSSION................................................................. 619
DIVISION A.—LEPTOMERYCINI........................................... 622
Subfamily 1.—Leptomerycine............................................ 622
i. *Leptomeryx* Leidy.................................................. 622
   (1) *L. obliquidens* Lull, S. Dak.................................... 625
   (2) *L. transmontanus* Douglass, and (2a) (?)var., Mont........ 625
   (3) *L. mammifer* Cope, Canada.................................... 626
   (4) *L. evansi* Leidy, genotypic species, S. Dak., and (4a, b and c) vars., Nebr., Colo. and Mont........ 627
   (5) *L. minimus*, n.sp., S. Dak., and (5a and b) *L. var.* Nebr. and Colo........................................ 630
   (6) (?) *L. speciosus* Lambe, Canada................................. 630
      (a) *L. esculatus* Cope, Canada................................ 631
      (b) *L. semicinctus* Cope, Canada................................. 631
ii. *Heteromeryx* Matthew............................................. 632
   (1) *H. dispar* Matthew, genotypic species, S. Dak............. 632

DIVISION B.—HYPERTRAGULINI............................................ 633
Subfamily 2.—Hypertraguline.......................................... 633
iii. *Hypertragulus* Cope (and *Allomeryx* Sinclair)................ 633
   (1) *H. calcaratus* Cope, genotypic species, Colo., and (1a and b) vars., S. Dak. and Nebr......................... 635
   (2) *H. hesperius* Hay, Ore......................................... 636
      (a) *H. (A.) planiceps* (Sinclair), Ore.......................... 637
      (b) *H. species* Sinclair, Ore.................................... 637
xx

Contents

PAGE

(3) (?)H. minor, n.sp., Nebr. ................................. 638
(4) (?)H. minutus Lull, Oreg. ............................... 638
(5) (?)H. dakotensis, n.sp., S. Dak. ...................... 638

IV. Nanotragulus Lull........................................ 638
(1) N. albanensis, n.sp., Nebr. ......................... 640
(2) N. ordinatus (Matthew), S. Dak., and (2a) var., Wyo... 641
(3) N. loomisi Lull, genotypic species, Wyo. ............ 641
(3a) N. lulli, n.sp., S. Dak. .............................. 643

Table xvii. Limb measurements ................................ 643

DIVISION C.—Hypisodontini.................................... 644
Subfamily 3.—Hypisodontinae................................ 644
v. Hypisodus Cope ........................................... 644
(1) H. minimus Cope, genotypic species, Colo.............. 645
(1a) H. ringens Cope, Colo. ................................ 645
(2) H. alacer Troxell, Nebr................................ 646

VI (APPENDIX).—CAMELIDÆ (IN PART).......................... 648
DIVISIONS PSEUDOCERATINI AND STENOMYLINII.............. 648
DIVISION A.—PSEUDOCERATINI (Late Tertiary).............. 649
Subfamily 1.—Pseudoceratinae................................ 649
i. Pseudoceras, new genus .................................. 649
(1) P. skinneri, n.g. and sp., Nebr......................... 650
(2) P. wilsoni, n.sp., and (2a) var., Nebr. ................ 651
(3) P. potteri, n.sp., Nebr.................................. 652
(4) P. klausi, n.sp., N. Mex.................................. 652
[For comparison:
(5) (?)Eotylopus profectus Matthew, Mont................. 653]

DIVISION B.—STENOMYLINII (Middle and Late Tertiary).... 656
Subfamily 2.—Stenomylinae................................... 656
ii. Rakomylus, new genus (Late Tertiary).................. 657
(1) R. raki, n.g. and sp., N. Mex........................... 657

iii. Stenomylus Peterson (Middle Tertiary)................ 658
(1) S. gracilis Peterson, genotypic sp., Nebr.; (1a) var., Wyo. 660
(2) S. crassipes Loomis, Nebr................................ 661
(3) S. hitchcocki Loomis, Nebr............................... 662
# LIST OF ILLUSTRATIONS

## Reconstructions

<table>
<thead>
<tr>
<th>Fig.</th>
<th>Scale</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontispiece. Pronghorns and deer of the American Late Tertiary (five new genera and subgenera)</td>
<td>approx. 1/6</td>
<td>ii</td>
</tr>
<tr>
<td>1. Deer of the American Tertiary (five genera and subgenera)</td>
<td>1/6</td>
<td>xxviii</td>
</tr>
<tr>
<td>2D. Rak’s Deer, Barstow, California</td>
<td>approx. 1/6</td>
<td>44</td>
</tr>
<tr>
<td>19. Deer of the American Quaternary</td>
<td>1/6</td>
<td>188</td>
</tr>
<tr>
<td>27. Pronglets, Merycodontini, of the American Late Tertiary</td>
<td>1/6</td>
<td>270</td>
</tr>
<tr>
<td>49. Pronghorns, Antilocaprini, of the American Late Tertiary</td>
<td>1/6</td>
<td>468</td>
</tr>
<tr>
<td>55. Bovids of the American Quaternary</td>
<td>1/6</td>
<td>538</td>
</tr>
<tr>
<td>59. Protoceratids of the American Tertiary</td>
<td>1/6</td>
<td>594</td>
</tr>
</tbody>
</table>

## Outline Drawings

### Introduction

2. Cranial proportions and horn-pedicel or -core form and position in Cervidae, Giraffidae, Antilocapridae, Protoceratidae and Bovidae. (Premaxilla-vertex distances reduced to unity.)

2A. Bullar region of the skull in Tertiary and Recent Artiodactyls

2B. Form and pattern of p4 and proportions of p4 relative to m3 in brachydont to subhypodont Cervidae, Protoceratidae and Hypertragulidae, and in the hypodont Antilocapridae and Bovidae. (Anteroposterior diameters of p4s, occlusal views, and of m3s, lateral views, respectively brought to unity.)

2C. *Prosynthetoceras siouxiensis davensens*, n. subsp., type, Dawes County, Nebraska: horn-pedicle

### I.—Cervidae

#### Dromomerycini and Aletomerycini

3. Size range in American Tertiary Cervids: mandibular milk dentitions

4. Size range in Cervids of the American Tertiary: mandibular dentitions, lateral views

4A. Size range in Cervids of the American Tertiary: mandibular and maxillary dentitions, occlusal views
Illustrations


9. *Dromomeryx* Douglass, *Rakomeryx*, n.g., and *Yumaceras*, n.g.: mandibular denticions


10A. *Rakomeryx*, n.g., *Dromomeryx* Douglass and *Yumaceras*, n.g.: maxillary denticions

11. *C.* (Procranioceras) *skinneri*, n.subg. and sp., subgenotype, Brown County, Nebraska: skull

12. *Cranioceras* and *Procranioceras* species, Late Tertiary of New Mexico and Nebraska: skull and horn-pedicles

12A. *Cranioceras* Matthew, *Procranioceras*, n.subg., and *Yumaceras*, n.g., comparison of horn-pedicles, Late Tertiary of Nebraska, Colorado and Texas, and *Cranioceras* and (?)*Drepanomeryx* ref. female skulls, Nebraska

13. *Rakomeryx* raki, n.g. and sp., genotype, and *R. jorakianus*, n.sp., type, Late Tertiary, Barstow, California: skulls


14A. *Dromomeryx* Douglass and *Subdromomeryx*, n.subg., Late Tertiary of Montana: partial skulls

14B. *Dromomeryx* Douglass, *Subdromomeryx*, n.subg., and *Bouromeryx*, n.subg., Late Tertiary of Nebraska: skulls and horn-pedicles

15. *Matthomeryx* matthewi, n.subg. and sp., subgenotype and ref., Dawes County, and *Drepanomeryx* falciformis Sinclair, genotype and ref., Sioux County, Nebraska: horn-pedicles and mandibular rami

15A. *Yumaceras* falkenbachii, n.sp., type, Guymon, Oklahoma: mandibular ramus
Illustrations

Fig. 16. *Aletomeryx gracilis* Lull, sexual and individual variation, Cherry County, and *A. marshallensis*, n.sp., type, Box Butte County, Nebraska: skulls, Middle Tertiary

16A. *Aletomeryx marshallensis*, n.sp., Box Butte County; *A. scotti* (Matthew), type, Garman “Loup Fork”; and *Sinclairomeryx sinclairi*, n.g. and sp., genotype and ref., Sioux County, Nebraska, Tertiary: skulls

16B. *Sinclairomeryx sinclairi*, n.g. and sp., and *S. riparius*, var. or species, Late Tertiary, Sioux County, Nebraska: partial skulls

17. *Yumaceras*, n.g., *Dromomeryx* Douglass and *Cranioceras* Matthew, Late Tertiary of Colorado, Montana and Nebraska: referred limb elements


CERVINI

20. *Procoileus*, n.subg., subgenotype, Uppermost Pliocene of Eden, California, and types of three *Odocoileus* species, Pleistocene of California and Nebraska: dentitions and horn-pedicles


20B. *Cervus aquangus*, n.sp., type, and *Odocoileus cascensis*, n.sp., ref., Pleistocene of California: skull, dentitions and antlers


BLASTOMERYCINI

22. *Parablastomeryx gregori*, n.g. and sp., genotype and ref., Late Tertiary, Cherry County, Nebraska: skulls

22A. Blastomerycini (three new species), Late Tertiary of Nebraska and New Mexico: skull and mandibular dentitions

23. *Blastomeryx* Cope, *Parablastomeryx*, n.g., ref., *Longirostromeryx*, n.g., and, for comparison, *Pseudoceras*, n.g., Late Tertiary of New Mexico, Colorado, Nebraska and South Dakota: mandibular dentitions
II.—Antilocapridæ

**Merycodontini**

26. *Plioceros*, n.g., *Cosoryx* Leidy and *Paracosoryx*, n.subg., Late Tertiary of Nebraska: skulls........... 266
28 and 28A. *Subparacosoryx*, n.subg., subgenotype, *Meryceros*, n.g., *Cosoryx* Leidy and *Ramoceros*, n.g., genotype (in pt.), American Late Tertiary: skulls... 272, 273
28B and C. *Meryceros warreni johnsoni*, n.subsp., variation in skulls, Crookston Bridge, Cherry County, Nebraska. 274, 275
28D. *R. (Merriamoceros) coronatus* (Merriam), ref., largest so-far-collected horn, Barstow, California. 285
29 and 30. *Ramoceros ramosus* (Cope), variation in horns, Late Tertiary of New Mexico... 296, 297
31 and 32. *Ramoceros ramosus quadratus*, n.subsp., type and ref., variation in horns, Late Tertiary of New Mexico 298, 299
33 and 34. *R. (Paramoceros)*, n.subg., variation in horns, Late Tertiary of New Mexico and Nebraska...... 300, 301
35a *Meryceros*, n.g., *M. (Submeryceros)*, n.subg., *R. (Paramoceros)*, n.subg., and *R. (Merriamoceros)*, n.subg., comparison of horns, Late Tertiary of New Mexico and California.................. 302
35A. *Meryceros*, n.g., and *R. (Merriamoceros)*, n.subg., comparison of horns and mandibular rami, Late Tertiary of California (N.S.M. horns, Nebraska, 2-5-9-35 and 7-7-9-34). 303
36. *Cosoryx* Leidy, comparison of horns and posterior crania, Late Tertiary of Nebraska, Kansas, Colorado and New Mexico... 304
36A. *Cosoryx* Leidy, comparison of horns and posterior crania, Late Tertiary of Nebraska, Montana, Kansas, Colorado and New Mexico... 305
37. *C. (Paracosoryx) wilsoni*, n.subg. and sp., subgenotype (in pt.) and ref., variation in horns and mandibular
Illustrations

<table>
<thead>
<tr>
<th>FIG.</th>
<th>Scale</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>37A.</td>
<td>Paracosoryx burgensis, n.sp., type, and Cosoryx furcatus Leidy, variation in horns, Burge Quarry, Cherry County, Nebraska</td>
<td>1</td>
</tr>
<tr>
<td>38.</td>
<td>C. (Subcosoryx) cerroensis, n.subg. and sp., variation in horns, mandibular rami and metatarsi; and R. (Paramoceros) martha, n.sp., Round Mountain Quarry, New Mexico</td>
<td>1</td>
</tr>
<tr>
<td>38A.</td>
<td>C. (Paracosoryx) alticomnis, n.sp., type and ref., variation in horns, Barstow, California</td>
<td>1</td>
</tr>
<tr>
<td>39.</td>
<td>Meryceros, n.g., and Subparacosoryx, n.subg., comparison of horns, Late Tertiary of Nebraska, New Mexico, Colorado and California</td>
<td>1</td>
</tr>
<tr>
<td>39A.</td>
<td>Meryceros, n.g., and C. (Paracosoryx), n.subg., comparison of horns, Late Tertiary of New Mexico and California</td>
<td>1</td>
</tr>
<tr>
<td>40.</td>
<td>Meryceros nenzelensis, n.sp., type and ref., variation in skulls and horns, Nenzel, Cherry County, Nebraska</td>
<td>1</td>
</tr>
<tr>
<td>41 and 42.</td>
<td>Merycodontini mandibular dentitions, Late Tertiary of New Mexico</td>
<td>1</td>
</tr>
<tr>
<td>43.</td>
<td>Merycodontini mandibular dentitions, Late Tertiary of Colorado, South Dakota and Kansas</td>
<td>1</td>
</tr>
<tr>
<td>44.</td>
<td>Submeryceros, n.subg., Paracosoryx, n.subg., and Meryceros, n.g., mandibular dentitions, Late Tertiary of Nebraska</td>
<td>1</td>
</tr>
<tr>
<td>45.</td>
<td>Cosoryx Leidy, (?)Meryceros, n.g., and (?)Plioceros, n.g., mandibular dentitions, Late Tertiary of Nebraska (and South Dakota)</td>
<td>1</td>
</tr>
<tr>
<td>46 and 47.</td>
<td>Merycodontini mandibular dentitions, Late Tertiary of California</td>
<td>1</td>
</tr>
<tr>
<td>47A.</td>
<td>R. (Merriamoceros) coronatus (Merriam), ref., mandibular ramus [unique in presence of pi (dp2)], Late Tertiary of Barstow, California</td>
<td>1</td>
</tr>
<tr>
<td>48.</td>
<td>Late Tertiary Antilocapridae and Merycodontini: relative size of metapodials</td>
<td>1</td>
</tr>
</tbody>
</table>

ANTILOCAPRIN

<table>
<thead>
<tr>
<th>FIG.</th>
<th>Scale</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.</td>
<td>Texoceros, n.g., and Plioceros, n.g., horn-cores, Oklahoma, New Mexico and Nebraska; and Proantilocapra Barbour and Schultz, genotype, Nebraska</td>
<td>1</td>
</tr>
<tr>
<td>51.</td>
<td>Osbornoceros osborni, n.g. and sp., genotype and ref., Uppermost Tertiary, Leyden, New Mexico: partial crania and horn-cores</td>
<td>1</td>
</tr>
<tr>
<td>51A.</td>
<td>Ilingoceros Merriam, variation in horn-cores (and Sphenophalos Merriam cross section), Thousand Creek, Nebraska</td>
<td>1</td>
</tr>
<tr>
<td>52.</td>
<td>Texoceros, n.g., Plioceros, n.g., and Osbornoceros, n.g., Late Tertiary: mandibular dentitions</td>
<td>1 &amp; 1</td>
</tr>
<tr>
<td>52A.</td>
<td>Osbornoceros, n.g., Ilingoceros Merriam, Plioceros, n.g., Texoceros, n.g., Late Tertiary, and Capromeryx Matthew, Pleistocene: mandibular and maxillary dentitions</td>
<td>1 &amp; 1</td>
</tr>
</tbody>
</table>
Illustrations

![Illustration](image_url)

<table>
<thead>
<tr>
<th>FIG.</th>
<th>SCALE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>52B.</td>
<td>(?) Texoceros edensis, n.sp., type and ref., Uppermost Pliocene, Eden, California: mandibular dentitions</td>
<td>1</td>
</tr>
<tr>
<td>53.</td>
<td>Hayoceros, n.subg., Capromeryx Matthew, Stockoceros, n. subg., and Tetrameryx Lull, horn-cores, Pleistocene.</td>
<td>½</td>
</tr>
<tr>
<td>54.</td>
<td>Antilocaprin mandibular and maxillary dentitions, Pleistocene.</td>
<td>1</td>
</tr>
</tbody>
</table>

III.—BOVIDÆ

ANTILOPINI AND OVINI

56. Oreamnos Raf., Neotragocerus M. and C., Saiga ricei, n. sp., type, and Ovis dorshii, n.sp., type: horn-cores. | ½ | 542 |

BOVINI

57. Superbison crassicornis (Richardson), Pleistocene of Alaska: horn-cores and sheaths. | 1 | 570 |
58. Superbison crassicornis (Richardson) and Bos bunnelli, n. sp., Pleistocene of Alaska: maxillary and mandibular dentitions. | ½ & 1 | 571 |

IV.—PROTOCERATIDÆ; AND V.—HYPERTRAGULIDÆ

PROTOCERATINI; AND LEPTOMERYCINI, HYPERTRAGULINI AND HYPISODONTINI

60. Protoceras celer Marsh and Prosynthetoceras francisi, n. subg. and sp., subgenotype, South Dakota and Texas: skulls. | ½ | 598 |
61. Synthetoceras tricornatus Stirton, from Texas: skull, mandible and 3d metacarpal. | ½ | 599 |
(Protoceras and Prosynthetoceras rostral horns). | ½ |
62. Protoceras celer Marsh, South Dakota, Prosynthetoceras francisi, n.subg. and sp., subgenotype (in pt.) and Synthetoceras tricornatus Stirton, Texas: skull and dentition. | ½ & 1 | 600 |
63. Protoceras celer Marsh, South Dakota, and Prosynthetoceras francisi, n.subg. and sp., subgenotype, Texas: skulls. | ½ & 1 | 601 |
64. Hypisodus Cope, Nanotragulus Lull, Leptomeryx Leidy, and Hypertragulus Cope, Nebraska, Colorado, Wyoming and South Dakota: skulls or mandibular rami. | 1 | 616 |
65. Leptomeryx Leidy, Nanotragulus Lull, (?) Eotylopus Matthew, Protoceras Marsh and Syndyoceras Barbour, Middle Tertiary; Paratoceras, n.g., and Synthetoceras Stirton, Late Tertiary: skull or mandibular rami. | ½ & 1 | 617 |

[VI (APPENDIX).—CAMELIDÆ (IN PART)]

PSEUDOCERATINI

66. Pseudoceras, n.g., Nebraska and New Mexico, (?) Synthetoceras rileyi, n.sp., type, and Prosynthetoceras, n. subg., ref., southeastern Texas, Late Tertiary: mandibular dentitions. | ½ & 1 | 648 |
Illustrations

<table>
<thead>
<tr>
<th>FIG.</th>
<th>SCALE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>67.</td>
<td>½</td>
<td>654</td>
</tr>
<tr>
<td>68.</td>
<td>½ &amp; 1</td>
<td>655</td>
</tr>
</tbody>
</table>

STENOMYLINI

67. *Rakomylus*, n.g., and *sp.*, genotype, Late Tertiary of New Mexico: skull. (And scaled p4 and m", continuation of Fig. 2B, pages 20, 21.)

68. *Rakomylus*, n.g., Late Tertiary of New Mexico, and *Stenomylus* Peterson, Middle Tertiary of Nebraska and Wyoming: mandibular and maxillary dentitions.

PHOTOGRAPHS

40A. Method of filing the fossil data, exampled by three plaster plaques holding Sioux County, Nebraska, *Paracosoryx* and Barstow, California, *Merriamoceros* specimens.

48A. *C. (Paracosoryx) wilsoni*, n.subg. and *sp.*, ref., Long Quarry, Sioux County, Nebraska: immature skeleton. (approx.)

LIST OF INSTITUTIONS CITED AND ABBREVIATIONS USED

| F:A.M. | Frick Collection (American Mammals or) American Museum of Natural History |
| F:B:A.M. | Frick:Barbour, American Mammals |
| A.M. | American Museum of Natural History |
| " (M.) | " (M.) " (Dept. of Mammalogy) |
| Amh. Coll. | Amberat College |
| A.N.S.P. | Academy of Natural Sciences of Philadelphia |
| Brit. Mus. | British Museum (Natural History) |
| C.I.T. | California Institute of Technology |
| C.M. | Carnegie Museum of Pittsburgh |
| Col. M. | Colorado Museum of Natural History |
| Geol. Mus., Ottawa, Canada | Geological Museum, University of Ottawa, Canada |
| H.C. | Harold Cook Collection, Agate, Nebraska |
| H.C.–A.M. | Harold Cook: American Museum of Natural History |
| Kans. Univ. | University of Kansas Museum |
| L.A.M. | Los Angeles Museum |
| Marshall Coll. | Dr. C. E. Marshall, Livingston, Montana |
| M.C.Z. | Museum of Comparative Zoology, Harvard University |
| N.M. | U. S. National Museum |
| "  " Biol. Surv. | "  " Biological Survey Collection |
| N.S.M. | Nebraska State Museum |
| P.U. | Princeton University |
| Royal Ontario Mus. | Royal Ontario Museum of Zoology |
| Stanford Univ. | Stanford University |
| T.A.M.C. [College Station, Mark Francis Collection] | Texas Agricultural and Mechanical College |
| Univ. Aris. | University of Arizona Museum |
| U.C. or U.C.-"M" | University of California Museum of Paleontology |
| Univ. Iowa | University of Iowa |
| Univ. Pa. | University of Pennsylvania |
| Univ. Toronto | University of Toronto |
| Y.P.M. | Yale University, Peabody Museum of Natural History |

1Now Alaska University.
FIG. 1. Deer forms of the American Tertiary.
Reconstructions × approximately 1 (except B, slightly oversize, and E × 1/12).

Lull's Deerlet (A)
*Ateomyza gracilis* Lull (p. 147)

Douglass' Deer (c)
*Dromomeryx whifordi* Sinclair (p. 109)

Three-horned Deer (B)
*Orocidoceras granti*, n.sp. (p. 75)

Sinclair's Deer (E)
*Deplanomeryx falcoformis* Sinclair (p. 137)

Matthew's Deer (E)
*Matthomeryx matthewi*, n.subg. and sp. (p. 137)
HORNED RUMINANTS

of NORTH AMERICA

INTRODUCTION

The variously specialized deer, pronghorns and protoceratines of the Tertiary, and deer, pronghorns, aberrant-antelope, sheep and bison of the Quaternary, represent so many forerunners of the surviving horned and antlered creatures of America of today. The present volume describes a large number of heretofore unknown members of these several American Tertiary and Quaternary groups and presents a tentative reclassification of the whole, together with a catalogue of the available fossil remains.

The Cervidae, Antilocapridae, Bovidae and Protoceratidae include in their membership all of the American horned as contrasted to hornless Ruminantia, such as the Hypertragulidae, Camelidae and Oreodontidae. The diminutive Antilocaprid Merycodontini afford the richest known record of actual variations occurring within bands of horned mammals of closely related species over a wide geologic and geographic range. The presence of horns permits a much more detailed division of the material of this report between genera and subgenera than would be possible had the classification to be restricted to the usual slightly marked characters in hornless groups of skull, dentition and limbs. Much unexpected evidence as to the kinds, characters and affinities of these ancestral Rumi-
nantia, particularly of the Cervidae and Antilocapridae, has been one of the results of the intensive investigation during the past fifteen years of western Tertiary deposits. Well may one ponder the rule of nature responsible for so many and such curiously diversified forms.

There are enumerated in the present volume a total of seventy-one North American genera and subgenera (forty-nine genera from the Tertiary and twenty-two from the Pleistocene-Recent) of the five families, Cervidae, Antilocapridae, Bovidae, Protoceratidae and (hornless) Hypertragulidae. Twenty-nine of the Tertiary and two of the Pleistocene genera and subgenera are new. Of the one hundred and seventy geologic and geographic species and subspecies, ninety-five are new. (Incidental to the discussion of these forms, two curious new genera are described under the Camelidae for the purpose of comparison in the Appendix—Chapter VI).

The preliminary classification (p. 31) of the American Tertiary and Quaternary deer and pronghorns, census of the known forms and catalogue of the now available evidence (past and present) afford a glimpse of the range of morphologic characters in several distinct groups and the degree of variation within the individual, and are interesting in connection with hypotheses as to the origins and affinities of the living forms. The classification permits of an orderly presentation and arrangement of the present data and may aid in the identification of unlisted remains in other institutions and the assimilation of the evidence yet to come.

The difficulty of securing a balanced arrangement, inasmuch as one division or one group may be far better represented than another both by material and species, is obvious. The extinct forms of the families of the present report are subdivided for the matter of convenience between ten more or less homogeneous divisions (including the Hypertragulidae, thirteen divisions)—such divisions being exampled in the case of the Antilocapridae by the Merycodontini and Antilocaprini. The thirteen divisions are further divided into twenty-nine subfamilies—exampled in the case of the Antilocapridae by the Ilngocerotinae, Pliocerotinae, Stockocerotinae and Antilocaprini. The twenty-nine subfamilies embrace seventy-one genera and subgenera. The subfamilies, as originally construed in these studies, were predominantly horizontal groupings. More recent evidence, witnessing the occurrence in the Middle and Late Tertiary, and again in the Late and Uppermost Late Tertiary, of certain closely allied forms which seem to differ only in degree of specialization,
has indicated the present use of several of the subfamilies in an additional phyletic sense. Thus the Cervid subfamilies, Cranioceratinae and Dromomerycinae, as here limited, include Late Tertiary and more progressive Uppermost Late Tertiary forms. Also (though more questionably) the Barbouroomerycinae, Aletomerycinae and Longirostromerycinae embrace forms from both the Middle and Late Tertiary. The Antilocaprid subfamily, Antilocaprinae, contains genera from both the Late Tertiary and Quaternary. The Protoceratid subfamily, Synthetoceratinae, embraces a specialized genus and subgenus from the Late -Uppermost Late Tertiary. (The Camelid subfamily, Stenomylinae, includes genera from both the Middle and Late Tertiary.) Notable examples of continuing specialization are afforded by the two remarkable trihorned groups, Procranioceras-Cranioceras and Prosynthetoceras-Synthetoceras, respectively representing closely allied couplets in the remote Cervid and Protoceratid families. While Procranioceras comes from the main, and certain of the Cranioceras remains from the uppermost portion of the Late Tertiary, and it is evident that the Cervid Cranioceras and Protoceratid Synthetoceras are advanced over their respective subgenera, it remains to be determined whether in either family the more progressive genus was restricted entirely to higher beds and the less progressive subgenus confined to lower beds, or whether both subgenera and genera were partly or largely contemporaneous and merely derivatives of parallel developments. However, it may be noted that while Parablastomeryx, from the uppermost Tertiary of Nebraska, is more progressive than Pseudoparablastomeryx of lower beds, it is less progressive than Blastomeryx from intermediate levels.¹

Forms are given generic (or subgeneric) rank on observable differences in the dentition, mandible, skull or cranial appendages, when such characters are believed to indicate the presence of a more or less fundamental difference between the particular form and that next nearest akin. (See footnote 2, page 30.)

Of the ten major divisions, but one (Protoceratini) is represented previous to the Lower Miocene, where three additional divisions first appear. A fifth and sixth division are introduced in the main Late Tertiary and the four remaining divisions first are encountered definitely in the Quaternary—at which time only one (Antilocaprinæ) of the five earlier divisions is still represented. (The three Hypertragulid divisions were confined to the Oligocene and Lower Miocene.)

¹ "It is an interesting and significant fact that ancestral and derivative genera may continue to live side by side in the same region." W. B. Scott, 1913, p. 375.
The four families of horned ruminants of the section "Pecora" of North American Middle Tertiary to Recent time, of ten here tentatively recognized divisions, and the (hornless) Hypertragulidae of three additional divisions, are the respective subjects of the five ensuing chapters:

I.—Cervidae (reconstructions, frontispiece [in part] and Figs. 1, 2D, 19), inclusive of the horned Dromomerycini and Aletomerycini and hornless Blastomerycini of the Middle and Late Tertiary, and the Cervini of the Pleistocene-Recent;

II.—Antilocapridae (reconstructions, frontispiece [in part] and Figs. 27, 49), embracing the Merycodontini of the Late Tertiary and the Antilocaprini of the Late Tertiary to Recent;

III.—Bovidae (reconstructions, Fig. 55), of the divisions Antilopini, Ovini and Bovini. The Bovidae, like the true Cervinae, possibly were unknown in America previous to the Pleistocene;

IV.—Protoceratidae (reconstructions, Fig. 59), here limited to the horned Protoceratini of the Middle to Late Tertiary; and

V.—Hypertragulidae, inclusive of the hornless Leptomerycini, Hypertragulini and Hypisodontini of the Middle Tertiary, are of doubtful Pecoran affinity (and see Appendix, VI, Camelidae, in part).

It may be presumed that the maximum differentiation within the several major families of American horned ruminants in their Tertiary-Quaternary heyday may have been fully equivalent to the remarkable differentiation observable in the case of the Antilopini of modern equatorial Africa. Thus the twenty-one here recognized North American Tertiary-Quaternary genera and subgenera of the Antilocapridae, and twenty-seven genera and subgenera of the Cervidae, might be compared with the some twenty genera and subgenera of the one Recent African division, Antilopini.

---

1 The Eurasian Giraffidae are absent. [W. D. Matthew (1929, Bull. Geol. Soc. Amer., XL, p. 408) includes in the Giraffidae the European Tertiary Palaeomerycidae.] The hornless Camelidae and Oreodontidae are the subjects of separate reports now in progress.

2 Merycodontidae of Matthew (1904) and Antilocapridae (in part) of Matthew (1929). Zittel (1893) places Cosoryx Leidy, together with Palaeomeryx and Blastomeryx, in the Cervuline. Schlosser-Zittel (1923) recognize the one family Antilocapridae and transfer to this Hypisodus Cope (here of the Hypertragulidae) and Aletomeryx Lull (here of the Cervidae).

3 The Hypertragulidae has been referred by W. B. Scott (1913) to the Tylopoda and by W. D. Matthew (1929) to the Pecora (see synonymy, Chapter V).
Because of the relative abundance of the fossil data, the present report deals in greater portion with the Tertiary-Quaternary Antilocapridae and the Tertiary Cervidae than with the Protoceratidae, Hypertragulidae or Bovidae. Each of the five chapters embraces a tentative reclassification of the known membership of the particular family, including a review of the types and synonymy, and a catalogue and consideration of all of the known fossil evidence. The latter includes that previously described, that amassed during our own field investigations of the past fifteen years and important additional data made available through the generous cooperation of Professor Erwin H. Barbour of Nebraska State University. A total of seven thousand six hundred and forty-three distinct specimens of skulls, jaws, horns, dentitions and limbs is enumerated or described, and of these some five hundred and fifty-two are figured in the drawings of the ninety-three text figures (exclusive of ten pages of reconstructions and photographs).

"Middle" and "Late" Tertiary

Determination of morphological affinity and phylogeny in the families here under discussion, and solution of the attendant problems of local time correlation, must be preceded by a clearer understanding of the nature and number of the forms which comprise each of the particular family groups. Without more data than have yet been available, any lengthy discussion of affinity or origin seems futile. Such discussion must await the accumulation of that mass of first-hand fossil evidence promised by the toil of able collectors. With the primary object of gaining some insight into the actual membership of these extinct American Ruminantia, it has been deemed advisable to consider as respectively broadly contemporaneous the current subdivisions of (a) "Upper Oligocene" to "Lower Miocene" and (b) "Middle Miocene" to "Upper Pliocene." For convenience, the former here are tentatively united as the "Middle" Tertiary and the latter as the "Late" Tertiary. It is not sufficiently recognized that a major break in the mammalian faunas of the Upper Tertiary occurs between the long-current "Lower Miocene" and "Middle Miocene," and that the so-called faunas of the "Middle Miocene," "Upper Miocene" and "Lower Pliocene" yet largely defy such subdivision. Following the "Middle Pliocene," and preceding the "Uppermost Pliocene," there appears to have been a further though less marked cutting-off of old and introduction of new forms. The present study of

---

1 The total 7643 specimens is divided as follows: F:A.M. numbers, 5409; A.M. numbers, 1154; N.S.M. numbers, 725; and other numbers, 355. See detailed count under each chapter.
these horned ruminants and uncompleted researches on several contemporaneous family groups indicate the danger of attempting to force the fossil data into undefinable and meaningless periods. Apparent faunistic differences may be due to differences in facies. Thus, in the case of the Middle Tertiary, observed differences may be in large part a resultant of the very probably generally rather humid environment represented by the present known deposits of that time, the fossil yield showing relatively a great prevalence of brachyodont forest-dwelling types. Conversely, in the case of the "drier" Late Tertiary, accumulations with remains of the brachyodont forest-residing types are extremely rare as compared to the many and widely distributed deposits carrying hypsodont plains-dwelling forms. In the Late Tertiary the relative preponderance of evidence as to the tall-crowned Merycodonts, as compared to the meagerness of evidence as to the short-crowned Cervids, is paralleled by a similar relative abundance of data regarding the tall-crowned grazing Protohippines and camelids and scarcity of data as to the short-crowned browsing Hypohippines, tapirs and pigs.

The vanished rivers of the North American Tertiary that frequently may have limited living species, as do today the narrow streams of eastern Africa, occasionally must have mingled in their eddies and deposits the carcasses of creatures coming not only from opposite banks but quite different habitats. Chief among the complications of correlation studies are such mixture of remains from different sources and the uncertainties of local stratigraphy through major inequalities of the ancient depositional surfaces, redeposition through cutting and filling, and the usual disjointed and pockety character of most fossil occurrences.

In the present report, due prominence is accorded evidence as to stratigraphic succession within the here-designated Middle, Late and Uppermost Late Tertiary by the segregation of forms representative of different vertical (and horizontal) distribution under (tentative) stratigraphic (and geographic) species, subspecies or races. There is still probability that a clearer knowledge of the here-considered Pecora eventually may point to certain of the commoner and better-marked genera's or subgenera's usefulness as "time fossils" in the elucidation of stratigraphic problems. In passing, it may be observed that while certain brachyodont Blastomerycini and moderate-crowned Aletomerycini are found in deposits correlated with both the Middle and Late Tertiary, the larger of the brachyodont Dromomerycini and all of the so-far-known hypsodont Merycodontini (relatively plentiful) do not appear

---

1 The association of different forms at different localities and in different strata has been recorded as clearly as possible, so that such findings eventually may be readily comparable with the results of similar studies on other groups (the Carnivora, the Equidae and the Camelidae). The final interpretation of the faunal assemblages, of their relative stages and of the sequence of the enveloping strata will never be fairly read except in the light of the whole.
before the Late Tertiary. The hypsodont Antilocapridina seem to arrive only in the latest Tertiary. In the American Middle Tertiary the Cer-
vidae are represented by Blastomerycini and rare Aletomerycini; the Proteroceratidae are confined to the single genus; and the Antilocapridae are unknown. With the close of the Middle Tertiary, certain widely differering Aletomerycini suddenly emerge; the larger Dromomerycini for the first time appear; the Middle Tertiary Blastomerycini and Protoceratini are replaced by allied forms; the small hornless Hypertragulidae vanish; the grazing Merycodontini, heretofore unknown, become widespread and dominant; the once abundant Oreodonts are greatly reduced; and the Camelidae and Equidae are continued by a variety of forms of variable affinities. In our collections from the Uppermost Late Tertiary, most of the Dromomerycini, Aletomerycini and Blastomerycini, and the Merycodontini so far are absent though the Antilocapridina are well represented. Certain of the Antilocapridina, camels and horses (their remains usually differentiable from those of earlier horizons) continue into the Quaternary. The true Cervids (in part at least) and Bovidae of the American Quaternary are of apparent Asiatic origin. The prevalence in Late Tertiary deposits of tall-crowned Artiodactyls and Proto-
hippines has been interpreted as due to the curtailment of forests and the wide spread of hard grasses. Among the new arrivals of this time are the Proboscideans. The so-far-evidenced vertical distribution of the thirteen divisions of the five families, Cervidae, Antilocapridae, Bo-
vidae, Proteroceratidae and Hypertragulidae, is indicated in the diagram on the following page. The present recognized distribution of genera, sub-
genera and species of the four Tertiary families is given in the tables (pages 41–43, 268–269, 597, 618).

In the tables the number assigned to the species in this volume is inserted oppo-
site its genus and below its locality. The species from the type area are marked by ( ) and from other than type areas by [ ]. The localities are provisionally divided between the three subdivisions, Uppermost and Main Late Tertiary and Middle Ter-
tary. Attachment of formation names to the localities, deposits or quarries is avoided pending the advancement of parallel studies on the Camelidae, Equidae and Carnivora. Many problems are yet to be clarified and additional data from the field may indicate the reallocation of certain genera and species. The present alloca-
tion must be considered as no more than a convenient working arrangement. The earliest portion of the Sheep-Snake Creek sequence may represent a partial holdover from the Lower Miocene of damp forest-loving forms. It is possible that the Sheep Creek and the Upper Harrison were in part contemporaneous. Forest elements tend to be lacking from the richer collections from the relatively later levels of the Snake Creek sequence where the fauna is predominantly of plains-dwellers. The Lower Snake Creek, Pawnee Creek, Sante F6 and Barstow ostensibly include a number of overlapping phases of the main Late Tertiary. Species from the Burge, Crookston (Valentine) and Devil’s Gulch quarries, Nebraska, suggest separate phases of a

Data point to Plioceros and particularly Texoceros, Ilingoceros and Osbornoceros occurring only at higher levels than Cosoryz, and the absence of Cosoryz in the lower levels where Meryceros is generally common.

generally later sequence. A peculiar southern facies, seen in the Clarendon of Texas, was possibly partially contemporaneous with the last. The poorly represented Ricardo may have pertained to more advanced time. The channel faunas of the Nebraskan Upper Snake Creek and Xmas zones, like the faunas of Thousand Creek, Nevada, and the Upper Rio Grande, New Mexico, may have slightly preceded those of Eden, California, Hemphill, Texas, and Guymon, Oklahoma. The three latter, of near Blanco Uppermost Tertiary age, are noteworthy for the occurrence of rare *Hymanarctos*, *Rhynchotherium* and late camel and horse forms.

**Distribution of the Thirteen Divisions of the American—**

<table>
<thead>
<tr>
<th></th>
<th>I. Cervidæ</th>
<th>II. Antilopini</th>
<th>III. Bovidæ</th>
<th>IV. Proto-Ceratidæ</th>
<th>V. Hypertragulidæ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaternary</td>
<td>Recent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pleistocene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Tertiary</td>
<td>Uppermost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main</td>
<td>Dromomerycini</td>
<td>Bovini</td>
<td>Antilopini</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower Miocene</td>
<td>Aetomerycini</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upper Oligocene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1 *Hymanarctos guymonensis*, n.sp., type, crushed cranium, F:A:M.30399, exhibits a dentition closely resembling *H. gregori* of Eden, California, and *H. siwalensis* of the Siwaliks. The Oklahoma skull is the first skull of the genus from America. Detached teeth from Miami Quarry, Hemphill County, that are indistinguishable from *H. gregori*, are referred to a subspecies, *H. guymonensis miamensis*. (*Hymanarctos* is unrecognised as yet from the Blanco.)

2 Osborn, H. F., 1936, Proboscidea, I.
Résumé of Certain Cranial and Skeletal Characters in American Cervidae, Antilocapridae and Bovidae versus Protoceratidae, Hypertragulidae and Camelidae

(See keys to genera and subgenera, pp. 32–39)

\[ p_1 \] lost; \( C/ \), when retained, tending caniniform; \( /C \) incisiform; \( p_4 \) partially molariform; bullæ inflated; metapodials 3 and 4 fused, laterals reduced to lost.

**Pecora Vera**

Male (except Blastomerycini) with paired supra-postorbital solid horn-pedicles; dentition brachydont to subhypsdont. ................................. I.—Cervidae

Male with paired supra-orbital–forked-tending and solid horn-cores; dentition strongly hypsdont. ...................... II.—Antilocapridae

Male with paired postorbital hollow horn-cores; dentition subhypsdont to hypsdont. .............................. III.—Bovidae

\( p_1 \) tending retained (absent in Protoceratid Prosynthetoceras and Synthetoceras); \( C/ \) tending detached caniniform; \( /ps \) laterally compressed-sectorial; dentition brachydont to subhypsdont (hypsdont in Hypisodontini); metapodial keels confined to plantar surface.

**Pecora Dubia**

Metacarpals short, detached, and laterals generally retained; male with rostral armament and paired postorbital horn-cores; bullæ small. .............................. IV.—Protoceratidae

Metacarpals short, detached, and laterals retained; male without horns; bullæ inflated. .......................... V.—Hypertragulidae

**Tylopoda**

Metacarpals either short and detached or elongate and consolidated, laterals lost; male without horns; bullæ large, filled; \( Is/ \) tending retained, \( I^1 \) and \( /C \) caniniform. VI.—Camelidae

Preceding a general discussion of the characters of the Cervidae, Antilocapridae and Bovidae and of the Protoceratidae and Hypertragulidae, the five families and thirteen divisions may be very briefly re-enumerated:
I.—Cervidae

Reconstructions, Frontispiece (in part) and Figures 1, 2D, 19

The extinct deer of the Middle-Late Tertiary of America are considered below under three tentative divisions, Dromomerycini, Aletomerycini and Blastomerycini. The Pleistocene-Recent deer are referred to the Cervini. The three Tertiary divisions include some twenty-one known genera and subgenera, sixteen of which are new to the literature.

The horned and moderate to long horn-pedicled Dromomerycini, with short-crowned teeth and largely unreduced premolars, of the Late Tertiary, were represented apparently by smaller forms at earlier levels. All have disappeared before the Pleistocene. They include the remarkable creatures—Cranioceras Matthew, Procranioceras, n.subg., Rakomeryx, n.g., Dromomeryx Douglass, Sinclairomeryx, n.g., Drepanomeryx Sinclair and Matthomeryx, n.subg. Middle Tertiary forerunners of the Dromomerycini are seen in the moderate horn-pedicled Barbouromeryx, n.g., and the less conservative Protobarbouromeryx, n.subg. It seems inadvisable to recognize a family Dromomerycidae. The American Dromomerycini may yet prove to be represented in the Eastern Hemisphere by certain of the broadly contemporaneous "Palæomerycidae." The characters of the Palæomeryx\(^1\) cranium still remain in question. Dromomerycini dentitions recall in moderate degree the Recent Cervini, certain of the extinct European forms and the Asiatic-African Giraffidae.

The tall-pedicled and undoubtedly deciduous-horned Aletomerycini of the Middle Tertiary witness the presence in North America at an early date of a highly developed Cervid stock. The division questionably includes several very distinct groups—Yumaceras of the Uppermost Late Tertiary, and Sinclairomeryx of the early Late and Aletomeryx of the Middle Tertiary—having in common a reduction of the premolars. In their reduced premolars, the Aletomerycinae proper are more specialized than the Recent Asiatic Cervulus, which they parallel in subhypodont molars and elongate horn-pedicles. Representatives of the Aletomerycinae\(^2\) are unrecognized above the earliest levels of the Late Tertiary. Originally Aletomeryx proper was referred to the Antilocapridae. The nasal bosses of Sinclairomeryx recall the armed maxillae of the Protoceratines.

---

1 Premolars of none of the American Dromomerycini are as large-proportioned as in the Museum's example of P. haupti or the Palæomeryx specimens figured by Filhol.

2 It is barely possible that the slender and long-muzzled Longirostromeryx, n.g., with greatly reduced premolars, subhypodont cheek teeth and as yet unknown cranial characters, may prove to be allied to this subfamily.
The only evidence known to the writer that is suggestive of the actual presence in our own Late Tertiary of a true Cervine is a questioned mandibular fragment from the Uppermost Pliocene of Eden, California. Cervini of the several existing genera—the slender-horned Odocoileus and Cervus, and the palmate Rangifer, Alces and extinct giant Cervalces—were widely distributed in the North American Quaternary. The common ancestral stem of the Quaternary Cervini might be sought among the precursors of the yet scantily known groups here included in the Blastomerycini (exemplified in Pseudoparablastomeryz), which recall, in variable measure, such widely remote forms as the Recent Moschini and Tragulina and the Oligocene Leptomerycini. The Tertiary Dromomerycini, in horn-pedicles, and the Aletomerycini, in dentition, were already more specialized than the modern deer.

Blastomerycini, of varied character, occur in both the Middle and Late Tertiary. Certain forms are suggestive of Micromeryx of contemporary European deposits. Through their lack of horns and in the enlarged upper canines of the males, the Blastomerycini tend to parallel the Recent Asiatic Moschini. The division includes several very different genera and subgenera. While Parablastomeryx, in cranial aspect, broadly recalls the figures of Dremotherium of the European Tertiary and Moschus of Recent Asia, the limb proportions are so widely different that it is evident that no actual connection exists between the extinct American and European or Recent Asiatic forms. Parablastomeryx of the Late Tertiary is forecast in the Middle Tertiary Pseudoblastomeryx, much as Longirostromeryx seems to be in the Middle Tertiary Machæromeryx. While the Blastomeryx dentition indicates definite Cervid affinity, any theory that the Blastomerycini includes primitive horned forms is yet to be substantiated; none has been observed. William D. Matthew (1908) considered that Leptomeryx Leidy of the Upper Oligocene might represent a group lying in the direction of Blastomeryx.

The Cervid Dromomerycini, Aletomerycini and Blastomerycini of the Middle and Late Tertiary and Cervini of the Quaternary are treated in detail in Chapter I of this report. See hypothetical reconstruction of heads in the flesh, frontispiece (in part) and Figures 1, 2D, 19, pages ii, xxviii, 44, 188.

II.—Antilocapridæ

Reconstructions, Frontispiece (in part) and Figures 27, 49

The Late Tertiary forerunners of the surviving American pronghorn, as seen in the horn-cores, are considered as of two diverse hypsodont
divisions, the Merycodontini and Antilocaprini. The diminutive and fascinating Merycodontine pronglets are among the best represented of these Tertiary forms. The Antilocaprini are relatively rare and their known remains are largely confined to relatively late horizons. They might be divided for convenience into forked-tending and elongate-twisted-tending horn-core groups. Middle Miocene representatives of the Antilocapridae are as yet unknown. Four of the six subfamilies belong to the Late Tertiary (Ramocerotinae and Cosorycinæ of the main and Ilingocerotinae and Pliocerotinae of the Uppermost Late Tertiary), and two to the Tertiary and Pleistocene-Recent (Stockocerotinae and Antilocaprinae).

Two or more distinct kinds of horns or horn-cores seem to have been evolved by the respective branches of the Antilocaprid family:

1. Antler-like with tendency to burr, which, in certain forms, probably was deciduous as in the deer, exampled in the Ramocerotinae—"Pseudocervicorn"—and
2. Forked, burrless, with deciduous sheath, exampled in the Antilocaprinae—"Pliocervicorn."

The probability of the Ramoceros horn being in degree deciduous, and the new evidence as to horn growth in Ramoceros and in Cosoryx, are discussed below (see Merycodontini "Horns," page 280).

An hypothetical series exampleing possible former stages in transition from the forked horn-core to the simple core of the modern pronghorn, noting that a single modern blade-like (though stubby) horn-core was borne as early as the Late Tertiary by Proantilocapra, is suggested by the cores of four contemporaneous Quaternary forms, the:

(a) symmetrically forked core of Stockoceros (compare the rather similar core of the Tertiary Plioceros and somewhat similar but burred horn of Tertiary Meryceros);
(b) disproportionately elongated posterior fork of Hayoceros; or
(c) much reduced anterior fork of Capromeryx, and the
(c') abrogated anterior fork of the core (with retention of the fork by the sheath alone) in Antilocapra.

The spiraled horn-cores of Ilingoceros and Osbornoceros recall parallel adaptations in the Tragelaphinæ of Africa and the Suleman Markhor of Asia.

Hypsodont and smooth-textured Merycodontine and Antilocaprine molars, the former confined to the American Late Tertiary and the latter continuing into the Quaternary and surviving in the Recent pronghorn, are as yet unknown from Eurasiatic horizons. While the present evidence is that these tall-crowned groups were wholly of American origin and distribution, there is the possibility that closely related forms yet will be discovered in the little-known Tertiary of Asia. It is amazing

1 See discussion, page 26.
that all of these varied Antilocapridae should have become extinct before the close of the Quaternary, except for the one genus and species, *Antilocapra americana*.

The Merycodontini and Antilocaprini are considered in detail in Chapter II. The heads of outstanding examples are shown hypothetically in the flesh in the frontispiece (in part) and Figures 27 and 49.

III.—Bovidae

Reconstructions, Figure 55

The Bovids, or hollow-horned ruminants of the American Quaternary, superficially may be considered as of three grand divisions, the Antilopini, the Ovini and the Bovini. The American Antilopini, as here interpreted, embrace the goat-antelope, *Oreamnos*; the questioned *Neotragocerus*; and the gazelle-antelope, *Saiga*, here first described from this continent. The loosely drawn Ovini include the Euceratherinae, the Ovine and the Ovibovinae. The Bovini are represented by *Bison* and (?) *Poephagus*, the latter here first recorded from the Western Hemisphere. As discussed in Chapter III, the Bovidae was probably largely of Eurasian origin. The discovery of the saiga and of the yak-like form in the Quaternary of Alaska is unexpected.

IV.—Protoceratidae

Reconstructions, Figure 59

The strange multiple-horned, short-footed Protoceratids—or "protoceratines"—of the Middle and Late Tertiary are referred to a single division, Protoceratini. The armed muzzle is recalled in the case of the deer by the nasal bosses of the recently discovered *Sinclairomeryx* cranium.

The Protoceratidae was erected by Marsh in 1891 for reception of the then newly described White River Protoceras. [Matthew (1909) and Scott (1913) referred the latter genus directly to the Hypertragulidae.] *Syndyoceras* Barbour (1905) represents an allied genus from the Lower Miocene. *Paratoceras*, n.g., *Synthetoceras* Stirton (1932) and the equally curious *Prosynthetoceras*, n.subg., witness the survival into the Late Tertiary of highly specialized members of this group. The family of the one division, Protoceratini, is discussed in Chapter IV. The heads are reconstructed, Figure 59.
V.—Hypertragulidæ

The status of the Hypertragulidæ is much confused in the literature. The genus *Leptomeryx* has been cited as ancestral to both the deer and *Antilocapra*. Discussion of the affinity of several of the here included genera will be carried further in the forthcoming report on the Camelidæ, at which time additional evidence may be available. The hornless *Leptomerycini*, Hypertragulini and Hypisodontini, embrace a number of extremely diverse and variably brachyodont to hypsodont forms. The non-Pecoran character of the same is witnessed in the detached caniniform p¹, the compressed and frequently aborted condition of the anterior premolars, the short proportions and usually unconsolidated condition of the metapodials and the incomplete metapodial keels.

A Late Tertiary form, *Pseudoceras*, n.g., suggestive both of *Hymenoceras* and the camel, and a Late Tertiary representative of the aberrant Middle Tertiary camel, *Stenomylus*, are discussed in the Appendix, Chapter VI.

Characters in the American Pecora

In the detailed consideration of the many forms here enumerated or studied, clarity is gained and unnecessary and confusing repetition avoided by stating at once those characters which are assumed to be germane to all and those other characters which separate the five families, Cervidæ, Antilocapridæ, Bovidæ, Protoceratidæ and Hypertragulidæ. ¹ In the horned forms of the American Late Tertiary so far observed, the cranial axes are considerably bent. A broad contact² usually exists between the premaxillæ and the nasals. The orbits (typically) are closed. Lacrimal vacuities (excepting Bovidæ and Protoceratidæ), infra-orbital and supra-orbital foramina are present. The upper incisors are lost and p¹ are absent (except in *Protoceras*, *Syndyoceras* and the Hypertragulidæ, where the p¹ are present and detached as in the Camelidæ). Dp¹ (p¹) may be lost (*Cranioceras* and *Cosoryx*) or retained non-detached (*Dromomeryx*). The C/ may be absent in the Cervids (*Dromomeryx*), or enlarged caniniform (males of Blastomerycini, Cervulæ and Moschinae). The C/ occasionally is present in the Antilocaprids (male of *Meryceros*). The /C is always incisiform. (The p² are de-

¹ Subsequent to the allocation of a dentition or partial dentition to a particular family and genus where the typical dentition is already known (and has been carefully figured) there is little excuse for needless duplication by re-mention of such dental characters and minutiae (in the description of species). (See footnote 2, page 30.)

² *Saiga* is a noteworthy exception.
tached from the $p_3$ only in the Hypertragulini.) Notable differences exist in the length of the symphyses and diastemata, in the proportions of the premolars and molars, in the height of the tooth crowns and in the form of the cranial appendages.

Facial fossae are typical of the deer; lacrimal vacuities are present in both Cervids and Antilocaprids, and absent in the Bovids and Protoceratids. The form of the cranial occiput tends to be characteristic of the several families though the same may vary greatly in a single family as exampled in the case of the Cervidae. The form of the bullar region is worthy of particular investigation (see Fig. 2A). In the Cervidae the bullae are moderate, in the Antilocapridae much inflated, in the Bovidae swollen, in the Protoceratidae uninflated, in the Hypertragulidae inflated, in the Camelidae large and filled, and in the Oreodontidae peculiarly characteristic. The position of the hyoid depression tends to be typical in several of the families, the same being notably posterior in the case of the Cervidae.

**Craniæ and Horns (Fig. 2)**

The position and form of the horn-pedicle or -core and proportions of the crania in the case of certain examples of the Cervidae, Giraffidae, Antilocapridae, Protoceratidae and Bovidae are indicated in the scaled outlines of Fig. 2.

In the Tertiary deer the skull is apt to be somewhat slender, the cranium posterior to the orbits proportionately elongate and the horn-pedicles tall and superimposed over the orbits, as compared to the condition in Recent American Cervids—where the orbits tend to be more prominent, the posterior cranium to be fuller and less produced, and the horn-pedicles (the extreme being seen in *Rangifer*) to be relatively posterior. An instructive parallel to the elongate horn-pedicles of the Tertiary forms is observed in the Recent Asiatic muntjac, *Cervulus*. In the Cervidae the horn-pedicles may be directed either anteriorly or posteriorly. The “horns” of the giraffe (ossified from separate centers and pointing posteriorly) and of *Synthetoceras* (pointing postero-outwardly) are distinct from the horn-pedicles of the deer and -cores of the pronghorns. In the Antilocapridæ the definitely supra-orbital cores may tilt slightly forward as in the pronghorn, or posteriorly as in *Plioceros*. In the Bovidae the hollow horn-cores incline posteriorly of the vertical, as in *Oreamnos* and *Ovis*, or are strongly depressed, as in *Bison* and *Ovibos*. The scaled sketches indicate the variable condition of the premaxillary border, as well as the relative position of the inion, condyles, foramina, the extent of the cheek tooth series, and the absence or presence of facial vacuities and depressions.

---

1 The comparison of diastema lengths in broken ramal specimens is complicated through the actual length in any one specimen being dependent on the size of the individual, wherefore the diastema in a larger individual with moderately proportioned symphysis may measure longer than in a smaller individual with a longer-proportioned symphysis.
Fig. 2. Contrasted cranial proportions and horn-pedicle or -core form and position in examples of Cervidae, Giraffidae, Antilocapridae, Protoceratidae and (Continued on next page)
Bovidae. (Premaxilla-vertex distances reduced to unity.)

C = condyle; CS = cross section of orbital "horn"; F = maxillary pit of deer; HC = horn-core; HP = horn-pedicle; MA = auditory meatus; NF = nasofrontal suture; 2 = anterior edge of p2; 3 = posterior edge of m3.

Fig. 2 (continued from preceding page)
Fig. 2A. Comparison of the bullar region of the skull in Middle and Late Tertiary and Recent Artiodactyls.

X \frac{1}{4}. (See legend, page 23.)
TEETH

The tooth plan in the Cervidae and Antilocapridae is confined largely to minor variations of the two (conservative) patterns respectively exemplified by the Recent:

Deer—dentition brachyodont to subhypsdont, and
Pronghorn—dentition highly hypsdont.

While there are forms with somewhat shorter- or longer-crowned teeth in each family, there is as yet (even irrespective of cranial and other characters) no known phylogenetic series exhibiting (actual) passage from a "deer" to a "pronghorn" dentition. It may be presumed that the "acquisition" of taller-crowned teeth occurred independently in each family as in the Equidae.

The low- to moderate-crowned tooth forms embrace the Cervid:

(a) brachyodont Dromomerycini, which exhibit bizarre specializations of the horn-pedicles and include the three-horned Cranioceratinae, the Dromomerycinae, the Barbouromerycinae and Dromomerycinae;

(b) subhypsdont Aletomerycini and Cervini, provided with variable-lengthed horn-pedicles bearing deciduous caps or antlers; and

(c) brachyodont Blastomerycini, which were hornless, so far as known, and had enlarged Cs/ in the males (as in the Recent Asiatic Moschini).

The short brachyodont to subhypsdont molars also occur in the (Giraffids and) Protoceratids and Hypertragulids.

The tall-crowned tooth forms are confined to the Antilocaprid:

(d) Merycodontini of diverse horn or horn-core design. Pending the solution of the horn morphology, the Merycodontini tentatively may be considered as of two sections: (d') Ramoceratinae, in which the Cervid-antler-like horns were probably deciduous, and (d") Cosorycinae, with forked horn-cores of special form. And

(e) Antilocaprin of several distinct subgroups with forked-tending horn-cores that include: (e') the diversified forms of the Quaternary, near relatives of the sole survivor (pronghorn) of Recent time, and (e") a series of allied specializations and the remarkable twisted-cored Ilingoceratinae of the Late Tertiary.

Extremely hypsdont to moderately hypsdont molars are exemplified, respectively, by the pronghorns and Bovids of the Quaternary.

The dental pattern within the brachyodont and hypsdont groups is remarkably homogeneous. Tooth variation in the case of each group is confined largely to size, interproportions of the premolars, molars and last molars, subsidiary differences in the presence or absence of cingula and accessory folds, and the degree of molariformity in the p₄. While the

(A) brachyodont forms are characterized by the rugosity of the unworn cheek teeth, a tendency in the upper molars to basal cingula, intercolumnar tubercles and variably developed external styles, and in the lower molars to the presence of anterior "Auchenia" and posterior cingula, "Palæomeryx" folds and intercolumnar tubercles, the

(B) hypsdont forms are furnished with smooth-surfaced molars having tall prismatic crowns that generally lack early-formed roots, as well as cingula, or accessory folds and tubercles, though the latter occasionally may be present.
HYPERTRAGULUS Cope, ref. A.M.7933

CAMELID species F.A.M.22260

HYEMOSCHUS Gray, rec. A.M.1353617

PSEUDOCERAS, n.g., ref. F.A.M.33722

PARATOCERAS, n.g., ref. F.A.M.33409

SYNTHETOCERAS Stirton, ref. F.A.M. 32464

LEPTOMERYX Leidy, ref C.M. 455 rev.

PARABLASTOMERYX, n.g., type F.A.M.31360

PSEUDOBLASTOMERYX, n.subg., ref A.M.13014 rev.

LONGIROSTROMERYX, n.g., type F.A.M.32405 rev.

SINCLAIROMERYX, n.g., ref. F.A.M.31216 rev.

PROCRANIOCERAS, n.subg., ref. F.A.M.31253

Fig. 2B. Comparative form and pattern of the p4s and of the proportions of p4 relative to m3 in examples of the brachyodont to subhyptodont Cervidae, Protoceratidae and Hypertragulidae, and in the hypsodont Antilocapridae and Bovidae. (Continued on next page)
<table>
<thead>
<tr>
<th>Species</th>
<th>Reference</th>
<th>Anteroposterior Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRANIOCERAS Matthew</td>
<td>ref. F.A.M.32401</td>
<td>26 mm.</td>
</tr>
<tr>
<td>DROMOMERYX Douglass</td>
<td>ref. F.A.M.31228</td>
<td>28.5 mm.</td>
</tr>
<tr>
<td>YUMACERAS, n.g.</td>
<td>ref. F.A.M.31633</td>
<td>25.9 mm.</td>
</tr>
<tr>
<td>RANGIFER H. Smith</td>
<td>rec. A.M.C.173688</td>
<td>25 mm.</td>
</tr>
<tr>
<td>TEXOCEROS, n.g.</td>
<td>ref. F.A.M.32159</td>
<td>19 mm.</td>
</tr>
<tr>
<td>ILINGOCEROS Merriam</td>
<td>ref. F.A.M.32207 &amp; 32220</td>
<td>20 mm.</td>
</tr>
<tr>
<td>COSORYX Leidy</td>
<td>ref. F.A.M.32071</td>
<td>14.5 mm.</td>
</tr>
<tr>
<td>ANTILOCAPRA Ord</td>
<td>rec. A.M.C.121294</td>
<td>24.2 mm.</td>
</tr>
<tr>
<td>OREAMNOS Rafinesque</td>
<td>rec. A.M.C.35541</td>
<td>30.2 mm.</td>
</tr>
<tr>
<td>BISON H. Smith</td>
<td>rec. A.M.C.3757</td>
<td>45.2 mm.</td>
</tr>
<tr>
<td>OVIS Linnaeus</td>
<td>rec. A.M.C.19835</td>
<td>22 mm.</td>
</tr>
</tbody>
</table>

**Fig. 2B** (continued from preceding page)

(Anteroposterior diameters of p4s, occlusal views, and of m4s, lateral views, respectively brought to unity.)

- end., entoconid; hyd., hypoconid; med., metaconid; med., metastylid; pad., paraconid; prd., protoconid. Measurements in the right-hand column are the actual anteroposterior diameters of m4s. (Continued, Figure 67, page 654.)

This figure has not been cited in the detailed lists.
The \(p_4\), through its tendency to approach molariformity in different members of the Pecora, retains a diagnostic character to greater degree than any other tooth of the series. The pattern of the \(p_4\) and the \(p_4\) proportions relative to \(m_3\) are shown (Fig. 2B) in unworn to slightly worn examples of the Camelidae, Hypertragulidae, Protoceratidae, Cervidae, Antilocapridae and Bovidae.

The Camelid \(p_4\) is relatively simple, there being no metaconid and the crests being confined to the protolophid (paraconid-protoconid) and compressed talonid (metastylid-entoconid and hypoconid)—which occasionally encloses, or partially encloses, a lenticular fossa. (In Recent \textit{Hyemoschus} the \(p_4\) is of similar compressed sectorial form to the camel but may be larger compared to its \(m_3\).)

The unworn to slightly worn \(p_4\) of:

- \textit{Hypertragulus} is primitive in the detached and rudimentary condition of the metaconid and entoconid columns, which are separated from the main external crest by a longitudinal crease.
- \textit{Pseudoceras}, in place of the typical antero-median metaconid, exhibits a postero-median "metastylid."
- \textit{Synthetoceras} and of \textit{Paratoceras} similarly substitutes "metastylid" for metaconid and, in the worn \(p_4\), this unites with a diminutive entoconid and the hypoconid margin to enclose a posterior pit. The \textit{Synthetoceras} \(p_4\) is proportionately small and the \(m_3\) tall-crowned compared to \textit{Paratoceras}. (A somewhat parallel development of metastylid versus metaconid is seen in the hypsodont \textit{Texoceros} and \textit{Ilingoceros}.)
- \textit{Parablastomeryx} and of \textit{Blastomeryx} is of simple Cervid pattern, the small metaconid and entoconid separately uniting with the proto-hypolophid crest.
- \textit{Cranioceras}, of \textit{Dromomeryx} and of \textit{Yumaceras} is characterized by the metaconid being large and extended and united anteriorly and posteriorly with crotchetts from the protoconid so as to shut in an anterior fossetette. In \textit{Procranioceras} the metaconid is unexpanded and the fossetette unformed.
- \textit{Sinclairovumeryx} and of \textit{Longirostromeryx} retains a definitely Cervid pattern though the \(p_4\) is small relative to the \(m_3\).
- \textit{Rangifer} exhibits the metaconid as a separate and complex column, un-uniting with the protolophid, and an entoconid and hypoconid of similar detached columnar form.
- Antilocaprids and of Bovids (versus Cervids) is tall-crowned though at times, as in \textit{Merycercos} and \textit{Oreamnos} (and \textit{Saiga}), small relative to the much enlarged and tall-crowned \(m_3\).
- Merycodonts differs from that of \textit{Texoceros} and \textit{Ilingoceros} in the tendency to development of the metaconid rather than metastylid portion of the median acces-

---

1 The cusps of the \(p_4\), following an interpretation of the Osborn terminology, may be known as:
- Antero-outer cusp, protoconid; postero-outer, hypoconid; antero-inner, paraconid; median-inner, (anterior corner) metaconid (and posterior) metastylid; and postero-inner, entoconid. The same cusps may be developed in the \(p_4\) and occasionally traces of these may occur in the \(p_3\) (see \textit{Rangifer}). The paraconid and protoconid form the protolophid. Crotchetts from the protolophid may unite this with the hypoconid and the entoconid and at times with the metaconid (into a typical "E" pattern). The metaconid may be conveniently considered as tending to be replaced by a variably developed metastylid in the brachydont-subhypsodont camel, \textit{Hyemoschus} Gray (1845), \textit{Pseudoceras}, \textit{Synthetoceras} and \textit{Paratoceras}, as well as in the hypsodont \textit{Picroceros} and \textit{Ilingoceros}. The main cusps, crotchetts and lophas are well shown in the Cervid \textit{Dromomeryx} and \textit{Yumaceras} of Fig. 2B.

sory column. In the pronghorn, both metaconid and metastylid are developed, enclosing anterior and posterior fossettes.

Bovids may have a formed anterior fossette as in *Ovis*, or be open as in *Oreamnos* and (typically) in *Bison*.

**LIMBS**

The limb elements in the ruminant groups under discussion differ in variable degree in size and proportions and, in measure, are characteristic of the several families. Unfortunately such elements are found but rarely in association with skull and jaws, and in certain genera still are unrecognized. For convenience of reference the fossil data relative to the limbs are segregated and separately detailed at the end of the respective chapters. Tables of the limb measurements and proportions of Recent and fossil species are included, so far as possible, in the discussion of the several families, and certain metapodials are figured. An interesting comparison, where the material allows, is that of the metapodial and skull lengths (see page 24), the metapodials tending to be slenderer and more elongate in the Antilocapridae than in the Cervidae, more moderate-proportioned in the Bovidae, and shorter and unconsolidated in the Protoceratidae and Hypertragulidae. Broadly speaking, in these several families the ulna remains distinct, the fibula is greatly reduced, the carpus is of standard pattern and the navicular and cuboid are united. In the Cervidae (versus certain of the Antilocapridae), Bovidae and Protoceratidae, the radius is long relative to the metacarpus, the metacarpus and its second phalanx are shorter than the metatarsus and its phalanx and the laterals frequently are retained. (Middle Tertiary

---

**Fig. 2A.** Comparison of the bullar region of the skull in Middle and Late Tertiary and Recent Artiodactyls.

*FO, foramen ovale; FR, foramen rotundum; MA, auditory meatus; PP, paroccipital process; S, stylomastoid foramen; Z, depression for tympanohyal; 5, lacerated foramina; 6, glenoid foramina; 7, condylar foramen.*


F:A.M.31500, *Dromomeryx whitfordi* Sinclair, ref., rev., Sioux Co., Nebr. (See also Figs. 2, 14 and page 118.)


N.S.M.1-21-8-34, *Meryceros warreni johnsoni*, n.subsp., ref., Cherry Co., Nebr. (See also Fig. 28C and page 363.)


IV.—**Protoceratidae.** T.A.M.C., *Prosynthetoceras francisi*, subgenotype, San Jacinto Co., Tex. (See also Figs. 2, 60–63 and page 606.)

A.M.1220, *Protoceras celeri* Marsh, ref., Cheyenne River, S. Dak. (See page 611.)

V.—**Hypertragulidae.** A.M.1343, *Leptomeryx evansi* Leidy, ref., Lower *Oreo-

VI.—**Camelidae.** F:A.M.25062, specimen, Cherry Co., Nebr.

deer may retain the lateral metacarpals complete.\(^1\) In *Antilocapra* proper the limbs and feet are slender, the humerus and pes are shorter, the first phalanx of the manus is longer proportioned, the metacarpal length approximates the metatarsal, the metacarpus is less deeply grooved posteriorly and the metatarsus anteriorly; all laterals are absent and the third phalanx of the manus is deeper, blunter anteriorly and more extended posteriorly than in the deer. (Late Tertiary Merycodonts may retain the lateral splints and rudimentary phalanges in the manus.\(^2\))

\textbf{METACARPAL LENGTH RELATIVE TO SKULL LENGTH}

(Skull length measured from back of condyles to front of premaxillae)

<table>
<thead>
<tr>
<th>Genus</th>
<th>Specimen</th>
<th>Brit. E. Africa</th>
<th>Formula</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>[GIRAFFIDAE]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Giraffa camelopardalis reticulata</em></td>
<td>A.M.(M.)82001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CERVIDAE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Parablastomeryx gregorii</em></td>
<td>F:A.M.31380</td>
<td>Nebraska</td>
<td>151/(160) = (94)%</td>
<td></td>
</tr>
<tr>
<td><em>Barbouroweryx trigonoconesus</em></td>
<td>N.S.M.3-27-11-33</td>
<td>&quot;</td>
<td>143/(185) = (78)%</td>
<td></td>
</tr>
<tr>
<td><em>Pseudoblastomeryx falckenbacki</em></td>
<td>F:A.M.31530</td>
<td>Wyoming</td>
<td>90/(120) = (75)%</td>
<td></td>
</tr>
<tr>
<td><em>Aletomeryx marlandensis (9)</em></td>
<td>Unassociated</td>
<td>Nebraska</td>
<td>151/195 = (77)%</td>
<td></td>
</tr>
<tr>
<td><em>A. gracilis</em></td>
<td>Average unassociated</td>
<td>&quot;</td>
<td>121/(173) = (70)%</td>
<td></td>
</tr>
<tr>
<td><em>Dromomeryx borealis</em></td>
<td>C.M.327</td>
<td>Montana</td>
<td>220/(330) = (67)%</td>
<td></td>
</tr>
<tr>
<td><em>D. whitfordi</em></td>
<td>Unassociated</td>
<td>Nebraska</td>
<td>/380 = (67)%</td>
<td></td>
</tr>
<tr>
<td><em>Protoceras skinneri</em></td>
<td>F:A.M.31251</td>
<td>&quot;</td>
<td>172/270 = 60%</td>
<td></td>
</tr>
<tr>
<td><em>Machameroryx tragulus</em></td>
<td>A.M.20548</td>
<td>&quot;</td>
<td>73.5/(111) = (66)%</td>
<td></td>
</tr>
<tr>
<td>Recent Cervinid (p. 190)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANTILOCAPRIDE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Plioceros dehlini</em></td>
<td>F:A.M.32101</td>
<td>Nebraska</td>
<td>125/(152) = (82)%</td>
<td></td>
</tr>
<tr>
<td><em>C. (Paracosoryx) wilsoni</em></td>
<td>Unassociated</td>
<td>&quot;</td>
<td>107/(143) = (75)%</td>
<td></td>
</tr>
<tr>
<td><em>Cosoryx furcatus</em></td>
<td>F:A.M.32450</td>
<td>Nebraska</td>
<td>98/(135) = (73)%</td>
<td></td>
</tr>
<tr>
<td><em>Meryceros warreni johnsoni</em></td>
<td>Average unassociated</td>
<td>&quot;</td>
<td>122/179 = (68)%</td>
<td></td>
</tr>
<tr>
<td><em>M. nelsonensis</em></td>
<td>Unassociated</td>
<td>&quot;</td>
<td>130/(202) = (64)%</td>
<td></td>
</tr>
<tr>
<td>Recent Antilocapra (p. 541)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOVIDE (Recent) (p. 541)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROTOCERATIDE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Protocesta salter</em></td>
<td>Unassociated</td>
<td>South Dakota</td>
<td>89/213 = (42)%</td>
<td></td>
</tr>
<tr>
<td><em>Synthetoceras tricornatus</em></td>
<td>Unassociated</td>
<td>Texas</td>
<td>150/410 = (37)%</td>
<td></td>
</tr>
<tr>
<td>HYPERTRAGULIDE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Leptolophoryx transi</em>, var.</td>
<td>C.M.997</td>
<td>Nebraska</td>
<td>49/(84) = (58)%</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>Unassociated</td>
<td></td>
<td>40/(109)</td>
<td></td>
</tr>
</tbody>
</table>

\(*\) Length metacarpus/length skull.
( ) approximate; ( ) estimated.

\(^1\) As observed by Professor Barbour in the case of (?) *Aletomeryx marlandensis*, ref.—presence or absence of the laterals in the case of the pes indeterminate (page 186). Communicated November, 1936.

\(^2\) See recently secured largely complete skeleton of an immature individual of *Paracosoryx wilsoni*, from Sioux County (page 316).
Differentiation and Parallelism in the Cervidae and Antilocapridae

The Cervidae and Antilocapridae, to which the present volume is largely confined, have certain broadly common characters and exhibit in some respects a corresponding range of diversification. Thus, the:
- Size may be small to large with limbs short to longer-proportioned;
- Jaws and diastemata abbreviate to elongate;
- Tooth crowns more or less strongly brachydont (deer), or hypsodont (pronghorn);
- Premolars, relative to molars, larger or smaller; and the Cranial appendages may take the form of either shorter or taller horn-pedicles (deer), or forked to antler-like horn-cores (pronghorn)—see below.

Examples of this parallelism may be cited in each of the two families:
- Small size—the Cervid Blastomeryx and Antilocaprid Submeryceros; and
- Large size—the Cervid Yumaceras and Dromomeryx and Antilocaprid Texoceros
- Shortness of the diastema and large size of the premolars—the Cervid Pseudoparablastomeryx and the Antilocaprid Paracosoryx; and
- Maximum elongation of the diastema and reduction of the premolars—the Cervid Longirostromeryx and the Antilocaprid Subcosoryx.

“Horn” simplicity—the Cervid brocket and the Antilocaprid Meryceros; and
“Horn” complexity—the stag and the Antilocaprid Ramoceros.

The extreme production of the occiput resulting in the third or occipital horn of Cranioceras appears to be no more than a magnification of the incipient production occurring in Dromomeryx. No parallel to this exists in the Antilocapridae. Rostral appendages which culminate in the great forked horns of Synthetoceras and Prosynthetoceras may occur in modified form in the Cervidae (Sinclairomeryx, n.g.) but are unknown in the Antilocapridae.

“Horns,” Horn-Pedicles and Horn-Cores

See Figure 2 and Cross Section

Some five kinds of cranial armament are evolved in the males of the several groups through elevation of the frontal bones and variable adaptation of the adjacent skin-hair covering. The growth of such “horns” may be traced in any one genus and species through a series of individuals from the smooth frontal state of immaturity to the horned stages of maturity. It is possible to select certain actually largely con-
temporaneous genera as broadly exempling as many hypothetical stages in the “evolution” of the most complex of such appendages, thus:

(1) “Sinecorn,” a primitive hornless stage (paralleling the condition in the immature of all, and in the females of many, of the horned forms)—Cervid Blastomerycini (Family I, Division D) and Hypertragulid Leptomerycini, Hypertragulini and Hypisodontini (Family V, Divisions A, B and C).

(2) “Pseudocorn,” an “elementary” stage of smaller to larger supracranial excrescences, skin- and hair-covered and enlarged through life (paralleled at times in adolescent and in female individuals of other groups)—The Giraffidae of Asia and Africa and Protoceratidae (Family IV).

(3) “Cavicorn,” a balanced and continuing adjustment between the growing, hollow horn-core and its persistent sheath (both sexes)—Bovid Antilocopini, Ovini and Bovini (Family III, Divisions A, B and C).

(4) “Pliocervicorn,” an adaptation presumably permitting periodic shedding and replacement of the sheath, and “Antilocapricorn,” a more progressive adaptation of the same order. Forked to blade-like and solid horn-cores with deciduous to partially deciduous envelope—Antilocaprid Antilocaprin (Family II, Division B).

(4a) “Pseudocervicorn,” interpreted as an elaboration of the “Pliocervicorn” stage involving a splitting of the solid “core” into “incipient pedicle” and distal “core-envelope” portions, and a shedding or partial shedding of the latter. Solid forked core (Cosoryx and Merycros) or branched core-antler on more or less differentiated frontal pedicle (Ramoceros)—Antilocaprid Merycondontini (Family II, Division A).

(5) “Cervicorn,” a permanent and solid frontal pedicle, skin-covered and bearing a deciduous capping or antler and inclusive of “Cervicorn primitiva,” tall-proportioned pedicle, and “Cervicorn” proper, short pedicle bearing relatively tall antler—Cervid Drassomerycini, Aletomerycini and Cervini (Family I, Divisions A, B and C).

While the brachydont to hypsodont Cervids and the hypsodont Antilocaprids and Bovids severally exhibit some four or more major types of paired frontal appendages:

Solid pedicles........................................... “Cervicorn,”
“Pseudocervicorn” and
“Pliocervicorn” and
“Antilocapricorn,” or
“Cavicorn.”

Solid cores..............................................
Hollow pedicles........................................

The Cervids and Protoceratids, unlike the Antilocaprids and Bovids, in addition contain groups which develop:

Accessory rostral appendages....................... Sinclairomeryx and Protoceratini;

Accessory occipital appendages..................... Cranioceratinae and Protoceratini; or are

Entirely hornless..................................... Blastomerycini.

Among forms of the eastern hemisphere—the male of the existing giraffe may bear a third or (naso-) frontal “horn”; a second and anteriorly placed pair of horns occurs on the frontals of the antelope, Tetraceros, in certain sheep and very occasionally in other members of the Bovidae.
Horn Development and Form

Among Middle Tertiary deer the sequence of growth stages in the development of the horn-pedicle within the individual from youth to advanced maturity is exampled particularly well by our fine Aletomeryx series (Fig. 16). Dicrocerus, of the European Late Tertiary, further witnesses the antiquity of the Cervid antler whose most primitive spiked-horn stage is retained in the South American brocket and in the Cervus and Odocoileus yearling buck. With the occurrence in the American Middle Tertiary (and European Late Tertiary) of fully developed Cervuline-horned forms, it is unnecessary to search for ancestral stages of horn development within the Middle Tertiary Blastomerycini. By the Middle Tertiary the primitive frontal-excence stage in process of evolution into a definitely horned stage, had long since passed. It must be presumed that the Dromomeryxine and Aletomerycine "horn-core" was actually a horn-pedicle which in life was covered with skin and hair, and periodically bore distally a corneous capping of "antler" form. In immaturity, and doubtlessly in maturity in certain of the less specialized forms, the capping would have approached in simplicity to that in immature Cervus (and Antilocapra). Both Recent and extinct Cervid genera are characterized by the form and position of the horn-pedicles (Fig. 2).

There is evidently a slightly different morphology in the case of the horn-pedicles of the four Cervids:

(a) Dromomeryx—probably primitively capped,
(b) Aletomeryx—possibly with Cervulus-like antlers,
(c) Sinclairomeryx—in respect to its nasal bosses, and
(d) Cranioceras—in respect to the third or cranial horn.

The widely varying character of the cranial appendages among the Antilocapridae has been noted on a preceding page. Highly specialized antlered types of horns seem to have been evolved, surprisingly enough in the Antilocaprid Ramoceros, n.g., as well as in the Cervidae. Recent evidence for the first time exhibits the adolescent "horn" stage in both Meryceros, n.g., and Cosoryx. The evenly worn condition of the core-tips of a Meryceros cranium from Crookston seems indicative of a periodically non-sheath covered "core" renewed through shedding, versus the sheath-protected and permanent core of the Antilocapridi. (Further evidence as to the probably at times deciduous character of the horns in the Merycodontini is presented under that section.)
Historical

The first notice in the literature of any of the Tertiary forms here under consideration is Leidy's description of Leptomeryx in 1853, which was followed by Leidy's descriptions of Merycodus in 1854 and of Cosoryx in 1869. Foremost among the discussions of the affinities and broader taxonomic problems of the American Cervidae, Antilocapridae, Prodoceratidae and Hypertragulidae are those of Edward D. Cope, William B. Scott and William D. Matthew. Cope (1874) suggested that Cosoryx Leidy was the ancestor of the Cervidae, and subsequently (1877) remarked:

"It is not probable that this genus is the immediate ancestor of Cervus, from the fact that the molar teeth display in their prismatic form a higher degree of specialization than belongs to that genus. It is probable that the true ancestor combined the dental type of Cervus, with the distinct roots and short crowns of the molars, with the type of horns [of Cosoryx] ... [The] molars [of Dromomeryx borealis] differ from those of [Cosoryx] much as those of the deer differ from the molars of the antelope. While [Cosoryx] was probably the ancestor of Antilocapra, Blastomeryx was the ancestor of Cervus or Cariacus." (Dromomeryx Douglass had not then been described and Cope uses Blastomeryx for both Dromomeryx borealis and Blastomeryx gemmifer.)

Matthew (1908) observes Blastomeryx "... proves to be a very primitive deer, approximately ancestral to the American Cervidae, and derivable in its turn from the Oligocene genus Leptomeryx, whose relationship to the Cervid phylum had not been suspected. We are thus enabled to trace the ancestry of the American Cervidae back to the Oligocene, by successive stages known from the entire skeleton, and not merely from the inadequate evidence of teeth and jaws... The fossil species in successive levels in the same locality will show usually successive approximations toward the next higher generic stage. But all are approximately, not exactly, in genetic succession ... we are dealing usually with an approximate, not an exact phyletic series... With this reservation ... I believe that we can trace the ancestry of the American Cervidae back to Leptomeryx... Camellomeryx [of the Uinta] cannot be directly ancestral to Leptomeryx, and I suspect that if it is ancestral to any of the Hypertragulidae its affinities are rather with Heteromeryx..."

A list of the previously described genera and respective geontypic species of the Cervidae, Antilocapridae, Prodoceratidae and Hypertragulidae, arranged according to the dates of description, recalls many interesting dissertations on these forms. Twenty-three genera have heretofore been described from the Tertiary and three from the Pleistocene. Of these, nine represent the Cervidae, eight the Antilocapridae, four the Prodoceratidae and five the Hypertragulidae. The Quaternary Bovidae include in addition some eight extinct and four Recent genera and sub-genera, the:

Extinct: Bootherium Leidy (1852), Euceratherium Furlong and Stock (1904), Preptoceras Furlong (1905), Symbos Osgood (1905), Neotragocerus Matthew and Cook (1909), Superbison Nobis (1930), and newly reported Saiga and Poephagus; Recent: Oreamnos, Ovis, Ovibos, Bison.
The section of the present report dealing with the American Tertiary Cervidae originally was suggested through the discovery of a beautifully preserved skull and mandible of a three-horn-pedicled deer, and the realization that this represented the long-questioned genus, Cranioceras. Later it was decided to include in the one report both the Cervidae and Antilocapridae, as the inclusion of the latter would be facilitated through the preliminary studies previously undertaken by Martha Frick on the extensive collections of Merycodontine horns from New Mexico. Then, with the purpose of covering all of the so-far-known horned Ruminantia of the American Tertiary-Quaternary, the chapters on the Bovidae and Protoceratidae were added. Since the manuscript was consigned to the press, one unexpected discovery has followed another and these have permitted many additions to, and amplifications and corrections of, the original text and figures.

1 And more recently the Cervid, *Pediomeryx* Stirton, 1936, genotypic species *P. hemphillensis* Stirton.
2 To conserve space, a formal bibliography is omitted, as all of the major references to the literature are cited as to volume and page in the synonymies heading the detailed lists of genera, subgenera and species.
The thirty-three new genera and subgenera, and the respective genotypic and subgenotypic species\(^1\) of the Cervidae, Antilocapridae and Protoceratidae (and Camelidae) described in the present report are:

<table>
<thead>
<tr>
<th>NEW GENERA AND SUBGENERA</th>
<th>GENOTYPIC(^2) AND SUBGENOTYPIC SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FAMILY</strong></td>
<td><strong>SUBFAMILY</strong></td>
</tr>
<tr>
<td>Cervidae</td>
<td>Genotypic Species</td>
</tr>
<tr>
<td><em>Prococranioceras</em>, n.subg.</td>
<td><em>P. skinneri</em></td>
</tr>
<tr>
<td><em>Rakomeryx</em>, n.g.</td>
<td><em>R. raki</em></td>
</tr>
<tr>
<td><em>Subdromomeryx</em>, n.subg.</td>
<td><em>S. scotti</em></td>
</tr>
<tr>
<td><em>Bouromeryx</em>, n.subg.</td>
<td><em>B. milleri</em></td>
</tr>
<tr>
<td><em>Barbouromeryx</em>, n.g.</td>
<td><em>B. trigonocorneus</em> (B. &amp; S.)</td>
</tr>
<tr>
<td><em>Probarbouromeryx</em>, n.subg.</td>
<td><em>P. sweeti</em></td>
</tr>
<tr>
<td><em>Protobouroumeryx</em>, n.subg.</td>
<td><em>P. marshallensis</em></td>
</tr>
<tr>
<td><em>Mathomeryx</em>, n.subg.</td>
<td><em>M. matthewi</em></td>
</tr>
<tr>
<td><em>Yumaceras</em>, n.g.</td>
<td><em>Y. figginsi</em></td>
</tr>
<tr>
<td><em>Sinclairomeryx</em>, n.g.</td>
<td><em>S. sinclairi</em></td>
</tr>
<tr>
<td><em>Prococileus</em>, n.subg.</td>
<td><em>P. edensis</em></td>
</tr>
<tr>
<td><em>Longirostromeryx</em>, n.g.</td>
<td><em>L. merriami</em></td>
</tr>
<tr>
<td><em>Parablastomeryx</em>, n.g.</td>
<td><em>P. gregori</em></td>
</tr>
<tr>
<td><em>Pseudoparablastomeryx</em>, n.subg.</td>
<td><em>P. scotti</em></td>
</tr>
<tr>
<td><em>Probklstomeryx</em>, n.subg.</td>
<td><em>P. primus</em> (Matthew)</td>
</tr>
<tr>
<td><em>Pseudoblastomeryx</em>, n.subg.</td>
<td><em>P. falkenbachi</em></td>
</tr>
<tr>
<td><strong>Antilocapridae</strong></td>
<td><strong>Camelidae</strong></td>
</tr>
<tr>
<td><em>Ramoceros</em>, n.g.</td>
<td><em>R. osborni</em> (Matthew)</td>
</tr>
<tr>
<td><em>Paramoceros</em>, n.subg.</td>
<td><em>P. brevicornis</em></td>
</tr>
<tr>
<td><em>Merriamoceros</em>, n.subg.</td>
<td><em>M. coronatus</em> (Merriam)</td>
</tr>
<tr>
<td><em>Subcosoryx</em>, n.subg.</td>
<td><em>S. cerroensis</em></td>
</tr>
<tr>
<td><em>Paracosoryx</em>, n.subg.</td>
<td><em>P. wilsoni</em></td>
</tr>
<tr>
<td><em>Subparacosoryx</em>, n.subg.</td>
<td><em>S. savaronis</em></td>
</tr>
<tr>
<td><em>Meryceros</em>, n.g.</td>
<td><em>M. warreni</em> (Leidy)</td>
</tr>
<tr>
<td><em>Submeryceros</em>, n.subg.</td>
<td><em>S. crucianus</em></td>
</tr>
<tr>
<td><em>Osbornoceros</em>, n.g.</td>
<td><em>O. osborni</em></td>
</tr>
<tr>
<td><em>Plioceros</em>, n.g.</td>
<td><em>P. blicki</em></td>
</tr>
<tr>
<td><em>Tezoceros</em>, n.g.</td>
<td><em>T. guymonensis</em></td>
</tr>
<tr>
<td><em>Stockoceros</em>, n.subg.</td>
<td><em>S. conklingi</em> (Stock)</td>
</tr>
<tr>
<td><em>Hayoceros</em>, n.subg.</td>
<td><em>H. falkenbachi</em></td>
</tr>
<tr>
<td><strong>Protoceratidae</strong></td>
<td><strong>Camelidae (in part)</strong></td>
</tr>
<tr>
<td><em>Prosynthetoceras</em>, n.subg.</td>
<td><em>P. francisi</em></td>
</tr>
<tr>
<td><em>Paratoceras</em>, n.g.</td>
<td><em>P. macadamsi</em></td>
</tr>
<tr>
<td><em>Pseudoceras</em>, n.g.</td>
<td><em>P. skinneri</em></td>
</tr>
<tr>
<td><em>Rakomykus</em>, n.g.</td>
<td><em>R. raki</em></td>
</tr>
</tbody>
</table>

1 Six of the new genera and subgenera are based on previously described species.

2 As here used, genotype equals the type of the genotypic species, i.e., the genoholotype of Schuchert (1897) of that species; the genotypic species equals the genotype (Schuchert, 1905). The type of the genus as here used is synonymous only with the type of the genotypic species. Confusion and error result through carelessness in this regard.

The type of the species is the original specimen from which the species was first described. In the case of extinct mammals, the genus must be based on the remains of one particular individual. The correctness of reference of a seeming “topotype” (Thomas, per Schuchert, 1905) collected at the exact locality and seemingly from the identical stratum that furnished the type, may be open to serious question.

In the case of the forms of the present volume, the genus or subgenus is used to set apart a form or forms distinguished by some apparently material osteological character or characters; a species or subspecies, to designate areal or vertical distribution when observed characters are of doubtful importance but when the associated forms point to a distinct faunistic phase.

(And see footnote 1, pages 3, 6, 14 and Merycodont text page 322.)
Tentative Reclassification
(See preceding key to the five families, p. 9)

The here adopted recategorization of the North American Tertiary Cervidae, Antilocapridae, Protoceratidae and Hypertragulidae, and Quaternary Cervidae, Antilocapridae and Bovidae, based on characters of the teeth and horns, places the included species in thirteen divisions, some twenty-nine subfamilies and seventy-one genera and subgenera—forty-nine from the Tertiary and twenty-two from the Pleistocene-Recent.

There are many complications in attempting to secure a balanced taxonomic arrangement, and to afford proportionate importance to each group relative to the whole, through the greater completeness of knowledge of the membership of certain groups and the paucity or lack of such knowledge regarding other groups. While the Cervidae and Antilocapridae are homogeneous families and in the case of certain of their Tertiary branches there is considerable knowledge, the Bovidae are far from homogeneous and their Tertiary history is, to all practical purposes, unknown. It is hoped that the present revision of the several families, in conjunction with similar studies now in progress on the fossil Camelidae, Equidae, Oreodontidae and Carnivora, may afford a new basis for interpretation of the American Tertiary.

Cranial and dental characters distinguishing the several subfamilies, genera and subgenera of the American

I.—Cervidae
II.—Antilocapridae
III.—Bovidae
IV.—Protoceratidae
V.—Hypertragulidae (and
VI.—Camelidae, in part)

are given in the six tentative keys of the following pages (compare Figures 2, 2A and 2B and other figures throughout the text):

---

1 Total of seventy-nine genera and subgenera are enumerated—see footnote 1, page 2.
I.—CERVIDÆ Gray (1821). BRACHYODONT TO LESS BRACHYODONT

Males with supra-postorbital, solid, bony horn-pedicles (Fig. 2)

**Division A.—Dromomerycini. Late Tertiary or Middle Tertiary...**

**BRACHYODONT**

(Compare European Late Tertiary *Paleomerycidae* Lydekker, 1883, in part—"not deciduous"?)

Premolars tending large; /ms with "Paleomeryx" fold; diastema moderate; horn-pedicles elongate-tending, supra-postorbital, occasionally with basal flange (probably skin-covered and bearing deciduous horny caps or antlers); occiput variably produced.

Pedicles tall, erect and slightly compressed laterally; occiput strongly produced.............**Subfamily 1.—Cranioceratinæ**

(Median occipital appendage)

p₄ open.............IA.—Cranioceras Matthew

(Less brachyodont, premolars smaller)

p₄ tending closed...IA.—Procranioceras, n.subg.

(Brachyodont, premolars larger)

Pedicles tall, directed anteriorly, bowed; tendency to basal post-orbital flange and closed p₄......**Subfamily 2.—Dromomerycini**

Pedicles strongly bowed, flange slight (p₄ may be open)...II.—Rakomeryx, n.g.

Pedicles moderately bowed, basal flange heavy; p₄ closed....III.—Dromomeryx Douglass

IIIA.—Subdromomeryx, n.subg.

(Smaller)

Pedicles erect, curving anteriorly; moderately short; cross section triangular; p₄ open......**Subfamily 3.—Barbouromerycini**

IV.—Bouromeryx, n.subg.

(Middle Tertiary)...V.—Barbouromeryx, n.g.

".............VA.—Probarbouromeryx, n.subg.

".............VB.—Protobarbouromeryx, n.subg.

(Premolars reduced)

Pedicles tall, directed posteriorly, slightly twisted; post-orbital flange rudimentary; p₄ open..............**Subfamily 4.—Drepanomerycini**

VI.—Drepanomeryx Sinclair

Pedicle slender proximally and expanded distally

VII.—Matthomeryx, n.subg.

Pedicle heavier and narrowed distally

**Division B.—Aletomerycini. Late Tertiary or Middle Tertiary....Less Brachyodont to Subhyopsodont**

Premolars much reduced; "Paleomeryx" fold absent; diastema considerable; horn-pedicles without flange.
Frick, Horned Ruminants. Introduction

Size large; pedicles tall, cross section round; p₄ closed molariform. Subfamily 5.—Yumaceratinae

VIII.—Yumaceras, n.g.

Size small to moderate; pedicles moderate to tall, cross section triangular; p₄ open. Subfamily 6.—Aletomerycinæ

(Compare European Cervulus Solater and Diceros Lartet)

Pedicles erect. IX.—Aletomeryx Lull (Middle Tertiary)

(Nasals medium-sized)

Pedicles bent forward. X.—Sinclairomeryx, n.g.

(Nasals elongate and with bosses)

Males with postorbital, solid, bony pedicles

DIVISION C.—Cervinæ. Pleistocene-Recent............. Less Brachydont

(Cervinæ Gray, 1821, in part.)

Horn-pedicles moderate, and capped with variably shaped antlers; premolars tending large and diastema moderate.

p₃ open, p₄ usually closed, /ps moderate; diastema moderate; metacarpals tending long. Subfamily 7.—Cervinæ ("Plesiometacarpalia")

(?)XI.—Procoileus, n.subg.

(Eden Uppermost Pliocene)

Pedicle directed out and upward. Frontoparietal suture slightly concave. XII.—Cervus Linnaeus (1758)

(Posterior nares undivided)

Subfamily 8.—Odocoilæ ("Telemetacarpalia," in part)

Pedicle well posterior of orbit and projecting posteriorly. Frontoparietal suture deeply concave. XIII.—Odocoileus Rafinesque (1832)

and Eucervus Gray (1866)

(Posterior nares divided)

[(?) Sangamon Hay]

p₃ and p₄ tending closed, columns detached, and /ps large relative to /ms; diastema long; metacarpals tending shorter. Subfamilies 9—9a.—Alcenæ-Rangiferinæ

("Telemetacarpalia," in part)

(Rangiferinæ Brooke, 1828)

XIV.—Cervalces Scott (1885)

Pedicle adjacent to orbit and projecting laterally. Frontoparietal suture straight. XV.—Alces Gray (1821)

(Nasals abbreviated; posterior nares undivided)
Pedicle erect and, like orbit, markedly posterior. Fronto-parietal suture very deeply concave. 

\[\text{XVI.} - \text{Rangifer Hamilton Smith (1827)} \]  
(Female with rudimentary horn-pedicles; posterior nares divided)

[South America.........Subfamilies 8 and 9a (cont.).—ODOCOILE- 
(Tentatively, for comparison—unstudied.) \text{NÆ AND (?) RANGIFERINÆ}

\[\text{XVII.} - \text{Pudu Gray} \]  
Spike-horned

\[\text{XVIII.} - \text{Hippocamelus Leuckart} \]  
Single-forked antlers

\[\text{XVIII.} - \text{Blastocerus Wagner} \]  
Anterior beam biforked, posterior shaft triforked.

\[\text{XIX.} - \text{Including Masama Rafinesque,} \]  
and extinct Ozotoceros Ameghino, Paleoodocoileus Spellmann, Paracerus Ameghino, Morenelaphus Carette and Antifer Ameghino]

Males typically without pedicles or horns

**DIVISION D.—BLASTOMERCINI. MIDDLE OR LATE TERTIARY. BRACHYODONT TO SUBHYPSODONT**  
[Compare Eurasiaic Recent Moschus Linneus (1758) and Tertiary Micromeryx Lartet (1851).]

**Late Tertiary**

**Manus normal**

Diastema very long (top of cranium unknown; (subhypsodont. .Subfamily 10.—LONGIROSTROMERCINÆ 

\[\text{XX.} - \text{Longirostromeryx, n.g.} \]  
Premolars reduced

\[\text{XXI.} - \text{Blastomeryx Cope} \]  
Diastema more moderate, premolars normal to large

Diastema moderate to short; brachyodont. .Subfamily 11.—PARABLASTOMERCINÆ 

\[\text{XXII.} - \text{Parablastomeryx, n.subg.} \]  
Diastema tending short, premolars large

\[\text{XXIII.} - \text{Pseudoparablastomeryx, n.subg.} \]  
Diastema very short

**Middle Tertiary**

(See above). .Subfamily 10.—LONGIROSTROMERCINÆ (cont.) 

\[\text{XXIII.} - \text{Machæromeryx Matthew} \]  
Premolars tending moderate

(See above). .Subfamily 11.—PARABLASTOMERCINÆ (cont.) 

\[\text{XXIV.} - \text{Problastomeryx, n.subg.} \]  
Premolars moderate

**Manus short (PSEUDOBLASTOMERCINÆ. .Subfamily 11.—PARABLASTOMERCINÆ (cont.) 

\[\text{XXV.} - \text{Pseudoblastomeryx, n.subg.} \]  
Premolars large
II.—ANTILOCAPRIDÆ Gray (1866). **Hypodont**

Males with "horns" distally forked (or so tending). Division—(A) typically burred, (B) burless.

**Division A.—Cosorycini ("Merycodontini"). Late Tertiary**

(Hypodontidae Matthew, 1904.)

"Horns" typically burred (indeterminate whether horn-pedicles with partially deciduous antlers, or horn-cores with deciduous sheaths):

Postorbital, three- or more-tined "antlers" extending posteriorly and outwardly and presumably partly deciduous. . . . . . . . . Subfamily 1.—**Ramocerotinæ**

I.—*Ramoceros*, n.g.

Points successive

IA.—*Paramoceros*, n.subg.

Points distal and crotched

IB.—*Merriamoceros*, n.subg.

Small, multi-pointed

Supra-orbital and erect forked

"horns" or horn-cores. . . . . . . Subfamily 2.—**Cosorycinæ** Cope (1889),

in part

Cross section tending:

(a) Circular, shaft slender. . . . . . . . . . . . . . . . . . . . . . . II.—*Cosoryx* Leidy (1869)

Diastema and premolars moderate

IIA.—*Subcosoryx*, n.subg.

Diastema moderate, premolars greatly reduced

IIB.—*Paracosoryx*, n.subg.

Diastema abbreviated, premolars moderately heavy

(b) Compressed, shaft relatively heavy. . . . . . . . . . . . . . . . . . III.—*Meryceros*, n.g.

Muzzle and diastema elongate

IIIA.—*Submeryceros*, n.subg.

Small, forks individually burred

**Division B.—Antilocaprin. Late Tertiary—Pleistocene or Recent**

Horn-cores typically forked (always burrless), supra-orbital, sheaths deciduous (or so tending).

Late Tertiary

Horn-cores long, twisted. . . . . . Subfamily 3.—**Ilingocerotinæ**

Posteriorly directed; basal cross section crescent-shaped. . . . IV.—*Osbornoceros*, n.g.

(No indication of forking)

Erect, spiraled; basal cross section oval-tending. . . . . . . . V.—*Ilingoceros* Merriam

(Forked in immaturity)

(IVa.—*Sphenophalos* Merriam)
Late Tertiary (cont.)
Horn-cores short, transversely flattened and forked or unforked:
  Forked..................................Subfamily 4.—Pliocerotinæ
Core base erect, flattened terminal points short........vi.—Plioceros, n.g.
Subfamily 5.—Stockocerotinæ (in part)
Core base moderate, forks long....................vii.—Texoceros, n.g.
Unforked, blade-like...........Subfamily 6.—Antilocaprinæ
  Basal cross section triangular,
  small..................................viii.—Proantilocapra Barbour and Schultz
Tertiary to Recent
Core compressed, dagger-like,
  larger..............................xiii.—Antilocapra Ord (1818)¹
  Sheath forked
Pleistocene
Forked..................................Subfamily 5.—Stockocerotinæ (cont.)
Core base deeply cleft and forks either:
  Subequal..............................ix.—Stockoceros, n.subg.
  Unequal:
    Posterior branch largest...x.—Capromeryx Matthew (1902)¹
      Posterior branch forwardly directed (size small)
    xi.—Tetrameryx Lull¹
      Posterior accessory branch divergent and tall, cross section oval-rounded
Anterior branch largest...xii.—Hayoceros, n.subg.
    (And note Ceratomeryx Gazin.)
    Anterior or main branch enlarged, flattened (equivalent to core of Antilocapra) and divergent posterior branch of oval-rounded cross section (sheath possibly three-pronged)

¹ "Caproceros," "Tetramoceros" and the Dicranocerus Hamilton Smith (1827) might have been preferable to Capromeryx, Tetrameryx and Antilocapra.
III.—BOVIDÆ Gray (1821). HYPSODONT TO SO-TENDING
(American Quaternary “Cavicornia” probably largely of Eurasian derivation)

Both sexes with hollow horn-cores having permanent sheaths; with possible exception of Neotragocerus, unrepresented from American pre-Quaternary. Heavy, short-tending metapodials, distal splints absent (lateral phalanges tending absent or represented by hooves).

Horns straight to slightly curved:
DIVISION A.—ANTILOPINI

Subfamily 1.—ANTILOPINÆ (in part)
Nasals normal. . . (?I).—Neotragocerus Matthew and Cook (1909). (?Late Tertiary)
II. —Oreamnos Rafinesque (1817)
Nasals abbreviated. . . III.—Saiga Gray (1843)

Horns revolute or so-tending:
DIVISION B.—OVINI

Subfamily 2.—EUCERATHERINÆ
IV. —Euceratherium Furlong and Sinclair (1904)
V. —Preptoceras Furlong (1905)
(Horn bases taller)
(Aftonius Hay and Taurotragus ref. Gidley, questioned)

Subfamily 3.—OVINÆ Baird (1857),
in part (and OVICAPINÆ Noack, 1887, in part)
VI. —Ovis Linneus (1758)

Subfamily 4.—OVIBOVINÆ Gill (1872)
Nasals shorter . . . . VII.—Ovibos Blainville (1816)
(Liops Gidley and Gidleya Cossmann)
Nasals longer . . . . VIII.—Symbos Osgood (1905)
IX. —Boðkerium Leidy (1852)
(Horns slender, less depressed and more spreading)

DIVISION C.—BOVINI

Subfamily 5.—BOVINÆ
X.—Bos Linneus (1758), in part—Poéphagus Gray (1843)
(Horns slender, elongate)
XI. —Bison H. Smith (1827)
(Horns heavy, cores shorter)
XII. —Superbison Nobis (1930)
(Horns heavy, cores longer)
IV.—PROTOCERATIDÆ Marsh (1891). BRACHYODONT TO SUBHYPSODONT

Males with variable cranial armament; nasals abbreviated; bullae small; metacarpals short and detached (latterals generally retained).

THE PROTOCERATINI. LATE TERTIARY OR MIDDLE TERTIARY.

p\textsubscript{1} absent

Late Tertiary

Diastema long. . . . . . . . Subfamily 1.—SYNTHETOCERATINÆ

Paired postorbital and consolidated rostral “horns”:

p\textsubscript{3} lost, crowns subhypsodont. I.—Synthetoceras Stirton (1932)

p\textsubscript{2} present, crowns brachydont. . . . . . . . . II.—Prosynthetoceras, n.subg.

p\textsubscript{1} retained

Middle Tertiary

Diastema and premolars moderate. . . . . . . . . Subfamily 2.—SYNDYOCERATINÆ

Paired postorbital and paired rostral “horns”:

IV.—Syndyoceras Barbour (1905)

Late Tertiary or Middle Tertiary

Diastema short and premolars large. . . . . . . Subfamily 3.—PROTOCERATINÆ

Late Tertiary. . . . . . . . V.—Paratoceras, n.g.

(Cranium unknown)

Middle Tertiary (smaller). . . . . VI.—Protoceras (and Calops) Marsh (1891)
V.—HYPERTRAGULIDÆ Cope (1879). BRACHYODONT OR HYP sodont. MIDDLE TERTIARY

Males hornless; nasals normal; bullæ inflated; four detached metacarpals
(in Leptomeryx and Nanotragulus).

BRACHYODONT

DIVISION A.—Leptomerycini. (SIZE SMALL)

p₂ in series, premolars large, p₄ Cervid-formed. Subfamily 1.—LEPTOMERYCINÆ

Oligocene

I.—Leptomeryx Leidy (1853)

II.—Heteromeryx Matthew (1905)

DIVISION B.—Hypertragulini.

p₃ tending detached, p₄ unicuspid. Subfamily 2.—HYPERTRAGULINÆ

Premolars:

Oligocene

(a) Reduced.........................III.—Hypertragulus Cope (1874)

IIIa.—Allomeryx Sinclair (1906)

or

(b) More reduced and Lower Miocene

crowns taller.....................IV.—Nanotragulus Lull (1922)

(Pes tetradactyl)

HYP sodont

DIVISION C.—Hypisodontini. (SIZE DIMINUTIVE)

p₁ adjoining /C, p₃ tending detached (or lost), /ps reduced. Subfamily 3.—HYPISODONTINÆ

Oligocene

V.—Hypisodus Cope (1873)

(Laterals retained in pes)

[APPENDIX—VI].—CAMELIDÆ (in part). BRACHYODONT TO HYP sodont

Hornless; premolars compressed laterally.

BRACHYODONT

DIVISION A.—Pseudoceratinï.

Diastema short......Late Tertiary......Subfamily 1.—PSEU DOCERATINÆ

I.—Pseudoceras, n.g.

(Condition of C/, p¹ and cranium unknown)

HYP sodont

DIVISION B.—Stenomylinî.

Diastema tending short. Subfamily 2.—STENOMYLINÆ

Late Tertiary. II.—Rakomylus, n.g.

Premolars (?) absent

Middle Tertiary. III.—Stenomylus Peterson (1906)

Premolars reduced
Family I.—Cervidæ

The vanished deer forms of Middle Tertiary to Quaternary America are referred, in the present volume, to the four divisions:

Dromomerycini, Late Tertiary
Aletomerycini, Middle Tertiary and early Late Tertiary
Cervini, Quaternary,1 and
Blastomerycini, Middle Tertiary and Late Tertiary.

Reconstructions of the heads of several of the more outstanding of the extinct genera are shown in the frontispiece (in part) and Figures 1, 2D and 19. The Dromomerycini include a number of moderate to large forms with curiously specialized crania and horn-pedicles. The dentition is more generalized than in Aletomeryx. Palæomeryx Meyer and Dicrocerus Gervais of the European Tertiary may prove to represent the Dromomerycini division. Aletomeryx, in taller-crowned molars and reduced premolars, is more specialized than the later appearing Dromomerycini, and in the reduction of the premolars is more advanced than the Recent Cervini. The male Aletomeryx, in enlarged upper canines and tall horn-pedicles, parallels the Asiatic muntjæ (Cervulus). The Blastomerycini include brachyodont and less brachyodont forms of moderate to small size. The male Blastomerycini, in sabre-formed canines and in lack of horn-pedicles, are suggestive of the musk deer (Moschus) of Asia. Blastomeryx and Micromeryx of the European Tertiary are possibly related. In the general Introduction (and Key) the cranial, dental and horn-pedicle characters of these early American Cervids have been discussed in comparison with the family, Antilocapridæ. The three-page table gives the so-far-recognized distribution of the genera, subgenera and species. The four divisions are taken up in detail in the following pages, the genera and species appearing under the numbers shown in the table.

In several instances, closely allied Dromomerycini forms suggest progression.—This is exemplified in the case of the three-horn-pediced Cranioceratæ, by the smaller horn-pedicles and molars, more brachyodont crowns and larger premolars of Procranioceras skinneri from Devil's Gulch, as compared to Cranioceras granti from the definitely later accumulations of Kat and Leptarctus Quarries, Nebraska. It is exemplified again, though less markedly, in the Dromomerycinae by the larger size of the very similarly formed horn-pedicles and dentition of the Late Tertiary Subdromomeryx, as compared to the Middle Tertiary Probarbouroumeryx and Barbouroumeryx; the larger size of Dromomeryx as compared to its Late Tertiary contemporary Subdromomeryx; and the greater molariformity of the p4 of Dromomeryx (and Subdromomeryx) as contrasted with that of Barbouroumeryx.

1 The Eastern Divisions, Cervulini and Moschini, are unrecognized in America.
<table>
<thead>
<tr>
<th>A.—DROMOMERYCINI</th>
<th></th>
<th></th>
<th>UPPERMOST</th>
<th>LATE TERTIARY</th>
<th>MIDDLE TERTIARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranioceras &amp; Procranioceras</td>
<td>I, I A</td>
<td>[1][1]</td>
<td>[1a]</td>
<td>(7)</td>
<td>(5)</td>
</tr>
<tr>
<td>Rakomeryx, n. g.</td>
<td>II</td>
<td>(1)</td>
<td>(2)</td>
<td>*[5]</td>
<td>(4)</td>
</tr>
<tr>
<td>Dromomeryx Douglass</td>
<td>III</td>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subdromomeryx</td>
<td>III A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Continued on next page)
Table I—Continued. [The column headings are the same as on the preceding page.]

<table>
<thead>
<tr>
<th>LATE TERTIARY</th>
<th>MIDDLE TERTIARY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Genus Number</td>
</tr>
<tr>
<td></td>
<td>Edna, Calif.</td>
</tr>
<tr>
<td></td>
<td>H. C. 1, Tex. &amp;</td>
</tr>
<tr>
<td></td>
<td>*Guymon, Okla.</td>
</tr>
<tr>
<td></td>
<td>Yuma Co., Colo.</td>
</tr>
<tr>
<td></td>
<td>Kansas.</td>
</tr>
<tr>
<td></td>
<td>Massai. *&amp;*Skull Spring,</td>
</tr>
<tr>
<td></td>
<td>Oreg.</td>
</tr>
<tr>
<td></td>
<td>Virgin Valley, Nev.</td>
</tr>
<tr>
<td></td>
<td>Pawnee Cr., Colo.</td>
</tr>
<tr>
<td></td>
<td>Burge, Nebr. &amp; *Midway,</td>
</tr>
<tr>
<td></td>
<td>Groolston, equiv. &amp; *Devil's Gulch, Nebr.</td>
</tr>
<tr>
<td></td>
<td>*Sh. C. &amp; *D. Co, Nebr.</td>
</tr>
<tr>
<td></td>
<td>Mont. &amp; *S. Dak.</td>
</tr>
</tbody>
</table>

A.—Dromomerycini—Continued

<table>
<thead>
<tr>
<th>Bouromeryx, n.subg.</th>
<th>IV</th>
<th></th>
<th>Specimen Count</th>
<th>66</th>
<th>Barbouromeryx &amp; Probabarbouromeryx</th>
<th>V, WA</th>
<th>(4)</th>
<th>(5)</th>
<th>88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drepanomeryx Sinclair</td>
<td>VI</td>
<td></td>
<td></td>
<td>5</td>
<td>Protobarbouromeryx, n.subg.</td>
<td>VB</td>
<td>*6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathomeryx, n.subg.</td>
<td>VII</td>
<td></td>
<td>*(2)</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B.—Aletomerycini

<table>
<thead>
<tr>
<th>Yumaceras, n.g.</th>
<th>VIII</th>
<th>*(2)</th>
<th>(2a)</th>
<th>(1a)</th>
<th>*(1b)</th>
<th></th>
<th>Specimen Count</th>
<th>50</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sinclairomeryx, n.g.</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aletomeryx Lull</td>
<td></td>
<td>IX (1)</td>
</tr>
</tbody>
</table>

Total 710

Total 90

Total 176

Total 255
<table>
<thead>
<tr>
<th>C.—CERVINI</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Procoileus</em>, n. subg.</td>
<td>XI (1)</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D.—BLASTOMERYCINI</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Longirostromeryc, n.g.</td>
<td>XX</td>
<td>‡(2)</td>
<td>?(4a)</td>
</tr>
<tr>
<td>Problastomeryc, n.subg.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. <em>Matthew</em></td>
<td></td>
<td>XXIII (1)</td>
<td></td>
</tr>
<tr>
<td>Blastomeryc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cope Size Groups iv–v</td>
<td>XXI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problastomeryc, n.subg.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size Groups iii and iv</td>
<td></td>
<td>XXIV (2a)</td>
<td>(2)</td>
</tr>
<tr>
<td>Parablastomeryc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size Groups vi–vii</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudoblastomeryc, n.subg.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudoparablastomeryc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size Groups iv and v</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parablastomeryc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size Groups vi–vii</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudoparablastomeryc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>297</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Total | 66 |

| Late Tertiary Total | 1186 |
| Middle Tertiary Total | 411 |
| Grand Total | 1,597 |

1. Questions the generic or subgeneric reference.

2. *Leptopteryx*, *Kat*, *Xmas*, *Bear Creek and *Quinn Quarries, Cherry and Brown Counties; and *Upper Snake Creek (including Oclott Quarry, Sioux County, Nebraska. [See text for other localities: Hans Johnson's Ranch, Boiling Springs Bridge and Deep Creek (Cranioceras grantii, ref.), page 36, and *Macherezos* Quarry (Parablastomeryc gregari, ref.), page 243.]

*1, *2 refer to localities as shown in column headings.

Alignment of Late and Middle Tertiary forms is not intended to indicate actual ancestry.
DIVISIONS A.—DROMOMERYCINI, AND B.—ALETOMERYCINI

Frontispiece, d–e, and Figures 1A–E, 2D (Reconstructions), 3 (in part) (Deciduous Dentitions), 2, 2A (in part) and 11–16B (Skulls, Horn-Pedicles and Mandibles), 4–4A (in part) and 5–9, 15A (Mandibular Dentitions), 4A (in part) and 10–10A (Maxillary Dentitions), 17–18 and (in part) 25–25B (Limbs)

DISCUSSION

The Dromomerycine and Aletomerycine divisions of the Cervidæ (reconstructions, frontispiece, d–e, and Figs. 1, 2D) here are considered as embracing some six subfamilies of fourteen horned genera and subgenera of the later Tertiary of North America. They have the general characters of brachyodont to subhypsodont molars; paired postorbital unforked bony horn-pedicles that are more or less forwardly directed and bowed, twisted or basal-flanged; a peculiar prominence of the occiput; and heavy-proportioned limbs of brocket to red deer size. The dentition
of certain of the brachyodont Dromomerycini is very deer-like except for the somewhat broader and lower molar crowns, less compressed and diagonal inner lophs, and more prominently developed accessory folds and cingula. As contrasted to Antilocapra, the teeth are low to moderate-crowned and, in the unworn state, rugose; the p3 is generally elongate anteroposteriorly relative to p4; and the incisors (lower) are relatively short. The American dentitions (see figures) have many of the characters of the Palaomerycinæ of the European Late Tertiary. (In none of the species of Palaomeryx, unfortunately, has the form of the skull or the form of the horn-pedicle been determined.) In Division A, the brachyodont Dromomerycini, the anterior and posterior cingula or shelves, intervalley tubercles and external styles are usually well developed. The lower molars are provided with a "Palaomeryx" fold and an anterior shelf of somewhat "Auchenia" pattern, and the opposed median edges of the inner crescents of the unworn maxillary series exhibit crotchets. In Dromomeryx the posterior molars are proportionately enlarged relative to the premolars, and the p4 is somewhat molariform. In Division B, the subhypodont Aletomerycini, the teeth are longer-crowned, the cingula and folds less developed and the premolars typically reduced. The proportions of the premolars relative to the molars, and of p3 relative to p4, and the form and pattern of the p3 and p4 tend to differ in moderate degree throughout the several genera and subgenera. As seen in the limbs, the stature varied in the two divisions from the brocket-sized Aletomeryx to the large red-deer-sized Yumaceras. The data as to the limbs are discussed and figured on a later page (see 169). Lateral phalanges and metacarpals II and V, or their splints, may be retained.

The longest Dromomerycini-Aletomerycini cheek tooth series (D. whitfordi, 113 mm.) measures twice the length of the shortest (A. gracilis, 55.5 mm.). The length of the series in different individuals of the same species may vary up to 13%. The proportion of the moderately worn m1/m3 varies from 81% in Parablastomeryx gregorii to 58% in Bouromeryx pseudonebrascensis and in Matthomeryx matthewi. The dp1 is not developed in Cranioceras and Procranioceras; it is present in Dromomeryx, Rakomeryx, Subdromomeryx, Bouromeryx, Aletomeryx, Sinclairomeryx and Matthomeryx. As yet its condition is unknown in Barbouromeryx, Probarbouromeryx, Protobarbouromeryx, Drepanomeryx and Yumaceras.

Eight of the fourteen here recognized American Dromomerycine-Aletomerycine genera and subgenera are represented by crania. Knowledge of five is confined to the horn-pedicles and referred dentitions and of
one to the dentitions alone. Hypothetical reconstructions of the heads in the flesh of *Cranioceras*, *Procranioceras*, *Rakomeryx*, *Dromomeryx*, *Drepanomeryx*, *Mathomeryx*, *Aletomeryx* and *Sinclairomeryx* are shown in the aforementioned figures (see frontispiece, d–e, and Figs. 1, 2D). Outstanding examples of crania, dentitions and limbs are comparatively illustrated in Figures 5–18 and (in part) 3, 4–4A, 25–25B. The Dromomerycini (with the exception of certain small Barbouromerycines of the Middle Tertiary) appear suddenly and unheralded in the Late Tertiary. The Aletomerycini are known in a number of closely allied and already specialized forms from the Middle and early Late Tertiary, and by the larger and widely differing group from the Uppermost Tertiary. *Aletomeryx* is suggestive of a higher-crowned, smaller-premolared and taller-horn-pedicled *Barbouromeryx*, and *Yumaceras*, of a somewhat similarly advanced *Dromomeryx*.

It may be recalled that *Cranioceras* and *Drepanomeryx* formerly were referred to the Bovidae, and *Aletomeryx* to the Antilocapridae. The homology of the Dromomerycine "horn" and the Cervine horn-pedicle previously has not been recognized.

A brief résumé of the characters of the six subfamilies and fourteen genera and subgenera of the Dromomerycini and Aletomerycini is given below. The respective species, their synonymy, type specimens and referred remains are discussed in order in the following pages.

**DIVISION A.—DROMOMERYCINI**

| SIZE GROUPS¹ | I. Cranioceratinae...II TO III....I. *Cranioceras* Matthew (1918) |
|             | IA. *Procranioceras*, n.subg. |
| 2. Dromomerycinæ...II TO V...II. *Rakomeryx*, n.g. |
|             | III. *Dromomeryx* Douglass (1909) |
|             | IIIA. *Subdromomeryx*, n.subg. |
| 3. Barbouroumerycinæ...III TO VI...IV. *Bouromeryx*, n.subg. |
|             | V. *Barbouromeryx*, n.g. |
|             | VA. *Probarbouromeryx*, n.subg. |
|             | VB. *Protobarbouromeryx*, n.subg. |
| 4. Drepanomerycinæ...II TO III...VI. *Drepanomeryx* Sinclair (1915) |
|             | VII. *Mathomeryx*, n.subg. |

¹ The size groups are based on the lengths of ml–ma; the smallest size group (VI–) of the Dromomerycini-Aletomerycini is slightly larger than the largest size group (III+) of the Blastomerycini.
DIVISION B.—ALETOMERYCINI

SIZE GROUPS

5. Yumaceratinae...I TO III...VIII. Yumaceras, n.g.
6. Aletomerycinae...IV TO VI...IX. Aletomeryx Lull (1920)
   X. Sinclairomeryx, n.subg.

[The two divisions, C.—CERVINI proper (males horned), and D.—BLASTOMERYCINI (hornless), are discussed in subsequent sections of the report.]

Certain Characters of Above Genera

I. Cranioceras Matthew is stamped by the presence of the “third” or median occipital horn. The genus, and genotypic species C. unicornis, were based by William D. Matthew in 1918 on the portion of a posterior horn collected by Albert Thomson (1916) in the Tertiary of Sioux County, Nebraska. Remarkably enough, the genus heretofore generally has been referred to the Bovidae. Matthew supposed “…it to be more probably an antelope than anything else, but it might be cervid, dicotyloid, or even perissodactyl…”. The fragmentary type has remained a bone of contention, as a median occipital horn\(^1\) seemed an anomaly. The correctness of Matthew’s identification has been substantiated through the discovery by Morris F. Skinner in the summer of 1933 of a fine three-horned skull with associated ramus and other remains at Devil’s Gulch, Brown County, Nebraska (Fig. 11). Discoveries by the same collector in the stratigraphically later Leptarctus-Kat Quarry zone during the past summer of 1936, include several partial skulls with cranial horns (Fig. 12). The latter in their straight un recurved character differ strikingly from the strongly recurved horn of the Devil’s Gulch skull and resemble the fragmental Cranioceras unicornis genotype. The Devil’s Gulch form is placed in a new subgenus and species, Procranioceras skinneri. The specimens from the later channels are referred to the genus proper under C. granti, n.sp. The new form, Procranioceras, is distinguished by its notably brachydont molars and large-proportioned premolars from the apparently later-occurring Cranioceras proper, in which the size averages larger, the molars are slightly taller-crowned, premolars proportionately smaller, and the occipital horn

\(^1\) There were those who believed the specimen to represent “…probably part of an ulna, possibly from a rhinoceros.” (Cook, H. J. and M. C., 1933, Nebr. Geol. Surv., Paper No. 5, p. 57.)
of the male is of rounder cross section, more posteriorly directed and longer. A cranium and partial cranium from the higher level indicates that in the female the supra-orbital horns were absent and the cranial horn retained only in a greatly reduced state (Fig. 12). The new evidence has been received as the present pages were coming through the press, preventing the inclusion of all the specimens within the text. *Cervulus sinclairi* was based by Matthew (1918) on Snake Creek rami which, in part at least, seem referable to *Cranioceras*. Through present knowledge of the genus it would seem that the fragmentary paired horn-pedicles from the Santa Fé marls, described and figured by Cope (1877) under *Dicrocerus teres*, pertain to *Cranioceras* or to a closely allied form. Joseph Rak's ten years' collections from the New Mexican deposits embrace several ramal dentitions of approximate form. The John C. Blick Pawnee Creek series include a typical horn-pedicle. The new Clarendon collection contains several supra-orbital horn-pedicles and one occipital horn.

In *Cranioceras* the *p*₄ fossettes are open; the *p*₂-*p*₄ tend to be larger versus the *m*₁-*m*₃, and the diastema to be slightly longer than in *Dromomeryx*. The northern and southern Nebraska, New Mexico, Colorado and Texas specimens, pending further evidence, are held apart under geographic species. *Cranioceras teres* (Cope) has precedence. It is important to note that the premolar proportions and even the *p*₄ pattern at times vary among different specimens from the same locality. Certain mandibular dentitions which are intermediate to *Cranioceras* and *Bouromeryx* are referred tentatively to a separate species of the latter. *Cranioceras* reconstruction, Fig. 1B; *Procranioceras*, frontispiece, E.

II. *Rakomeryx*, new genus, introduces a remarkable form from the Mojave Desert of California. The genus is at once characterized by the forwardly directed and laterally bowed supra-orbital horn-pedicles that retain a trace of the basal Dromomerycine flange. A large series of referred dentitions from the same Barstow beds are noticeable for the proportionate slenderness of the premolars and particularly for the small proportions of the *p*₂. A partial and hornless skull, apparently representing the female, exhibits the characteristic Dromomerycine projection of the occiput. The premolars perhaps tend to be more reduced relative to the molars, the *p*₄ to lack the usual enlargement of the internal median column and the diastema to be shorter than in the more typical members of this division. Remains from Oregon and Nevada are referred to the genus. Reconstruction, Fig. 2D.
III. Dromomeryx Douglass is characterized by tall, paired horn-pedicles with strong forward tilt and prominent basal wings. The dentition is typified by the moderate size of the premolars relative to the molars, the retention in the calf of dp₁, and the closed anterior fossette of p₄. The genus is already well known through the papers of Cope, Scott and Douglass. The range, Montana and Nebraska, has been extended by our field parties to Colorado. What appears to be a small edition of the genus is seen in Subdromomeryx, n.subg., from Montana and Nebraska. Two ramal dentitions exhibit p₄s with formed anterior fossettes typical of Dromomeryx proper. Reconstruction, Fig. 1c.

IV. Bouromeryx, new subgenus, V, Barbouromeryx, n.g., VA, Probabarouromeryx, n.subg., and VB, Protobarouromeryx, n.subg. Barbouromeryx, n.g., from the Middle Tertiary of Nebraska, is nicely exampled in the genotype, B. trigonocorneus, partial skull, mandible and skeletal elements of the University of Nebraska collection. The genus is characterized by relatively small general size, shortness of horn-pedicles, extremely brachydont dentition, large premolars, p₄ fossette unformed and usual "Palseomeryx" folds. Protobarouromeryx, n.subg., from the same Middle Tertiary, differs from Barbouromeryx in the smaller proportions of its premolars. Under Bouromeryx, n.subg., are grouped several species from the Late Tertiary of Nebraska, Montana and Colorado. As at present known, the mandibular dentitions of certain of these forms somewhat resemble Cranioceras; others differ from Barbouromeryx mainly in larger size. As glimpsed in the lower dentition, Barbouromeryx might lie near to the direct ancestral line of Bouromeryx and the more conservative of the Late Tertiary Dromomerycini. Similarly Protobarouromeryx, with reduced premolars, and the contemporary but taller-crowned and still smaller-premolarized Aletomeryx might represent—the one a more conservative and the other a more progressive Middle Tertiary descendant of still earlier and yet unknown Probabarouromeryx-like ancestors.

VI. Drepanomeryx Sinclair is noteworthy for the superficial resemblance of its horn-pedicle to the antler of the fallow deer. Unfortunately this genus, as seen in the single so-far-known horn-pedicle of the type specimen from Sioux County, Nebraska, is as yet very much of an enigma. The pedicle retains a bare suggestion of the basal flange so generally characteristic of the Dromomerycine group. It is possible that two partial crania from the type area, which are peculiar in the
strongly posterior position of the orbit, may represent the same genus. One of the two specimens is hornless save for a small excrescence on the posterior border of the orbit, and may have been a female. Reconstruction, Fig. 1e. VII. *Matthomeryx*, new subgenus, exemplified by a cranial saddle bearing large, twisted and inwardly bowed horn-pedicles and by mandibular rami from Dawes County, Nebraska, may have belonged to quite a distinct group or to one fairly closely allied to the curious *Drepanomeryx*. The horn-pedicles are directed posteriorly as in the latter, versus anteriorly in *Dromomeryx*. *Matthomeryx* reconstruction, Fig. 1d.

The three remaining genera, *Yumaceras*, *Aletomeryx* and *Sinclairomeryx*, are proportionately taller-crowned than the preceding. The *Yumaceras* and *Sinclairomeryx* remains are derived from the Late Tertiary. The *Aletomeryx* remains come from horizons which at present are correlated with the Lower Miocene or Middle Tertiary. In their subhypsodonty, missing "Palæomeryx" fold and moderate to notably small-proportioned premolars, the three forms afford definite evidence of early specialization on the part of certain of the Tertiary Cervids. For convenience, the three genera are assigned to a taller-crowned Division, the Aletomerycini. The shape of the horn-pedicles of the three genera is so widely different that the same might well be referred to three distinct subfamilies.

VIII. *Yumaceras*, new genus, rests on a cranial saddle with partial horn-pedicles from northeastern Colorado. The form of the bony pedicle differs from any so far observed. The genus is believed to be witnessed by fragmentary dentitions from the same area and Texas, and by better-preserved dentitions from Oklahoma, all of which have the common characters of tall tooth crowns and reduced premolars. The Oklahoma dentition might seem to bear much the same relationship to *Dromomeryx* that the *Aletomeryx* dentition does to *Bouromeryx*.

*Aletomeryx* Lull, with erect, and *Sinclairomeryx*, n.subg., with peculiar anteriorly bent horn-pedicles, are based, respectively, on crania from the Lower Miocene and later Sheep Creek of Nebraska. In life the horn-pedicles ostensibly supported corneous antlers after the manner of the not too dissimilar pedicles of *Dicrocerus* and *Cervulus*. IX. *Aletomeryx* is represented by a very remarkable series of skulls, jaws and limb elements from the northern Nebraska type locality, in our own and in the Yale and Nebraska State Universities' collections. The speci-
mens are witness to a wide variation in the height of the horn-pedicles, the height, as studied in combination with the wear of the teeth, seeming to be dependent upon sex and age. (See Fig. 1A, reconstruction of head as in flesh.) Closely allied but larger forms are seen in an Aletomerycine horn-pedicle, female crania and other remains in the University of Nebraska, from apparent Lower Miocene beds of Box Butte, Dawes and Morrill Counties, Nebraska. X. *Sinclairomeryx*, new genus, of the Sheep Creek beds, is remarkable for the elongate, extremely slender and anteriorly arched postorbital horn-pedicles, for the elongate nasals bearing Dicerathere-like bosses and for the deep maxillary pits. In life corneous appendages were doubtlessly borne on the paired nasal bosses as well as on the bulbous tips of the paired horn-pedicles. The genus is represented in a series of partial crania and a considerable collection of mandibular dentitions. The latter, though of larger size than in *Aletomeryx*, are characterized by Aletomerycine-like subhyp-sodont molars and reduced premolars. The elongate nasals and nasal bosses of *Sinclairomeryx* are in contrast to the short nasals and stout maxillary horns of the Protoceratidae. (Compare reconstructions of heads in the flesh, frontispiece, D, and Fig. 59.)

The craniometry of the forty-four named species (twenty-nine of which are new), fourteen genera and subgenera, of the six subfamilies of the two Cervid Divisions,

A.—**Dromomerycini**
1.—Cranioceratinæ
2.—Dromomerycinae
3.—Barbouromerycinae
4.—Drepanomerycinae, and

B.—**Aletomerycini**
5.—Yumaceratinæ
6.—Aletomerycinae,

is preliminarily discussed, commencing with page 75 and following the measurement tables and comparative illustrations of the examples of dentitions. The limb elements of the two divisions are considered in the next following section of the report.
<table>
<thead>
<tr>
<th>Collection No.</th>
<th>Tooth Wear</th>
<th>Tooth</th>
<th>( \frac{m_2}{PS~d.} )</th>
<th>( \frac{Pr-P_4}{m_1-m_2} )</th>
<th>( \frac{P_2}{P_4} )</th>
<th>( \frac{P_3}{m_2} )</th>
<th>( \frac{P_4}{m_4} )</th>
<th>( \frac{P_3}{m_3} )</th>
<th>See Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranioceras unicornis Mathew, ref., Sioux Co., Nebr...</td>
<td>A.M.17338</td>
<td>w+</td>
<td>29.6/48 = 62%</td>
<td>(39.)/64.5 = (60)%</td>
<td>15.</td>
<td>13.4/15. = 99%</td>
<td>45%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;A.M.22384</td>
<td>w</td>
<td>27.4/53 = 52</td>
<td>(35.8)/(8.5) = (61)%</td>
<td>13.9</td>
<td>13.5/13.9 = 97</td>
<td>49 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;ref. F:AM.31204</td>
<td>m+</td>
<td>24.4</td>
<td>31.5/53.8 = 59</td>
<td>9.</td>
<td>37/12.5 = 90</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. mefferdi, n.sp., ref., Cherry Co., Nebr...</td>
<td>F:AM.32367</td>
<td>m</td>
<td>25.</td>
<td>41.5/58 = 69</td>
<td>12.5 = 78</td>
<td>50</td>
<td>15./16. = 94</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>&quot;ref. Dawes Co., Nebr...</td>
<td>F:B:AM.32860</td>
<td>m+</td>
<td>27.5/60 = 42%</td>
<td>(70)</td>
<td>12./16.7 = 72</td>
<td>44</td>
<td>16./16.7 = 96</td>
<td>58 4, 4A</td>
<td></td>
</tr>
<tr>
<td>C. (P.) skinneri, subgenotype, Brown Co., Nebr...</td>
<td>F:AM.31250</td>
<td>m+</td>
<td>23.4/51 = 46%</td>
<td>34.6/56. = 62</td>
<td>8.5/14. = 61</td>
<td>36</td>
<td>12.7/14. = 91</td>
<td>54 11</td>
<td></td>
</tr>
<tr>
<td>&quot;ref. F:AM.31251</td>
<td>w+</td>
<td>23.2/46 = 51</td>
<td>34.3/53.8 = 64</td>
<td>9.5/13.5 = 70</td>
<td>41</td>
<td>12.5/13.5 = 92</td>
<td>54 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. dakotensis, n.sp, type, Rosebud, S. Dak...</td>
<td>A.M.10952</td>
<td>m</td>
<td>24.5</td>
<td>37.8/59.7 = 63</td>
<td>10./15. = 67</td>
<td>41</td>
<td>13.5/15. = 90</td>
<td>55 7</td>
<td></td>
</tr>
<tr>
<td>C. teres (Cope), ref., N. Mex...</td>
<td>F:AM.31286</td>
<td>w</td>
<td>38.</td>
<td>(35.)/14.</td>
<td></td>
<td></td>
<td></td>
<td>13.5/14. = 96</td>
<td>57 8</td>
</tr>
<tr>
<td>&quot;ref. F:AM.31284</td>
<td>m</td>
<td>23.</td>
<td>54.5/14.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. grunii, n.sp., ref., W.</td>
<td>F.A.M. 32401</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. danescens, n.sp., type</td>
<td>F.A.M. 32454</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; ref., Cherry Co., Nbr...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; ref., Todd Co., Nbr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dromeromyza ategondy Sinai,</td>
<td>F.A.M. 32211</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ref., Sioux Co., Nbr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 322455</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 32454</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 31504</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.M. 198724</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 31306</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.M. 19873</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 31299</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 9450</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M. 31782</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Continued on next page)
| Collection No. | Tooth Wear | m₃ | Pr-P₄ | p₂ | p₂/p₄ | p₂/m₃ | p₂/p₄ | See Fig. |
|----------------|------------|-----|-------|----|--------|--------|--------|_________|
| *Rakomyrz raki*, n.sp. (or *R. jorakianus*, n.sp.), ref., Barstow, Calif. | F:AM.31353 | M++ | 26.  | 36.5 | 9.5    | 13.7  | 69     | 37      |
|                |            |     | 47.  | 62.5 |        |        |        | 13.7    | 95      |
|                |            | W   | 26.6 | 36.7 | 9.1    | 14.   | 65     | 34      |
|                |            |     | 44.5 | 61.  |        |        |        | 14.     | 52, 8   |
| *R. yeronensis*, n.sp., type, Mojave Desert, Calif. | F:AM.31800 | M+  | 27.5 | (39.5) | (65) | 13.5  |        | 13.5    |
|                |            |     |      | (60) |        |        |        | 100     |
| *Yumaceras falkenbachii*, n.sp., ref., Okla. | F:AM.32104 | M+  | (27.) | 37.5 | 9.1    | 14.8  | 61     | 34      |
|                |            |     |      | (56) |        |        |        | 14.     |
|                |            | W   | 26.3 | 38.  | 10.5   | 15.2  | 69     | 40      |
|                |            |     |      | (59) |        |        |        | 15.2    |
| *Sinclairomyrz riparius*, var., ref., Sioux Co., Nebr. | F:AM.31223 | M+  | 23.5 | 25.5 | 7.1    | 10.4  | 68     | 30      |
|                |            |     | 33.5 | 52.5 |        |        |        | 8.7, 37 |
| *S. riparius* (Matthew), ref., Sioux Co., Nebr. | A:AM.18958 | M   | 21.7 | 25.1 | 6.4    | 10.   | 64     | 29      |
|                |            |     | 28.5 | 50.  |        |        |        | 10.     |
| *Bouromyrz paumensis*, n.sp., type, Pawnee Creek, Colo. | F:AM.31290 | W   | 21.7 | (33) |        |        |        | 12.     |
|                |            |     | 47.5 | (69) |        |        |        | 12.     |
| (?) *B. americanus* (Douglass), type, Mont. | C:AM.705  | M+  | 21.  | (31) | 9.     | (11.4)| (79)   | 43      |
|                |            |     | (47.2) | (66) |        |        |        | (11.4)  |

Table II—Continued
<table>
<thead>
<tr>
<th>Species</th>
<th>Collection Details</th>
<th>M+</th>
<th>21.</th>
<th>34.5</th>
<th>32.</th>
<th>12.5</th>
<th>9.</th>
<th>43</th>
<th>12.</th>
<th>96</th>
<th>57</th>
<th>5, 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>B. milleri</em>, subgenotype</td>
<td>A.M.21533</td>
<td></td>
<td>61</td>
<td>49.</td>
<td>65</td>
<td>72</td>
<td></td>
<td></td>
<td>96</td>
<td></td>
<td></td>
<td>5, 7</td>
</tr>
<tr>
<td>Sioux Co., Nebr................</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Subdromomeryx scotti</em>, ref.</td>
<td>F.A.M.31212</td>
<td>M+</td>
<td>83</td>
<td>46.5</td>
<td>(67)</td>
<td>69</td>
<td></td>
<td></td>
<td>89</td>
<td></td>
<td></td>
<td>5, 7</td>
</tr>
<tr>
<td>Sioux County, Nebr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M.32487</td>
<td>M+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbouronomyx trigonocorneus</td>
<td>N.S.M.3-27-11-33</td>
<td>M</td>
<td>74</td>
<td>40.</td>
<td>70</td>
<td>73</td>
<td></td>
<td></td>
<td>90</td>
<td></td>
<td></td>
<td>5, 7, 14</td>
</tr>
<tr>
<td>(B. &amp; S.), genotype, Dawes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co., Nebr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Probauromeryx sweeti</em>, n.</td>
<td>N.S.M.57-6-7-34</td>
<td>M+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>subg. and sp., ref., Morrill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co., Nebr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>N.S.M.21-25-6-35</td>
<td>M+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>52</td>
</tr>
<tr>
<td><em>Protobauromeryx marshallensis</em>, subgenotype, Morrill Co., Nebr................</td>
<td>N.S.M.3-24-7-34</td>
<td>W</td>
<td>37.</td>
<td>(22.5)</td>
<td>(61)</td>
<td>9.</td>
<td></td>
<td></td>
<td>89</td>
<td></td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>[Sinclairomyx—see above.]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Aletomyx lugii</em>, n.sp., type,</td>
<td>N.S.M.13-1-7-32</td>
<td>W</td>
<td>66</td>
<td>40.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4, 4A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morrill Co., Nebr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>A. marshallensis</em>, n.sp., ref., Box Butte Co., Nebr.</td>
<td>N.S.M.11-24-8-34</td>
<td>W</td>
<td>66</td>
<td>40.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4, 4A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M.32330</td>
<td>M</td>
<td>52</td>
<td>40.</td>
<td>56</td>
<td>85</td>
<td>5</td>
<td>36</td>
<td>88</td>
<td></td>
<td></td>
<td>46</td>
</tr>
<tr>
<td>A. gracilis (Lull), ref., Cherry Co., Nebr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>F.A.M.32334</td>
<td>-M</td>
<td>57</td>
<td>37.5</td>
<td>57</td>
<td>9.</td>
<td>9</td>
<td>34</td>
<td>80</td>
<td></td>
<td></td>
<td>48</td>
</tr>
</tbody>
</table>

( ) approximate; ( ) estimated.
### Key to Illustrations of Dromomerycini-Aletomerycini

(For immature dentitions, see Fig. 5)

<table>
<thead>
<tr>
<th>Lower Dentitions</th>
<th>Lower Views</th>
<th>Upper Dentitions</th>
<th>Upper Views</th>
<th>Cranial or Horns</th>
<th>Limbs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Figure 4A</strong> (in part)</td>
<td><strong>Figure 4</strong> (in part)</td>
<td><strong>Figure 4A</strong> (in part)</td>
<td><strong>Figure</strong></td>
<td><strong>Figure</strong></td>
<td></td>
</tr>
<tr>
<td>N.S.M.3.24-7-34, Probobouroumeryx marlandensis, n.</td>
<td>x</td>
<td></td>
<td></td>
<td>[14]sot, r.</td>
<td>[25A]r</td>
</tr>
<tr>
<td>N.S.M.97-25-6-35, Probobouroumeryx sweeti, n.</td>
<td>x</td>
<td>x</td>
<td></td>
<td>[14]sot, r.</td>
<td>[25A]r</td>
</tr>
<tr>
<td>N.S.M.5-18-7-34, A. marlandensis, n.</td>
<td>x</td>
<td></td>
<td></td>
<td>[18A]r</td>
<td></td>
</tr>
<tr>
<td>F:B.A.M.32378, Sinclairomeryx tedi, n.</td>
<td>x</td>
<td></td>
<td></td>
<td>[18A]r</td>
<td></td>
</tr>
<tr>
<td>F:A.M.32487, Subdromomeryx scotti, n.</td>
<td>x</td>
<td></td>
<td></td>
<td>[18A]r</td>
<td></td>
</tr>
<tr>
<td>F:A.M.32455, Cranioceras clarendonensis, n.</td>
<td>x</td>
<td>F:A.M.32417, n (act. 8th spec.)</td>
<td></td>
<td>[18A]r</td>
<td></td>
</tr>
<tr>
<td>F:A.M.32454, &quot; &quot; &quot; &quot;</td>
<td>x</td>
<td>F:A.M.32422, n (act. 10th spec.)</td>
<td></td>
<td>[18A]r</td>
<td></td>
</tr>
<tr>
<td>F:B.A.M.32860, C. meffordi, var.</td>
<td>x</td>
<td></td>
<td></td>
<td>[18A]r</td>
<td></td>
</tr>
<tr>
<td>F:A.M.31509, Dromomeryx whitedti, n (for molar, see Fig. 9).</td>
<td>x</td>
<td></td>
<td></td>
<td>[18]n, [14]t, r.</td>
<td>[17]n</td>
</tr>
<tr>
<td><strong>Figure 7</strong></td>
<td><strong>Figure 5</strong></td>
<td><strong>Figure 10</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F:A.M.31216, Sinclairomeryx riparius, var. n.</td>
<td>(act. 6th spec.)</td>
<td></td>
<td></td>
<td>5ot, 14ot.</td>
<td>5ot</td>
</tr>
<tr>
<td>A.M.18958, (?) S. riparius, n.</td>
<td>x</td>
<td></td>
<td></td>
<td>[16A]ot, r.</td>
<td>[16B] r</td>
</tr>
<tr>
<td>A.M.21533, Bouroumeryx milleri, n.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F:A.M.31290, B. pauniensis, n.</td>
<td>x</td>
<td>P.U.10401, Subdromomeryx antilopinus, n.</td>
<td></td>
<td>14At</td>
<td>18t</td>
</tr>
<tr>
<td>A.M.10952, Cranioceras daboensis, n.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F:A.M.31253, C. (F.) skinneri, n.</td>
<td>x</td>
<td>(see also Fig. 12)</td>
<td></td>
<td></td>
<td>[18]n</td>
</tr>
</tbody>
</table>

---

56
<table>
<thead>
<tr>
<th>Figure 8</th>
<th>Figure 6</th>
<th>Figure 10A</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:AM.31284, &quot; &quot; &quot;</td>
<td>F:AM.31283, n.</td>
<td>[18]γ</td>
</tr>
<tr>
<td>F:AM.31200, Rakomeryx yermomensis, τ</td>
<td>F:AM.312200, Craniodorsa unicornis, n.</td>
<td>[18]γ</td>
</tr>
<tr>
<td>F:AM.312325, Rakomeryx rahi (or jorakianus), n.</td>
<td>F:AM.31788A, Rakomeryx rahi (or jorakianus), n.</td>
<td>[15]γ, τ, [18]n</td>
</tr>
<tr>
<td>F:AM.31341, Rakomeryx rahi (or jorakianus), n.</td>
<td>F:AM.312200, Craniodorsa unicornis, n.</td>
<td>[18]n</td>
</tr>
<tr>
<td>A.M.15584, Palomeryx kaupii, n. Europe</td>
<td>[See above, Fig. 10]</td>
<td></td>
</tr>
<tr>
<td>F:AM.31509, &quot; &quot; &quot; (for premolars, see Fig. 4A)</td>
<td>A.M.22386, Dromomeryx whitfordi, n. (act. 8th spec.)</td>
<td>[17]n</td>
</tr>
<tr>
<td>F:AM.31225, Rakomeryx rahi (or jorakianus), n.</td>
<td>F:AM.31780, n.</td>
<td>[14]τ</td>
</tr>
<tr>
<td>F:AM.312325, Rakomeryx rahi (or jorakianus), n.</td>
<td>F:AM.312200, Craniodorsa unicornis, n.</td>
<td>[14]τ</td>
</tr>
<tr>
<td>F:AM.312325, Rakomeryx rahi (or jorakianus), n.</td>
<td>F:AM.312200, Craniodorsa unicornis, n.</td>
<td>[14]τ</td>
</tr>
<tr>
<td>F:AM.31214, &quot; &quot; &quot;</td>
<td>F:AM.31676, n (m4 only)</td>
<td>[18]n</td>
</tr>
</tbody>
</table>

x = lateral view of identical mandibular dentition (2d column), or occlusal view of associated maxillary dentition (3d column).

τ = type, or = genotype, srt = subgenotype, n = referred.

Figures of crania, horns or limbs, as indicated in the last two columns: unbracketed = identical or associated specimen; bracketed = same species but different specimen.

Species not cited in the table: Craniodorsa graniti, τ (F:AM.32064) and n (F:AM.32065, 32066), Fig. 12; n (F:AM.32170), Fig. 12A; n (F:AM.32126), Fig. 12A; C. paumienesis, τ (F:AM.31294), Fig. 12A; Subdromomeryx scotti, srt (F:AM.33758) and n (F:AM.33757, 33759, 33786), Fig. 14B; S. wilsoni, τ (F:AM.33809), Fig. 14B; Bournomeryx pseudonebrascensis, n (F:B:AM.34050, 34024), Fig. 14B; Drepanomeryx foliiformis, ot (F.U.12072), Fig. 15; A. marshi, n (A.M.14264), Fig. 25A.
**Summary of Dromomerycini and Aletomerycini Specimens**

| Genus No. | Late Tertiary | Cranial Horns Maxillaries Mandibles Limbs Total Asso. Total Specimens |
|-----------|---------------|------------------|----------------|----------|-------------------|-------------------|
| **DIVISION A.—DROMOMERYCINI** | | | | | | |
| II | Procranioceras, n.subg. | | | | | | | | |
| VI | Bouromeryx, n.subg. | 2 | 2 | 10 | 48 | 6 | 66 | 66 | |
| VII | Mathomeryx, n.subg. | 1 | 3[1] | 3 | 11 | 7 | 2 | 5 | |
| VIII | **DIVISION B.—ALETOMERYCINI** | | | | | | |
| IX | Yumaceras, n.g. | 4 | 10[4] | 11[3] | 85 | 40 | 133 | 7 | 126 |
| X | Sinclairomeryx, n.g. | | | | | | | | |
| **MIDDLE TERTIARY** | | | | | | |
| V | **DIVISION A.—DROMOMERYCINI** | | | | | | |
| VB | Probobouromeryx, n.subg. | 1 | 2[1] | 10 | 30 | 27 | 78 | 1 | 77 |
| **DIVISION B.—ALETOMERYCINI** | | | | | | |
| | | 48 | 80 | 77 | 97 | 114 | 410 | 7 | 126 |
| Total Late Tertiary Grand Totals | 986 | 50 | 886 | |

*Including 60 miscellaneous.
[ ]Associated specimens.

**Fig. 3.** Size range in American Middle and Late Tertiary Cervids, as seen in lateral views of mandibular milk dentitions.

X 1. 1, anterior cingulum; 2, posterior cingulum; 3, "Palaeomeryx" fold; 4, intercolumnar or accessory tubercle of ml; p1 considered identical with dp.

F:A.M.31354, (?)Pseudoblastomeryx mara, n.sp., type, rev., Cherry Co., Nebr. (See page 260.)

A.M.22388B, Blastomeryx gemmifer medius (Matthew), var., ref., Sioux Co., Nebr. (See page 240.)

F:A.M.32291A, Aletomeryx gracilis Lull, ref., Cherry Co., Nebr. (See page 159.)

A.M.18959, (?)Sinclairomeryx riparius (Matthew), ref., rev., Sioux Co., Nebr. (See page 166.)

F:A.M.32491, Subdromomeryx scotti, n.subg. and sp., tent. ref., Sioux Co., Nebr. (See page 125.)

F:A.M.31199, Bouromeryx nebrascensis, n.sp., ref., Sioux Co., Nebr. (See page 131.)

F:A.M.32216A, Cranioceras clarendonensis, n.sp., ref., rev., Clarendon, Tex. (See page 96.)

F:A.M.32375, Cranioceras mefferdi, n.sp., ref., Cherry Co., Nebr. Cranioceras, versus Dromomeryx, /dps larger relative to ml and p1 absent. (See page 89.)

F:A.M.31804, Rakomeryx vermonensis, n.sp., ref., Mojave Desert, Calif. (See page 106.)

F:A.M.32146, Yumaceras falkenbachi, n.sp., ref., Texas Co., Okla. (See page 145.)

