I.

RELATIONSHIPS AND STRUCTURE OF THE SHORT-FACED BEAR, ARCTOTHERIUM, FROM THE PLEISTOCENE OF CALIFORNIA.

By JOHN C. MERRIAM and CHESTER STOCK.

With ten plates and five text-figures.

CONTENTS.

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INTRODUCTION.

The peculiar short-faced Californian bear, known as *Arctotherium simum*, was described by Cope in 1879 from a single specimen, consisting of a skull minus the lower jaw, found by J. A. Richardson in 1878 in Potter Creek Cave on the McCloud River in northern California. Since the description of *A. simum*, a nearly perfect skull with lower jaw and a large quantity of additional material, representing nearly all parts of the skeleton and dentition of this species, has been obtained from the deposits of Potter Creek Cave as a result of further work carried on for the University of California by E. L. Furlong and by W. J. Sinclair in 1902 and 1903.

Splendid material of *Arctotherium* has also been secured in the Pleistocene asphalt beds at Rancho La Brea by the Los Angeles Museum of History, Science, and Art. In 1911, J. C. Merriam directed attention to the presence of arctotheres in the Pleistocene fauna from Rancho La Brea, describing a few remains collected in these beds by the University of California. While no complete skeleton has been exhumed, approximately eleven are known from Rancho La Brea. Recently a few belonging to arctotheres have been obtained in an asphalt deposit near McKittrick, California.

In the present paper an endeavor is made to review all available material of *Arctotherium* now in the Museum of Palaeontology, University of California, and in the Los Angeles Museum of History, Science, and Art. For permission to study the Rancho La Brea collection in the Los Angeles Museum and for the opportunity thus afforded to render a fuller statement regarding *Arctotherium* than could be given from an investigation of a single collection, the authors wish to express their sincere appreciation to Dr. Wm. Alanson Bryan, Director of the Museum. Thanks are extended to Dr. Joseph Grinnell, Director of the Museum of Vertebrate Zoology, University of California, and to the United States National Museum for the loan of specimens of Recent bears. The illustrations have been prepared by John L. Ridgway.

SYSTEMATIC POSITION OF ARCTOTHERIUM AND ITS ALLIES WITH RELATION TO THE TYPICAL URSIDAE.

The bears of the western hemisphere, including both Recent and Pleistocene forms, are divisible into two well-defined groups. One is represented by the typical *Ursus*, including several groups of species,[1] by *Evarctos* and by *Thalarctos*. The other group contains the living *Tremarctos* of South America and the allied fossil species of both South and North America included in the genus *Arctotherium*. The second of these divisions is separated from the typical bears by the following characters:

(1) Skull with facial and frontal regions relatively short and broad.
(2) General presence of more than one infra-orbital and of more than two incisive foramina.
(3) Great anterior extension and depth of masseteric fossa and its division by a high, sharp ridge into two distinct excavations.
(4) Dental series generally closed.
(5) $P\underline{4}$ with metacone forming a shearing blade.
(6) $M\underline{1}$ and $M\underline{2}$ relatively short and broad.
(7) $M\overline{1}$ with trigonid trenchant rather than crushing, and without accessory tubercles.
(8) Atlas with posterior opening of vertebrarterial canal on upper side of transverse process in advance of posterior edge.
(9) Humerus with entepicondylar foramen.

Both of these groups have been represented in North America at least as far back as Middle Pleistocene time, and occur in deposits of both the Atlantic and Pacific coasts. As far back as they have been traced in America the distinctive characters continue to separate them, and are in fact more strongly expressed in some of the oldest forms known than in the existing species. The differences between the groups are greater than those ordinarily separating genera, and if we bring the classification of the bears to a level on which it will express the true relationships within the family they must be known as subfamilies. To represent their positions more distinctly, it is proposed that the name Arctinae[2] be applied to the first group and Tremarctinae to the second.

Within the Tremarctinae are two small groups represented by *Tremarctos* and *Arctotherium*. The true *Tremarctos* is known only in the Recent fauna, while *Arctotherium* is extinct. The typical *Arctotherium* is distinguished from the typical *Tremarctos* by its larger size, shorter head, simpler teeth, and ordinarily by a larger number of infraorbital foramina. If we had only the typical specimens of

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[1] For a recent review of some of the living bears of North America see C. Hart Merriam North American Fauna No. 41, U. S. Depart. Agriculture, Bur. Biol. Surv., 1918.

[2] The name Ursinae has been used by Lydekker (1884, p. 239) to include *Ursus*, *Arctotherium*, and *Hyaenarctos*, contrasted with the dogs (Caninae) in his Ursidae; by Trouessart for the true bears, *Tremarctos*, *Melursus*, and *Hyaenarctos*, separated from the Ailurinae including *Ailuropus* and *Ailurus*; by Burmeister (1866, p. 144) to include the South American *Tremarctos*, *Arctotherium*, *Procyon cancrivorus*, and *Nasua socialis*; and by Winge (1895, p. 46) to include *Amphicyon*, *Simocyon*, *Hemicyon*, *Hyaenarctos*, *Aeluropus*, *Arctotherium*, *Melursus*.

Arctotherium and *Tremarctos*, there would be no difficulty in distinguishing the two genera, but there exists in *Arctotherium* (*Ursus*) *haplodon* Cope of the Port Kennedy Fissure, Pennsylvania, a form which is in many respects intermediate. This species was referred by Cope to *Ursus*, as he was uncertain concerning the character of the lower jaw in *Arctotherium*. Arctothere material from Potter Creek Cave and from Rancho La Brea in California shows the lower jaw to be essentially as in the South American *Arctotherium* or in *Tremarctos*. In most points the characters of the skull and dentition in the type from Pennsylvania are those of *Arctotherium*, but M1 is narrower than in typical *Arctotherium* and M2 has a larger heel than is seen elsewhere in that genus. The skull is imperfectly preserved in the specimen studied by Cope and is not well prepared, so that it has not been possible to make a satisfactory examination of the infraorbital foramina, but there appears to be but one opening. In all of these characters this specimen approaches the living *Tremarctos* of South America more closely than does any other form of *Arctotherium*. This species makes the separation of the two types more difficult. Nevertheless, they are to be considered as representing fairly distinct generic or subgeneric groups.

In the comparative table on page 6 a number of characters are listed in which *Tremarctos* and *Arctotherium* show distinctly closer affinity to *Hyaenarctos* and its allies of the Pliocene than is seen in the Pleistocene and Recent bears of the genus *Ursus*.

ORIGIN OF THE TREMARCTINAE.

Within the past few years notable additions have been made to our knowledge of the bears of the late Tertiary. Hyaenarctid bears of the genera *Hyaenarctos* and *Indarctos* were regarded until recently as characteristic of the Old World, but close relatives of these forms are now known to occur in Pliocene deposits in North America.

Since the tentative determination of *Hyaenarctos* by Freudenberg (1910, pp. 205–209, pl. 21, fig. 2; pl. 22, fig. 2.) from the brown coal of Tehuichila near the boundary between the States of Hidalgo and Vera Cruz, Mexico, hyaenarctid remains have been described by Sellards (1916) from Florida, by Merriam, Stock, and Moody (1916) from eastern Oregon, and by Childs Frick (1921) from southern California.

The occurrence in the North American Pliocene of forms of the *Hyaenarctos* type, with characters tending toward those of *Arctotherium* and *Tremarctos*, gives support to the assumption that the American Tremarctinae of the Pleistocene and Recent periods represent a line passing through or very close to the *Hyaenarctos* group. It is now possible to consider the origin of the Pleistocene members of the Tremarctinae in America rather than in Eurasia.

TABLE 1.

TREMARCTOS.	ARCTOTHERIUM.	HYAENARCTOS.
1. Skull short and broad.	Skull short and broad.	Skull short and broad.
2. One infra-orbital foramen.	2 or more infra-orbital foramina.	3 infra-orbital foramina.
3. Median incisive foramen large.	Median incisive foramen large.	
4. Double masseteric fossa.	Double masseteric fossa.	Long, partly divided masseteric fossa.[1]
5. $P\underline{4}$ with metacone tending to form shearing blade; protocone opposite notch between paracone and metacone.	$P\underline{4}$ with metacone tending to form shearing blade; protocone opposite notch between paracone and metacone.	$P\underline{4}$ with metacone as shearing blade; protocone anterior in position.
6. $M\underline{1}$, longer than wide; 3 inner tubercles; metastyle present.	$M\underline{1}$, square or slightly longer than wide; 3 inner tubercles; metastyle may be present.	$M\underline{1}$, square; inner tubercles; incipient metastyle present.
7. $M\underline{2}$, heel not long or narrow, but relatively broad.	$M\underline{2}$, heel relatively short and narrow.	$M\underline{2}$, without heel.[2]
8. $M\overline{1}$, protoconid and paraconid forming shearing blades.	$M\overline{1}$, protoconid and paraconid forming shearing blades.	$M\overline{1}$, protoconid and paraconid forming shearing blades.
9. Humerus with entepicondylar foramen.	Humerus with entepicondylar foramen.	Humerus not known.[3]

We may conceive of *Arctotherium*, or its immediate predecessor, as originating in North America in the Pliocene and entering South America after the land connection between the two continents was established.

Two forms from South America described by Ameghino (1889) as *Pararctotherium* and *Proarctotherium* have been assumed to be ancestral types of the South American arctotheres. *Pararctotherium* is known from the Pampean formation, which corresponds to a considerable portion of the Pleistocene of North America. *Pararctotherium* is clearly a member of the *Arctotherium* group in which $M\overline{2}$ is considerably specialized. The anterior premolars of *Pararctotherium* are crowded, and the facial region was evidently shortened. There is no good reason for considering that this type is ancestral to *Arctotherium;* in fact, it may be one of the more specialized members of the *Arctotherium* group.

Proarctotherium is known from a very fragmentary specimen consisting of $M\overline{2}$ and $M\overline{3}$ from Parana. The Parana deposits have been assumed to be Pliocene, and may contain a small number of North American Pliocene types. Ameghino's figure (Ameghino, 1889, p. 319, pl. 21, fig. 1) of the type specimen shows a $M\overline{2}$ not

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[1] Double masseteric fossa apparently present in *Agriotherium* (*Hyaenarctos*) *schneideri* Sellards.

[2] $M\underline{2}$ with short and broad heel in *Indarctos salmontanus* Pilgrim and in *Indarctos? oregonensis* Merriam, Stock, and Moody.

[3] Humerus with entepicondylar foramen in *Indarctos? oregonensis* Merriam, Stock, and Moody.

differing materially from that of *Arctotherium.* $M\overline{3}$ is large and elongate, approximating the form seen in typical Pleistocene *Arctotherium,* as in *A. simum.*

The type specimen of *Proarctotherium* evidently represents a typical member of the *Arctotherium* group. As the occurrence of a representative of the *Hyaenarctos* type seems now fairly established for the late Tertiary of Mexico, it is of course possible that a member of the group reached South America with the earliest of the emigrants from North America. While the characters of $M\overline{2}$ in the Parana form do not differ greatly from those of *Hyaenarctos,* $M\overline{3}$ is of a distinctly more advanced type. The nature of the specialization of $M\overline{3}$ is such as we commonly find associated with an antero-posteriorly elongated heel of the last upper molar and is not to be expected in a Pliocene bear. Apparently the geologic occurrence of the Parana specimen must remain in doubt until other material of this nature appears in the Parana.

SUMMARY OF SPECIES OF ARCTOTHERIUM IN THE PLEISTOCENE OF NORTH AMERICA.

Five species of arctotheres have been described from the Pleistocene of North America: *Arctodus pristinus* Leidy; *Arctotherium simum* Cope; *Arctotherium haplodon* Cope; *Arctotherium yukonense* Lambe; *Arctotherium californicum* J. C. Merriam.

Arctodus pristinus was described from South Carolina by Leidy (1854). Leidy's later description of *Arctodus* (Leidy, 1860) is accompanied by figures of the type specimen, an unworn second lower molar. *Arctodus* therefore seems determinable, but the writers hesitate to assign this form to the generic group to which the later described arctotheres of North America have been referred until Leidy's original material can be examined. Should the characters of *Arctodus* be shown eventually to agree with those of *Arctotherium,* the former name has priority, for *Arctodus* antedates *Arctotherium* Bravard.

