NEW CANID AND RHINOCEROTID REMAINS FROM THE RICARDO PLIOCENE OF THE MOHAVE DESERT, CALIFORNIA

BY

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INTRODUCTION

The mammalian fauna from the Ricardo deposits of the Mohave Desert of California, as recorded and described by Merriam,[1] represents one of the largest and most important assemblages known from the Pliocene of western North America. In view of the significance which attaches to this fauna further work in the Ricardo area seemed highly desirable, particularly since extensive exposures of the Ricardo beds in this region remained to be examined in detail.

This investigation was continued through the support of Miss Annie M. Alexander and at the suggestion of Dr. John C. Merriam. With the personal coöperation of Miss Alexander and Miss Louise Kellogg, the Ricardo beds in the vicinity of Last Chance Gulch, four miles east of Red Rock Cañon, have been carefully explored. The collections thus secured include canid and rhinocerotid forms not previously recorded from the Ricardo, as well as proboscidean and artiodactyl remains which furnish additional information concerning types already described.

[1] Merriam, J. C., Tertiary mammalian faunas of the Mohave Desert, Univ. Calif. Publ. Bull. Dept. Geol., vol. 11, 437*a*–437*e*, 438–585, 253 figs. in text, 1919.

The present paper describes the types new to the fauna. Studies of the Ricardo mammals based upon the new materials secured may, it is hoped, assist further in establishing the relationship of the Ricardo assemblage to the later Tertiary faunas of the Great Basin and Great Plains regions.

The illustrations have been prepared by Mr. John L. Ridgway.

LOCATION OF MATERIAL

Last Chance Gulch traverses the El Paso Mountains (Searles Lake Quadrangle, U. S. Geological Survey), four miles northeast of Red Rock Cañon. At a locality three miles north of the entrance to Last Chance Gulch occur Ricardo deposits which in their stratigraphic position and lithologic characters closely resemble those described by C. L. Baker in the Red Rock Cañon region to the west. The Ricardo deposits in Last Chance Gulch have been mentioned by Baker,[2] who states that above the basal beds of conglomerate followed by an andesitic tuff-breccia are bluish gray tuffs. The bluish gray beds contain arkosic and clayey materials similar to deposits in the lower portion of the Ricardo section in Red Rock Cañon as recorded by J. P. Buwalda in a measured section given in Merriam's paper.[3] In Last Chance Gulch the horizons from which the canid remains and some of the rhinocerotid material were obtained are situated between the basal beds and the basaltic lava flows in the lower portion of the Ricardo. At one locality in this lower series occur many remains of fossil tree trunks. The fossil trees are located in section 8, T. 29 S., R. 30 E., Mt. Diablo Base and Meridian. Mammalian remains were found in the Ricardo both above and below the horizon that contains the petrified trees.

The specimens referred to *Hadrocyon* and to *Peraceras?* sp. were taken from Ricardo deposits in the immediate vicinity of the locality where the tree trunks occur, but were found approximately 25 feet higher in the section. A second specimen of a rhinoceros, determined as the genus *Aphelops*, was collected by Newton Brown in Ricardo deposits below the lavas in the region of Scenic Cañon, between Last Chance Gulch and Red Rock Cañon.

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[2] Baker, C. L., Physiography and structure of the western El Paso Range and the southern Sierra Nevada, Univ. Calif. Publ. Bull. Dept. Geol., vol. 7, pp. 123–125, 1912.

[3] Merriam, J. C., *op. cit.*, p. 448.

DESCRIPTION OF MATERIAL

HADROCYON MOHAVENSIS n. gen and n. sp.

Type specimen, No. 26792, U. C. Mus. Pal. Vert. Coll., plates 7 and 8.

Size approximating that of amphicyonine genera *Amphicyon* and *Pliocyon*. Dentition $\frac{3}{3}?, \frac{1}{1}, \frac{3}{3}, \frac{3}{3}$. Stout canine; $P_{\bar{1}}$ absent; $P_{\bar{2}}$ separated by diastemata from canine and $P_{\bar{3}}$; crown of $P_{\bar{4}}$ directed outward and with well developed accessory tubercle behind large principal cusp. $M_{\bar{1}}$ with relatively small heel in which apparently the hypoconid does not overshadow in size the entoconid.

Skeletal characters like those in American amphicyonine genera.

This dog type is known from the Ricardo deposits by a fragmentary lower jaw and skeletal parts including humerus, tibia, metapodials, astragalus, and ribs, all specimens definitely associated.