A.M.18875 & F:A.M.31508, Dromomeryx whitfordi Sinclair, ref., Sioux Co., Nebr. (See pages 121, 118.)
Fig. 3. Size range in American Middle and Late Tertiary Cervids, as seen in mandibular milk dentitions—Blastomerycini, Aletomerycini and Dromomerycini, lateral views.  
X 1. (See legend, page 58.)
Fig. 4. Size range in Cervids of the American Middle and Late Tertiary. Blastomeryx Cope, Protobarbouromeryx, n.subg., Probarbouromeryx, n.subg., Aetomeryx Lull, Sinclairomeryx, n.g., Subdromomeryx, n.subg., Cranicoseras Matthew and Dromomeryx Douglass, lateral views of mandibular dentitions.

× 4. (See occlusal views, Fig. 4A, opposite [excepting N.S.M.21-25-6-35] and legend, page 67).
Fig. 4A. Size range in Cervids of the American Middle and Late Tertiary. Blastomeryx Cope, Protobarbouromeryx, n.subg., Probarbouromeryx, n.subg., Aleomeryx Lull, Sinclairomeryx, n.g., Subdromomeryx, n.subg., Craniochera Matthew and Dromomeryx Douglass, occlusal views of mandibular and maxillary dentitions.

X 1. (See lateral views, Fig. 4, opposite [excepting N.S.M.14-25-6-35, F:A.M.32417 and 32422] and legend, page 67.)
Fig. 5. *Aletomeryx* Lull, *Barbouromeryx*, n.g., (?)*Sinclairomeryx*, n.g., (?)*Subdromomeryx*, n.subg., *Bouromeryx*, n.subg., and *Procranioceras*, n.subg., mandibular dentitions, lateral views compared.

$\times \frac{1}{4} (mst \times 1)$. (See legend, page 68.)
FIG. 6. *Cranioceras* Matthew, *Rakomeryz*, n.g., and *Dromomeryz* Douglass, mandibular dentitions, lateral views compared. 

X \*1. (See legend, page 68.)

63
FIG. 7. Aletomeryx Lull, Barbouromeryx, n.g., (?)Sinclairomeryx, n.g., (?)Subdromomyx, n.subg., Bouromeryx, n.subg., Cranioceras Matthew and Procranioceras, n.subg., mandibular dentitions, occlusal views compared.

× 1. (See legend, page 69.)
Fig. 8. *Cranioceras* Matthew, *Rakomeryx*, n.g., and *Palzomeryx* Meyer (Europe), mandibular dentitions, occlusal views compared. 

X 1. (See legend, page 69.)

65
Fig. 9. *Dromomeryx* Douglass, *Rakomeryx*, n.g., and *Yumaceras*, n.g., mandibular dentitions, occlusal views compared.

X 1. (See legend, page 72.)
Figs. 4 and 4A. Size range in Cervids of the American Middle and Late Tertiary. Dromomycini and Aletomycini (and Blastomeryx) mandibular and maxillary dentitions.

Lateral views X ½, occlusal X 1. PS, posterior border symphysis; 1, anterior cingulum; 2, posterior cingulum; 3, "Palseomeryx" fold; and 4, intercolumnar or accessory tubercle.

Fig. 4. N.S.M.23-12-7-34, Blastomeryx gemmifer medius (Matthew), var., ref., rev., from Dawes County, Nebraska. (See page 241.)

N.S.M.3-24-7-34, Protobarbouromyx marslandensis, n.subg. and sp., subgenotype, from Box Butte County, Nebraska. (See page 136.)

N.S.M.21- and 97-25-6-35, Probarbouromyx sweeti, n.subg. and sp., ref., from Morrill County, Nebraska. (See page 135.)

N.S.M.13-1-7-32, Aletomeryx lugni, n.sp., type, rev., from Morrill County, Nebraska. (Premolars from 14-1-7-32.) (See page 161.)

N.S.M.5-18-7-34, Aletomeryx marslandensis, n.sp., ref., from Box Butte County, Nebraska. (p2, slightly enlarged, from another specimen of the same number.) (See page 168.)

F:B:A.M.32878, Sinclairomeryx tedi, n.sp., ref., from Dawes County, Nebraska. (See page 163.)

F:A.M.32487, Subdromomeryx scotti, ?ref., rev., from Sioux County, Nebraska. (See page 124.)

F:A.M.32455 and 32454, Cranioceras clarendonensis, n.sp., ref. and type, rev., from Clarendon, Texas. (See pages 95, 94.)

F:B:A.M.32860, Cranioceras mefferdi, (?)var., rev., from Dawes County, Nebraska. (Y = additional talonid cusp.) (See also Fig. 9 and page 118.)

Fig. 4A. Occlusal views of mandibular specimens of Fig. 4 (excepting N.S.M. 21-25-6-35) and three additional maxillary specimens:

F:A.M.32417 and 32422, rev., Cranioceras clarendonensis, n.sp., ref., from Clarendon, Texas. (See page 96.)

N.S.M.14-25-6-35, Probarbouromyx sweeti, n.subg. and sp., ref., from Morrill County, Nebraska. (See page 135.)
Figs. 5 and 6. Mandibular dentitions, lateral views compared.

$\times \frac{1}{4}$ (ms $\times 1$). PS, posterior border symphysis; 1, anterior cingulum; 2, posterior cingulum; 3, "Palaeomeryx" fold; and 4, intercolumnar or accessory tubercle of ms.

**Fig. 5.** F:A.M.32290 and 32286, *Aletomeryx gracilis* Lull, ref., from Antelope Creek, Cherry County, Nebraska.

(See pages 159, 158.)

N.S.M.3–27–11–33, *Barbouromeryx trigonocorneus* (Barbour and Schultz), genotype, from Dawes County, Nebraska.

(See also Figs. 7, 10 [dentition], 2, 14 [skull], 25 [limbs] and page 134.)


(See also Fig. 7 [A.M.18958 and F:A.M.31216] and pages 166, 165.)

F:A.M.31386, *Sinclairomeryx sinclairi*, n.g. and sp., ref., from Sioux County, Nebraska.

(See page 164.)


(See also Fig. 7 and page 124.)

A.M.21533, *Bouromeryx milleri*, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(See also Fig. 7 and page 130.)


(See also Figs. 7, 12 and page 87.)

**Fig. 6.** F:A.M.31280 and 31285, *Cranioceras teres* (Cope), ref., from Santa Cruz, New Mexico.

(See also Fig. 8 [F:A.M.31280] and page 93.)

A.M.22384, *Cranioceras unicornis* Matthew, ref., rev., from Sioux County, Nebraska.

(See page 83.)

F:A.M.31341, *Rakomeryx raki* (or *jorakianus*), n.sp., ref., rev., from Green Hills, Barstow, California.

(See also Fig. 8 and page 102.)

F:A.M.31299 and 31306 (ms, rev.), *Dromomeryx pawniensis*, n.sp., ref., from Pawnee Creek, Colorado.

(See also Fig. 9 [F:A.M.31306] and page 116.)

F:A.M.31228 and A.M.22386 (rev.), *Dromomeryx whitfordi* Sinclair, ref., from Sioux County, Nebraska.

(See also Fig. 9 [F:A.M.31228] and page 119.)
Figs. 7, 8 and 9. Mandibular dentitions, occlusal views compared.

1. anterior cingulum; 2. posterior cingulum; 3. "Paleomeryx" fold; 4. intercolumnar or accessory tubercle.

Fig. 7. F:A.M.32326, Aletomeryx gracilis Lull, ref., from Antelope Creek, Cherry County, Nebraska.

N.S.M.3-27-11-33, Barbouromeryx trigonocorneus (Barbour and Schultz), genotype, from Dawes County, Nebraska.


F:A.M.31212, Subdromomeryx scotti, ?ref., rev., from Sioux County, Nebraska.

A.M.21533, Bouromeryx milleri, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

F:A.M.31290, Bouromeryx pawniensis, n.sp., type, rev., from Pawnee Creek, Colorado.


F:A.M.31800, Rakomeryx yermonensis, n.sp., type (p4 and m3 rev.), from east of Yermo, Mojave Desert, California.

F:A.M.31200, Cranioceras unicornis Matthew, ref., from Sioux County, Nebraska.

F:A.M.31325 and 31341, Rakomeryx raki (or jorakianus), n.sp., ref., from Green Hills, Barstow, California. F:A.M.31325, p4 and p3 reversed from opposite side.

F:A.M.15584, Paleomeryx kaupi Meyer, ref., from Orleans, France.

Fig. 9. (See legend, page 72.)
Fig. 10. Aletomeryx Lull, Barbouromeryx, n.g., (?)Sinclairomeryx, n.g., Subdromomeryx, n.subg., Cranioceras Matthew, Procranioceras, n.subg., (?)Drepanomeryx Sinclair and Paleoameryx Meyer (Europe), maxillary dentitions, occlusal views compared.

× 1. (See legend, page 72.)
Fig. 10A. *Rakomeryx*, n.g., *Dromomeryx* Douglass and *Yumaceras*, n.g., maxillary dentitions, occlusal views compared.

X 1. (See legend, page 73.)

71
Fig. 9. F:A.M.31228 and 31509, Dromomeryx whitfordi Sinclair, ref., from Sioux County, Nebraska. (Y, F:A.M.31509 = additional talonid cusp.)

(See also Figs. 4, 4A [F:A.M.31509], 6 [F:A.M.31228] and pages 119, 118.)

F:A.M.31306, Dromomeryx pawniensis, n.sp., ref., rev., from Pawnee Creek, Colorado.

(See also Fig. 6 [ma only] and page 116.)

C.M.827, Dromomeryx borealis (Cope), ref., from Montana.

(See also Figs. 10A, 14A and page 115.)

F:A.M.31782, Rakomeryx raki (or jorakianus), n.sp., ref., rev., from Green Hills, Barstow, California.

(See page 102.)

F:A.M.31522, Yumaceras falkenbachi, var., from Miami, Texas.

(See page 145.)

F:A.M.32134, 31673 (rev.) and 32104, Yumaceras falkenbachi, n.sp., ref., from Guymon, Texas County, Oklahoma. (F:A.M.32134, p3 and p4 germs.)

(See pages 145, 144.)

Col.M.200, Yumaceras ffigginsi, n.g. and sp., tentatively ref., rev., from Yuma County, Colorado.

(See page 144 [Col.M.214B].)

Figs. 10 and 10A. Maxillary dentitions, occlusal views compared.

X 1. 1, anterior cingulum; 2, posterior cingulum; 4, intercolumnar or accessory tubercle.

Fig. 10. F:A.M.32303, Aletomeryx gracilis Lull, ref., rev., from Antelope Creek, Cherry County, Nebraska.

(See also Fig. 16 and page 157.)

N.S.M.3–27–11–33, Barbouromeryx trigonocorneus (Barbour and Schultz), genotype (in part), from Dawes County, Nebraska.

(See also Figs. 5, 7 [mandibular dentition], 2, 14 [skull], 25 [limbs] and page 134.)

A.M.18956, (?)Sinclairomeryx riparius (Matthew), type, from Sheep Creek, Sioux County, Nebraska.

(See page 165.)

P.U.10401, Subdromomeryx antilopinus (Scott), type, from Deep River, Montana.

(See also Figs. 14A [skull], 18 [limbs] and page 123.)

A.M.10953, Cranioceras dakotensis, n.sp., ref., rev., from east of Rosebud, South Dakota.

(See page 91.)

F:A.M.31250, Cranioceras (Procranioceras) skinneri, n.subg. and sp., subgenotype (in part), from Devil's Gulch, Brown County, Nebraska.

(See also Figs. 2, 11, 12 and page 86.)

F:A.M.31211, (?)Drepanomeryx species, ?ref., from Stonehouse Draw, Sioux County, Nebraska.

(See page 140.)

A.M.15584, Paleomeryx kaupi Meyer, ref. (detached), from Orleans, France. (Compare mandibular dentition, A.M.15584 [different individual], Fig. 8.)

F:A.M.31283, Cranioceras teres (Cope), ref., from Santa Cruz, New Mexico.

(See page 93.)
Frick, Horned Ruminants. I—Cervide

Fig. 10A. F:A.M.31788A (rev.) and 31325, Rakomeryx raki (or jorakianus), n.sp., ref., from Green Hills, Barstow, California. (See also Figs. 8, 18 [F:A.M.31325, mandible, limbs] and page 104.)

F:A.M.31245, Dromomeryx whitfordi Sinclair, ref., rev., from Sioux County, Nebraska. (See page 121.)

C.M.827, Dromomeryx borealis (Cope), ref., rev., from Montana. (See also Figs. 9, 14A and page 115.)

F:A.M.31780, Rakomeryx raki (or jorakianus), n.sp., ref., from Green Hills, Barstow, California. (Combined from both sides.) (See page 102.)

F:A.M.31251, 31250 (subgenotype in part) and 31253, C. (P.) skinneri, n.subg. and sp., ref., rev., from Devil's Gulch, Brown County, Nebraska. (See also F:A.M.31251, Fig. 18 [doubtfully associated metacarpus]; F:A.M.31250, Figs. 10 [dentition], 2, 11 [cranum]; F:A.M.31253, Figs. 5, 7 [dentition]; and pages 87, 86.)

F:A.M.31674 and 31676 (m* only), Yumaceras falkenbachi, n.sp., ref., from Guymon, Texas County, Oklahoma. (See page 145.)

F:A.M.31294, Cranioceras paumiensi, n.sp., type, rev., from Pawnee Creek, Colorado. (See page 93.)

F:A.M.31262 (?ref rev.) and 31270 (ref.) of Cranioceras granti, n.sp., from Brown and Cherry Counties, Nebraska. (See pages 86, 85.)

F:A.M.32458, 32463, 32469 and 32466 (rev.), Cranioceras clarendonensis, n.sp., ref., from Clarendon, Texas. (See page 95.)

F:A.M.32243, Cranioceras mefferdi, n.sp., type (in part), (supra-orbital horn-pedicile, rev., and occipital horn), from Cherry County, Nebraska. (See page 89.)

A.M.18879, (?)Drepanomeryx species, ?ref., from Sioux County, Nebraska. (See page 140.)
Fig. 11. F:A.M.31250, Cranioceras (Procranioceras) skinneri, n.subg. and sp., subgenotype, from Devil's Gulch, Brown County, Nebraska.

X 1. A, B, C, cross sections of horns; 1, vacuity; 2, supra-orbital foramen; 3, auricular depression. (See also frontispiece [reconstruction x], Figs. 2 [cranium], 10, 12 [maxillary dentition] and page 86.)
DIVISION A.—DROMOMERYCINI

Subfamily 1.—Cranioceratinae

I. CRANIOCERAS Matthew
IA. PROCRANIOCERAS, new subgenus

Statement

The subfamily is at present limited to the peculiar three-horn-pediced genus, Cranioceras, and the closely allied though less progressive subgenus, Procranioceras. The general characters of the genus and its interesting history in the literature are mentioned on a preceding page and need not be repeated here. While at first glance the Procranioceras cranium is not un-Antilocaprine-like, the dentition is typically of Cervid-Giraffid form. The broad sagittal area is posteriorly produced and elevated in the median, transversely-flattened and anteriorly-curving occipital horn; the paired erect frontal horn-pedicles of the male have a rotund cross section (and lack any basal flange); the orbits are relatively far forward; the premolars are moderate to large, the $p_4$ anterior fossette open, and the molars definitely brachyodont. In the genus proper, as compared to the subgenus, the occipital horn-core of the male is of rounder cross section, is directed more posteriorly and may be longer; the anterior premolars are shorter-proportioned and the molars taller-crowned. In the female the supra-orbital horns are absent and the third horn reduced to a slight elevation of the occipital area.

The Procranioceras skull follows the deer in differing from the pronghorn by the more anterior position of the orbit, the lower maxillæ, the narrower anterior muzzle, the slenderer premaxillary border, the wider incisive foramina and broader supra-occipital. The paired frontal appendages, which in form and anterior position seem to parallel the antelope rather than the deer, actually are highly specialized muntjac-like pedicles rather than Antilocaprine horn-cores. The skull, while at once more suggestive of Dromomeryx than of any more recent ruminant, differs widely from the latter in the more anterior position of the orbits, the erectness of the paired horn-cores, the absence of any
trace of the postorbital flange, and in the characters of the sagittal area, with its remarkable, backwardly directed, forwardly curved median-occipital horn.

Description of skull (see Procranioceras skinneri, F:A.M.31250 and 31251, Figs. 2, 11, 12): The dorsal profile slopes upwardly from the muzzle to the elevated bases of the paired horn-pedicles, is somewhat convex over the brain case, and thence is produced postero-upwardly and forwardly along the occipital horn. The slender tapering horn-pedicles, save for a slight inward bowing, stand erect over the posterior orbits. Moderately compressed laterally, particularly at the base, they have the external surface marked with veining. The notably "bulbous" pedicle tips are suggestive of a one-time corneous apex. The median occipital horn is strongly concave anteriorly and convex posteriorly, being anteroposteriorly broad in its median extent, but much compressed laterally and somewhat narrowed posteriorly. (It may be presumed hypothetically that this horn is formed of a union of bilaterally symmetrical elements of the supra-occipital and of the parietales.) The basicranial axis is angulated. The muzzle is relatively elongate and of slender, rounded cross section. The premaxilla-nasal contact is broad; the premaxillae viewed inferiorly are extremely slender. Upper incisors and canines, dp1 (i.e., p1) are never developed. The anterior edge of the orbit lies above the middle of m2; the posterior border, though prominent, is slender. The parietal crests are continued to the lateral bases of the occipital horn where they enclose a wide and anteroposteriorly concave area, marked medianly by the prominent depression of the auricular attachments. The usual supra-orbital foramina, lacrimal vacuities and suborbital foramina (above p2–p3) are present. The incisive foramina of the anterior palate are slender and much elongated; the posterior palatal border is unproduced and the palatal width greatly restricted anterior to p4. The proportionately small occipital condyles are surmounted by a restricted and backwardly dished muscular concavity. The occipital processes are wide and the mastoid area prominent. The bullæ, in our material, are but partially preserved and the meatus are lost. The glenoid surface is furnished with a strongly elevated posterior margin. The zygomatic arches are slender and elongate. The diastema, as seen in the mandible, is moderate relative to the size of the teeth. The mandibular angle is broadly rounded and the condyle rather low. The condition of the inferior incisors and canines is shown by a Clarendon, Texas, mandible (F:A.M.33703) to have been much as in Dromomeryx. The premolars and molars are notably brachy-
odont. Compared to the last-named genus, the premolars tend to be proportionately larger, the \( p_4 \) anterior fossette is unformed, and the limb elements tend to be smaller, though seemingly of the same general proportions and there is no \( dp_1 \) (\( p_3 \)).

The *Cranioceras unicornis* type horn is noticeably larger, heavier and directed more posteriorly, and the premolars, as seen in referred dentitions, are smaller than in *Procranioceras skinneri* from Devil’s Gulch. The type ramus of *Dyseomeryx (Cervus) sinclairi* Matthew, from the Snake Creek, is tentatively identified with *C. unicornis*. Other specimens from Sioux County of smaller size, but with similarly proportioned premolars, may represent smaller individuals of the one species. The lower molars are larger and the premolars notably reduced compared to the smaller type of *Procranioceras skinneri*. In *P. skinneri*, as compared to *Bouromeryx nebrascensis*, the molars are very much larger while the premolars are approximately the same size and, therefore, proportionately much smaller. There is doubt as to the reference of an interesting mandibular ramus from the uppermost zone of Sioux County. The specimen, while resembling referred *C. unicornis* and *C. granti* rami in the size and proportions of its teeth, differs from both in its relatively shorter postsymphysial distance. *Cranioceras granti*, from the stratigraphically high *Leptarctus* Quarry of Cherry County, in dentition and occipital horn tends to resemble the genotypic species from possibly equivalent beds of Sioux County. The species is named in honor of Madison Grant, explorer-naturalist. Remains from the stratigraphically intermediate Midway Quarry and other localities in Cherry County, are referred to a new species, *C. mefferdi*. For present convenience, specimens from the stratigraphically lower Valentine A Quarry and from Keya Paha and Box Butte County localities, which in size and general proportions closely resemble *P. skinneri*, are separately and questionably grouped under the latter. Referred limbs from the *Leptarctus* Quarry of Cherry County are extremely heavy-proportioned, approximating the largest Sioux County *Dromomeryx* material. *Cranioceras* limbs from Sioux County are intermediate to the last and to the largest of the limbs referred to *Procranioceras*.

Problems exist as to *C. teres* from New Mexico and *C. clarendonensis* from Texas. Referred ramal dentitions from the former area are remarkable through exhibiting a \( p_4 \) which differs from the typical *Cranioceras* pattern in the detached and not un-*Rangifer*-like condition of the inner middle column, and occasional Texas \( p_4 \)s may have the anterior fossette closed. Among the *Cranioceras*-like ramal dentitions from
Fig. 12. *Cranioceras* and *Procranioceras* species, from the Late Tertiary of New Mexico and Nebraska.

$X \times \frac{1}{4}$ (dentin $X \times 1$). (See legend, page 73.)
Fig. 12A. *Cranioceras* Matthew, *Procranioceras*, n.subg., and *Yumaceras*, n.g. (Col.M.214), comparison of horn-pedicles from the Late Tertiary of Nebraska, Colorado and Texas.

(*Cranioceras* and (?)*Drepanomeryx* referred female skulls from Nebraska.)

\[ \times \frac{1}{3} \] (See legend, page 73.)
several Nebraskan localities, certain minor variations are observed in size, relative proportions of the premolars, premolar pattern and length of diastema. It is probable that some of these may be due to individual and sex variation. (A nearly equal variation seems to occur in both the Recent deer and pronghorn.) Unfortunately “horns” are poorly represented. A horn-pedicle from Colorado is not definitely separable from what appears to be an adolescent Procranioceras horn from Devil’s Gulch, Nebraska (Fig. 12A). In marked contrast to the two latter heavy-proportioned and forwardly curving pedicles are the tall, slender and posteriorly directed horn-pedicles from Clarendon, Texas, and Quinn Ranch, Nebraska. Similarly the dentitions from Clarendon, in the stubby proportions of p₄ (at times closed condition of p₄ fossette) and tendency to taller-crowned molars with less marked folds, point to definite differentiation between the forms from later and earlier horizons. A horn-pedicle from Pawnee Creek, Colorado, is made the type of a species, C. pawiensis, and a ramus from South Dakota the type of a further distinct species, C. dakotensis. Smaller Cranioceras forms possibly may prove to be represented by the mandibular rami grouped on a later page under Bouromeryx pseudonebrascensis.

The ramal dentitions referred to Cranioceras are readily distinguishable from notably slenderer-proportioned dentitions with proportionately much smaller premolars and taller, less brachydont-crowned molars, in which the “Paleomeryx” fold tends to be absent, described below under Sinclairomeryx, n.g., and Aletomeryx Lull.

Species of the genus and subgenus are recognized from Brown, Cherry, Box Butte and Sioux Counties, Nebraska, S. Dakota, Montana, New Mexico, Texas and Colorado. The largest and smallest forms are exampled by Nebraskan remains. The known crania and several examples of the dentition are figured. For discussion and figures of limb elements, see page 169.
Summary of Named Species and Subspecies

The ten tentatively recognized species and subspecies, of which six are based on skulls or horns, one on an upper molar and three on ramal dentitions, are enumerated below:

Species (1) and (1a) are of the genus proper. Species (2) is of the subgenus, and to this are referred tentatively species (3) to (4a) and (6). Species (5) and (7) may or may not prove directly allottable to the genus.

(1) *Cranioceras unicornis* Matthew, genotypic species, from Sioux County, Nebraska.

**Genotype.**—Section of occipital horn-pedicle, A.M.17343. This paper, Fig. 12.

(1a) *Cranioceras granti*, n.sp., from *Leptarctus* Quarry, Cherry County, Nebraska.

**Type.**—Posterior cranium, F:A.M.32064. This paper, Fig. 12.

(2) *Cranioceras* (*Procranioceras*) *skinneri*, n.subg. and sp., from Devil's Gulch, Brown County, and questionably referred from Cherry, Keya Paha and Box Butte Counties, Nebraska.

**Subgenotype.**—Skull with horn-pedicles, left ramus and complete dentition, F:A.M.31250. This paper, Figs. 2, 10, 11, 12.

(3) *Cranioceras mefferdi*, n.sp., from Cherry County, and questionably referred from Brown and (?) (3a) Dawes County, Nebraska.

**Type.**—Partial skull, F:A.M.32243. This paper, Fig. 12A.

(4) *Cranioceras dakotensis*, n.sp., from vicinity of Rosebud Agency, South Dakota.

**Type.**—Right ramus, A.M.10952. This paper, Fig. 7.

(4a) *Cranioceras kinseyi*, n.sp., from Montana.

**Type.**—Right ramus, Kinsey Coll. 3-6-1927.

(5) *Cranioceras teres* (Cope), from New Mexico.

**Type.**—Cranial fragment with portions of horn-pedicles, N.M.2044 [F:A.M. cast]. This paper, Fig. 12.
(6) *Cranioceras pawniensis*, n.sp., from Pawnee Creek, Colorado.

**Type.**—Right horn-pedicle, F:A.M.31294. This paper, Fig. 12A.

(7) *Cranioceras clarendonensis*, n.sp., and (?)var., from Clarendon, Texas.

**Type.**—Right ramus, F:A.M.32454. This paper, Figs. 4, 4A.

**Referred.**—Cranial saddle with horns, F:A.M.32458.

(7a) (?)*Cranioceras texanus* (Hay), from Navasota, Texas.

**Type.**—Right m³, College Station Collection.

---

**Detailed Lists of Types, Referred Specimens, and Synonymy**

*Cranioceras*, total available specimens, 322; numbered and listed, 272; uncatalogued, 50.

(1) *Cranioceras unicornis* Matthew, genotypic species

From Sioux County, Nebraska

See description under preceding statement.

*Cranioceras unicornis* Matthew, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, p. 223, Fig. 19.

*Cervavus sinclairi* Matthew, 1918, ibid., p. 218.

*Blastomeryx (Dyseomeryx) sinclairi* (Matthew) (in part), 1924, ibid., L, pp. 194 and 198.²

**Genotype.**—Section of occipital horn-pedicle. A.M.17343

Collected from Snake Creek⁴ beds, E. Sinclair Draw, in 1916.

Figured by Matthew, 1918, Fig. 19; this paper, Fig. 12.

(Ramus, A.M.17344 [figured under 17144], tentatively referred by W. D. M. [1918], not of *Cranioceras*—now the type of *Prosynthetoceras siouzensis*, n. sp. [see page 607].)

---

¹ "Pawnee Creek beds" evidently in error for Snake Creek beds.

² Refers to species incomplete skull (A.M.18879) here tentatively referred to *Matthomeryx matthewi*.

³ Suggestive of "Hipparion Zone" but reported Snake Creek and, according to A. Thomson, possibly Sheep Creek.
REFERRED MANDIBULAR DENTITIONS.—

Six specimens collected by Jack Wilson:

- Left fragment with $p_2$ (br.)-m$_2$. (m+)
  - F:AM.31200 From Sinclair Quarry, 1932. This paper, Fig. 8.
- Left ramus, $p_2$-m$_2$. (w)
- Right fragment with $p_2$-m$_2$. (m)
- Left fragment with $m_1$ (br.)
  - F:AM.31201 From W. Sinclair Draw, 1933.
  - F:AM.31201A and B From E. Sinclair Draw, 1933.
  - F:AM.31200

Three specimens collected by Albert Thomson:

- Right ramus with symphysis, $p_2$ (br.)-m$_2$. (w)
  - A.M.22384 From Sinclair Draw, 1927. This paper, Fig. 6. Formerly catalogued under "Neotragocerus?"

- Left ramus with diastema and $p_2$ alveolus, $p_3$-m$_3$. (w+)
  - Figured by Matthew, 1918, Fig. 17, as the type of Cervus sinclairi, which becomes synonymous with Cranioceras unicornis. (W. D. M. [1918, p. 218], includes in type A.M.17337 and 17336.)
  - A.M.18880 From Sinclair Draw, 1921.

REFERRED MAXILLARY DENTITIONS.—

- Left maxilla with $p_4$-m$_2$. A.M.18880 From Sinclair Draw, 1921.

See limbs, page 176.

REFERENCE QUESTIONED.—

Smaller specimen, molars approximating, but premolars smaller than in the Devil's Gulch remains:

- Partial right ramus with $p_2$-m$_2$. (m+)
  - F:AM.31204 From W. Sinclair Draw, 1933.

Large specimen exceeding above F:AM.31200 in size (probably generically distinct):

- Left fragment with $p_3$ alveolus and $p_4$-m$_2$. (w+)
  - A.M.21470 From "The Pits" S. of Pliohippus Draw, 1925.

From uppermost zone (resembles C. granti):

- Left ramus with diastema, $p_2$ (br.)-m$_2$. (w)
  - F:AM.31868 From Olcott Quarry, 1936.
(1a) *Cranioceras granti*, new species

From Upper Zone, Cherry County, Nebraska

Several extremely useful specimens lately secured from the upper zone point to a resemblance between the *Cranioceras* of this uppermost horizon and the genotypic species from Sioux County, as contrasted with the somewhat smaller, shorter-crowned and less specialized subgenus (*Procranioceras*) from the Devil's Gulch area. As previously remarked, the remains average larger, the molars are taller-crowned, the premolars relatively smaller and the cranial horn noticeably more elongate, rounder in cross section and more posteriorly directed than in *Procranioceras*. The female of the genus is indicated in a cranium and partial cranium from the same beds, in which the supra-orbital horn-pedicles are absent and the broad, flat and posteriorly produced sagittal area bears but a rudiment of the usual cranial horn (Fig. 12).

**Type.**—Posterior cranium with bases of paired supra-orbital horn-cores and depressed, notably elongate and straight cranial horn.

[Horn twice as long (height above occipital depression, 244 mm. versus 122 mm.) and condyles larger (referred teeth less brachydont and premolars smaller) than in *P. skinneri* type.]

**Referred (five starred specimens with closed p4).**—

From type locality, 1936:

Left horn-pedicle, tip missing. (Specimen bent posteriorly as in *C. clarendonensis*; basal cross section triangular, short anteriorly and rounded posteriorly.) ................................. F:A.M. 32064 From Leptarctus Quarry. Collected by the Morris F. Skinner party in 1936. This paper, Fig. 12.

Five mandibular rami—tooth series tending smaller than *C. granti*, F:A.M.33714:

Left ramus with symphysis, p1-m4. (Symphysis distance tending long.) ................................................................. (w) 34030

Right ramus with symphysis, p1 alveolus, p1-m4. (Symphyssal distance tending short.) .................................................. (m++) 34031

Left ramus with symphysis, p1 alveolus and p1-m4. ............... (w) 34032

Left ramus with diastema, p1-p4 alveoli and p4-m4 **(m++) 34033

Left fragment with diastema, p1-m1(br.) .......................... (m) 34034

Two maxillae:

Right maxilla with dp*-m* (erupting) and germs of p*-p* ......... 34035

Right maxilla with p*-m* .............................................. (w++) 34036
From Kat Quarry Channel localities:

Posterior end of cranium with occipital horn. E.K. 32084
Partial cranium with left supra-orbital horn-pedicle and basal half of cranial horn; dentition missing. (Heavy, stubby proportions of orbital horn-pedicle suggest adolescent individual.) W.K. 33709
Right supra-orbital horn-pedicle. E.K. 33719
Hornless skull with p4–m4, muzzle missing. (w) K. 31270

*Fig. 12* A

Top of cranium showing border of orbit, large supra-orbital foramina, frontoparietal suture, auricular pit and abbreviated occipital horn of adolescent female. E.K. 32065

**MANDIBULAR RAMI**

Left ramus with incisive border–m3. (p4 tending larger than in other specimens) (m) W.L.K. 33714
Left ramus with p4–m3. * (m+) W.L.K. 33715
Left ramus with diastema, alveoli and p4–m3 (m+) E.K. 33710

*Fig. 12*

Left fragment with p4–m3. (w+) E.K. 33711
Right fragment with m1–m3. (m+) K. 31248
Unassociated m3 and m4 E.K. 32068B, A
Left fragment with incisive border–m3. (w) Q.K. 33713

**MAXILLARY DENTITIONS**

Left maxilla with p2–m3. (w) E.K. 32066

*Fig. 12*

Left maxilla with p4(br.)–m3. (w) E.K. 32067
Detached p3. E.K. 32068

**RAMI, IMMATURE**

Four immature rami. E.K. 33712, A–C
Right ramus with dp4–m3. K. 31249
Left fragment with dp4–m1. K. 31265

---

1 K. = Kat Quarry Channel (collected 1931, 1932 and 1934).
E.K., Q.K., W.K., W.L.K., = East, Quarter, West and West Line Kat Quarry Channels (collected 1936).
From various localities (cited only in part in Table I):

(a) From Brown County:

Right horn-pedicle.
F:A.M.31262 From Quinn Ranch, 1928.
This paper, Fig. 12A.
(Tall, slender, resembling Clarendon F:A.M.32463 versus P. skinneri.)

Right fragment of horn-pedicle.
F:A.M.31263 From Deep Creek, 1933.

Right ramus with dp₄-m₃ and p₃-p₄ germs.
(p₂ germ quite small.)
F:A.M.31261 From Quinn Ranch, 1928.

(b) From Cherry County:

Right fragment with p₃, p₄ alveoli and p₃-m₁.
(M+)

Right dp₃-m₃ (erupting).
F:A.M.32086 From 1½ mi. below Boiling Spring Bridge, 1934.
(Specimen is suggestive of F:A.M.31242, right dp₃-m₃, from Snake Creek Quarry 1, horizon B.)

From Bear Creek, 1934:

Left ramus with symphysis, p₃ alveolus and p₃-m₃.
*(M) 32401

Right fragment with p₃-m₁.
*(M) 32402

Immature left ramus with dp₃-m₁.
32403

Left maxilla with p₄-m₄.
(M) 32400

Referred limb elements from the same horizon are a little larger than those associated with the type of Subdromomeryx antilopinus (see Limb Section, page 177).

(2) C. (Procranioceras) skinneri, new subgenus and species

From Devil’s Gulch, Brown County, and Questionably Referred from Cherry, Keya Paha and Box Butte Counties, Nebraska

The species has been discussed in the introductory statement. The remains are of smaller size than the average from Sioux and Cherry Counties, Nebraska.

Subgenotype.—Skull with paired supra-orbital horn-pediciles and median occipital horn, left ramus and complete dentition. (M+)

F:A.M.31250 From Devil’s Gulch, Horse Quarry, 1933.
This paper, Figs. 2, 10, 11, 12.
REferred FROM Type Area.—

Skull with broken paired pedicles and base of occipital horn, mandible, dentition; and doubtfully associated atlas and axis, right and left metacarpi (see Limb Section, page 177).

(w+)

Palate and detached horn-pedicles.

Cranial fragment with right horn-pedicle (and ?occipital horn).

Seven rami:

Partial left ramus with p₇-m₄. (m)

Right ramus with p₇-p₈ alveoli and p₄-m₄(br.). (m)

Left ramus with diastema, p₇-p₈ alveoli and p₄-m₄. (m)

Left fragment with p₄-m₄. (m)

Left fragment with p₇-m₄. (m) (Smaller.)

Right fragment with m₁ (br.)-m₂. (m)

Right ramus with dp₄-m₂ (erupting).

One maxillary specimen:

Right maxilla with dp²-m² (erupting).

See limbs, page 177.

TENTATIVELY REFERRED FROM CHERRY, KEYA PAHA AND BOX BUTTE COUNTIES.—

(a) From Valentine A Quarry, Cherry County:

Right ramus with diastema and p₄-m₄. (m+)

(p₄ proportionately as reduced as in F:A.M.31250, p₄ posterior inner fold with peculiar loop, size approximating P. skinneri type specimen.)
Right p3-m3.  N.S.M.8-11-8-30
Left m3.  N.S.M.2-16-7-31
Right ramus with symphysis and dp1-m3.  N.S.M.19-2-9-30
Left fragment with dp4-m3.  N.S.M.9-2-8-30
Right fragment with dp5-dp6.  N.S.M.19-29-7-30
Left maxilla with p1-m4.  N.S.M.16-8-9-31
(w)
Left dp4-m1.  N.S.M.2A-16-7-31
Left p1-m4.  (m++) (Smaller.)  N.S.M.42-11-8-15
Left fragment with dp5-dp6.  N.S.M.8-5-8-30
Right fragment with dp1-dp4.  N.S.M.2-16-7-31

(b) From Keya Paha County:
Left m4(br.)-m4.  N.S.M.6-29-7-15

(c) From Box Butte County:
Right ramus with p1-m4.  N.S.M.2-28-6-33
Left dp4-m4 and premolars in germ.

The P. skinneri referred specimens from Box Butte and Keya Paha Counties are not cited on Table I.

(3) Cranioceras mefferdi, new species

From Cherry County, and Questionably Referred from Brown and Dawes Counties, Nebraska

The dentition and the paired pedicle bases of the type are larger, the base and tip indicate a longer-proportioned pedicle and the cranial horn is notably slighter than in the P. skinneri type specimen. This cranium was secured in November, 1935, and, like the two crania from Devil's Gulch, was collected by Morris F. Skinner and his assistant, R.
L. Mefferd. The more recent evidence suggests that this species, from intermediate, *P. skinneri*, from earlier, and *C. granti*, from later horizons, may represent widely differing forms.

**Type.**—Fragmental skull with cranial saddle, bases of paired supra-orbital horn-pedicles, occipital area with slender cranial horn, and p^4^-m^1. (m+)

From 1 mi. due N. of Nenzel Quarry, S. side of N.E. ¼ Sec. 19, T. 33 N., R. 32 W., near head of Spring Canyon. Stratigraphic horizon presumably equal to the Midway Quarry. This paper, Fig. 12A.

**Tentatively Referred.**

(a) From Midway Quarry, Cherry County, 1934:
Right ramus with symphysis and p$_{2}$-m$_{2}$. (m)
Size larger than largest Devil's Gulch specimens.

Two immature rami with dp$_{2}$-m$_{1}$.  
F:A.M.32375 and 32375A This paper, Fig. 3.

Slightly smaller:
Right m$_{1}$.  
F:A.M.32368
Right m$_{1}$.  
F:A.M.32368A

(See Limb Section, page 178.)

(b) From Brown County:
Right fragment with dp$_{2}$-m$_{2}$ (erupting).  
F:A.M.31257  From Moore Creek, 1933.
Right ramus and left symphysis, p$_{2}$ alveolus and p$_{2}$-m$_{3}$. (A)
F:A.M.31254  From Fairfield Creek, 1929.

(c) From Burge Quarry, Cherry County, 1935:
Right dp$_{2}$-m$_{4}$ (erupting)  
F:A.M.32085
and p$_{4}$ germ.

(d) From Nenzel Quarry (9 mi. S. of Nenzel), Cherry County, 1934:
Right m$_{2}$-m$_{3}$. (m+)
F:A.M.32200
Right maxilla, p$_{3}$-m$_{1}$. (w)  
F:A.M.32199
Bulletin American Museum of Natural History

(3a) Var.—genus in doubt

From Survey Quarry, Dawes County, Nebraska
Collected by Ted Galusha, 1935

[Premolars unreduced, dp1 (p1) represented by alveolus, diastema length unknown. Reconsideration indicates possibly Procranioceras, (?) P. galushi, n.sp., definitely not Cranioceras.]

SEVEN RAMAL SPECIMENS

<table>
<thead>
<tr>
<th>Description</th>
<th>F:B:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with p3—m2</td>
<td>32860</td>
</tr>
<tr>
<td>Left ramus with p3—p2 broken, and p1—m2</td>
<td>32861</td>
</tr>
<tr>
<td>Left ramus with p2—m2 (br.)</td>
<td>32862</td>
</tr>
<tr>
<td>Right fragment with p2—m2 (smaller)</td>
<td>32863</td>
</tr>
<tr>
<td>Left fragment with p4—m2</td>
<td>32865</td>
</tr>
<tr>
<td>Left fragment with p4 (br.)—m2</td>
<td>32865A</td>
</tr>
<tr>
<td>Right fragment with m2—m3</td>
<td>32865B</td>
</tr>
</tbody>
</table>

FOUR MAXILLARY SPECIMENS

<table>
<thead>
<tr>
<th>Description</th>
<th>F:B:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left maxilla with p4—m2</td>
<td>32864</td>
</tr>
<tr>
<td>Left fragment with m1—m2</td>
<td>32864A</td>
</tr>
<tr>
<td>Left fragment with m1—m2</td>
<td>32864C</td>
</tr>
<tr>
<td>Left fragment with m2—m3</td>
<td>32864B</td>
</tr>
</tbody>
</table>

Two ramal fragments, twenty upper and twenty-five lower detached teeth, F:B:A.M. Coll.

(4) Cranioceras dakotensis, new species

From Vicinity of Rosebud Agency, South Dakota


Moderate-sized remains from an unknown horizon in the vicinity of the Rosebud Agency probably rather represent a Late Tertiary contemporary of C. (Procranioceras) skinneri than a Lower Miocene forerunner of the genus. The form is known through a ramus and a maxilla and other fragments secured by the American Museum expedition of 1903. The slightly worn teeth of the ramus (A.M.10952) exhibit the characteristic low crowns, molar folds and styles, and open p4 of Procranioceras. The ramal teeth in size approximate the Devil's Gulch P. skinneri, large referred ramus (F:A.M.31253), but the premolars, particularly p2—p3, relative to the m3, which is larger than in F:A.M.31253, are smaller-proportioned than in the latter specimen. (Compared to the single available specimen of the European Palæomeryx, the premolars are notably small.) The remains include larger- and smaller-sized teeth, the larger being exemplified by the type ramus and the smaller by specimen A.M.10952C.
TYPE.—Right ramus with p_3–m_3. (M) A.M.10952 From vicinity of Rosebud Agency, 1903. This paper, Fig. 7.

REFERRED Specimens Secured by A.M.N.H. 1903 Expedition.—

Three maxillae approximating type in size, from three miles east of Rosebud:

- Right maxilla, p^1–m^2. (M) A.M.10953 This paper, Fig. 10.
- Right p^4–m^4. (M) A.M.10954
- Right maxilla, p^4–m^4. (w++) A.M.10955

Smaller-sized than type (approximating smallest of Valentine Railway Quarry A):

- Left fragments with p_3–m_1 and m_3(br.)–m_4. (w++) A.M.10956
- Left fragment, m_3–m_4. (M) A.M.10952C
- Right m_4 (M+) and p^4 (w). A.M.10952A and B

See metatarsus, page 178.

QUESTIONABLY Referred (tending subhypodent).—

Right m^3. A.M.10957 Big Spring Canyon, 1903.

(4a) Cranioceras kinseyi, new species

From Lower Madison Valley Beds, Montana

The genus is recognized in a mandibular ramus from Montana, placed at the writer's disposal through the kindness of C. A. Kinsey of Belgrade, Montana, and in a partial cranium, collected by Charles Falkenbach.

TYPE.—Right ramus with diastema, p_1 root–m_4. (w+) Kinsey Coll. 3-6-1927 From Lower Madison Valley Beds.

REFERRED.—

From Deep River, 7 miles S.E. of Fort Logan, 1925: A.M.

- Right fragment with p_3–m_3. .............................................. (w++++) 21329
- Right fragment with p_3–m_3(br.) ....................................... (w+) 21317
- Right fragment with p_3(br.)–p_4 ........................................ (M++) 21365

From north end of N. Boulder Creek, 1936:

- Portion of palate and dentition with left orbit and root of horn-pedicle, associated with basioccipital area and partial right mandibular dentition. (Not included in count.) F:A.M. (w++) 34193
(5) **Cranioceras teres** (Cope)

From New Mexico


*Dicrocerus teres* Cope, 1875, Proc. Acad. Nat. Sci. Phila., XXVII, p. 257; 1877, Rept. U. S. Geog. Surv. W. 100th Merid. (Wheeler), IV, Pt. II, pp. 347, 356, Pl. LXXXI, Fig. 7; Pl. LXXXII, Fig. 6.

*Palaeomyx teres* (Cope) [according to Gidley], 1907, Bull. U. S. Nat. Mus., No. 53, Pt. II, pp. 31, 33.

**Type.**—Fragment of top of N.M.2044 From the Santa Fé marls. Cranium with portions of horn-pedicles. Figured by Cope, 1877, Pl. LXXXI, Fig. 7; Pl. LXXXII, Fig. 6; this paper, Fig. 12.

The fragmental type specimen, which so far as observable is suggestive of *Cranioceras*, eventually may prove to have outstanding characters of its own. As observed above, the three more moderately worn of the five referred ramal dentitions from this area are remarkable through differing from the Nebraskan *Cranioceras* remains in the detached and Rangifer-like condition of the p₄ median column. The several rami exhibit a moderate variation in size, a specimen from the generally later deposits of the upper Rio Grande being the smallest.

**Referred.**—

Fragment of frontal with portion of right horn base. F:A.M.31279 From ?Santa Cruz.

**Tentatively Referred from Santa Cruz, New Mexico** (remains under (b) and (bb) probably of distinct forms).—

(a) Size somewhat exceeding F:A.M.31250 from Devil’s Gulch:

Partial right ramus, posterior symphysis, p₁ alveolus, and p₁–m₄ (br.). (w) F:A.M.31236 From red layer, 1927.

Right fragment with p₅–m₅. (m) F:A.M.31281 From red layer, 1925.

Left ramus with p₅ (br.)–m₅. (w++) F:A.M.31284 From red layer, 1927. This paper, Fig. 8.

Left fragment with m₅–m₆ (br.). (w) F:A.M.31281 From red layer, 1925.
Partial left immature ramus with dp₂-m₁.  
F:A.M.31282

Left fragment with p₂ (br.)-m₂.  
(w++)  
F:A.M.31285  
From red layer, 1927.  
This paper, Fig. 6.

Left maxilla with p₄-m₃.  
(m+)  
F:A.M.31283  
From “green.”  
This paper, Fig. 10.

Partial right maxilla with m₁-m₃.  
(w+)  
F:A.M.31287  
From red layer, 1927.

(b) Size smaller than F:A.M.31250, teeth slenderer:  
Partial left ramus with p₂ (br.)-m₁.  
(m+)  
F:A.M.31280  
From second wash, 1931.  
This paper, Figs. 6, 8.

(bb) Specimen from Rio Grande slope with smaller-proportioned p₄:  
Left p₄-m₃.  
(m)  
F:A.M.31288  
1930.

See limbs, page 179.

(6) **Cranioceras pawniensis**, new species

From Pawnee Creek, Colorado

The collections of the John C. Blick Colorado party include a horn-pedicle with attached portion of frontal bone. The specimen is very similar to a specimen from Devil’s Gulch (F:A.M.31264) which is interpreted as representing a somewhat immature individual of *Cranioceras*. The pedicle is less elongate, somewhat thicker-proportioned in the mid-extent, and more attenuated distally than in the mature specimens. The tip is of the characteristic bulbous form. [Note the differences between this specimen and the taller and slenderer horn-pedicle from Quinn Ranch (F:A.M.31262) which may be of an adolescent individual of the Clarendon stage.] No *Cranioceras*-like teeth other than those of the smaller-sized remains described as *Bouromeryx pawniensis* have been found at Pawnee Creek.¹

**Type.**—Right horn-pedicle on frontal fragment.  
F:A.M.31294  
From “west of buttes, middle horizon,” 1931.  
This paper, Fig. 12A.

See referred limbs, page 179.

¹ No record exists of the Pawnee Creek specimens mentioned, but not enumerated, by Matthew (1904) under *Palaeomeryx* species. Bull. Amer. Mus. Nat. Hist., XX, p. 129.
(7) **Cranioceras clarendonensis**, new species

From MacAdams Quarry, Clarendon, Texas

Figures 3, 4, 4A, 12A (in part)

The characters of the permanent and deciduous teeth of a number of specimens, secured in the Clarendon beds early in 1935, resemble *Cranioceras*. The size varies from slightly smaller to larger than the remains from Devil's Gulch. Two specimens (F:A.M.32211 and 31374), in which the p₄ is unworn, are interesting in exhibiting a partially closed anterior fossette. While the same fossette is closed in two of the worn specimens (F:A.M.31373 and 31372), in other worn specimens of otherwise similar character the fossette seems to have been open. The symphyses of specimen F:A.M.32212 is slimmer than in any of the Devil's Gulch rami, but the molars are of *Cranioceras* proportions, being larger than in the Colorado *Bouromeryx*. An immature maxillary, F:A.M.32425, and ramal series, F:A.M.32213, respectively resemble Devil's Gulch specimens, F:A.M.31260 and 31257. Larger individuals are exampled by the type, F:A.M.32454 (Figs. 4, 4A), and conspicuously smaller-sized individuals by a ramus, F:A.M.32455 (Figs. 4, 4A). One specimen, F:A.M.32415, is but doubtfully referred to the species. Since these lines were sent to the press, the Clarendon field party has secured an extremely interesting cranial saddle with tall paired horn-pedicles attached, a second cranial fragment bearing a similar pedicle, a third skull fragment with a very slender but less markedly elongate pedicle (?adolescent), a fourth specimen with a stubby post-like and non-tapering horn-pedicle (compare Fig. 12A) and additional mandibular rami. The first two and, in less degree, the third of the horn-pedicles differ from the *P. skinneri* type in their greater height and slenderness.

Possibly taller supra-orbital pedicles and slighter occipital horns may prove to be characteristic of such relatively late horizons as Clarendon. The heavy post-like pedicle (F:A.M.32459) may belong to a distinct species if not genus. A dental stage paralleling *C. granti* is suggested by the above-noted mandibular rami with closed p₄ fossettes.

**F:A.M.**

**TYPE.**—Right ramus with symphysis and p₁–m₄................. (m+) 32454

*Figs. 4, 4A*
Frick, Horned Ruminants. I—Cervide

REFERRED FROM TYPE LOCALITY, 1934–35.—

HORN-PEDICLES

Portion of top of cranium with both horn-pedicles (tall and crushed) ........................................... Fig. 12A 32458
Fragment of cranium with left horn-pedicle (tall and crushed) ......................................................... 32458A
Right horn-pedicle (tall and extremely slender) and frontlet.. Fig. 12A 32463
Crushed occipital horn with fragment of skull............ Fig. 12A 32466

Left horn-pedicle (short and uncrushed) on cranial fragment (specimen of noticeably different form from P. skinneri and probably of a distinct genus—see ramal fragment F:A.M.32415 below). .................. Fig. 12A 32459

TWENTY-SIX MANDIBULAR DENTITIONS

Starred specimens indicate p₄ with formed anterior fossette. The form of the fossette, especially as seen in F:A.M.32455, is suggestive of Dromomeryx rather than Cranioceeras—see above.

Larger individuals (size of type):

Left ramus with p₃–m₃. .................................................. (M) 32211
Left ramus with p₃–m₃. .................................................. *(M+) 31373
Right ramus with symphysis and p₃–m₄(br.) .................. (M+) 33704
Left ramus with diastema and p₃–m₄(br.) ......................... (M+) 33705
Right fragment with p₃–m₃. ........................................... (W) 33706
Right fragment with p₃–m₄. ........................................... *(M+) 33707
Right ramus with p₃–m₃. ............................................. (W+) 31372
Right ramus with p₃–p₄ alveoli and p₄–m₄. .................... (W) 31372A
Left crushed ramus with symphysis, /Is and /C–m₃. ........ (W+) 31371
Right fragment with symphysis, p₄–p₄ alveoli and p₄–m₁.... (M+) 32456
Right fragment with p₃–m₈(br.) .................................... *(M+) 33708
Right fragment with p₃–m₈(br.) .................................... (W) 32415A
Right ramus with p₄–m₄ ............................................... (W) 32412
Four fragmental rami (32413 from Pegran Place) ............ 32413,
                                                              32414, 32415B, 32212A

Smaller individuals:

Right ramus with diastema and p₃–m₃ ........................ *(M) 32455
Figs. 4, 4A

Left ramus with symphysis and p₃–m₃ ........................ *(W) 33700
Right ramus with symphysis and p₃–m₄(br.) .................. (M+) 32455A
Left ramus with diastema and p₃–m₄ ............................ (W+) 32212
Mandible with diastema and p3-m4................. (w+) 31370
Left fragment with p2-m3................................
Left ramus with diastema and p1-m3 (p4 missing) .... (M+) 31374
Left ramus with p1-m3................................. (w) 33702
Right ramus with symphysis, I2-m3.................... (w+) 33703

FIFTEEN MAXILLARY DENTITIONS

Larger individuals:

Right maxilla with p2-m3................................. (−m) 32422

Left maxilla with p2-m3................................
Right maxilla with p3-m3................................
Left maxilla with p2-m3................................
Right maxilla with p3-m3 (this and the following specimen slightly largest of the series)........ (M+) 32418
Right maxilla with p2-m3................................. (w) 32424
Right maxilla with p3-m3................................
Left maxilla with p2-m3................................
Right m1-m3...........................................
Left p2-m1 (p2-p3 large and with external styles)..... (M) 32411
Right p2-m3...........................................
Left p4-m3(br.)........................................

Smaller individuals:

Right maxilla with p4-m3................................. (M+ 32423
Left p4-m3...........................................
Right m1-m3...........................................

TEN IMMATURE MANDIBULAR DENTITIONS

Larger individuals:

Mandible with /C and p4 alveoli, dp4-m4 (erupting)........ 32213
Two ramal fragments with dp1-m1 and maxillary fragment with dp5-dp4.......................... 32218
Left ramus with dp1-m1 (erupting)....................... 32214
Right fragment with dp2-m6 (erupting)................... 32410
Right fragment with dp2-m1 and germ of p4............... 32416
Right fragment with dp2-m1 (erupting) (teeth broken).... 32217
Right fragment with dp2-m1............................... 32217A

Smaller individuals:

Right ramus with diastema and dp1-m1 (erupting)........ Fig. 3 32216A
Right ramus with dp4-m3 (erupting)........................ 32216B
Left fragment with dp4-m3 (erupting) and p4 germ........ 32216
SIX IMMATURE MAXILLARY DENTITIONS

Larger individual:
Right maxilla with dp⁴-m⁴ (erupting) ........................................ 32425

Smaller individuals:
Left maxilla with dp⁴-m⁴ (erupting) ........................................ 32215
Right maxilla with p⁴ and dp⁴-m⁴ ........................................ 32215A
Left maxilla with dp⁴-m⁴ ..................................................... 32215B
Two fragmental maxillae ................................................... 32420A

See limbs, page 179.

(?) Larger Variety
From Clarendon

A larger-sized specimen, from the same exposure as the above remains, indicates the presence of a distinct form. While the molars are considerably longer anteroposteriorly than in the above specimens, the p₄ is no larger and is widely open anteriorly, the peculiar reduction of the posterior edge of the inner column recalling Rakomeryx of Barstow. The specimen is held for the time being as indeterminate. (Compare indeterminate horn, F:A.M.32459, p. 95.)

Right fragment with p₄— m₄. (m) .................................................. F:A.M.32415

(7a) (?) Cranioceras texanus (Hay)
From Navasota, Texas


TYPE.—Molar, upper right.  College Station Collection  Figured by Hay, 1924, Pl. ii, Figs. 8 and 9.

REFERRED FROM TYPE LOCALITY.—
Etc. molars.  College Station Collection

(Dromomeryx ? angustidens Hay, 1924, p. 16, Pl. ii, Figs. 6 and 7, possibly a camelid.)
Fig. 13. F: A.M. 31320, Rakomeryx raki, n.g. and sp., genotype, and F: A.M. 31332, R. jorakanus, n.sp., type, from the Late Tertiary, Green Hills, Barstow, California.

× 4. A, B, cross sections; N, nasal; 2, supra-orbital foramen; 4, frontoparietal suture. (See pages 101, 105.)
Subfamily 2.—Dromomerycinae

II. Rakomeryx, new genus

III. Dromomeryx Douglass

IIIA. Subdromomeryx, new subgenus

The characters of the genera and subgenera, Rakomeryx, Dromomeryx and Subdromomeryx, have been touched on in the discussion, page 48. The males of the subfamily are provided with basally flanged horn-cores that are bowed and directed anteriorly.

II. Rakomeryx, new genus

Figures 2D, 13 and (in part) 3, 6, 8, 9, 10A; Limbs (in part) 18

Statement

The genus has been discussed briefly on a preceding page. The genotypic species, Rakomeryx raki, is based on a portion of a cranium with anteriorly tilted and strongly bowed supra-orbital horn-pedicles from the Mojave Desert, California. The horn-pedicles distally are much attenuated; proximally, and as viewed from in front, they are concave with a lateral enlargement suggestive of an adaptation of the Dromomerycine flange. A questioned species, R. jorakianus, is based on a second cranial specimen from the same Green Hills horizon, in which the horn-pedicles (unfortunately crushed) lack the characteristic tilting and bowing of the first specimen.

The teeth associated with the two cranial specimens are too fragmentary for definite comparison with the some fifty-odd dentitions and partial dentitions secured from the same beds, and ostensibly representative of one or both species. While the better preserved of these dentitions exhibit the same short crowns, cingular folds and intercolumnar styles occurring in Dromomeryx, they tend to differ from the latter in the smaller proportions of the lower premolars, $p_2$ and $p_3$. However, the postsymphysial to $p_2$ distance, which is exhibited in three of the rami of the best represented Green Hills subgroup (unrepresented in other specimens), tends to be of the general proportions of Dromomeryx. As in the latter, there is a tendency toward molariformity in the $p_4$, the an-
terior fossette in the best preserved specimen (F:A.M.31328) being closed, and to retention of the dp\(_4\), as indicated by the alveolus preserved in two specimens.

A third *Rakomeryx* species, *R. yermonensis*, is seen in a few specimens from the deposits near Yermo, correlated with the First Barstow Division. The premolars are slender and somewhat different, particularly as seen in the p\(_3\), from the Green Hills remains. The Yermo specimens are of moderate to moderately small size. Two additional species of the genus are indicated in fragmental remains from Virgin Valley, Nevada, and from southeastern Oregon.

The occurrence of a *Dromomeryx*-like form in the Barstow area was noted by John C. Merriam (1919, p. 524), who recorded under "*Dromomeryx* or *Cervus?*, n.sp." a dp\(_4\)-m\(_1\) (U.C.21218) and p\(_4\)-m\(_1\) (broken) (U.C.21219), observing that the particular specimens "differ from *Dromomeryx* in entire absence of the palaeomeryx fold..."

The Barstow dentitions, as seen in the lower molars, indicate individuals ranging in size from the largest *Dromomeryx* to the smallest *Cranioceras*. Definite allocation of the large series of dentitions from the type horizon to the two Barstow species, based on the horns, is unwarranted because of the lack of absolute association, and these dentitions are, while waiting further evidence, held under (a) to (d)—the intermediate-sized remains being by far the commonest. The small-sized dentitions include a maxillary and mandibular series associated with a hornless cranium, here interpreted as representing a female. A form further differing from the last is suggested by a ramal fragment carrying a very slender p\(_2\)-p\(_4\) (F:A.M.31324).

(For data and figures regarding the limbs, see page 169.)
Summary of Named Species

Three Barstow species:

(1) *Rakomeryx raki*, n.g. and sp., from the Green Hills, Barstow, California.
    
    **Genotype.**—Top of cranium, ?associated m^2, etc., F:A.M.31320. This paper, *Fig. 15*.

(2) *Rakomeryx jorakianus*, n.sp., from the Green Hills, Barstow, California.
    
    **Type.**—Crushed posterior cranium and ?associated right maxilla, F:A.M.31332. This paper, *Fig. 15*.

(3) *Rakomeryx yermonensis*, n.sp., from the vicinity of Yermo, Mojave Desert, California.
    
    **Type.**—Mandible, F:A.M.31800. This paper, *Fig. 8*.

Two questioned species from Nevada and Oregon:

(4) *Rakomeryx* species, from Virgin Valley, Nevada.
    
    **Example.**—m/ (broken), U.C.10676.

(5) *Rakomeryx gazini*, n.sp., from southeastern Oregon.
    
    **Type.**—Partial left horn-pedicle, C.I.T.351.

Detailed Lists of Types, Referred Specimens, and Synonymy

*Rakomeryx*, total available listed specimens, 68.

(1) *Rakomeryx raki*, new genus and species

From Green Hills, Barstow, California


**Genotype.**—Top of cranium with left and tip of right horns, and questionably associated m^2 and fragments of pelvis and ribs.

(1927)

F:A.M.31320

This paper, *Fig. 15*.

(The associated m^2 is of the "moderate" size section.)
**Referred Dentitions (May Include Specimens of *R. jorakianus*) from the Green Hills.**

(a) **Largest size.** (Lower molars approximating smallest *Dromomeryx.*)

Three specimens:

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Number</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left and right maxillae with p²-m². (M)</td>
<td>F:A.M.31780</td>
<td>1931.</td>
</tr>
<tr>
<td>Right fragment with p₅-m₅. (W)</td>
<td>F:A.M.31345</td>
<td>1924.</td>
</tr>
</tbody>
</table>

(b) **Moderate size.**

(The postsymphysial distance preserved in four specimens, F:A.M. 31353, 31340, 31341 and 31342.)

Eighteen mandibular dentitions:

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Number</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandible with symphysis and p₃-m₄. (M⁺⁺)</td>
<td>F:A.M.31353</td>
<td>1936.</td>
</tr>
<tr>
<td>(See associated maxilla below.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandible with symphysis and p₃-m₄. (W)</td>
<td>F:A.M.31340</td>
<td>1927.</td>
</tr>
<tr>
<td>Left fragment with p₃-m₄. (W)</td>
<td>F:A.M.31343</td>
<td>1930.</td>
</tr>
<tr>
<td>Left fragment with p₄-m₄ (m₁ and m₃ br.). (M)</td>
<td>F:A.M.31801</td>
<td>1932.</td>
</tr>
<tr>
<td>Partial right ramus with m₁-m₄. (W)</td>
<td>F:A.M.31344</td>
<td>1924.</td>
</tr>
<tr>
<td>Right ramus with symphysis and p₄-m₄. (W⁺)</td>
<td>F:A.M.31342</td>
<td>1924.</td>
</tr>
<tr>
<td>Right fragment with p₄-m₄. (W)</td>
<td>F:A.M.31805</td>
<td>1931.</td>
</tr>
<tr>
<td>Left fragment with p₅-m₅. (M)</td>
<td>F:A.M.31328</td>
<td>1934.</td>
</tr>
<tr>
<td>Left fragment with p₅-m₅. (W)</td>
<td>F:A.M.31329</td>
<td>1934.</td>
</tr>
</tbody>
</table>
Left fragment with p4 (br.)-m4. (w+) F:A.M.31347
Left fragment with m3-m1. (m) F:A.M.31806 1924.
Left fragment with m2-m3. (m) F:A.M.31807 1931.

/ms approximating largest size (maxillary dentition as yet unrecognized):
Left ramus with p1-m2 and partial m3. (m) F:A.M.31323 1931.
Left fragment with p2-m2 and partial m2. (m) F:A.M.31784 1931.
Right fragment with p3-m2. (m+) F:A.M.31785 1931.

Eight maxillary specimens:
Left maxilla with p2-m2. (M++) F:A.M.31353 1936.
(See associated mandible above.)
Right maxilla with p1-m2. (M) F:A.M.31327 1934.
Left maxilla with p2-m3. (w) F:A.M.31789 1931.
(Note no intercolumnar styles.)
Right maxilla with p2-m3. (M+) F:A.M.31790 1931.
Partial right maxilla with m1-m3. (w) F:A.M.31333 1930.
Partial right maxilla with m2-m3. (w) F:A.M.31794 1931.
Partial right maxilla with m2-m2(br.). (w) F:A.M.31334 1924.
Partial right maxilla with p4 and m2-m3. (w+) F:A.M.31332 1931.
(Presumably associated with horns of type of R. jorakianus, see page 105.)
Five detached upper teeth:

- Detached right and left $m^2$s. 
  F:A.M.31795 1924.
- Detached left $m^2$-$m^3$. 
  F:A.M.31335 1924.
- Detached $m^2$ (large). 
  F:A.M.31320 1927.
  (Possibly camelid—associated with the type of remains of $R. raki$, see page 101.)

Two immature maxillae:

- Partial right maxilla with $dp^4$-$m^1$. 
  F:A.M.31336 1930.
- Partial right maxilla with $dp^4$(br.)-$dp^4$. 
  F:A.M.31337 1924.

(c) Moderately smaller size.

Five dentitions:

- Partial skull (crushed) with $p^2$-$m^4$, and mandible with $p_r-m_3$ ($p_r-p_3$ br.). ($M+$) 
  From bottom of Green Hills, 1929. 
  This paper, Figs. 8, 10A.
  (Hornless and probably female.) 
  (See associated limb elements, page 179. This paper, Fig. 18.)

- Right fragment with $p_r$-$m_4$ and possibly associated right maxilla with $p^2$-$m^4$. ($M$) 
  F:A.M.31788 and A 1931. 
  This paper, Fig. 10A (maxilla).

- Left fragment with $p_r-m_4$. ($W$) 
  F:A.M.31322 1924.

- Right fragment with $p_r-p_4$. ($M+$) 
  F:A.M.31326 1930.

- Partial left maxilla with $p^4$-$m^3$. ($W+$) 
  F:A.M.31792 1932.

(cc) Slightly smaller than above, size approximating smallest $C. granti$ (F:A.M. 33718).

- Right fragment with $p_3$ and $m_1$-$m_4$. ($M+$) 
  F:A.M.31808 1928.

(d) Slenderer premolars.

- Right fragment with $p_r$-$p_4$. ($M+$) 
  F:A.M.31324 1924.
Two tentatively referred immature rami:

- Right ramus with dp1 alveolus and dp1-m3 (eruption).
- Right ramus with dp1-m2.

**PROBABLY REFERABLE, TWO SPECIMENS RECORDED UNDER Dromomeryx or Cervus?**

**MERRIAM (1919).—**

- dp1-m1. U.C.21218 Figured by Merriam, 1919, Fig. 136.
- p4-m4(br.). U.C.21219 Figured by Merriam, 1919, Fig. 137.

(See Limb Section, page 179.)

(2) **Rakomeryx jorakianus**, new species

*From Green Hills, Barstow, California*

**TYPE.**—Crushed posterior cranium with both horn-pedicles, and questionably associated right maxilla with p4-p4 and m2-m3.

(See Limb Section, page 179.)

(3) **Rakomeryx yermonensis**, new species

*From the Vicinity of Yermo, Mojave Desert, California*

**TYPE.**—Mandible with p1-m4.

- (Size moderate.) F:A.M.31800 From quarry 5 mi. E. of Yermo, 1932. This paper, Fig. 8.

**REFERRED FROM TYPE LOCALITY, 1932.—**

- Size of type:
  - Partial right ramus with p4(br.)-m4. (w+)
  - Right maxilla with p4-m3 (m1 br.). (m+)
  - F:A.M.31803
  - F:A.M.31791
Moderately smaller size:
Left ramus with $p_4$ (br.)–$m_1$. (m–) F:A.M.31799

Partial right maxilla with $p^1$–$m^1$. (m) F:A.M.31793

Immature:
Left fragment, $dp_r$–$m_1$. F:A.M.31804 This paper, Fig. 3.

(4) **Rakomeryx** species

From Virgin Valley, Nevada


*Dromomeryx* sp. a, near borealis (COPE), MERRIAM, 1911, ibid., VI, p. 280, Figs. 60, 62.

*Dromomeryx* sp. b MERRIAM, 1911, ibid., VI, p. 282, Figs. 61a, b.

**EXAMPLE.**—m/ (broken). U.C.10676 Figured by Gidley, 1908, Figs. 8 and 9.

**REFERRED.**—
Maxilla with $m^1$–$m^4$ (br.). U.C.11470 Figured by Merriam, 1911, Figs. 61a, b.

(No larger than *S. antilopinus*.)

$m_1$. U.C.11748 Figured by Merriam, 1911, Fig. 62.

(Larger-proportioned than U.C.11470.)

Triangular base of horn-pedicle. U.C.11628 Figured by Merriam, 1911, Fig. 63, under *Dromomeryx* species.

Partial forelimb. U.C.19417 Figured by Merriam, 1911, Figs. 60a, b.

John C. Merriam cites as longer and slenderer than Douglass' Montana specimen. (See Dromomerycene skeletal elements, page 180.)

(5) **Rakomeryx gazini**, new species

From Southeastern Oregon

*Blastomeryx borealis* COPE, referred COPE, 1886, Amer. Nat., XX, p. 368 (lists only).

Frick, Horned Ruminants. I—Cervidae

TYPE.—Partial left horn-pedicle.

C.I.T.351

From Skull Spring, S.E. Oregon.

Figured by Gazin, 1932, Fig. 16a.

REFERRED FROM TYPE LOCALITY.—

Partial right horn-pedicle.

C.I.T.453

Figured by Gazin, 1932, Fig. 16b.

Maxillary fragment.

C.I.T.449

Figured by Gazin, 1932, Fig. 17a.

Right ramal fragment with p<sub>r</sub>m<sub>1</sub>.

C.I.T.350

Figured by Gazin, 1932, Fig. 17b.

(p<sub>r</sub> anterior fossette formed.)

C. L. Gazin observes that the horn-pedicle is more robust and is markedly curved versus the Montana Dromomeryx.

The fragmentary evidence on which Palaeomeryx? sp. <i>a</i> and <i>b</i> is based (listed by Merriam and Sinclair, 1907, and by Gazin, 1932), from the Mascall of Oregon, may represent a very closely allied form or forms.

TENTATIVELY REFERRED FROM COTTONWOOD CREEK (not cited on Table I).—

Partial palate with p<sup>4</sup>-m<sup>3</sup>. A.M.8204

Cope Collection.

(Def.)

(Approximating in size Dromomeryx whitfordi, ref., F:A.M.31245.)

Fragmentary left tibia, A.M.8204X etc.

(See Dromomerycine skeletal elements, page 180.)

Fig. 14. Dromomeryx Douglass, Barbouromeryx, n.g., and Probarbouromeryx, n.subg.

X : A, A', B, cross sections; MA, auditory meatus; PN, posterior end nasals; PS, posterior border symphysis; 2, supra-orbital foramen.

F:A.M.31500, 31501 (rev.), 31503 (rev.) and P.U.12054, type, of D. <i>whitfordi</i>

Sinclair, from Sioux County, Nebraska.

(See also Figs. 2, 2A [F:A.M.31500] and pages 118, 117.)

F:A.M.31297, <i>D. pauniensis</i>, n.sp., type (B, rev.), from Pawnee Creek, Colorado.

(See page 116.)

A.M.8134 and 8133, rev., and 8132, genotype, of <i>D. borealis</i> (Cope), from Montana.

(See pages 115, 114.)

N.S.M.3-27-11-33, <i>B. trigonocorneus</i> (Barbour and Schultz), genotype, from Dawes County, Nebraska.

(See also Figs. 2 [cranium], 5, 7, 10 [dentition], 25 [limbs] and page 134.)

N.S.M.53— and 93-25-6-35, <i>P. sweeti</i>, n.subg. and sp., subgenotype and ref., from Morrill County, Nebraska.

(See page 135.)
Fig. 14. *Dromomeryx* Douglass (larger), *Barbouromeryx*, n.g., and *Probarbouromeryx*, n.subg. (smaller specimens), from the Tertiary of Nebraska, Colorado and Montana. × 1. (See legend, page 107.)
III, Dromomeryx Douglass and IIIA, Subdromomeryx, new subgenus

Figures 1c, 14A, 14B and (in part) 2, 2A, 3, 4, 4A, 6, 9, 10, 10A, 14;
Limbs (in part) 17, 18

Statement

The characters of the genus and subgenus, Dromomeryx and Sub-
dromomeryx, have been cited in the preceding discussion.

Douglass' deer, Dromomeryx, genotypic species D. borealis (Cope),
is based on a partial cranium from Montana. While the genus
at times has been thought of in connection with the ancestry of the
pronghorn, and the reconstruction of the head (see Figure 1, recon-
struction c) superficially is perhaps more suggestive of the pronghorn than
of any other living American ruminant, actually both dental and cranial
characters are Cervid. Compared to Antilocapra, the skull is larger, the
orbit and horns are more anteriorly placed, the cranium is propor-
tionately longer through the strangely produced occiput, the teeth,
rather than hypsodont, are very notably brachyodont, and the limb ele-
ments are heavy Cervid-proportioned.

The characters of the small elk-sized skull are best seen in the superb
specimen of an aged individual (Fig. 14), collected by Jack Wilson from
Sioux County. The new specimen permits the study of the disposition
of bones and sutures not preserved in any heretofore available specimen.
The outstanding features are the strong, forwardly directed supra-
orbital horn-pedicles, their prominent basal wings, and the orbits
lying deep sunk within the latter. The horn-pedicles, which are
deply grooved on the antero-outer face, form an angle of approximately
60° with the plane of the nasals. The position of the orbit and the
width of the pedicle flanges must have resulted in the living animal
having been extremely susceptible to attack from the rear. The dorsal
profile is moderately straight save for swellings over the posterior two-
thirds of the nasals and the brain case and the elevation of the back-
wardly and upwardly produced occiput. A narrow slit-like vacuity
parallels the anterior wing of the frontal, and a wide though shallow ant-
orbital depression occupies the lacrimal and malar areas. The muzzle is
elongate and slightly tapering, the nasal-premaxilla contact wide and
the anterior ends of nasals extend well beyond the contact. The speci-
men is broadest over the protruding flanges of the horn-bases and
abruptly constricted posterior to the same. Parietal crests pass back of
the horn-pedicles to merge in the sagittal crest, which is carried upward
on the narrow and much produced occiput (see A.M.8132). The pos-
terior horn of Cranioceras is very evidently no more than an extreme
adaptation of the Dromomerycine occiput. Scott (1895) observes, the
"... occiput is utterly unlike that of any existing ruminant and has
more the peculiar shape characteristic of Oreodontidae." The basi-
cranial axis is moderately bent. The anterior border of the orbits and
posterior edge of the palate lie opposite the m3. The wide glenoid sur-
face, moderate-sized paroccipital processes, prominent mastoids and
constricted auditory bulla and meatus are all preserved and well shown
in the specimen. The usual supra-orbital foramina occur at the inner
bases of the horn-pediciles; infra-orbital foramina above p2 and marked
parietal foramina anterior to the inion (A.M.8132).

Douglass observes that at least vestiges of portions of the lateral
metapodials are retained (these are not now exampled in the material);
that the humerus is proportionately larger than in Antilocapra; that the
radius and ulna are separate; that the trapezoid-magnum and navicular-
cuboid are united; that the distal keels on the metapodials are high;
and that the unguals are high and narrow.

The genus, genotypic species Dromomeryx borealis (Cope), was de-
scribed by Douglass in 1909. Previously such remains had been confu-
sed with Blastomeryx Cope and Palaeomeryx von Meyer. The genus
is well marked in the peculiarly forwardly directed paired horn-pediciles
with basal flange, dp1 retained, moderate premolars relative to molars,
and the molariform tendency in both p4 and p3, especially noteworthy
in the generally formed p4 anterior fossette. Among all the here-de-
scribed Dromomerycini dentitions, that of Dromomeryx comes perhaps
nearest to that of the modern deer. The premolars tend to be smaller-
proportioned; the p4 anterior fossette is closed (as it tends to be in Cra-
nioceras); a similar fossette may be developed in p3; the dp1 is retained;
and the diastema is shorter in contrast with Cranioceras.

W. D. Matthew (1918) observes: "Dromomeryx is undoubtedly allied by its
teeth to the European Palaeomeryx; its "horns" are of the giraffid type, distinct from
the deciduous antlers of cervids and merycodonts and from the true horns of the
Bovidae."

In addition to the three1 somewhat equal-sized geographic species
here recognized from Montana, Colorado and Nebraska, a smaller form,
Subdromomeryx, is witnessed in remains from Montana and Nebraska.
The partial cranium of the type of S. antilopinus in the Princeton Uni-
versity collection, described by William B. Scott (1895) and refigured
in the present paper (Fig. 14A), exhibits the base of a supra-orbital horn-

1 Douglass, 1909, p. 477, probably because of Matthew's citation of "Palaeomeryx" as occurring
in New Mexico and Pawnees Creek, Colorado, mistakenly tabulated Dromomeryx from both these
areas.
pedicle of the same general form but considerably smaller size than the genus proper. An unexpected series of partial skulls of *S. antilopinus* size has been secured in the Sheep Creek beds (fall of 1936) by Jack Wilson. The crania (Fig. 14B) indicate the considerable increase in height of the horn-pedicle in the aged individual, as compared to one which has just attained maturity. Two lower tooth series have the anterior fossette of p₄ closed. (A collection of mandibular rami from the same beds in which the anterior fossette of p₄ is unformed, is for the present held in a separate subgenus, *Bouromeryx*, under which they were described in my original manuscript.) For figures and comparison of limb elements, see page 169.

Summary of Six Dromomerycine Species

*Dromomeryx* (and *Subdromomeryx*), six species based on specimens showing the horn-pedicles.—

1. *Dromomeryx borealis* (Cope), genotypic species, from Montana.
   **Genotype.**—Partial cranium, A.M.8132 (Cope Coll.). This paper, *Fig. 14* (horn section).

2. *Dromomeryx pawniensis*, n.sp., from Pawnee Creek, Colorado.
   **Type.**—Top of cranium, F:A.M.31297. This paper, *Fig. 14*.

3. *Dromomeryx whitfordi* Sinclair, from Sioux County, Nebraska.
   **Type.**—Partial left and right horn-pedicles, P.U.12054. This paper, *Fig. 14*.

4. *Subdromomeryx antilopinus* (Scott), from Montana.
   **Type.**—Portions of cranium and skeletal elements, P.U.10401. This paper, *Figs. 10*, 14A, 18.

4a. *Subdromomeryx scotti*, n.subg. and sp., from Sioux County, Nebraska.
   **Subgenotype.**—Partial cranium, F:A.M.33758. This paper, *Fig. 14B*.

4b. *Subdromomeryx wilsoni*, n.sp., from Sioux County, Nebraska.
   **Type.**—Partial cranium, F:A.M.33800. This paper, *Fig. 14B*.

(*Dromomeryx* citation of Douglass (1909), from New Mexico, apparently following Matthew (1909), "*Palzomeryx teres*"—see footnote, page 110; Texas *Dromomeryx* ? *angustidens* Hay, 1924, p. 16, Pl. ii, Figs. 6 and 7, possibly a camelid.)
Fig. 14B. *Dromomeryx* Douglass (F:B:AM.32868), *Subdromomeryx*, n. subg., and *Bouromeryx*, n. subg. (F:B:AM.34050 and 34024), from the Late Tertiary of Nebraska.

× ½ (dentition × 1). (See legend, page 115.)
Detailed Lists of Types, Referred Specimens, and Synonymy

*Dromomeryx*, total available specimens, 156; numbered and listed, 129; uncatalogued, 27. *Subdromomeryx*, total available specimens, 76; numbered and listed, 74; uncatalogued, 2.

(1) **Dromomeryx borealis** (Cope), genotypic species

From Montana


*Blastomeryx borealis* (COPE), MATTHEW, 1908, ibid., XXIV, p. 546.


*Dromomeryx borealis* (COPE), DOUGLASS, 1909, Ann. Carn. Mus., V, pp. 457-471, Pls. LXIX-LXI; Pl. LXII, Figs. 3, 4; Pl. LXIII, Figs. 1, 3, 6; Text-Figs. 1-3.

Genotype.—Partial cranium with left horn-pedicle and cheek teeth. 
Cope Coll. A.M.8132 From Deep River beds, Montana. 
Figured by Cope, 1889, Figs. 16, 19; by Douglass, 1909, Fig. 1; this paper, Fig. 14 (horn section).

Referred.¹—

Cope Collection specimens:
Craniun with bases of horn-pedicles and cheek teeth. A.M.8133 This paper, Fig. 14 (horn section).

¹ Secured by Charles Falkenbach (1936) from E. New Chicago: F:A.M.
Partial mandible including pr-ml. ........................................ (w) 34190
Slightly smaller right ramus with pr-ml ................................ (w) 34191
(Not included in count.)

Fig. 14A. *Dromomeryx* Douglass and *Subdromomeryx*, n. subg. 
× 1. 1, vacuity; 2, supra-orbital foramen.
C.M.827, D. borealis (Cope), ref., from Montana, occiput after A.M.8132. (Y, horn as restored by Douglass, 1909.)
(See also Figs. 9, 10A and page 115.)
P.U.10401, S. antilopinus (Scott), type, from Deep River, Montana. (See also Figs. 10 [dentition], 18 [limbs] and page 123.)
Frick, Horned Ruminants. I—Cervidae

Posterior cranium with base of horn-pedicle.  
(Largest horn-pedicle.)

Carnegie Museum specimens:

Major portion of skull, ramus, and skeletal elements.  
(Is best of the here listed specimens.)

Palate, occiput, and skeletal elements.

(And see Dromomerycine limb elements, page 180.)

C. A. Kinsey Collection specimen:

Photographs show a partial skull with nicely preserved dentition from White Cliff, Yellowstone River.

(2) **Dromomeryx pawniensis**, new species

*From Pawnee Creek, Colorado*


---

**Fig. 14B.** *Dromomeryx Douglass*, *Subdromomeryx*, n.subg., and *Bouromeryx*, n.subg.

× ⅔ (dentition × 1).  A, cross section.

F:B:A.M.32868, *D. whitfordi*, var., from Dawes County, Nebraska.  
(See page 122.)

F:A.M.33758 (subgenotype), 33757, 33759 (adolescent) and 32835, *S. scotti*, n.subg. and sp., from Sioux County, Nebraska.  
(See pages 123, 124.)

F:A.M.33800, *S. wilsoni*, n.sp., type, from Sioux County, Nebraska.  
(See page 126.)

F:B:A.M.34050 (rev.) and 34024, (?)*Bouromeryx pseudonebrascensis*, n.sp., ref., from Dawes County, Nebraska.  
(See page 132.)
Type.—Top of cranium with partial horn-pedicles.  

F:A.M.31297  From near Pawnee Buttes.  
Collected by the John C. Blick party, 1931.  
This paper, Fig. 14.

Referred, Collected by the John C. Blick Party.—


Twelve partial rami of moderate and less moderate-sized individuals. (The form of the p₄ is shown best in slightly worn F:A.M.31302 and 31301 and unworn F:A.M.31306.)

Moderate-sized:

Partial right ramus with p₂—m₂. (M)

F:A.M.31306  From Horse Quarry, 1932.  
This paper, Figs. 6 (M), 9.

Right fragment with p₂ alveolus, p₃—m₄. (M+)

F:A.M.31301**  From east of camp, 1932.

Partial right ramus with p₂—m₃ (br.). (W)

F:A.M.31303  From Section 8, 1931.

Right fragment with m₂ (br.)—m₃. (M+)

F:A.M.31308  1932.

Right fragment with p₃—m₄ (m₁ br.). (M)

F:A.M.31302  1931.

Left fragment with m₁—m₂. (W++)

F:A.M.31300  From Section 8, 1931.

Right fragment with m₁—m₄. (M+)

F:A.M.31305  1933.

Right fragment with m₂ (br.)—m₄. (W)

F:A.M.31310  From Section 8, 1931.

Smaller-sized:

Left ramus with symphysis, I.roots, p₁—m₂. (M+)

F:A.M.31299**  From Section 8, 1931.  
This paper, Fig. 6.

Right fragment with p₂ (br.)—m₄. (W)

F:A.M.31304  From Mastodon Quarry, 1931.

Right fragments with p₁—p₄, m₂—m₄. (M+)

F:A.M.31307  From Lower Mastodon Quarry, 1932.

Right fragment with p₂ alveolus and p₁—m₂. (M)

F:A.M.31309  From Section 8, 1931.

**See page 117, footnote.
Maxillary fragments:

Right m₁-m₂. F:A.M.31311
Right m₁, m₂ and left m₁. F:A.M.31317C, A and B

Two rami of the American Museum Expedition, 1901:

Right ramus with diastema and p₃-m₄. (w++)  A.M.9450
Partial right ramus with p₄(br.─m₃. (w+)   A.M.9451

See Limb Section, page 181.

(3) Dromomeryx whitfordi Sinclair

From Sioux County, Nebraska


Dromomeryx borealis (COPE), MATTHEW, 1924, ibid., p. 72 (cited as also present).

Type.—Partial left and right horn-pedicles. P.U.12054 Figured by Sinclair, 1915, Loc. 10000C Fig.17; this paper, Fig.14.

Since the editing of the present pages, a beautifully preserved skull (Fig. 14), a cranial saddle with portions of both horn-cores and orbits, and several mandibular rami have been secured from the Echo Quarry of Sioux County by Jack Wilson. The skull has been described on a preceding page. The rami include individuals of moderate to largest size. One of the new rami is remarkable in exhibiting an abnormal m₃ with double-columned heel (Fig. 9). The ¹p₂ anterior fossette is less formed than usual, and in one specimen (F:A.M.31506) the p₄ anterior fossette is open. The posterior half of a skull with orbital horn-cores, and other remains collected in Dawes County by Ted Galusha, indicate the presence of this or a closely allied species.

Referred remains in the American Museum and Princeton Museum collections from the vicinity of the type locality, Sinclair Draw, Snake

¹ For tendency to formed anterior fossette in p₃ see specimens starred (***) in detailed lists: Sioux County, pages 118, 119, 120; Dawes County, page 122; and Pawnee Creek, page 116.
Creek area, represent three size variants: (a) largest-sized teeth, typified by the well-preserved specimens, A.M.22386 and 18873; (b) intermediate, exampled by P.U.12086; and (c) moderate-sized, exampled by (F:A.M.31226 and) A.M.18872A. The last approximate the average of the Pawnee Creek remains. In the Sinclair paratype right ramus, P.U. 12086, Sinclair's (1915) figure 18, the p₂ is slenderer and the p₄ anterior fossette less formed than the average.

**REferred REMains Collected FROM Echo Quarry by Jack Wilson, 1934-35.—**

- Skull, left side beautifully preserved, right side less well preserved and horn-pedicle broken, occiput damaged. (w++)
- B.L. = 353 mm.
- Much worn p²-m₂ = 95 versus
- Moderately worn F:A.M.31195 = 100

The specimen, characterized on a preceding page, for the first time shows the form of the facial vacuity, orbital depression, bullae, etc.

- Cranial saddle. F:A.M.31503 This paper, Fig. 14.
- Frontlet and horn-core. F:A.M.31501 This paper, Fig. 14.
- Left adolescent horn-pedicle. F:A.M.31502

(a) Large to largest:
- Left fragment, p₂-m₃. (M+) F:A.M.31505
- Right ramus, p₃-m₃. (M+)
- Left ramus, p₂-m₃. (w+)
- Immature left ramus with diastema and dp₁-m₃ (un-erupted).
- Left ramus with symphy-sis and p₂-m₃ (note peculiar m₃ heel with fourth crest).
- Right ramus with p₃ al-veolus and p₃-m₃. (M+)
- Left ramus with p₃-m₃ (br.). (M)

**See page 117, footnote.
Left ramus with \( p_2 \) alveolus and \( p_3 - m_2 \). (w)  
Right maxilla, \( p^2 - m^2 \). (m+)

(c) Moderate-sized:
- Left ramus, symphysis, /Is alveoli, \( p_3 - m_3 \)(br.). (w)
- Left ramus with symphysis and \( p_1 - m_2 \). (w+)

**REFERRED, PREVIOUSLY COLLECTED FROM THE GENERAL AREA.—**

**TWENTY-EIGHT RAMI**

(a) Largest:
- Right ramus with diastema, \( p_3 - m_4 \)(br.). (m+)
  - A.M.22386** From Sinclair Draw, Ashbrook Pasture, 1927.  
  - This paper, *Fig. 6.*
- Right ramus with symphysis, \( dp_1 \) alveolus and \( p_3 - m_2 \). (w)
  - A.M.18873** From Quarry A, Sinclair Draw, 1921.
- Partial left ramus with \( p_1 - m_2 \). (m+)
  - F:A.M.31243 From W. Sinclair Draw, 1933.

(b) Intermediate-sized:
- Partial left ramus with \( p_3 - m_3 \). (m+)
  - F:A.M.31228 From W. Sinclair Draw, 1933.  
  - This paper, *Figs. 6, 9.*
  - (\( m_3 \) smaller than in other specimens.)
- Partial right ramus with \( p_3 - m_2 \). (m+)
  - P.U.12086 From Snake Creek beds, 1914.  
  - Figured by Sinclair, 1915, *Fig. 18* (as paratype).
- Partial right ramus with \( p_3 \)(br.)-\( m_2 \). (w+)
  - F:A.M.31227 From W. Sinclair Draw, 1933.
- Partial left ramus with \( p_3 - m_2 \). (w)
- Right fragment with \( p_3 - m_2 \). (m)
  - A.M.17331 From Snake Creek area, 1916.
- Left fragment, \( p_4 - m_2 \). (m+)
- Right fragment with \( p_4 - m_2 \). (m+)
  - F:A.M.31235 From E. Sinclair Draw, 1933.
<table>
<thead>
<tr>
<th>Right fragment with p₃-m₃. (w)</th>
<th>F:A.M.31234</th>
<th>From E. Sinclair Draw, 1933.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left fragment, p₄-m₄. (M+)</td>
<td>A.M.17334</td>
<td>From Snake Creek area, 1916.</td>
</tr>
<tr>
<td>Left fragment with p₂ alveolus and p₃-m₃. (w)</td>
<td>A.M.17332</td>
<td>From Snake Creek area, 1916.</td>
</tr>
<tr>
<td>Left fragment with p₁-m₁ (br.) and m₃. (M+)</td>
<td>A.M.22362**</td>
<td>From Ashbrook Pasture, 1927.</td>
</tr>
<tr>
<td>Right fragment with p₁-m₁. (M)</td>
<td>F:A.M.31233</td>
<td>From E. Sinclair Draw, 1933.</td>
</tr>
<tr>
<td>Right fragment with m₁-m₃. (M+)</td>
<td>F:A.M.31244</td>
<td>From W. Sinclair Draw, 1932.</td>
</tr>
<tr>
<td>Left fragment, p₂-m₁. (w)</td>
<td>F:A.M.31232</td>
<td>From E. Sinclair Draw, 1933.</td>
</tr>
<tr>
<td>Left fragment with m₁-m₃. (w+)</td>
<td>A.M.17335</td>
<td>From Snake Creek area, 1916.</td>
</tr>
<tr>
<td>Left fragment with p₁-m₂ (br.). (M+)</td>
<td>A.M.14123</td>
<td>From Snake Creek area, 1908.</td>
</tr>
<tr>
<td>Left fragment, p₂-m₃. (M+)</td>
<td>F:A.M.31231</td>
<td>From W. Sinclair Draw, 1933.</td>
</tr>
<tr>
<td>Left fragment with m₂-m₃. (M+)</td>
<td>F:A.M.31225</td>
<td>From Sinclair Draw, 1933.</td>
</tr>
<tr>
<td>Right fragment with m₃-m₃. (M+)</td>
<td>F:A.M.31236</td>
<td>1932.</td>
</tr>
<tr>
<td>Right fragment with m₄-m₄. (M+)</td>
<td>F:A.M.31237</td>
<td>From E. Sinclair Draw, 1933.</td>
</tr>
<tr>
<td>Left fragment with m₄-m₄. (w+)</td>
<td>A.M.14124</td>
<td>From Snake Creek area, 1908.</td>
</tr>
<tr>
<td>Right fragment with m₅-m₅. (M)</td>
<td>A.M.14125</td>
<td>From Snake Creek area, 1908.</td>
</tr>
</tbody>
</table>

(c) Moderate-sized, slender (reference questioned):

<table>
<thead>
<tr>
<th>Left ramus with symphysis, p₂ alveolus, p₃-m₃. (M+)</th>
<th>F:A.M.31226</th>
<th>From E. Sinclair Draw, 1933.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left fragment with p₁-m₃ (br.). (M+)</td>
<td>A.M.18876**</td>
<td>From Quarry B, Sinclair Draw, 1921.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(/m₃ small. Best examples of smaller.)</td>
</tr>
<tr>
<td>Left fragment with p₃-m₃. (M+)</td>
<td>A.M.18872A**</td>
<td>From Quarry A or B, Sinclair Draw, 1921.</td>
</tr>
</tbody>
</table>
EIGHT IMMATURE RAMI

Left ramus with symphysis, dp1 alveolus, dp2-m2 (erupting) and germs.
A.M.18875 From Quarry A or B, Sinclair Draw, 1921.
This paper, Fig. 5.

Left ramal fragment with dp1-m1 and germs (dp4-
F:A.M.31239 From Sinclair Quarry, 1932.
dp4 br.).

Left ramal fragment with
dp1-dp2 alveoli, dp3-m1
F:A.M.31240 From E. Sinclair Draw, 1933.
and germs.

Right dp1 alveolus and
dp2-m2.
F:A.M.31241 From E. Sinclair Draw, 1933.

Right dp2-m1.
F:A.M.31242 From Quarry No. 1, 1932.

Left dp1 alveolus-dp1.
F:A.M.31202 From Sinclair Draw, 1933.

Left dp4-m1 and alveoli.
A.M.17336 From Snake Creek area, 1916.

Left dp3-m1.
A.M.17333 From Snake Creek area, 1916.

THREE MAXILLE

Right maxilla with p4-m3.
(m) F:A.M.31245 From Sinclair Quarry, 1932.
This paper, Fig. 10A.

Right maxilla, p4-m1. (A) A.M.18874 From Sinclair Draw, 1921.

Right m2-m3. (m) A.M.14124A From Snake Creek area, 1908.

Also (a) two premolars and fourteen somewhat larger detached molars, and (b)
four premolars and seven more moderate-sized detached molars.

REFERRED LIMB ELEMENTS (see Limb Section, pages 181, 182).—

EXAMPLED.—

Larger size:

Right metatarsus, 235 mm. F:A.M.31881 From E. Sinclair Draw, 1933.
This paper, Fig. 17.

Note right metacarpus, F:A.M.31873 (this paper, Fig. 18), from E. Sinclair Draw, listed under Oranioceras, possibly may represent a small-sized individual of Dromomeryx. (See page 176.)
Dromomeryx whitfordi, Var.

From Observation Quarry, Dawes County, Nebraska

Collected by Ted Galusha, 1936

**Example.**—Posterior half of cranium with right horn-core intact, and produced and elevated occipital crest. 

| F:B:A.M. | Fig. 14B | 32868 |

**Referred.**—

Cranial saddle with both horn-pedicles, basal flanges indicating larger individual than above. [From Lone Tree Prospect.] 34040

**Eleven Mandibular Rami**

<table>
<thead>
<tr>
<th>Rami</th>
<th><strong>(w+)</strong></th>
<th>33754</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandible with symphysis and p₂-m₂</td>
<td>(w++)</td>
<td>34020</td>
</tr>
<tr>
<td>Left ramus with symphysis and p₂-m₂</td>
<td>(m++)</td>
<td>33777</td>
</tr>
<tr>
<td>Left ramus with diastema and p₂-m₂</td>
<td>(m)</td>
<td>33777</td>
</tr>
<tr>
<td>Left ramus with symphysis and p₂-m₂</td>
<td><strong>(w)</strong></td>
<td>33750</td>
</tr>
<tr>
<td>Left ramus with symphysis and p₂-m₂</td>
<td>(w)</td>
<td>33752</td>
</tr>
<tr>
<td>Left ramus with symphysis and p₂-m₂</td>
<td><strong>(w++)</strong></td>
<td>33755</td>
</tr>
<tr>
<td>Right ramus with p₂-m₂</td>
<td><strong>(w)</strong></td>
<td>34020A</td>
</tr>
<tr>
<td>Right symphysis and p₂-m₁</td>
<td>(w)</td>
<td>33770A</td>
</tr>
</tbody>
</table>

Three immature rami:

<table>
<thead>
<tr>
<th>Rami</th>
<th><strong>(w+)</strong></th>
<th>33771</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left immature ramus with diastema and dp₂-m₁</td>
<td>Questions.</td>
<td>33777</td>
</tr>
<tr>
<td>Right ramus with diastema, dp₂ and dp₄(br.)-m₂</td>
<td>(w)</td>
<td>33778</td>
</tr>
</tbody>
</table>

**Two Maxillary Specimens**

<table>
<thead>
<tr>
<th>Rami</th>
<th><strong>(w)</strong></th>
<th>33753</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left p²-m²</td>
<td>(w)</td>
<td>34021</td>
</tr>
</tbody>
</table>

**Tentatively Referred** (smaller-toothed).—

**Three Immature Rami**

<table>
<thead>
<tr>
<th>Rami</th>
<th><strong>(w+)</strong></th>
<th>34041</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with diastema and p₁-m₂</td>
<td>(m+)</td>
<td>34042</td>
</tr>
<tr>
<td>Right fragment with p₁ alveolus, dp₂-m₁</td>
<td>(w+)</td>
<td>34043</td>
</tr>
</tbody>
</table>

Referred limbs, page 182.

**Questionably Referred from Gilmore Quarry, Dawes County, Collected by Ted Galusha, 1935.**—

<table>
<thead>
<tr>
<th>Rami</th>
<th><strong>(w)</strong></th>
<th>1-20-7-35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right p₄-m₁</td>
<td>(m+)</td>
<td>32879</td>
</tr>
<tr>
<td>Right m₁(br.)-m₂</td>
<td>(w+)</td>
<td>32879A</td>
</tr>
<tr>
<td>Fragment with right m²-m₄</td>
<td>(w)</td>
<td>1-20-7-35</td>
</tr>
</tbody>
</table>

**See page 117, footnote.**
(4) **Subdromomeryx antilopinus** (Scott)

From Deep River, Montana


*Dromomeryx antilopinus* Scott, 1913, A History of Land Mammals in the Western Hemisphere, p. 237, Fig. 128.

**Type.**—Portions of cranium bearing horn-pedicle, broken p¹–p⁴ and m¹–m²; also partial elements of both fore and hind limbs and feet, considered as of same individual (see details under skeletal elements, page 182).

m¹–m² = 44 mm. (and approximating *B. americanus*, ref., C.M.706).

**REFERRED² FROM DEEP RIVER.**—

Right p²–m². (m+). A.M.8134A Cope Collection.

Anteroposterior length p²–m² = 43 mm. (Teeth small, broken; specimen formerly placed with *D. borealis* and never before prepared.)

Right fragment with p₄. (p₄ fossa closed.) A.M.21311 From 7 miles S.E. of Fort Logan, 1925.

(4a) **Subdromomeryx scotti**, new subgenus and species

From Greenside Quarry, Sioux County, Nebraska, 1936

**Subgenotype.**—Skull (nasals and premaxilla missing) with complete dentition and portions of both horn-pedicles. (w)

**REFERRED.**—

Skull, including left premaxilla, horn-pedicles and complete dentition. (m+). F:A.M.33757 This paper, *Fig. 14B*.

(Adolescent individual, horn-pedicles short.)

---

¹ Secured by Charles Falkenbach (1936) from E. New Chicago:

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.34192</td>
<td>Right fragmental ramus with m³–m₄ (w)</td>
</tr>
</tbody>
</table>

(The above specimen not included in the general count of specimens.)
Posterior two-thirds of skull with left horn-pedicle and \( p^1-m^3 \) \( (m^3 \text{ erupting but unworn, horn-pedicle notable smaller than in above specimen. Horn very suggestive of } \textit{Barbouromeryx trigonocorneus}) \)

Right mandibular ramus with \( p_1-m_3 \) \( (m+) \)
\( (p_4 \text{ anterior fossette closed.}) \)

**Tentatively Referred (Slenderer-Toothed).—**

A series of mandibular rami from the Greenside Quarry (type locality), and from Thomson Quarry, that differ from the one above-listed ramus in the open character of the \( p_5 \), and that are distinguished from the specimens grouped below under \textit{Bouroumeryx} by their notably slender and less brachydont molars, are very tentatively held as a separate section under this subgenus. The proportionately large and reduced premolars and subhypsodont-tending molars are suggestive of a stage intermediate to the Sioux County (Thomson Quarry) \textit{Sinclairomeryx} and the more typical of the Sioux County \textit{Bouroumeryx}. The specimens are divided between subgroups \( (a) \) diastema short, premolars moderate and \( (b) \) diastema longer, premolars somewhat reduced.

\( (a) \) Diastema short, premolars moderate:

From Greenside Quarry:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A:M.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with symphysis and ( p_1-m_3 )</td>
<td>32487</td>
<td>( (m+) ) Figs. 4, 4A</td>
</tr>
<tr>
<td>Right ramus with symphysis and alveoli, ( p_1-m_3 )</td>
<td>32494</td>
<td>( (w+) )</td>
</tr>
<tr>
<td>Right fragment with symphysis and ( p_1-m_2 )</td>
<td>32498A</td>
<td>( (w) )</td>
</tr>
<tr>
<td>Left ramus with symphysis and ( p_1-m_2 )</td>
<td>32493</td>
<td>( (w) )</td>
</tr>
<tr>
<td>Right ramus with symphysis and ( p_1(br.)-m_4 )</td>
<td>32497</td>
<td>( (w++) )</td>
</tr>
<tr>
<td>Right fragment with ( p_1 ) and ( m_1-m_3 )</td>
<td>32496A</td>
<td>( (a) )</td>
</tr>
<tr>
<td>Right fragment with ( p_1-m_3(br.) )</td>
<td>32497A</td>
<td>( (m++) )</td>
</tr>
</tbody>
</table>

From Thomson Quarry:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A:M.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with symphysis and ( p_1-m_3 )</td>
<td>31212</td>
<td>( (m) ) Figs. 5, 7</td>
</tr>
</tbody>
</table>

Length of tooth series approximating \textit{Bouroumeryx milleri}; the tooth series being of nearly the same length but the teeth somewhat slenderer, the \( /p_5 \) proportionately larger, the \( /m_5 \) smaller and the diastema still shorter than in A.M.21533.

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A:M.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with ( p_1(br.)-m_3 )</td>
<td>31218</td>
<td>( (m+) )</td>
</tr>
</tbody>
</table>
Right ramus with p4(br.)–m3

Right fragment with m1–m4(br.)

(b) Diastema longer, premolars somewhat reduced:

From Greenside Quarry:

Right ramus with symphysis and p4–m3
Left ramus with symphysis and p4–m3
Left ramus with symphysis and p4–m3
Right ramus with symphysis and p4–m3 (m3 br.)
Right ramus with symphysis and p4–m3 (p2 and p4 br.)
Right fragment with p4–m3 (P2 and P4 br.)

Five immature rami:

Immature left ramus with diastema and dp4–m1
Immature left ramus with diastema and dp2–m1
Right ramus with diastema, p1 alveolus and dp3–m4 (erupting)
Right ramus with diastema, p1 alveolus and dp3–m1
Right ramus with diastema and dp3–m4 (no sign of p1 alveolus)

Questionably referred (with larger m3):

Right ramus with symphysis and p4–m3
Left m1–m3
Left fragment with m3

A fragmental mandibular specimen, with teeth of the general size of F:A.M. 31212, is worthy of particular notice. The specimen (F:A.M. 32499), from Greenside Quarry, is remarkable in the retention of what seems to be a p1. The tooth is diminutive and is only slightly separated from the p2.

Left ramus with (?)p1 and p4–m3

Doubtful. From Long Quarry [probably distinct species (4aa)]:

Length of diastema unknown, teeth tending smaller and slenderer-crowned:

Left p4–m3
Left p2 alveolus and p4–m3
Right p4–m3
(4b) **Subdromomeryx wilsoni**, new species

From Thomson Quarry, Sioux County, Nebraska

**TYPE.**—Posterior one-half of skull with both horn-pedicles.

(F: A. M. 33800 1936. This paper, Fig. 14B.)

(The small size of the cranium and the anteroposterior and transverse slenderness of the horn-pedicle bases contrast with the remains described above under *S. scotti.*)

**REFERRED.**—

From Thomson Quarry, 1934 and 1936:

F: A. M.

- Left mandibular ramus with $p_2$ base–$m_1$ ($p_4$ closed) ........ (M+) 32500
- Left ramus with $p_2$–$m_2$ ($p_4$ open) ................ (W+) 32888

Three maxillae:

- Right maxilla with $p^2$–$m^2$ ....................... (M) 32889
- Right maxilla with $p^2$–$m^2$ ....................... (W+) 32889A
- Left maxilla with $p^4$–$m^2$ .......................... (W) 32889B

Doubtful. From Long Quarry, 1935 [probably distinct species (4bb)]:

- Right $m_2$–$m_4$ .............................. (M) 32897
Frick, Horned Ruminants. I—Cervidae

Subfamily 3.—Barbouromerycinae

IV. BOUROMERYX, NEW SUBGENUS
V. BARBOUROMERYX, NEW GENUS
VA. PROBARBOUROMERYX, NEW SUBGENUS
VB. PROTOBARBOUROMERYX, NEW SUBGENUS

Figures (in part) 2, 3, 4, 4A, 5, 7, 10, 14; Limbs (in part) 25

Statement

The Late Tertiary Bouromeryx, n.subg., and Middle Tertiary Barbouromeryx, n.g., Probarbouromeryx, n.subg., and Protobarbouromeryx, n.subg., have been mentioned in the introductory discussion, page 49.

Bouromeryx, n.subg., is allowed to embrace a large and varied series of mandibular dentitions characterized by short-crowned molars, open P4, and (where observable) short-tending diastema (page 130). While the range of individual and sexual variation is unknown, a number of distinct species are evidently involved. For convenience the remains are divided between “superspecies” (“S” 1–3) embracing six species and subspecies:

“S”-1. Species (1), (1b), (2) and (3), moderate-sized, from Sioux County, Nebraska, Montana and Colorado; and (1a), small-sized, from Sioux County, Nebraska. Species (1) and (1a), from the Sheep Creek zone, tend to exhibit relatively large-proportioned premolars.

“S”-2. Species (1c), large-sized, from Dawes County (Observation Quarry), Nebraska, differs from the preceding species in its notably larger size and shorter-proportioned diastema.

“S”-3. Species (1d), moderate-sized, from Dawes County (Observation Quarry), Nebraska, with longer-proportioned diastema. The specimens, save for their smaller size, tend to recall Procranioceras.

Orbital horn-cores [F:B:A.M.34050 from Dawes County (Observation Quarry)] are more like Cranioceras than Dromomeryx in the external base lacking the indentation and outward flare characteristic of the latter. It is believed that the Dawes specimens pertain to the Bouromeryx species of the mandibular rami. The subgenus, perhaps, might be referred better to the Cranioceratinae than to the Barbouromerycinae.

Barbouromeryx is well seen in the genotypic species, B. trigonocorneus (Barbour and Schultz), from the vicinity of Antelope Creek, Dawes County, Nebraska. The type, excepting for small size and relatively
short and strongly bulbous-tipped horn-pedicles with bare suggestion of postorbital flanges, recalls Dromomeryx proper. Its most striking characters—the production of the occiput and elevation of the sagittal crest, the anteriorly set orbit, the brachyodont and unreduced premolars and the heavy-proportioned limbs—as observed by Barbour and Schultz, are Dromomerycine. The metapodials are barely as long as in Parablastomeryx gregorii. An enlarged upper canine, found in apparent association with the type specimen, points to the males of the genus being armed with sabre-like canines, as in Aletomeryx and Blastomeryx. Barbouromeryx seems to differ from Dromomeryx in size, canines, open p1 and less elongate horn-pedicles. This brachyodont genus is definitely more conservative than contemporary Aletomeryx. The unique type specimen differs from Aletomeryx in the slightly larger size, more prominent sagittal crest, more produced occiput, heaver and shorter horn-pedicles, notably more brachyodont molars and unreduced premolars. The teeth are practically unworn; with age it is highly probable that, as in Aletomeryx, the height of the horn-pedicles would somewhat increase. There is a large suborbital vacuity, the glenoid is broad and the bullae moderate. Probarbouromeryx and Protobarbouromeryx are erected for small forms from the Middle Tertiary. In the late the premolars are proportionately reduced. This reduction of the premolars, were it not for the lowness of the tooth crowns, would suggest that the species occupied middle ground between Barbouromeryx and Aletomeryx.

Summary of Barbouromerycine Species

Late Tertiary (large to moderate size).

(1) Bouromeryx milleri, n.subg. and sp., from Sioux County, Nebraska.

Subgenotype.—Mandible, A.M.21533. This paper, Figs. 5, 7.

(1a) Bouromeryx submilleri, n.sp., from Sioux County, Nebraska.

Type.—Right ramus, F:A.M.33729.

(1aa) (?)Bouromeryx parvus (Cook), from Sioux County, Nebraska.

Type.—Partial left ramus, H.C.295.
Frick, Horned Ruminants. I—Cervidae

(1b) Bouromeryx nebrascensis, n.sp., from Echo Quarry, Sioux County, Nebraska.
   Type.—Right ramus, F:A.M.31193.

(1c) Bouromeryx supernebrascensis, n.sp., from Dawes County, Nebraska.
   Type.—Right ramus, F:B:A.M.33733.

(1d) (?)Bouromeryx pseudonebrascensis, n.sp., from Dawes County, Nebraska.
   Type.—Left ramus, F:B:A.M.33735.

(2) (?)Bouromeryx americanus (Douglass), from Montana.
   Type.—Left ramus, C.M.705.

(2a) Bouromeryx madisonius (Douglass), from Montana.
   Type.—Ramal fragment, C.M.755. (Possibly Cranioceras.)

(3) Bouromeryx pawniensis, n.sp., from Pawnee Creek, Colorado.
   Type.—Partial right ramus, F:A.M.31290. This paper, Fig. 7.

Middle Tertiary (smaller size.)

(4) Barbouromeryx trigonocorneus (Barbour and Schultz), genotypic species, from Antelope Creek, Dawes County, Nebraska.
   Genotype.—Partial skull, both rami, and skeletal elements, N.S.M. 3-27-11-33. This paper, Figs. 2, 5, 7, 10, 14, 25.

(5) Probarbouromeryx sweeti, n.subg. and sp., from Bridgeport, Morrill County, Nebraska.
   Subgenotype.—Right and left frontlets with portions of horn-pedicles, N.S.M.53-25-6-35. This paper, Fig. 14.

(6) Protobarbouromeryx marslandensis, n.subg. and sp., from Box Butte County, Nebraska. (Premolars somewhat reduced.)
   Subgenotype.—Left ramus, N.S.M.3-24-7-34. This paper, Figs. 4, 4A.
Detailed Lists of Types, Referred Specimens, and Synonymy

IV. Bouromeryx, new subgenus, V. Barbouromeryx, new genus, VA, Probarbouromeryx, new subgenus, and VB, Proprotobarbouromeryx, new subgenus

Bouromeryx, total available specimens, 66. Barbouromeryx, total available listed specimens, 11. Probarbouromeryx, total available specimens, 77; numbered and listed, 62; uncatalogued, 15. Proprotobarbouromeryx, total available listed specimens, 2.

(See preceding statement of characters.)

(1) Bouromeryx milleri, new subgenus and species

From Sioux County, Nebraska

Subgenotype.—Well preserved mandible with symphysis and p_r-m_3 of both sides. (M+)

A.M.21533 Collected by Paul C. Miller, 1925, from "Sheep Creek," Aphelops Draw. This paper, Figs. 5, 7.

<table>
<thead>
<tr>
<th></th>
<th>(?) Subdromomeryx scotti</th>
<th>B. parvus H.C.295</th>
<th>B. milleri A.M.21533</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F:A.M.31212</td>
<td>(according to Cook)</td>
<td></td>
</tr>
<tr>
<td>Post. edge symphysis—post. edge m_1...</td>
<td>104 mm.</td>
<td>111 mm.</td>
<td>115 mm.</td>
</tr>
<tr>
<td>Ant. edge p_2 alveolus—post. edge m_1...</td>
<td>77.5</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>p_r-m_3...</td>
<td>58</td>
<td>56</td>
<td>61.5</td>
</tr>
<tr>
<td>p_4...</td>
<td>12.5</td>
<td>11</td>
<td>12.2</td>
</tr>
<tr>
<td>m_2...</td>
<td>20</td>
<td>20</td>
<td>21.5</td>
</tr>
<tr>
<td>Depth ramus below p_4...</td>
<td>20</td>
<td>24</td>
<td>20.4</td>
</tr>
</tbody>
</table>

Questionably Referred from Sioux County Localities.—

F:A.M.

Left fragment with p_r-m_2... (m) 1933 31207
Right fragment with p_r-p_4... (w) 1933 31208
Right fragment with symphysis and p_2(br.)—p_4... (w) 1933 31210

A.M.

Right ramus with symphysis, dp_1 alveolus, dp_3—dp_4 1923 20531
Left dp_r—m_1... 1922 18958

F:A.M.

Right maxilla with m_1—m_3 and p_4 root... (M+) 1933 31209

(Limb elements may possibly be represented in the series listed under Subdromomeryx scotti, page 183.)
(1a) **Bouromeryx submilleri**, new species
From Greenside Quarry, Sioux County, Nebraska
(Size small)

**Type.**—Right ramus with p$_2$-m$_3$. (Size of *Subdromomeryx wilsoni*, F:A.M. 32500, and *Sinclairomeryx riparius*, var., F:A.M. 32469.). (m) 33729

(1aa) (?) **Bouromeryx parvus** (Cook)
From Sioux County, Nebraska


**Type.**—Left partial ramus H.C.295 From Snake Creek beds, 1914.
Figured by Cook, 1922, p. 21.

(1b) **Bouromeryx nebrascensis**, new species
From Echo Quarry, Sioux County, Nebraska

**Type.**—Right ramus with p$_2$-p$_3$ alveoli and p$_4$-m$_3$...... (w) 1935 31193

**Referred.**—
Immature left ramus with dp$_1$-m$_2$ and p$_4$ germ...... *Fig. 3* 1934 31199

(1c) **Bouromeryx supernebrascensis**, new species
From Observation Quarry, Dawes County, Nebraska, 1936

**Type.**—Right ramus with diastema and p$_2$-m$_3$...... (m) 33733

**Referred.**—
Right ramus with diastema and p$_2$-m$_3$...... (w) 33734
Left ramus with diastema and dp$_1$-m$_1$...... 34007A
Partial right maxilla with p$_4$-m$_1$...... (w) 34008A
(1d) (?Bouromeryx pseudonebrascensis, new species
From Observation Quarry, Dawes County, Nebraska

**Type.**—Left ramus with symphysis and p_r-m_3........... (w+)

**Referred.**—
Two horn-cores on cranial fragments (questioned):
Right specimen........................................... *Fig. 14B* 34050
Left specimen (relatively slender)...................... *Fig. 14B* 34024

Eleven mandibular rami:
Mandible with symphysis and p_r-m_3................. (w) 34011
Right ramus with symphysis and p_r-m_3............. (m) 34012
Left ramus with symphysis and p_r-m_3............. (w+) 34001
Left ramus with diastema and p_r-m_3............. (w+) 34002
Left fragment with diastema and p_r-p_4.......... (m+) 33736
Three right rami with p_r-m_3...................... (m++ to w+) 34003-5
Right ramus with diastema (br.) and p_r-m_4...... (m+) 34006
Two left fragments with p_r-m_2 and p_r-m_4(br.)... (w) 34006A, B

**Immature:**
Right ramus with diastema and dp_r-m_2(erupting). 34007
Right ramus with diastema, p_1 alveolus, dp_r-m_1. 34013
Left ramus with dp_r-m_2.............................. 34007B

Four maxillary specimens:
Left maxilla with p^4-m^4................................ (w+) 34008
Three fragments........................................ (w) 33737,A,B

Twelve unlisted mandibular rami, F:B:A.M. Coll.
See limbs, page 183.

(2) (?Bouromeryx americanus (Douglass)
From Madison River, Montana


*Dromomeryx? americanus* DOUGLASS, 1909, Ann. Carn. Mus., V, p. 472, Pl. lxii, Figs. 1, 2; Pl. lxiii, Fig. 2.

**Type.**—Left ramus with p_r-m_3. C.M.705 Figured by Douglass, 1899, Pl. iv, Fig. 3; 1909, Pl. lxii, Figs. 1, 2.
Referred.—

Right broken $p_1^1-m_2^1$. C.M.706 Figured by Douglass, 1899, Pl. iv, Fig. 2; 1909, Pl. lxiii, Fig. 2.

$p_3 = ((14))$ mm. $m_3 = (15.7)$ mm.
$p_4 = (11) m_4 = (15.5)$

[Douglass remarked that the dimensions of this specimen approximated $S. antilopinus$ (Scott).]

Fragment of right ramus A.M.9753 From Madison River.
with $p_4-m_2$. ($w^+$)

(2a) Bouromeryx madisonius (Douglass)

From Western Montana


Type.—Ramus with three broken molars ......................... C.M.755
Teeth slenderer and unworn crowns taller-appearing than in C.M.705.

Tentatively Referred.—

$p_4$ ................................................................. C.M.2146

(3) Bouromeryx pawniensis, new species

From Pawnee Creek, Colorado

Several mandibular specimens, with teeth of considerably smaller size than the smallest examples of Procranioceras from Devil’s Gulch, are placed in the above species. It is recalled that Cranioceras is known from Pawnee Creek in a single horn-pedicle specimen. The Colorado teeth are slightly larger than in B. nebrascensis.

Type.—Partial right ramus with $p_4$ alveolus and $p_4-m_2$.
($w$) F:A.M.31290 From two miles W. of Mastodon Quarry, 1931.

This paper, Fig. 7.

Referred.—

Right fragment with $m_4-m_2$ and alveoli. ($M^+$) F:A.M.31291 From Section 8, 1931.

Right and left $m_3$s, left $m_2$. F:A.M.31292A,B
Smaller-sized:
Left m₁-m₃. (w) F:A.M.31293 From Section 8, 1931.
m¹ right. F:A.M.31293A

(4) Barbouromeryx trigonocorneus (Barbour and Schultz), genotypic species

From Antelope Creek, Dawes County, Nebraska

Dromomeryx trigonocorneus Barbour and Schultz, 1934, Amer. Mus. Novitates, No. 734, p. 4, Fig. 1 (in part).

Genotype.—Partial skull, complete except for right horn-pedicle and muzzle anterior to cheek-tooth series, with p²-m² present; right and left rami with I₁-I₃, /C, and p₂-m₃; and skeletal elements (see page 183). (M)

N.S.M.3-27-11-33 From 3½ mi. S., 9½ mi. W. of Hay Springs, on S. side of Antelope Creek, Dawes County, Nebraska. Collected November 27, 1933. Prepared by F. Walker Johnson, Univ. Nebraska, ’34. Figured by Barbour and Schultz, 1934, Fig. 1; this paper, Figs. 2, 5, 7, 10, 14; limbs, Fig. 25.

The authors observe: “During the preparation of the skull, a long xiphoid tusk was found in the matrix near the palate. The association is intimate enough to warrant the assumption that this is, in fact, a canine of this specimen and not that of some stray Blastomeryx buried there intrusively.”

As noted above, the eruption of the teeth is only just complete and it might seem that with age the height of the horn-pediciles would have increased.

Referred, Collected at B Quarry Locality by Ted Galusha, the Discoverer of the Type, 1935-36. — F:B:A.M.

Right ramus with p₂ alveolus and p₂-m₂ ............... (w+) 32872A
Right ramus with p₂-m₃ and alveoli .................... (w++) 32872
Left p₂-p₄ .................................................. (w++) 32873
Right m₁-m₂ (slightly smaller) ......................... (w++) 32873D
Right m₁-m₃ ............................................... (w+) 32873A
Left m₁-m₂ ............................................... (w+) 32873B
Right m₂-m₃ ............................................... (w++) 32873C
Left dp-m₃ ................................................... 32873F
Right maxilla with p₄-m₄ ................................ (M+) 32869
Detached right m₁ (and fragments) ..................... 32869A
(5) **Probarbouromeryx sweeti**, new subgenus and species

From Quarry 1, Bridgeport, Morrill County, Nebraska

(Molars smaller than in the preceding species, but averaging larger than in *Parablastomeryx gregori*.)

**SUBGENOTYPE.**—Right and left frontlets preserving portions of horn-pedicles and superior borders of orbits with lacrimal indentations. ...........................  
*Fig. 14*  53-25-6-35

REFERRED (collected together with the type by Messrs. Schultz, Meade, Rathbun and Franzan).—

**HORN-PEDICLE**

Left horn-pedicle on frontlet (pedicle slightly larger and externally more hollowed). ...........................  
*Fig. 14*  93-25-6-35

**RAMI**

Right ramus with symphysis and *p₂-m₂* (*p₃* br.)  
(m)  57-6-7-34

Left ramus with *p₁-m₃*  
*Figs. 4, 4A*  
(m)  97-25-6-35

Left fragment with symphysis and *p₂-m₃*  
(w)  95-25-6-35

Slightly smaller:

Left ramus with symphysis and *p₂-m₃*.  
*Fig. 4*  
(m)  21-25-6-35

Left ramus with *p₁-m₃*.  
(m)  20-25-6-35

Left ramus with *p₂* alveolus and *p₁-m₃*.  
(w)  80-6-7-34

Right fragment with symphysis, *p₂* alveolus and *p₃-p₄*.  
(m)  130-25-6-35

Right fragment with symphysis, *p₂* alveolus and *p₃-p₄*.  
(w)  99-25-6-35

Left fragment with *p₂* alveolus and *p₁-m₂*.  
(w)  129-25-6-35

Right fragment with *p₁-m₂*.  
(m)  75-6-7-34

Some fifteen ramal fragments; and fragments of rami [from Quarry 2], of similar proportions to the above slightly smaller specimens.

**MAXILLÆ**

Left maxilla with *p²-m²*.  
*Fig. 4A*  
(m)  14-25-6-35

Right maxilla with *p³(br.)-m²*.  
(w)  13-25-6-35

Right maxilla with *p³(br.)-m²*.  
(w+)  42-25-6-35

Several fragments.
CANINES

Large Cs/, two unworn, two worn ....................... 27-, 26-, 25-
and 114-25-6-35

Nine large to smaller partial Cs/......................... 28-25-6-35, etc.

IMMATURE RAMAL DENTITIONS

Left ramus with symphysis, dp1, dp2 alveoli and dp3-m1. 54-6-7-34
Left fragment with dp3-m2............................... 94-25-6-35

Slightly smaller-sized:

RAMI

Right fragment with m1-m2................................ (M) 19-25-6-35
Left fragment with m1-m2................................ (w+) 74-6-7-34

MAXILLÆ

Right fragment with m1-m3............................... (M) 28-25-6-35
Left fragment with m3.................................. (w) 29-25-6-35

Larger-sized variation (from Quarry 2):

Right fragment with m1-m2............................... (M++) 25-1-9-32

See Limb Section, page 184, for collection of elements including metacarpus and metatarsi from Quarries 1 and 2 of more slender proportions than B. trigonocornerus.

(6) Protobarbouromeryx marslandensis, new subgenus and species

From Lower Miocene, Box Butte County, Nebraska

SUBGENOTYPE.—Left ramus N.S.M.3-24-7-34 From 11 miles S.W. of Marsland.
with p1 alveolus, p3-m2.
(w)

(Premolars smaller-proportioned but general size of /ms approximating P. sweeti.)

TENTATIVELY REFERRED.—

Left m3. N.S.M.7-26-7-34 From Dawes County, 6 miles W. of Marsland.
Subfamily 4.—Drepanomerycinae

VI. Drepanomeryx Sinclair
VII. Matathomeryx, new subgenus

Figures 1d–e, 15 and (in part) 10, 12A

Statement

Two extremely interesting forms, Drepanomeryx and Matathomeryx, based on peculiar horn-pedicles, are held together provisionally in this subfamily. The strangely formed type horn-pedicles agree to the degree that they are directed posteriorly, widely bowed inwardly, moderately twisted and have bulbous-formed tips. The pedicle distally is expanded in Drepanomeryx and narrowed in Matathomeryx. The dentition of Matathomeryx, as seen in referred mandibular specimens, is characterized by large Dromomeryx-like molars, extremely moderate-sized premolars and open p4. The dentition of Drepanomeryx is not definitely recognized. (See discussion, page 49.)

VI. Drepanomeryx.—The genotype and only definitely known specimen has been credited to the Lower Snake Creek. A broken, triangular-shaped facet, occurring at the postexternal base of the horn-pedicle, is suggestive of the one-time presence of a small postlateral flange. This facet lies on the postero-externally sweeping edge that is continuous with the wedge-shaped inner ridge. The attached cranial fragment carries portions of the supra-orbital foramen, the superior border of the orbit, and the production of the postorbital process with a deep groove separating the outer orbit from the cranium. Through the courtesy of Doctors Sinclair and Jepsen, I am able to refigure this specimen. In the original discussion, Sinclair (1915) observes, in regard to the horns: “...Rising immediately above upper posterior margin of orbit, sloping backward and upward and at the same time curving inward, at base almost circular, but flattening upward in the transverse plane extending backward and inward from the orbits, producing a scimitar-like structure which curves inward toward its fellow on the opposite side....” (See reconstruction, Fig. 1E.)

The writer once surmised that the ramal dentitions listed under Sinclairomeryx might possibly prove to represent Drepanomeryx or a closely allied form—but welcome recent evidence now witnesses the unique character of the paired horn-pedicles and nasal bosses of the former genus.
VII. *Matthomeryx*.—The subgenotypic specimen, a portion of cranium with both horn-pedicles attached, collected by T. Galusha from Dawes County, was received long after these pages were in press. The strongly backward direction of the pedicles, their posterior position over the orbits and general form, as shown in adjacent illustrations (Fig. 15), are highly suggestive of the *Drepanomeryx* genotype. Distally the pedicles are narrowed rather than expanded, as in the latter. The position of the orbit relative to the $m^2$ is evidently posterior. (See reconstruction, Fig. 1d.) The mandibular symphysis and diastema are elongate, the proportions of the posterior mandible unusually large relative to the molars and the premolars are reduced, versus *C. granti*.

It is possible that the two partial crania with strongly posteriorly placed orbits, listed below, may represent (*Matthomeryx* or) *Drepanomeryx*. One of the specimens exhibits a very rudimentary postorbital horn, such as might be expected in a female, see Figure 12A; the second specimen lacks the supra-orbital area. The worn teeth of the two specimens, so far as observable, do not definitely differ from those of *Matthomeryx* referred dentitions.

Summary of Drepanomerycine Species

*Drepanomeryx* Sinclair.

Horn-pedicles directed posteriorly, strongly bowed inwardly, shafts slender and tips expanded.

(1) *Drepanomeryx falciformis* Sinclair, genotypic species, from Sioux County, Nebraska.

**Genotype.**—Left and detached partial right horn-pedicles, P.U.12072. This paper, Fig. 15.

*Matthomeryx*, new subgenus.

Horn-pedicles, as far as observable, differ from *Drepanomeryx* in their heavy proportions and narrow, unexpanded tips.

(2) *Matthomeryx matthewi*, n.subg. and sp., from Dawes County, Nebraska.

**Subgenotype.**—Partial skull preserving the orbits and large, backwardly directed horn-pedicles, F:B:A.M.33740. This paper, Fig. 15.
Fig. 15. F.B.A.M.33740 (subgenotype), 33739 (immature), 33741 (rev.) and 33742 (rev.), *Matthomeryx matthewi*, n.subg. and sp., from Observation Quarry, Dawes County, Nebraska.

P.U.12072, *Drepanomeryx falciformis* Sinclair, genotype, from Sioux County, Nebraska.

A.M.22382, (?)*Drepanomeryx* species, from Sioux County, Nebraska.

× ½ (dentition × ½). A, B, C, D, cross sections; 2, supra-orbital foramen; 4, frontoparietal suture. (See pages 141, 140.)
Detailed Lists of Types, Referred Specimens, and Synonymy

VI, Drepanomeryx Sinclair and VII, Matthomeryx, new subgenus

Drepanomeryx, total available listed specimens, 5; Matthomeryx, 17.

(1) Drepanomeryx falciformis Sinclair, genotypic and only known species

From Sioux County, Nebraska

Reconstruction, Figure 1e


Genotype.—Left horn-pedicle (tip lacking) on cranial fragment and detached portion of right horn-pedicle.

(Notable for increase of width distally—suggestive of fallow-deer antler.)

(The ramus with p2-m4, premolars relatively large and unreduced, and /C alveolus [H.C. Collection 365], as figured by Harold Cook (1922, p. 21), is more suggestive of the Camalidae.)

(1a) Indeterminate species

From Sioux County, Nebraska

Example.—Top of cranium with horn-pedicles.

A.M.22382 From Sinclair Draw, Sheep Creek Channel, 1927.
This paper, Fig. 15.

Questionably Referred.—

(a) Large portion of posterior cranium, $\varphi$, with p2-m4. (w+)

(Discussed and referred by W. D. M. (1924, p. 198) to Blastomeryx (Dyseomeryx) sinclairi (Matthew), the ramal type of which now is tentatively transferred to C. unicornis Matthew.)

(b) Portion of anterior skull with both maxillae with p3-m2. (w+) (Heretofore catalogued under Neotragocerus.)

(b) Portion of anterior skull with both maxillae with p3-m2. (w+) (Heretofore catalogued under Neotragocerus.)

(c) Left fragment with p2-m1.

F:A.M.31211 From Stonehouse Draw, 1932.
This paper, Fig. 10.
(2) **Matthomeryx matthewi**, new subgenus and species

From Observation Quarry, Dawes County, Nebraska

Reconstruction, Figure 1d

Collected by Ted Galusha, 1936

**Subgenotype.**—Cranial fragment with orbits and large, backwardly directed horn-pedicles.

<table>
<thead>
<tr>
<th>Description</th>
<th>Specimen No.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tentatively Referred.—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immature left horn-pedicle.</td>
<td>33739</td>
<td>Fig. 15</td>
</tr>
<tr>
<td>Immature left horn-pedicle.</td>
<td>34023</td>
<td></td>
</tr>
</tbody>
</table>

Eleven mandibular rami and three doubtfully referred maxillary specimens:

<table>
<thead>
<tr>
<th>Description</th>
<th>Specimen No.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with symphysis, two /Is, /C and p4–m3.</td>
<td>33741</td>
<td>(w++) Fig. 15</td>
</tr>
<tr>
<td>Partial mandible with symphysis and both p3–m3s.</td>
<td>33746</td>
<td>(w)</td>
</tr>
<tr>
<td>Partial mandible with p2–m4.</td>
<td>33751</td>
<td>(m+)</td>
</tr>
<tr>
<td>Left ramus with symphysis and p2–m3.</td>
<td>33747A</td>
<td>(w++)</td>
</tr>
<tr>
<td>Right ramus with p1–m4, angle and vertical ramus</td>
<td>33742</td>
<td>(w)</td>
</tr>
<tr>
<td>Right ramus with p2–m4.</td>
<td>33743</td>
<td>(m)</td>
</tr>
<tr>
<td>Left ramus with diastema and p2–m3.</td>
<td>33744</td>
<td>(w++)</td>
</tr>
<tr>
<td>Right ramus with symphysis and p1–m3.</td>
<td>33747</td>
<td>(w++)</td>
</tr>
<tr>
<td>Right ramus with p3–m4.</td>
<td>33770</td>
<td>(M++)</td>
</tr>
<tr>
<td>Immature right fragment, p1 alveolus, p4 germ, dp4–m4.</td>
<td>34025</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p3–m4. (Smaller than any of the above.)</td>
<td>33745</td>
<td>(w)</td>
</tr>
<tr>
<td>Right maxilla with p3–m3.</td>
<td>33748</td>
<td>(w)</td>
</tr>
<tr>
<td>Left maxilla with p3(br.)–m3.</td>
<td>33748A</td>
<td>(w+)</td>
</tr>
<tr>
<td>Right fragment with p4–m3.</td>
<td>34021A</td>
<td>(M+)</td>
</tr>
</tbody>
</table>

---

**Fig. 15A.** *Yumaceras falkenbachi*, n.sp., type (F:A.M.31633), from Guymon, Oklahoma.

Lateral view × 1/3, occlusal × 1. (See also Fig. 2B and page 144.)
DIVISION B.—ALETOMERYCINI

Subfamily 5.—Yumaceratinae

VIII. YUMACERAS, new genus

Figures 15A and (in part) 2B, 3, 9, 11, 12A, 14A

Statement

A number of moderately large to large-sized dentitions from Yuma County, Colorado, Roberts County, Texas, Texas County, Oklahoma, and Kansas, in which the tooth crowns are subhypsodont, the premolars reduced and the p4 anteroposteriorly compressed with the forward fossette closed, are tentatively grouped under the genus. It is worthy of note that while the remains are associated in the several formations with species of Texoceros, n.g., the Merycodontini and the more typical of the Dromomerycini seem to be absent. Of the four species and variants recognized here, the two from Yuma County, Colorado, are the largest and may possibly prove subgenerically distinct from the more moderate-sized form from Guymon and its still smaller variant from Miami. The Guymon specimens approximate Dromomeryx in size. As compared to the latter, the premolars are notably compressed antero-posteriorly; the p4 anterior fossette, as noted above, is similarly closed; the teeth are considerably taller-crowned and the “Palæomeryx” fold is absent; and, while the molars tend to be larger, the premolars are smaller, the p2 notably so. The teeth, as giraffe-like as deer-like, differ in proportions from those of any Artiodactyl known to me. While the number of occurrences of teeth and jaws at Guymon seem to indicate the possibility of securing data as to the crania and horns, to date all efforts have been unrewarded. The genotypic species is based on a cranial saddle with horn-core bases (Col.M.214) from Yuma County, Colorado, figured by Harold Cook (1922) under “?Cervid, genus and species indeterminate.” It is surmised that the genotypic species is represented by the portion of a mandibular ramus from the same area. The teeth of this specimen considerably exceed in size the largest Dromomeryx. The particular horn-cores, which are of oval-triangular basal cross section, evidently were widely divergent. The specimen at first glance is not unsuggestive of a very heavy-skulled pronghorn, but the “horns” are not compressed and the general characters and proportions are quite
different from Antilocapra. Broadly considered, the specimen perhaps has more of the general appearance of Cranioceras than of any other form so far available to the writer. (See discussion, page 50.)

Summary of Species

The several species and variants, one based on the above-mentioned cranial saddle and four on portions of dentitions, are:

(1) *Yumaceras fagginsi*, n.g. and sp., from Yuma County, Colorado.

**Genotype.**—Frontal saddle with horn-pedicle bases, Col.M.214. This paper, *Fig. 12A*.

(1a) More moderate-sized species.

**Example.**—Left ramal fragment, Col.M.(3)222b.

(1b) *Yumaceras*, genotypic-sized species, from Clark County, Kansas.

**Example.**—Right m, F:A.M.30913.

(2) *Yumaceras falkenbachi*, n.sp., from Guymon, Texas County, Oklahoma.

**Type.**—Left ramus, F:A.M.31633. This paper, *Figs. 2B, 15A*.

(2a) Variant, from Miami Quarry, Texas.

**Example.**—Left ramal fragment, F:A.M.31522. This paper, *Fig. 9*.

Detailed Lists of Types, Referred Specimens, and Synonymy

VIII. **YUMACERAS, new genus**

Total available listed specimens, 50

(1) *Yumaceras fagginsi*, new genus and species

From Yuma County, Colorado


**Genotype.**—Frontal saddle with horn-pedicle bases. Col.M.214 [or 214(4)] Figured by Cook, 1922, p. 27; this paper, *Fig. 12A*. 
QUESTIONABLY REFERRED.—

Partial right ramus with \( p_4 \) (br.)-\( m_3 \) and etc. alveoli. \((-m)\)  
Col. M. 214B  
Figured by Cook, 1922, p. 28; this paper, Fig. 9 (Col. M. 200).

(Lower premolars relative to molars very small-proportioned versus \textit{Rangifer}, and smaller-proportioned than in \textit{Dromomerix}.)

Upper molar (br.) \((w+)\)  
Col. M. 196

See Limb Section, page 184.

(1a) \textit{Yumaceras}, More Moderate-Sized Species  
From Yuma County, Colorado

\textbf{Example.—} Left ramal fragment with \( p_2-m_1 \) \((w+)\)  
Col. M. (3) 222b  
Cook, 1922, p. 13, noted "\textit{Palaeomeryx, sp.}"  
(\textit{Smaller.})

(1b) \textit{Yumaceras}, Genotypic-Sized Species  
From Clark County, Kansas

\textbf{Example.—} Right \( m_2 \)  
F: A.M. 30913  
From J. Dakin Quarry, 1936.  
(See Limb Section, page 184.)

(2) \textit{Yumaceras falkenbachi}, new species  
From Guymon, Texas County, Oklahoma, 1934–35

\textbf{Type.—} Left ramus with /Is, /C and \( p_2-m_3 \) \((m+)\)  
F: A.M. 31633  
F.A.  
This paper, Figs. 2B, 15A.

\textbf{Referred.—}  
Left ramus with \( p_2-m_2 \) and base of \( m_3 \) \((m+)\)  
F: A.M. 32104  
R.D.  
This paper, Fig. 9.

Right fragment with \( p_2-p_4 \), broken \( m_1-m_3 \) \((w)\)  
F: A.M. 31670  
H.D.

Right \( p_2-m_3 \) \((w++)\)  
F: A.M. 31673  
R.D.  
This paper, Fig. 9 \((m_3 \text{ only})\).

Left fragment with diastema.  
F: A.M. 32135  
H.D.

\textsuperscript{1} \underline{Localities:}  
F = Flats, H = Highway, R = Railroad or Railroad Cut.  
\underline{Horizons:}  
A = Top Sandy Clay, C = Sandy Clay, D = Sand.

\textsuperscript{2} Right \( p_4-m_2 \) \((w)\), F: A.M. 33201, from H.D.
Yumaceras falkenbachi, Var.

From Miami Quarry, Texas

( Smaller and near type specimen in size.) (Compare Pediomeryx Stirton, 1936, Journ. Pal., X, No. 7, p. 644, Fig. 1.)

\textbf{Example.---}Left fragment with only very slightly worn Pr-P4.

Right m1-m4. (w++) F:A.M.32883 (Not included in specimen count.)

Metacarpus. F:A.M.31518 From upper layer, 1933.

(See Limb Section, page 185.)
Fig. 16. *Aletomerux gracilis* Lull, ref., sexual and individual variation (F:A.M. 32310, 334, 324 and 322 of females; others of males), from Antelope Creek, Cherry County, Nebraska; and *A. marslandensis*, n.sp., type (N.S.M.50–28–8–34), from Marsland, Box Butte County, Nebraska, Middle Tertiary. (Specimens crushed.)

X 4. (See also Fig. 10 [F:A.M.32303], and pages 157–159, 162.)
Subfamily 6.—Aletoemerycinae

IX. ALETOMERYX LULL (Middle Tertiary)

X. SINCLAIROMERYX, NEW GENUS (Late Tertiary)

Statement

The subfamily proper is characterized by moderate to small size, sub-hypsodont tooth crowns and strongly reduced premolars, and by the males so far observed having enlarged upper canines and slender horn-pedicles with bulbous extremities that point to the former presence of terminal antlers. Two widely differing genera are recognized, Aletoemeryx Lull (with which Dyseomeryx Matthew is apparently synonymous) and Sinclairomeryx, new genus. The molars are very deer-like. Present evidence points to the subfamily being represented so far only by remains from the Middle and earliest Late Tertiary. The Aletoemeryx gracilis Quarry is considered by Morris F. Skinner to be older than the deposits of the Valentine area, Cherry County. The quarry may well represent a Lower Miocene stage. The American Museum specimens heretofore referred to A. (Dyseomeryx) marshi are reported to have come from the Harrison. The Sinclairomeryx riparius mandibular rami are of definite Sheep Creek origin. While the faunal association in the case of the University’s Aletoemeryx marslandensis is not unsuggestive of Sheep Creek, the particular pocket is reported by C. Bertrand Schultz as lying stratigraphically within the Harrison. Preceding the detailed listing of the fossil evidence, the characters (also see page 50) of the two tentatively included genera may be discussed briefly:

IX. Aletoemeryx Lull, the genotypic species A. gracilis, was based on remains from the vicinity of Antelope Creek, Cherry County, Nebraska. As observed on a previous page, the genus might be regarded as exemplifying in its subhypsodont tooth crowns, notably reduced premolars, and males with elongate horn-pedicles, a less conservative and more progressive Barbouromeryx. The tips of the horn-pedicles afford every indication that the same were once furnished with some manner of capping. (Our reconstruction hazards that such consisted of an antler
somewhat of the form of the European *Dicrocerus*.) Lull has noted that the "horn-cores" (pedicles) were probably covered by skin and hair, as in the case of the giraffe.

Knowledge of the genus recently has been augmented through the remarkable series of specimens of both sexes and various growth stages secured during the summer of 1934 from the vicinity of the type locality by Morris F. Skinner. The series includes, besides several exhibition blocks and yet unprepared material, some twenty-six well-represented skulls, several of which have the premaxilla and large canine alveolus well preserved, and a collection of mandibular rami and limb elements. The new evidence is extremely important through the information afforded as to the variation in horns and body size (metacarpal lengths varying from 116.5 mm. to 129 mm.) occurring in largely contemporaneous members of the one extinct species, and the welcome light that this tends to throw on individual and sexual variation in allied groups. Strangely enough, adequate remains of immature individuals retaining the deciduous dentition, which are so well represented in the case of several of the Merycodontini, seem lacking. The state of the molars affords a ready interpretation to the growth stages exhibited by the horn-pedicles: (a) small to elongate-slender nubs in aged females, (b) small female-like pedicles in adolescent males, and (c) moderate to elongate pedicles in aged to more aged males (see Fig. 16). The average male *Aletomeryx* seems to be larger-toothed than the female.

Characters of *Aletomeryx*.—The cheek teeth are subhypodont, the premolars reduced, upper incisors lost, upper canine (male) enlarged and lower canine incisiform; the orbits are closed and placed anteriorly, the forward border above m²; the posterior occiput is moderately produced (F:A.M.32305); the nasals are fairly short (F:A.M.32301); the anterior premaxillae are extended and flattened and posteriorly are in contact with the nasals; a suborbital vacuity is present (the glandular pits of the deer may be absent); the glenoid is very broad; the bullae are small (F:A.M. 32310); the angle of the mandible is prominently produced (versus Merycodontini and Antilocaprin); the metapodials are slender (in length approximating *Problastomeryx primus*), and lateral splints and phalanges were retained in the manus and lateral phalanges at least in the pes. [Possibly the "splints" are broken remnants of formerly complete metacarpals, as recently observed in (?)*A. marslandensis*, var. (page 163).]

The supra-orbital horn-pedicles are somewhat backwardly directed and dished anteriorly. The convex and tuberous distal ends, as noted
above, give every indication of having once borne some form of horn. The pedicle is particularly well exampled in the male, F:A.M.32300; the shaft is flat posteriorly, the cross section at the base being broadly triangular, through the mid-extent oval-tending, and through the bulbous tip laterally compressed. The postero-inferior corner is furnished with a narrow vane (reminiscent of the Dromomerycine flange) that separates it from the postero-inferior border of the orbit. The inferior corner is continuous with the lambdoidal crests which unite posteriorly. The anterior edge of the pedicle runs upward from the superior border of the orbit. The pedicle is tallest in F:A.M.32300, equaling one-third of the skull length and standing, as in the Yale University specimen, 52 mm. above the orbit; less tall in F:A.M.32301, and again in F:A.M.32303; rudimentary in adolescent female F:A.M.32310; and small and slender in F:A.M.32322, female. A notable variation exists between the aged male and female in skull, tooth, horn and limb dimensions (compare Fig. 16, male F:A.M.32303, versus female F:A.M.32322).

Richard S. Lull (1920) in his description of the genus, observing that Matthew believes Aletomeryx to be related to the Antilocapridae with its nearest relative Merycodus, himself considers the genus to be ancestral to the pronghorn. None of the large number of individuals in the Yale Collection, including nineteen or more partial skulls, seems to have indicated that the male retained an enlarged upper canine. Lull considers, "...The distal dilatation of the horn precludes the possibility of a dermal horn... The horns are not antler-like, and hence could hardly have been comparable to those of existing deer... The conclusion reached is that the horns of Aletomeryx were covered permanently with hairy skin comparable to those of the giraffe or the developing antlers of the deer. This would be a primitive condition leading to that of the prongbuck on the one hand, where the hair develops into a dermal horn by agglutination, or to the deer on the other, where the velvet is shed, laying bare the osseous antler, which in turn is lost. There is no evidence that the horns of Aletomeryx were ever shed... The female horn is merely a low, rounded protuberance with a subtriangular base."

"Blastomeryx" marshi, described by Professor Lull (1920) from the general Antelope Creek-Fort Niobrara area, was based on a fragmental skull and jaws with worn dentition, large C/ alveoli and rudimentary horn. W. D. Matthew (1924) referred to the species two fragmentary crania (A.M.14264 and A), in the American Museum Collection from the Harrison, and at the same time transferred it to Dyseomeryx. Matthew observed these two fragmental crania to differ from Aletomeryx in
Fig. 16A. N.S.M.1-13-6-35, *Aletomeryx marslandensis*, n.sp., ♀, ref. (skull rev.), from Box Butte County, Nebraska. M.C.Z.17743, *A. scotti* (Matthew), type, from Garman "Loup Fork," Nebraska. F.A.M.33791 (genotype, rev.) and 33790 (♀, ref., rev.), *Sinclairomeryx sinclairi*, n.g. and sp., from Sioux County, Nebraska. × 4. A, B, C, cross sections. (See also Fig. 2 [F.A.M.33791] and pages 162, 161, 164.)
the possession of larger anterior premolars, more rudimentary horn-cores and a differently shaped skull. The specimens in size somewhat approximate Parablastomeryx gregorii but differ from the latter in the presence of the rudimentary horn and in the notably smaller-proportioned premolars and larger molars. While Aletomeryx gracilis and Dyseomeryx marshi may be generically distinct, and even the Aletomeryx Quarry remains may include more than one form, the writer suspects that Aletomeryx and Dyseomeryx represent but one genus. Our large male Aletomeryx in its large C/ (unknown to Lull), as in its skull length and cheek tooth series length, resembles the "D. marshi" type specimen of Lull's figure 25. Moreover, the metapodial lengths fall within the measurements of our large series of Aletomeryx specimens. The reported small size of the pedicles in the "D. marshi" fragmental type specimen, in which the teeth are said to be much worn, but the C/ enlarged, suggests an aberrant individual. William D. Matthew (1924), in addition to "D. marshi" referred to Dyseomeryx certain species from the later Miocene. Dyseomeryx riparius Matthew, here transferred to Sinclairomeryx; Dyseomeryx sinclaii Matthew, questionably transferred to Cranioceras unicornis; and Blastomeryx (Dyseomeryx) scotti Matthew, transferred to Aletomeryx.

"Blastomeryx" scotti Matthew, from an indefinite northern Nebraska horizon, represents a larger but presumably closely allied form to Aletomeryx gracilis. Lull (1920) observed the similarity between the two species. The "B." scotti type, according to Matthew, is the cranial fragment first mentioned by Scott (1890) in his recharacterization of the Cope genus Blastomeryx. This specimen (M.C.Z.17743, Fig. 16A), collected by Garman from the "Loup Fork" of Nebraska, and now in the Museum of Comparative Zoology, Harvard University, exhibits a small postorbital excrescence or rudimentary horn-pedicle apparently of the form so well exemplad in several of the new Aletomeryx skulls. (Remains held under the same M.C.Z. catalogue number with the type frontal fragment represent six individuals of doubtful reference, i.e., limb elements of four different-sized mature, and tooth fragments of two immature individuals.)

Scott (1890) observed the position of the rudimentary horn to be posterior to the orbit, more as in Cariacus, versus over the orbit as in Cosoryx and Antilocapra. Cope (1878) has stated "... While Dicrocerus [Merycodus] was probably the ancestor of Antilocapra, Blastomeryx was the ancestor of Cervus or Cariacus."

Aletomeryx marslandensis, n.sp., is represented by A. scotti-sized remains in which the p$_4$ tends to be large relative to the much reduced p$_3$-
The specimens were secured from Box Butte County by C. B. Schultz and party, 1934–1936, and placed at the writer's disposal through the courtesy of Professor Erwin H. Barbour. The material includes a frontal saddle with unusually elongate horn-pedicles, and a small collection of maxillary and ramal dentitions with reduced premolars. The horn-pedicles are somewhat taller and the referred dentitions are larger than in the largest known individual of A. gracilis. The teeth are smaller than in Sinclairomeryx riparius. The specimens were associated with a partial ramus of an immature individual of Nanotragulus and with remains of several Carnivora.

X. Sinclairomeryx, new genus, while paralleling the smaller Aletomeryx in slender subhypodont molars and reduced to much reduced premolars, notably differs from the latter in the slender and curved, paired postorbital horn-pedicles, elongate nasals, nasal bosses and deep maxillary pits. The genus and species are based on one of several partial crania secured from Thomson Quarry by Jack Wilson long after these pages had gone to press. The type is an unusually beautiful cranium, lacking only the premaxillae and tips of nasals. The genus previously had been known to the writer alone by a series of mandibular rami from the same beds. The genus is named in memory of William J. Sinclair, one of the original investigators of these beds and the describer of Drepanomeryx of the same area. In a few unworn dentitions the “Paleomeryx” fold is traceable, though only in most rudimentary condition. The p₄ anterior fossette is unformed; the molars are very deer-like, though the crowns are somewhat shorter and broader and the lobes less deeply incised than in modern deer. While the cheek tooth series is taller, the diastemata lengths approximate those in Bouromeryx milleri (actual m₃ lengths vary from near that of the latter to larger than Procranioceras skinneri), the molars are lighter built and longer anteroposteriorly, the premolars are notably reduced and the jaws slenderer than in the latter. William D. Matthew (1924) places a similar mandibular ramus from the Sheep Creek type locality under a species of “Dyseomeryx,” the small genotypic species of which (see above) here is considered to be synonymous with Aletomeryx. It is very probable that the present species and the type of Blastomeryx (Dyseomeryx) riparius (A.M.18956) may represent one and the same form. The Sheep Creek form is represented in the new Jack Wilson collection by the above-mentioned partial skulls and a series of mature and a number of immature rami with dp₁–m₁ (erupting). It is interesting to find the dp₁ retained as
in *Dromomeryx*. A maxilla secured at the type locality by Jack Wilson in 1934, seems to evidence the retention of the upper canine. The teeth of this specimen are suggestive of *Aletomeryx* remains in the University of Nebraska collection from Marsland, Box Butte County. (While it is possible that the Sheep Creek remains here divided between the species and variants may represent individual or sexual differences within a single species, the tentative recognition of the variants immediately calls attention to the observed characters.)