A. haplodon from the Port Kennedy Fissure, Pennsylvania, seems considerably nearer to the existing species of *Tremarctos* of South America than is *A. simum.* It seems to be also the nearest of all the *Arctotherium* species to *Tremarctos* forms, but in spite of a stronger resemblance to *Tremarctos* is still apparently a typical *Arctotherium.*

A. yukonense from Gold-Run Creek, Yukon, is based by Lambe (1911) on a skull that exceeds in size the specimen described by Cope as *A. simum.* In several characters *A. yukonense* exhibits similarity to *A. simum.*

A. simum was described by Cope (1879; 1891) from northern California, while *A. californicum* was determined by J. C. Merriam

FIG. 1.—Outline map showing known occurrences of Pleistocene and Pliocene bears in the United States west of the Wasatch Range.

(1) *Arctotherium simum* Cope, Potter Creek Cave, Shasta County, California; (2) *Arctotherium californicum* Merriam, Rancho La Brea, California; (3) *Arctotherium*, near *simum* Cope, McKittrick, California; (4) *Hyaenarctos gregoryi* Frick, Pliocene Eden beds near Beaumont, California; (5) *Indarctos? oregonensis* Merriam, Stock, and Moody, Pliocene Rattlesnake beds, Eastern Oregon.

(1911) on a small collection consisting principally of metapodials secured at Rancho La Brea, California. The type from the asphalt beds was decidedly larger than representatives of *Arctotherium simum* from Potter Creek Cave and the two forms were regarded as specifically distinct. It appears evident, from present study, that the disparity in size between the arctotheres of northern and southern California may not be greater than that falling within the limits of sexual variation in some living bears.

Until the time relationship of the mammalian faunas from Potter Creek Cave and from Rancho La Brea can be definitely established, it seems desirable to recognize the arctothere from the latter deposit as a species or at least as a subspecies, distinct from *A. simum*. Considering the North American members of the genus, *Arctotherium simum*, *A. californicum*, and perhaps *A. yukonense*, represent a group of very closely related species.

OCCURRENCE IN CALIFORNIA OF ARCTOTHERES AND ASSOCIATED FAUNAS.

POTTER CREEK CAVE.

The occurrence of vertebrate remains in the Pleistocene deposits of Potter Creek Cave, Shasta County, California, has been fully discussed by W. J. Sinclair (1904). The deposits which accumulated in this cave consisted in large part of reddish cave-earth interstratified with gravel or rubble layers and stalagmitic materials. The depth to which excavation could be carried varied considerably in different portions of the cave, the greatest depth reached being about 25 feet. The stratigraphy of the deposits was determined with little difficulty in most cases and over a large portion of the cave it was possible to determine the time of entombment of each specimen with reference to the time of burial of other remains nearby.

Remains of *Arctotherium* were found scattered through the greater part of the cave accumulation. The bones were in most instances disconnected and scattered about, but near the middle of the cave many of the bones of several individuals were found together. The skull described by Cope was obtained at this place, and presumably belongs to an individual represented by one of the skeletons now in the collection of the University of California.

It is interesting to note that the arctotheres, while associated with the genus *Ursus* in the Pleistocene mammalian assemblage living in the region of Potter Creek Cave, were represented by a greater number of individuals than were the latter.

The mammalian fauna of Potter Creek Cave contains the following forms:

Scapanus latimanus (Bachman).
Antrozous pallidus pacificus C. H. Merriam.
Arctotherium simum Cope.
Ursus n. sp.
Aenocyon dirus (Leidy).
Vulpes cascadensis C. H. Merriam.
Urocyon cinereoargenteus townsendi C. H. Merriam.
Bassariscus astutus raptor (Baird).
Mustela arizonensis (Mearns).
Spilogale n. sp.
Mephitis occidentalis Baird.
Taxidea n. sp. (?).
Felis, probably n. sp.
Felis n. sp.
Lynx fasciatus Rafinesque.
Lynx fasciatus n. subsp. (?).
Neotoma cinerea occidentalis Baird.
Microtus californicus (Peale).
Thomomys microdon Sinclair.
Thomomys leucodon C. H. Merriam.
Aplodontia californica fossilis Sinclair.
Marmota flaviventer (Audubon and Bachman).
Citellus beecheyi douglasi (Richardson).
Eutamias sp.
Callospermophilus chrysodeirus (C. H. Merriam).
Sciurus douglasi albolimbatus Allen.
Sciuropterus alpinus klamathensis C. H. Merriam.
Sylvilagus auduboni (Baird).
Nothrotherium shastense Sinclair.
Megalonyx wheatleyi (?) Cope.
Megalonyx jeffersonii (?) (Desmarest).
Megalonyx n. sp.
Megalonyx sp.
Camelid.
Bison sp.
Odocoileus sp. a.
Odocoileus sp. b.
Euceratherium collinum Sinclair and Furlong.
Oreamnos americanus (Ord).
Platygonus (?), sp.
Equus occidentalis Leidy.
Equus pacificus Leidy.
Mammut americanum (Kerr).
Elephas primigenius Blumenbach.

RANCHO LA BREA.

Remains of arctotheres were first encountered at Rancho La Brea during the investigation conducted by the Department of Palaeontology, University of California. Later work by the Los Angeles Museum resulted in the collection of much additional material, representing probably not less than eleven individuals. A nearly complete skull and well-preserved limb elements were obtained in Pit 60 excavated by the Los Angeles Museum. Further notable collections were made by the Museum in Pits 77, 17, 9, and scattered materials have been obtained from other excavations. It is evident that *Arctotherium* was a contemporary of the typical Pleistocene mammalian assemblage from Rancho La Brea and was one of the largest of the carnivores occurring in this fauna. We note again an occurrence of this type in greater numbers than the bears of the genus *Ursus*. The mammals identified in the Rancho La Brea fauna are listed as follows:

Carnivora:
- Arctotherium californicum Merriam, J. C.
- Ursus sp.
- Aenocyon dirus (Leidy).
- Aenocyon milleri (Merriam, J. C.)
- Canis occidentalis furlongi Merriam, J. C.
- Canis ochropus orcutti Merriam, J. C.
- Canis andersoni Merriam, J. C.
- Urocyon californicus Mearns.

Carnivora:—*Cont.*
- Taxidea, possibly n. sp.
- Mephitis occidentalis n. subsp.?
- Spilogale sp.
- Mustela sp.
- Smilodon californicus Bovard.
- Felis atrox bebbi Merriam, J. C.
- Felis daggetti Merriam, J. C.
- Lynx ruffus californicus Mearns.

Edentata:
- Mylodon harlani Owen.
- Mylodon harlani tenuiceps Stock.
- Megalonyx jeffersonii californicus Stock.
- Nothrotherium shastense Sinclair.

Artiodactyla:
- Camelops hesternus (Leidy).
- Capromeryx minor Taylor.
- ?Antilocapra americana (Ord).
- Odocoileus, sp.

Artiodactyla—*Cont.*
- Bison antiquus Leidy.
- Platygonus, possibly n. sp. or n. subsp.

Perissodactyla:
- Equus occidentalis Leidy.
- ?Tapirus sp.

Proboscidea:
- Mammut americanum (Kerr)?
- Elephas imperator Leidy?

Many rodents and lagomorphs.

McKITTRICK.

Excavation in an asphalt deposit near McKittrick, California, by the Carnegie Institution of Washington in cooperation with the Museum of Palaeontology of the University of California has yielded a Pleistocene fauna somewhat different from that of Rancho La Brea. A preliminary survey of the mammalian assemblage by Merriam and Stock[1] shows the presence of the following forms:

- Arctotherium, near simum Cope.
- Aenocyon dirus (Leidy).
- Canis, near ochropus Esch.
- Felis atrox Leidy.
- Felis, near daggetti Merriam, J. C.
- Mylodon? sp.
- Taxidea sp.
- Equus occidentalis Leidy.
- Antilocapra? sp.
- Bison sp.
- Camel, slender limbed form (Lama).
- Camelops sp.
- Mammut, near americanum (Kerr).

To this list other forms will probably be added as the excavation progresses and the fauna is studied in greater detail. Remains of *Arctotherium* are still incomplete, consisting only of a few teeth. The specimens represent a type close to *Arctotherium simum.*

ODONTOLOGY AND OSTEOLOGY OF ARCTOTHERIUM.

In the following description of *Arctotherium* from the Pleistocene of California the principal comparisons have been made on the one hand with known representatives of the Pliocene hyaenarctid group and on the other with existing members of the genera *Ursus* and *Tremarctos.* A skull and a skeleton of *Tremarctos ornatus* from South America (Nos. 171011 and 194309, U. S. Nat. Mus.) were available, and of the genus *Ursus* the skull and skeletal material of brown, black, and grizzly bears in the collections of the Museum of Vertebrate Zoology, University of California, were used.

DENTITION.

Dental formula: $\frac{3}{3}, \frac{1}{1}, \frac{4}{4}, \frac{2}{3}$

Incisors $\underline{1}$ and $\underline{2}$ are of nearly equal size, while incisor $\underline{3}$ is distinctly larger. The canine is relatively heavier than in *Tremarctos.* The crowns have the dimensions and proportions near those of *Indarctos? oregonensis* from the Rattlesnake formation (Lower

[1] Science, n. s., vol. 54, pp. 566–567, 1921.

Pliocene) of eastern Oregon. The roots may be smaller, relative to the size of the crown in *Arctotherium*, but are not thinner in either transverse or antero-posterior diameter. The three anterior premolars are single-rooted and are situated close together as in *Tremarctos*.

P$\underline{1}$ is larger than P$\underline{2}$ or P$\underline{3}$. The crown of the tooth has a single cusp, which in the skull, No. 3001 U. C. C., from Potter Creek Cave, is excavated considerably on the inner side of the base. P$\underline{2}$ is missing in the specimens from California, but according to the alveolus it was smaller than P$\underline{1}$ (plate 5, fig. 2).

P$\underline{4}$ is three-rooted. In this tooth the metacone tends to form a shearing blade as in *Tremarctos* (plate 5, figs. 1 and 2). In *Ursus* the metacone tends to be conical. The position of the protocone is opposite the notch between paracone and metacone, as in *Tremarctos*. This cusp varies somewhat in size, but is not as large as the cusp in *Hyaenarctos* and in *Indarctos* (plate 5, fig. 3). In *Ursus* the protocone seems generally to be situated slightly farther posteriorly than in *Arctotherium*. The position of the protocone is distinctly farther back than in *Hyaenarctos* and in modern carnivores in which this cusp is normally located at the inner side of the anterior end of the tooth. The parastyle, which is so largely developed in *Indarctos? oregonensis* and in *Hyaenarctos*, is absent in *Arctotherium*, but may be suggested in some specimens. The parastyle is figured by Blainville[1] in his illustration of the dentition of *Tremarctos ornatus*, but is absent in specimen 171011 of the U. S. National Museum.

M$\underline{1}$ is three-rooted. The largest but shortest root supports the inner side. The two outer roots support principally the paracone and metacone. The root supporting the metacone is the larger of the two. The crown of this tooth has more the proportions of M$\underline{1}$ of *Hyaenarctos* than of either *Ursus* or *Tremarctos*. M$\underline{1}$ in the arctotheres of California approaches more nearly a perfect quadrate form than in other known species of *Arctotherium*. It is much nearer the square form in *A. simum* than in *A. bonaerense*. No cingulum is present along the inner side, as in *Ursus*, in which respect *Arctotherium* is more like *Tremarctos*. The antero-internal end of the tooth is angular, however, due to a variable development of a cingulum, making this part nearer rectangular and much more prominent than in *A. bonaerense* or in other species.

The paracone and metacone are the prominent cusps on the crown of M$\underline{1}$. In contrast to the tooth in *Hyaenarctos* a parastyle is present and a style posterior to the metacone (metastyle) is also developed. The metastyle and particularly the parastyle are more prominent features in *Arctotherium* than in *Ursus* or in *Tremarctos*. A cingulum may be faintly defined along the outer base of the meta-

[1] H. M. D. Blainville, Ostéographie des mammifères, Atlas 2, pl. 12, 1864.

cone. In M$\underline{1}$ of *Hyaenarctos gregoryi* according to Frick (1921, p. 342, figs. 51*a* and 51*b*) a marked cingulum is lacking. Of the three distinct internal tubercles in M$\underline{1}$ of *A. simum*, the middle one is usually the largest or longest; it is relatively more prominent than in *Ursus*. In *Tremarctos* an inner ridge is present and does not show clear division into tubercles, as in *Arctotherium*. This seems to be true also for *Hyaenarctos gregoryi*. The ridge connecting the antero-internal cusp with the parastyle is not so pronounced as in *Ursus*. Between the principal inner and outer cusps are several minor tubercles, while in this region in M$\underline{1}$ of *Tremarctos* the enamel is crenulated. A character found in this tooth of *Arctotherium*, which is not seen in other bears, is the presence of a tubercle (hypostyle) near the middle of the posterior side.