Hadrocyon is shown by lower jaw specimen 26792 to be comparable in size to *Aelurodon meandrinus* Hatcher and *Dinocyon gidleyi* Matthew, forms regarded by W. D. Matthew as falling within the limits of the genus *Pliocyon*. The incisors, although not preserved in 26792, seem to have been three in number with the lateral incisor distinctly larger than the medial ones. The canine is large and well worn. $P_{\bar{1}}$ is absent. The alveolus for $P_{\bar{2}}$ is separated from the canine by a diastema 22 mm. in length and from the alveolus for $P_{\bar{3}}$ by a distance of 8 mm.

The alveolus is situated farther toward the inner side of the jaw than that for $P_{\bar{3}}$. $P_{\bar{2}}$ and $P_{\bar{3}}$ are two-rooted and both teeth are distinctly smaller than $P_{\bar{4}}$. $P_{\bar{3}}$ is not inclined backward so much as in *Aelurodon*. The tooth is inclined outward with reference to a vertical anteroposterior plane passed through the ramus. An outward inclination of the tooth crown was presumably characteristic also of $P_{\bar{3}}$. The crown of $P_{\bar{4}}$ does not widen posteriorly as in *Aelurodon*, and bears behind the principal cusp a well developed accessory cusp. There is no indication of a cingulum at the base of the posteroexternal side of this cusp.

The crown of $M_{\bar{1}}$ is badly damaged and the characters of the trigonid region cannot be satisfactorily determined. The talonid region appears to be relatively short and presents no direct evidence that the hypoconid overshadowed in size the entoconid to the extent seen in the amphicyonines. As suggested by markings on the heel of $M_{\bar{1}}$ the entoconid was a fairly large cusp. The Ricardo specimen differs from *Aelurodon* and is more like the amphicyonine forms in having large posterior molar teeth. $M_{\bar{2}}$ and $M_{\bar{3}}$ are not preserved in no. 26792. $M_{\bar{2}}$ possessed large roots. $M_{\bar{3}}$ was single rooted.

The ramus of the mandible is much heavier than that of *Aelurodon*, and resembles in this character such forms as *Pliocyon* (*Aelurodon*) *meandrinus* and *Pliocyon* (*Dinocyon*) *gidleyi*. The ramus does not exhibit the sinuous sweep of the inferior border seen in *Aelurodon* but is fairly straight, in which respect it resembles more, perhaps, *Pliocyon gidleyi*. The masseteric fossa is not sharply defined along the lower anterior border. The posterior mental foramen lies beneath the posterior root of $P_{\bar{3}}$. A larger anterior foramen is situated beneath $P_{\bar{2}}$. Two smaller foramina, lying close together, are situated still farther forward and are in line with those already mentioned. Finally, a large foramen is situated close to the symphyseal border beneath the incisor series. The symphyseal surface is large.

Fortunately several skeletal elements have been found associated with the ramus of the mandible from the Ricardo and undoubtedly belong to the same individual. A humerus and a tibia are badly crushed. The humerus lacks also the proximal end and the inner condyle. In this specimen the deltoid ridge is well defined and extends relatively farther down on the anterior face of the shaft than in *Smilodon*. The position of this crest is somewhat comparable to that in *Indarctos? oregonensis*. The supinator crest is well developed and the entepicondylar foramen is large. At the distal end the radial surface appears to be flattened and more like that in *Arctotherium* than like that in *Smilodon*, although this cannot be stated with certainty since the lower end of the humerus has suffered from crushing.

The tibia is short and the cnemial crest extends well down the length of the shaft. The internal malleolus, as viewed from the anterior side, does not form a prominent projection. The groove for the tendon of the flexor longus digitorum is broad and is separated by a well defined ridge from the groove for the tendon of the tibialis posticus. The trochlea is oblique. The size of the astragalus is comparable to that seen in the astragalus of *Smilodon*. It also somewhat resembles this element in shape. The trochlea is narrower and the median groove is deeper than in the Pleistocene saber-tooth cat. No astragalar foramen is present. The navicular surface is broad. The inner calcaneal facet is of small extent, reaching about halfway across the calcaneal surface of the astragalus. Two metapodials, metatarsals IV and V, are known of *Hadrocyon*. These elements are short with proximal ends relatively large. Metatarsals IV and V are not much longer than the comparable metapodials in *Daphænodon superbus*. In metatarsal IV the articulating surfaces for the adjacent metapodials and for the cuboid are large. The lower or plantar facet on the inner side of the fourth metapodial, articulating with metatarsal III, is in contact with the cuboidal surface. The surface for union with metatarsal V is continuous from the dorsal to the plantar border. The surface of articulation for the cuboid is broad toward the plantar side and extends practically to the plantar border of the proximal end. Along the middle of the posterior face of the shaft is an extensive rugose area for ligamentous attachment.