The similarity (except for size) between the mandibular dentitions of *Aletomeryx* and the mandibular dentitions referred to *Sinclairomeryx* and *Yumaceras*, indicate (if the reference is correct) the impossibility of securing satisfactory interpretation of such remains without knowledge of the horn-cores and crania.

On the following pages the known cranial and mandibular remains of the subfamily *Aletomerycinae* are listed under the two genera and several species. The skeletal elements are considered in comparison with those of the Dromomerycini section as a whole at the end of the chapter, page 169 (see Fig. 25A). The second species tentatively enumerated under *Aletomeryx* may prove, as may the several *Sinclairomeryx* species, to be respectively synonymous. Crania are figured (Figs. 16, 16A, 16B), illustrating among characters those of the premaxillae, nasals and horn-pedicle. The drawings show the small size of the *Aletomeryx* horn-pedicle in the mature female and adolescent male, and the relatively large size in the aged male and in the still larger type of *A. marslandensis*. The upper teeth are comparatively figured, Fig. 10, and the lower, Figs. 5 and 7. *Aletomeryx* species (1)–(1b) are relatively smaller and (1c)–(3a) relatively larger.

Summary of Named Species

IX. *Aletomeryx* Lull. (Harrison beds, in part.)

(1) *Aletomeryx gracilis* Lull, genotypic species, from Cherry County, Nebraska.

Genotype.—Skull, jaws and skeleton, Y.P.M.10732.

(1a) *Aletomeryx marshi* (Lull), from Harrison beds, Nebraska.

Type.—Skull, mandible, etc., Marsh Coll., Y.P.M.10756.
(1b) *Aletomeryx gracilis*, var., from Barbour-Hemingford Quarry, Box Butte County, Nebraska.

**Example.**—Right ramus, N.S.M.13-28-7-36.

(1c) *Aletomeryx scotti* (Matthew), from Garman "Loup Fork," Nebraska.

**Type.**—Frontal fragment, M.C.Z.17743. This paper, *Fig. 16A*.

(2) *Aletomeryx lugni*, n.sp., from Bridgeport, Morrill County, Nebraska.

**Type.**—Right ramus, N.S.M.13-1-7-32. This paper, *Figs. 4, 4A*.

(3) *Aletomeryx marslandensis*, n.sp., from Marsland, Box Butte County, Nebraska.

**Type.**—Part of cranial saddle with horn-pedicle, N.S.M.50-28-8-34. This paper, *Fig. 16*.

(3a) (?) *Var.*, from Dawes County, Nebraska.

**Example.**—Skull, mandible and skeleton, N.S.M.1-11-8-36. This paper, *Fig. 25B* (limb).

X. *Sinclairomeryx*, new genus. (Sheep Creek beds, in part.)

(4) *Sinclairomeryx sinclairi*, n.g. and sp., from Sioux County, Nebraska.

**Genotype.**—Skull, F:A.M.33791. This paper, *Figs. 2, 16A*.

(4a) (?) *Sinclairomeryx riparius* (Matthew), from type area, Sioux County, Nebraska.

**Type.**—Left maxilla, A.M.18956. This paper, *Fig. 10*.

(4aa) Questioned variant from type locality.

**Example.**—Right ramal fragment, F:A.M.31216. This paper, *Figs. 5, 7*.

(4aaa) Questioned variants or species, from Thistle and Long Quarries, Sioux County, Nebraska.

**Example.**—Left ramus, F:A.M.32469.

(5) *Sinclairomeryx tedi*, n.sp., from Dawes County, Nebraska.

**Type.**—Right ramus, F:B:A.M.32875.
Detailed Lists of Types, Referred Specimens, and Synonymy

IX, **ALETOMERYX LULL AND X, SINCLAIROMERYX, new genus**

*Aletomeryx*, total available specimens, 255; numbered and listed, 192; uncatalogued, 63. *Sinclairomeryx*, total available listed specimens, 126.

Reconstructions, Frontispiece, d, and Figure 1A

(See limbs, page 185 and Figures 25A, 25B, in part.)

(1) **Aletomeryx gracilis** Lull, genotypic species

From the (?)Middle Tertiary, Cherry County, Nebraska


**GENOTYPE.**—Skull. Y.P.M.10732

From talus slope near the mouth of Antelope Creek, northwestern part of Cherry County, Nebraska. Figured by Lull, 1920, Pl. 1 and Text-Figs.

**COMPARATIVE MEASUREMENTS**

<table>
<thead>
<tr>
<th>Aletomeryx gracilis</th>
<th>Parablastomeryx gregorii</th>
<th>(After Lull, '20, Parablastomeryx A. gracilis gregorii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>p........ 5 mm.</td>
<td>6.5 mm.</td>
<td>Humerus...... (108) mm. 145 mm.</td>
</tr>
<tr>
<td>p........ 6.7</td>
<td>8.3</td>
<td>Radius...... (120) 149</td>
</tr>
<tr>
<td>p........ 9</td>
<td>8.5</td>
<td>Metacarpus...... (117) 151</td>
</tr>
<tr>
<td>m1...... 12</td>
<td>9</td>
<td>Femur...... (140) 186</td>
</tr>
<tr>
<td>m2...... 13</td>
<td>9.5</td>
<td>Tibia...... (170) 218</td>
</tr>
<tr>
<td>m4...... 16.8</td>
<td>14.3</td>
<td>Metatarsus...... (138) 172</td>
</tr>
</tbody>
</table>

**REFERRED.**—

Partial skulls, jaws and skeleton (composite), etc., of the Marsh Collection.

Some sixty specimens (exclusive of a large exhibition block with numerous skulls and jaws as yet unprepared) were secured by M. F. Skinner from vicinity of the type locality, as discussed under the genus in the introductory statement, page 148. (And see Limb Section, page 185.)
Eleven male skulls (grouped according to $p^a-m^a$ lengths):

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat crushed skull with moderate horn-pedicles, $p^a-m^a$ and premaxilla. (m)</td>
<td>32303</td>
<td>$p^a-m^a = 52$ mm.</td>
</tr>
<tr>
<td>Laterally crushed skull, premaxilla, $p^a-m^a$. (w+)</td>
<td>32320</td>
<td>$p^a-m^a = 51.3$ mm.</td>
</tr>
<tr>
<td>Laterally crushed skull with $p^a-m^a$ and premaxilla. (w+)</td>
<td>32302</td>
<td></td>
</tr>
<tr>
<td>Skull, premaxilla, top of cranium missing. (w)</td>
<td>32293</td>
<td>$p^a-m^a = 45$ mm.</td>
</tr>
<tr>
<td>Crushed skull with left and broken right horn-pedicles, $p^a-m^a$, no premaxilla. (w)</td>
<td>32301</td>
<td></td>
</tr>
<tr>
<td>Crushed skull with small horn-pedicles, $p^a-m^a$, no premaxilla. (m)</td>
<td>32304</td>
<td></td>
</tr>
</tbody>
</table>

Fifteen female skulls (grouped according to $m^1-m^1$ lengths):

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushed skull, no premaxilla. (w)</td>
<td>32313</td>
<td></td>
</tr>
<tr>
<td>Crushed skull with right $p^a-m^a$. (m)</td>
<td>32295</td>
<td>$m^1-m^1 = 36$ mm.</td>
</tr>
<tr>
<td>Crushed skull with right premaxilla and $p^a-m^a$. (m+)</td>
<td>32324</td>
<td>(premaxilla)</td>
</tr>
<tr>
<td>(Horn-nubs not showing.)</td>
<td></td>
<td>$m^1-m^1 = 35.8$ mm.</td>
</tr>
<tr>
<td>Skull with short, slender horn-pedicles, $p^a-m^a$, premaxilla missing. (w)</td>
<td>32322</td>
<td>$m^1-m^1 = 33.8$ mm.</td>
</tr>
<tr>
<td>Skull with premaxilla and $p^a-m^a$. (w+)</td>
<td>32316</td>
<td></td>
</tr>
<tr>
<td>Skull with partial premaxilla and $p^a-m^a$. (w)</td>
<td>32318</td>
<td></td>
</tr>
<tr>
<td>Crushed skull with premaxilla and $p^a-m^a$. (w+)</td>
<td>32321</td>
<td></td>
</tr>
<tr>
<td>Partial skull with left premaxilla and $p^a-m^a$. (w+)</td>
<td>32306</td>
<td>(Horn area gone.)</td>
</tr>
<tr>
<td>Crushed skull with premaxilla. (w+)</td>
<td>32307</td>
<td></td>
</tr>
<tr>
<td>Small right horn-nub.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crushed skull with $p^a-m^a$, no premaxilla. (w)</td>
<td>32319</td>
<td>Tiny left horn-nub.</td>
</tr>
<tr>
<td>(m)</td>
<td>32294</td>
<td>$m^1-m^1 = 30.5$ mm.</td>
</tr>
</tbody>
</table>
Crushed partial skull with F:A.M. p²-p³(br.), m¹-m³. (w) 32296
Tiny left horn-nub.
Partial skull with p¹-m¹. (m) Tiny left horn-nub. 32297
Laterally crushed skull with no premaxilla. (w+) 32317

Crushed skull with left F:A.M. horn-nub. (w++) 32323
Fragmental maxillae and palates.

Eight skulls or partial skulls of adolescent females (grouped according to p⁴-m³ lengths):

<table>
<thead>
<tr>
<th>Skull with p²-m³, no premaxilla. (m)</th>
<th>F:A.M. 32310</th>
<th>Crushed partial skull with left p²-m³ and right p⁴-m⁴. (m) 32314</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiny horn-nubs.</td>
<td>Fig. 16</td>
<td>p⁴-m³ = 40.7 mm.</td>
</tr>
<tr>
<td>p⁴-m³ = 41.5 mm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skull with p²-m³, no premaxilla.</td>
<td>F:A.M. 32311</td>
<td>Crushed skull with right horn-nub, right p⁴-m³ and left p²-p⁴. (m) 32308</td>
</tr>
<tr>
<td>(Horn-nubs not showing.)</td>
<td></td>
<td>p⁴-m³ = 40 mm.</td>
</tr>
<tr>
<td>p⁴-m³ = 41 mm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skull with p²-m³, no premaxilla.</td>
<td>32312</td>
<td>Crushed skull with p⁴-m³. (m) 32298</td>
</tr>
<tr>
<td>Horn-nubs.</td>
<td></td>
<td>Right horn-nub.</td>
</tr>
<tr>
<td>p⁴-m³ = (41) mm.</td>
<td></td>
<td>p⁴ = 39.6 mm.</td>
</tr>
<tr>
<td>Crushed skull, palate and part of occiput, right p²-m³ and left p⁴-m³. (m) 32314A</td>
<td></td>
<td>p⁴-m³ = 39 mm.</td>
</tr>
<tr>
<td>p⁴-m³ = 41 mm.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Four immature maxillary dentitions:

<table>
<thead>
<tr>
<th>Palate with dp²-m¹.</th>
<th>32283</th>
<th>Left fragment, dp²-m¹. 32309</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial skull, dp²-m¹.</td>
<td>32284</td>
<td>Right fragment, dp²-dp⁴. 32285</td>
</tr>
</tbody>
</table>

Nineteen mandibular rami (grouped according to series lengths):

<table>
<thead>
<tr>
<th>Partial mandible with symphysis, p₁-m₂. (m)</th>
<th>32285</th>
<th>Left ramus with symphysis, I₁ and p₁-m₁. (m) 32330</th>
</tr>
</thead>
<tbody>
<tr>
<td>p₁ = 10 mm.</td>
<td>Fig. 5</td>
<td>p₁ = 8.4 mm.</td>
</tr>
<tr>
<td>Left ramus with symphysis and p₁-m₁. (m)</td>
<td>32326</td>
<td>Partial left ramus with symphysis, p₁-m₁. (m) 32331</td>
</tr>
<tr>
<td>p₁ = 8.8 mm.</td>
<td>Fig. 7</td>
<td>p₁ = 9.4 mm.</td>
</tr>
<tr>
<td>Left ramus with symphysis and p₁-m₁. (m)</td>
<td>32325</td>
<td>Partial left ramus with dp₁ about to fall and p₁-m₁. (m) (Marked &quot;see skull and limbs.&quot;) 32332</td>
</tr>
<tr>
<td>Mandible with symphysis, I₁ (erupting), p₁-m₁. (m)</td>
<td>32287</td>
<td>p₁ = 8.8 mm.</td>
</tr>
</tbody>
</table>

Mandible with symphysis and \( p_1-m_3 \) \((w)\)
\( p_4 = 8.5 \text{ mm.} \)

Left ramus with symphysis, \( /I_s \) and \( p_3 \) alveoli and \( p_3-m_3 \) \((w)\)
\( p_4 = 9 \text{ mm.} \)

Adolescent mandible with symphysis, \( /I_s \), \( p_2 \) alveoli, \( p_2-m_2 \) and partial skull.
\( p_4 = 9 \text{ mm.} \)

Mandible, \( p_4-m_4 \) \((w)\)
\( p_4 = 9.7 \text{ mm.} \)

Right ramus with symphysis and \( p_4-m_4 \) \((w)\)
\( p_4 = 8.5 \text{ mm.} \)

Left ramus with symphysis and \( p_4-m_4 \) \((w)\)
\( p_4 = 7.6 \text{ mm.} \)

Three immature rami:
Right ramus with \( dp_4-m_1 \)
\( 32291 \)
Left \( dp_1 \) alveolus and \( dp_2-m_1 \)
\( 32291A \)

(See Limb Section, page 185.)
TYPE.—Fragmental skull with worn teeth, large C/ alveoli, and reduced horn-pedicles, etc.

Y.P.M.10756  Yale College Expedition of 1873. Figured by Lull, 1920, Fig. 25.

(?)REFERRED.

Skull, jaws, ? ♀.

Y.P.M.10937

As figured by Lull, B.L. approximates (162) 'mm., and series (56) mm.

\[ \begin{align*}
  p^1 &= 6.5 \text{ mm.} & m^1 &= 10 \text{ mm.} & p_3 &= 5 \text{ mm.} & m_1 &= 9 \text{ mm.} \\
  p^3 &= 7 & m^1 &= 13 & p_3 &= 7 & m_2 &= 12.5 \\
  p^4 &= 7 & m^1 &= 12.5 & p_4 &= 7 & m_3 &= 17.5 \\
  \end{align*} \]

Length of diastema = 37.5

REFERRED.—

Two specimens collected by Albert Thomson from the Harrison, three miles northeast of Agate, and referred to *Dyseomeryx marshi* (Lull) by Matthew, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 196:

Portion of right side of cranium showing rudimentary postorbital horn-core, \( p^2-m^1 \); and ramus with \( m_1-m_3 \).

A.M.14264

Partial skull with \( p^1-m^3 \); and nearly complete mandible with /Is, \( p_2-m_3 \).

A.M.14264A

(See skeletal elements (A.M.14264) associated with above skulls, Dromomerycine-Aletomerycine Limb Section, page 186, and Fig. 25A.)

In specimen A.M.14264 there is a rudiment of a postorbital horn which in its crushed condition probably appears of larger than actual size. The noticeably posterior position of the orbit is presumably largely an accompaniment of advanced age. The diastema is moderately short and the premolars somewhat small relative to the greatly worn molars. Teeth, metapodials and tibia, so far as may be observed, are all suggestive of *Aletomeryx*. Slender but complete laterals were retained in the manus of A.M.14264A.

(1b) *Aletomeryx gracilis*, Var.

From Barbour-Hemingford Quarry, Box Butte County, Nebraska, 1936

(Not cited on Table 1)

N.S.M.

EXAMPLE.—Right ramus with \( p_4-m_3 \) (erupting).............. 13-28-7-36
QUESTIONABLY REFERRED.— N.S.M.

Right fragment with m₂(br.)—m₃. ............................... (M++) 29-28-7-36
Left fragment with m₃(br.), m₂. ............................... (w) 15-28-7-36

MAXILLA

Right fragment with m₁, m₁ ............................... (M) 21-28-7-36

Smaller specimens from the same locality closely approximate A. gracilis in size and might best be referred to that species:

Right ramus with symphysis and p₃—m₂. ...................... (m) 1-28-7-36

Twenty-five rama and four maxillary dentitions, N.S.M. Coll. Four metacarpi (see page 186) are only very slightly heavier than the largest A. gracilis.

Larger species (1c)—(3a):

(1c) Aletomeryx scotti (Matthew)
From Garman "Loup Fork," Nebraska
(See discussion under A. gracilis, page 152.)

Blastomeryx Cope, referred Scott, 1890, Bull. Mus. Comp. Zool., XX, p. 76. (Figs. 7, 8 and 9B are of detached limbs—see footnote1.)


TYPE.—Fragment of frontal bone with rudimentary horn-core.

M.C.Z.17743  Garman collection.
This paper, Fig. 16A.

(2) Aletomeryx lugni, new species
From Bridgeport, Morrill County, Nebraska

QUARRY  N.S.M.
Right ramus with diastema, p₁—p₄, alveoli and m₁—m₃. ............................... (w) 3 13-1-7-32

REFERRED.—

FOUR RAMI
(tending larger than type)

Left ramus with diastema, p₁ roots and p₃—m₄(br.)...  (w) 3 14-1-7-32

1 The number M.C.Z.17743 includes, besides the above supra-orbital fragment, a left ramus with dp—m₂, and limb elements of three different individuals, which are cited in the Merycodontini Division of this report under Cosoryx furcatus in the Limb Section, page 460.
Left $p_2$ alveolus and broken $p_3-m_3$............. (w) 3 9-1-7-32
Right $p_3-p_4$ alveoli and $p_4-m_1$................. (w) 3 8-1-7-32
Right $p_3-p_4$ alveoli and $p_4-m_1$................. (m) 2 30-27-9-33

TWO IMMATURE RAMI

Right dp$_1-m_1$............................................... 1-2-7-34
Right dp$_1-m_1$............................................... 3 19-2-7-34

TWO IMMATURE MAXILLÆ

Right dp$^1-m^1$............................................... 3 19-2-7-34
Left dp$^1-dp^4$............................................... 3 19-2-7-34

See Limb Section, page 186, for metatarsi, N.S.M.6- and 7-1-7-32.
(In length approximating smaller specimens of *Sinclairomeryx riparius* from Snake Creek.)

(3) *Aletomeryx marslandensis*, new species

From Marsland, Box Butte County, Nebraska

This most interesting species is larger than *A. gracilis* and smaller than *S. riparius*. The only known horn-pedicle resembles, but is considerably taller than, the largest *A. gracilis* pedicle. Cranial characters, as seen in the crushed skull of a female with rudimentary horn-bosses, parallel those of the smaller *Aletomeryx*. The premaxillary tips are broad, spatulate, and the vertical branches narrow and extended, there are no Cs, the nasals are of moderate length and deeply indented, there is no sagittal crest. The specimens were collected by Messrs. Schultz, Meade, Rathbun and Franzan, and placed at the writer's disposition through the courtesy of Dr. E. H. Barbour.

**TYPE.**—Top of cranium retaining outline of orbits and both horn-pedicles, left broken......................... Fig. 16 50-28-8-34

**REFERRED.**—

Female cranium, slightly broken posteriorly, with rudimentary horn-bosses, and left ramus; dentition completely represented.................................................... (w++) 1-13-6-35

Left maxilla with $p^4-m^4$ (erupting), etc..................... 8-24-8-34
Right maxilla with $p^4$ (br.)–m$^4$ (erupting). (Possibly of above individual.)................................................................. 41-28-8-34

Left $p^2-m^3$..................................................... (w) 45-28-8-34
Frick, Horned Ruminants. I—Cervidae

Fragment of posterior cranium with small horn-pedicle, left maxilla with p4-m3, mandibular portions with p3-m3 (p4 large)................................. (-M) N.S.M. 5-18-7-34
Left ramus with symphysis and p2-m3............................... (M) 5-18-7-34

Figs. 4, 4A

Left ramus with diastema and p4-m3............................... (w) 44-11-7-35
Right ramus with symphysis and m3(br.)-m4........... (w) 13-19-7-35
Right ramus with p3-m2........................................ (M) 5-18-7-34
Left and right partially broken m1-m3(eriupting)........ (-M) 5-18-7-34
Fragment with left p2-m3(br.) (p4 large)..................... (M) 1-24-8-34
Fragment with left p2-m3....................................... (w+) 8-22-8-34

Smaller-sized:

Right p2-m3..................................................... (m) 46-28-8-34
Right ramus with p2-m2 (p2 very small)............... (w) 11-24-8-34
Left m1(br.)-m3............................................ (w) 52-28-8-34

Immature specimens:

Left maxilla with dp2-m2(br. and erupting)........................................ 13-24-8-34
Right maxilla with dp3(br.)-m1(eriupting).................. 11-28-8-34
Left dp3.................................................. 12-24-8-34
Left dp2-m3(eriupting). (In smallness of dp2-dp3, re-
sembles Sheep Creek A.M.18959.)........................... 7-14-8-34
Left dp2-m1(eriupting)................................ 37-28-8-34
Left dp2-dp3........................................... 35-28-8-34
Left dp2-dp4(br.)........................................ 12-28-8-34

See Limb Section, page 186, for a longer and a shorter metacarpus.

(Metapodials not as heavy as B. trigonocorneus. No longer but slightly heavier than Sinclairomeryx riparius.)

(3a) (?)Aletomeryx marslandensis, Var.

From 15 Miles Northeast of Marsland, Dawes County, Nebraska

EXAMPLE.—A remarkable specimen, including well-preserved hornless skull, mandible, dentition complete, and nearly complete skeleton. p4 is large relative to greatly reduced p2-p3. Right and left manus retain slender but complete metacarpals II and V. Collected by Grayson Meade. (Not included in count.)............. Fig. 25B N.S.M. 1-11-8-36
(4) Sinclairomeryx sinclari, new genus and species
From Thomson Quarry, Sioux County, Nebraska

Genotype.—Skull, complete save for premaxillae and left maxilla, exhibiting paired postorbital horn-pedicles, paired nasal excrescences and $p^1$–$m^1$.

(See under (4a).)

Referred.—
- Partial skull (nasals and premaxillae missing) with portions of right and left horn-pedicles and $m^1$–$m^4$. (w)
- Portion of cranium with right and base of left horn-pedicles.
- Portion of skull with left horn-pedicle.
- Frontal saddle with both horn-pedicles.
- Portion of frontal with proximal one-half left horn-pedicle. (Immature.)
- Detached right horn-pedicle.
- Female skull (lacking nasals and premaxillae) with paired postorbital rudimentary horn-nubs, $p^1$–$m^1$. ($m^{++}$) Molars of larger size than in preceding specimens.

Seven rami

<table>
<thead>
<tr>
<th>F:A.M.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.33791</td>
<td>1936. This paper, Figs. 2, 16A.</td>
</tr>
<tr>
<td>F:A.M.33730</td>
<td>This paper, Fig. 16B.</td>
</tr>
<tr>
<td>F:A.M.33792</td>
<td>This paper, Fig. 16B.</td>
</tr>
<tr>
<td>F:A.M.33793</td>
<td>This paper, Fig. 16B.</td>
</tr>
<tr>
<td>F:A.M.33794</td>
<td>This paper, Fig. 16B.</td>
</tr>
<tr>
<td>F:A.M.33795</td>
<td>This paper, Fig. 16B.</td>
</tr>
<tr>
<td>F:A.M.33731</td>
<td>1933.</td>
</tr>
<tr>
<td>F:A.M.33790</td>
<td>This paper, Fig. 16A.</td>
</tr>
</tbody>
</table>

F:A.M.33727

Left fragment with $p_r$–$m_b$. ($w^+$) 31386

Left fragment with $p_r$–$m_b$. ($m^+$) 31387

Left fragment with $p_r$–$m_b$. ($m^+$) 20531X

Right fragment with $p_r$–$m_b$(br.). ($m$) 18958X

Partial left ramus with $m_r$–$m_s$, etc. alveoli. ($m$) 20531A.M.

Right ramus with symphysis and $p_r$–$m_b$. (Molars less large.). ($m^+$) 20531

(164) Bulletin American Museum of Natural History [Vol. LXIX}
Right ramus with $p_2-m_3$ (molars smaller and approximating (w) A.M.18935, S. riparius, ref.); angle, etc., preserved ....... Fig. 16B 33728

Limb elements may possibly be represented in the series listed under S. riparius, page 187.

(4a) (?)Sinclairomeryx riparius (Matthew)

From Type Area, Sioux County, Nebraska

While the premolars of the type maxilla of (?)S. riparius seem to be smaller-proportioned than in the type cranium of S. sinclairi, the latter eventually may prove to represent the same form as S. riparius, which would then take precedence. The molars of the mandibular rami listed below are smaller than in the case of the specimens listed under S. sinclairi.

Ramus possibly slighter, postsymphysis to anterior $m_1$ distance possibly shorter, and premolars, especially $p_1$, less reduced, versus S. riparius, var.


Type.—Left maxilla with $p^2-m^4$. (m) A.M.18956 From Stonehouse Draw, Sheep Creek, 1922. Figured by Matthew, 1924, Fig. 58; this paper, Fig. 10.

Referred from Stonehouse Draw, Collected by Albert Thomson, 1922–25 [A.M. Numbers] and Jack Wilson, 1933–34 [F:A.M. Numbers].—

Left ramus with symphysis and $p_2-m_3$. (m) A.M.18958 Figured by Matthew, 1924, Fig. 59; this paper, Figs. 5, 7.

Nine rami, etc.

Right ramus with symphysis and $p_2-m_3$. (m+) 21476 Right fragment with $p_r-m_3$ and alveoli of $p_s$. (m) A.M. 20531A

Partial left ramus with $p_r-m_3$. (m) 18958W Left fragment with $p_r-p_s$. 18958Z

Left ramus with $p_3$ alveolus and $p_r-m_3$. (m+) F:A.M. Right ramus with diastema, $p_r-m_3$. (w) 31390

Partial right ramus with $p_3$ alveolus, $p_r-m_3$. (m+) 31217 Two badly worn specimens. 31391–2

Three maxilla

Portion of left maxilla with $p^4-m^4$, alveoli of $p^2-p^1$ and indication of retention of C/. (M) F:A.M. 31246

Left maxilla with $p^2-m^4$. A.M. (M+) 18935

Fragment with $p^2-m^4$. (w) 18957
Slightly smaller:

**THREE RAMI, ETC.**

Right ramus with symphysis, /Is alveoli, \( p_4 - m_2 \) (m)

Left fragment with symphysis, \( p_2 \) alveolus, \( p_4 - m_2 \)

*Fig. 5*

31247

31247A

Left ramus with diastema and \( p_2 - m_2 \) (w)

Three badly worn specimens. 31579A, B, C

**61332**

**IMMATURE INDIVIDUALS**

The Stonehouse Draw collection contains a number of rami with milk teeth which are apparently referable to the species. A certain size variation, as remarked above, is noted in the /dps.

**SIXTEEN RAMI**

<table>
<thead>
<tr>
<th>Right ( dp_2 - m_2 ) (erupting).</th>
<th>A.M. 18845</th>
<th>Right ( dp_1 - m_1 ) (erupting).</th>
<th>A.M. 18959</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.</td>
<td>31220</td>
<td>Four immature rami.</td>
<td>18959</td>
</tr>
<tr>
<td>Right ( dp_2 - m_2 ) (erupting).</td>
<td>31219</td>
<td>Two smaller immature</td>
<td>18959</td>
</tr>
<tr>
<td>Right ( dp_2 - dp_4 )</td>
<td>31394</td>
<td>left rami.</td>
<td>18959</td>
</tr>
<tr>
<td>A.M.</td>
<td>20531B</td>
<td>Left ( dp_1 - m_1 ) (erupting).</td>
<td>18959X</td>
</tr>
<tr>
<td>Right ( dp_2 - m_1 ) (br.).</td>
<td>18959</td>
<td>(( dp_2 ) somewhat heavier.)</td>
<td>18959</td>
</tr>
<tr>
<td>(( dp_1 ) apparently smaller.)</td>
<td></td>
<td>Three fragments.</td>
<td>18959</td>
</tr>
</tbody>
</table>

**TWO MAXILLES**

<table>
<thead>
<tr>
<th>Right maxilla with ( dp^2 - m^1 ) (erupting).</th>
<th>A.M. 31216</th>
<th>Left maxilla with ( dp^2 - m^1 ) (br.).</th>
<th>A.M. 18957Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.</td>
<td>31221</td>
<td>dp^1 (br.)</td>
<td>18957Y</td>
</tr>
</tbody>
</table>

(For limb elements referred to this species and the following variants, see Limb Section, page 187.)

(4aa) Questioned Var.

From Type Locality, Sioux County, Nebraska

Characterized by notably small premolars versus (?) *S. riparius*. The size range, as gauged in the *m_2*, was about the same as in the species.

**EXAMPLE.—** Right fragment with \( p_4 - m_3 \) (erupting).

F:A.M. 31216 From Thomson Quarry, Stonehouse Draw, 1933.

This paper, *Figs. 5, 7.*
Referred.—

Four specimens collected by Jack Wilson from the type locality:

- Right ramus with diastema, \( p_5(\text{br.})-m_1 \)  \( (M+) \)  F:A:M.31214 1934.
- Left ramus with diastema, \( p_4-m_4 \)  \( (M+) \)  F:A:M.31223 1934.
- Left fragment, \( p_4-m_4 \)  \( (M) \)  F:A:M.31224 1934.
- Right fragment with \( p_4-m_4(\text{br.}) \)  \( (w) \)  \( \text{Smallest } p_4 \)  F:A:M.31215 1933.

Two fragments collected by Albert Thomson in the same general locality:

- Right fragment with \( p_4-m_4(\text{erupting}) \)  A:M.18958U 1922.
- Right ramus with symphysis and \( p_4-m_4 \)  \( (M+) \)  A:M.18958B  From (?)Sheep Creek beds, 1922.

This paper, Fig. 7.

(The specimen is somewhat intermediate to the above and \( S. \ riparius \) proper.)

(4aaa) Questioned Vars. or Species

From Thistle and Long Quarries, Sioux Country, Nebraska

Referred from Thistle Quarry, 1935-36.—

- Detached right horn-pedicle (?adolescent, tip ?slender)  \( \dots \) Fig. 16B  33738
- Portion of left horn-pedicle  \( \dots \)  33732

Molars approximating in size Thomson Quarry specimens:

- Right ramus with symphysis and \( p_4-m_4(\text{lacking heel}) \)  \( (M) \)  33020
- Right fragment with \( m_4-m_3 \)  \( (w) \)  33020A
- Left ramus with symphysis and \( p_2-m_4 \)  \( (M+) \)  33021

Referred from Long Quarry, 1935.—

A distinct species is probably represented by specimens from Long Quarry in which the teeth are of smaller size than in the above Thomson Quarry specimens, and seemingly more nearly approximating \( Aletomeryx \) of the Bridgeport Quarry.

- Left ramus with \( p_4-m_4 \)  \( (w) \)  32469
- Right \( dp_4-m_1 \)  \( \dots \)  32469A
(5) Sinclairomeryx tedi, new species

From Ginn Quarry, Dawes County, Nebraska

The remains from Ginn Quarry, collected by Ted Galusha in November, 1935, include a series of fragmental mandibular rami in which the molars are of larger size but the premolars proportionately smaller than in *Barbouromeryx trigonocornes*. The teeth are slightly heavier but of very similar proportions to the above specimens from Long Quarry. In the immature dentition the dp1–m1, while larger, are of much the proportions of *Aletomeryx* and but very slightly smaller than a specimen from Long Quarry, which itself is moderately suggestive of the Sioux County A.M.18959. In several of the Dawes County immature specimens the dp1 alveolus tends to be slightly separated from the dp3. As compared to an immature *Barbouromeryx*, while the dp4 may be approximately the same length, the dp2–dp3 and m1 are notably smaller.

**TYPE.**—Right ramus with diastema and p2–m3............. (M+) 32875

**REFERRED FROM TYPE LOCALITY.**—

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with p4(br.)–m2</td>
<td>w 32876</td>
</tr>
<tr>
<td>Left p4–m2</td>
<td>w+ 32876A</td>
</tr>
<tr>
<td>Left ramus with p4–m4(erupting)</td>
<td>32877</td>
</tr>
<tr>
<td>Left ramus with p4–m4(erupting)</td>
<td>32877A</td>
</tr>
<tr>
<td>Left ramus with m1(br.)–m4</td>
<td>m 32877B</td>
</tr>
<tr>
<td>Left ramus with symphysis and p1–m1 and Figs. 4, 4A</td>
<td>w+++ 32878</td>
</tr>
<tr>
<td>Left ramus with symphysis and p1–m1</td>
<td>w+++ 32878A</td>
</tr>
<tr>
<td>Left ramus with symphysis and p1–m1</td>
<td>w++++ 32878B</td>
</tr>
<tr>
<td>Left p1–m1</td>
<td>w+++++ 32878C</td>
</tr>
<tr>
<td>Left ramus with p1–m1 and angle</td>
<td>w+++++ 32878D</td>
</tr>
<tr>
<td>Several maxillary specimens including:</td>
<td></td>
</tr>
<tr>
<td>Right p4–m4</td>
<td>(M+) 32866</td>
</tr>
<tr>
<td>Left p4–m4</td>
<td>(w+) 32866A</td>
</tr>
<tr>
<td>Immature rami:</td>
<td></td>
</tr>
<tr>
<td>Left dp1–m1(erupting)</td>
<td>32867</td>
</tr>
<tr>
<td>Left dp1–m1 (detached dp1 alveolus)</td>
<td>32867A</td>
</tr>
<tr>
<td>Left dp1–m1</td>
<td>32867B</td>
</tr>
<tr>
<td>Left dp1–m1</td>
<td>32867C</td>
</tr>
<tr>
<td>Left dp1–m1</td>
<td>32867D</td>
</tr>
<tr>
<td>Right dp1–m1</td>
<td>32867E</td>
</tr>
<tr>
<td>Left dp1–dp4</td>
<td>32867F</td>
</tr>
</tbody>
</table>

See Limb Section, page 187.
DROMOMERYCINE AND ALETOMERYCINE LIMB ELEMENTS

Figures 17, 18; and (in part) 25, 25A, 25B

Statement

The collections contain certain detached and a few associated limb elements of relatively heavy proportions. The several cases where such elements are directly associated with skulls, partial skulls, or dentitions, have been useful in the interpretation and tentative allocation of the detached specimens—see detailed lists (page 176). The specimens cover a considerable range in size. Certain of the more typical examples are figured. The largest form is represented by a Yuma County metacarpus referred to Yumaceras, n.g., the smallest by the Aletomeryx remains. The Dromomeryx borealis type limbs and the elements referred to D. whitfordi and to Rakomeryx species from Nevada and Oregon are of only slightly smaller dimensions than the largest. Remains of more moderate size include a Rakomeryx metatarsus from Barstow, and the specimens from Sioux County, Nebraska, hypothetically interpreted as the male of Cranioceras unicornis. A fourth group is represented by the Montana Subdromomeryx antilopinus type, by moderate specimens referred to Cranioceras unicornis from Sioux County, Nebraska, by the slightly smaller elements allocated to C. (P.) skinneri, n.subg. and sp., by the associated limbs of the Rakomeryx female (and the questioned A.M.8132A, a distal end of radius from Montana) and by elements doubtfully referred to Bouromeryx, n.subg. The larger of the elements grouped under Sinclairomeryx riparius form a fifth size group. A sixth and still smaller group is examed by the limbs of the Barbouromeryx genotype, and by certain detached elements from Sioux County of smaller size than the last, which are allocated to S. riparius. Seventh and eighth size groups are seen in the Aletomeryx elements. The retention of extremely slender but complete metacarpals II and V is so far exampled in but one specimen.¹

¹ (?) Aletomeryx marslandensis, pp. 163, 186, N.S.M.1-11-8-36. Fig. 25B.
Fig. 17. *Yumaceras*, n.g., *Dromomeryx* Douglass and *Cranioceras* Matthew, comparison of referred limb elements from the Late Tertiary of Colorado, Montana and Nebraska.

× 1. (See legend, page 174.)

170
Fig. 18. *Rakomeryx*, n.g., *Cranioceras* Matthew, *Subdromomeryx*, n.subg., *Procranioceras*, n.subg. (and *?Texoceras* n.g.), comparison of referred limb elements from the Late Tertiary of California, Nebraska and Montana.

× 1/2. (See legend, page 174.)
<table>
<thead>
<tr>
<th>Collection No.</th>
<th>Limb Size Group¹</th>
<th>Humerus (mm)</th>
<th>Radius (mm)</th>
<th>Metacarpus (mm)</th>
<th>Femur (mm)</th>
<th>Tibia (mm)</th>
<th>Metatarsus (mm)</th>
<th>Humerus/Radius</th>
<th>Metacarpus/Radius</th>
<th>Tibia/Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Yumaceras figginsi</em>, (?)ref., Yuma Co., Colo...</td>
<td>F:AM.31518</td>
<td>IV</td>
<td>233</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Y. falkenbachii</em>, var., ref., Miami, Tex...</td>
<td></td>
<td>IV</td>
<td>210</td>
<td>284</td>
<td>290</td>
<td>235</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dromomeryx whitfordi</em>, ref., Sioux Co., Nebr...</td>
<td>Unassoc., pp.181-2</td>
<td>II</td>
<td>237</td>
<td>214</td>
<td>290</td>
<td>235</td>
<td></td>
<td>(96)</td>
<td>(90)</td>
<td>82</td>
</tr>
<tr>
<td><em>Rakomeryx</em> species, ref., Virgin Valley, Nev...</td>
<td>U.C.19417</td>
<td>II</td>
<td>(244)</td>
<td>(235)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dromomeryx borealis</em>, ref., Mont...</td>
<td>C.M.1542</td>
<td>II</td>
<td>217</td>
<td>227</td>
<td>220</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot; &quot;</td>
<td>C.M.827</td>
<td>III</td>
<td></td>
<td>251</td>
<td>223-217</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cranioceras mefferdi</em>, ref., Cherry and Brown Cos., Nebr...</td>
<td>Unassoc., p. 178</td>
<td>III</td>
<td></td>
<td>197-183</td>
<td>218</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. unicornis</em>, ref., Sioux Co., Nebr...</td>
<td>Unassoc., p. 176</td>
<td>III-IV</td>
<td></td>
<td>193-179</td>
<td>212</td>
<td>232-207</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. granti</em>, ref., Cherry Co., Nebr...</td>
<td>Unassoc., p. 177</td>
<td>IV+</td>
<td></td>
<td>188</td>
<td>214</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Rakomeryx raki</em> (or <em>jorakianus</em>), ref., Barstow, Calif...</td>
<td>Unassoc., p. 180</td>
<td>III</td>
<td></td>
<td>197</td>
<td>184</td>
<td>(246)</td>
<td></td>
<td></td>
<td></td>
<td>(80)</td>
</tr>
<tr>
<td><em>Subdromomeryx antilopinus</em>, ref., Mont...</td>
<td>P.U.10401</td>
<td>IV+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cranioceras teres</em>, ref., N. Mex...</td>
<td>F:AM.31691</td>
<td>IV</td>
<td></td>
<td>166</td>
<td>181</td>
<td>173</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Rakomeryx raki</em> (or <em>jorakianus</em>), ref., ♀, Barstow, Calif...</td>
<td>F:AM.31325</td>
<td>IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Listed according to approximate lengths.

Table III

DROMOMERCINE AND ALEOMERCINE COMPARATIVE LIMB MEASUREMENTS AND RATIOS

172
<table>
<thead>
<tr>
<th>Species</th>
<th>Ref.</th>
<th>Size Group</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
<th>Width/Height Ratio</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranioceras dakotensis, ref., E. of Rosebud, S. Dak.</td>
<td>A.M.22502</td>
<td>IV</td>
<td>174</td>
<td>(248)</td>
<td>198</td>
<td></td>
</tr>
<tr>
<td>C. (P.) skinneri, ref., Brown Co., Nebr.</td>
<td>Unassoc., p. 177</td>
<td>IV</td>
<td>158</td>
<td>196</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?)C. clarendonensis, ref., Clarendon, Tex.</td>
<td>F:A.M.32453</td>
<td>IV</td>
<td></td>
<td>190</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aletomeryx marslandensis, ref., Box Butte Co., Nebr.</td>
<td>N.S.M.5-18-7-34</td>
<td>V–VI</td>
<td>156–148</td>
<td>166–154</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barbouromeryx trigonocorneus, genotype, Dawes Co., Nebr.</td>
<td>N.S.M.3-27-11-33³</td>
<td>VI</td>
<td>142</td>
<td>186</td>
<td>164</td>
<td>90  91  76</td>
</tr>
<tr>
<td>Probarbouromeryx sweeti, ref., Morrill Co., Nebr.</td>
<td>Unassoc., p. 184</td>
<td>VI</td>
<td>140</td>
<td>160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aletomeryx lugi, ref., Morrill Co., Nebr.</td>
<td>N.S.M.6-1-7-32</td>
<td>VII⁺</td>
<td></td>
<td>152</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?)A. marslandensis, var., Dawes Co., Nebr.</td>
<td>N.S.M.1-11-8-36⁴</td>
<td>VI</td>
<td>(((124))</td>
<td>153</td>
<td>155</td>
<td>152 (81) 91  84</td>
</tr>
<tr>
<td>A. marshi, ref., Sioux Co., Nebr.</td>
<td>A.M.14264²</td>
<td>VII</td>
<td>127</td>
<td>161</td>
<td>133</td>
<td>94  79</td>
</tr>
</tbody>
</table>

( ) approximate; ( ) estimated.

1 The limb size groups, as here used, are distinct from limb size groups (I–VIII) of the Blastomerycini-Merycodontini subfamilies—Aletomeryx Size Groups VII–VIII approximating the Blastomerycini-Merycodontini Size Groups III–IV.

2 Larger specimens may be of Sinclairomeryx sinclai or of Subdromeryx.

³ N.S.M.3-27-11-33: femur/tibia = 90%; metatarsus/tibia = 80%; metacarpus/metatarsus = 87%.

⁴ N.S.M.1-11-8-36: femur/tibia = 88%; metatarsus/tibia = 84%; metacarpus/metatarsus = 91%.

⁵ A.M.14264: metatarsus/tibia = 83%; metacarpus/metatarsus = 89%. 
Genera and Species Relisted

Some twenty-seven of the species and subspecies seem to be represented by limb elements; where the association is definite, the species are starred. (Compare species summaries, pages 81, 101, 111, 128, 138, 143, 154, and see measurement table, page 172. Numbers in parentheses refer to species in the preceding discussion of dentitions.) Examples of the limb elements, as previously observed, are comparatively shown in Figs. 17, 18, and (in part) 25, 25A, B, versus a metatarsus of the Antilocaprine *Texoceros*, n.g. (A.M.22473, Fig. 18), and certain Blastomercyini.

The limb size groups, as here used, are distinct from Limb Size Groups I–VIII of the Blastomerycine-Merycodontine subfamilies, *Aletomeryx* Size Groups VII–VIII approximating the Blastomerycine-Merycodontine Size Groups III–IV.

---

**Figs. 17 and 18.** Aletomerycini and Dromomerycini (and *?Texoceros*), comparison of referred limb elements.

× †. Solid-line bracket indicates associated limbs; broken-line bracket indicates limbs of more than one individual.

**Fig. 17.** Col.M.218, *Yumaceras figginsi*, n.g. and sp., tentatively ref., left metacarpus, from Yuma County, Colorado.

(See page 184.)

C.M.1542, *Dromomeryx borealis* (Cope), ref., left radius and ulna, and right metacarpus, from Montana.

(See page 181.)

F:A.M.31881, *Dromomeryx whitfordi* Sinclair, ref., right metatarsus, from Sioux County, Nebraska.

(See page 182.)

A.M.18872 and F:A.M.31884, *Cranioceras unicornis* Matthew, ref., right metacarpus and left metatarsus, from Sioux County, Nebraska.

(See page 176.)

**Fig. 18.** F:A.M.31830 and 31325, *Rakomeryx raki* (or *jorakianus*), n.sp., ref., left metatarsus and ‡ right humerus, radius and metacarpus, from Green Hills, Barstow, California.

(See also Figs. 8, 10A [mandible, maxilla of F:A.M.31325] and pages 180, 179.)

F:A.M.31873, *Cranioceras unicornis* Matthew, ref., right metacarpus, from Sioux County, Nebraska.

(See page 176.)

P.U.10401, *Subdromomeryx antilopinus* (Scott), right metacarpus and left radius (considered as of same individual as the type), from Deep River, Montana.

(See also Figs. 10, 14A [apparently associated dentition and skull] and page 182.)

F:A.M.31915, 31251 and 31918, *Procranioceras skinneri*, n.subg. and sp., ref., left humerus, right metacarpus and metatarsus, from Devil's Gulch, Brown County, Nebraska.

(See also Fig. 12 [skull and mandible doubtfully associated with F:A.M.31251] and page 177.)

A.M.22473, (?)*Texoceros altidens* (Matthew), ref., right metatarsus, from Sioux County, Nebraska.

(See pages 508, 518.)
Frick, Horned Ruminants. I—Cervidae

* = elements associated

I. Cranioceras Matthew (and IA. Procranioceras, n.subg.)—Limb size groups III and IV

1. C. unicornis Matthew, from Sioux County, Nebraska. This paper, Fig. 17 (A.M.18872 and F:A.M.31884); Fig. 18 (F:A.M.31873).
   (1a) C. granti, n.sp., referred, from upper zone, Cherry County, Nebraska.

2. C. (P.) skinneri, n.subg. and sp., referred, from Devil’s Guleh, Brown County, Nebraska. This paper, Fig. 18 (F:A.M.31915, 31918 and 31251).
   (3) C. mefferdi, n.sp., referred, from Cherry and Brown Counties, and (?)(3a) var., from Dawes County, Nebraska.

3. C. dakotensis, n.sp., referred, from three miles east of Rosebud, South Dakota.

4. C. paunensis, n.sp., referred, from Santa Cruz, New Mexico.

5. C. gazini, n.sp., referred, from Pawnee Creek, Colorado.

6. C. clarendonensis, n.sp., referred, from Clarendon, Texas.

Species (4a) and (7a) are not represented by limbs.

II. Rakomeryx, new genus—Limb size groups II and III (9 IV)

* (1) or (2), R. raki (or jorakianus), n.sp., referred, from Green Hills, Barstow, California. This paper, Fig. 18 (F:A.M.31830 and 31325).

(4) R. species, from Virgin Valley, Nevada.

5. R. gazini, n.sp., referred, from Oregon.

Species (3) is not represented by limbs.

III. Dromomeryx Douglass—Limb size group II

*(1) D. borealis (Cope), referred, from Montana. This paper, Fig. 17 (C.M.1542).

(2) D. paunensis, n.sp., referred, from Pawnee Creek, Colorado.

(3) D. whitfordi Sinclair, from Sinclair and Antelope Draws, Sioux County, Nebraska. This paper, Fig. 17 (F:A.M.31881).

III. Subdromomeryx, new subgenus—Limb size group IV+ to V

*(4) S. antilopinus (Scott), from Montana. This paper, Fig. 18 (P.U.10401).

(4a) S. scotti, n.subg. and sp., questionably referred, from Sioux County, Nebraska.

Species (4b) is not represented by limbs.

IV. Bouromeryx, new subgenus—Limb size group IV

(1b) B. nebrascensis, n.sp., referred, from Echo Quarry, Sioux County, Nebraska.

(1d) (?B. pseudonebrascensis, n.sp., referred, from Dawes County, Nebraska.

Species (1), (1a), (1aa), (1c), (2), (2a) and (3) are not represented by limbs.

V. Barbouromeryx, new genus—Limb size group VI

(Dromomerycini Limb Size Groups v to VIII approximate Limb Size Groups I to IV of the Blastomerycini series.)

*(4) B. trigonocorneus (Barbour and Schultz), from Antelope Creek, Dawes County, Nebraska. This paper, Fig. 25 (N.S.M.3-27-11-33).

VA. Probarbouromeryx, new subgenus—Limb size group VI

(5) P. sweeti, n.subg. and sp., referred, from Bridgeport Quarry, Morrill County, Nebraska. This paper, Fig. 25A (N.S.M.29-27-9-33 and 36-27-9-33).

VB, Protobarbouromeryx, new subgenus, VI, Drepanomeryx Sinclair, and VII, Matthomeryx, new subgenus, are not represented by limbs.
VIII. Yumaceras, New Genus—Limb Size Groups I and IV
(1) Y. figginsi, n.g. and sp., (?) referred, from Yuma County, Colorado. This paper, Fig. 17 (Col.M.218).
(1b) Y. species, from Clark County, Kansas.
(2) Y. falkenbachi, n.sp., referred, from Guymon, Texas County, Oklahoma.
(2a) Y. falkenbachi, var., from Miami Quarry, Texas. Species (1a) is not represented by limbs.

IX. Aletomeryx Lull—Limb Size Groups VII and VIII
(Metapodials are intermediate to Size Groups II and III of the Blastomerycine series.)
(1) A. gracilis Lull, from Cherry County, Nebraska. This paper, Fig. 25A (F:AM. 31931 and 31932); Fig. 25B (F:AM.32248).
(1a) A. marshi (Lull), referred, from Cherry County, Nebraska. This paper, Fig. 25A (A.M.14264).
(1b) A. gracilis, var., from Box Butte County, Nebraska.
(2) A. lugni, n.sp., referred, from Morrill County, Nebraska.
(3) A. marslandensis, n.sp., referred, from Box Butte County, and (3a) (?) var., from Dawes County, Nebraska. This paper, Fig. 25B (N.S.M.1-11-8-36). Species (1c) is not represented by limbs.

X. Sinclairomeryx, New Genus—Limb Size Groups V and VI
(4a) (?) S. riparius (Matthew), and vars., referred, from Sioux County, Nebraska.
(4aaa) Questioned vars. or species, from Sioux County, Nebraska.
(5) S. sedi, n.sp., referred, from Dawes County, Nebraska.

Detailed Lists of Limb Elements of the Above Genera and Species

I. Cranioceras Matthew (and IA, Procranioceras, New Subgenus)

(1) C. unicornis Matthew
From Sioux County, Nebraska

The male hypothesically exampled by specimens of smaller size than D. whitfordi, and larger size than S. antilopinus. (Specimens may represent in part small individuals of D. whitfordi.)

**Example.—** Right metacarpus, 197 mm.
A.M.18872 From Sinclair Draw, 1921. This paper, Fig. 17.
Left metatarsus.
F:AM.31884 From Quarry No. 1, 1932. This paper, Fig. 17.
Calcaneum.
F:AM.31885 From E. Sinclair Draw, 1933.

The female is apparently exampled by several moderate-sized specimens.

**Example.—** Left metacarpus.
Two left metacarpi.
F:AM.31871 and 31872 From E. Sinclair Draw, 1933.
Right metacarpus, 183 mm.
F:AM.31873 From E. Sinclair Draw, 1932. This paper, Fig. 18.
Calcaneum and two astragalii.
From Snake Creek area.
From Upper Zone, Cherry County, Nebraska

To this species are allocated a series of metacarpi (see F:A.M.31925 and 31926) of heavier and shorter proportions than typical *Cranioceras granti*, and nearest approached by a specimen (F:A.M.31518) from Miami, Texas. More elongate elements from the same quarry, of smaller size than *Dromomeryx whitfordi* and of larger size than *Subdromomeryx antilopinus*, resemble a Sioux County *Cranioceras* referred metacarpus, A.M.18872.

**REFERRED.**

From *Leptarctus* Quarry, 1936 (more recently received specimens):

<table>
<thead>
<tr>
<th></th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left radius</td>
<td>33716C</td>
</tr>
<tr>
<td>Three right and one left metacarpus (B = 193 mm.)</td>
<td>33717B-E</td>
</tr>
<tr>
<td>Two left and one right metatarsus (G = 207 mm.)</td>
<td>33718E, G, F</td>
</tr>
</tbody>
</table>

From Kat Quarry, 1931, 1933 and 1936:

<table>
<thead>
<tr>
<th></th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two right and one left radius</td>
<td>33716, A-B</td>
</tr>
<tr>
<td>Two right (31925 = 179 mm.) and one left (193 mm.) metacarpus</td>
<td>31925-7</td>
</tr>
<tr>
<td>One right and three left metacarpi (G = 185 mm.)</td>
<td>33717, A, F, G</td>
</tr>
<tr>
<td>Right tibia (crushed)</td>
<td>33718H</td>
</tr>
<tr>
<td>Four left and one right metatarsus (33718 = 232 mm.)</td>
<td>33718, A-D</td>
</tr>
<tr>
<td>Two right metatarsi, 212 and (213) mm. (slightly shorter than <em>C. mefferdi</em> referred specimen)</td>
<td>32070, 32069</td>
</tr>
<tr>
<td>Two astragali</td>
<td>31923, 31248A</td>
</tr>
</tbody>
</table>

From Bear Creek, 1934:

<table>
<thead>
<tr>
<th></th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left metatarsus</td>
<td>32404</td>
</tr>
<tr>
<td>Two astragali</td>
<td>32404A, B</td>
</tr>
</tbody>
</table>

The largest metacarpus, F:A.M.33717B = 193 mm.; the smallest, F:A.M.31925 = 179 mm. The largest metatarsus, F:A.M.33718 = 232 mm.; the smallest, F:A.M.33718G = 207 mm. (See Table III, page 172.)

**REFERENCES.**

Eight examples from Devil's Gulch, Horse Quarry, Brown County:

<table>
<thead>
<tr>
<th></th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left humerus.</td>
<td>31915</td>
</tr>
<tr>
<td>This paper, Fig. 18.</td>
<td></td>
</tr>
<tr>
<td>Right and left metacarpi, 174 mm.; atlas and axis.</td>
<td>31251</td>
</tr>
<tr>
<td>This paper, Fig. 18 (right metacarpus).</td>
<td></td>
</tr>
<tr>
<td>[See doubtfully associated skull and mandible, page 87 (this paper, Fig. 12)—but limbs small, suggesting female—(metatarsi may be of two individuals).]</td>
<td></td>
</tr>
<tr>
<td>Right metatarsus, 196 mm.</td>
<td>31918</td>
</tr>
<tr>
<td>This paper, Fig. 18.</td>
<td></td>
</tr>
<tr>
<td>Right femur, (248) mm.</td>
<td>31929</td>
</tr>
<tr>
<td>Four astragali.</td>
<td>31930A-D</td>
</tr>
</tbody>
</table>

(2) *C. (P.) skinneri*, n.subg. and sp., tentatively referred

From Brown and Cherry Counties, Nebraska
One example from Plum Creek, Brown County:
Left calcaneum and astragalus. F:A.M.31917

Two examples from Valentine Quarry A, Cherry County, 1935 (tentative):
Right tibia. F:A.M.32088
Right metatarsus, 216 mm. F:A.M.31919

(3) *C. mefferdi*, n.sp., referred
From Cherry and Brown Counties, Nebraska

**Tentatively Referred.**—
Left, 251 mm., and right femora. F:A.M.32397 and 32398 From Midway Quarry, Cherry County, 1934.

**Questionably Referred.**—
Distal end of right femur, distal third of right tibia, right metatarsus, 223 mm., calcaneum, astragalus, tarsals, and one 1st, two 2d and two 3d phalanges. (Size large—see *C. granti*.)
Left metatarsus, 217 mm. F:A.M.31928 From ?Quinn Quarry, Brown County, 1927.
Left calcaneum. F:A.M.31921 From head of Moore Creek, Brown County, 1930.

Four examples from Burge Quarry, Cherry County, 1935 (tentative):
Right metacarpus, 175 mm. F:A.M.32907
Right crushed metacarpus. F:A.M.32909
(Proportions approximating *C. granti*, F:A.M.31925.)
Two left metatarsi. F:A.M.31924, A
Larger = 215 mm.

(?) (3a) Var.

Tentatively referred specimen from Survey Quarry, Dawes County, 1935 (approximating, but heavier than F:A.M.31870):

**Example.**—Left metacarpus, F:B:A.M.32858
183 mm.

(4) *C. dakotensis*, n.sp., referred
From Three Miles East of Rosebud, South Dakota

**Example.**—Left metatarsus. A.M.22502
Very slightly larger and heavier, but near to *Procranioceras skinneri*
(5) *C. teres* (Cope)

From Santa Cruz, New Mexico

**EXAMPLE.**—Distal one-half right humerus.
(Slightly smaller than that referred to *P. skinneri*.)

Right tibia.  
Partial calcaneum.  
Astragalus.

(6) *C. pawniensis*, n.sp., referred

From Pawnee Creek, Colorado

**EXAMPLE.**—Left tibia (br.).  
From Quarry Hill.  
(The specimen is larger than *C. teres* and about the size of *S. antilopinus*.)

Specimens from the Pawnee Creek area:

Two 1st, one 2d phalanges, four astragali, tarsus.  
(Possibly *Dromomeryx*, in part.)

(7) (?) *C. clarendonensis*, n.sp., referred

From Clarendon, Texas

**EXAMPLE.**—Left metatarsus, 190 mm.  
Left radius (distal portion crushed).  
Calcaneum and two astragali.

II. *Rakomeryx*, new genus

(1) or (2) *R. raki* (or *jorakianus*), n.sp., referred

From Barstow, California

Size close to Devil's Gulch *Procanioceras skinneri*.

**EXAMPLE.**—Right and distal one-half left humerus, right and distal end left radius, three carpals, right metacarpus, one 1st, one 2d and one 3d phalanx.

(See associated hornless skull and mandible, page 104. This paper, *Figs. 8, 10A.*
Six specimens from the Green Hills, 1930–31:
Left metacarpus, 188 mm. F:A.M.31783 From Steepside Quarry, 1936.
Left metatarsus, 214 mm. F:A.M.31830 This paper, Fig. 18.
(Slightly larger than S. antilopinus.)
Right metatarsus and crushed right tibia of elongate proportions.
(Metatarsus slender, approximate length of F:A.M.31830.)
Right partial tarsus, and metatarsus.
Two partial 1st phalanges. F:A.M.31830A
Astragalus. F:A.M.31831

(4) R. species

From Virgin Valley, Nevada


REFERRED.—Distal portion U.C.19417 Figured by Merriam, 1911, left humerus, left radius and Figs. 60a, b.
uina, left metacarpus (br.),
two 1st, two 2d and one 3d phalanges.

Specimen apparently of large size. John C. Merriam (1911, p. 282) observes: “In the limb figured (Fig. 60a) a section of the middle of the bone [metacarpus] was missing... Without considering the missing fragment the length of this bone is greater and the form more slender than that of the anterior metapodial figured by Douglass.” (Dromomeryx borealis.) (See measurement table.)

(5) R. gazini, n.sp., referred

From Oregon

EXAMPLE.—Distal one-third A.M.8204X From Cottonwood Creek, left tibia, and astragalus. 1879.
(Approximating D. whitfordi size.)

III. Dromomeryx DOUGLASS

(1) D. borealis (Cope), referred

From Montana

(See Douglass, 1909, Ann. Carn. Mus., V, p. 465, Pl. LX, Figs. 1–4.)
Elements associated with partial skull:

Distal two-thirds both humeri, both radii, left and proximal half right ulna, left carpus and four right carpals, both metacarpi, right tibia, distal one-fourth right calcaneum, astragalus and tarsals, proximal two-thirds right metatarsus, four 1st, three 2d and three 3d phalanges, part of atlas, and six cervical and four dorsal vertebrae.

(The tibia is of the same length, but, like the partial metatarsus, is slightly heavier than the same elements of Dromomeryx whitfordi from Snake Creek. The partial humerus and the radius are longer and heavier, and the metacarpus shorter and slenderer, compared to C.M.827.)

Elements associated with skull and ramus:

Right humerus, radius and metacarpus, part of pelvis and sacrum, five cervical and five lumbar vertebrae.

 FIGURED by Douglass, 1909, Pl. IX, Figs. 1, 2 (left fore-limb and manus); Fig. 4 (right tibia); this paper, Fig. 17 (left radius and ulna, right metacarpus).

EXAMPLE.—

Three specimens from 6 miles N.E. of Pawnee Buttes, 1901:

Distal one-third right A.M.9450A metatarsus.

(Approximating D. borealis.)

Calcaneum and astragalus. A.M.9450B and C

(2) D. pawniensis, n.sp., referred

From Pawnee Creek, Colorado

Partial metatarsus slightly larger than Nebraska specimen.

EXAMPLE.—

Right metacarpus, 210 mm. F:A.M.33001 From A.D. (Echo Quarry).

Left femur. F:A.M.31876 From W.S.D.

Two complete and distal two-thirds portion of right tibia. F:A.M.31877-9 From E.S.D.

Right and left immature tibia. F:A.M.31880 From W.S.D., A.D. 31874

(3) D. whitfordi Sinclair, referred

From Sinclair and Antelope Draws, Sioux County, Nebraska, 1932-35

EXAMPLE.—
Right metatarsus, 235 mm. F:A.M.31881 From E.S.D. This paper, Fig. 17.

Distal end of metatarsus. F:A.M.31874A From A.D.

Eleven astragali. F:A.M.31882A-K

One calcaneum. F:A.M.31883 From W.S.D.

Note considerably smaller-sized elements here referred to *Cranioceras unicornis*—may in part represent a small female of the above.

(?) *Dromomeryx whitfordi*, Var.

From Observation Quarry, Dawes County, Nebraska, 1936

**EXAMPLE.**—

Distal portion right humerus. F:B:A.M.33774A

Right metacarpus (length 233 mm.; Size Group I). (Approximating *Yumaceras*, Col.M.218.) F:B:A.M.33756

Right metacarpus (length 223 mm.; Size Group II). (Question reference—much smaller than Observation Quarry F:B:A.M.33756 and slightly larger than Echo Quarry F:A.M.33001. May represent *Matthomeryx*.) F:B:A.M.33772

Left tibia (crushed). F:B:A.M.33774

**III A. Subdromomeryx, New Subgenus**

(4) *S. antilopinus* (Scott)

From Montana

Metacarpus slender and slightly longer than Devil’s Gulch *Procranioceras* referred; moderately larger than Barstow hornless *Rakomeryx* elements, F:A.M.31325.

**EXAMPLE.**—Distal one-fourth right and partial left humerus, partial right radius, left radius and partial ulna, right and distal four-fifths left metacarpus, partial right and left femur, distal four-fifths right and proximal one-third left tibia, right calcaneum, astragalus and tarsals, partial right metatarsus, three vertebrae, etc. fragments.

(See apparently associated cranium, page 123. This paper, *Figs. 10, 14A*.)

**QUESTIONABLY REFERRED.**—

Distal one-third right radius. A.M.8132A
(4a) *S. scotti*, n.subg. and sp. (questionably referred Long Quarry)

From Sioux County, Nebraska

From Greenside and Long (rare) Quarries:

- Two right and one left humeri ........................................ 33010, A, B
- Partial right and partial left humerus .................................. 33010C, D
- Distal half right humerus (Long Quarry) .................................. 33010E
- Right and left radii (32014, Long Quarry) .............................. 32014, 33011
- Left (165 mm.) and two right metacarpi ................................. 33012, A, B
- Two right metacarpi (heavier than above and C [154 mm.] slightly shorter) ........................................ 33012C, D
- Two left femora .............................................................. 33013, A
- Three left tibiae ............................................................. 33014, A, B
- Right tibia (heavier than above) .......................................... 33014C
- Two right and one left (187 mm.) metatarsi ............................. 31947, 33015, 32830
- One right and two left (B = 170 mm.) metatarsi (smaller than above) ........................................ 33015A, B, C

IV. *Bouromeryx*, new subgenus

(The questionably allocated limbs are larger and heavier and the mandibular rami are smaller than in the case of *S. scotti*.)

(1b) *B. nebrascensis*, n.sp., referred

From Camp Site, Echo Quarry, Sioux County, Nebraska, 1934

- Distal one-third metacarpus (approximating in size *C. unicornis*) ........ 31875A

(1d) (?) *B. pseudonebrascensis*, n.sp., referred

From Observation Quarry, Dawes County, Nebraska, 1936

- Nearly complete right humerus (crushed) .............................. 34009
- Left radius ................................................................. 34009A
- Right metacarpus .......................................................... 34010
- Right metatarsus ........................................................... 34010A
- Right metatarsus ........................................................... 33773

V. *Barbouromerxy*, new genus

(4) *B. trigonocorneus* (Barbour and Schultz)

From Antelope Creek, Dawes County, Nebraska

Genotype (in part).- Skeletal elements, including left and partial right humerus, both radii, right and part of left ulna, left metacarpus, left femur, tibia, tarsus, metatarsus, two 1st, two 2d and two 3d phalanges, ribs and etc. fragments.

(See associated partial skull and rami, page 134. This paper, Figs. 2, 5, 7, 10, 14.)
VA. Probabarouromeryx, new subgenus

(5) *P. sweeti*, n.subg. and sp., referred
From Bridgeport Quarry, Morrill County, Nebraska

Metatarsi intermediate between the longest and shortest *S. riparius* specimens.

<table>
<thead>
<tr>
<th>REferred.</th>
<th>QUArRY</th>
<th>N.S.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal portion of right humerus.</td>
<td>1</td>
<td>76-25-6-35</td>
</tr>
<tr>
<td>Left metacarpus.</td>
<td>2</td>
<td>29-27-9-33</td>
</tr>
<tr>
<td>Left metatarsus, 160 mm.</td>
<td>2</td>
<td>36-27-9-33</td>
</tr>
<tr>
<td>Right metatarsus, 147 mm.</td>
<td>2</td>
<td>38-27-9-33</td>
</tr>
<tr>
<td>Two right partial metatarsi.</td>
<td>1</td>
<td>49-25-6-35</td>
</tr>
<tr>
<td>Two complete and one partial calcanea.</td>
<td>1</td>
<td>34-, 69- and 33-25-6-35</td>
</tr>
<tr>
<td>Seven astragali.</td>
<td>1</td>
<td>6-7-34, 35-, 72- and 136-25-6-35</td>
</tr>
<tr>
<td>Three 1st, one 2d and two 3d phalanges.</td>
<td>1</td>
<td>6-7-34, 138-, 43-, 45-, 47-25-6-35 and 6-7-34</td>
</tr>
<tr>
<td>Smaller-sized:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two astragali.</td>
<td>1</td>
<td>36- and 37-25-6-35</td>
</tr>
<tr>
<td>Two 2d and one 3d phalanges.</td>
<td>1</td>
<td>6-7-34</td>
</tr>
</tbody>
</table>

VIII. Yumaceras, new genus

(1) *Y. figginsi*, n.g. and sp., (?)referred
From Yuma County, Colorado

**Example.**—Left metacarpus. Col.M.218 This paper, *Fig. 17*. (Length = 233 mm., versus *Dromomeryx borealis* metacarpus, 214 mm.)

**REferred.**—
Right and left astragali. Col.M.713/T

(1b) *Y. species*
From Clark County, Kansas

**Example.**—Left metacarpus, F:AM.30914 From J. Dakin Quarry, 1936. 238 mm.

(2) *Y. falkenbachi*, n.sp., referred
From Guymon, Texas County, Oklahoma

**Example.**—Two left astragali. F:AM.32145, A
Frick, Horned Ruminants. I—Cervidae

(2a) Y. falkenbachii, Var.

From Miami Quarry, Texas


The metacarpus is almost the size of the Kat Quarry specimen, F:A.M.31926; is much heavier than Procranioceras of Devil's Gulch or Cranioceras of Sioux County; and is slightly shorter and heavier than Subdromomeryx antilopinus type. The specimen is very much smaller than (?)Y. figginsi referred specimen.

IX. Aleomeryx Lull

(1) A. gracilis Lull

From Cherry County, Nebraska

REFERRED.—Skeleton (composite). Y.P.M. Coll.

From talus slope near the mouth of Antelope Creek, northwestern part of Cherry County, Nebraska. Figured by Lull, 1920, Pl. 1 and Text-Figs.

(See skulls and jaws, and comparative measurements, page 156.)

REFERRED FROM VICINITY OF THE TYPE LOCALITY.—

Right, two left and five partial humeri. F:A.M.32249, A; 32250, A, B; 32251, A, B

Largest, F:A.M.32249 = 116 mm.; smallest, F:A.M.32251 = (104) mm.

Three right, three left and three partial radii. F:A.M.32252, A; 32253, A-C; 32254, A; 32255

Largest, F:A.M.32252 = 139 mm.; smallest, F:A.M.32255 = 121 mm.

Four right, three left and two partial metacarpi. F:A.M.31931 (Fig. 25A); 32248 (Fig. 25B); 32256, B-D; 32257, A; 32258

Largest, F:A.M.31931 = 127 mm.; smallest, F:A.M.32258 = 115 mm.

Right, two left and one partial femur. F:A.M.32259; 32260; 32261, A


Two right and two left, and one fragmental immature tibia. F:A.M.32262, A; 32263, A, B

Largest, F:A.M.32262 = (174) mm.; smallest, F:A.M.32263A = 164 mm.

Seven right, seven left and five partial metatarsi. F:A.M.31932 (Fig. 25A); 32264-8; 32269, A-C; 32270, A-C, AA; 32271, A-C

Largest, F:A.M.32264 = 141 mm.; smallest, F:A.M.32270AA = 129 mm.

Two distal portions of laterals. F:A.M.32248A, AA

Twelve first and four third lateral phalanges. F:A.M.32248B-M and N, P-R

Two distal portions of laterals (F:A.M.32248A, AA), two first (32248I, F) and two third lateral phalanges (32248R, P), together with metacarpus (32248) and its phalanges (32248S, T)—all unassociated—are figured, Fig. 25B.

See (?) Aleomeryx marlandensis, var., N.S.M.1-11-8-36, pages 163, 186. Fig. 25B.
(1a) *A. marshi* (Lull), referred

From the Harrison, 3 Miles Northeast of Agate, Nebraska

Right and left distal humeri, left and proximal right radius and ulna, left carpus, left metacarpus with slender fifth metacarpal attached, left distal two-thirds femur, left and distal one-half right tibia, right and left tarsi and metatarsi, four 1st, four 2d and two 3d phalanges, etc. fragments.

(Associated with partial crania, A.M.14264 and 14264A, see page 160.)

As compared to *Parablastomeryx gregorii*, F:A.M.31360, from Cherry County, in *A. marshi* the metacarpus is slightly shorter versus the radius, the metatarsi slightly longer as compared to the tibiae, and the metacarpus of the same length as the metatarsus.

(1b) *A. gracilis*, Var.

From Barbour-Hemingford Quarry, Box Butte County, Nebraska, 1936

**Questionably Referred.**

- Two right and two left metacarpi.
- Etc. foot bones.

(2) *A. lugni*, n.sp., referred

From Bridgeport, Morrill County, Nebraska

**Referred.**—Two right metatarsi.

N.S.M.6- and

From Quarry 3.

7-1-7-32

(Length = 152 mm., versus 160 mm. of *Probarbouromyx sweeti*.)

(3) *A. marslandensis*, n.sp., referred

From Marsland, Box Butte County, Nebraska

**Referred.**—Two left metacarpi.

(N.S.M.5-18-7-34

(Length = 148–156 mm.)

- Right metacarpus.
- Right metatarsus, 169 mm.
- Left metatarsus, 153 mm.

Several partial limb and numerous foot bones, N.S.M. Coll.

A skull, mandible and skeleton, N.S.M.1-11-8-36, of a female from the Middle Tertiary of Box Butte County (kindness of Professor Barbour) is of remarkable interest in witnessing the retention in this early deer of metacarpals II and V, which, though extremely slender medianly, are complete. Whether lateral metatarsals were similarly retained or represented by splints is not indicated. This new evidence suggests the possibility that the proximally broken splints of *A. gracilis* actually may represent complete lateral metacarpals. *Fig. 25B.*
X. *Sinclairomeryx*, new genus

(4a) (?) *S. riparius* (Matthew), and Var., referred

From Sheep Creek, Sioux County, Nebraska

Larger and smaller individuals are exemplified in a series of limb bones from the Sheep Creek beds, Sioux County, Nebraska. The dimensions, broadly considered, tend to approximate those of the *Barbouromeryx* genotype. The metapodials are disproportionately larger (or smaller). The specimens are rather tentatively referred to *Sinclairomeryx*, so well represented in rami, etc., from the same deposit. Certain of the larger specimens well may represent *S. sinclairi* or even *Subdromomeryx*.


<table>
<thead>
<tr>
<th>Larger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left humerus, (141) mm.</td>
</tr>
<tr>
<td>Left radius, (165) mm.</td>
</tr>
<tr>
<td>Right metacarpus, (165) mm.</td>
</tr>
<tr>
<td>Right femur, (177) mm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smaller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right humerus, head missing.</td>
</tr>
<tr>
<td>Two right radii.</td>
</tr>
<tr>
<td>Right radius, (140) mm.</td>
</tr>
<tr>
<td>Left metacarpus, (140) mm.</td>
</tr>
<tr>
<td>Right metacarpus.</td>
</tr>
</tbody>
</table>

(4aaa) Questioned Vars. or Species

From Long, Echo and Thistle Quarries, Sioux County, Nebraska

**REFERRED.—**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Right radius.</td>
<td>31886</td>
<td>Two left radii.</td>
<td>33016, A</td>
</tr>
<tr>
<td>Right tibia.</td>
<td>31888</td>
<td>Left metacarpus.</td>
<td>33017</td>
</tr>
<tr>
<td>Right metatarsus.</td>
<td>31887</td>
<td>Right and left femora (br.)</td>
<td>33018, A</td>
</tr>
<tr>
<td>(Length = 158 mm.)</td>
<td></td>
<td>Four left metatarsi.</td>
<td>33019, A–C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>From Echo Quarry:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Right femur.</td>
<td>31875</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left tibia.</td>
<td>31889</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal one-half right tibia.</td>
<td>31889A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(5) *S. tedi*, n.sp., referred

From Ginn Quarry, Dawes County, Nebraska, 1935

**REFERRED.—** Right tibia. | F:B:A.M.32859
Fig. 19. Deer forms of the American Quaternary.

Heads in flesh × approximately 1/12 (c oversize). (See legend, page 195.)

White-tail (A)  
Odocoileus Rafinesque

Caribou (B)  
Rangifer H. Smith

Giant Elk (C)  
Cervalces Scott

Elk (D)  
Cervus Linnaeus

Moose (E)  
Alces Gray
A comprehensive comparative study of the dental and cranial characters of the living deer of the world might indicate a working classification of the same adaptable to the need of the palaeontologist. The lack of a comparative osteology on the living deer is paralleled by the general absence of similar data on most mammalian groups. Probably there has been no great change in the deer since the Pleistocene and the species of today represent no more than the survivors of certain of the numerous species of that time. Our own deer of the New World, with the exception of the wapiti, have been shown by Brooke (1878) to differ from the great majority of the deer of the Old World by the retention of the distal ends of the lateral metacarpals, by the tendency of the pre-maxillary branches not to reach the nasals and, with the added exception of the moose, by the division of posterior nasal cavity into two distinct chambers. A casual examination of the dentitions suggests a tentative subdivision of the North American Cervini to between four subfamilies, the (Plesiometacarpalia) Cervinæ and the (Telemetacarpalia) Odocoilæ, Alcenæ and Rangiferinæ. The Cervinæ (Cervus) with posterior nares undivided and Odocoilæ (Odocoileus) with nares divided, resemble one another in moderate-proportioned premolars, open p3, tendency to closed anterior fossette in P4 and moderate-lengthed diastema. The teeth differ from Alces (posterior nares undivided) and Rangifer (posterior nares divided), in which the premolars are unusually large-proportioned, the unworn premolar columns detached, the p3 closed, the diastema long and the metacarpals shorter-proportioned. The dentition of Rangifer is recalled in moderate degree by that of the giraffe. Examples of the mandibular tooth series of Recent Alces, Cervus, Rangifer and Odocoileus are illustrated in Figure 20A.

Representatives of the modern deer (Cervini) generally have been considered not to have appeared in North America previous to the Pleistocene; therefore, the suggestion of the occurrence in the Uppermost Pliocene of Eden, southern California, of a Cervine is of unusual interest. The Eden evidence is presented below, and at the same time occasion is taken to describe briefly, enumerate and partially figure certain new Cervines (Cervini) from the Pleistocene of (b) North America and of (c) Ecuador.

1 See footnote 2, next page.
**TABLE IV**

**Metacarpal Length Relative to Skull Length in Certain of the Cervini**

(Skull length measured from back of condyles to front of premaxilla)

<table>
<thead>
<tr>
<th>Species</th>
<th>Gender</th>
<th>Skull Length (mm)</th>
<th>Location</th>
<th>Metacarpus Length (mm)</th>
<th>Length Metacarpus/Length Skull (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alces americana shirasi</em></td>
<td>♂</td>
<td>A.M.(M.)100348</td>
<td>Wyoming</td>
<td>310</td>
<td>59%</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot;</td>
<td>♀</td>
<td>100349</td>
<td>&quot;</td>
<td>307</td>
<td>59%</td>
</tr>
<tr>
<td><em>Rangifer montanus</em></td>
<td>♂</td>
<td>3760</td>
<td>Maine</td>
<td>222</td>
<td>60%</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot;</td>
<td>♀</td>
<td>23481</td>
<td>Colombia</td>
<td>103</td>
<td>64%</td>
</tr>
<tr>
<td><em>Mazama citae sancta-martae</em></td>
<td>♂</td>
<td>42403</td>
<td>British Guiana</td>
<td>112</td>
<td>67%</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot;</td>
<td>♀</td>
<td>35655</td>
<td>N. Y. Zoo</td>
<td>292</td>
<td>67%</td>
</tr>
<tr>
<td><em>Cervus canadensis</em></td>
<td>♂</td>
<td>35619</td>
<td>Central Park Zoo</td>
<td>296</td>
<td>67%</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot;</td>
<td>♀</td>
<td>14090</td>
<td>&quot;</td>
<td>185</td>
<td>69%</td>
</tr>
<tr>
<td><em>Cervus elaphus</em></td>
<td>♂</td>
<td>14444</td>
<td>&quot;</td>
<td>233</td>
<td>69%</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot;</td>
<td>♀</td>
<td>14085</td>
<td>&quot;</td>
<td>182</td>
<td>69%</td>
</tr>
<tr>
<td><em>Odocoileus columbianus</em></td>
<td>♂</td>
<td>35733</td>
<td>&quot;</td>
<td>181</td>
<td>76%</td>
</tr>
<tr>
<td>&quot; &quot; &quot; &quot;</td>
<td>♀</td>
<td>8363</td>
<td>&quot;</td>
<td>190</td>
<td>77%</td>
</tr>
</tbody>
</table>

*Length metacarpus = **Length skull**

1 Length metacarpus, 151/165 = 91%; Moschus, 93.5/121 = 77%; Muntiacus, 86/155 = 55%; Tragulus, 37/86.5 = 44%

2 Three of the North American genera occur as well in the eastern hemisphere: (Telemetacarpalia) *Rangifer*, *Alces* and (Plesiometacarpalia) *Cervus*. Of the four remaining Eurasian genera, *Capreolus* and the hornless *Hydrelaphus* tend to parallel *Rangifer*, and *Cervulus* and the hornless *Elaphodus* to parallel *Cervus* in metacarpal characters. The condition of the metacarpals in the hornless Moschini is as in *Rangifer*. The widely differentiated forms of *Cervus* are divided by Lydekker between *Elaphine* (typical), Sikine, Damine, Rusine, Rucervine and Elaphurine subdivisions.

(A) (?) Cervini from the Uppermost Tertiary

Subfamily 7.—Cervidae

XI. Procoileus, new subgenus

Total available specimens, 3

Figure 20 (in part)

(1) Procoileus edensis, new subgenus and species

From Eden Beds, Southern California

A ramal fragment with p2–m1 from the Eden Beds is practically unique in pointing to the possibility of the presence of a true Cervine in America as early as the Uppermost Pliocene. The premolars are compressed and high-crowned; the p2 is proportionately small, the p3–p4 moderately tall, the p4 with formed anterior fossette; and the m1 moderate-crowned and having a well-developed median column. The compression of the premolars and the large size of p4 versus the m1 (worn) are indicative of a Cervine rather than a Dromomerycine form. The p3 and m1 somewhat approximate in size, but p4 is larger and closed, and p2 smaller than in a specimen of Dama.


Subgenotype.—Portion of right ramus with p2–m1(br.). F:A.M.31772 From No. 3 Stratum, Marble Canyon, November 28, 1922.

This paper, Fig. 20.

Tentatively Referred.—

Portion of a premolar. U.C.24036 Figured by Frick, 1921, Text-Fig. 95.

Inferior half of astragalus. U.C.23779 Figured by Frick, 1921, Text-Fig. 96.
Fig. 20. *Procoileus*, n. subg., subgenotype, from the Uppermost Pliocene of Eden, California (F: A.M.31772), and types of three *Odocoileus* species, from the Pleistocene of California and Nebraska.

Dentitions × 1, antler base and horn-pedicle × ½. (See legend, page 195.)
Fig. 20A. *Odocoileus* Rafinesque (A), *Rangifer* H. Smith (B), *Cervus* Linnaeus (c and c') and *Alces* Gray (D), of Recent North America, mandibular dentitions compared.

Lateral views × \( \frac{1}{4} \), occlusal × 1. (See legend, page 195.)
Fig. 20B. *Cervus anguine*, n.sp., type (F:AM.31776), and *Odocoileus cascensis*, n.sp., ref., from the Pleistocene of California. Skull and dentitions × 1, antlers × 1/4. (See legend, page 195.)
Fig. 19. Details of Cervini heads in flesh:

(A) *Odocoileus virginianus borealis* (Miller)
(B) *Rangifer osborni* Allen
(C) *Cervalces alaskensis*, n.sp., from the Pleistocene of Alaska (reconstructed after *C. scotti* type)
(D) *Cervus alaskensis*, n.sp., from the Pleistocene of Alaska (length on curve 128 cm.)
(E) *Alces americana americana* (Clinton)

A, B and E based on specimens shot by author.
A, from Essex County, New York, 1899, and
B and E, from Cassiar Province, B. C., 1910.

Figs. 20, 20A and 20B. Cervini from the Uppermost Pliocene, Pleistocene and Recent of North America.

Dentitions $\times 1$ (excepting lateral views, Fig. 20A, $\times \frac{1}{4}$); antlers, antler base and horn-pedicle $\times \frac{1}{4}$. A, B, cross sections of antlers; PS, posterior border symphysis.

Fig. 20. F:A.M.31772, *Procoileus edensis*, n.subg. and sp., subgenotype, rev., from the Uppermost Pliocene, Eden, California.

(See page 191.)


(See page 202.)

F:A.M.17813 and 17811, *Odocoileus cascensis*, n.sp., type and ref., from El Casco, California.

(See page 201.)

F:A.M.25528 (rev.) and 25538, *Odocoileus sheridanus*, n.sp., type and ref., from Hay Springs, Sheridan County, Nebraska.

(See page 200.)

F:A.M.17834C and 31775 (rev.), *Odocoileus cascensis*, n.sp., ref., respectively, base of immature antler and horn-pedicle, from El Casco, California.

(See page 201.)

Fig. 20A. Details of Recent Cervini mandibular dentitions:
PS, posterior border symphysis.

(A) *Odocoileus virginianus* (Zimmermann), $\varphi$, A.M.(M.)13792.
(B) *Rangifer granti* Allen, $\sigma$, A.M.(M.)73698, from Alaska.
(C) *Cervus roosevelti* Merriam, $\varphi$, A.M.(M.)24153, from British Columbia.
(C') *Cervus elaphus* Linnaeus, $\varphi$, A.M.(M.)16866, from Europe (for comparison).
(D) *Alces americana* (Clinton), $\varphi$, A.M.(M.)8049, from Minnesota.

Fig. 20B. F:A.M.31776, *Cervus aquangae*, n.sp., type, from southern California.

(See page 200.)


(See page 201.)
(8) CERVINI FROM THE PLEISTOCENE OF NORTH AMERICA

Subfamily 7.—Cervinae (cont.)

XII. CERVUS LINNAEUS

Subfamily 8.—Odocoileinae

XIII. ODOCOILEUS RAFINESQUE

Subfamily 9.—Alcinae

XIV. CERVALCES SCOTT

XV. ALCES GRAY

Subfamily 9a.—Rangiferinae

XVI. RANGIFER H. SMITH

Figures 19, 20A, 20B and (in part) 20, 25B

Statement

Species of Odocoileus Rafinesque (1832), Cervus Erxleben (1777), Alces Gray (1821), Cervalces Scott (1885) and Rangifer H. Smith (1827) have been reported from North American Pleistocene deposits. Moreover, Cervus, Alces, Cervalces and Rangifer are present in our recent collections from the deeply frozen deposits that overlie the auriferous gravels of the Fairbanks area, Alaska.¹ Cervalces has hitherto been unrecognized in the far north.

The opportunity is taken to record and figure several undescribed Cervines from the Nebraskan, New Mexican and Californian Quaternary, the forms being tentatively referred to Recent genera under several separate species, and at the same time to mention briefly the new Alaskan Cervalces.

The largest of the new Cervine species approached a small wapiti in size. It is exemplified in a metatarsus and partial antler collected by Joseph Rak at Las Cruces, New Mexico. As seen in the metatarsus, the

stature of the species was intermediate between the wapiti and the European red deer. The form may be known as *Cervus lascrucensis*.

A deciduous antler of peculiar character, secured by Guy E. Hazen from an outlier of the San Timoteo Pleistocene, seems to be indicative of an unknown deer of *Odocoileus hemionus* size. The specimen, which is much compressed laterally and extensively and deeply veined, does not appear referable to any Recent species. It is made the type of a new species tentatively referred to *Cervus, C. aquange*.

Two mandibular specimens differ from *O. virginianus* in the greater elongation of the diastema. An even more elongate diastema was reported by Cope for the *O. virginianus*-sized ramus of his type of *Cariacus dolichopsie* from the Pleistocene of Indiana.¹ The first of the two new specimens is important in, for the first time, adding a Cervine to the Hay Springs-Sheridan fauna. This Sheridan species considerably exceeds in size any Recent *Odocoileus*. The top of a large cranium bearing portions of the horns, Nebraska State Museum Collection, from the gravel deposits of northern Nebraska, may belong to the Hay Springs form. The second and more average-sized of the mandibular specimens is from El Casco, California, and of a species well represented in both horns and rami. It is probable that this form is closely allied to or identical with that described in 1921 from the not far distant Bautista deposit. It was observed that the metapodials in the case of the latter were slenderer and longer-proportioned than in Recent *Odocoileus*. Collections made by the late Joseph Rak in the vicinity of the El Casco locality include *Megalonyx, Tapirus, Equus, (?)Tetrameryx*, etc. A variety of the El Casco deer may be represented by a series of horns collected in Imperial County, California, by Guy E. Hazen in the spring of 1936.

A ramus from the Pleistocene in the vicinity of Agate, Nebraska (H.C.-A.M.254), which contrasts with the above in the shortness of the diastema and heaviness of the $p_2$, is taken as the type of a new species and tentatively referred to *Odocoileus, O. cooki*, n.sp.

Oliver P. Hay (1924) indicates the wide distribution in the Pleistocene of Cervid forms. Possibly when all the evidence is restudied a number of genera or subgenera will be found to be represented in addition to those now recognized. *Sangamona* Hay (1920), genotypic species *S. fugitiva*, type molar from Tennessee, is said to have been larger than *Odocoileus*.

¹ The type left ramus of (?)*Odocoileus dolichopsie* (Cope), from Vandenburg County, Indiana, according to Cope, was of the size of *O. virginianus*, but the diastema was an inch longer and the tooth-line shorter. (Cariacus dolichopsie Cope, 1878, Bull. U. S. Geol. and Geog. Surv. Terr., IV, p. 376: Amer. Nat., XII, p. 189.)
While a majority of the Quaternary Cervid remains have been identified with the existing species, a number of new forms have been described:

*O. virginianus* (fossilis) (Leidy, 1854), from Mississippi; *O. whitneyi* (Allen, 1876), from Wisconsin; *C. lucasi* Hay (1927), from Idaho; *O. ensifer* (Cope) (1889), from Whitman County, Washington; *O. lewicornis* (Cope) (1896), from Port Kennedy Cave, Pennsylvania; *O. sellardsii* Hay (1917), from Florida; *Rangifer muscatinensis* Leidy (1879), from Iowa; *Alces brevitubalis* Cope (1889) and *A. semipalmatus* Cope (1889), from Whitman County, Washington; *A. shimeki* Hay (1914), from Iowa; *A. runnymedensis* Hay (1923), from South Carolina.

The evidence as to the Alaskan *Cervalces* was secured in the vicinity of Fairbanks by John B. Dorsh of the joint American Museum-Alaska University expedition working in coöperation with the U. S. Smelting, Refining and Mining Company. The evidence consists in proximal portions of two antlers which are of the right and left sides, respectively, and may represent one individual. The right antler is the better preserved and is selected as the type. The distance from the burre to the beginning of the palmation is 25% greater than in the largest previously known specimen, that from Toronto, and is over twice the length of that of the beautiful Princeton genotype (see measurement table, page 203). A fine *Cervalces*-like antler from Nebraska has been called to the attention of the writer by Professor Erwin H. Barbour. In the Nebraskan horn more of the palmation is preserved than in the Alaskan remains, but as the proximal portion of the shaft unfortunately is broken, a comparison of the length of beam is impossible. The two new occurrences result in the giant genus now being known from Kentucky, New Jersey, Iowa, Nebraska, Ontario and Alaska.

*Rangifer*, like *Alces*, has been cited (Hay, 1923, '24, '27) from Quaternary deposits in the eastern, central and western regions of the United States, Ontario and Grinnell Land (*Rangifer* only). Both genera are well represented in the collections from the Fairbanks area, Alaska (to be reported on later).

Pleistocene-Recent Cervini of North America are here considered as of four subfamilies: *Cervinæ* (*Cervus*), *Odocoilæ* (*Odocoileus* and *Eucervus*), *Alcenæ* (*Cervalces* and *Alces*) and *Rangiferinæ* (*Rangifer*).

---

1 The generic reference of the peculiarly interesting Florida species, *Blastocerus extraneus* Simpson (1928), is yet to be confirmed. In the type, right p3-m3, A.M. 23457, the ps are relatively small, and *p*4 "open."

2 C. B. Shults and E. B. Howard (1935, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 287, Pl. xiii, Figs. 1-2; Pl. xiv, Fig. 7) tentatively refer to *Rangifer* as a species, *R. frickii*, an extremely interesting dentition of a large Caribou-like Cervid from Burnet Cave, New Mexico. The teeth, unfortunately, are much worn. The fossettes of *p*-ps apparently were formed. The specimen is characterized by the large proportionate size of the premolars and the length of the diastema anterior to the same.
Summary of New North American Pleistocene Species

The evidence as to the six new North American Pleistocene species of *Cervus*, *Cervalces* and *Odocoileus* is listed in the following pages:

XII. *Cervus* Linnaeus.

(1) *Cervus lascruensis*, n.sp., from Las Cruces, New Mexico.
    **Type.**—Partial antler, F:A.M.31741.

(2) *Cervus aquanga*, n.sp., from Aguanga, southern California.
    **Type.**—Right horn-core, F:A.M.31776. This paper, *Fig. 20B.*

XIII. *Odocoileus* Rafinesque.

(1) *Odocoileus sheridanus*, n.sp., from Hay Springs, Sheridan County, Nebraska; and Var.
    **Type.**—Right ramal fragment, F:A.M.25528. This paper, *Fig. 20.*
    **Example.**—Posterior cranium, N.S.M.1-11-27.

(2) *Odocoileus cascensis*, n.sp., from El Casco, California; and Vars.
    **Type.**—Left ramus, F:A.M.17813. This paper, *Fig. 20.*
    **Example.**—Partial antler, U.C.23419.

(3) *Odocoileus cooki*, n.sp., from Agate, Sioux County, Nebraska.
    **Type.**—Left ramus, H.C.-A.M.254. This paper, *Fig. 20.*

XIV. *Cervalces* Scott.

(1) *Cervalces alaskensis*, n.sp., from Fairbanks area, Alaska.
    **Type.**—Fragment of a right antler, A.C.-F:A.M.30496.

Detailed Lists of New Types, Referred Specimens, and Synonymy

*Cervus*, total available listed specimens, 6; *Odocoileus*, 37; *Cervalces*, 5

XII. CERVUS LINNAEUS

Head in Flesh, Figure 19d

(1) *Cervus lascruensis*, new species

From the Pleistocene of Las Cruces, New Mexico

**Type.**—Partial antler. F:A.M.31741 Joseph Rak, collector, 1929.
Referred.—


Length = 242 mm. (Intermediate in size between Cervus elaphus and Alces americana.)

(2) Cervus aguangelae, new species

From Southern California

The form is represented by a peculiarly laterally compressed and very unusually deeply and extensively veined horn. The horn in some ways is more suggestive of Rangifer or Dama than of Odocoileus.

Type.—Right horn-core, broken distally.

F:A.M.31776 1933. From the vicinity of Aguanga, Section 15, 1933.

This paper, Fig. 20B.

Referred from the same locality.—


XIII. Odocoileus Rafinesque

Head in Flesh, Figure 19A

(1) Odocoileus sheridanus, new species

From Hay Springs, Sheridan County, Nebraska

Type.—Right fragment with posterior symphysis, p4(br.), alveoli of p2 and P4* (M+)

F:A.M.25528 Charles Falkenbach, collector, 1928.

This paper, Fig. 20.

Referred.—

Left fragment with m1–m4. (M+)

F:A.M.25538 1929. This paper, Fig. 20.

Two detached m3s. (w)

Teeth considerably larger, diastema actually shorter than in F:A.M.17813 from El Casco. p4 smaller, diastema apparently slightly longer-proportioned than in European red deer, A.M.(M.)16866, female.
(1a) (?) Variety
From Pleistocene Gravels, Northern Nebraska

**Example.**—Posterior part of cranium with portion of horns.

Size approximating largest of El Casco specimens, F:A.M.17834B, in which the brow tine is located nearer the base.

(2) *Odocoileus cascensis*, new species
From El Casco, California

**Type.**—Left ramus with diastema and p<sub>r</sub>–m<sub>2</sub>. (M)  F:A.M.17813  Joseph Rak, collector.  This paper, *Fig. 20*.

**Referred.**—
- Right fragment with p<sub>r</sub>–m<sub>2</sub>. (M)  F:A.M.17814
- Fragment with dp<sub>r</sub>–dp<sub>r</sub>.  F:A.M.17820A

Slightly larger:
- Left ramus, p<sub>r</sub>–m<sub>2</sub>. (M)  F:A.M.17811  This paper, *Fig. 20*.
- Left fragment, p<sub>r</sub>–m<sub>2</sub>. (w+)  F:A.M.17812
- Palate with p<sup>2</sup>–m<sup>3</sup>.  F:A.M.17810A  This paper, *Fig. 20B*.
- Detached maxillary and mandibular teeth.

Four specimens of antlers:
- Portion of right antler.  F:A.M.17834A  This paper, *Fig. 20B*.
- Portion of right antler.  F:A.M.17834B  This paper, *Fig. 20B*.
- Portion of frontal with bases of both antlers.  F:A.M.31775  From Aguanga horizon, Section 15, 1933.  This paper, *Fig. 20*.
- Base of immature antler.  F:A.M.17834C  From El Casco.  This paper, *Fig. 20*.
(2a) Variety
From Bautista, Southern California


**Example.—** Partial antler. U.C.23419 Figured by Frick, 1921, Text-Fig. 6.

**Referred.—**
Specimens, including fragment of ramus and a series of associated limb elements, figured, 1921, Text-Figs. 5 and 9–12.

(2b) Variety
From Carrizo Creek, Southern California

**Example.—** Right antler, posterior point missing. F:A.M.31862 Collected spring, 1936, by Guy E. Hazen. (The anterior branch is single-pointed.)

**Referred.—**
Two large and one small antler base. F:A.M.31863,A,B
Thirteen portions of antlers of smaller and larger individuals, F:A.M. Coll.
Fragments of dentitions and limbs, F:A.M. Coll.
[Limb proportions approximate *Odocoileus hemionus*, A.M.(M.)122667, from Alberta, Canada.]

(3) *Odocoileus cooki*, new species
From the Pleistocene, Vicinity of Agate, Sioux County, Nebraska

**Type.—** Left ramus with diastema, p4–m3. H.C.-A.M.254 This paper, Fig. 20.

Premolars, particularly p4, and molars a little larger, but diastema shorter than in Recent *O. virginianus*, A.M.(M.)164. A proportionate heaviness of the p4 is seen in an Ecuadorian fossil.
Evidence witnessing the former occurrence in Alaska of the extinct giant elk, Cervalces, is of much interest. Species of the genus have been described from New Jersey, genotypic species Cervalces scotti; from Toronto, Ontario, C. borealis; and from Iowa, C. roosevelti. Remains have been referred to the last from Illinois and Oklahoma, and to indeterminate species\(^1\) from Pennsylvania, Virginia, Kentucky and Missouri. The Alaska specimens indicate a considerably larger individual than any heretofore known. The (1) Alaska, (2) Ontario, (3) Iowa and (4) genotypic New Jersey evidence is as follows:

(1) **Cervalces alaskensis**, new species

From Fairbanks Area, Alaska

<table>
<thead>
<tr>
<th>Type.</th>
<th>Burr, palmation of right antler, possibly of same individual</th>
<th>A.C.-F:A.M.</th>
<th>Secured by John B. Dorsh, 1933</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Similar portion of left antler.</td>
<td>A.C.-F:A.M.</td>
<td>1933.</td>
</tr>
</tbody>
</table>

**Measurements**

<table>
<thead>
<tr>
<th>C. alaskensis, n.sp., type</th>
<th>C. borealis</th>
<th>C. roosevelti</th>
<th>C. scotti (Lydekker), 1898, Princeton Univ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.C.-F:A.M.</td>
<td>Bensley, 1913</td>
<td>Hay, 1913</td>
<td>Iowa Coll.</td>
</tr>
<tr>
<td>30496</td>
<td>Univ. Toronto</td>
<td>Univ. Iowa Coll.</td>
<td></td>
</tr>
<tr>
<td>Burr to palmation</td>
<td>430 mm.</td>
<td>300 mm.</td>
<td>180 mm.</td>
</tr>
<tr>
<td>Diameter of shaft</td>
<td>70</td>
<td>60</td>
<td>55</td>
</tr>
</tbody>
</table>

(2) **Cervalces borealis** Bensley

From Toronto, Ontario


\(^1\) The references as to indeterminate species from Pennsylvania, Virginia, Kentucky and Missouri are: Frankstown Cave, Pennsylvania, Peterson (1925); Saltville, Virginia, Peterson (1917); Bigbone Lick, Kentucky, Hay (1923); and Kimmawick, Missouri, Koch (1840), Hay (1924).
TYPE.—Right antler.  
Univ. Toronto  
20176  
From the Toronto interglacial.  
Figured by Bensley, 1913, Text-Fig., p. 2.

(3) *Cervalces roosevelti* Hay

From Iowa


TYPE.—Partial right antler and skull.  
Univ. Iowa Coll.  
From near Denison, Crawford County, Iowa.  
Figured by Hay, 1913, Fig. 1.

(4) *Cervalces scotti* (Lydekker), genotypic species

From New Jersey

*Cervus americanus* Harlan, 1825, Fauna Americana, p. 245.


*Alces scotti* Lydekker, 1898, The Deer of All Lands, p. 60, Fig. 14 (after Scott).

*Cervalces scotti* (Lydekker), Scott, 1913, A History of Land Mammals in the Western Hemisphere, p. 195, Fig. 113(3), pp. 208, 209, Fig. 117. Hay, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 261, Text-Figs. 91, 92 (after Scott).

GENOTYPE.—Complete skeleton save for right scapula and humerus and a few caudal vertebrae, a few podials and ribs.

Princeton  
Univ. Coll.  
From (Rev. A. A. Haines) Mt. Hermon, near Delaware Station, New Jersey.  
Figured by Scott, 1885, Pl. ii, Text-Figs. 2, 5 [and 7, tarsus], and 1913, Figs. 113(3) and 117.  
Figured by Lydekker, 1898, Fig. 14 (after Scott).

Nasals said to be longer, palmation smaller and more distinctly divided into an anterior and posterior branch, than moose; horn-pediciles longer than in *Alces* and legs exceedingly long with distal ends of laterals present.

1 Hay (1923) records under *C. roosevelti* referred, teeth from Oklahoma and bones from Joliet, Illinois.
(c) *Cervini from the Quaternary of South America*

Subfamilies 8 and 9a.—*Odocoilinae* and *Rangiferinae* (cont.)

XVII. **Pudu** Gray

XVIII. **Hippocamelus** Leuckart

XVIII A. **Blastocerus** Wagner

XIX. **Mazama** Rafinesque, Ozotoceros Ameghino, *Palaedodochoileus* Spillmann; *Paraceros* Ameghino, *Morenelaphus* Carette and *Antifer* Ameghino

Figure 21

Statement.

One or more undescribed South American deer seem to be represented in the collections secured in Ecuador by John C. Blick and Charles Falkenbach in the winter of 1930–1931.  

Numerous species have been described by several authors, and the South American deer, Recent and fossil, are in great need of detailed revision. The most outstanding recent review, that of Kraglievich (1932), has suggested to the writer tentative recognition of some nine genera, Recent and extinct—the small and spike-horned *Pudu*; the forked-horned Andean *Hippocamelus*; *Blastocerus*, with anteriorly directed main beam; a group with branched horns, including *Odocoileus* (*Palaedodochoileus*), *Ozotoceros* and *Mazama*, and the three varied to indefinitely characterized extinct genera, *Paraceros*, *Morenelaphus* and *Antifer*. Certain of the remains of the three latter are indicative of possible *Rangifer* affinity. The hypothesis that Recent neotropical and Ethiopian forms represent so many remnants of earlier specializations now preserved far from the centers of original dispersal, presages the finding of near allies of the forms of the South American Quaternary in the Tertiary of North America.

---

1 See *Cusieronius humboldti* and *Cordillerion andium* remains: Nobis, 1933, Bull. Amer. Mus. Nat. Hist., LIX, p. 629, and Fig. 29A.

2 Ameghino, F., 1889, Contribución al Conocimiento de los Mamíferos Fósiles de la República Argentina; Burmeister, H., 1879, Description physique de la République Argentine, III, Pt. 1; Carette, E., 1922, Revista del Museo de la Plata, XXVI; Castellanos, A., 1924, Revista de la Universidad Nacional de Córdoba, XI, Nos. 4–5–6; Kraglievich, L., 1932, Anales del Museo de Historia Natural de Montevideo (2), III; Rusconi, C., 1931, La Semana Médica, No. 53; Spillmann, F., 1931, Die Säugetiere Ecuador's im Wandel der Zeit, Pt. I.
The Ecuadorian *Cervus* species and *C. cf. chilensis*, listed by Branco,\(^1\) and *C. chimborazi* and *C. riobambensis*, mentioned without description by Wolf,\(^2\) seem to be indeterminate, though the latter has been identified with *Hippocamelus* by Kraglievich. Franz Spillmann (1931) discusses and partially figures Ecuadorian deer remains under several new genera and species—*Protomazama equatorialis*, *Palaeodocoileus antonii*, *P. gracilis* and *P. abeli*.

*Pudu* and *Hippocamelus* are unrepresented in our Ecuadorian collections. The largest and most striking of the new remains are referred to *Blastocerus blicki*, n.sp. This form is exampled by several antlers from Alangesi characterized by the disproportionate development of the anterior or “brow shaft” and abortion of the posteriorly directed “main shaft,” and, in aged specimens, by the peculiar and heavily tuberculated condition of the horns. A somewhat similar appearing antler from Brazil is figured by Lydekker\(^3\) (Fig. 75) as representing a malformed individual of *Blastocerus (Mazama) dichotoma*. While the antlers of the new type specimen, an adolescent individual, are simply forked, a heavier referred partial antler is suggestive of the forward or “brow shaft” having been divided.

A very *Odocoileus*-like antlered deer is observed in a large series of remains including dentitions and limbs from the Punin area. The rami exhibit a relatively short diastema versus a specimen of the Recent *B. dichotoma* (A.M.[M.]36952), and shorter diastema and larger p\(_4\), but approximate-sized molars, compared to the Pleistocene *Odocoileus* species from El Casco, California. The remains are tentatively allocated to *Palaeodocoileus gracilis* Spillmann. A possible variant of the latter is represented by a large fragmental antler; and another and slightly smaller form is indicated by ramal portions from Punin. A fourth and even smaller-sized variant or species is witnessed by a few ramal fragments from the coastal oil fields about Salinas. This latter, which may be equivalent to the Spillmann *P. antonii*, does not much exceed in dimensions the Recent *Pudu*. Several of the Ecuadorian dentitions are characterized in unworn to moderately worn specimens by the detached antero-inner and posterior lophs of the p\(_4\) (see Fig. 21), the latter condition being partially reminiscent of that in *Rangifer*. The anterior p\(_4\) fossette is closed only in certain worn teeth. Examples of the antlers of *B. blicki* and of *P. gracilis*, ref., and of the ramal dentitions of the variants of the two latter, are figured on an adjoining plate (Fig. 21).

---

\(^1\) Branco, W., 1883, Palont. Abh., I, Hft. 2, p. 42.

\(^2\) Wolf, T., 1892, Geografía y Geología del Ecuador, p. 373.

\(^3\) Lydekker, R., 1898, The Deer of All Lands.
Fig. 21. *Paleolotoceras gracile* Spillmann, ref. *P. setacea*, n.s.p., type (F.A.M. 28254) and *Bactoceras bicirrus*, n.s.p., ref. and type (F.A.M. 28251 and 28250), from the Pleistocene of Ecuador.

Dentition: x 1.3, and x 1 and x 1 (as indicated).

(See legend, page 209.)
Summary of New Ecuador Species
(See measurement tables, pages 214, 210.)

The four species recognized in the new remains are:

**SIZE GROUP I (LARGEST).**

   - **Type.**—Frontals with antlers, F:A.M.28250. This paper, Fig. 21.

**SIZE GROUP II [AND II*].**

2. *Paleoodocoileus gracilis* Spillmann, from Quebrada Chalang District.
   - **Type.**—Posterior portion of crushed skull.
   - **Reference.**—Frontals with antlers and associated maxilla, F:A.M. 28261. This paper, Fig. 21.

**SIZE GROUP III.**

   - **Example.**—Partial right ramus, F:A.M.28281.

**SIZE GROUP IV.**

   - **Type.**—Partial left ramus, F:A.M.28284. This paper, Fig. 21.

---

*Fig. 21.* *Paleoodocoileus* Spillmann and *Blastocerus* Wagner, from the Pleistocene of Ecuador. (See pages 210, 213, 209.)
- Dentitions X 1, antlers X ½ and ¼ (as indicated). PS, posterior border symphysis.
- F:A.M.28251 and 28250, *B. blicki*, n.sp., ref. and type, from Alangesi.
Detailed Lists of Types and Referred Ecuador Specimens

_Blastocerus_, total available listed specimens, 6; _Palæoodocoileus_, 149

(1) **Blastocerus blicki**, new species

From Alangesi

**TYPE.**—Frontals with antlers. F:A:M.28250 From Mastodon Hill, Alangesi. This paper, Fig. 21.

**REFERRED.**—Four partial antlers on cranial fragments, from Alangesi:

Partial left frontal with partial antler. F:A:M.28251 This paper, Fig. 21.

Left antler and two antler portions. F:A:M.28252-4

One example from San Francisco Wash:

Detached m2. F:A:M.28257

(Unrepresented in limb elements.)

(2) **Palæoodocoileus gracilis** Spillmann

From Quebrada Chalang District


**TYPE.**—Posterior portion of crushed skull, left side nearly complete, right antler broken.

**REFERRED FROM QUEBRADA CHALANG DISTRICT.**—

**PARTIAL ANTLERS, SKULLS OR FRONTAL FRAGMENTS**

Seven specimens from Spring Quarry:

<table>
<thead>
<tr>
<th>F:A:M.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28261</td>
<td>Frontals with antlers. (See maxilla.)</td>
</tr>
<tr>
<td>28262</td>
<td>Partial left frontal with antler (approximately twice the size of F:A:M.28261).</td>
</tr>
<tr>
<td>28263</td>
<td>Left antler.</td>
</tr>
</tbody>
</table>
Fourteen from Spring Quarry:

- Right and left maxillae with F:A.M. p1–m4. (m) 28230
  (See partial female skull.)
- Right maxilla, p1–m4. (w) 28261
  (See antlers. This paper, Fig. 21.)
- Right maxilla, p1–m4. (w) 28231
- Partial left maxilla with m1–m4. (m) 28273
- Partial left maxilla with m1–m4. (m+) 28233
- Partial left maxilla with p3 and m1–m4. (m+) 28234
- Partial right maxilla with m1–m4. (m) 28235
- Partial right maxilla with m1–m4. (w) 28237
- Partial left maxilla, p4–m3. (w) 28261
- Partial left maxilla, p4–m3. (M) 28230
- Partial left maxilla, p4–m3. (M+) 28232
- Partial right maxilla with F:A.M. ML–m3. (M+) 28237
- Partial left maxilla with ml–m3. (w+) 28238
- Partial left maxilla with ml–m3. (A) 28239
- Partial right maxilla with m2–m3. (M) 28234
- Partial left maxilla with m2–m3. (M+) 28236
- Partial right maxilla with m2–m. (w) 28241
- Partial left maxilla, p3. (W) 28242

One from Hillside Quarry:

- Left maxilla, p2–m4. (w) 28272

One from Sloth Quarry:

- Left maxilla, p1–m4. (M+) 28232

Twenty-six more moderate-sized specimens:

Nineteen from Spring Quarry:

- Right ramus with symphysis and p3–m4. (w) 28200
- Left ramus with symphysis and p3–m4. (M+) 28201
- Left ramus with symphysis, p2 alveolus and p3–m4. (M+) 28202
- Right ramus with symphysis, p2 alveolus, p3–m4. (w) 28203

Twenty-nine ramal:

Two slightly larger ramal fragments from San Francisco Wash:

- Partial right ramus with p3–m4. (m) 28256
- Left fragment with p3–p4. (w) 28255

Twenty-six more moderate-sized specimens:

Size of premolars relative to molars, as seen in three specimens:

<table>
<thead>
<tr>
<th>Wear</th>
<th>Series</th>
<th>F: /ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.28200. (m+) 87 mm.</td>
<td>35.7 = 69%</td>
<td></td>
</tr>
<tr>
<td>F:A.M.28201. (m+) 89</td>
<td>36.5 = 70</td>
<td></td>
</tr>
<tr>
<td>F:A.M.28207. (m+) 89</td>
<td>36.5 = 70</td>
<td></td>
</tr>
</tbody>
</table>
Frick, Horned Ruminants: *I—Cervidae*

Left ramus with symphysis, F:A.M. p₂ p₄ alveolus and p₂–m₃. (w) 28204
Partial left ramus with p₂ alveolus and p₂–m₄. (w) 28205
Partial left ramus with p₂–m₃. (w) 28206
Partial right ramus with p₂–m₃. (M) 28207
Partial left ramus with p₂–m₄. (w+) 28208
Right fragment with symphysis and p₂–m₃. (M+) 28209

Seven from Hillside Quarry:
Left ramus with symphysis and p₂–m₃. (w) 28274
Left ramus with symphysis and p₂–m₃. (w+) 28275
Left ramus with symphysis and p₂–m₄. (w) 28276
Partial left ramus with p₂–m₄. (w+) 28277

One somewhat smaller-sized specimen than above, from Sloth Quarry:
Left ramus, p₂–m₃. (w+) 28228

**Rami, Immature**

Six from Spring Quarry:
Left ramus with symphysis and dp₂–m₃. 28222
Right ramus with symphysis and dp₂–m₃. 28223
Partial left ramus, dp₂–m₃. 28224

**Limb Elements**

The detached limb elements are listed under (a) larger, and (b) smaller-sized. The size difference presumably is due to individual and sexual variation. The largest metacarpus (F:A.M.28185) measures 188 mm., the smallest (F:A.M.28184B), 163 mm.; the largest metatarsus (F:A.M.28188) measures 226 mm., the smallest (F:A.M. 28187E), 198 mm. (See measurements, Table V, page 214, and note composite skeleton.)
(a) Larger:

Distal four-fifths left humerus.  
Two left and one right radii.  
Two left metacarpi.  
Left metacarpus.  
Distal two-thirds left femur.  
Left tibia.  
Two left tibiae.  
Right metatarsus.  
Right metatarsus.  
Two right and one left metatarsi. Several calcanea and astragali, carpal and tarsal bones, phalanges and vertebrae.

(b) Smaller:

Left humerus, and fragment.  
Two right radii.  
Left radius.  
Left radius.  
Two left and one right metacarpi.  
Left metacarpus.  
Two right femora.  
Right and two partial femora.  
Three right and three left tibiae.  
Four right and two left metatarsi. Numerous calcanea, astragali, carpal and tarsal bones, phalanges and vertebrae.
A composite skeleton has been built up from Spring Quarry remains, plus tibiae from Sloth Quarry:


[A larger form (Size Group 1ix) is exemplified by the peculiar base of an antler, F:A.M.28266.]

(3) Palaeodocoileus gracilis, Var.

From Punin

EXAMPLE.—Partial right ramus with p4–m3. (M+)

REFERRED.—

Partial left ramus with m1–m2. (M+)

(Limbs unrepresented.)

(4) Palaeodocoileus salinæ, new species

From Salinas

TYPE.—Partial left ramus with p4–m3. (M) 28284

REFERRED FROM TYPE LOCALITY.—

Left antler. 28264
Partial left frontal bone with partial antler. 28265
Partial left maxilla with m2–m3. (M) 28283
Right fragment with p1–m3. (W) 28285

Two limb elements of P. gracilis size:

Left radius. 28197F
Right metatarsus (immature). 28186
<table>
<thead>
<tr>
<th>TABLE V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limb Measurements and Ratios</strong></td>
</tr>
</tbody>
</table>

**Palaeocholeus gracilis** Spillmann, Referred

[And Recent Deer for Comparison]

<table>
<thead>
<tr>
<th></th>
<th>Humerus</th>
<th>Radius</th>
<th>Metacarpus</th>
<th>Femur</th>
<th>Tibia</th>
<th>Metatarsus</th>
<th>Humerus/Radius</th>
<th>Metacarpus/Radius</th>
<th>Femur/Tibia</th>
<th>Metatarsus/Tibia</th>
<th>Metacarpus/Metatarsus</th>
<th>Radius/Tibia</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. gracilis Spillmann, ref., Ecuador (Composite skeleton)</td>
<td>See p. 213</td>
<td>183</td>
<td>192</td>
<td>173</td>
<td>250</td>
<td>256</td>
<td>210</td>
<td>95</td>
<td>90</td>
<td>98</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>P. gracilis Spillmann, ref., Ecuador (Largest elements, unassociated)</td>
<td>See pp. 211, 212</td>
<td>(204)</td>
<td>210</td>
<td>188</td>
<td>265</td>
<td>288</td>
<td>226</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Smallest elements, unassociated)</td>
<td>&quot;</td>
<td>180</td>
<td>180</td>
<td>163</td>
<td>233</td>
<td>250</td>
<td>198</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odocoileus virginianus,♂ (Recent)</td>
<td>A.M.(M.)70047</td>
<td>197</td>
<td>218</td>
<td>208</td>
<td>252</td>
<td>280</td>
<td>244</td>
<td>81</td>
<td>95</td>
<td>90</td>
<td>87</td>
<td>83</td>
</tr>
<tr>
<td>&quot;♀ (Recent), N.Y. Zoo, aberrant</td>
<td>A.M.(M.)14085</td>
<td>165</td>
<td>188</td>
<td>190</td>
<td>218</td>
<td>245</td>
<td>220</td>
<td>98</td>
<td>100</td>
<td>92</td>
<td>90</td>
<td>86</td>
</tr>
<tr>
<td>Odocoileus columbiaus,♀ (Recent)</td>
<td>A.M.(M.)35733</td>
<td>191</td>
<td>200</td>
<td>182</td>
<td>245</td>
<td>276</td>
<td>224</td>
<td>95</td>
<td>91</td>
<td>92</td>
<td>90</td>
<td>81</td>
</tr>
<tr>
<td>Cervus elaphus (Recent)</td>
<td>A.M.(M.)14090</td>
<td>180</td>
<td>190</td>
<td>185</td>
<td>232</td>
<td>256</td>
<td>206</td>
<td>94</td>
<td>97</td>
<td>90</td>
<td>81</td>
<td>90</td>
</tr>
</tbody>
</table>

( ) approximate; [ ] estimated.

1 As seen in the radii, the difference between the largest and smallest elements is 12%; in the humeri, the difference is 14%.
DIVISION D.—BLASTOMERYCINI

Frontispiece, c; Figures 22, 22A, 23, 23A, 24 and (in part) 3, 4, 4A; Skeletal Elements 23B and (in part) 25, 25A, 25B

The diminutive hornless deerlets from the Late Tertiary, here held together under the Blastomerycini, include a number of ostensibly distinct forms that in certain instances differ widely in the proportions of the diastema and of the anterior premolars. The group seems best considered divided between two subfamilies, the Longirostromerycinae and Parablastomerycinae. The former is represented by the genera, Longirostromeryx, n.g., and Blastomeryx Cope, and the latter by Parablastomeryx, n.g., and Pseudoparablastomeryx, n.subg. Deerlets of the earlier Middle Tertiary, heretofore referred to Blastomeryx proper, are exemplified in the remains transferred to Pseudoblastomeryx, n.subg., in Problastomeryx, n.subg., and in the much smaller Machæromeryx Matthew. The three latter forms are treated separately under a Middle Tertiary (a) Section (page 251) and the Late Tertiary forms under (A) Section (page 217).

For distribution, see Cervidae distribution table, page 43.

The relatively primitive Parablastomerycinae may have lain close to the ancestral Cervid stem. The genesis of the comparatively highly specialized Longirostromerycinae possibly may be reproduced, in part, in the mandibular rami of the broadly contemporaneous forms—Pseudoparablastomeryx scotti, Parablastomeryx gregorii, Blastomeryx gemmifer medius, (?)Longirostromeryx blicki and Longirostromeryx clarendonensis, which in turn exhibit taller-crowned molars, smaller premolars and longer diastemata.

Summary of Blastomerycini Specimens

<table>
<thead>
<tr>
<th>Genus No.</th>
<th>Crania</th>
<th>Maxillae</th>
<th>Mandibles</th>
<th>Limbs</th>
<th>Total Elements</th>
<th>Assoc. Elements</th>
<th>Total Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) LATE TERTIARY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XX Longirostromeryx, n.g.</td>
<td>25</td>
<td>127</td>
<td>9</td>
<td>161</td>
<td></td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>XXII Parablastomeryx, n.g.</td>
<td>4[3]</td>
<td>4[1]</td>
<td>4</td>
<td>21</td>
<td>9</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>XXIIA Pseudoparablastomeryx, n.subg.</td>
<td>55</td>
<td>201</td>
<td>45</td>
<td>304</td>
<td>7</td>
<td>297</td>
<td></td>
</tr>
<tr>
<td>(b) MIDDLE TERTIARY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XXIII Machæromeryx Matthew...</td>
<td>11</td>
<td>1[1]</td>
<td>1[1]</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total Late Tertiary</td>
<td>304</td>
<td>7</td>
<td>297</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Totals</td>
<td>386</td>
<td>33</td>
<td>363</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ ] associated specimens.
FIG. 22. F:A.M.31360 (genotype) and 31361 (ref.), *Parablastomeryx gregorii*, n.g. and sp., from the Late Tertiary, Xmas Quarry, Cherry County, Nebraska.

Maxillary and mandibular dentitions, occlusal views × 1; skulls and mandible, lateral and dorsal views × ½. (See also Figs. 25, 25B [F:A.M.31360, skeletal elements] and p. 243.)

See mandibular dentitions, Figs. 22A, 23 and 23A, pages 221–223.
(A) **LATE TERTIARY SECTION**

Subfamily 10.—*Longirostromerycinæ*

**XX.** *LONGIROSTROMERYX, NEW GENUS*

**XXI.** *BLASTOMERYX COPE*

Subfamily 11.—*Parablastomerycinæ*

**XXII.** *PARABLASTOMERYX, NEW GENUS*

**XXIIA.** *PSEUDOPARABLASTOMERYX, N. SUBG.*

[(a) Middle Tertiary Blastomercini, page 251.]

Frontispiece, c; Figures 22, 22A, 23, 23A and (in part) 3, 4, 4A

**Statement**

The new collections from the Late Tertiary contain a splendid series of *Blastomeryx*-like mandibles and other remains from New Mexico, and two largely complete skulls and an interesting series of mandibles from northern Nebraska. Hitherto, evidence as to the Late Tertiary Blastomercini has been confined to the single m3s from Colorado and New Mexico of the Cope collection and a few mandibular fragments from other areas.

The *Blastomeryx*. genotypic species is *B. gemmifer* Cope, from the Pawnee Creek, Colorado, the genotype being the m3 of the Cope collection. The previously given skull characters of the genus proper have been based entirely on remains from the Lower Miocene. One of the new Nebraska skulls (*Parablastomeryx*) is associated with a mandible and complete series of limb elements. While the resemblance of this skull itself to the smaller *Moschus moschiferus* of Recent Asia is notable, the limbs are relatively much longer and heavier-proportioned than in the latter. The Blastomercini, in mandibular characters, as a whole exhibit a far greater range of variation than do the Merycodontini. Thus in the relatively primitive *Parablastomeryx* the diastema is short and the premolars large; while in the highly specialized *Longirostromeryx* the diastema is extremely elongate and the premolars reduced. The evident elongation of the muzzle in the latter well may have been paralleled by equivalent specializations of the supra-orbital area and of the limbs.
The hypsodont tendency in the molars and the proportionate smallness of the premolars in *Longirostromeryx* actually are far more suggestive of *Aletomeryx* than of *Parablastomeryx*. In the new species, *L. clarendonensis*, the reduction of the premolars, with occasional loss of p₃, is extreme and greater than in any other member of the Pecora vera here described. *Parablastomeryx* is so far definitely recognized only in the large Cherry County species. Moderate-sized *Blastomeryx* forms are known from Brown, Cherry, Dawes and Sioux Counties, Nebraska, and from Colorado and New Mexico. It is strange that no Blastomerycine remains so far have been observed in the very extensive collections from the Mojave Desert, California. *Longirostromeryx* species are recorded from South Dakota, from Brown, Cherry and Sioux Counties, Nebraska, and from New Mexico and Texas.

As seen in the fine new Nebraska specimens, the *Parablastomeryx* skull is hornless; the orbit anteriorly placed and closed; the bullae moderate; the upper canines (male) large sabre-like; the lower canines small incisive-formed; the diastemata short (versus extremely long in *Longirostromeryx*); the p₄; lost; the cheek teeth very low-crowned (versus less so in *Longirostromeryx*); the premolars large (versus small in *Longirostromeryx*); the lower molars with Dromomerycine-like folds (often indistinguishable because of small size) and accessory columns; and the distal ends of lateral metacarpals and reduced lateral digits of manus and pes retained. The discussion of the osteology of *Blastomeryx* by Matthew (1908) was based wholly on remains from the Lower Miocene. Certain detached limb elements hypothetically are allocated to the several named Colorado, New Mexico and Sioux County, Nebraska, species and variants and a few shorter and heavier metapodials to the Sioux and Brown Counties, Nebraska, *B. elegans* and *B. mefferdi*. (See Figure 25A.)

Compared to Recent *Moschus* (A.M.[M.][57078], the Nebraska *Parablastomeryx* skull (F:A.M.31361) exhibits a basilar length of ((145)) versus 121 mm.; post C/ to foramen magnum distance, 120 versus 91 mm.; length of cheek tooth series, 54 versus 40 mm.; metacarpal length, 150 versus 93.5 mm.; percentage of cheek tooth series to basilar length, 38 versus 33%: percentage of cheek tooth series to foramen magnum-post C/ distance, 45 versus 44%; metacarpal length to basilar length, 97 versus 77%; foramen magnum-post C/ distance to length metacarpus, 125 versus 97%; and P.S. distance to cheek tooth series, 33 versus 53%. Compared to *Meryceros*, n.g. (N.S.M.2-3-8-34), the Nebraska skull (F:A.M.31361) is of approximately the same over-all length, but the
cranium, posterior to the orbits, is longer and narrower-proportioned, the frontals lack the interorbital elevation, horns are absent, the orbits are much larger, much more anteriorly placed and less produced laterally, the cheek tooth series occupies a proportionately larger area, and the upper canines are large and caniniform. In short, the form and proportions of both the cranium and the teeth, as well as of the limbs, are neither Moschine nor Merycodontine. A diminutive mandibular ramus with large, stubby-proportioned premolars and an abbreviation of the diastema exceeding that of Parablastomeryx, is tentatively placed under the latter as a subgenus, Pseudoblastomeryx. A metatarsus from the same locality is the shortest so far known to the writer. The two specimens were secured long since these pages were consigned to the press.

It seems advisable to restrict the genus Blastomeryx to remains from the Late Tertiary and to transfer those Lower Miocene remains heretofore referred to the genus (see following section, page 251) to separate genera or subgenera, Problastomeryx and Pseudoblastomeryx. With the questioned exception of Macheromeryx, so far as at present observable, the more typical of the Lower Miocene remains are prognostic of the short-diastemaed and large-premolared and later Parablastomeryx.

The Blastomerycini specimens are subdivided for convenience according to the length of the molar tooth series. The dik-dik to roe-deer-sized remains on this basis fall into five size groups which approximate Size Groups III–VII of the Merycodontini. It has seemed important in the case of the widely distributed Blastomeryx of Size Groups IV–V to continue to hold intact the several occurrences by treating the same as representing so many distinct species and subspecies. The two Parablastomeryx skulls and examples of the variable ramal dentitions of the several genera and subgenera are illustrated (Figs. 22, 22A, 23 and 23A). A reconstruction of the head in the flesh is given in the frontispiece (c). Limb elements associated with or hypothetically allocated among the Late Tertiary forms, and those elements associated with the latter described Lower Miocene specimens, are also exampled [Figs. 23B and (in part) 25, 25A, 25B, and see Limb Sections, pages 245, 260].

1 [Sinolomeryx (Blastomeryx-Dyseomeryx) riparius (Matthew, 1924), from Sheep Creek, Nebraska, (?)Altomeryx (Blastomeryx) scotti (Matthew, 1924), from northern Nebraska, and (?) Dromomeryx, "Blastomeryx sp." Gazin (1932), from Skull Spring Miocene Quarry, Oregon, were formerly considered as of the genus Blastomeryx.]

2 The largest size group (IV+) of the Blastomerycini-Merycodontini is slightly smaller than the smallest size group (V–) of the Dromomerycini-Altomerycini.
Key to Genera and Subgenera

10. LONGIROSTROMERCINÆ

Postsymphysial distance long.

Premolars reduced and tooth crowns subhypssodont:

*Longirostromeryx* merriami, n.g. and sp.

**Genotype.**—Right ramus, F:A.M.32405, from Cherry County, Nebraska.  
Size Group III. This paper, *Fig. 23A.*  
(P.S. distance approximates 69% of cheek tooth series length.)

(?)*Longirostromeryx* blicki, n.sp.

**Type.**—Right ramus, F:A.M.31734, from Santa Clara, New Mexico.  
Size Group V. This paper, *Fig. 22A.*  
(P.S. distance as above, premolars less reduced.)

Premolars moderate and tooth crowns brachyodont:

*Blastomeryx* gemmifer Cope, genotypic species.

**Genotype.**—Left m3, A.M.8301, from Pawnee Creek, Colorado.  
Size Group V. This paper, *Fig. 25.*  
(In referred specimen F:A.M.31389, P.S. distance approximates 41% of cheek tooth series length.)

11. PARABLASTOMERYCINÆ

Postsymphysial distance short.

Premolars large and tooth crowns brachyodont:

*Parablastomeryx* gregorii, n.g. and sp.

**Genotype.**—Skull, mandible and partial skeleton, F:A.M.31360, from east Cherry County, Nebraska. Size Group III+. This paper, *Figs. 22, 25.*  
(P.S. distance is equivalent to 27% of cheek tooth series length, approximating proportions in *Pseudoblastomeryx advena.*)

*Pseudoparablastomeryx* scotti, n.subg. and sp.

**Subgenotype.**—Right ramus, F:B:A.M.33763, from Dawes County, Nebraska. Size Group VI. This paper, *Fig. 22A.*  
(P.S. distance approximates 18% of cheek tooth series length.)

---

1 See bottom of next page.
FIG. 22A. Blastomerycini from the Late Tertiary of Nebraska and New Mexico, skull and mandibular dentitions. (See pages 244, 235.)
Lateral views × 1, occlusal × 1. PS, posterior border symphysis.

F:B:A.M.33768 (rev.), 33763 (subgenotype, rev.) and 33769 (rev.), *Pseudoparablastomeryx scotti*, n.subg. and sp., from Dawes County, Nebraska.


F:B:A.M.33775, (?)*Parablastomeryx galushi*, n.sp., type, rev., from Dawes County, Nebraska.

A considerably larger species of (?) *Longirostromeryx* than any here described is suggested by a mandibular fragment (F:A.M.32915, with right p4–m1 and alveoli of p3–p4), from Pratt Ranch, Brown County, 1934. Reference doubtful—brachyodont, length of diastema unknown. Anteroposterior diameter p4 = 7.8 mm.; m1 = 9.8 mm. (A possibly allied form may be represented by indeterminate fragments from Midway Quarry.)
Fig. 23. Blastomeryx Cope, Parablastomeryx, n.g., ref., Longirostromeryx, n.g., and, for comparison, Pseudoceras, n.g. (F: A.M. 31561), from the Late Tertiary of New Mexico, Colorado, Nebraska, Texas and South Dakota, mandibular dentitions, lateral and occlusal views compared.

× 1. (See legend, page 226.)
Fig. 23A. Blastomeryx Cope and Longirostromeryx, n.g., from the Late Tertiary of Nebraska, South Dakota, Texas and New Mexico, mandibular and maxillary dentitions compared.

Lateral views of rami × ½, of mandibular dentitions × 1; lateral and occlusal views of maxillary dentitions × 1. (See legend, page 226.)
Summary of Named Species and Subspecies from the Late Tertiary

The four genera and subgenera, and the some seventeen geographic and stratigraphic species¹ and subspecies of Size Groups III–VII, and their respective type specimens, may be summarized:

SIZE GROUPS III AND IV.

(1) **Longirostromeryx wellsi** (Matthew), from Little White River, South Dakota. (s. g. III+.)

Type.—Left ramal fragment, A.M.9823. This paper, Fig. 23.

(2) **Longirostromeryx merriami**, n.g. and sp. (s. g. III), and vars. A and B (s. g. IV), from Brown and Cherry Counties, Nebraska.

Genotype.—Right ramus, F:A.M.32405. This paper, Fig. 23A.

(2a) **Longirostromeryx serpentis**, n.sp., from Sioux County, Nebraska. (s. g. III.)

Type.—Left ramus, A.M.22029. This paper, Fig. 23.

(3) **Longirostromeryx novomexicanus**, n.sp., from New Mexico. (s. g. III.)

Type.—Partial left ramus, F:A.M.31395. (/ps broken.)

(4) **Longirostromeryx clarendonensis**, n.sp., from Texas. (s. g. III and IV.)

Type.—Right ramus, F:A.M.31669. This paper, Fig. 23A.

(4a) (?) **Longirostromeryx vigoratus** (Hay), from Texas. (s. g. IV.)

Type.—Left m₃–m₅, Mark Francis Coll.

SIZE GROUP V.

(5)² (?) **Longirostromeryx blicki**, n.sp., from New Mexico.

Type.—Right ramus, F:A.M.31734. This paper, Fig. 22A.

SIZE GROUP IV.

(6) **Blastomeryx elegans** Matthew and Cook, from Sioux County, Nebraska.

Type.—Partial left ramus, A.M.14101. (/ps large.)

¹ While the evidence is that the species are undoubtedly numerous, the data in many cases are unfortunately fragmentary.
²(5) also includes dentitions of Size Group IV; (8c) includes referred material of Size Group VI.
SIZE GROUP V.

(7) Blastomeryx mefferdi, n.sp., from Devil’s Gulch, Brown County, Nebraska.
    TYPE.—Partial left ramus, F:A.M.31375.

(8) Blastomeryx gemmifer Cope, genotypic species, from Colorado.
    GENOTYPE.—Left m₃, A.M.8301. This paper, Fig. 23.

(8a) Blastomeryx gemmifer medius (Matthew), and var., from Sioux County, Nebraska.
    TYPE.—Partial left ramus, A.M.18955. (/ps moderate.)

(8b) Blastomeryx gemmifer var valentinensis, n.subsp., from Valentine, and (8bb), (?) var. A, from Midway Quarry, Cherry County, Nebraska.
    TYPE.—Partial left ramus, N.S.M.10-6-9-31. (/ps small.)

(8c)¹ Blastomeryx gemmifer, var., from Montana.
    EXAMPLE.—Partial right ramus, A.M.21356. [/ps large as in (7) B. mefferdi.]

(9) Blastomeryx mollis Merriam, from Virgin Valley, Nevada.
    TYPE.—₃₄, U.C.11565 (or ?11564).

SIZE GROUP VI.

(10) Blastomeryx francesca, n.sp., from New Mexico.
    TYPE.—Left ramal fragment, F:A.M.31433.

SIZE GROUP VII.

(11) Blastomeryx francescita, n.sp., from New Mexico.
    TYPE.—Right m₁(br.)—m₃, F:A.M.31425. This paper, Fig. 23.

SIZE GROUP III+.

(12) Parablastomeryx gregorii, n.g. and sp., from Xmas Quarry, east Cherry County, Nebraska.
    GENOTYPE.—Skull, mandible and partial skeleton, F:A.M.31360. This paper, Figs. 22, 25.
    REFERRED.—Left ramus, F:A.M.31364. This paper, Fig. 23.

¹See footnote 2, preceding page.
SIZE GROUP III.

(13) (?) *Parablastomeryx galushi*, n.sp., from Dawes County, Nebraska.

Type.—Partial skull, F:B:A.M.33775. This paper, Fig. 22A.

SIZE GROUP VI.

(14) *Parablastomeryx* (*Pseudoparablastomeryx*) *scotti*, n.subg. and sp., from Observation Quarry, Dawes County, Nebraska.

Subgenotype.—Mandibular ramus, F:B:A.M.33763. This paper, Fig. 22A.

The details regarding the above species, including synonymy and lists of referred remains, are given in the pages following the measurement tables and preceding the consideration of the Blastomerycine remains from the Lower Miocene.

---

**Fig. 23.** Blastomerycini mandibular dentitions from the Late Tertiary, lateral and occlusal views compared. (See pages 230-243, 651.)

× 1. PS, posterior border symphysis.


A.M.8301, *Blastomeryx gemmifer* Cope, genotype, Pawnee Creek, Colo.


---

**Fig. 23A.** Blastomerycini from the Late Tertiary, mandibular and maxillary dentitions compared. (See pages 230–240.)

Lateral views of rami × ½, of mandibular dentitions × 1; lateral and occlusal views of maxillary dentitions × 1. PS, posterior border symphysis.


A.M.10967, *Longirostromeryx wellsi* (Matthew), ref., S. Dak.


<table>
<thead>
<tr>
<th>Size Group</th>
<th>Collection No.</th>
<th>Tooth Wear</th>
<th>$m_3$ PS d.</th>
<th>$Pr-P_4$</th>
<th>$Pr$</th>
<th>$P_3$</th>
<th>$P_4$</th>
<th>See Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late Tertiary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parablasteromyx gregorii, ref. E. Cherry Co., Nebr.</td>
<td>III+</td>
<td>F:A.M.31364</td>
<td>M</td>
<td>14.7</td>
<td>23.7</td>
<td>7.4</td>
<td>8.3</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>21.</td>
<td>= 70%</td>
<td>35.5</td>
<td>67%</td>
<td>8.9</td>
<td>93%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>“</td>
<td>F:A.M.31363</td>
<td>W+++</td>
<td>15.5</td>
<td>(22.)</td>
<td>35.</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“ genotype</td>
<td>F:A.M.31360</td>
<td>M</td>
<td>14.</td>
<td>23.</td>
<td>6.5</td>
<td>8.5</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18.</td>
<td>= 70%</td>
<td>33.</td>
<td>76</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>Longirostromyxy wellsi (Matthew), type, L.W.R., S. Dak.</td>
<td>“</td>
<td>A.M.9823</td>
<td>M+</td>
<td>14.5</td>
<td>(14.4)</td>
<td>(40)</td>
<td>5.2</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>36.</td>
<td></td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>L. serpentis, n.sp., type, Sioux Co., Nebr.</td>
<td>III</td>
<td>A.M.22029</td>
<td>W++</td>
<td>—</td>
<td>(14.5)</td>
<td>4.2</td>
<td>6.3</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>L. merriami, genotype, Cherry Co., Nebr.</td>
<td>“</td>
<td>F:A.M.32405</td>
<td>M+</td>
<td>14.7</td>
<td>(14.)</td>
<td>(39)</td>
<td>4.8</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>33.</td>
<td>= 45</td>
<td>36.</td>
<td></td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>“ var. A, example, Brown Co., Nebr.</td>
<td>IV</td>
<td>Col.M.1000</td>
<td>M+</td>
<td>13.7</td>
<td>(13.)</td>
<td>(40)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35.</td>
<td>= 39</td>
<td>32.5</td>
<td></td>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>L. novomexicanus, n.sp., type, N. Mex.</td>
<td>III</td>
<td>F:A.M.31395</td>
<td>M</td>
<td>14.</td>
<td>13.5</td>
<td>40</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>“</td>
<td>F:A.M.31669</td>
<td>M+</td>
<td>15.5</td>
<td>14.</td>
<td>4.</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>34.</td>
<td>= 46</td>
<td>34.</td>
<td></td>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>L. clarendonensis, n.sp., type, Tex.</td>
<td>“</td>
<td>F:A.M.32460</td>
<td>W+</td>
<td>—</td>
<td>(9.5)²</td>
<td>(5.6)</td>
<td>3.7</td>
<td>(5.6)</td>
</tr>
</tbody>
</table>

(Continued on next page)
<table>
<thead>
<tr>
<th>Size Group</th>
<th>Collection No.</th>
<th>Tooth Wear</th>
<th>$m_2$ (PS d.)</th>
<th>$p_{r-p_1}$ (m_1-m_3)</th>
<th>$p_2$</th>
<th>$p_4$</th>
<th>$p_4$</th>
<th>$p_4$</th>
<th>$p_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. clarendonensis, ref. (p_2 absent)</td>
<td>iv F:A.M.31519</td>
<td>M++</td>
<td>13.3</td>
<td>9.3</td>
<td>5.5</td>
<td>5.5</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“ ”</td>
<td>m</td>
<td>13.0</td>
<td>(9.0)</td>
<td>(29)</td>
<td>(6.0)</td>
<td>(6.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?) L. bicki, n.sp., ref., N. Mex.</td>
<td>v F:A.M.31398</td>
<td>m-</td>
<td>12.3</td>
<td>15.3</td>
<td>4.3</td>
<td>6.2</td>
<td>5.4</td>
<td>6.2</td>
<td>87</td>
</tr>
<tr>
<td>“ ref. (smaller)</td>
<td>“ ”</td>
<td>w</td>
<td>11.0</td>
<td>14.2</td>
<td>3.6</td>
<td>5.8</td>
<td>5.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blastomeryx elegans M. and C., ref.,</td>
<td>A.M.17345</td>
<td>m</td>
<td>14.0</td>
<td>19.0</td>
<td>5.3</td>
<td>7.5</td>
<td>6.5</td>
<td>7.5</td>
<td>87</td>
</tr>
<tr>
<td>Sioux Co., Nebr.</td>
<td>“ ”</td>
<td>“ ”</td>
<td>“ ”</td>
<td>((17.4)) = (57)</td>
<td>7.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“ type.</td>
<td>A.M.14101</td>
<td>m</td>
<td>12.5</td>
<td>(18.0) = (64)</td>
<td>7.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“ ?ref.</td>
<td>F:A.M.32019</td>
<td>m</td>
<td>12.0</td>
<td>23.0 = 52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. gemmifer valentinensis, type,</td>
<td>N.S.M.10-6-9-31</td>
<td>M+</td>
<td>12.6</td>
<td>16.0</td>
<td>4.3</td>
<td>7.0</td>
<td>5.5</td>
<td>7.0</td>
<td>79</td>
</tr>
<tr>
<td>Cherry Co., Nebr.</td>
<td>“ ”</td>
<td>“ ”</td>
<td>“ ”</td>
<td>((17.0)) = (60) = 68.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“ B. mefferdi, n.sp., type, Brown Co.,</td>
<td>F:A.M.31375</td>
<td>m</td>
<td>12.5</td>
<td>(17.0) = (63)</td>
<td>6.8</td>
<td>6.8</td>
<td>88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nebr.</td>
<td>“ ”</td>
<td>“ ”</td>
<td>“ ”</td>
<td>((19.0)) = (63)</td>
<td>6.5</td>
<td>7.0</td>
<td>93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. gemmifer, var., example, Mont...</td>
<td>A.M.21356</td>
<td>M+</td>
<td>12.0</td>
<td>17.3</td>
<td>5.1</td>
<td>7.0</td>
<td>7.0</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>B. g. medius (Matthew), type, Sioux</td>
<td>A.M.18955</td>
<td>M+</td>
<td>12.0</td>
<td>16.4</td>
<td>4.8</td>
<td>6.6</td>
<td>6.6</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Co., Nebr...</td>
<td>“ ”</td>
<td>“ ”</td>
<td>“ ”</td>
<td>28.0 = 59</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“ ref.</td>
<td>F:A.M.31389</td>
<td>w</td>
<td>11.0</td>
<td>18.0 = 61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>See Fig.</td>
<td>25A</td>
<td>23</td>
<td>44</td>
<td>52</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28A</td>
<td>48</td>
<td>54</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Collection</td>
<td>Mass (g)</td>
<td>Length (mm)</td>
<td>Width (mm)</td>
<td>Proportion (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------</td>
<td>----------</td>
<td>-------------</td>
<td>------------</td>
<td>----------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>B. gennifer</em> Cope, ref., N.E. Colo...</td>
<td>A.M.9449</td>
<td>11</td>
<td>16.7</td>
<td>25.5</td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Middle Tertiary:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. primus</em> (Matthew), subgenotype, U. Rosebud, S. Dak.</td>
<td>A.M.13822</td>
<td>12.5</td>
<td>6.</td>
<td>7.5</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pseudoblastomeryx falkenbachii</em>, n.sp., ref., Lusk, Wyo.</td>
<td>F:A.M.31532</td>
<td>w</td>
<td>20.</td>
<td>27.5</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. schultzi</em>, n.sp., type, Morrill Co.</td>
<td>N.S.M.128-25-6-35</td>
<td>v</td>
<td>17.5</td>
<td>27.</td>
<td>4.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>P. advena</em> (Matthew), type, Rosebud, S. Dak.</td>
<td>A.M.13014</td>
<td>11</td>
<td>6.7</td>
<td>70</td>
<td>54.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>VII</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Machaxomeryx tragulus</em></td>
<td>A.M.20548</td>
<td>9.5</td>
<td>12.5</td>
<td>21.</td>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

( ) approximate; ( ( ) ) estimated.


* Measurement cited is p<sub>p</sub>-p<sub>s</sub> (p<sub>s</sub> absent).
Detailed Lists of Types, Referred Specimens, and Synonymy

*Longirostromeryx*, total available listed specimens, 161; *Blastomeryx*, 111; *Parablastomeryx*, 16; *Pseudoparablastomeryx*, 9.

(Mandibular Measurement Table VI, pages 227–229)

(Skeletal elements, associated or referred, are listed separately, p. 246.)

**XX. LONGIROSTROMERYX, NEW GENUS**

(Size Groups III and IV alone represented.)

(Mandibular ramus and symphysis extremely long and slender; diastema elongate and unusually developed; p₁–p₂ greatly reduced and anteroposterior length equivalent to 40% of length from postsymphysis to p₂. In *L. clarendonensis*, the most specialized species so far observed, p₁ is usually absent.)

**SIZE GROUPS III AND IV.**

(1) *Longirostromeryx wellsi* (Matthew)

From Little White River, South Dakota

(Size Group III+)

*Blastomeryx wellsi* MATTHEW, 1904, Bull. Amer. Mus. Nat. Hist., XX, p. 125, Fig. 18; 1908, ibid., XXIV, p. 545.


**TYPE.**—Left fragment with p₁–m₃. (M+)

A.M.9823 Collected in 1902 by H. F. Wells. Figured by Matthew, 1904, Fig. 18; this paper, Fig. 23.

**REFERRED.**—

Left ramus with symphysis, d₁p₁–m₂ (erupting), p₁–p₄ germs.

A.M.10967 Collected in 1903. This paper, *Fig. 25A.*

(2) *Longirostromeryx merriami*, new genus and species

From Cherry and Brown Counties, Nebraska

(Size Group III)

**GENOTYPE.**—Right ramus with diastema beautifully preserved, p₂ alveolus and p₁–m₃. (M)

F:AM.32405 From Bear Creek, Cherry County, 1934. This paper, *Fig. 25A.*
Frick, Horned Ruminants. I—Cervidae

REFERRED.—

Left fragment with m₄–m₃.
F:A.M.32406 From type locality, 1934.

Doubtful (/ps larger):

Left fragment with p₁–p₄ alveoli and m₁–m₂. (M)
F:A.M.31356 From Horsethief Canyon, Brown County, 1929.

Immature partial right fragment with p₄, germ of p₄ and dp₄–m₂.
F:A.M.31369

Var. A

(Dentitions tending less tall, near Size Group iv)

EXAMPLE.—Left ramus with diastema, p₁–p₂ alveoli and p₁–m₂. (M+)
Col.M.1000 From Quinn Ranch, collected by N. J. Vaughan, 1930.
This paper, Fig. 23.

REFERRED FROM QUINN RANCH, BROWN COUNTY.—

Partial right ramus with p₂–p₄ alveoli and m₁–m₃. (M+)
F:A.M.31355 1928.

Left fragment, m₁–m₃. (w)
F:A.M.31357 1928.

Right fragment with m₁–m₃. (w)
Col.M.1001 Collected by N. J. Vaughan, 1930.

Left fragment with m₂.
F:A.M.31358 1927.

See metatarsus, page 247.

Var. B

Smaller (/ps larger)

From Burge Quarry, Cherry County, 1934–35

REFERRED.—

Right ramus with partial diastema, p₁–p₄ alveoli and p₁–m₃ (M+); left m₃.
F:A.M.32246 and A

Left fragment with p₁–m₄. (M++)
F:A.M.32905

Right fragment with m₁–m₂ and detached symphysis. (w)
F:A.M.32246B
Left ramus, p4-m3. (w+)  N.S.M.22-14-6-34
Left maxilla with p4 alveolus and p3-m4. (m+)
Left maxilla, p4-m3. (M++)  F:A.M.32245
See metacarpus, page 247.

Two fragments from Boiling Springs:
Left p4-m1. (m)  F:A.M.32408
Left m1-m3. (m)  F:A.M.32409

QUESTIONABLY REFERRED FROM WILLOW CREEK, 5 MILES N.W. OF LONG PINE, BROWN COUNTY.—
Right fragment with symphysis, p5 alveolus and p4-p5. (M)  F:A.M.31556 1930.
(Adolescent, and diastema relatively short.)

(2a) **Longirostromeryx serpentin**, new species
From Sioux County, Nebraska
(Size Group iii)


**TYPE.—**Left ramus with symphysis and p4-m3. (w++)  A.M.22029 From Kilpatrick Pasture, Quarry 7, 1926. This paper, Fig. 25.

**REFERRED FRAGMENTS FROM OLCOTT HILL, 1925.—**
Left fragment, p4-m1. (m)  A.M.18847
Right fragment with alveolus and p4-p5. (w++)  A.M.18846
Left fragment with p5 alveoli and m1(br.)-m3. (M+)
Large canine.  A.M.21471A
Three /ms.  A.M.14118 From Snake Creek area, 1908.
(Mentioned by W. D. Matthew.)

See metatarsus, page 247.
(3) *Longirostromeryx novomexicanus*, new species

From New Mexico

(Size Group iii)

**Type.**—Partial left ramus with \( p_r-p_s \) alveoli and \( p_r-m_s \). \((m)\)

F: A.M. 31395 From upper layer, Santa Cruz, 1927.

May be further represented in the collection by fragmentary specimens. (See measurement table, page 227, and referred metatarsus, page 247.)

(4) *Longirostromeryx clarendonensis*, new species

From Clarendon, Texas

(Size Groups iii and iv)

\( p_s \) tending totally lost, \( p_r-p_s \) greatly reduced, molars moderately subhypsodont. Two forms may be represented: A smaller-sized species, represented by three specimens in all of which the \( p_s \) is lost, and a larger-sized form in which this tooth is retained. The larger form in size approximates that from Bear Creek, but apparently exceeds this in the great length of the diastema.

**Type.**—Right ramus with symphysis and \( p_r-m_s \). \((m+)\)


This paper, Fig. 23A.

**Referred from Type Locality.**—

- Right ramus with posterior symphysis, \( p_r-m_s \). \((w)\)

F: A.M. 33022 1936.

(Not included in specimen count.)

- Crushed right ramus with diastema, \( p_r \) roots and \( p_r-m_s \). \((w++)\)

F: A.M. 32462 1935.

(Premolars of larger size.)

- Smaller (Size Group iv):

  Right ramus with symphysis, \( p_s \) and \( p_r(br.)-m_s \). \((br.)\). \((w+)\)

F: A.M. 32460 1935.