In M$\underline{2}$ there were evidently four original root elements. The roots beneath paracone and metacone tend to diverge widely, the element below the metacone being in some cases united with the posterior root supporting the heel. In *Arctotherium* the root supporting the protocone may or may not unite with the root below the heel. The corresponding tooth of *Indarctos? oregonensis* has two distinct external roots supporting paracone and metacone, but they do not diverge. The inner and posterior regions are supported by a large, broad root comparable to that occurring in most specimens of *Arctotherium* from California.

The crown of M$\underline{2}$ is a little narrower than in *A. bonaerense*. Like M$\underline{1}$ the anterior inner corner is nearly rectangular, owing to the prominence of the cingulum. The transverse width across the paracone is greater than that across the metacone, as in *Indarctos? oregonensis* (plate 5, fig. 4), while in *Ursus* and in *Tremarctos* this difference is not so noticeable. No cingulum is present along the inner side, in which character *Arctotherium* agrees with *Tremarctos* and differs from *Ursus*. The inner tubercles are faintly indicated.

M$\underline{2}$ differs from that of *Indarctos? oregonensis* in its smaller width and much longer talon. In *Arctotherium* the primitive quadritubercular portion of the tooth is longer anteroposteriorly and the heel is much longer. The arrangement of the tubercle is much the same in the two types, but the tubercles show stronger lateral compression in *Arctotherium*.

The crown of the lower canine in *A. simum* is sharply concave on the posterior side. The three anterior premolars of the lower dentition have simple cusps and are single-rooted teeth, as in *Tremarctos* (plate 5, figs. 5 and 6). In *Hyaenarctos punjabiensis*, as figured by Lydekker (R. Lydekker, 1884, pl. 31, fig. 1 and 1*a*) there are only two alveoli present in front of P$\overline{4}$. According to Sellards (1916, p. 99) a single alveolus, probably for P$\overline{2}$, is present in *Agriotherium* (*Hyaenarctos*) *schneideri* anterior to P$\overline{4}$ (plate 5, fig. 7).

$P\overline{4}$ has a larger crown than in the preceding teeth in *Arctotherium*, with a single cusp as in *Tremarctos* and in *Ursus*. The two roots have fused. In *Tremarctos* and in *Ursus* the roots are separated. In the Indian *Hyaenarctos* and in the Florida *Agriotherium* $P\overline{4}$ is a much larger tooth than in *Arctotherium*. In the Florida specimen (plate 5, fig. 7), as shown by Sellards, $P\overline{4}$ possesses an anteroposterior diameter which is approximately half that of $M\overline{1}$. The crown of the tooth is supported by two large roots.

$M\overline{1}$ in *Arctotherium* resembles this tooth in *Tremarctos* and differs from that in *Ursus* in possessing a shearing trigonid region. In $M\overline{1}$ of *Ursus* a series of tubercles extends forward from the metaconid to the paraconid, giving a crushing trigonid region. *Arctotherium* also resembles *Hyaenarctos* in having a shearing trigonid. In *Agriotherium* (*Hyaenarctos*) from Florida, along the inner side of the base of the paraconid, there is present a vestige of a cingulum which is absent in *Arctotherium* and in the Indian *Hyaenarctos punjabiensis*. $M\overline{1}$ in *Arctotherium* does not taper to the anterior end so noticeably as in the Recent or Pliocene members of the Tremarctinae.

The metaconid in $M\overline{1}$ is relatively smaller than in *Ursus*. In *Hyaenarctos* this cusp is quite prominent. In *Arctotherium* the outer side of $M\overline{1}$ is deeply indented between trigonid and talonid regions—more so than in *Hyaenarctos* and distinctly more so than in *Tre-*

TABLE 2.—*Measurements (in millimeters) of dentition of Arctotherium simum from Potter Creek Cave, No. 3001, University of California collection.*

	No. 3001.		No. 3001.
Greatest transverse diameter of incisor series, measured at cingulum of $I\underline{3}$	57.2	$M\underline{2}$, greatest antero-posterior diameter	35
Length from anterior side of $\underline{C}$ to posterior side of $M\underline{2}$	136.8	$M\underline{2}$, greatest transverse diameter	22
Length from anterior side of $P\underline{4}$ to posterior side of $M\underline{2}$	76	Length from anterior side $\overline{C}$ to posterior side of $M\overline{3}$	155
$I\underline{1}$, greatest transverse diameter	7.9	Length from posterior side $\overline{C}$ to anterior side of $M\overline{1}$	46
$I\underline{2}$, greatest transverse diameter	9	Length from anterior side $M\overline{1}$ to posterior side of $M\overline{3}$	77
$I\underline{3}$, greatest transverse diameter	10.8	$\overline{C}$, antero-posterior diameter at base of enamel	39
C, antero-posterior diameter at base of enamel	27.9	$P\overline{4}$, antero-posterior diameter	12.5
$P\underline{1}$, greatest antero-posterior diameter	10.4	$P\overline{4}$, transverse diameter	7.8
$P\underline{3}$, greatest antero-posterior diameter	8.5	$M\overline{1}$, antero-posterior diameter	31.5
$P\underline{3}$, greatest transverse diameter	5	$M\overline{1}$, transverse diameter across protoconid	15
$P\underline{4}$, greatest antero-posterior diameter	20.5	$M\overline{1}$ width of heel	16
$P\underline{4}$, transverse diameter across protocone	15	$M\overline{2}$, antero-posterior diameter	27
$M\underline{1}$, greatest antero-posterior diameter	24	$M\overline{2}$, transverse diameter across protoconid	19.5
$M\underline{1}$, greatest transverse diameter.	23	$M\overline{3}$, antero-posterior diameter	20
		$M\overline{3}$, transverse diameter across protoconid	16

marctos. The entoconid is relatively farther forward than in *Ursus*, *Arctotherium* resembling *Hyaenarctos* and *Tremarctos* in this respect.

$M\overline{2}$ of *Arctotherium* resembles the tooth in *Hyaenarctos*, and differs from that in *Ursus* in possessing a transverse diameter across the trigonid region which is greater than that across the talonid region. The trigonid region is basin-shaped and is bordered posteriorly by

TABLE 3.—*Measurements (in millimeters) of dentition of Arctotherium californicum. Los Angeles Museum collections.*

	No. Z 1.	No. Z 2.	No. Z 4.	No. Z 5.
Greatest transverse diameter of incisor series, measured at cingulum of $I\underline{3}$	64.2	....	....	....
Length from anterior side of $\underline{C}$ to posterior side of $M\underline{2}$.	144.4	....	145.6	....
Length from anterior side of $P\underline{4}$ to posterior side of $M\underline{2}$.	80.8	81.3	....	....
$I\underline{1}$, greatest transverse diameter	8.9	....	....	....
$I\underline{2}$, greatest transverse diameter	9.2	....	....	....
$I\underline{3}$, greatest transverse diameter	10.7	....	....	....
$\underline{C}$, anteroposterior diameter at base of enamel	29.3	....	26.5	....
$P\underline{1}$, greatest anteroposterior diameter	....	....	....	....
$P\underline{2}$, anteroposterior diameter of alveolus	6.5	....	....	....
$P\underline{3}$, greatest anteroposterior diameter	7.9	....	....	....
$P\underline{3}$, greatest transverse diameter	5	....	....	....
$P\underline{4}$, greatest anteroposterior diameter	20.5	20.8	23.5	....
$P\underline{4}$, transverse diameter across protocone	15.8	15.8	17.1	....
$M\underline{1}$, greatest anteroposterior diameter	25.2	25.4	25	26.3
$M\underline{1}$, greatest transverse diameter	22.8	23.2	24	24.9
$M\underline{2}$, greatest anteroposterior diameter	36.5	25.9	37.3	35.8
$M\underline{2}$, greatest transverse diameter	22.9	23.3	23.6	23.7
$M\underline{2}$, anteroposterior diameter of heel from metacone to end	13.7	15.3	14	....

	No. Z 6.	No. Z 7.	No. Z 8.	No. Z 9.	No. Z 10.	No. Z 19.	No. Z 53.	No. Z 52.
Length from anterior side $\overline{C}$ to posterior side of $M\overline{3}$	......	......	......	......	......	......	......	......
Length from posterior side $\overline{C}$ to anterior side of $M\overline{1}$	......	......	......	......	......	......	49.5	......
Length from anterior side $M\overline{1}$ to posterior side of $M\overline{3}$	......	......	81	*a*81	82	......	84	84
$\overline{C}$, anteroposterior diameter at base of enamel	*a*27	......	*a*27	......	......	......	30.7	......
$P\overline{4}$, anteroposterior diameter	......	......	13.5	......	......	13.8	13.2	......
$P\overline{4}$, transverse diameter	......	......	7.2	......	......	8.5	17.2	......
$M\overline{1}$, anteroposterior diameter	35	31.3	32.4	32	31.7	32.4	33.5	32
$M\overline{1}$, transverse diameter across protoconid	16.6	15.1	16	15.5	14.5	16.2	15.3	15.6
$M\overline{1}$, width of heel	18	16.7	16.7	17	17.2	17.2	17.5	16.5
$M\overline{2}$, anteroposterior diameter	31.7	30.2	30.8	30.4	30.4	31.4	28	29.1
$M\overline{2}$, transverse diameter across protoconid	22.4	21	21.4	21.6	20.8	21.6	21.8	21.3
$M\overline{3}$, anteroposterior diameter	......	21.4	21.3	21.8	21.9	......	22.1	22.6
$M\overline{3}$, transverse diameter across protoconid	......	17	17.2	17	16.9	......	17.6	17.8

a. Approximate.

the large protoconid and metaconid. The talonid region is relatively short as in *Hyaenarctos* and *Tremarctos*, differing in this respect from that in *Ursus*. The crown of $M\overline{2}$ shows a smaller number of tubercles than in *Ursus*, but a greater number than in *Hyaenarctos*.

$M\overline{3}$ is supported by a single root. The crown is subtriangular, differing in shape from that in *Hyaenarctos*. It is bordered by a low rim of enamel within which the surface is marked by a number of small papillae. In lacking a decided tuberculation the occlusal surface in this tooth resembles that in *Tremarctos* and differs from that in *Ursus*.

That the molar teeth may vary in size independently of the size of the skull is indicated by specimens of the lower jaw from Rancho La Brea. In No. Z 29, $M\overline{1}$ and $M\overline{2}$ are larger than the corresponding teeth in No. Z 7, yet the ramus of the former, measured between these teeth, shows a height 15 mm. less than in the latter.

AXIAL SKELETON.

Skull.—The skull of *Arctotherium* from Potter Creek Cave described by Cope and the complete specimen (plate 2) from the same locality, now in the collection of the University of California, are distinctly smaller than the skull of *A. yukonense*. Most of the skull materials from Rancho La Brea resemble more in size *A. simum* than *A. yukonense*. One specimen, No. Z 5, L. A. M., unfortunately poorly preserved, belonged apparently to a very large male individual, approaching in size the type described by Lambe.

In the proportions of the skull *Arctotherium* resembles *Tremarctos*. The skull is not as wide across the zygomatic arches (plate 3, fig. 1) as in the large brown bears of Alaska. In *Arctotherium* the snout is distinctly broader and the cranium is noticeably wider across the postorbital processes and at the postorbital constriction than in *U. sheldoni*. The external nares, contrasted with those of *Ursus*, are relatively large and their greatest width is situated above the middle of the opening, giving it a true cordate cross-section. In *Ursus* the greatest diameter is nearer the base of the opening, and the outline is not distinctly cordate. The nasal bones are short and broad, the transverse diameter of the nasals taken together and at their anterior end equaling considerably more than half their length. The superior process of the premaxillary is usually short and blunt, more as in *Tremarctos* than in *Ursus*. The dorsal surface of the frontal behind the postorbital processes is not sharply demarcated laterally by temporal crests. The frontal region is gently convex transversely except for a slight median concavity. Viewed from the side, the frontal vaults higher above the orbits than in either *U. sheldoni* or in *Tremarctos* and the dorsal contour does not drop so abruptly to the muzzle as in the former. The orbit is comparable in size to that in the large brown bears, but is directed laterally rather more than in these forms. The position of the orbit in *Tremarctos* is more like that in *Ursus*.