In metatarsal V the outer plantar border is elevated above the plane of the facet for the cuboid by the development of a heavy outer and outer-plantar tuberosity. These tuberosities are closely joined and are defined in proximal view only by a narrow transverse groove which incises the proximal border. The shaft is broader than in *Daphænodon superbus*.

Measurements of No. 26792

Ramus and lower dentition

Depth of ramus at P_2, measured normal to inferior border	54.3 mm.
Depth of ramus between P_4 and M_1	64.2
Depth of ramus at posterior end of M_1	72.2
Length of symphysis	70.7
C, anteroposterior diameter at base of enamel	24.9
C, transverse diameter at base of enamel	19.7
P_2, anteroposterior diameter of alveolus	12.8
P_3, anteroposterior diameter of alveolus	14.4
P_4, anteroposterior diameter	22.6
P_4, greatest width	11.7
M_1, anteroposterior diameter	44.

M_1, greatest width across paraconid-protoconid blade	*a* 16.6
M_1, width of heel	*a* 16.4
M_2, anteroposterior diameter of alveolus	24.
Length from anterior end of canine to posterior end of M_1	151.6

Astragalus

Greatest length	50.8 mm.
Greatest width	50.1
Least distance across neck	23.1

Metapodials	Metatarsal IV	Metatarsal V
Greatest length	79. mm.	75.4 mm.
Anteroposterior diameter of proximal end	24.1	28.3
Least width of shaft	11.	12.8
Greatest width of distal end	19.1	18.5

a, approximate.

Relationship of Hadrocyon

The canid type represented by specimen 26792 is quite certainly not to be referred to *Aelurodon*. This is clearly shown by the large size and shape of the ramus of the mandible, by the dentition and by the characters of the limb elements. Merriam describes the remains of large dogs from the Ricardo and refers the forms tentatively to *Aelurodon*. One type, *Aelurodon? aphobus*, is based on a fragment of a maxillary with several teeth, no. 21507, U. C. Coll. This specimen lacks the enlarged upper molar dentition required by the large size of the lower molars in *Hadrocyon*. A fragmentary ramus of the mandible with worn teeth, no. 22470, from the Ricardo described by Merriam as *Aelurodon?* possibly *aphobus*, is certainly not related to *Hadrocyon*.

In a comparison with the amphicyonine dogs of the Great Plains Tertiary, the Ricardo material of *Hadrocyon* suggests relationship in large size and strength of lower jaw and in the relatively well developed molar teeth. Further indication of relationship exists in the structural characters seen in the skeletal elements. Characters presented in the humerus, tibia, and astragalus are like those seen in comparable elements, presumably of amphicyonine types, from the Sheep Creek horizon or *Merychippus primus* zone (Stonehouse Draw locality) of Nebraska. The latter material has been described by Matthew and referred to the amphicyonine dogs, although no undisputed association of skull and skeletal material has yet come to light from the Snake Creek region. It should be noted, in passing, that the Lower Snake Creek (*Merychippus paniensis* zone) and the Sheep Creek (*Merychippus primus* zone) are not regarded as the correlatives of the

Ricardo horizon. The latter appears to have more faunal elements in common with the Upper Snake Creek (*Hipparion affine* zone) and is generally regarded as the correlative of this horizon. According to the faunal list given by Matthew, the greater number of the Amphicyoninae occurs in the Lower Snake Creek. *Pliocycon?* sp. is, however, recorded from the Upper Snake Creek beds.

Amphicyon ingens, no. 18272 A. M. N. H., from the Lower Snake Creek is much larger than the Ricardo *Hadrocyon.* $P_{\frac{1}{1}}$ is present in this form and $P_{\frac{4}{4}}$ is relatively smaller than in *Hadrocyon.* In *A. ingens* as in *Hadrocyon* $P_{\frac{3}{3}}$ is removed from $P_{\frac{4}{3}}$ by a short diastema. A paratype of this species, $M_{\frac{1}{1}}$ no 18273 A. M. N. H., is only a little longer but distinctly wider than the corresponding tooth in the Ricardo specimen. In *A. ingens,* as stated by Matthew, the carnassial possesses the crested heel of the true amphicyonines. While we cannot be certain of the structure of the heel in $M_{\frac{1}{1}}$ of *Hadrocyon* because of the broken and worn condition of the tooth, the markings on the heel suggest an absence of the typical characters found in this region of $M_{\frac{1}{1}}$ of the amphicyonines from the Snake Creek. It would be desirable, however, to await further information concerning the structure of the heel before definite statement is made. It is possible that the heel of $M_{\frac{1}{1}}$ in the Ricardo genus possessed in an unworn state the characters of a crested heel seen in $M_{\frac{1}{1}}$ of the amphicyonine dogs.