This paper, Fig. 23A.
Left ramus with portion of diastema, p$_{1}$-m$_{2}$, (m+). F:A.M.31519 1935. This paper, Fig. 23A.

Right m$_{3}$ [and dp$_{4}$]. F:A.M.31521 [and A]

Left fragment with p$_{2}$ alveolus and p$_{4}$-m$_{2}$ (p$_{2}$ alveolus absent). (M) F:A.M.31520 (From Carrell Creek, 1929.) This paper, Fig. 25.

See metatarsus, page 247.

(4a) (?)Longirostromeryx vigoratus (Hay)

From Texas

(Size Group ?iv)

[Length of symphysis indeterminate and proportions of p$_{4}$ unknown. May represent the same form as (4). The three specimens listed below are in the Mark Francis collection, College Station, Texas.]


**Type.**—Left m$_{2}$ and m$_{3}$.

Moderately worn. From Garvin Gully. Figured by Hay, 1924, Pl. ii, Figs. 13, 14.

**Referred.**—

m$_{3}$, right. Figured by Hay, 1924, Pl. ii, Figs. 17, 18.

Unworn.

m$_{1}$, right, in fragment of jaw. Figured by Hay, 1924, Pl. ii, Figs. 15, 16.

m$_{1}$ = 10 mm.

(5) (?)Longirostromeryx bicki, new species

From New Mexico

(The species includes dentitions of Size Groups iv– to v. Premolars less reduced than in Longirostromeryx proper. Tooth crowns as tall as *B. elegans* versus *B. gemmifer medius.*)

TYPE.—Right mandibular ramus with symphysis and p1–m2. (w)

REFERRED FROM SANTA CLARA.—

Left fragment, p1–m2. (A) F:A.M.31398 Santa Clara Canyon, 1930. This paper, Fig. 25.

Right fragment with p1–m2 (br.). (M) F:A.M.31415 From Santa Clara, 1928.


Right ramus, dp4(br.)–m2. F:A.M.31417 Santa Clara Canyon, 1930.

REFERRED FROM SANTA CRUZ.—

Partial right ramus with p1 alveolus, p1–m2(br.). (M) F:A.M.31399 From red layer, 1925.

Right fragment, p1–m2. (M+) F:A.M.31400 From red layer, 1927.

Right fragment, p1–m2. (M) F:A.M.31401 From red layer, 1927.

Left fragment with p1–m2 (p1 and m1 br.). (w) F:A.M.31426 From red layer, 1927.

Right fragment with p1 alveolus and p1–m2. (M) F:A.M.31402 From 2d wash, 1927.

Left fragment, p1–m2. (w) F:A.M.31427 From 2d wash, 1930.

Right fragment, p1–m2. (M) F:A.M.31404 1926.

Left fragment with p1 and p1–m2. (w) F:A.M.31405 From red layer, 1927.

Left fragment with p1 alveolus and p1–m2. (w++) F:A.M.31406 From red layer, 1927.

Right fragment, p1–m2. (M) F:A.M.31407 From red layer, 1927.

Right fragment with p1–m2 (br.). (A) F:A.M.31408 From 1st wash, lower layer, 1928.

Left fragment, m1–m2. (M+) F:A.M.31409 From red layer, 1927.

Right fragment, m1–m2. (M+) F:A.M.31410 1926.

Left fragment, m1–m2. (w+) F:A.M.31411 1927.

Left fragment, m1–m2. (w++) F:A.M.31412 From red layer, 1927.

Right fragment, m1–m2. (w+) F:A.M.31413 From red layer, 1927.
Right fragment with m₁–m₃ (br.).  (M+)
F:A.M.31414  From red layer, 1927.

Right fragment with p₄–m₃.
F:A.M.31419  1927.

Left fragment, p₄–m₃.  (M+)
F:A.M.31403  1925.

Left ramus with dp₄(br.)–m₃.
F:A.M.31418

REFERRED FROM GENERAL AREA.—
Right fragment with m₃.
N.M.2360  From the Santa Fé marls, Cope Coll.
Figured by Cope, 1877, Pl. LXXXII, Figs. 13, 13a.

Cope (1877, pp. 350, 360) remarks that his specimen from the Santa Fé marls resembles closely the more fully worn Colorado type m₃. According to Cope, "long diameter of crown" measured 12 mm.

Our collection includes some seventy-five unlisted fragmental rami and immature mandibular and maxillary specimens.

REFERRED MAXILLARY SPECIMENS FROM SANTA CRUZ.—
Partial palate, p₄–m₄.  (M)
F:A.M.31429  1927.

Partial right maxilla with p₄–m₃.  (M)
F:A.M.31430  1926.

Partial right maxilla with m₁–m₃.  (M)
F:A.M.31432

SMALLER SPECIMENS FROM SANTA CRUZ.—
Right fragment, p₄–m₂.  (M+)
F:A.M.31421  From 1st wash, 1928.

Right fragment, p₄–m₂.  (M)
F:A.M.31422  From 1st wash, 1928.

Left fragment, m₁–m₃.  (w)
F:A.M.31423  From 2d wash, 1927.

Right fragment, m₁–m₃.  (M)
F:A.M.31424  From red layer, 1927.

Right fragment, p₄–m₃.  (w)
F:A.M.31420  From Santa Fé area, 1925.

Etc. ramal fragments.

Right maxilla with p₄–m₄.  (M)
F:A.M.31428  From 1st wash, 1928.
This paper, Fig. 25A.

Partial right maxilla with m₁–m₄.  (M)
F:A.M.31431  1927.

See Limb Section, page 247.
Frick, Horned Ruminants.  I—Cervidae

XXI. BLASTOMERYXCOPE

(Size Groups iv—vii)

SIZE GROUP IV.

(6) Blastomeryx elegans Matthew and Cook

From Sioux County, Nebraska


Type.—Partial left ramus with p3—m2.  (M)


From Snake Creek, M. panicoensis zone, 1908.

Figured by Matthew and Cook, 1909, Fig. 23.

REFERRED FROM SNAKE CREEK BEDS.—

Five mature partial rami:

<table>
<thead>
<tr>
<th>Partial left ramus with p3—m2</th>
<th>A.M. 14101</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right fragment with p2 alveolus and p3—m2</td>
<td>(M) 17345</td>
</tr>
<tr>
<td>Right fragment with m1(br.)—m2</td>
<td>(M+) 17341</td>
</tr>
<tr>
<td>Left fragment with m3—m2</td>
<td>(W) 17347</td>
</tr>
<tr>
<td>Right fragment with m3—m2</td>
<td>(W+) 17348</td>
</tr>
</tbody>
</table>

Two immature rami:

| Left fragment with dp1—dp2 alveoli, dp3—m4(br.) | 17346 |
| Right fragment with dp3—m2 | 17349 |

QUESTIONABLY REFERRED FROM ANTELOPE DRAW.—

(Diastema longer, /ps relatively larger and /ms slenderer, versus above. Perhaps distinct species.)

<table>
<thead>
<tr>
<th>Right ramus with symphysis, p2 alveolus and p3—m2</th>
<th>F:A.M. 32019</th>
</tr>
</thead>
<tbody>
<tr>
<td>From campsite, Echo Quarry, 1935. This paper, Fig. 23A.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Left fragment, p3—m2</th>
<th>F:A.M. 31385</th>
</tr>
</thead>
<tbody>
<tr>
<td>1933.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Large C/</th>
<th>F:A.M. 32019A</th>
</tr>
</thead>
</table>

See Limb Section, page 247.
Tentatively Referred Var. from Observation Quarry, Dawes County, Collected by T. Galusha, 1936.—

(Molars heavy, brachydont, p₂ greatly reduced.)

Example.—Left fragment with p₁-m₂ .................. (m) 33776
Partial skull with left m₁–m₄(right maxilla and muzzle missing) .................. (w) 34051
Posterior portion of skull with frontlets .................. 34051A
Left ramus with symphysis and p₁–m₃(br.) .................. (w++) 34054
Right ramus with diastema and p₁–m₄ .................. (w+) 33760
Left fragment with m₁–m₄ .................. 33761
Left immature ramus with dp₁–m₂ .................. 34053
Left maxilla with p₄–m₄ .................. (m) 34052
Partial right maxilla with p₄, m₁(br.), m₃ and m₄ .................. (m+) 33762

Size Group V.

(7) Blastomeryx mefferdi, new species

From Devil’s Gulch, Brown County, Nebraska

Type.—Partial left ramus with p₂ alveolus and p₁–m₃. (m) F:A.M.31375 From Horse Quarry, Devil’s Gulch, 1933.

(Taller-crowned than B. gemmifer group.)

Referred.—

Right fragment with p₁–p₂ alveoli and p₁–m₃. (m) F:A.M.31381 From Devil’s Gulch, 1934.

Referred, Two Immature Rami.—

Partial left ramus with dp₁–dp₂ alveoli, dp₁–m₂ and m₃ germ. F:A.M.31378 From general area.

Right fragment with dp₁–dp₂ alveoli and dp₁–m₂(br.). F:A.M.31380 From Horse Quarry, Devil’s Gulch, 1933.

See Limb Section, page 248.

(8) Blastomeryx gemmifer Cope, genotypic species

From Colorado


GENOTYPE.—Left m₃. A.M.3301 From Pawnee Creek, Colorado. Cope Collection, 1873. This paper, Fig. 23.

Tooth is worn. Anteroposterior diameter measures 13 mm.

REFERRED.—Left ramus with pr-m₃. (w++) A.M.9449 From west of Pawnee Buttes, 1901. Figured by Matthew, 1904, Fig. 17.

(For "associated" skeletal elements, see Limb Section, page 248.)

(8a) Blastomeryx gemmifer medius (Matthew)

From Sheep Creek, Sioux County, Nebraska

Blastomeryx medius Matthew, 1924, Bull. Amer. Mus. Nat. Hist., L, p. 195, Fig. 57.

TYPE.—Partial left ramus with pr-m₃. (M+)

A.M.18955 From Stonehouse Draw, 1922. Figured by Matthew, 1924, Fig. 57.

(As seen in F:A.M.31389, diastema shorter than in New Mexican 31399.)

REFERRED.—

Left ramus with diastema, pr-p₄ alveoli, pr-m₃. (w) F:A.M.31389 From Stonehouse Draw, 1933.
Partial left maxilla, dp₄-m₁. A.M.18957B From Stonehouse Draw, 1922.
Left ramus with diastema, pr-p₄ alveoli, m₁-m₃. (M+)

F:A.M.32831 From Greenside Quarry, 1935.
Left fragment, m₃-m₄. (M) F:A.M.32831A From Greenside Quarry, 1935.

(8aa) Var.

(/ps heavier)

(Locality in question; not cited in Table I)

Right ramus with diastema, p₃ alveolus and pr-m₃. (w) A.M.22388 From Ashbrook Pasture, Sheep Creek channel bed, 1927.
Right fragment with pr-p₄ alveoli and pr-m₃. (w) A.M.22388A From Ashbrook Pasture, Sheep Creek channel bed, 1927.
Immature partial left ramus with dp$_2$-m$_1$.  
A.M.22388B From Ashbrook Pasture, Sheep Creek channel bed, 1927. 
This paper, Fig. 3.

Palate with p$_4$-m$_1$. (M+)  
A.M.21549 From Aphelops Draw, 1925. 
This paper, Fig. 23A.

Partial right maxilla with p$_4$-m$_3$. (w)  
A.M.22472 From Ashbrook Pasture, 1927.

Left p$_3$-m$_2$. (w+) (Larger.)  

QUESTIONABLY REFERRED FROM ANTELOPE CREEK (3 Miles South and 8 Miles West of Hay Springs, Dawes County), COLLECTED BY JOHNSON, MEADE AND ASSOCIATES, 1933.——

Right fragment with p$_6$(br.)-m$_4$(br.). (w+)  
N.S.M.7-27-11-33

Left fragment, m$_1$-m$_2$. (w+)  
N.S.M.8-27-11-33

Left fragment, m$_2$-m$_3$. (M)  
N.S.M.9-27-11-33

Left fragment, m$_3$-m$_2$. (w)  
N.S.M.10-27-11-33

Left fragment with p$_5$-p$_4$.  
N.S.M.11-27-11-33

Left fragment, m$_1$-m$_2$. (M)  
N.S.M.15-27-11-33

Detached left m$_3$, right m$_2$.  
N.S.M.15-27-11-33

Etc. ramal fragments.

Partial right maxilla with p$_4$-m$_1$. (M)  
N.S.M.4-27-11-33

Partial left maxilla with m$_1$-m$_4$. (w)  
N.S.M.5-27-11-33

8 detached upper molars.  
N.S.M.15-27-11-33

Large C/.  
N.S.M.15-27-11-33

FROM SAME LOCALITY, COLLECTED BY MORRIS F. SKINNER, 1934.——

Right p$_3$-m$_2$. (w)  
N.S.M.1-12-7-34

Left p$_3$-m$_2$. (w++)  
N.S.M.2-12-7-34

Right p$_3$-m$_2$. (w)  
N.S.M.3-12-7-34

Left p$_3$-m$_2$. (w)  
N.S.M.4-12-7-34

Left m$_1$-m$_2$.  
N.S.M.6-12-7-34

Left m$_3$.  
N.S.M.7-12-7-34

Left m$_3$-m$_2$.  
N.S.M.8-12-7-34

Left m$_1$-m$_2$.  
N.S.M.9-12-7-34
Three Cs./. N.S.M.10-, 11- and 12-12-7-34
Left maxilla with p4–m3. N.S.M.13-12-7-34
Right maxilla with m2–m3. N.S.M.14-12-7-34
Dpr–m1. N.S.M.16-12-7-34 and etc. fragments.

Smaller:
Right ramus, p4–m3. (m) N.S.M.23-12-7-34 This paper, Figs. 4, 4A.
(m3 brachydont versus N.S.M.15-27-11-33.)

See Limb Section, page 248.

(8b) **Blastomeryx gemmifer valentinensis**, new subspecies

From Cherry County, Nebraska

**Type.**—Partial left ramus with p5–m3. (M+)

N.S.M.10-6-9-31 From Quarry A, Valentine, Cherry County.

(8bb) (?)Var. A

From Cherry and Brown Counties, Nebraska

**Example.**—Left fragment with p5–m3. (M+)

F:A.M.32244 From Midway Quarry, Cherry County, 1934.

**Referred.**—

C/.

F:A.M.32384 From Midway Quarry, Cherry County, 1934.

Left fragment with p5–m3. (M+)

F:A.M.31376 From Elliot Ranch, Brown County, 1933.

(/ms heavier than in *B. mefferdi* type, F:A.M.31375.)

(8c) **Blastomeryx gemmifer**, Var.

From Montana

**Example.**—Partial right ramus with p5–m3. (M+)

A.M.21356 From seven miles S. of Logan. Collected by Mook and Williams, 1925.

**Tentatively Referred (Size Group VI) from the Same Locality.**—

Right fragment with p5 alveolus and p5–m3. (w++)

A.M.21357

Detached m1.

A.M.21366
(9) **Blastomeryx mollis** Merriam

From Nevada


**TYPE.** — $m_3$  

U.C.11565  

From Virgin Valley, Nevada.  

(or ?11564)  

Figured by Merriam, 1911, Fig. 56.

**REFERRED FROM TYPE LOCALITY.**

- Anterior fragment of ramus with premolars, or $?dps.$  
  
  U.C.11567  
  
  Figured by Merriam, 1911, Fig. 57.

- Fragment with "$p_3$ and alveolus of $p_2$."  
  
  U.C.12609  
  
  Figured by Merriam, 1911, Fig. 58.

John C. Merriam (p. 280) observes, "The stage of advance of this species is close to that of *B. primus* and *B. olcottii*, and it may possibly be united with one of these forms when more material is available for study."

**SIZE GROUP VI.**

(10) **Blastomeryx francescia**, new species

From New Mexico

**TYPE.** — Left fragment with  

$ml-mn$.  

F:A.M.31433  

From Santa Fé area, 1927.

**SIZE GROUP VII.**

(11) **Blastomeryx franciscita**, new species

From New Mexico

**TYPE.** — Right fragment with  

$m_1(br.)-m_2$.  

F:A.M.31425  

From Santa Cruz.  

This paper, *Fig. 23.*

**REFERRED.**

- Right fragment with $p_3$ root,  
  
  $p_4(br.)-m_3(br.)$.  
  
  F:A.M.31397  
  
  From Santa Cruz, 1925.

- Right fragment with $m_1$  
  
  (br.)$-m_2$.  
  
  F:A.M.31434  
  
  From S.E. of White Operation, 1926.
XXII. Parablastomeryx, new genus

Frontispiece, Reconstruction c

Size Group III+ (Size Groups I and II Unrepresented).

(12) Parablastomeryx gregorii, new genus and species

From East Cherry County, Nebraska

Genotype.—Skull, mandible, dentition (excepting Cs/) and skeletal elements
(see page 249). (–m)

REFERRED, COLLECTED WITH TYPE AT TYPE LOCALITY BY M. F. SKINNER AND PARTY,
1932.—

Slightly larger than type:

Skull, nearly complete, with C/–p^{3}, p^{4}–m^{4}. (–m)

Left ramus with symphysis and p_r–m_2. (m)

[Note partial skull (F:A.M.33720) from Hans Johnson Quarry, of smaller size
than above, referred tentatively to Pseudoceras.]

Type-sized:

Left maxilla with p^{4}–m^{4}........................................... (w++) 31362
Partial mandible with symphysis, p_2 alveolus and p_r–m_2...... (w+) 31363
Partial left ramus with p_r–m_2........................................... (m) 31365
Partial right ramus with p_r–p_4 alveoli, p_r–m_2.................. (m+) 31366
Left fragment, p_r–m_2.................................................. (m+) 31367
Right fragment with m_3–m_4........................................... (w+) 31368

See Limb Section, page 249.

REFERRED FROM MACHERODUS QUARRY CHANNELS, 1934 AND 1936 (not separately
cited in Table I).—

Type-sized:

Left ramus with /Is–p_2 alveoli, p_r–m_2.................................. (w++) 32914
Left m_2–m_3.......................................................... (m+) 32914A

Slightly larger individual:

Left ramus with diastema, p_r–p_4 broken, p_4–m_2............... (w++++) 31359
(13) (?) Parablastomeryx galushi, new species

From Dawes County, Nebraska

**TYPE.**—Partial cranium (lacking distal end of muzzle and the base of skull posterior to the last molars) with p2–m3.

Molars slightly taller-crowned and with less pronounced cingula, premolars of similar form but of slightly smaller proportions and post-/C diastema apparently slightly longer than in *P. gregorii*. Orbit anteriorly placed; indication of sabre-formed canine.

---

**XXIIA. Pseudoparablastomeryx, new subgenus**

**SIZE GROUP VI.**

(14) *P. (Pseudoparablastomeryx) scotti*, new subgenus and species

From Observation Quarry, Dawes County, Nebraska

**SUBGENOTYPE.**—Mandibular ramus with diastema, p4 alveolus, pr–m3 (br.).

The postsymphysial distance is equivalent to approximately 18% of the cheek-tooth series length versus 27% in *Parablastomeryx*. The proportion between the premolars and molars and between p4 and p3 approximates that in the latter genus. 

p4–p3 = (17.3) mm., m1–m2 = ((24.5)).

The specimen equals in size *Blastomeryx francesca* and is slightly smaller and with shorter diastema than *Pseudoblastomeryx advena*.

**REFERRED.**

Right ramus with symphysis, p4 alveolus and pr–m3 (br.)... F:B:A.M. 33768

Right m1–m2... F:B:A.M. 33769

Left partial ramus with p4 alveolus and m1–m2... F:B:A.M. 34026

Right maxilla, p1–m3... F:B:A.M. 33767

A questionably referred metacarpus measures 49 mm.; a metatarsus, 66 mm. (See Limb Section, page 249.)
Limb Elements Representing the Above Late Tertiary Blastomerycine Genera and Species

Figures 23B and (in part) 25, 25A, 25B

The Late Tertiary Blastomerycine remains include skeletal elements associated with jaws or dentitions only in the case of *Parablastomeryx gregorii*. A partial skeleton unassociated with the dentition is examples by a specimen from New Mexico, F:A.M.31729, in which the laterals are represented by a lone third phalanx. The *Parablastomeryx* skeleton is notable for the large size of the limb elements, and interesting in showing the fusion of the proximal splints and the detached, well-preserved distal splints in the fore and lateral phalanges in both fore and hind feet. Additional associated remains are available in the case of the Lower Miocene *Pseudoblastomeryx* forms (see following section). The associated limb elements of *Parablastomeryx gregorii*, the metapodials tentatively referred to certain other Late Tertiary forms, and examples of the better represented Middle Tertiary *Problastomeryx* and *Pseudoblastomeryx* limbs, are illustrated on adjoining plates [Figs. 23B and (in part) 25, 25A, 25B].

The following Late Tertiary genera and species are represented by limb elements; where the association is definite, the species are starred. The numbers preceding species are the same as used above.

(Compare species summary, page 224; for measurements see combined Middle and Late Tertiary Blastomerycini and Merycodontini measurement table, pages 448–450; and compare Table IV, page 190.)

![Fig. 23B](image-url)
SUMMARY OF GENERA, SUBGENERA AND SPECIES REPRESENTED BY LIMB ELEMENTS

XX. Longirostromeryx, new genus, referred

Limb size group III–. (Tooth size groups III to V.)
(2) L. merriami, n.g. and sp., var. A and B, referred, from Brown and Cherry Counties, Nebraska.
(2a) L. serpentis, n.sp., referred, from Sioux County, Nebraska.
(3) (?)L. novomexicanus, n.sp., referred, from New Mexico.

Limb size group IV. (Tooth size groups III to V.)
(4) L. clarendonensis, n.sp., referred, from Texas.
(5) (?)L. blicki, n.sp., referred, from New Mexico.

Species (1) and (4a) are not represented by limbs.

XXI. Blastomeryx Cope

Limb (-tooth) size group IV.
(6) B. elegans Matthew and Cook, referred, from Sioux County, Nebraska. This paper, Fig. 25A (A:M.22474D and 14132E).

(tooth size group V.)
(7) B. mefferdii, n.sp., referred, from Brown County, Nebraska.
(8) B. gemmifer Cope, referred, from northeastern Colorado.
(8a) B. gemmifer medius (Matthew), referred, and var., from Sioux and Dawes Counties, Nebraska. This paper, Fig. 25A (A:M.14132 and F:A:M. 31901).

Species (8b), (8c), (9), (10) and (11) are not represented by limbs.

Limb size groups VII and VIII.
(11x) Three ?Blastomerycine species, from Cherry, Dawes and Sioux Counties, Nebraska. This paper, Fig. 25B (F:B:A:M.34027 and A); Fig. 25A (A:M.14131).

XXII. Parablastomeryx, new genus

Limb size group I. (Tooth size group III+) *
(12) P. gregorii, n.g. and sp., from east Cherry County, Nebraska. This paper, Figs. 25, 25B (F:B:A:M.31360).

Species (13) is not represented by limbs.

XXIIA. Pseudoparablastomeryx, new subgenus

Limb size group IX. (Tooth size group VI.)
(14) P. scotti, n.subg. and sp., questionably referred, from Dawes County, Nebraska. This paper, Fig. 25B (F:B:A:M.33765 and 33764).
### Detailed Lists of Limb Elements of Above Genera and Species

#### Limb Size Group III

(2) *L. merriami*, n.g. and sp., vars. A and B, referred

From Brown and Cherry Counties, Nebraska

<table>
<thead>
<tr>
<th>Element</th>
<th>Specimen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left metacarpus</td>
<td>F:A.M.32247</td>
<td>From Burge Quarry, 1935.</td>
</tr>
<tr>
<td>Left metatarsus</td>
<td>F:A.M.31954</td>
<td>From Quinn Quarry, 1927.</td>
</tr>
</tbody>
</table>

(2a) *L. serpentis*, n.sp., referred

From Sioux County, Nebraska

<table>
<thead>
<tr>
<th>Element</th>
<th>Specimen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left metatarsus</td>
<td>A.M.22474E</td>
<td>From Quarry A, 1921.</td>
</tr>
</tbody>
</table>

(3) (?)*L. novomexicanus*, n.sp., referred

From New Mexico

<table>
<thead>
<tr>
<th>Element</th>
<th>Specimen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right metatarsus</td>
<td>F:A.M.31723</td>
<td>From San Ildefonso, 1927.</td>
</tr>
</tbody>
</table>

#### Limb Size Group IV

(4) *L. clarendonensis*, n.sp., referred

From Texas

<table>
<thead>
<tr>
<th>Element</th>
<th>Specimen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion of right humerus, left radius, distal one-half metacarpus, etc.</td>
<td>F:A.M.32461A,B,C</td>
<td></td>
</tr>
</tbody>
</table>

(5) (?)*L. blicki*, n.sp., referred

From New Mexico

<table>
<thead>
<tr>
<th>Element</th>
<th>Specimen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skeletal elements: distal one-half right humerus, right radius, carpus, metacarpus (br.), distal one-half right and one-third left tibia, right and left tarsi, right and left metatarsi, four 1st, four 2d and two 3d phalanges, one lateral 3d phalanx</td>
<td>F:A.M.31729</td>
<td>From Cuyamungue, 1930. This paper, Fig. 25A (left metatarsus).</td>
</tr>
</tbody>
</table>

(6) *B. elegans* Matthew and Cook, referred

From Sioux County, Nebraska

<table>
<thead>
<tr>
<th>Element</th>
<th>Specimen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left metacarpus, 110 mm.</td>
<td>A.M.22474D</td>
<td>From Quarry A, 1921. This paper, Fig. 25A.</td>
</tr>
<tr>
<td>Right metatarsus, 120 mm.</td>
<td>F:A.M.31899</td>
<td>From E. Sinclair Draw, 1933.</td>
</tr>
<tr>
<td>Left metatarsus</td>
<td>F:A.M.31900</td>
<td>From W. Sinclair Draw, 1933.</td>
</tr>
</tbody>
</table>
Three left and one right metatarsi.

Right metacarpus.
Right radius.

(7) B. mefferdi, n.sp., referred
From Brown County, Nebraska

(8) B. gemmifer Cope, referred
From Northeastern Colorado

Skeletal elements: distal one-half tibia, tarsus and proximal two-thirds metatarsus.

(See “associated” left ramus, page 239.)

Distal two-thirds right tibia.

(8a) B. gemmifer medius (Matthew), referred, and var.
From Sioux and Dawes Counties, Nebraska

Limb size groups VII and VIII.

(11x) Three ?Blastomerycine species
(May represent distinct genera)

(a) Limb S.G. VII.
From Cherry County, Nebraska

Left metatarsus, 79 mm.
From Dawes County, Nebraska

Right radius and metatarsus, 77 mm.

F:B:A.M.34027 Observation Quarry, 1936.
and A This paper, Fig. 25B.

(Doubtful; somewhat longer-proportioned than in *Pseudoparablastomeryx scotti*, ref.) (Not included in specimen count.)

(b) LIMB S.G. VIII.

From Sioux County, Nebraska

Right metatarsus.

A.M.14131 From Snake Creek beds, 1908.
(Not cited in Table I.) Figured by Matthew and Cook, 1909, Fig. 25, under (?)*Merycodus*, sp. indesc.; this paper, Fig. 25A.

LIMB SIZE GROUP I.

(12) *P. gregorii*, new genus and species

From East Cherry County, Nebraska

Genotype (in part).— F:A.M.31360 From Xmas Quarry, 1932.
Skeletal elements including this paper, Figs. 25, 25B.
both scapulae, humeri, radii and unæ, carpi, metacarpi,
splints and phalanges, pelvis,
both femora, one patella,
both tibias, tarsi and meta-
tarsi, four lateral splints with
phalanges.

For assembled metacarpus and metatarsus, see Fig. 25B. The three pairs of second and third lateral phalanges associated with the specimen witness the presence of these elements in both manus and pes.

(Note skull and mandible, page 243. This paper, Fig. 22.)

Referred from Xmas Quarry, 1932.—

Distal four-fifths right hu-
F:A.M.31955A
merus.

Right femur.
F:A.M.31955

Distal two-thirds left tibia.
F:A.M.31955B

LIMB SIZE GROUP IX.

(14) *P. (P.) scotti*, n.subg. and sp., questionably referred

From Observation Quarry, Dawes County, 1936

Distal one-third left hu-
F:B:A.M.33766A
merus and right radius (br.).
and 33766

Right metacarpus, 49 mm.
F:B:A.M.33765 This paper, Fig. 25B.

Left metatarsus, 66 mm.
F:B:A.M.33764 This paper, Fig. 25B.
Fig. 24. Blastomerycini from the Middle Tertiary of Nebraska, Wyoming and South Dakota, skull, mandibular and maxillary dentitions compared. (See pages 254, 256-259.)

Lateral views ×½, occlusal × 1. PS, posterior border symphysis.

A.M.20548, *Machæromeryx tragulus* Matthew, genotype (in part), from Sioux County, Nebraska (Upper Harrison).


N.S.M.109-25-6-35 (rev.), 128-25-6-35 (type, rev.) and 15-25-6-35 (p2 from 96-25-6-35), *Pseudoblastomeryx schulzi*, n.sp., from Morrill County, Nebraska.

A.M.13014, *Pseudoblastomeryx advena* (Matthew), type, rev., from the Rosebud, South Dakota.

A.M.13822, *Problastomeryx primus* (Matthew), subgenotype (in part), rev., from the Upper Rosebud, South Dakota. (See also Fig. 25A [metatarsus].)
(b) **MIDDLE TERTIARY SECTION**

Subfamily 10.-**Longirostromycinae** (cont.)

XXIII. **MACHÆROMERYX MATTHEW**

Subfamily 11.-**Parablastomycinae** (cont.)

XXIV. **PROBLASTOMERYX, NEW SUBGENUS**

XXV. **PSEUDOBLASTOMERYX, NEW SUBGENUS**

Figures 24 and (in part) 3; Skeletal Elements (in part) 25A

Statement

*Problastomeryx* and *Pseudoblastomeryx*, new subgenera, are erected to take several ostensibly hornless forms with large upper canines, from the Lower Miocene. The specimens differ from the more average of the Late Tertiary remains of the preceding section in their greater tendency to shorter-proportioned diastemata, lower crowns and larger-proportioned premolars, in this lying perhaps nearest to the genus *Parablastomeryx*. The eight here enumerated species seem to be divisible between a longer- and a shorter-limbed group: *Problastomeryx* with metapodials less elongate than in *Parablastomeryx*, and *Pseudoblastomeryx* with metapodials of noticeably smaller size. The latter group is nicely exampled by specimens secured in northeastern Wyoming by C. Falkenbach and E. DeGroot, including a beautifully preserved skull and jaws (*P. falkenbachi*, Fig. 24). The limbs are never abbreviated as is characteristic of *Dremotherium* and *Tragulus*. *Pseudoblastomeryx* is exampled further in the slightly smaller forms, *P. advena* (Matthew) and *P. schultzi*, n.sp. Remains of the latter were recently discovered in Morrill County by C. Bertrand Schultz and made available for study through the kindness of Professor Barbour. The p³ inner root in the species *P. falkenbachi* is prominent as in *Parablastomeryx gregorii*, versus the constricted, rounded border in (?)*Longirostromeryx blicki*.

*Problastomeryx* and *Pseudoblastomeryx* specimens previously have been used in large measure to characterize *Blastomeryx* Cope, based (pp. 217, 238) on the Late Tertiary Pawnee Creek m3. In the absence of
the characteristic premolar portion of the series, doubt may arise as to
the allocation of small Lower Miocene specimens between Blastomeryx¹
and Leptomeryx-Hypertragulus.

The diminutive slender-limbed and less brachyodont-tending Machæ-
romeryx is more suggestive of a specialized species from the Mio-Plio-
cene than of the primitive forms of this section. There is the possibility
that M. tragulus Matthew may prove to have borne horns and perhaps to
have been nearer allied to the Aletomerycini than to the Blastomerycini.

As observed above, the Lower Miocene Blastomerycine limbs actu-
ally may be of moderately elongate proportions, though not as elongate
as in Parblastomeryx gregorii, or they may be of shorter proportions
(Pseudoblackmeromyx falkenbachi, P. advena and Machæromeryx tragulus),
compared to their respective dentitions and to the hypothetically normal
condition in Blastomeryx and in the Merycodontini. The metacarpi of
P. falkenbachi and P. advena retain the splint bones. It is presumed that
in all six of the Lower Miocene species, vestiges of the proximal ex-
ternal and internal splints (the same tending to be coössified with the
head of the metacarpals) and their distal extremities and phalanges were
retained in the manus and occasionally in the pes. The later P.
gregorii exhibits detached remnants of the laterals and their phalanges in
the manus and of lateral phalanges only in the pes. Some slight
evidence as to the possible condition in Blastomeryx is seen in the
lone phalanx associated with the partial skeletal elements referred to the
New Mexican (?)|Longistrostromeryx blicki. [A further example may be
represented by the Pawnee Creek, Colorado, metacarpus with lateral
phalanges (A.M.9475) heretofore referred to M. (Ramoceros) osborni.]
The retention of the laterals is evidenced in both Aletomeryx gracilis and
in A. marshi, as thereunder noted. It may be recalled that William D.
Matthew (1908) reported the Lower Miocene Blastomerycini then
known to him to be furnished with formed fore and hind cannon bones,
apparently complete lateral digits in the fore limb and proximal splints
in the hind limb and a metatarsus shorter and more robust than in
Merycodus.

¹ Harold J. Cook (1934, The American Midland Naturalist, XV, No. 2, p. 157), figures and
describes three new species from the Lower Miocene which he refers to Blastomeryx Cope. The spe-
cies are based on certain interesting fragments from the Harrison Beds. B. pristinus, type m3,
Plate III, Fig. 4, and B. cursor, type p—m2 and referred m3, Plate IV, Figs. 4 and 5, are apparently of
P. schultzi size. B. tanillus, type m—m and two m3, etc., Plate III, Figs. 5 and 6, have the di-
Dimensions of diminutive Leptomeryx-Hypertragulus. The large size of the premolars in the non-
hypsodont Meryodus prodromus Cook, type palate from the Harrison Beds, Plate III, Fig. 7, tends
to recall B. cursor rather than Merycodus.
Summary of Lower Miocene Species

(A) **WITH MODERATE-PROPORTIONED LIMBS.**

**SIZE GROUP VII+**.

(1) *Macheromeryx tragulus* Matthew, genotypic species, from six miles northeast of Agate, Nebraska (Upper Harrison).

Genotype.—Portions of skull, mandible and skeleton, A.M.20548.

This paper, *Fig. 24.*

(B) **WITH LONG-PROPORTIONED LIMBS.**

**SIZE GROUP III.** [LIMBS, SIZE GROUPS III- TO IV.]

(2) *Problastomeryx olcotti* (Matthew), 1908, from the Harrison, Lusk, Wyoming.

Type.—Left ramus, A.M.13224 (in part).

[Dentition near, limbs shorter than *P. primus*; length tibia near, metatarsus short as compared with the much larger-toothed *Aleomeryx marshi*.]

(2a) *Problastomeryx* species, from Dawes County, Nebraska.

Example.—Right fragment with m1-m6, F:B:A.M.32871.

(3) *Problastomeryx primus* (Matthew), 1908, subgenotypic species, from the Upper Rosebud, South Dakota.

Subgenotype.—Partial skull, both rami and skeletal elements, A.M. 13822. This paper, *Figs. 24* (ramus), *25A* (left metatarsus).

[Limbs slightly larger (tibia actually longer) but teeth relatively much smaller than *A. marshi*.] Compare A.M.13824, page 624.

(AA) **WITH MODERATE-PROPORTIONED LIMBS ("PSEUDOBLASTOMERYCINÆ").**

**SIZE GROUP V.**

(4) *Pseudoblastomeryx falkenbachi*, n.subg. and sp., from Lusk, Wyoming.

Subgenotype.—Partial skull and skeletal elements, F:A.M.31530.

This paper, *Fig. 25A* (right metacarpus and metatarsus).

[p1-p5 widely different from *P. olcotti*, as seen in referred muzzle.]

**SIZE GROUP V.** [LIMBS, SIZE GROUP VI.]

(5) *Pseudoblastomeryx advena* (Matthew), 1907, from the Rosebud, South Dakota.

Type.—Partial right ramus, A.M.13014. This paper, *Fig. 24.*
(5a) (?) *Pseudoblastomeryx advena*, smaller var., from the Upper Rosebud, South Dakota.

**Example.**—Portions of skeletal elements, A.M.13823. This paper, Fig. 25A (right metatarsus).

(6) *Pseudoblastomeryx schultzi*, n.sp., from Bridgeport, Morrill County, Nebraska.

**Type.**—Right ramus, N.S.M.128-25-6-35. This paper, Fig. 24.

**SIZE GROUP VI. (LIMBS UNKNOWN.)**

(7) (?) *Pseudoblastomeryx marsa*, n.sp., from west Cherry and Dawes Counties, Nebraska.

**Type.**—Immature right ramus, F:A.M.31354. This paper, Fig. 3.

**Detailed Lists of Middle Tertiary Types, Referred Specimens (Including Limbs) and Synonymy**

*Macheromeryx*, total available listed specimens, 1; *Problastomeryx*, 12; *Pseudoblastomeryx*, 53.

**SIZE GROUP VII+.**

(1) *Macheromeryx tragulus* Matthew, genotypic species

From Upper Harrison Beds, Nebraska


**Genotype.**—Palate with large C3/, p4–m4 and right one-half base of skull; mandible with p1–m2. (M+)

**Limbs of Size Group VII+.**

Right and left scapulae, humeri, ulno-radials, metacarpi, phalanges, partial right and left femora, distal two-thirds left tibia, left and distal one-half right metatarsus, calcaneum and astragalus, several carpals and tarsals, three 1st, two 2d and two 3d phalanges, 7 cervical, 9 dorsal and 4 lumbar vertebrae, pelvis and sacrum.

From 6 miles N.E. of Agate, 1923.

Figured by Matthew, 1926, Figs. 1, 2; this paper, Fig. 24.

Note: Length /ps and diastema moderate; length /ps (12.3 mm.) equaling 63% of diastema length (19.5 mm.); /ps tending simple, p4 broadly open inwardly.
Size Group III.

(2) *Problastomeryx olcottii* (Matthew)

From the Harrison, Lusk, Wyoming

Premolars relatively large, symphysis missing, Cs/ large


**Type.—**Left ramus without symphysis, with p₃ alveolus, p₃—m₃, (M+).

Teeth slightly worn.

From 9 miles S.E. of Lusk, 1907.

Figured by Matthew, 1908, Fig. 3.

**Referred from Type Locality, 1907 (at least three individuals held under same number with type).—**

Left p₃—m₃.

Unworn.

A.M.13224A (in part)

Large unworn C/.

A.M.13224

Figured by Matthew, 1908, Fig. 2.

C/ (br.), unworn.

A.M.13224

Worn right maxilla with p₄—m₄, and possibly associated right ramal fragment with p₃—m₃.

A.M.13224

Figured by Matthew, 1908, Fig. 11 (in part).

**Referred Limb Elements.**—

Matthew (1908, p. 544) notes under A.M.13224, “upper and lower jaws, hind limbs and feet,” and (A), “lower jaw and hind foot of a younger individual...” A reexamination of these limbs, from nine miles southeast of Lusk, indicates the presence of at least three individuals, all of Size Groups III—IV, and large for the jaws.

(1) Moderately large:

Left metatarsus, 127 mm.

A.M.13224

(2) Moderate:

Right tibia, 163 mm., tarsus and metatarsus, one 1st, one 2d and one 3d phalanx.

A.M.13224

Figured by Matthew, 1908, Fig. 7.

(3) Moderately small:

Right metatarsus, one 1st and one 2d phalanx, etc. fragments.

A.M.13224A (in part)
(2a) Problastomeryx species
From Dawes County, Nebraska

**Example.**—Right fragment F:B:A.M.32871 From B Quarry, Antelope Valley, 1935.

with $m_1$-$m_4$ (M+)

$m_3$ = 12.3 mm.

(So far as visible, resembles *P. primus*.)

**Indeterminate Species from Same Locality.**—

Right fragment with $m_1$— F:B:A.M.32874 1935.

$m_3$ (M+)

(Larger than *Parablastomeryx* and smaller than *Barbouromeryx trigonocorneus*.)

(3) Problastomeryx primus (Matthew), subgenotypic species
From the Upper Rosebud, South Dakota

Shortness of diastema indicated in broken symphysis. Premolars relatively large, molars with both types of folds and columns. Cs/ seen in associated remains. Limbs relatively large and approximating *Aletomeryx marshi*.


**Subgenotype.**—Skull and both rami with worn dentition (including broken C/right), and associated skeletal elements.

Limbs of Size Group III:

Right radius, right carpus, right and partial left femur, left and distal one-half right tibia, left calcaneum, left and right astragali and tarsals, left and distal one-half right metatarsus, three 1st, two 2d and one 3d phalanges, etc. fragments.

REFERRED FROM PORCUPINE BUTTE, 1906.—

Partial left ramus with A.M.13016

$m_1$-$m_2$.  

(Atlas and scapula reported but not found.)
SIZE GROUP V.

(4) **Pseudoblastomeryx falkenbachi**, new subgenus and species

From Lower Miocene, Lusk, Wyoming

Premolars small and limbs very small relative to *P. olcottii*

**Subgenotype.**—Partial skull with C/i-alveolus and p¹–m³, and skeletal elements (see below).

**Length of limbs approximates Size Group v, Merycodontini:**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.31530</td>
<td>From 18 miles S.E. of Lusk, 1933.</td>
<td>This paper, <em>Fig. 25A</em> (right metacarpus and metatarsus).</td>
</tr>
</tbody>
</table>

**REFERRED.**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.31531</td>
<td>From 20 miles S.E. of Lusk, 1935.</td>
<td>This paper, <em>Fig. 24</em>.</td>
</tr>
<tr>
<td>F:A.M.31530A</td>
<td>From Little Muddy Creek, 1933.</td>
<td></td>
</tr>
</tbody>
</table>

**Very Questionably Referred.**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.31532</td>
<td>From 12–15 miles S. of Lusk, 1932.</td>
<td>(Diastema short, size (Size Group iv) larger than above specimens and nearly as large as <em>P. olcottii.</em>)</td>
</tr>
<tr>
<td>F:A.M.32849</td>
<td>From 10 miles S.E. of Lusk, 1935.</td>
<td></td>
</tr>
</tbody>
</table>
Pseudoblastomeryx advena (Matthew)

From the Rosebud, South Dakota

Premolars large; shortness of diastema indicated in broken symphysis


**Type.**—Partial right ramus with $p_r$–$m_2$. (M)

A.M.13014

From west of Porcupine Creek.

Figured by Matthew, 1908, Fig. 4; this paper, Fig. 24.

**Questionably Referred** (larger than type, limbs smaller than $P. falkenbachi$):

Muzzle with enlarged Cs/, $p^+$s and $p^-$s, and associated skeletal elements (wrongly reconstructed).

A.M.13015

From Porcupine Creek, 1906.

Figured by Matthew, 1908, Fig. 6.

Limbs of Size Group VI:

Partial right scapula, distal end left humerus, proximal half right radius, right and left partial ulnae, right and distal one-half left metacarpus, and proximal two-thirds left femur, left calcaneum and astragalus, one tarsal, left metatarsus, one 1st and one 2d phalanx.

Matthew observes that A.M.13015 "...shows the structure of manus and pes almost identical with that of $B. gemmifer$.”

(5a) (?)Pseudoblastomeryx advena, Smaller Var.

From the Upper Rosebud, South Dakota

**Example.**—Distal third right tibia, right metatarsus, two 1st, one 2d and two 3d phalanges.

A.M.13823

From 1 mile W. of Horse Creek, 1907.

This paper, Fig. 25A (right metatarsus).
(6) **Pseudoblastomeryx schultzi**, new species

From Quarry 1, Bridgeport, Morrill County, Nebraska

**TYPE.**—Right ramus with symphysis and p$_r$-m$_z$........ (m+) 128-25-6-35

**REFERRED.**—

Type-sized:

- Left ramus with symphysis, p$_z$ alveolus and p$_r$-m$_z$..... (m+) 127-25-6-35
- Left ramus with symphysis, p$_z$ alveolus and p$_r$-m$_z$..... (w) 15-25-6-35

**REFERRED.**—

**Slightly larger than type:**

- Right fragment with p$_r$ alveolus and p$_r$-m$_z$............ (w+) 60-61-6-7-34
- Right fragment with symphysis and p$_r$-p$_z$................. (m+) 16-25-6-35
- Right fragment with p$_r$-m$_z$............................ (w+) 100-25-6-35
- Right fragment with dp$_r$-m$_z$............................ 59-6-7-34
- Right maxilla with p$_t$-m$_z$............................... (m) 109-25-6-35
- Left fragment with m$_1$(br.)-m$_z$........................... (w) 31-25-6-35

**Limbs, Size Group vi:**

(The metapodial length equals, but the metapodials are slightly slenderer-proportioned than *P. advena.*)

- Distal portion right humerus.................................. 75-25-6-35
- Right metacarpus (90 mm.).................................... 116-25-6-35
- Right metatarsus (98 mm.)..................................... 117-25-6-35
- Two calcanea.................................................. 70- and 71-25-6-35
- Eight astragali.................................................. 38-, 39-, 73-, 74-, 137-25-6-35, 25-6-34, 6-7-34, 6-7-34

**Five 1st, one 2d and three 3d phalanges; one tarsal.**

**Questionably Referred** (from 6 mi. S.W. of Bridgeport, S. R. Sweet, collector, 1932).—

- Partial skull and left ramus with dp$_r$ and m$_z$, part of right ramus, two whole and three broken phalanges........ A.M.27762
SIZE GROUP VI.

(7) (?)Pseudoblastomeryx marxa, new species

From West Cherry and Dawes Counties, Nebraska

Type.—Immature right ramus with dp4–m,(br.) and germs of p3–p4.

F:A.M.31354 From 1 mile west of Aleto-
meryx Quarry, 1934. This paper, Fig. 3.

Tentatively Referred.—

From B Quarry, Antelope Valley, Dawes County, collected by Ted Galusha, 1935:

Right fragment, p3–m3 (w) F:B:A.M.32870
Two left m3s. F:B:A.M.32870A and B
Right fragment with m1 (br.)–m3 (–m) F:B:A.M.32870D
(Shape slightly larger.)
Left m3–m3 (m) F:B:A.M.32870C
(Shape smaller.)

Summary Re Limb Elements of Above Blastomerycines

Figure 25A (in part)

Some six of the above Middle Tertiary species seem to be represented by limb elements. In four of these the limbs are in definite association.

(Compare limb elements of the Late Tertiary species, summary, page 246; and for measurements see combined Middle and Late Tertiary Blastomerycini and Merycodontini measurement table, pages 448–450.)

Résumé of Represented Genera, Subgenera and Species

(Details are given under the respective forms, see preceding pages.)

* = elements associated with dentitions

(A) With moderate-proportioned limbs.

XXIII. Machæromeryx Matthew

Limb (-tooth) size group VII+.

*(1) M. tragulus Matthew, from six miles northeast of Agate, Nebraska
(Upper Harrison).
(b) With long-proportioned limbs.

XXIV. Problastomeryx, new subgenus

Limb size groups III–to IV. (Tooth size group III.)

(2) *P. olcotti* (Matthew), from the Harrison, Lusk, Wyoming.

Limb (-tooth) size group III.

*(3) P. primus* (Matthew), subgenotypic species, from the Upper Rosebud, South Dakota. This paper, *Fig. 25A* (A.M.13822).

Species (2a) is not represented by limbs.

(a) With moderate-proportioned limbs.

XXV. Pseudoblastomeryx, new subgenus

Limb (-tooth) size group V.

*(4) P. falkenbachii*, n.subg. and sp., from Lusk, Wyoming. This paper, *Fig. 25A* (F.A.M.31530).

Limb size group VI. (Tooth size group V.)

*(5) P. advena* (Matthew), from the Rosebud, South Dakota. This paper, *Fig. 25A* (A.M.13015).

*(5a) (?)P. advena*, smaller var., from the Upper Rosebud, South Dakota. This paper, *Fig. 25A* (A.M.13823).

(6) *P. schultzi*, n.sp., from Bridgeport, Morrill County, Nebraska.

Species (7) is not represented by limbs.

---

**FIGS. 25 AND 25A.** Dromomerycini, Blastomerycini and Aletomerycini genera from the Tertiary, comparison of limb elements.

× †. Solid-line bracket indicates associated limbs; broken-line bracket indicates limbs of more than one individual.

Fig. 25. N.S.M.3–27–11–33, *Barbouromeryx trigonocorneus* (Barbour and Schultz), limbs of genotype, from Dawes County, Nebraska.

(See also Figs. 5, 7, 10 [dentition], 2, 14 [skull] and page 183.)

F:A.M.31360, *Parablastomeryx gregorii*, n.g. and sp., limbs of genotype, from Xmas Quarry, Cherry County, Nebraska.

(See also Fig. 22 [skull and mandible], 25B [partial manus and pes] and page 249.)

Fig. 25A. (See legend, page 265.)
Fig. 25B. Foot elements of certain Cervidae and Antilocapridae from the Tertiary and Recent.  
× 4. (See legend, next page.)
Fig. 25A. N.S.M.29-27-9-33 and 36-27-9-33, Probarbouromeryx sweeti, n.subg. and sp., ref., left metacarpus and metatarsus, from Bridgeport Quarry, Morrill County, Nebraska. (See page 184.)

A.M.13822, Problastomeryx primus (Matthew), subgenotype (in part), left metatarsus, from the Upper Rosebud, South Dakota. (See Fig. 24 [ramus] and page 256.)

F.A.M.31931 and 31932, Aletomeryx gracilis Lull, ref., right metacarpus and left metatarsus, from Antelope Creek, Cherry County, Nebraska. (See page 185.)

A.M.14264, Aletomeryx marshi (Lull), ref., left metacarpus (note side view showing interior lateral) and left metatarsus, from the Harrison, Nebraska. (See page 186.)

A.M.22474D and 14132E, Blastomeryx elegans Matthew and Cook, ref., left metacarpus and metatarsus, from Sioux County, Nebraska. (See pages 247, 248.)

F.A.M.31729, (?)Longirostromeryx blicki, n.sp., ref., left metatarsus, from Cuyamungue, New Mexico. (See page 247.)

A.M.14132 and F.A.M.31901, Blastomeryx gemmifer medius (Matthew), ref., left metacarpus and right metatarsus, from Sioux County, Nebraska. (See page 248.)

F.A.M.31530, Pseudoblastomeryx falkenbachi, n.subg. and sp., subgenotype (in part), right metacarpus and metatarsus, from Lusk, Wyoming. (See page 257.)

A.M.13015, Pseudoblastomeryx adeva (Matthew), (?)ref., right metacarpus and left metatarsus, from the Rosebud, South Dakota. (See page 258.)

A.M.13823, (?)Pseudoblastomeryx adeva (Matthew), smaller var., right metatarsus, from the Upper Rosebud, South Dakota. (See page 258.)

A.M.14131, ?Blastomerycine species, right metatarsus, from Sioux County, Nebraska. (See page 249.)

Fig. 25B. A.M.[M.]5036, Antilocapra americana Ord, ♂, partial manus and pes (Recent).

F.A.M.32101, Plioceros dehlini, n.sp., type (in part), ♀, partial manus and pes, from Cherry County, Nebraska. (See Fig. 26 [skull and mandible] and page 516.)

F.A.M.31592, Ramoceros ramosus (Cope), ref., partial manus, from New Mexico. (See Figs. 28, 28A, 29, 30 [partial cranium and horns], 48 [limbs] and page 453.)

F.A.M.32479A and 33789, Paracosoryx wilsoni, n.subg. and sp., ref., rev., right metacarpus and immature manus, from Sioux County, Nebraska. (See Fig. 48A [F.A.M.33789] and pages 462, 316.)

N.S.M.59-4-7-34, Cosoryx fureatus Leidy, ref., partial manus, from Cherry County, Nebraska. (See page 459.)

A.M.6782, Leptomeryx evansi or var., ref., pes and partial manus, from Logan County, Colorado. (See page 629.)

N.S.M.23-6-8-30, Meryceros warreni johnsoni, var., ref., pes, from Cherry County, Nebraska. (See page 466.)

A.M.9475, (?)Cosoryx fureatus, var. or subsp., ref., partial manus, from Colorado. (Lateral phalanges of pes, figured by Matthew, 1904, Fig. 16, supplied in error.) (See Fig. 48 [limbs] and page 461.)

A.M.[M.]122358, Odocoileus virginianus (Zimmermann), ♂, partial manus and pes (Recent).

F.A.M.31360, Parablastomeryx gregorii, n.g. and sp., genotype (in part), partial manus and pes, from Cherry County, Nebraska. (See Fig. 22 [skull and mandible], 25 [limbs] and page 249.)

N.S.M.1-11-8-36, (?)Aletomeryx marslandensis, var., rev., right metacarpus, from Dawes County, Nebraska. (See pages 163, 186.)

F.A.M.32248, Aletomeryx gracilis Lull, ref., partial manus, from Cherry County, Nebraska. (See page 185.)
Fig. 26. *Plioceros*, n.g., ref. (F:A.M.32101), *Cosoryx* Leidy, ref. (F:A.M.32426 and 32450) and *Paracosoryx*, n.subg., ref. (F:A.M.32399), comparison of Antilocaprin and Merycodontini skulls from the Late Tertiary of Nebraska.

× 4. A, B, cross sections of horn. (See legend, next page.)
FAMILY II.—ANTilocapridæ

See Reconstructions: Frontispiece, A & B, and Figures 27 and 49

The Antilocapridæ, in the present volume, are divided between the:

MERYCodontini, Late Tertiary, and
ANTilocaprinI, Late Tertiary and Quaternary.

Reconstructions of the heads of the more outstanding genera and subgenera are shown in the frontispiece, A and B, and Figures 27 and 49. The family is as yet unrecognized outside of America and quite unknown previous to the Late Tertiary. The “horn” characters of the Merycodontini, “pronglets,” and AntilocaprinI, “pronghorns,” have been discussed at some length in the general Introduction. The dentitions are uniformly hypsodont. The adjoining table gives the distribution of the genera and subgenera as at present recognized. The two divisions are considered in detail in the following pages, where the different genera and species appear under the numbers used in the table. Without the evidence of the horns, the Merycodontini are distinguished with difficulty from small AntilocaprinI. It is quite possible that a primitive hornless Merycodontini or AntilocaprinI actually may be present and unrecognized in the collections of hornless and subhypsodont-tending Blastomerycini.

Hypothetically—Forked horn-cored AntilocaprinI ancestors gave rise to the unforked core and forked sheath of the modern pronghorn. The Stockoceros forked core was derived from the burrless Plioceros core and not from Meryceros. Differentiation in the Merycodontini was accompanied by downward retreat of thehorn-core burr (and facial skin) and elongation of the sheath (Cosoryx), or tendency to separation of the horn-core into basal pedicle and partially deciduous antler (Ramoceros).

The two following tables summarize graphically the known distribution of the here recognized genera and subgenera of the divisions AntilocaprinI and Merycodontini, and the number of available specimens.

---

1 There is no record of the occurrence of an Antilocaprid in South America. The several doubtful references in the early literature to antelope forms were based on fragmentary remains yet to be proven non-Cervid—see A. maquinensis and Leptotherium majus and minus of the Brazilian Caves, Lund (1841), Branco (1883) and Ameghino (1889); and Platatherium pampeum Ameghino from the upper Pampean.

---

Fig. 26. F:A:M.32101, Plioceros dehlini, n.sp., type (?female), from Snake River, Cherry County, Nebraska. (See also Fig. 25B [partial manus and pes] and page 497.)

F:A:M.32426 and 32450 (immature), Cosoryx furcatus Leidy, ref., from Gordon Creek, Cherry County, Nebraska. (See page 341.)

F:A:M.32399, C. (Paracosoryx) wilsoni, possibly distinct var., rev., from Sioux County, Nebraska. (See page 352.)
<table>
<thead>
<tr>
<th>B.—Antilocapridi</th>
<th>Uppermost</th>
<th>Lowermost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Osbornoceros, n.g.</strong></td>
<td>IV</td>
<td>(1)</td>
</tr>
<tr>
<td><em>Ilingoceros</em> Merriam</td>
<td>V</td>
<td>(1a)</td>
</tr>
<tr>
<td><em>Sphenophalos</em> Merriam</td>
<td>VA</td>
<td>(4)</td>
</tr>
<tr>
<td><em>Plioceros, n.g.</em></td>
<td>VI</td>
<td>*? (3)</td>
</tr>
<tr>
<td><em>Texoceros, n.g.</em></td>
<td>VII</td>
<td>? (5)</td>
</tr>
<tr>
<td><em>Proantilocapra</em> Barbour and Schultz</td>
<td>VIII</td>
<td>*? (1)</td>
</tr>
</tbody>
</table>

**Table VII**

**Antilocaprid Genera, Subgenera and Species of the American Late Tertiary—Occurrence and Totals of Available Specimens**

(Roman and Arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in () from type, and in [] from other than type area for the particular species.) (See Introduction, page 7.)

| Specimen Count | 51 | 29 | 2 | 54 | 203 | 1 |

...Total Antilocapridi 340

268
<p>| | | | | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Merycodontini</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramoceros, n.g.</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paramoceros, n.</td>
<td>IA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*(5)</td>
<td>*(7)</td>
<td>(9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterosaurus, n.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merriamoceros, n.</td>
<td>IB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cosoryx Leidy</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcosoryx, n.subg.</td>
<td>IIA</td>
<td>*(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paracosoryx, n.</td>
<td>IIB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*(9)</td>
<td>*(8)</td>
<td>*(11)</td>
<td>*(11a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subparacosoryx, n.</td>
<td>IIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*(10)</td>
<td>*(12)</td>
<td>[11b]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meryceros, n.g.</td>
<td>III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(6)</td>
<td>*(7)</td>
<td>(1)</td>
<td>(5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submerycroses, n.</td>
<td>IIIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* *, † refer to localities as shown in column headings.
† †t questions the generic or subgeneric reference.

Merycodontini specimens unallocated to species, not included in table 825
Total Merycodontini 4219
Late Tertiary Antilocaprin 340
Quaternary Antilocaprin (page 476) 88
Antilocaprin and Merycodontini, Grand Total Available Specimens 4642
Fig. 27. Pronglets, Merycodontini, of the American Late Tertiary.
Reconstructions $\times$ approximately 1. (See legend, page 277.)

Meryceros, n.g. (A)                  Paracosoryx, n.subg. (B)
Subparacosoryx, n.subg. (AA)         Paramoceros, n.subg. (C)

Paracosoryx, ref. species (BB)

Paramoceros, ref. species (D)        Ramoceros, n.g. (E)

See Merriamoceros reconstruction, Frontispiece, A

270
DIVISION A.—MERYCODONTINI

Subfamily 1.—Ramocerotinae

I. Ramoceros, new genus

IA. Paramoceros, new subgenus

IB. Merriamoceros, new subgenus

Subfamily 2.—Cosorycinae

II. Cosoryx Leidy

IIA. Subcosoryx, new subgenus

IIB. Paracosoryx, new subgenus

IIC. Subparacosoryx, new subgenus

III. Meryceros, new genus

IIIA. Submeryceros, new subgenus

Frontispiece, A, and Figure 27 (Reconstructions); Figures 28–40 and (in part) 2, 2A, 26 (Skulls and Horns); 41–47A and (in part) 28B, 35A, 37, 37A, 38 (Mandibular Dentitions); (in part) 26, 28A–C, 37, 37A, 40 (Maxillary Dentitions); (in part) 25B, 38, 48 (Limbs)

Sections: I, Discussion; II, “Horns”; III, Dentitions and Mandibular Rami; IV, Limbs

Section I.—Discussion

The diminutive Antilocaprid pronglets, or Merycodontini, the Merycodons of the literature, had a wide range in the Late Tertiary of North America. They are characterized by tall-crowned teeth, slender elongate limbs and especially by the pseudo-Cervine-formed “horns” of the males. While the latter differ in shape and in position, at times being antler-like and highly suggestive of the deer, the uniformly tall-crowned dentitions are at once distinguishable from the contemporary Cervids of similar size (Blastomerycini) in which the teeth are brachydont and the superior canines much enlarged. Heads of the more characteristic of the so far recognized forms are shown in hypothetical reconstruction as in life on the opposite page (Fig. 27) and the frontispiece, A. Unrecognized in the uppermost and but doubtfully present in the lowermost
Fig. 28. Merycodontini genera and subgenera, *Subparacosoryx*, n.subg. (A.M. 17339, subgenotype), *Meryceros*, n.g. (N.S.M.1–17–6–32, 20–8–7–33 and F:A.M. 31163), *Cosoryx* Leidy (F:A.M.31511 and A.M.8497) and *Ramoceros*, n.g. (A.M. 9476 and F:A.M.31592), comparison of skulls from the American Late Tertiary.

Occipital views × 4. (See legend, page 277.)
Fig. 28A. Merycodontini genera and subgenera, *Subparacosoryx* n.subg. (A.M. 17339, subgenotype), *Meryceros*, n.g. (N.S.M.16-16-6-33, F:A.M.31163 and N.S.M.20-8-7-33), *Cosoryx* Leidy (F:A.M.31511) and *Ramoceros*, n.g. (A.M.9476 and F:A.M.31592), comparison of skulls from the American Late Tertiary.

Lateral views × 4. (See legend, page 277.)
Fig. 28B. *Merycros warreni johnsoni*, n. subsp., age, sexual and individual variation as shown in skulls of three adolescent individuals (N.S.M.1-19-9-34, 4-7-9-34 and 9-7-9-34), mature female (N.S.M.2-9-8-34, rev.), and two mature males (N.S.M. 1-23-7-34, and 2-3-8-34, type) from Crookston Bridge, Cherry County, Nebraska.

× 4. (See also Figs. 2 [N.S.M.1-23-7-34], 28C [N.S.M.2-9-8-34, 1-23-7-34 and 2-3-8-34] and pages 363-365.)
Fig. 28C. *Meryceros warreni johnsoni*, n.subsp., sexual and individual variation in three mature males (N.S.M.2-3-8-34, type, 1-23-7-34 and 1-21-8-34), and mature female (2-9-8-34), from Crookston Bridge, Cherry County, Nebraska. X §. FLP, foramen lacerum posterius; FO, foramen ovale; FR, foramen rotundum; GR, glenoid foramen; MA, auditory meatus. In palatal view of N.S.M.2-3-8-34, the vomer and adjacent area have been supplied from 1-21-8-34, and the palatal suture from 2-9-8-34. (See also Figs. 2 [N.S.M.1-23-7-34], 2A [N.S.M.1-21-8-34], 28B [N.S.M.2-3-8-34, 1-23-7-34 and 2-9-8-34] and pages 393, 394.)
levels, Merycodont remains are of frequent occurrence in the formations of the main portion of the Late Tertiary where the pronglets are the best represented of the horned groups. Their plentifulness, great diversification and considerable vertical range might make these fascinating remains easily read records of variation and development, were it not for the scarcity of definitely associated material. With the vast collections that the future may produce, the Merycodonts well may prove to be one of the best keys to Late Tertiary correlation. The manner of the growth and the question of replacement of the "horns" have long been in doubt. The genotypic species, *Merycodus necatus* Leidy (1854), was based on fragmental and indefinitely characterized teeth from the Bijou Hills and remains indeterminate.

Since the original completion of the present preliminary studies and attempted subdivision of the Merycodontini, mainly on the characters of the horns (because of dearth of associated dentitions), certain collections have been secured, from restricted and well-defined horizons of widely remote localities in New Mexico, north and southwest Nebraska and California, of definitely associated horns, crania and mandibles. Interestingly enough, such recent finds include series of horns, which in a number of instances differ from those of other localities, and mandibular rami of equally well-defined character. These additional collections have permitted some adjustment of our original treatment of the group. As might be expected, Merycodontini horns and teeth tend to vary independently; the mandible and dentition evidently were more conservative than the horns.

The Merycodontini, on the previously known and the more recently available and far more ample data as to the characters of the horns and (to less degree) dentitions, are divided between three main—*Ramoceros*, n.g., *Cosoryx* Leidy and *Meryceros*, n.g.—and several minor groups. As more fully discussed below, it is impossible as yet to determine which of these groups is represented by the lost type of *Merycodus* Leidy or, in many cases, definitely to allocate detached ramal dentitions and limbs from localities in New Mexico, Nebraska and California. Because of the advantage for ready intercomparison of like parts with like, and on account of the scarcity, until recently, of definitely associated remains, consideration of the Merycodontini in these pages has been divided between the introductory Discussion (Part I), and three separate but cross-referenced sections, "Horns" (Part II), Dentitions (Part III) and Limbs (Part IV).

---

1 Total specimens, 4219.
Fig. 27. Reconstructions based on:

(A) *Meryceros warreni johnsoni*, n.subsp., Crookston Bridge Quarry, Cherry County, Nebraska

(AA) *Subparacosoryx savaronis*, n.subg. and sp., Sioux County, Nebraska

(B) *Paracosoryx wilsoni*, n.subg. and sp., Sioux County, Nebraska

(BB) *Paracosoryx alticornis*, n.sp., Barstow, California

(C) *Paramoceros brevicornis*, n.subg. and sp., Barstow, California

(D) *Paramoceros marthae*, n.sp., Santa Fé County, New Mexico

(E) *Ramoceros ramosus* (Cope), Santa Fé County, New Mexico

Figs. 28 and 28A. Merycodontini genera and subgenera, comparison of skulls from the American Late Tertiary.

Occipital and lateral views × 4. A, B, cross sections of horns.

Fig. 28. A.M.17339, C. (Subparacosoryx) savaronis, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(N.S.M.1–17–6–32, *Meryceros warreni johnsoni*, n.subsp., ref. 9, from Crookston Bridge, Cherry County, Nebraska.

(Fig. 28A and page 353.)


(A.M.8497, *Cosoryx* Leidy, ref., from Driftwood Creek, Hitchcock County, Nebraska.

(A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), from Pawnee Creek, Colorado.

(A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), from Pawnee Creek, Colorado.

(A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), from Pawnee Creek, Colorado.

(A.M.9476, *Ramoceros osborni* (Matthew), genotype (in part), from Pawnee Creek, Colorado.

Fig. 28A. A.M.17339, C. (Subparacosoryx) savaronis, n.subg. and sp., subgenotype, from Sioux County, Nebraska.

(N.S.M.16–16–6–33, *Meryceros warreni johnsoni*, var., ref. 9, from Valentine, Cherry County, Nebraska.

(Fig. 28A and page 353.)


(Fig. 28A and page 368.)

See also Figs. 28 [posterior view of cranium], 29, 30 [horns], 25B [partial manus], 48 [limbs], and page 324.)
Characters of the Merycodontini

The dentition is strongly hypsodont; the Is/ and p\textsubscript{1} are lost; unenlarged Cs/ are retained, at least occasionally, in both sexes (Fig. 28B); and the /Cs are incisive-formed. The lengths of the paired frontal appendages of the mature males vary from 50 to 100% of the skull lengths and are of several distinct forms, viz.: (Ramoceros) three- to four-pointed postorbital "antlers," (Cosoryx) moderate to tall supra-orbital shafts with short-tending forked prongs, and (Meryceros) shorter and more laterally compressed shafts with variable forks. The basal burrs are single or multiple, lightly attached or frequently absent. The frontal area of the skull anteromedian to the horn-cores is strongly depressed; the nasals and muzzle may be extremely long and slender; the premaxillae widely separate the anterior nasals and maxillæ; the tubular orbits are strongly produced laterally; the postorbital ridges are united in a low sagittal crest (the parietal area being relatively short in Ramoceros and longer in Meryceros); the inion is broad, indented and over-reaches the condyles; the posterior palate is produced and tubular; the auditory bullæ are full (possibly less so in Ramoceros) and the auditory meatus long and erect (possibly more so in Cosoryx); unossified pre-orbital vacuities and both infra- and supra-orbital foramina are present; the limbs are of slender Antilocaprine proportions, the metacarpal length apparently somewhat approximating the incisive border to foramen magnum distance. Remnants of the laterals and their phalanges were retained occasionally, at least, in the manus (Fig. 25B).

The skull is definitely pronghorn-like versus deer-like, the orbits being prominent and tubular, the nasals and muzzle long and slender, the premaxilla-nasal contact wide, the muzzle and incisive border unconstricted distally, the lacrimal glandular depression of the deer absent, the horns postero-supra-orbital (versus frequently more posterior to the orbit) and the frontoparietal suture straight (versus inverted U-shaped in the deer). While the enlargement of the occipital area and tubular condition of the posterior palate are perhaps suggestive of the deer rather than the pronghorn, the condition of the posterior cranium must have been primarily dependent on horn form. The arrangement of the postglenoid, of the hyoid troughs of the bullæ, etc., tend to be Antilocaprine.

Examples of the crania of Ramoceros, Cosoryx and Meryceros are figured on two adjacent pages in lateral and occipital views, Figs. 28 and 28A, and examples of the Crookston and Nenzel Meryceros in three Figs. 28B, C and 40. The drawings portray the depression of the relatively
low posterior occipital area, the moderate development of the sagittal crest, the indentation of the relatively wide inion, the fullness and position of the bullae and the arrangement of the mastoid area, etc. They further indicate the more posterior and depressed position of the horns, the relatively short posterior cranium and more circular horn section of Ramoceros versus Cosoryx and Meryceros. The writer has yet to view a complete or nearly complete skull of Ramoceros. As seen in Meryceros and Cosoryx the premaxillae and nasals are extremely elongate and slender and the occipital area low and unproduced. The figures portray the slenderness of the muzzle, the prominence of the orbits and the elevation of the midfrontal area of the cranium. Additional crania are illustrated on Figures 2, 26, 37 and 37A (in part).

Ramoceros, n.g., and Meryceros, n.g., are well represented by the fine series of detached horns and dentitions, etc., in the collections amassed by the late Joseph Rak from the Santa Fé area, New Mexico. The former genus is almost unknown elsewhere. Cosoryx Leidy is seen in rare examples from several scattered areas and in the very useful series secured by M. F. Skinner from a northern Nebraska locality. Subcosoryx, n.subg., with uniquely reduced premolars, is limited so far to the single New Mexican horizon. Paracosoryx, n.subg., with peculiarly abbreviated diastema, is recognized in remains collected by Jack Wilson from localities in western Nebraska and the Mojave, California. Meryceros, represented in our collections by many detached specimens from various areas, is best observed in the exquisite series collected by F. W. Johnson and party at Crookston in northern Nebraska and placed at the writer’s service through the kindness of Professor E. H. Barbour of the Nebraska State University. This superb series of skulls, associated and non-associated rami and limbs, and a fine Meryceros series secured by M. F. Skinner from Nenzel, indicate the considerable variation in size and other characters occurring within two species of the genus. Additional specimens, discovered some months after the completion of our original studies, have permitted a rechecking of the Merycodontine evidence as a whole and a more satisfactory allocation of detached mandibular and maxillary dentitions to the species represented by horns. Far more time than has been given to the Merycodontini well might be spent in further and more careful study of the now available collections. The present and preliminary revision at best must be considered no more than a step toward a clearer understanding of this diversified and formerly widely distributed group.
The Problem of the "Horns"

The actual method of growth and nature of the covering of the Merycodontini "horn" remains a conundrum, though the available evidence as here interpreted points to the probability of there having been, in such forms at least as Ramoceros, a from time to time replacement somewhat after the method in the Recent deer. The small to large examples suggestive of growth stages in the extensive New Mexican series of horns of the several Ramoceros shapes, plus our inability to understand how such hardened structures went through the necessary changes attendant on increase of size except by some process of periodic shedding and replacement as in the deer, seem to indicate their necessarily deciduous character. Variable-sized examples of several such horn series are figured. The Nenzel and Crookston Meryceros collections include four crania with dp²–dp⁴ (worn) and nub-like horn-cores, the specimens being interpreted as of immature males in rudimentary "spike-horn" stage (F:A.M. 32175 [Fig. 40] and N.S.M.4- and 9-7-9-34, and 1-19-9-34 [Fig. 28B]). The nubs in specimens N.S.M.9-7-9-34 and 1-19-9-34 indicate the former presence of distal extremities now broken off or shed. Again a lone fragment of Ramoceros, from Fairfield Creek, Nebraska, shows a mature horn-pedicle with burr, above which the horn has been broken off—by accident or natural shedding. The "core" in Meryceros is placed more anteriorly than in the case of the pedicle in Aletomeryx gracilis. A specimen of Paracosoryx wilsoni (F:A.M.32895, Fig. 37) is especially interesting in the aborted character of the shaft of one side which, exhibiting a second burr some distance above the first, suggests that the horn is in process of repair. The anterior prong of the opposite "undamaged" shaft in this specimen is extremely rudimentary, the fork sharply contrasting with the extremely palmate fork of specimen F:A.M.32399 (Fig. 26). While a very rudimentary unforked stage is recognized in the case of the immature horn of Meryceros, neither the unforked nor forked stages are as yet recognized in the three- to four-pronged Ramoceros.

It is necessary (as observed above) to look upon the Merycodontini as of the Antilocapride, notwithstanding the apparent general similarity of the Merycodontine horn to the Cervine antler rather than to the Antilocaprine horn-core. The absence of shed horns with burrs attached might be due to several causes. In the first place, accumulations of the preserved remains were probably largely seasonal and ever dependent on a supply of feed and water for the animals in or about...
areas where sediments were accumulating. Examples of the "winter" hornless state might be missing from sedimentary deposits through the herds dwelling at that season in highlands undergoing erosion rather than in such basins of sedimentary accumulation. The cross sections of horns taken both above and below the origin of the burr always seem to exhibit a similar structure of variably porous central core with intermediate middle and dense outer areas. It seems natural that the lightly attached burr should frequently be lost through breaking off of the same through wear in life (see muntjac) or subsequent chance. The burr may be lightly attached in the Recent deer in the early velvet stage. Multiple burrs might be accounted for through periodical retreat of the velvet and encroachment of the head covering. As the Merycodontini are not Cervids, but are Antilocaprids with an horn adaptation outwardly simulating that of the Cervids, the presence of shed horns with Cervid-like burr attached, in final analysis, is not necessarily to be expected.

Since this manuscript was originally prepared for the press, interesting light has been thrown on the question of the Merycodontine "horn" through the superb series of male crania of Meryceros secured from Crookston Bridge by F. W. Johnson and party of the University of Nebraska. The horns themselves tend to exhibit the two major shapes observed in remains from New Mexico and Nenzel, Nebraska, a taller, more slender and less flared, and a shorter, heavier and more branching horn. Interestingly enough a comparison of the tooth wear and horn form in the Crookston Bridge series indicates that the more slender-shaped and burrless horns belong to the less aged individuals. It may be that the tall burrless shaft with moderate-length forks was typical of early maturity, and the shorter burred shaft with longer fork was developed with more advanced age. The anterior prongs of one Crookston specimen are very definitely worn, the wear being prominent on both prongs, and evidently having taken place in life and when that portion, at least, of the horns was unprotected by covering. A similar condition would be impossible in the case of Antilocapra where, although the sheath is deciduous, the core is never uncovered. In the particular specimen the anterior prongs are relatively short—the anterior fork normally in the Crookston series being longer than the posterior. The occurrence in both the Crookston and Nenzel series of immature specimens in which m3 has not erupted and the horns are represented by rudimentary nub-like processes, and in the case of two such specimens the apparent evidence as to the former presence of a "shed" capping, has been noted. In the Recent pronghorn calf, with m2 unerupted, the future
cores are but "pin-points"; with p⁴ and m³ about to erupt they become sizable nubs. The Burr of a lately secured Paracosoryx wilsoni horn-core lies just below the fork and indicates a height of facial skin proportionate to that of Cervulus.

The specimens then available seem to have suggested to E. D. Cope that the Merycodontine horns were in the process of becoming deciduous. Cope (1874, p. 16) concludes "that the genus Cosoryx represents the ancestral type of the Cervidæ, and explains the origin of the remarkable type of horns of that family...; the separation of the dead from the living bone by suppuration..." (1877, p. 348) "...It is very probable that a genus allied to the present one gave origin to the family of the Deer. It is obvious that the horns of Dicrocerus did not possess a horny sheath as in the Bovidae, from the fact of their being branched. As the sheath grows by addition at the base, the presence of branches, which necessarily obstruct its forward movement, would be fatal to the process. There is much to be said in favor of the view that the horns were covered with an integument, probably furred, as in the Giraffe and young of the Deer. Thus there are grooves on the beam for superficial blood-vessels, which must have been protected by skin. [p. 349]...It is not probable that this genus is the immediate ancestor of Cervus, from the fact that the molar teeth display in their prismatic form a higher degree of specialization than belongs to that genus. It is probable that the true ancestor combined the dental type of Cervus, with the distinct roots and short crowns of the molars, with the type of horns here described..." Cope (1877, p. 347) follows Gervais in assigning Cosoryx Leidy (and Merycodus Leidy) to Dicrocerus Gervais. Dicrocerus, genotypic species D. elegans, and referred species of the European Miocene, are generally conceded to be of the Cervidæ. While certain of the "horns" from Sansan as figured by Filhol (1891, Pls. xxxv, Figs. 4, 6; xxxvi, Figs. 6, 4; and xxxvii, Figs. 10–12) recall certain of the here-figured Merycodontini, it is yet to be proven that the former represent more than specializations of the Cervid horn-pedicle.

W. B. Scott (1890, p. 84) observes that the condition of the burr of Cosoryx "can hardly be regarded as... evidence that the antler was deciduous."

W. D. Matthew (1904, p. 105) once considered the horns to have been deciduous, observing "...Antlers supra-orbital, deciduous, branched, three-tined in mature, two-tined in younger adult, probably single-tined or absent in earlier stages... brow tine absent..." (1918, p. 220, under Fig. 18) "...Two complete burrs and traces of a third are pre-
served, indicating repeated shedding of the antlers, probably annual.” Matthew (1924, pp. 202–206), in the course of a detailed reconsideration of the evidence, observes “... Antlers on both male and female... Antlers are not more than once forked, except in one species or group of species... The forking is not a progressive character... The ‘antlers’ are unlike those of the Cervidae in their smooth hard surface... The burr... may be single, double or triple... is very easily broken off and leaves no perceptible scar... NEVER FOUND BROKEN OFF AT THE BURR... Obviously a multiple burr could not normally occur with a deciduous antler. But in Merycodus the multiple burr is certainly a normal character. It appears to me far more reasonable, therefore, to conclude that the bony horn-cores were not deciduous... If, as now appears, the ‘antlers’ were NOT deciduous but their sheath periodically renewed as in Antilocapra, it does not appear that there is any evidence left for cervid affinities. All the characters conform in indicating antilocaprid relationship.”

E. L. Furlong (1932, pp. 152–154) agrees with Cope that the Merycodus antlers were of a different character from the deciduous antlers of the deer. “No specimens or records examined show the horn shed from above or at the burr... If these animals annually shed their horns it appears reasonable to suppose that, among so many specimens occurring in the fossil record, some would show the separation of the beam carrying the tines at the point of normal separation in the region of the burr, as in the deer... The burrs are not ankylosed to the beam nor does this tissue form any part of the beam as in Odocoileus... A transverse section through the burr and underlying beam shows a distinct line of demarcation between the two... The burrs, then, may be regarded as the terminal point of the heavier skin covering of the head, and the initial point of growth of the lighter covering of the antlers...”

Available Crania

While the characters of the skull of Meryceros and Cosoryx now are observable in well-preserved specimens, many of the cranial details in Ramoceros are still unknown. Outstanding among the available Meryceros remains is the series of some twenty-six mature skulls in the University of Nebraska collection from Crookston, Cherry County. Five of these specimens show the premaxillae, preserved also in two specimens from Valentine A and Burge Quarries. (Crookston, Figs. 28B and 28C; Valentine, Fig. 28A; and Burge, Fig. 37A.) The characters of the Co-
soryx crania are nicely shown by two Gordon Creek specimens—an immature skull (F:A.M.32450, Fig. 26) in which the premaxillae are preserved, and a female specimen (F:A.M.32426, Fig. 26) which is unique in the Merycodontine series in the retention of the pterygoids and beautiful preservation of that area. The most useful Merycodontine cranial specimens known to the writer are:

**Ramoceros ramosus** (Cope), referred, from New Mexico
F:A.M.31592, posterior cranium with horns and associated maxilla (w) and limbs. Figs. 29, 33A, 30, 43. $m^3 = (15.5)$ mm.

**R. osborni** (Matthew), from Colorado
A.M.9476, posterior one-third cranium with horns associated with $p^1-m^1$ (w+). Figs. 25, 29A, 43. $m^3$ base = 12.8 mm.

**R. (Paramoceros) howarde**, n.sp., from Brown County, Nebraska
F:A.M.31271, cranial saddle with horns and $m_1-m_2$ (w+). Figs. 33, 34. $m^3$ base = 15.5 mm.

**Cosoryx ilfonsensis**, n.sp., referred, from New Mexico
F:A.M.31730, female skull with $p^1-m^1$ (w). $m^3 = 12.1$ mm.

**C. furcatus** Leidy, referred, from Midway Quarry, Cherry County, Nebraska
F:A.M.32376, posterior cranium with burred horn-cores. F:A.M.32377, posterior cranium with burred right horn-core. Figs. 36, 36A.

**C. furcatus** Leidy, referred, from Gordon Creek, Cherry County, Nebraska
N.S.M.1-9-8-28, partial skull with horn and $p^1-m^1$ (w). Figs. 28, 36A. $m^3 = 11.5$ mm.
F:A.M.32450, immature skull and jaws, premaxilla and /dls preserved, and $dp^1-m^1$. Fig. 26.
F:A.M.32426, cranium with $p^1-m^1$ (w). Anterior muzzle missing. Specimen unique in that the pterygoids are preserved. Fig. 26. $m^3 = 10$ mm.

**C. furcatus** Leidy, referred, from Burge Quarry, Cherry County, Nebraska
F:A.M.32902, skull including partial premaxilla, horns and dentition (m+). Figs. 8, 37A. $m^3 = 11.5$ mm.

**C. furcatus** Leidy, referred, from Hitchcock County, Nebraska
A.M.8497, posterior cranium with horns. Figs. 28, 36.

**C. furcatus sternbergi**, n.subsp., from Kansas
F:A.M.31511, posterior cranium with horns, Figs. 28, 36A, 36, 36A, and associated ramus, Fig. 45.

**C. furcatus mooki**, n.subsp., from Montana
A.M.21370, portion of cranium with horns, and $m_1-m_2$ (w). Fig. 36A. $m^3 = 12.8$ mm.

**C. (Paracosoryx) wilsoni**, n.subg. and sp., from Sioux County, Nebraska
F:A.M.32470, cranium with horns, lacking anterior muzzle (m+). Fig 37. $m^3 = 11.5$ mm.
F:A.M.31191, cranium with horns, lacking muzzle (A). Fig. 37. $m^3 = 10.5$ mm.

**C. (Subparacosoryx) savaronis**, n.subg. and sp., from Sioux County, Nebraska
A.M.17339, posterior cranium with horns and $m_1-m_3$ (w+). Figs. 33, 33A. $m^3 = 9.7$ mm.
A.M.22746, partial cranium with left horn and short-crowned $m_2-m_3$ (m+). Fig. 39. $m^3 = 10.4$ mm.
A.M.17340, posterior cranium without teeth.
Meryceros nenzelensis, n.sp., from Nenzel, Cherry County, Nebraska

Frick, Horned Ruminants. II—Antilocapridæ

Meryceros nenzelensis, n.sp., from Nenzel, Cherry County, Nebraska

50 skulls or partial skulls from Crookston, 11 with attached rami, and 5 with premaxilla preserved (N.S.M.2-3-8-34, 1-27-7-34, 1-23-7-34, 3-5-9-35 and 2-15-8-35). Figs. 88B, 88C.

N.S.M.1-17-6-32, partial female skull with p1-m2 (m). Fig. 88. m3 = 10.4 mm.

N.S.M.26-17-6-32, crushed female skull with p1-m2 (w). m2 = 11.0 mm.

Two from Valentine Quarry A:

N.S.M.20-8-7-33, skull with horns and p1-m2 (A). Figs. 28, 28A. m3 = 11.3 mm.

SUMMARY OF MERYCOTHINI SPECIMENS

<table>
<thead>
<tr>
<th>Genus</th>
<th>No.</th>
<th>Maxillae</th>
<th>Mandibles</th>
<th>Limbs</th>
<th>Total Elements</th>
<th>Assoc. Elements</th>
<th>Total Specimens</th>
</tr>
</thead>
</table>

[ ] associated specimens.

Fig. 28D. R. (Merriamoceros) coronatus (Merriam), ref. (F:A.M.31145), largest so-far-collected horn, from Barstow, California. (Unlisted.)

Lateral and superior views × $. (See Figs. 35, 35A [in part] and page 332.)

The characters of the mandible and dentitions are partially résumé on page 313, and those of the skeleton on page 316.
Distribution of Genera and Subgenera

As judged by specimens of the "horns" in the Late Tertiary of:

(1) **NEW MEXICO** [large collections]—

*Ramoceros* and

*Meryceros*, of several variations, are common from the Santa Cruz area, and present at Ojo Caliente and Skull Ridge;

*Cosoryx* (the predominant Niobrara, Nebraska, form), is relatively scarce, though the peculiar *Subcosoryx* is well represented at the type locality;

*Paramoceros* is known only from Pojuaque; and

*Submeryceros* is extremely rare.

(2) **COLORADO** [small collection]—

*Ramoceros*, *Cosoryx*, *Meryceros* and *Submeryceros* are all represented.

(3) **KANSAS, SOUTH DAKOTA AND MONTANA** [even smaller collections]—

Except for the single example of *Paramoceros*, *Cosoryx* is the only form that has so far been found.

(4) **NEBRASKA** [large Nenzel, Gordon Creek, Midway and Crookston series]—

*Ramoceros* (Fairfield Creek, Brown County and south Hitchcock County), and

*Paramoceros* (Dutch Creek, Brown County) are rare;

*Cosoryx* seems to have been the predominant form, being represented from some nine localities, including the Gordon Creek, Swallow and Midway Quarries of northern, and Hitchcock County deposits of southern, Nebraska;

*Paracosoryx* is limited to Sioux County and Dawes County; *Subparacosoryx* is recognized alone from Sioux County; and

*Meryceros* is confined to a few localities in the vicinity of the Niobrara, more notably Crookston Bridge and Nenzel of Cherry County; and to a single occurrence in Dawes County.
(5) **California** [large collections from Barstow]—

*Paramoceros* from the upper beds and *Merriamoceros* from the Second Division are extremely rare;

*Paracosoryx* replaces *Cosoryx* and, like the following genera—

*Meryceros* and *Submeryceros* (rare)—

is known only from the uppermost horizons;

Barstow thus witnessing a somewhat different assemblage from that of the Rocky Mountains.

(6) **Nevada** [fragmental only]—

*Paracosoryx*, referred, and *Meryceros* are recognized.

(For mandibular dentitions considered according to above areas, see page 373.)

Although no definitely known form has been recognized in the Middle Tertiary,¹ the Merycodontini, as shown above, were widely dispersed in the North American Late Tertiary. (While unreported from Eurasian localities, it is doubtfully possible that certain fragmentary specimens from the European Miocene, at present identified with *Dicrocerus* Gervais, may be found referable to this division.)

The several more widely disseminated Merycodontine groups may well prove of assistance as time markers in the correlation of Late Tertiary strata. The predominance² of *Cosoryx* over *Meryceros* and the rarity of *Ramocephalus* in Nebraskan deposits, the commonness of *Ramocephalus* and *Meryceros* relative to *Cosoryx* in the case of New Mexico, and the predominance of *Meryceros* and *Paracosoryx* in the case of California, seem more than chance coincidence. The wide separation of certain forms of the Mojave Desert and of the Great Plains areas is worthy of note. Notable also is the evident absence of representatives of the division from the relatively late horizons represented by the Xmas Quarry of Cherry County, Nebraska, and Clarendon of Texas, and its possible absence from the earlier Sheep Creek and Devil's Gulch deposits of

¹ Cook, Harold J. and Margaret C., 1933, Nebr. Geol. Surv., Paper No. 5, p. 30, mention *Merycodus* as occurring in the Upper Harrison.

² Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 161, Pl. 11, Fig. 7, describes and figures, "Two second upper molars, from a single individual, from a badly disintegrated skull" (HC812), from the Upper Harrison of Nebraska, as the type of a new species, *Merycodus prodromus*. The author's figure, and statement, "Smaller than any described species of *Merycodus*, with somewhat less hypsodont molars than those of the known, and geologically later, species of the genus," suggest that the teeth are actually of some other group than the Merycodontini.

² 537 *Cosoryx* specimens are listed in these pages, from twenty-six localities, and 538 *Meryceros* specimens, from thirteen localities in Nebraska.
Nebraska. As elsewhere remarked, the northern Nebraska deposits yielding Cosoryx, as so far observed, seem to be stratigraphically higher than those that yield Meryceros. Subcosoryx occurs near the very top of the main Tertiary of the New Mexican area. Moreover, there is a distinct absence of remains of the Merycodont group from those evidently later localities yielding Texoceros, n.g.—such as Guymon, Oklahoma; Miami, Texas; and Yuma County, Colorado.

FOUR SPECIES OF SIOUX COUNTY, NEBRASKA

The difficulty in the determination of the number and sequence of forms at any one locality is exemplified in the case of the long-collected deposits of Sioux County, where there is question as to whether the Merycodontines occur at a single horizon or in both the so-called Snake and Sheep Creek. Some four or five species seem to be represented—

Two species are recognized in the horns (reconstructions, Fig. 27, AA and B):

Paracosoryx wilsoni—Tall-shafted horn-cores and limbs from Long Quarry—metapodials smaller than Size Group IV. And

Subparacosoryx savaronis—Unusually small-horned crania from Sinclair Draw, apparently accompanying limbs of Size Group IV. The same may prove synonymous with Paracosoryx sabulonis (Matthew and Cook), see below. And

Four species are distinguishable in the mandibular rami:

Paracosoryx wilsoni, referred—Short-diastemaed specimens typical of the area and of the Wilson Long Quarry.

Paracosoryx sabulonis (Matthew and Cook)—The type is a ramus from Sinclair Draw which may prove to be of the form represented by the small crania from that area, in which case the species would supplant S. savaronis.

Cosoryx furcatus var., referred, Size Group III—Type ramus closely resembles Garman specimen (M.C.Z.10101) and indicates a similar large C. furcatus-like horn. A few large limbs (Size Group III) are tentatively referred.

(?)Submeryceros minor serpentinus, Size Group VI—Horns as yet unknown.

The above-noted Sioux County Merycodontine horns are of two distinct forms of generalized Cosoryx pattern and tend to differ from the Great Plains species in the extreme height of the shaft in the case of the one, and in the smallness of horns and crania in the case of the second. The burr in both species (when retained) is situated unusually high above the orbit, and the points of the fork are short and strongly bent inwardly, the posterior point tending to be longer than the anterior. [In one of the long-shafted specimens the crotch is peculiarly flattened and the points are laterally expanded—versus the reduction of the cross section of the
crotch and shortness of the points in the remainder of the same *Paracosoryx wilsoni* series (see Fig. 26 versus 37).]

None of the mandibular rami of the large series derived from the same Sioux County exposures has been found directly attached to skulls, but the rami, in their short diastemata, are quite as characteristic as any of the horns. It is presumed that the larger and smaller rami (Size Groups III–IV) and notably small limb elements (Size Groups IV and V) from the Wilson horizons represent no more than individual variation within the *P. wilsoni* species. The rather similar but slighter type ramus of *Paracosoryx sabulonis* (Matthew and Cook) and other slender-proportioned rami may possibly represent the species of the small crania likewise secured from Sinclair Draw by Albert Thomson. The single elongate Sioux County ramus of the Princeton collection differs from all the above, both in the elongation of the diastema and general large size (Size Group III), and closely approximates the Museum of Comparative Zoology Garman ramus associated with the *Cosoryx furcatus* horns, described by W. B. Scott (1890). A few distinctly smaller Merycodontine rami (Size Group VI) from the Wilson horizons are referred to (?) *Submeryceros minor serpentinus*. (Recently secured remains from Ginn Quarry, Dawes County, Nebraska, include a few horn-cores and mandibular rami with short-proportioned diastemata closely resembling the Sioux County *Paracosoryx*.)

William D. Matthew (1924), in a résumé of the available evidence, tabulates *M. necatus* and *M. necatus* var. *sabulonis* as occurring in both the Sheep Creek and Lower Snake Creek, and the slightly larger (?) *T. (M.) altidens* as occurring alone in the Upper Snake Creek or Hipparion Zone. (p. 198) "... *Merycodus* is fairly common in the *Merychippus primus* zone, this being the earliest record of its occurrence. The upper and lower jaws, limb and foot bones do not show any uniform distinctions from the more abundant material secured in the *M. paniensis* zone. It is quite possible that skulls or antlers might show such distinctions. *Merycodus* appears at this point as an invading immigrant, so far as we can judge. There is nothing in the extensive and well studied fauna of the Lower Miocene that could stand as ancestral to it. It appears suddenly, just as *Blastomeryx* appears suddenly at an earlier point (Upper Rosebud and Upper Harrison)." Matthew notes (1909) that a large series of Sioux County limb and foot bones, A.M.14125 and 14132, agree pretty nearly in size with *R. osborni* except that the fore limb bones (and jaw) are somewhat smaller; and further that a series of rami, A.M. 14102–17, run uniformly smaller and slenderer than Leidy’s specimen.
Through non-association of teeth, limbs and horns (as noted above), it is impossible in cases to definitely allot the two former to the genera and subgenera, based primarily on the character of the horns. To facilitate further study and the comparison of future discoveries, the Merycodontine horns, teeth and limbs which have been available to the writer are carefully enumerated in three separate sections with cross-references in the case of associated remains. The horns are listed according to large, medium and small under the nine genera and subgenera and thirty-four species and subspecies, and the dentitions and limb elements are referred to the same and ten additional species and subspecies, divided between six size groups (which parallel Size Groups II–VII of the Blastomerycine section).

Subfamilies, Genera and Subgenera as Viewed in "Horns"
(See Details, Section II, Page 323)

The three here recognized Merycodontine genera and six subgenera (see Figs. 26, 28–40 and reconstructions, frontispiece, A, and Fig. 27) are based largely on characters of the "horns." These nine subdivisions form a ready means of grouping the forty-four1 listed species and subspecies, many of which are based at present mainly on occurrence.

SUBFAMILY I.—RAMOCEROTINÆ

I. Ramoceros, new genus, and two subgenera:

The genus is characterized by the depressed postorbital position of the three- to four-pointed "antlers," which are of remarkably Cervine appearance; the basal "pedicle" is depressed and directed outwardly and posteriorly; the tips (not always symmetrical) flare widely; the shafts are slender with circular-tending cross section and are deeply curved anteriorly.

Ramoceros Proper

( Genotypic Species R. ramosus (Cope), from New Mexico)

The shaft is long, with a forwardly directed prong ("brow tine") at two-thirds distance above the base, and distally is bi- or tri-forked.

---

1 Thirty-one species and subspecies are based on horns, one on skull and skeleton and twelve on dentitions. Three of the latter include referred horns. Of the forty-four species, thirty-eight are named. Including three unnamed vars., there are listed (p. 317) forty-seven species, subspecies and vars.
This surprising genus is well represented in our New Mexican collection (typical specimens figured by Cope, 1877, under *Dicrocerus furcatus* Leidy); and is known by the mounted skeleton from Colorado (the type of *M. osborni* Matthew, 1904), and by an antler from Hitchcock County, Nebraska. (See figured growth stages of New Mexican horns, Figs. 29–32.)

IA. *Paramoceros*, new subgenus

(Subgenotypic Species *R. (P.*) brevicornis*, from Barstow, California)

The main shaft is short (in the California subgenotype) to long (in Rocky Mountain variation) and the secondary shaft is reduced, the lower and two terminal prongs simulating a tri-pointed crotch. The subgenus is well represented in the variation from New Mexico; is known in partial crania from Brown County, Nebraska (F: A.M.31271) and Kansas (F: A.M.31510); and is typified in the interesting subgenotypic specimen from Barstow, California (F: A.M.31348), in which the shaft is erect and much shorter than in the foregoing. (See figured growth stages in New Mexican series, Figs. 33, 34.) An apparently related adaptation with distinctly palmate crotch is exampled by a single horn-core from New Mexico (F: A.M.31580).

IB. *R. (Merriamoceros)*, new subgenus

(Subgenotypic Species *R. (M.) coronatus* (Merriam), from California)

The “horns” are remarkable for their small size, tendency to palmation and multitubercular pointing. They recall, in minor measure, miniature moose antlers (Figs. 28D, 35, 35A). A crushed skull recently has been added to the collection. The mandible is slender, the diastema short and the p₂ proportionately large. In a single and unique specimen (F: A.M.31144, Fig. 47A) the p₁ (dp₁) is retained.

**SUBFAMILY 2.—COSORYCINÆ**

II. *Cosoryx* Leidy (1869) and three subgenera:

The horns are single-forked, erect and supra-orbital, with tall slender shafts of circular cross section, the shaft tending to be differentiated from the basal pedicle, tilted slightly forwardly and outwardly, and rotated so that the longer anterior points are directed inwardly.
Cosoryx Leidy, Proper

(Genotypic Species C. furcatus Leidy, from the Niobrara)

Described in 1869 on a partial horn-core, the genus is now well represented by specimens from several different areas. The horns exhibit a great range in size. While certain dimensional differences may prove specific, the specimens are tentatively interpreted as largely representing growth differences. Certain less typical horns approach in form specimens here referred to the following Meryceros group. Cosoryx, should Merycodus ever be definitely determined (elsewhere discussed), may prove to be a synonym of the latter. Cosoryx proper is widely distributed in the upper levels of the Great Plains deposits. The largest horns are found in the collection from New Mexico, and smaller-sized examples in the series from the Midway Quarry, Nebraska, and in a single small-horned cranium from Montana. The series of horns probably include several growth stages. They may be divided tentatively between larger and smaller, the more moderate being exampled by the C. furcatus Leidy Niobrara type horn. A few less typical specimens approach certain specimens here referred to the following genus, Meryceros. The average of the horns does not differ materially from the reduced-premolared Subcosoryx. In Sioux County, Nebraska, and the Mojave Desert, California, Cosoryx is replaced by the abbreviated-diastemaed Paracosoryx. In this the burr tends to be situated higher on the shaft, which is typically slender and extremely elongate, and the points are reduced and recurved, the posterior being the longer. In the smaller of the species from Sioux County the shaft is noticeably short.

IIA. Subcosoryx, new subgenus

(Subgenotypic Species C. (S.) cerroensis, from Santa Fé, New Mexico)

Premolars greatly reduced. The large series of horns from the type locality exhibit considerable variation in form (see below).

IIB and C. Paracosoryx and Subparacosoryx, new subgenera

(Subgenotypic Species C. (P.) wilsoni and C. (S.) savaronis, from Sioux County, Nebraska)

Diastema short, premolars large; burrs set high, shafts elongate (Paracosoryx) or short (Subparacosoryx).
III. *Meryceros*, new genus, and one subgenus:

The genus is characterized by forked supra-orbital and laterally compressed horns or horn-cores. Certain questioned specimens seem to be partially intermediate to the more typical *Meryceros* forms and to *Cosoryx-Paracosoryx*. Such horn-cores are exampled in certain large specimens from New Mexico, California and Nebraska (page 354).

*Meryceros*

(Genotypic Species *Cervus warreni* Leidy, 1858, from the Niobrara, Nebraska)

Horn-cores may be tentatively divided according to individual form between horns taller and less compressed, and resembling certain specimens here referred to *Cosoryx*; horns more compressed with non-divergent points (not unsuggestive of the Antilocaprine *Stockoceros*); and *Meryceros* proper, horns shorter with variably compressed and more wedge-shaped shafts. While certain of the *Meryceros* horns are particularly suggestive of *Stockoceros*, n.subg., of the Pleistocene, the similarity is not real, the latter bearing a definitely burrless horn-core. (It is yet to be demonstrated to what degree the great size differences occurring in the material are due to growth stages, individual variation or specific difference.) *Meryceros* horn characters are discussed in greater detail below, under the remains from Crookston Bridge and Nenzel Quarries. The diastemata and muzzle are long.

IIIA. *Submeryceros*, new subgenus

(Subgenotypic Species *M. (S.) crucianus*, from Santa Cruz, New Mexico)

Diminutive, forked horns, peculiar in that burrs are developed separately on each fork instead of basally on the central shaft. Exampled in a few specimens from Santa Cruz, and in the specimen figured by Cope (1877, Pl. lxxxii, Fig. 4), from an adjacent area. Tentatively referred species rest on several rare mandibular specimens of Size Groups vii from Nebraska and Colorado.
Five historic species based on horn specimens are readily identifiable through specimens in the present collections, viz.: *Cosoryx ramosus* Cope, from New Mexico, equals *Ramoceros ramosus* (Cope); *Merycodus osborni* Matthew, from Pawnee Creek, equals *Ramoceros osborni* (Matthew); *Merycodus coronatus* Merriam equals *R. (Merriamoceros) coronatus* (Merriam); *Cosoryx furcatus* Leidy, from the Niobrara, is abundantly represented; and *Cervus warreni* Leidy equals *Meryceros warreni* (Leidy). Compare indeterminate species, page 315.

As above noted, the some five hundred examples of horns (including one hundred and ninety-three on crania or partial crania) are listed in Section II, “Horns,” under the nine genera and subgenera and thirty-eight species and unnamed vars., which are subdivided according to local occurrence and cross-referenced when associated with other remains.

Outstanding examples of the several “horn” forms are figured in the following series of seventeen plates, Figures 29–40 inclusive.

---

**Figs. 33 and 34.** *R. (Paramoceros), n.subg.*, individual and age variation in horns from the Late Tertiary of New Mexico and Nebraska.

Posterior and lateral views × 1.

F:A.M.31619 and 31624, rev., and 31620, type, of *R. (P.) martha*, n.sp., from New Mexico.

(See pages 330, 329.)

F:A.M.31271, *R. (P.) howar&d*, n.sp., type, from Dutch Creek, Brown County, Nebraska.

(See page 330.)


(See page 331.)

**Fig. 35.** *Meryceros*, n.g., *M. (Submeryceros), n.subg.*, *R. (Paramoceros), n.subg.*, and *R. (Merriamoceros), n.subg.*, comparison of horns from the Late Tertiary of New Mexico and California.

Lateral and posterior views × 1.


(See page 369.)

F:A.M.31495, subgenotype, 31496 and 31497, *M. (Submeryceros) crucianus*, n.subg. and sp., from Santa Cruz, New Mexico.

(See page 370.)


(See page 331.)

F:A.M.31350 and 31351, *R. (Merriamoceros) coronatus* (Merriam), ref., from Green Hills, Barstow, California.

(See page 333.)
Fig. 35A. *Meryceros*, n.g., and *R.* (*Merriamoceros*), n.subg., comparison of horns and mandibular rami from the Late Tertiary of California (and N.S.M. horns from Nebraska).

Lateral and superior views of horns and lateral views of rami $\times \frac{1}{2}$; occlusal view of ramal dentition $\times 1$. PS, posterior border symphysis.

F:A.M.31019 (rev.) and 31020, ref. mandibular rami; 31022 (rev.), 31024A (rev.), 3146 (rev.) and 31177 (var., rev.), ref. horns, *R.* (*Merriamoceros*) *coronatus* (Merriam), from Barstow, California. (See pages 437, 333.)

F:A.M.32822 and 32811, *Meryceros joraki*, n.sp., ref., from Barstow, California. (See page 389.)

N.S.M.2-5-9-35 and 7-7-9-34, *Meryceros warreni johnsoni*, n.subsp., ref., from Crookston Bridge Quarry, Cherry County, Nebraska. (See page 364.)

Figs. 36 and 36A. *Cosoryx* Leidy, comparison of horns and posterior crania from the Late Tertiary of Nebraska, Montana, Kansas, Colorado and New Mexico.

Lateral and posterior views $\times \frac{1}{2}$.

Fig. 36. N.S.M.1–9–8–28, *C. furcatus* Leidy, ref., from Gordon Creek, Cherry County, Nebraska. (See also Fig. 36A and page 341.)

A.M.8497, *C. furcatus* Leidy, ref., from Driftwood Creek, Hitchcock County, Nebraska. (See also Fig. 28 and page 344.)

F:A.M.31511, *C. furcatus sternbergi*, n.subsp., type (in part), from Kansas. (See also Figs. 28, 28A, 36A; ramus, Fig. 43; and page 344.)

F:A.M.32377, *C. furcatus* Leidy, ref., rev., from Midway Quarry, Cherry County, Nebraska. (See also Fig. 36A and page 340.)

F:A.M.31296, *C. furcatus* var., ref., immature, from Pawnee Creek, Colorado. (See also Fig. 36A and page 347.)

F:A.M.31435, *C. ilfonsensis*, n.sp., type, from San Ildefonso, New Mexico. (See also Fig. 36A and page 339.)

F:A.M.31272, *C. furcatus* Leidy, ref., from Long Pine, Brown County, Nebraska. (See also Fig. 36A and page 343.)

Fig. 36A. Specimens of Fig. 36 (excepting A.M.8497), and:

A.M.21370, *C. furcatus mooki*, n.subsp., type (in part), from Montana. (See page 345.)
Fig. 29. *Ramoceros ramosus* (Cope), individual and age variation in ref. horns (F:A.M.31617 [rev.], 31618 [rev.], 31592, 31588 [rev.] and 31590), from the Late Tertiary of New Mexico.

Posterior views × 4. (See also Fig. 30 [lateral views, opposite]: Figs. 25B, 28, 28A, 48 [partial manus, cranium, limbs of F:A.M.31592]; and pages 326, 327, 324.)
Fig. 30. *Ramoceros ramosus* (Cope), individual and age variation in ref. horns from the Late Tertiary of New Mexico.

Lateral views $\times \frac{1}{4}$ of five horns of Fig. 29 (opposite).

297
Fig. 31. *Ramoceros ramosus quadratus*, n.subsp. (F:A.M.31598 with fourth point "budding," 31581, type, and 31584), individual and age variation in horns from the Late Tertiary of New Mexico.

Posterior views × ½. (See also Fig. 32 [lateral views, opposite] and pages 328, 327.)
FIG. 32. *Ramoceros ramosus quadratus*, n.subsp., individual and age variation in horns from the Late Tertiary of New Mexico. Lateral views $\times \frac{1}{2}$ of three horns of Fig. 31 (opposite).
Fig. 33. *R. (Paramoceros)*, n.subg., individual and age variation in horns from the Late Tertiary of New Mexico and Nebraska.

Posterior views × ½. (See also Fig. 34 [lateral views, opposite] and legend, page 294.)
Fig. 34. *R. (Paramoceros)*, n.subg., individual and age variation in horns from the Late Tertiary of New Mexico and Nebraska.

Lateral views × ⅓. (See also Fig. 33 [posterior views, opposite] and legend, page 294.)
Fig. 35. *Meryceros*, n.g., *M.* (Submeryceros), n.subg., *R.* (Paramoceros), n.subg., and *R.* (Merriamoceros), n.subg., comparison of horns from the Late Tertiary of New Mexico and California.

Lateral and posterior views × ½. (See legend, page 294.)
Fig. 35A. Meryceros, n.g., and R. (Merriamoceros), n.subg., comparison of horns and mandibular rami from the Late Tertiary of California (and N.S.M. horns from Nebraska).

Lateral and superior views of horns and lateral views of rami × ½; occlusal view of ramal dentition × 1. (See legend, page 295.)
Fig. 36. *Cosoryx* Leidy, comparison of horns and posterior crania from the Late Tertiary of Nebraska, Kansas, Colorado and New Mexico.
Lateral views $\times \frac{1}{4}$. (See also Fig. 36A [posterior views, opposite, excepting A.M.8497] and legend, page 295.)
Fig. 36A. Cosoryx Leidy, comparison of horns and posterior crania from the Late Tertiary of Nebraska, Montana, Kansas, Colorado and New Mexico. Posterior views × ½. (See also Fig. 36 [lateral views, opposite, excepting A.M.21370] and legend, page 295.)
Fig. 37. *C. (Paracosoryx) wilsoni*, n.subg. and sp. (F.A.M.32471, 31191, 31743 [var. B], 32470 [subgenotype, in part], 31192 [rev.], 31192A [adolescent], 32895 [unsymmetrical horns and burrs: a = right horn, rev.] and 32007 [var. C], age and individual variation in skulls, horns and mandibular rami, from Sioux County, Nebraska; and *C. (P.) daviesensis*, n.sp., type (F:B:A.M.32856), from Dawes County, Nebraska (Late Tertiary).

Lateral views (and one anterior) × 4. Ps, posterior border symphysis; 2, supra-orbital foramen. (See pages 351, 352, 354, 429, 430.)
Fig. 37A. *Paracosoryx burgensis*, n.sp. (F:A.M.32900, type, rev.), and *Cosoryx furcatus* Leidy, ref. (F:A.M.32900A [rev.], 32900F [adolescent], 32908, 32902 [skull] and 32906 [rev.]), age and individual variation in horns from Burge Quarry, Cherry County, Nebraska.

Lateral views (and one dorsal and anterior) X h. a, median ossification; PN, posterior end nasal; PS, posterior border symphysis. (See also Fig. 2 [F:A.M.32902] and pages 342, 343, 418.)
FIG. 38. *C. (Subcosoryx) cerroensis*, n.subg. and sp., ref., age and individual variation in horns (F:A.M.33114, 33105 [rev.], 33113H, 33108 [rev.] and 33116 [rev.]), mandibular rami (F:A.M.32921, 32938 and 31996) and metatarsi (F:A.M. 32971 and 32974); and *R. (Paramoceros) marthae*, n.sp., (?) ref. (F:A.M.33100 and 32953), from Round Mountain Quarry, New Mexico.

Lateral views (and one posterior) X 4. PS, posterior border symphysis; arrow (F:A.M.33100), base of third prong. (See also Fig. 42 [F:A.M.31996] and pages 337-339, 393-394, 456; and 330, 403.)
Fig. 38A. *C. (Paracosoryx) alticornis*, n.sp. (F:A.M.31150, 31153 [rev.], 31151 and 31154, type), individual and age variation in horns from Barstow, California.

Lateral and posterior views × ½. (See page 347.)
Fig. 39. *Meryceros*, n.g., and *Subparacosorpus*, n.subg., A. M. 22746 only, comparison of horns from the Late Tertiary of Nebraska, New Mexico, Colorado and California.

Lateral views (and one posterior) × 4. (See legend, page 313.)
Fig. 39A. *Merycros*, n.g., and *C. (Paracosoryx)*, n.subg., F:A.M.31159, comparison of horns from the Late Tertiary of New Mexico and California. Lateral views (and one posterior) × \( \frac{3}{4} \). (See legend, page 313.)
FIG. 40. *Meryceros nenseleensis*, n.sp., age and individual variation (F:A.M. 32177, 32175 [adolescent], 31960 [rev.], 31958 [rev.], 32186 and 32174, type), from Nenzel, Cherry County, Nebraska.

× §. P, posterior end nasal. (See pages 360, 361.)
The one thousand and ninety-five listed, and some two thousand mentioned mandibular and maxillary specimens which have been available for study are considered below, under Section III. The Merycodontine teeth, so far as observable, except for smaller size, are very like those of modern *Antilocapra*. The size overlap evidently existing between the smaller teeth of the larger Antilocaprini—see *Plioceros* and *Texoceros*, and the larger of the specimens included below under the Merycodontini—leaves such reference of the latter at times open to question.

Fig. 39. *Meryceros*, n.g., and *Subparacosoryx*, n.subg., comparison of horns from the Late Tertiary of Nebraska, New Mexico, Colorado and California.  
Lateral views (and one posterior) $\times \frac{1}{4}$.  
A.M.22746, *C. (Subparacosoryx) savaronis*, n.subg. and sp., ref., from Sioux County, Nebraska.  
(See page 353.)  
(See page 358.)  
(See page 367.)  
(See page 366.)  
F:A.M.31164 and 31162 (rev.), *Meryceros joraki*, n.sp., ref., from Barstow, California.  
(See pages 368, 369.)  
(See pages 357, 358.)

Fig. 39A. *Meryceros*, n.g., and *C. (Paracosoryx)*, n.subg., comparison of horns from the Tertiary of New Mexico and California.  
Lateral views (and one posterior) $\times \frac{1}{4}$.  
(See pages 356, 357.)  
(See page 347.)  
F:A.M.31439 and 31448 (rev.), *Meryceros major*, n.sp., type and ref., from Santa Cruz, New Mexico.  
(See page 355.)
The Merycodontine mandibles and detached rami exhibit certain differences in the elongation of the post-C diastema, in the proportions of premolars relative to molars, in the height of the crowns and in actual size.

The ramal diastema is rarely preserved intact, and definite measurements are impossible in the case of worn teeth. With age and wear, through the anteroposterior shortening of the anterior teeth and the forward crowding and greater prominence of the diagonally advancing m3, the actual linear dimensions of the teeth of any one specimen are continually changing. A series of proportionate measurements have been taken of a certain number of more typical examples (see Table VIII, page 384). The data indicate that in the slightly worn specimens the anteroposterior diameter of the smallest m3 (Size Group VII, F:A.M. 30991, 9.3 mm.) is approximately but 48% of the largest (Size Group II, F:A.M.30925, 19.5 mm.), and the length from posterior border of symphysis to m3 in the smallest ramus (Size Group VI, F:A.M.31577, 16 mm.) approximates 53% of that of the largest (F:A.M.30925, 30 mm.).

More moderate variations are observed in a series of Recent Antilocapra: The anteroposterior diameter of the smallest m3 (A.M.[M.]5036, 18.5 mm.) is approximately 77% of the largest (A.M.[M.]11095, 24.5 mm.), and the length from posterior border of symphysis to m3, inclusive, in the smallest ramus (A.M.[M.]5036, 36 mm.) approximates 75% of the largest (A.M.[M.]11095, 48 mm.).

The rôle of sex in connection with size and relative proportions of p2 and the successive premolars is unknown. Intercolumnar styles tend to be the rule in the m3 and styles occur at times in the posterior molars, being more prominent in aged specimens and more noticeable in the case of the Barstow remains than in those from other areas.

In addition to the difficult problems of the number and of the possible relationships of the forms represented by the large available series of variable horns and rami, there are perplexing questions as to which of these are represented by the type specimens of previously named species, when such types were ramal or partial ramal dentitions unassociated with horns.

As noted above, Merycodus Leidy, genotypic species M. necatus Leidy (1854), was founded on a ramal fragment from the Bijou Hills. The genotype was never figured and its present whereabouts1 is un-
known. Pending the securing of a definite neotype from the type locality, the species and genus remain indeterminate. Leidy’s measurements of the \( p_4 - m_1 \) indicate a relatively large size. *Cosoryx* Leidy, as elsewhere observed (see page 292), may prove to be synonymous with the former genus.

*Paracosoryx sabulonis* (Matthew and Cook), 1909, from Sioux County, Nebraska, type, slender ramus with short diastema, as discussed above, may supplant *Subparacosoryx savaronis*, n.subg. and sp., based on a small cranium from the same general area. The actual affinity is yet to be determined in:

* M. *tehuanus* (Cope), 1877, from New Mexico, type representing an immature individual [*Dicrocerus tehuanus* Cope, 1877; ??*Merycodus tehuanus* (Cope) Matthew, 1909]; and

* M. *grandis* Hay, 1924, from Texas, based on worn and broken horn fragments,

* M. (?)*agilis* Douglass, 1899, from western Montana, based on a female skull, and

* (?)C. (Paracosoryx) nevadensis* (Merriam) [*Merycodus nevadensis* Merriam, 1911], from High Rock Canyon, Nevada, and

* (?)C. (Paracosoryx) species* (Gazin), 1932, from Malheur County, Oregon, based on mandibular fragments, must await more definite determination.

* M. *altidens* Matthew, 1924, type A.M.18981, right ramal fragment with \( m_3 \), from Upper Snake Creek, is questionably transferred to (?) *Texoceros*.

The large *Dicrocerus teres* Cope is allocated to *Cranioceras*.

* Dicrocerus trilateralis* Cope, in the ramal fragment at least, is probably of the Camelidae.

More recently the available data as to the mandibular characters in *Cosoryx* and *Meryceros* have been largely increased through receipt of the several fine series of crania, rami and limb elements from the Midway, Nenzel and Crookston Bridge Quarries that include certain associated skulls and mandibles. The variations observed in these specimens are touched on in Section III, page 372.

As noted above, the eight hundred and thirty-nine specimens of lower dentitions in the following section of the report are listed under six size groups which parallel Size Groups II–VII of the Blastomerycini and are tentatively allocated on the basis of the post-diastema length and the size of the molars (see page 372). Examples of more outstanding variants are figured, Figs. 41–47A and (in part) 28B, 35A, 37, 37A, 38. Incidentally, certain examples of upper dentitions are shown in plates of horns and crania, Figs. 26, 28A–C, 37, 37A, 40 (in part).
Characters of Limbs

(For General Discussion and Details, See Section IV, Page 447)

The limb elements, mainly detached, exhibit a range in length fully compatible with the size range shown by the mandibles and teeth. Examples of the actual dimensions and proportions are given in the tables, and in certain cases specimens allocated to the group are figured, Figs. 25B, 38, 48 (in part). The only two Merycodontine-like metacarpals exhibiting rudiments of the lateral phalanges heretofore known to the writer are the Colorado specimen, A.M.9475, originally referred to R. (M.) osborni1 and now transferred to (?)Cosoryx furcatus, and the New Mexican specimen here allocated to (?)Longirostromeryx blicki, n.sp. (F: A.M.31729). The actual condition of the manus and pes in most of the genera and subgenera, as the observations of authors thereon, yet remains in doubt.

William D. Matthew (1904, p. 105) wrote, "... Lateral toes on both fore and hind feet represented by tiny vestiges of the three phalanges...." (1924, p. 206) "The extreme reduction of the lateral digits, greater than among Cervidae and less than in Antilocapra or most true antelopes...; while the grooved back of the metapodials... was quite obviously a primitive character, both in theory and from the record, and is shown by all Miocene ruminants of any group at all, and retained by some antelopes as well as by most deer."

E. L. Furlong (1927, p. 175) observes that the sum of Antilocaprid characters in the limbs of Merycodonts "... leads inevitably to the conclusion that the major part of the structures reflect the skeletal attributes of the Antilocapridae... The cervid characters present in the merycodonts are many of them common to all artiodactyls." (The atlas and axis are fashioned as in Antilocapra versus deer.)

The definite retention of both lateral splints and phalanges in the manus of Paracosoryx wilsoni of Long Quarry, Sioux County, Nebraska, is attested through the discovery of a largely complete skeleton of an immature individual at the close of the 1936 field season by the J. Wilson party. The metacarpal length of this specimen is but 76% of a mature specimen from the same beds (Fig. 25B). The specimen includes the mandible, portions of a crushed skull with dp2-ml, and all of the limb elements with the exception of the distal one-half of the right tibia, the lateral splints of the left manus, and portions of vertebrae and ribs. The right manus retains both rudimentary splints and phalanges. Evidence is lacking as to the possible similar retention of lateral splints or phalanges in the pes. (Fig. 48A.)

1 R. (Merycodus) osborni, type, skeleton, lateral phalanges of manus and pes restored in plaster.
Summary of Species and Subspecies

The forty-seven below-enumerated species, subspecies and varieties (thirty-eight named) are principally of interest as records of geological and geographical occurrences. Of the forty-seven, thirty-eight rest on evidence of the horns and nine on evidence of the mandible. The synonyms and list of types and referred remains are detailed on the following pages. The available horn specimens number five hundred and thirty-two, maxillary and mandibular specimens three thousand two hundred and nine, and limb specimens five hundred and fifty-three. (See Distribution Table VII, pages 268–269.)

The horn characters of the nine here recognized genera and subgenera have been discussed on preceding pages (p. 290).

SUBFAMILY 1.—RAMOCEROTINÆ

I. Ramoceros, new genus.

(1) *Ramoceros ramosus* (Cope), 1874, from New Mexico.

Type (revised).—Three-pronged “antler,” N.M.1144. Figured by Cope, 1877, Pl. lxxx, Figs. 1 and 2.

(2) *Ramoceros ramosus quadratus*, n.subsp., from New Mexico.

Type.—Left horn, F:A.M.31581. This paper, Figs. 31, 32.

(3) *Ramoceros osborni* (Matthew), genotypic species, from Pawnee Creek, Colorado.

Genotype.—Partial skull, ramus and skeletal elements, A.M.9476. This paper, Figs. 28, 28A (skull), 43 (ramus).

(4) *Ramoceros hitchcockensis*, n.sp., from Hitchcock County (and referred from Brown County), Nebraska.

Type.—Left horn-core, N.S.M.1-26-8-30.

IA. Paramoceros, new subgenus.

(5) *R. (Paramoceros) marthæ*, n.sp., from New Mexico.

Type.—Left horn on cranial fragment, F:A.M.31620. This paper, Figs. 33, 54.

(6) *R. (Paramoceros) howardæ*, n.sp., from Dutch Creek, Brown County, and (?)var., from Crookston Bridge, Cherry County, Nebraska.

Type.—Top of cranium with horns, F:A.M.31271. This paper, Figs. 33, 54.
(7) *R. (Paramoceros) kansanus*, n.sp., from Kansas.
Type.—Left horn, F:A.M.31510.

(8) *R. (Paramoceros) palmatus*, n.sp., from New Mexico.
Type.—Left horn, F:A.M.31580. This paper, Figs. 33, 34.

(9) *R. (Paramoceros) brevicornis*, n.subg. and sp., from Barstow, California.
Subgenotype.—Frontal saddle with horns, F:A.M.31348. This paper, Fig. 35.

IB. *Merriamoceros*, new subgenus.

(10) *R. (Merriamoceros) coronatus* (Merriam), subgenotypic and only known species, from Barstow, California.
Subgenotype.—Partial horn-core, U.C.20052.

SUBFAMILY 2.—COSORYCINÆ

II. *Cosoryx* Leidy (and IIA. *Subcosoryx*, new subgenus).

(1) *C. (Subcosoryx) cerroensis*, n.subg. and sp., from New Mexico.
Subgenotype.—Left ramus, F:A.M.32978. This paper, Fig. 48. (See Dentition Section III, page 392.)

(2) *Cosoryx ilfonsensis*, n.sp., from New Mexico.
Type.—Top of cranium and horns, F:A.M.31435. This paper, Figs. 36, 36A.

(3) *Cosoryx furcatus* Leidy, genotypic species, from the Niobrara; and referred remains from Cherry, Brown and Hitchcock Counties, Nebraska.
Genotype.—Partial horn-core, N.M.148 [A.M.9994, cast]. (Small.)

(4) *Cosoryx furcatus stembergi*, n.subsp., from Kansas.
Type.—Top of cranium with horns, and associated left ramus, F:A.M.31511. This paper, Figs. 28, 28A, 36, 36A (cranium and horns), 43 (ramus).
(5) *Cosoryx furcatus*, var. or subsp., from Little White River, South Dakota.

**Example.**—Horn on frontal fragment, A.M.10966.

[(5a) *Merycodus necatus* Leidy, from the same area, indet.]

(Genotype lost and never figured.)

(6) *Cosoryx furcatus mooki*, n.subsp., from Montana.

**Type.**—Partial cranium with horns, and associated ramal fragment, A.M.21370. This paper, *Fig. 36A.*

(6a) (?)*Cosoryx agilis* Douglass, from Madison Valley beds, Montana.

**Type.**—Immature partial skull, mandible and skeletal elements, C.M. 703.

(6b) (?)*Cosoryx* var., from the Yellowstone River, vicinity of Gardiner, Montana.

**Example.**—Left immature ramus, Marshall Collection No. 2.

(7) *Cosoryx furcatus*, var. or subsp., from Colorado.

**Example.**—Portion of horn and ?associated right maxilla, A.M.22710.

IIB. *Paracosoryx*,¹ new subgenus (and IIC. *Subparacosoryx*, new subgenus).

(8) *C. (Paracosoryx) alticornis*, n.sp., from Barstow, California.

**Type.**—Elongate horn-core, F:A.M.31154. This paper, *Fig. 38A.*

(8a) (?)Var. or *Cosoryx* species, from Barstow, California.

**Example.**—Left horn on cranial fragment, F:A.M.31175.

(9) *C. (Paracosoryx) furlongi*, n.sp., from the Ricardo Pliocene, California.

**Type.**—Partial cranium, maxillary series, ramus, etc., U.C.26795.

(10) *C. (Paracosoryx)* species, from the Tejon Hills, California.

**Example.**—Partial antler, U.C.22332.

(11) *C. (Paracosoryx) loxocerus* (Furlong), from vicinity of Tonopah, Nevada.

**Type.**—Right ramus, C.I.T.1301.

¹ See *Paracosoryx burgen8i8*, n.sp., page 343.
(11a) (?)C. (Paracosoryx) nevadensis (Merriam), from High Rock Canyon, Nevada.
   **Type.**—Left ramal fragment, U.C.12608.

(11b) C. (Paracosoryx) var., from Virgin Valley, Nevada.
   **Example.**—Slender antler, U.C.11319.

(12) (?)C. (Paracosoryx) species (Gazin), from Skull Spring, Oregon.
   **Example.**—Right fragment of immature ramus, C.I.T.383.

(13) C. (Paracosoryx) wilsoni, n.subg. and sp., from Sioux County, Nebraska.
   **Subgenotype.**—Partial cranium, F:A.M.32470. This paper, Fig. 37.

(14) C. (Subparacosoryx) savaronis, n.subg. and sp., from Sioux County, Nebraska.
   **Subgenotype.**—Small partial cranium with horns, A.M.17339. This paper, Figs. 28, 28A.

(14a) C. (Paracosoryx) sabulonis (Matthew and Cook), from Sioux County, Nebraska.
   **Type.**—Right ramus, A.M.14109. This paper, Fig. 44.

(15) C. (Paracosoryx) dawesensis, n.sp., from Dawes County, Nebraska.
   **Type.**—Left horn-core, F:B:A.M.32856. This paper, Fig. 37.

(16) C. (Paracosoryx) species, from Sheridan County, Nebraska.
   **Example.**—Frontlet with left horn-core, N.S.M.9-1-8-33.

III. *Meryceros*, new genus.

The horns of each of the following species, where well represented, tend to exhibit two main variations, including (a) typically compressed–wedge-shafted, and (b) less tall, more waisted and wider branching "M. warreni"-like vars.

(1) *Meryceros major*, n.sp., from New Mexico.
   **Type.**—Left horn, F:A.M.31439 (of unusual size). This paper, *Fig. 39A*.

(2) *Meryceros crucensis*, n.sp., from New Mexico.
   **Type.**—Right horn on cranial fragment, F:A.M.31466. This paper, *Fig. 39A*. 
(3) *Meryceros nenzelensis*, n.sp., from Nenzel, Cherry County, Nebraska.

**Type.**—Partial skull with heavy, branching horn, F:A.M.32174. This paper, *Fig. 40.*

(4) *Meryceros warreni* (Leidy), 1858, genotypic species, from the Niobrara, Nebraska.

**Genotype.**—Right horn-core on cranial fragment, N.M.149 [A.M. 15596, cast].

(4a) *Meryceros warreni johnsoni*, n.subsp., from Crookston Bridge, Cherry County, Nebraska.

**Type.**—Skull with premaxillae and mandible, N.S.M.2-3-8-34. This paper, *Figs. 28B, 28C.*

Including local vars. from Cherry and Brown Counties, Nebraska.

(4b) *Meryceros warreni*, var., from Dawes County, Nebraska.

**Example.**—Right horn-core, F:B:A.M.31393.

(5) *Meryceros warreni*, var. or subspecies, from Pawnee Creek, Colorado.

**Example.**—Both horns, F:A.M.31319. This paper, *Fig. 39.*

(6) *Meryceros joraki*, n.sp., from Barstow, California.

**Type.**—Major portion of cranium, F:A.M.31163. This paper, *Figs. 28, 28A.*

(7) *Meryceros hookwayi* (Furlong), from vicinity of Tonopah, Nevada.

**Type.**—Right ramus, C.I.T.1257.

IIIA. *Submeryceros*, new subgenus.

(8) *M. (Submeryceros) crucianus*, n.subg. and sp., from Santa Cruz, New Mexico.

**Subgenotype.**—Left horn, F:A.M.31495. This paper, *Fig. 35.*

For convenience, several small species and subspecies, known alone by mandibular rami, are questionably referred to this subgenus:
(9) (?)Submeryceros minor, n.sp., from New Mexico. (Size Group VI.)
Type.—Left ramal fragment, F:A.M.30988. This paper, Fig. 41.

(9a) (?)Submeryceros minor serpentinus, n.subsp., from Snake Creek, Sioux County, Nebraska.
Type.—Right ramus, F:A.M.31577. This paper, Fig. 44.

(9b) (?)Submeryceros minor pawniensis, n.subsp., from Pawnee Creek, Colorado.
Type.—Partial left ramus, F:A.M.31643. This paper, Fig. 43.

(10) (?)Submeryceros minimus, n.sp., from New Mexico. (Size Group VII.)
Type.—Right ramal fragment, F:A.M.30991. This paper, Fig. 41.

"Fossil species," as frequently used (footnote 2, page 30), tends to become a synonym of occurrence. In the Merycodontini, observed differences of form are largely restricted to the nine recognized genera and subgenera. (See discussion, on previous pages, of the characters which distinguish these from one another.) With advancing knowledge of the kinds of extinct mammals and their distribution in geologic time, the present and ever more cumbersome-becoming system of binomial nomenclature under which the fossil "species" is designated by name may be supplanted, in part, by some such system of key numbers (or letters) as used in the distribution tables of this report.

Hypothetically, primitive Subparacosoryx and Paracosoryx-like horn-cores may have given rise to the horns of Cosoryx and to the three-tined antler of Paramoceros and Ramoceros. A short-shafted Ramoceros predecessor may have been ancestral to Merriamoceros. Among the heavier-proportioned of the Cosoryx-like horns—the more elongate are separable from Paracosoryx mainly through the position of the burr; the less elongate grade into the least squat of the horns grouped under Meryceros. Separately burred prongs, as seen in Submeryceros, may have preceded the burred shafts of both Subparacosoryx and Meryceros.

The detailed listing of the above forty-seven species, subspecies and varieties, thirty-eight based on the occurrence of horns and nine of mandibular specimens, their types and synonymy, and a catalogue of the specimens referred to each, arranged according to genera and localities, follows.
Frick, Horned Ruminants. II—Antilocapridæ 323

SECTION II.—MERYCODONTINI "Horns"

Frontispiece, \(\lambda\); Figures 27–40 and (in part) 2, 26

Genera, Subgenera and Species; Synonymy, Types and Referred Horns

I. RAMOCEROS, NEW GENUS

Reconstruction, Figure 27e

The genus is erected to include those heretofore rarely represented forms bearing Cervine-like horns with three to four points. It is typified by \(R. ramosus\) (Cope) from New Mexico and \(R. osborni\) (Matthew) from Colorado, selected as the genotypic species. (See Ramocerotineæ, page 290.)

(1) Ramoceros ramosus (Cope), 1874

From the Santa Fé Marls, New Mexico

The three-pronged "antler" figured by Cope (1877, Plate lxxx, Figures 1 and 2), under "Dicrocerus furcatus," is considered as the type. It would seem probable that this is the same horn which Cope (1874) originally described under Cosoryx ramosus. Cope (1874, p. 149): "This species is larger than the C. furcatus, Leidy, and exhibits two antlers instead of one, of which the first is given off at a point much further from the base than in that species... Mandibles with teeth of two species of this genus were found... The larger differs in the elevation of the intercrescentic column of the first molar... this may however be but an individual variation. The diastema is long, and the ramus of that point quite slender." Cope (1877, legend for Fig. 5, Pl. lxxxii) cites a partial mandibular ramus (N.M.5390) as the type of \(D. ramosus\), which at this time he transfers to Dicrocerus necatus Leidy, referred.

[The remaining specimens on Plate lxxx seem representative of the \(R. (Para-moceros) marthæ\) form in which the secondary shaft is greatly reduced to absent.]


TYPE.—Three-pronged “antler.” N.M.1144 Figured by Cope, 1877, Pl. lxxx, Figs. 1 and 2.
REFERRED (collected by Joseph Rak and associates).—

New specimens, F:A.M. Collection. See lists and figures (Figs. 29, 30, and [in part] 28, 28A):

Five large-moderate-sized horn-cores:

- Right horn on cranial fragment, 1st and 2d points, tips broken, 3d missing. Burr.
- Right horn, 1st point broken, 2d and 3d points complete, base missing.
- Left horn, 1st point tip broken, 2d and 3d points complete, base missing.
- Left portion of horn (larger), 1st and 3d points missing.
- Top of cranium and unsymmetrical, burred horns (left shorter, with three points, right longer-shafted, with 2d and 3d points missing).

(See associated ramus, maxilla and limbs, Dentition Section III, page 399; Limb Section IV, page 453. Limbs, this paper, Figs. 26B, 48.)

Three fragmental horn-cores from Santa Cruz:

- Left horn, points broken.
- Right horn, 1st point complete, 2d and 3d points broken.
- Left horn, 1st point tip broken, 2d and 3d points missing.

Two moderate-sized specimens:

- Right horn, three points complete, with brrr.
- Right horn on cranial fragment, 1st and 3d points missing, 2d point broken near tip. No brrr.
Six fragments:

Distal portion of left horn, 1st point missing, 2d and 3d points complete; and associated left maxillary fragment with m₁–m₃.

Right horn on cranial fragment, 1st point broken, 2d and 3d points missing, no burr.

Left shaft with burr, points missing.

Fragment.

F:A.M.31628 Between old and new Santa Fé roads, 1926.
F:A.M.31599 From Santa Fé area, 1925.
F:A.M.31600 Under Pojuaque Bluffs, 1926.
F:A.M.31601B From Ojo Caliente, red, 1926.
F:A.M.31629 From Santa Cruz, 1st wash, 1928.

Twenty-two small-sized specimens:

Right horn on cranial fragment, 1st and 2d point tips broken, 3d point missing; with burr.

Left horn on cranial fragment, points broken, with burr.

Right horn on cranial fragment, 1st point complete, 2d and 3d points missing; with burr.

Right horn on cranial fragment, points broken, burr remnant.

Right horn on cranial fragment, points missing, ?trace of burr.

Distal portion of right horn, point tips broken.

Left horn, 1st point tip broken, 2d and 3d points missing, no burr.

F:A.M.31603 From Santa Cruz.
F:A.M.31604 From Santa Fé area, 1927.
F:A.M.31605 From Santa Fé area, 1927.
F:A.M.31606 From Santa Cruz, 1927.
Left horn, 1st point missing, 2d and 3d point tips broken, no burr.

F:A.M.31610 From Santa Cruz, upper red layer, 1st wash, 1928.

Left horn, 1st point complete, 2d and 3d points missing, no burr.

F:A.M.31611 From Santa Cruz, 1st wash, 1928.

Left horn on cranial fragment, 1st point tip broken, 2d point complete, 3d point broken, burr remnant.

F:A.M.31612 From Ojo Caliente, 1925.

Left horn on cranial fragment, 1st point tip broken, 2d and 3d points missing, no burr.

F:A.M.31613 From Santa Cruz, 1925.

Left horn on cranial fragment, 1st point broken, 2d and 3d points missing, with burr.

F:A.M.31614A From Santa Cruz, 1925.

Fragment of horn, points broken.

F:A.M.31614B From Santa Cruz.

Fragment of horn, points broken.

F:A.M.31614C

Left horn, 1st and 2d points broken near tips, 3d point missing, no burr.

F:A.M.31615 1928.

Right shaft on cranial fragment, points broken, no burr; and etc. fragments.

F:A.M.31616A From Santa Cruz, upper red layer, 1st wash, 1928.

Portion of right shaft on cranial fragment, points missing, burr remnant; and etc. fragments.

F:A.M.31616B From Santa Cruz, 1927.

Two fragments of horns.

F:A.M.31616C, D From Santa F6 area, 1927.

Right horn on cranial fragment, 1st and 2d points missing, 3d point tip broken, no burr.

F:A.M.31627 From Santa Cruz.

Right horn on cranial fragment, 1st and 2d point tips broken, 3d point missing, with burr.

F:A.M.31617 1925.

1st point depressed.

This paper, Figs. 29, 30.
Frick, Horned Ruminants. II—Antilocapridae

Right horn on cranial fragment, 1st and 2d points broken, 3d point complete, with heavy burr.

Peculiar.

[Additional specimens (not included in the count), secured by the John C. Blick party from West Pojuaque Bluffs in the 1936 season, include:

1. Portions of extremely large horn (resembling *Paramoceros*, but heavier) F:A.M.31632
2. Left partial horn (approximating *Paramoceros*, F:A.M.31619) F:A.M.31630A
3. Two left horns, points broken (resembling *Ramoceros*, F:A.M.31592) F:A.M.31631, 31630
5. Right horn, tip broken (approximating smallest of the *Ramoceros* specimens) F:A.M.31474]

(2) *Ramoceros ramosus quadratus*, new subspecies

From New Mexico

**Type.**—Left horn, 1st point forked, tips broken, 2d and 3d points broken.

F:A.M.31581

Santa Cruz, red layer, 1927.

Collected by Joseph Rak.

This paper, *Figs. 31, 32.*

**Size large.** (Proximal shaft missing thus leaving no evidence regarding burr.)

**Referred.**—

1. Left horn, 1st point forked, 2d and 3d points and proximal end of shaft missing.

F:A.M.31582

From Santa Cruz, 1st wash, upper layer, 1928.

Two moderate-sized specimens:

1. Left horn on cranial fragment, points missing.

F:A.M.31583

From Santa Cruz.

1st point forking not shown, burr indicated.

2. Left horn, 1st point forked; tips broken, proximal end of shaft missing.

F:A.M.31584

1928.

This paper, *Figs. 31, 32.*

One large-sized specimen with burr remnant, upper beam very much reduced:

1. Left horn on cranial fragment, 1st point missing, 2d and 3d points complete, burr remnant.

F:A.M.31602

From N. Pojuaque Bluffs, 1933.
One moderate-sized specimen:

Left horn, 1st point complete and with incipient fork, 2d broken, 3d missing. With burr.

"Brow" tine reveals incipient forking.

EXACT REFERENCE QUESTIONED.—

Three broken shafts:

Left shaft on cranial fragment, points missing. Burr indicated.

Horn-core, points missing, no burr.

Horn-core, points missing, tendency toward burr.

Lower portions of five shafts, with burrs, on cranial fragments:

Right and left. Burr indicated.

Right.

Right.

Fragment (burr heavy).

(3) Ramoceros osborni (Matthew), genotypic species

From Pawnee Creek, Colorado


Genotype.—Partial skull, ramus and skeletal elements.

A.M.9476 From Cedar Creek, 1901. Figured by Matthew, 1904, Pl. iii and Text-Figs. 1–3 (skull and ramus), 9–13, 15 (skeletal elements); this paper, Figs. 28, 28A (skull), 43 (ramus).

(See Dentition Section III, page 406, and Limb Section IV, page 454.)

While the ramus (A.M.9475), heretofore considered part of "cototype" and figured by Matthew (1904, Fig. 8), is suggestive of the type, the horns, maxilla and limbs (A.M.9475) may have belonged to different individuals. The horns are of C. furcatus and not of R. osborni form.
(4) Ramoceros hitchcockensis, new species

From Nebraska

Type.—Left three-pointed antler-like horn-core.

N.S.M.1-26-8-30 From first canyon west of Burroak Creek (a side branch of Driftwood Creek), Hitchcock County.

Referred.—

Base of right core, with burr. A.M.8509 Hazard Collection. From (?) southern Nebraska.

Tentatively Referred.—

Mature horn-core, broken off above burr. F:A.M.31180 From Fairfield Creek, Brown County.

IA. Paramoceros, new subgenus

Reconstructions, Figure 27c, d

(5) R. (Paramoceros) martha, new species

From New Mexico


Type.—Left horn on cranial fragment, points missing, no burr.

F:A.M.31620 From Santa Cruz, upper layer, 1928. Slender shaft. Size large. Collected by Joseph Rak. This paper, Figs. 33, 34.

Referred.—

Fragments from the Santa Fé marls figured by Cope, 1877, Pl. lxxx, Figs. 3, 4 and 6, doubtfully referred here.

Three large-sized specimens from Santa Cruz:

Right horn on cranial fragment, 1st point broken, 2d and 3d points missing, no burr. F:A.M.31621 1925.
Right horn on cranial fragment, points missing, with burr, and associated calcaneum; and fragment of horn.

Specimen from Pojuaque Bluffs:


Five small-sized specimens (possibly distinct species):

Two from North Pojuaque Bluffs:

Right horn on cranial fragment, points complete, trace of burr. F:A.M.31619 1933. This paper, Figs. 33, 34.

Left horn on cranial fragment, no burr, 1st point complete, 2d and 3d points missing. F:A.M.31625 1928. From west side, 1928.

Three from Santa Cruz:

Right horn on cranial fragment and burr, 1st point complete, 2d point missing, 3d point tip broken. F:A.M.31624 1925. This paper, Figs. 33, 34.

Left horn, 1st and 2d points missing, 3d point tip broken, no burr. F:A.M.31626 1928.


Doubtfully referred specimen from Round Mountain Quarry, collected in November, 1935 [possibly of an aberrant individual of C. (Subcosoryx) cerroensis]:

Left horn-core on cranial fragment, posterior inner point broken. F:A.M.33100 1929. This paper, Fig. 38.

(6) R. (Paramoceros) howardae, new species

From Dutch Creek, Brown County, Nebraska

Type.—Top of cranium with horns (points missing, burrs heavy) and m1-m2. (w++) F:A.M.31271 1929. Collected by Morris F. Skinner. This paper, Figs. 33, 34.

Size moderate. (See Dentition Section III, page 413.)
(?) Var.

From Crookston Bridge Quarry, Cherry County, Nebraska

**Example.**—Basal portion of N.S.M.6-19-9-34 horn.
(Not cited in Distribution Table VII; not included in specimen count.)

(7) **R. (Paramoceros) kansanus**, new species

From Kansas

**Type.**—Left horn with small posterior point, anterior points missing, no burr; and associated astragalus and phalanx.

(See referred mandible, Dentition Section III, page 410; and limbs, Limb Section IV, page 455.)

(8) **R. (Paramoceros) palmatus**, new species

From New Mexico

**Type.**—Left horn on cranial fragment, tips broken. Crotch is noticeably palmate.

(See referred mandible, Dentition Section III, page 410; and limbs, Limb Section IV, page 455.)

(9) **R. (Paramoceros) brevicornis**, new subgenus and species

From Barstow, California

**Subgenotype.**—Frontal saddle with horns, shaft short, heavy three-tined crotch. Burrless.

**Referred.**—
Left horn on frontal fragment, points broken, with burr. Size moderate.

Frick, Horned Ruminants. II—Antilocapridae
Reconstruction, Frontispiece, A

(10) R. (Merriamoceros) coronatus (Merriam), subgenotypic species

From Barstow, California


This peculiar pronglet is represented in the new collections by a crushed cranium with partial dentition and unsymmetrical horn-cores, some fifteen listed detached cores, six listed mandibular rami with symphyses preserved and a number of partial rami. The majority of these remains were secured from Steepside Quarry of the Green Hills horizon by the Jack Wilson party in the winter and spring of 1936. The horns and mandibular dentitions are sufficient witness to the distinctness of the form, which remains unrecognized beyond the Green Hills deposit.

The "horn" (Figs. 28D, 35, 35A) consists of an erect supra-orbital shaft bearing an elongate, somewhat expanded and horizontally lying summit. The superior border of the orbit extends to an unusual degree within the base of the shaft. The shaft apparently was directed slightly outwardly and anteriorly. It is somewhat flattened, particularly at the fork, externally at this point being convex and inwardly concave to deeply cupped. In the smaller and what appear to be less aged specimens (exampled in the unsymmetrical horns of the only known skull), the underlying structure of elementary anterior and double posterior prongs is visible. In the larger individuals the whole top of the horn—the equivalent of the typical anterior prong and double posterior prongs—is extended in a general palmate surface whose periphery bristles with ten or more tubercular-like points. None of the specimens retains a burr (if this were ever present). The bullæ, as seen in the one cranium, are small. A series of mandibular rami, six with symphyses preserved, was secured with the horns. The diastema is short and slender and the p₂ proportionately large. The specimens fall in Size Groups III to III–. A metacarpus of moderately heavy proportions is credited to the species. The mandibular characters (Figs. 35A, 47A) indicate that Merriamoceros may prove most nearly related to the Sioux County Paracosoryx.

John C. Merriam (1913, p. 338) observes that the peculiarities of the type specimen "... may be accounted for on the assumption that it is a 'sport' or 'monstrosity' of Merycodus necatus, a common form in the Mojave region ..." but (1919, p. 524) believes it "... desirable to recognize this form as distinct from other species and probably nearest to Merycodus."
SUBGENOTYPE.—Partial horn-core. Size large.

REFERRED (collected by Jack Wilson and associates).—

(a) From Steepside Quarry, 1936:

Posterior two-thirds of cranium (crushed) with unsymmetrical horn-cores and left m\(^1\)–m\(^4\). (Small individual)................. (w) 31025

Five large-sized specimens:

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>Fig.</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right horn on cranial fragment. (Eleven or more points.)</td>
<td>31146</td>
<td></td>
</tr>
<tr>
<td>Left horn on cranial fragment</td>
<td>31024</td>
<td></td>
</tr>
<tr>
<td>Right horn (possibly same individual as above)</td>
<td>31024A</td>
<td></td>
</tr>
<tr>
<td>Right horn on cranial fragment. (The most massive specimen.)</td>
<td>31037</td>
<td></td>
</tr>
<tr>
<td>Right horn</td>
<td>31037A</td>
<td></td>
</tr>
</tbody>
</table>

Four moderate-sized specimens:

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>Fig.</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right horn on cranial fragment. (Smallest of the four specimens.)</td>
<td>31022</td>
<td></td>
</tr>
<tr>
<td>Right horn on cranial fragment</td>
<td>31037B</td>
<td></td>
</tr>
<tr>
<td>Left horn on cranial fragment</td>
<td>31021</td>
<td></td>
</tr>
<tr>
<td>Left horn on cranial fragment. (This and F:A.M.31350 present the simplest and least expanded horns.)</td>
<td>31147</td>
<td></td>
</tr>
</tbody>
</table>

Five smaller-sized specimens:

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left horn on cranial fragment</td>
<td>31148</td>
</tr>
<tr>
<td>Left horn on cranial fragment</td>
<td>31149</td>
</tr>
<tr>
<td>Right horn on cranial fragment</td>
<td>31023</td>
</tr>
</tbody>
</table>

From Green Hills, indefinite locality, 1930 and 1932:

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>Fig.</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>8+ pointed horn</td>
<td>31351</td>
<td></td>
</tr>
<tr>
<td>Left horn on cranial fragment. (But 3 anterior and 3 posterior points.)</td>
<td>31350</td>
<td></td>
</tr>
<tr>
<td>Also 9 fragmental horns, F:A.M. Coll.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Variant A, from Yermo, 1932:

Portion of orbit bearing right horn (and possibly associated basal fragment of left horn). Anterior and posterior extremities of summit subequal, shaft at fork deeply cupped inwardly. Perhaps nearest approached by F:A.M. 31148. Figure 35A 31177

(See referred rami, Dentition Section III, page 437; and metacarpus, Limb Section IV, page 455.) (Note lately secured large horn, F:A.M.31145, Fig. 28D, and mandibular ramus, F:A.M.31144, Fig. 47A.)
The genus *Cosoryx*, as noted above, may prove to be synonymous with *Merycodus* Leidy, should it ever be possible to definitely determine the latter. The genotypic species is *C. furcatus* Leidy and the genotype is a partial horn-core from the Niobrara, which is characterized by relative slenderness and circular cross section of its shaft.

*Cosoryx* is best portrayed in referred remains secured by Morris F. Skinner from the so-called Gordon Creek and Midway Quarries, Cherry County, Nebraska. The tall slender-shafted horns of small to larger size are very similar to the type of *C. furcatus* Leidy from the Niobrara and to a specimen with partial mandible from Hitchcock County, Nebraska (A.M.8497). Certain of the smaller horns are not unsuggestive of a Colorado specimen heretofore known as the "cotype of *M. osborni*" (A.M.9475). While the teeth are noticeably heavier, the crania and limbs are smaller, the muzzle proportionately shorter and the nasals more abbreviated and slender as compared to the Crookston *Meryceros*. The premaxilla, nasals and /Is are known to the writer in but a single immature specimen (F:A.M.32450, Fig. 26) from Gordon Creek. A partial skull of a female (F:A.M.32426, Fig. 26) from the same area is the only Merycodontine specimen preserving the pterygoids.

A collection of one hundred and six mandibular rami, forty-six maxillae, eighty-nine horns and many other remains,\footnote{Four hundred and thirty mature and two hundred and ten immature unlisted partial and fragmental rami; one hundred and forty mature and thirty-four immature unlisted partial maxillae and numerous detached upper teeth.} secured while these pages were coming through the press, introduces an heretofore unknown *Cosoryx*, remarkable for the reduction of the premolars. This highly specialized form is referred to a distinct subgenus and species, *Cosoryx (Subcosoryx) cerroensis*. The specimens were quarried from an unusually rich fossiliferous stratum, lying directly beneath the heavy conglomerates of the Pajarito Plateau on the western bank of the Rio Grande and discovered by William Klaus of our Santa Fé field party. The horns are of generally slender proportions with elongate forks. The shafts range from short-moderate to tall; the forks, from moderate to very widely branching, or exceptionally, non-spreading. Certain of the taller-shafted, more moderate-forked specimens suggest the type of *Co-
soryx ilfonsensis. (A single three-pronged horn-core associated with the same collection is referred to Paramoceros marthæ.) The mandibular rami range between Size Groups iii–v and are of generally uniform character, with long diastema and extremely reduced p₂–p₃. The nub-like p₂ is occasionally lost. (A single specimen, exhibiting a noticeably short diastema and retaining the p₂ germ unerupted, is considered as an abnormality. Two fragmental specimens differ from the main series in the large size of the p₄ and p₃ (retained only in one specimen) and, like the above horn, are referred tentatively to the above species, R. (P.) marthæ.)