The parietal region is not materially different from that of *Ursus*, except possibly in the nature of the parietal foramina, of which there is on each side, in skull 3001 U. C. C., a large lower foramen near the parietal-squamosal suture and a smaller one just below the point of union of the sagittal and lambdoidal crests. In skull Z 1 L. A. M. Coll. from Rancho La Brea, the two foramina, comparable to those in the Potter Creek Cave specimen, are present only on the right side. In No. Z 1 the smaller foramen is situated lower than in No. 3001. A sagittal crest is formed by the parietals. The lambdoidal crest possesses a simple convex curve from the median line to the squamosal. A thin median longitudinal crest is present on the occiput (plate 4, fig. 2). The foramen magnum is larger than in *Ursus sheldoni* and it is oval in shape, with greatest diameter transverse. The paroccipital process is thin toward the base and comes to a blunt point somewhat as in *Tremarctos*. The lower end is almost of even length with the mastoid process. In *Ursus* the process is thicker and does not descend nearly so far as the mastoid process. The paroccipital process is not so far removed from the condyle in *Arctotherium* as in *Ursus*. While the mastoid process in *Arctotherium* is heavy, it is not as prominently developed as in *Ursus*. The process possesses, however, more individuality than in *Tremarctos*.

The tympanic forms a small but distinct bulla (plate 3, fig. 2). This structure is apparently better developed than in *Tremarctos*. In *Ursus* the tympanic is flattened. Laterally the tympanic is drawn out into a process between the mastoid and the postglenoid processes as in *Tremarctos*. The condylar foramen is relatively small and is situated close to the inner base of the paroccipital process and to the foramen lacerum posterius. No tuberosity is formed where basioccipital and tympanic meet as in *Ursus*.

Behind the pterygoid the alisphenoid continues the lateral wall of the posterior narial opening and the postero-inferior margin ascends directly to the front and to the outer side of the eustachian canal and the foramen lacerum medius. The foramen ovale seems to be situated slightly closer to the foramen lacerum medius than in *Ursus*. An alisphenoid canal is present. The foramen rotundum lies within the recess of the alisphenoid canal. Close to the anterior opening of this canal is situated the foramen lacerum anterius as in the skull of *Tremarctos;* in *Ursus* the two openings are farther apart.

The lateral wall of the frontal behind the postorbital process projects considerably beyond that forming the floor of the orbit and its border extends downward and backward from the process, defining the grooves that lodge nerves and blood-vessels to the eye.

The foramen transmitting a branch of the trigeminal nerve and blood-vessels to the interior of the nose is much larger than in the Alaskan brown bears, while the posterior opening of the palatine canal is quite small. There are two external infraorbital openings which are quite widely separated and lead into canals that are distinct to the orbital face of the maxillary. In the type specimen of *Arctotherium simum* three facial exits are present. In *Tremarctos* and in *Ursus* only a single facial exit occurs.

The post-narial notch is farther behind the tooth rows in *Arctotherium* (plate 3, fig. 2) than in either *Tremarctos* or in *U. sheldoni*. The palate is absolutely and relatively wider than in *Ursus*. The post-palatine foramina are situated about opposite the front end of $M\underline{2}$; in *Tremarctos* they are slightly farther forward, while in *Ursus* they are situated about opposite the hypocone in $M\underline{2}$. The grooves running forward from these foramina seem less distinct than in *Ursus*. The farthest point forward in median line reached by the maxillo-palatine suture is nearly opposite the middle of $M\underline{1}$, in which respect *Arctotherium* resembles *Tremarctos*, while in *Ursus* the suture forms a $\wedge$ with the apex reaching a point opposite the posterior cusp of $P\underline{4}$.

Three anterior palatine openings are present, but the medial opening is much larger than in *Ursus*, *Arctotherium* resembling *Tremarctos* in this character.

Mandible.—A very marked characteristic of the ramus of the mandible of *Arctotherium* (plate 4, fig. 3) is the presence of a double masseteric fossa, the two depressions being separated by a sharp, oblique ridge extending from the anterior base of the coronoid process to the posterior inferior margin.[1] The upper fossa has about the area and depth of that in *Ursus americanus* and is very little smaller than that of *Arctotherium bonaerense*. The anterior or lower depression is very deep and may extend forward to a point below the middle of $M\overline{2}$. At the lower margin where the fossa comes very close to the inferior border of the jaw it may have a depth of 15 mm. or more. A double masseteric fossa occurs in other species of arctotheres and in *Tremarctos*, but is absent in *Ursus*. In the mandible of *Hyaenarctos punjabiensis*, figured by Lydekker (1884, pl. 31, fig. 1), the region posterior to $M\overline{3}$ is not well preserved. There is, however, no indication of a fossa extending along the horizontal ramus below the posterior molar teeth, as in the Pleistocene genus.

In the fragmentary ramus of *Agriotherium* (*Hyaenarctos*) *schneideri* (Sellards, E. H., 1916, pl. 12), from the Bone Valley formation (Upper Miocene or Lower Pliocene) of Florida, there occurs a type of masseteric fossa comparable, apparently, to that in *Arctotherium*.

[1] Ameghino (1902, p. 228), in the description of the species *Arctotherium wingei*, states that the masseteric fossa is simple, but the evidence of his figures is not entirely clear on this point.

The region posterior to $M\overline{3}$ is also broken away in this specimen, but a noticeable depression is present in the horizontal ramus lying for the most part beneath $M\overline{3}$. There seems good reason for believing that this fossa is equivalent to the lower depression in *Arctotherium.*

Several jaws have been found in Potter Creek Cave, in which the coronoid process is preserved. This process is broad at the base and at its upper end projects backward as a sharp process, as in *Tremarc-*

TABLE 4.—*Comparative measurements (in millimeters) of skulls of Arctotherium simum and A. californicum.*

	Arctotherium simum from Potter Creek Cave, No. 3001, U. C. Coll.	Arctotherium californicum from Rancho La Brea, No. Z 1, L. A. M. Coll.
Cranium.		
Length, anterior end of premaxillary to inion	391	418.2
Length, anterior end of premaxillary to posterior end of condyle	...	387.4
Length, anterior end of premaxillary to inferior notch between condyles	...	362.8
Length, anterior end of premaxillary to anterior border of posterior nasal opening	...	210.5
Length, from posterior end glenoid cavity to posterior end of condyle	...	111.9
Length, anterior side of premaxillary to posterior side of auditory meatus	300	323.4
Length, from postorbital process of frontal to inion	220	244.8
Length, from anterior border of premaxillary to anterior side of orbit	110	132
Length, from anterior border of orbit to posterior side of auditory meatus	192	189
Greatest width across muzzle from outer walls of canine alveoli	101.5	106.8
Width across frontal at narrowest point between orbits	112	126
Greatest width across postorbital processes	*a*150	154
Least width of post-orbital constriction	...	100
Greatest width across zygomatic arches	...	247.6
Greatest width across mastoid processes	*a*167	185.7
Greatest diameter across condyles	...	77
Palate, width between middle internal borders of $M\underline{1}$	80	71
Width of nasals anteriorly	47	...
Length of nasals	81	...
Width of anterior nares	77	76.4
Height of anterior nares	63	...
Height of orbit	50	50
Height, inferior border of maxillary to top of frontal between postorbital processes of frontal	121	143.4
Height of inion above superior border of auditory meatus	94	103.2
Height of inion above base of occipital condyles	...	119.8
Mandible.		
Length from posterior side of condyle to anterior alveolar border	262	...
Height at anterior end $M\overline{1}$	58.5	...
Height at anterior end $M\overline{3}$	75.4	...
Thickness below posterior end $M\overline{1}$	25.5	...

a. Approximate.

tos. While the horizontal ramus is large and heavy, it by no means reaches the dimensions seen in *Agriotherium* (*Hyaenarctos*) from the Tertiary of Florida. In the rami of *Arctotherium* from Rancho La Brea two mental foramina have been noted. The anterior foramen is the larger and is situated below the posterior end of $P\overline{4}$, while the posterior foramen is below the middle of $M\overline{1}$. In specimen 3001 U. C. C., from Potter Creek Cave, a small foramen is situated below the protoconid of $M\overline{1}$, a larger foramen below the front end of $P\overline{4}$, and a still larger foramen between and below the alveoli for $P\overline{3}$ and $P\overline{2}$. In *Agriotherium* (*Hyaenarctos*) *schneideri* the largest of the mental foramina is situated below the posterior end of $P\overline{4}$. Several smaller foramina are apparently present below the anterior premolars. In *Tremarctos* the anterior foramen is below $P\overline{3}$, while the small posterior foramen is below the posterior root of $M\overline{1}$.

Vertebrae.—The number of vertebrae of *Arctotherium simum* found in Potter Creek Cave is small, as is the case with most of the mammalian forms occurring in this deposit. Several cervical and dorsal vertebrae, found on or near the surface by Richardson, during one of his early visits to the cave, are the property of the U. S. National Museum and have been kindly loaned for study. The collections of the Los Angeles Museum contain dorsal and lumbar vertebrae belonging to *A. californicum*, but unfortunately many of these lack epiphyses and are poorly preserved. It is impossible at present to give the number of vertebrae of the dorsal, lumbar, and caudal regions, but the presumption is that the number is similar to that of the closely allied *Tremarctos*. In a member of the latter genus (No. 194309, U. S. Nat. Mus.) the vertebral formula is C 7, D 13, L 7, S 3, Ca 8 or 9.

In the atlas of *Arctotherium* (plate 6, figs. 1, 1*a*) the posterior opening of the vertebrarterial is on the upper side of the transverse process some distance in advance of the posterior margin, much as in the Canidae. In *Tremarctos* a somewhat similar position is to be noted for this opening. In *Ursus* the opening is on the upper side of the posterior face of the transverse process. In *Arctotherium* the posterior border of the transverse process is slightly notched, but the plates supporting the posterior articular faces for the axis are not so prominent as they may be in *Ursus*, and there is a very narrow posterior notch. The following gives in millimeters the measurements of the atlas of *Arctotherium simum* from Potter Creek Cave, No. 3035, University of California collection:

Greatest width across lateral processes	*a*177
Greatest transverse diameter across anterior articular faces	33.6
Least anteroposterior diameter of dorsal wall of neural canal	87.6
Greatest height of neural canal	39

a. Approximate.

The axis (plate 6, figs. 2, 2*a*) resembles that in *Tremarctos* and differs from that in *Ursus* in the following characters:

The relative size of the neural canal, the pointed odontoid process, and the depth of the neural spine in front of the pedicle of the arch.

The transverse process, although broken on each side of the single specimen available from Rancho La Brea, appears to have been short as in *Tremarctos*. The pedicle of the neural arch is narrow anteroposteriorly.

The following gives (in millimeters) the measurements of the axis of *A. californicum* from Rancho La Brea, No. Z 39, L. A. M. Coll.:

Transverse diameter across articulating surfaces for atlas	84.6
Greatest transverse width across postzygapophyses	64
Greatest length of neural spine	*a*80.7
Least anteroposterior diameter of pedicle of neural arch	22
Greatest length of vertebra from anterior end of odontoid process to posterior face of centrum	*a*82

a. Approximate.

In the cervical series from Potter Creek Cave (No. 2654, U. S. Nat. Mus.) the individual vertebrae are smaller than in the large Alaskan brown bear. The lateral processes are not well preserved. They appear to have been more slender than in *Ursus*. In these vertebrae the neural canal is large, the dorso-ventral diameter being greater than in the large brown bear.

TABLE 5.—*Measurements (in millimeters) of cervical vertebrae, No. 2654, U. S. Nat. Mus.*

	Cervical 3.	Cervical 4.	Cervical 5.	Cervical 6.	Cervical 7.
Length of centrum	36.6	37.8	37.3	35.9	33.9
Width of centrum between inner borders of vertebrarterial canals	36	40.8	42.1	43.5	....
Depth of centrum across posterior face	27.7	28.8	28.5	29	32
Greatest width across prezygapophyses	59.6	*a*68	70	....	74.4

a. Approximate.

A sacrum (No. Z 113, L. A. M. Coll.) of *A. californicum* is shown in plate 6, figures 9, 9*a*. In this specimen 3 sacral vertebrae are present. The posterior end is broken. The neural spines are distinct and all were presumably more prominent than in *Ursus*. The sacral foramina are larger than in the latter genus. The measurements of sacrum follow, in millimeters:

Greatest length (approx.)	145
Greatest width of anterior end (approx.)	130
Width across anterior articulating processes	56.3

APPENDICULAR SKELETON.