Amphicyon sinapius as represented by specimen 18258 A. M. N. H. is more like *Hadrocyon* in character of size than is *A. ingens.* No. 26792 from the Ricardo is slightly larger with stronger symphyseal region. In *A. sinapius* $P_{\frac{1}{1}}$ is present. $P_{\frac{3}{3}}$ is separated by a short diastema from $P_{\frac{4}{3}}$ as in *Hadrocyon.* Judging from the alveolus, $M_{\frac{2}{2}}$ in the Ricardo form was larger than in *A. sinapius.*

So far as comparisons can be made with *Ischyrocyon,* the Ricardo species differs in being much larger. $P_{\frac{4}{4}}$ in no. 26792 is narrower than in *Ischyrocyon* and $M_{\frac{1}{1}}$ may not have the type of heel seen in the carnassial of the latter genus.

Hadrocyon is much larger than *Pliocyon medius,* known by a well preserved skull from the Lower Snake Creek beds. Unfortunately no mandibular material of the latter species has been found. In *Pliocyon* the lateral incisor is separated from the canine by a diastema whereas in the lower jaw of the Ricardo form no such space exists between the alveolus of $I_{\frac{3}{3}}$ and C. There is no post-canine diastema in *P. medius* and premolars $_{\frac{1}{1}}$ to $_{\frac{3}{3}}$ inclusive occupy a relatively smaller space than in *Hadrocyon.*

In *Canis (Pliocyon) ursinus* from the Santa Fé marls the lower jaw is smaller than that of *Hadrocyon*. This specimen shows a deep anterior extension of the masseteric fossa and M_3 appears to have been two-rooted, and P_1 is present. These characters are lacking in the Ricardo specimen. The Santa Fé specimen resembles *Hadrocyon* in the straight inferior border of the ramus, in the well spaced anterior premolar teeth, and in the position of the anterior mental foramen.

Aelurodon (Pliocyon) meandrinus, known by a fragment of the ramus of a mandible without well preserved teeth from the Republican River beds, Nebraska,[4] is a large form comparable in size to *Hadrocyon*. P_1 is present, the first three premolars are situated close together and P_4 extends along the outer side of M_1 for a greater distance than that seen in *Hadrocyon*. Measurements given by Hatcher for this specimen correspond somewhat to those of the Ricardo form. Hatcher calls attention to the fact that in *A. meandrinus* the anterior end of P_3 lies to the outside of the posterior root of P_2. In *Hadrocyon* a similar relationship exists between P_3 and P_2. It is possible that among the forms compared with *Hadrocyon* Hatcher's type shows closest similarity to the Ricardo genus.

APHELOPS sp.

Two types of rhinoceroses are now known from the Ricardo deposits, but unfortunately these forms are represented only by lower jaw material. The specimen referred to the genus *Aphelops,* no. 27109 U. C. Coll., shown on plate 9, was collected by Newton Brown in Scenic Cañon at a stratigraphic horizon in the lower part of the Ricardo near that in which *Hadrocyon* and *Peraceras?* sp. were obtained in Last Chance Gulch.

In no. 27109 M_3 is not completely erupted and P_2 is partly broken. In this specimen the horizontal ramus is shallow and the symphysis is very long. An anterior mental foramen is present below the anterior portion of P_3. A procumbent tusk of fair size is present.

The length of the premolar series (P_2 to P_4 inclusive) as measured at the base of the crown of the teeth is approximately 125 mm. The comparable measurement for the molar series (M_1 to M_3 inclusive) is approximately 148 mm.

The characters presented by no. 27109 are more like those in *Aphelops* than like those in *Teleoceras fossiger.* The Ricardo form may be related to *A. melacorhinus,* but it seems desirable to await further material of this type before a specific determination is made.

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[4] Hatcher, J. B., On a small collection of vertebrate fossils from the Loup Fork beds of northwestern Nebraska; with note on the geology of the region, Am. Nat., vol. 28, pp. 239–240, figs. 1, 1*a*, 1894. Matthew refers this form to *Pliocyon* (see Matthew, W. D., Third contribution to the Snake Creek fauna, Bull. Am. Mus. Nat. Hist., vol. 50, p. 113, 1924).

MEASUREMENTS OF NO. 27109

Length of dental series, $P_{\bar{3}}$ to $M_{\bar{3}}$ inclusive	187. mm.
$P_{\bar{3}}$, greatest anteroposterior diameter	41.2
$P_{\bar{4}}$, greatest anteroposterior diameter	44.2
$M_{\bar{1}}$, anteroposterior diameter	46.9
$M_{\bar{3}}$, anteroposterior diameter	53.
Length of symphysis	135.8

PERACERAS? sp.