The full-fledged Midway limbs are small as compared to Meryceros of Crookston. And while the metacarpus approximates, the metatarsus is much shorter than in the mount of the genotype of Ramoceros osborni (Matthew). The Round Mountain Quarry limbs are considerably larger than the Midway. They are of about the size of the moderately small individuals of the Crookston collection.

Re (a) Midway and (b) Gordon Creek Cosoryx Series:
(a) The Midway Quarry series includes two posterior crania with burred horns, seven posterior crania without horns (females), and seven detached horn-cores, only two of these with burr. (The general slenderness of the burrless specimens evidences young individuals). The mandibular rami (see Dentition Section III, page 414) include some one hundred and twenty-four largely complete lower dentitions, ninety of mature and thirty-four of immature individuals, almost again as many less complete to fragmentary specimens, and a considerable number of maxillary or partial maxillary dentitions. A moderate variation is seen in the size of the teeth and rami, the limits being exampled by the small specimen, F:A.M.32362, and the large specimen, F:A.M.32354. Some ten rami have the premolars complete and another ten have the dentition complete save for the p₂. The p₂ at times was absent in life, as shown by absence of alveolus. The lower incisors are not preserved in any specimen. The series includes a large assortment of limb elements (see Limb Section IV, page 458), the great majority of which, strangely enough, represent immature individuals.
(b) The Gordon Creek Quarry collection contains a large percentage of partial crania, with a predominance of males. The horn-cores include a very diminutive specimen (an immature individual) as well as the tallest specimen of the entire Cosoryx series. The height of the latter horncore (N.S.M.15-27-7-29) approximates that of the differently propor-
tioned *Paracosoryx wilsoni* subgenotype from Long Quarry, Sioux County. As noted above, the series includes the only *Cosoryx* specimens with the premaxilla and nasals at present known to the writer, and the only Merycodontine specimen retaining the pterygoids.

*Cosoryx* is now represented by remains from New Mexico; Kansas; Montana; Brown, Cherry and Hitchcock Counties, Nebraska; and Colorado.

A subgenus, *Paracosoryx*, replaces the genus in Sioux County, Nebraska, and Barstow, California. The same is characterized by height of the burr, tendency at times to extreme elongation of the horn shaft, and shortness of the diastema. The subgenotypic species is *P. wilsoni* of Sioux County. A species, *P. furlongi*, from the Ricardo Pliocene is referred to the subgenus, which, by study of the literature, seems to be represented in the University of California collections from Tejon Hills, Virgin Valley and Tonopah,¹ Nevada. The first subgenus, *Subcosoryx*, so far recognized only from one New Mexican locality, is characterized by the extreme reduction of the premolars, as noted above.

[See discussion of the genus, page 292, and see summary of fifteen here recognized *Cosoryx*, *Paracosoryx* and *Subcosoryx* species and subspecies (exclusive of unnamed), page 318.]

(1) *C. (Subcosoryx) cerroensis*, new subgenus and species

From Round Mountain Quarry, New Mexico

Subgenotype.—See Dentition Section III, page 392.

Referred, Eighty-Nine “Horn” Specimens (anterior tine the longer).—

Typical specimens with long shaft and long tines with tendency to rather wide flare and bending of tips:

Large to moderate, with tendency to enlargement in both shaft and tine: F:AM.

Right horn, tips broken ........................................ 33104
Right horn, tips missing ........................................ 33106
Right horn with double burr, on cranial fragment ........... 33107
Right and left horns ........................................... 33107A,B
Left horn with burr ........................................... 33107C
Pair of horns with burrs, on cranial saddle ................. 33109
Left horn ...................................................... 33114E
Right shaft, forks broken ...................................... 33109A

¹ C. (Paracosoryx) lozocerus (Furlong, 1935), from Tonopah.
Frick, Horned Ruminants. II—Antilocapridae  

Right and left horns with burrs........................................ 33114C,F
Two forks.............................................................................. 33111B,C
Right horn with double burr.............................................. Fig. 38 33108
Left horn with double burr.................................................. 33110
Left horn with Burr.................................................................. 33108C
Right and left horns.............................................................. 33115C,B
Left horn with double burr, posterior tip broken.................. 33108D
Left horn with trace of burr.................................................. 33110A
Left horn (see associated left ramus, page 394)................. 33112
Pair of horns, left with burr.............................................. 33115
Right horn............................................................................. 33115A
Left horn, tips broken.......................................................... 33108A
Left horn on cranial fragment, posterior tip broken............. 33108B
Left horn with burr.............................................................. 33114D
Two right horns with burrs.................................................. 33110B,E
Right horn with burr............................................................ 33110H
Right horn, trace of burr and fragment of left horn............. 33110C
Two right horns with trace of burr....................................... 33110I,F
Two right horns with burrs.................................................. 33110D,G
Left horn............................................................................... 33110J

Smaller:

Right horn with burr.......................................................... 33111E
Right and left horns.......................................................... 33111D,F
Left and right horns with burrs.......................................... 33111G,N
Right horn............................................................................ 33110K
Three right horns with burrs.............................................. 33111A,H,I
Left horn, tips broken........................................................ 33112B
Right horn with double burr.............................................. 33110M
Left horn with burr, tips broken........................................ 33113B
Left horn with burr (and fragment of right)....................... 33110P
Left horn with burr, on cranial fragment, and fragments of right horn ......................................................... 33113
Left horn, tips broken........................................................ 33115D
Left crushed horn with burr.............................................. 33113A
Left horn with double burr, tips broken............................ 33112D
Left crushed horn.............................................................. 33113C
Left horn with burr, base broken........................................ 33110L
Right horn with burr.......................................................... 33113E
Right horn with double burr.............................................. 33112C
Left horn with burr, tips broken........................................ 33113G
Right horn............................................................................ 33113F
Left horn with double burr.............................................. Fig. 38 33113H
Right horn with double burr.............................................. 33113D

Smallest size:

Left horn, tips broken........................................................ 33113I
Right horn............................................................................ 33113J
Less typical, including variants having:

Shorter shafts with wide-spread tines (the extreme being shown in F:A.M. 33105):

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right horn fragment (suggestive of heavier specimen from Santa Cruz, F:A.M. 31439)</td>
<td>33105</td>
</tr>
<tr>
<td>Right horn (br.) with burr, on cranial fragment.</td>
<td>33104A</td>
</tr>
<tr>
<td>Right horn</td>
<td>33116</td>
</tr>
<tr>
<td>Pair of horns with burr, bases broken</td>
<td>33116A</td>
</tr>
<tr>
<td>Right horn with burr</td>
<td>33116B</td>
</tr>
<tr>
<td>Left horn with burr, posterior fork broken</td>
<td>33116C</td>
</tr>
<tr>
<td>Right horn with heavy double burr</td>
<td>33116D</td>
</tr>
<tr>
<td>Left horn with burr</td>
<td>33116E</td>
</tr>
<tr>
<td>Right horn with burr</td>
<td>33114B</td>
</tr>
<tr>
<td>Left horn (anterior tine much longer)</td>
<td>33120</td>
</tr>
</tbody>
</table>

Several cranial saddles indicate the presence of individuals in which the horn-cores are peculiarly rotated antero-inwardly:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranial saddle with pair of heavy horn-cores with burrs</td>
<td>33121</td>
</tr>
<tr>
<td>Pair of horn-cores with extremely heavy burrs</td>
<td>33122</td>
</tr>
<tr>
<td>Cranial saddle with both horns with burrs</td>
<td>33119</td>
</tr>
<tr>
<td>Cranial saddle with both horns with burrs</td>
<td>33118</td>
</tr>
<tr>
<td>Left horn with burr (and ?associated mandible, page 393)</td>
<td>33117</td>
</tr>
</tbody>
</table>

Certain new Round Mountain specimens closely resemble specimens of the following species, *Cosoryx ilfonsensis*. These specimens are held with the above Round Mountain material only for the matter of present convenience. The specimens average large for association with the small dentitions with reduced premolars from the same beds. These specimens, like the horn-cores of *C. ilfonsensis* and of the New Year Quarry, Barstow, the M.C.Z. Garman-Scott specimen, the tall horn from Burge Quarry, and, in less degree, the type horn of *Merycader crucensis*, in their elongate shafts and short-tined forks, are suggestive of a massively developed *Paracosoryx*—excepting that they lack the elevated burrs typical of the latter. A very similar horn has recently been observed from Sheridan County and from Morrill County, Nebraska (page 354).

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left horn</td>
<td>33123A</td>
</tr>
<tr>
<td>Left horn (crushed)</td>
<td>33123</td>
</tr>
</tbody>
</table>

Tall shafts with short-tending tines:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left horn with burr. (Very similar to San Ildefonso F:A.M.31499 and recalling the heavier M.C.Z. Garman Scott specimen.)</td>
<td>33106A</td>
</tr>
<tr>
<td>Left horn</td>
<td>33106B</td>
</tr>
<tr>
<td>Right horn with burr</td>
<td>33111</td>
</tr>
<tr>
<td>Left horn with burr, posterior fork broken</td>
<td>33106C</td>
</tr>
<tr>
<td>Left crushed horn</td>
<td>33106E</td>
</tr>
</tbody>
</table>
Frick, Horned Ruminants. II—Antilocapridæ

Left horn, anterior fork broken..................
Left horn with double burr, anterior fork broken...
Pair of horns with burrs.......................... Fig. 33

Two immature specimens:
Crushed cranial fragment with parts of both horns
with burrs...........................................
?Right horn.........................................

See referred rami and maxillæ, Dentition Section III, page 392; and limbs, Limb Section IV, page 456.

(2) Cosoryx ifonsensis, new species

From New Mexico

(See discussion on opposite page)

Type.—Top of cranium and horns, with burr.

F:A.M.31435 From San Ildefonso, near spring, 1933.
This paper, Figs. 36, 36A.

Referred.—

(a) Four moderate-sized specimens (similar to F:A.M.31435):
Cranial saddle with both horns, burred.


Left horn on cranial fragment.

F:A.M.31464 From Santa Clara, 1928.

Partial horn, without burr.

F:A.M.31436 From Pojuaque, on road to Chimayo, 1925.

Partial horn, without burr.


(b) Three very large-sized specimens (larger than any other cores referred to Cosoryx—and almost equally suggestive of a variation of M. major):
Left horn.

F:A.M.31440 From Santa Fé area, 1927.

Left horn, points broken.

F:A.M.31442 From Santa Clara, 1928.

Horn, points broken. (Tallest.)

F:A.M.31438 From Santa Cruz.

In discussions of horns from the Santa Fé marls, E. D. Cope (1877), under his Dicrocerus furcatus, figures no specimen of the typical furcatus form nor that could be referred to this species. Cope (1875, Proc. Acad. Nat. Sci. Phila., XXVII, p. 257) lists several specimens of Merycodus, Cercus and Cosoryx, transferred to the Gervais genus.
(3) **Cosoryx furcatus** Leidy, genotypic species

From the Niobrara; referred remains from Cherry, Brown and Hitchcock Counties, Nebraska

(See previous discussion, page 335.)


**GENOTYPE.**—Partial horn-core with straight cylindrical shaft, measuring 2½ inches. N.M.148 [A.M.9994, cast] From the Niobrara. Figured by Leidy, 1869, Pl. xxviii, Fig. 8.

**REFERRED.**—

Leidy, 1869, from the Niobrara:

"A second and more cylindrical specimen." A.M.9994A [Cast]

Fort Niobrara, American Museum collection:

Four horn fragments, and fragment without burre. A.M.8572 and A

New material from:

Cherry County localities: (a) Midway Quarry, (b) Gordon Creek, (c) Swallow, Snake River, (c') Steer Creek and Snake River localities, (c") Talus, 100 feet (Midway Channel) below Xmas Quarry, (d) Burge Quarry (new var.);

Brown County localities: (e) Long Pine, (f) Moore Creek, (g) Above Devil's Gulch, (h') Idaho, near Jamison's, (h") Horsethief Canyon;

Hitchcock County. (i) Garman Loup Fork (large var.), and from (j) Hitchcock County.

(a) Midway Quarry (horns fully as small and slender as the genotype):

Posterior cranium with burred horn-cores. F:A.M.32376

Posterior cranium with burred right horn-core. F:A.M.32377 This paper, Figs. 36, 36A,

Left horn-core with burre. F:A.M.32378

Five burred horn-cores, evidently immature. F:A.M.32379 and A–D

Basal fragment of horn-core with burr; and fork. F:A.M.32380 and A

Burred horn-core and fork of core. ?*Meryceros*. F:A.M.32381 and 32380B
Seven posterior crania F:A.M.32382 and A-F (hornless).

(For ramal and maxillary dentitions, see Section III, page 414; for limb elements, see Section IV, page 458.)

(b) Gordon Creek:

Nebraska State Museum specimens from east side of Gordon Creek, about \( \frac{1}{2} \) mile north of the falls, 50 feet below top of canyon:

Greater part of skull, part of left frontlet of a second, and two immature horn-cores of a third and a fourth individual.

("Skeletal elements from same pit may include parts of same individual.")

Partial horn-core, immature.

Four from P. H. Young Ranch (on Gordon Creek):

Left horn-core. N.S.M.15-24-7-29 Tallest of the series, approximating *Paracosoryx wilsoni* in height.

Partial horn-core. N.S.M.35-27-7-29

Partial right horn-core. N.S.M.12-19-7-29

Partial horn-core. N.S.M.17-1-8-29

F:A.M. Collection specimens from Gordon Creek Quarry, 1934 (near genotype):

Immature skull and jaws, premaxilla and /dIs preserved, dp\( 2-3 \)-m\( 3 \), atlas, \( \varphi \). (Brain case broken.) (See associated limbs, Section IV, page 458.)

Cranium, anterior muzzle missing, pterygoids, etc., preserved, p\( 1-3 \)-m\( 1 \), \( \varphi \). (m)

Posterior cranium with left burred horn-core.

Cranial saddle with left burred horn-core and base of right.

Posterior cranial fragment, hornless, \( \varphi \).
Cranial fragments, attached right horn-core and detached left horn-core.

Largest of the series and slightly taller than the genotype.

Broken left horn-core and fragment of left core, burrless.

Nine horn fragments (three with burr).

(For ramal and maxillary dentitions, see Section III, page 416; for limb elements, see Section IV, page 458.)

(c) Swallow Quarry, Snake River:

Nearly complete skull, p² alveolus and p¹-m¹. \((M+)\)

N.S.M.25-22-6-34

Nearly complete skull, \(\varphi\), with p²-m². \((M+)\)

N.S.M.3-27-6-34

Left horn-core on frontlet, burrless.

N.S.M.10-26-6-34

(Only moderately smaller than Scott’s specimen.)

(And see maxilla and rami, Dentition Section III, page 417; and limbs, Section IV, page 459.)

(c’) Steer Creek and Snake River localities:

Right burrless horn-core on portion of frontlet.

N.S.M.3-28-6-35

Left burrless horn-core on portion of frontlet.

N.S.M.10-27-6-34

Right burrless horn-core.

N.S.M.27-25-6-32 (General area.)

(c’*) Talus, 100 feet (“Midway Channel”) below Xmas Quarry:

Horn base without burr. \(F:A.M.31277\) 1933.

(d) Burge Quarry:

Cranium, premaxilla retained, with p²-m¹. \((M+)\)

(F:A.M.32902 This paper, Figs. 2, 37A.

(Top of saddle between horns showing ossification from an evident injury.)

Posterior portion of cranium with both horns, burrless.

F:A.M.32903
Crushed cranium with dp\textsuperscript{4}–m\textsuperscript{2}, and right ramus with dp\textsubscript{1}–m\textsubscript{2}, ♀.

Four horns, moderate.  
Horn, tall and slender.  
Horn, small, immature.  

(See Dentition Section III, page 418; and Limb Section IV, page 460.)

Notably taller than the above specimens and, unlike the latter, highly suggestive of Paracosorux—say P. burgensis, n.sp. A radius (F:A.M.32912) and metacarpus (F:A.M.32913), approximating the large Nenzel versus the smaller Burge limbs, may pertain to the same form:

**Type.**—Right horn on F:A.M.32900 This paper, Fig. 37A. frontlet, burrless.  
(Species P. burgensis is not included in the preceding enumeration of species.)

(e) Nine miles north of Long Pine, 1933:

Pair of horns with burr.  
(Only moderately smaller than Scott's specimen.)

Two fragments with F:A.M.31273 1933. slightly shorter shaft, without burr.

(See possibly associated ramus, F:A.M.31273A, Dentition Section III, page 423.)

(f) Moore Creek:

Horn fragment with burr, and skull fragment.  
(See ?associated rami, F:A.M.31274, Dentition Section III, page 419; this paper, Fig. 45.)

Three fragments without F:A.M.31278 Locality questioned. burr.

(g) Above Devil's Gulch:

Basal fragment with burr; F:A.M.31275 From talus slope, 1932. (and ?fragments of scapula).

(h³) Id., near Jamison's:

Right fragment on frontal.  
Right fragment.  
Fragment.  
N.S.M.4-3-11-13 (Plum Creek.)  
N.S.M.3-3-11-13
(h²) Horsethief Canyon:
Top of immature cranium with immature horn-nubs. F:A.M.31189 From No. 1 lower zone 1934.

(i) Garman Loup Fork Collection (C. furcatus, large var.):
This specimen is that described and figured in reconstruction by William B. Scott in 1890. The horn is larger than the Leidy type specimen.
Left horn-core, partial mandible, m¹, one-half pelvis, portion of scapula, series of vertebrae, metapodial.
M.C.Z.10101 [F:A.M. cast] Skeleton figured by Scott, 1890, under Cosoryx furcatus referred; ramus, this paper, Fig. 45.

(See Dentition Section III, pages 418, 429; Limb Section IV, page 460.)

(j) Hitchcock County, Southern Nebraska:
Top of cranium and horns, with burr. A.M.8497 From Driftwood Creek, 1879.
Labeled “Merycodus furcatus Leidy.” (See ramus under same number, Dentition Section III, page 434.)

(4) Cosoryx furcatus sternbergi, new subspecies
From Kansas

Type.—Top of cranium and horns, with burr. F:A.M.31511 From Section 1, 2 mi. S. and ¼ mi. E. of Dinsmore, Kansas, 1933.
This paper, Figs. 28, 28A, 36, 36A (cranium and horns), 43 (ramus).

(See associated left ramus, Dentition Section III, page 410.)

(5) Cosoryx furcatus, Var. or Subspecies
From South Dakota

Example.—Right horn, with burr, on frontal fragment. A.M.10966 From Little White River, South Dakota, 1903.

(Size moderately large.)
REFE`EtD. Horn, with burr. A.M.10963 From 15 mi. N.E. of Rosebud Agency, South Dakota, 1903.

(See questionably referred limb elements, Section IV, page 461.)

The above specimens may prove the equivalent of *Merycodus necatus* Leidy described from the general area. The present whereabouts of the type is unknown. The same evidently represented a relatively large form. The type never has been figured, and the genus and species at the present writing seem to be indeterminate. The evidence may be recorded for comparison, i.e.:

(5a) *Merycodus necatus* Leidy, 1854, indeterminate genotypic species

From Bijou Hills, South Dakota


**Genotype.**—Ramal fragment

?Lost with p4-m1.

According to Leidy “allied to Muska”:

p4 anteroposterior distance = 8 mm., and

m1 = 8 (approaching Size Group II).

(6) *Cosoryx furcatus mooki*, new subspecies

From Montana

**Type.**—Partial cranium with m1-m2 and horns, with burr. A.M.21370 From 10 miles S. of Logan, Montana.

Collected by C. C. Mook and C. S. Williams, 1925.

This paper, Fig. 36A.

(See associated ramal fragment, Dentition Section III, page 411.)

*C. f. mooki* may prove to be synonymous with—
Cosoryx agilis DOUGLASS, 1899, The Neocene Lake Beds of Western Montana, Univ. Mont., Thesis, p. 23, Pl. iv, Fig. 1.


**Type.**—Immature partial skull, with mandible and partial manus, pes, radius, ulna, etc.

Absence of horns suggests female.

According to Douglass, premolars = 45 mm., molars = 27.5 mm.

(See Dentition Section III, page 411, and Limb Section IV, page 461.)

Cosoryx Var.

From Montana

The very interesting collection of C. E. Marshall contains a left immature ramus (No. 2) and a left ramus with m3–m3 (No. 2a) from the Late Tertiary deposits on the Yellowstone River near the Gardiner entrance to Yellowstone National Park. (See Dentition Section III, page 411.) A right horn-core (points missing), 1-F-MV, of a large individual of Cosoryx has been called to our attention through the kindness of C. A. Kinsey of Belgrade, Montana.

**Cosoryx furcatus, Var. or Subspecies**

From Colorado

**Example.**—Portion of horn and possibly associated right maxilla with p3–m3.

(See Dentition Section III, page 407.)

**Tentatively Referred.**—

Cranial saddle with horn-cores.

Specimen heretofore known as part of "cotype" of M. osborni Matthew. (See questionably associated ramus and maxilla, Dentition Section III, page 406; and limb elements, Limb Section IV, page 461.)
QUESTIONABLY REFERRED.—

Left horn, without burr, on cranial fragment.
(?) Immature.  F:A.M.31296  Collected by John C. Blick, Pawnee Creek, east of camp, 1932.
This paper, Figs. 36, 36A.

(8) C. (Paracosoryx) alticornis, new species
From First Division, Barstow, California

Shaft unusually slender and elongate

TYPE.—Extremely elongate horn, flattened at the fork, proximal end missing and evidence as to burr in question.
Height at crotch = 155+ mm.

REFERRED.—
Top of cranium and broken horns with burr.
(Horn bases connected by unusual elevation of the frontals.)

Horn with burr, tips missing.
(Specimen as heavy, but considerably shorter than type.)

Horns that, with one exception (F:A.M.31159), are slenderer than the type, and are notably more elongate than in the following New Year Quarry variant.

(See referred maxillae and rami, Dentition Section III, pages 437-438, 443; and limbs, Limb Section IV, page 461.)
(8a) (?)Var. or Cosoryx species

From New Year Quarry, First Division, Barstow, California, 1934

Horns shorter and heavier-proportioned than in above. Specimens more resembling certain of the large Cosoryx forms, as C. ilfonsensis.

**Example.**—Left horn on cranial fragment, with burr. 

F:A:M.31175

**Referred.**—

Right horn on cranial fragment, with burr.

F:A:M.31172

Left horn on cranial fragment, with burr.

F:A:M.31173

Left horn on cranial fragment, without burr.

F:A:M.31174

Left horn on cranial fragment, without burr.

F:A:M.31176

(See referred maxillae and rami, Dentition Section III, pages 438, 443.)

(9) C. (Paracosoryx) furlongi, new species

From the Ricardo Pliocene, California


*Merycodus* cf. *furcatus* Leidy, ref. Furlong, 1927, ibid., XVII, p. 147, Pl. xxiv, Fig. 3; Pl. xxvi, Fig. 1; and Pl. xxvii, Fig. 4.

The partial cranium with tall-shafted biforked horn-cores and associated ramus from the Ricardo (U.C.26795), figured by E. L. Furlong (1927, Pls. xxvi and xxvii), is taken as the type. The describer observes that the burrs are absent and that the posterior tine is rotated outwardly versus *M. necatus*, in which the same is parallel to the skull axis. The shaft, while of approximately the same length, seems heavier than in Barstow, F:A:M.31150, in which the burrs are present. The horns are shown as slanting more forwardly than is usual in Cosoryx specimens from the Great Plains area.

John C. Merriam (1919) notes and figures, among other remains from the Ricardo area, a partial horn-core with tall, slender beam (U.C. 23448, Fig. 235). He also figures an m₃ in which the third lobe is tend-
ing to division, the specimen to him seeming to be suggestive of *Capromeryx*.

**Type.**—Partial cranium with tall horn, maxillary series, ramus, etc.

(See Dentition Section III, page 444; and associated metatarsus, Limb Section IV, page 462.)

**Referred.**—

Three horn-cores (one with U.C.27243 Figured by Furlong, 1927, Pl. 27249 xxviii, Figs. 1–3, under 27242 "*Merycodus species.*"

Et cetera remains in the University of California collection.

Et cetera ramal fragments in the writer's collection, see Dentition Section III, page 444.

(10) **C. (Paracosoryx) species**

From the Tejon Hills, California


**Example.**—Partial antler. U.C.22332 From Chanac fauna of Tejon Hills. Figured by Merriam, 1916, Fig. 17.

(11) **C. (Paracosoryx) loxocerus** (Furlong)

From the Vicinity of Tonopah, Nevada


A tall slender-shafted and short anterior-tined species from the vicinity of Tonopah has been described recently by E. L. Furlong. The cores are reported to be strongly inclined posteriorly. A backward inclination to such degree might be questioned as previously unobserved.

**Type.**—Right ramus, p₂–m₄. C.I.T.1301 Figured by Furlong, 1935, Pl. ii, Figs. 4, a–b.
REFERRED AND FIGURED BY FURLONG, 1935.—

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog Number</th>
<th>Plate and Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontlet with burred horn-cores.</td>
<td>C.I.T.705</td>
<td>Pl. II, Figs. 1 and 1a.</td>
</tr>
<tr>
<td>Frontlet with burred horn-core shafts.</td>
<td>C.I.T.697</td>
<td>Pl. II, Figs. 2 and 2a (abnormal).</td>
</tr>
<tr>
<td>Frontlet with burred horn-cores.</td>
<td>C.I.T.696</td>
<td>Pl. III, Figs. 1 and 1a.</td>
</tr>
<tr>
<td>(Apparently the best example of the tallest horns.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burred horn-core.</td>
<td>C.I.T.707</td>
<td>Pl. IV, Figs. 1 and 1a.</td>
</tr>
</tbody>
</table>

(11a) (?) C. (Paracosoryx) nevadensis (Merriam)

From High Rock Canyon, Nevada


Type.—Left fragment with m1–m3. U.C.12608 From High Rock Canyon. Figured by Merriam, 1911, Fig. 65.

Merriam (1911, p. 285) states “... this form was considerably smaller than M. furcatus, M. necatus, and M. osborni.”

m2 = 7.6 mm.; m3 = 11.5

(See Dentition Section III, page 445.)

(11b) C. (Paracosoryx) Var.

From Virgin Valley, Nevada

Merycodus, near furcatus (Leidy), Merriam, 1911, Univ. Cal. Pub. Bull. Dept. Geol., VI, p. 284, Fig. 66.

Exampled by a slender antler (U.C.11319), the shaft of which, according to the author, up to point of branching, measures 110 mm. (Fig. 66, p. 284). The type of Merycodus nevadensis Merriam (1911) from High Rock Canyon may represent the same form, and in such case the species becomes P. nevadensis (Merriam).
(12) (?)C. (Paracosoryx) species (Gazin)

From Skull Spring Miocene, Oregon

Merycodus? species a and b Gazin, 1932, Carn. Inst. Wash. Pub. 418, p. 85, Fig. 19a.

EXAMPLE.—Right fragment of immature ramus, dp4-2.

(See Dentition Section III, page 445.)

From Malheur County, Oregon. Figured by Gazin, 1932, Fig. 19a.

(13) C. (Paracosoryx) wilsoni, new subgenus and species

From Sioux County, Nebraska

Subgenotype.—Crushed skull with tall, slender horns and p2-m3, muzzle and burrs missing. (w) F:A.M.32470 From Long Quarry, 1935. Collected by Jack Wilson and associates. This paper, Fig. 37.

Height at crotch = 91 mm.

The horns are notable in height of shaft and reduction of fork. While resembling Paramoceros of the Barstow area in the height and slenderness of the shaft, the horns are smaller and the short distal forks possibly more dished inwardly. Two more recently secured specimens are of interest: F:A.M.32886 exhibits a taller shaft than any of those here listed (height 128+ mm.); F:A.M.32887 is unique in that the burr is situated only slightly below the fork. Lateral splints and phalanges are retained in the manus of the skeleton of an immature individual, F:A.M.33789, page 316 and Figs. 25B, 48A.

REFERRED FROM TYPE LOCALITY.—

Crushed skull with tall, slender horns and p2-m3, muzzle and burrs missing. (Height at crotch 102 mm.) F:A.M.31191 Fig. 37

Partial skull with horns and p2-m3. [Horns extremely interesting, as noted above; anterior fork of left horn rudimentary, right shaft slenderer than left and exhibiting second burr at the base of the fork (missing). Shaft relatively short.]............. F:A.M.32895 Fig. 37

Posterior portion of skull with both horns, no burrs. .......... F:A.M.32896

Top of skull with right horn with burr, and right orbit. ...... F:A.M.32888

Extremely tall left horn with burr. ....................... F:A.M.32471 Fig. 37

Right horn with burr on cranial fragment .................. F:A.M.33000

Left horn fragment with burr ....................... F:A.M.33000A

Two right horns with burrs ............................... F:A.M.33000C–D

Left horn with burr ........................................ F:A.M.33000H

Left horn without burr ...................................... F:A.M.32473

Right horn with double burr on cranial fragment ................................. F:A.M.31192 Fig. 37

Right horn with burr ........................................ F:A.M.32002

Right horn with burr on cranial fragment ................................. F:A.M.33000E
Right horn without burr.......................... 32472
Right horn with burr on cranial fragment........ 33000F
Left partial horn with burr........................ 33000I
Right horn without burr.......................... 33000J
Shafts relatively short:
  Left horn with double burr.......................... 33000K
  Right horn fragment without burr.................. 32003
Horn fragment with triple burr..................... 33000L
Five horn fragments.................................. 32473B, C
  33000G, M, N
Small fork............................................. 32004

Immature:
Right horn with burr (fork rudimentary)........... 33000B
Left horn with burr (fork rudimentary)............. Fig. 37 31192A

Seven female crushed partial skulls:
Partial skull with p²–m³............................. (m) 32474
Partial skull with p²–m³(emanating)................. (m) 32475
Partial skull with p²–m³............................. (w++) 32476
Posterior half skull with m₁–m₃ and orbits preserved (m) 32899
Portion of skull with p²–m³ and orbits preserved... (w+) 32899A
Portion of skull with p²–m³.......................... (w) 32899B
Crushed skull with p²–m³............................ (w+) 32899C
Two fragments of skulls................................ 32899D–E

REFERRED FROM ECHO QUARRY.—

Horn fragment with burr............................. 32473A
Small fork.............................................. 32473D
Fragment of skull..................................... 32899F

See short-diastemaed rami (Dentition Section III, page 429) and limb elements (Limb Section IV, page 462) from Long Quarry, tentatively referred to this species.

Doubtfully Distinct
From Sioux County, Nebraska

Crotch of fork broadly expanded, possibly through injury. Specimen may represent a new species.

  cranium with tall horns
  (distally broken) and
  m₁–m₃. (m)
This paper, Fig. 26.
(14) C. (Subparacosoryx) savaronis, new subgenus and species

From Sioux County, Nebraska

(See discussion, page 288)

Subgenotype.—Posterior cranium with horns, m1–m3. (w+)

A.M.17339 From Sinclair Quarry, 1916.
Figured by Matthew, 1918, Fig. 18 (under M. necatus Leidy); this paper, Figs. 28, 28A.

Referred.—

Posterior cranium without teeth.

A.M.17340 1916.

Partial cranium, crushed, with left horn, m1–m3. (w+)

A.M.22746 1916. This paper, Fig. 39.

Broken posterior cranium without horns.

A.M.22744 From Quarry B, 1921.

Broken posterior cranium without horns.

A.M.22745 From Quarry B, 1921.

(And see referred rami, Dentition Section III, page 430.)

(14a) C. (Paracosoryx) sabulonis (Matthew and Cook), 1909

From Sioux County, Nebraska


Merycodus necatus Leidy, referred Matthew, 1918, ibid., XXXVIII, p. 219, Fig. 18.


The type is a well-preserved right ramus in which the diastema is somewhat short as compared to the Santa Cruz remains, but moderately longer than in the shorter of the Snake Creek remains. It seems necessary, as noted above, pending the securing of more satisfactory evidence, to hold the possibly equivalent crania from the general area in a separate species, S. savaronis.

Type.—Right ramus with symphysis and p2–m4. (M+)

A.M.14109 From Snake Creek area, Sioux County, 1908.
Figured by Matthew and Cook, 1909, Fig. 24; this paper, Fig. 44.

(See referred rami, Dentition Section III, page 430; and limbs, Section IV, page 462.) (And see fragments, A.M. collection.)
(15) C. (Paracosoryx) dawesensis, new species
From Dawes County, Nebraska

**Type.**—Left horn-core. F:B:A.M.32856 From Ginn Quarry, 1935. This paper, Fig. 37.

**Referred from Type Locality.**—
Basal portion of two horn-cores, with burrs.
(See Dentition Section III, page 434.)

(16) C. (Paracosoryx) species
From Sheridan County, Nebraska
(Not cited in Distribution Table VII)

**Example.**—Frontlet with left N.S.M.9-1-8-33 horn-core (points broken).
(Height from top of orbits to crotch = 124 mm.)
(Not included in specimen count.)

This stout and recently received specimen recalls the question of the allocation of such similar specimens (page 338) as:
New Mexican Cosoryx ilfonsensis, questionably referred, 31440, height 98 mm., and 31442, height 94 mm. at crotch;
Nebraskan Paracosoryx burgensis, type, 32900, height 110 mm. (slenderer); (through the kindness of Professor E. H. Barbour, we have seen, since the setting-up of this page, a left frontlet with horn-core [N.S.M.10-18-36, Eunice Mauer Coll., from 8 miles south of Bridgeport, Morrill County, Nebraska], which closely resembles 32900 in form, but is of much larger size [height from top of orbits to crotch = 130 mm.]);
Mojave Paracosoryx or Cosoryx var., series including 31175, height 102 mm., which differ mainly from the Meryceros crucensis type, 31466, height 84 mm., in the more circular cross section of the shaft and absence of similar wedged condition of the fork.

III. Meryceros, new genus

Reconstruction, Figure 27A

The genotypic species is M. warreni (Leidy), from the Niobrara. (See discussion of characters of Meryceros and Submeryceros, page 293, and description of M. nenzelensis, page 359, and of M. warreni johnsoni, page 362.)
Frick, Horned Ruminants. II—Antilocapridae

(1) **Meryceros major**, new species

From New Mexico

The type specimen is remarkable for its large size, tallness of the shaft and wide bowing of the fork. The tentatively referred specimens are of more normal size. The smaller of the latter tend to approximate certain of the wider-forked specimens of *Meryceros crucensis* (see M. "warreni"-like). A wide difference exists between the shape of the elongate and flaring type specimen and the referred heavy, compact F:A.M.31445.

**(Horn of Unusual Size)**

**Type.—** Left horn, proximal end of shaft missing.

(No evidence re burr.)

F:A.M.31439 From Santa Cruz, 1928. Collected by Joseph Rak. This paper, *Fig. 39A.*

**Tentatively Referred.—**

Right horn on cranial fragment, without burr.

F:A.M.31448 From Santa Clara, 1928. This paper, *Fig. 39A.*

(Note somewhat similar specimen from Round Mountain Quarry, 1935.)

Right shaft, points broken, trace of burr.


Partial left horn on cranial fragment.

F:A.M.31460 From White Operation, 1925.

Pair of partial horns on frontlets.

F:A.M.31396 From 1st wash, Santa Cruz, 1935.

Left horn on cranial fragment, without burr.

F:A.M.31450 From Santa Cruz, 1929.

Left horn, without burr.

F:A.M.31451 From Santa Cruz.

More compressed, wedge-like, points less spreading:

**Moderate-sized:**

Right horn on cranial fragment, without burr.

F:A.M.31461 From Santa Cruz.

**Larger-sized:**

Right horn on cranial fragment, with burr.

(Shaft indicative of former burr.)

F:A.M.31449 From Santa Cruz, 1928.

Fragmental horn.

F:A.M.31452 From Santa Cruz, 1929.

**Largest-sized:**

Left horn on cranial fragment, with burr.

(Very heavy and lacking in bowing.)

F:A.M.31445 From red layer, Santa Cruz, 1927.
(2) *Meryceros crucensis*, new species

From New Mexico


*Cosoryx necatus* Leidy, referred Cope, 1889, Amer. Nat., XXIII, p. 128, Fig. 18 (1 and 2).

(a) Shafts Compressed, Fork Wedge-Shaped, Points Narrowed

(Specimens somewhat resembling larger section of *Cosoryx*. See *C. ilfonsensis*.)

**Tall-Shafted**

Type.—Right horn on cranial fragment, without burr. (Tallest.)

F:A.M.31466 From Santa Cruz, 1927. Collected by Joseph Rak. This paper, Fig. 39A.

**REFERRED.**

Top of cranium and horns. F:A.M.31444

[And see specimen of preceding section, F:A.M.31461.]

Without burr

Three from Santa Fé area:


Two from Skull Ridge:


Top of cranium and horns. F:A.M.31443 From Santa Cruz, 1925. This paper, Fig. 39A.

Tall, narrow-waisted, but shorter than F:A.M.31444. With burr. Left horn heavy.


**Shorter**

Top of cranium and horns, with burr. F:A.M.31472 From Pojuaque Bluffs, 1930. This paper, Fig. 39A.
Frick, Horned Ruminants. II—Antilocapridæ

1925.

Fragment and right horn, without burr. F:A.M.31475

(?) IMMATURE

Right horn on cranial fragment, suggestion of burr. F:A.M.31470 From Skull Ridge, 1927. This paper, Fig. 59A.

Horn, without burr. F:A.M.31471 From Santa Cruz, 1927.

Cope (1877, Pl. lxxxix, Figs. 2 and 3) figures under Dicrocerus necatus Leidy, specimens from New Mexico which closely resemble certain specimens listed above (see F:A.M.31475).

(b) SHAFTS SQUAT AND NARROW-WAISTED—M. "WARRENI"-LIKE

MODERATELY LARGE-SIZED

EXAMPLE.—Top of cranium and horns, with burr. F:A.M.31473 From Santa Cruz, 1928.

REFERRED.—

Without burr


Right horn on cranial fragment. F:A.M.31454 From Santa Cruz, 1928. This paper, Fig. 59.

(Narrow-waisted.)

Left horn on cranial fragment. F:A.M.31455 From Ojo Caliente, 1931. This paper, Fig. 59.

Horn on cranial fragment. F:A.M.31456 From Santa Clara, 1928.


With burr


Horn. F:A.M.31480 From Santa Cruz, 1928.

Horn. F:A.M.31481 Between old and new Santa Fé roads, 1926.


Right horn. F:A.M.31477 From Santa Cruz, 1928. This paper, Fig. 59.

(Suggestive of Barstow skull, F:A.M.31163.)
Right horn on cranial fragment, very heavy. F:A.M.31478 From Santa Cruz, 1928. This paper, Fig. 39.
Left horn on cranial fragment. F:A.M.31479 From Ojo Caliente, 1929.
Left horn on cranial fragment. F:A.M.31483 From Santa Fé.

Without burr

Right horn. F:A.M.31476 From Santa Cruz, 1926. (Might be a small individual of F:A.M.31450.)
Right horn on cranial fragment. Large. F:A.M.31484 From Santa Cruz, 1928. This paper, Fig. 39.
Right horn. Large. F:A.M.31485 From Santa Cruz, 1928. This paper, Fig. 39.
Horn. F:A.M.31487 From Santa Fé area, 1924.
Left horn. F:A.M.31488 From Santa Cruz, 1928.
Left horn on cranial fragment. F:A.M.31489 From Santa Cruz, 1928.
Horn. F:A.M.31490 From Santa Cruz, 1928.

QUESTIONABLY REFERRED.—
Top of cranium and broken horns. F:A.M.31446 From Santa Cruz, upper layer, 1928.

DIMINUTIVE
With burr

Right horn on cranial fragment. F:A.M.31491 From Santa Cruz, 1928. This paper, Fig. 39.
Right horn on cranial fragment. F:A.M.31492 From San Ildefonso, 1929. This paper, Fig. 39.

Without burr

Right horn on cranial fragment. F:A.M.31494 From S.E. White Operation, 1926. This paper, Fig. 39.
(3-4) Meryceros nenzelensis, new species, and M. warreni (Leidy),
genotypic species

From Cherry County, Nebraska

Meryceros-like horns, while generally less common in the vicinity of
the Niobrara River than those of Cosoryx form, are known from several
localities, including Crookston Bridge, Valentine Quarry A, Fairfield
Creek, etc., and unusually heavy-proportioned examples are present
from the vicinity of Nenzel. The latter are described as a separate spe-
cies, and those from the former localities referred to M. warreni (Leidy)
and varieties. Distinctly smaller-sized horns of questioned Meryceros
form, typical of the Snake Creek, Sioux County, deposits, are held under
Subparacosoryx. The Nebraska Meryceros horns, as in the case of the
specimens from New Mexico, etc., may be conveniently divided accord-
ing to shape between tall, compressed or short, with spreading points.
Certain evidence points to heavy burrs being an accompaniment of in-
creasing age. The available skulls and horns are described in the fol-
lowing pages. Enumeration of the mandibular rami and limb elements
is withheld for the general comparative statements, pages 372, 447.

(3) Meryceros nenzelensis, new species

From Nenzel, Cherry County, Nebraska

Figures 40 and (in part) 44

Specimens of much heavier proportions than usual in the remains here
referred to M. warreni are well represented in a series of skulls and partial
skulls, detached horns, rami and limb elements secured by Morris F.
Skinner from a deposit in the vicinity of Nenzel. The horns are rather
similar to specimens from Santa Cruz, New Mexico, and, as in the case
of the latter, include examples of both tall compressed and short flar-
ing shapes. The size of the horns may be moderate (evidently adoles-
cent) to large and may be either burrless or burred. The largest horn
happens to be of extremely heavy proportions, the main beam being
somewhat short with heavy burr and the points long and bowed. One
partial cranium, with dp²–m², is particularly interesting in exhibiting the rudimentary horn nubs of the immature male. The metapodials from Nenzel average somewhat larger than those from Crookston Bridge, and while the largest metacarpus is slightly larger than the largest specimen from New Mexico (here referred to \textit{Ramoceros ramosus}), the smallest is considerably larger than the metacarpus of the type of \textit{R. osborni}.

\textbf{Type.—} Partial skull with F:A.M.32174 This paper, \textit{Fig. 40.}

heavy, branching horn without burr. (M+)

(Best muzzle. Core resembling New Mexican F:A.M.31456.)

\textbf{Referred.—}

\textbf{Short, with Spreading Points, "Warreni"-like Shape}

Heavy burred left horn with short beam and long forks.

F:A.M.32186 This paper, \textit{Fig. 40.} (Largest.)

\textbf{More Wedge-Shaped Horn-Cores}

Crushed partial skull with tallest horn, burlless, and m²–m³. (M+)

F:A.M.31911

Skull with p¹–m³, burred horn bases, and ramus. (M+)

F:A.M.31902 This paper, \textit{Fig. 44} (ramus only).

Posterior cranium with tallest main beam, without burr.

F:A.M.32177 This paper, \textit{Fig. 40.}

Posterior cranium with horns, without burr.

(Approximating F:A.M.32174.)

F:A.M.32178

Posterior cranium with left horn, without burr. (Smaller.)

F:A.M.32179

Burrless horns (?pair), approximating F:A.M.31911. and 31963

F:A.M.31961

Burred horn. (Slender.)

F:A.M.32182

Partial horn. (Heavier.)

F:A.M.32183
MODERATE TO SMALL SIZE

Right horn, without burr. F:A.M.32180
Right horn, without burr. F:A.M.32181
Right horn, without burr. F:A.M.31958 This paper, Fig. 40.
(Smallest.)
Partial horn. (Large.) F:A.M.32185
Right horn with tall beam and burr. F:A.M.31960 This paper, Fig. 40.
Right horn, with burr. F:A.M.32184 (Heavier. Larger than F:A.M.32185.)

Six fragmental crania:
Posterior portion of immature skull with diminutive pedicle, dp²-m³ (germ). (μ) F:A.M.32175 This paper, Fig. 40. (Smaller size.)
Posterior cranium (fine), horn bases with burrs. F:A.M.32176
Top of cranium with horn bases with burrs. F:A.M.31959
Three fragments. F:A.M.31962, 31964A and B

(See referred rami and maxilla, Dentition Section III, page 421; and limb elements, Limb Section IV, page 463.)

(4) Meryceros warreni (Leidy), 1858, genotypic species

From the Niobrara, Nebraska


GENOTYPE.—Right horn-core on cranial fragment, two-thirds of anterior prong missing. N.M.149 From Niobrara River. Figured by Leidy, 1869, Pl. xxvii, Fig. 12. ("Cotype")

Shaft squat, with burr.

The ramal fragment with p₄-m₃, tentatively referred to the species by Leidy (1869), who observed that the teeth were the size of Cervus virginianus, may have represented a Dromomerycini.
(4a) **Meryceros warreni johnsoni**, new subspecies

From Crookston Bridge Quarry, Cherry County, Nebraska

Collected by Johnson, Meade and Associates

Figures 28B, 28C; and (in part) 2, 2A, 28, 35A

The superb series of skulls and other remains from Crookston in the University of Nebraska collection comprises far and away the best series of Merycodontine remains from a single locality. The whole has been placed at the service of the writer by Professor E. H. Barbour. The series includes some seventeen skulls of mature males with teeth and horns, seven having rami attached; two rare skulls of immature males exhibiting a rudimentary "spike-horn" stage; eight skulls of hornless females, three with rami attached, and one of these with associated limb elements, and three skulls of immature females, one with ramus. F. W. Johnson accounts for the beautiful preservation of these specimens through the same having been buried in a layer of fine and largely unconsolidated sand. The remains are definitely smaller than those from Nenzel. The shape of the horns varies much after the manner of the series from other localities between (a) the tall-slender-compressed and (b) the shorter-branching shapes. Interestingly enough, in the present case the horn-cores of the less aged skulls are burrless, the more aged, burred. Four specimens (see three skulls and one detached muzzle) are particularly interesting in confirming the toothless character of the pre-maxilla, previously shown only in a female from Valentine Quarry A. In several of the crania the C/ alveolus is preserved and in at least two specimens Cs/, of moderate size, are retained. The series illustrates the extreme slenderness of the muzzle and nasals, the peculiar maxillary groove of aged specimens, the lacrimal vacuities, the bullæ, the sutures, the occipital crest, the depression of the inion (strongest in aged specimens), the proportions of the limbs, etc. The condition of the /Is and incisor-formed /C is the same as shown in specimens from Valentine Quarry A and from New Mexico. The dentitions, as seen in the skull specimens and in the large collection of detached mandibular rami, tend to fall within Size Groups III–IV (and ?V), there occurring a moderate difference in the dimensions of teeth and the length of the diastemata, as elsewhere noted. Views of five of the crania are given on Figures 28B, 28C. The material includes:
TYPE.—Complete skull, premaxillae, C/ alveoli and mandible. (Forks short.) ........................................ N.S.M. (w) 2-3-8-34

Figs. 28B, C

B.L........................................ = 163 mm.
p1-m1........................................ = 47
p2-m2........................................ = 45.6
Superior orbit to crotch of horn ..................... = 57

REFERRED.—

17 (and type) skulls, or partial skulls, of mature males with teeth and horns, including
7 with rami, 4 with premaxillae preserved and 3 showing Cs/:

13 (including type) specimens m++ to w++ with (a) shafts tall, slender and forks
tending short:

3 (including type) with burrless horns:

(Type skull—see above)........................................ N.S.M. (w) 2-3-8-34

Figs. 28B, C

Skull, lacking premaxillæ, and mandible. (Poster-
terior tine of right horn fractured ?during life.) ..... (m++) 3-3-8-34

Skull with premaxillæ (nasals broken), and man-
dible........................................ (m++) 1-27-7-34

1, horns tallest, with moderate fork (near Valentine
Quarry B, N.S.M.20-8-7-33):

Crushed skull, anterior premaxillæ missing........... 2-15-8-34

4 (aged) with burred horns and shorter forks:

Skull with nasals, premaxillæ missing. (Anterior
forks worn.)........................................ (w+) 1-21-8-34

Figs. 2A, 28C

Elongate skull with left premaxilla, Cs/, left max-
illa and ramus........................................ (w++) 1-23-7-34

Figs. 2, 28B, C

Cranial saddle with horns, palate and mandible... (w++) 8-7-9-34

Skull lacking premaxillæ................................. (w) 1-15-8-35

3 with burred horns and slightly longer forks:

Crushed skull with right horn and base of left, and
right maxilla, premaxillæ missing. (Shaft short, 43.5 mm.) ........................................ (w+) 18-17-9-34

Skull with horns, premaxillæ missing................ (w) 1-15-8-34

Top of skull with right horn............................. 16-17-9-34
2 poorly preserved skulls with burrless horns, 1 with the shortest forks:

Crushed skull with partial horns, nasals, left C/, (premaxillae missing), right and partial left ramus. N.S.M. (w+) 4-3-8-34

Crushed skull with horns and mandible. (Shortest forks of Crookston series, tips measuring 41 and 31 mm.) (w) 7-7-9-34

5 skulls (and 1 horn) w to w+++ of (b) "warreni" shape, shafts tending heavier and with longer tines:

4 with moderately long shafts:

Skull with burrless horns, premaxillae (crushed) showing left C/. (w) 3-5-9-35

Skull with burred horns, premaxillae missing. (Longest forks, 89 mm.) (w++) 2-5-9-35

Partial skull with burred horns and right maxilla... (w++) 9A-15-8-35

Skull with burrless horns and nasals, premaxillae missing. (w) 3-9-8-34

Detached burred horn, large.................. 3-21-8-34

1 with shortest shaft:

Skull with burred horns and nasals, premaxillae missing. (Shortest shaft, 42 mm.) (w) 4-9-8-34

8 partial skulls of hornless females, 3 with associated rami (1 with partial limb elements):

Complete skull and mandible with premaxillae, Cs/ and p^*-m^*, /Is-/Cs and p3-m3. (Large sized.) (m+) 2-15-3-35

Skull, premaxillae missing. (w) 6-5-9-35

Skull and mandible. (w+) 2-9-8-34

Skull, ramus and etc. limb elements. (m++) 1-3-8-34

Skull. (w+) 7-3-8-34

Posterior half of cranium. 2-21-8-34

Skull with p^*-m^*. (m) 1-17-6-32

Skull with p^*-m^*. (w) 26-17-6-32
3 immature hornless partial skulls with dp³–dp⁴ and m¹–m²: N.S.M.

Skull ........................................... 3-7-9-34

Skull and proximal two-thirds metacarpus .............. 5-9-8-34

Skull and atlas ................................ 6-7-9-34

4 immature skulls with indication of slight supra-orbital protuberance, dp³–dp⁴ and m¹–m², premaxillae missing (1 with ramus and limb elements):

Skull, and ramus with symphysis, /I(rupting) and dp²–m₂; right ulno-radius and metacarpus with distal epiphysis missing ........................................ 10-15-8-35

3 skulls, premaxillae missing ........................................ 4-5-9-35, 5-5-9-35, 7-15-8-35

3 immature and rudimentarily horned partial skulls with dp³–dp⁴ and m¹–m²:

Skull with horn nubs, and ? femur .................. Fig. 28B 4-7-9-34

Skull with horn nubs .................. Fig. 28B 1-19-9-34

Skull with left rudimentary horn base .......... (−m) 9-7-9-34

5 specimens with burrless horns:

Maxilla and horns ........................................... (w) 6-3-8-34

Three horn-cores ........................................... 12-7-9-34, 14-17-6-32, 7-27-7-34

Nearly complete skull with fine premaxillae-maxilla, etc., and horns ........................................... (w) 5-3-8-34

6 specimens with burred horns:

Top of cranium with horns ................................... 3-27-7-34

Two maxillae with horns .................................. (w+) 10-7-9-34

Horns (fragmental) ........................................... 11-7-9-34

Partial skull and horns ........................................... 2-7-9-34

Fragmental palate with muzzle, and partial palate ... (w) 2-27-7-34, 5-7-9-34

The following specimens were received too late to be included in this paper: 6 partial skulls with horns, 5 horns, 5 partial skulls of hornless females and 2 immature skulls of hornless females.

(See referred rami, Dentition Section III, page 423; and limbs, Limb Section VI, page 464.)
(4a') Variation

From Valentine Quarries "A" and "B," Cherry County, Nebraska

The University of Nebraska Quarries and other exposures in the vicinity of Valentine have produced several fine crania and numerous rami of Size Groups iii* and iv (Subgroups 1–3). There seems to be little reason for separating the average of these horns and rami from the remains from the Crookston horizon. The main beam of the horns varies from short [as in *M. warreni* type, fine skulls from Snake River (N.S.M. 1-23-7-34), and Fairfield Creek (F:A.M.31276)] to quite tall (N.S.M. 20-8-7-33). The material includes:

Two male and one female skulls:
- Skull with p³–m³ and burrless horns, largely complete except for the muzzle. (A)
  - N.S.M.20-8-7-33 From Railway loc. "B" quarry, on same level as loc. "A" but on west side of tracks and north of ravine. This paper, Figs. 28, 28A.
- Posterior cranium with left horn base and burr, no teeth. N.S.M.7-8-16
- Skull, ♀, with p³–m³ and muzzle, posterior cranium missing. (M+)
  - N.S.M.16-16-6-33 This paper, Fig. 28A.

Sixteen horn-cores of moderate to smaller size:
- Six with burrs. N.S.M.5-22-8-30, 5-28-7-30, 11-23-8-30, 23-22-7-31, 21-22-7-31, 15-11-8-30
- Three without burrs. N.S.M.6-17-6-32, 22-22-7-31, 5-7-8-30
- Seven partial horn-cores. N.S.M.3-28-7-30, 50- and 51-12-7-30, 2-15-7-31, 9-1-9-31

(See referred rami and maxillae, Dentition Section III, page 426; and limbs, Limb Section IV, page 466.)

(4a*) Variation

From Fairfield Creek, 45 feet above Brule, Brown County, Nebraska

Horns are taller than *M. warreni* type

**Example.**—Pair of horns, and associated limb fragments and ramus. F:A.M.31276 1930. This paper, Fig. 39.

(See Dentition Section III, page 423; and Limb Section IV, page 466.)

Frick, Horned Ruminants. II—Antilocapridæ

(4b) Meryceros warreni, Var.
From Dawes County, Nebraska

Example.—Right horn-core F:B:A.M.31393 From Quarry E, 1935.
with anterior fork missing.
(Not included in specimen count.)

(5) Meryceros warreni, Var. or Subspecies
From Pawnee Creek, Colorado

(Only very slightly larger than the smallest New Mexican, F:A.M.31491.)

Example.—Both horns. F:A.M.31319 From east of camp, 1931.
This paper, Fig. 39.
Right horn. F:A.M.31295 From Horse Quarry, 1933.
Horn. F:A.M.31295A From east of camp, 1931.

(6) Meryceros joraki, new species
From Barstow, California

Merycodus necatus LEIDY, FURLONG, 1927, ibid., XVII, p. 147, Pls. xxiv, xxv.

Merycodontine horns are rare in the Barstow deposits. Until recently, Meryceros has been but sparsely represented. Eustace L. Furlong (1927) describes and figures a cranium with characteristic horns (and mandible and fore and hind limb bones—U.C.26781) under Merycodus necatus. John C. Merriam (1919) figures from Barstow, under Merycodus species, a posterior cranium with horn-core bases, and, under Merycodus necatus? Leidy, other horn-cores [also several partial rami and detached teeth (Figs. 126–131)]. All of these specimens seem to fall within the moderate-shafted, compressed and wedge-shaped horn-core section of the present report. Since the preceding pages were sent to the press, we have received a collection of partial crania with horns, detached horns and partial upper and lower dentitions from two new localities in the upper layers of the First Division (Leader and Hidden Quarries). The horns exhibit about the same size range as previously
known specimens. The posterior tines are notably abbreviated relative to the anterior tines. A single specimen (F:A.M.32810) has the two tines separately burred, much as in the considerably smaller *Submeryceros crucianus* [see (8) below]. The specimen is interpreted doubtfully as a young individual of the general Leader Quarry series—see Figure 35 of the latter, compared to intermediate-sized and heavily burred F:A.M.32822, and unusually large and lightly burred F:A.M.32811 (Fig. 35A) from the same locality. Cranium F:A.M.31850 is provided with unusually large-sized molars (Size Group II). The horns, or more correctly horn-cores, are listed below.

**Type.**—Major portion of cranium with cheek teeth and right horn. (w)

(See Dentition Section III, page 439.)

**Referred.**—

**LARGE INDIVIDUALS**

- Right horn with fragment of burr. F:A.M.31156 From Hemicyon Stratum, 1926.
- Broken horn. F:A.M.31155 From Hemicyon Stratum, 1926.

**MORE MODERATE-SIZED**

- Right horn (burless) on cranial fragment, and ?associated distal end of humerus. F:A.M.31158 From an indefinite horizon, 1926.
- Left horn, with burr. F:A.M.31157 From Valley View, 1933.

**MODERATE-SIZED**

- (Type—see above.) F:A.M.31163 Hemicyon Stratum, 1926. This paper, Figs. 28, 28A.
- Partial left horn. F:A.M.31164 From North End, 1930. This paper, Fig. 39.
- Horn, burr showing. F:A.M.31168 From White Layer, \( \frac{1}{2} \) mi. above cabin, 1926.
Right horn and possibly associated ramal fragment. 

(Dark-colored.) The shaft is short with heavy burr and fork points wide spreading. (See Dentition Section III, page 442.)


IMMATURE (SMALL-DIMINUTIVE)

Left horn, without burr. F:A.M.31161 Hemicyon Stratum, 1926.

ADDITIONAL SPECIMENS SECURED BY JACK WILSON PARTY OF 1934–35.—

Thirty-three horn-cores from Leader Quarry:

Large: F:A.M.
Left crushed horn on cranial fragment, with burr........ Fig. 35A 32811
Right horn-core.............................................. 32812
Posterior portion of cranium with both horn-cores (br.) with burrs. 32813
Two horn-cores, one with burr................................ 32814,A
Two pairs of broken horn-cores................................. 32815,A
Pair of horn-cores on partial cranium, with burrs............. 32816
Partial horn-core with very heavy burr......................... 32817
Two partial horn-cores, second with burr...................... 32817A,B
Horn-core on cranial fragment, without burr................... 32818
Pair of horn-cores on cranial fragment, with burr.............. 32819

Thirteen horn-cores of more moderate size:
Three horn-cores with burrs.................................. 32820,A,D
Three horn-cores, without burr................................ 32820B,C,F
Pair of horn-cores with burrs................................ 32820E
Six horn-cores, two with burrs................................ 32820G–L

Sub-moderate-sized:
Three horn-cores with burrs................................... 32821,A,B

Variations of form exampled by:
Peculiar horn-core with short base and extremely developed burr........... Fig. 35A 32822
Three horn-cores with tips less divergent, two with burrs............. 32823,A,B
Left horn-core with separately burred tines—size small. Fig. 35 32810

Three from Hidden Hollow Quarry:
Posterior two-thirds portion of cranium with both horn-cores with burrs, and m1–m4. 31850
Posterior portion of cranium with more slender horn-cores with burrs. 31851
Partial horn-core with burr.................................... 31852

(See referred rami and maxilla, Dentition Section III, pages 438–441, 443; and questionably referred limbs, Limb Section IV, page 466.)
(7) **Meryceros hookwayi** (Furlong)

From the Vicinity of Tonopah, Nevada


**Type.**—Right p$_2$–m$_3$ (m$_1$ represented by roots).

C.I.T.1257 Figured by Furlong, 1935, Pl. v, Figs. 3, a–b.

**Referred and Figured by Furlong.**—

Frontlet with burred horn-cores. C.I.T.1240 Pl. v, Figs. 1 and 1a.

(See Dentition Section III, page 445.)

---

III A. **Submeryceros, new subgenus**

(8) **M. (Submeryceros) crucianus**, new subgenus and species

From Santa Cruz, New Mexico


The specimen figured by Cope (Pl. lxxxii, Fig. 4) under *D. necatus*, while slightly larger, in the presence of a separate burr on the base of each prong of the fork, closely resembles our specimens. [A maxilla of the same individual is figured by Cope (Pl. lxxxii, Fig. 3) and an m$_3$ (Fig. 4)].

Separate burr at base of each prong

**Subgenotype.**—Left horn. F:A.M.31495 This paper, Fig. 35.

**Referred.**—

Left horn. F:A.M.31496 This paper, Fig. 35.

Right horn on cranial fragment. F:A.M.31497 This paper, Fig. 35.

Horn. F:A.M.31498

To the subgenus are questionably allotted a number of Size Group
vi–vii partial mandibular rami which have been placed (see Dentition Section III, pages 403, 433, 407, 404) in four species and subspecies:

(9) (?) *S. minor*, n.sp., from New Mexico.
(9a) (?) *S. minor serpentinus*, n.subsp., from Snake Creek, Nebraska.
(9b) (?) *S. minor pawsiensis*, n.subsp., from Pawnee Creek, Colorado.
(10) (?) *S. minimus*, n.sp., from New Mexico.

Fig. 40A. Method of filing the fossil data, exemplified by three plaster plaques holding Sioux County, Nebraska, *Paracosoryx* and Barstow, California, *Merriamoceros* specimens.
SECTION III.—MERYCodontini Dentitions and Mandibular Rami

Figures 41–47A and (in part) 28B, 35A, 37, 37A, 38; Maxillary Dentitions (in part) 26, 28A–C, 37, 37A, 40

Statement (See Merycodontini Discussion)

One thousand and ninety-five here listed and some two thousand one hundred and eleven unlisted and more or less fragmentary Merycodontini mandibular or maxillary dentitions have been available for study. The near Antilocaprine form of the Merycodontine dentition has been remarked in the preceding discussion, Section I, page 313. At this point there were briefly discussed: variations in size, in elongation of the post-/C diastema, interproportions of premolars and molars and height of tooth crowns; also the imperfect condition of many important specimens, the tooth changes that occur with wear and the several perplexing questions as to named species (including the genotypic *M. necatus* Leidy) where the types have been rami unassociated with horns.

The unusual wealth of evidence immediately suggests an alluring field for investigation of the degree to which distinct but closely allied forms (having an indeterminate range of individual variation and percentage of abnormality) may be recognized on mandibular and dental characters alone. The apparent insufficiency of this unusually complete evidence calls attention to the danger of attempting to decipher too minutely the relatively meager evidence alone available in the case of the great majority of extinct mammalian groups. Leidy little suspected the ramifications of the Merycodontini when in 1854 he described, on the basis of the then available mandibular fragments, "*Merycodus necatus* ... a small ruminant allied to the Musks." The detailed lists (pp. 391–445) illustrate the relative abundance of remains of Size Groups III and IV, and at the same time the rarity of Size Groups V to VII. As observed above, since it is impossible as yet definitely to characterize the dentitions or limbs of the three groups based on the horns—*Ramoceros*, *Cosoryx* and *Meryceros*—there continues to be a lack of definiteness of reference, in the case of many of the detached ramal and maxillary dentitions and limb elements, to species based on the horns. The frequency of occurrence of the horns of several genera and subgenera in certain localities is presumptive of the probability of the same genera being propor-
tionately well represented in the dentitions. The measurements and percentages in the case of representative mandibles are given in the seven-paged table and a considerable number of such examples are comparatively illustrated [Figs. 41–47A and (in part) 28B, 35A, 37, 37A, 38]. The available mandibles and dentitions, for present and future ease of reference, are considered according to area of occurrence. Cosoryx and Meryceros are best seen in the very remarkably preserved mandibles from several Nebraska localities, and the respective characters of these genera are discussed in some detail in connection with associated remains from the Midway and Crookston Quarries. Subcosoryx is illustrated in a fine series from New Mexico. Ramoceros, so well represented in the horns from New Mexico, is but doubtfully identified among the mandibular rami from the same area. The amassed data in regard to the dentitions, according to the above-explained plan of the report, are recorded under the six major geographical divisions:

(1) NEW MEXICO—including Ramoceros, Paramoceros, Cosoryx, Subcosoryx, Meryceros and Submeryceros, pages 391–405.

(2) COLORADO—including Ramoceros, Cosoryx, [Meryceros] and Submeryceros, pages 406–407.

(3A) SOUTH DAKOTA, (3B) KANSAS AND (3C) MONTANA—with Paramoceros and Cosoryx, pages 408–409, 410, 411.

(4) NEBRASKA—
Brown and Cherry Counties, including Paramoceros, Cosoryx and Meryceros, pages 412–427, and
Sioux, Dawes and Hitchcock Counties, with Ramoceros, Cosoryx, Paracosoryx, Subparacosoryx and Submeryceros, pages 428–434.

(5) CALIFORNIA—
Barstow, including Paracosoryx, Merriamoceros and Meryceros, pages 435–443, and
Ricardo, with Paracosoryx, page 444.

(6) NEVADA AND OREGON—Paracosoryx and Meryceros, rare, page 445.

The adjacent series of comparative figures present certain of the more typical mandibular rami arranged according to area. These figures are followed by seven pages of measurements and percentages of outstanding examples (Table VIII).
Fig. 41. Examples of Merycodontini mandibular dentitions from the Late Tertiary of New Mexico, lateral views (and one occlusal) compared.

× 1. (See legend, page 377.)
Fig. 42. Examples of Merycodontini mandibular dentitions from the Late Tertiary of New Mexico, lateral views (and two occlusal) compared. × 1. (See legend, page 377.)
Fig. 43. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Colorado (F.A.M.31643, 31635, 31636 and A.M.9476), South Dakota (A.N.S.P.11362 and 11417) and Kansas (F.A.M.31515 and 31511), lateral views compared.

× 1. (See legend, next page.)
Figs. 41 and 42. Examples of Merycodontini mandibular dentitions from the Late Tertiary of New Mexico, lateral views (and three occlusal) compared.

× 1. PS, posterior border symphysis.

Fig. 41. F:A.M.30991, (?) Submeryceros minimus, n.sp., type, rev., from Cuyamungue. (See Size Group VII, page 404.)

F:A.M.30985, ref., rev., and 30988, type, of (?) Submeryceros minor, n.sp., from Cuyamungue and Tesuque, respectively. (See Size Group VI, page 403.)


F:A.M.30964, 30976 and 30944, Ramoceros, Cosoryx or Meryceros species, from Santa Cruz, San Ildefonso and Pojuaque Bluffs. (See Size Groups IV and III, pages 402, 401.)

Fig. 42. F:A.M.31996 and 32978, C. (Subcosoryx) cerroensis, n.subg. and sp., ref. and subgenotype, from Round Mountain Quarry. (See also Fig. 38 [F:A.M.31996] and Size Groups III, V, pages 393, 392.)

F:A.M.30992 (rev.), 30961, 30924, 30925 (rev.) and 30915 (rev.), Ramoceros, Cosoryx or Meryceros species, from Skull Ridge (30992), Santa Clara (30924) and Santa Cruz.

(See Size Groups II, IIA and II, pages 400, 398, 397.)

Fig. 43. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Colorado, South Dakota and Kansas, lateral views compared.

× 1. PS, posterior border symphysis.

F:A.M.31643, (?) Submeryceros minor pawniensis, n.subsp., type, from Pawnee Creek, Colorado. (See Size Group VI, page 407.)

A.M.9476, Ramoceros osborni (Matthew), genotype (in part), rev., and F:A.M. 31635 and 31636, rev., from Pawnee Creek, Colorado. (See also Figs. 28, 28A [cranium of A.M.9476] and Size Group III, page 406.)

A.N.S.P.11362 and 11417, Cosoryx furcatus, var. or subsp., rev., from Little White River and Sweetwater, South Dakota, respectively. (See Size Group III, page 408.)

F:A.M.31515, Cosoryx furcatus, var., rev., from Republican River Beds, Kansas. (See Size Group III, page 410.)

F:A.M.31511, Cosoryx furcatus sternbergi, n.subsp., type (in part), from Kansas. (See also Figs. 28, 28A, 36, 36A [cranium and horns] and Size Group III, page 410.)
Fig. 44. Submeryceros, n.subg. (F.A.M.31577), Paracosoryx, n.subg. (A.M.14109, 14110, 22065 and 20530) and Meryceros, n.g. (F.A.M.31902), examples of mandibular dentitions from the Late Tertiary of Nebraska, lateral (and three occlusal) views compared.

X 1. (See legend, page 382.)
Fig. 45. Cosoryx Leidy, (?)Meryceros, n.g. (F:A.M.31542) and (?)Plioceros, n.g., ref. (F:A.M.31190 and 31543), examples of mandibular dentitions from the Late Tertiary of Nebraska (and South Dakota [A.M.9825]), lateral (and two occlusal) views compared.

× 1. (See legend, page 382.)
Fig. 46. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Barstow, California, lateral views compared. × 1. (See legend, page 383.)
FIG. 47. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Barstow and Ricardo (F: A.M. 31859), California, lateral views compared. X 1. (See legend, page 383.)
FIGS. 44 AND 45. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Nebraska (and South Dakota [A.M.9825]), lateral (and five occlusal) views compared.

X 1. PS, posterior border symphysis.

FIG. 44. F:A.M.31577, (?)Submeryceros minor serpentinus, n.subsp., type, rev., from East Sinclair Draw, Sioux County, Nebraska.
(See Size Group VI, page 433.)
A.M.14109, Paracosoryx sabulonis (Matthew and Cook), type, rev., from Sioux County, Nebraska.
(See Size Group IVB, pages 353, 431.)
A.M.14110, 22065 and 20530, Paracosoryx sabulonis (Matthew and Cook), or P. savaronts, n.sp., ref., rev., from Sioux County, Nebraska.
(See Size Groups III-IV, Vars. A, B and A, respectively, pages 430, 431.)
F:A.M.31902, Meryceros nenzelensis, n.sp., ref., rev., from Nenzel, Cherry County, Nebraska.
(See Size Group II, page 421.)

FIG. 45. F:A.M.31274, (?)Cosoryx furcatus Leidy, ref., from Moore Creek, Brown County, Nebraska.
(See Size Group III, page 419.)
F:A.M.31542, (?)Meryceros var., rev., from above Devil's Gulch, Brown County, Nebraska.
(See Size Group III, page 422.)
A.M.9825, Cosoryx furcatus, var. or subsp., rev., from Little White River, South Dakota.
(See Size Group III, page 408.)
F:A.M.31543, Plioceros floblairi, n.sp., ref., from J. Wilson Ranch, Brown County, Nebraska.
(See Size Group III, page 496.)
P.U.12117, Cosoryx furcatus Leidy, large var., from Sioux County, Nebraska.
(See Size Group IIIA, page 429.)
M.C.Z.10101, Cosoryx furcatus Leidy, ref. Scott, large var., from Garman Loup Fork Collection, Nebraska.
(See Size Group IIIa, pages 418, 429.)
F:A.M.31190, Plioceros floblairi, n.sp., ref., from Fairfield Falls Quarry, Brown County, Nebraska.
(See Size Group III, page 496.)
Figs. 46 and 47. Examples of Merycodontini mandibular dentitions from the Late Tertiary of Barstow and Ricardo (F:A.M.31859), California, lateral views compared.

× 1. PS, posterior border symphysis.

Fig. 46. *Meryceros joraki*, n.sp., ref.
F:A.M.31095, from Third Division.
(See Size Group V, page 443.)
F:A.M.31083 (m1 rev.), from Fourth Division.
(See Size Group IVD, page 442.)
F:A.M.31081, rev., from Third Division.
(See Size Group IVC, page 442.)
(See Size Group IVB, page 442.)
F:A.M.31090, rev., from Valley View Quarry.
(See Size Group IVA, page 441.)
F:A.M.31032 (rev.) and 31036, from North End.
(See Size Groups IV and IIIC, page 439.)
F:A.M.31056, var., rev., from the Green Hills.
(See Size Group IIIF, page 441.)

Fig. 47. F:A.M.31057 (rev.) and 31055, *Meryceros joraki*, var., from Green Hills.
(See Size Group IIIF, page 441.)
(See Size Group IIIB, page 438.)
(See Size Group IIIA, page 437.)
(See Size Group IIID, page 439.)
(See Size Group III, page 444.)
<table>
<thead>
<tr>
<th>Table VIII</th>
<th>Merycodontinae Manibles</th>
<th>Comparative Measurements and Ratios</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locality</td>
<td>Size Group</td>
<td>Page</td>
<td>Collection No.</td>
</tr>
<tr>
<td>Ramoceros, Cosoryx or Meryceros species</td>
<td>105</td>
<td>297</td>
<td>30915</td>
</tr>
<tr>
<td>St. Cruz</td>
<td>A</td>
<td>19.5</td>
<td>30.</td>
</tr>
<tr>
<td>St. Clara</td>
<td>30924</td>
<td>30.</td>
<td>17.</td>
</tr>
<tr>
<td>St. Cruz</td>
<td>M+</td>
<td>16.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Nebraska</td>
<td>421</td>
<td>31902</td>
<td>30961</td>
</tr>
<tr>
<td>Meryceros nenzenenis, ref.</td>
<td>Cherry Co., Nenzel</td>
<td>Kansas</td>
<td>II</td>
</tr>
<tr>
<td>R. (Paramoceros) kansasus, ref.</td>
<td>Kansas</td>
<td>New Mexico</td>
<td>105</td>
</tr>
<tr>
<td>Poquita Bluffs</td>
<td>M+</td>
<td>(16.)</td>
<td>(57)</td>
</tr>
<tr>
<td>Ramoceros, Cosoryx or Meryceros species</td>
<td>Skull Ridge</td>
<td>28.</td>
<td>15.4</td>
</tr>
<tr>
<td>(No sign of P$_3$)</td>
<td>30796</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Taxi</td>
<td>Service Area</td>
<td>Location</td>
<td>Days</td>
</tr>
<tr>
<td>------</td>
<td>--------------------</td>
<td>----------------</td>
<td>------</td>
</tr>
<tr>
<td>A</td>
<td>Pittsburgh</td>
<td>Allegheny</td>
<td>7</td>
</tr>
<tr>
<td>B</td>
<td>Cleveland</td>
<td>Cuyahoga</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>Chicago</td>
<td>Cook</td>
<td>6</td>
</tr>
</tbody>
</table>

(Continued on next page)
<table>
<thead>
<tr>
<th>Locality</th>
<th>Size</th>
<th>Group</th>
<th>Page</th>
<th>Collection No.</th>
<th>Tooth Wear</th>
<th>( m_3 ) PS d.</th>
<th>( Pr-P_4 ) ( m_1-m_3 )</th>
<th>( P_3 ) ( P_4 )</th>
<th>( P_3 ) ( m_3 )</th>
<th>( P_4 ) ( m_4 )</th>
<th>( P_3 ) ( P_4 )</th>
<th>( P_3 ) ( m_3 )</th>
<th>( P_4 ) ( m_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>C. (Paracosoryx) wilsoni</em>, ref.</td>
<td>III</td>
<td>430</td>
<td>F:AM.</td>
<td>32007</td>
<td>M</td>
<td>14.5</td>
<td>20. = 57%</td>
<td>5. = 63%</td>
<td>34%</td>
<td>7. = 88%</td>
<td>48%</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>429</td>
<td>&quot;</td>
<td>32005</td>
<td>M</td>
<td>14. = 78</td>
<td>18. = 53</td>
<td>4.4 = 58</td>
<td>31</td>
<td>6.3 = 83</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. (P.) sabulonis</em> or <em>C. (S.) savaronis</em>, ref., A var.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>431</td>
<td>20530</td>
<td>14. = 82</td>
<td>32.5 = (54)</td>
<td>7.5</td>
<td>39</td>
<td>6.3</td>
<td>45</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>432</td>
<td>22740 A</td>
<td>14.5 = 80</td>
<td>(19) = (58)</td>
<td>8.5</td>
<td>39</td>
<td>7.5</td>
<td>93</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td><em>C. (P.) alticornis</em>, ref.</td>
<td>III</td>
<td>437</td>
<td>F:AM.</td>
<td>31040 M+</td>
<td>16.5</td>
<td>24. = 69</td>
<td>(17) = (48)</td>
<td>7.3</td>
<td>5.8</td>
<td>3.8</td>
<td>38</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>438</td>
<td>31041</td>
<td>14. = (64)</td>
<td>(33.5) = (51)</td>
<td>7.2</td>
<td>31</td>
<td>7.2</td>
<td>(36) 47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>439</td>
<td>31043 M+</td>
<td>14.3</td>
<td>17. = 52</td>
<td>4.5 = 64</td>
<td>31</td>
<td>6.</td>
<td>86</td>
<td>42 47</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>440</td>
<td>31054 M+</td>
<td>14.5 = (56)</td>
<td>32. = (62)</td>
<td>7.4</td>
<td>34</td>
<td>6.</td>
<td>92</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>451</td>
<td>31054 M+</td>
<td>13.9</td>
<td>19.2 = 60</td>
<td>5.2 = 65</td>
<td>37</td>
<td>6.4</td>
<td>80</td>
<td>46 47</td>
<td></td>
</tr>
<tr>
<td><em>Meryceros joraki</em>, ref.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Table VIII—Continued**
<table>
<thead>
<tr>
<th>F.A.M.</th>
<th>31073</th>
<th>31032</th>
<th>31036</th>
<th>31049</th>
<th>31027</th>
<th>31055</th>
<th>31057</th>
<th>31019</th>
<th>31020</th>
<th>427</th>
<th>423</th>
<th>424</th>
<th>428</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.2</td>
<td>497</td>
<td>30.5</td>
<td>60.6</td>
<td>63.5</td>
<td>62.2</td>
<td>61.7</td>
<td>65.3</td>
<td>66.7</td>
<td>67.6</td>
<td>66.2</td>
<td>66.3</td>
<td>65.6</td>
<td>65.4</td>
</tr>
<tr>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>(15.5)</td>
<td>(17.5)</td>
<td>(17.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
<td>(16.)</td>
</tr>
<tr>
<td>30.5</td>
<td>60.6</td>
<td>63.5</td>
<td>62.2</td>
<td>61.7</td>
<td>65.3</td>
<td>66.7</td>
<td>67.6</td>
<td>66.2</td>
<td>66.3</td>
<td>65.6</td>
<td>66.3</td>
<td>65.6</td>
<td>65.4</td>
</tr>
<tr>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
</tbody>
</table>

(Continued on next page)
<table>
<thead>
<tr>
<th>Localities</th>
<th>Size</th>
<th>Group</th>
<th>Page</th>
<th>Collection No.</th>
<th>Tooth Wear</th>
<th>( m_1 ) PS d.</th>
<th>( p_{r-p_1} ) ( m_1-m_2 )</th>
<th>p_2 ( p_4 )</th>
<th>P_4 ( m_3 )</th>
<th>P_2 ( m_4 )</th>
<th>See Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Merycers w. johnsoni</em>, var...</td>
<td>IV</td>
<td>N.S.M.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nebraska</td>
<td></td>
<td></td>
<td>426</td>
<td>20-11-8</td>
<td>M+</td>
<td>13.3</td>
<td>( \frac{17.8}{25.5} = 52% )</td>
<td>5.</td>
<td>6.</td>
<td>86%</td>
<td>45%</td>
</tr>
<tr>
<td>Cherry Co., Valentine A Q.</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.8</td>
<td>30. = 59%</td>
<td>6.</td>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>1C-15-7</td>
<td>31</td>
<td>M</td>
<td>13.2</td>
<td>18.2 = 61</td>
<td>5.3</td>
<td>0.6</td>
<td>76</td>
<td>7.</td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>3-21-7-30</td>
<td>30</td>
<td>M+</td>
<td>13.2</td>
<td>15.5 = 53</td>
<td>4.5</td>
<td>5.4</td>
<td>90</td>
<td>42</td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>427</td>
<td>6-23-8-30</td>
<td>M+</td>
<td>14.1</td>
<td>15. = 49</td>
<td>4.3</td>
<td>5.5</td>
<td>87</td>
<td>39</td>
</tr>
<tr>
<td><em>Ramoceros</em>, <em>Cosoryx</em> or <em>Merycers</em></td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>402 -F-A-M</td>
<td>13.5 = 52</td>
<td>12.</td>
<td>4.1</td>
<td>78</td>
<td>33,41</td>
</tr>
<tr>
<td>species...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26. = 57</td>
<td>30. = 74</td>
<td>6.8</td>
<td>4.4</td>
<td>68</td>
<td>39</td>
</tr>
<tr>
<td>New Mexico</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.2</td>
<td>30. = 74</td>
<td>6.8</td>
<td>4.4</td>
<td>68</td>
<td>39</td>
</tr>
<tr>
<td>St. Cruz</td>
<td></td>
<td>&quot;</td>
<td>393</td>
<td>31996</td>
<td>W</td>
<td>12. = 44</td>
<td>6.5 = 74</td>
<td>5.4</td>
<td>6.8</td>
<td>88</td>
<td>42</td>
</tr>
<tr>
<td><em>C. (Subcosoryx) ceroensis</em>, ref...</td>
<td>III</td>
<td></td>
<td>32921</td>
<td>w</td>
<td>&quot;</td>
<td>15.5 = 52</td>
<td>34. = 42</td>
<td>6.2</td>
<td>5.5</td>
<td>81</td>
<td>38</td>
</tr>
<tr>
<td>Round Mt.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>32943</td>
<td>&quot;</td>
<td>M</td>
<td>13. = 48</td>
<td>15. = 48</td>
<td>3.9</td>
<td>6.5</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>&quot;</td>
<td>IV</td>
<td>&quot;</td>
<td></td>
<td></td>
<td>&quot;</td>
<td>14.9</td>
<td>18.5 = 56</td>
<td>5.</td>
<td>6.5</td>
<td>90</td>
<td>44</td>
</tr>
<tr>
<td>Nebraska</td>
<td>&quot;</td>
<td>&quot;</td>
<td>415</td>
<td>32354</td>
<td>W</td>
<td>14.9</td>
<td>33. = 72</td>
<td>5.7</td>
<td>6.5</td>
<td>88</td>
<td>40</td>
</tr>
<tr>
<td><em>Cosoryx furcatus</em>, ref...</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>14.9</td>
<td>((16.)) = 56</td>
<td>6.5</td>
<td>6.5</td>
<td>88</td>
<td>40</td>
</tr>
<tr>
<td>Cherry Co., Midway Q.</td>
<td></td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>14.2 = 59</td>
<td>(48) = 59</td>
<td>6.5</td>
<td>6.5</td>
<td>88</td>
<td>40</td>
</tr>
</tbody>
</table>

388
<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>F.A.M.</th>
<th>M</th>
<th>M+</th>
<th>Number of</th>
<th>Fertile</th>
<th>Males</th>
<th>MALE</th>
<th>MALE</th>
<th>MALE</th>
<th>MALE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cosorzyx furcatus</em>, ref</td>
<td>Nebraska, Cherry Co., Midway Q.</td>
<td>IV 415 32362</td>
<td>M+</td>
<td>14. 24.5 = 57</td>
<td>15.3 33. = 46</td>
<td>4. 6.4 = 63</td>
<td>29</td>
<td>5.5 6.4 = 86</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. (Paracosorzyx) sabulonis or C. (S.) savaronis</em>, ref., A var...</td>
<td>Gordon Creek</td>
<td>III 416 32071</td>
<td>M</td>
<td>14.3 22.5 = 64</td>
<td>(35.) 18.7 = (53)</td>
<td>5.4 7.7 = 70</td>
<td>38</td>
<td>6.4 7.7 = 83</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. (P.) sabulonis</em>, type, B var...</td>
<td>Sioux Co.</td>
<td>IV 430 A.M. 26885</td>
<td>W</td>
<td>13.2 23. = 57</td>
<td>17.5 29.5 = 59</td>
<td>5. 7. = 71</td>
<td>38</td>
<td>6.4 7. = 91</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ramoceros, Cosorzyx or Meryceros</em> species</td>
<td>New Mexico, St. Cruz</td>
<td>&quot; 403 F.A.M. A 30977</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Meryceros joraki</em>, tent. ref</td>
<td>California Barstow</td>
<td>&quot; 441 31090</td>
<td>M</td>
<td>13.5 30.5 = 59</td>
<td>(18.) 18. = 79</td>
<td>6.8 7. = 91</td>
<td>46</td>
<td>6.8 7. = 96</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot; 442 31079</td>
<td>M+</td>
<td>14. 23. = 61</td>
<td>18. 30.5 = 59</td>
<td>5.5 7. = 79</td>
<td>39</td>
<td>6.4 7. = 91</td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot; 31096</td>
<td>M</td>
<td>11.5 28.5 = (63)</td>
<td>(18.) 28.5 = (63)</td>
<td>6.8 6.8 = 96</td>
<td>57</td>
<td>6.8 6.8 = 96</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot; 31080</td>
<td>W+</td>
<td>14.5 31. = (52)</td>
<td>(16.) 28.5 = (52)</td>
<td>7. 7. = 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. (Subcosorzyx) cerreoensis</em>, subgenotype</td>
<td>New Mexico, Round Mt.</td>
<td>V 392 32978</td>
<td>M+</td>
<td>14.2 28.5 = 50</td>
<td>13.3 32. = 42</td>
<td>3.3 5.8 = 57</td>
<td>23</td>
<td>4.6 5.8 = 79</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; ref...</td>
<td>&quot;</td>
<td>&quot; 394 32938</td>
<td>M+</td>
<td>13.8 28.5 = 48</td>
<td>13.3 28. = 48</td>
<td>3.6 6. = 60</td>
<td>26</td>
<td>4.8 6. = 80</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot; 32940C</td>
<td>M</td>
<td>12.5 27.5 = 45</td>
<td>31. 31. = 6.2</td>
<td>6.2 6.2 = 6.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Continued on next page)
<table>
<thead>
<tr>
<th>Locality</th>
<th>Size</th>
<th>Group</th>
<th>Page</th>
<th>Collection No.</th>
<th>Total No.</th>
<th>( m_3 )</th>
<th>( \frac{p_3-p_4}{m_1-m_3} )</th>
<th>( p_3 )</th>
<th>( p_4 )</th>
<th>( m_3 )</th>
<th>( p_4 )</th>
<th>( m_3 )</th>
<th>( p_4 )</th>
<th>( m_3 )</th>
<th>( p_4 )</th>
<th>( m_3 )</th>
<th>( p_4 )</th>
<th>( m_3 )</th>
<th>( p_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. (Subcosorvix) cerroensis, tent. ref.</td>
<td>v</td>
<td>396</td>
<td>F:A:M. 30982</td>
<td>M+</td>
<td>14.5</td>
<td>( ((14.)) )</td>
<td>29.2</td>
<td>5.6</td>
<td>4.5</td>
<td>5.6</td>
<td>80%</td>
<td>31%</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?) R. (Paramoceros) marthae, ref.</td>
<td>iv</td>
<td>403</td>
<td>32953</td>
<td>M+</td>
<td>13.</td>
<td>29.</td>
<td>7.5</td>
<td>4.5</td>
<td>5.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merycros warreni johnsoni, ref. or var.</td>
<td>v</td>
<td>425</td>
<td>N.S.M. 27-15-8-35</td>
<td>W</td>
<td>14.4/31</td>
<td>15.6</td>
<td>4.7</td>
<td>72%</td>
<td>33%</td>
<td>5.7</td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; (p₄ rudimentary)&quot;</td>
<td>&quot; &quot;</td>
<td>&quot; &quot;</td>
<td>7-9-8-34</td>
<td>M+</td>
<td>13</td>
<td>14.8</td>
<td>3.</td>
<td>6.3</td>
<td>48</td>
<td>90</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. (Paracosorvix) sabulonis, or C. (S.) savaronis, tent. ref.</td>
<td>&quot; &quot;</td>
<td>432</td>
<td>A.M. 26888</td>
<td>W</td>
<td>12.4</td>
<td>16</td>
<td>4.6</td>
<td>77</td>
<td>5.7</td>
<td>95</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?) Submerycros minor, type.</td>
<td>vi</td>
<td>403</td>
<td>30988</td>
<td>M</td>
<td>10.5</td>
<td>( ((16.)) )</td>
<td>6.4</td>
<td>5.8</td>
<td>91</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot; ref.&quot;</td>
<td>&quot; &quot;</td>
<td>30985</td>
<td>W</td>
<td>10.5</td>
<td>( ((14.)) )</td>
<td>24.5</td>
<td>4.5</td>
<td>92</td>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?) S. minor pawniensis, type.</td>
<td>&quot; &quot;</td>
<td>407</td>
<td>31643</td>
<td>W</td>
<td>18</td>
<td>15.5</td>
<td>4.5</td>
<td>92</td>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?) S. minor serpentinus, type.</td>
<td>&quot; &quot;</td>
<td>433</td>
<td>31577</td>
<td>M</td>
<td>10.1</td>
<td>16</td>
<td>4.2</td>
<td>69</td>
<td>5.5</td>
<td>90</td>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?) S. minimus, type.</td>
<td>vii</td>
<td>404</td>
<td>30991</td>
<td>M+</td>
<td>9</td>
<td>( ((11.5)) )</td>
<td>21.6</td>
<td>5</td>
<td>5</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

() approximate; (( )) estimated.
The amassed data as to dentitions of the Merycodontini (see pages 313 and 372, also compare the forty-seven named and unnamed species, subspecies and vars., listed page 317, and the immediately preceding Measurement Table VIII, page 384) are recorded under the six geographic areas (see page 373) of:

(1) New Mexico
(2) Colorado
(3A) South Dakota, (3b) Kansas and (3c) Montana
(4) Nebraska
(5) California
(6) Nevada and Oregon.

(1) Merycodontini Dentitions from New Mexico

**Ramoceros, Paramoceros, Cosoryx, Subcosoryx, Meryceros** and **Submeryceros** species

(See Horn Section II, page 323)

Figures 41, 42 and (in part) 38

New Mexico Merycodontine dentitions in our collections are represented by some two hundred and eleven partial mandibular and ninety-four partial maxillary series listed below, and by one thousand two hundred and seventy mentioned partial rami and maxilla, and numerous fragments. While all of the molars are tall-crowned and the diastemata average moderately long to long, with no evidence of the occurrence of forms with short diastemata, there are considerable differences in size and in the proportions of the premolars. These rami and maxillary dentitions, as observed in the Merycodontini discussion, are referred to II–vii of the tentative size groups (of the general Merycodontini-Blastomerycini size-group scheme, Size Group i being unrepresented in typical Merycodontine remains). From the infrequency of the occurrence of horns of **Paramoceros** and **Submeryceros**, it may be presumed, perhaps, that they rarely are represented by the dentitions. From the frequency of the occurrence of horns of **Meryceros**, it may be presumed that the group is particularly well represented in the collections of mandibles from the same areas. Two rami are associated with cranial portions of **Ramoceros**.

Size Group ii proper is rare. The molars are heavier-lobed and the diastemata relatively shorter than in the following groups. Several of these rami might be referred equally well to **Plioceros blicki**, n.g. and sp.

Size Groups iía and iiii are the commonest, and exhibit moderate variations of types with long symphyses and tall molars. These mandibular remains probably represent no more than smaller and larger individuals of the same form. In iía the diastemata are relatively slightly longer and the premolar series slightly larger than in Group iii. A single ramus (F:A.M.30976) of Size Group iii exhibits a notably large p₄ and an m₃ with strongly convex posterior border, well-marked rib and total absence of p₂.
A ramus of Size Group IIIA (F:A.M.31592) and a maxilla and skeletal elements are associated with the cranial saddle and horns of *Ramoceros ramosus* (Cope), referred. A right ramus (F:A.M.31711) is associated with a partial skeleton of Size Group III from an horizon above Skull Ridge. A somewhat shorter-diastemataed specimen is observed in F:A.M. 30961, Size Group IIIA. This last specimen rather closely approximates Cherry County, Nebraska, specimens exampled by N.S.M.14-22-8-30.

Size Group IV, except for possibly slightly larger-proportioned premolars, has the characters of Size Group III, with the exception of the *Subcosoryx* remains (s.g. IV–V) in which the anterior premolars are greatly reduced.

As remarked in the discussion, specimens of the notably smaller Size Groups VI–VII are made the types of two new species of *Submeryceros*. Size Group VI, (?)S. minor, and Size Group VII, (?)S. minimus, respectively represent more diminutive-sized forms in which, unfortunately, the diastema lengths are unknown and the presence or absence of antlers remains in question. Size Group VI exhibits relatively large premolars and Size Group VII a generally more evenly proportioned tooth series.

Representative specimens of the several size groups are figured in adjacent plates (Figs. 41, 42). The remains are taken up in detail in subsequent pages according to the above order.

The above-noted, New Mexican ramal and maxillary dentitions are listed under *C. (Subcosoryx) cerroensis*, n.subg. and sp., Size Groups III–V, and indefinitely under *Ramoceros, Paramoceros, Cosoryx, Meryceros* and *Submeryceros* species, divided between Size Groups II–VII.

**SIZE GROUPS III–V.**

*C. (Subcosoryx) cerroensis*, new subgenus and species

From Round Mountain Quarry, Santa Clara, New Mexico

**SUBGENOTYPE.**—Left ramus with I₁–I₅, /C and p₅–m₄... (M+) 32978  
*Fig. 42*

**REFERRED FROM TYPE LOCALITY.**

The referred specimens, in addition to some eighty-nine “horns” (p. 336) and twenty-four limb elements (p. 456), include the one hundred and fifty-two maxillary and mandibular specimens of larger and smaller individuals listed below under Size Groups III to V. The mandibular specimens are characterized by reduction of the premolars, particularly p₂ and p₃, and elongation and slenderness of the diastema. (F:A.M.32923 differs in both the shortness of the diastema and in the non-eruption of p₂.) The smallest p₂ is seen in F:A.M.31996 (2.4 mm.); the largest p₂ in F:A.M.32921 (4.5 mm.); the smallest m₁ in F:A.M.32940C (m) (12.5 mm.); and, excepting extremely worn specimens, the largest m₁ in F:A.M.32921 (m+) (16 mm.). The third lobe of m₁ is variably developed. The heaviest ramus is F:A.M.32946; the slenderest is F:A.M.32955D.
SEVENTY-SEVEN MANDIBULAR RAMI

S.G. III.

Three relatively large specimens with anterior premolars greatly reduced:

Left ramus with p2–m3(br.) ........................................ (w) 31996

Figs. 38, 42

Left fragment with symphysis, p2 root and p1–p4 .......... (w) 32920

Right fragment with diastema, p2 root and p3–m1 ...... (w) 32920A

Six less large:

Right ramus with p2 root and p3–m4 ......................... (M+) 32922

Left ramus with diastema and p2–m2 ....................... (w) 32921

Fig. 38

Left ramus with p3–m2 .............................................. (M++) 32921A

Left fragment with p2–m2 ....................................... (−M) 32929

Right fragment with p4–m2 ..................................... (w) 32933

Left fragment with p4–m2 .................................... (M) 32933A

S.G. IV.

Twenty-seven smaller:

Mandible with symphysis, /Is, /Cs and p2–m3. (See questionably assoc. horn, Horn Section II, p. 338.) ........ (w) 33117

Partial mandible with right /I−/Is, /C root and p1–m5 ... (M) 32943

Right ramus with diastema and p2–m2 ...................... (w) 32941

Right ramus with symphysis, /I, p2–p4 alveoli, p5–m4 ... (M) 32930

Right ramus with symphysis, p2–m1(br.) and m3 .......... (w) 32946

Left ramus with diastema, p3 root and p3–m5 ............. (w) 32928

Right ramus with diastema, p2 alveolus and p3–m5 ...... (M+) 32928A

Left ramus with symphysis, p2–p4 alveoli and p3–m5 ... (M++) 32945

Right ramus with symphysis, p5 alveolus and p4–m5 ... (M++) 32945A

Left ramus with symphysis, p5 alveolus and p4–m5 ....... (M) 32945B

Mandibular symphysis with right ramus, /Is and /Cs roots, p2 alveolus, p3(br.), p5–m5(br.) ...................... (w+) 32945C

Left fragment with p2–m3 ........................................ (M+) 32945D

Left fragment with p3–m3 ...................................... (M+) 32942

Right ramus with p2 alveolus and p3–m3 .................. (M++) 32925

Left fragment with p3–m2 ....................................... (M+) 32925A

Right ramus with p2 alveolus and p3–m3(br.) .......... (M) 32924

Right fragment with p2 alveolus and p3–m3(br.) ...... (w) 32949A

Left ramus with p3(br.)–m3(br.) and m3–m5 .......... (w) 32925B

Left fragment with p3 alveolus and p3(br.)–m5(br.) ... (M+) 32936

Left ramus with p2 alveolus and p3–m3 ................. (M+) 32936A

Right ramus with p3 alveolus and p3(br.)–m3 .......... (w) 32936B

Right fragment with symphysis and p3–m3 .......... (M++) 32937

Left ramus with symphysis, /ps alveoli and m1–m5 ... (w) 32927

Right ramus with p4–m1 and m2 .......................... (M) 32931

Left fragment with p4 alveolus and p4–m4(br.) ...... (M++) 32932

Left ramus with broken p4–m1 and m2–m4 .......... (w) 32935

Right fragment with p4 alveolus and p4–m4(br.) ... (M+) 32934
s.g. v.

Twenty-two large:

Right ramus with I₁, I₃, /C and p₃-m₄. ........................................ (w) 32956
Partial mandible with right I₁-I₃, ?/C and p₃-m₄. ........................... (m) 32955
Partial mandible with left I₁-I₃, /C alveolus and p₃-m₄. ....................... (w) 32955A
Left ramus with left ?/C and p₄(br.)-m₄. ........................................ (m) 32955B
Right ramus with symphysis and p₅-m₄(br.) ....................................... (m++) 32955C
Left ramus with symphysis and p₅(br.)-m₄. ....................................... (m) 32955D
Left ramus with symphysis, p₃ alveolus and p₄-m₃. (See questionably associated horn, Horn Section II, page 337.) .......................... (m++) 33112X
Right ramus with diastema and p₅-m₃. ............................................... (m) 32955E
Left ramus with p₅-m₃. ................................................................. (w) 32955F
Left ramus with diastema and p₅-m₃. ............................................... (m++) 32955G
Right ramus with p₅-m₃. ................................................................. (m) 32955H
Right ramus with symphysis, I₁, p₃ alveolus and p₄-m₄. ......................... (m++) 32955I
Right ramus with diastema, p₂-p₃ alveoli and p₅-m₃............................ (-m) 32955J
Right ramus with diastema and p₅-m₃. ............................................... (m++) 32947
Right ramus with symphysis, p₂-p₃ alveoli, p₃(br.)-m₂ (br.) and m₃(br.) ................................................................. (w) 32947A
Left fragment with p₂-m₃(br.). ....................................................... (m++) 32947B
Right ramus with p₂-m₃. ................................................................. (w) 32947C
Left fragment with p₂-m₃. ............................................................. (w) 32949G
Left fragment with p₂-m₃(br.). ....................................................... (m++) 32949H
Left fragment with p₂-m₃. ............................................................. (w+) 32949E
Right fragment with p₂-m₃. ............................................................. (w) 32938A
Left fragment with p₂ alveolus and p₃-m₃(br.) .................................... (m++) 32938B

Nineteen smaller:

Left ramus with symphysis, roots of I₁-/C and p₃-m₃. .......................... (m++) 32938

Right ramus with symphysis, p₃ alveolus, p₄(br.)-m₄(br.). ..................... (w) 32939
Left ramus with symphysis, p₄-m₃. .................................................. (w) 32939A
Left ramus with diastema and p₄-m₃. ............................................... (m) 32944
Left ramus with p₄-m₃................................................................. (m) 32944A
Left ramus with p₄-m₃. ................................................................. (m+) 32940
Left ramus with p₄-m₃. ................................................................. (m+) 32940A
Left ramus with symphysis, p₄ alveolus, p₅-m₄(m₄(br.)). ....................... (m++) 32940B
Left ramus with symphysis, p₂-p₃ alveoli and p₄-m₃. ........................... (-m) 32940C
Left fragment with symphysis, roots /Is-/C, p₃ alveolus and p₃-m₄. ........ (w) 32940D
Left fragment with symphysis, p₃ alveolus, p₄-m₃(br.). ......................... (m) 32940E
Left ramus with diastema and p₄-m₃. ............................................... (w+) 32940F
Right ramus with p₅ root and p₅-m₃. ............................................... (w) 32949C
Right ramus with p₅-m₃. ............................................................... (w+) 32949F
Left fragment with diastema, p₅ alveolus, p₅-m₃(br.). ........................ (w) 32949B
Right fragment with p₅-m₃. ........................................................... (w) 32940G
Right ramus with p₅(br.)-m₃. ....................................................... (m) 32940H
Left fragment with p₁-m₄. ............................................................. (w+) 32940I
Left ramus with p₅ root and p₅-m₃(br.). .......................................... (m+) 32948

Four hundred and thirty partial and fragmental rami of both size groups, F:A.M. Coll.
FORTY-ONE MAXILLARY SPECIMENS

**S.G. IV.**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right p²-p³, p⁴ alveolus and m¹-m³</td>
<td>(m)</td>
<td>32951</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(w)</td>
<td>32951E</td>
</tr>
<tr>
<td>Left p³-m²</td>
<td>(w++)</td>
<td>32951B</td>
</tr>
<tr>
<td>Left p⁴(br.)-m⁴(br.)</td>
<td>(M++)</td>
<td>32951F</td>
</tr>
<tr>
<td>Left p⁴-m³</td>
<td>(M++)</td>
<td>32952F</td>
</tr>
<tr>
<td>Right p¹-m³</td>
<td>(m)</td>
<td>32951G</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(−m)</td>
<td>32951A</td>
</tr>
<tr>
<td>Right p¹-m²</td>
<td>(m)</td>
<td>32951H</td>
</tr>
<tr>
<td>Right p²-m²</td>
<td>(m)</td>
<td>32951I</td>
</tr>
<tr>
<td>Four fragments with m¹-m³</td>
<td>(w)</td>
<td>32951J-M</td>
</tr>
</tbody>
</table>

**Sixteen smaller:**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left p²-m²</td>
<td>(m)</td>
<td>32952G</td>
</tr>
<tr>
<td>Left p²-m²(br.)</td>
<td>(w)</td>
<td>32952H</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(w)</td>
<td>32952I</td>
</tr>
<tr>
<td>Left p³-m²</td>
<td>(w)</td>
<td>32952A</td>
</tr>
<tr>
<td>Left p³-m²</td>
<td>(w)</td>
<td>32952C</td>
</tr>
<tr>
<td>Left p³-m²</td>
<td>(M++)</td>
<td>32952J</td>
</tr>
<tr>
<td>Right p¹-m³</td>
<td>(w)</td>
<td>32952K</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(M++)</td>
<td>32952L</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(w)</td>
<td>32952B</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(w+)</td>
<td>32952D</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(w+)</td>
<td>32952E</td>
</tr>
<tr>
<td>Right p²-m³(br.)</td>
<td>(−m)</td>
<td>32952N</td>
</tr>
<tr>
<td>Left p² and m¹-m³</td>
<td>(w)</td>
<td>32952P</td>
</tr>
<tr>
<td>Right p¹(br.) and m¹-m³</td>
<td>(M+)</td>
<td>32952Q</td>
</tr>
<tr>
<td>Right m¹-m³</td>
<td>(w)</td>
<td>32952R</td>
</tr>
</tbody>
</table>

**S.G. V.**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left p²-m²</td>
<td>(M+)</td>
<td>32952</td>
</tr>
<tr>
<td>Right p²(br.)-m²</td>
<td>(M+)</td>
<td>32957</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(M)</td>
<td>32957A</td>
</tr>
<tr>
<td>Left p²-m²</td>
<td>(M)</td>
<td>32957B</td>
</tr>
<tr>
<td>Right p²-m³</td>
<td>(M++)</td>
<td>32957C</td>
</tr>
<tr>
<td>Left p²-p³ roots and p²-m³</td>
<td>(w)</td>
<td>32957D</td>
</tr>
<tr>
<td>Left p⁴-m³</td>
<td>(w)</td>
<td>32957E</td>
</tr>
<tr>
<td>Left p²-m² (m¹ br.)</td>
<td>(w+)</td>
<td>32957F</td>
</tr>
<tr>
<td>Right m¹-m³</td>
<td>(M+)</td>
<td>32957G</td>
</tr>
</tbody>
</table>

**Three smaller:**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left p²-m²</td>
<td>(w)</td>
<td>32958</td>
</tr>
<tr>
<td>Right p⁴-m³</td>
<td>(M++)</td>
<td>32958A</td>
</tr>
<tr>
<td>Right p²-m²</td>
<td>(M++)</td>
<td>32958B</td>
</tr>
</tbody>
</table>

One hundred and forty partial maxillae and numerous detached upper teeth of both size groups, F:A.M. Coll.
TWENTY-SIX IMMATURE RAMI

Right ramus with symphysis, I₁-I₃ and dp₁-m₁........... 32950
Left ramus with diastema and dp₁⁻m₂................... 32950A
Right ramus with dp₂⁻m₂................................ 32950B
Right ramus with dp₂⁻m₃(erupting)...................... 32950K
Right ramus with diastema and dp₃⁻m₃.................... 32950L
Fragment with /Is⁻/Cs.................................... 32950C
Right ramus with diastema and dp₄⁻m₄(erupting)........ 32950M
Left ramus with dp₃⁻m₄(erupting)....................... 32950D
Left ramus with dp₄⁻m₄(erupting)....................... 32950N
Left ramus with diastema and dp₄⁻m₄(erupting)........ 32950E
Right ramus with diastema and dp₅⁻m₅(br.).............. 32950F
Left ramus with dp₅⁻m₅................................ 32950P
Right ramus with dp₅, roots dp₄ and dp₄⁻m₄............ 32950G
Left fragment with dp₅⁻m₃................................ 32950H
Left fragment with partial diastema and dp₃(br.)⁻m₁. 32950I
Right fragment with diastema and dp₁⁻m₁................ 32950J
Right fragment with dp₂⁻m₂................................ 32950Q
Left fragment with dp₂⁻m₁................................ 32950R
Right fragment with dp₂⁻m₁................................ 32950S
Left fragment with dp₂⁻m₁................................ 32950T
Right fragment with dp₂⁻m₂................................ 32950U
Left ramus with diastema and dp₄(br.)⁻m₅.............. 32950V
Left ramus with dp₅⁻m₅(br.) and m₃...................... 32950W
Right fragment with dp₅⁻m₅................................. 32950X
Right fragment with dp₅⁻m₅................................. 32950Y
Right fragment with dp₇⁻dp₄ (Note large dp₄.)......... 32950Z

Two hundred and ten partial and fragmental immature rami, F:A.M. Coll.

FIVE IMMATURE MAXILLÆ

Left dp₂⁻m¹................................................. 32959A
Left dp²⁻m¹................................................. 32959B
Left dp²⁻m¹................................................. 32959C
Left dp²⁻m¹(br.)......................................... 32959D

Thirty-four partial immature maxillæ, F:A.M. Coll.

TENTATIVELY REFERRED FROM OTHER NEW MEXICAN LOCALITIES.—
s.o. v. Premolars as small as in above.

Right fragment with p₄ alveolus and p₃⁻m₂. (M+) F:A.M.30982 From Pojuaque Bluffs, 1927.
Left fragment with m₁ (br.) and m₁⁻m₂. This paper, Fig. 41.
Left fragment with m₁ (br.) and m₁⁻m₂. From Ojo Caliente, 1931.
SIZE GROUP IV.

Undetermined Species
From Round Mountain Quarry, 1936

(Compare P. marthae, page 403). In the example (F:A.M.32923), the postsymphysial distance is 19 mm. and m₃/PS. d. = 66%, versus in C. (S.) cerroensis type ramus (F:A.M.32978), in which the postsymphysial distance is 28.5 mm. and m₃/PS. d. = 50%.

**EXAMPLE.**—Left ramus with symphysis, /C(erupting), detached p₂ germ and p₇(br.)–m₈.......................... (m) F:A.M. 32923

**REFERRED.**—
Right ramus with diastema, p₂(br.), p₉(roots) and p₄–m₈... (w+) 32960
Left ramus with diastema and p₄–m₈.......................... (w) 32961

(?)-Var.

Diastemata missing, premolars relatively large, and suggestive of the above rather than C. (S.) cerroensis.

**EXAMPLE.**—Left ramus with p₄–m₃.......................... (m) F:A.M. 32962

**REFERRED.**—
Right ramus with p₄(br.)–m₃.......................... (m+) 32963
Right fragment with p₅(br.)–m₃.......................... (m) 32964
Left fragment with p₅–m₃(br.).......................... (M+) 32926
Right fragment with p₄–m₃(br.) and m₈................ (w) 32965
Right fragment with p₄–m₈ (teeth br.).................. (w) 32965A
Right fragment with p₄–m₈.......................... (w) 32965B
Left fragment with p₄–m₈.......................... (m++) 32965C
Right ramus with p₄–m₈ (teeth br.)..........................

SIZE GROUPS II–IVA.

*Ramoceros, Cosoryx or Meryceros* species

**S.G. II.**

**EIGHT RAMI**

**Four from Santa Cruz:**
Right ramus with symphysis and p₃–m₃. (w) F:A.M.30915 From 1st wash, 1930. This paper, *Fig. 42.*
Left fragment with m₂–m₃ (br.). (m) F:A.M.30919 From 1st wash, 1928.
Left fragment with m₂ (br.). (m) F:A.M.30920 From 1st wash, 1928.
Left fragment with m₂–m₃ (br.). (w) F:A.M.30922 From 2d wash, 1927.

**Two from Santa Clara:**
Left ramus with symphysis, p₅–p₉ and m₁–m₈. (w) F:A.M.30916 From Rio Grande slope, 1931.
Right fragment with m₁–m₈. (w) F:A.M.30918 1930.
Two from San Ildefonso area:

Left fragment with $p_2-m_1$ alveoli and $m_2-m_3$ (br.).
Partial left ramus with $p_2-p_4$, $m_1$ alveolus and $m_2-m_3$. (M)

One from indefinite locality:
Partial left maxilla with $p^4$ (br.)-m$.^4$. (w+)

MAXILLA

S.G. IIIA.

TWENTY-THREE RAMI

Twelve from Santa Cruz:

Right ramus with symphysis, $p_2-p_4$ alveoli and $p_4-m_4$. (A)
Left ramus with symphysis, $p_2-m_4$. (M+)
Partial left ramus with $p_2-m_4$ ($p_4$ and $m_3$ br.). (w)
Partial left ramus with $p_2-m_4$. (M)
Partial left ramus with $p_2-m_3$ (m3 br.). (w)
Partial left ramus with $p_3-m_4$. (w)
Partial left ramus with $p_4-m_4$. (w)
Left fragment, $p_2-m_3$. (M+)
Left fragment with $p_2-p_4$ alveoli and $p_4-m_4$. (M+)
Partial left ramus with $p_2-m_3$. (w)
Partial right ramus with symphysis, $p_3$, $m_1-m_4$. (w)
Partial right ramus with $p_1-m_3$. (w)
Partial right ramus with diastema, $p_3-p_4$ alveoli, $p_4-m_3$ (teeth broken). (M+)

Five from Santa Clara:

Left ramus with symphysis, $l_1-l_3$, /C root, $p_2$ alveolus and $p_1-m_3$. (M)
Left ramus with symphysis, $p_3-p_4$ alveoli and $m_1-m_5$ (m3-br. br.). (M+)
Right ramus with symphysis, $p_2$, $m_1-m_4$. (w)
Partial right ramus with $p_1-m_3$. (w)
Partial right ramus with $p_1-m_2$. (w)

F:A.M.30917, 1929.
F:A.M.30928, 1930.

F:A.M.31965, 1926.

F:A.M.30925, 1927. From 1st wash, 1928. This paper, Fig. 42.
F:A.M.30961, 1927. This paper, Fig. 42.
F:A.M.30956, 1927.
F:A.M.30938, 1927. From 1st wash, 1928.
F:A.M.30924, 1931. This paper, Fig. 42.
Four from Pojuaque Bluffs:
Partial right ramus with p₃ alveolus, p₅-m₃. (M+)
Partial right ramus with p₃ alveolus, p₅-m₃. (w)
Left fragment, p₃-m₃. (w)
(Fr:oceros ramosus (Cope), referred. See associated cranium, maxilla and limbs, Horn Section II, page 324; this Section, above; and Limb Section IV, page 453. This paper, Figs. 28, 28A, 29, 30 [cranium and horns], 25B, 48 [limbs].)

Mandible with symphysis, p₅-m₃. (w)
(Fr:oceros ramosus (Cope), referred. See associated maxilla below, and limbs, Section IV, page 453.)

Two from Skull Ridge:
Right fragment with p₃ alveolus and p₅-m₃. (w)
(See associated partial skeleton, Limb Section IV, page 457.)

Partial left ramus with p₅-m₃. (w)

Nineteen Maxillae

Nine from Santa Cruz:
Right maxilla, p₄-m₄. (w)
Partial right maxilla with p₄-m₄. (w)
Partial right maxilla with p₄-m₄. (w)
Partial left maxilla with p₄-m₃. (w)
Partial right maxilla with m₁-m₃. (M+)
Partial skull, p₅-m₃. (M) F:A.M.31971 From 1st wash, 1928.
Partial left maxilla with p₄-m₃. (M+)
Partial right maxilla with p₄-m₃. (M+)
Partial right maxilla with p₄-m₃. (w)

One from Santa Clara:
Partial palate, p₅-m₄.(M+) F:A.M.31975 1931.

One from Lower Pojuaque Bluffs:
Partial left maxilla with p₄-m₄. (w)
(Ramoceros ramosus (Cope), referred. Above-noted cranium, ramus and limbs, Horn Section II, page 324; this Section, above; and Limb Section IV, page 453. This paper, Figs. 28, 28A, 29, 30 [cranium and horns], 25B, 48 [limbs].)

One from Pojuaque Bluffs:
Partial left maxilla with m₁-m₃. (w)
(Ramoceros ramosus (Cope), referred. See associated mandible above, and limbs, Section IV, page 453.)
One from Skull Ridge:
Right maxilla with $p^4-m^2$ (p$^4$ br.). (M+).

F:A.M.31977 1926.

One from southeast of White Operation:
Partial left maxilla with $p^4-m^3$(br.). (w)

F:A.M.31978 1926.

Five from indefinite localities:
Partial right maxilla with $p^4-m^3$. (w)
Partial left maxilla with $p^4-m^3$. (M)
Partial right maxilla with $m^1-m^3$. (M+)
Partial left maxilla with $m^1-m^3$. (M+)
Partial right maxilla with $m^1-m^3$. (M+)

F:A.M.31976 1925.
F:A.M.31979 1926.
F:A.M.31980 1925.
F:A.M.31981 1926.
F:A.M.31982 1925.

S.G. IX.

RAMUS

One from Skull Ridge:
Partial right ramus with $p_2$ alveolus, $p_3-m_2$. (M+).

F:A.M.30992 1930.
This paper, Fig. 42.

S.G. III.

TWENTY-THREE RAMI

= $p_2$ large

Eleven from Santa Cruz:
Mandible with left symphyssis and $p_5-m_2$. (w)
Left ramus with symphyssis, $p_2$ (br.), $p_3-m_2$. (w)
Right ramus with symphysis, $p_2$ alveolus and $p_3-m_3$(br.). (w)
Left fragment with $p_4-m_2$ (br.). (w)
Left fragment with $p_5$ alveolus and $p_4-m_2$. (M)
Left fragment with $p_5$ (br.) and $p_4-m_3$(br.). (M+)
Right ramus with symphysis, partial $p_5-p_3$ and $p_5-m_2$. (w)
Right ramus with symphysis, I$^1-I_3$, /C, $p_2$ alveolus and $p_3-m_3$(br.). (w)
Partial left ramus with $p_4$ alveolus and $p_3-m_2$. (w)
Left fragment, $p_4-m_2$. (M+)
Right fragment with $p_5$ alveoli and $p_4-m_2$. (A)

F:A.M.30946 1929.
F:A.M.30948 From 1st wash, 1928.
F:A.M.30950 From 1st wash, 1928.
F:A.M.30952 From 1st wash, 1928.
F:A.M.30954 From 1st wash, 1928.
F:A.M.30965 From 1st wash, 1928.
F:A.M.30947 From 2d wash, 1930.
F:A.M.30963 1926.
F:A.M.30951 From upper layer, 1927.
F:A.M.30963 From upper layer, 1927.
F:A.M.30980 From 1st wash, 1928.

(/ns slender)
Four from Santa Clara:
- Partial left ramus with p<sub>4</sub>–m<sub>2</sub>. (M)
- Right fragment with p<sub>3</sub>–p<sub>4</sub> alveoli, p<sub>r</sub>–m<sub>3</sub>. (M+ small)
- Right fragment with p<sub>4</sub> alveolus and p<sub>r</sub>–m<sub>3</sub>. (W+)
- Partial right ramus with p<sub>r</sub>–m<sub>2</sub> (m<sub>2</sub> br.). (M+)

Two from San Ildefonso (?Cosoryx, ref.):
- Left fragment with p<sub>4</sub> alveolus and p<sub>r</sub>–m<sub>3</sub>. (W+)
- Left fragment with p<sub>4</sub> alveolus and p<sub>r</sub>–m<sub>3</sub>. (M)

This paper, Fig. 41.

Three from Pojucaque Bluffs:
- Partial mandible with p<sub>4</sub> alveolus and p<sub>r</sub>–m<sub>3</sub>. (M)
  (See associated palate, next page.)
- Partial right ramus with p<sub>r</sub>–m<sub>2</sub> (m<sub>1</sub> br.). (A)
- Right ramus with symphysis and p<sub>r</sub>–m<sub>3</sub>. (M)

One from Skull Ridge:
- Right ramus with symphysis and p<sub>r</sub>–m<sub>3</sub>. (M+)

Two from indefinite localities:
- Left fragment with p<sub>4</sub> alveolus and p<sub>r</sub>–m<sub>3</sub>. (M)
- Right fragment with p<sub>r</sub>–m<sub>3</sub>. (M+)

Eleven maxillae

Two from Santa Clara:
- Right maxilla, p<sup>4</sup>–m<sup>1</sup>. (W+)
- Partial left maxilla with p<sup>4</sup>–m<sup>2</sup>. (M)

Two from San Ildefonso:
- Skull (female), p<sup>4</sup>–m<sup>1</sup>. (M)
  (?Cosoryx ilfonsensis, n.sp., referred. See associated limbs, Section IV, page 456.)
- Partial left maxilla with m<sup>1</sup>–m<sup>3</sup>. (M)

Three from North Pojucaque Bluffs:
- Left maxilla, p<sup>4</sup>–m<sup>1</sup>. (M)
- Left maxilla, p<sup>4</sup>–m<sup>1</sup>. (M)
- Partial left maxilla with p<sup>4</sup>–m<sup>1</sup>. (M)
One from Pojuaque Bluffs:
  Palate with p$^2$–m$^2$. (M)  F:A.M.31733  1929.
  (See associated partial mandible, preceding page.)

Three from indefinite localities:
  Right maxilla, p$^1$–m$^1$. (M+)  F:A.M.31993  1925.
  Right maxilla, p$^1$–m$^1$. (w)  F:A.M.31994
  Partial left maxilla with p$^2$–m$^2$. (M+)

S.G. III'.

One from Santa Cruz:
  Left maxilla, p$^2$–m$^2$. (A)
  (Note p$^3$!)
  F:A.M.31986  From 1st wash, 1928.

S.G. IV.

Four from Santa Cruz:
  Left ramus with symphysis and p$^2$–m$^2$. (m)
  Right fragment with p$^3$–p$^4$ alveoli and m$^1$–m$^3$. (w)
  Left fragment with p$^4$ alveolo and m$^4$–m$^6$. (m)
  Left fragment with m$^1$ alveolus and m$^2$. (w)

One from North Pojuaque Bluffs:
  Left fragment with m$^1$–m$^8$. (m)
  F:A.M.30969  1927.

Two from the vicinity of Espanola:
  Right fragment with p$^3$ alveolus and p$^2$–m$^1$. (M+)

One from Tesuque:
  Right fragment with m$^1$–m$^8$. (m+)
  F:A.M.30967  1931.

From Santa Cruz:
  Partial left maxilla with p$^1$–m$^2$. (w)
  Right maxilla, p$^1$–m$^2$. (M+)
  F:A.M.31998  1927.
  F:A.M.31999  1931.
S.G. IVa. (Large p4.)

**RAMUS**

One from Santa Cruz:
- Right fragment with p4 alveolus and p4–m2 (m3 br.) (A)
- F:A.M.30977 From 1st wash, 1928.

One from indefinite locality:
- Partial right maxilla with p2–m2 (A)
- F:A.M.32000 Note large p4.

Maxilla

Three hundred and forty-two unlisted partial rami, forty-seven unlisted partial maxillae and numerous smaller fragments from Santa Fé area, F:A.M. Coll.

(?)R. (Paramoceros) marthae, new species

From Round Mountain Quarry, New Mexico

**REFERRED.**

- Left ramus, p4–m2. (M+) F:A.M.32953 This paper, Fig. 38.
- Left ramus, p4–m2. (M+) F:A.M.32954

Size Group VI.

(?)Submeryceros minor, new species

**TYPE.**—Left fragment with p2 alveolus, p3–m1. (M)
- F:A.M.30988 From Tesuque, 1930. This paper, Fig. 41.

**FOUR TENTATIVELY REFERRED RAMI.**

One from North Pojuaque Bluffs:
- Right fragment with m1 (br.)–m2. (A)
- F:A.M.30989 1927.

Two from Cuyamunquie:
- Right fragment with p4–m1. (w)
- F:A.M.30985 1931. This paper, Fig. 41.
- Left fragment with m1–m2. (M)
- F:A.M.30986 1930.

One from indefinite locality:
- Right fragment with m2–m3 (br). (M)
- F:A.M.30987 1928.
SIZE GROUP VII.

(?)*Submeryceros minimus*, new species

**TYPE.—** Right fragment with p2-p7 alveoli and p7-m3 (m2 br.). (M+)

F:A.M.30991 From Cuyamungue, 1933.

This paper, Fig. 41.

**UNALLOCATED IMMATURE SPECIMENS:**

**TWENTY-FOUR RAMI, IMMATURE**

Left ramus with symphysis, I, and dp3-m2.

F:A.M.30993A

Left ramus with symphysis, I1 roots and dp3-m2.

F:A.M.30993B From Santa Clara, 1931.

Left ramus with symphysis and dp3-m3 (erupting).

F:A.M.30993C From Santa Clara Canyon, 1931.

Right ramus with symphysis and dp4-m2 (teeth broken).

F:A.M.30993D From Santa Clara Canyon, 1931.

Left ramus with symphysis and I1-m2.

F:A.M.30993E From North Pojuaque Bluffs, 1927.

Left ramus with partial symphysis and dp3-m2 (erupting).

F:A.M.30993F From Lower Pojuaque Bluffs, 1928.

Partial left ramus with dp3-m2.

F:A.M.30993G From 1st wash, Santa Cruz, 1928.

Right fragment, dp4-m2.

F:A.M.30993H Santa Clara Canyon, 1931.

Left fragment, dp3-m2.

F:A.M.30993I 1927.

Left fragment, dp4-m2.

F:A.M.30993J From Santa Clara, 1931.

Right fragment, dp4-m2.

F:A.M.30993K 1st wash, Santa Cruz, 1928.

Left fragment with dp3-m2 (erupting).

F:A.M.30993L 1928.

Left fragment, dp1-m2.

F:A.M.30993M From Santa Cruz, 1927.

Left fragment, dp1-m2.

F:A.M.30993N Santa Clara Canyon, 1931.

Right fragment, dp2-m2.

F:A.M.30993O 1927.

Partial right ramus with dp3-m2.

F:A.M.30993P From 1st wash, Santa Cruz, 1928.

Right fragment with dp4-m2 (erupting).

F:A.M.30993Q From upper layer, Santa Cruz, 1927.

Right fragment, dp3-m2.

F:A.M.30993R 1st wash, Santa Cruz, 1930.

Left fragment, dp3-m2.

F:A.M.30993S 1930.

Right fragment, dp4-m2.

F:A.M.30993T 1st wash, Santa Cruz, 1928.

Left fragment, dp1-m2.

F:A.M.30993U From San Ildefonso, 1930.

Left fragment, dp4-m2.


Right fragment, dp2-m4.

F:A.M.30993W 1927.

Left fragment with dp2-m1.

F:A.M.30993X Between old and new Santa Fé roads, 1926.

Sixty-three unlisted immature partial rami and numerous fragments, F:A.M. Coll.
TWELVE MAXILLÆ, IMMATURE

<table>
<thead>
<tr>
<th>Description</th>
<th>COL. No.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palate with dp²-m²</td>
<td>F:A.M.30994A</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Right maxilla, dp²-m²</td>
<td>F:A.M.30994B</td>
<td>Santa Clara Canyon, 1930.</td>
</tr>
<tr>
<td>Left maxilla with dp²-m¹</td>
<td>F:A.M.30994C</td>
<td>From Santa Clara, 1928.</td>
</tr>
<tr>
<td>Right maxilla, dp¹-m²</td>
<td>F:A.M.30994D</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Right maxilla, dp²-m²</td>
<td>F:A.M.30994E</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Right maxilla, dp²-m¹</td>
<td>F:A.M.30994F</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Left maxilla with dp²-m¹</td>
<td>F:A.M.30994G</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Left maxilla with dp²-m¹</td>
<td>F:A.M.30994H</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Left maxilla with dp²-m¹</td>
<td>F:A.M.30994I</td>
<td>1st wash, Santa Cruz, 1928</td>
</tr>
<tr>
<td>Right maxilla with dp²-m²(erupting)</td>
<td>F:A.M.30994J</td>
<td>From North Pojuaque Bluffs, 1927</td>
</tr>
<tr>
<td>Right maxilla, dp²-m²</td>
<td>F:A.M.30994K</td>
<td>From Santa Cruz, 1927.</td>
</tr>
<tr>
<td>Left maxilla with dp²-m¹</td>
<td>F:A.M.30994L</td>
<td>From Santa Cruz, 1925.</td>
</tr>
</tbody>
</table>

Four unlisted immature partial maxillae, F:A.M. Coll.
(2) Merycodontini Dentitions from Colorado

Ramoceros, Cosoryx, [Meryceros] and Submeryceros species

Figure (in part) 43

The few known Pawnee Creek, Colorado, dentitions are of Size Group III, with the exception of the single examples of Size Groups II, IV and VI. The Size Group VI ramus, as in the case of similar specimens from New Mexico, is set apart under (?)Submeryceros, (?)S. minor pawniensis, n.subsp.

SIZE GROUP II.

RAMUS

One from "Horse" Quarry:
Right fragment with broken m$_1$–m$_3$. F:A.M.31634 1933.

SIZE GROUP III.

TEN RAMAL DENTITIONS

Two from Cedar Creek:
Ramal dentition of genotype. (w++) A.M.9476 1901.
(Figured by Matthew, 1904, Pl. III and Text-Fig. 1; this paper, Fig. 43 (ramus).

[Genotype of Ramoceros osborni (Matthew). See Horn Section II, page 328; this paper, Figs. 25, 25A (cranium); and associated limb elements, Section IV, page 454.]

Left maxilla with p$_2$–m$_5$ A.M.9475 1901.
(w); and very questionably associated right ramus with p$_2$–m$_5$.
(Figured by Matthew, 1904, Figs. 7 (maxilla), 8 (ramus), as cotype of M. osborni.

(Tentatively referred to Cosoryx furcatus, var. or subsp., heretofore known as part of "cotype" of M. osborni Matthew. See questionably associated horns, Section II, page 346; and limb elements, Section IV, page 461.)

Six from "Horse" Quarry:
Mandible with symphysis and p$_1$–m$_5$............. (w+) 1932 31635
Partial right ramus with p$_1$–m$_5$................. (w) 1932 31636
Right fragment with p$_1$ alveolus and p$_1$–m$_3$(br.).. (m) 1933 31633
Right fragment with m$_1$–m$_3$ (m$_1$–m$_3$ br.)......... (m) 1933 31635
Right fragment with m$_2$............................... (m+ 1932 31641
Left fragment with m$_3$............................... (m) 1932 31642
Two from Mastodon Quarry:
Right fragment with p₄ alveolus and p₁-m₂........ (M) 1932 31637
Left fragment with p₁-m₁.......................... (M) 1931 31640

**SIZE GROUP IV.**

**MAXILLA**

Right maxilla, p²-m³. (w)  A.M.22710  40 miles N. of Sterling, 1901.
(Cosorux furcatus, var. or subs. See questionably associated horn, Section II, page 346.)

**SIZE GROUP VI.**

(?)Submeryceros minor pauniensis, new subspecies

**TYPE.—**Left ramus with p₁-

m₃(br.). (w)  F:A.M.31643  From Lower Mastodon

Quarry, 1932.

This paper, *Fig. 43.*

**REFERRED FROM TYPE LOCALITY.—**

Left fragment, m₁-m₂. (A)  F:A.M.31644  1932.
(3A) Merycodontini Dentitions from Little White River, South Dakota

Cosoryx furcatus, Var. or Subsp.

Figures (in part) 43, 45

The few available Merycodontine dentitions from the Little White River, South Dakota, are referred to Cosoryx Leidy on account of the known horns from the same area being confined solely to that genus. The latter possibly was the predominant genus in South Dakota as in northern Nebraska. The specimens include some seven fragmental rami of the Hayden Survey collection, now in the Academy of Natural Sciences of Philadelphia, which the writer has had the privilege of examining and which apparently formed the major part of the data available to Leidy. [Unfortunately there is not found in the Academy’s collection a specimen with p4-m1, or one which might represent the Leidy (1869) type.] The American Museum collection contains a broken ramus from the general area (A.M.9825X, 1902). W. D. Matthew’s statement (1918, p. 219) as to the type of M. necatus Leidy (1869) being in the American Museum collection was probably a typographical error, as the specimen has never been entered in the Museum’s catalogue.

While the length of symphysis is not preserved in any of the Little White River material, the proportions of the several rami and teeth, so far as observable, agree with, or are indistinguishable from specimens from the Ainsworth area. The South Dakota specimens are divided between Size Groups iii and iv.

### Size Group III.

#### Four Rami

- **Right partial ramus with pr-m3 (m2 and m3 br.).**
  - A.N.S.P.11362
  - From Little White River, Hayden Survey, 1866.
  - This paper, Fig. 45.

- **Partial right ramus with pr-m4 (br.).**
  - A.M.10059
  - From Little White River, 1903.

- **Right ramus with symphysis and pr-m4. (M)**
  - A.M.9825
  - From Little White River, 1902.
  - This paper, Fig. 45.

- **Right fragment with m1-m2.**
  - (This specimen labeled “M. necatus.”)
  - A.N.S.P.11417
  - From Sweetwater, 18 miles northwest of Devil’s Gate, Hayden Survey, 1870.
  - This paper, Fig. 43.

#### Maxilla

- **Right maxilla with p4-m1.**
  - A.M.10958
  - From Little White River, 1903.
Size Group IV. Ten from Little White River.

**RAMI**

- Partial right ramus with \( p_4 \) (erupting), \( m_1 - m_4 \) (br.).
- Right fragment, \( p_4 - m_3 \).
- Partial right ramus with \( p_2 - p_4 \) alveoli, \( m_1 - m_2 \) (w).
- Detached \( m_2 \) and \( m_3 \).

Immature and smaller than preceding:

- Left fragment, \( dp_2 - m_2 \).
- Right fragment without teeth.
- Four detached \( m_2 \)s.

(And note *Cosoryx* horn fragment, A.M.10966, from the same area—see Horn Section II, page 344.)
Merycodontini Dentitions from Kansas

Cosoryx furcatus sternbergi, n.subsp., and R. (Paramoceros) kansanus, ref.

Figure (in part) 43

The meager available evidence in regard to the Merycodontine dentitions of Kansas consists of two partial mandibles and a skull associated with ramus, of Size Group III, collected by George F. Sternberg in 1933 and 1934. Three forms may possibly be represented, the one having a diminutive and the others a larger p2. Unfortunately, all but one of the specimens are greatly worn.

SIZE GROUP II.

R. (Paramoceros) kansanus, referred

Partial mandible with p3- F:A.M.31512 From north fork of Sappa Creek, northwest of Achilles, 1933.

p3 rather large.

(See associated partial skeleton, F:A.M.31512, and identical-sized F:A.M. 31512A [this paper, Fig. 48], Limb Section IV, page 455; and see type horn, F:A.M.31510, Horn Section II, page 331.)

SIZE GROUP III.

Cosoryx furcatus sternbergi, new subspecies

TYPE.—Partial left ramus F:A.M.31511 with p3-m3. (w+)

(Also associated with cranium and horns, see Section II, page 344.)

From Section 1, 2 miles south and ½ mile east of Dinsmore, 1933. This paper, Figs. 43 (ramus), 28, 28A, 36, 36A (cranium and horns).

Cosoryx furcatus, Var.

Example.—Right ramus F:A.M.31515 with symphysis and p3- m3. (m+)

From Republican River Beds, Phillips County, 1934. This paper, Fig. 43.
(3c) Merycodontini Dentitions from Montana

**Cosoryx** species

The observed remains from Montana consist of a fragmental mandible with partial cranium bearing horns, from the vicinity of Logan, here made the type of *C. furcatus mooki*, n.subsp., and several ramal fragments in the Marshall collection from a restricted deposit on the Yellowstone River, north of Gardiner, and the original Douglass type from Madison Valley.

**SIZE GROUP III.**

*C. furcatus mooki*, new subspecies

From 10 Miles South of Logan, Montana

**TYPE** (in part).—Left fragment of ramus, p2-m3. (w)

A.M.21370

Collected by C. C. Mook and C. S. Williams, 1925.

(See associated partial cranium with horns, Horn Section II, page 345. This paper, Fig. 38A.)

(?)*Cosoryx agilis* Douglass

From Madison Valley Beds, Montana

**TYPE** (in part).—Mandible.

C.M.703

(See associated partial cranium without horns, Horn Section II, page 346, and associated limbs, Limb Section IV, page 461.)

(?)*Cosoryx* Var.

From the Yellowstone River, Vicinity of Gardiner, Montana

**EXAMPLE.**—Left immature ramus.

Marshall Coll. No. 2

Left ramus with m2-m3.

Marshall Coll. No. 2a

(Recorded, Horn Section II, page 346.)
Pursuant to the general scheme of the Merycodontini section, the mandibular rami from Nebraska are considered first as to area of origin, and second as to form. The majority of the specimens are referred to Cosoryx and to Meryceros. Ramoceros, which so far is evidenced by only a few horns, is not definitely represented by ramal dentitions. Our own collection and that kindly placed at the writer’s disposal by Professor E. H. Barbour of the University of Nebraska, include some four hundred and thirty-six listed Merycodontine rami, of which nineteen specimens are definitely associated with upper dentitions.

Cosoryx is known by horn-cores and a large series of miscellaneous remains, all of relatively small size, from Midway Quarry, in larger remains from Gordon Creek, and in occasional specimens from Quinn Quarry and several scattered deposits. Interestingly enough, at neither the Midway Quarry nor Gordon Creek have other than Cosoryx horns been observed. The Cosoryx rami, with the exception of a few fragmental and indefinitely referable specimens of Size Group iiA, fall into Size Groups iii and iv. The specimens from (d) various Brown and Cherry County localities, for convenience of reference, are divided according to variable characters between subsections A–C.

Meryceros is represented by a remarkable series of skulls, horns and mandibular specimens from Nenzel, Crookston and Valentine, etc., all horns from these localities being confined to the one genus. The remains from Nenzel are notably larger than those from Crookston. Notwithstanding the much wider distribution of Cosoryx, on account of the wonderful series from Nenzel and Crookston, Meryceros is far and away the best represented Nebraskan Merycodontine. The Meryceros remains from Nenzel are referred to Size Groups ii–iii, and those from Crookston, Valentine, etc., to Size Groups iii–v.

Paracosoryx is represented by a few partial skulls and possibly as well by certain short-diastemated rami from Sioux and Dawes Counties. The remains are of relatively small size with short-averaging diastema and are referable (save for a few specimens of Size Group v) to Size Groups iii–iv. Submeryceros is so far observed alone in the small mandibular rami of Size Group vi from Sioux County.

Ramoceros, as noted under the horn section, is recognized from Nebraska alone in single horns from Hitchcock and Brown Counties, and Paramoceros by a single partial cranium, F:A.M.31271, and possibly by rami, F:A.M.31555 and 31551, from Dutch Creek, Brown County.

In the following pages the dentitions are successively and separately listed under:


(b) Sioux County—Cosoryx [no horns], Paracosoryx [sp. (13, 14), pp. 351, 353] and Submeryceros [no horns].

(c) Hitchcock County—Cosoryx [horns, sp. (3)], p. 344] and ?species. (No rami referred: Ramoceros [horns, sp. (4), p. 329].)

(4A) BROWN AND CHERRY COUNTY LOCALITIES

Paramoceros, Cosoryx and Meryceros

PARAMOCEROS, new subgenus

SIZE GROUP III.

THREE RAMI

With moderately large premolar series

Two from Dutch Creek (Paramoceros howardei):

Partial right ramus with $p_3-m_2$. (W+)

(See associated limb elements, Section IV, page 455.)

Left fragment, $m_1-m_2$. (M+)

F: A. M. 31555 1929.

F: A. M. 31551 1930.

One from indefinite locality:

Partial right ramus with $p_3-m_2$. (W)

(No trace of $p_2$ alveolus!)

F: A. M. 31558 1927.

? Also two specimens of page 419.

PARTIAL SKULL

One from Dutch Creek:

Partial skull with partial antlers and $m_1-m_4$. (W++)

F: A. M. 31271 1929. This paper, Figs. 33, 34.

[Type of R. (Paramoceros) howardei, n. sp.—see Horn Section II, page 330.]

COSORYX LEIDY

The available mandibular remains of Cosoryx include the fine series of specimens associated with skulls secured in the summer of 1934 from Midway and Gordon Creek Quarries in Cherry County, and a number of tentatively referred specimens from Fort Niobrara and Quinn Quarry.

The finest Cosoryx series from a single locality is that secured from the Midway Quarry by Morris F. Skinner, of some one hundred and twenty-four largely complete lower dentitions, some ninety of mature and thirty-four of immature individuals, and almost again as many less complete to fragmentary specimens, and a considerable number of maxillary or partial maxillary dentitions as well as the partial skulls above described. The rami fall into Size Groups III and IV. The symphysial area is proportionately short and the teeth relatively large. In the smaller specimens the diastemata are moderate, the $p_3-p_4$ smaller, the molar ribs less prominent and the crowns perhaps shorter than in the Meryceros remains from Crookston Bridge. The anterior premolars are lighter and the diastemata less short than in the more typical remains from Snake Creek. A second series of similar individuals is seen in the remains from Gordon Creek in the University of Nebraska Collection.
The type horn of *Cosoryx* Leidy came from the vicinity of the Niobrara, and as Merycodontine horns from many of the poorly represented Niobrara localities are of *Cosoryx* form, it seems probable that most of the detached rami listed below may belong to that genus. The specimens are generally referable to *C. furcatus* or vars., Size Group III. A few questioned and fragmental specimens of Size Group II A, on account of the absence of horns of *Meryceros*, are as well held under the former genus. The length of the postsymphysial distance varies from moderately long to short. There are no known specimens with such moderate to short symphysis as met with at Snake Creek. (It is difficult to make a statement re II A inasmuch as the symphysis is missing, or certain of the premolars are missing, or the teeth are greatly worn, in all the available specimens.) In the well-represented series of Group III are included the questioned variants “x” and “y,” and forms with particularly noticeable reduction of the p2 (see five specimens). There is no evidence of *Cosoryx* or *Meryceros* in the large collections from the stratigraphically high Xmas Quarry. *Cosoryx*, like *Meryceros*, has so far not been definitely encountered in the apparently stratigraphically low Devil’s Gulch Quarry.

The mandibular remains from the several Brown and Cherry County localities are detailed in the following pages under:

*Cosoryx furcatus* Leidy, referred or vars.

(a) From Midway Quarry, Size Groups III and IV
(b) From Gordon Creek, Size Groups III and IV
(c) From Swallow Quarry, Size Groups III and III-
(d) From various localities, Size Groups II A, III, III*, III Y, IV and Immature, unallocated

(a) From Midway Quarry, 1934 [Size Groups III and IV]:
Exampled, Size Group III by F:A.M.32354 and Size Group IV by F:A.M. 32362. (See partial skulls and horn-cores, Section II, page 340; and limbs, Section IV, page 458.)

**THIRTY-FOUR RAMI**

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with symphysis, part of dp (worn) and m 1-m 8...</td>
<td>(a) 32338</td>
</tr>
<tr>
<td>Right ramus with symphysis, p3 alveolus and p 1-m 8(br.)...</td>
<td>(w+) 32339</td>
</tr>
<tr>
<td>Right ramus with symphysis, p 1 alveolus and p 1-m 8...</td>
<td>(w) 32340</td>
</tr>
<tr>
<td>Left ramus with symphysis, p 1-p 2 alveoli and p 4-m 4...</td>
<td>(w) 32341</td>
</tr>
<tr>
<td>Left ramus with symphysis, p 3 alveolus and p 1-m 2...</td>
<td>(w) 32342</td>
</tr>
<tr>
<td>Left ramus with symphysis, /ls and /O alveoli, p 3 root and p 1-m 2...</td>
<td>(w) 32343</td>
</tr>
<tr>
<td>Right fragment with p 1 root and p 2-m 3...</td>
<td>(m+) 32344</td>
</tr>
<tr>
<td>Left ramus with symphysis, p 1-p 3 alveoli and p 1-m 2...</td>
<td>(m+) 32345</td>
</tr>
</tbody>
</table>
Right ramus with symphysis, $p_2-p_4$ alveoli and $p_1-m_3$ .......... (M) 32346
Left ramus with symphysis, $p_2$ alveolus and $p_1-m_3$ .......... (W) 32347
Left ramus with symphysis, $p_2$ alveolus (br.) and $p_1-m_3$ .......... (M+w) 32348
Right ramus with symphysis, $p_2$ alveolus and $p_1-m_3$ .......... (W) 32349
Right ramus with symphysis, $p_2$ alveolus and $p_1-m_3$ (anterior ramus heavy-proportioned) .......... (W+) 32350
Right ramus with symphysis, /Is, /C and $p_2$ alveoli, $p_1-m_3$ .......... (W) 32351
Left ramus with symphysis, /Is, /C and $p_2$ alveoli and $p_1-m_3$ .......... (W) 32352
Left ramus with symphysis, $p_2$ alveolus and $p_1-m_3$ .......... (W) 32353
Left ramus with symphysis, /Is and /C alveoli and $p_1-m_3$ .......... (W) 32354
Partial left ramus with $p_1-m_3$ (m3 br.) .......... (M) 32355
Partial right ramus with symphysis and $p_1-m_3$ (br.) .......... (W) 32356
Right ramus with symphysis and $p_1-m_3$ .......... (W) 32358
Right ramus with symphysis, /Is and /C alveoli and $p_1-m_3$ .......... (W) 32359
Right ramus with symphysis and $p_1-m_3$ .......... (W) 32360
Left ramus with symphysis, $p_2$ alveolus and $p_1-m_3$ .......... (M) 32361

Smaller:

Right ramus with symphysis and $p_1-m_3$ .......... (W) 32357
Right ramus with partial symphysis and $p_1-m_3$ (p2 small) .......... (M+w) 32362
Right fragment with $p_1-m_3$ .......... (M) 32363
Left fragment with $p_1-m_3$ .......... (W) 32364
Left ramus with symphysis, /Is, /C and $p_2$ alveoli and $p_1-m_3$ .......... (M) 32365
Right ramus with partial diastema, $p_2$ root and $p_1-m_3$ .......... (W) 32366

Immature:

Left ramus with symphysis, 2 /Is erupting, dp$_3$-dp$_4$ and m$_1$-m$_3$ .......... (erupting) 32370
Right ramus with symphysis, /I erupting, dp$_3$-dp$_4$ and m$_1$-m$_3$ .......... (erupting) 32371
Right ramus with symphysis, /I erupting, dp$_2$ alveolus, dp$_3$-dp$_4$ and m$_1$-m$_3$ .......... (erupting) 32372
Right ramus with symphysis, /I erupting, dp$_2$ alveolus, dp$_3$-dp$_4$ and m$_1$-m$_3$ .......... (erupting) 32373
Left ramus with symphysis, 2 /Is erupting, dp$_2$ alveolus, dp$_3$-dp$_4$ and m$_1$-m$_3$ .......... (erupting) 32374

Sixty-one mature and twenty-nine immature unlisted rami, F:A.M. Coll.

SEVEN MAXILLAe

Left maxilla with p$_2$-m$_2$ .......... (W+) 32383
Left maxilla with p$_2$-m$_3$ .......... (M) 32383A
Left maxilla with p$_2$-m$_3$ .......... (W) 32383B
Right maxilla with p$_2$ alveolus and p$_1$-m$_3$ .......... (W+) 32383C
Right maxilla with p$_2$-m$_3$ .......... (W) 32383D
Right maxilla with p$_2$-m$_3$ .......... (W) 32383E
Left maxilla with p$_1$-m$_3$ .......... (W) 32383F

Six mature and ten immature unlisted partial upper dentitions and several detached upper teeth, F:A.M. Coll.
(b) FROM GORDON CREEK [SIZE GROUPS III AND IV]:

(See partial crania and horn-cores, Section II, page 341; and limbs, Section IV, page 458.)

**THIRTY-FOUR RAMI**

**Twenty in F:A.M. Collection, 1934:**

- Right ramus with symphysis and p$_1$m$_3$. ..................  (m) 32071
- Right ramus with symphysis, p$_2$ alveolus and p$_3$m$_3$. .... (m) 32072
- Right ramus with symphysis, incisive alveoli, p$_3$ alveolus and p$_1$m$_3$. ..........................  (m) 32434
- Right ramus with broken symphysis and p$_2$m$_3$. ........... (m) 32437
- Left ramus with broken symphysis, p$_2$ alveolus and p$_3$m$_3$... (w) 32438
- Left ramus with broken symphysis, p$_2$ alveolus and p$_3$m$_3$.  (m) 32435
- Right ramus with broken symphysis, p$_3$ alveolus and p$_1$m$_3$. (m) 32436
- Right ramus with symphysis, p$_2$ alveolus and p$_3$m$_3$(br.).  (w) 32073
- Right ramus with symphysis, incisive alveoli and p$_2$m$_3$..... (w++) 32439
- Partial right ramus with p$_3$ alveolus and p$_2$m$_3$. ........ (m) 32074
- Partial left ramus with p$_1$-p$_2$ alveoli and p$_1$m$_3$. ..... (m+) 32075
- Right fragment with p$_1$-p$_2$ alveoli and p$_1$m$_3$. ......... 32433
- Right ramus with p$_1$-p$_2$ alveoli and p$_1$m$_3$. ............ (w) 32440
- Left fragment with p$_1$-p$_2$ alveoli and p$_1$m$_3$. .......... (m+) 32078
- Partial left ramus with p$_1$-p$_2$ alveoli and m$_3$m$_3$. .... (w) 32076
- Left fragment with p$_1$-p$_2$ alveoli and m$_3$m$_3$. .......... (w) 32079
- Right ramus with p$_1$ alveolus and p$_3$m$_3$. ................. (m) 32077
- Right fragment with p$_1$-p$_2$ alveoli and p$_1$m$_3$. ......... (m) 32080
- Left fragment with m$_3$m$_3$. ................................ 32081
- Left fragment with m$_3$m$_3$. ................................ (w) 32082
- Some seventeen unlisted fragments.

**Fourteen in the Nebraska State Museum:**

- Right ramus with symphysis and p$_1$m$_3$. ..................  (m+) 6-31-7-29
- Right ramus with symphysis and p$_1$m$_3$. .................. (m+) 24-19-7-29
- Right ramus with symphysis, p$_3$ alveolus and p$_1$m$_3$. .... (w) 10-2-8-29
- Left ramus with p$_1$ alveolus and p$_3$m$_3$. ................  (w) 7-31-7-29
- Partial left ramus with p$_1$ alveolus and p$_3$m$_3$. ....... (m) 7-2-8-29
- Partial left ramus with p$_1$-p$_2$ alveoli and p$_3$m$_3$. .... (m) 9-2-8-29
- Partial left ramus with p$_1$ alveolus and p$_3$m$_3$. ....... (w) 10-1-8-29
- Left fragment with p$_1$m$_3$ (/ps br.) ....................... (w) 1-9-8-28
- Left fragment with p$_1$-p$_2$ alveoli and p$_1$m$_3$. ........ (m+) 7-2-8-29
- Right fragment with p$_1$m$_3$. ............................... (w) 3-1-8-29
- Left fragment with p$_1$ alveolus and p$_1$m$_3$. ............  (m+) 2-30-7-29
- Right fragment with m$_3$m$_3$. ................................ (m) 8-1-8-29
- Right fragment with p$_1$m$_3$ (teeth broken) ................ (A) 1-27-7-29
- Right fragment with p$_1$m$_3$. ............................... (m) 11-31-7-29

**SIX IN THE F:A.M. COLLECTION, 1934:**

Left ramus with symphysis, /I erupting, dp$_2$ alveolus, dp$_1$-m$_1$(erupting) ..............................................  (F:A.M.) 32442
Right ramus with symphysis and dp₂-m₂........................... F:A.M. 
Left ramus with symphysis, incisive alveoli and dp₂-m₂. 322434
Partial right ramus with dp₂ alveolus and dp₁-m₂. 320090
Partial right ramus with dp₁-dp₄ alveoli and dp₁-m₂. (erupting) 32091
Immature partial mandible. (See associated partial palate, below.) 32430

Eleven unlisted immature rami.