Scapula.—This element (plate 7, figs. 1, 1*a*) is a trifle narrower and longer than in the Alaskan brown bear, *Ursus sheldoni*, and seems to approach in its proportions the scapula in *Tremarctos*. The anterior border, in its extent from the upper third to the coracoid region, has uniform curve as in *Tremarctos*. In *U. sheldoni* the anterior and inferior borders are demarcated by a sharp angle. The antero-inferior region of the prescapular fossa seems also to be bent more to the inner side in this form than in either *Arctotherium* or in *Tremarctos*. The posterior border in the upper half is carried back considerably as in *Tremarctos* and in *Ursus*. The acromion resembles that in *Tremarctos*. The end of the process does not curve inward as in *Ursus*. In front and at the base of the spine, about 80 mm. above the glenoid fossa, is a foramen, while on the opposite side of the spine are two larger foramina. These foramina are distinctly larger than in *U. sheldoni* and have a somewhat different position.

No distinct articulating facet is present in either *Arctotherium* or in *Tremarctos* on the posterior side of the spine near the base and along the inferior border as in *Ursus sheldoni*.

TABLE 6.—*Measurements (in millimeters) of scapula.*

	A. californicum, Rancho La Brea, No. Z 30, L. A. M. Coll.
Length, measured from glenoid articulation to dorsal border along axis of spine	331
Greatest width taken normal to anterior border	252
Greatest anteroposterior diameter of inferior extremity	95.2
Transverse diameter of glenoid articulation to outer side of acromion	119.5

Humerus.—The upper arm bone (plate 7, figs. 2, 2*a*, 3, 3*a*) is considerably longer than that of the large brown bear and may equal or exceed in length the humerus of the Pliocene *Indarctos? oregonensis*. Specimens of the humerus of *Arctotherium* from Potter Creek Cave and from Rancho La Brea are decidedly more slender than that of the Pliocene form. At the proximal end the groove between the head and the greater tuberosity is not so deep as in *Ursus*. The greater tuberosity does not have a deep excavation on the outer surface as in *Ursus*. The bicipital groove is wider and shallower than in *Ursus*, resembling the groove in the humerus of *Tremarctos*.

The proximal half of the shaft does not flatten transversely and widen anteroposteriorly relatively so much as in *Felis atrox* or in *Smilodon*. The deltoid ridge is not prominent, nor is the supinator ridge so conspicuous as in *Ursus*.

Arctotherium resembles *Indarctos? oregonensis* and *Tremarctos*, and differs from *Ursus* in the presence of an entepicondylar foramen in the humerus. The bar inclosing the opening is more slender than in the large Pleistocene Felidae from Rancho La Brea.

TABLE 7.—*Measurements (in millimeters) of humerus.*

	A. simum, Potter Creek Cave.		A. californicum, Rancho La Brea.		
	No. 3001, U. C. C.	No. 3039, U. C. C.	No. Z 30, L. A. M. C.	No. Z 77, L. A. M. C.	No. 20085, U. C. C.
Greatest length	447.8	445.7	497	....	446.3
Greatest antero-posterior diameter of proximal end measured from anterior end of greater tuberosity	110	....	118.5	....	107.6
Greatest width of proximal end	91.9	90	97.3	....	95.2
Transverse diameter of shaft at middle	41.2	40.9	43.5	46.4	42.4
Antero-posterior diameter of shaft at middle	46.2	48.7	53	60	48.8
Greatest width at distal end	123.2	....	126.8	156	126.7
Greatest width of distal articulation	90.2	91.6	97	116.4	92.8

Ulna.—The ulna (plate 8, figs. 1 and 2) is decidedly longer than that in the large brown bear and in the Pleistocene *Felis atrox.* When the bone is oriented so that the coronoid process is directed anteriorly, the plane of the olecranon process is seen to be widely removed from the principal longitudinal plane of the shaft. This divergence, seen also in *Ursus* and in *Tremarctos,* is much greater than that in the ulna of *Felis atrox* or of *Smilodon.* Also in *Arctotherium,* as in other ursids, the articulating surface for the humerus, situated at the upper end of the sigmoid notch and on the radial side of the ulna, reaches much nearer to the proximal border of the olecranon than in the ulna of either of the large Pleistocene felids from Rancho La Brea. The process forming the proximal end of the sigmoid notch is much more slender than in *Felis atrox* or in *Smilodon.*

TABLE 8.—*Measurements of ulna (in millimeters).*

	A. simum, Potter Creek Cave.		A. californicum, Rancho La Brea.		
	No. 3426, U. C. Coll.	No. 3145, U. C. Coll.	No. Z 30, L. A. M. Coll.	No. Z 32, L. A. M. Coll.	No. 20088, U. C. Coll.
Greatest length	445.8	421.2	471	*a*475	433.5
Greatest width of olecranon process	79.3	71.5	84	....	*a*66
Width from posterior border to tip of coronoid process	71	83.6	85.4	....	75.3
Least distance from sigmoid notch to posterior border	41.5	46	46.7	....	39.6
Greatest diameter of distal end	46.8	50.4	....	....	46

a. Approximate.

The posterior border of the ulna is rounded, in which respect *Arctotherium* is more like *Tremarctos* than like *Ursus*. A continuous articulating surface is present for the radius as in *Tremarctos*, not divided as in *Ursus*. At the distal extremity the radial facet is relatively much smaller than in *Ursus*. The distal end of the shaft in No. Z 30 is slender, relatively more so than in *Ursus*. In a second specimen from Rancho La Brea (No. Z 32) this part of the shaft is much heavier.

Radius.—This fore-arm bone (plate 8, figs. 3, 3*a*, and 3*b*) resembles rather closely in shape the corresponding limb element in *Tremarctos*. The proximal extremity appears to be more as in *Tremarctos* than in *Ursus*. The shaft at the middle is not so heavy as in *Ursus*.

TABLE 9.—*Measurements of radius (in millimeters).*

	A. simum, Potter Creek Cave.		A. californicum Rancho La Brea, No. Z 32 L. A. M. Coll.
	No. 10262 U. C. Coll.	No. 3427 U. C. Coll.	
Greatest length	374.5	389.3	....
Greatest diameter of proximal extremity	52.4	56.3	63
Width of shaft at middle	31.4	37.3	35
Thickness of shaft at middle	19	24	22
Greatest diameter of distal extremity	*a*59	73.6	....

a. Approximate.

Carpus.—The scaphoid-lunar of *Arctotherium* presents in anterior view (plate 8, fig. 4*a*) a much deeper surface than that of *Ursus*. The postero-internal process is less massive than in the latter form. On the distal side (plate 8, fig. 4), the articulating surface for trapezium and trapezoid is less extensive than in *Ursus* and indicates perhaps that the first metacarpal was less divergent in *Arctotherium* than in *Ursus*.

The most striking difference between *Arctotherium* and *Ursus* in the appearance of the cuneiform (plate 8, figs. 6, 6*a*) is the greater transverse extent of this element in the former genus. *Arctotherium* resembles *Tremarctos* in this respect. The ulnar articulating surface appears flatter than in *Ursus*.

In the unciform (plate 8, figs. 5, 5*a*) the lower forward end of the lateral articulating surface for cuneiform is carried on a distinct process, well shown in anterior view. The upper posterior portion of this surface is apparently not so extensive as in *Ursus*. The distal articulation for metacarpals IV and V does not show the disparity between anteroposterior and transverse diameters seen in *Ursus*.

The trapezium (fig. 2) is long and rather narrow. Posteriorly it is heavier than in *Ursus*. The articulating surface for the scaphoid-lunar (S-L) is noticeably less extensive than in *Ursus*. The surface for the trapezoid (Td) is, however, rather large. An inner view (fig. 2*b*) shows these surfaces not so sharply separated as in *Ursus*. The surface for metacarpal I is long and narrow. In the pisiform (fig. 4) the posterior process is more compressed than in *Ursus*.

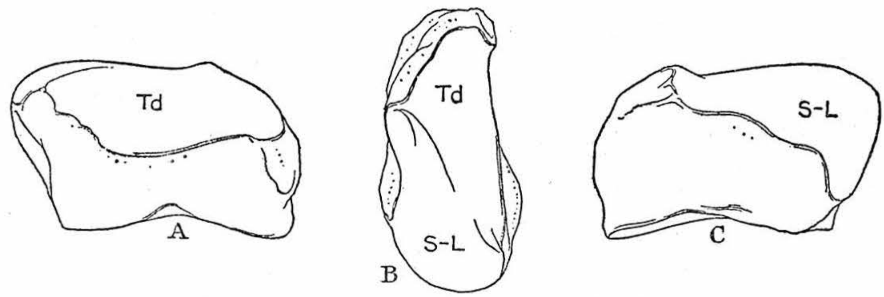


FIG. 2.—*Arctotherium californicum* Merriam. Trapezium, No. 24252, U. C. C., ×1. A, view of trapezoid surface (Td); B, inner view, surface for scaphoid-lunar (S–L); C, view of surface for scaphoid-lunar.

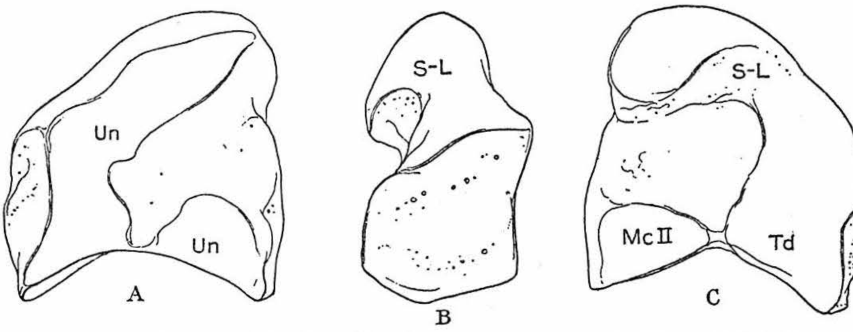


FIG. 3.—*Arctotherium californicum* Merriam. Magnum, No. Z 106, L. A. M. C. ×1. A, outer view, surfaces for unciform (Un); B, anterior view, surface for scaphoid-lunar (S–L); C, inner view, trapezoid surface (Td); surface for metacarpal II (McII).

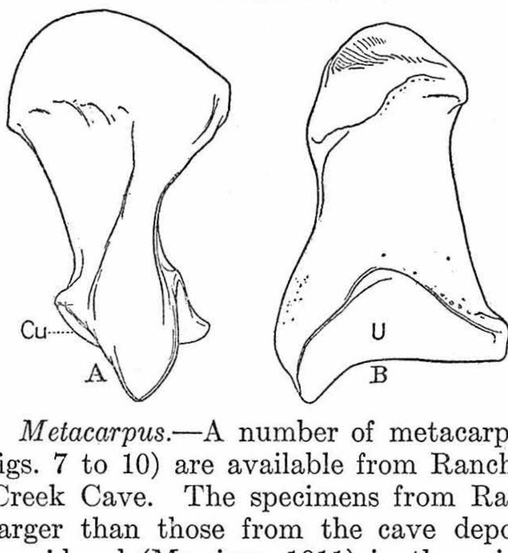
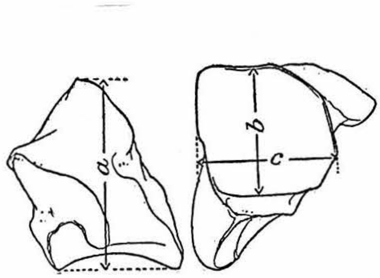


FIG. 4.—*Arctotherium californicum* Merriam. Pisiform, No. Z 110, L. A. M. C. ×1. A, external view, cuneiform surface (Cu); B, view of ulnar side, surface for ulna (U).