The second type of rhinoceros, no. 27110 U. C. Coll., shown on plate 10, was collected by Miss Alexander in the Ricardo deposits of Last Chance Gulch. This specimen differs decidedly from no. 27109 in the following characters: (1) a deeper ramus, (2) distinctly shorter symphysis, and (3) absence of a procumbent tusk. Two mental foramina are present, one beneath the anterior root of $P_{\bar{3}}$ and the other beneath $P_{\bar{2}}$.

In no. 27110 the ramus is deep and heavy, yet the symphyseal area for union with the left ramus is surprisingly small. The dentition, as preserved, includes the series $P_{\bar{3}}$ to $M_{\bar{3}}$. The sockets for the roots of $P_{\bar{2}}$ are also shown. Below the anterior margin of the ramus and situated almost half way between $P_{\bar{2}}$ and the symphysis is another tooth socket.

No. 27110 differs from *Aphelops* and from *Teleoceras* in the greatly shortened symphyseal region and in the absence of a lower tusk.

In the Ricardo specimen the length of the molar series does not greatly exceed that of the premolar series, in which character no. 27110 again differs from *Teleoceras*. While the lower jaw of *Peraceras* from the Great Plains region is unknown, several skulls are available and the characters of the genus based upon the skull have been clearly stated by Matthew.[5] The tentative determination of no. 27110 as *Peraceras* is based not only upon the distinctive differences existing between this type and *Aphelops* and *Teleoceras*, but also upon the fact that the characters seen in the anterior region of the ramus and inferior dentition are consonant with the characters noted by Matthew in the anterior region of the skull and superior dentition of *Peraceras*.

Dr. Matthew has kindly examined the illustrations of the rhinoceros material from the Ricardo and has made the following comment:

"First as to your No. 27109, there are two or more species alike in the jaws so far as I can see, *malacorhinus, ceratorhinus*, etc. Whether or not these are valid species, the jaws could not be satisfactorily distinguished. Your specimen belongs to the *malacorhinus* group of the *Hipparion* zone, that would seem reasonably certain.

The second jaw, No. 27110, may very well be the lower jaw of *Peraceras*, so far as I can see. It is not *Teleoceras*, the molars are too small relatively; and it is not the *malacorhinus* group of *Aphelops* on account of the difference in symphysis and tusks. The shortening of the muzzle in *Peraceras*, by analogy with *Opsiceros*, should involve a shortening of the symphysis. Absence of the upper tusks might indicate reduction of the lower tusks, but not necessarily. It certainly fits what one might expect, and if not *Peraceras* would have to represent something unknown. I have not seen anything like this in our Plains material, although I have been looking for the jaw and skeleton of *Peraceras*."

[5] Matthew, W. D., Bull. Am. Mus. Nat. Hist., vol. 38, p. 207, 1918.

MEASUREMENTS OF NO. 27110

Length of dental series, P_3 to M_3 inclusive	*a* 214.2 mm.
P_3, greatest anteroposterior diameter	*a* 33.
P_4, greatest anteroposterior diameter	*a* 40.
M_1, greatest anteroposterior diameter	*a* 43.7
M_2, greatest anteroposterior diameter	46.4
M_3, greatest anteroposterior diameter	*a* 49.
Length of symphysis	62.4
Greatest length of ramus measured from anterior end to posterior border of ascending ramus	430.
Height of ascending ramus measured from inferior border to tip of coronoid process	*a* 250.
Greatest depth of ramus at posterior end of M_3, measured normal to inferior border	94.3

a, approximate.

CORRELATION AND AGE OF THE RICARDO FAUNA

Recognition of the distinctiveness of the Ricardo and Barstow faunas of the Mohave Desert and comparison of these faunas with Tertiary mammalian assemblages of the Pacific Coast, Great Basin, and Great Plains regions by J. C. Merriam have been instrumental in establishing more definitely the sequence of faunas for the late Miocene and Pliocene of North America. The studies have been particularly helpful in the determination of the relationships of the mammalian assemblages known from the Snake Creek region of Nebraska.[6] Three faunal horizons are now recognized by Matthew in the Snake Creek region, (1) Upper Snake Creek or *Hipparion affine* zone, (2) Lower Snake Creek or *Merychippus paniensis* zone, and (3) Sheep Creek or *Merychippus primus* zone.

The investigations of Merriam and of Matthew have clearly shown the presence of a number of types in the Snake Creek, particularly in the Upper Snake Creek as now faunally defined by Matthew, corresponding to forms known from the Ricardo.

In the Snake Creek the amphicyonine group is recorded chiefly from the lower horizon (*Merychippus paniensis* zone), the list of the vertebrate fauna given by Matthew including only *Pliocyon?* sp. from the Upper Snake Creek. The latter occurrence may represent a survival of amphicyonine forms in the later stage. Presuming that *Hadrocyon* belongs to the Amphicyoninae, the genus may likewise represent a survival of the group in the Ricardo.