Four in the Nebraska State Museum:
Left fragment with dp₂-m₂. 1-9-8-28
Left fragment with dp₁-m₂. 9-29-7-29
Left fragment with dp₂-m₂. 1-9-8-28
Right fragment with dp₂-dp₄ alveoli and dp₄-m₂. 4-19-7-29

TWO SKULLS AND FOUR MAXILLES

One in the Nebraska State Museum:
Partial skull with left horn-core and palate, p²-m². (See Horn Section II, page 341. [And note partial horn-cores.]) Figs. 36, N.S.M. 36A (horn) 1-9-8-28

Five in the F:A.M. Collection, 1934:
Partial right maxilla with m²-m₄. (m+) 32087
Left maxilla with p²-m₃. (m+) 32451
Partial right maxilla with m¹-m₄. (a) 32452
Six maxillary fragments and etc. detached upper teeth, F:A.M. Coll.

Immature skull with premaxillae and mandible with /dIs preserved, dp₂-m₂ and m₂ germ. (Skull broken.) (See Horn Section II, page 341; and see associated limbs, Section IV, page 458.) Fig. 36 32450
Immature partial palate. (See associated partial mandible, above.) 32430

(e) FROM SWALLOW QUARRY [SIZE GROUPS III AND III-]:
(See partial skulls, Section II, page 342; and limbs, Section IV, page 459.)

FOUR RAMI

N.S.M.
Left ramus with diastema and p₃-m₄. ..................... (m) 53-4-7-34
Right ramus with symphysis, /Is and /Cs alveoli, p₃-p₁ (br.) and p₁-m₁. ..................... (m) 54-4-7-34
Right ramus with diastema and p₃-m₄. ..................... (m+) 24-4-7-34
Partial right ramus with p₄-m₄. ..................... (m+) 26-4-7-34

FOUR RAMI, IMMATURE

23-4-7-34
20-4-7-34
22-4-7-34
29-22-6-34

Ten partial or immature unlisted rami, N.S.M. Coll.
TWO SKULLS

Nearly complete skull with left horn base, etc. .......... 25-22-6-34
Nearly complete skull, etc. ...................................... 3-27-6-34
(See Horn Section II, page 342.)

MAXILLA

Left maxilla with p²-m² .................................. (M+) 60-4-7-34

(d) FROM VARIOUS CHERRY AND BROWN COUNTY AND OTHER LOCALITIES [SIZE GROUPS II TO IV].

S.G. III AND IV.

Five from Burge Quarry:
Right ramus, p₄-m₂. (M)  F:A.M.32906  This paper, Fig. 37A.
Immature left ramus with symphysis, /1₄, /C, dp₂ alveoli and dp₂=m₂.
Immature right ramus with dp₂-m₂.
(See associated cranium, Horn Section II, page 343.)
Left p²-m².  (w)  F:A.M.32910
Right p²-m².  (M)  F:A.M.32911

S.G. IIIA. Premolars apparently moderate-sized.
(Held here only tentatively as may represent a Meryceros nen泽ensis-like form.)
Two from Quinn Quarry:
Right fragment with m₃-m₂.  (M+)  F:A.M.31549  1927.
Left fragment, p₄-m₂.  (M+)  F:A.M.31552  1927.

S.G. IIIx. Diastema long, p₂ small.
Cosoryx furcatus, large var. [William B. Scott's "Cosoryx furcatus"], from Garman Loup Fork Collection:
Partial mandible with symphysis, p₁-p₄ alveoli, m₁, m₂ alveolus and m₃.
(See associated left horn-core, m₁ and skeletal elements, Horn Section II, page 344; Limb Section IV, page 460. And see similar ramus [P.U.12117] from Sioux County, Nebraska, page 429, and Fig. 45.)

S.G. IIIy.
Four rami from the Niobrara referred by Leidy (1858, p. 23, and 1869) to Merycodus necatus Leidy, in which the molars are said to be much more nearly the form of those of the sheep than of those of the deer or musk.

SEE.—Ramus with p₂ alveolus and p₄-m₂.
N.M.5385  Figured by Leidy, 1869, Pl. xiv, Figs. 9, 10. (The missing p₄ replaced.)
p₄, according to figure, measures 6.8 mm., and small versus the Bijou Hills type of M. necatus Leidy.
An American Museum ramus (A.M.9825), from South Dakota, appears to be somewhat near to the Leidy figure.
Mandible

One from Moore Creek:

Nearly complete mandible with p4 alveolus and p4-
m2. (w)

(See? associated pair of horns, F:A.M.31274, referred to Cosoryx furcatus
Leidy, Horn Section II, page 343.)

Two from Fairfield Creek (possibly of Meryceros warreni johnsoni, var., page 423):

Right ramus with sym-

F:A.M.31554 1930.

physis, p3-p4 alveoli and

p4(br.)-m2(br.) (w+)

Left fragment with p3-p4

F:A.M.31563 1930.

alveoli and m1-m3. (w)

(Compare Fairfield Falls specimen with extremely elongate diastema and

reduced premolars under Pioceros floblairi, ref., page 496.)

Six from Quinn Quarry:

Partial left ramus with p3-
m3(br.). (M+)

F:A.M.31568 1927.

Right fragment with m1-
m3. (M)

F:A.M.31562 1928.

Right fragment with p4-
m2. (w+)

F:A.M.31560 1927.

Left fragment, p4-m2. (M+)

F:A.M.31550 1927.

Right fragment with p4-
m2. (w+)

F:A.M.31567 1928.

Right fragment with m1-
m3. (M)

F:A.M.31565 1927.

Two from Dutch Creek (probably of Paramoceros howarde, page 413):

Partial left ramus with p3-
m3. (M+)

F:A.M.31559 1929.

Fragmental mandible with

p4-m2. (M+)

F:A.M.31569 1929.

Twenty-four unlisted partial rami, F:A.M. Coll.

Unallocated Immature Specimens:

Partial skull (crushed) with dp4-m1, associated

F:A.M.32092  From Elliot Quarry, 1933.

partial mandible with dp4-
m3 and germs.

Eleven Rami, Immature

Left ramus with dp4-m2.


Partial right ramus with
dp4-m2.

F:A.M.32095  From Fairfield Creek, 1928.

Right fragment with dp4-
m2(ereupting).

F:A.M.32096  From an indefinite locality,

1929.

Left fragment, dp4-m2.


Left fragment with dp4-
m3(ereupting).

F:A.M.32098  From above north side of

Devil's Gulch, 1933.
| Right fragment with dp4–m3 (erupting). | F:A.M.32099 | From Dutch Creek, 1929. |
| Left fragment, dp1–m1. | F:A.M.32100 | Indefinite locality, 1929. |
| Right fragment, m1–m3. | F:A.M.31566 | Indefinite locality, 1929. |
| Left fragment, dp4–m3. | N.S.M.2-12-7-28 | From Fort Niobrara. |
| Left ramus with symphysis, /1, dp3–m3 (dp4 br.). | N.S.M.30-11-8-30 | From an indefinite locality. |

Sixteen unlisted immature partial rami, F:A.M. Coll.

**Meryceros, new genus**

*Meryceros* Size Group II is exemplified in several fine series of specimens from Cherry County, including the large-sized individuals from Nenzel which are suggestive of specimens from New Mexico, and the more moderate-sized individuals from Crookston and Valentine Quarries. A number of dentitions from Brown County are questionably referred to the genus, Size Groups II–III.

Attention has already been called to the remarkable series of crania, several with mandibles attached, and of detached mandibular rami, etc., secured in the summer of 1934 by F. W. Johnson, of the University of Nebraska, at Crookston and here referred to a new subspecies in honor of the discoverer. The horizontal ramus averages long and slender, the diastema elongate and the teeth moderate-proportioned. The specimens are so far indistinguishable from specimens of Snake River and Quarry A, and, with the latter, are referred to Size Groups III–IV. The Crookston series attests to the degree of variation in the size of the teeth, notably of the p2, and form of the m3 heel, that may occur within a series of individuals from a single deposit. The ramus with the longest symphysis is that of an aged male skull (N.S.M.1-23-7-34, m++, Figs. 28B, 28C); the next longest, in which the teeth are approximately the same size, is that of a mature male skull (N.S.M.3-3-8-34). These two specimens approximate the Valentine Quarry rami exemplified by N.S.M. 1-27-8-30 of Size Group IV. More moderate-sized rami are seen in two female skulls (N.S.M.2-9-8-34 and 1-3-8-34), and in the type male skull (N.S.M.2-3-8-34, Figs. 28B, 28C). A considerably slenderer-toothed ramus, in which the lower premolars, particularly p2, are notably smaller, is exemplified by ramus N.S.M.7-9-8-34, the same being approximated by Valentine Quarry N.S.M.3-21-7-30, and remains of s.g. v. In the typical *Meryceros* mandible the horizontal ramus is elongate and slender,
the symphysis and diastema are longer, the premolars tend larger and the molar crowns shorter than in *Cosoryx*.

The *Meryceros* dentitions from Cherry and Brown Counties, Nebraska, are listed below, divided between:

(a) From Nenzel, Cherry County, Size Groups II–III.
(b) From Brown County, Size Groups IIb–III.
(c) From Crookston Bridge, Cherry County, Size Groups III–V.
(d) From Snake River, Cherry County, Size Group III.
(e) From Valentine Quarry A, Cherry County, Size Groups IIIx–IV.

(a) **From Nenzel, Cherry County**

*Meryceros nenzelensis*, new species

The notably large-toothed and heavy-limbed Nenzel form is seen in some sixteen mandibular rami, a number of skulls, including one with mandible attached (see Horn Section II, page 359), and a series of limb elements (see Limb Section IV, page 463), secured by Morris F. Skinner. This Nenzel form, as observed on a preceding page, nearer resembles individuals from Santa Cruz, New Mexico, than the average of *Meryceros* remains from the Nebraska area. Examples of the rami are figured. The rami are listed below under the species based on the horns and crania.

Twenty-seven examples from nine miles south and one mile west of Nenzel on the Niobrara River; Morris F. Skinner, collector, 1934:

### Size Group II

<table>
<thead>
<tr>
<th>Ramus Type</th>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with symphysis and p4–m3. (See associated skull, Horn Section II, page 360.)</td>
<td>Fig. 44</td>
<td>31902</td>
</tr>
<tr>
<td>Partial right ramus with symphysis and m1–m3</td>
<td>(w)</td>
<td>32187</td>
</tr>
<tr>
<td>Partial right ramus with p3–m3</td>
<td>(M+)</td>
<td>32188</td>
</tr>
<tr>
<td>Left ramus with symphysis, /Is and /C alveoli and p3–m3</td>
<td>(w)</td>
<td>32169</td>
</tr>
<tr>
<td>Left fragment with p3–m3 (m1–m3 longest)</td>
<td>(M+)</td>
<td>31903</td>
</tr>
<tr>
<td>Right fragment with p3–m3</td>
<td>(w+)</td>
<td>31904</td>
</tr>
<tr>
<td>Left fragment with p1–m3</td>
<td>(M+)</td>
<td>32189</td>
</tr>
<tr>
<td>Left fragment with m1–m3</td>
<td>(w)</td>
<td>31905</td>
</tr>
<tr>
<td>Left fragment with p3 alveolus and p4–m3</td>
<td>(w)</td>
<td>31906</td>
</tr>
<tr>
<td>Right fragment with p4–m3</td>
<td>(w)</td>
<td>31908</td>
</tr>
<tr>
<td>Right fragment with m4–m3</td>
<td>(w+)</td>
<td>31907</td>
</tr>
<tr>
<td>Left fragment with m4</td>
<td>(w)</td>
<td>31910</td>
</tr>
<tr>
<td>Eight unlisted fragments, F:A.M. Coll.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Size Group III

<table>
<thead>
<tr>
<th>Ramus Type</th>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with symphysis, p3–p4 alveoli and p4–m3</td>
<td>(M)</td>
<td>32171</td>
</tr>
<tr>
<td>Partial left ramus with p3 alveolus and p4–m3</td>
<td>(M+)</td>
<td>32170</td>
</tr>
<tr>
<td>Left fragment with m4</td>
<td>(M+)</td>
<td>31909</td>
</tr>
<tr>
<td>Left fragment with p4–m4</td>
<td>(M+)</td>
<td>31964</td>
</tr>
</tbody>
</table>
RAMI, IMMATURE

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with symphysis and dp₂-m₂</td>
<td>32172</td>
</tr>
<tr>
<td>Left ramus with symphysis and dp₃-m₂</td>
<td>32173</td>
</tr>
<tr>
<td>Right ramus with symphysis and dp₄-m₂</td>
<td>32190</td>
</tr>
<tr>
<td>Left ramus with symphysis, /C and I₅ erupting, dp₂-d₄ alveoli and dp₄-m₂</td>
<td>32191</td>
</tr>
<tr>
<td>Left fragment with dp₂-m₂</td>
<td>32192</td>
</tr>
<tr>
<td>Left fragment with dp₃-m₂</td>
<td>32193</td>
</tr>
<tr>
<td>Left fragment with dp₄-m₂</td>
<td>32194</td>
</tr>
</tbody>
</table>

Ten fragments of immature rami, F:A.M. Coll.

FOUR MAXILLÆ

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right maxilla with p²-m₄</td>
<td>31916</td>
</tr>
<tr>
<td>Partial left maxilla with m₁-m³</td>
<td>31912</td>
</tr>
<tr>
<td>Partial right maxilla with detached p⁴ and m²-m³</td>
<td>31913</td>
</tr>
<tr>
<td>Partial left maxilla with p⁴-m³</td>
<td>31914</td>
</tr>
</tbody>
</table>

Two unlisted partial maxillae, F:A.M. Coll. (one not included in specimen count).

A questionably distinct form is exampled by a single ramus in which the shortness of the postsymphysis is suggestive of the Sioux County remains:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with diastema and p₃-m₄</td>
<td>32168</td>
</tr>
</tbody>
</table>

(b) FROM BROWN COUNTY

(?)Meryceros Var., or Vars.

(Certain specimens possibly of Cosoryx.)

SIZE GROUP IIA.

FOUR RAMI

Two from horizon above Devil’s Gulch:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial mandible with p₁ alveolus and p₃-m₂ (p₁-m₁ br.)</td>
<td>1932</td>
</tr>
<tr>
<td>Left fragment with p₂-p₄ alveoli and p₄-m₂</td>
<td>1930</td>
</tr>
</tbody>
</table>

One from Williams Canyon:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left fragment with p₁-m₁</td>
<td>1929</td>
</tr>
</tbody>
</table>

One from Rattlesnake Canyon:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left fragment with p₃ alveolus and p₅-m₂</td>
<td>1932</td>
</tr>
</tbody>
</table>

SIZE GROUP III.

SEVEN RAMI

Three from above Devil’s Gulch:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial left ramus with p₂-m₃</td>
<td>1933</td>
</tr>
<tr>
<td>Right ramus with symphysis, p₁-m₁ and m₁ (br.)</td>
<td>1932</td>
</tr>
</tbody>
</table>

Left fragment with m₁-m₂                                                   | 1932   |

Three from Deep Creek:

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial mandible with p₄ alveolus and p₃-m₂; and associated partial left maxilla with p⁴(br.)-m³</td>
<td>1929</td>
</tr>
</tbody>
</table>
Partial left ramus with p\textsubscript{3}–m\textsubscript{3}. \( \text{(w)} \) 1933 31557
Left fragment with m\textsubscript{1}–m\textsubscript{2}. \( \text{(m+)} \) 1933 31564

One from nine miles north of Long Pine:

Right fragment with p\textsubscript{4}–m\textsubscript{3}. (Possibly associated Cosoryx horn fragments, F:A.M.31273, Horn Section II, page 343.) \( \text{(w)} \) 1933 31273A

THREE RAMI
With large premolar series

Right ramus with symphysis and p\textsubscript{2}–m\textsubscript{2}. \( \text{(w+)} \) 25 A.M.8561 Cope Collection. From Fort Niobrara.
(Note intercolumnar styles on m\textsubscript{2}–m\textsubscript{3}.)

Partial right ramus with p\textsubscript{3}–m\textsubscript{3}. \( \text{(m+)} \) 1933 31276 From 45 ft. above Brule Fairfield Creek, 1930.

(\textit{Meryceros warreni johnsoni}, var. See associated pair of horns, Section II, page 366; and limbs, Section IV, page 466. This paper, \textit{Fig. 39}, horns.)
(See Valentine Quarry A specimens, page 426, and Fairfield Creek specimens, page 419.)

Partial right ramus with p\textsubscript{2} alveolus, p\textsubscript{2}–m\textsubscript{2}. \( \text{(w)} \) 20 N.S.M.1-3-11-13 From Plum Creek.

FOUR MAXILLAE

One from above Devil’s Gulch:

Right maxilla with p\textsubscript{2}–m\textsubscript{3}. \( \text{(a)} \) 1931 2-3-11-13

One from Plum Creek:

Partial right maxilla with p\textsubscript{4}–m\textsubscript{2}. \( \text{(w)} \) 1931 5-3-11-13

Two from Deep Creek:

Partial left maxilla (listed under associated mandible, see preceding page). \( \text{(M+)} \) 1929 31541
Immature left maxilla with dp\textsubscript{3}–m\textsubscript{2}. \( \text{(m+)} \) 1931 32093

(c) \textbf{FROM CROOKSTON BRIDGE QUARRY, CHERRY COUNTY}

\textit{Meryceros warreni johnsoni}, new subspecies, referred
(See Horn Section II, page 362; Limb Section IV, page 464.)

\textbf{SIZE GROUPS III–IV.}

Specimens collected by the University of Nebraska field party under the leadership of F. W. Johnson, 1935:

\textbf{TEN MANDIBULAR RAMI}

S.G. III.

Mandible with /Is, /Cs and p\textsubscript{2}–m\textsubscript{3}. (See associated skull, Horn Section II, page 364.) \( \text{(m+)} \) 1929 2-15-8-35
Right ramus with symphysis and p\textsubscript{2}–m\textsubscript{3}. \( \text{(m+)} \) 1929 12-27-8-35
Right ramus with symphysis and l\textsubscript{1}–m\textsubscript{3}. \( \text{(w)} \) 1931 3A-27-8-35
Right ramus with symphysis and p\textsubscript{1}–m\textsubscript{3}. \( \text{(m+)} \) 1931 28-15-8-35
Right ramus with symphysis and p\textsubscript{2}–m\textsubscript{3}. \( \text{(m+)} \) 1931 33-15-8-35
Collected by the same party in 1934:

**S.G. III-IV.**

**THIRTY-TWO MANDIBULAR SPECIMENS**

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>Side</th>
<th>Age</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>30-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis, p&lt;sub&gt;r&lt;/sub&gt; alveolus and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(M++)</td>
<td>9-9-8-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C broken alveoli and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(M+)</td>
<td>10-9-8-34</td>
<td></td>
</tr>
<tr>
<td>Mandible. (See associated skull, Horn Section II, p. 363.)</td>
<td>(M+++</td>
<td>3-3-8-34</td>
<td></td>
</tr>
<tr>
<td>Mandible. (See associated skull, Horn Section II, p. 364.)</td>
<td>(M++)</td>
<td>7-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Fragmental rami. (See associated skull, Horn Section II, page 364.)</td>
<td>(M++)</td>
<td>4-3-8-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>6-21-8-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus. (See associated skull, Horn Section II, page 363. This paper, Figs. 2, 28B, 28C.)</td>
<td>(M+++</td>
<td>1-23-7-34</td>
<td></td>
</tr>
<tr>
<td>Mandible. (See associated skull, Horn Section II, p. 363.)</td>
<td>(w+)</td>
<td>8-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(M+)</td>
<td>23-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Mandible. (See associated skull, Horn Section II, p. 363.)</td>
<td>(M++)</td>
<td>1-27-7-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(M+)</td>
<td>3-23-7-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt;, /C and p&lt;sub&gt;r&lt;/sub&gt; alveoli, p&lt;sub&gt;r&lt;/sub&gt;-p&lt;sub&gt;r&lt;/sub&gt;, m&lt;sub&gt;3&lt;/sub&gt; roots and m&lt;sub&gt;3&lt;/sub&gt;-m&lt;sub&gt;3&lt;/sub&gt;</td>
<td>(w++)</td>
<td>8-9-8-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>4-23-7-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>22-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C alveoli, p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>20-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C alveoli and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>12-3-8-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C alveoli and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>11-9-8-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(M+)</td>
<td>10-15-8-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C alveoli and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>8-3-8-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C alveoli and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(M+)</td>
<td>14-9-8-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus. (See associated skull, Horn Section II, page 364, and limbs, Section IV, page 464.)</td>
<td>(M++)</td>
<td>1-3-8-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with symphysis and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>24-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Left ramus with p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>25-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Mandible. (Type, in part. See associated skull, Horn Section II, page 363. This paper, Figs. 28B, 28C.)</td>
<td>(M++)</td>
<td>2-3-8-34</td>
<td></td>
</tr>
<tr>
<td>Right fragment with p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(w)</td>
<td>25-7-9-34</td>
<td></td>
</tr>
<tr>
<td>Right ramus with symphysis, /I&lt;sub&gt;s&lt;/sub&gt; and /C broken alveoli and p&lt;sub&gt;r&lt;/sub&gt;-m&lt;sub&gt;2&lt;/sub&gt;. (No p&lt;sub&gt;r&lt;/sub&gt; alveolus.)</td>
<td>(M+)</td>
<td>5-23-7-34</td>
<td></td>
</tr>
</tbody>
</table>
Right ramus with symphysis and p₂-m₃. .......... (w) 18-9-8-34
Right ramus with symphysis, p₂ alveolus and p₂-m₃. (p₂ held inverted and unerupted within ramus) .......... (m+) 22-9-8-34
Left ramus with symphysis, /I₃ and /C alveoli and p₂-m₃. .......... (w++) 4-21-8-34
Mandible. (See associated skull, Horn Section II, page 364. This paper, Figs. 28B, 28C.) ................. (w) 2-9-8-34
Right ramus with symphysis, p₃-p₄, m₁ roots and m₂-m₃. .......... (w++) 6-15-8-34

THIRTEEN RAMI, IMMATURE

Right ramus with symphysis and dp₂-m₃ .......... 23-9-8-34
Right ramus with symphysis and dp₂-m₃ .......... 9-3-8-34
Right ramus with symphysis and dp₂-m₃ .......... 7-21-8-34
Right ramus with symphysis and dp₂-m₃ .......... 16-9-8-34
Right ramus with symphysis, dp₂ alveolus and dp₂-m₃ (erupting) .......... 19-7-9-34
Right ramus with symphysis and dp₂-m₃ .......... 21-7-9-34
Left ramus with symphysis, I₃, /I₃ and dp₂-m₃ .......... 28-7-9-34
Left ramus with symphysis, I₃, /I₃ (erupting) and dp₂-m₃ .......... 34-7-9-34
Right ramus with symphysis and dp₂-m₃ .......... 42-7-9-34
Left ramus with symphysis and dp₂-m₃ .......... 12-15-8-34
Left ramus with symphysis, dp₂ alveolus and dp₂-m₃ .......... 13-9-8-34
Left ramus with symphysis, dp₂-dp₂ alveoli and dp₂-m₃ .......... 11-3-8-34
Right ramus with symphysis and dp₂-m₃ .......... 7-17-6-32
Numerous unlisted nearly complete or fragmental mature and immature rami, N.S.M. Coll.

(And note skulls already enumerated under Horn Section II, pages 363-365.)

SIZE GROUP V.
(Small individuals of above species, or distinct var.; p₃ of second specimen disproportionately small.)

TWO MANDIBULAR RAMI

Left ramus with symphysis and p₃-m₃ .......... (w) 27-15-8-35
Left ramus with symphysis, /I₃ and /C alveoli and p₃-m₃. .......... (m+) 7-9-8-34

(d) FROM SNAKE RIVER, CHERRY COUNTY, NEBRASKA
Meryceros warreni johnsoni, referred

SIZE GROUP III.

FOURTEEN RAMI

Larger:
Right fragment with p₄-m₃ .......... (a) 16-25-6-32
Right fragment with p₃-p₄ and m₂-m₃ .......... (w+) 16-25-6-32
Left fragment with m₂-m₃ .......... (w) 31-25-6-32
Immature partial left ramus with symphysis and dp₂-m₃. .......... 22-25-6-32
Smaller:

Right fragment with p4 alveolus and p4-m2.............. (m+) 16-25-6-32
Right fragment with p4 alveolus and p3-m3.............. (m+) 11-8-14
Left fragment with p3-m3................................ (w) 1-15-8-14
Right fragment with p3-p2 alveoli and p4-m3.............. (m+) 22-25-6-32
Right fragment with m2-m3................................ (w) 16-25-6-32
Right fragment with m2-m3................................ (m) 16-25-6-32
Left fragment with p2-p3................................ (m) 16-25-6-32
Left fragment with m2...................................... (m+) 22-25-6-32
Right fragment with p4-m1................................ (m) 31-25-6-32
Left fragment with m1, immature............................ 16-25-6-32

(e) FROM VALENTINE Quarry A, CHERRY County

Meryceros warreni johnsoni, Var.
In the Nebraska State Museum Collection
(And note skulls and horns, Horn Section II, page 366; and limbs, Limb Section IV, page 466.)

30 MANDIBULAR RAMI

**SIZE GROUP III**

Partial right ramus with symphysis and p4-m2.............. (m+) 14-22-8-30
Left fragment with m2-m3................................ (w+) 30-28-7-30
Immature right fragment with symphysis, dp2; p4 and p4 (not erupted)............................ 16-29-7-30

**SIZE GROUP IV**

Mandible with symphysis, /Is, /C root and p2-m4.............. (m+) 1-27-8-30
Mandible with symphysis and p2-m3. (p4 right missing and alveolus closed.)............................. (w) 22-2-9-30
Right ramus with symphysis and p3-m3...................... (m) 1-15-7-31
Left ramus with symphysis and p3-m3(br.).................. (m+) 40-22-6-31
Left ramus with symphysis and p2-m3...................... (m+) 20-11-8-15
Right ramus with symphysis and p2-m3...................... (w) 22-28-7-30
Left ramus with symphysis, /Is and p2-m3.................. (w) 2-7-8-30
Left ramus with symphysis and p3(br.)-m2................ (w) 15-5-8-30
Right ramus with symphysis and p3-m2...................... (w+) 5-8-8-30
Partial left ramus with p2-m3.............................. (m+) 4-21-7-30
Partial left ramus with p2-m3......................... (m+1) 1A-15-7-31
Partial right ramus with p2-m3.......................... (m+) 79-21-7-31
Partial right ramus with p4 alveolus and p2-m4. (Note large premolars and different m3.)............. (m+) 16-17-6-32

Slightly smaller:

Partial right ramus with p3-m4........................................ (m) 1B-15-7-31
Left ramus with symphysis and p3-m4............................... (m) 1C-15-7-31
Right ramus with symphysis, p4 alveolus and p3-m4.............. (m) 1D-15-7-31
Left ramus with symphysis and p2-m3............................... (w) 2-6-8-30

(s.g. v):

Left ramus with symphysis and p4-m3............................... (m+) 17-11-8-15
Right ramus with symphysis and p3-m3............................... (m+) 3-21-7-30
Frick, Horned Ruminants. II—Antilocapridæ

Fifteen rami, immature

N.S.M.

Right ramus with symphysis and P3-M4...

(m+) 6-23-8-30

Right ramus with symphysis and P3-M4...

(m+) 21-21-7-30

Right ramus with symphysis and P3-M4(br.)...

(m) 44-22-6-31

Partial left ramus with P3-M4...

(m) 7-11-8-15

Partial right ramus with P3-M4...

(w+) 18-11-8-15

Partial right ramus with P3-M4(br.)...

(w+) 42-22-6-31

Partial right ramus with P3-M4...

(w+) 10-9-8-30

Right fragment with P3-M4...

(M+) 11-11-6-34

Fifteen rami, immature

N.S.M.

Right ramus with symphysis and dp3-M2...

1-15-7-31

Right ramus with symphysis and dp3-M2...

17-21-8-30

Partial right ramus with dp3-M2...

16-17-6-32

Partial left ramus with dp3-M2...

1-15-7-31

Partial left ramus with dp3-M2...

22-25-8-30

Partial right ramus with dp3-M2...

9-9-8-30

Left fragment with dp4-M2...

1-15-7-31

Left fragment with dp4-M2...

45-22-6-31

Left fragment with p4-p3 and dp4-m3(erupting)...

1-15-7-31

Right fragment with dp4-M2...

2-26-8-30

Right fragment with dp4-M2...

16-17-6-32

Left fragment with dp4-M2...

3-28-8-30

Left fragment with dp4-M2...

41-22-6-31

Right fragment with dp4-M1...

16-17-6-32

Right fragment with dp4-M1...

11-26-8-30

Numerous unlisted mature and immature partial rami, N.S.M. Coll.

Collected by the Morris F. Skinner Party, 1935

Five mandibular rami

F:A.M.

Left ramus with symphysis and p3-m4...

(M++) 31182

Left ramus with symphysis and p3-m4...

(w) 31183

Left ramus with symphysis and p3-m4...

(M+) 31185

Right ramus with symphysis, p3, p3 alveolus and p4-m4...

(w+) 31184

Left ramus with symphysis and p3-m4 (s.g. v)...

(M+) 31186

Twenty-six partial mature and immature rami, F:A.M. Coll.

Two maxillæ

(w) 31187

(w+) 31188

Size group IV.

Skulls

Two male and one female skulls and various horn-cores listed in Horn Section II, page 366. Figs. 28 and 28A.

Five maxillæ

N.S.M.

Left maxilla with p4-m4...

(M+) 5-23-8-30

Partial left maxilla with p4-m4...

(M+) 84-21-7-31

Partial right maxilla with p4-m4...

(M+) 26-31-7-30

Partial left maxilla with m1-m2...

(M) 1-7-6-32

Partial right maxilla with m1-m2...

(M) 12-22-8-30
(4B) SIoux County Localities

Cosoryx Leidy, Paracosoryx, n.subg., ref., and Submeryceros, n.subg.

The occurrence of Merycodontini at the Sheep Creek horizon is in question, the evidence as to their presence at best being fragmentary. Matthew (1924) credits Merycodus to both the Sheep and Snake Creek, not attempting to distinguish species.

The mandibular specimens from Sioux County, Nebraska (see page 288), are divided between:

Cosoryx furcatus, large var.
Example.—Left ramus, P.U.12117. This paper, Fig. 45. (Compare Plioceros.)

C. (Paracosoryx) wilsoni, n.subg. and sp.
Subgenotype.—Partial skull, F:A.M.32470. This paper, Fig. 37.

C. (Paracosoryx) sabulonis (Matthew and Cook)
Type.—Right ramus, A.M.14109. This paper, Fig. 44. [Compare C. (Subparacosoryx) serpentinus, n.subg. and sp. Subgenotype.—Posterior cranium, A.M.17339. This paper, Figs. 32, 33A. (Skulls only).]

M. (Submeryceros) minor serpentinus, n.subsp.
Type.—Right ramus, F:A.M.31577. This paper, Fig. 44.

The listed F:A.M. and A.M. Sioux County collections include some thirty-six rami with diastema preserved, twenty-seven partial and fragmental rami, five maxillae and nineteen partial skulls—in addition to three hundred and seventy-one uncatalogued partial and fragmental rami and fifty-one unlisted partial maxillae. The rami fall in Size Groups III—VI.

Size Group IIIa, Cosoryx furcatus, large var., is seen in the Garman Loup Fork specimen (M.C.Z.10101) associated with large horn-core, etc., on which William B. Scott (1890) based his reconstruction of Cosoryx furcatus. This form is distinct in the elongation of the diastema and the heaviness and straightness of the ramus, the proportionate smallness of $p_2$ and resulting shortness of the premolar relative to the molar portion of the series. The form is evidenced at Snake Creek in the lone ramus, here figured (Fig. 45), of the Princeton University Collection (P.U.12117).

Size Groups IIIb and c remains are noteworthy for the extreme shortness and heaviness of the diastema, and are referred to C. (Paracosoryx) wilsoni, n.subg. and sp. The teeth generally are extremely heavy-proportioned relative to the size of the ramus though the $p_2$ may be small. The form is represented by a fine series of mandibular rami and a number of partial crania collected by Jack Wilson and party from Long Quarry. The rami are tentatively subdivided under b and c according to heaviness of the teeth.

Size Group IV rami, exhibiting a moderate-lengthed diastema and relatively large $p_2$, as exemplified in the type specimen of Paracosoryx sabulonis (Matthew and Cook), are held under that species. It is possible that the latter species may be represented as well by certain small partial crania and horn-cores from the same area. The numerous rami may be divided tentatively into size variations A and B. The actual
postsymphysial distance of twenty measured specimens varies from 25 to 18 mm. The absence of any very notable gap in the series suggests that such differences are largely a matter of individual variation. Comparison of the specimens is complicated on account of tooth wear and the frequently broken condition of the diastema, absence of \( p_2 \), etc.

The type ramus (A.M.14109) falls within variation B.

The rare specimens of small Size Group vi are placed questionably in \textit{Submeryceros}. The horns, as noted above, are unknown. Size Group vi, as exampled in a ramus and referred fragments, exhibits a diastema that tends to be short, but premolars of relatively large size.

\textit{Ramoceros} is so far unrecognized from Sioux County deposits. (Horns of the genus are indicated alone in Nebraska collections by a horn and horn fragment from Hitchcock County, and a horn fragment from Fairfield Creek, Brown County. \textit{Paramoceros} is known from Nebraska only by the Dutch Creek, Brown County, horn specimen.)

The Sioux County mandibular remains are listed below:

**Size Group IIIA**—with long diastema and small \( p_4 \).

\textit{Cosoryx furcatus}, large var.

**RAMUS**

Example from Snake Creek area, locality 1000D:

- Left ramus with symphysis and \( p_2-m_3 \). \((M+)-\)
  - Is very similar to—

  [Partial mandible with symphysis, \( p_2-p_4 \) alveoli, \( m_1, m_2 \) alveolus and \( m_3 \); left horn-core and possibly associated \( m_1 \), etc.

  M.C.Z.10101 Garman Loup Fork collection.
  - Skeleton figured by Scott, 1890, under \textit{Cosoryx furcatus} referred.

  This paper, \textit{Fig. 45} (ramus).]

(See Horn Section II, page 344; this Section, page 418; and Limb Section IV, page 460.)

**Size Groups IIIB and C**—with short diastema, heavy teeth and reduced \( p_4 \).

\textit{C. (Paracosoryx) wilsoni}, new subgenus and species, referred

(And see Horn Section II, page 351, and Limb Section IV, page 462.)

**Variation B. Heavy.**

**SEVEN RAMI**

From Long Quarry, 1934–35:

- Right ramus with \(/Is\) alveoli and \( p_2-m_3 \).................. \((M)\) 32005
- Left ramus with \(/Is\) alveoli and \( p_2-m_3 \).................. \((M+)\) 31743
  - \textit{Fig. 57}

- Right ramus with \(/Is\) alveoli and \( p_2-m_3 \).................. \((M)\) 31744
- Left ramus with \(/Is\) alveoli and \( p_2-m_3 \).................. \((w)\) 31745
- Left ramus with \(/Is\) and \( p_2 \) alveoli, \( p_2-m_3 \)................. \((w)\) 31746
- Right ramus with posterior symphysis, \( p_2 \) alveolus and \( p_2-m_3 \). \((M)\) 31747
- Right fragment with symphysis, \( p_2 \) alveolus and \( p_2-m_3 \)...... \((M)\) 31748
VARIATION C. Symphysis, compared to B, lighter and p$_2$-p$_4$ larger.

EIGHT RAMI

From Long Quarry, 1934-35:

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with /I and alveoli, p$_2$-m$_3$</td>
<td>(m)</td>
<td>32007</td>
</tr>
<tr>
<td>Left ramus with symphysis, /Is alveoli and p$_2$-m$_3$</td>
<td>(m)</td>
<td>32008</td>
</tr>
<tr>
<td>Left ramus with p$_2$ alveolus and p$_2$-m$_3$</td>
<td>(w)</td>
<td>32010</td>
</tr>
<tr>
<td>Right ramus with symphysis, /Is alveoli and p$_2$-m$_3$</td>
<td></td>
<td>32011</td>
</tr>
<tr>
<td>Right ramus with p$_2$ alveolus and p$_2$-m$_3$</td>
<td>(w++)</td>
<td>32012</td>
</tr>
<tr>
<td>Right ramus with symphysis, /Is alveoli and p$_2$-m$_3$</td>
<td>(m)</td>
<td>32006</td>
</tr>
<tr>
<td>Left ramus with diastema, p$_2$ alveolus and p$_2$-m$_3$</td>
<td>(M)</td>
<td>32009</td>
</tr>
</tbody>
</table>

Some one hundred and ninety-five unlisted additional mandibular rami or partial rami from the same locality, F:A.M. Coll.

Some forty unlisted rami or partial rami from the same locality, F:A.M. Coll., including six rami with dp$_2$-m$_1$ (F:A.M.32482, A-E).

Smaller variation (actually Size Group iv) and suggesting *P. sabulonis*:

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with symphysis, /Is alveoli, p$_1$ alveolus and p$_2$-m$_3$</td>
<td>(w)</td>
<td>32001</td>
</tr>
</tbody>
</table>

**MAXILLÆ**

Some seven partial maxillary series ...................... 32477, A-F

Thirty-one mature and seven immature unlisted partial maxillae, F:A.M. Coll.

**SIZE GROUPS III-IV.**

*Paracosoryx sabulonis* (Matthew and Cook), referred, or *S. savaronis*, referred

With moderate postsymphysial distance, and relatively large premolars. The series of rami may be divided into two slightly larger and smaller variations, A and B, the type falling into the latter. (See synonymy and referred horns, Horn Section II, page 353; and limbs, Limb Section IV, page 462.)

VARIATION A. (S.G. IV.)

Seventeen from general Snake Creek area:

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with symphysis and p$_2$-m$_3$</td>
<td>(M+)</td>
<td>26882</td>
</tr>
<tr>
<td>Right ramus with symphysis and p$_2$-m$_3$</td>
<td>(w)</td>
<td>26885</td>
</tr>
<tr>
<td>Right ramus with symphysis, p$_2$ alveolus and p$_2$-m$_3$</td>
<td>(m)</td>
<td>26880</td>
</tr>
<tr>
<td>Right ramus with symphysis, p$_2$ alveolus and p$_2$-m$_3$</td>
<td>(w)</td>
<td>26875</td>
</tr>
<tr>
<td>Left ramus with symphysis and p$_2$-m$_3$</td>
<td>(w)</td>
<td>26879</td>
</tr>
<tr>
<td>Right ramus with symphysis, p$_3$ alveolus and p$_2$-m$_3$</td>
<td>(w)</td>
<td>26881</td>
</tr>
<tr>
<td>Right ramus with symphysis and p$_2$-m$_3$</td>
<td>(w+)</td>
<td>26876</td>
</tr>
<tr>
<td>Left ramus with symphysis, p$_2$-p$_3$ alveoli and p$_4$-m$_4$</td>
<td>(M+)</td>
<td>26877</td>
</tr>
<tr>
<td>Right ramus with symphysis, p$_2$-p$_3$ alveoli and p$_4$-m$_4$</td>
<td>(w+)</td>
<td>1908 14110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fig. 44</td>
</tr>
</tbody>
</table>
Frick, Horned Ruminants.  II—Antilocapridæ

Left ramus with symphysis and p₄-m₂ (m₁ br.)...... (w+) 1908 14110A
Left ramus with symphysis, p₃-p₄ alveoli and p₄-m₂...... (w) 26878
Partial right ramus with p₂-m₃.......................... (M+) 1916 22751
Partial right ramus with p₂-ms.......................... (M+) 26883
Partial left ramus with p₃ alveolus and p₃-m₃...... (w) 26887
Partial right ramus with p₃ alveolus and p₄-m₃...... (w) 26886
Partial left ramus with p₃ alveolus and p₄-m₃...... (w+) 1916 22751

Seven from Quarry A, Sinclair Draw:
Right ramus with symphysis, p₃ and m₁ alveoli, p₃-p₄ and m₂-m₃................. (w+) 1916 22734
Left ramus with symphysis, p₃-p₄ alveoli and p₄-m₃...... (w) 1921 22743B
Partial right ramus with p₃-m₃.......................... (M+) 1921 22743C
Partial left ramus with p₃-m₃.......................... (w) 1921 22743D
Left fragment with p₄-m₂............................... (M) 1921 22743E
Partial right ramus with p₄ alveolus and p₄-m₃.... (w+) 1921 22743A
Left fragment with p₃-p₄ alveoli and p₄-m₃. (Note "heel" m₃.)...................... (w) 1921 22743

Two from Quarry B:
Partial right ramus with p₄-m₃.......................... (M) 1921 22744
Left fragment with p₃(br.)-m₃. (Note larger, and "heel" m₃.)..................... (w+) 1921 22744A

Heavier variation (Size Group III)—towards P. wilsoni, var. B:
Two from general Snake Creek area:
Right ramus with symphysis and p₃-m₃................. (w) 26890
Left ramus with symphysis, /I, p₃ alveoli, p₃-m₃...... (A) 26891

Two from vicinity of Stonehouse Draw:
Right ramus with symphysis, p₃ alveolus and p₃-m₃. (M) 1923 20530

Rights fragment with p₃-m₃............................. (w) 1923 20530X

VARIATION B. (SIZE GROUP IV.) (Symphysis slighter.)
Six from general Snake Creek area:

Right ramus with symphysis and p₃-m₃. (M+) A.M.14109 1908, Figured by Matthew and Cook, 1909, Fig. 24; this paper, Fig. 44. A.M.
[Type of P. sabulonis (Matthew and Cook).]

Right ramus with symphysis, p₃-p₄ alveoli, p₄-m₄...... (w) 1908 14105
Partial right ramus with p₃-m₃.......................... (M+) 1908 22409
Left ramus with partial symphysis and p₃-m₄...... (M+) 1916 22735
Partial left ramus with p₃-m₄.......................... (M+) 1916 22751
Partial right ramus with p₃ root and p₄-m₃.... (M) 26884

One from Quarry No. 6, Lower Snake Creek:
Right ramus with partial symphysis and p₄-m₄...... (M+) 1926 22065

Fig. 44
Variation (from Quarry B), larger and questioned—teeth towards *P. wilsoni*, Size Group III, var. c:

Right ramus with symphysis, p₃ alveolus and p₄-m₃. (A) 1921  22739
Right ramus with symphysis, p₅ alveolus and p₄-m₃. (A) 1921  22740

One hundred and thirty mature and six immature unlisted partial rami from general Snake Creek area.

**MAXILLE**

Six from Snake Creek area:

Posterior half of skull with horns and partial right maxilla with m₁–m₄.

(Type of *Subparacosoryx savaronis*, n.subg. and sp. See Horn Section II, page 353.)

Right maxilla, p₂–m₄. (w) A.M.26889
Right maxilla, p₃–m₄. (w) F:A.M.31388
Left maxilla, p₄–m₄. (m+) A.M.22736  Quarry B, 1921.
Right maxilla, m₁–m₄. (m+) A.M.22737  Quarry B, 1921.
Left maxilla with dp₁–m₃. A.M.20530  Vicinity of Stonehouse Draw, 1923.

Six unlisted maxillae and numerous detached teeth.

**SIZE GROUP V.** Tentatively referred to these species.

**FOUR RAMI**

Partial right ramus with p₅–m₅. (w) A.M.26888  From Snake Creek area.
Right fragment with m₁ (br.)–m₃. P.U.12133  From locality 1000D.
Right fragment with m₂–m₃. F:A.M.31576  From Quarry No. 7, W. Sinclair Draw.

**UNALLOCATED IMMATURE SPECIMENS:**

**RAMI, IMMATURE**

Fourteen from Snake Creek area:

Left fragment with dp₂ (root)–m₃(erupting). F:A.M.31578  Antelope Draw, 1933.
Right ramus with symphysis, p₅, dp₄, m₁–m₄ (erupting) and p₄ germ. A.M.22741  Quarry B, 1921.
Left ramus with symphysis and dp₁–m₃(erupting). A.M.22744  Quarry B, 1921.
Right fragment with dp₁–m₃(erupting). A.M.14107  1908.
Right fragment with dp₁–m₃(erupting). A.M.22743  Quarry A, 1921.
Left fragment with dp_{4} m_{3} (erupting).
A.M.22742 1921.

Right ramus with dp_{4} - m_{1}.
A.M.22747 1916.

Right ramus with symphysis and dp_{4} - m_{1} (erupting).
A.M.22747 1916.

Left fragment with dp_{4} - m_{3} (erupting).
A.M.14102 1908.

Right fragment, dp_{4} - m_{1}.
A.M.22744 Quarry B, 1921.

Left fragment, dp_{4} - m_{1}.
A.M.22752 Quarry A, 1921.

Right fragment, dp_{4} - m_{1}.
A.M.20530 Stonehouse Draw vicinity, 1923.

Left fragment, dp_{4} - m_{3}.
A.M.22751 1916.

Left fragment, dp_{4} - m_{1}.
A.M.21473 Olcott Hill, 1925.

**SIZE GROUP VI.**

(?) *Submeryceros minor serpentinus*, new subspecies

Diastema moderately short, premolars relatively large

**TYPE.—** Right ramus with symphysis and p_{4} - m_{2}.

\(F: A.M. 31577\)
From E. Sinclair Draw, 1933.
This paper, Fig. 44.

**FOUR RAMI, ETC., TENTATIVELY REFERRED.—**

One from vicinity of Stonehouse Draw:
Left fragment with p_{4} (br.) - m_{2} .................. \((w)\) 1923 20530A

One from Thistle Quarry:
Left p_{4} - m_{1} ........................................ \((M+)\) 1935 31571

Two from general Snake Creek area:
Right fragment with m_{3} .......................... \((M)\) 1916 22749
Detached m_{2} and m_{3} .......................... 1916 22749
(4c) HITCHCOCK COUNTY LOCALITIES

SIZE GROUP III.

*Cosoryx furcatus* Leidy, referred

Partial ramus. A.M.8497 From Driftwood Creek, 1879. Cope Collection.

(See top of cranium and horns under same number, Section II, page 344. This paper, *Figs. 28, 36.*

Merycodontine species, referred

Right ramus with partial symphysis, p₂ alveolus and p₃-m₂. A.M.8499 Cope Collection. (M+)

Teeth seemingly taller and heavier, and symphysis longer than in Snake Creek, Size Group III.

N.S.M.

Left ramus with symphysis and dp₃-m₁.............................. 9-4-29
Right ramus with symphysis and m₁.............................. 9-4-29

(4d) DAWES COUNTY (GINN QUARRY)

SIZE GROUP IV.

*C. (Paracosoryx) dawesensis*, n.sp., referred

FOUR RAMI

Right mandibular ramus with diastema and p₂(br.)-m₃. F:B:A.M. 32854
Three immature rami with dp₂-m₁.............................. 32854A-C

TWO MAXILLÆ

Left maxilla with p₂-m².............................. (m) 32853
Left p² root-m¹.............................. (w) 32853A

(See Horn Section II, page 354.)

SIZE GROUP VI.

(?) *Submeryceros minor serpentinus*, var.

EXAMPLE.—Right ramus with p₄-m₄ and alveoli............. (M) 33779

---

Fig. 47A. *R. (Merriamoceros) coronatus* (Merriam), ref., rev. (F:A.M.31144), from Upper Steepside Quarry, Barstow, California. [Specimen unique in presence of p₁ (dp₁).]

X 1. (See page 437.)
Merycodontine partial mandibles and detached teeth occur from top to bottom of the Barstow deposits. The present collection contains some one hundred and twenty-eight listed rami, forty-one listed partial maxillae, two hundred and forty-two unlisted partial rami, thirty-nine unlisted partial maxillae and numerous fragments. Were the diastemata and the $p_2$s more generally preserved, the task of determining the number of forms present might be simpler. The rami, compared with those from New Mexico, are shallower and have slenderer-compressed molars, with less noticeably elongate crowns. Definite comparison may be made only in the case of specimens with unworn $m_3$s. Size Group $\Pi$ (single specimen) and Size Groups $\Pi$, $\Pi V$ and $V$ are present. There is the usual difficulty in allocation of particular rami through overlap, the smallest specimens of Size Group $\Pi$ being approximated by the largest of Size Group $\Pi V$.

The relative frequency of occurrence of horns and dentitions suggests the allocation of the Barstow dentitions to Paracosoryx and Meryceros. As Paracosoryx horns are encountered so far only in several restricted quarries, the commoner of the rami from the same localities, which happen to exhibit a relatively moderate diastema and small $p_2$, are referred to this subgenus. Meryceros horns occur only in certain First Division localities, and the subgenus is thought to be represented by ramal specimens from the same localities that have a relatively moderate symphysis and large-tending $p_3$-$p_4$. (Paramoceros, based on horns of rare occurrence from the Green Hills, is probably unrepresented by ramal remains.) Merriamoceros is witnessed by a recently secured series of rami with short diastema and large-proportioned $p_2$ of Size Group $\Pi$ to $\Pi V$. The specimens were obtained, together with a fine collection of horns, from the Steepside Quarry in the Green Hills, Barstow. The mandibular characters recall smaller individuals of Paracosoryx from Sioux County, Nebraska. (One unique specimen retains the $p_1$.)

Thus specimens from the Mojave, unlike those from New Mexico and northern Nebraska, include evidence of forms with short-proportioned diastema, such as occurs among the Sioux County, Nebraska, remains. Size Group $\Pi$ is exampled by a partial ramus from an indefinite horizon.

Size Group $\Pi$ is represented by:

Specimens from Steepside Quarry in the Green Hills, see above.

Rami from Skyline and New Year Quarries that exhibit relatively short premolar versus molar series and moderately long diastemata.
Small Skyline F:A.M.31042 closely resembles New Year F:A.M. 32043. The rami are believed to represent the same Paracosoryx as seen in the horns from these quarries.

Specimens from Hemicyon Stratum, North End, White Operation, Leader and Hidden Hollow Quarries tend to taller crowns. Specimen F:A.M.31054, Hemicyon Stratum, is larger and has relatively larger p₃-p₄ than most specimens from this locality. It is apparent that the difference in crown height is due in measure to age—and more unworn dentitions are needed. The specimens of this paragraph are believed to represent Meryceros joraki, the horns of which occur at the same localities.

A ramus from Manix (F:A.M.31027) that is unique in its notably reduced p₃-p₄ and prominent m₃ talonid.

Rami from the Green Hills, certain of which exhibit a p₃-p₄ that seem large relative to the molars (F:A.M.31057, 31062, 31061, 31064).

Size Group iv is exampled by specimens with a premolar-molar series of apparently average proportions and diastema of moderate length, from the First, Second, Third and Fourth Divisions.

Size Group v is well represented in the Barstow area, Third Division. The premolars are large relative to the molars (the lower premolars being larger-proportioned than in Size Group iv).

Unfortunately the examples from the various localities which exhibit larger and smaller premolars, except in a few cases, have the diastema incomplete. Were the Barstow specimens better preserved it is possible that the same might generally be subdivided, as in the case of certain Green Hills specimens (Size Group iiiIB), between specimens with smaller premolars and longer-tending diastema (F:A.M.31055 and 31056) and specimens with larger premolars and shorter-tending diastema (F:A.M. 31057 and 31059). A similar variation occurs in the case of certain Steepside Quarry specimens (Size Group iii, F:A.M.31038 having shorter diastema and larger premolars than F:A.M.31019). Smaller specimens with relatively small premolars and larger specimens with relatively large premolars (diastema lacking) may be cited in the case of several localities, as follows:

<table>
<thead>
<tr>
<th>Exemplified from:</th>
<th>Size Group</th>
<th>F:A.M. Number</th>
<th>F:A.M. Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skyline Quarry....</td>
<td>IIIA</td>
<td>31041</td>
<td>31040</td>
</tr>
<tr>
<td>New Year Quarry....</td>
<td>IIIAA</td>
<td>32034, 32045, 32043</td>
<td>32042</td>
</tr>
<tr>
<td>Hemicyon Stratum....</td>
<td>IIIB</td>
<td>31071, 31073</td>
<td>31072, 31076</td>
</tr>
<tr>
<td>White Operation....</td>
<td>IIIID</td>
<td>31053</td>
<td>31049</td>
</tr>
<tr>
<td>Valley View Quarry.....</td>
<td>IVA</td>
<td>31090</td>
<td>31092</td>
</tr>
<tr>
<td>Second Division....</td>
<td>IVB</td>
<td>31089</td>
<td>31096</td>
</tr>
<tr>
<td>Third Division....</td>
<td>IVC</td>
<td>31085, 31084</td>
<td>31063, 31081</td>
</tr>
</tbody>
</table>
The Barstow dentitions, including some one hundred and twenty-eight rami and forty-one maxillary specimens (exclusive of unlisted fragments), may be listed according to locality and size groups, as follows:

**SIZE GROUP II**—represented by a single fragment from an indefinite area.

<table>
<thead>
<tr>
<th>Rami</th>
<th>Count</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left fragment with ( p_1-m_2 )</td>
<td>( (w) )</td>
<td>1923 31026</td>
</tr>
</tbody>
</table>

**SIZE GROUP III**—is relatively common and includes examples of *Merriamoceros*, *Paracosoryx* and *Meryceros*.

**III—TO IV.**

*R. (Merriamoceros) coronatus* (Merriam), referred

Eleven from Steepside Quarry, 1936:

<table>
<thead>
<tr>
<th>Rami</th>
<th>Count</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with symphysis and ( p_1-m_2 )</td>
<td>( (w) )</td>
<td>*31019</td>
</tr>
<tr>
<td>Right ramus with diastema and ( p_1-m_2 )</td>
<td>( (w) )</td>
<td>31020</td>
</tr>
<tr>
<td>Left ramus with posterior symphysis and ( p_1-m_2 )</td>
<td>( (w+) )</td>
<td>31019E</td>
</tr>
<tr>
<td>Right ramus with symphysis and ( p_2-m_2 )</td>
<td>( (w) )</td>
<td>31038</td>
</tr>
<tr>
<td>Left ramus with symphysis, ( p_2 ) alveolus and ( p_1-m_2 )</td>
<td>( (M+) )</td>
<td>31038A</td>
</tr>
<tr>
<td>Left ramus with symphysis, ( p_2 ) alveolus and ( p_1-m_2 )</td>
<td>( (M+) )</td>
<td>*31019F</td>
</tr>
<tr>
<td>Left ramus with symphysis and ( p_3(br.)-m_2 )</td>
<td>( (w++) )</td>
<td>31019D</td>
</tr>
<tr>
<td>Right ramus with ( p_2 ), ( p_3(br.) ) and ( p_1-m_2 )</td>
<td>( (w) )</td>
<td>*31019G</td>
</tr>
<tr>
<td>Right ramus with posterior symphysis, ( p_2 ) root, ( p_1-m_4(br.) )</td>
<td>( (w+) )</td>
<td>31019C</td>
</tr>
<tr>
<td>Left ramus with ( p_3-m_2 )</td>
<td>( (M+) )</td>
<td>31019A</td>
</tr>
<tr>
<td>Left ramus with ( p_3-m_2 )</td>
<td>( (w+) )</td>
<td>31019B</td>
</tr>
</tbody>
</table>

Seventy-one fragmental rami and twenty-five partial maxillae, F:A.M. Coll.

Right ramus with \( p_1-m_2 \) (collected 1937, not included in count) | \( (w) \) | 31144 |

**III A.**

*C. (Paracosoryx) alticornis*, n.sp., referred

Fourteen from Skyline Quarry:

**ELEVEN RAMI**

**Larger:**

<table>
<thead>
<tr>
<th>Rami</th>
<th>Count</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with symphysis, ( p_2 ) alveolus and ( p_3-m_2 )</td>
<td>( (M+) )</td>
<td>1933 31040</td>
</tr>
<tr>
<td>Right fragment with ( p_2-p_3 ) alveoli and ( p_1-m_2 )</td>
<td>( (w) )</td>
<td>1933 31044</td>
</tr>
<tr>
<td>Left fragment with ( m_1(br.)-m_2 )</td>
<td>( (w) )</td>
<td>1933 31039</td>
</tr>
<tr>
<td>Left fragment with ( m_1-m_2 )</td>
<td>( (w+) )</td>
<td>31028</td>
</tr>
</tbody>
</table>

**Smaller:**

<table>
<thead>
<tr>
<th>Rami</th>
<th>Count</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ramus with symphysis, ( p_2 ) alveolus and ( p_3-m_2 )</td>
<td>( (M) )</td>
<td>1933 31041</td>
</tr>
<tr>
<td>Partial mandible with ( p_2 ) alveolus and ( p_3-m_2 )</td>
<td>( (M+) )</td>
<td>1933 31042</td>
</tr>
<tr>
<td>Partial left ramus with ( p_3-m_2 )</td>
<td>( (M+) )</td>
<td>1933 31043</td>
</tr>
</tbody>
</table>

**Fig. 47**
Right fragment with p₂ alveolus, p₃(br.)-m₃ (br.).  (w) 1933 31045
Right fragment with p₄(br.)-m₃.  (w) 1933 31046
Partial right ramus with m₂.  (m) 1933 31047
Left fragment with p₄-m₄.  (w) 1933 31048
Ten unlisted partial rami, F:A.M. Coll.

THREE MAXILLE
Left maxilla with p₂-m₂.  (w) 1932-33 32024
Right maxilla with p₄-m₃.  (w) 1932-33 32025
Right maxilla with p₄-m₂.  (w) 1933 32026
Two unlisted immature partial maxillas, F:A.M. Coll.

IIIA—

(?C. (Paracosoryx) alticornis, var. (or Cosoryx species)

Thirteen from New Year Quarry, 1934 (/ms tending small):

ELEVEN RAMI

Partial right ramus with p₂-m₂.  (See right maxilla below.).  (M+) 32034
Partial left ramus with p₂-m₂.  (M+) 32042
Partial right ramus with p₃-m₂.  (M) 32043
Partial right ramus with p₄ alveolus, p₅-m₄.  (w) 32044
Right fragment with p₃-m₃ (m₁ br.).  (M) 32045
Right fragment with p₄ alveolus, p₅-m₄.  (w+) 32046
Right fragment with p₅-m₅.  (A) 32047
Right fragment with p₆ alveolus, p₇-m₇.  (M) 31068
Right fragment with p₇-m₇.  (A) 31069
Left fragment with p₈-m₈ (m₁ and m₃ br.).  (M+) 32040
Right fragment with p₉(br.)-m₉.  (M+) 32041
Three unlisted partial rami, F:A.M. Coll.

FOUR MAXILLE

Partial left maxilla with p₁-m₁.  (A) 32035
Partial right maxilla with p₁-m₁.  (A) 32036
Right maxilla with p₁-m₁.  (M+) 32034

One from First Division, 1924:

Partial left maxilla with m₁-m₂.  (M+) 31819

IIIB—EEE. *Meryceros joraki*, n.sp., referred (in part)

Nineteen from the Hemicyon Stratum:

ELEVEN RAMI

Larger:

Left fragment with p₃-m₃ (with larger p₄).  (M) 1930 31054

Partial left ramus with p₃-p₄ alveoli and p₅-m₅ (m₃, m₅ br.).  (M) 1931 31072

Right fragment with m₃-m₃.  (M+) 1924 31030

Right fragment with m₅(br.)-m₅.  (w) 1926 31031
| Right fragment with $p_4-m_3$ | (M+) | 1927 | 31075 |
| Right fragment with $m_2-m_4$ (br.) | (W+) | 1926 | 31078 |

Smaller (possibly Size Group IV):

| Partial right ramus with $p_3$ alveolus and $p_4-m_3$ | (M+) | 1931 | 31071 |
| Right fragment with $p_3$ alveolus and $p_4-m_3$ | (M) | 1926 | 31073 |
| Right fragment with $p_3-m_3$ | (M) | 1926 | 31074 |
| Left fragment with $p_3-m_3$ | (M+) | 1926 | 31076 |
| Right fragment with $p_4$ (br.)$-m_3$ | (W) | 1926 | 31077 |

**SKULL**

Major portion of skull with dentition and right horn. (w) 1926 31163

(Type of *Meryceros foraki*, n.sp.—see Horn Figs. 23, 23A Section II, page 368.)

| Left maxilla with $p_2-m_2$ | (M+) | 1926 | 31820 |
| Left maxilla with $p_3-m_4$ | (M) | 1926 | 31821 |
| Left maxilla with $p_4-m_4$ | (M+) | 1930 | 31822 |
| Right maxilla with $p_2-p_4$ and $m_2-m_4$ | (W) | 1925 | 31823 |
| Right maxilla with $p_4-m_4$ | (M) | 1923 | 31824 |
| Right maxilla with $p_4-m_4$ | (M) | 1923 | 31825 |
| Left maxilla with $d_2-m_2$ | (M+) | 1926 | 31826 |

**IIIc.**

Nine from North End (IV*):

| Partial right ramus with $p_3$ alveolus and $p_4-m_3$ | (M) | 1931 | *31032 |
| Left fragment with $p_3$ alveolus and $p_4-m_3$ | (M+) | 1930 | *31033 |
| Left fragment with $p_4-m_3$ | (M) | 1930 | 31034 |
| Left fragment with $p_4-m_3$ | (M) | 1931 | *31035 |
| Left fragment with $p_4-m_3$ | (M+) | 1931 | 31036 |

| Partial palate with $p_4-m_4$ | (M+) | 1930 | 32020 |
| Right maxilla with $p_4-m_4$ | (M) | 1931 | 32021 |
| Right maxilla with $m_4-m_4$ | (W) | 1930 | 32022 |
| Left maxilla with $p_4-m_4$ | (W) | 1930 | 32023 |

**IIId.**

Twelve from White Operation:

| Partial right ramus with $p_4$ (br.)$-m_3$ (m_1 br.) | (W) | 1930 | 31051 |
Left fragment with $p_4-m_3$.......................... (w) 1930 31053

Smaller:
Left fragment with $p_4-m_3$.......................... (M+) 1927 31052

SEVEN MAXILLÆ
Partial palate with $p^1-m^2$........................ (w) 32027
Left maxilla with $p^4-m^3$........................ (w) 32028
Right maxilla with $m^2-m^4$....................... (M++) 32029
Right maxilla with $m^3-m^4$....................... (W+) 32030
Left maxilla with $m^1-m^3$....................... (W) 1927 32031
Right maxilla with $m^2-m^4$....................... (W) 1927 32032
Right maxilla with $m^2-m^4$....................... (W) 1927 32033

IIEE.
Seventeen from Leader Quarry, 1935, collected by Jack Wilson’s party:

ELEVEN RAMI

Larger:
Left fragment with $p_3$ alveolus and $p_4-m_3$(br.) .......... (A) 32801
Right fragment with $p_4-m_3$........................... (A) 32801A
Left fragment with $p_3-m_3$(br.)........................ (w+) 32801B
Right fragment with $p_4-m_3$........................... (w+) 32802C
Left fragment with $p_4-m_3$........................... (w+) 32802E

Smaller:
Left fragment with $p_3-m_3$........................... (w) 32802
Right fragment with $p_3-p_3$ alveoli and $p_4-m_3$(br.) ... (m) 32802A
Left fragment with $p_4$(br.)--$m_3$.................... (m) 32802B
Left fragment with $p_4-m_3$........................... (m) 32802D
Right fragment with $p_4-m_3$........................... (m) 32802F
Right fragment with $p_3$ alveolus and $p_4-m_3$............. (m) 32803

SIX MAXILLÆ

Left maxilla with $p^1-m^2$........................... (m) 32805
Right maxilla with $p^1-m^2$........................... (w) 32805A
Left maxilla with $p^4-m^3$........................... (m+) 32805B
Left maxilla with $p^4-m^3$........................... (m) 32805C
Left fragment with $p^4-m^2$........................... (A) 32805D
Left fragment with $p^4-m^2$........................... (M+) 32805E

IIIEE.

RAMI

Two from Hidden Hollow Quarry, 1935, collected by Jack Wilson’s party:

Right ramus with symphysis and $p_3-m_3$.................. (w) 31845
Left fragment with $p_3-m_3$............................ (m) 31846
One from the vicinity of Manix:

Right fragment with p₂ alveolus and p₃–m₄. (Note "heel" of m₄.) ................................ (w) 1932 31027

III. (Merycros joraki, var.)

Twenty-two from the Green Hills:

EIGHTEEN RAMI

Larger:

Left fragment with p₂–m₃. ........................................... (w+) 1931 31029

Smaller:

Mandible with symphysis, p₂, p₃ alveolus and p₄–m₃. (m+) 1930 31055

Right ramus with symphysis, p₂ alveolus and p₃–m₃. (m+) 1931 31056

Right ramus with symphysis and p₃–m₄. ................. (m+) 1931 31057

Right ramus with symphysis and p₃–m₄. ................. (w+) 1931 31058

Partial left ramus with p₂ alveolus, p₃ and m₁–m₄. (m) 1930 31059

Right fragment with p₃–m₄. ........................................... (m+) 1929 31060

Right fragment with p₃–m₄. ........................................... (m+) 1930 31061

Left fragment with p₄–m₄. ........................................... (m+) 1931 31062

Left fragment with p₄–m₄ (m₁ br.). (w) 1930 31064

Right fragment with p₄(br.)–m₃. ................. (w+) 1930 31065

Left fragment with p₄–m₃. ........................................... (w+) 1930 31066

Left fragment with m₃–m₄. ........................................... (w+) 1930 31067

Partial left ramus with p₂ alveolus and p₃–m₃. (m+) 1930 31084

Left fragment with p₄–m₄. ........................................... (m+) 1930 31085

Right fragment with p₃–p₅ alveoli and p₄–m₄(br.)... (m+) 1930 31086

Partial left ramus with p₃–p₅ alveoli and p₄–m₄(br.). (a) 1930 31087

Right fragment with m₁–m₃. .................. (a) 1928 31088

FOUR MAXILLÆ

Larger:

Right maxilla with p₄–m₄. ........................................... (m) 1930 31812

Left maxilla with p₄–m₄. ........................................... (m+) 1930 31813

Smaller:

Right maxilla with p₄–m₄. ........................................... (m) 1932 31814

Right maxilla with p₄–m₄. ........................................... (m+) 1932 31815

Size group IV—is well represented by mandibular specimens here referred tentatively to Merycros joraki (A–D); and to (?) Merriamoceros coronatus, var. (e):

A.

RAMI

Three from Valley View Quarry:

Partial right ramus with p₂ alveolus and p₃–m₄. (m) 1933 31090

Fig. 46
Partial left ramus with $p_2-m_4$.

Right fragment with $p_2-p_8$ alveoli and $p_4-m_3$ (br.).

B.

Five from Second Division:

Mandible with symphysis and $p_1-m_4$.

Left fragment with $p_4-m_2$. (See possibly associated horn referred to *Meryceros joraki*, n.sp., Horn Section II, page 369. This paper, *Fig. 39*).

Left fragment with $p_2$ alveolus and $p_4-m_3$ (br.).

Left fragment with $p_2$ alveolus and $p_4-m_3$.

Two from indefinite locality:

Right maxilla with $m_1-m_8$.

Left maxilla with $m_1-m_8$.

C.

RAMI

Three from Third Division:

Right ramus with symphysis, $p_2-p_4$ alveoli and $p_4-m_2$.

Right fragment with $p_2-p_8$ alveoli and $p_4-m_3$.

Right fragment with $p_4-m_4$ (br.).

D.

MANDIBLE

One from Fourth Division:

Partial mandible with $p_4$ (br.)–$m_3$.

E.

RAMI

Two from Yermo Quarry:

Right fragment with $m_2-m_3$.

Right fragment with $d_p-m_1$.

One hundred and fifty-eight mature and immature unlisted partial rami, twelve unlisted partial maxillae and numerous smaller fragments, F:A.M. Coll.
SIZE GROUP V. (Tentatively referred to M. joraki, may represent separate form.)

RAMAL FRAGMENTS

Three from Third Division, 1926:
Left fragment with p1-m2.......................... (w) 31094
Left fragment with p1-m2.......................... (M+1) 31095
Right fragment with p1 alveolus and p1-m2(br.)...... (M+1) 31097

SIZE GROUPS III-V.

TWENTY-THREE RAMI, IMMATURE

(?)C. (Paracosoryx) alticornis, n.sp., referred

Five from Skyline Quarry, 1933:
Left fragment with dp1-m2.......................... 31098C
Partial right ramus with dp3-m1.................... 31098D
Right fragment with dp3-m1.......................... 31098E
Right fragment with dp4-m1.......................... 31098F
Left fragment with dp5-m1.......................... 31098G

One from May Day Quarry, 1934:
Partial left ramus with dp2-m1...................... 31098H

(?)C. (Paracosoryx) alticornis, var., referred

Six from New Year Quarry, 1934:
Left ramus with symphysis and dp3-m1................ 31099F
Partial right ramus with dp3-m1.................... 31099G
Partial left ramus with dp3-m1...................... 31099H
Partial right ramus with dp3-m1.................... 31099I
Right fragment with dp4-m1.......................... 31099J
Right fragment with dp5-m1.......................... 31099K

(?)Meryceros joraki, n.sp., referred

Five from White Operation, 1927:
Right fragment with dp4-m1.......................... 31099A
Right fragment with dp4-m1.......................... 31099B
Right fragment with dp4-m1.......................... 31099C
Right fragment with dp4-m1.......................... 31099D
Left fragment with dp5-m1.......................... 31099E

Four from Leader Quarry, 1935 (approximating Size Group III):
Right fragment with dp1-m2 (erupting)............... 32804
Left fragment with dp1-m2.......................... 32804A
Two smaller fragments.............................. 32804B, C

Two from Lower Green Hills, 1931:
Right fragment with dp4-m1.......................... 31098A
Left fragment with dp4-m1.......................... 31098B

MAXILLA, IMMATURE

One from the Green Hills, 1930:
Left maxilla with dp4-m2............................ 31816
(5B) RICARDO PLIOCENE LOCALITIES

C. (Paracosoryx) furlongi, referred

(See synonymy under same, Horn Section II, page 348)

Figure (in part) 47

The type of the above species is a skull in the collection of the University of California (see p. 349). The several here listed fragments were collected by Joseph Rak while passing through Ricardo Canyon, November 15, 1923. The specimens (see unworn m₃, F:A.M.31859) differ from the earlier remains from Barstow in the greater height of the crowns. The p₄ (see unworn fragment, F:A.M.31857) seems to have been very large.

### SIZE GROUP III.

<table>
<thead>
<tr>
<th>Rami</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right fragment with m₂-m₃</td>
<td>31856</td>
</tr>
<tr>
<td>Right fragment with p₄-m₁</td>
<td>31857</td>
</tr>
<tr>
<td>Left fragment with m₁-m₄</td>
<td>31855</td>
</tr>
<tr>
<td>Detached right m₂</td>
<td>Fig. 47</td>
</tr>
<tr>
<td>Detached right m₃</td>
<td>(M) 31859</td>
</tr>
</tbody>
</table>

**Immature:**

<table>
<thead>
<tr>
<th>Rami</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Left fragment with dp₄-m₁</td>
<td>31860</td>
</tr>
<tr>
<td>Right fragment with dp₄</td>
<td>31860B</td>
</tr>
</tbody>
</table>

### SKULL

**Type.—** Partial cranium U.C.26795 Figured by Furlong, 1927, Pl. xxiv, Fig. 3; Pl. xxvi, Fig. 1; and Pl. xxvii, Fig. 4.

(See associated metatarsus, Limb Section IV, page 462.)

---

**Fig. 48.** Late Tertiary Antilocaprinae and Merycodontini, relative size of metapodials.

1. Brackets indicate limbs assigned to a single species.

Col.M.219, (?)*Texoceros vaughani*, questionably ref., right metatarsus, from Yuma County, Colorado.

(See Limb Size Group I, pages 507, 518.)

F:A.M.31513, (?)*Plioceros var.*, left metacarpus, from Beaver Creek, Kansas.

(See Limb Size Group I, pages 497, 517.)

F:A.M.31671 and 31672, *Texoceros guymonensis*, n.sp., ref., left metacarpus and right metatarsus, from Guymon, Oklahoma.

(See Limb Size Group II, page 518.)

(Continued on next page)
Dentitions from Nevada and Oregon

**Paracosoryx** and **Meryceros** species

As noted in preceding pages of the Horn Section, the following four species have been based on mandibular rami: two from the vicinity of Tonopah and one from High Rock Canyon, Nevada, and one from Skull Spring, Oregon.

Two species from the vicinity of Tonopah, Nevada, in the collections of the California Institute of Technology:

* Paracosoryx loxocerus (Furlong).
  * **Type.**-Right ramus, C.I.T.1301.

* Meryceros hookwayi (Furlong).
  * **Type.**-Right pr-m, C.I.T.1257.

One species from High Rock Canyon, Nevada, in the collections of the University of California:

* (?) Paracosoryx nevadensis (Merriam).
  * **Type.**-Left fragment with m-m, U.C.12608.

One species from Skull Spring Miocene, Oregon, in the collections of the California Institute of Technology:

* (?) Paracosoryx species (Gazin).
  * **Example.**-Right fragment of immature ramus, C.I.T. 383.
Fig. 48. Late Tertiary Antilopepini and Merycodontini, relative size of metapodials. X 1. (See legend, pages 444, 445.)
SECTION IV.—MERYCODONTINI LIMB ELEMENTS

Figures 48A and (in part) 25B, 38, 48

Statement

The Merycodontine limbs are definitely of slender elongate Antilocaprine form. Metapodials allocated to the division vary in size from smaller specimens of the dimensions of the Lower Miocene Aletomeryx “marshi” to larger specimens which approximate in length the smaller individuals of the Pliocerotinae. The metapodial lengths are equivalent to Size Groups II–v of the joint Merycodontini-Blastomerycini series. Unfortunately, little associated skeletal material is so far available. The nearest to a complete skeleton\(^1\) associated with skull and dentition is that of the Ramoceros osborni type. Other cases of associated limbs are exampled by the elements accompanying Paramoceros kansanus, F:A.M. 31512 and 31512A; Paramoceros, F:A.M.31555, from Dutch Creek; and immature Cosoryx, F:A.M.32450, from Gordon Creek, Nebraska.

The limb proportions of the Ramoceros osborni type skeleton, Size Group IV+, though somewhat slighter, tend to approximate Aletomeryx marshi. While in the Merycodontines the proximal ends of the splint bones apparently tend to be fused and retained, there is an unfortunate meagerness of evidence\(^1\) as to the definite retention or loss of the distal splints and phalanges. (The splints and phalanges shown in the R. osborni type specimen are of plaster.) While lateral phalanges are retained in one of the Colorado metacarpi (A.M.9475) formerly referred to R. osborni (now tentatively transferred to Cosoryx), there is no evidence of the distal splints themselves ever having been present. Though the dimensions of the R. osborni radius approximate those of the genotype of Proantilocapra Barbour and Schultz, the humerus, metacarpus and metatarsus, interestingly enough, are less elongate than in Proantilocapra. It is recalled that associated limbs from New Mexico, referred in a previous section of the report to (?)Longirostromeryx blicki, exhibit a lone lateral phalanx, and that the type of Parablastomeryx gregorii shows the fused proximal and detached distal remnants of the lateral metacarpals as well as complete lateral phalanges. Different-sized examples of Merycodontine metapodials are illustrated (Fig. 48) in conjunction with specimens of Ramoceros ramosus, of Paramoceros kansanus and of “Proantilocapra.” (Also see Merycodontini and Blastomerycini comparative limb measurements and ratios of Table IX, following page.)

\(^1\) The beautifully preserved skeleton of an immature individual of Paracosoryx wilsoni secured at the close of the 1936 field season from Long Quarry, Sioux County, Nebraska, by the Jack Wilson party, exhibits the retention of splints and lateral phalanges in the manus. (F:A.M.33789, Figs. 25B and 48A.)
<table>
<thead>
<tr>
<th>Localities</th>
<th>Collection No.</th>
<th>Limb Size Group</th>
<th>Humerus</th>
<th>Radius</th>
<th>Metacarpus</th>
<th>Femur</th>
<th>Tibia</th>
<th>Metatarsus</th>
<th>Humerus/Radius</th>
<th>Metatarsus/Radius</th>
<th>Radius/Tibia</th>
<th>See Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Parablastomeryx gregori, sub-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>genotypic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>†Probarbouromyx settei, ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morrill Co., &quot;</td>
<td>Unassoc., p. 184</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ramoceros ramosus, ref.</td>
<td>Unassoc., p.453-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. F6, N. M.</td>
<td>F.A.M.31592^2</td>
<td>ii</td>
<td>140-136</td>
<td>138-130</td>
<td>190</td>
<td>152</td>
<td>146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. (Paramoceros) kansasus, ref.</td>
<td>Rawlins Co., Kans.</td>
<td></td>
<td>140</td>
<td>138-130</td>
<td>190</td>
<td>152</td>
<td>146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. (Paracosoryx) furlongi, type</td>
<td></td>
<td></td>
<td>140</td>
<td>138-130</td>
<td>190</td>
<td>152</td>
<td>146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(part)</td>
<td>U.C.26795</td>
<td>&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(?)C. (P.) species, ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra Co., Nebr.</td>
<td>Unassoc., p. 463</td>
<td>&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merycros nenzenensis, ref.</td>
<td>Cherry Co., &quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>Unassoc., p.463-4</td>
<td></td>
<td>140-137</td>
<td>136-125</td>
<td>141-125</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. warreni johnsoni, ref.</td>
<td>&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;</td>
<td>N.S.M.19-19-9-34^2</td>
<td></td>
<td>125-109</td>
<td>143-122</td>
<td>155-140</td>
<td>175-160</td>
<td>137-122</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

See additional ratios, p. 451.
<table>
<thead>
<tr>
<th>Species</th>
<th>Locality</th>
<th>Specimen</th>
<th>Genitalia</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. warreni johnsoni, var.</td>
<td>Cherry Co., Nebr.</td>
<td>Unassoc., p. 466</td>
<td>III to v</td>
<td>131</td>
<td>125-105</td>
<td>132</td>
<td>167</td>
</tr>
<tr>
<td>‡Plioceros dehlini (?), type (part)¹</td>
<td>“</td>
<td>F:AM.32101²</td>
<td>III</td>
<td>129</td>
<td>125</td>
<td>140</td>
<td>172</td>
</tr>
<tr>
<td>(?).R., C. and, or, M. species</td>
<td>St. Fé, N. M.</td>
<td>Unassoc., p. 457</td>
<td>III, IV</td>
<td>128</td>
<td>128-119</td>
<td>137</td>
<td></td>
</tr>
<tr>
<td>*Problastomeryx primus, subgenotype (part)</td>
<td>U. Rosebud, S. D.</td>
<td>A.M.13822²</td>
<td>III</td>
<td>(137)</td>
<td>150</td>
<td>178</td>
<td>136</td>
</tr>
<tr>
<td>*P. olcotti, ref.</td>
<td>Lusk, Wyo.</td>
<td>Unassoc., p. 255</td>
<td>III-, IV</td>
<td></td>
<td></td>
<td>163</td>
<td>127</td>
</tr>
<tr>
<td>*Longirostromeryx serpentis, ref...</td>
<td>Sioux Co., Nebr.</td>
<td>A.M.22474E</td>
<td>III-</td>
<td></td>
<td></td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>(*?).L. novemexicanus, ref.</td>
<td>S. Ildefonso N. M.</td>
<td>F:AM.31723</td>
<td>“</td>
<td></td>
<td></td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>*L. clarendonensis, ref.</td>
<td>Clarendon, Tex...</td>
<td>F:AM.32461</td>
<td>IV</td>
<td></td>
<td></td>
<td>117</td>
<td></td>
</tr>
<tr>
<td>‡Proantilocapra platycornea, genoty (part)¹</td>
<td>Cherry Co., Nebr.</td>
<td>N.S.M.2-5-8-30²</td>
<td>III-</td>
<td>107</td>
<td>119</td>
<td>116</td>
<td>168</td>
</tr>
<tr>
<td>C. (Subcosoryx) cerroensis, ref...</td>
<td>Round Mt., N. M.</td>
<td>Unassoc., p. 456</td>
<td>III, IV</td>
<td>129-117</td>
<td>114</td>
<td>138</td>
<td>172-170</td>
</tr>
<tr>
<td>Ramoceros osborni, genotype (part).</td>
<td>Pawnee Cr., Colo.</td>
<td>A.M.9476*</td>
<td>IV+</td>
<td>98</td>
<td>119</td>
<td>112</td>
<td>(140)</td>
</tr>
<tr>
<td>(?).C. (Paracosoryx) sabulonis or (?).C. (S.) savarnis, ref...</td>
<td>Sioux Co., Nebr.</td>
<td>Unassoc., p. 462-3</td>
<td>IV</td>
<td>113</td>
<td>116</td>
<td>141</td>
<td>168-129</td>
</tr>
<tr>
<td>*Blastomeryx elegans, ref.</td>
<td>“</td>
<td>Unassoc., p. 247</td>
<td>IV</td>
<td></td>
<td></td>
<td>110</td>
<td>120</td>
</tr>
<tr>
<td>*B. gemmifer medius, ref.</td>
<td>“</td>
<td>Unassoc., p. 248</td>
<td>“</td>
<td></td>
<td></td>
<td>113</td>
<td>120</td>
</tr>
<tr>
<td>(?).Longirostromeryx bicki, ref...</td>
<td>Cuyam'gue, N. M.</td>
<td>F:AM.31729</td>
<td>“</td>
<td></td>
<td></td>
<td>112</td>
<td>120</td>
</tr>
</tbody>
</table>

(Continued on next page)
<table>
<thead>
<tr>
<th>Locality</th>
<th>Collection No.</th>
<th>Limb Size Group</th>
<th>Humerus</th>
<th>Radius</th>
<th>Metacarpus</th>
<th>Femur</th>
<th>Tibia</th>
<th>Metatarsus</th>
<th>Humerus/Radius</th>
<th>Metacarpus/Radius</th>
<th>Radius/Tibia</th>
<th>See Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>(?)Submeryceros minimus, var.</td>
<td>St. Fé, N. M.</td>
<td>F.A.M.31731</td>
<td>V</td>
<td>91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Pseudoblastomeryx falkenbachi, subgenotype (part).</td>
<td>Lusk, Wyo.</td>
<td>F.A.M.31530</td>
<td>“</td>
<td>(94)</td>
<td>(98)</td>
<td>109</td>
<td>(96)</td>
<td>(92)</td>
<td>(69)</td>
<td>25A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*P. advena, ref.</td>
<td>Rosebud, S. D.</td>
<td>A.M.13015</td>
<td>VI</td>
<td>80</td>
<td>97</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*P. schultzi, ref.</td>
<td>Morrill Co., Nebr.</td>
<td>Unassoc., p. 259</td>
<td>“</td>
<td>80</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Machneromyx tragulus, genotype (part).</td>
<td>Harrison, “</td>
<td>A.M.20548</td>
<td>VII+</td>
<td>83</td>
<td>92</td>
<td>73</td>
<td>(105)</td>
<td>90</td>
<td>90</td>
<td>79</td>
<td>25A</td>
<td></td>
</tr>
<tr>
<td>*(?)Blastomerycine species</td>
<td>Cherry Co., “</td>
<td>F.A.M.32195</td>
<td>VII</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“ ref.</td>
<td>Sioux Co., “</td>
<td>A.M.14131</td>
<td>VIII</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Blastomerycini; † Dromomerycini; ‡ Antilocaprin; ( ) approximate measurement.

1 For comparison.
2 For additional ratios, see next page.
The referred limb elements from the several areas are representative of the following Limb Size Groups:

<table>
<thead>
<tr>
<th>Limb Size Groups</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) New Mexico</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Colorado</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) South Dakota, Kansas and Montana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Nebraska:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown, Keya Paha and Cherry Counties</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sioux County</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) California:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barstow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ricardo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Species Relisted

Twenty-two or more species and subspecies seem to be represented by limb elements; where the association is definite, the species are starred. (Numbers in parentheses refer to species in Horn Section II—compare species summary, page 317. See Figs. 48A and [in part] 25B, 38, 48, and Measurement Table IX.)

* = elements associated with horns or dentitions

Ramoceros, NEW GENUS

*(1) R. ramosus (Cope), referred, from New Mexico. This paper, Figs. 25B, 48 (F:A.M.31592).
   [Limb Size Group II.]

*(3) R. osborni (Matthew), from Pawnee Creek, Colorado.
   [Limb Size Group IV+.

Species (2) and (4) are not represented by limbs.
Paramoceros, new subgenus

*(6) R. (P.) howardei, referred, from Dutch Creek, Brown County, Nebraska.
   [Limb Size Group III.]

*(7) R. (P.) kansanus, n.sp., referred, from Kansas. This paper, Fig. 48 (F.A.M. 31512A and 31514).
   [Limb Size Group II–.]

Species (5), (8) and (9) are not represented by limbs.

Merriamoceros, new subgenus

(10) R. (M.) coronatus (Merriam), referred, from Barstow, California.
   [Limb Size Group IV.]

Cosoryx Leidy (and Subcosoryx, new subgenus)

(1) C. (S.) cerroensis, n.subg. and sp., from New Mexico. This paper, Fig. 38
   (F:A.M.32971 and 32974).
   [Limb Size Groups III and IV.]

*(2) (?C. ilfonsensis, n.sp., referred, from San Ildefonso, New Mexico.
   [Limb Size Group III.]

*(2x) (?R., C. and, or, M. species, from New Mexico. This paper, Fig. 48 (F:A.M. 31719 and 31721).
   [Limb Size Groups III and IV.]

*(3, in part) C. furcatus Leidy, referred, from Cherry and Brown Counties, Nebraska.
   This paper, Fig. 85B (N.S.M.59-4-7-34).
   [Limb Size Groups IV and V.]

*(3, in part) C. furcatus, large var., from Garman Loup Fork Collection, Nebraska.
   [Limb Size Group II.]

(5) (?C. furcatus, var. or subsp., referred, from Little White River, South Dakota.
   [Limb Size Group III.]

(6a) (?C. aqilis Douglass, from Madison Valley Beds, Montana.
   [Limb Size Group uncertain, immature.]

(7) (?C. furcatus, var. or subsp., referred, from Colorado. This paper, Figs. 25B, 48
   (A.M.9475).
   [Limb Size Group IV+.]

Species (4), (6) and (6b) are not represented by limbs.

Paracosoryx, new subgenus [and (?Subparacosoryx, new subgenus]

(8) C. (P.) alticornis, n.sp., referred, from Barstow, California.
   [Limb Size Group III.]

*(9) C. (P.) furlongi, n.sp., from Ricardo, California.
   [Limb Size Group II–.]

(13) C. (P.) wilsoni, n.subg. and sp., referred, from Antelope Draw, Sioux County, Nebraska.
   This paper, Figs. 25B (F:A.M.32479A, 33789), 48A
   (F:A.M.33789).
   [Limb Size Groups IV and V.]

(14a) (?C. (P.) sabulonis (Matthew and Cook), and possibly (14) (?C. (S.) savaronis, n.subg. and sp., referred, from Sioux County, Nebraska.
   [Limb Size Group IV+.]

(14b) (?C. (P.) species, from Sioux County, Nebraska.
   [Limb Size Group II–.]

Species (8a), (10), (11), (11a), (11b), (12), (15) and (16) are not represented by limbs.

Meryceros, new genus

(3) M. nenzelensis, n.sp., referred, from Nenzel Quarry, Cherry County, Nebraska.
   [Limb Size Groups II and III.]

(4a) M. warreni johnsoni, n.subsp., referred, from Crookston Bridge Quarry, and (4a') var. from Valentine Quarry A, Cherry County, Nebraska.
   This paper, Fig. 85B (N.S.M.23-6-8-30).
   [Limb Size Groups II to V.]

Species (8a), (10), (11), (11a), (11b), (12), (15) and (16) are not represented by limbs.
(6) (?)*M. joraki*, n.sp., referred, from Barstow, California.

Species (1), (2), (4), (4b), (5) and (7) are not represented by limbs.

*Submeryceros*, NEW SUBGENUS

(10) (?) *S. minimus*, var., from New Mexico. This paper, *Fig. 48* (F:A.M.31731).

Species (8), (9), (9a) and (9b) are not represented by limbs.

Detailed Lists of Limb Elements of the Above Genera and Species

*Ramoceros*, NEW GENUS

**Limb size group II.**

(1) *R. ramosus* (Cope), referred

From New Mexico

Limb elements are exampled by four referred partial skeletons (two of which are associated with dentition) and etc. detached bones:

- Partial right and left humerus, partial radius, left manus: metacarpus, two 1st, two 2d, two 3d phalanges; partial right and distal four-fifths left tibia, right pes: tarsus, metatarsus, two 1st phalanges; left pes: tarsus, metatarsus (broken), two 1st phalanges.

(See associated posterior one-half of skull, left maxilla and left ramus, Horn Section II, page 324; Dentition Section III, page 399. This paper, *Figs. 28, 28A, 29, 30* [cranium and horns].)

Distal four-fifths right and one-half left humerus, fragments of right and left radii, left and distal four-fifths right metacarpus, three 1st phalanges, distal one-half left femur, left, 190 mm., and distal three-fourths right tibia, right tarsus, proximal portions left and right metatarsi.

(See associated partial left maxilla and partial mandible, Dentition Section III, page 399.)

Distal two-thirds left humerus, distal one-half metacarpus, two partial tibiae, calcaneum, distal three-fourths and two-thirds metatarsus.

**F:A.M.31592** From Lower Pojuaque Bluffs. This paper, *Figs. 25B* (partial manus), 48 (left metacarpus and right metatarsus).

**F:A.M.30941** From Pojuaque Bluffs, 1929.

**F:A.M.31698** From N. Pojuaque Bluffs, 1928.
Immature:
Distal one-fourth left humerus, proximal one-fifth radius and ulna, right and left metacarpi, nearly complete femur, distal one-fourth right tibia, left and proximal two-thirds right metatarsus, right calcaneum and astragalus, and partial left calcaneum.

Etc. detached limb elements:
Distal one-half right humerus.
Right radius, 136 mm.
Left radius, 140 mm.
Nearly complete right radius.
Right metacarpus, 138 mm.
Left metacarpus, 130 mm.
Distal one-third right tibia.
Left metatarsus, 146 mm.
Right metatarsus, 152 mm.

Limb size group IV+.

(3) *R. osborni* (Matthew)
From Pawnee Creek, Colorado

**Genotype** (in part).—Skeletal elements, including: right and distal three-fourths left humerus, both ulnae, radii, carpi and metacarpi; two 1st, two 2d and one 3d phalanges of right manus; two 1st, two 2d and one 3d phalanges of left manus; partial pelvis, distal one-fifth right and two-thirds left tibia, both tarsi and metatarsi; two 1st, two 2d and two 3d phalanges of right pes; two 1st, two 2d and two 3d phalanges of left pes; several vertebrae.

(No evidence of lateral phalanges—supplied in mount in plaster.)

(See associated partial skull and ramus, Horn Section II, page 328; Dentition Section III, page 406. This paper, *Figs. 28, 28A* [skull], 45 [ramus].)
Frick, Horned Ruminants. II—Antilocapridæ

**Paramoceros, new subgenus**

**Limb size group III.**

(6) *R. (P.) howardii*, referred

From Dutch Creek, Brown County, Nebraska

Left humerus, nearly complete right and three-fourths left radius, distal one-third metacarpus, proximal one-half right femur, nearly complete right tibia, right calcaneum and astragalus, proximal two-thirds right metatarsus, etc. detached phalanges.

(See associated partial ramus, Dentition Section III, page 413.)

**Limb size group II—.**

(7) *R. (P.) kansanus*, n.sp., referred

From Kansas

Astragalus and 1st phalanx. F:A.M.31510 From M. F. Frake’s ranch, 16 miles S.E. of Trenton, Nebraska, 1933.

(See questionably associated type horn, Section II, page 331.)

Left humerus; right humerus, radius and ulna articulated; right carpus and metacarpus, left femur, right and broken left tibia.

(See associated partial mandible, Dentition Section III, page 410.)

Left radius, ulna and metacarpus articulated; distal one-half right radius, right metacarpus, distal one-third left femur, right tibia and left metatarsus.

Slenderer:

Right metacarpus, 135 mm. A.M.2667 From Phillips County, 1894.

Left metacarpus. F:A.M.31514 Silica mine at Calvert, 1933. This paper, *Fig. 48* (left metacarpus and metatarsus).

**Merriamoceros, new subgenus**

**Limb size group IV.**

(10) *R. (M.) coronatus* (Merriam), referred

From Steepside Quarry, Barstow, California

Right metacarpus, 111 mm. F:A.M.31020A
Limb size groups III to V.

(1) *C. (S.) cerroensis*, n.subg. and sp., referred
From Round Mountain Quarry, New Mexico
As seen in radii, the maximum variation in length is 10%

**S.G. III.**

<table>
<thead>
<tr>
<th>Description</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right radius, 129 mm</td>
<td>32968</td>
</tr>
<tr>
<td>Left femur, 138 mm</td>
<td>32969</td>
</tr>
<tr>
<td>Two right tibias, 172-170 mm</td>
<td>32970A</td>
</tr>
<tr>
<td>Two right metatarsi, 132-129 mm</td>
<td>32971</td>
</tr>
<tr>
<td>Two left and two right metatarsi</td>
<td>32971A,D,C,E</td>
</tr>
</tbody>
</table>

**S.G. IV.**

Articulated: distal half right humerus, radius (124 mm.)
with portion of ulna and right metacarpus (116 mm.)

Distal third left humerus.
Right radius, 119 mm.
Right metacarpus.
Right metacarpus, 116 mm.

Two left metacarpi.
Left metacarpus, 114 mm.
Distal half left tibia.
Right metatarsus, 124 mm.

**S.G. V. (Immature.)**

Left radius, 117 mm.
Immature right metatarsus and two 1st phalanges.
Immature left metatarsus.
Several tarsals, carpals and footbones, F:A.M. Coll.

(See horns, Section II, page 336; and ramal and maxillary dentitions, Section III, page 392.)

**Limb size group III.**

(2) (?)*C. ilfonsensis*, n.sp., referred
From New Mexico

Distal one-half left humerus, nearly complete left ulno-radius, left carpus, proximal two-thirds left metacarpus, distal one-third left tibia, left tarsus, broken left metatarsus, two 1st phalanges, etc. fragments.

(See associated skull [female], Dentition Section III, page 401.)
Immature specimen:

Partial left scapula, right femur (minus head and condyles), right tibia, left pes: tarsus (except calcaneum), metatarsus, one 1st, one 2d phalanx; right pes: calcaneum, metatarsus, three 1st, three 2d, two 3d detached phalanges; and two vertebrae.

**Limb size groups III and IV.**

(2x) (?) R., C. and, or, M. species

From New Mexico

**S.G. III.**

Distal two-thirds right humerus, nearly complete right ulno-radius, right carpus and metacarpus, distal two-thirds left femur, proximal one-third left tibia.

(See associated right ramus, Dentition Section III, page 399.)

Distal one-half left humerus.

<table>
<thead>
<tr>
<th>Bone Location</th>
<th>Specimen Code</th>
<th>Location/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left radius, 128 mm.</td>
<td>F:A.M.31715</td>
<td>From Tesuque, 1930.</td>
</tr>
<tr>
<td>Distal one-third left radius.</td>
<td>F:A.M.31716B</td>
<td>From Santa Fé area.</td>
</tr>
<tr>
<td>Left metacarpus.</td>
<td>F:A.M.31717</td>
<td>From Espanola area, 1928.</td>
</tr>
<tr>
<td>Left metacarpus.</td>
<td>F:A.M.31718</td>
<td>From Santa Clara, 1931.</td>
</tr>
<tr>
<td>Right metacarpus, 124 mm.</td>
<td>F:A.M.31719</td>
<td>From Santa Fé area, 1924.</td>
</tr>
<tr>
<td>Left metacarpus, 128 mm.</td>
<td>F:A.M.31716</td>
<td>From an indefinite locality.</td>
</tr>
<tr>
<td>Right metacarpus, distal end missing.</td>
<td>F:A.M.31720</td>
<td>From North Pojuaque Bluffs, 1927.</td>
</tr>
<tr>
<td>Left metatarsus, 137 mm.</td>
<td>F:A.M.31721</td>
<td>From west side of North Pojuaque Bluffs, 1928.</td>
</tr>
<tr>
<td>Right metatarsus.</td>
<td>F:A.M.31722</td>
<td>From Santa Fé area.</td>
</tr>
</tbody>
</table>

**S.G. IV.**

Distal four-fifths left humerus.

<table>
<thead>
<tr>
<th>Bone Location</th>
<th>Specimen Code</th>
<th>Location/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right metacarpus, 119 mm.</td>
<td>F:A.M.31712</td>
<td>From Santa Clara Canyon, 1931.</td>
</tr>
</tbody>
</table>
LIMB SIZE GROUPS IV AND V.

(3, in part) *C. furcatus* Leidy, referred
From Cherry and Brown Counties, Nebraska

(a) From Midway Quarry, Cherry County, 1934:

Several less complete and immature limb bones are not listed below. Two metacarpi, F:A.M.32387 and 32389, are unusually slender-proportioned. The longest metatarsus, F:A.M.32394, is 11% longer than the shortest, F:A.M.32396C.

Left radius, 117 mm. F:A.M.32385
Left radius, 108 mm. F:A.M.32386
Two right metacarpi. F:A.M.32388 and A
Right metacarpus, 111mm. F:A.M.32387
Left metacarpus, 104 mm. F:A.M.32389
Right femur, 139 mm. F:A.M.32390
Eleven femora. F:A.M.32390A–K
Right femur, 123 mm. F:A.M.32390L
Three broken femora. F:A.M.32390M, N and P
Two broken left tibie. F:A.M.32391 and A
Left tibia, 151 mm. F:A.M.32391B
Left tibia. F:A.M.32392
Two left tibie. F:A.M.32393 and A
(Slightly immature.)

Right metatarsus, 121 mm. F:A.M.32394
Eight metatarsi. F:A.M.32394A–D, 32395, 32396, A and C
Left metatarsus, 109 mm. F:A.M.32396B
Also several calcanea, astragali and phalanges.


(See partial crania and horn-cores, Section II, page 340; and ramal and maxillary dentitions, Section III, page 414.)

(b) From Gordon Creek Quarry, Cherry County:

Right humerus, radius and femur, left tibia and metatarsus, one complete and one partial right calcaneum, two right astragali, left tarsals and two phalanges. (There is no certainty of the association of the limbs.) .................................................. N.S.M. 1-9-3-28

Articulated immature specimen, 1934:
Distal four-fifths left and one-half right humerus, both radii and ulne, right carpus and metacarpus, both femora, right patella, proximal two-thirds right and one-half and distal end of left tibia, left metatarsus, two 1st, two 2d and two 3d phalanges, twelve vertebrae, sacrum, parts of both ilia, etc. ribs. (See associated skull and mandible, Horn Section II, page 341; Dentition Section III, page 417. This paper, *Fig.* 26.) .................................................. F:A.M. 32450

Detached mature specimens, 1934. As seen in radii, the maximum variation length is 9%:
Five partial humeri. F:A.M.32444 and A–D
Frick, Horned Ruminants. II—Antilocapride

Left radius, 115 mm. F:A.M.32445
Two left radii. F:A.M.32445A, B
Left radius, 105 mm. F:A.M.32445C
Right metacarpus, 107 mm. F:A.M.32446
Right metacarpus. F:A.M.32446A
Left metacarpus, 100 mm. F:A.M.32446B
Right femur, 130 mm. F:A.M.32447
Right tibia, 160 mm. F:A.M.32448
Four tibiae. F:A.M.32448A, B, D, E
Left tibia, 143 mm. F:A.M.32448C
Left metatarsus, 120 mm. F:A.M.32449
Four metatarsi. F:A.M.32449A-D
Right metatarsus, 107 mm. F:A.M.32449E
Left metatarsus. N.S.M.13-31-7-29
Also several immature and incomplete limbs.

(See partial crania and horn-cores, Section II, page 341; and ramal and maxillary dentitions, Section III, page 416.)

(c) From Swallow Quarry, Snake River, Cherry County, 1934:

An articulated fore-leg, N.S.M. 59-4-7-34, and other immature fore and hind-leg bones are included in the collection from Swallow Quarry and listed below. A metatarsus, N.S.M. 75-4-7-34, is 8% larger than the shortest, N.S.M. 9-4-7-34.

Articulated mature specimens:
Distal three-fourths right humerus, right ulno-radius, 125 mm., carpus and metacarpus, all phalanges .................................................. N.S.M. 59-4-7-34
Fig. 25B
Left tibia (head missing), tarsus, metatarsus and all phalanges .......... 1-4-7-34

Articulated immature specimens:
Right tibia (distal epiphysis missing), two tarsals, metatarsus and all phalanges .......................................................... 3-4-7-34
Right femur and tibia (proximal epiphyses missing) ......................... 4-4-7-34
Distal two-thirds left humerus, left radius (distal epiphysis missing). 2-4-7-34

Detached mature specimens:
Left metacarpus .................................................. 11-4-7-34
Right tibia, 163 mm. ........................................ 78-4-7-34
Left tibia, 150 mm. ........................................ 6-4-7-34
Right tibia .................................................. 77-4-7-34
Right metatarsus, 126 mm. .................................... 75-4-7-34
Left metatarsus ............................................. 52-4-7-34
Right metatarsus, 117 mm. .................................... 9-4-7-34
Left metatarsus ............................................. 4-4-7-34

(See partial skulls, Section II, page 342; and ramal and maxillary dentitions, Section III, page 417.)
(d) From Burge Quarry, Snake River, Cherry County, 1935:
Partial skeleton, including right radius and ulna, nearly complete left radius, three carpals, left metacarpus, right femur and tibia, left metatarsus and two tarsals.  F:A:M.  32369
Etc. detached limbs, F:A:M. Coll.

**Limb size group IV** (*C. furcatus* Leidy, referred).

(e) From McConnell’s Ranch, Brown County, 1932:
Right metacarpus.  31948

(f) From Quinn Quarry, Brown County, 1927:
Proximal one-half left and right metacarpus.  31948A,B
Left tibia.  31951
Three partial metatarsi.

(g) From upper layer, Dutch Creek, Brown County, 1929:
Distal one-third right and left tibia, proximal portions right and left metatarsus, left tarsus and parts of pelvis.  32083

**Limb size group II.**

(3, in part) *C. furcatus*, large var.

From Garman Loup Fork Collection, Nebraska

Distal portion left scapula, distal one-half right and three-fourths left humerus, proximal portion left ulna, four left carpals, proximal one-half and distal one-fourth left and distal two-thirds right metacarpus, distal one-third left tibia, right and left tarsi, proximal one-half left and one-third right metatarsus, four 1st and two 2d phalanges.  M.C.Z.  17743

One-half pelvis, portion of scapula, series of vertebrae, metapodial.  M.C.Z.  10101
Skeleton figured by Scott, 1890, Pl. 7, under Cosoryx furcatus referred.  (See associated left horn-core, Horn Section II, page 344; and partial mandible, etc., Dentition Section III, pages 418, 429.  [F:A:M. cast]

This paper, *Fig. 45, ramus.*)

Somewhat smaller:

Distal one-third left humerus, right and proximal four-fifths left radius  M.C.Z.  10095
and partial calcaneum.

Proximal portion right ulna, right and left radii, right metacarpus, distal one-fourth left tibia, right metatarsus, one 1st phalanx.  17743

Distal one-half left humerus, proximal portion right ulna, proximal three-fourths right metacarpus, distal end right tibia, partial right calcaneum, right astragalus, right and proximal one-half and distal one-third left metatarsus.  17743

[In addition to the above, the Burge Quarry has produced in 1935 two specimens of the larger Size Group II, whose reference remains in doubt:

Left radius, 140 mm.  F:A:M.  32912
Left metacarpus, 127 mm.  F:A:M.  32913]
LIMB SIZE GROUP III.

(5) (?) C. furcatus, var. or subsp., referred
From Little White River, South Dakota
Distal one-fourth humerus, right metatarsus (distal end missing), distal one-fourth metatarsus. ........................................... 11405
Two astragali. ........................................... 11360A
11361A

LIMB SIZE GROUP UNCERTAIN.

(6a) (?) C. agilis Douglass
From Madison Valley Beds, Montana
Partial manus, pes, radius, C.M.703
ulna, etc.
(Probably limbs of different individuals found with type immature partial skull and mandible. See Horn Section II, page 346; Dentition Section III, page 411.)

LIMB SIZE GROUP IV+.

(7) (?) C. furcatus, var. or subsp., referred
From Colorado
Three examples from Cedar Creek, 1901:
Right manus: two carpals, metacarpus, two 1st, one 2d phalanges, rudimentary 1st, 2d and 3d internal lateral phalanges; right pes: two tarsals, metatarsus, and two 1st phalanges.
Figured by Matthew, 1904, Text-Figs. 14, 16 (partial manus and pes); this paper, Figs. 25B (partial manus), 48 (right metacarpus and metatarsus).
(See questionably associated forked horns, left maxilla and ramus, Horn Section II, page 346; Dentition Section III, page 406.)
Distal one-fourth right and left tibia, both tarsi and metatarsi (left without distal epiphyses), two right 1st phalanges .......... A.M. 9473
Distal half both humeri, distal half right radius, right metatarsus, calcaneum, etc. fragments ........................................... 9474

Fragment from Pawnee Creek:
Distal one-fourth left tibia ........................................... 31646

Paracosoryx, new subgenus [and (?) Subparacosoryx, new subgenus]

LIMB SIZE GROUP III.

(8) C. (P.) alticornis, n.sp., referred
From Barstow, California
Left metacarpus. F:A.M.31841 Valley View Quarry, 1933.
Broken left tibia. F:A.M.31844 From Skyline Quarry, 1933.
Proximal one-half left metatarsus. F:A.M.31834D From Skyline Quarry, 1933.
Limb size group II.---

(9) *C. (P.)* furlongi, n.sp.
From Ricardo, California

<table>
<thead>
<tr>
<th>Metatarsus.</th>
<th>Length</th>
<th>Diameter middle shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.C.26795</td>
<td>140 mm</td>
<td>11</td>
</tr>
</tbody>
</table>

(See associated type partial cranium, maxillary series and ramus, Horn Section II, page 349; Dentition Section III, page 444.)

Limb size groups IV and V.

(13) *C. (P.)* wilsoni, n.subg. and sp., referred
From Long Quarry, Antelope Draw, Sioux County, Nebraska, 1934–35

The larger limbs are somewhat smaller than the limbs referred to (?)*C. (Paracosor- soryx) sabulonis* (Matthew and Cook).

<table>
<thead>
<tr>
<th>Limb element</th>
<th>Length</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left humerus, 104 mm</td>
<td></td>
<td>31937</td>
</tr>
<tr>
<td>Five left and two right partial humeri</td>
<td></td>
<td>31937A-C,31944,A-C</td>
</tr>
<tr>
<td>Right radius, 123 mm</td>
<td></td>
<td>31938</td>
</tr>
<tr>
<td>Four right and four left radii</td>
<td></td>
<td>31938A,32478,B-G</td>
</tr>
<tr>
<td>Right radius, 114 mm</td>
<td></td>
<td>32478A</td>
</tr>
<tr>
<td>Right radius, 106 mm</td>
<td></td>
<td>32478H</td>
</tr>
<tr>
<td>Right metacarpus, 110 mm</td>
<td></td>
<td>32479H</td>
</tr>
<tr>
<td>Nine right and four left metacarpi</td>
<td></td>
<td>32479,B-G,J-N,P</td>
</tr>
<tr>
<td>Right metacarpus, 97 mm</td>
<td></td>
<td>Fig. 25B</td>
</tr>
<tr>
<td>Right femur, 133 mm</td>
<td></td>
<td>31939A</td>
</tr>
<tr>
<td>Right femur</td>
<td></td>
<td>31939</td>
</tr>
<tr>
<td>Right femur, (123) mm</td>
<td></td>
<td>31939B</td>
</tr>
<tr>
<td>Right tibia, 159 mm</td>
<td></td>
<td>31940</td>
</tr>
<tr>
<td>Eleven right and six left tibias</td>
<td></td>
<td>31940A,31945,A,B,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32480,A-E,G,H,J-N</td>
</tr>
<tr>
<td>Right tibia, 140 mm</td>
<td></td>
<td>32480I</td>
</tr>
<tr>
<td>Left metatarsus, 125 mm</td>
<td></td>
<td>31941</td>
</tr>
<tr>
<td>Five right and nine left metatarsi</td>
<td></td>
<td>31946,A-D,32481A-I</td>
</tr>
<tr>
<td>Left metatarsus, 107 mm</td>
<td></td>
<td>32481</td>
</tr>
</tbody>
</table>

Immature skeleton, F:A.M.33789, Fig. 25B, 48A. (See pages 316, 351 and 447 [footnote].) (Collected 1936; not included in count.)

(See referred crania, Section II, page 351; and referred ramal and maxillary dentitions, Section III, page 429.)

Limb size group IV+.---

(14a) (?)*C. (P.)* sabulonis (Matthew and Cook), referred, and possibly (14) (?)*C. (S.)* savaronis, n.subg. and sp., referred
From Sioux County, Nebraska

Twenty-one detached limb elements from Snake Creek area:

<table>
<thead>
<tr>
<th>Limb element</th>
<th>Length</th>
<th>Quarry</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left humerus, 113 mm</td>
<td>A.M.22473D</td>
<td>B</td>
<td>1921</td>
</tr>
<tr>
<td>Right humerus</td>
<td>A.M.22474A</td>
<td>A</td>
<td>1921</td>
</tr>
<tr>
<td>Distal four-fifths right humerus</td>
<td>A.M.22474B</td>
<td>A</td>
<td>1921</td>
</tr>
</tbody>
</table>
Frick, Horned Ruminants. II—Antilocapridæ

LIMB SIZE GROUP II—

(14b) (?)C. (P.) species
From Sioux County, Nebraska
(Not cited in Table VII)

<table>
<thead>
<tr>
<th>Limb Part</th>
<th>Specimen</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right radius, 130 mm</td>
<td>F:A.M.31897</td>
<td>From E. Sinclair Draw, 1933.</td>
<td></td>
</tr>
<tr>
<td>Right metacarpus, 128 mm</td>
<td>A.M.22477C</td>
<td>From Stonehouse Draw, 1923.</td>
<td></td>
</tr>
<tr>
<td>Right tibia, 165 mm</td>
<td>A.M.22475</td>
<td>From Quarry C, 1921.</td>
<td></td>
</tr>
<tr>
<td>Right tibia, 152 mm</td>
<td>A.M.14125</td>
<td>From Snake Creek area, 1908.</td>
<td></td>
</tr>
<tr>
<td>Two right metatarsi. A =</td>
<td>A.M.22477X, A</td>
<td>From Stonehouse Draw, 1923.</td>
<td></td>
</tr>
<tr>
<td>139 mm.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Meryceros, new genus**

LIMB SIZE GROUPS II AND III.

(3) *M. nenzelensis*, n.sp., referred
From Nenzel Quarry, Cherry County, Nebraska, 1934
(See Horn Section II, page 359, and Dentition Section III, page 421.)

A difference of 12% between the longest and shortest metatarsi

<table>
<thead>
<tr>
<th>Limb Part</th>
<th>Specimen</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left humerus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distal four-fifths left humerus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right radius</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal three-fourths left radius</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal four-fifths left radius</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two right metacarpi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left metacarpus, 116 mm</td>
<td>A.M.22473G</td>
<td>Quarry B, 1921.</td>
</tr>
<tr>
<td>Left metacarpus</td>
<td>A.M.14132G</td>
<td>1908.</td>
</tr>
<tr>
<td>Right femur</td>
<td>A.M.22474C</td>
<td>Quarry A, 1921.</td>
</tr>
<tr>
<td>Right femur, 141 mm</td>
<td>A.M.22473H</td>
<td>Quarry B, 1921.</td>
</tr>
<tr>
<td>Right tibia, 129 mm</td>
<td>A.M.14125A</td>
<td>1908.</td>
</tr>
<tr>
<td>Right tibia (br.), 168 mm</td>
<td>A.M.22473C</td>
<td>Quarry B, 1921.</td>
</tr>
<tr>
<td>Two left tibiae</td>
<td>A.M.22473A, B</td>
<td>Quarry B, 1921.</td>
</tr>
<tr>
<td>Right metatarsus, 133 mm</td>
<td>A.M.22474F</td>
<td>Quarry A, 1921.</td>
</tr>
<tr>
<td>Right metatarsus, 127 mm</td>
<td>A.M.22473E</td>
<td>Quarry B, 1921.</td>
</tr>
<tr>
<td>Left metatarsus</td>
<td>A.M.22474G</td>
<td>Quarry A, 1921.</td>
</tr>
<tr>
<td>Left metatarsus</td>
<td>A.M.14132F</td>
<td>1908.</td>
</tr>
</tbody>
</table>

(See referred horns, Section II, page 353; and ramal and maxillary dentitions, Section III, page 430.)
Three left metacarpi .............................................................. 32225-7
Right metacarpus, 136 mm. .................................................. 32241
Right metacarpus, 125 mm. .................................................. 32241A
Right metacarpus ................................................................. 32228
Left metacarpus (distal epiphyses missing) .................. 32241B
Right femur, 156 mm. ......................................................... 32229
Right femur, 151 mm. ......................................................... 32230
Left tibia (head missing) .................................................... 32231
Distal four-fifths of three tibias ........................................ 32232-3, 32242
Two right tibias (incomplete, immature) .................... 32242A, B
Right metatarsus, 141 mm. ................................................. 32234
Five metatarsi ........................................................................ 32235-8, 32240
Right metatarsus, 125 mm. .................................................. 32239

Limb size groups II to IV.

(4a) *M. warreni johnsoni*, n.subsp., referred

From Crookston Bridge Quarry, Cherry County, Nebraska

(See Horn Section II, page 362, and Dentition Section III, page 423.)

The material includes an articulated hind-limb, N.S.M.1-3-8-34. Larger, intermediate and smaller-sized limbs are represented. The longest radius, N.S.M.42-17-9-34, is 17% longer than the shortest, N.S.M.31-15-8-34.

Articulated:

Left femur, 149 mm., tibia, 171, calcaneum and astragalus, metatarsus (124), and two 1st phalanges.

(In the same block as above, but apparently limbs of two or more individuals):

Left scapula, right and left radii, 135 mm., proximal one-half right ulna, left metacarpus (120), right metacarpus with all phalanges, left femur, 148, left metatarsus, 127, right metatarsus.

Larger than above:

Left metatarsus, 133 mm. .................................................. N.S.M.1-3-8-34
Both femora, 140 mm., patellae, tibias, 165, tarsi, metatarsi, 122, pelvis, sacrum and lumbar vertebra.

(Bones articulated.)

Detached elements:

Left humerus, 125 mm. .................................................. N.S.M.29-3-8-34
Left humerus, 109 mm. .................................................. N.S.M.91-15-8-35
Two humeri. ..................................................................... N.S.M.49-17-9-34, 37-15-8-34
Frick, *Horned Ruminants. II—Antilocapridae*

Two partial humeri. N.S.M.35, 23-15-8-34
Right humerus (immature). N.S.M.36-15-8-34
Right radius and ulna. N.S.M.30-15-8-34
Right radius, 143 mm. N.S.M.42-17-9-34
Twelve radii. N.S.M.23, 39, 41, 43, 44, 46-48, -17-9-34
12-19-9-34
32, 33-15-8-34
27-3-8-34
Right radius, 122 mm. N.S.M.31-15-8-34
Fifteen metacarpi. N.S.M.22, 30-34, 36-17-9-34
39, 41, 42, 44-15-8-34
19, 20, 22-3-8-34
7-19-9-34
Left metacarpus, distal epiphyses missing.
(See associated immature skull, Horn Section II, page 365.)

Left metacarpus, 130 mm. N.S.M.13-27-7-34
Left metacarpus, 114 mm. N.S.M.11-27-7-34
Right metacarpus, 112 mm. N.S.M.65-15-8-35
Seven femora. N.S.M.55, 57-60, -17-9-34
18-15-8-34
25-3-8-34
Left femur. N.S.M.4-7-9-34
(See associated skull, Horn Section II, page 365. This paper, Fig. 28B.)

Right femur, 155 mm. N.S.M.2-28-8-35
Left femur, 150 mm. N.S.M.17-15-8-34
Right femur, 140 mm. N.S.M.56-17-9-34
Six tibias. N.S.M.19, 21, 26, 27-15-8-34
9-17-6-32
13-27-7-34
Left tibia, 175 mm. N.S.M.22-15-8-34
Left tibia and astragalus articulated. N.S.M.24-3-8-34
Right tibia, 160 mm. N.S.M.53-17-9-34
Left metatarsus, 137 mm. N.S.M.28-17-9-34
Seventeen metatarsi. N.S.M.10, 12, 14, 15-27-7-34
8-10, -19-9-34
21-3-8-34
26, 27, 29, 37, 38-17-9-34
4, 12-17-6-32
40, 43-15-8-34
Right metatarsus with three tarsals articulated. N.S.M.23-3-8-34
Left metatarsus, 122 mm. N.S.M.45-15-8-34
Right metatarsus and two phalanges articulated. N.S.M.38-15-8-34

Five humeri, eleven radii, twenty-one metacarpi, nine femora, eighteen tibias and twenty-five metatarsi, N.S.M. Coll., 1935.

Also numerous immature partial limbs, N.S.M. Coll.
Var. from Fairfield Creek, Brown County:
Proximal fragment of ulna
F:A.M.31276 From 45 feet above Brule, and left calcaneum.
1930.
(See questionably associated horns, Section II, page 366; and ramus, Den-
tition Section III, page 423. This paper, Fig. 39, horn.)

LIMB SIZE GROUPS III TO V.

(4a’) Variation
From Valentine Quarry A, Cherry County, Nebraska

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>F:A.M.</th>
<th>N.S.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right radius, 131 mm., and ulna</td>
<td>31956</td>
<td>7-28-7-30</td>
</tr>
<tr>
<td>Left metacarpus, 125 mm.</td>
<td>31949</td>
<td>25-8-8-30</td>
</tr>
<tr>
<td>Three right and one left metacarpi.</td>
<td>31949A-D</td>
<td>23-6-8-30</td>
</tr>
<tr>
<td>Left metacarpus, 114 mm.</td>
<td>31949E</td>
<td></td>
</tr>
<tr>
<td>Left metacarpus, 107 mm.</td>
<td>31956A</td>
<td></td>
</tr>
<tr>
<td>Left femur, 132 mm.</td>
<td>31950</td>
<td></td>
</tr>
<tr>
<td>Right metatarsus, 130 mm.</td>
<td>31952</td>
<td></td>
</tr>
<tr>
<td>Two right and one left metatarsi.</td>
<td>31952A-C</td>
<td></td>
</tr>
<tr>
<td>Left metatarsus, 116 mm.</td>
<td>31952D</td>
<td></td>
</tr>
<tr>
<td>Left metacarpus, 105 mm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left tibia, 167 mm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left tarsus, metatarsus, 118 mm., and all superior phalanges.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 25B (pes)

Four examples from Fort Niobrara area:

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>F:A.M.</th>
<th>N.S.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal one-fourth right humerus.</td>
<td>8572B</td>
<td></td>
</tr>
<tr>
<td>Distal one-fourth right radius.</td>
<td>8572C</td>
<td></td>
</tr>
<tr>
<td>Right tibia.</td>
<td>8572D</td>
<td></td>
</tr>
<tr>
<td>Proximal one-fourth right metatarsus.</td>
<td>8572E</td>
<td></td>
</tr>
</tbody>
</table>

LIMB SIZE GROUPS III AND IV.

(6) (?)M. joraki, n.sp., referred
From Barstow, California

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>F:A.M.</th>
<th>From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal one-half right radius.</td>
<td>F:A.M.31834A</td>
<td>1923.</td>
</tr>
<tr>
<td>Proximal one-half left radius.</td>
<td>F:A.M.31841B</td>
<td>From Green Hills, first layer above Third Division, 1928.</td>
</tr>
<tr>
<td>Left radius with proximal end of ulna, (127.5) mm.</td>
<td>F:A.M.31843</td>
<td>From Hidden Hollow Quarry, 1935.</td>
</tr>
<tr>
<td>Left metacarpus, 117.8 mm.</td>
<td>F:A.M.31843A</td>
<td>Hidden Hollow Quarry, 1935.</td>
</tr>
<tr>
<td>Proximal one-half right metacarpus.</td>
<td>F:A.M.31841A</td>
<td>From an indefinite locality.</td>
</tr>
<tr>
<td>Distal one-half right tibia.</td>
<td>F:A.M.31834B</td>
<td>1923.</td>
</tr>
<tr>
<td>Right metatarsus, (132) mm.</td>
<td>F:A.M.31843B</td>
<td>Hidden Hollow Quarry, 1935.</td>
</tr>
<tr>
<td>Proximal one-third right metatarsus.</td>
<td>F:A.M.31834C</td>
<td>1923.</td>
</tr>
</tbody>
</table>
Submeryceros, NEW SUBGENUS

LIMB SIZE GROUP V.

(10) (?) S. minimus, Var.
From New Mexico
Left metacarpus, 91 mm. F:A.M.31731 1933.

This paper, Fig. 48.

---

Fig. 48A. C. (Paracosoryx) wilsoni, n.subg. and sp., ref. (F:A.M.33789), immature skeleton, from Long Quarry, Sioux County, Nebraska.

× approximately 1/4. Arrow indicates lateral phalanges. (See also Fig. 25B [manus] and pages 316, 351, 447 [footnote] and 462.)
Fig. 49. Pronghorns, Antilocaprin, of the American Late Tertiary and (A, AA and D) Quaternary.
Reconstructions X approximately 1. (See legend, page 470.)

Subpronghorn (A)
Capromeryz Matthew

Prepronghorn (c)
Plioceros, n.g.

Hay's Pronghorn (b)
Hayoceros, n.subg.

Barbour's Pronghorn (b)
Proantilocapra Barbour and Schultz

Quentin's Pronghorn (AA)
Stockoceros, n.subg.

Spiraled Pronghorn (b)
Hingoceros Merriam

See Osbornoceros reconstruction, Frontispiece, a

468
DIVISION B.—ANTILOCAPRINI

(a) Late Tertiary Section
[See (b) Pleistocene Section, page 521.]

Subfamily 3.—Ilingocerotinæ

IV. Osbornoceros, new genus
V. Ilingoceros Merriam
VA. Sphenophalos Merriam

Subfamily 4.—Pliocerotinæ

VI. Plioceros, new genus

Subfamily 5.—Stockocerotinæ
(Tertiary portion)

VII. Texoceros, new genus

Subfamily 6.—Antilocaprinæ
(Tertiary portion)

VIII. Proantilocapra Barbour
     and Schultz

Frontispiece, b; Figures 49b, c, e, 50, 51, 51A, 52, 52B, and (in part) 26, 45, 52A;
Limbs (in part) 18, 25B, 48
(See Table VII, Species Distribution, page 268; Table X, Mandibular Dentition Measurements, page 488; and Table XI, Limb Measurements, page 511.)

Statement

There is increasing evidence of the wide diversification of the members of the pronghorn group, Antilocaprinæ, in the Late Tertiary and Quaternary. The forms are characterized by tall-crowned teeth and tendency to forked horn-cores, which show a slight to marked twist and
total absence of the burrs so typical of the Merycodontini. While there is but one recorded occurrence from Tertiary deposits of an Antilocaprinus species with simple unforked pronghorn-like horn-core, remains now are known from a number of widely separated Tertiary areas which are indicative of the occurrence of allied species with forked cores of several different shapes. (See reconstructions, frontispiece, b and Fig. 49b, c, e.) Though certain of the latter horn-cores are recalled in moderate degree in the forked sheath of the pronghorn, and detached teeth to all practical purposes are indistinguishable from the tall-crowned teeth of the latter, it may be presumed that these Tertiary horn-cores and teeth (with the possible exception of Proantilocapra) only represent a number of extinct contemporaries of the actual and yet to be discovered ancestors of the several Quaternary and single surviving Recent North American pronghorns. As observed in the Introduction and below in the discussion of the forms from the Pleistocene, the horn-cores of certain individuals of Pliocene Meryceros and Texoceros, and of Pleistocene Stockoceros, might be shown as a morphologic series in which the horn-core bases are successively more compressed dorsoventrally and elongated anteroposteriorly. Plioceros, with base enlarged and tips greatly reduced, the curious Osbornoceros, n.g., and the strongly spiraled horn-cored Ilingoceros lie without this series.

The several genera and subgenera—the twisted-cored IV, Osbornoceros; V, Ilingoceros (and VA, Sphenophalos); VI, Plioceros and VII, Texoceros, with forked horn-cores; and VIII, Proantilocapra, with simple cores—are interpreted as representative of at least four distinct subfamilies1 of a Late Tertiary Section of the Division, Antilocaprinus— Ilingocerotine, Pliocerotinae, Stockocerotinae (in part) and Antilo-

---

1 Had not this manuscript been long in print before the receipt of the Osbornoceros specimens, the same should have been referred to a separate subfamily, Osbornocerotinae.
caprineæ (in part). [For the Pleistocene members of the Stockocerotæ and Antilocaprineæ proper, see Section (b).] Following a brief discussion of the characters of these genera and subgenera, the species of each are enumerated and the synonymy, types and referred specimens listed in detail. The distribution of the Late Tertiary Antilocaprini, as at present recognized, is shown in Table VII, page 268.

The posterior section of a cranium with a slender, twisted and unforked horn-core is taken as the type of a new genus and species, Osbornoceros osborni (frontispiece, B and Fig. 51). The specimen, together with other remains of the same form, was secured by the John C. Blick and Charles Falkenbach party late in the fall of 1935 from a restricted exposure of the uppermost beds of the New Mexican pre-Pleistocene. The horn-cores are unique for the American Tertiary, in their slenderness, dorsoventrally compressed and laterally extended bases and narrow twisted and posteriorly sweeping extremities. The inferior cross section is sharp anteriorly, deeply concave externally and rounded posteriorly. The mandibular diastema is shorter and the m₃ third lobe is smaller than the anterior lobes and lacks the accessory vein common to most of the Antilocaprini. The mandibular incisors and incisiform /C and the cheek teeth are tall-crowned (the latter approximating Size Group II of the Merycodontini). The new genus, like Ilingoceros, is believed to be definitely of the Antilocapridæ rather than the Bovidæ. (While there is no evidence of forking, a tendency to this might be shown in the case of an immature horn; possibly the sheath was forked.)

The horn-cores of Ilingoceros differ from Osbornoceros much as those of the Suleman Markhor differ from the domestic goat. The few rami known from the general horizon previous to the discovery of the horn-cores were referred tentatively to Plioceros. It is possible that the new genus is represented by fragmental dentitions from other areas in the present collections. The Osbornoceros evidence includes examples of the extremely slender, upright-tending adolescent and noticeably heavier, more twisted and possibly more postero-outwardly directed mature horn-cores. The section of a cranium with horn bases shows the frontals to have been as fully depressed, but the horns more upright than indicated in the type. The horn (tip missing) of the type specimen is nearly as large as the largest detached specimens. Several mandibular rami are heavier-proportioned and have larger m₃s than the average. One specimen is unusually slender. The genus and genotypic species are dedicated to Henry Fairfield Osborn.
The strange spiraled-cored *Ilingoceros* (see reconstruction, Fig. 49e), genotypic species *I. alexandrae* Merriam, from the Thousand Creek Beds, Nevada, is represented in our collections by useful portions of the horn-cores of mature and immature individuals, and a well-preserved ramus secured by the John C. Blick party in the summer of 1934. The tightly spiraled cores of this remarkable Antilocaprine seem to have been directed slightly backward and bowed slightly outward. The twist in the right core is clockwise, as in *Osbornoceros* and the incipient twist in *Plioceros* or the stronger twist in the markhor. The diameter of the shaft seems to diminish unevenly upwardly, with the result that it may be wider in the middle than either proximally or distally. Two diminutive specimens associated with the new remains exhibit a terminal fork highly suggestive of the type of *I. schizocera*. The latter type may represent no more than an adolescent or female individual of *I. alexandrae*—a possibility previously noted by Merriam. The immature to adolescent specimens tend to be somewhat intermediate to the mature *Ilingoceros* specimens on the one hand and to *Plioceros* on the other, though differing notably from the latter in the anteroposterior narrowness of the shaft and in its proportionate elongation and increase of twist. The *Ilingoceros* horn-core, as seen in the small core of the type of *I. schizocera*, might be spoken of as a constricted and drawn-out *Plioceros* core. (The core of the type of *Sphenophalos nevadanus*, as judged by the figure, possibly was more like *Ilingoceros* than the remains which have heretofore been referred to *Sphenophalos* [see below] and which here are transferred to *Plioceros*, new genus.) In the newly secured and so far only known ramus, the *Ilingoceros* postsymphysial distance is relatively short, the teeth are very tall-crowned, p3–p4 large and the m3 talonid reduced. *Ilingoceros* in forked core and teeth is Antilocaprine rather than Antelope. Figures of the Blick immature cores and of the previously described and similar core (type of *I. schizocera*), together with a reconstruction of the mature horn-core, based on the new Blick specimens and those previously figured, are given on an adjoining plate (Fig. 51A). *Ilingoceros* so far has been found only in the Thousand Creek area from whence specimens of *Sphenophalos* and *Plioceros* as well, it is recalled, are reported.

Knowledge of *Sphenophalos* Merriam to date is confined to the single fragmental type horn-core from Thousand Creek, Nevada. The specimen is figured and described as having a wedge-shaped cross section which is narrowest antero-externally. John C. Merriam (1911, p. 286), in comparing the genotype with a core (U.C. 12537) from the same Thousand Creek area, here transferred to *Plioceros* species, observes "...
12537 ... is wider anteroposteriorly, but much thinner transversely than the type specimen. It also differs somewhat from the type in the nature of the region on the posterior side of the base of the horn-core. In the type-specimen, this region is very broadly rounded or nearly flat transversely. In no. 12537 the posterior basal region is relatively much narrower, and a low longitudinal keel is developed on the middle of the posterior surface. In this specimen the tendency of the horn-core to flare anteroposteriorly a short distance above the base is more distinctly shown than in the type material..." (The fragmental genotype of S. nevadanus Merriam as figured is not wholly unsuggestive of the New Mexican Osbornoceros.)

Plioceros, n.g. (see reconstruction, Fig. 49c), is erected to take a few horn-cores from New Mexico and Nebraska, and somewhat similar remains from Nevada and Oregon. The Nevada and Oregon specimens previously have been allocated in entirety to Sphenophalos Merriam. In the genotypic species, Plioceros blicki, from New Mexico, the horn-cores are solid, heavy-proportioned, laterally compressed and distally bluntly bifurcate, with the lower and anterior prong depressed outwardly and posteriorly. (The tendency to twist in the right core is clockwise.) The median cross section of the core is slender dumbbell-shaped. The horns are situated on the upper posterior portion of the orbit, sloping slightly backwardly and outwardly and tend to widen upwardly. The genotypic New Mexican core lacks the noticeable basal constriction of the Nevada and Oregon specimens. The constriction in one of the latter is particularly marked through the prominence and anterior welling-out of the front edge above the orbit. Several of the Nevada cores are considerably taller and larger than that from Santa Cruz. The small Nebraskan and the Battleship, New Mexico, specimens exhibit a thickening of the posterior border. Knowledge of the horn-cores of the group is confined so far to remains from New Mexico, Nebraska, Nevada and Oregon. As seen in a referred mandibular ramus from New Mexico (Fig. 52), the diastema is long and the m<sub>2</sub> talonid moderate.

The female Plioceros skull is believed to be represented by a specimen from Cherry County (Fig. 26, F:A.M.32101). The teeth are tall and Antilocaprine-like; the diastema long, the premaxilla and anterior ramus slender; the orbits, notable for their prominence outwardly and dorsally, are capped by paired and anteroposterior-stretching excrescences of the frontals; the mid-frontals are domed; the parietal ridges running posterior to the orbits are not united and the posterior as-
pect of the occiput is broad. The low supra-orbital excrescences are interpreted as the rudimentary horns of the female. These tend to occupy the position of the horn-core base of *Plioceros floblairi*, n.sp., and *Meryceros*, rather than of *Proantilocapra*. A posterior thickening of these excrescences would be necessary to produce a horn-core of the form of the latter. (In the relatively low-crowned and short-diastemaed Cervid *Aletomeryx*, the horn-core in both mature and rudimentary state is confined to the posterior orbit.) The new cranium compared to the Crookston *Meryceros* is smaller and shorter, the premaxillae slenderer, the orbit possibly larger-proportioned, the rudimentary "horns" of very distinctive form and the bullae smaller. The teeth are heavier-proportioned than in the Crookston specimens and differ from the latter in the larger-proportioned p₃ as well as the divided third column of the m₃. The associated limbs are approximated by elements of the Crookston series.

*Texoceros*, n.g., is based on a remarkably interesting partial horn-core (Fig. 50) secured by Charles Falkenbach from Oklahoma. The core evidently belongs to the Antilocaprid so well represented by mandibular rami and other remains from that area and from Miami, Texas. The horn, in the development of the forks relative to the size of the basal shaft, stands almost intermediate to Tertiary *Plioceros* and Pleistocene *Stockoceros*. The specimen differs from *Plioceros* in the greater division of the anterior and posterior areas, the median constriction, the wider forking, the elongation and greater rotundity of the forks in cross section and slightly more posterior situation on the orbit. The anterior fork is flexed outwardly and the posterior fork inwardly, as in *Plioceros* and *Meryceros*. As seen in Guymon specimens, the mandibular diastema is of moderate length and the m₃ third lobe and vein expanded. Remains from the Uppermost Pliocene of Eden are very tentatively referred to the genus, which is similarly credited with detached rami from Miami, Texas, and from Yuma County, Colorado, and with the much-questioned teeth of "*Merycodus altidens*" Matthew of Sioux County, Nebraska.

*Proantilocapra* Barbour and Schultz (see reconstruction, Fig. 49b) is represented alone by the unique type specimen from Cherry County, Nebraska, with horn-core form approaching that of Recent *Antilocapra*. The core differs from the core of the pronghorn mainly in the noticeably smaller size and blunt tuberous versus attenuated character of the tip. The condition in *Proantilocapra* suggests a possibly primitive state of development in which, while the basal portion of the core was still
covered with skin, a corneous and deciduous sheath arose about the sharp anterior surface. The left horn-core with portion of the orbit, right maxillary dentition and the broad Antilocaprine-like occipital region are well preserved in the type specimen. The mandibular angle is more prominent, the cheek teeth series, though similar, somewhat slenderer and taller-crowned and the $p_4$ smaller than in the nearest-alike Merycodont [compare Size Group IV, A.M.14109, type of Cosoryx (Paracosoryx) sabulonis (Matthew and Cook)]. The limb elements are somewhat shorter, particularly the humerus and metapodials, and the posterior molars are smaller than corresponding elements in Ramoceros osborni (Matthew), from Colorado. The Proantilocapra specimen represents a remarkably near approach in the Late Tertiary to Recent Antilocapra. The very presence at so early a date of this "advanced" form indicates the gulf that separates the broadly contemporaneous Plioceros from direct pronghorn ancestry. The writer has enjoyed the privilege of first-hand examination of the unique type specimen through the kindness of Professor E. H. Barbour.

In the earlier New Mexican, Nebraskan, Virgin Valley of Nevada, and Oregon deposits, the Antilocaprid Merycodontini are found associated with rare Dromomerycine forms; but in the later deposits of the Eden of California, the Thousand Creek of Nevada, the Rattlesnake of Oregon, Miami of Texas, Guymon of Oklahoma, and Yuma County of Colorado, where occur the Antilocaprini forms of the present section, the Merycodontini have not so far been encountered.

Whereas the largest of the mandibular rami allocated to the present Plioceros section approximate a large Recent Antilocapra in size, small detached $m_3$s from the Snake Creek are only very slightly larger than those of Cosoryx of Size Group II; and the $m_3$ of the small Plioceros from Deep Creek, Nebraska, is no larger than the $m_3$ of a Merycodontine maxilla of Size Group IV. Certain New Mexican and Colorado fragments indicate individuals fully as large or slightly larger than those represented by the average of the Oklahoma and Texas specimens. The series from these two latter areas, as previously noted, witness a normal size variation. It is highly probable that the teeth of the smaller members of this section, even when better known, frequently will be found to be indistinguishable from those of certain of the largest Merycodontini. The teeth from Eden tend to be more compressed laterally and taller-crowned than the average of the teeth from the earlier exposures.
The Tertiary Antilocaprini remains in the present report are divided between the six genera: IV, Osbornoceros, new genus; V, the twisted-cored Ilingoceros Merriam; VA, the questioned Sphenophalos Merriam; VI, Plioceros, new genus; VII, Texoceros, new genus; and VIII, Proantilocapra Barbour and Schultz. Examples of each are illustrated in the adjoining figures (Figs. 50–52B). Ilingoceros and Sphenophalos originally were referred to the Bovidae. The included remains well may embrace still other genera or subgenera, particularly in the case of the horn-core and dentitions from Eden. Even well-preserved rami may be allocated but doubtfully between the several here-described genera and species. The Pleistocene Antilocaprini are considered in a separate and following section (b).
Fig. 51. Osbornoceros osborni, n.g. and sp., age and individual variation in crania and horn-cores (F.A.M.32980 [genotype], 32990 [anterior view, left horn slightly restored from opposite], 32996 [section A rev.] and 32981 [rev.]), from the Uppermost Tertiary, Leyden, New Mexico.

Lateral, anterior, posterior and dorsal views × 4. A, B, C, cross sections of horn-cores. (See page 490.)
Fig. 51A. *Hingoceros* Merriam, age and specific variation in horn-cores (and U.C.11887, *Sphenophalos* Merriam cross section), from the Thousand Creek Beds, Nevada.

$X \times 1$. (See legend, page 480.)
Fig. 50. *Tezoceros*, n.g., and *Plioceros*, n.g., horn-cores; *Proantilocapra* Barbour and Schultz, partial skull and mandible.

X 1. A, cross section of horns; PS, posterior border symphysis.

F:A.M.31675, *Tezoceros guymonensis*, n.g. and sp., genotype, from Guymon, Oklahoma. (See page 501.)

F:A.M.31682 and 31683, *Plioceros blicki*, n.g. and sp., genotype and small ref., from New Mexico. (See page 495.)

F:A.M.31570, *Plioceros floblairi*, n.sp., type, rev., from Deep Creek, Brown County, Nebraska. (See page 496.)

N.S.M.2-5-8-30, *Proantilocapra platycornea* Barbour and Schultz, genotype (maxilla rev.), from Cherry County, Nebraska. (After Barbour and Schultz, 1934.) (See also Fig. 48 [limbs] and page 510.)

Fig. 51A. *Ilingoceros* Merriam, age and specific variation in horn-cores (and U.C.11887, *Sphenophalos* Merriam cross section), from the Thousand Creek Beds, Nevada.

X 1. A, B, cross sections of horns.

F:A.M.32201 and 32202 (tip rev.) combined, lateral and posterior views, and A and B, cross sections; 32209 (rev.) and 32206, immature, of *Ilingoceros alexandrzi* Merriam, ref. (See page 492.)

U.C.11893, *Ilingoceros schizoceras* Merriam, type, rev. (After Merriam, 1911.) (See page 493.)

U.C.11880, *Ilingoceros alexandrzi* Merriam, cross section of genotype. (After Merriam, 1909.) (See page 492.)

And for comparison:

U.C.11887, *Sphenophalos nevadanus* Merriam, cross section of genotype. (After Merriam, 1909.) (See page 494.)
Summary of Named Species

The six Late Tertiary genera and sixteen species and subspecies, whose synonymy and details are listed on subsequent pages, may be briefly considered under four subfamilies:

SUBFAMILY 3.—ILINGOCEROTINÆ

IV. Osbornoceros, new genus. (Size Groups II and III.)
Horn-core base compressed, extremity twisted.

(1) Osbornoceros osborni, n.g. and sp., from New Mexico.

GENOTYPE.—Posterior half of cranium with left horn-core, F:A.M. 32980. This paper, Fig. 61.

V. Ilingoceros Merriam. (Size Group I+.)
Horn-core spiraled.

(1) Ilingoceros alexandra Merriam, genotypic species, from Thousand Creek, Nevada.

GENOTYPE.—Basal portion of left horn-core, U.C.11880. This paper, Fig. 51A (cross section).

(1a) Ilingoceros schizoceras Merriam, from Thousand Creek, Nevada.

TYPE.—Right horn-core, U.C.11893. This paper, Fig. 51A.

VA. Sphenophalos Merriam.
Questioned.

(1) Sphenophalos nevadanus Merriam, genotypic species, from Thousand Creek, Nevada.

GENOTYPE.—Base of horn-core attached to portion of skull, U.C. 11887. This paper, Fig. 51A (cross section).

(1a) Sphenophalos species, Merriam, Stock and Moody, from the Rattlesnake, Oregon.

EXAMPLE.—Basal portion of horn-core, U.C.22428.
VI. *Plioceros*, new genus. (Size Groups I to III.)
Horn-core base laterally compressed and tips short.

(1) *Plioceros blicki*, n.g. and sp., from New Mexico. (S.G. I.)
   **Genotype.**—Pair of horn-cores, F:A.M.31682. This paper, *Fig. 50*.

(2) *Plioceros floblairi*, n.sp., from Brown County, Nebraska.
   (S.G. II TO III.)
   **Type.**—Left horn-core and associated maxillae, F:A.M.31570. This paper, *Fig. 50*.

(2a) *Plioceros dehlini*, n.sp., from Snake River, Cherry County, Nebraska. (S.G. III.)
   **Type.**—Skull, mandible and nearly complete limbs, F:A.M.32101. This paper, *Fig. 26*.

(2b–c) (?) *Plioceros* vars., from southern Nebraska and Kansas.
   Are exampled only in limb elements, see Limb Section, page 517.
   From: (2b) Hitchcock County, Nebraska, and (2c) Kansas.

(3) *Plioceros* species, from Harper, Malheur County, Oregon.
   **Example.**—Left horn-core, C.I.T.16.

(3a) Smaller var., from Rome, Malheur County, Oregon.
   **Example.**—Right horn-core, C.I.T.396.

(4) *Plioceros* species and vars., from Thousand Creek, Nevada.
   **Examples.**—Horn-cores, C.I.T. and U.C. collections.

SUBFAMILY 5. **STOCKOCEROTINÆ**
(Tertiary Portion)

VII. *Texoceros*, new genus. (Size Groups I, II and IV.)
Horn-core base deeply cleft and forks long.

(The small size of the molars in (?) *T. minorei* and elongation of the diastema in (?) *T. vaughani* and (?) *T. edensis* indicate the presence of a group or groups apart from *Texoceros*, and possibly more closely resembling *Plioceros*.)
(1) *Texoceros guymonensis*, n.g. and sp., from Guymon, Texas County, Oklahoma. (s.g. I and II.)

**Genotype.**—Left horn-core, F:A.M.31675. This paper, *Fig. 50.*

(1a) *Texoceros texanus* (Hesse), from Hemphill County, Texas. (s.g. I.)

**Type.**—Left ramus with p3-m2, U.C.30337.

(1b) (?) *Texoceros minorei*, n.sp., from Guymon, Oklahoma. (s.g. IV.)

**Type.**—Left fragment with p3-m2, F:A.M.31668. This paper, *Fig. 52.*

(2) (?) *Texoceros vaughani*, n.sp., from Wray, Yuma County, Colorado. (s.g. II.)

**Type.**—Mandibular symphysis, F:A.M.31312A. This paper, *Fig. 52.*

(3) (?) *Texoceros* species, from Benson, Arizona.

**Example.**—Maxillary teeth, F:A.M.32060.

(4) (?) *Texoceros altidens* (Matthew), from "Upper Snake Creek," Sioux County, Nebraska. (s.g. I--)

**Type.**—Right ramal fragment, A.M.18981.

(5) (?) *Texoceros edensis*, n.sp. (s.g. I), and var. A, from the Uppermost Pliocene, Eden, California.

**Type.**—Left ramus, F:A.M.31765. This paper, *Fig. 52B.*

**Subfamily 6.**—*Antilocaprinae* (Tertiary Portion)

**VIII. Proantilocapra** Barbour and Schultz. (Size Group III.)

Horn-core tending laterally compressed and blade-like.

(1) *Proantilocapra platycornea* Barbour and Schultz, genotypic species, from Cherry County, Nebraska.

**Genotype.**—Partial skull, mandible and skeletal elements, N.S.M. 2-5-8-30. This paper, *Figs. 48* (limbs), 50 (partial skull and ramus).

[See (a) Pleistocene Section, Antilocaprinae, page 521.]
Fig. 52. *Texoceros*, n.g., *Plioceros*, n.g. (F:A.M.31689) and *Osbornoceros*, n.g. (F:A.M.32987), from the Late Tertiary, mandibular dentitions compared. Lateral views \( \times \frac{1}{2} \), occlusal \( \times 1 \). (See legend, page 487.)
Fig. 52A. *Osbornoceros*, n.g., *Ilingoceros* Merriam (F:A.M.32207 and 32210), *Plioceros*, n.g. (F:A.M.31681B), *Texoceros*, n.g. (F:A.M.32132G, H, and 32138), from the Late Tertiary, and *Capromeryx* Matthew (F:A.M.31749), from the Pleistocene, mandibular and maxillary dentitions compared.

Lateral views × ½, occlusal × 1. (See legend, page 487.)
Fig. 52B. (?) *Texoceros edensis*, n.sp., age and individual variation in mandibular dentitions (F:A.M.31768, 31759, 31758, 31763, 31762, 31770 [var. A, rev.], 31750 [rev.] and 31765, type), from Uppermost Pliocene, Eden, California.

× 1. PS, posterior border symphysis.  (See pages 509, 508.)
Figs. 52 and 52A. *Texoceros*, n.g., *Plioceros*, n.g., *Osbornoceros*, n.g., *Ilino-ceros* Merriam (Late Tertiary) and *Capromeryx* Matthew (Pleistocene), mandibular and maxillary dentitions compared.

Lateral views \( \times \frac{1}{4} \), occlusal \( \times 1 \). PS, posterior border symphysis.

Fig. 52. F:A.M.31668, (?) *Texoceros minorei*, n.sp., type, from Texas County, Oklahoma.

(See page 506.)

F:A.M.31312 and A, (?) *Texoceros vaughani*, n.sp., ref., rev., and type, from Yuma County, Colorado.

(See page 506.)

F:A.M.31665, 32132B (rev.) and F (rev.), 32159 (rev.), 32121 and 32147 (rev.), *Texoceros guymonensis*, n.g. and sp., ref., from Texas County, Oklahoma.

(See pages 504, 501.)


(See page 495.)

F:A.M.32987, *Osbornoceros osborni*, n.g. and sp., ref., from Leyden, New Mexico.

(See page 491.)

Fig. 52A. F:A.M.32997 (rev.), 32985, 32988B (rev.), 32996A and 32983 (rev.), *Osbornoceros osborni*, n.g. and sp., ref., from Leyden, New Mexico.

(See pages 491, 490.)


(See page 493.)

F:A.M.31749, *Capromeryx furcifer* Matthew, var., from Stegomastodon Quarry, Brown County, Nebraska.

(See page 529.)


(See page 495.)

F:A.M.32132G, H (rev.) and 32138, *Texoceros guymonensis*, n.g. and sp., ref., from Texas County, Oklahoma.