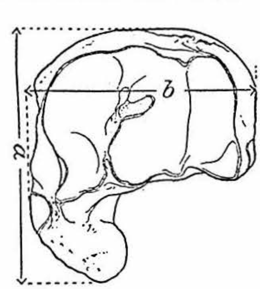
Metacarpus.—A number of metacarpals of *Arctotherium* (plate 8, figs. 7 to 10) are available from Rancho La Brea and from Potter Creek Cave. The specimens from Rancho La Brea are generally larger than those from the cave deposit. Difference in age was considered (Merriam, 1911) in the original description of *A. cali-*

TABLE 10.—*Measurements of carpal elements of Arctotherium simum, Potter Creek Cave, and Arctotherium californicum, Rancho La Brea.*

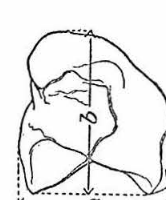
Species.	Collection and No.	Description.	Milli-meters.
		Scaphoid-lunar:	
A. simum.	U. C. 5975	Greatest anteroposterior diameter (*a*-axis)	56.3
Do.	U. C. 5975	Greatest transverse diameter (*b*-axis)	56
Do.	U. C. 24253	Greatest anteroposterior diameter (*a*-axis)	71.6
Do.	U. C. 24253	Greatest transverse diameter (*b*-axis)	71.8
A. calif.	L. A. M. Z 105	Greatest anteroposterior diameter (*a*-axis)	58.7
Do.	L. A. M. Z 105	Greatest transverse diameter (*b*-axis)	57.5
Do.	L. A. M. Z 108	Greatest anteroposterior diameter (*a*-axis)	....
Do.	L. A. M. Z 108	Greatest transverse diameter (*b*-axis)	73
Do.	L. A. M. Z 109	Greatest anteroposterior diameter (*a*-axis)	59.4
Do.	L. A. M. Z 109	Greatest transverse diameter (*b*-axis)	57.7
Do.	L. A. M. Z 135	Greatest anteroposterior diameter (*a*-axis)	62.2
Do.	L. A. M. Z 135	Greatest transverse diameter (*b*-axis)	62.5
		Cuneiform:	
Do.	L. A. M. Z 47	Anteroposterior diameter	43
Do.	L. A. M. Z 47	Greatest transverse diameter	58
Do.	L. A. M. Z 107	Anteroposterior diameter	42.8
Do.	L. A. M. Z 107	Greatest transverse diameter	52.2
		Unciform:	
Do.	U. C. 24067	Proximo-distal diameter (*a*-axis)	47.6
Do.	U. C. 24067	Anteroposterior diameter of distal articulating surface (*b*-axis)	34.7
Do.	U. C. 24067	Transverse diameter of distal end (*c*-axis)	36.5
Do.	L. A. M. Z 45	Proximo-distal diameter (*a*-axis)	50.8
Do.	L. A. M. Z 45	Anteroposterior diameter of distal articulating surface (*b*-axis)	38.5
Do.	L. A. M. Z 45	Transverse diameter of distal end (*c*-axis)	39.7
		Magnum:	
Do.	L. A. M. Z 133	Greatest anteroposterior diameter (*a*-axis)	40.7
Do.	L. A. M. Z 133	Greatest proximo-distal diameter (*b*-axis)	40.4
Do.	L. A. M. Z 106	Greatest anteroposterior diameter (*a*-axis)	36
Do.	L. A. M. Z 106	Greatest proximo-distal diameter (*b*-axis)	35
		Trapezium:	
Do.	U. C. 24252	Length	38.2
Do.	U. C. 24252	Depth	22.7
Do.	U. C. 24252	Width	18
		Pisiform:	
Do.	L. A. M. Z 110	Length	49.6
Do.	L. A. M. Z 110	Greatest diameter of articulating end	31.5



Unciform.



Scaphoid-lunar.



Magnum.

fornicum. Merriam also stated that a single metapodial in the University of California collections from the asphalt deposits resembles in form and in dimensions the corresponding bone of *A. simum* from Potter Creek Cave. The latter specimen, No. 21004, is a third metacarpal and in a comparison with another median metacarpal from the asphalt beds shows clearly the range in size which characterizes the arctotheres of the Rancho La Brea fauna.

Metacarpal I in *Arctotherium* (plate 8, fig. 7) is relatively short in contrast to metacarpals II to V and is absolutely shorter than the corresponding element in *Ursus*. The shaft is relatively slender. At the proximal end of the median metacarpal the anterior articulating surface for metacarpal IV is more extensive than in *Ursus*. The anterior face of the proximal end is somewhat excavated. At the proximal end of metacarpal V the articulating surface for the unciform is broader transversely and the lateral process does not appear to be so rugose as in *Ursus*.

TABLE 11.—*Measurements of metacarpals (in millimeters).*

A. simum, Potter Creek Cave, No. 3040 U. C. Coll.	I	II	III	IV	V
Greatest length	72.6	96.8	104	106.2	104
Anteroposterior diameter of proximal end	24.2	30	31.6	31	32.3
Least width of shaft	10.8	13.4	14	15.8	16.1
Greatest width at distal end	19.5	23.3	26.5	25.7	25.5

A. californicum, Rancho La Brea No. 17754, U. C. Coll.	I	III	IV	V
Greatest length	86.8	126.7	130.5	130.2
Anteroposterior diameter of proximal end	29.8	39.3	41.7	43.5
Least width of shaft	13.9	18.7	23	21
Greatest width of distal end	25.7	29.9	34	34

A. californicum, Rancho La Brea	12768 U. C. Coll. I	Z 93 L. A. M. Coll. I	14816 U. C. Coll. II	21004 U. C. Coll. III	Z 124 L. A. M. Coll. IV	Z 117 L. A. M. Coll. V
Greatest length	75.7	81.5	114.3	107.6	123	128.3
Anteroposterior diameter of proximal end	23.5	24.8	36.5	33.3	36.9	38.1
Least width of shaft	10.6	11.6	18.6	14.6	18.6	20.8
Greatest width of distal end	19	21.2	29.4	24.8	29.7	32.6

Pelvis.—The pelvis of *Arctotherium* (plate 9, figs. 1 and 2) is represented only by fragmentary materials, including, however, all the principal parts. The ilium appears to be relatively shorter than in *Tremarctos*. The outer end is narrowed more than in *Ursus*. The neck of the ilium immediately in front of the acetabulum is wide as in *Tremarctos.* The pubis in No. Z 48 L. A. M. Coll. is relatively narrower than in either *Ursus* or in *Tremarctos.* The obturator foramen in this specimen is not so wide dorsoventrally as in *Ursus.*

TABLE 12.—*Measurements of pelvis of A. californicum, Rancho La Brea (in millimeters).*

	Z 51 L. A. M. Coll.	Z 50 L. A. M. Coll.	Z 48 L. A. M. Coll.
Ilium, length from rim of acetabulum to anterior border	*a*185	...	...
Ilium, greatest width	*a*175	...	...
Ilium, least width of neck in front of acetabulum	65	*a*78	...
Acetabulum, transverse diameter	...	87	...
Obturator foramen, greatest anteroposterior diameter	...	...	90.3
Obturator foramen, greatest dorsoventral diameter	...	...	58.3

a. Approximate.

Femur.—The thigh bone of *Arctotherium* (plate 9, figs. 3, 4, 4*a*) possesses a relatively slender shaft, and the lower end is rather broad with anterior face more rounded than in *Ursus.* The lower, inner border of the shaft, above the inner condyle, does not form a sharp ridge. At the proximal end the digital fossa is smaller than in *Ursus* and the lesser trochanter is slightly higher than in the latter genus. At the distal end the patellar surface does not extend upward so far as in *Ursus* and the inner condyle does not reach distinctly below the distal surface of the outer condyle. The latter character suggests, perhaps, that the distal end of the femur in *Arctotherium* was not turned inward as far as in *Ursus.*

TABLE 13.—*Measurements of femur (in millimeters).*

	A. simum Potter Creek Cave, No. 10211, U. C. Coll.	A. californicum Rancho La Brea, No. 20082, U. C. Coll.
Greatest length	513.5	501.8
Greatest transverse width of proximal end taken at right angles to long axis of shaft	...	127
Anteroposterior diameter of head	61	62.2
Transverse diameter of shaft at middle	*a*44.5	41.6
Anteroposterior diameter of shaft at middle	*a*37.2	32.9
Greatest width of distal end	110.4	108.5
Greatest anteroposterior diameter of distal end	83	84.6

a. Approximate.

Tibia.—When viewed from the front the shaft of the tibia (plate 10, fig. 1) shows slightly more curvature in longitudinal extent than in *Ursus,* thus resembling that in *Tremarctos.* Above the cnemial crest the anterior border of the dorsal surface is deeply notched. This notch is, however, not so wide as in *Ursus;* it is inconspicuous

TABLE 14.—*Measurements of patella (in millimeters).*

	Arctotherium californicum Rancho La Brea.	
	No. Z 97 L. A. M. Coll.	No. Z 98 L. A. M. Coll.
Greatest length	72.2	80
Greatest width	59	69.3
Anteroposterior diameter through middle of femoral surface	31	38

in the tibia of *Tremarctos* under observation. On the posterior side of the tibia (plate 10, fig. 3) the two lines marking the attachment of the flexor digitorum muscle, and extending from the base of the outer articulation of the proximal end obliquely toward the inner side, are much farther apart than in *Ursus, Arctotherium* resembling *Tremarctos* in this respect. The outer line is quite distinct in its extent along the posterior face and may be traced to the distal end.

Another specimen (No. Z 76, L. A. M. Coll.) from Rancho La Brea lacks the proximal and distal epiphyses. It is heavier than the element described above.

TABLE 15.—*Measurements cf tibia (in millimeters).*

	Arctotherium simum, Potter Creek Cave.		A. californicum, Rancho La Brea.	
	No. 3034 U. C. Coll.	No. 3724 U. C. Coll.	No. Z 31 L. A. M. Coll.	No. Z 76 L. A. M. Coll.
Total length measured along inner side	359	*a*387.6	404	....
Greatest width of proximal end	106.6	110.1	110.7	....
Transverse diameter of shaft at middle	34.4	37	40.7	43
Anteroposterior diameter of shaft at middle	37.7	41.8	41.6	45.6
Greatest transverse diameter of distal end	87.1	85.6	88.4	....
Greatest anteroposterior diameter of distal end	47.4	*a*51	52	....

a. Approximate.

Tarsus.—In the calcaneum (plate 10, figs. 4, 4*a*) the posterior process appears to be relatively narrower in transverse diameter than in *Ursus*. The outer facet for the astragalus is flatter, while the inner facet is supported by a process more pointed than in *Ursus*.

Several astragali of *Arctotherium* (plate 10, figs. 5, 5*a*) are available from Rancho La Brea and from Potter Creek Cave. Specimens from the asphalt beds show some variation in size. The smallest specimen in the Rancho La Brea collection is distinctly larger than that of

Ursus. No astragalar foramen is present. In *Arctotherium* the outer calcaneal facet is relatively narrow. There appears to be less disparity in size between outer and inner calcaneal facets than in *Ursus*.

In the cuboid of *Arctotherium* the obliquity of the proximal surface for the calcaneum varies somewhat. On the inner side of the cuboid and along the proximal two-thirds are the three articulating surfaces, all connected, for astragalus, navicular, and ectocuneiform. A small facet situated on the inner side and along the distal margin, and separated from the proximal surfaces, articulates also with the ectocuneiform. In the cuboid of the Pliocene *Indarctos? oregonensis* the large proximal facet for the ectocuneiform is discrete. The transverse ridge on the plantar surface of the cuboid of *Arctotherium* is quite prominently developed.

In the navicular (fig. 5) a distinct process is developed on the distal side posterior to the cuneiform surfaces. This process is more pronounced than in *Ursus*.