[6] See W. D. Matthew, Third contribution to the Snake Creek fauna, Bull. Am. Mus. Nat. Hist., vol. 50, p. 69, 1924.

The rhinoceroses from the Ricardo may be regarded as corresponding to types known from the Upper Snake Creek. It is worthy of note, however, that the genus *Teleoceras* known from the Upper Snake Creek is not recorded from the Ricardo.

Merriam[7] has stated that the fauna from the Republican River of the Great Plains is not far removed in time from the stage of faunal evolution shown by the Ricardo. Matthew[8] tentatively regards the Republican River and the Ricardo as equivalent faunal stages. *Hadrocyon* may represent a form closely related to *Pliocyon meandrinus* (Hatcher), and the two rhinoceroses from the Mohave region may closely correspond to types known from the Republican River. *Teleoceras fossiger* is well represented in the Republican River fauna, but is absent in the Ricardo.

The newly described materials furnish further evidence that the Ricardo fauna is related to that of the Upper Snake Creek. The occurrence of *Hadrocyon, Aphelops,* and *Peraceras?* suggests rather strongly that the Ricardo horizon is faunally not distantly removed in time from the Republican River. It is possible that the Ricardo stage occupies a position between the Republican River and the slightly later stage of the Upper Snake Creek.

The Republican River has been regarded as latest Miocene or earliest Pliocene.

Should it be established that the *Hipparion* horses in North America appear first in the late Miocene and not in the early Pliocene, a view formerly held by H. F. Osborn and recently advocated by W. D. Matthew,[9] then the presence in the Ricardo fauna of mammals having affinities with Miocene types would perhaps offer further support to a view that the Ricardo is Uppermost Miocene rather than Lower Pliocene in age. On the other hand, the amphicyonine form and the rhinoceroses may represent a survival in the Lower Pliocene of mammals that are perhaps more typical of the Miocene. There remains the possibility that the Ricardo fauna is, in part at least, in a transitional stage from Miocene to Pliocene, and includes several Miocene forms from the lower beds of the Ricardo section.

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[7] Merriam, J. C., Relationships of Pliocene mammalian faunas from the Pacific Coast and Great Basin provinces of North America, Univ. Calif. Publ. Bull. Dept. Geol., vol. 10, pp. 440–441, 1917.

[8] Matthew, W. D., Correlation of the Tertiary formations of the Great Plains, Bull. Geol. Soc. Am., vol. 35, p. 752, 1924.

[9] Matthew, W. D., *op. cit.*, pp. 752–753, 1924.

Within the Pacific Coast and Great Basin provinces amphicyonine-like forms are known only from the Rattlesnake Pliocene[10] of eastern Oregon. The material is fragmentary and of doubtful relationship and quite clearly does not belong to *Hadrocyon*. The dogs of the Thousand Creek appear to represent principally the genus *Aelurodon*.

Rhinoceroses are known from the middle and later Tertiary of the West but determinations have been difficult because of lack of complete materials. The forms known from the Miocene (Virgin Valley, Cedar Mountain) have been tentatively referred to the genus *Aphelops*. *Teleoceras* is represented by a species near *T. fossiger* in the Thousand Creek region, and a similar form probably occurs in the Rattlesnake. It is possible that other types of rhinoceroses may be recognized in the Rattlesnake when the complete fauna is studied. The Rattlesnake fauna is regarded as more closely related to the Ricardo than is that of the Thousand Creek.

SUMMARY

Three genera are added to the mammalian fauna known from the Ricardo deposits of the Mohave Desert, California.

The remains of a new type of dog, described as *Hadrocyon mohavensis*, belong to a form clearly distinguished from *Aelurodon*. *Hadrocyon* is presumably more closely related to the Amphicyoninae.

Two types of rhinoceroses are now known from the Ricardo. The first specimen is referred to the genus *Aphelops*, the second specimen is tentatively determined as belonging to *Peraceras*.