(See page 504.)
<table>
<thead>
<tr>
<th>Site Location</th>
<th>Collection No</th>
<th>Tooth</th>
<th>West</th>
<th>Collection</th>
<th>Tooth</th>
<th>West</th>
<th>Comparison</th>
<th>See Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATE TERTIARY:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ilingoceros alexandra</em> Merriam, ref., Thousand Cr., Nev.</td>
<td>32207</td>
<td>F:A.M.</td>
<td>31.</td>
<td>25.5</td>
<td>30.5</td>
<td>20.</td>
<td>(74)%</td>
<td>91%</td>
</tr>
<tr>
<td><em>Osbornoceros osborni</em>, n.g. and sp., ref., Round Mt., N. Mex.</td>
<td>32985</td>
<td>w</td>
<td>35.</td>
<td>57</td>
<td>35.</td>
<td>71</td>
<td>(8)%</td>
<td>(88)%</td>
</tr>
<tr>
<td><em>Plioceros blacki</em>, n.g. and sp., ref., San Ildefonso, N. Mex.</td>
<td>31689</td>
<td>w</td>
<td>40.</td>
<td>51</td>
<td>42.</td>
<td>92</td>
<td>(55)%</td>
<td>92%</td>
</tr>
<tr>
<td>P. fiolairi, n.sp., ref., Brown Co., Nebr.</td>
<td>31190</td>
<td>w++</td>
<td>35.</td>
<td>54</td>
<td>37.</td>
<td>43</td>
<td>(23)%</td>
<td>25%</td>
</tr>
<tr>
<td>P. dehlini, n.sp., type (?), Cherry Co., Nebr.</td>
<td>32101</td>
<td>m+</td>
<td>15.</td>
<td>18.6</td>
<td>33.6</td>
<td>55</td>
<td>(8)%</td>
<td>83%</td>
</tr>
<tr>
<td><em>Proantilocapra platycornea</em> B. and S., genotype, Cherry Co., Nebr.</td>
<td>2-5-8-30</td>
<td>m+</td>
<td>22.4</td>
<td>67</td>
<td>30.6</td>
<td>59</td>
<td>(24)%</td>
<td>7%</td>
</tr>
<tr>
<td>(?)<em>Tezoceros edensis</em>, n.sp., type, Eden, Calif.</td>
<td>31765</td>
<td>m+</td>
<td>39.</td>
<td>30.6</td>
<td>30.6</td>
<td>59</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>T. texanus (Hesse), ref., Hemphill Co., Tex.</td>
<td>31651</td>
<td>m++</td>
<td>19.</td>
<td>42.</td>
<td>42.</td>
<td>9</td>
<td>(20)%</td>
<td>9</td>
</tr>
<tr>
<td>T. guymonensis, n.g. and sp., ref., Texas Co., Okla.</td>
<td>32147</td>
<td>w+</td>
<td>20.5</td>
<td>20.4</td>
<td>41.</td>
<td>50</td>
<td>(lost)</td>
<td>5.3</td>
</tr>
<tr>
<td>T. guymonensis, n.g. and sp., ref., Texas Co., Okla.</td>
<td>32121</td>
<td>m+</td>
<td>34.</td>
<td>60</td>
<td>41.</td>
<td>8.7</td>
<td>(36)</td>
<td>9</td>
</tr>
<tr>
<td>Specimen</td>
<td>Sex</td>
<td>M+</td>
<td>M+</td>
<td>M+</td>
<td>M+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T. guymonensis, ref. (cont.)</td>
<td>&quot;</td>
<td>32122</td>
<td>M+</td>
<td>19.5</td>
<td>38.5</td>
<td>5.3</td>
<td>28</td>
<td>6.8</td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>32154</td>
<td>M+</td>
<td>30.5</td>
<td>21.</td>
<td>18.7</td>
<td>25.5</td>
<td>5.9</td>
</tr>
<tr>
<td>&quot;</td>
<td>&quot;</td>
<td>II</td>
<td>32161D</td>
<td>M+</td>
<td>31.</td>
<td>(18.3)</td>
<td>(18.5)</td>
<td>(54)</td>
</tr>
<tr>
<td>(? T. vaughani, n.sp., ref., Yuma Co., Colo.</td>
<td>&quot;</td>
<td>32151</td>
<td>M+</td>
<td>19.</td>
<td>39.5</td>
<td>7.6</td>
<td>37</td>
<td>7.1</td>
</tr>
<tr>
<td>(? T. minorei, n.sp., type, Texas Co., Okla.</td>
<td>IV</td>
<td>31312</td>
<td>M</td>
<td>17.</td>
<td>20.</td>
<td>8.3</td>
<td>33</td>
<td>7.9</td>
</tr>
<tr>
<td>C. furcifer var., Brown Co., Nebr.</td>
<td>I</td>
<td>31749</td>
<td>M+</td>
<td>17.5</td>
<td>23.5</td>
<td>8.8</td>
<td>34</td>
<td>8.2</td>
</tr>
<tr>
<td>Hayoceros falkenbachii, n.subg. and sp., ref., Sheridan Co., Nebr.</td>
<td>A-1</td>
<td>2772</td>
<td>M+</td>
<td>31</td>
<td>40</td>
<td>41</td>
<td>(9.2)</td>
<td>10.</td>
</tr>
<tr>
<td>Recent (for comparison):</td>
<td>&quot;</td>
<td>A.M.(M.)</td>
<td>75243</td>
<td>M</td>
<td>21.</td>
<td>29.</td>
<td>7.2</td>
<td>34</td>
</tr>
<tr>
<td>Antilocapra americana Ord, ref. (♂), Wyo.</td>
<td>&quot;</td>
<td>11006</td>
<td>M</td>
<td>22.5</td>
<td>31.</td>
<td>8.5</td>
<td>38</td>
<td>11.</td>
</tr>
<tr>
<td>(♀), Mont.</td>
<td>&quot;</td>
<td>11008</td>
<td>M+</td>
<td>23.5</td>
<td>24.</td>
<td>5.5</td>
<td>23</td>
<td>7.8</td>
</tr>
</tbody>
</table>

( ) Approximate; ( ) estimated.
* Measurements taken partly from Fig. 50; † measurements taken partly from Fig. 54.
Detailed Lists of Types, Referred Specimens, and Synonymy

Total available specimens, 340: Osbornoceros, 51; Ilíngoceros, 29; Sphenophalos, 2; Plioceros, 54; Texoceros, 203; Proantilocapra, 1.

For size groups, see summary of named species, pages 481-483.

IV. OSBORNOCEROS, NEW GENUS

Reconstruction, Frontispiece, b

The genus, as remarked above, is represented by a fine series of skull portions, horn-cores, dentitions and limbs from the uppermost beds of the Santa Fé area. As yet it is elsewhere unrecognized.

(1) Osbornoceros osborni, new genus and species

From the Vicinity of Leyden, New Mexico

Genotype.—Posterior one-half of cranium with left horn-core, portion of frontals and the superior border of the left orbit. F:A.M. 32980

Referred from Type Locality.—

Skulls, Horns or Maxillae

Portion of cranium with bases of both horn-cores. (See possibly associated mandible, F:A.M.32996A.)...... Fig. 51 32996

Right horn-core (nearly complete). Slightly larger than type....................................................... Fig. 51 32981

Left horn-core (end missing).................................................. 32982

Posterior portion of skull with both horn-cores of adolescent individual. (Horns extremely slender.)........ Fig. 51 32990

Palate with both p₁-m₈s.................................................. (w+) 32983

Palate with both p₁-m₈s.................................................. Fig. 52A 32984

Left maxilla with p₁-m₄(br.)................................................. 32990A

Right maxilla with p₁-m₄(br.)............................................. 32990B

Left maxilla with dp₁-m₄(erupting)........................................ 32990C

Mandibular Specimens

Right ramus with symphysis, broken dp₁-dp₄, and m₁-m₂ (erupting).............................................. Fig. 52A 32988B

Partial left ramus with p₄(br.), m₂-m₄ and alveoli........ (w++) 32986

Left fragment with p₃-m₂ and roots of p₄-p₅................. (w) 31687

Nearly complete mandible with portions of symphysis and p₃-m₂.......................................................... Fig. 52A 32996A

Left ramus with p₂(br.)-m₂.............................................. (w) 31686
Frick, Horned Ruminants. II—Antilocapridæ

Left ramus with portion of symphysis and \( p_2-m_3 \). \( w++ \) 32999
Both rami with \( p_2-m_4(br.) \). \( w++ \) 32999A
Mandible with three \( /I_s, /C \) and \( p_2-m_3 \). (Moderate-sized.) \( w \) 32985
Right ramus with symphysis, alveoli and \( m_1(br.)-m_3 \). (Slender.) \( Fig. 52A \)

Seven immature:

Left ramus with \( d_1/C \) and \( dp_2-m_3(erupting) \). \( Fig. 52 \) 32987
Left ramus with \( dp_2-m_3 \). 32988
Left ramus with portions of symphysis, \( dp_2-m_3(erupting) \). 32988C
Partial right ramus with \( dp_2-m_3 \). 32988D
Right fragment with \( dp_2-m_3(dp_4 br.) \). 32988E
Left fragment with \( dp_2-m_3(erupting) \). 32988F
Right partial ramus with \( dp_2-m_3(erupting) \). 32988A

A number of fragmental mandibular and maxillary speci-
mens, F:A.M. Coll.

Two metatarsi, etc. (See Limb Section, pages 514–515.)
Two unguals (unusually compressed laterally), F:A.M. Coll.

**Questionably Referred from Possibly Contemporaneous Pockets.—**

Right maxilla with \( p_4^1-m_1 \) and \( m_3 \). (From W. Rio
Grande, above San Juan.) (See associated limb ele-
ments, page 515.) 32989
Left fragment with \( p_4-m_3 \). (From E. Alcalde, 1927.) \( w \) 31685

V. **Ilingoceros Merriam**

Reconstruction, Fig. 49E

The genus, as observed on a foregoing page (see discussion, page 472),
includes the genotypic and a small referred species.

(1) **Ilingoceros alexandriæ** Merriam, genotypic species

From Thousand Creek Beds, Nevada

Figs. 1–5; 1911, ibid., VI, p. 299, Figs. 78–80.
GENOTYPE.—Basal portion of left horn-core with part of frontal. U.C.11880 From Thousand Creek beds. Figured by Merriam, 1909, Figs. 1 and 4; 1911, Fig. 79; this paper, Fig. 51A (cross section, after Merriam, 1909).

RECORDED BY JOHN C. MERRIAM FROM TYPE LOCALITY.—

Left horn-core base. U.C.11894 Figured by Merriam, 1909, Fig. 5.

"Questioned."

Frontal saddle. U.C.11882 Figured by Merriam, 1909, Fig. 3.

"I. species."

Horn-core section. U.C.11892 Figured by Merriam, 1909, Fig. 2; 1911, Fig. 80.

"Form B."

Fragment of core. U.C.11886 Figured by Merriam, 1911, Figs. 78a, b.

Questioned teeth. U.C.12613, 12605, 12610, 12604, 19418 Figured by Merriam, 1911, Figs. 68-72, under "Sphenophalos or Ilingoceros."

[Compare metatarsus (U.C.19419), figured by Merriam, 1911, Fig. 74, under I. schizoceras.]

NEW EVIDENCE SECURED BY JOHN C. BLICK PARTY (1934).—

Horns

Pair of horn-core bases, F:A.M.32201 This paper, Fig. 51A.
together with two distal sections of horn-core. F:A.M.32202 This paper, Fig. 51A.

Long section of right horn-core. F:A.M.32203

Three basal horn fragments. F:A.M.32204,A,B

Three disintegrated horn sections. F:A.M.32205,A,B

Two diminutive forked horn-cores. F:A.M.32206 This paper, Fig. 51A.

and 32209

[Interpreted as representing immature individuals. Specimens highly suggestive of the larger core of the type of the Merriam referred species (see following), which tentatively is interpreted as representing an adolescent or female individual of the genotypic species.]
Frick, Horned Ruminants. II—Antilocapridae

DENTITIONS

Right ramus with /Is alveoli (br.), p2-m2(br.); and partial left ramus with p4, m1(br.), m2. (m)

Two m3s.
Left m3.
Right m3.
pt-m1.
And fragments.

F:A.M.32207 This paper, Fig. 52A.
F:A.M.32208 and 32210B
F:A.M.32210 This paper, Fig. 52A.
F:A.M.32210A
F:A.M.32210C

(1a) Ilingoceros schizoceras Merriam

From Thousand Creek, Nevada

Ilingoceros schizoceras Merriam, 1911, ibid., VI, p. 292, Figs. 73–76.

TYPE.—Right horn-core.
(Small-sized.)

U.C.11893 From Thousand Creek beds.
Figured by Merriam, 1909, Fig. 6; 1911, Fig. 73; this paper, Fig. 51A (after Merriam, 1911).

REFERRED.—

Right metatarsus.
(See Limb Section, page 515.)

U.C.19419 Figured by Merriam, 1911, Fig. 74.

VA. SPHENOPHALOS Merriam

The genus (as discussed above) is only indefinitely characterized in the fragmental genotype from Thousand Creek. (The figured cross section of the fragmental horn is even suggestive of the cross section of Osbornoceros. A careful comparison of actual specimens is to be desired.)
(1) Sphenophalos nevadanus Merriam, genotypic species
From Thousand Creek, Nevada


Genotype.—Base of horn-core attached to portion of skull. U.C.11887 Figured by Merriam, 1909, Fig. 7; by Furlong, 1932, Pl. iv, Fig. 8; this paper, Fig. 51A (cross section, after Merriam, 1909).

John C. Merriam figures the horn as tilted posteriorly and as of egg-shaped cross section, with the apex lying above the mid-orbit. (Exact characters in question.)

(1a) Sphenophalos species, Merriam, Stock and Moody
From the Rattlesnake, Oregon

Sphenophalos sp., Merriam, Stock and Moody, 1925, Carn. Inst. Wash. Pub. 347, p. 90, Fig. 43, a, b and c.

Example.—Basal portion of horn-core with fragment of orbit. U.C.22428 Figured by Merriam, Stock and Moody, 1925, Fig. 43, a, b and c.

As seen in the figure, the specimen seems to differ in postorbital contour from all specimens known to the writer. U.C.22428 may possibly represent yet another distinct genus or subgenus.

VI. Plioceros,1 NEW GENUS
Reconstruction, Fig. 49c

Plioceros, n.g., is recognized from New Mexico, Nebraska, Nevada and Oregon, and tentatively from Kansas. (See discussion, page 473.) The types of the some five species and several geographical varieties represented by horn-cores (one by skull and mandible and associated limbs), and the two additional occurrences suggested by limb elements,

1 Plioceros is used advisedly, with the knowledge that "Plioceras" has been employed by Quatrefages (1867, Hist. Nat. des Annelés, p. 381) for a genus of Vermes which is not in current use.
are enumerated on a preceding page (page 482). The detailed evidence is as follows:

(1) **Plioceros blicki**, new genus and species

*From New Mexico*

**Genotype.**—Pair of horn-cores showing portions of orbit and frontal bone.

**REFERRED.**—

Left horn-core of small or immature individual, and possibly associated phalanx.

**REFERRED RAMI** (size large, tooth series only slightly shorter but diastema considerably longer than in Nevada *Ilincoceros* referred, F: A. M. 32207, and Oklahoma *Texoceros*).—

Left ramus with symphysis, \(p_2\) alveolus, \(p_2-m_2\). (w)

\(P.S.-m_3\) inclusive = 108 mm. (Size Group I)

\(p_2\) alveolus—\(m_3\) = 65 (versus F: A. M. 31684 = 64 mm.)

Right ramus with \(p_2\) and \(p_3\) alveoli—\(m_3\). (w)

**TENTATIVELY REFERRED** (certain specimens may represent Merycodontini, Size Group II, forms), size fully equaling Colorado and largest Oklahoma remains of *Texoceros*.—

Partial right ramus with \(p_4-m_2\), alveoli of \(p_3-p_4\). (w)

Left fragment with \(p_4\) (br.) and \(m_1-m_3\) (br.).

Two detached \(m^3\)s.

Left fragment with \(m_1-m_3\), and \(p_4\) germ. (A)

Right fragment with \(m_1-m_4\) (teeth br.). (w)

(Somewhat larger and heavier than above and notably larger than *Osbornoceros* from the same area.)

(Metapodials indicate the presence of smaller individuals approximating *P. dehlini* size [Limb Size Group III].)
(2) *Plioceros floblairi*, new species

From Brown County, Nebraska

**Type.**—Left horn-core and associated maxillae with $p^2_-$ and $m^4$. (w)

F:A.M.31570

From Deep Creek, 1930.

This paper, Fig. 50.

Length of tooth series actually shorter through wear, but proportions very suggestive of *Plioceros dehlini*, n.sp., cranium (F:A.M.32101) from Cherry County, Nebraska. Horn-core is the smallest so far known of *Plioceros* form. Morris F. Skinner reports both F:A.M.31570 and 32101 as coming from top of section.

**Tentatively Referred.**—

(a) From Fairfield Falls Quarry:

It is possible that a peculiar mandibular ramus (F:A.M.31190) from Fairfield Falls Quarry, which in unusually elongate diastema and reduced premolars recalls specimens of the smaller genus *Longirostromeryx*, may represent the same Brown County species.

Left ramus with symphysis and $p_r$-$m_s$. (w++)

F:A.M.31190

1934.

This paper, Fig. 45.

(b) From J. Wilson Ranch (slightly larger than type, but smaller than F:A.M.31190):

A single ramus, referred from this locality, exhibits tall, narrow-lobed molars, a long slender $p_4$, and an $m_1$ with a well marked talonid. The postsymphysial distance was evidently long. (The distance from the $p_2$ alveolus to the broken tip measures 29 mm., and yet there is no sign of the anterior mental foramen or of the beginning of the symphysis.)

Partial left ramus with $p_r$-

F:A.M.31543

1933.

This paper, Fig. 45.

(c) From Q. Kat Quarry Channel:

Left ramus with diastema

F:A.M.33726

1936.

and $m_1$-$m_2$. (w+)

(d) From E. Kat Quarry Channel:

Left fragment with $m_3$-$m_4$ (erupting).

F:A.M.32196

1936.

(e) From *Leptarctus* Quarry Channel:

Left fragment with $m_4$-$m_5$

F:A.M.34035

1936.

(M+)

Left immature ramus with diastema and $dp_3$-$m_4$.

F:A.M.34036

1936.

(See Limb Section, page 516.)
(2a) Plioceros dehlini, new species
From Snake River, Cherry County, Nebraska

See discussion (page 473) of specimen, which includes the only so-far-known skull referred to the genus.

Type.—Skull lacking much of muzzle but exhibiting both premaxilla, maxillary dentition, palate and all of cranium posterior to the anterior border of the orbits, including bulle, etc.; mandible and dentition completely represented (excepting I₁–I₂ (M+); and nearly complete representation of limb elements (see Limb Section, page 516, and Fig. 25B.)

Postsymphysial distance... = 22.4 mm. m₃ Postsymphysial distance = 67%
p₃ = 4.2 p₃ Postsymphysial distance = 51%
p₄ = 6.3 p₄ /ps series... = 18.6 /ps series = 55%
m₄... = 15. /ms series... = 33.6 /ms series

(2b-c) (?) Plioceros Vars.

Limb elements from a Nebraska and a Kansas locality are interpreted as representing a possible variation or variations of the genus Plioceros. (See Limb Section, page 517.)

(2b) From Hitchcock County, Nebraska
Note skeletal elements. A.M.8501 From Oak Canyon, 1880.
Possibly the same individual as represented by right ramal fragment with broken p₄–m₃ (A.M.8501). [Tooth size approximating Leyden, New Mexico, specimen (F:A.M.31686).]

(2c) From Beaver Creek, Kansas¹
Note left metacarpus, etc. F:A.M.31513 1933.
This paper, Fig. 48.

¹From Clark County, Kansas
(Not included in specimen count)

Left fragment with m₃ and broken m₄. (w) F:A.M.30912
Etc. detached ms/. F:A.M.30912A–E
(3) Plioceros species
From Harper, Malheur County, Oregon


Example.—Left horn-core. C.I.T.16 Figured by Furlong, 1932, Pl. 1, Figs. 1–4.

Referred, Larger-Sized Specimen.—
Right horn-core. C.I.T.17 Figured by Furlong, 1932, Pl. 1, Figs. 5–8.

According to figure, posterior horn-tip = 135 mm. above supra-orbital border, versus 90 mm. in largest New Mexican specimen.

Specimens tall and, according to the figures, in the prominent production or bulging of the main anterior edge and constriction of the base, differ from the New Mexican and certain of the Thousand Creek specimens.

(3a) Smaller Var.
From Rome, Malheur County, Oregon


Example.—Right horn-core. C.I.T.396 Figured by Furlong, 1932, Pl. II, Figs. 1 and 2.

Smaller than preceding C.I.T.16. According to figure, posterior tip would have been 80 mm. above the superior border of the orbit, and thereby approximating the 90 mm. of the largest New Mexican specimen. Base narrowed.

Horn-core. C.I.T.395 Figured by Furlong, 1932, Pl. II, Figs. 3, 4 and 5.

Cranial fragment. C.I.T.399 Figured by Furlong, 1932, Pl. II, Figs. 6 and 7.

(4) Plioceros species and Vars. A and B
From Thousand Creek, Nevada

Tall, slight-waisted

EXAMPLE.—Two horn-cores. C.I.T. Coll. Figured by Furlong, 1932, Pl. iii, Figs. 1–6.

REFERRED.—

Partial pair of horn-cores and three ms./. U.C.31525 From 1.1 mi. W. of Hot Spring, Thousand Creek beds, Humboldt County, Nevada, 1930. Figured by Stirton, 1932, Figs. 1–3.

Var. A

(Specimens more fragmentary and possibly smaller than those of Furlong Plate iii. Narrow-waisted as in Rome, Oregon, specimens.)


REFERRED.—

Basal section of horn-core. U.C.12537 Figured by Merriam, 1911, Figs. 67a and b. Horn-core of strongly “tied-in” appearance in both U.C.12537 and 22427. Horn-core (fragmentary). U.C.11888 Figured by Furlong, 1932, Pl. iv, Fig. 6; Pl. v, Fig. 4.

(Note U.C.11887, figured by Furlong, 1932, Pl. iv, Fig. 8, is the genotype of *Sphenophalos.*)

Var. B


EXAMPLE.—Horn-core. U.C.22429 Figured by Merriam and Stock, 1928, Fig. 13.
VII. Texoceros, New Genus

The Texoceros horn-core (Fig. 50), in the deep division of the base and elongation of the fork, is distinct from that of Plioceros, n.g., and more approaches the form of Pleistocene Stockoceros, n.subg. The base is considerably less deeply incised than in the latter. The figured horn-core from Guymon is the only Texoceros horn specimen definitely known. It is presumed that the Guymon or a closely allied species is represented by the rami and detached teeth from Miami Quarry, Texas. To the genus, as noted (p. 474), are very doubtfully referred the several species based on certain smaller teeth from Yuma County, Colorado, from Arizona and from Snake Creek, Nebraska. A fourth species of Texoceros possibly may be represented by the interesting partial horn-core, mandibular rami and detached teeth from the Uppermost Pliocene of Eden, California.

The collection from the Guymon-Optima deposits of Oklahoma includes the partial horn-core, ninety-three mandibular rami, or partial rami, fifteen maxillae and many detached teeth and limb elements secured by the Charles Falkenbach 1934–35 field party. The great majority of the specimens exhibit only a moderate size variation (Fig. 52) and are interpreted, respectively, as of males and females of one species, T. guymonensis. A few noticeably larger specimens of somewhat different form may represent a second species. The latter are exemplified by a mandibular ramus, F:A.M.32147, which lacks trace of the p2 and tends to be heavier-toothed and shorter-diastemaed than any other specimen in the series; by a number of detached m3s (Figs. 52, 52A); and by a notably heavier metapodial which is 18% longer than the short-
est of the Guymon specimens (see Limb Section, p. 517). A third and smaller Guymon form is questionably referred to the genus as a distinct species, (?)T. minorei.

The type specimens and remains referred to the seven above-listed *Texoceros* species from Oklahoma, Texas, Colorado, Arizona, Nebraska and California (see p. 483) are:

(1) **Texoceros guymonensis**, new genus and species

*From Guymon, Texas County, Oklahoma, 1934*

**Genotype.—**Left horn-core with superior border of orbit, etc., anterior prong (broken) and tip of posterior prong missing.  

*Fig. 50*  

**F: A.M.**  

**H-D**  

**31675**

**Referred.—**

(a) Teeth tending heavy and diastema short:

- Right ramus with symphysis and pr-m (no sign (w+))  
  *Fig. 52*  
  **H-D**  
  **32147**

- Left fragment with pr-p, alveoli and pr-m (a)  
  **H-C**  
  **32126**

- Three mature right and two left m (m+)-(w+)  
  B only, *Fig. 52*  
  **F-D**  
  **32132A**

(And see large maxilla, F: A.M. 32150E, and metatarsus, F: A.M. 32149.)

**Eighty Mandibular Specimens**

(b) Molars more moderate-sized, /ps slighter:

(Five specimens exhibit smaller-sized teeth than the average: F: A.M. 32165, 32151, 32161D, 32162C and 32158B.)

- Left ramus with symphysis and pr-m (m+)  
  **F: A.M.**  
  **32121**

- Right ramus with symphysis, pr alveolus, pr-m (m+)  
  **R-D**  
  **32108**

- Left ramus with partial symphysis, pr alveolus and pr-m (w+)  
  **F-D**  
  **32130**

- Left ramus with symphysis and pr-m (br.) (m+)  
  **F-B**  
  **32154**

- Right ramus with symphysis and pr-m (a)  
  **F-C**  
  **32159**

- Right ramus with diastema and pr-m (m+)  
  **F-A**  
  **32162**

- Left ramus with symphysis and pr-m (m+)  
  **R-D**  
  **32122**

- Left ramus with pr-m (w)  
  **F-D**  
  **32165**

- Right ramus with symphysis and pr-m (p and m br.) (w+)  
  **F-B**  
  **32155**

1 **Locality:** F = Flats, H = Highway, R = Railroad or Railroad Cut.  
**Horizons:** A = Top Sandy Clay, B = Clay, C = Sandy Clay, D = Sand.
Crushed mandible with p2-m3 (see page 506)........ (M+)
Left ramus with symphysis and p2-m3............. (w)  F-C 32161G
Partial right ramus with p2 alveolus and p3-m3.. (m)  R-D 32111
Left fragment with p2-m3.......................... (m)  F-B 32152
Left fragment with partial symphysis, p2-m3... (M)  F-C 32161B
Partial left ramus with p3-m3..................... (M)  R-D 32109
Left ramus with symphysis, p2 alveolus, p3-m3. "  " 32106
Partial right ramus with p2 alveolus and p3-m3.. (M+) "  32107
Partial left ramus with p2 alveolus and p3-m3... (M+) "  32113
Left ramus with symphysis, p2 alveolus, p3-m3... (w+) "  32124
Partial right ramus with p2 alveolus and p3-m3. (w+) "  32105
Right fragment with p3 alveolus and p4-m3...... (M+) "  32112
Partial left ramus with roots of all premolars, and
m1-m2........................................ (w++) "  32110
Partial left ramus with p3-m1 alveoli and m3-m2. (w) "  32114
Partial left ramus with p3 alveolus and p4-m1... (w+) "  32127
Partial left ramus with alveoli of /Is and p4-p5,
and p3-m1...................................... (w+) "  32128
Right fragment with p2(br.)-m2.................... (w+) "  32166
Left ramus with p2 alveolus and p3-m3 (m2 br.).. (m) "  32166A
Anterior portion of ramus with diastema, p2-m1.. (m) "  32166B
Left fragment with p2 alveolus and p3-m3....... (w) "  32115
Right fragment with p2-m3........................ (w) "  32116
Left fragment with m1-m2......................... (m) "  32129
m3, left (representing smallest size)............ (m) "  32133
Right fragment with p3 alveolus and p4-m3..... (w)  F-B 32153
Left fragment with p3(br.)-m3.................... (w) "  32156
Right fragment with p3 alveolus, p4 and m1-m3... (w+) "  32158
Left fragment with broken p4-m3, and m4....... (m+) "  32158A
Right fragment with m1-m2....................... (M+) "  32158B
Left fragment with p4-m3........................ (w) "  32158D
Right ramus with symphysis, fragments of p3 and
p4, m2-m3.................................... (w++) "  32158E
Left fragment with distorted symphysis, /Is and
p3(br.)-m2(br.)................................. (w) "  32158F
Right fragment with p3-m3 (m3 and m3 crushed). (w) "  32158G
Right ramus with p3-m3 (crushed)................ (w+) "  32158H
Right fragment with crushed dentition.......... "  32158I
Right fragment with p4-m3........................ (M+) "  32158J
Left fragment with p4-m3......................... (w) "  32158K
Right fragment with p4-m3 (teeth broken)...... (M+) "  32158L
Left crushed ramus with symphysis and p2-m3... (w+) "  32158M
Right ramus with p$_1$–m$_2$.......................... (a) F-C 32160
Right fragment with p$_r$–m$_2$..................... (w) " 32161A
Left fragment with partial symphysis, p$_2$ alveolus and p$_r$–m$_2$........ (w) " 32161C
Left fragment, symphysis, p$_2$ alveolus, p$_r$–m$_2$.. (m+) " 32161D
Left fragment with m$_1$–m$_2$.......................... (m) " 32161E
Right fragment with p$_4$(br.)–m$_2$..................... (w) " 32161F
Left fragment with broken teeth.................. " 32161I
Right fragment with p$_2$–m$_2$....................... (m+) " 32162A
Right fragment with symphysis and p$_r$–m$_2$..... (w++) " 32162B
Left fragment with partial symphysis, p$_2$ alveolus and p$_r$–m$_2$... (w) " 32162C
Left fragment with symphysis, p$_2$ alveolus, p$_r$–m$_2$.. (w) " 32162D
Left ramus with partial symphysis, p$_2$–p$_r$ alveoli and p$_r$–m$_2$....... (w) F-D 32163
Right ramus with symphysis, p$_2$ alveolus, p$_r$–m$_2$.. (w) " 32164
Left ramus with partial symphysis, p$_2$(br.)–m$_2$.. (w++) " 32164A
Right fragment with partial symphysis, p$_2$ alveolus and p$_r$–m$_1$........ (a) " 32164B
Left fragment with p$_2$–m$_2$............................. (m+) " 32164C
Right ramus with partial symphysis, p$_2$ alveolus and p$_r$–m$_2$........ (w) " 32165A
Left fragment with partial symphysis, p$_r$–m$_1$ and m$_2$...................... (w) " 32165B
Right fragment with partial symphysis, p$_2$ alveolus and p$_r$–m$_2$...... (w) " 32165C
Right fragment with partial symphysis, p$_2$ alveolus, p$_r$ root and p$_r$–m$_2$...(w) " 32165D
Left fragment with partial symphysis, p$_2$ alveolus, p$_r$ root and p$_r$–m$_2$....(w+) " 32165E
Left fragment with p$_r$–m$_2$............................. (w+) " 32165F
Left crushed ramus with symphysis, p$_r$–m$_2$(br.)... " 32148
Left fragment with p$_2$ alveolus and p$_r$–m$_2$.......... (w+) " 32165G
Right fragment with p$_r$–m$_1$(crushed)................ " 32165H
Left fragment with p$_r$–m$_2$............................. (w+) R-C 32167
Left fragment with p$_2$ alveolus and p$_r$–m$_2$.......... (m+) " 32167A
Right fragment with p$_4$, m$_1$(br.)–m$_2$.................. (m+) " 32167B
Right fragment with p$_2$ alveolus and p$_r$–m$_2$....... (w) " 32167C
Left fragment with symphysis and p$_2$–m$_1$.......... (w) H-B 32126A
Right ramus with symphysis, p$_2$ alveolus, p$_r$–m$_2$.. (w) H-D 31666
Left ramus with symphysis, p$_2$ alveolus, p$_r$–m$_2$.. (a) " 31667
Right ramus with partial symphysis, p$_2$ alveolus and p$_r$–m$_2$....... (m+) " 32123

Numerous incisors.
THIRTEEN MAXILLARY DENTITIONS

Left fragment with p²-m² (m² br.) .............................................. (w) F-B 32150
Right fragment with p²-m³ ........................................................ (w+) “ 32150A
Right fragment with p¹-m² ....................................................... (w++) “ 32150B
Right fragment with p¹-m³ ........................................................ (m+) “ 32150C
Left fragment with m²-m³ .......................................................... (w) “ 32150G
Right fragment with p²-m³ (p²-m¹ br.) .................................... (m+) F-C 32150D
Left maxilla with p²-m³ ............................................................. (m) R-C 32138

Right fragment with p¹-m³ ........................................................ (m+) “ 32139
Right fragment with m¹-m³ ....................................................... (m+) “ 32140
Right fragment with m¹-m² ........................................................ (m) “ 32141
Left maxilla with p²-m³ ............................................................. (m+) H-D 32137
Left fragment with m²-m³ .......................................................... (m+) Area 32150F
Right fragment with m²-m³ (larger) .......................................... (w+) “ 32150E

IMMATURE DENTITIONS

ELEVEN RAMI

Right ramus with dp³-m¹ .............................................................. R-D 32144
Partial mandible with dp²-m₁(br.) represented .......................... Fig. 52 F-C 31665
Right fragment with p³-p₄, dp²-m₂ .......................................... “ 32161
Left fragment with crushed symphysis, /Is, p₃, dp₄, m₁-m₂ ........ (w) “ 32161H
Right fragment with dp³-dp₄ roots, dp³-m₁ (erupting) .............. “ 31663
Left fragment with dp³-m₁ ........................................................ Area 31663A
Right fragment with dp²-m₁(br.) .............................................. “ 31664
Left fragment with alveoli and dp³-m₁ ..................................... “ 32158C
Left ramus with partial symphysis and dp³-m₁ .......................... “ 32157
Left fragment with dp³-m₁(erupting) ........................................ F-D 31664A
Left ramus with dp₄, m₁-m₂, p₃-p₄ in germ ............................... H-C 32146

TWO MAXILLÆ

Fragment with dp¹-dp⁴, m²(br.) and m³(br.) .............................. F-D 31661
Left fragment with dp² alveolus and dp¹-m¹ ............................... “ 31662

And many unlisted ramal and maxillary fragments, and detached lower and upper teeth, from the same general area. Largest and smallest m₃s are exampled respectively by: m₃s, F:A.M.32132G and H (this paper, Fig. 52); and m₃s, F:A.M.32132B and F (this paper, Fig. 52).

(See referred limb elements, Limb Section, page 517.)
1937] Frick, Horned Ruminants. II—Antilocapridae

(1a) Texoceros texanus (Hesse)

From Hemphill County, Texas

Merycodus sp. nov. Matthew, Reed and Longnecker, 1932, Univ. Texas Bull. No. 3231, p. 65.


Type.—Left ramus with incisive alveoli and p4–m4. (w++)

U.C.30337 From N. W. Hemphill County, Texas.

Figured by Hesse, 1935, Figs. 4, 5 (in part).

The teeth as figured are smaller than most of the following remains and seemingly even smaller than the smallest of the T. guymonensis specimens.

Referred from Miami Quarry.—

MODERATE-SIZED

Partial left ramus with p4–m4. (m++)

F:A.M.31651 1933.

Left fragment, p4–m4. (w)

F:A.M.31651A 1933.

Partial left ramus with m1–m2 and germs of p3 and p4.

Col.M.1335

Etc. detached teeth (1932–33): Etc. detached teeth of smaller size (1933):

m2. Col.M.1335A m2. F:A.M.31655

m2. F:A.M.31652 m1. F:A.M.31656

m1. Col.M.1335 m1. F:A.M.31657

m1. F:A.M.31653 m3. F:A.M.31658

m1. F:A.M.31654 m2. F:A.M.31659

m1. F:A.M.31660

As noted above, the five following species possibly lie nearer to *Plioceros* than to *Texoceros*.

(1b) (?) *Texoceros minorei*, new species

From Guymon, Oklahoma

Teeth are smaller than any of the other remains of the present section. Molar crowns tall and extremely slender.

**TYPE.**—Left fragment with p$_r$–m$_2$. (m+)


This paper, *Fig. 52.*

Compared to small *T. guymonensis*, F:A.M.32151:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>p$_s$</td>
<td>5.2 mm.</td>
<td>6.1 mm.</td>
<td>m$_p$</td>
<td>8.6 mm.</td>
</tr>
<tr>
<td>p$_r$</td>
<td>6.4</td>
<td>7.6</td>
<td>m$_s$</td>
<td>9.1</td>
</tr>
<tr>
<td>p$_n$</td>
<td>7.4</td>
<td>8.1</td>
<td>p$_r$–m$_n$</td>
<td>36.</td>
</tr>
</tbody>
</table>

(2) (?) *Texoceros vaughani*, new species

From Wray, Yuma County, Colorado

Portions of mandibular rami and teeth from this area indicate a longer diastema, larger-proportioned p$_s$ and relatively smaller last lobe and vein of m$_4$ than common in the Guymon *Texoceros*, and might be referred to *Plioceros*. (The Wray specimens exhibit a certain size variation.)

**TYPE.**—Mandibular symphysis with p$_s$–p$_2$, alveoli and p$_r$–m$_2$. (m+)


This paper, *Fig. 52.*

**REFERRED** (larger than type).—

Right ramus with p$_r$–m$_2$. (m)

F:A.M.31312 1934.

This paper, *Fig. 52.*

Left ramus with partial diastema, p$_s$–p$_n$, alveoli and p$_t$ (br.)–m$_2$. (w)

F:A.M.31645 1936.

(Not included in specimen count.)

Left fragment with p$_r$–m$_1$ and alveoli of p$_s$, m$_r$–m$_n$.

Col.M.222

Right and left m$_s$. F:A.M.31313, A

Left maxilla with m$^1$–m$^s$. F:A.M.31314

Detached p$^1$–p$^t$. F:A.M.31315, A

Etc. detached ms/ and ps/.
Astragalus. F:A.M.31648 From Section 8.
Right metatarsus. Col.M.219 This paper, Fig. 48.
   (Larger and probably distinct species, approximating Guymon F:A.M. 32149.)
   (See Limb Section, page 518.)

(3) (?)Texoceros species
From Benson, Arizona
A few teeth from Benson, Arizona, would seem to represent a small member of this group rather than a Merycodontine species.

Left m^3. F:A.M.32061 1929.
m^2, broken. F:A.M.32062 1929.

(4) (?)Texoceros altidens (Matthew)
From “Upper Snake Creek,” Sioux County, Nebraska
(The teeth are shorter-crowned than those from Oklahoma, and may be referred only tentatively to the genus.)


Type.—Right fragment of ramus with worn m^3. A.M.18981 From Upper Snake Creek. Figured by Matthew, 1924, Fig. 60.

“Paratypes” (from type horizon).—
m^3. A.M.18981a Figured by Matthew, 1924, Fig. 60.
m^4. A.M.18981b

REFERRED.—
Left fragment with p^-m^3. F:A.M.33749 From Hipparion affine Zone, Merychippus Draw, 1936.
Detached m^3 and detached m^2. A.M.21475 From S. of Pliohippus Draw, 1925.
Three detached m3s. (M+, w)
A.M.18981 From Quarry No. 1.

Detached m4. (w++)
A.M.21475 S. of Pliohippus Draw, 1925.
(Third lobe noticeably much enlarged versus above.)

Detached right m4. (w)
A.M.18981c Smaller.

Right metatarsus.
A.M.22473 Quarry B, Snake Creek, 1921.
(See Limb Section, page 518).

(5) (?) Texoceros edensis, new species
From Uppermost Pliocene, Eden, California


Under "Antilocapra?, n.sp." the writer (1921) described and figured several detached upper and lower molars and a horn-core from the Eden beds. The slightly smaller dimensions but marked general similarity of the teeth to those of the living form were observed. The horn, as then drawn (Text-Fig. 101), is very suggestive of a modified Stockoceros core.

Among the collections from the same Uppermost Pliocene deposit subsequently secured by the late Joseph Rak, are a considerable number of partial rami and detached teeth not definitely distinguishable from those previously described. The teeth are exceptional for their long crowns and lateral compression. In the elongation of the anterior ramus and of the crowns of the posterior molars, and in the transverse narrowness of the teeth, the specimens differ from the equally large though heavier rami from Oklahoma. The type ramus and teeth are notably more slender than in Hayoceros. Larger and smaller size variations are present.

TYPE.—Left ramus with symphysis, p2-p4 alveoli and p4-m4(br.). (M+)
F:A.M.31765 This paper, Fig. 52B.

REFERRED SLIGHTLY LARGER-SIZED PARTIAL DENTITIONS AND DETACHED TEETH FROM TYPE LOCALITY.—

MEDIUM-SIZED
Right fragment with all /ps alveoli and m1-m4.
F:A.M.31750 This paper, Fig. 52B.
Left fragment with m₁ (br.)-m₁.  F:A.M.31752

Right fragment with m₁ (br.)-m₄(br.).  F:A.M.31753

Left fragment with m₂-m₃.  F:A.M.31754

Nine detached teeth:

Right m¹.  F:A.M.31755

Left m¹.  F:A.M.31756

Right m².  F:A.M.31757

Left m₃.  F:A.M.31758  This paper, Fig. 52B.

Left m₄.  F:A.M.31759  This paper, Fig. 52B.

Left m₅(br.).  F:A.M.31760

Right m₅.  F:A.M.31761

Left m₅(br.), unworn.  F:A.M.31762  This paper, Fig. 52B.

Left m₆.  F:A.M.31763  This paper, Fig. 52B.

Three detached teeth, small, type-sized:

m₁.  F:A.M.31766

m₂.  F:A.M.31767

m₃.  F:A.M.31768  This paper, Fig. 52B.

Two Eden specimens figured (1921) under Antilocapra?, collected by Joseph Rak:

Partial forked horn-core.  U.C.23421 Figured by Frick, 1921, Text-Fig. 101.

Partial carpus.  U.C.23432 Figured by Frick, 1921, Text-Figs. 102a, b.

(5a) Var. A

(Smaller. Anterior ramus abruptly narrowing and premolars reduced.)

Example.—Right fragment with p₄(br.)-m₁ and detached m₃. (w++)  F:A.M.31770  This paper, Fig. 52B.

Left fragment with (?) broken p₃-p₄.  (M)  F:A.M.31771

Left fragment, p₄-m₃. (w+)  F:A.M.31751

Left maxilla, (?)dp⁴-m₅.  F:A.M.31769
VIII. **Proantilocapra** Barbour and Schultz

Reconstruction, Fig. 49b

Known so far alone in the genotypic species from Cherry County, Nebraska (see discussion, page 474).

(1) **Proantilocapra platycornea** Barbour and Schultz

From Cherry County, Nebraska

*Proantilocapra platycornea* Barbour and Schultz, 1934, Amer. Mus. Novitates, No. 734, p. 3, Fig. 1 (in part).

**Genotype.**—Partial skull with left maxilla, $p^2$ alveolus, $p^3-m^3$ in place; left horn-core attached to a piece of the frontal, portion of occipital area; two rami with partial diastema, $p_2$ alveolus, $p_3-m_3$ in place; and unusually well represented skeletal elements (see Limb Section, page 519). ($M^+$)

Ant. $p_3-m_3 = 44.5$ mm.

(For measurements, see Barbour and Schultz, 1934, p. 1.)
### Table XI

**Antilocaprini Comparative Limb Measurements and Ratios**

<table>
<thead>
<tr>
<th>Collection No.</th>
<th>Limb Size Group</th>
<th>Humerus (mm)</th>
<th>Radius (mm)</th>
<th>Metacarpus (mm)</th>
<th>Femur (mm)</th>
<th>Tibia (mm)</th>
<th>Metatarsus (mm)</th>
<th>Humerus/Radius (%)</th>
<th>Metacarpus/Radius (%)</th>
<th>Femur/Tibia (%)</th>
<th>Metatarsus/Tibia (%)</th>
<th>Radii/Radius (%)</th>
<th>See Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late Tertiary:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ilingoceros schizoceras</em>, ref., Thousand Cr., Nev.</td>
<td>U.C.19419</td>
<td>I+</td>
<td></td>
<td>147</td>
<td>193</td>
<td>157</td>
<td>(190)</td>
<td>76</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Osbornoceros osborni</em>, ref., Round Mt., N. Mex.</td>
<td>Unassoc., p. 514</td>
<td>II+</td>
<td></td>
<td></td>
<td>140</td>
<td>140</td>
<td>(172)</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Plioceros blicki</em>, ref., Santa Clara, N. Mex.</td>
<td>F:AM.31694</td>
<td>I</td>
<td></td>
<td>129</td>
<td>125</td>
<td>140</td>
<td>140</td>
<td>97</td>
<td>81</td>
<td>81</td>
<td>89</td>
<td>75</td>
<td>25B</td>
</tr>
<tr>
<td>(?) <em>P. var.</em>, Beaver Cr., Kans.</td>
<td>F:AM.31513</td>
<td>I-</td>
<td>107</td>
<td>119</td>
<td>116</td>
<td>168</td>
<td>132</td>
<td>90</td>
<td>97</td>
<td>79</td>
<td>88</td>
<td>70</td>
<td>48</td>
</tr>
<tr>
<td><em>Proantilocapra platycornea</em>, genotype, Cherry Co., Nebr.</td>
<td>N.S.M.2-5-8-30</td>
<td>III-</td>
<td>151-136</td>
<td>147-140</td>
<td>175-148</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(See Pleistocene measurements on following page.)*
<table>
<thead>
<tr>
<th>Collection No.</th>
<th>Limb Size Group</th>
<th>Humerus</th>
<th>Radius</th>
<th>Metacarpus</th>
<th>Femur</th>
<th>Tibia</th>
<th>Metatarsus</th>
<th>Humerus/Radius</th>
<th>Metacarpus/Radius</th>
<th>Femur/Tibia</th>
<th>Metatarsus/Tibia</th>
<th>See Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PLEISTOCENE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. konklingi</em>, ref., Shelter Cave, N. Mex.</td>
<td>L.A.M., unassoc.</td>
<td>II+</td>
<td>147.5</td>
<td>156</td>
<td>153.6</td>
<td>165.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. minor</em>, ref., Rancho La Brea, Calif.</td>
<td>U.C.12516</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RECENT (for comparison):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Antilocapra americana</em>, ref. (<em>♂</em>), Wyo.</td>
<td>A.M.(M.)75243</td>
<td>AA-1</td>
<td>174</td>
<td>202</td>
<td>206</td>
<td>220</td>
<td>253</td>
<td>216</td>
<td>86</td>
<td>102</td>
<td>87</td>
<td>85</td>
</tr>
<tr>
<td>&quot; (<em>♂</em>), Wyo.</td>
<td>A.M.(M.)100353</td>
<td>&quot;</td>
<td>170</td>
<td>190</td>
<td>204</td>
<td>220</td>
<td>248</td>
<td>215</td>
<td>90</td>
<td>107</td>
<td>89</td>
<td>87</td>
</tr>
<tr>
<td>&quot; (<em>♀</em>), N. Y. Zoo.</td>
<td>A.M.(M.)19350</td>
<td>&quot;</td>
<td>179</td>
<td>207</td>
<td>220</td>
<td>220</td>
<td>263</td>
<td>226</td>
<td>86</td>
<td>106</td>
<td>84</td>
<td>86</td>
</tr>
</tbody>
</table>

() approximate.
Limb Elements Representing the Above Late Tertiary Antilocaprini Genera and Species

Figures (in part) 18, 25B, 48

(For skulls, horn-cores and dentitions, see preceding section.)

Certain long and slender metapodials of this section approximate Size Group I of the Blastomerycine series. The one so far represented metapodial of *Ilingoceros* is of a larger size group, I+. Size Group I to I+ include metapodials of *Plioceros* from New Mexico and from Hitchcock County, Nebraska. The largest limbs grouped under *Texoceros guymonensis*, which, as noted below, are only tentatively referred and may represent a distinct species, approximate Size Group I, while the smaller and more commonly represented elements of the species are of Size Group II. The female *Plioceros dehlinii* and the *Proantilocapra platycornea* skeletons, from Cherry County, fall in Size Group III to III+, and the New Mexican *Osbornoceros* in Size Group II to II+.

Some ten of the species and variants seem to be represented by limb elements; where the association is definite, the species are starred.

(Compare species summary, page 481; and see measurement table, page 511. Numbers in parentheses refer to species in the preceding discussion of dentitions. Compare Pleistocene limb elements, page 535.)

**Genera and Species Relisted**

IV. *Osbornoceros*, new genus

**Limb size groups II and II+.

*(1) O. osborni*, n.sp., referred, from New Mexico.

V. *Ilingoceros Merriam*

**Limb size group I+.**

(1a) *I. schizoceras* Merriam, referred, from Thousand Creek beds, Nevada. Species (1) is not represented by limbs.

VA. *Sphenophalos Merriam*

Not represented by limbs.

VI. *Plioceros*, new genus

**Limb size groups I to III.**

(1) *P. Blicki*, n.sp., referred, from New Mexico.
Limb size group II.
(2) *P. foblairei*, n.sp., referred, from Brown and Cherry Counties, Nebraska.

Limb size group III.
*(2a) *P. dehlini*, n.sp., 9, from Snake River, Cherry County, Nebraska. This paper, Fig. 25B (F:A.M.32101).

Limb size group I-.
(2b–2c) (?) *P. var. or vars.*, represented only in skeletal elements from:
(2b) Hitchcock County, Nebraska
(2c) Kansas
Species (3), (3a) and (4) are not represented by limbs.

VII. *Texoceros*, new genus

Limb size groups I and II.
(1) *T. guymonensis*, n.sp., referred, from Guymon, Texas County, Oklahoma. This paper, Fig. 48 (F:A.M.31671 and 31672).

Limb size group I.
(2) (?) *T. vaughani*, n.sp., very doubtfully referred, from Yuma County, Colorado. This paper, Fig. 48 (Col.M.219).
(4) (?) *T. altidens* (Matthew), referred, from Sioux County, Nebraska. This paper, Fig. 18 (A.M.22473).
Species (1a), (1b), (3), (5) and (5a) are not represented by limbs.

VIII. *Proantilocapra* Barbour and Schultz

Limb size group III-.
*(1) *P. platycornea* Barbour and Schultz, from Cherry County, Nebraska. This paper, Fig. 48 (N.S.M.2-5-8-30).

Detailed lists of limb elements of the above genera and species

IV. *Osbornoceros*, new genus

Limb size groups II and III+.
(1) *O. osborni*, n.sp., referred
From Santa Fé Area, New Mexico
(Metatarsi approximating average specimens from Guymon, Oklahoma, and slightly larger than largest Merycodonts from New Mexico.)

Referred from Leyden Quarry, 1935.—

<table>
<thead>
<tr>
<th>Element</th>
<th>Length</th>
<th>F:A.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right radius</td>
<td>147 mm</td>
<td>32998</td>
</tr>
<tr>
<td>Right tibia</td>
<td>193 mm</td>
<td>32991</td>
</tr>
</tbody>
</table>
Right, 157 mm., and left metatarsi
Partial left calcaneum, left astragalus and tarsal bone
Three 1st and two 2d phalanges, F:A.M. Coll.
Two unguals (unusually compressed laterally), F:A.M. Coll.

TENTATIVELY REFERRED FROM SAN JUAN, 1935 (metatarsi slightly shorter and noticeably narrower-proportioned, dorsoventrally, than in the above)—possibly of *Plioceros*—

Distal one-half right humerus and articulated radius. (See associated maxilla, page 491.)
Distal two-thirds left humerus and ulno-radius (probably associated)
Distal halves of right and left tibia.
Right and left metatarsals.

Immature specimens:
Distal two-thirds right humerus, right radius with proximal portion of ulna (articulated), left humeral trochlea, left radius (distal epiphysis missing), right metacarpus and calcaneum

One 1st, two 2d and two 3d phalanges, F:A.M. Coll.
Several vertebrae and fragments of limbs, F:A.M. Coll.

V. *Ilingoceros* Merriam

LIMB SIZE GROUP I+.

(1a) *I. schizoceras* Merriam, referred
From Thousand Creek Beds, Nevada
Right metatarsus, (190) mm. U.C.19419 Figured by Merriam, 1911, Fig. 74.

VI. *Plioceros*, NEW GENUS

LIMB SIZE GROUPS I AND III.

(1) *P. blicki*, n.sp., referred
From New Mexico

S.G. I.

Distal end right tibia, right tarsus and nearly complete right metatarsus.
Distal one-fourth left tibia.

F:A.M.31694 From Santa Clara, 1930.
F:A.M.31732 From Santa Fé, 1928.

S.G. III.

QUESTIONABLY REFERRED (possibly distinct, approximating size of *P. dehlini*).—
Right metacarpus. F:A.M.31709 First ridge, Taos road, 1927.
Left metatarsus (proximal end broken). F:A.M.31710 From above San Juan, 1928.
Limb size group II.

(2) *P. florblairi*, n.sp., referred

From Brown and Cherry Counties, Nebraska

Questionably referred (from Xmas Quarry level).—

<table>
<thead>
<tr>
<th>Limb Segment</th>
<th>Specimen Number</th>
<th>Location</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal one-fourth right humerus</td>
<td>F:A.M.31933</td>
<td>From Dutch Creek, 1929</td>
<td></td>
</tr>
<tr>
<td>Left radius, 139 mm.</td>
<td>F:A.M.31934</td>
<td>Kat Quarry channel, 1933</td>
<td></td>
</tr>
<tr>
<td>Right metacarpus, 132 mm.</td>
<td>F:A.M.31935</td>
<td>From Deep Creek, 1930</td>
<td></td>
</tr>
<tr>
<td>Distal one-half right tibia.</td>
<td>F:A.M.31936</td>
<td>Kat Quarry channel, 1931</td>
<td></td>
</tr>
<tr>
<td>Left metatarsus, 144.5 mm.</td>
<td>F:A.M.32197</td>
<td>E. Kat Quarry channel, 1936</td>
<td></td>
</tr>
<tr>
<td>Proximal one-third left metatarsus</td>
<td>F:A.M.31943B</td>
<td>From J. Wilson Ranch, 1933</td>
<td></td>
</tr>
<tr>
<td>Proximal two-thirds left metatarsus</td>
<td>F:A.M.31943D</td>
<td>From Hans Johnson's Quarry, 1931</td>
<td></td>
</tr>
<tr>
<td>Astragalus</td>
<td>F:A.M.31936A</td>
<td>From an indefinite locality</td>
<td></td>
</tr>
</tbody>
</table>

Larger, possibly male or distinct species not included in specimen count):

<table>
<thead>
<tr>
<th>Limb Segment</th>
<th>Specimen Number</th>
<th>Location</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left metacarpus, 158 mm.</td>
<td>F:A.M.34044</td>
<td><em>Machetodus</em> Quarry, 1936</td>
<td></td>
</tr>
<tr>
<td>Right femur</td>
<td>F:A.M.34046</td>
<td>Kat Quarry channel, 1936</td>
<td></td>
</tr>
<tr>
<td>Left metatarsus, 162.5 mm.</td>
<td>F:A.M.34045</td>
<td><em>Leptarctus</em> Quarry, 1936</td>
<td></td>
</tr>
</tbody>
</table>

Limb size group III.

(2a) *P. dehlini*, n.sp. (2)

From Snake River, Cherry County, Nebraska

Type (in part).—Distal one-half both humeri, left radius and ulna, greater portion of right ulna, one carpal, both metacarpi, three 1st, one 2d and two 3d phalanges, three cervical, ten dorsal, six lumbar and three caudal vertebrae, twenty-one complete and partial ribs, right ilium, right femur, right and nearly complete left tibia, both calcanea, left astragalus, two left tarsals, both metatarsi, four 1st, four 2d and three 3d phalanges, etc. fragments.

(See associated skull and mandible, page 497. This paper, *Fig. 26B* (partial manus and pes).

(For measurements, see Table XI, page 511.)

Questionably referred, limb size group III (from Xmas Quarry level, Brown, Keya Paha and Cherry Counties, Nebraska).—

<table>
<thead>
<tr>
<th>Limb Segment</th>
<th>Specimen Number</th>
<th>Location</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left and distal one-fourth right radius, proximal portion left ulna, right metacarpus, calcaneum and metatarsus, two 1st phalanges and one patella</td>
<td>F:A.M.31942</td>
<td>From Murphy's Gulch, 1933</td>
<td></td>
</tr>
</tbody>
</table>
Frick, Horned Ruminants. II—Antilocapridæ

Limb size Group I—.

(2b) (?) P. Var.

From Hitchcock County, Nebraska

EXAMPLE.—Distal one-fourth left tibia, astragalus, one tarsal and proximal one-fourth metatarsus.

F:A.M.31943 From an indefinite locality, 1927.
F:A.M.31957 From 1 mile E. of Garner Bridge, 1934.

F:A.M.31943A From an indefinite locality, 1927.
F:A.M.31943C From Moore Creek, 1931.
F:A.M.31936D From Lessig Ranch.
F:A.M.31936B From an indefinite locality.

VII. Texoceros, new genus

Limb size groups I and II.

(1) T. guymonensis, n.sp., referred

From Guymon, Texas County, Oklahoma, 1934

Limb elements are not as plentifully represented as the rami; (a complete humerus, femur and tibia are so far wanting). A large size variation is noticed in a tentatively referred metatarsus, F:A.M.32149, which is 18% longer than the shortest specimen, F:A.M.32143D (see measurement table, page 511). This may represent a distinct species.

B.G. II.

Right radius. F:A.M.32120 From R-D.¹
Left radius, 136 mm. F:A.M.32120A From F-D.

¹ For abbreviations see footnote, page 501.
Right metacarpus, 147 mm.  F:A.M.32118  From R-D.
Right metacarpus.  F:A.M.32118A  From F-B.
Left metacarpus.  F:A.M.31671  From R-D.

Right metacarpus, 140 mm.  F:A.M.32118B  From F-B.
Right metacarpus (epiphysis missing).  F:A.M.32118C  From F-D.
Partial right tibia.  F:A.M.32119D  From F-C.
Right metatarsus.  F:A.M.32143  From R-D.
Right metatarsus.  F:A.M.31672  From R-D.
Right metatarsus.  F:A.M.32143A  From R-D.
Right metatarsus.  F:A.M.32119A  From R-D.
Right metatarsus.  F:A.M.32119  From R-D.
Left metatarsus, 148 mm.  F:A.M.32143D  From F-D.
Right metatarsus (epiphysis missing).  F:A.M.32143C  From F-C.

IMMATURE

Nearly complete associated right radius, metacarpus and 1st phalanx.  F:A.M.32102  From F-B.

S.G. I.

Left radius, proximal end crushed, (151) mm.  F:A.M.32103  From F-C.
Right metatarsus, 175 mm.  F:A.M.32149  From H-C.
Left metatarsus.  F:A.M.32142  From H-D.

LIMB SIZE GROUP I.

(2) (?)/T. vaughani/, n.sp., very doubtfully referred
From Wray, Yuma County, Colorado
Right metatarsus, 172 mm.  Col.M.219  This paper, Fig. 48.
(Large and probably distinct species, approximating Guymon F:A.M.32149.)
Distal end of metapodial.  F:A.M.31316A
Astragalus.  F:A.M.31316

From Northeastern Colorado:
Astragalus.  F:A.M.31648  From Section 8.

(4) (?)/T. altidens/ (Matthew), referred
From Sioux County, Nebraska
Right metatarsus, 179 mm.  A.M.22473  Quarry B, Snake Creek, 1921.
This paper, Fig. 18.
**VIII. Proantilocapra Barbour and Schultz**

**Limb size group III—.**

(1) *P. platycornea* Barbour and Schultz

From Cherry County, Nebraska

<table>
<thead>
<tr>
<th>Genotype (in part)</th>
<th>N.S.M.2-5-8-30</th>
<th>From the Lower Pliocene, 40 feet below top of the exposed Tertiary, approx. one mile below mouth of Steer Creek, on E. side of Snake River.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left humerus</td>
<td>107 mm</td>
<td>This paper, Fig. 48 (metacarpus and metatarsus).</td>
</tr>
<tr>
<td>Left radius</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>Left metacarpus</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Distal half left femur</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>Left tibia</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>Right metatarsus</td>
<td>132</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous ribs and vertebrae</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(See associated partial skull and mandible, page 510. This paper, Fig. 50.)

---

**Fig. 53. Antilocaprin horn-cores from the Pleistocene.**

- A', A', cross sections of horns; F, postorbital foramen; 2, supra-orbital foramen.

- F:A.M.25526, *Hayoceros falkenbachi*, n.subg. and sp., subgenotype, from Hay Springs, Sheridan County, Nebraska. (See page 533.)

- F:A.M.25687 and 25688, *Capromeryx fuscifer* Matthew, ref., from Hay Springs, Sheridan County, Nebraska. (See page 528.)

- L.A.M.174 (cast), *Stockoceros conklingi* (Stock), subgenotype, from Shelter Cave, New Mexico. (After Stock, 1930.) (See page 526.)

- A.M.13220 (S.M.U.1.50, cast), *Tetrameryx shuleri* Lull, genotype, from Dallas, Texas. (See page 531.)

- A.M.22489, *Stockoceros onusrosagris* (Roosevelt and Burden), ref., rev., from southern Arizona. (See page 527.)
Fig. 53. Hayoceros, n.subg. (F:A.M.25526), Capromeryx Matthew*(F:A.M. 25687, 25688), Stockoceros, n.subg. (L.A.M.174, cast, and A.M.22489) and Tetrameryx Lull (A.M.13220, cast (S.M.U.1.50)), comparison of horn-cores from the Pleistocene.

× 1. (See legend, page 519.)
Pleistocene genera of the Antilocaprid subfamilies, Stockocerotinae and Antilocaprini, are considered as represented by single allied forms in the immediately preceding epoch—Texoceros, new genus, evidencing Stockoceros, new subgenus, and the small Proantilocapra suggesting Antilocapra. The balance of the known Pleistocene genera differ rather markedly in horn-cores from the so-far-known forms of the Tertiary, though they closely parallel one another and the latter in their slender tall-crowned cheek teeth. Five genera and subgenera are recognized: IX, Stockoceros, new subgenus; X, Capromeryx Matthew; XI, Tetrameryx Lull; XII, Hayoceros, new subgenus; and XIII, Antilocapra Ord, referred. The nearest approach to actual resemblance between Quaternary and Tertiary horn-cores is that of Stockoceros and the Pliocene Texoceros. [The Meryceros horn, with its much deeper depression between the cylindrical terminal forks, its relative slenderness and its typical burred base is definitely distinct.] It is presumed that the variable horn-cores of the Pleistocene genera were covered with a sheath somewhat after the manner of the sheath in Antilocapra. Possibly

Neomeryx finni Parks, from Saskatchewan, type, three right mandibular molars and one incisor, may prove to be distinct, but the teeth in themselves are not definitely separable from teeth of the Recent pronghorn. (1925, Bull. Geol. Soc. Amer., XXXVI, p. 432, Pl. x.) Platatherium pampaeum Ameghino, from the Upper Pampean of South America, type, end of horn-core, and referred dental fragments, appear too fragmentary for possible allocation, at least without an examination of the specimens themselves. The teeth of the Platatherium referred ramus, as figured, are certainly not of Antilocaprine form.
the sheath in *Hayoceros*, as in the Recent species, was provided with an anterior coreless prong. Ancestral forms of the symmetrically forked (*Plioceros*), *Texoceros* and *Stockoceros*, as suggested on a preceding page, may have given rise to *Hayoceros*, with disproportionately elongate posterior fork, *Capromeryx*, with reduced anterior fork, *Proantilocapra*, with abrogated anterior fork, and *Antilocapra*, with anterior fork absent but reproduced in the horn sheath.

Definite evidence of the Pleistocene occurrence of the pronghorn itself seems to be offered by remains from Rancho La Brea and McKittrick, California (see Furlong, 1932, Carn. Inst. Wash. Pub. 418, p. 32). Examples of Pleistocene, as of Late Tertiary, Antilocaprini horn-cores are extremely rare. The heads of three of the five here-described genera have been hypothetically reconstructed as in life on Fig. 49A, AA, D, page 468. The more characteristic of the specimens are also illustrated (Figs. 53, 54 and [in part] 52A). It is worthy of note that no yet known Pleistocene nor pre-Pleistocene dentition exhibits the p₄ with closed anterior fossette as in *Antilocapra*.

Summary of Named Species

The five Quaternary genera and subgenera, (horn characters) and species are:

SUBFAMILY 5.—STOCKOCEROTINÆ, CONTINUED

IX. *Stockoceros*, new subgenus.

Small to large-sized; symmetrically divided forks of circular cross section.

(1) *Stockoceros conklingi* (Stock), subgenotypic species, from Shelter Cave, Organ Mountains, New Mexico.

SUBGENOTYPE.—Left horn-core on frontal fragment, L.A.M.174 [A.M. cast 27018]. This paper, Fig. 53.

(2) *Stockoceros onusrosagris* (Roosevelt and Burden), from southern Arizona.

TYPE.—Skull with horn-cores, A.M.22488.
X. Capromeryx\textsuperscript{1} Matthew.

Small-sized; diminutive anterior accessory fork and main posterior fork, extremities of both bent anteriorly.

(1) Capromeryx furcifer Matthew, genotypic species, from Hay Springs, Sheridan County, Nebraska.

Genotype.—Left ramal fragment, A.M. 2771. This paper, Fig. 54.

(1a) Capromeryx furcifer, var., from Stegomastodon Quarry, Brown County, Nebraska.

Example.—Left ramus, F:A.M. 31749. This paper, Fig. 52A.

(1b) Capromeryx gidleyi, n.sp., from Benson, Arizona.

Type.—Portion of horn-core, F:A.M. 23324.

(2) Capromeryx minor Taylor, from Rancho La Brea, California.

Type.—Immature ramus, U.C. 12523.

(2a) Capromeryx minor Taylor, var., from McKittrick, California.

Example.—Two upper and two lower molars and calcaneum, C.I.T. 15.

(2b) (?)Capromeryx var., from Bautista Beds, California.

Example.—Astragalus, etc., U.C. 23527 (or 23527A).

(3) Capromeryx mexicana Furlong, from Tequixquiac, Mexico.

Type.—Skull and large portion of skeleton, U.C. 26648.

XI. Tetrameryx\textsuperscript{1} Lull.

Large-sized; main anterior fork of slender circular cross section, and accessory tall posterior fork of heavier cross section, directed posteriorly and slightly twisted.

(1) Tetrameryx shuleri Lull, genotypic species, from Dallas, Texas.

Genotype.—Left maxilla and detached top of cranium with horn-core, So. Methodist Univ. 1.50 [A.M. cast 13220]. This paper, Fig. 53.

\textsuperscript{1} "Caproceros" and "Tetramoceros," like Dicranocerus Hamilton Smith, would have been preferred for Capromeryx and Tetrameryx, the same having nothing in common with the deer.
(2) (?)Tetrameryx (Stockoceros or Hayoceros) species, from Bautista Beds and San Timoteo Canyon, California.

**Example.**—Portions of horn-cores, U.C.23420 (in part).

**XII. Hayoceros, new subgenus.**

Large-sized; main fork of blade of Antilocapra-like cross section, and secondary and posterior fork of slender, circular cross section, (?) taller and backwardly directed. Compare recently reported XIIA, Ceratomeryx Gazin (page 533), of the "Upper Pliocene."

(1) *Hayoceros falkenbachi*, n.subg. and sp., from Hay Springs, Sheridan County, Nebraska.

**Subgenotype.**—Left forked horn-core, F:A.M.25526. This paper, *Fig. 53."

**SUBFAMILY 6.—ANTilocaprinae, CONTINUED**

**XIII. Antilocapra Ord, referred.**

Large-sized; unforked, blade-like horn-core, anterior edge sharp (as in anterior fork of *Hayoceros*), posterior edge round.

---

*Fig. 54. Antilocaprini mandibular and maxillary dentitions from the Pleistocene, lateral views compared.*

× 1.

F:A.M.17824B and 17824, (?)Tetrameryx (or Hayoceros) species, from San Timoteo Canyon, California.

(See page 532.)

F:A.M.25522 (rev.), 25689 (rev.), 25521, 25523 (rev.) and A.M.2771, genotype of Capromeryx furcifer Matthew, from Hay Springs, Sheridan County, Nebraska.

(See pages 528, 529.)


(See page 533.)
Fig. 54. Antilocaprini mandibular and maxillary dentitions from the Pleistocene, lateral views compared.

× 1. (See legend, preceding page.)
Detailed Lists of Types, Referred Specimens, and Synonymy

Total available specimens, 83: *Stockoceros*, 18; *Capromeryx*, 29; *Tetrameryx*, 8; *Hayoceros*, 24; *Ceratomeryx*, 2; *Antilocapra*, 2.

IX. **STOCKOCEROS, NEW SUBGENUS**

Reconstruction, Figure 49AA

The subgenotypic species, *S. (Tetrameryx) conklingi* (Stock), is based on a small symmetrically-forked horn-core from a New Mexico cave deposit.¹ A second and more magnificent species is seen in the Roosevelt-Burden form from a cave of southern Arizona. This species is unusually well represented by the remains discovered, collected and described by Quentin Roosevelt and J. W. Burden, and presented by them to the American Museum. Should the small *S. conklingi* type, as indicated by Stock, represent an immature individual, it is possible that the latter and the Roosevelt-Burden *Stockoceros onurosagris* are closely allied. In the Arizona remains the teeth are somewhat smaller and the diastema longer-proportioned than in either the pronghorn or *Hayoceros*.

(1) **Stockoceros conklingi** (Stock), subgenotypic species

From Shelter Cave, New Mexico


**SUBGENOTYPE.**—Left horn-core on frontal fragment. L.A.M.174 From Shelter Cave, Organ Mountains, New Mexico. [A.M.cast 27018] Figured by Stock, 1930, Fig. 1a; this paper, Fig. 53.

**REFERRED FROM TYPE LOCALITY.**—

Partial (anterior) horn-core. L.A.M.175 Figured by Stock, 1930, Fig. 1b.

Right toothless ramus. L.A.M.176 Figured by Stock, 1930, Fig. 1c.

See humerus, radius, metacarpus and metatarsus listed under limb elements, page 536. Chester Stock finds the metapodials relatively heavier than in *Antilocapra*.

¹ Other remains from a New Mexican cave deposit are described by Edgar B. Howard and C. Bertrand Schultz (1935, Proc. Acad. Nat. Sci. Phila., LXXXVII, p. 288): The remains, which the writer has been privileged to see through the courtesy of Mr. Howard, are very similar to the Roosevelt-Burden *Stockoceros*. 
(2) Stockoceros onusrosagris (Roosevelt and Burden)

From Southern Arizona

Tetrameryx onusrosagris Roosevelt and Burden, 1934, Amer. Mus. Novitates, No. 754, p. 4, Fig. 1.

Type.—Skull with horn-cores, 
P2–P4 alveoli and P4–M4, 
premaxilla missing.

Referred.—

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.M.22489</td>
<td>Partial skull with right horn-core and M1–M2.</td>
<td>This paper, Fig. 53.</td>
</tr>
<tr>
<td>A.M.22484</td>
<td>Fragment of posterior basal area of skull.</td>
<td></td>
</tr>
<tr>
<td>A.M.22484</td>
<td>Five detached horn-cores.</td>
<td></td>
</tr>
<tr>
<td>A.M.22490</td>
<td>Left ramus with P3 alveolus–M4.</td>
<td>Figured by Roosevelt and Burden, 1934, Fig. 1.</td>
</tr>
<tr>
<td>A.M.22484</td>
<td>Ramal fragments.</td>
<td></td>
</tr>
<tr>
<td>A.M.22483</td>
<td>Skeletal elements (see Limb Section, page 536).</td>
<td></td>
</tr>
</tbody>
</table>

X. Capromeryx Matthew

Reconstruction, Figure 49A

Horn-cores secured at Hay Springs by Charles Falkenbach and party witness the presence of both Capromeryx and Hayoceros. The latter is possibly represented as well by the large-sized antelopine-like teeth from the area, formerly referred to Antilocapra. The smaller genus also is witnessed by a partial horn-core secured by Joseph Rak from the Pleistocene in the vicinity of Benson, Arizona. Closely allied species have been described from the Pleistocene of Rancho La Brea and Mexico, and a possible occurrence of the genus has been noted in the Bautista Beds, California.

The Capromeryx horn-cores are less than half the size of Antilocapra; the anterior fork is rudimentary, the main fork flattened and bent anteriorly and deeply grooved posteriorly; both forks tend to curve slightly forward and converge; the horns are situated rather
posteriorly (the supra-orbital foramina being more median of the horn in Antilocapra); the bullae (see Mexican) are greatly expanded; (the diastemata are said to be proportionately shorter than in Antilocapra); the teeth are characteristically Antilocaprine, except that the m₃ lacks the usual fourth lobe. The p₂–p₃ seem proportionately smaller than in the larger-sized remains referred to Hayoceros.

William D. Matthew (1902) bases the genotypic species, C. furcifer, on a ramus from Hay Springs. He observes the latter to be about two-thirds the lineal diameter of Antilocapra, the premolars more nearly like Merycodus, and the molars as fully hypsodont as in Antilocapra, and that "... the new genus, Capromeryx, may, when better known, prove to be a transition between the antelope deer and Antilocapra..."

(1) Capromeryx furcifer Matthew, genotypic species

From Hay Springs, Sheridan County, Nebraska


Genotype.—Left fragment with p₂–m₃. A.M.2771 From Hay Springs, Nebraska, 1897.

Figured by Matthew, 1904, Fig. 20; this paper, Fig. 54.

Referred Remains Secured by the Charles Falkenbach Party.—

Left horn-core on cranial fragment. F:A.M.25687 This paper, Fig. 53.


This paper, Fig. 53.

Right fragment with p₂ roots, p₂–m₂. F:A.M.25689 1929.

This paper, Fig. 54.

Nine detached teeth:

Three m₃s. F:A.M.25522 1929.

A and B This paper, Fig. 54.

m₂. F:A.M.25692

Two m₃s. F:A.M.25693–4

m₃. F:A.M.25523 This paper, Fig. 54.
Two m2s. F:A.M.25521 This paper, Fig. 54. and A

A metatarsus approximates that of (?)Plioceros var. (F:A.M.31513, 140 mm.) from Kansas, and is slightly larger than the specimen from Rancho La Brea figured by Taylor (1911, Fig. 3). (See referred limb elements, Limb Section, page 536.)

(1a) Capromeryx furcifer, Var.
From Stegomastodon Quarry, Brown County, Nebraska
Secured by Morris F. Skinner in the summer of 1934.

Example.—Left ramus with pr-m4 (M+). F:A.M.31749 This paper, Fig. 52A.

(1b) Capromeryx gidleyi, new species
From Curtis Flats, Benson, Arizona

Type.—Portion of horn-core, F:A.M.23324 which apparently represents the posterior and main spike of the left side.

Height = 90+ mm.
Cross section slender, four-sided and typically grooved anteriorly as in Capromeryx.

(2) Capromeryx minor Taylor
From Rancho La Brea, California


Type.—Immature ramus. U.C.12523 Figured by Taylor, 1911, Fig. 1.

Referred.—

Immature ramal fragment. U.C.12817 Figured by Taylor, 1911, Fig. 2.

Metapodials, etc. U.C.12516, etc. Figured by Taylor, 1911, Figs. 3–6. (See Limb Section, page 536.)
REFERRED BY CHANDLER.—

Horn-core on portion of cranium, and detached upper and lower partial dentitions and limb elements.


(2a) **Capromeryx minor** Taylor, Var.

From McKittrick, California


**EXAMPLE.**—Two upper and two lower molars and calcaneum.

**C.I.T.15** Figured by Furlong, 1930, Figs. 1 and 2.

(2b) (?)**Capromeryx**, Var.

From Bautista Beds, California


**EXAMPLE.**—Astragalus, etc.

**U.C.23527** (or 23527A) Figured by Frick, 1921, Text-Figs. 15, 16.

(See Limb Section, page 537.)

(3) **Capromeryx mexicana** Furlong

From Tequixquiac, Mexico


**TYPE.**—Skull and large portion of skeleton.

**U.C.26648** Figured by Furlong, 1925, Figs. 7–9.

**REFERRED.**—

**Immature partial skull and limb elements.**

**U.C.26649** Figured by Furlong, 1925, Fig. 10 (dentition).
XI. **TETRAMERXY LULL**

(1) **Tetrameryx shuleri** Lull, genotypic species, 1921

From Dallas, Texas


**Genotype.**—Left maxilla with $p^3-m^3$, and detached top of cranium with tall, deeply forked horn-core.

Ps/ small relative to ms/ and ms/ considerably larger than in Recent *Antilocapra*. R. S. Lull (1921, p. 167) observes: "There is no doubt that *Tetrameryx* represents an aberrant genus of the family Antilocapridae, characterized by the heretofore unique feature of deciduous horn sheaths over permanent cores, and differing from the typical genus, which it closely resembles in size and dentition, by the presence of the additional posterior horn and probably by the absence of the distinctive 'prong' on the horn sheaths of the recent genus." According to the latter—

- Breadth across orbits \(= 112\) mm.
- Breadth between base of anterior horns \(= 44\)
- Length anterior horns from orbital rim \(= 110\)
- Length posterior horns from orbital rim \(= 297\)

**Tentatively Referred.**—

Distal portion of left F:A.M.31516 From Rock Creek, Texas, metatarsus.

(See Limb Section, page 537.)

(2) (?) **Tetrameryx** (or *Hayoceros*) species

From Bautista and San Timoteo Canyon, California

*Antilocapra?*, one or more species, Frick, 1921, Univ. Cal. Pub. Bull. Dept. Geol., XII, p. 300, Text-Fig. 18.

The portions of horn-cores and the different teeth listed below, from the Bautista and El Casco beds, indicate the local presence of large Antilocaprine individuals in addition to the questioned smaller form tentatively referred to *Capromeryx*. The Bautista core tips, as figured in 1921, are suggestive of the prong of *Tetrameryx*, *Stockoceros* or the smaller of the two prongs of *Hayoceros*. 
EXAMPLE.—

From the Bautista Beds:

| Portions of horn-cores. | U.C.23420 (in part) | Figured by Frick, 1921, Text-Fig. 18. |

From San Timoteo Canyon, southern California:

| Left m². (w) | F:A.M.17824B | This paper, Fig. 54. |
| Right m¹. (w+) | F:A.M.17826 |
| Left m₃. (w) | F:A.M.17824 | This paper, Fig. 54. |
| (?)dp₃ and dp₄ | F:A.M.17823 |

Apparently Larger Size

(Teeth very large, m¹ exceeding m³ of T. shuleri type maxilla.)

EXAMPLE.—Right maxillary specimen with m¹(br.)—m³(br.).


XII. HAYOCEROS, NEW SUBGENUS

Reconstruction, Figure 49d

(1) HAYOCEROS falkenbachi, new subgenus and species

From Hay Springs, Sheridan County, Nebraska

An unsymmetrically forked horn-core from the Hay Springs Pleistocene is referred to a new subgenus and species. The specimen, which was discovered by Charles Falkenbach in 1928, is unique in that the anterior fork is notably larger than the posterior. The anterior fork in cross section is sharply narrowed anteriorly and rounded posteriorly. The posterior fork (unfortunately broken near the base) is of cylindrical cross section, is directed posteriorly and has a prominent foramen at its median external root. The anteriorly narrowed blade-like anterior fork is at once suggestive of the core of Antilocapra. It is perhaps directed even more forward than in the latter. The resemblance between the anterior fork of the present specimen and that of Antilocapra has sug-
gested that the specimen was provided with a similar sheath and therefore was "six-pronged" (see head restoration, Fig. 49b). The metapodials, as seen in referred specimens, were of approximately the same length, but notably heavier than in A. americana.

Subgenotype.—Left forked horn - core (described above).

REFERRED TEETH FROM NiOBARA RIVER, NEAR GRAYSON (referred by previous authors to Antilocapra, and forming the basis of the reported presence of the genus at Hay Springs).—

Left partial ramus with p1–m2. A.M.2772 This paper, Fig. 54.

Five detached teeth:

p4, m3, m4, m2 and incisor. A.M.2773

REFERRED REMAINS SECURED BY THE CHARLES FALKENBACH PARTY, 1929-30.—

Left fragment with p2 alveolus and p3(br.)–m2. F:A.M.25680 This paper, Fig. 54.

Right partial ramus with p3–p4 and dp4–m1. F:A.M.25681 This paper, Fig. 54.

Three detached teeth:

m2. F:A.M.25682 This paper, Fig. 54.

m3(br.). F:A.M.25683

m2. F:A.M.25684 This paper, Fig. 54.

(See referred limb elements, Limb Section, page 537.)

XIIA. Ceratomeryx Gazin

(1) Ceratomeryx prenticei Gazin, genotypic species

From the Upper Pliocene of Idaho

Ceratomeryx prenticei Gazin, 1935, Journ. Pal., IX, p. 390, Fig. 1.
The description of this extremely interesting Stockocerotine has been received since the present report was put in press. The small-proportioned horn-cores of the figured specimen, and its occurrence in the Uppermost Pliocene, suggest the possibility of the same representing the female, or a somewhat immature individual, of a precursor of the Hay Springs genus. The posterior and inward position of the horn-cores differs from that in Plioceros and more resembles the condition in both Stockoceros and Hayoceros. The latter is particularly recalled because of the relative smallness of the posterior horn. In a referred specimen retaining the deciduous dentition, the horns are said to be smaller, transversely flattened and nearly of one size, and to resemble on a small scale, as seen in lateral view, the horns of the type of Stockoceros (Tetrameryx) conklingi. The author observes, "The occurrence of C. prenticei in the Upper Pliocene suggests that it may lie in or near an ancestral position to Tetrameryx, as known from the Dallas sand pits..."

**Genotype.**—Cranial portion of skull with 1st-5th cervicals. N.M.13760 From Hagerman Lake Beds, Hagerman, Idaho. Figured by Gazin, 1935, Fig. 1.

(Approximate length of anterior horn, 74 mm.)

**Referred.**—Immature skull, right hind limb and 2d-4th dorsal vertebrae. N.M.13761

**XIII. Antilocapra Ord, referred**

From the Pleistocene

A portion of an Antilocapra cranium with fairly complete left horn-core, L.A.M.Z885, and a right horn-core, C.I.T.46, have been reported by E. L. Furlong (1932, Carn. Inst. Wash. Pub. 418, p. 34) from Rancho La Brea and the McKittrick Beds of California. As no horn-core of Antilocapra has been found, so far, in the Hay Springs deposits, it is impossible to establish definitely the occurrence of this genus in that area where its presence would, of course, be expected. The teeth from Hay Springs are placed with the type horn-core of Hayoceros. Teeth from the San Timoteo-El Casco area, which may belong to Antilocapra, are referred similarly to the latter genus.

Hay (1923–1927) lists among the Quaternary occurrences of Antilocapra: Galena, Illinois; Wisconsin; Iowa; Kansas; Arizona; Contra Costa County and Concord Quadrangle, California; and Fossil Lake, Oregon.
Limb Elements Representing the Above Pleistocene Genera and Species

(For skulls, horn-cores and dentitions, see preceding section.)

Some eight of the species seem to be represented by limb elements; where the association is definite, the species are starred. (Compare species summary, page 522; and see measurement table, page 512.)

**Genera and Species Relisted**

**IX. Stockoceros, new subgenus**

(1) *S. conklingi* (Stock), referred, from Shelter Cave, New Mexico. (Limb Size Group II+.)

(2) *S. onurosagris* (Roosevelt and Burden), referred, from southern Arizona. (Limb Size Group A-I.)

**X. Capromeryx Matthew**

(1) *C. furcifer* Matthew, referred, from Hay Springs, Sheridan County, Nebraska. (Limb Size Group II+.)

(2) *C. minor* Taylor, referred, from Rancho La Brea, California. (Limb Size Group I.)

*(2a) *C. minor* Taylor, var., from McKittrick, California.

(2b) *(?) C. var., from Bautista Beds, California.

*(3) *C. mexicana* Furlong, from Tequixquiac, Mexico.

Species (1a) and (1b) are not represented by limbs.

**XI. Tetrameryx Lull**

(1) *T. shuleri* Lull, tentatively referred, from Rock Creek, Texas.

**XII. Hayoceros, new subgenus**

(1) *H. falkenbachi*, n. subg. and sp., referred, from Hay Springs, Sheridan County, Nebraska. (Limb Size Group AA-I, approximating Limb Size Group II of the Dromomerycini series.)

**XIII. Antilocapra Ord**

(See measurements, Recent species, page 512.)
Detailed Lists of Limb Elements of the Above Genera and Species

IX. Stockoceros, new subgenus

(1) *S. conklingi* (Stock), referred
From Shelter Cave, New Mexico
Humerus and radius. L.A.M.179 Figured by Stock, 1930, Fig. and 180 2.
Metacarpus and metatarsus. L.A.M.185 Figured by Stock, 1930, Fig. and 187 3.

According to Chester Stock, metacarpus, *T. conklingi*, 153.6–147.5 mm. versus *Capromeryx*, 146.7, and *Antilocapra*, 218.4; metatarsus, 165.6 mm. versus *Capromeryx*, 161.7, and *Antilocapra*, 229.

(2) *S. onusrosars* (Roosevelt and Burden), referred
From Southern Arizona
Skeletal elements of several individuals, including one ulnoradius (br.), distal half of second and top of ulna; metacarpus, tibia and metatarsus; etc. fragments.

X. Capromeryx Matthew

(1) *C. furcifer* Matthew, referred
From Hay Springs, Sheridan County, Nebraska
Distal portion left humerus. F:A.M.25673
Left metatarsus. F:A.M.25672
Length = 164 mm.
Astragalus (br.). F:A.M.25672A

(2) *C. minor* Taylor, referred
From Rancho La Brea, California

Referred.—
Left metatarsus, distal one-half metacarpus, astragalus and one 3d phalanx.
Metatarsus = 150 mm. (Fig. 3).

Referred by Chandler, 1916.—“Limb elements.”
Frick, Horned Ruminants. II—Antilocapridae

(2a) C. minor Taylor, Var.
From McKittrick, California

**EXAMPLE.—Calcaneum.** C.I.T.15 Figured by Furlong, 1930, Fig. 2.
According to Furlong (1930, p. 51), presumably associated with upper and lower molars.

(2b) (?)C. Var.
From Bautista Beds, California

**EXAMPLE.—Astragalus and** U.C.23527 Figured by Frick, 1921, Text-
section of a distal end of (or 23527A) Figs. 15, 16.
an associated metapodial.

(3) C. mexicana Furlong
From Tequixquiac, Mexico

**TYPE (in part).—“Large por-
tion of skeleton.”** U.C.26648
(See associated skull, page 530.)

**REFERRED.**
“Limb elements.” U.C.26649
(See associated immature partial skull, page 530.)

XI. Tetameryx Lull

(1) T. shuleri Lull, tentatively referred
From Rock Creek, Texas, 1929

**F:A.M.**
Distal portion of left metatarsus 31516

XII. Hayoceros, new subgenus

(1) H. falkenbachi, n.subg. and sp., referred
From Hay Springs, Sheridan County, Nebraska

(SIZE approximating Dromomerycini Limb Size Groups II to III.)
(Heavier than Antilocapra americana, A.M.[M.]19350.)

**F:A.M.**
Two specimens secured by the Charles Falkenbach party, 1929–30:
Distal one-half right humerus 25671
Left metacarpus (br.) 25670

**A.M.**
American Museum specimens from the Niobrara River near Grayson, Sheridan
County, 1897:
Distal four-fifths right tibia 2775
Right metatarsus, 223 mm. 2774
1st phalanx 2774
Two 1st phalanges and five astragali.
Fig. 55. Bovids of the American Quaternary.
Heads in flesh × approximately 1. (See legend, page 540.)

Mountain Sheep (A)
Ovis Linnaeus

Mountain Goat (c)
Oreamnos Rafinesque

Furlong's Antelope (e)
Preptoceras Furlong

Saiga (b)
Saiga Gray

Leidy's Muskox (p)
Bolotherium Leidy

Muskox (f)
Ovibos Blainville
Exploration of the Western Tertiary has failed as yet to shed light on the antecedents of the American Cavicornia, which so far have not been definitely recognized in deposits of the Western Hemisphere preceding those of Pleistocene time. A possible exception exists in the case of Neotragocerus Matthew and Cook, as there is still question as to the stratigraphic level of the lone evidence, a Nebraska horn-core, and whether the same may not have been derived from the pre-Pleistocene.1

The known American Quaternary Cavicornia may be considered conveniently as representative of five major subfamily groups, one of which—the extinct Euceratherinae of the Pacific slope—was perhaps indigenous, but four of which—the Antilopinae, Ovinae, Ovibovinae and Bovinae—were probably of Old World origin. The most interesting of the five groups is that embracing the three aberrant Antilopines, the questioned Neotragocerus, the Saiga, here first described from America, and the surviving American goat-antelope, Oreamnos. The rarity of Quaternary remains of the latter and of the mountain sheep is due undoubtedly to habitat. The Ovinae, Ovibovinae and Bovinae ranged in the Pleistocene throughout the Holarctic regions of both hemispheres. The recent discovery in Alaska of a small Ovine of the proportions of individuals of the domesticated race is unexpected. In Quaternary America the Ovibovines had a wide distribution and were represented by at least three distinct genera. The bison, previous to the recent discovery of the remains of the yak-like creature described below from the Quaternary of Alaska, was believed to have been the only Bovine to have reached America. The Alaskan Bovidae are to be further discussed in a forthcoming study of the amassed evidence regarding the extinct fauna of the Fairbanks region. Observations on Quaternary forms are confined here to brief statements as to the genera and species, an enumeration of the types and synonymy and a list of the more important of the present available specimens.

---

1 Reports of the occurrence of Bison in pre-Pleistocene deposits are not substantiated by the evidence. Marsh (1877) is generally considered as having been in error in assigning the types of B. alleni and B. ferox to the "Lower Pliocene." Bison was doubtfully reported from the Snake Creek of Nebraska by Matthew and Cook (1909): "... we do not regard the presence of this Pleistocene genus in the Snake Creek fauna as satisfactorily proven." Matthew (1924) did not include Bison in the fauna from the Snake-Sheep Creek area.

539
The three present recognized divisions, five subfamilies and twelve genera and subgenera of American Pleistocene-Recent Bovidae are:

**DIVISION A.—ANTILOPINI**
Subfamily 1.—ANTILOPINÆ
   I. *Neotragocerus* Matthew and Cook (1909)  
      (Possibly from the Tertiary)  
   II. *Oreamnos* Rafinesque (1817)  
   III. *Saiga* Gray (1843) (*S. ricei*, n.sp., from Alaska)

**DIVISION B.—OVINI**
Subfamily 2.—EUCERATHERINÆ
   IV. *Euceratherium* Furlong and Sinclair (1904)  
   V. *Preptoceras* Furlong (1905), and questioned  
      (a) *Aftonius* Hay (1913), and  
      (b) *Taurotragus* ref. Gidley (1913)

Subfamily 3.—OVINÆ
   VI. *Ovis* Linnaeus (1758) (*O. dorshi*, n.sp., from Alaska)

Subfamily 4.—OVIBOVINÆ
   VII. *Ovibos* Blainville (1816)  
      (*Liops* Gidley and Gidleya Cossmann)  
   VIII. *Symbos* Osgood (1905)  
   IX. *Bootherium* Leidy (1852)

**DIVISION C.—BOVINI**
Subfamily 5.—BOVINÆ
   X. *Bos* Linnaeus (1758) (*B. bunnelli*, n.sp., from Alaska)  
   XI. *Bison* H. Smith (1827)  
   XII. *Superbison* Nobis (1930)

**Fig. 55.** Details of Bovidæ heads in flesh:
(A) *Ovis dalli* stonei (Allen)  
(C) *Oreamnos americanus* columbæ Hollister  
   (a and c after specimens shot by author, Cassiar Province, B. C., 1910)  
(B) *Saiga ricei*, n.sp., restored from photograph of Recent *Saiga*, Morden-Graves  
   North Asiatic Expedition  
(P) *Bootherium sargenti* Gidley, hypothetical reconstruction  
(E) *Preptoceras* sinclairi Furlong, hypothetical reconstruction  
(F) *Ovibos moschatus* (Zimmerman), after Recent specimen
The marked difference between the limb proportions of the several genera is indicated in the adjoining table of metacarpal versus skull lengths.

**Table XII**

**Metacarpal Length Relative to Skull Length in the American Antilocapinae, Ovinae, Ovibovinae and Bovinae, Versus in Antilocapra**

(Skull length measured from back of condyles to front of premaxilla.)

<table>
<thead>
<tr>
<th>Genus</th>
<th>Sex</th>
<th>Metacarpal Length</th>
<th>Skull Length</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antilocapra americana</td>
<td>♀</td>
<td>A.M.(M.)19350</td>
<td>N. Y. Zoo</td>
<td>265</td>
</tr>
<tr>
<td></td>
<td>♂</td>
<td>&quot;</td>
<td>&quot;</td>
<td>206</td>
</tr>
<tr>
<td></td>
<td>♀</td>
<td>&quot;</td>
<td>&quot;</td>
<td>204</td>
</tr>
<tr>
<td>Saiga tatarica.........</td>
<td>♂</td>
<td>85301</td>
<td>Asia</td>
<td>235</td>
</tr>
<tr>
<td>Euceratherium Sinclairi</td>
<td>♂</td>
<td>U.C.8896</td>
<td>California</td>
<td>180</td>
</tr>
<tr>
<td>Ovis canadensis ......</td>
<td>♀</td>
<td>A.M.(M.)122672</td>
<td>Alberta</td>
<td>183</td>
</tr>
<tr>
<td></td>
<td>♂</td>
<td>&quot;</td>
<td>&quot;</td>
<td>184</td>
</tr>
<tr>
<td>Oreamnos montanus...</td>
<td>♂</td>
<td>35541</td>
<td>N. Y. Zoo</td>
<td>252</td>
</tr>
<tr>
<td></td>
<td>♂</td>
<td>&quot;</td>
<td>&quot;</td>
<td>110</td>
</tr>
<tr>
<td>Ovibos moschatus.......</td>
<td>♂</td>
<td>19346</td>
<td>Hudson Bay</td>
<td>465</td>
</tr>
<tr>
<td>Bison bison athabasca.</td>
<td>♂</td>
<td>98953</td>
<td>Alberta</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td>♂</td>
<td>&quot;</td>
<td>&quot;</td>
<td>205</td>
</tr>
<tr>
<td>Superbison crassicornis</td>
<td>♂</td>
<td>A.C.-F:A.M. Coll. (Unassociated)</td>
<td>Alaska</td>
<td>241</td>
</tr>
<tr>
<td></td>
<td>♀</td>
<td>&quot;</td>
<td>&quot;</td>
<td>196</td>
</tr>
<tr>
<td>Bos grunniens.........</td>
<td>♂</td>
<td>A.M.(M.)10730</td>
<td>N. Y. Zoo</td>
<td>151</td>
</tr>
</tbody>
</table>

1 Length metacarpus
    Length skull

The three Bovidae divisions and the available remains referable to each are discussed in the following pages.

× 1. (See legend, next page.)
DIVISION A.—ANTILOPINI

Subfamily 1.—Antilopinae

I. Neotragocerus Matthew and Cook
   (Questioned Tertiary Occurrence)

II. Oreamnos Rafinesque

III. Saiga Gray

Figures 55b, c and (in part) 2A, 56

The most interesting of the five Bovid groups occurring in North America, as observed in the foreword, is that of the Antilopinae, embracing the questioned Neotragocerus, the Saiga, here first described from America, and the Recent Oreamnos. The rarity of remains of all three genera well may have been occasioned by their Alpine habitat.

I. Neotragocerus Matthew and Cook

Figure (in part) 56

The genus was based (1909) on a horn-core reported as coming from the Upper Snake Creek, Nebraska. John C. Merriam (1918) referred to the genus under a separate species a horn-core from the late Pliocene or early Pleistocene of Oregon. The original describers, speaking of the type, observe: "Its surface is that of the horn cores of Bovidae, easily distinguished from the horn core of the Pronghorn Antelope by the coarser and less compact structure of the surface... It approaches Oreamnos in form and surface about as nearly as any modern genus with which we have made comparison, but lacks the curvature of that genus."

Fig. 56. Oreamnos Raf., Neotragocerus M. and C., Saiga ricei, n.sp., and Ovis dorshii, n.sp., comparison of horn-cores.

× 1. A, cross sections of horn-cores.
A.M.[M.]19837, Oreamnos montanus (Ord) (Recent, for comparison).
(See page 545.)

A.M.14141, Neotragocerus improvisus Matthew and Cook, genotype, from the Tertiary of western Nebraska.
(See page 544.)

(See page 547.)

(See page 555.)
Two species have been recognized:

1) *Neotragocerus improvisus* Matthew and Cook, genotypic species, from Snake Creek, Sioux County, Nebraska.

   **Genotype.**—Horn-core, A.M.14141. This paper, Fig. 56.

2) (?) *Neotragocerus lindgreni* Merriam, from the Idaho formation.

   **Type.**—Horn-core, N.M.3941.

Detailed Lists of Types, Referred Specimens, and Synonymy

1) *Neotragocerus improvisus* Matthew and Cook, genotypic species

   From the *Hipparion* Zone, Snake Creek, Sioux County, Nebraska


   **Genotype.**—Horn-core. A.M.14141 Figured by Matthew and Cook, 1909, Fig. 26; this paper, Fig. 56.

There is serious doubt as to the previous provisional references of partial dentitions:

   Two maxillary fragments A.M.14136 Provisionally referred and figured by Matthew and Cook, 1909, Fig. 27.

   with m1-m3. and 14133

   (Apparently camel.)

   Ramus with p4-m3. P.U.12106 Provisionally referred and figured by Sinclair, 1915, Fig. 16.

   (Here tentatively transferred to *Pro-synthetoceras siouxensis*, n.sp.—see page 607.)

2) (?) *Neotragocerus lindgreni* Merriam

   From the Idaho Formation

TYPE.—Horn-core. N.M.3941 From the Idaho formation, 3 mi. E. of Boise. Figured by Merriam, 1918, Fig. 2.

Said to be slenderer and perhaps more compressed laterally than in *N. improvisus* Matthew and Cook, and longer, slenderer and more distinctly flattened transversely than in *Oreamnos*.

II. *Oreamnos Rafinesque* (1817)

*Head in Flesh, Figure 55c; and (in part) 2A, 56*

Remains of the peculiar American goat-antelope, the White or Rocky Mountain "goat," *Oreamnos montanus* (Ord) (see outline of horn-core, Fig. 56), of Recent North America, seldom are encountered in Quaternary deposits. The species, as noted below, was identified (a) by Matthew (1902) from Whitman County, Washington; (b) by Sinclair (1905) in foot elements from Potter Creek Cave, California; and more recently (1925) (c) by Chester Stock, in additional remains from Potter Creek and Samwel Caves. *Oreamnos* so far is unrepresented in the Fairbanks, Alaska, collection.

The genotypic species is *Oreamnos montanus* (Ord, 1815), the *Rupicapra americana* of Blainville, 1816. Three Recent local races or subspecies have been named: *O. montanus kennedyi* (Elliot, 1900) from southern Alaska; *O. montanus columbiæ* (Holister, 1912) from northern British Columbia; and *O. montanus missolæ* (Allen, 1904) from Montana and Idaho.

The three Quaternary references are:

(1a) *Oreamnos montanus*, Var.

From Whitman County, Washington


EXAMPLE.—Parts of horn.

(Whereabouts unknown.)

---

(1b) Oreamnos montanus, Var.

From Potter Creek Cave, California


EXAMPLE.—Parts of two meta-carpi. U.C.4312 and 4382 Figured by Sinclair, 1905, Pl. xx, Figs. 3, 4.

(1c) Oreamnos montanus, Var.

From Samwel Cave, California


Remains not reported.

III. SAIGA GRAY

Head in Flesh, Figure 55b; and (in part) 56

It is surprising to find the strange Asiatic gazelle-antelope, Saiga, occurring in the Quaternary fauna of Alaska. While the range of Saiga today is reduced to the steppes of western Siberia, the genus is said to have extended into Poland as late as 1800 and to have been present in France in Palæolithic time. Smith Woodward (1890) identifies it in the Quaternary of the British Isles. Saiga is represented in the Alaska collection by a portion of the skull, inclusive of the horn-cores, posterior portion of the frontals and the occiput (Fig. 56). There would seem to be little question as to the correctness of the identification of the specimen. The same is characterized by the typical elevation of the frontal and frontoparietal sutures in respect to the depression of the bones themselves, the strong angulation of the posterior cranium, the elevation of the superior border of the orbit, the extent of the parietais and

---

of the mastoids, the height of the smooth horn-core bases as contrasted with the deeply fluted horn-cores, the breadth between the horn bases, and the outwardly and backwardly sweeping, laterally compressed and sharply tapering horn-cores which are slightly bowed medially as viewed anteriorly. The distance between the mid-anterior horn bases approximates that from theinion to the mid-horn base. The sutures of the specimen are but little consolidated, indicating an adolescent individual.

The Alaska specimen approximates very closely an Asiatic skull [A.M. (M.)85301] in the Morden collection. The latter exhibits the diminutive size of $I_1$ and $/C$, $p_2$ (minute alveoli) missing, $p_3$ small, tooth crowns tall, nasals abbreviated and anterosuperior portions of the maxillae greatly attenuated. Nehring (1891) reports the presence of three premolars in the case of remains from Moravia, Czechoslovakia. While the horn-cores of the saiga are in moderate degree not unsuggestive of the Rocky Mountain goat, the serow and the goral, they more closely resemble those of the goitered gazelle of Asia, *Gazella subgutterosa*. The only specimen available of the latter [A.M.(M.)60381] represents a slightly immature individual that is of considerably smaller size than the Asiatic and Alaska saigas. The *G. subgutterosa* specimen and a mature specimen of *Gazella granti* [A.M.(M.)54150] exhibit a suggestion of the elevation of the frontal and frontoparietal sutures characteristic of *Saiga*. The new species is named in honor of Neil A. Rice, in recognition of his support of the Alaska investigations. A partial metacarpus and partial metatarsus of proportions of the Recent Asiatic form may represent the same new species. It is expected that continued investigation in the Fairbanks area may produce additional remains. A more detailed description of the new type will be given in the forthcoming report on the Pleistocene Fauna of Alaska.

(1) **Saiga ricei**, new species

From the Fairbanks Area, Alaska

**Type.**—Posterior half of cranium with horn-cores. A.C.-F:A.M.30495 From Lillian Creek, 1930. This paper, Fig. 56.

**Tentatively Referred.**—

- Proximal one-half right A.C.-F:A.M.30503 From Gilmore, 1931. metacarpus.
- Proximal two-thirds right A.C.-F:A.M.30503A From Goldstream, 1933. metatarsus.
DIVISION B.—OVINI

Subfamily 2.—Euceratherinæ

IV. EUCERATHERIUM FURLONG AND SINCLAIR

V. PREPTOCERAS FURLONG, AND QUESTIONED

(a) AFTONIUS HAY AND (b) TAUROTRAGUS REF. GIDLEY

Reconstruction, Figure 55E

Statement

Euceratherium Furlong and Sinclair (1904) and Preptoceras Furlong (1905) (see reconstruction, Fig. 55E) from the California Quaternary caves, Aftonius Hay (1913) from the Iowa Pleistocene, and Taurotragus, referred Gidley (1913), from a Maryland cave, possibly represent a single group of closely related forms. Stock-Furlong (1927), in their consideration of remains from McKittrick, observe “... In view of possible variation in the characters of the horn cores, the suggestion may be warranted that the McKittrick form and the [two] types from the California caves [Preptoceras and Euceratherium] represent in reality a single generic group. Should this prove to be the case the type the Preptoceras would possibly belong to a young male and the type of Euceratherium to an older female... Undoubtedly the greatest similarity exists between the California Pleistocene types and Ovibos... How closely the... group is related to the Pleistocene and Recent musk oxen can best be determined when information is available concerning the Pliocene precursors of these forms.” The horn-core on which Aftonius Hay is based is suggestive of the California specimens. Taurotragus americanus Gidley, as pointed out by C. L. Gazin, seems to be related to the American Euceratherium rather than to the African Taurotragus group. It is always possible that the types of the two Samwel Cave genotypic species, Euceratherium collinum and Preptoceras sinclairi, may be of a female and an immature male of the same genus. For the present Preptoceras well may be retained as a distinct subgenus characterized by the less tall and upright, and more horizontally directed and widely spreading horn-cores.

The ten more prominent of the recorded occurrences of the remains of Euceratherinæ are given (the first five being from California areas). The types and synonymy are cited in the following pages.
Summary of Named Species

(1) *Euceratherium collinum* Furlong and Sinclair, genotypic species, from Samwel Cave, Shasta County, California.

**Genotype.**—Partial cranium, U.C."M"8751.

(1a) *E. (Preptoceras) sinclairi* (Furlong), from Samwel Cave, Shasta County, California.

**Type.**—Partial skull, mandible and skeleton, U.C.8896.

(2) *Euceratherium collinum*, referred Sinclair, from Potter Creek Cave, Shasta County, California.

**Example.**—Broken horn-cores, etc., U.C. Coll.

(3) *Euceratherium collinum*, referred Stock, from Hawver Cave, Eldorado County, California.

**Example.**—Detached molars, U.C.21467–8.

(4) *Euceratherium* species, referred Stock-Furlong, from Klamath River, Siskiyou County, California.

**Example.**—Horn-core, U.C."M"2337.

(5) *E. (Preptoceras)* species, referred, from McKittrick, California.

**Example.**—Partial skull, right ramus and foot, U.C."M"27118–9.

(6) (?) *E. (Preptoceras) mayfieldi* (Troxell), from Rock Creek, Texas.

**Type.**—Partial skull and horn-cores, Y.P.M.10920.

(7) (?) *E. (Aftonius) calvini* (Hay), from Missouri Valley, Iowa.

**Type.**—Pair of horn-cores, Univ. Iowa Coll.

(8) (?) *E. (Taurotragus) americanum* (Gidley), from Cumberland Cave, Maryland.

**Type.**—Right maxillary dentition, N.M.7622.

(8a) (?) *Euceratherium americanum* (Gidley), referred Gazin, from the vicinity of Alton, Illinois.

**Example.**—Lower left molar, N.M.3987.
Euceratherium collinum morrisi Schultz and Howard, from Burnet Cave, New Mexico.

Type.—Posterior portion of skull with horn-cores, A.N.S.P.13418.

(9a) (?) E. (Preptoceras) sinclairi neomexicana (Schultz and Howard), from Burnet Cave, New Mexico.

Type.—Left horn-core, A.N.S.P.13807.

(10) (?) E. (Preptoceras) cf. sinclairi, referred Freudenberg, from the Valley of Mexico.

Detailed Lists of Types, Referred Specimens, and Synonymy

(1) Euceratherium collinum Furlong and Sinclair, genotypic species

From Samwel Cave, Sierra Nevada Range, Shasta County, California


Genotype.—Partial cranium U.C. “M” 8751 Figured by Sinclair and Furlong, 1904, Pls. L, LI and Text-Fig. 1.

The genotype, which may be of a female, and the type of Preptoceras sinclairi Furlong, an immature male from the same locality, may represent but one form.

(1a) Euceratherium (Preptoceras) sinclairi (Furlong)

From Samwel Cave, Sierra Nevada Range, Shasta County, California


Type.—Partial skull, mandible, and skeleton of young individual.

U.C. 8896 Figured by Furlong, 1905, Pl. xxiv and (skeleton) Pl. xxv.

(Length of the metacarpal 180 mm., and the metatarsal 190 mm., according to Furlong.)

Furlong (1905, p. 168) states: "... Its closest affinity is with its contemporary Euceratherium. It stands in about the same relation to the Ovinae as does the latter and is tentatively placed in that subfamily..." The type, probably an immature
male, as pointed out by Gazin (1933), actually may be of *E. collinum* Furlong and Sinclair, from the same cave.

(2) **Euceratherium collinum**, referred Sinclair

From Potter Creek Cave, Sierra Nevada Range, Shasta County, California


**Example.**—Broken horn-cores, detached teeth and foot-bones. U.C. Coll. Foot-bones figured by Sinclair, 1905, Pl. xx, Figs. 1, 2.

(3) **Euceratherium collinum**, referred Stock

From Hawver Cave, Eldorado County, California


**Example.**—Detached molars. U.C.21467 and 21468

(4) **Euceratherium** species, referred Stock-Furlong

From Klamath River, Gottville, Siskiyou County, California


**Example.**—Horn-core. U.C."M"2337 Figured by Stock-Furlong, 1927, Fig. 1.

(5) **Euceratherium (Preptoceras)** species, referred

From McKittrick, California


**Example.**—Partial skull, right ramus, and foot. U.C."M"27118 and 27119 Figured by Stock-Furlong, 1927, (skull) Pls lx-lxii, (ramus) Pl. lxiil, (foot) Text-Fig. 5.

(Stock-Furlong and Gazin agree in the resemblance of these remains to *Euceratherium*. )
(6) (?)Euceratherium (Preptoceras) mayfieldi (Troxell)
From Rock Creek, Texas


**Type.**—Partial skull and horn-cores.  
*Y.P.M.10920* Figured by Troxell, 1915, Figs. 1, 2.

(7) (?)Euceratherium (Aftonius) calvini (Hay)
From the Pleistocene of Iowa

"Ruminant" Calvin, 1909, Bull. Geol. Soc. Amer., XX, p. 350, Pl. xxiii, Fig. 1.  

**Type.**—Pair of horn-cores with portion of frontals.  
*Univ. Iowa Coll.* From Cox Gravel Pit, Missouri Valley, Harrison County, Iowa.  
Figured by Calvin, 1909, Pl. xxiii, Fig. 1; by Hay, 1914, Pl. xxxiv, Figs. 4, 5 and Text-Fig. 95.

**Tentatively Referred by Hay, 1914.—**  
Left metatarsus.  
(Length 204 mm.)  
*Univ. Iowa Coll.* From Turin, Monona County, Iowa.  
Figured by Hay, 1914, Pl. xxxiv, Figs. 1. 2.

(8) (?)Euceratherium (Taurotragus) americanum (Gidley)
From Cumberland Cave, Maryland

*Taurotragus americanus* Gidley, 1913, Smithsonian Misc. Coll., LX, No. 27, p. 1, Pl. 1, Fig. 2; 1914, ibid., LXIII, No. 8, p. 16, Figs. 18, 19; 1920, Rept. Smithsonian Inst. for 1918, p. 283.  
Frick, Horned Ruminants. III—Bovidae

Type.—Right maxillary dentition. N.M.7622 Figured by Gidley, 1913, Pl. 1, Fig. 2.

REFERRED BY C. L. GAZIN, 1933.—
Ramal dentition.

(8a) (?) Euceratherium americanum, referred Gazin
From the Vicinity of Alton, Illinois


Example.—Lower left molar. N.M.3987 Collected at Kimmswick, Missouri, about 20 mi. S. of St. Louis and 40 mi. S. of Alton, Ill.

(Height of tooth 50 mm.; length 53 mm.; thickness at base of first lobe, 23 mm.; at base of second lobe, 24 mm.; at base of third lobe, 15 mm.)

(9) Euceratherium collinum morrasi Schultz and Howard
From New Mexico


Type.—Posterior portion of skull with horn-cores. A.N.S.P.13418 From Burnet Cave, New Mexico.
Figured by Schultz and Howard, 1935, Pls. xiii, Figs. 3–4; xiv, Figs. 1–4, 10.

DOUBTFULLY REFERRED SPECIMENS FROM TYPE LOCALITY.—

<table>
<thead>
<tr>
<th>Specimen Description</th>
<th>A.N.S.P. Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palate with right m₁–m³ and left m²–m³</td>
<td>13808</td>
</tr>
<tr>
<td>Left ramus with p₁–m₂ and right ramus with p₄–m₄</td>
<td>13806</td>
</tr>
<tr>
<td>Metacarpal</td>
<td>13950</td>
</tr>
<tr>
<td>Astragalus</td>
<td>13982</td>
</tr>
<tr>
<td>1st and 2d phalanges</td>
<td>13423 and 13438</td>
</tr>
</tbody>
</table>
(9a) (?)Euceratherium (Preptoceras) sinclari neomexicana  
(Schultz and Howard)  
From New Mexico  

Phila., LXXXVII, p. 291, Pl. xii, Figs. 2–3.  

TYPE.—Left horn-core. A.N.S.P.13807 From Burnet Cave, New  
Mexico.  
Figured by Schultz and Howard, 1935, Pl. xii, Figs. 2–3.  

(10) (?)Euceratherium (Preptoceras) cf. sinclari, referred Freudenberg  
(1921)  
From the Valley of Mexico  

Preptoceras cf. sinclari referred FREUDENBERG, 1921, Geologie von Mexiko, pp. 137,  

Freudenberg merely cites as present.

Subfamily 3.—Ovineæ

VI. OVIS LINNÆUS  

Figure 55A and (in part) 56  

Genotypic species, Ovis aries Linnaeus (1758)  

Statement  
Knowledge of the wild sheep of the North American Pleistocene has  
been limited mainly to a few cave finds. The general absence of the  
sheep and of the goat in sedimentary accumulations perhaps may be ac-
counted for sufficiently by the mountainous habitat of both. The  
Alaska collection is of especial interest in including, besides partial crania  
of mountain sheep with horn-cores of Ovis dalli shape, a specimen of a  
much smaller form more nearly resembling Ovis aries.
The rather typical *O. dalli*-like crania are referred to a subspecies, *O. dalli kaiseni*, named in memory of Peter C. Kaisen, the leader of the two first Alaska College-American Museum expeditions of 1929 and 1930.

The domestic sheep, like the goat and the ox and unlike the horse, has been supposed to have been absent from the Western Hemisphere until introduced by the early voyagers from Europe. The second Alaskan form is much smaller than any Rocky Mountain sheep and lacks the characteristic prominence of the anterior orbital margin and the large and upright horn-cores of the latter. The specimen is remarkably suggestive of an average domestic ewe: in size, in tendency toward a similar depression postero-inward of the horn bases, and in the small, broadly flaring and downwardly curved horn-cores. The unique and curious find is referred to a distinct species, *Ovis dorshi*, after John B. Dorsh of Alaska College, leader of the Joint Alaska College-American Museum expeditions of 1933–1935.

Ten or more subspecies or races of the two species of Recent mountain sheep have been deemed worthy of recognition:

*O. canadensis canadensis* Shaw (1804), from Alberta to Arizona; *O. c. californiana* (Douglas) (1829), from California to Washington; *O. c. sierrae* (Grinnell) (1912), from the Sierras; *O. c. gaillardi* Mearns (1907), from Sonora and southwestern Arizona; *O. c. nelsoni* (Merriam) (1897), from Nevada to Lower California; *O. c. auduboni* Merriam (1901), from the Badlands; *O. c. texiana* Bailey (1912), from Texas and New Mexico; *O. dalli dalli* (Nelson) (1884), from Alaska and the Yukon; *O. d. fannini* (Hornaday) (1901), from the Yukon; *O. d. stonei* (Allen) (1897), from northern British Columbia (see figured head, Fig. 55a). (After H. E. Anthony, 1928.)

An extinct species, *O. mamillaris* Hildreth (1837), has been based on a skull from Ohio. The two here recognized forms from the Quaternary of Alaska are:

1. **Ovis dalli kaiseni**, new subspecies

   **Type.**—Nearly complete skull. A.C.-F:A.M.30700 1930.


2. **Ovis dorshi**, new species

   **Type.**—Posterior half of cranium with horn-cores. A.C.-F:A.M.30701 1931.

   **This paper, Fig. 56.**

---

1 The investigation in 1931 was continued by Doctor Albert S. Wilkerson of Alaska College, and in 1932 by Professor Ray Henrickson, assisted by Wilson Walton.
Subfamily 4.—Ovibovinæ

VII. Ovibos Blainville
VIII. Symbos Osgood
IX. Bootherium Leidy

Figure 55D, F

Statement

The existing genus Ovibos Blainville and the extinct genera Symbos Osgood and Bootherium Leidy seem to have been widely distributed in North America during the Quaternary. Remains are referred to Ovibos from the prehistoric deposits of France, as well as from the Quaternary of Asia. While Ovibovinae so far are unreported from Rancho La Brea, California, all three genera are represented in the collections from Fairbanks, Alaska. As seen in these remains, there is no longer cause for question as to the presence of distinct cranial characters in Symbos as compared to Ovibos. Definite knowledge yet seems to be lacking as to in what degree the tooth characters of Symbos differ from Ovibos and Bootherium.

A splendid specimen of Symbos from Fairbanks shows the hitherto unrecognized elongation of the nasals and muzzle, and permits a recharacterization of the genus. As compared to Ovibos, Symbos is larger, the nasals are much longer proportioned, the occiput is higher, the condyles are larger and the orbits are lower and more posteriorly placed. The basal horn-core plate is thicker dorsoventrally, longer-proportioned anteroposteriorly, and medianly undivided and deeply excavated as compared to Ovibos. In Symbos, while the greatest over-orbital breadth of the cranium is 48% of the distance from the anterior nasals to the inion, versus 65% in Ovibos, the nasals equal 94% of the distance from the anterior border of the frontals to the inion, versus 58% in Ovibos. The horns of the genus Bootherium are at once distinguishable from those of the two preceding genera by the absence of the basal plate and their marked relative slenderness and outward direction. A giant Ovibovine species, indicated by a humerus from Fairbanks, recalls certain huge Ovibovine remains from the Quaternary of Idaho, once shown to the writer by James W. Gidley.

The Alaska Quaternary has yielded remains of four different musk-oxen: Ovibos yukonensis Gidley, (?)Ovibos giganteus, new species, Sym-
bos tyrrelli Osgood and Bootherium nivicolens Hay. The Alaskan O. yukonensis remains were originally referred directly to the Recent O. moschatus. S. tyrrelli Osgood seems to resemble S. cavifrons (Leidy) from Indian Territory. B. nivicolens Hay is said to resemble both B. bombifrons (Harlan) from Kentucky and B. sargenti Gidley from Michigan.

The three genera, VII, Ovibos Blainville, VIII, Symbos Osgood and IX, Bootherium Leidy, and their species, types and referred remains, as recorded in the literature or newly encountered in Alaska, are summarized in the following pages.

Summary of Named American Species

VII. Ovibos1 Blainville.

(1) Ovibos moschatus (Zimmerman), genotypic species, Recent and fossil.

(2) Ovibos appalachicolus Rhoads, from Durham Cave, Pennsylvania.

TYPE.—Horn-core base, A.N.S.P.29.

(3) (?)Ovibos zuniensis (Gidley), from New Mexico.

TYPE.—Top and back portion of skull and horn-cores, N.M.5100.

(4) Ovibos yukonensis Gidley, from the Palisades of the Yukon, Alaska.

TYPE.—Nearly complete skull, N.M.5728.

(4a) Ovibos proximus Bensley, from Ontario, Canada.

TYPE.—Brain case, horn-cores and portion of skull, Royal Ontario Mus. Coll.

(5) (?)Ovibos giganteus, n.sp., from the Fairbanks area, Alaska.

TYPE.—Humerus, A.C.-F:A.M.30498.

1 An extinct form is indefinitely reported by Rütimayer (1885, Verh. Nat. Gesellach. Basel, IV, p. 328), Ovibos fossitus; and a skull and other remains from northern Russia have been referred to the same by Pavlov (1906, Mém. Acad. Imp. Sci. St. Pétersbourg [8], XXI, No. 1, p. 28, Pls. II and III [in part]).
VIII. *Symbos* Osgood.

(1) *Symbos cavifrons* (Leidy), from Indian Territory.

**Type.**—Cranium, A.N.S.P. Coll.

(1a–e) *Symbos cavifrons* vars., from Iowa, Indiana, Nebraska, Illinois and Missouri; and (1cc) *S. convexifrons* Barbour, from Nebraska.

**Examples.**—Skulls and partial crania—see details following.

(2) *Symbos tyrrelli* Osgood, genotypic species, from Yukon Territory.

**Genotype.**—Skull, N.M.2555.

IX. *Bootherium* Leidy.

(1) *Bootherium bombifrons* (Harlan), genotypic species, from Big Bone Lick, Kentucky.

**Genotype.**—Partial skull and horn-cores, A.N.S.P. Coll.

(1a) (?) *Bootherium bombifrons*, var., from "Frankstown Cave," Pennsylvania.

**Example.**—Fragmentary remains, C.M.11036.

(1b) *Bootherium bombifrons*, var., from (?) Douglas County, Nebraska.

**Example.**—Fragmentary skull portion, N.S.M.193-25-5-27.

(2) *Bootherium sargenti* Gidley, from Grand Rapids, Michigan.

**Type.**—Upper portion of skull, Kent Scientific Mus. Coll.

(3) *Bootherium nivicolens* Hay, from Alaska.

**Type.**—Top of cranium with horn-cores, N.M.2324.
Detailed Lists of Types, Referred Specimens, and Synonymy

VII. OVIBOS BLAINVILLE
Reconstruction, Figure 55f

Remains from Pennsylvania, New Mexico, Ontario and Alaska have been made the types of as many extinct species, and specimens from other Quaternary localities have been referred to the living species. The six forms currently recognized are:

(1) Ovibos moschatus (Zimmerman), genotypic species

Quaternary remains referred to the living species have been reported from New Jersey, Pennsylvania, Ohio, Indiana, Iowa, Nebraska, Minnesota, South Dakota, Colorado, Oklahoma, Ontario, Alberta and Alaska. The three Recent North American species and subspecies are: Ovibos moschatus wardi Lydekker (1900), from Greenland; O. m. niphocus Elliot (1905), from Wager Inlet, Northwest Territory, Canada; and O. m. moschatus (Zimmerman) (1870), from Barren Ground and west of Hudson Bay—evidently the type area.

A skull (N.M.14413) of the Recent species is figured by Osgood (1905, Pl. xxxvii, Fig. 1; Pl. xxxviii, Fig. 1; Pl. xxxix, Fig. 3) under Ovibos moschatus. According to C. L. Gazin (communicated), the skull together with the rest of the skeleton was collected by W. L. Hardesty in 1873 or 1874, east of the mouth of the Mackenzie River.

(2) Ovibos appalachicolus Rhoads

From Pennsylvania


Type.—Horn-core base. A.N.S.P.29 From Durham Cave, near Riegelsville, Bucks County, Pennsylvania.

Frankstown Cave (?) Bootherium bombifrons, var., referred remains may represent the above species. (See Peterson, 1926.)
(3) *Ovibos zuniensis* (Gidley)

From New Mexico


*Gidleya zuniensis* COSSMANN, 1907, Rev. Crit. Palæozool., XI, p. 64.

**Type.**—Top and back portion of skull and horn-cores.

N.M.5100 From 4½ mi. E. of Zuni, New Mexico.

Figured by Gidley, 1906, Figs. 1–3.

(Horn-cores said to be relatively longer, less robust, and less drooping than in *Ovibos* and *Symbos*, and foramen magnum confined entirely to occipital base of skull.)

(4) *Ovibos yukonensis* Gidley

From the Palisades of the Yukon, Alaska


*Ovibos yukonensis* GIDLEY, 1908, Proc. U. S. Nat. Mus., XXXIV, No. 1627, p. 681, Pls. LVII–LVIII and Text-Fig.

**Type.**—Nearly complete skull with m²–m³. (w)

N.M.5728 Collected by Gilmore in 1907 from Palisades of the Yukon.

Figured by Gidley, 1908, Pls. LVII–LVIII and Text-Fig.

**REFERRED.**—

Four crania or partial crania. A.C.-F: A.M. Coll. From the Fairbanks area, 1929–33.

(4a) *Ovibos proximus* Bensley

From the Late Pleistocene, Ontario, Canada

*Ovibos proximus* BENSLEY, 1923, Univ. Toronto Studies, Biol. Ser., No. 23, p. 1, Pls. I, II.

**Type.**—Brain case, horn-cores and nasofrontal portion of skull.

Royal Ontario Mus. Coll. From Iroquois Beach Deposits, Ontario.

Figured by Bensley, 1923, Pls. I, II.

1 Possibly of the same form, but indeterminate:


A giant Ovibovine species is indicated by a humerus from Fairbanks, secured by the Joint Alaska College-American Museum of Natural History Expedition. The specimen is made the type of a new species, tentatively allocated to the genus Ovibos. Determination of the affinity of this great Alaskan species and the giant Idaho form secured by James W. Gidley in 1930 would be of high interest.

**TYPE.**—Humerus.  
A.C.-F: A.M. 30498  From Fairbanks area, Alaska.

Length 390 mm., versus National Museum specimen from Idaho, estimated 470 mm., versus Recent O. moschatus referred, from Greenland [A.M. (M.) 100058], 250 mm.

VIII. **SYMBOS** OSGOOD

Specimens have been referred to the extinct species, *S. cavifrons* (Leidy), from the Pleistocene of Indian Territory, Iowa, Indiana, Nebraska, Illinois, Missouri, Ohio, West Virginia and Pennsylvania. Remains from Alaska are placed in a distinct species, *Symbos tyrrelli* Osgood. *S. tyrrelli* may represent the female of *S. cavifrons*. [Lydekker (1898) and others considered *S. cavifrons* to represent a male of *B. bombifrons*.] The genus is recharacterized on a preceding page. The two species and several variations are:

1. **Symbos cavifrons** (Leidy)

From Indian Territory


*Bootherium cavifrons* Leidy, 1852, Smith. Contrib. Knowl., V, Art. 3, pp. 12-17, Pl. iii, Figs. 1, 2; Pl. iv, Fig. 1.

*Ovibos priscus* Rütimeyer (in part), 1865, Verh. Nat. Gesellsch. Basel, IV, p. 328. (Proposed to include both *O. bombifrons* and *O. cavifrons*.)

*Scaphoceros cavifrons* (Leidy), Osgood, 1905, Smithson. Misc. Coll., XLVIII, No. 1589, p. 181, Pl. XL, Fig. 1; Pl. xli, Fig. 1; Pl. xlii, Fig. 1.


Hay, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 298, Pl. xxxvi, Fig. 4 (after Osgood).
Type.—Cranium. A.N.S.P. Coll. From near Fort Gibson, Indian Territory. Figured by Leidy, 1852, Pl. iii, Figs. 1, 2; Pl. iv, Fig. 1; by Osgood, 1905, Pl. xll, Fig. 1; Pl. xl, Fig. 1; by Hay, 1914, Pl. xxxvi, Fig. 4.

(1a) **Symbos cavifrons**, Var. From Iowa


**EXAMPLE.**—Skull. Univ. Iowa 107 From the loess of the Missouri River at Council Bluffs, Iowa. Figured by Hay, 1914, Pl. xxxvii, Fig. 3 (photograph of skull).

(1b) **Symbos cavifrons**, Var. From Hebron, Indiana


**EXAMPLE.**—Skull. A.M.14369 Figured by Hay, 1912, Text-Figs. 49, 50; 1914, Figs. 98, 99; by Allen, 1913, Text-Fig. 25, Pls. xvii, xviii [i.e., A.M.14365].

(1c) **Symbos cavifrons**, Var., and (1cc) *S. convexifrons* Barbour From Nebraska

S. cavifrons, var., BARBOUR, 1931:

**Exemplified.**—Six partial crania.  
Respectively from an indefinite locality; Cambridge, Furnas County; Endicott, Jefferson County; Otoe County; Gage County; Spring Ranch, Clay County.  
Figured by Barbour, 1931, Figs. 139–144.


**Type.**—Right horn-core, etc.  
(Not included in count.)  
From Cherry County.  
Figured by Barbour, 1934, Figs. 173, 174.

(1d) Symbos cavifrons, Var.  
From Illinois


**Example.**—Posterior cranium.  
N.M.7800 From Manito, Mason County, Illinois.  
(Tip to tip of horn-cores = 437 mm., versus 525 mm. of Hebron specimen.

**Referred by Hay to Symbos promptus?** —

?Lower left second molar.  
N.M.9011 From Alton, Madison County, Illinois.  
(Crown is 34 mm. long, 25 mm. wide at base.)

(1e) Symbos cavifrons, Var.  
From Missouri


**Example.**—Fragment of cranium.  
From New Madrid, Missouri.

---

1 Osgood (1905, p. 180) observes that "*Bos pallasi*i was based on the same specimens as *Bos pallantis* and is therefore a synonym. It is, moreover, preoccupied by *Bos pallasi* Baer 1823, proposed for a different animal. In the same paper in which DeKay proposed the name *pallasi*, he described a specimen from New Madrid, Missouri, which evidently belongs to the species later called *cavifrons* by Leidy."
(2) **Symbos tyrrelli** Osgood, genotypic species

From Yukon Territory

*Scaphoceros tyrrelli* Osgood, 1905, Smithsonian. Misc. Coll., XLVIII, No. 1589, p. 174, Pl. XXXVII, Fig. 2; Pl. XXXVIII, Fig. 2; Pl. XXXIX, Fig. 1; Pl. XL, Fig. 2.


**Genotype.**—Skull, well preserved, with much worn teeth.

From Bonanza Creek, Yukon Territory.

Figured by Osgood, 1905, Pl. XXXVII, Fig. 2; Pl. XXXVIII, Fig. 2; Pl. XXXIX, Fig. 1; Pl. XL, Fig. 2; by Hay, 1914, Pl. XXXVII, Figs. 1, 2.

**Referred.**—

- Posterior portion of skull and one attached horn-core. N.M. Coll. Secured with type from Bonanza Creek by J. B. Tyrell.

**Referred from Fairbanks, Collected by the Joint Alaska College-American Museum Expedition.**—

- A fine partial skull with A.C.-F:A.M.30501 1934. nasals preserved, dentition lacking.
- Left mandibular ramus A.C.-F:A.M.30502 1931. with p$_{r}$–m$_{s}$ (w)

Allocated to this genus, which includes the majority of the Alaskan finds, because of p$_{s}$ with closed anterior fossette (versus open in Recent *Ovibos*).

Postsymphyial distance = 78 mm., p$_{r}$–m$_{s}$ = 175, p$_{s}$ = 16, p$_{t}$ = 23, p$_{u}$ = 26.

---

**IX. Böotherium Leidy**

Reconstruction, Figure 55b

Three species have been described from the Pleistocene: *B. bombi-
frons (Harlan), genotypic species, from Kentucky; B. sargenti Gidley, from Michigan; and B. nivicolens Hay, from Alaska. Questioned remains from Pennsylvania and from Nebraska have been referred to B. bombifrons. Additional evidence as to the genus is afforded by the newly secured Alaskan specimens.

(1) Bootherium bombifrons (Harlan), genotypic species
From Big Bone Lick, Kentucky

"... nearly allied to the bison?" WISTAR, 1818, Trans. Amer. Phil. Soc. (n.s.), I, p. 379, Pl. xi, Figs. 10, 11.

Bos bombifrons Harlan, 1825, Fauna Americana, p. 271.


Bootherium bombifrons (Harlan), Leidy, 1852, Smithson. Contrib. Knowl., V, Art 3, p. 17, Pl. iv, Fig. 2; Pl. v, Figs. 1, 2. Osgood, 1905, Smithson. Misc. Coll., XLVIII, No. 1589, p. 181, Pl. xxxix, Fig. 2; Pl. xli, Fig. 2; Pl. xl, Fig. 2. Hay, 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 291, Pl. xxxv, Figs. 1, 2.

(Proposed to include both O. bombifrons and O. cavifrons.)

Genotype.—Partial skull and horn-cores.
A.N.S.P. Coll. Collected for President Jefferson by General Clark
Figured by Wistar, 1818, Pl. xi, Figs. 10, 11; by Leidy, 1852, Pl. iv, Fig. 2; Pl. v, Figs. 1, 2; by Osgood, 1905, Pl. xxxix, Fig. 2; Pl. xli, Fig. 2; Pl. xl, Fig. 2; by Hay, 1914, Pl. xxxv, Figs. 1, 2.

(1a) (?)Bootherium bombifrons, Var.
From "Frankstown Cave," Pennsylvania

Bootherium bombifrons (Harlan), Peterson, 1926, Ann. Carn. Mus., XVI, No. 2, p. 258, Pl. xix, Figs. 1–13; Pl. xx, Figs. 1–8; and Pl. xxi.

Example.—Fragmentary remains of possibly three individuals.
C.M.11036,a,b From Frankstown Cave, Pennsylvania.
Figured by Peterson, 1926, Pl. xix, Figs. 1–13; Pl. xx, Figs. 1–8 (11036); and Pl. xxi (11036b).

(C.M.11036 said to be most completely preserved.)

Frankstown Cave remains possibly are of the same species as those of Durham Cave (see Ovibos appalachicus Rhoads, page 559).
(1b) Boötherium bombifrons, Var.

From Nebraska

Bootherium sp. indt. Barbour, 1931, Bull. Nebr. State Mus., I, No. 25, p. 227, Fig. 146.

Example.—Single fragmentary skull portion.

N.S.M.193-25-5-27 From (?)Douglas County, Nebraska.
Figured by Barbour, 1931, Fig. 146.

(2) Boötherium sargenti Gidley

From Grand Rapids, Michigan


Type.—Upper portion of skull with horn-cores. Kent Scientific Mus. Coll. Figured by Gidley, 1908, Pl. LIX.

(Two-thirds the size of Recent muskox and somewhat larger than type of B. bombifrons, according to Gidley.)

(3) Boötherium nivicolens Hay

From Alaska


Type.—Top of cranium with horn-cores. N.M.2324 From Eschscholtz Bay.
Figured by Hay, 1915, Pl. xxxi.

REFERRED SPECIMENS FROM THE FAIRBANKS AREA, SECURED BY THE ALASKA COLLEGE-AMERICAN MUSEUM EXPEDITION.—

and apparently associated tips of horn-sheaths of heavy proportions.
DIVISION C.—BOVINI

Subfamily 5.—Bovine

X. **BOS LINNAEUS**

XI. **BISON H. SMITH**

XII. **SUPERBISON NOBIS**

Figures 57, 58

Statement

Unfortunately, so far nothing is definitely known as to the American Tertiary forerunners of the far-flung Bovines of Quaternary time, those vast herds that stretched across the northern areas of both hemispheres—the British Isles, northern Europe,\(^1\) Asia and America. That in the history of the known forms many species were involved, and that there was a mingling from time to time of remote races and strains, well may be believed. The genus *Bison* appears suddenly and widespread in the Pleistocene accumulations of America. Recent explorations in the vicinity of Fairbanks, Alaska, indicate the apparent presence of a contemporary second and more yak-like form in the local Pleistocene. Though there is some question as to the age of the cranial specimens the evidence, such as it is, is extremely interesting in affording the first intimation of the occurrence of *Bos* (*Poephagus*) on this continent. The type and referred specimens were secured in the summer of 1934 by John B. Dorsh of the Joint Alaska College-American Museum Expedition. The material is referred to a new species, *Bos bunnelli*, named in honor of Charles E. Bunnell, President of Alaska University.

The *Bison* remains from the North American Quaternary for convenience may be divided on the character of the size of the horn-cores between *Bison* proper, in which the cores are of moderate dimensions, and the subgenus *Superbison*, in which they may greatly exceed in size those of Recent species. *Superbison* was originally employed by the writer (1930) for the form from the Alaskan Quaternary. *Superbison* and *Bison* are both represented in fossil remains from Kentucky, Ohio, Nebraska, Kansas and Texas. *Superbison* alone is recognized in the col-

---

\(^1\) *Superbison latifrons* is partially suggested in remains from northern Russia figured under *B. priecus* by Paviow (1906, Pl. iv, Figs. 5 and 5a), and from England, figured under *B. bonasus* by Lucas (1899, Pl. Lxxi).
lections from Alaska, Idaho and Arizona, and *Bison* only from Indiana, Iowa, New Mexico, California and Oregon. A skull from the Texas Pleistocene, of shorter proportions than the ordinary, has been made the type of a third subgenus, *Simobison* Hay and Cook (1930). *Stelabison* Figgins (1933) has been proposed for certain Nebraskan forms which exhibit well-defined columns on the outer sides of the upper molars. Some twelve of the types of the twenty-one heretofore named Quaternary species and subspecies consist of horn-cores or partial horn-cores, the associated dentitions being unknown. As yet there seems to be no record of a Recent-sized *Bison* horn-core having been found in definite association with *Superbison* remains. In the several cases where evidence exists as to man’s association with extinct *Bison* species, according to C. Bertrand Schultz, the remains are of the smaller *Bison*, evidence as yet being lacking as to the contemporaneity of man and *Superbison*. The pre-Pleistocene occurrences reported by Matthew and Cook (1909) of *Bison* species in the “Nebraska Tertiary,” and by Marsh (1877) of the types of *B. allenii* and *B. ferox* in the “Lower Pliocene,” were probably in error. The remains were evidently from the Pleistocene. For the purpose of a preliminary survey of the named species and convenience in future study, the so-far-listed Quaternary forms are divided below according to size between the genus and the larger *Superbison*, and grouped according to occurrence: (a) East, (b) West of the Mississippi and (c) Alaska. A careful reexamination of the named types, in the light of the more lately amassed Fairbanks evidence, is greatly to be desired.

In the following pages, *Bos bunnelli*, n.sp., is described and the twenty-odd named species of the American Quaternary *Superbison* and *Bison* are listed, together with the types and referred remains.

X. *Bos Linnaeus*

(1) *Bos* (Poëphagus) bunnelli, new species

From the Fairbanks Area, Alaska

Figure (in part) 58

Marked interest is attached to the discovery in the Pleistocene of

---

1 *Bos Linnaeus* (1758, Syst. Nat. [10], I, p. 71; 1766, ibid. [12], I, p. 98), *Bos taurus* Linnaeus (type), from Poland; *B. bison* Linnaeus, from Europe; and *B. bison* Linnaeus, from western United States.

Alaska of a Bovine that differed from the bison much as do the gaur and yak. The new ox is represented in the Fairbanks collection by the anterior two-thirds of a cranium and a number of maxillary and ramal dentitions. While the skull, so far as observable, resembles the banting and gaur versus the bison, the characters seem even more like those of the yak than either of the last. (Nothing actually as yet is known of the prehistory of the yak.) The orbits are placed relatively forward and are far less protruding or tube-like, the nasals were apparently proportionately narrower, and were in near contact with the vertical wings of the premaxillae, the incisive border was more flared, the unworn tooth crowns notably narrower and taller, the premolar pattern different and the premolar bases more compressed anteroposteriorly than in the bison. The horn-cores and occiput are unfortunately missing. A very tentatively referred metapodial is long and ox-like compared to the short and heavy metapodials of both bison and yak. Recognition of the presence of this non-bison form in Alaska suggests that a near ally, or allies, of the same may be represented amid certain of the remains from deposits of the Great Plains now allocated to the bison. Since the above was written, a partial cranium with horn-cores (A.C.-F:A.M.30507) has been discovered by John B. Dorsh and his assistants, Archibald Roosevelt Jr. and Walter Sullivan.

Type.—Anterior two-thirds of skull with orbits, maxilla, premaxilla and palate completely preserved, p2 alveolus and p1–m1. (M+)

Referred from Fairbanks Area.—

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Description</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.C.-F:A.M.30659</td>
<td>Anterior two-thirds of skull with orbits, maxilla, premaxilla and palate completely preserved</td>
<td>1934</td>
</tr>
<tr>
<td>A.C.-F:A.M.30507</td>
<td>Anterior portion of cranium with horn-cores suggestive of Recent yak</td>
<td>1935</td>
</tr>
<tr>
<td>A.C.-F:A.M.30660</td>
<td>Palate with dentition</td>
<td>1934</td>
</tr>
<tr>
<td>A.C.-F:A.M.30657, 30658 and 30662</td>
<td>Three partial mandibles with dentitions</td>
<td>1929, 1932</td>
</tr>
</tbody>
</table>

This paper, Fig. 58 (A.C.-F:A.M.30658).

And a number of detached teeth.

The smallest m3 approximates (35.5) mm., and the largest m3 (43.5) mm. in length.

---

1 A reconsideration of the evidence in the light of newer finds, raises question as to the occurrence of certain of the yak-like specimens and suggests that these may be of more recent origin than the typical fossils of the Alaskan Pleistocene.
Fig. 57. Superbison crassicornis (Richardson), ref., from the Pleistocene of Alaska; dorsal views of A.C.-F:AM.30600, horn-core at right angles, and 30595, backwardly directed; occipital views of A.C.-F:AM.30568 (female), and 30523 and 30601 (large males) with horn-⦁ sheaths.
XI. BISON H. SMITH AND XII. SUPERBISON NOBIS

Figures 57 and (in part) 58

Joel A. Allen (1876), in "The American Bisons, Living and Extinct," recognized three species: the living bison, *B. americanus* Catesby (1754), and two fossil species from Big Bone Lick, Kentucky, *B. latifrons* (Harlan, 1825) and *B. antiquus* Leidy (1852). Allen records the three earliest descriptions of fossil bison remains as: first, the part of a cranium of the gigantic form described by Peale (1803) from Kentucky [later *B. latifrons* (Harlan)]; second, the greater portion of a skull, etc., from Brazos River, Texas, described by Carpenter (1846) [*S. chaneyi* (Cook)]; and third, the molar teeth discussed by Leidy (1852) from Natchez, Mississippi (*Bison* sp.). Frederick A. Lucas (1899) recognizes six extinct American species: *B. occidentalis* Lucas and *B. crassicornis* Richardson, based on Alaskan remains; *B. antiquus* Leidy and *B. latifrons* (Harlan), types from Kentucky; *B. alleni* Marsh, type from Kansas; and *B. ferox* Marsh, type from Nebraska. The more recent researches of Hay, Cook, Figgins and others bring the number of described species and subspecies of extinct *Bison* from the United States to twenty. C. B. Schultz (1934) observes that the bison evidence from Nebraska alone is allotted currently to eight different species: *B. ferox* Marsh, type; *B. alleni* Marsh, referred; *B. antiquus* Leidy, referred; *B. occidentalis* Lucas, referred; *B. latifrons* (Harlan), referred; *B. regius* Hay, referred; *B. angularis* Figgins, type; and *B. rotundus* Figgins, type. Allen (1876) discusses and illustrates variation of skull form occurring in the Recent bison of North America, and Leidy (1869) even considers the Kentucky types of *B. latifrons* and the much smaller *B. antiquus* as representing the male and female of the same species. The fine series of bison crania and partial crania from the Fairbanks district is interpreted here as representing one widely varying Alaskan species. If this interpretation is correct, a fully commensurate variation would be expected in the different species dwelling to the south.

The Alaskan bison exhibit wide differences in the horn-cores and more moderate differences in the teeth. The Fairbanks series includes one hundred and fifty crania and partial crania and nearly two hundred mandibular rami and partial rami. (Six crania are nearly complete and three of these retain the dentitions.) As the gaps between the extreme forms in the case of the Fairbanks remains, both in the horns and teeth, are fairly well filled in by specimens of intermediate character, it seems unnecessary to believe that the same represent more than one
widely varying species. Several of the more marked Alaskan horn shapes are reminiscent of those of named species from more southern localities. The smaller of the Alaskan mature horn-cores (spread of 780 mm.) are fully as large or larger than the type of B. antiquus Leidy and the average of the remains from Folsom, New Mexico, and Rancho La Brea, California. The largest of the Alaskan cores is smaller than the types of B. latifrons Leidy, B. chaneyi and the more magnificent B. regius. The horn-cores of the B. chaneyi type are notably heavier in section and longer through the recurving of the tips (versus non-curved in the Alaska), though the total spread is no greater than in our largest Alaskan specimen. It might be expected that horn growth in the bison of the inhospitable far north would average less than in more favored species of the southwest. Six of the Alaskan maxillae exhibit a column, or a tendency to a column, on the exterior side of the m³ (A, Fig. 58). Columns are almost universally present on the labial side of the lower molars, the prominence of these being seemingly dependent on the state of tooth wear. Measurements of the series of Alaskan crania are given in the adjoining table.

As previously observed, S. crassicornis (Richardson, 1852-1854) was based on relatively small, S. occidentalis (Lucas, 1898) on approximately similar-sized, and S. alaskensis (Rhoads, 1897) on larger-sized remains.

The Alaskan crania of the Fairbanks collection may be considered according to:

(a) when viewed dorsally, as to whether the horn-cores are:
   directed sharply posteriorly relative to the occipital plane (A.C.-F:A.M. 30595, Fig. 57) or
   directed more parallel to the same plane and at right angles to the skull axis (A.C.-F:A.M.30600, Fig. 57), or

(b) when viewed posteriorly, as to whether the core bases are:
   depressed relative to the plane of the frontals (A.C.-F:A.M.30601, Fig. 57), or
   more continuous with that plane (A.C.-F:A.M.30523, Fig. 57).

And when the horn sheaths are retained, the specimens may be again divided:

(c) when viewed posteriorly, as to whether the sheath tips tend:
   to extend straight out from the skull (apparently S. regius type), or
   to recurve toward one another as in Alaskan specimens (Fig. 57).

As different groupings of the several above enumerated variations occur, each variation seems to be mutually independent. S. occidentalis (Lucas) apparently resembles the smaller of the Fairbanks specimens. The type of B. antiquus Leidy, as observed by Lucas, conforms to the
second and rarer variation under (a); *S. alaskensis* (Rhoads), somewhat suggestive of *B. latifrons*, may represent the first variation under (b). The above several horn shapes are exemplified in both large and widespread and in smaller-sized specimens. The occiput, as viewed posteriorly, may be deep or shallow. The breadth of the condyles in the largest Alaskan male is 147 mm., and in the smallest Alaskan female, 116 mm. The difference in stature, as gauged in the metacarpi, was marked, the shortest specimen measuring but 81% of the longest.

Sixteen notably smaller Alaskan crania or partial crania with very slender horns are interpreted as having belonged to cows. The rareness of the examples of the cow in this rich collection parallels the absence in the literature of reports of females from United States localities (with the exception, perhaps, of Rancho La Brea). In the younger of the Alaskan males, in which the sutures are less consolidated and the cores slenderer, the horn sheaths do not extend so far on to the skull, the core and frontal being separated by the non-sheathed core-base. In bulls in their prime, with the tips of the horn sheaths unworn, the sheaths, measured on the outer curve, may be 50% longer than the core itself.

As a preliminary to a needed reexamination of the supporting material, in the light of the great series of remains from Alaska, the more important references to extinct American bison in the literature are grouped below according to area. As noted above, these remains have been placed under some twenty named species. The most magnificent of all is *B. regius* Hay from Kansas, in which the spread between core tips was approximately six feet. Other large forms are seen in the types of *B. chaneyi* Cook and *B. latifrons* Leidy. The smaller-horned forms include the types of *B. antiquus* Leidy, *B. taylori* Hay and Cook, *B. oliverhayi* Figgins, *B. texanus* Hay and Cook and *B. californicus* Rhoads. The Alaskan type, *B. crassicornis* Richardson, is, as noted above, of an individual of about the size of the Alaskan type, *B. occidentalis* Lucas, and of similar small size compared to the type specimen of *B. alaskensis* Rhoads. (See opposite measurement table.)

As noted on a preceding page, for the purpose of a preliminary survey, the recorded Quaternary forms are grouped in the following lists under *Bison* and *Superbison* according to area of occurrence.
P-

V-

I--,
' -

%--

0-.
0-

eH 0OCO.COV-4
roow
r00%-10

1-o

-

La
t,.

'0

A;'

rj

z

¢4

:2

Z

ms
CamO2mm m mm mm
g! w

*
.
*

G~~~~

as.

e-I-.
-%
10110

-_
Co
*

n

a

co

-

-

--4
=
*

.

V-

0


Summary of Recorded Quaternary Species and Races

(A) East of the Mississippi

(1) *Superbison latifrons* (Harlan, 1825), from Kentucky.
   **Type.**—Fragment of skull with horn-cores, A.N.S.P. Coll.

(1x) *Bison antiquus* Leidy (1852), from Kentucky.
   **Type.**—Partial horn-core, A.N.S.P. Coll.

(2a–g) *Superbison* or *Bison* species (remains fragmentary), from:

(2a) Florida.
   **Example.**—Skull, N.M. Coll.

(2b) Georgia.
   **Example.**—Ramal fragment, A.N.S.P. Coll.

(2c) South Carolina.
   **Example.**—Teeth.

(2d) Pennsylvania.
   **Example.**—Remains of three individuals.

(2e) Massachusetts.

(2f) New York.
   **Example.**—Skull, Syracuse Univ. Coll.

(2g) Mississippi.
   **Example.**—Teeth, A.N.S.P. Coll.

(3) *Superbison* species, from Ohio.

(3x) *Bison sylvestris* Hay (1915), from Ohio.
   **Type.**—Portions of skull and right ramus, Norwalk (Ohio) Mus. Coll.

(3x–1) *Bison* species, from Indiana.
   **Example.**—Skull, Earlham College Coll., Richmond, Indiana.

(B) West of the Mississippi

(4) *Superbison* species, from Snake River, Idaho.
   **Example.**—Skull, C. W. Greene Coll. in Stanford Univ

(4x) *Bison* species, from Iowa.
   **Example.**—Fragment with single horn-core, N.M.2349.

(5) *Superbison alleni* (Marsh, 1877), from Kansas.
   **Type.**—Left horn-core, Y.P.M.911.

(5a) *Superbison crampianus* (Cope, 1894), from Kansas.
   **Type.**—Portions of skull and horn-cores, A.N.S.P.3.

---

1 According to Lucas (1899, p. 756) *Bos scaphoceras* Cope, type from Nicaragua, equals *Ovis*; *Bison alticornis* Marsh equals *Triceratops*; and *Bison appalachicolus* Rhoads equals *Ovibos*. 
Frick, Horned Ruminants. III—Bovidae

(5b) **Superbison regius** (Hay, 1914), from Kansas.
   **Type.**—Skull, A.M.14346.

(5x) **Bison** species of Williston’s mount, from Kansas.
   **Example.**—Mounted skeleton, Kansas Univ. Mus. Coll.

(5x⁻¹) **Bison kansasis** McClung (1905), from Kansas.
   **Type.**—Horn-core and partial cranium, Kansas Univ. Coll.

(6) **Superbison ferox** (Marsh, 1877), from Nebraska.
   **Type.**—Broken horn-core, Y.P.M.910.

(6a) **Superbison angularis** (Figgins, 1933), from Nebraska.
   **Type.**—Portion of skull with horn-cores, Hastings Mus. 4710 [Col.M.11641].

(6b) **Superbison rotundus** (Figgins, 1933), from Nebraska.
   **Type.**—Portion of skull with horn-cores, Col.M.1187.

(6x) **Bison** species, from Nebraska.
   **Example.**—Assembled skeleton, N.S.M.1-31-11-31.

(7x) **Bison taylori** Hay and Cook (1928), from New Mexico.
   **Type.**—Skeleton, Col.M.1236.

(7x⁻¹) **Bison oliverhayi** Figgins (1933), from New Mexico.
   **Type.**—Crushed skull, Col.M.1240.

(8) **Superbison chaneyi** (Cook, 1928), from Texas.
   **Type.**—Partial skull with horn-cores, Col.M.1147.

(8x) **B. (Stelabison) francisi** Figgins (1933), from Texas.
   **Type.**—m³, Col.M.1363.

(8x⁻¹) **B. (Simobison) figginsi** Hay and Cook (1930), from Texas.
   **Type.**—Mount, Col.M.574.

(8x⁻²) **Bison texanus** Hay and Cook (1928), from Texas.
   **Type.**—Skull and partial skeleton, Col.M.629.

(9) **Superbison arizonica** (Blake, 1898), from Arizona.
   **Type.**—Horn-cores, Univ. Ariz. Mus. Coll.

(10x) **Bison californicus** Rhoads (1897), from California.
   **Type.**—Posterior cranium with both horn-cores, A.N.S.P.297.

(10x⁻¹) **Bison** species (Condon, 1902), from Oregon.
   **Example.**—Skull, (?Univ. Oreg. Coll.

(10x⁻²) **Bison** species, from Valley of Mexico.
   **Example.**—Detached m³, F.A.M.23346.

(c) **Alaska**

(11) **Superbison crassicornis** (Richardson, 1854), from Alaska.
   **Type.**—Portion of skull with broken horn-cores, Brit. Mus. 1A.
(11a) *Superbison occidentalis* (Lucas, 1898), from Alaska.  
**Type.**—Partial skull with horn-cores, N.M.4157.

(11b) *Superbison alaskensis* (Rhoads, 1897), from Alaska.  
**Type.**—Skull and horn-cores, Univ. Penna. 13754.