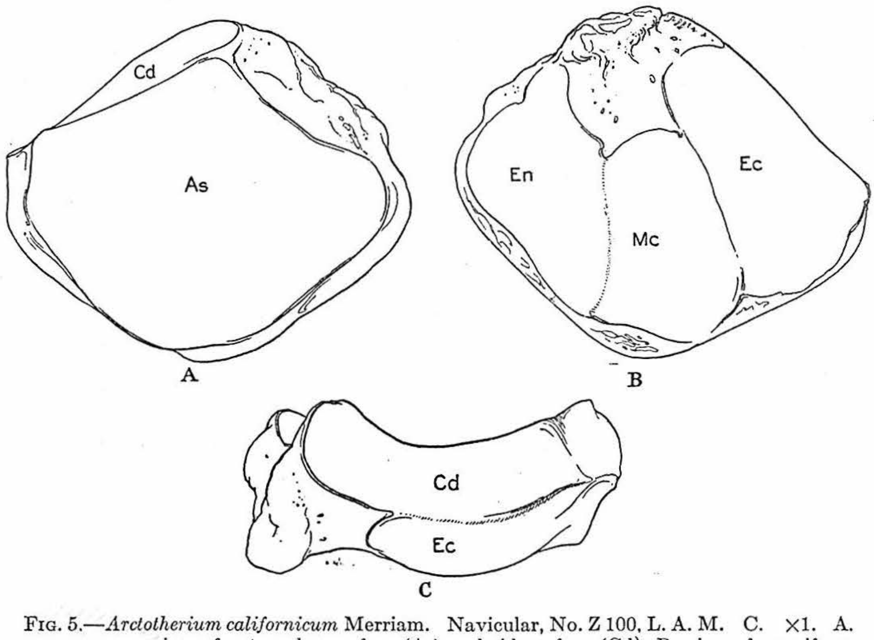
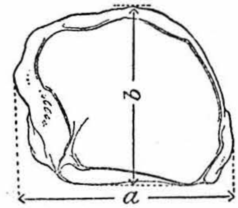


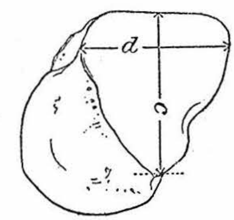
FIG. 5.—*Arctotherium californicum* Merriam. Navicular, No. Z 100, L. A. M. C. ×1. A, view of astragalar surface (As), cuboid surface (Cd); B, view of cuneiform surfaces, entocuneiform surface (En), mesocuneiform surface (Mc), ectocuneiform surface (Ec); C, outer view.

In the ectocuneiform both the articulating surfaces for the navicular and for metatarsal I are concave in anteroposterior direction. The surface for the metapodial is slightly wider transversely, but is shorter in anteroposterior diameter than the surface for the navicular.

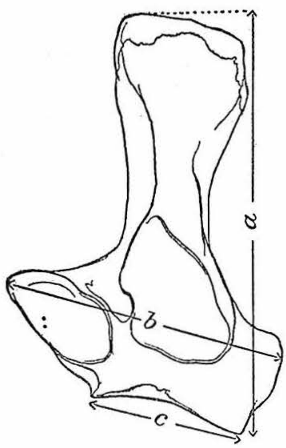
The upper posterior extremity of the ectocuneiform forms a larger tuberosity than in *Ursus*.



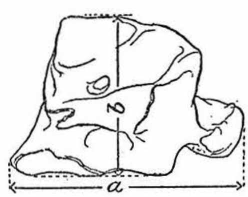
Navicular.



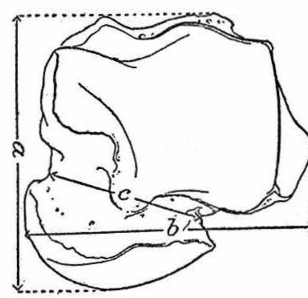
Cuboid.



Calcaneum.



Cuboid.



Astragalus.

TABLE 16.—*Measurements (in millimeters) of tarsal elements of Arctotherium simum from Potter Creek Cave, University of California collection, and A. californicum from Rancho La Brea, Los Angeles Museum collection.*

Calcaneum.	A. simum, No. 10214.	A. californicum, Rancho La Brea.			
		No. Z 81.	No. Z 84.	No. Z 83.	No. Z 114.
Greatest length (*a*-axis).........	110	*a* 116.5	*a* 115.6	*a* 127	111.5
Greatest width measured obliquely across sustentaculum (*b*-axis).....................	77.8	85.6	86.7	87.2	75.8
Width of cuboid facet (*c*-axis)...	39.4	45.8	48.5	50.7	41.8

Astragalus.	A. simum, No. 10215.	A. californicum.				
		No. Z 112.	No. Z 111.	No. Z 96.	No. Z 94.	No. Z 115.
Greatest length (*a*-axis).............	65.8	79	78	82.8	67.8	73
Greatest width (*b*-axis).............	72.6	86.2	80.4	87.4	72.5	79.3
Least distance across neck (*c*-axis)......	40	48.2	44.3	*b* 50.3	41.6	43.2

a. This measurement does not include the epiphysis at the end of the tuber calcis.
b. Approximate.

TABLE 16.—*Continued.*

Cuboid.	A. simum, No. 4311.	A. californicum.		
		No. Z 103.	No. Z 104.	No. Z 134.
Greatest antero-posterior diameter (*a*-axis)	*b* 46	63.7	53	60.9
Greatest proximo-distal diameter (*b*-axis)	34.3	42.1	35.9	41
Length of metatarsal facet (*c*-axis)	33.3	42	37	42.7
Width of metatarsal facet (*d*-axis)	29.2	38	30.8	38.7

Navicular.	A. californicum.		Ectocuneiform.	A. californicum. No. Z 43.
	No. Z 95.	No. Z 100.		
Antero-posterior diameter (*a*-axis)	55.4	58.8	Greatest proximo-distal diameter (*a*-axis)	22.7
Transverse diameter (*b*-axis)	43.5	47.5	Antero-posterior diameter (*b*-axis)	37

b. Approximate.

Metatarsus.—The first metapodial in the pes (plate 10, fig. 6) is relatively short in contrast to that in *Ursus*. The shaft in metatarsal III increases slightly in width from the proximal third to the distal extremity. The posterior facet on the outer side of the proximal end in this metapodial is directed less proximally than in *Ursus*. In the fourth metatarsal the two articulating facets on the outer side of the proximal end are sometimes separated rather widely. On the inner side of the proximal end the forward facet is concave as in *Ursus*. The posterior facet shows division into two parts, the lower for

TABLE 17.—*Measurements (in millimeters) of metatarsals of Arctotherium californicum from Rancho La Brea, Los Angeles Museum collection, and University of California collection.*

Metatarsal.	Collection and No.	Greatest length.	Antero-posterior diameter of proximal end.	Least width of shaft.	Greatest width of distal end.
I	Z 102, L. A. M.	75.2	32	12	21.3
I	Z 101 L. A. M.	73.2	27.7	10.8	18.3
II	Z 40 L. A. M.	101.3	36.8	16.3	24.8
III	Z 99 L. A. M.	106.3	37.8	16	23.2
III	Z 90 L. A. M.	121.2	41.8	20.8	30.5
IV	Z 99 L. A. M.	115.7	38	17.4	25.2
IV	Z 88 L. A. M.	....	40.6	19.8	....
V	Z 99 L. A. M.	115.8	37	15.6	24.5
V	Z 85 L. A. M.	*a*129	....	19.8	30.8
V	No. 24251 U. C. Coll.	110	39.8	13.8	24.3

a. Approximate.

metatarsal III and the upper part for the ectocuneiform. In the fifth metatarsal the lateral process of the proximal end is prominent, but is relatively not so deep dorso-ventrally as in that of *Ursus.*

Phalanges.—A number of phalanges of *Arctotherium* have been found at Potter Creek Cave and at Rancho La Brea. Several specimens, presumably of *Arctotherium*, from the asphalt deposits are shown on plate 10, figures 9 to 14. The terminal phalanges have the claw-core shortened, in which respect *Arctotherium* differs from *Ursus.*

TABLE 18.—*Measurements of phalanges of A. californicum from Rancho La Brea, Los Angeles Museum collection.*

Phal. No.	Mus. No.	Measurements.	Milli-meters.
I	Z 130	Greatest length.	64.4
I	Z 130	Greatest width of proximal end.	34.7
I	Z 137	Greatest length.	56.9
I	Z 137	Greatest width of proximal end.	34.8
II	Z 138	Greatest length.	33.1
II	Z 138	Greatest width of proximal end.	21.5
II	Z 138	Depth of proximal end.	18.4
II	Z 139	Greatest length.	34.4
II	Z 139	Greatest width of proximal end.	22
II	Z 139	Depth of proximal end.	18.2
III	Z 140	Length.	35.5
III	Z 140	Greatest depth of proximal end.	26.5
III	Z 141	Length.	39.4
III	Z 141	Greatest depth of proximal end.	28.7

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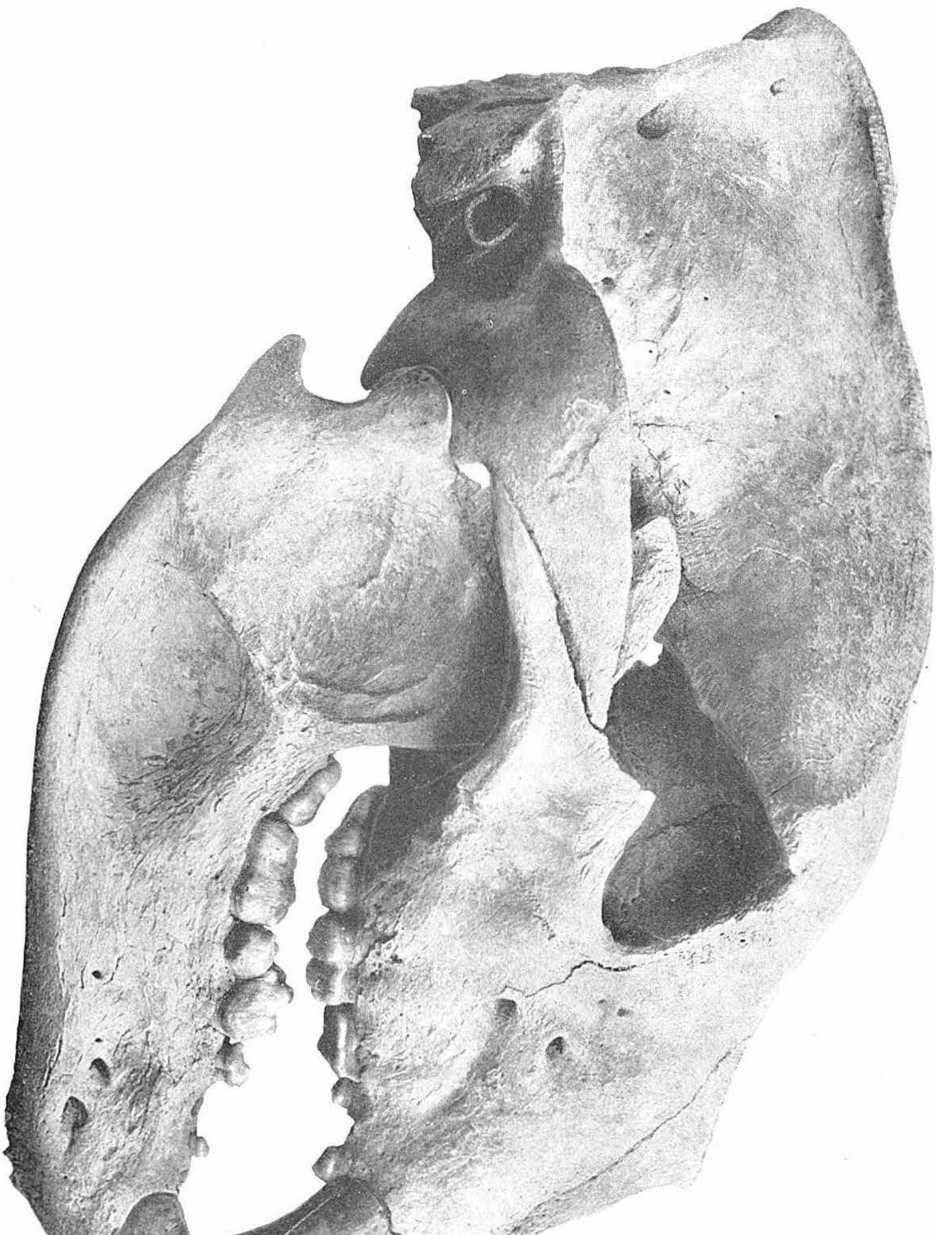
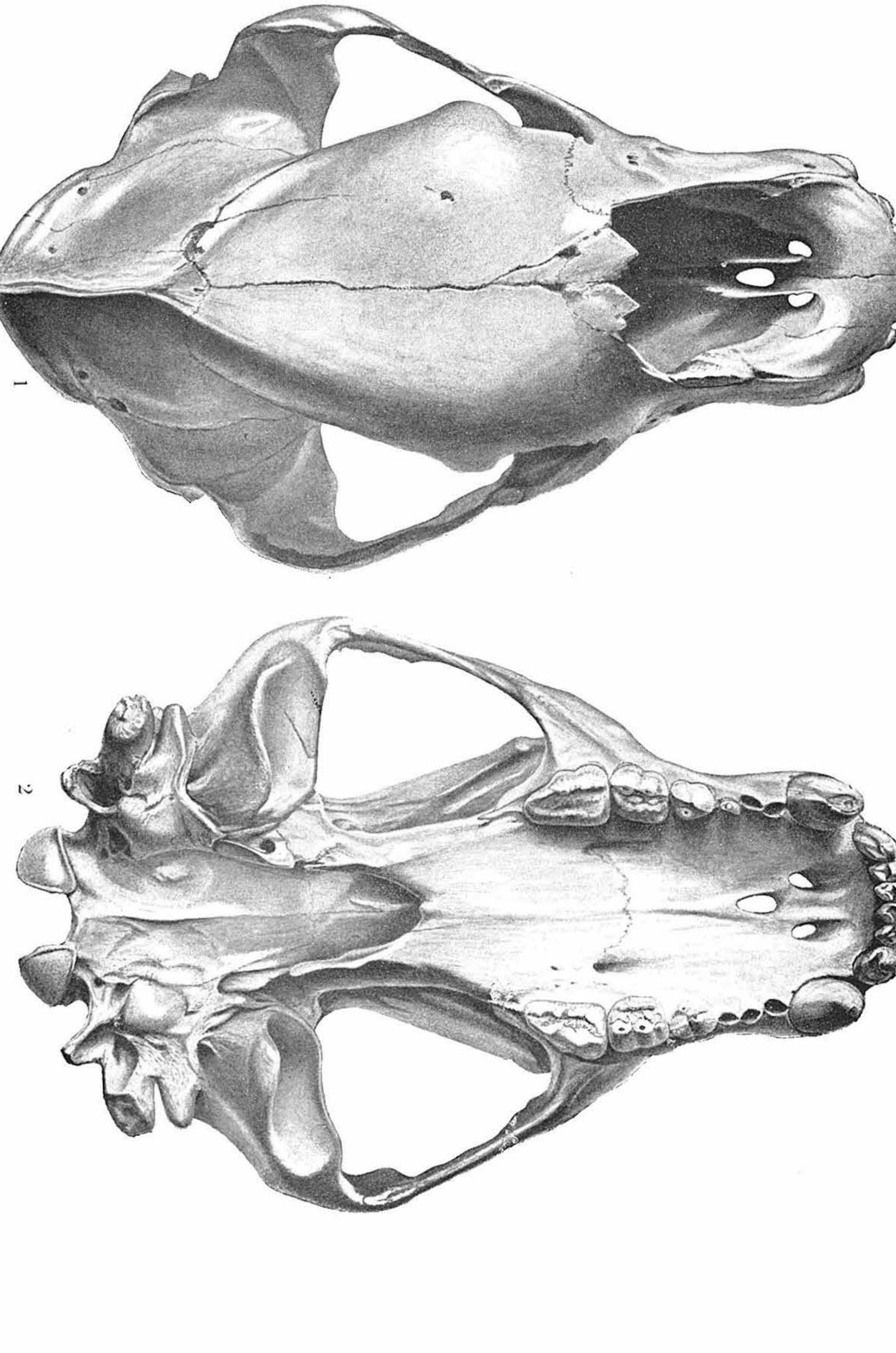
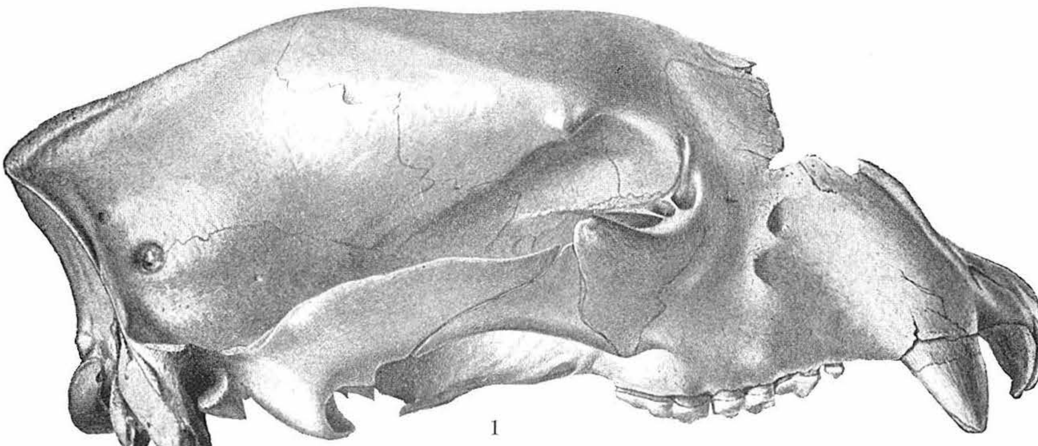
Arctotherium simum Cope. Restoration of head by Charles R. Knight under direction of John C. Merriam and Chester Stock.