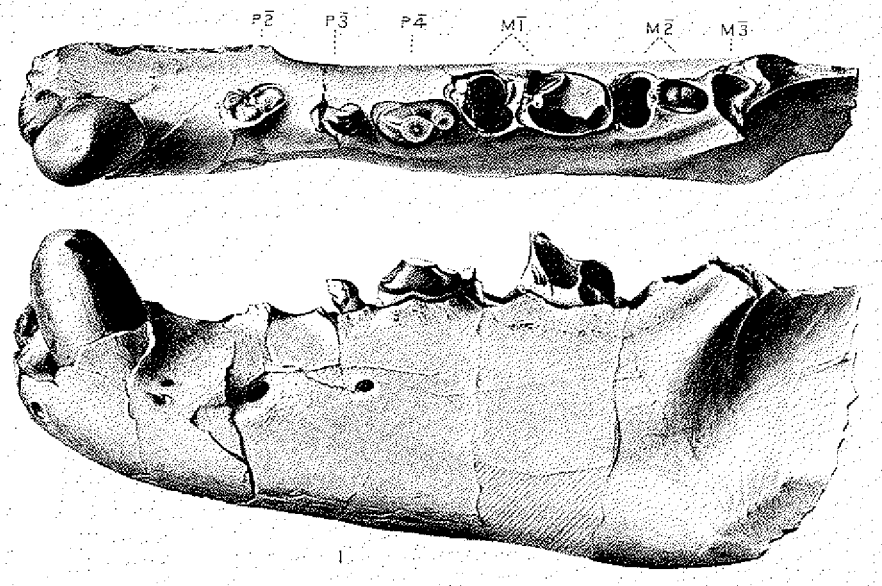
The new materials furnish further evidence that the Ricardo fauna is related to that of the Upper Snake Creek (*Hipparion affine* zone) of the Great Plains region. The occurrence of *Hadrocyon*, *Aphelops*, and *Peraceras?* suggests again that the Ricardo horizon is faunally not distantly removed from the Republican River. It is possible that the Ricardo stage occupies a position between the Republican River and the slightly later stage of the Upper Snake Creek. The presence of these forms may lend support to the view that the Ricardo fauna, or at least that portion of it which occurs in the lower beds of the Ricardo section, approximates the latest Miocene even more closely in time than has been hitherto determined.

[10] Merriam, J. C., Stock, C., and Moody, C. L., Carnegie Institution of Washington Publication 347, pp. 60–61, 1925. Mr. Childs Frick has recently obtained material belonging to the Amphicyoninae in the Barstow Upper Miocene. The specimens have not as yet been described.

EXPLANATION OF PLATE 7

Hadrocyon mohavensis n. gen. and n. sp.

Fig. 1, Left ramus of mandible, outer view and occlusal view of lower dentition; fig. 2, metatarsals IV and V; fig. 3, astragalus, dorsal and ventral views; fig. 4, thoracic ribs; No. 26792 U. C. Coll.; × 0.50. Ricardo Pliocene, Mohave Desert, California.



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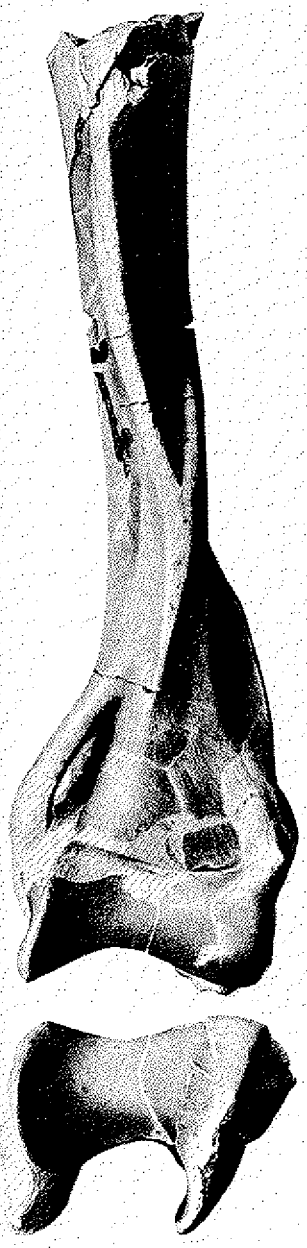
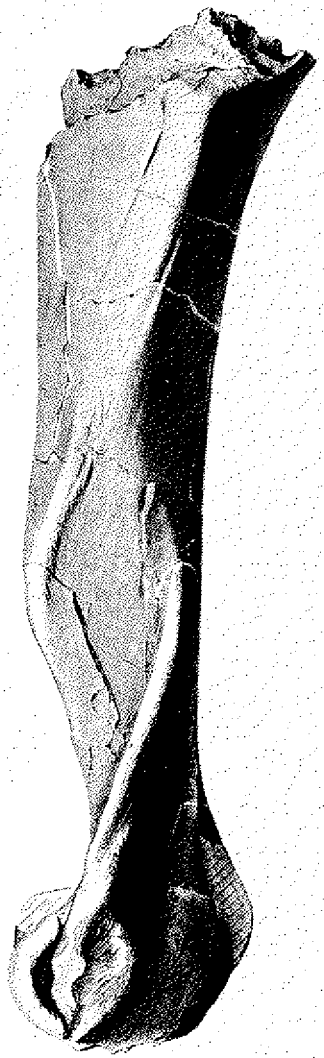
EXPLANATION OF PLATE 8

Hadrocyon mohavensis n. gen. and n. sp.