**Recent Species and Subspecies**

(12) *Bison bison* (Linnaeus), genotypic species, Recent.

(12x-1) *Bison bison* Figgins (1933) (Southern form), from Texas.  
**Example.**—Skull and teeth, Col.M.628.

(12x-2) *Bison bison septemtrionalis* Figgins (1933) (Northern form), from Nebraska.  
**Type.**—Skull, Col.M.1362.

(12x-3) *Bison bison* haningtoni Figgins (1933) (Highland form), from Colorado.  
**Type.**—Mount, Col.M.2.

(12x-4) *Bison bison* oreonius Bailey (1932), from Oregon.  
**Type.**—Skull and skeleton, N. M. Biol. Surv. Coll. 250145.

(13) *Bison bison athabascs* Rhoads (1897) (Woodland form), from Canada.  
**Type.**—Adult male, Geol. Mus., Ottawa, Canada.

(14) *Bison bison* pennsylvanicus Shoemaker (1915), from Pennsylvania.

**Detailed Lists of Types, Referred Specimens, and Synonymy**

(A) **East of the Mississippi**

(1) *Superbison latifrons* (Harlan)

*From Kentucky*  
*Bos latifrons* Harlan, 1825, Fauna Americana, p. 273.  

**Type.**—Fragment of skull with A.N.S.P. Coll. From Big Bone Lick, Kentucky.  
(Spread = 6 feet from tip to tip.)  
Figured by Leidy, 1852, Pl. 1.

(1x) *Bison antiquus* Leidy

*From Kentucky*  
*Allen*, 1876, American Bisons, Living and Extinct, p. 21 (in part).  
*Hay*, 1913, Proc. U. S. Nat. Mus., XLVI, p. 164, Text-Fig. 1.
Frick, Horned Ruminants. III—Bovidae

*Bos priscus* LYDEKKER, 1898, Wild Oxen, Sheep and Goats of All Lands, p. 61.

**Type.**—Partial horn-core on A.N.S.P. Coll. From Big Bone Lick, Kentucky.
Figured by Leidy, 1852, Pl. II, Fig. 1; by Lucas, 1899, Pls. LXVII and LXVIII; by Hay, 1913, Text-Fig. 1.

(2a) (?)Superbison or *Bison* species

From Florida


**Example.**—Imperfect skull. N.M. Coll. From Withlacoochee River, Florida.
Metacarpal. N.M.1989 From Peace Creek, Florida.
Detached teeth. From Peace Creek, Florida.

(2b) (?)Superbison or *Bison* species

From Darien, Georgia


**Example.**—Fragment of ramus with teeth. A.N.S.P. Coll. From Darien, Brunswick, Georgia.
Figured by Owen, 1847, Pl. vi.

(2c) (?)Superbison or *Bison* species

From South Carolina


**Example.**—Teeth. From Ashley River, South Carolina.
(2d) (?)Superbison or Bison species
From Pennsylvania


**EXAMPLE.**—Remains of three individuals of *Bos.* From Port Kennedy Cave, Pennsylvania.

(2e) (?)Superbison or Bison species
From Massachusetts

*Bison bison* (LINNÆUS), ALLEN (G.M.), 1920, Journ. Mamm., I, p. 161, Fig. 2. HAY, 1923, Carn. Inst. Wash. Pub. 322, p. 266.

**EXAMPLE.**—Maxilla of a calf. Boston Soc. Nat. Hist. Coll. From Orleans, Cape Cod. Collected by Dr. A. W. Grabau. Figured by Allen, 1920, Fig. 2.

(2f) (?)Superbison or Bison species
From New York


**EXAMPLE.**—Skull of bison. Syracuse Univ. Coll. From Syracuse, Onondaga County, New York.

(2g) (?)Superbison or Bison species
From Mississippi


(3) Superbison species
From Ohio

*Bison latifrons* (HARLAN), LUCAS, 1899, Proc. U. S. Nat. Mus., XXI, p. 769, Pl. LXXXII. HAY, 1913, ibid., XLVI, p. 193, Pl. XIX, Fig. 1; 1914, Ann. Rept. for 1912, Iowa Geol. Surv., XXIII, p. 327, Pl. XLII, Fig. 1.
EXAMPLE.—Horn-cores and intervening part of forehead.  From Brush Creek, Adams County, Ohio.  Figured by Lucas, 1899, Pl. LXXIX, anterior and superior views; by Hay, 1913, Pl. xix, Fig. 1; 1914, Pl. XLII, Fig. 1 (after Allen).

(Above large-sized species probably distinct from B. sylvestris.)

(3x) **Bison sylvestris** Hay

*From Ohio*


**Type.**—Portions of rear of skull and part of right ramus, with last premolar and anterior two molars.


(3x−1) **Bison species**

*From Indiana*


**Example.**—Skull.  From Vincennes, Indiana.  Figured by Hay, 1913, Text-Figs. 2, 3; 1914, Figs. 100, 101.

(B) **WEST OF THE MISSISSIPPI**

(4) **Superbison species**

*From Snake River, Idaho*


**Example.**—Skull.  From Snake River, Idaho.  Figured by Lucas, 1899, Pls. LXXIX, LXXX.

C. W. Greene Coll. in Stanford Univ.  According to Hay, 1914:

- Length of horn-core, upper curve = 720 mm.
- Circumference at base of horn-core = 480

Two molars.  N.M. Coll.  Collected by W. H. Hackney on south bank of Snake River, 10 miles from Glens Ferry, Idaho.
Bison species

From Iowa


**Example.**—Fragment with single horn-core.

According to Hay, 1914:

Length of horn-core, upper curve = 300 mm.

" " " lower curve = 375 mm.

(5) Superbison alleni (Marsh)

From Kansas


**Type.**—Left horn-core.

Y.P.M.911 From Blue River, Manhattan, Kansas.

Figured by Lucas, 1899, Pls. LXXVII, LXXVIII.

(5a) Superbison crampianus (Cope)

From Kansas


**Type.**—Portion of skull anterior to the orbits, greater part of left horn-core and smaller part of right horn-core.

A.N.S.P.3 From Wellington, "near the middle of the southern part of Kansas."

Figured by Cope, 1894, Pl. XXII, Figs. 1–4.

[According to Cope (1894), length of horn-core on outside curve = 720 mm.]

(5b) Superbison regius (Hay)

From Kansas


**Type.**—Skull.

A.M.14346 From Hoxie, Sheridan County, Kansas.

Figured by Hay, 1913, Pl. XVIII, Figs. 1, 2; 1914, Pl. XLII, Figs. 2, 3.
(5x) **Bison species**

From Kansas

*Bison antiquus* Leidy, referred Stewart, 1897, Kans. Univ. Quart., VI, No. 3, p. 127, Pl. xvii, Fig. 2. Lucas, 1899, ibid., VIII, No. 1, p. 17, Pl. ix, Fig. 1.


**EXAMPLE.**—Mounted skeleton. Kans. Univ. Mus. Coll. [Williston mount] From Logan (or Gove) County, Kansas. Collected and mounted by H. T. Martin. Figured by Stewart, 1897, Pl. xvii, Fig. 2 (side view of skull); by Lucas, 1899, Pl. ix, Fig. 1 (posterior view of skull); Fig. 2 (side view of skull and jaws); 1899, Pl. Ixxvi (superior view); by McClung, 1908, Pl. xiv; by Hay, 1913, Text-Figs. 4, 5 and 6; 1914, Text-Fig. 102.

(C. B. Schultz considers the specimen to resemble *B. taylori* and to come from the same general horizon.)

(Referred by Stewart, 1897, to *B. antiquus*; by Lucas, 1899, and McClung, 1908, to *B. occidentalis*.)

(5x⁻¹) **Bison kansensis** McClung

From Kansas


**TYPE.**—Horn-core and hinder part of skull. Kans. Univ. Coll. From 1½ mi. E. of North Lawrence, Kansas. Secured by C. H. Sternberg. Figured by McClung, 1905, Fig. 10.

(6) **Superbison ferox** (Marsh)

From the "Lower Pliocene" of Nebraska


**TYPE.**—Broken horn-core. Y. P. M. 910 Figured by Lucas, 1899, Pl. Ixxx.

(Estimated as measuring 560+ mm. in length when complete.)
TENTATIVELY REFERRED SPECIMEN (doubtfully reported by Matthew and Cook [1909] from the Snake Creek Tertiary, representing an individual of larger size than any of the Alaskan remains).

Right ramus with p\(_4\) (br.)- A.M.14135 1908.

m\(_1\)-m\(_2\) = 115 mm., versus Recent Bison [A.M.(M.)3758] = 104 mm.

(6a) **Superbison angularis** (Figgins)

From Nebraska

Unnamed *Bison* species Figgins, 1931, Proc. Col. Mus. Nat. Hist., X, No. 3, p. 22, Pls. i, Fig. 2, No. 1; ii, Fig. 3, No. 1; and iii, Fig. 4, No. 1.

*Bison angularis* Figgins, 1933, ibid., XII, No. 4, p. 23, Pl. iv.

**Type.**—Portion of skull with horn-cores.


Figured by Figgins, 1931, Pls. i, Fig. 2, No. 1; ii, Fig. 3, No. 1; and iii, Fig. 4, No. 1; 1933, Pl. iv.

(Measures, tip to tip, 1541 mm. and outer curve, 845 mm.)

(6b) **Superbison rotundus** (Figgins)

From Nebraska

Unnamed *Bison* species Figgins, 1931, Proc. Col. Mus. Nat. Hist., X, No. 3, p. 22, Pls. i, Fig. 2, No. 2; ii, Fig. 3, No. 2; and iii, Fig. 4, No. 2.

*Bison rotundus* Figgins, 1933, ibid., XII, No. 4, p. 24, Pl. v.

**Type.**—Portion of skull with horn-cores.

Col. M.1187 (Measures, tip to tip, 1578 mm.) From Dorchester, Saline County, Nebraska (A. M. Brookings, Director, Hastings Museum).

Figured by Figgins, 1931, Pls. i, Fig. 2, No. 2; ii, Fig. 3, No. 2; and iii, Fig. 4, No. 2; 1933, Pl. v.

(6x) **Bison** species

From Nebraska

*Bison occidentalis* Lucas, Barbour and Schultz, 1932, Bull. Nebr. State Mus., I, No. 32, p. 263, Fig. 163.

**Example.**—Assembled skeleton.

N.S.M.1-31-11-31 From 8 mi. S.W. of Grand Island, Hall County, Nebraska.

Figured by Barbour and Schultz, 1932, Fig. 163.

Messrs. Barbour and Schultz now consider the specimen to resemble the New Mexican *B. taylori*. (Communicated.)
(7x) **Bison taylori** Hay and Cook

From Folsom, New Mexico


*Bison sp. indet.* Hay and Cook, 1930, ibid., IX, No. 2, p. 30, Pl. x, Fig. 1.

*Stelabison taylori* (Hay and Cook), Figgins, 1933, ibid., XII, No. 4, p. 20, teeth figured Pl. 1, Figs. 3, 4.

**Type.**—Skeleton.

*Col.M.1236* From 8 mi. W. of Folsom, New Mexico.

Figured by Hay and Cook, 1930, Pl. VIII, Figs. 1, 2; Pl. x, Figs. 2, 3; by Figgins, 1933, Pl. 1, Figs. 3, 4 (teeth).

[Cores of medium length and moderately curved, slighter than in *B. texanus*. Figgins (1933) figures *m*₃ with column, as in *B. occidentalis*, and, on character of external molar styles, transfers the species to *Stelabison*.]

**Tentatively Referred.**—

**Skull.**

*Col.M.1237* From Folsom, New Mexico.

Figured by Hay and Cook, 1930, Pl. x, Fig. 1 (indeterminate).

Figgins (1933, p. 20) indicates that Cook (Hay and Cook, 1930) considers the specimen as merely the female of *B. taylori*, but that he himself considers it as of *B. occidentalis* referred.

Left partial ramus with p₃-m₄(br.). (w)  

m₂ = (40) mm.

*F:A.M.30973* From Santa Fé Pleistocene, New Mexico, 1925.

Right fragment with p₂ (br.)-m₁. (m)

*F:A.M.30974* From Santa Fé Pleistocene, New Mexico, 1925.

Left metatarsus.

*F:A.M.30975* From Hot Springs, New Mexico, 1928.

(7x⁻¹) **Bison oliverhayi** Figgins

From New Mexico


**Type.**—Crushed skull. (w+)

*Col.M.1240* From Folsom, New Mexico.

Figured by Figgins, 1933, Pl. III.

**Referred by Figgins.**—

Crushed skull.

*Col.M.1360* From Scotts Bluff, Nebraska.

Figured by Figgins, 1933, Pl. II, Figs. 5 and 6 (dentition).

Crushed skull.

From Oklahoma.
(8) Superbison chaneyi (Cook)
From Vernon, Texas

Unnamed *Bison* species, Figgins, 1931, ibid., X, No. 3, p. 22, Pls. 1, Fig. 2, No. 3; II, Fig. 3, No. 3; and III, Fig. 4, No. 3.

**Type.**—Partial skull with horn-cores. From Vernon, Texas. Figured by Cook, 1928, Figs. 1, 2; by Figgins, 1931, Pls. 1, Fig. 2, No. 3; II, Fig. 3, No. 3; and III, Fig. 4, No. 3.

(Horns like “cupid bow.” Size compares with largest known. Length on upper curve = 42 inches.)

**Tentatively Referred.**—

Four teeth in ramal fragment.

(Provisionally referred by Lucas [1899] to *B. latifrons*.)

**Cranium.** From Onion Creek, Travis County, Texas. Figured by Carpenter, 1846, Figs. 1, 2; by Hay, 1913, Pl. xix, Fig. 3 (after Blake).

The numerous references to this cranium in the literature are as follows:


(8x) *Bison* (Stelabison) francisi Figgins
From Texas


**Type.**—m2. From Hearne, Robertson County, Texas. Figured by Figgins, 1933, Pl. II, Figs. 1, 2 (of m2).

**Referred.**—

Partial horn-core and mandibular ramus. From Waco, Texas.

Referred by J. D. Figgins, etc. fragmental specimens in the collection of the Agricultural and Mechanical College, College Station, Texas.
(8x⁻¹) **Bison (Simobison) figginsi** Hay and Cook

From Texas

Cook, 1928, ibid., VIII, No. 3, p. 35.

*Simobison figginsi* Hay and Cook, 1930, ibid., IX, No. 2, p. 23, Pl. vii, Figs. 1, 2.


**Type.**—Mount.  
Col. M. 574  
From Colorado, Mitchell County, Texas.  
Figured by Hay and Cook, 1930, Pl. vii, Figs. 1, 2.

**Questionably Referred.**—

Portion of cranium with base of right horn-core.  
F: A. M. 23347  
From 9 mi. W. of Silverton, Texas.

(8x⁻²) **Bison texanus** Hay and Cook

From Dawson County, Texas

*Bison texanus* Hay and Cook, 1928, Proc. Col. Mus. Nat. Hist., VIII, No. 2, Pt. 1, p. 33; 1930, ibid., IX, No. 2, p. 25, Pls. viii, Figs. 3–5; ix, Figs. 1–3; and x, Fig. 1.

**Type.**—Skull and partial skeleton.  
Col. M. 629  
From Michies, Dawson County, Texas.  
Figured by Hay and Cook, 1930, Pls. viii, Figs. 3–5; ix, Figs. 1–3; x, Fig. 1.

**Referred from Type Locality.**—

Partial skull.  
(w+)  
Col. M. 631

(9) **Superbison arizonica** (Blake)

From the Quaternary of Arizona

*Bos arizonica* Blake, 1898, Amer. Geol., XXII, p. 65.


**Type.**—Horn-cores.  
Univ. Ariz.  

[Lucas (1899, p. 756) considered *Bos arizonica* Blake as a synonym of *B. latifrons*.]
Bison californicus Rhoads
From California


Bison californicus Rhoads, 1897, Proc. Acad. Nat. Sci. Phila., XLIX, p. 501, Pl. XII, Fig. 2.


Type.—Posterior cranium with both horn-cores. A.N.S.P.297 From Pilarcitos Valley, near San Francisco, California. Figured by Leidy, 1873, Pl. XXVIII, Figs. 4, 5; by Rhoads, 1897, Pl. XII, Fig. 2; by Lucas, 1899, Pl. LXIX.

Questionably Referred (approximating Superbison in size).—

Left crushed ramus with p4-m3, detached /I, and partial right maxilla with p4-m4. (Probably associated.) (w) m3 = 52 mm. F:A.M.31070, From White Water Canyon, Beaumont, California.

Referred from Rancho La Brea (listed by Asa C. Chandler under B. antiquus).—

Thirteen more or less complete crania of various ages (four with horn-cores practically perfect, four entire with skull perfect or almost so, and five with dentition almost complete) and a large series of rami; in fact, parts of sixteen different animals.

Chandler observed an individual variation in the Rancho La Brea skull to the extent of about 20%.

(10x-1) Bison species (Condon)
From Oregon

Bos latifrons Harlan, Condon, 1902, The Two Islands and What Became of Them (not seen); 1910, A Revision of "The Two Islands," pp. 129, 130, 140, Pl. XXXIX.


Example.—Skull. (?)Univ. Oreg. Coll. From 5 or 6 mi. E. of the Dalles, Oregon. Figured by Condon, 1910, Pl. XXXIX.
(10x-9) **Bison** species

From Valley of Mexico

**EXAMPLE.**—Detached $m_2$. F:A.M.23346 From vicinity of Tesopaco, Mexico. Collected by Howard Scott Gentry and John Hilton, 1936.

**TENTATIVELY REFERRED FROM SAME LOCALITY.**—


(c) **ALASKA**

(11) **Superbison crassicorns** (Richardson)

From Alaska


*Bison priscus* Meyer, Richardson, 1852-1854, Zoology of the Voyage of H.M.S. Herald, pp. 33, 139, Pls. vi, Figs. 5, 6; vii, x, Figs. 1-6; xiii, Fig. 3. Referred Gilmore, 1908, Smithsonian. Misc. Coll., L], p. 34.


**Superbison crassicorns** (Richardson), Nobis, 1930, Nat. Hist., XXX, No. 1, p. 71.

**Type.**—Portion of skull with broken horn-cores. Brit. Mus. 1A From Eschscholtz Bay, Alaska. [Beechey Coll.] Figured by Buckland, 1831, Pl. III, Fig. 1; by Richardson, 1852-1854, Pl. IX.

Circumference of more perfect horn-core at base (according to Richardson, 12.6 inches) = 320 mm.

**Cotype.**—Large horn-core. Brit. Mus. 91 Figured by Richardson, 1852-1854, Pl. xiii, Figs. 1, 2. Circumference at widest point near base (according to Richardson, 15.2 inches) = 386 mm.

Richardson (1852-1854, p. 43): "... it has therefore been considered a horn-core of an older and probably a male individual of the race that produced the skull marked No. 1A, and to which, from the thickness of its horns, I have given the distinctive epithet of *crassicorns*..."
Allen (1876, p. 24) states: "... The differences existing between the remains referred by Richardson to 'B. priscus' and 'B. crassicornis' are not greater than those that obtain between the two sexes of Bison americanus; hence it seems possible that all of the bison remains described from Eschscholtz Bay may belong to one and the same species, the larger representing the male and the smaller the female, of the form Richardson named Bison crassicornis, which is very probably the same as the B. antiquus of Leidy..."

Lucas (1899, p. 761) states: "... The validity of Richardson's Bison crassicornis hinges on the question of the identity of his type I, A, with Leidy's B. antiquus..."

REFERRED BY VARIOUS AUTHORS TO B. crassicornis—TYPE-SIZED SPECIMENS.—

(a) By Lucas:

Horn-core with partial cranium. N.M.1584 From Alaska. Figured by Lucas, 1899, Pls. LXXIII and LXXIV.

Partial skull with broken horn-cores. Univ.Pa.13753 From Point Barrow, Alaska. Figured by Lucas, 1899, Pl. LXXV.

(b) By Gilmore and Hay:

Craniun. N.M.5726 From Little Minook Creek, near Rampart, Alaska. Figured by Gilmore, 1908, Pl. x; by Hay, 1913, Pl. xiv, Figs. 1, 2.

(c) By Holland:

Skull. C.M.3247 From the Yukon, Alaska. Figured by Holland, 1915, Pl. XLIII.

REFERRED BY GILMORE AND HAY TO B. alleni—LARGER THAN TYPE-SIZED [see S. alaskensis (Rhoads)].—


PREVIOUSLY REFERRED TO B. priscus—SMALLER THAN TYPE-SIZED.—

(a) By Richardson:

Partial cranium with horn-cores. Brit. Mus. 24589 From Eschscholtz Bay, Alaska. (Probably represents an unusually small bull or a large cow.)

(b) By Gilmore:

Horn-cores. From the "Palisades" on the Yukon River. [Appear to resemble the Richardson figure (see Pl. xiii, Fig. 3).]

REFERRED TO S. crassicornis, SPECIMENS SECURED BY THE JOINT ALASKA COLLEGE-AMERICAN MUSEUM EXPEDITION.—

While these specimens are placed under the Richardson species, which here is
tentatively considered to include the two Alaskan species of Rhoads and Lucas, the Fairbanks series might be conveniently subdivided, the larger remains being held under *S. crassicornis alaskensis* (Rhoads) and the smaller specimens under *S. crassicornis* proper. As observed above, *S. crassicornis occidentalis* (Lucas) represents an individual differing but slightly from the *S. crassicornis* type specimen, as judged by figures and measurements. The Fairbanks series includes some one hundred and fifty crania and partial crania, nearly two hundred mandibular rami and partial rami, and skeletal remains. (Six crania are nearly complete and three of these retain the dentitions.) See measurement table, page 575, and Figs. 57, 58, for outstanding specimens.

(11a) **Superbison occidentalis** (Lucas)

*From Alaska*

*Bison antiquus* Leidy, referred Allen, 1876, American Bisons, Living and Extinct, p. 21, Pl. iv.


**Type.—** Partial skull with horn-cores. N.M.4157 From Fort Yukon, Alaska. (Richardson, collector) Figured by Lucas, 1899, Pl. lxv; by Hay, 1913, Pl. ix, Figs. 3, 4; 1914, Pl. xxxix, Figs. 2, 3.

[Figgins (1933, p. 18): "...As the type of *Bison occidentalis* consists of only the horncores, frontals and occipital, a question must attach to the characters of the dentition..."]

**Referred by Lucas.—**

Specimens from St. Michael, Fort Yukon, figured by Allen, 1876, Pl. iv, *B. antiquus*.

**Referred by Gilmore.—**

Rear of skull bearing complete horn-cores. N.M.2643 From Old Crow River, Canada. Figured by Gilmore, 1908, Pl. xii; by Hay, 1913, Pl. xi, Figs. 3, 4.

**Referred by Hay.—**

Skull. A.M.13721 From Dawson, Yukon Territory. Figured by Hay, 1913, Pl. x, Figs. 1-8; 1914, Pl. xl, Figs. 1, 2.

Figgins (1933) cites as standing for type of *Stelabison occidentalis*, and figures m$^4$ with pillar, Pl. 1, Figs. 1, 2.
(11b) **Superbison alaskensis** (Rhoads)
From the Pleistocene of Northern Alaska


**TYPE.**—Skull and horn-cores. Univ. Pa. 13754 From near Point Barrow Alaska. Figured by Rhoads, 1897, Pl. xii, Figs. 3, 6.

The type specimen (Univ.Pa.13754), as shown in the measurement table (page 575), exceeds in dimensions the largest of the Fairbanks crania. Were it desired to divide the Alaska remains according to size, the smaller specimens would be referred to *S. crassicornis* proper, which *S. crassicornis occidentalis* (Lucas) approximates, and the larger to *S. crassicornis alaskensis* (Rhoads).

**RECENT SPECIES AND SUBSPECIES**

**XI. BISON H. SMITH**

Genotypic species, *Bison bison* (Linneus)

The Recent remnants of the genus in North America have been placed in a species and five subspecies.

**(12x-1)** \*Bison bison bison* Figgins

**Southern Form**


*Bison bison bison* FIGGINS, 1933, ibid., XII, No. 4, p. 27, Pl. vi.

**TYPICAL OF SOUTHERN FORM.**—

Skull and teeth. Col.M.628 From Michies, Dawson County, Texas, Figured by Hay and Cook, 1930, Pl. xi, Figs. 2, 3; by Figgins, 1933, Pl. vi.

**(12x-2)** \*Bison bison septemtrionalis* Figgins

**Northern Form**


**TYPE.**—Skull. Col.M.1362 From 6 mi. N.E. of Palmer, Nebraska, Figured by Figgins, 1933, Pl. vii, and also tooth series.

**(12x-3)** \*Bison bison haningtoni* Figgins

**Highland Form**


**TYPE.**—Mount. Col.M.2 From Rock Creek, Park County, Colorado. Figured by Figgins, 1933, Pls. viii, ix.
**1937**

*Frick, Horned Ruminants. III—Bovidae* 593

**Cotype.**—Adult male skull. 

Col. M. 1369 from Alma, Park County, Colorado. 

Figured by Figgins, 1933, Pl. viii.

(12x-4) *Bison bison oregonus* Bailey 

From the Westernmost Point Reached by Buffalo, 
the Blue Mountains of Oregon, Malheur Cave 


**Type.**—Skull and skeleton. 

(Adult male.) 

N. M. Biol. Surv. Coll. 250145 from the dry bed of Malheur Lake, Oregon. 

Collected, 1931, by George M. Benson, Keeper of Malheur Wild Life Refuge.

(Similar in general characters to *Bison bison bison* of southwestern Texas, but slightly larger. With *Bison bison athabascae* there are greater differences. With *Bison occidentalis*, its nearest fossil relative, there is no close connection.)

(13) *Bison bison athabascae* Rhoads 

Woodland Form 

From Canada 

*Bos* or *Bison americanus* (= *Bison bison*). 


**Type.**—Adult male. 

Geol. Mus., Ottawa, Secured presumably in March, 1892, by Indians within 50 mi. S.W. of Canada Fort Resolution, Great Slave Lake.

(Specimen consists of well-mounted skin, with accompanying skull and horn-cores separate.)

(14) *Bison bison pennsylvanicus* Shoemaker 

From Pennsylvania 


Shoemaker (1911, pp. 16, 17) states "...In color the Pennsylvania bison was very dark, many of the old bulls being coal black, with grizzly white hairs around the nose and eyes. The hair was very short, with a tendency to crispness or curliness, especially at the joints. The hump, so conspicuous on the western bison was notable by its absence... The legs were long, and fore and back legs evenly placed, the heavy front and meagre hind-quarters of the western bison were not present, in other words the Pennsylvania bison was a beautifully proportioned beast... Apparently the horns were much like those of *Bison bonasus* of Lithuania and the Caucasus..."
Fig. 59. Protoceratids of the American Tertiary.
Reconstructions × approximately 1.

(c) Protoceras Marsh, of the Oligocene (p. 609)
(b) Syndyoceras Barbour, of the Lower Miocene (p. 607)
(a) Prosynhetoceras, n.subg., of the Late Tertiary (p. 602)
Family IV.—Protoceratidae
(Marsh, 1891)

Division.—Protoceratini

Subfamily 1.—Synthetoceratinae

I. Synthetoceras Stirton
II. Prosynthetoceras, n. subg.

Subfamily 2.—Syndyoceratinae

III. Syndyoceras Barbour

Subfamily 3.—Protoceratinae

IV. Paratoceras, new genus
V. Protoceras Marsh (and Calops Marsh)
VI. Pseudoprotoceras Cook

Figures 2C, 59–63 and (in part) 2, 2A, 23, 65, 66

The Protoceratidae of Marsh embraces the peculiar rostral-horned forms of the American Tertiary exemplified in Protoceras of the early Middle Tertiary and the new Paratoceras of the Late Tertiary; Syndyoceras of the Middle Tertiary; and Synthetoceras and the new Prosynthetoceras of the Late Tertiary. The rostrocranial armament and enlarged saber-form upper canines of the males, the small uninflated tympanic and the short detached metacarpals are outstanding characters. It is unexpected to discover in the Late Tertiary large and spectacular representatives of a family believed to have been extinct since the Middle Tertiary. Perhaps the survival of these strange creatures, with primitive auditory bullae and limbs, actually may have been due in considerable measure to their unique defensive armament.

The cranial processes of the Protoceratidae, ostensibly a different adaptation from the horn-pedicles of the Cervidae and the horn-cores of the Antilocapridae, recall in some degree the horn processes of certain of the Giraffidae. There is evident need for further comparative study of
the cranial armament of all five Artiodactyl families. The present family at once differs from the Cervidae, Antilocapridae and Bovidae in the remarkable development of the muzzle with its unique rostral horn or horns, and in the form of the auditory area, dentition and feet. The specialization of the muzzle is greater than in the case of the Bovid Saiga or Oreodont Cyclopidius. The four-toed manus parallels the similar primitive condition in the Hypertragulidae. It is largely on the foot characters that Protoceras has from time to time been placed in the latter family.

Since this chapter was originally sent to press, our party, under John Lynch, operating at the MacAdams Ranch, Clarendon, Texas, type locality, has obtained four skulls with orbital and forked rostral horns, a palate with unworn dentition and seven partial mandibles of Synthetoceras. The crania and mandibles exhibit the loss of p2 and reduction of p3. A fifth cranium of a more primitive form has been discovered in southeastern Texas, the same differing from the above specimens in its considerably smaller size, retained p2s and notably smaller, short-crowned molars. This specimen has been available for study through the helpful cooperation of Dr. Mark Francis of the Agricultural and Mechanical College of Texas. It is made the type of Prosynthetoceras francisi, named in honor of Dr. Francis. Paratoceras is based on a mandibular ramus from the MacAdams Ranch quarry. It is of smaller size than the above specimens and differs markedly from Synthetoceras in the large and nonreduced premolars and low-crowned molars, in these characters more resembling Protoceras of the White River. (Certain relatively diminutive and more Leptomeryx-sized remains of heretofore unobserved form from the Late Tertiary of Nebraska and New Mexico are referred to a new genus, Pseudoceras, and briefly discussed in the Appendix. When better known, these remains possibly may prove to be allied more nearly to the Protoceratidae than to the Camelidae.)

While it might be preferable to refer the three genera, Synthetoceras, Syndyoceras and Protoceras, to distinct divisions, the same are here considered as of one Protoceratini division of three subfamilies:

1.—SYNTHETOCERATINÆ. Late Tertiary.
2.—SYNDYOCERATINÆ. Middle Tertiary.
3.—PROTOCERATINÆ. Middle and Late Tertiary.

(Description continued p. 602)
**TABLE XIV**

**PROTOCERATID GENERA, SUBGENERA AND SPECIES OF THE AMERICAN MIDDLE AND LATE TERTIARY—Occurrence and Totals of Available Specimens**

[Roman and Arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in () from type area for the particular species. (See Introduction, page 7.)]

<table>
<thead>
<tr>
<th>Genus Number</th>
<th>Late Tertiary</th>
<th>Genus Number</th>
<th>Middle Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clarenceon ( &amp; *E. Section, Tex.</td>
<td></td>
<td>Harrison, Nebr.</td>
</tr>
<tr>
<td></td>
<td>Sioux ( &amp; Dawes Co., Nebr.</td>
<td></td>
<td>Protoceras ( &amp; Chadron,</td>
</tr>
<tr>
<td></td>
<td>Specimen Count</td>
<td></td>
<td>Nebraska, White</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>River, S. Dak.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Specimen Count</td>
</tr>
<tr>
<td><strong>Protothetani</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthetoceras Stirton</td>
<td>I (1) (1a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prosynthetoceras, n. subg.</td>
<td>II (2) (3) (3a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paratoceras, n.g.</td>
<td>IV (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total 25</td>
<td></td>
<td>Total 29</td>
<td></td>
</tr>
<tr>
<td>Grand Total 54</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUMMARY OF PROTOCERATINI SPECIMENS**

<table>
<thead>
<tr>
<th>Genus No.</th>
<th>Genus</th>
<th>Cranis</th>
<th>Horns</th>
<th>Maxille</th>
<th>Mandibles</th>
<th>Limbs</th>
<th>Total Elements</th>
<th>Age of Elements</th>
<th>Total Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Syndyoceras Barbour</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>V</td>
<td>Protoceras (and Calops) Marsh</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>Pseudoprototheria Cook</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>27</td>
<td>30</td>
<td>20</td>
<td>14</td>
<td>101</td>
<td>47</td>
<td>54</td>
<td></td>
</tr>
</tbody>
</table>

[ ] associated.

* refers to locality as shown in column heading.

Alignment of Late and Middle Tertiary forms is not intended to indicate actual ancestry.
Fig. 63. A.M.643, Protoceras celer Marsh, ref., from South Dakota.
T.A.M.C., Prosynthetoceras francisi, subgenotype, from San Jacinto County, Texas.
Dorsal views of skulls × ½; anterior view of rostral horn × ½. A, B, cross sections of horns; MA, auditory meatus; OC, occipital condyle; PP, paroccipital process; RF, rostral foramen; RH, rostral horn; SF, suborbital foramen. (See also Figs. 60, 62 [A.M.643]; 2, 2A, 60-62 [T.A.M.C.]; and pages 612, 608.)
Detailed Lists of Types, Referred Specimens, and Synonymy

Total available specimens, 54: *Synthetoceras*, 20; *Prosynthetoceras*, 3; *Syndyoceras*, 2; *Paratoceras*, 2; *Protoceras* (and *Calops*), 26; *Pseudoprotoceras*, 1.

SUBFAMILY 1.—SYNTHETOCERATINÆ


Reconstruction, Figure 59A

The genus and genotypic species, *S. tricornatus*, rests on a crushed skull collected in the vicinity of Clarendon, Texas, by R. A. Stirton in 1931. The dentition has heretofore been unknown. A very beautifully preserved skull and other remains lately secured at the type locality afford welcome evidence as to certain characters of the cranium and dentition. The particular skull (Figs. 61, 62) is of a considerably smaller individual than the majority of the referred remains, which approximate the type in size (see measurement table, p. 606). The specimen may represent a female. The genus is noteworthy for the great forked horn that rises from near the tip of the muzzle. The skull otherwise indicates a very large and highly specialized *Protoceras*. The rostral horn evidently was derived through union of maxillary processes such as occur in the White River genus. The unobstructed nasal passage through the horn base has an opening dorsally and behind the horn. The paired frontal horns are of triangular basal cross section and situated quite posterior to the orbits. They seem to represent enlarged derivatives of the postorbital processes of *Protoceras*. The arrangement (see Figs. 2A, 62) of the paroccipital, mastoid and auditory area is peculiar to the two genera. Through the posterior position of the paired horns the cranium has the false appearance of being foreshortened. The genus differs from *Protoceras* in the elongation of the muzzle, loss of p1 and greatly reduced premolars. Stirton has observed foramina in the rostral horn on the lateral face below the fork and at the base, giving access to channels within the horn. Diagonally backwardly-passing surface channels connect the dorsal orifice posterior to the horn with the infra-orbital foramina, and a second pair of surface grooves pass from the latter to the supra-orbital foramina. The skull is noteworthy for its elongation and slenderness, the prominence of the large and posteriorly placed orbits, the wide flare of the premaxillæ, the canals running posteriorly from the incisive foramina, the deeply indented posterior palate, the long, slender paroccipitals, the small uninflated bullæ, the slight sagittal crest and the development of the temporal crests and strongly produced inion. Marked tuberosities occur on the anterior and inferior base of the paired horns and above the infra-orbital foramina. This
foramen lies just below the posterior corner of the postrostral opening. The C/ alveoli are small. A questioned and much smaller species, (?)S. rileyi, n.sp., is described from the southeast portion of the state.

The subgenotypic species, Prosynthetoceras francisi, is based on a cranium from southeastern Texas, which differs from the genus proper in its smaller size, notably smaller and shorter-crowned teeth, the retention of p² and the prominence of the C/ alveolus. A partial mandible from Sioux County, Nebraska, is made the type of a distinct species, P. siouxensis, and a rostral horn from Dawes County is indicated as a subspecies of the latter.

Four species and one subspecies of the genus and subgenus are recognized:

(1) Synthetoceras tricornatus Stirton, genotypic species, from Donley County, Texas.

Genotype.—Skull, U.C.31520.

(1a) (?)Synthetoceras rileyi, n.sp., from Walker County, Texas.

Type.—Partial mandible, F:A.M.34181. This paper, Fig. 66.

(2) Prosynthetoceras francisi, n.subg. and sp., from vicinity of Coldspring, San Jacinto County, Texas.

Subgenotype.—Skull, T.A.M.C. This paper, Figs. 2, 2A, 60, 61, 62, 63.

(3) Prosynthetoceras siouxensis, n.sp., from Sioux County, Nebraska.

Type.—Left ramus, A.M.17344. Figured by Matthew, 1918, Fig. 20.

(3a) Prosynthetoceras siouxensis dawesensis, n.subsp., from Dawes County, Nebraska.

Type.—Rostral horn, F:B:A.M.34022. This paper, Fig. 2C.

(1) Synthetoceras tricornatus Stirton, genotypic species

From the Clarendon of Texas


Genotype.—Skull with backwardly and inwardly curving paired frontal, and single median biforked nasal horns, m²–m³, and alveoli of m₁–p₁.

REFERRED FROM THE VICINITY OF THE TYPE.—

Four crania or partial crania:

Beautifully preserved skull with rostral and orbital horns, and dentition. (w)

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.L.</td>
<td>395 mm</td>
</tr>
<tr>
<td>Premaxilla-occipital condyle, incl.</td>
<td>443</td>
</tr>
<tr>
<td>Width over orbits</td>
<td>138</td>
</tr>
</tbody>
</table>

See measurement table, page 606.

Crushed cranium with paired orbital and forked rostral horns, left m²-m³. (w+)

(Cranium as large but horns slighter than in the type specimen. Portion of right side of specimen missing. The three horns, muzzle, left orbit and condyles well preserved.)

Disintegrated skull with left and part of right orbital horn, rostral horn with left fork missing, and p¹-m² of both sides. (w)

Posterior portion of cranium with right and base of left orbital horn, and palatal area with rostral horn, forks broken, and p¹-m² of both sides. (m+)

Two maxillary specimens:

Palate with p²-m². (m+)  
(Base of rostral horn and outline of nasal opening, supra-orbital foramen and alveolar troughs preserved. Ms/tall with anterior and median basal projections; ps/reduced; p² lost; p³ peculiarly formed, inner loph low, un-notched; styles tending to meet.)

Right immature maxilla with dp¹-dp⁴ and m¹-m³.

Six mandibular specimens:

Left ramus with part of symphysis and p⁴-m⁴. (m+)

Approximates in size the type skull (as seen in cast). Incisive border broadly flared, inferior posterior symphysis hollowed, diastema moderate, p₁-p₄ lost, p₅ and especially p₆ reduced, m₃ anteroposteriorly elongate and tall-crowned.
Partial mandible with symphysis and left p4 alveolus-m3. (w) F:AM.32465
Crushed mandible with I1-I3 and p3-m3. (w++) 32465
Mandible with symphysis and p3-m3. (w++) 33401
(Transferred to the University of Nebraska.)

(F:AM1.32468) Fig. 61

Left ramus with diastema, I3 root and p4(br.)-m3. (w) 33408

(F:AM1.33408) Fig. 61

Mandible with symphysis and dp2-dp4. 33420

(F:AM1.33410) Fig. 62

Right radius, 247 mm., and ulna. 33410
Left radius with proximal and distal portions of ulna. 33410A

(F:AM1.33410) Fig. 61

(1a) (?) Synthetoceras rileyi, new species

From the Vicinity of Huntsville, Walker County, Texas, 1936
(Premolars less reduced)

Type.—Right ramus with p3-m1 and left m1-m3. (m++) F:AM.34181
Collected by Claude Riley.

This paper, Fig. 66.

p2-p4 = 26, p1-p3 = 19, m1 = 21, p3-m3 = 76.8 mm.

(Not included in specimen count.)

(2) Prosynthetoceras francisi, new subgenus and species

From the Vicinity of Coldspring, Texas, 1935

The type cranium (Figs. 2, 2A, 60–63), as noted above, differs from the Donley County crania in its considerably smaller size and notably smaller and shorter-crowned dentition and retained p1. What evidently is the alveolus of an enlarged canine occurs at the anterior base of the rostral horn. The cranial characters are better shown than in several of the Clarendon skulls. Lacrimal vacuities, as in the case of Protoceras, are absent. The inverted U-shaped supra-occipital area, the peculiar paroccipital processes and peculiarly constricted bullae are well shown. The paired postorbital horns are broken; the rostral horn is proportionately heavy and long-forked. A right ramus from San Jacinto County (F:AM1.34180, Fig. 66), with symphysis, no trace of p5, greatly reduced p1-p4 and m1-m3 of approximately the size of the type specimen, is tentatively referred to the same. (p1-p3 = 17.7, m3 = 28 mm.)
**SUBGENOTYPE.**—Skull with C/alveolus, p\(^2\)-m\(^3\), rostral horn and bases of paired horns. (M\(^+\))

**REFERRED.**—Right ramus, F:A.M.34180; right maxilla, 34182. (Not counted.)

<table>
<thead>
<tr>
<th>Synthetoceras tricornatus</th>
<th>Prosynthetoceras francisi</th>
<th>Paratoceras macadami</th>
<th>Subgenotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genotype</td>
<td>Referred</td>
<td>Genotype</td>
<td>Genotype</td>
</tr>
<tr>
<td>Foramen magnum to</td>
<td>mm.</td>
<td>mm.</td>
<td>mm.</td>
</tr>
<tr>
<td>anterior face of rostral</td>
<td>((375))</td>
<td>((360))</td>
<td>((330))</td>
</tr>
<tr>
<td>horn</td>
<td>mm.</td>
<td>mm.</td>
<td>mm.</td>
</tr>
<tr>
<td>Vertex to anterior face</td>
<td>407</td>
<td>((400))</td>
<td>390</td>
</tr>
<tr>
<td>of rostral horn</td>
<td>((400))</td>
<td>((400))</td>
<td>(345)</td>
</tr>
<tr>
<td>Width condyles</td>
<td>74</td>
<td>84</td>
<td>73</td>
</tr>
<tr>
<td>Rostral horn:</td>
<td>375</td>
<td>235</td>
<td>245</td>
</tr>
<tr>
<td>Height to fork, vertical</td>
<td>((380))-((315))</td>
<td>((280))-((240))</td>
<td>((250))</td>
</tr>
<tr>
<td>above palate...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total height on ant.</td>
<td>510</td>
<td>380</td>
<td>330</td>
</tr>
<tr>
<td>curve above palate</td>
<td>((485))-((420))</td>
<td>((260))</td>
<td>((450))</td>
</tr>
<tr>
<td>Orbital horn:</td>
<td>350</td>
<td>270</td>
<td>240</td>
</tr>
<tr>
<td>Length on outer curve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greatest spread...</td>
<td>370</td>
<td>((260))</td>
<td>360</td>
</tr>
<tr>
<td>Anteroposterior distance</td>
<td>230</td>
<td>((240))</td>
<td>210</td>
</tr>
<tr>
<td>between rostral and</td>
<td></td>
<td></td>
<td>180</td>
</tr>
<tr>
<td>paired horns...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Series p(^2)-m(^1)</td>
<td>(101)</td>
<td>114-101</td>
<td>101</td>
</tr>
<tr>
<td>(F:A.M.32467)</td>
<td>((105))</td>
<td>117</td>
<td>75</td>
</tr>
<tr>
<td>Pt(^-)-m(^1)</td>
<td></td>
<td></td>
<td>85</td>
</tr>
<tr>
<td>Ramus, p(^2)-ms inclusive</td>
<td>32464</td>
<td>F:A.M.34180</td>
<td>80</td>
</tr>
<tr>
<td>Ramus, p(^2)-ms inclusive</td>
<td></td>
<td></td>
<td>81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Synthetoceras tricornatus</th>
<th>Prosynthetoceras siouzensis</th>
<th>Syndyoceras cooki</th>
<th>Protoceras celer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referred</td>
<td>Type</td>
<td>Genotype</td>
<td>Referred</td>
</tr>
<tr>
<td>F:A.M.33407</td>
<td>A.M.17344</td>
<td>N.S.M.4-7-05</td>
<td>Males</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A.M.1228-643</td>
</tr>
<tr>
<td>Tip of premax. to</td>
<td></td>
<td></td>
<td>Females</td>
</tr>
<tr>
<td>anterior notch of</td>
<td></td>
<td></td>
<td>A.M.1220-6725</td>
</tr>
<tr>
<td>foramen magnum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>395</td>
<td>285(^1)</td>
<td></td>
</tr>
<tr>
<td>Width of condyles</td>
<td>73</td>
<td>((216))-214</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>((41))-38</td>
<td></td>
</tr>
<tr>
<td>Length p(^2)-m(^1) inclusive</td>
<td>101</td>
<td>((81))-69</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclusive</td>
<td>F:A.M.32465</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A.M.1238</td>
</tr>
<tr>
<td>Incisive border to</td>
<td>250</td>
<td>215</td>
<td>(132)</td>
</tr>
<tr>
<td>ms inclusive...</td>
<td></td>
<td>179</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length p(^2)-ms inclusive</td>
<td>110</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length p(^2)-ms inclusive</td>
<td>110</td>
<td>81</td>
<td>72</td>
</tr>
</tbody>
</table>

( ) approximate; (() ) estimated.

\(^1\) And length metatarsus = 130 mm.; communicated by E. H. Barbour, 1934.
(3) **Prosynthetoceras siouxensis**, new species

From Sioux County, Nebraska

The type mandibular ramus in general size and reduction of the premolars resembles the Clarendon rami. The diastema tends to be less elongate and the tooth crowns apparently shorter than in the latter.

(?) **Cranioceras unicornis** MATTHEW, referred MATTHEW, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, p. 224, Fig. 20.

**TYPE.**—Left mandibular ramus with alveoli of three incisors and incisiform canine, unbroken diastema and p2-m3.

Incisive border broadly flared, alveoli of I1-I4 and of adjacent incisiform /C, post-/C diastema moderately long, p1-p4 notably short and heavy, p5-p8 apparently about to be shed, m1 much worn, m2 with median column and cingulum, m3 relatively tall and crown tending to be concave outwardly.

A left ramus with p4-m3 (P.U.12106), referred to (?) **Neotragocerus improvisus** Matthew and Cook by Sinclair (1915), resembles A.M.17344 except in the smaller size of the m3.

(3a) **Prosynthetoceras siouxensis dawesensis**, new subspecies

From Observation Quarry, Dawes County, Nebraska

Collected by T. Galusha, 1936

**TYPE.**—Rostral horn. F:B:A.M.34022 This paper, Fig. 2C.

**TENTATIVELY REFERRED.**—

Right third metacarpal, F:B:A.M.34028 131 mm. long.

(Not included in specimen count.)

**SUBFAMILY 2.—SYNDYOCERATINÆ**

**III. SYNDYOCERAS** BARBOUR

From the Lower Miocene

Reconstruction, Figure 59B

The genus rests on the well-preserved genotype in the collection of the University of Nebraska, described by Erwin Hinckley Barbour. The same is characterized by the unreduced premolars, the paired rostral processes united over dorsal foramen, and paired postorbital horncores. The /C is incisiform, the p1 caniniform. The genotypic and only species is **Syndyoceras cooki** Barbour, from the Harrison of Nebraska.
(1) ** Syndyoceras cooki ** Barbour, genotypic species

From the Lower Miocene, Sioux County, Nebraska

* Syndyoceras cooki * BARBOUR, 1905, Nebr. Geol. Surv., II, Pt. 3 (unpaged), Pl. 1; 1906, Science, XXIII, p. 623. SCOTT, 1913, A History of Land Mammals in the Western Hemisphere, p. 404, Fig. 215.

**Genotype.**—Cranium with mandible and major portion of skeleton. N.S.M.4-7-05 Morrill Collection. Figured by Barbour, 1905, Pl. 1; this paper, Fig. 65 (cast of mandible).

**Tentatively Referred** (communicated by Erwin H. Barbour).—

Femur, tibia, twelve to fourteen vertebrae in articulation, and other unprepared parts. N.S.M.12-9-7-92 Found in large *Daxmontelix* rhizome close to the spot where type specimen was subsequently secured, 20 to 30 feet from Agate Road, 2 mi. from Agate Springs.

**Subfamily 3.—Protoceratinae**

Three genera are recognized:

IV. *Paratoceras*, n.g., from the Late Tertiary

V. *Protoceras* (and *Calope*) Marsh, from the Middle Tertiary (U. Oligocene)

VI. *Pseudoprotoceras* Cook, from the Middle Tertiary (L. Oligocene)

**IV. Paratoceras, new genus**

From the Clarendon of Texas

The genus is based on a mandibular ramus which evidently belonged to a somewhat smaller form, and one with a quite different dentition, from *Synthetoceras*. The closeness of the p₂ to the posterior border of the symphysis, the extreme compression of the premolars, the antero-posterior elongation of p₃ relative to p₄ and the low molar crowns at once recall the White River genus *Protoceras*. The p₂–m₃ distance actually but slightly exceeds that of a large individual of the latter. The unique type and referred specimens were collected, with the other Clarendon remains, by the John Lynch party on the MacAdams Ranch, through the helpful coöperation of the owners.
(1) Paratoceras macadamsi, new genus and species

From the Clarendon, Texas

Genotype.—Right ramus with p₃-m₄ and posterior border of symphysis. (M—)

<table>
<thead>
<tr>
<th>Paratoceras macadamsi, genotype</th>
<th>Protoceras celer, ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F:A.M.32457</td>
<td>A.M.1220</td>
</tr>
<tr>
<td>PP₃-P₄ = 44.5 mm.</td>
<td>44.5 mm.</td>
</tr>
<tr>
<td>P₃-M₄ = (96)</td>
<td>38. mm.</td>
</tr>
</tbody>
</table>

Referred.—

Left ramus with p₄-m₄. F:A.M.33409 (M)

V. Protoceras Marsh

From the Upper White River, South Dakota

Reconstruction, Figure 59c

Protoceras, of the White River Oligocene, is relatively well represented by skulls and jaws in the collections of several institutions. Marsh (1891–1897) referred the South Dakota remains of the Yale collection to two genera and five species. The material in the American Museum, described by Wortman and Osborn (1892), includes skulls of males and females. The specimens show a range in the size of the dentitions which is not dependent on sex, and a great difference in the development of the skull protuberances of the mature males. Many of the observed differences may be those of individual variation. Pending a much to be desired detailed study of all the material in the several collections, the described genera and species, types and more important references are briefly listed below.

Protoceras is characterized by the development, particularly in the males, of bony protuberances on the maxillae, parietales and frontals, these being rudimentary in the female. The closed orbits are posteriorly placed; the bullæ are uninflated; and the angle of the lower jaw is rounded and without hook-like processes. Marsh observed the striking parallelism between Protoceras and Dinoceras in the protuberances,
enlarged upper canines and absence of upper incisors. The tips of the abbreviated nasals lie only slightly anterior to the deeply incised edge of the posterior palate. A foramen may occupy the middle of the frontonasal suture. The unroofed nasal cavity seems indicative of some form of proboscis. The C/ was enlarged; the p', were small, double-rooted and detached; the succeeding ps were large, the /ps compressed laterally; and the molars brachydont. The ulna and radius were coössified and the fibula completely reduced. The cuboid and navicular already were united. The manus had four complete, and the pes two ununited, digits.

The genus and questioned subgenus and five species and types, as described by Marsh, the referred remains in the American Museum collection and the synonymy are given below:

(1) Protoceras celer Marsh, genotypic species.
   Genotype.—Female skull, Y.P.M. collection.

(2) Protoceras comptus Marsh.
   Type.—Im mature (?)female skull, Y.P.M. collection.

(3) Protoceras nasutus Marsh.
   Type.—Male skull, Y.P.M. collection.

(4) P. (Calops) cristatus Marsh.
   Type.—Female skull, Y.P.M. collection.

(5) P. (Calops) consors Marsh.
   Type.—Female skull, Y.P.M. collection.

(1) Protoceras celer Marsh, genotypic species

From the Protoceras Beds, South Dakota

1937]  
Frick, Horned Ruminants. IV—Protoceratidae

GENOTYPE.—Female skull, premaxillary area missing. Y.P.M. Coll. Figured by Marsh, 1893, Pl. vii; 1897, Text-Figs. 6, 7, and Pl. vii, Figs. 3. 4 (of brain casts).

REFERRED BY MARSH, 1897.—

Male skull and jaw. Y.P.M. Coll. Figured by Marsh, 1897, Pls. ii–v; vi, Fig. 1; and Text-Fig. 4.

Etc. ?female skulls.

REFERRED BY OSBORN AND WORTMAN (1892), AMERICAN MUSEUM SPECIMENS FROM CHEYENNE RIVER, SOUTH DAKOTA:—

Including larger and smaller individuals:

Large:

Male skull. B.L. = (225) mm. (Narrowness of rostrals possibly because of adolescence.)

Female skull, jaws and right humeri (2) (see listed below) (Much the largest-toothed specimen of the series.)

Moderate:

Female skull, jaws and skeleton (see listed below) (ramus)

Female skull. Figured by Osborn and Wortman, 1892, Text-Fig. 3.

Female skull. (Cingula exceptionally developed on molars.)

Back of skull, parietal horns, upper molars, astragalus and calcaneum.

Skull fragments, cervicals, foreleg, etc. (see listed below)

Anterior upper and lower jaws, I1–I3, small /C incisiform...

Immature:

Partial skull.

Immature maxilla with dp3–m3.

Immature mandible.

Immature ramus.

Immature right ramus.
Smaller individuals with smaller teeth:

Two uncrushed specimens (A.M.643 and N.M.6725) each exhibit an inter-nasofrontal foramen and broad rostral flanges. The specimens possibly represent *P. nasutus* Marsh.

**Male skull.** *(p² proportionately small).* B.L. = (200) mm. 
Figured by Osborn and Wortman, 1892, Text-Figs. 1, 2, 4; *(M+) 643*
this paper ........................................... Figs. 60, 62, 63

**Female skull and mandible.** B.L. = ((185)) mm........... *(m) 6725

**Male skull.** ........................................... *(A.M. 1223

**Female skull.** ........................................... *(w) 1229

**Female skull, crushed.** ........................................... 641

**Limb elements:**

Composite skeleton: Partial scapula, both humeri (partially restored), parts of ulno-radii, partial left carpus, left metacarpus (3d = 88 mm.), etc. phalanges, both femora, right and partial left tibia, both tarsi, left (102 mm.) and partial right metatarsus, etc. phalanges, ribs, vertebrae and pelvis. *(See female skull and jaws above. This paper, Fig. 65 [ramus]).* ........................................... 1236

Right and partial left humerus, both ulno-radii, partial carpi, both metacarpi (left 3d = 88 mm.), etc. phalanges, left femur, patella, partial tibia, tarsus, metatarsus (101 mm.), etc. phalanges. *(See skull fragments above.) Resembles specimen figured by Osborn and Wortman, 1892, Figs. 5 and 6 (manus and pes).* ........................................... *Fig. 60 1227

Partial tibia, both tarsi, both metatarsi (left = 103 mm.) and all phalanges .......... 644

Two right humeri. *(Listed above.*) ........................................... 1220

Pelvis and metapodials. *(Associated skull not located in 1900.*) ........................................... 1219

(2) Protoceras comptus Marsh

From the Protoceras Beds, South Dakota

Frick, Horned Ruminants. IV—Protoceratidae

Type.—Immature and possibly female skull with C/, p1, dp2–m3 (erupting).

[Maxillary plates not elevated along sides of nasals, parietal ridges with incipient rugosity. Skull length = 8 inches (203.2 mm.).]

(3) Protoceras nasutus Marsh

From the Protoceras Beds, South Dakota


Type.—Male partial skull. Y.P.M. Coll. Figured by Marsh, 1897, Text-Fig. 5 (lateral of anterior skull).

(Summits of maxillary horn-cores are oval versus triangular in cross section.)

VA. P. (Calops) Marsh

(4) P. (Calops) cristatus Marsh

From the Protoceras Beds, South Dakota


Type.—Female skull, said to be fairly well preserved.

[Parietal ridges elevated into distinct crests and without horns. According to Marsh: Skull length = approximately 6 inches (152.4 mm.); p2–m1 = 2½ inches (63.5 mm.).]

(5) P. (Calops) consors Marsh

From the Protoceras Beds, South Dakota


Type.—Female skull. Y.P.M. Coll. Figured by Marsh, 1897, Pl. vii, Figs. 1 and 2.
VI. Pseudoprotoceras Cook

The partial skull of the genotype is described as "... already having progressed too far in certain directions to be ancestral to Protoceras; seemingly representing a nearly related branch, or race ... While brachydont, the dentition is more nearly hypsodont than is the case in the more recent Protoceras of the Upper Oligocene... This species is much smaller than Protoceras... The recession of the anterior nares is remarkable, extending slightly back of the anterior rim of the orbits, though the nasal bones are relatively longer than in Protoceras celer Marsh."

(6) Pseudoprotoceras longinaris Cook

From Lower Chadron Beds, Nebraska

Pseudoprotoceras longinaris Cook, 1934, Amer. Mid. Nat., XV, No. 2, p. 149, Pl. III, Fig. 1.

Genotype.—Anterior portion of cranium, and astragalus and navicular.

H.C.507 From 9 miles north of Crawford, Nebraska.

Figured by Cook, 1934, Pl. III, Fig. 1.

Table XV

Protoceratini Comparative Limb Measurements and Ratios

<table>
<thead>
<tr>
<th></th>
<th>Locality</th>
<th>Collection No.</th>
<th>Radius</th>
<th>3d Metacarpal</th>
<th>Femur</th>
<th>Tibia</th>
<th>3d Metatarsal</th>
<th>See Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetoceras tricornatus, arguably referred...</td>
<td>Clarendon, Tex. Unassoc., p. 605</td>
<td></td>
<td>265</td>
<td>150</td>
<td>247</td>
<td>145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syndyoceras cooki, genotype (part) ..........</td>
<td>Sioux Co., Nebr. N.S.M.4–7–05¹</td>
<td></td>
<td>222</td>
<td>242</td>
<td>130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protoceras celer, ref .......</td>
<td>S. Dak. A.M.1227²</td>
<td>140</td>
<td>89</td>
<td>188</td>
<td></td>
<td></td>
<td>((192))</td>
<td>60</td>
</tr>
<tr>
<td>&quot; ...............</td>
<td>&quot; A.M.646</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

¹ N.S.M.4–7–05, femur/tibia = 92%; 3d metatarsal/tibia = 54%.
² A.M.1227, 3d metacarpal/radius = 64%; radius/tibia = ((73))%; femur/tibia = ((86))%.

((1)) estimated measurement.
Figs. 64 and 65. Protoceratid and Hypertragulid skulls or mandibular rami, lateral views (and two occlusal) compared.  

× 1 (excepting A.M.1236, N.S.M.4-7-05 and lateral views of F:A.M.32457 and 32464 × ½).  

PS, posterior border symphysis.

Fig. 64. C.M.883 (in part), Hypisodus alacer Troxell, ref., from Sioux County, Nebraska.  

(See page 647.)  

A.M.9354, Hypisodus minimus Cope, ref., from Pawnee Buttes, Colorado.  

(See page 646.)  

F:A.M.31525, Nanotragulus loomisi Lull, ref., from Muddy Creek, Lusk, Wyoming.  

(The bulla is supplied from F:A.M.31524 and the teeth partly from 31523; the position of p1 is after Schlaikjer, 1935, Pl. xli, Fig. 4.)  

(See page 642.)  

A.M.1347a, Leptomeryx minimus, n.sp., type, from the Protoceras Beds, South Dakota.  

(See page 630.)  

A.M.13821, Nanotragulus lulli, n.sp., type, from the Lower Rosebud, South Dakota.  

(See page 643.)  

A.M.1341, Hypertragulus calcarius, var., from Cheyenne River, South Dakota.  

(See page 635.)  

A.M.7918, Hypertragulus hesperius Hay, type, from the John Day, Oregon.  

(See page 636.)  


(See page 641.)  

A.M.13011, Nanotragulus ordinatus (Matthew), type, from the Lower Rosebud, Porcupine Creek, South Dakota.  

(See page 641.)

Fig. 65. A.M.11870, Leptomeryx evansi Leidy, ref., from Cheyenne River, South Dakota.  

(Premaxillary area after F.M. P12554, as communicated by E. S. Riggs.)  

(See page 627.)  

A.M.13734, Nanotragulus albanensis, n.sp., type, rev., from the Lower Harrison, Sioux County, Nebraska.  

(See page 640.)  

A.M.1332, Leptomeryx obliquidens Lull, ref., from the Protoceras Beds, South Dakota.  

(See also Fig. 67 and page 625.)  

C.M.809b, (?) Eotylopus profectus Matthew, ref., rev., from the Pipestone Beds, Montana.  

(See page 653.)  

A.M.1236, Protoceras celer Marsh, ref., female, from Cheyenne River, South Dakota.  

(See page 611.)  

F:A.M.32457, Paratoceras macadamsi, n.g. and sp., genotype, rev., from Clarendon, Texas.  

(See page 609.)  

F:A.M.32464, Synthetoceras tricornatus Stirton, ref., from Clarendon, Texas.  

(See page 604.)  

N.S.M.4-7-05, Syndyoceras cooki Barbour, genotype (in part), after cast, from the Lower Miocene, Sioux County, Nebraska.  

(See page 608.)
Fig. 64. *Hypisodus* Cope (C.M.883 and A.M.9354), *Nanotragulus* Lull, *Leptomeryx* Leidy (A.M.1347a) and *Hypertragulus* Cope (A.M.1341 and 7918), skulls or mandibular rami from Nebraska, Colorado, Wyoming, South Dakota and Oregon, lateral views compared.

× 1. (See legend, page 615.)
Fig. 65. *Leptomeryx* Leidy, *Nanotragulus* Lull (A.M.13784), (?) *Eotylopus* Matthew (C.M.809b), *Protoceras* Marsh (A.M.1236) and *Syndyoceras* Barbour (N.S.M.4-7-05), from the Middle Tertiary; *Paratoceras*, n.g. (F:A.M.32457) and *Synthetoceras* Stirton (F:A.M.32464), from the Late Tertiary, skull or mandibular rami, lateral views (and two occlusal) compared.

× 1 (excepting A.M.1236, N.S.M.4-7-05 and lateral views of F:A.M.32457 and 32464 × 4).

(See legend, page 615.)
**TABLE XVI**

**HYPERTRAGULID GENERA, SUBGENERA AND SPECIES OF THE AMERICAN MIDDLE TERTIARY—Occurrence and Totals of Available Specimens**

(Roman and arabic numbers refer, respectively, to genera and to species as numbered in this report. Arabic numbers in ( ) from type, and in [ ] from other than type area for the particular species.)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.—LEPTOMERICINIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leptomeryx Leidy</strong></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td><strong>Heteromeryx Matthew</strong></td>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>B.—HYPERTRAGULINIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hypertragulus Cope</strong></td>
<td>III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>311</td>
</tr>
<tr>
<td><strong>Nanotragulus Lull</strong></td>
<td>IV (1)</td>
<td></td>
<td>*(2)</td>
<td>(2)</td>
<td>*(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>39</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>751</td>
</tr>
<tr>
<td><strong>C.—HYPISODONTINIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hypisodus Cope</strong></td>
<td>V (2)</td>
<td></td>
<td></td>
<td>(1)</td>
<td>*(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>(1)</td>
<td>*(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>770</strong></td>
</tr>
</tbody>
</table>

*, †, refer to localities as shown in column headings.
1? ? questions the generic or subgeneric reference.
Family V.—Hypertragulidae

(Cope, 1879)

Divisions A.—Leptomerycini; B.—Hypertragulini; and C.—Hypisodontini

Figures 64 and (in part) 2A, 65, 67; Limbs (in part) 25B

Discussion

The Hypertragulidae of the literature embraces a number of hornless forms from the American Middle Tertiary. The family, as explained in the Introduction, is considered as of the divisions, Leptomerycini, Hypertragulini and Hypisodontini. Additional evidence from the field as to many of the here enumerated forms is much to be desired. The family is interesting in connection with the Pecora of the present report particularly because of previous citations of the included hornless genus Leptomeryx as a Cervid ancestor. Leptomeryx, with brachyodont dentition and short metacarpals, parallels in degree the Lower Miocene Pseudoblastomeryx, in which, however; the $p_2^2-p_3^3$ are definitely smaller, the diastema longer, $p_1$ unretained and the metapodials relatively very elongate. Hypertragulus is characterized by its sharp unicuspid $p_2-p_3$ and tendency to occurrence of an interpremolar diastema. The diminutive Hypisodontini, in the tall, slender crowns of their cheek teeth, parallel the Antilocapridae. The Hypertragulids, in the detached $p_1^1$ and tendency to compressed anterior premolars, are suggestive of the Camelidae, certain members of which retained short and detached metacarpals.

Cope (1879) placed the genera Leptomeryx and Hypertragulus in a family, the Hypertragulidae. "... This family connects the Tragulidae with more typical Ruminantia. It differs from that family in the absence of the fibula and the external metapodial bones. From the typical Ruminantia or Pecora, it differs in the incompleteness of the troclear keel of the metapodials, and the trenchant character of the premolars, excepting the last.” Zittel (1891–1893) includes Leptomeryx, Hypertragulus and Hypisodus in the Leptomerycinae. Marsh (1891) refers Protoceras to a distinct family, the Protoceratidae. Scott (1899) includes Protoceras, Leptomeryx, Hypertragulus and Hypisodus in the Leptomerycidae. Matthew (1905) "... regards the [Hypertragulid] group as an entirely independent offshoot of the primitive ruminant
stock, without especially near relations to any other group, and without any known descendants in the Miocene or later epochs. The tendency to podial coossification is a marked feature, allying them with Tragulids and Pecora, and one that never occurs in camels, although these have the metapodial reduction much more advanced. The wide difference in evolution between fore and hind feet separates them from all other groups. The fore foot, however, is not known in Hypertragulus and Hypisodus... In many respects they are strikingly like the primitive camels, but the resemblance is chiefly in archaic characters and would unquestionably be shared by all primitive ruminants, of no matter what group. The resemblances to Tragulus are also marked..." Scott (1913) interprets the Hypertragulidae as an early offshoot of cameline stock referable to the Tylopoda. Matthew (1908 and 1929) considers the genus Leptomeryx ancestral to certain deer and includes the family in the Pecora. Zittel (1923), listing Blastomeryx in the Hypertragulidae, places Protoceras with the giraffes in the Pellicornia and Hypisodus with the Antilocapridæ.

The subfamily Hypertragulinæ consists of the genera Hypertragulus and Nanotragulus; the Leptomerycinae of the typical genus Leptomeryx. The Leptomerycinae, with certain rather Cervid-like characters, induced Matthew (1908) to observe Leptomeryx to be "... an extremely primitive, unspecialized genus of pecoran stock ... [which] fulfil[s] ... the theoretical requirements for an ancestor of Blastomeryx." In the writer's opinion and as discussed below there would seem to be no very valid reason for placing Leptomeryx, as at present known, otherwise than within the Hypertragulidae, though the contemporaneous Hypertragulus Cope proper is definitely more camelid than Leptomeryx. Relationship between these groups and the eastern Tragulidae proper, Recent Hyemoschus Gray and Tragulus Brisson, and the Late Tertiary (?) Dorcatherium Kaup, is very doubtful. The Hypisodontinae is known alone by the diminutive genus Hypisodus of the Oligocene. Unfortunately, examples of the Hypertragulidae subfamilies and genera are largely absent or poorly represented in our new collections, with the exception of three Nanotragulus crania associated with jaws and limb elements, collected by Charles Falkenbach (1934) from the Lower Miocene in the vicinity of Lusk, Wyoming. The literature is greatly confused as to the different types and species, their characters and dimensions, and the allocation and distribution of the referred species and specimens. The present tentative résumé of the family is presented only pending a much needed thoroughgoing revision in the light of additional material from the type and other localities.
General Characters (where observable).—Bullae moderately inflated (versus larger in Nanotragulus and large in Hypisodus); molars brachyodont (in Leptomeryx and Hypertragulus—in part) to subhypsdont (in Nanotragulus) and hypsdont (in Hypisodus); C/ apparently small (unknown in Hypisodus); /C incisiform; premolars large and somewhat Cervid-formed (in Leptomeryx), compressed and tending to be strongly reduced (in Hypertragulus-Nanotragulus-Hypisodus); p¹ lost (in Leptomeryx) to retained and double-rooted (in Hypertragulus); p, detached caniniform, and single-rooted. Manus short and with four separate digits (unknown in Hypertragulus and Hypisodus); pes didactyl with formed to unformed cannon bone (tetradactyl in Nanotragulus); radius and ulna coossified (except in Leptomeryx—as in Protoceras); fibula distally detached (except in Hypertragulus and Hypisodus); keels of metapodial trochlea confined to palmar surface.

### SUMMARY OF HYPERTRAGULIDÆ SPECIMENS

<table>
<thead>
<tr>
<th>Division No.</th>
<th>Division</th>
<th>Genus</th>
<th>Crania</th>
<th>Maxilla</th>
<th>Mandibles</th>
<th>Limbs</th>
<th>Total Elements</th>
<th>Autoc. Elements</th>
<th>Total Specimens</th>
</tr>
</thead>
</table>

[1] associated; * including 26 etc.

The Hypertragulidæ are here tentatively considered under three divisions and subfamilies:

**Division A.—Leptomerycini.**
Subfamily 1.—Leptomerycinæ.

**Division B.—Hypertragulini.**
Subfamily 2.—Hypertragulinæ.

**Division C.—Hypisodontini.**
Subfamily 3.—Hypisodontinæ.

The general characters of the three divisions and allocated subfamilies and genera, together with the named species, the types and the synonymy, are briefed in the ensuing pages.
DIVISION A.—LEPTOMERYCINI

Subfamily 1.—**Leptomerycinae**

[**LEPTOMERYCIDE**: Scott, 1899 (in part)]

I. **LEPTOMERYX LEIDY** and

II. **HETEROMERYX MATTHEW**

* From the White River Oligocene

Figures (in part) 2A, 64, 65 and 67; Limbs (in part) 25B

Statement

The subfamily includes the genus *Leptomeryx*, genotypic species *L. evansi* Leidy (1853), and the questioned *Heteromeryx* Matthew, typically from the Upper Oligocene of South Dakota. *Leptomeryx* species of larger and smaller size are recognized from the Oligocene of Montana and Saskatchewan, and variable species of intermediate size from South Dakota, Colorado and Nebraska. The genus is not recognized as yet in the Lower Miocene. The seven species and the available and referred remains may be listed for convenience under three size groups. The latter approximately parallel the three size groups of the following subfamily and genus, *Hypertragulus* Cope. (The dimensions of the molars of Size Group I to Size Group III broadly approximate those of Size Group IV to Size Group VII of the Blastomerycini and Merycodontini.)

Characters.—I, procumbent and large; (I occasionally retained\(^1\)); C/ small, /C incisiform; p\(^1\) apparently absent; p\(^1\) caniniform, single-rooted and detached; diastema long; succeeding premolars long anteroposteriorly, compressed laterally (versus reduced in *Hypertragulus*); molars low-crowned and without “Palæomeryx” fold. The skull exhibits a diamond-shaped prelacrical vacuity; the bullæ are small. The radius and ulna, as the tibia and fibula, are separate; the navicular and cuboid are united; the manus has four short digits, the laterals being small, and the pes a formed cannon bone.

Compared to the Blastomerycini, the detached peg-like p\(^1\) is retained; the p\(^2\), though long anteroposteriorly, are compressed; the p\(^3\)–p\(^4\) inner cusps are less developed; the “Palæomeryx” fold is absent or too

\(^1\) Communicated by E. S. Riggs.
small to be detected; and the limbs are of primitive character. The teeth, as seen in the South Dakota remains (A.M.1345), are only slightly smaller than in *Pseudoblastomeryx advena* (A.M.13014), while the third metatarsal, as seen in a Colorado specimen (A.M.6782), measures 68 mm., versus a metatarsus referred to (?)*P. advena*, smaller var. (A.M.13823), 90 mm. The Colorado third metacarpal (A.M.6782) measures approximately 40 mm., and a Sioux County, Nebraska, third metacarpal (C.M.997) 49 mm., versus in *P. advena* (A.M.13015) 80 mm.

The *Leptomeryx* skull and dentition are not unsuggestive of the much larger *Parablastomeryx gregorii*; the orbits similarly are situated anteriorly, the bullæ small to inflated, the premolars proportionately large, particularly p²–p³, and the p₄ of Cervid pattern, but the diastemata are shorter-proportioned, a detached p₁ is present, the posterior angle of the ramus is rounded inwardly versus produced downwardly and the metapodials are short and detached versus in *P. gregorii*.

**Summary of Named Species**

The seven or eight *Leptomeryx* species are:

**SIZE GROUP I.**

(1) *Leptomeryx obliquiders* Lull (1922), from the *Protoceras* Beds, South Dakota.

_Type._—Posterior portion of skull and mandible, Y.P.M.10541.

(2) *Leptomeryx transmontanus* Douglass (1903), from the Oligocene, Montana.

_Type._—Partial skull, C.M.726.

(2a) (?)*Var.*, from the Pipestone Beds, Montana.

_Example._—Left ramal fragment, A.M.9684.

(3) *Leptomeryx mammifer* Cope (1885), from Swift Current Creek, Saskatchewan, Canada.

_Type._—Ramal fragment, Can. Geol. Surv. Coll.
SIZE GROUP II.

(4) *Leptomeryx evansi* Leidy (1853), genotypic species, from South Dakota.

**Genotype.**—Partial skull and jaw fragment, N.M.157.

(4a, 4b and 4c) *L. evansi*, or vars., from Nebraska; Cedar Creek, Colorado; and Pipestone, Montana.¹

**Examples.**—Ramal fragments.

SIZE GROUP III.

(5) *Leptomeryx minimus*, n.sp., from the *Protoceras* Beds, South Dakota.

**Type.**—Left p₄-m₂, A.M.1347a. This paper, Fig. 64.

(5a and 5b) vars., from Sioux County, Nebraska, and Cedar Creek, Colorado.

**Examples.**—Ramal fragments.

(6) (?) *Leptomeryx speciosus* Lambe (1908), from Saskatchewan, Canada.²

**Type.**—m/, Can. Geol. Surv. Coll.

As observed (page 252) there may be considerable doubt as to the allocation of partial cheek-tooth series from the Middle Tertiary deposits between the Leptomerycini and the Blastomerycini. A noteworthy example occurs in the case of a maxilla with p₄-m₂ (A.M.13824) from the Rosebud. In this specimen (Size Group i) the inner mid-root and cusp of the p₄ and p₂ are as prominently developed as in *Parablastomeryx gregorii* or *Pseudoblastomeryx falkenbachi*. Should the specimen be of the Blastomerycini, it may belong to *Problastomeryx primus* of the same beds (page 253); (if of the Leptomerycini, it would seem to represent a species lying near to *L. transmontanus* Douglass of the pre-Rosebud of Montana). A Blastomerycine is also questionably suggested in a fragment from Agate, Nebraska.³


² Questioned species (6a) and (6b), page 631, include *L. scutatus* Cope and *L. semicinctus* Cope (1889), based on remains from Saskatchewan, challenged by Matthew (1902).

³ Harold J. Cook (1934, loc. cit., p. 155) describes and figures a small species, *L. agatensis*, from the Lower Harrison of Agate, Nebraska, based on a maxilla with p₄-m₂.
Detailed Lists of Types, Referred Specimens, and Synonymy

Leptomeryx, total available specimens, 400; total listed, 52; unlisted, 348. Heteromeryx, total available listed specimens, 1.

SIZE GROUP I.

(1) Leptomeryx obliquidens Lull

From the Protoceras Beds, South Dakota


Type.—Posterior portion of Y.P.M.10541 skull and jaws with cheek teeth.

According to Lull (1922), size large, being one-fourth larger, and bullae less inflated than L. evansi of the Oreodon beds; "superior molars obliquely set"; and p3–m3 = 48 mm. versus 39 mm. in L. evansi.

Tentatively Referred from the Type Area of South Dakota.—

Left ramus with p3–m3 and A.M.1332 This paper, Figs. 65, 67.

p3 alveolus.

The specimen exhibits short diastema, p2 (alveolus) and p3. p3 (alv.)–m3 = (49) mm.

While the length of the three /ps approximates, the three /ms are far shorter than in Parablastomeryx gregorii. Similarly, while the /ps are longer, the /ms are shorter than in Problastomeryx primus.

(2) Leptomeryx transmontanus Douglass

From the Oligocene, Montana

Leptomeryx transmontanus DOUGLASS, 1903, Ann. Carn. Mus., II, No. 2, pp. 151, 167, Fig. 11.

Leptomeryx ? esulcatus COPE, MATTHEW, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 222, Fig. 15.


Type.—Partial skull.

C.M.726 From east of Drummond on Hellgate River.

m3 width = 8 mm. Figured by Douglass, 1903, Fig. 11.
From the Pipestone Beds, Montana

Ramal fragments from the Pipestone Beds of Montana, as compared to South Dakota A.M.1332 (Fig. 65), exhibit, in addition to larger size, a shorter pr-p₂ diastema and anteroposteriorly longer and more compressed pr-p₄. The pr is similarly detached and small peg-like. The p₁-m₂ length is estimated at 50+ mm. Examined by the remains in the American Museum collection referred by Matthew (1903) to L. mammifer Cope. It is possible that these Pipestone remains represent no more than larger individuals of the same species as the smaller remains listed below under (4c). According to Douglass' figure, the type specimen is of intermediate size.


**Example.**—Left ramus with p₁-p₂, and doubtfully associated m₁-m₂. (m₄+?)

\[ m₂ = 9.5 \text{ mm.} \]

**REFERRED, IN AMERICAN MUSEUM COLLECTION.—**

- Left ramal fragment with pr-p₄ and pr alveolus. A.M.9686 Figured by Matthew, 1903, Fig. 16 (in part).
- Left fragment with pr-p₂. A.M.9687 Figured by Matthew, 1903, Fig. 17.
- Right fragment with pr-m₂. A.M.9689 Figured by Matthew, 1903, Fig. 17 (₄).
- Right fragment with m₁-m₄(br.). A.M.9688
- Upper molar. A.M.9705

\[ 9 \times 10 \text{ mm.} \]

(3) *Leptomeryx mammifer* Cope (1885)

From Saskatchewan, Canada


**TYPE.**—Fragment of ramus Can. Geol. Surv. Coll. with m₁-m₄.

\[ m₂ = 9.8 \text{ mm. anteroposteriorly.} \]

**From Titanotherium Beds, Swift Current Creek.** Figured by Cope, 1891, Pl. xiv, Fig. 7.
Frick, Horned Ruminants. V—Hyptragulidæ

REFERRED.—

Upper molar. Can. Geol. Surv. Coll. Figured by Cope, 1891, Pl. xiv, Fig. 6.

SIZE GROUP II.

(4) Leptomeryx evansi Leidy (1853), genotypic species

From South Dakota


GENOTYPE.—Partial skull and jaw fragment.

m₂ = (6.9) mm. (according to figure).

REFERRED BY LEIDY (1869).—

Portions of several skulls, many fragments of jaws with teeth, and portions of skeleton.

Collected by Hayden, partly from the Mauvais Terres of White River, Dakota, and partly from Bear Creek (a tributary of the Cheyenne River).

REFERRED, FIVE OF MANY SPECIMENS IN THE AMERICAN MUSEUM, ALL FROM THE CHEYENNE RIVER, SOUTH DAKOTA.—

The remains from the general area in the American Museum include examples of slightly larger [p₃–m₃ (m), A.M.1345] and smaller individuals [m₁–m₂ (m+), A.M. 1347, referred to L. minimus]. Several Carnegie Museum rami are larger than the type of the latter, A.M.1347A.

Left ramus, p₃–m₃. (m) A.M.1345 1894.

Locked skull (premaxilla missing) and jaws with dentition. (w) A.M.11870 From Lower Oreodon Beds, Big Badlands, 1903.

B.L. = (100) mm. Figured by Scott, 1899, Pl. 1, Fig. 1; by Matthew, 1908, Text-Figs. 8, 10, 11; this paper, Fig. 65.

p₃ = 39.6

m₂ = ((9.2+))
Partial skull and jaws. A.M.1343 From Lower Oreodon Beds, 1894. This paper, Fig. 2A.


Partial skull and jaws. A.M.688 From Oreodon Beds, 1892.

Et cetera specimens in the American Museum.

REFERRED SPECIMEN IN THE CARNEGIE MUSEUM, FROM HARDING COUNTY, SOUTH DAKOTA.—

Right fragment with p4 alveolus and m1–m4. C.M.11734 1928.

The Field Museum of Chicago, as recorded by E. S. Riggs (1913, pp. 308, 393 and Pl. LXVIII), has on exhibition a splendid 4 × 7-foot slab from South Dakota containing some twenty-six individuals, of which nine are said to be articulated.

(4a) Leptomeryx evansi, or Var.

From Sioux County, Nebraska

EXAMPLE.—Right ramus with I1 (br.), roots of I–C, p1 alveolus (br.) and p7–m3.

(Largest of the C.M. specimens.)

REFERRED, CARNEGIE MUSEUM SPECIMENS FROM THE SAME AREA.—

Right and left rami with broken I1–C, p1–m3. C.M.3672

Right ramus with p1–p3 alveoli and p7–m3. C.M.455

Left ramus with I1 (br.), roots of I–C, p1–m3. C.M.512

One specimen from the Titanotherium Beds, Sand Creek:

Slightly immature, crushed portions of skull and jaws with partial dentition; anterior portion of skeleton.

Third metacarpal = 49 mm.
(4b) **Leptomeryx evansi**, or Var.

From White River Formation, Cedar Creek, Logan County, Colorado

**EXAMPLE.*—Left fragments A.M.6781 with dp<sup>1</sup>-dp<sup>4</sup>, and dp<sub>5</sub>-dp<sub>4</sub>, and right dp<sub>4</sub>.**

(Type of *Trimerodus cedrensis* Cope, 1873.)

**REFERRED, IN THE COPE COLLECTION.*—**

Fore and hind limb specimens:
- Radius = 74 mm.
- Third metacarpal = 40
- Third metatarsal = 68

Fragments of skeleton. A.M.6783

Numerous fragmental upper and lower jaws, and a few skeletal elements.

From Horsetail Creek, Logan County, 1879.

Figured by Scott, 1891, Figs. D-H; by Matthew, 1908, Figs. 9, 12-13 (in part); this paper, *Fig. 25B* (pes and partial manus).

In the American Museum Collection.

(4c) **Var.**

From Pipestone, Montana

REFERRED [specimens placed with *Leptomeryx esulcatus* Cope by Matthew (1903)], FROM WHITE RIVER, TITANOTHERIUM BEDS, PIPESTONE SPRINGS, MONTANA, 1902.—

Parts of lower jaws. A.M.9696, 9706, 9702

Figured by Matthew, 1903, Fig. 15, under *L. esulcatus*, referred.

One right and two left m<sub>1</sub>—m<sub>5</sub>.

A.M.9692, 9693 and 9695

Fragments of lower jaws. A.M.9694, 9697-9699, and 9707.

Detached upper teeth.
- m<sub>3</sub> = 8 × 8.5 mm.

REFERRED FRAGMENTS FROM PIPESTONE, MONTANA, IN THE CARNEGIE MUSEUM.—

(Teeth definitely taller-crowned, a trifle larger than in *L. minimus*.)

Right fragment, p<sub>1</sub>-p<sub>2</sub>. C.M.809
Left fragment with /Is and p4.
Right m1-m4(br.).

SIZE GROUP III.

(5) Leptomeryx minimus, new species
From the Protoceras Beds, South Dakota

TYPE.—Left p4-m3. (M) A.M.1347a This paper, Fig. 64.
m3 = 8.2 mm. p4 long anteroposteriorly, molars tending tall-crowned.

QUESTIONABLY REFERRED.—
Left fragment with m1-m2. A.M.1347 From Protoceras Beds, 1894.

Certain indefinite remains from South Dakota, referred by W. D. Matthew to L. semicinctus Cope, might be tentatively referred here.

(5a) Leptomeryx Var.
From Squaw Creek, Sioux County, Nebraska

EXAMPLE.—Right ramus with Col.M.657
p1-m2. (M+)

REFERRED.—
Etc. ramal fragments.

(5b) Leptomeryx Var.
From Cedar Creek, Logan County, Colorado

EXAMPLE.—Left fragment with Col.M.340
p1-m2. (w+)

(6) (?) Leptomeryx speciosus Lambe
From Saskatchewan, Canada


1 See footnote, next page.
Type.—Upper molar.  7.8 × 10.2 mm.  Can. Geol. Surv. Coll.  From Bone Coulee, Cypress Hills, 1904.
Figured by Lambe, 1908, Pl. viii, Figs. 10, 11.

Questioned from Bone Coulee, Cypress Hills, 1904, in the Can. Geol. Surv. Collection.—
Lower molar.  8 × 5.3 mm.  Figured by Lambe, 1908, Pl. viii, Figs. 12, 13.
m₃, 10.5 mm.  Figured by Lambe, 1908, Pl. viii, Figs. 14, 15.
Etc. teeth;

1 As observed in a foregoing footnote (page 624, footnote 2), the reference of the following Cope Saskatchewan species has been challenged by William D. Matthew. Their determination is left to the future.

(6a) Leptomeryx esulcatus Cope
From Saskatchewan, Canada

Leptomeryx esulcatus COPE, 1889, Amer. Nat., XXIII, No. 267, p. 154; 1891, Geol. Surv. Canada, Contrib. Canadian Pal., III, p. 22, Pl. xiv, Fig. 5.

Type.—A single superior molar.  6.5 × 7.5 mm.  Can. Geol. Surv. Coll.  From White River, Titanotherium Beds, Swift Current Creek.  Figured by Cope, 1891, Pl. xiv, Fig. 5.

(6b) Leptomeryx semicinctus Cope
From Saskatchewan, Canada


Type.—Upper molar.  14 × 15 mm.  Can. Geol. Surv. Coll.  From White River, Titanotherium Beds, Swift Current Creek.  Figured by Cope, 1891, Pl. xiv, Fig. 8.

William D. Matthew (1902) observes, "This is clearly not Leptomeryx, and is distinct from any described White River genus (except possibly Calops, with which I am unable to compare it...)

Referred by Matthew (1902), in American Museum Collection.—
Two upper molars.  (Whereabouts unknown.)  From the Protoceras Beds, South Dakota.
An interesting maxillary specimen from the Rosebud, which was considered by Matthew as of Leptomeryx obliquidens, well may be of the Blastomerycini (see page 624).¹

Leptomeryx sp. Matthew, 1908, Bull. Amer. Mus. Nat. Hist., XXIV, p. 548, Fig. 11 (in part).

Example.—Maxilla with p²— A.M.13824 Lower Rosebud Beds, from
m²(br.). (w) near No Flesh Creek, Pine
ms/ are larger than /ms of A.M.1332. Ridge Indian Reservation, South Dakota, 1907.
pms/ are not unsuggestive of both the Figured by Matthew, 1908, considerably larger Parablastomeryx and Fig. 11 (in part).
the still larger Heteromeryx.

II. Heteromeryx Matthew

From the Titanotherium Beds, South Dakota

The relationships of the genus Heteromeryx, still only represented in the fragmentary genotype described by William D. Matthew, are very doubtful. The latter (1905) considered H. dispar to be "... partly intermediate between Leptomeryx and Protoceras, retaining several primitive characters of both... Except for the coossified ulna and radius we might regard Heteromeryx as a possible ancestor of Protoceras; it comes from a much older horizon... The premolars recall those of Leptomeryx, but the molars resemble more nearly those of Protoceras except in the form and position of the heavy internal cingula..." The genus, on the character of the unreduced nasals, preferably is referred to the Leptomerycinae.

(1) Heteromeryx dispar Matthew, genotypic species


Genotype.—Crushed and A.M.12326 Figured by Matthew, 1905, fragmentary skull, including p¹—m³; portions Text-Figs. 4, 5 and 6.
ofore and hind feet.

(Matthew observes size a little larger than L. mammifer and somewhat less than Protoceras.)

¹ Harold J. Cook (1934, loc. cit., p. 155) bases a species, L. agatensis, on a maxilla from the Lower Mioene of Agate, Nebraska.
DIVISION B.—HYPERTRAGULINI

Subfamily 2.—Hypertragulinae

III. Hypertragulus Cope

IIIA. Allomeryx Sinclair

IV. Nanotragulus Lull

Figures (in part) 64, 65

The subfamily Hypertragulinae is tentatively interpreted as embracing the genus Hypertragulus Cope of the White River and John Day (with which Allomeryx is probably synonymous), and the widely differing genus Nanotragulus Lull (see page 639) of the Harrison and Rosebud.

III. Hypertragulus Cope (and IIIA, Allomeryx Sinclair)

The Oligocene Hypertragulus is so far known in four species—a small species and its variations from the Colorado—South Dakota—Nebraska area, a species of similar size from the John Day, and smaller species from the John Day and South Dakota—Nebraska area. The Lower Miocene remains from Montana and the Rosebud of South Dakota, previously referred to the genus, are more properly transferred to Nanotragulus. The anterior premolars of Hypertragulus are reduced and sharp-cusped, and the molar crowns less low, versus Leptomeryx. The premolars of Nanotragulus are relatively somewhat smaller, the $p_2-p_3$ diastema less, the tooth crowns taller and the bullae more swollen than in Hypertragulus proper. The John Day Hypertragulus hesperius Hay and diminutive (?)Hypertragulus minutus Lull exhibit a height of tooth crown which approximates that of Nanotragulus. The condition of the tooth crowns and bullae in Nanotragulus seems almost as suggestive of Hypisodus as of Hypertragulus. The premolars of the latter are much reduced and the anterior jaw somewhat abbreviated as compared to Leptomeryx. The /C is incisiform, the $p^1$ double-rooted and detached, the $p_2$ sharp, unicuspid and moderately detached, and the $p^3_p^4$ short and compressed. According to Cope (1879), the ulna and radius, like the cuboid and the navicular and the third and fourth metapodials, are coössified in H. calcaratus. The John Day, Oregon, H. hesperius, while differing in the relative shortness of the diastemata and in the larger premolars, approaches closely in height of crowns to the Lower Miocene Nanotragulus.
Summary of Named *Hypertragulus* Species

Five species and a number of variations are tentatively recognized (the same, while showing certain dimensional variations, fall within Size Groups III and IV of the *Leptomeryx-Hypertragulus* section):

**Size Group III.**

1. *Hypertragulus calcaratus* Cope, genotypic species, from the Upper Oligocene, Logan County, Colorado.
   
   **Genotype.**—Left maxilla, A.M.6815.

   (1a and 1b) *H. calcaratus* vars., from the Lower *Oreodon* Beds of South Dakota, and from Bridgeport, Nebraska.1
   
   **Examples.**—Partial skull and rami, A.M.1341 [this paper, Fig. 64 (ramus)]; and left maxilla, N.S.M.8-29-6-34.

   
   **Type.**—Locked skull and mandible, A.M.7918. This paper, Fig. 64.

   (2a) *H. (Allomeryx) planiceps* (Sinclair), from the John Day, Oregon.
   
   **Type.**—Cranium, U.C.104.

   (2b) *Hypertragulus* species Sinclair, from the *Promerychoerus* Beds, John Day, Grant County, Oregon.
   
   **Example.**—Right ramus, U.C.1348.

**Size Group IV.**

3. (1?)*Hypertragulus minor*, n.sp., from Bridgeport, Nebraska.
   
   **Type.**—Left m1–m2 (erupting) and germ of ?p4, N.S.M.9-3-7-34.

4. (2?)*Hypertragulus minutus* Lull, from the John Day, Oregon.
   
   **Type.**—Fragments of jaws and teeth, Y.P.M.10545.

5. (3?)*Hypertragulus dakotensis*, n.sp., from Big Badlands, South Dakota.
   
   **Type.**—Right p4–m2, A.M.689a.

---

Detailed Lists of Types, Referred Specimens, and Synonymy

*Hypertragulus* (and *Allomeryx*), total available specimens, 311; total listed, 29; unlisted, 282.

**SIZE GROUP III.**

(1) *Hypertragulus calcaratus* Cope, genotypic species

From Logan County, Colorado


**GENOTYPE.**—Left maxilla with $p^4-m^4$. (m)

**REFERRED FROM CEDAR CREEK.**

Right ramus with broken $/C$ and $p_1$, etc. alveoli and $m_3-m_4$.

Right $p_1$ root-$m_3$.

Right $/C$ alveolus-$p_4$ and $p_3-p_4$.

Smaller-toothed:

Left $p_{3-4}$.

**EXAMPLE.**—Anterior one-half skull with $C/\text{ and } p^1$ alveoli, $p^2-m^2$; and rami with $/C-p_1$ alveoli and $p_{3-4}$.

From the Lower *Oreodon* Beds, Cheyenne River, South Dakota

This paper, *Fig. 64* (ramus).
REFERRED.—

From Oreodon Beds, Cheyenne River, 1892:

Partial skull with small bulla, p\(^4\) (br.)–m\(^3\); left ramus with p\(_2\) (root) detached, p\(_3\) (root)–m\(_3\) (br.); and limb fragments.....

Left maxilla and ramus with dentition.................

(1b) Hypertragulus calcaratus, Var.

From Bridgeport, Morrill County, Nebraska

Example.—Left maxilla with N.S.M.8-29-6-34 p\(^4\)–m\(^3\). (M++)

(Slightly larger than H. calcaratus.)

REFERRED.—

Left m\(_1\)–m\(_2\). N.S.M.26-6-6-34

Right m\(_3\). (M)

Two fragments.

(2) Hypertragulus hesperius Hay

From the John Day, Oregon


As remarked on a previous page, the John Day remains of the Cope Collection referred to this species and to (?)H. minutus are somewhat taller-crowned than in the case of the H. calcaratus specimens. The series includes specimens which are of larger to considerably smaller dimensions than the type specimen. The larger-sized remains are exemplified by a right ramus with p\(_1\)–p\(_2\) roots and p\(_3\)–m\(_2\), A.M.7940, and a right ramus with p\(_1\) root–m\(_2\) (w+), A.M.7932; and the smaller-sized, by a right fragment with /C and p\(_3\) roots, p\(_1\), p\(_2\)–m\(_3\) (br.), A.M.7980, and a left fragment with p\(_3\)–m\(_3\), A.M.7969. The two latter specimens, A.M.7980 and 7969, are referred to (?)H. minutus.

Type.—Locked skull and jaws with I\(_4\) (br.), p\(_1^1\) detached and double-rooted, p\(_2\) detached, and p\(_3^2\)–m\(_3^2\). (w++)

p\(_1\)–m\(_2\) = ((30.5+)) mm.

Figured by Cope, 1889, Pl. vi; by Scott, 1899, Pl. i, Figs. 3, 4; this paper, Fig. 64.
Referred.—

Partial skull with $p_3^2-m_3^2$. A.M.7930
Partial skull with $p_3^2-m_3^2$, and portions of metatarsi. A.M.7916
Parts of right and left rami with /Is alveoli-$m_3$.
Right ramus with /C root-$m_3$ (in matrix). A.M.7979
Three rami. A.M.7936, 7947 and 7962

Slightly larger than type:

Right ramus with $p_1-p_2$ roots and $p_3^2-m_3^2$. (m+)
Right ramus with $p_1$ root-$m_3$ (w+)

(2a) Hypertragulus (Allomeryx) planiceps (Sinclair)

From Diceratherium Beds, John Day, Grant County, Oregon


Type.—Cranium, lacking muzzle, with $p_3^2$ root and $p_3^2-m_3^2$. (W++)

(Figured by Sinclair, 1905, Pl. xiv, Figs. 1, 2.

(According to figure, approximates Hypertragulus hesperius.)

(2b) Hypertragulus species Sinclair

From Promerychoærus Beds, John Day, Grant County, Oregon


Example.—Right ramus with roots of three small /Is and incisiiform /C, adjacent caniniform $p_1$, diastema, $p_3$ roots, long diastema, and $p_3^2-m_3$.

U.C.1343 Figured by Sinclair, 1905, Pl. xiv, Fig. 3.
SIZE GROUP IV.

CHARACTER OF LOWER MOLARS INTERMEDIATE BETWEEN Hypertragulus AND Nano-
tragulus, AND PERHAPS TENDING MORE NEARLY TO APPROXIMATE THE LATTER
THAN THE FORMER:

(3) (?)Hypertragulus minor, new species
From Bridgeport, Morrill County, Nebraska

Size of H. calcaratus, but tall crowns

TYPE.—Left m₁–m₃ (erupting) N.S.M.9-3-7-34
and germ of ?p₄.
m₁–m₃ = 19.5 mm.
Specimen made available for study through the kindness of the University of Nebraska.

(4) (?)Hypertragulus minutus Lull
From the Upper Oligocene, John Day, Oregon


TYPE.—“Fragments of upper Y.P.M.10545
and lower jaws and teeth.”

According to Lull, m₁–m₃ = 14 mm., versus 20 mm. in H. hesperius.

The writer finds that in the smallest specimen in the American Museum collection from the John Day, the m₁–m₃ measure 19.5 mm.

QUESTIONABLY REFERRED.—
Right fragment with roots of /C and p₁, p₁, p₁–m₁(br.).......... (M+)
Left fragment with p₁ (detached)–m₃. (m₁–m₃ = 19.5 mm.).. (M) 7969

(5) (?)Hypertragulus dakotensis, new species
From Protoceras Beds, Big Badlands, South Dakota, 1892

TYPE.—Right p₁–m₃. ....................................................... (w) 689a

REFERRED.—
Right p₁ (root)–m₃. (m₁–m₃ = 18.5 mm.) .................. (M+) 689b
IV. **NANOTRAGULUS LULL**

The *Nanotragulus* dentition tends to be intermediate in character to the more specialized forms of *Hypertragulus* and *Hypisodus*. The present data, interestingly enough, indicate *Nanotragulus* to be of definitely later occurrence than *Leptomeryx* and the two latter genera, the four recognized species all being derived from the Lower Miocene. The genotypic species is *N. loomisi* Lull. As seen in the alveoli of the type (A.M.13011) of the referred species, *N. ordinatus*, the /C and p₁ were nearly adjacent, the p₁ single-rooted and followed by a rather long diastema, the p₂ sharp, unicuspid, and at most slightly separated from p₃, the p₂–p₄ reduced, the /ms tall with reduced cingular tubercles, and the ramus very slender versus *Hypertragulus*. Loomis (1933) has observed that lateral toes were retained at least in his South Dakota specimens, also that the limbs of *Nanotragulus* were 20% longer than in Recent *Tragulus*. *Nanotragulus* definitely differs from *Hypertragulus* proper in greater reduction of the premolars, abbreviation of the p₂–p₃ diastema, more hypsodont and cingula-less molars and enlarged auditory bullae. Since writing the above our laboratory has discovered, embedded in the matrix of a large block of camel remains secured near the type locality of *N. loomisi*, the major portions of three skulls and a number of mandibular rami and skeletal elements of a small *Nanotragulus*-like form (see Fig. 64). The limb bones are of smaller size than those recorded from South Dakota.

**Summary of Named Species**

(The four named *Nanotragulus* species and referred remains fall within Size Groups I–IV of the *Leptomeryx-Hypertragulus* series):

**SIZE GROUP I.**

(1) *Nanotragulus albanensis*, n.sp., from the Lower Harrison, Nebraska.¹

**Type.**—Right ramus, A.M.13784. This paper, Fig. 65.

¹ Since the preparation of this manuscript a new species of *Nanotragulus*, *N. matthevi* Cook, has been described from Nebraska, and a species, *N. intermedius* Schlaikjer, from Goshen Hole, Wyoming.

Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 160, Pl. iv, Fig. 11, type, m₁–m₄, 21 mm., approximating Size Group III.

Schlaikjer, Erich M., 1935, Bull. Mus. Comp. Zool., LXXVI, No. 4, p. 178, Figs. 12, 13, Pl. xiv, Fig. 4, paratype, p₂–m₃, 25 mm. (according to figure), approximating smaller specimens of Size Group III (and versus 27 mm. given by Lull for his type of *N. loomisi*). The type is an immature individual with dp₁ retained. The reported dimensions, incompleteness of the posterior border of the orbit and relative smallness of the bullae may be due to adolescence.
Size group II.

(2) *Nanotragulus ordinatus* (Matthew), from the Lower Rosebud, South Dakota.

*Type*.—Left ramus, A.M.13011. This paper, *Fig. 64*.

(2a) *N. ordinatus*, var., from Keeline, Wyoming.

*Example*.—Right ramus, F:A.M.31534. This paper, *Fig. 64*.

Size group IV.

(3) *Nanotragulus loomisi* Lull, genotypic species, from the "?Monroe Creek," Wyoming.

*Genotype*.—Palate and partial mandible, Y.P.M.10330.

(3a) *Nanotragulus lulli, n.sp.*, from the Lower Rosebud, South Dakota.

*Type*.—Fragmental skull and partial rami, A.M.13821. This paper, *Fig. 64*.

Detailed Lists of Types, Referred Specimens, and Synonymy

*Nanotragulus*, total available specimens, 39 (9 unlisted)

Size group I.

(1) *Nanotragulus albanensis*, new species

From the Lower Harrison, Sioux County, Nebraska, 1907

(Heretofore allocated to *Hypertragulus ordinatus*)

*Type*.—Right ramus with $p_1$—$m_3$, (w) A.M.13784 This paper, *Fig. 65*.

$p_1$—$m_3$ inclusive = 52.5 mm.

($p_2$ not separated from $p_1$)

*Referred from Type Locality, Slightly Smaller Specimen*.—

Left ramus with $p_1$—$m_3$, (M) A.M.13785
SIZE GROUP II.

(2) **Nanotragulus ordinatus** (Matthew)

From Porcupine Creek, Lower Rosebud, South Dakota, 1906


**Type.**—Left ramus with $p_2$-$m_3$ and /C root ($p_1$ alveolus widely and $p_2$ slightly detached). (w) 

\[ p_1-m_4 \text{ inclusive} = (50.7) \text{ mm.} \]

**Referred.**—

Right fragment with distema, $p_r-p_2$ roots and $p_4$. (w) 

Left $m_1-m_2$. (m+) 

Left $dp_4-m_2$ (br.).

A.M.13011 A.M.13013 A.M.13013x A.M.13012

(2a) **Nanotragulus ordinatus**, Var.

From Keeline, Wyoming, 1931

**Example.**—Right ramus with $p_r-m_3$, in which $p_2$ is not separated. (w)

F:A.M.31534 This paper, Fig. 64.

**Referred from type locality.**—

Right ramus with $p_r-m_3$, in which $p_2$ is separated. (w+)

F:A.M.31535

Five fragmental rami. F:A.M.31536,A-D

SIZE GROUP IV.

(3) **Nanotragulus loomisi** Lull, genotypic species

From Big Muddy River, "?Monroe Creek," Wyoming

*Nanotragulus loomisi* Lull, 1922, Amer. Journ. Sci. (5), IV, p. 116, Fig. 1.
GENOTYPE.—Palate with upper cheek teeth and partial mandible.

Y.P.M.10330 From Castle Butte, near Spanish Mines, Big Muddy River, Wyoming, 1908.

Figured by Lull, 1922, Fig. 1.

According to Lull, p\textsuperscript{1} single-cusped, trenchant and detached, p\textsuperscript{3} trenchant, p\textsuperscript{4} unique, "triangular," lower molars with no accessory pillars, series subhypodont; specimen representing smallest so far described Lower Miocene Artiodactyl. p\textsuperscript{1}-m\textsuperscript{2} = 27 mm.

REFERRED FROM NEAR TYPE LOCALITY.—

Remains of some five or more individuals associated in one sandstone block, collected by Charles Falkenbach in the late fall of 1934. While the dentition measures slightly larger, the limbs are notably shorter than the South Dakota remains as measured by Loomis.

F:A.M.

Partial skull (lacking muzzle and superior occiput) and mandible with p\textsuperscript{2}-m\textsuperscript{2} ........................................ Fig. 64

Skull (dorsal area missing) and mandible with p\textsuperscript{1}-m\textsuperscript{2} ........................................ (w) 31523

Partial skull with p\textsuperscript{2}-m\textsuperscript{2} ........................................ (M+) 31524

Left ramus with symphysis, m\textsubscript{1}-m\textsubscript{2} and alveoli........................................ (w+) 31526

Right fragment with p\textsubscript{3}-m\textsubscript{2} ........................................ (w) 31528

Left fragment with p\textsubscript{4}-m\textsubscript{2} ........................................ (w+) 31529

Left fragment with m\textsubscript{1}-m\textsubscript{2} ........................................ (w) 31529A

Right fragment with partial symphysis, p\textsubscript{3} alveolus, p\textsubscript{4}, m\textsubscript{1} root and m\textsubscript{2}-m\textsubscript{3} ........................................ (w) 31529B

Left p\textsubscript{3}-m\textsubscript{2} ........................................ (w) 31529C

Two lower molars ........................................ (w) 31529D and E

Right m\textsuperscript{3}-m\textsuperscript{3} ........................................ (m) 31533

Left m\textsuperscript{3}-m\textsuperscript{3} ........................................ (m) 31533A

Limb elements (apparently representative of three different individuals, tentatively held under numbers F:A.M.31537-39; see measurements below):

Partial left scapula.

Left humerus.

Left radius and ulna.

Distal right humerus and proximal two-thirds radius and ulna, articulated.

Right and left nearly complete ilia and right femur, articulated.

Partial right ilium.

Left femur (superior trochanter missing and distal condyles crushed).

Right tibia, astragalus and calcaneum, articulated.

Distal four-fifths left tibia and astragalus, articulated.

Distal three-fourths right tibia.

Distal four-fifths left tibia, tarsus and metatarsus, articulated.

Distal end of right tibia and astragalus, articulated.

Right astragalus, partial calcaneum, left cuboid and fragments.

REFERRED FROM WILLOW CREEK, 1935.—

F:A.M.

Right ramus with posterior portion of symphysis and p\textsubscript{3}-m\textsubscript{2} ........................................ (w) 32850
(3a) *Nanotragulus lulli*, new species

From the Lower Rosebud, South Dakota

The bullae are extremely large versus John Day *Hypertragulus*. The detached limb elements are disproportionately large as compared to the Wyoming species *N. loomisi* (see comparative measurements following). Type slightly larger than *N. loomisi*.

*Nanotragulus loomisi* Lull, referred Matthew, 1926, Amer. Mus. Novitates, No. 215, p. 4, Fig. 3.


**TYPE.**—Fragmental skull with enlarged bullae and partial rami, exhibiting p2–m3. (M+)

*REFERRED.*—Four specimens, including skeletal elements cited by Loomis (1933) in the Amherst College collection.

**TABLE XVII**

*HYPERTRAGULINI COMPARATIVE LIMB MEASUREMENTS AND RATIOS*

<table>
<thead>
<tr>
<th>Localities</th>
<th>Collection No.</th>
<th>Humerus</th>
<th>Radius</th>
<th>3d Metacarpal</th>
<th>Femur</th>
<th>Tibia</th>
<th>3d Metatarsal</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Heteromeryx dispar</em>, genotypic (part)</td>
<td>A.M.123261</td>
<td>(117)</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Leptomeryx evansi</em>, var.</td>
<td>Logan Co., Colo.</td>
<td>A.M.67822</td>
<td>(73)</td>
<td>74</td>
<td>40</td>
<td>122</td>
<td>68</td>
</tr>
<tr>
<td>&quot;</td>
<td>Sioux Co., Nebr.</td>
<td>C.M.9972</td>
<td>76</td>
<td>79</td>
<td>49</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Nanotragulus lulli</em>, ref. (after Loomis, 1933)</td>
<td>S. Dak.</td>
<td>Amherst Coll. unassoc.</td>
<td>79</td>
<td>97</td>
<td>118</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td><em>N. loomisi</em>, ref.</td>
<td>Wyo.</td>
<td>F:A.M.31537-9 unassoc.</td>
<td>68</td>
<td>66.5</td>
<td>77</td>
<td>103</td>
<td>50</td>
</tr>
</tbody>
</table>

( ) approximate measurement.
1 A.M.12326, 3d metacarpal/radius = (60)%.
2 A.M.6782, humerus/radius = (69)%; 3d metacarpal/radius = 54%; radius/tibia = 61%; 3d metatarsal/tibia = 56%; 3d metacarpal/3d metatarsal = 59%.
3 C.M.997, humerus/radius = 96%; 3d metacarpal/radius = 62%.
DIVISION C.—HYPSODONTINI

Subfamily 3.—Hypisodontinae

V. HYPSODUS COPE

Figure 64 (in part)

Statement

The division is considered to embrace the single subfamily Hypisodontinae and the peculiar genus Hypisodus, genotypic species H. minimus Cope, from Colorado, and the referred species from Nebraska.

Newly available data as to this remarkable and so far poorly represented genus include a partial maxillary-mandibular series, a nearly complete mandible, and a partial skull and associated mandible from Sioux County, Nebraska, now in the Carnegie Museum collection. While the partial skull and mandible are of a much smaller creature than the American Museum Colorado partial skull and ramus, the several Nebraska and Colorado specimens may represent no more than different-sized individuals.

William D. Matthew (1902) observed that the genus' "real relationships are more nearly with Hypertragulus than anything else, but it is a remarkably modernized animal for the formation in which it is found." Matthew (1910) suggested that Hypisodus might have affinity with the Stenomylinae. Zittel (1923) transferred the genus to the Antilocapridæ. Additional data as to the character and distribution of Hypisodus are much to be desired.

Characters.—The skull apparently was extremely brachycephalic, the occiput narrow, produced posteriorly, the orbits large and enclosed, the lacrimal vacuity small and the bullæ much swollen. The mandible is said to have lacked the camelid hook. The p1 closely adjoined the /C, and like the latter was incisiform; the post-/C diastema was long; the p2 was apparently small and single-rooted with a tendency to be detached from p3; the p3 was reduced, the p4 elongate, compressed, and the molars notably hypsodont. The metatarsus seems to have been short relative to the basilar length of the skull. Matthew (1901) notes the ulna and radius, like the distal end of the fibula and tibia and the cuboid and navicular, to have been coössified; the median metatarsals to have been distinct and the laterals thread-like.
Summary of Named Species

(1) *Hypisodus minimus* Cope, genotypic species, from Logan County, Colorado.

**Genotype.**—Maxillary fragment, A.M.6543.

(1a) *Hypisodus ringens* Cope, from northeastern Colorado.

**Type.**—In question.

(2) *Hypisodus alacer* Troxell, from Nebraska. ¹

**Type.**—Partial skull and jaws, Y.P.M.10033.

Detailed Lists of Types, Referred Specimens, and Synonymy

*Hypisodus*, total available listed specimens, 19

(1) **Hypisodus minimus** Cope, genotypic species

From Colorado


*Hypisodus ringens* Cope and *Leptauchenia minima* Cope, 1873 (October), Synopsis New Vertebrata from the Tertiary of Colorado, pp. 7 and 14.


*Hypisodus minimus* Cope, referred Matthew, 1901, Mem. Amer. Mus. Nat. Hist., I, pp. 358, 440, Fig. 34; 1902, Bull. Amer. Mus. Nat. Hist., XVI, pp. 311, 316, Fig. 1.

**Genotype.**—Left fragment A.M.6543

with m¹–m³.

Molar series length = 12 mm.

Last molar length = 5

From Cedar Creek, Logan County, Colorado (White River Formation).

Cope Collection (Cope's No. 1, 1873).

¹ Cook, Harold J., 1934, Amer. Mid. Nat., XV, No. 2, p. 156, describes and figures two species, *H. paululus* from Crawford, Dawes County, and *H. iron8* from the Brule at the base of the Gering, Scotts Bluff, based on portions of mandibular dentitions—see figures and measurements.
Referred.—

Skull, lacking muzzle, and right ramus. A.M.9354 From vicinity of Pawnee Buttes, Colorado, 1901. Figured by Matthew, 1902, Fig. 1; this paper, Fig. 64 (bulla).

Posterior portion of skull, right maxilla with dp³-m³, right fragment with m₁-m₃; distal portion humerus, partial ulno-radius, partial pelvis, proximal portion femur, proximal end tibia, tarsus, partial metatarsus and laterals. A.M.8989 From Lewis Creek, Logan County, Colorado, 1898. Figured by Matthew, 1901, Fig. 34.

Among the specimens of Cope Collection from Colorado, 1873, are:

Symphysis with all alveoli, left ramus with p₄-m₁(br.), right ramus with p₃-p₄ roots and m₁(br.). [Perhaps Cope's type of H. ringens]... A.M. 6563, 6562 and 6561

Left fragment with dp₃-dp₄ alveoli and dp₄-m₃. 6551
Right fragment with p₃-p₄ alveoli, p₄-m₃(br.) 6554
Right fragment with symphysis, alveoli and dp₄(?). 6559
Left fragment with p₄(erupting)-m₃. 6565
Numerous ramal fragments with teeth (unlisted).

MAXILLÆ

Left fragment with p₄-m³. 6545
Right fragment with m₁-m³. 6546
Left fragment with m₁-m³. 6547
Right fragment with m³. 6550
Upper molar. 6549

(2) Hypisodus alacer Troxell

From Nebraska


Type.—Skull and jaws, anterior portions missing. Y.P.M.100033 Marsh Collection, 1870. Figured by Troxell, 1920, Figs. 1–3.

p₄-m³ = 15.7 mm. m₁-m₃ = 11.8
m₁-m₃ = 11 m₃ = 5
m³ = 4
REferred.—

In the Yale Collection [referred by Troxell (1920, p. 396) to H. minimus].—

Maxillary fragment with Y.P.M.10034 Marsh Collection, 1870. p1–m1.

Figured by Troxell, 1920, Fig. 4.

In the Carnegie Museum Collection, from the Oreodon Beds, Sioux County (C.M. 833 and 3684 small relative to Colorado A.M.9354):

Partial mandible with /Is–

p4 alveoli and p3–m3.

C.M.883 From Badland Creek. Collected by O. A. Peterson, 1901. (part)

This paper, Fig. 64.

Partial skull with enlarged bulle, p3–m3; and broken rami with p3–m2.

m1–m2 = 11.5 mm.

C.M.3684 From Warbonnet Creek. Collected by W. H. Utterback, 1900.

Right maxilla with p4–m4;

and two rami with p4–m2.

C.M.3981 From Badland Creek. Collected by O. A. Peterson, 1901.

A considerable number of fragmentary specimens.

In the Colorado Museum Collection:

Fragment of left ramus with m1–m2.


(An m3 has been questionably referred from Goshen Hole, Wyoming, by E. M. Schlakejer, 1935.)

Fig. 66. Pseudoceras, n.g., from Nebraska and New Mexico, (?)Synthetoceras rileyi, n.sp., and Prosynthetoceras, n.subg., ref., from southeastern Texas, Late Tertiary; mandibular dentitions compared.

Lateral views X 4, occlusal X 1. PS, posterior border symphysis.

F:A.M.31997 and 33790, Pseudoceras klausi, n.sp., type and ref., rev., from Round Mountain Quarry, New Mexico. (See page 652.)

F:A.M.33722, Pseudoceras potteri, n.sp., type, from Cherry County, Nebraska. (See page 652.)

F:A.M.33723, Pseudoceras skinneri, n.g. and sp., genotype, from Cherry County, Nebraska. (See page 650.)

F:A.M.34181, (?)Synthetoceras rileyi, n.sp., type, rev., from southeastern Texas. (See page 605.)

F:A.M.34180, Prosynthetoceras francisi, n.subg. and sp., ref., rev., from southeastern Texas. (See page 605.)
Preliminary descriptions are appended of two hitherto unknown Late Tertiary groups, the first consisting of small pseudocameline-like forms of uncertain relationship, and the second confined to a single peculiar, unexpected and highly specialized stenomyline species. The two groups are presented briefly below under the divisions Pseudoceratini and Stenomylini, referred to the Camelidae.

Fig. 66. *Pseudoceras*, n.g., from Nebraska and New Mexico, (?)*Synthetoceras rileyi*, n.sp. (F:A.M.34181) and *Prosyrhetoceras*, n.subg., ref. (F:A.M.34180), from southeastern Texas, Late Tertiary; mandibular dentitions compared. Lateral views × 1, occlusal × 1. (See legend, page 647.)
DIVISION A.—PSEUDOCERATINI

Subfamily 1.—Pseudoceratinæ

I. PSEUDOCERAS, new genus

Figures 66 and (in part) 23, 65

Statement

A group of diminutive species of doubtful Poëbrothere-like character is considered tentatively as representative of a distinct division, Pseudoceratini, of the Camelidæ.

The genotypic species, *P. skinneri*, is based on a small mandibular ramus of unusual appearance, collected in Cherry County, Nebraska, by Morris F. Skinner. The specimen is characterized by extremely short postsymphysis, simplified premolars and moderate-crowned molars provided with buttresses and tubercles. The I₁ is large and procumbent as compared to the smaller and erect I₂–I₃, and the /C large and recurved, the condition in /Is and /C trending to parallel that in the Recent Tragulidæ. A variation of the same form may be represented by a fragmentary specimen from the vicinity of Snake River, collected by the F. W. Johnson party of the University of Nebraska. A slighter species is based on mandibular remains from Brown County and a third and distinctly smaller species is recognized in remains from Cherry County. An equally small and possibly related species, with premolars of more reduced proportions and fully as short postsymphysial length, is described from Round Mountain Quarry, New Mexico. The shortness of the diastema of the genotype recalls both *Paratoceras* and *Protoceras*; however, the premolars are smaller-proportioned than in the much larger *Paratoceras*, and larger-proportioned than in *Synthetoceras*. A possibly distantly allied form is seen in remains from the Pipestone of Montana, which were questionably referred by Matthew to *Eotylopus* as a species, *E. profectus*. In this latter the diastema is even shorter, the premolars larger-proportioned and the molars notably lower-crowned than in any of the foregoing forms from the Late Tertiary. As in *E. profectus* the p₄ lacks the metaconid and the two strong subparallel crests running from the protocone to the heel enclose a narrow lenticular fossa. The genotypic and several referred species and variant are, with reservation, allocated, pending a better understanding of their characters, to the Camelidæ (rather than to the Protoceratidæ). Examples are illustrated in Figure 66.
Summary of Named Species

(1) *Pseudoceras skinneri*, n.g. and sp., from Cherry County, Nebraska.

**Genotype.**—Left ramus, F:A.M.33723. This paper, *Fig. 66*.

(2) *Pseudoceras wilsoni*, n.sp., from Brown County, Nebraska.

**Type.**—Partial right ramus, F:A.M.31561. This paper, *Fig. 23*.

(2a) Var., from Cherry County, Nebraska.

**Example.**—Left fragment of ramus, N.S.M.1-11-7-35.

(3) *Pseudoceras potteri*, n.sp., from Cherry County, Nebraska.

**Type.**—Left ramus, F:A.M.33722. This paper, *Fig. 66*.

(4) *Pseudoceras klausi*, n.sp., from Round Mountain Quarry, New Mexico.

**Type.**—Right ramus, F:A.M.31997. This paper, *Fig. 66*.

For comparison:

[(5) (?) *Eothylopus profectus* Matthew, from the Pipestone Beds, Montana.

**Type.**—Mandibular fragment, A.M.9681.]

Detailed Lists of Types, Referred Specimens, and Synonymy

*Pseudoceras*, total available specimens, 28; total listed, 23; unlisted, 5.

(1) **Pseudoceras skinneri**, new genus and species

From Cherry County, Nebraska

Collected in 1936 by Morris F. Skinner

**Genotype.**—Left ramus with I₃/C, p3–m₂ (m+) F:A.M.33723 From E. Kat Quarry.

This paper, *Fig. 66*.

[I₃ alveolus large, I₃–I₄ small; /C large, recurved; diastema short, postsymphysial distance very short; angle of jaw round and protruding; premolars camelid-formed. Length /ps = 22 mm., or 2½ times postsymphysical distance (8.5 mm.).]
REFERRED.—

Left mandibular ramus F:A.M.33721 From Mackerodius Quarry.
with p2–m4. (w+)

(Specimen preserves the posterior border of symphysis; postsymphysial
distance as short as in the above specimen; size approximating, but p4 heavier
than in F:A.M.31561.)

Left fragment with dia-

stema and p4(br.)–m2. (M++)

Left fragment with m1–m4. (A)

F:A.M.33724 From E. Kat Quarry Chan-

nel, 1936.

F:A.M.33725 From W. L. Kat Quarry

Channel, 1936.

REFERRED FROM EAST CHERRY COUNTY.—

Left fragment with m4. F:A.M.31377 From Xmas Quarry, 1932.
(M+)

Left fragment with dp2–
m3. F:A.M.31379 From Kat Quarry, 1931.

QUESTIONABLY REFERRED.—

Skull with p1–m4, muzzle F:A.M.33720 From Hans Johnson Quarry.
missing. (w++)

[Size of dentition approximating mandibular specimen (33721); orbits
placed noticeably forward; bullae small, inflated; occiput narrow, triangular.
Form of much worn p1–p4 not unsuggestive of Parablastomeryx.]

(2) Pseudoceras wilsoni, new species

From Brown County, Nebraska

[Extremely short diastema and large, compressed /ps. Length of /ps (19 mm.)
twice postsymphysial distance (9.5 mm.); crowns moderate.

TYPE.—Right ramus with dia-

stema, p2–m1 and m2. (M+)

F:A.M.31561 From J. Wilson Ranch,
Brown County, 1933.

This paper, Fig. 23.

REFERRED1 FROM TYPE LOCALITY.—

Right fragment with m1–
m2. (A)

F:A.M.31384 1934.

1 Left ramus with posterior symphysis and p1–m4 (M++), F.A.M.34000. (Not otherwise listed.)
(2a) Var.

From Snake River, Equivalent af Xmas Quarry Zone, Cherry County, Nebraska

**Example.**—Left fragment with posterior symphysis and p₁–m₁ (br.). (w+)

N.S.M.1-11-7-35 Collected by F. W. Johnson party, 1935.

(3) **Pseudoceras potteri**, new species

From Cherry County, Nebraska

**Type.**—Left mandibular ramus with p₁–m₁. (M)

F:A.M.33722 From Hans Johnson Quarry. This paper, Fig. 66.

[p₁–m₁ measuring 45.5 mm., as in *P. klausi*, versus *P. skinneri*, type (F:A.M. 33723), 53 mm.]

(4) **Pseudoceras klausi**, new species

From Round Mountain Quarry, New Mexico

**Type.**—Right ramus with p₁ F:A.M.31997 This paper, Fig. 66.

root–m₂. (M+)

(Proximity of posterior symphysis indicated.)

**Referred.**—

<table>
<thead>
<tr>
<th>Fragment</th>
<th>Collection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ramus with postsymphysis, p₁ alveolus and p₁–m₁. (w)</td>
<td>F:A.M.31980</td>
<td>Fig. 66</td>
</tr>
<tr>
<td>Right ramus with postsymphysis and p₁–m₁. (w+)</td>
<td>33781</td>
<td></td>
</tr>
<tr>
<td>Right ramus with p₁–m₁ (m₁ br.) (M++)</td>
<td>33782</td>
<td></td>
</tr>
<tr>
<td>Left ramus with p₁ (br.)–m₁. (w)</td>
<td>31983</td>
<td></td>
</tr>
<tr>
<td>Right fragment with p₁ root–m₁. (/ps slighter.) (w+)</td>
<td>31984</td>
<td></td>
</tr>
<tr>
<td>Left fragment with p₁–m₁. (M++)</td>
<td>33783</td>
<td></td>
</tr>
<tr>
<td>Left fragment with p₁–m₁. (w)</td>
<td>33784</td>
<td></td>
</tr>
<tr>
<td>Left p₁ root–m₁. (M)</td>
<td>31984A</td>
<td></td>
</tr>
<tr>
<td>Right m₁–m₂. (w+)</td>
<td>31984B</td>
<td></td>
</tr>
<tr>
<td>Five fragments.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Questionably Referred.**—

<table>
<thead>
<tr>
<th>Fragment</th>
<th>Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left maxilla with p₁–m₂. (M+)</td>
<td>31985</td>
</tr>
<tr>
<td>Right p₁–m₂. (M)</td>
<td>31985A</td>
</tr>
</tbody>
</table>
(5) (?) *Eotylopus profectus* Matthew

From the Pipestone Beds, Montana

[For comparison]

*Leptotragulus profectus* Matthew, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 224, Text-Fig. 18.

(?) *Eotylopus profectus* Matthew, ibid., XXVIII, p. 40.

**Type.**—Mandibular fragment with /Calveolus, short diastema and p2–m1.

A.M.9681  Figured by Matthew, 1903, Text-Fig. 18.

**Referred by Matthew.**—

Fragments.

A.M.9682  9683

**Referred by Writer.**—

Right ramus with p4–m3 (br.) and p1–p2 alveoli.

p4–m3 = 34.5 mm.

Diastema very short and /ps relatively large.

C.M.809b  This paper, *Fig. 65*.

Right fragment with p4, etc.

C.M.809a

Tooth crowns lower, premolars less compressed and diastema shorter than in *Protomeryx campester* Matthew (1901) or *Poebrotherium* Cope (1881). As noted by Matthew (1903) in *Eotylopus* (*Leptotragulus*) *profectus* the p4 "... has no deuterocone, but two strong posterior crests from protocone to heel sub-parallel, enclosing a narrow lenticular fossa. The third premolar is similar, but more compressed..." Matthew observes *L. profectus* as being one-fifth larger than *L. proavus* Scott of the Uinta and that "... It is throughout very suggestive of *Poebrotherium*, much more so than either *Protolopus* or *Leptotragulus proavus*, in the details and conformation of the molar and premolar cusps..." Matthew (1910) "... It is probable that the jaw fragments and teeth which I referred in 1903 to *Leptotragulus* (*L. profectus* Matthew) from the Lower Oligocene of Montana, belong to this genus, although they do not agree well enough for specific identity... *Eotylopus* is very much closer to *Protolopus* than to *Poebrotherium* and might much more readily be derived from it..." Matthew refers *Eotylopus* to the Leptotragulinae with affinities to the Camelidae. (The genotype *Eotylopus reedi* from the Lower Oligocene of Wyoming lacks diastemata in both jaws; the metacarpals are short detached with lateral digits complete, although slender, and distal keels confined to the palmar surface; and the lateral digits of the pes are reduced to nodules as in *Poebrotherium*. )
Fig. 67. *Rakomykus raki*, n.g. and sp., genotype (F:A.M.30990), from the Late Tertiary, north of White Operation, New Mexico. × 4. (See page 657.) (For comparison and abbreviations, see Fig. 2A.)

Scaled p₄ and m₃ (continuation of Fig. 2B). *Leptomeryx* (A.M.1332), camelid (F:A.M.24020), *Stenomylus* (A.M.14220 and 14221) and *Rakomylus* (F:A.M.30995, rev., 39 mm.) species.
**Fig. 68.** *Rakomyllus*, n.g., from the Late Tertiary of New Mexico (F:A.M. 30998 and 30995) and *Stenomyllus* Peterson, from the Middle Tertiary of Nebraska and Wyoming, mandibular and maxillary dentitions compared.

Lateral views $\times \frac{1}{4}$, occlusal $\times 1$. (See legend, next page.)
DIVISION B.—STENOMYLINI

Subfamily 2.—Stenomylinæ

II. RAKOMYLUS, NEW GENUS

III. STENOMYLUS PETERSON

Figures 68 and (in part) 67

Statement

The strongly hypsodont and most surprising Rakomylus, n.g., of the Late Tertiary, Stenomylus Peterson of the Middle Tertiary and diminutive Hypisodus Cope of the Middle Tertiary exhibit different states of anteroposterior elongation of the molars and reduction of the premolars. The maximum expansion of m₃ and reduction of the premolars is attained in the remarkable genus, Rakomylus, here first described. Points of agreement between Stenomylus and Hypisodus have been noted by previous authors. The Stenomylini (Figs. 67, 68) represent the extreme in cheek-tooth specialization in the Camelids, which differs from the families, Cervidæ, Antilocapridæ and Bovidæ, in embracing in its membership subhypsodont as well as a large range of variable hypsodont forms. The Rakomylus m₃, in height and expansion of the crown relative to the anterior teeth, exceeds any here-described Antilocaprid or Bovid. While, so far as observable, a Middle Tertiary Bouromeryx may have lain near the ancestral line of the Late Tertiary Barbouromerycinae and Dromomerycinae, and a Late Tertiary Paratoceras may have been descended from a Middle Tertiary Protoceras (Synthetoceras from Protosynthetoceras and that Late Tertiary form from an early Middle Tertiary Syndyoceras), the relatively better-documented evidence in the case of the Stenomylinæ almost points to Rakomylus as a direct and more highly specialized descendant of Stenomylus.

Fig. 68. Rakomylus, n.g., from the Late Tertiary of New Mexico, and Stenomylus Peterson, from the Middle Tertiary of Nebraska and Wyoming, mandibular and maxillary dentitions compared. (See pages 658, 660–662.)

Lateral views × 1, occlusal × 1. PS, posterior border symphysis.

C.M.11182a, Stenomylus gracilis Peterson (or S. hitchcocki Loomis), ref., from the Lower Harrison, Sioux County, Nebraska.

F:A.M.30998 and 30995 (rev.), Rakomylus raki, n.g. and sp., ref. (vertical ramus supplied from 30997), from Santa Fé area, New Mexico. (See also Fig. 67 [F:A.M. 30995].)

F:A.M.32841, Stenomylus gracilis, var., from Lusk, Wyoming. (Iσ/-p⁴ restored from A.M.14220.)

A.M.14220 [= 14220A and B combined], Stenomylus crassipes Loomis, ref., from the Lower Harrison, Sioux County, Nebraska. (See also Fig. 67.)

F:A.M.31178, Stenomylus gracilis Peterson, ref., from the Lower Harrison, Sioux County, Nebraska.
II. **Rakomylyus, new genus**

Total available listed specimens, 7

(1) *Rakomylyus raki*, new genus and species

From the Tertiary of Santa Fé, New Mexico

The genus is remarkable for the peculiar character of muzzle and dentition. The skull, while of the general aspect and size of *Stenomylus*, is stouter and differs very markedly in the development of the premaxillary-nasal area, the enlarged central incisors, the longer post-C/ diastema, the enlargement of posterior molars and abortion to loss of pre-molars, the elongation of the ascending premaxillary branches, shortness of the nasals and depth of the anteromaxillary fossae. The latter are suggestive of a proboscis-like development of the upper lip. 1\(^1\) and 1\(^2\) are very large; the smallness of C/ indicates a female; (p\(^1\)-p\(^2\) were never present); p\(^3\) is diminutive peg-like and p\(^4\) and m\(^1\) rudimentary relative to the greatly enlarged m\(^2\)-m\(^3\). The inferior area of the skull, pterygoids, glenoids, bullæ and condyles resemble *Stenomylus*. Noteworthy characters of the mandible are the abbreviation of the diastema, the apparent absence, in the aged series, of all of the premolars, the retention of the dp\(_4\) in immaturity and the extraordinary expansion of the last lobes of the tall-crowned m\(_3\). The mandibular ramus narrows sharply anteriorly, as is usual in the camel, but the mandibular angle is rounded and without hook (inner muscular depression prominent) and the condyle is low. An exaggerated *Stenomylus* is seen in the proportions of m\(_3\) relative to m\(_1\), the height of the m\(_3\) crown and great width of its second and third lobes as compared to the first. The diastema immediately anterior to m\(_1\), as shown in two of the best preserved specimens, together with the brevity of the postsymphysial–m\(_1\) distance, as shown in one specimen, tend to indicate the entire absence of p\(_4\). The dp\(_4\), relative to m\(_1\) (and m\(_3\)), is proportionately small as compared to the condition in *Stenomylus* (see Fig. 68). The limbs, as seen in metacarpi, were short-proportioned.

The genus is named in memory of Joseph Rak, who in years past collected its first observed remains from Santa Fé exposures. The only so-far-known skull was discovered the present summer in the same area by the John C. Blick party.

**Genotype.**—Well-preserved skull, complete save for postero-superior cranium, with Is/, C/ and p\(^4\)-m\(^3\). (Left m\(^1\) and \(m^3\) are shed.) ..................................................... (w+) F:A:M. Fig. 67 30990
Rakomylus raki

Genotype

F:A.M.30990

B.L. = 200 mm.

Post C/-p^4 diastema = 29

p^1-p^4 = (10)

m^1-m^2 = (53.5)

m^2 = (28.5)

Stenomylus crassipes

Referred

A.M.14221

197 mm.

22

18

54.5

21.5

REFFERED.—

Left and apparently associated right partial mandibular rami with portion of diastema, m^1, alveolus and m^2-m^3. (Collected by Joseph Rak, north of Santa Fé.) ........................................... Figs. 67, 68

Rakomylus raki

F:A.M.30995

16+

34+

15.7 mm.

28.5

Section of right ramus with portion of diastema, indication of posterior border of symphysis and m^1 alveolus-m^2. ........................................... (w+) 30996

Right posterior ramus showing rounded angle, low-lying condyle and m^3. ........................................... (w) 1933 30997

Left fragment with dp^4-m^1 (erupting) .......................... Fig. 68 1928 30998

Two small and unique metacarpi (F:A.M.30999 and A, length approximately 135 mm.), one of which was collected in the immediate vicinity of one of the above mandibular specimens, are referred to the genus. While the two specimens represent the smallest camelid-formed metacarpi from the Santa Fé area known to the writer, they are not disproportionately small for the type skull, their lengths being equivalent to the distance from the incisive border to opposite the anterior third of the orbit.

III. STENOMYLUS PETERSON

From the Middle Tertiary of Nebraska and Wyoming

The peculiarly specialized genus Stenomylus of the Middle Miocene represents an aberrant side-branch of the Camelidae. The genus is interesting, as noted above, in connection with the somewhat similarly but more specialized Rakomylus, n.g., of the New Mexican Late Tertiary. Peterson (1907) remarks on the resemblance of Stenomylus and Hypisodus. Consideration of Stenomylus here is confined to a relisting of the types and a few referred remains of the several described species and the recording of minor new evidence from Nebraska and Wyoming.
The description by Peterson of the genotypic species, *S. gracilis*, based on remains from the vicinity of the Niobrara, was followed by a discussion by Loomis (1910) of remains from the Amherst Quarry, where a great series of these little camelids has been obtained by several institutions. A reexamination of the fossil evidence as a whole is much to be desired, as the same should throw light on individual variation within the group and on the status of the three named species.

Heretofore undescribed specimens include: a fragmentary mandible and associated radius (F:A.M.31178, Fig. 68), obtained by Paul Miller (1927) from the vicinity of the Niobrara, of an individual of fully as large size as the *S. gracilis* type; and remains, collected near Lusk by Charles Falkenbach and east of Rawhide Buttes, Wyoming, by Paul Miller, which include a smaller variation ostensibly equivalent to that of the remains from the Amherst Quarry. Several of these newly secured specimens are figured on the adjoining plate in comparison with teeth of *Rakomylus*. A specimen of the deciduous dentition (C.M.11182a), figured through the kindness of Director Avinoff of the Carnegie Museum, shows the dp₂ widely detached and dp₃ much reduced.

Characters.—Three Is/ and C/ in series, slight diastema, p¹ small, double-rooted, p² greatly reduced (actually smaller than p¹), p³ small and tending to be slightly separated from p²; three /Is, incisiform-tending /C and p₁ in series, moderate diastema, p₄ double-rooted (lying halfway between p₁ and p₃ and posterior to the mental foramen), p₅ greatly reduced and approximating p₄, the anteroposterior diameter of the molar lobes consecutively increasing from m₁–m₃; horizontal ramus depth rapidly decreasing from angle to symphysis, typical camelid hook absent; posterior nares opposite posterior edge of m₁, no formed sagittal crest; fourth cervical longest, fifth cervical next to longest; metacarpus consolidated. (See table of measurements, page 663.)

**Summary of Named Species**

The genus is exampled by:

(1) *Stenomylus gracilis* Peterson, genotypic species, from the Niobrara, Nebraska.

**Genotype.**—Base of skull, mandible, certain limbs and vertebrae, C.M. 1610.

(1a) *Stenomylus gracilis*, var., from vicinity of Lusk, Wyoming.

**Example.**—Partial cranium and ramus, F:A.M.32841. This paper, Fig. 68.
(2) *Stenomylus crassipes* Loomis, from Amherst Quarry near Agate Spring post office, Nebraska.

**Type.**—Skull, mandible and skeletal elements, Amh.Coll.2150.

(3) *Stenomylus hitchcocki* Loomis, from Amherst Quarry ("slightly higher level").

**Type.**—Articulated female skeleton, Amh.Coll.2059.

Detailed Lists of Types, Certain Specimens, and Synonymy

*Stenomylus*, total available specimens, 43; total listed, 17; unlisted, 26.

(1) **Stenomylus gracilis** Peterson, genotypic species

*From the Lower Harrison Beds, Sioux County, Nebraska*


**Genotype.**—Base of skull with $p^1-m^3$, mandible with complete dentition and certain limbs and vertebrae.

$p^3$ greatly reduced.

Length upper series = (82) mm. (sum of tooth lengths).

Length metatarsus = 192

Length radius = 220

(See measurement table.)

**Referred, Secured in the General Vicinity by Paul Miller, 1927.**

Mandibular portions including left ramus with three /I/, alveoli of /C and $p^1$ and trace of $p^2$ alveolus, $m_2-m_3$ greatly worn, and right ramus with $m_3$.

Length radius = 229 mm.
QUESTIONABLY REFERRED (possibly S. hitchcocki Loomis).—

Fragmentary palate and both rami exhibiting dp²–m³ (erupting).

According to Loomis, the species is rather rare, larger than S. hitchcocki, with the metacarpals partially united, the upper molars narrower, the /C less incisiform and the p₁–p₃ diastema shorter.

(1a) Stenomylus gracilis, Var.

From the Vicinity of Lusk, Wyoming

EXAMPLE.—Partial cranium with p¹–m² and ramus with I₁–m₂. (w+)

REFERRED.—

Right ramus with p₁ alveolus and p₃(br.)–m₂.

Portions of skull including Is/ and p²–m³(erupting).

Slightly smaller:

Anterior portion of mandible with I₁–m₂. (w+)

Left p₁ alveolus–m₃.

Smaller, approximating S. crassipes in size:

Right ramus with p₁–m₃. (w++)

Left ramus with p₃(br.)–m₃. (w+)

(2) Stenomylus crassipes Loomis

From the Lower Harrison Beds, Sioux County, Nebraska

Type.—Skull lacking premaxilla, mandible, six cervical and three dorsal vertebrae, scapula, humerus, ulno-radius, carpals, metacarpals and phalanges.

Amh.Coll.2150 Figured by Loomis, 1910, Text-Figs. 27–30.

Referred.—

Left ramus with p₁-m₁ (erupting).
Loomis’ “cotype.”

Left ramus with p₄, distema and p₄(br.)-m₃ (erupting).

Skull, mandible and partial skeleton.
Catalogued under Stenomylus gracilis Peterson.

Skull and mandible. (≥m)
Right maxilla with p₄-m₁
(w)
Immature maxilla-premaxilla with Is/, Cs/ and p₁.

A.M.14220A This paper, Figs. 67, 68.
A.M.14220B
A.M.14221 This paper, Fig. 67.

According to Loomis, the general size of the skull approximates S. gracilis, but the neck and limbs shorter and heavier, the premolars much more reduced and the /C completely incisiform.

(3) Stenomylus hitchcocki Loomis¹

From the Lower Harrison Beds, Sioux County, Nebraska


According to Loomis, secured from a higher level of the Lower Harrison than S. crassipes.

1937] Frick, Horned Ruminants. Appendix—Camelids (in part) 663

**TYPE.**—Articulated skeleton, Amh.Coll.2059 From Amherst Quarry, 5 miles S.E. of Agate Spring post office. Figured by Loomis, 1910, Fig. 1.

(Loomis estimates height at shoulder = 27 inches [684 mm.].)

**REFERRED.**—

Six skulls, twelve jaws and four disarticulated skeletons in the Amherst Collection, and “four skeletons” in the American Museum Collection. (Loomis, 1910.)

The three composite skeletons (figured, 1912, Pls. xxi, xxii, Ann. Carn. Mus., VIII) representing male, female and immature, Carnegie Museum mounts, and the large series of composite skeletons of the American Museum’s mounted group have been referred to this species.

According to Loomis, this species is the least specialized and commonest of the three forms, and is distinguished by small size, metacarpals entirely separate, molars narrow, /C completely caniniform, p1–p4 diastema relatively long and the p4 greatly reduced.

**Measurements**

[Millimeters]

<table>
<thead>
<tr>
<th></th>
<th>Stenomylus gracilis Peterson</th>
<th>Stenomylus crassipes Loomis</th>
<th>Stenomylus hitchcocki Loomis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genotype</td>
<td>Type</td>
<td>Ref.</td>
<td>Type</td>
</tr>
<tr>
<td>C.M.1610</td>
<td>*A.C.2150</td>
<td>A.M.14220</td>
<td>*A.C.2059</td>
</tr>
<tr>
<td>B.L.</td>
<td>(?)204</td>
<td>(78)(M)</td>
<td>(79)(-M)</td>
</tr>
<tr>
<td>L/occ. condyle..</td>
<td>(82)</td>
<td>211</td>
<td>70(-M)</td>
</tr>
<tr>
<td>p2–m3</td>
<td>78(M)</td>
<td>(75)(-M)</td>
<td>(75)(-M)</td>
</tr>
<tr>
<td>pr–m3</td>
<td>(?)</td>
<td>194</td>
<td>215</td>
</tr>
<tr>
<td>Radius</td>
<td>220</td>
<td>182</td>
<td>166</td>
</tr>
<tr>
<td>Metacarpus.</td>
<td>166</td>
<td>*170</td>
<td>*170</td>
</tr>
<tr>
<td>Tibia</td>
<td>242</td>
<td>*213</td>
<td>*185</td>
</tr>
<tr>
<td>Metatarsus.</td>
<td>192</td>
<td>185</td>
<td>185</td>
</tr>
</tbody>
</table>

* From Loomis, 1910.

( ) approximate measurement.
INDEX OF GENERA AND SUBGENERA
MENTIONED IN THIS VOLUME

Page numbers starred = citation of genotype; page numbers *italicized* = genus cited in figure legends (and text); page numbers *italicized* and in ( ) = genus cited in figure captions; page numbers in **boldface** type = discussion of genus.


(Aftonius), 37, 540, 548-549, 552
Alces, 11, 33, (183), 189-190, (193), 195-196, 198, 200, 204
(Allomeryx), 29, 39, 633-635, 637
[Antelope, S.A.], 267
[Antifer, S.A.], 34, 205
(Aplocerus), 546
Bison, 13, 15, 23, 28, 37, 539-541, 559, 567-568, 572-574, 575, 576-578 (species listed), 579-593
[Blastocerus, S.A.], 34, 198, 205-206, (207), 208 (species listed), 209
Bootherium, 28, 37, (538), 540, 556-557, 558 (species listed), 559, 561, 564-565, 566
Bos, viii, 37, 540-541, 563, 565, 567-569, (571), 576, 578-580, 582, 587-589, 593
Bouroumyer, 30, 32, 42, 45-46, 48, 49, 50, 54-57, 58, (62), (64), 68-69, 77, 80, 93-94, 111, (118), 115, 123-124, 126, 127, 128-129 (species listed), *130-134, 153, 168-169, 175, 183, 656
(Calops), 29, 38, 595, 597, 602, 608, 610, 613, 631
[Camelomeryx, ?Hypertragulidae], 28
[Capreolus, E.H.], 190
("Capreoceros"), 36, 523
Capromeryx, 12, 29, 36, 349, (488), 470, 476, (485), 487, 489, 505, 507, 512, 517, 519, (520), 521-522, 523 (species listed), 524, 526, 527-528, 529-531, 535-537
(Cariacus, and see Odocoileus), 28, 152, 197
Ceramomeryx, 29, 36, 476, 524, 526, *533-534
Cervalces, viii, 11, 29, 33, (183), 195, 196, 198, 199 (species listed), 203-204

664
Index of Genera and Subgenera

(Cervavus), 77, 82, 83
[Cervulus, E.H.], 10, 15, 27, 33, 40, 50, 190, 282; synonym: 48
Cordillerion, 205
Cuvieronius, 205
[Cyclopidius, Oreodontidae], 596
[Dama, E.H.], 191, 200
[Dicranocerus], 36, 523
Dinoceras, 609
[Dorchatherium, E.H.], 620
[Dremertherium, E.H.], 11, 251
Drepanomeryx, viii, (xxviii), 10, 29, 32, 42, 45–46, 49, 50, 56–58, (70), 72–73, (79), 137, 138 (species listed), (139), *140, 153, 175
(Dyseomeryx), 77, 82, 140, 147, 149, 152–153, 159–161, 165, 219
[Elaphodus, E.H.], 190
Elephas, 196
Eotylopus, 615, (617), 649–650, 653
Equus, 197
Eucritherium, 28, 37, 540–541, 548, 549–550 (species listed), 551–554
Eucervus, 33, 198
[Gazella, E.H.], 547
[Gidleya], 37, 540, 560
[Grifafa, E.H.], 24
(Haploocerus), 546
Hayoceros, 12, 30, 36, (468), 470, 476, 489, 508, 512, 519, (520), 521–522, 524 (species listed); 526–528, 531, *532–535, 537
<table>
<thead>
<tr>
<th>Genera and Subgenera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heteromeryx, 28–29, 39, 618, 621, 622, 625, *632, 643</td>
</tr>
<tr>
<td>[Hippocamelus, S.A.], 34, 205, 206</td>
</tr>
<tr>
<td>Hyaenarctos, 8</td>
</tr>
<tr>
<td>[Hydrelaphus, E.H.], 190</td>
</tr>
<tr>
<td>[Hyemoschus, E.H.], 14, 22, 620</td>
</tr>
<tr>
<td>[Leptauchenia, Oreodontidae], 635, 645</td>
</tr>
<tr>
<td>Leptotragulus, 653</td>
</tr>
<tr>
<td>[Leptotherium, S.A.], 267</td>
</tr>
<tr>
<td>(Loeps), 37, 540, 560</td>
</tr>
<tr>
<td>Macheromeryx, 11, 24, 29, 34, 43, 215, 219, 229, (250), 251–252, 253 (species listed), *254, 260, 450</td>
</tr>
<tr>
<td>Mastodon, 196</td>
</tr>
<tr>
<td>Matthomeryx, (xxviii), 10, 30, 32, 42, 45–46, 50, 57–58, 82, 137, 138 (species listed), (139), 140, *141, 175, 182</td>
</tr>
<tr>
<td>[Mazama, S.A.], 34, 190, 205–206, 545</td>
</tr>
<tr>
<td>Megalonyx, 197</td>
</tr>
<tr>
<td>[Metoreodon, Oreodontidae], 23</td>
</tr>
<tr>
<td>[Micromeryx, E.H.], 11, 34, 40</td>
</tr>
<tr>
<td>[Morelaphus, S.A.], 34, 205</td>
</tr>
<tr>
<td>[Moschus, E.H.], 11, 34, 40, 190, 217, 218</td>
</tr>
<tr>
<td>[Muntiacus, E.H.], 190</td>
</tr>
</tbody>
</table>
**Index of Genera and Subgenera**

*Prosynthetoceras*, viii, 3, 9, 13, 23, 25, 30, (38), 82, 544, (504), 595–596, 597, (598), (599), (600), (601), 602, 603 (species listed), *605–607, 647, (648), 656

*Protobarbouroumeryx*, 10, 30, 32, 42, 45–46, 49, 55–56, 58, (60), (61), 67, 127, 128, 129 (species listed), 130, *136, 175


[Protomasama, S.A.], 206

[Protomeryx, Camelidae], 653

[Protolopus, Camelidae], 653


*Pseudoceras*, 14, 22, 30, 39, (222), 226, 243, 596, (647), (648), 649, *650 (species listed), 651–652


*Pseudoprotoceras*, 29, 595, 597, 602, 608, *614

[Puđu, S. A.], 34, 205–206


*Rakomylus*, 30, 39, (654), (655), 656, 656, *657, 658


Rhynchotherium, 8

[Rupicapra, E.H.], 545

*Saiga*, viii, 13–14, 22, 28, 37, (538), 539–540, 541, (542), 543, 546–547, 596

(Sangamona), 33, 197

(Scaphoceros), 561, 564

Simobison, 568, 577, 587

*Saëndieromeryx*, (ii), 10, 13, 22, 25–27, 30, 33, 42, 45–47, 50, 51, 54–56, 58, (60), (61), (62), (64), 67–69, (70), 72, 80, 124, 131, 137, 147, (150), (151), 152, 153–154, 155 (species listed), 156, 162–*164, 165–169, 173, 176, 184, 187, 219


*Sielabison*, 568, 577, 585–586, 591

*Stenomylus*, 14, 39, (654), (655), 656, 656–659, 659–*660 (species listed), 661–663

*Stockoceros*, 12, 30, 36, 267, 293, (403), 470, 474, 476, 500, 508, 512, 519, (520), 521, 522 (species listed), 524, *526–527, 531, 534–536

Index of Genera and Subgenera


Superbison, 28, 37, 540, 541, 567–568, (570), (571), 572–574, 575, 576–578 (species listed), 579–584, 586–592

Symbos, 28, 37, 540, 556–557, 558 (species listed), 560–564


Tapirus, 197
(Taurotragus), 37, 540, 548–549, 552–553

[Tetraceros, E.H.], 26

(“Tetramoceros”), 36, 523


(Tricornitocras), 500

[Tragulus, E.H.], 190, 251, 620, 639

Triceratops, 576

(Trimerodus), 627, 629

Yumaceras, viii, 10, 22, 25, 30, 33, 42, 45–47, 50, 54, 57, 58, (66), (71), 72–73, (79), (141), 142, *143 (species listed), 144–145, 154, 169, (170), 172, 174, 176, 182, 184–185