Fig. 1, Humerus, anterior and distal views; fig. 2, humerus, outer view; fig. 3, tibia, anterior view and view of distal end; No. 26792, U. C. Coll.; × 0.50. Restoration of inner condyle of humerus not designed to show this region accurately. Ricardo Pliocene, Mohave Desert, California.



1



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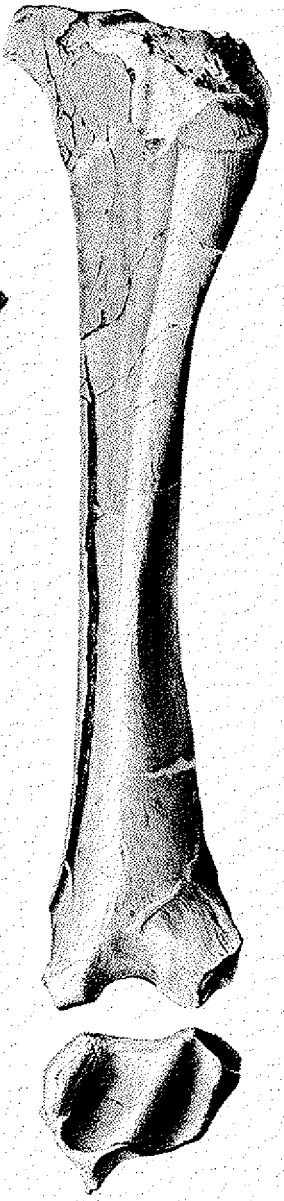
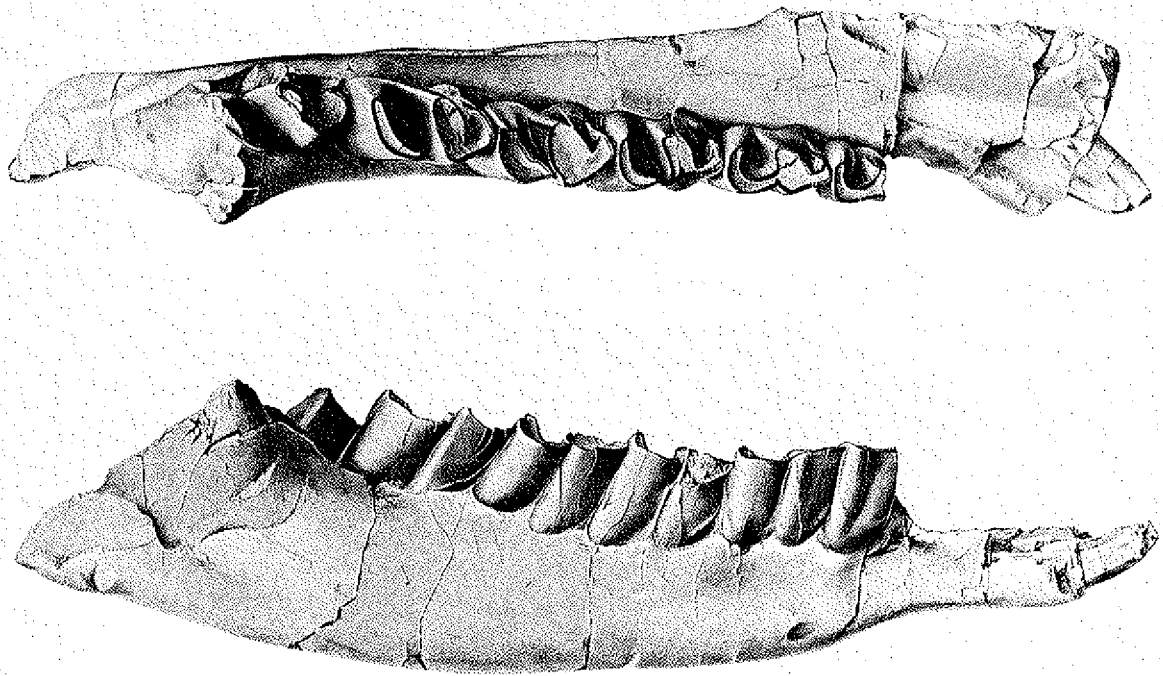


3

EXPLANATION OF PLATE 9

Aphelops sp.

Right ramus of mandible, No. 27109 U. C. Coll; outer and superior views; × 0.333. Ricardo Pliocene, Mohave Desert, California.



EXPLANATION OF PLATE 10

Peraceras? sp.

Right ramus of mandible, No. 27110 U. C. Coll.; outer and superior views: × 0.333. Ricardo Pliocene, Mohave Desert, California.