Arctotherium simum Cope Skull and mandible, No. 3001, lateral view, approx. ×0.50. University of California Collections, Potter Creek Cave.



Arctotherium californicum Merriam. 1 and 2, skull, No. Z 1, superior and inferior views, × 0.333. Los Angeles Museum Collections. Rancho La Brea Beds.



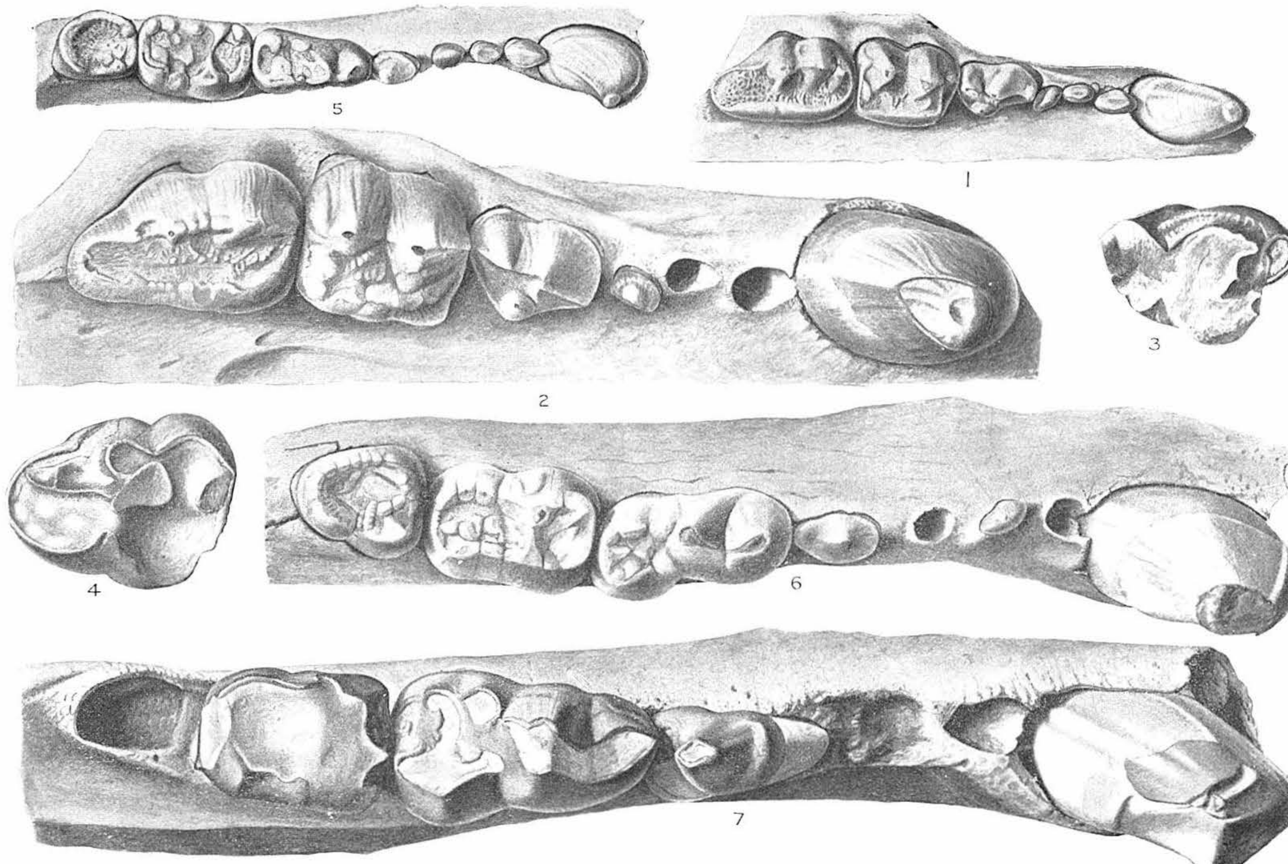
1

2

3

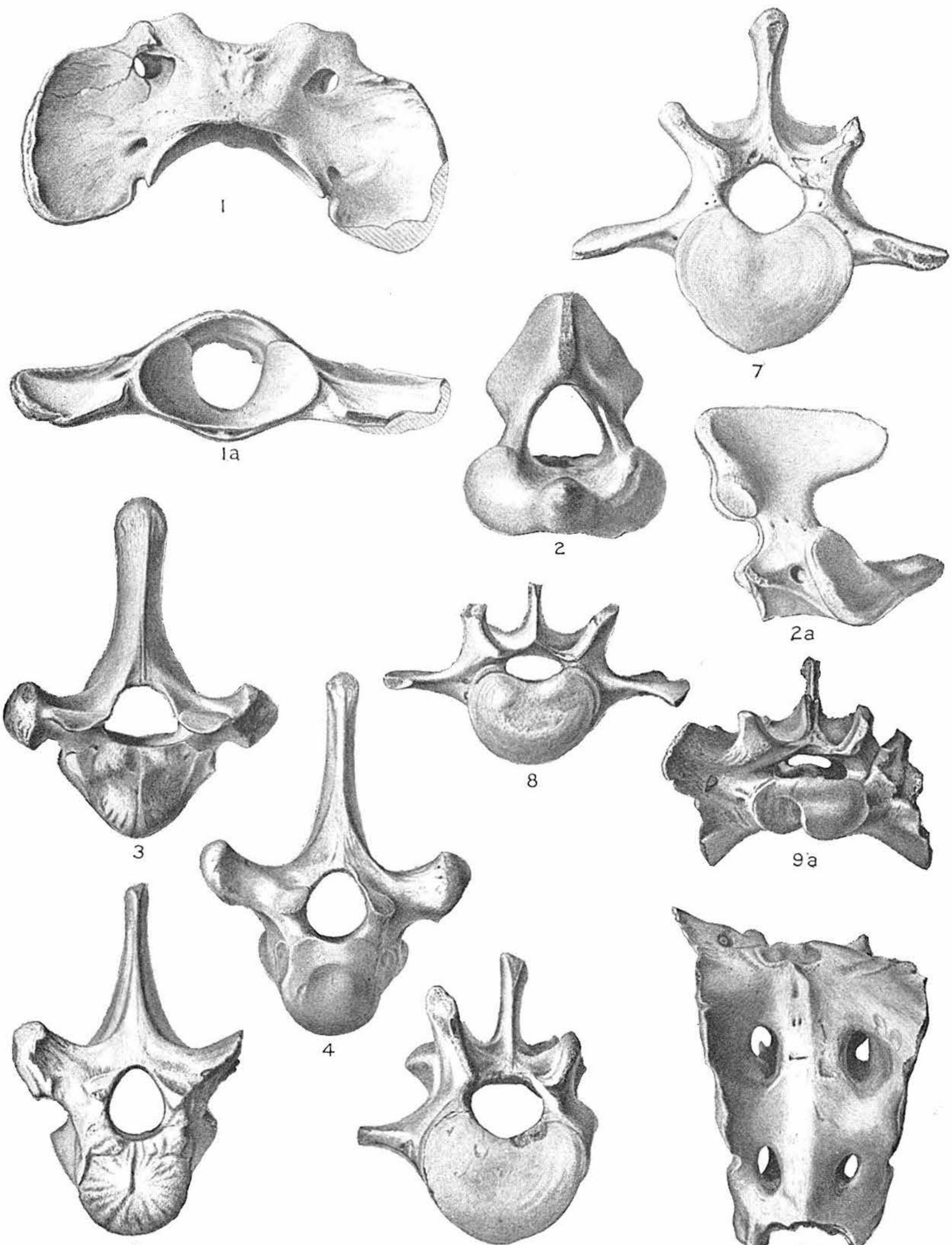
1 and 2. *Arctotherium californicum* Merriam. Skull No. Z 1, lateral and posterior views, × 0.333. Los Angeles Museum Collections, Rancho La Brea Beds.

3. *Arctotherium simum* Cope. Mandible, No. 3001, lateral view, × 0.333. University of California Collections, Potter Creek Cave.

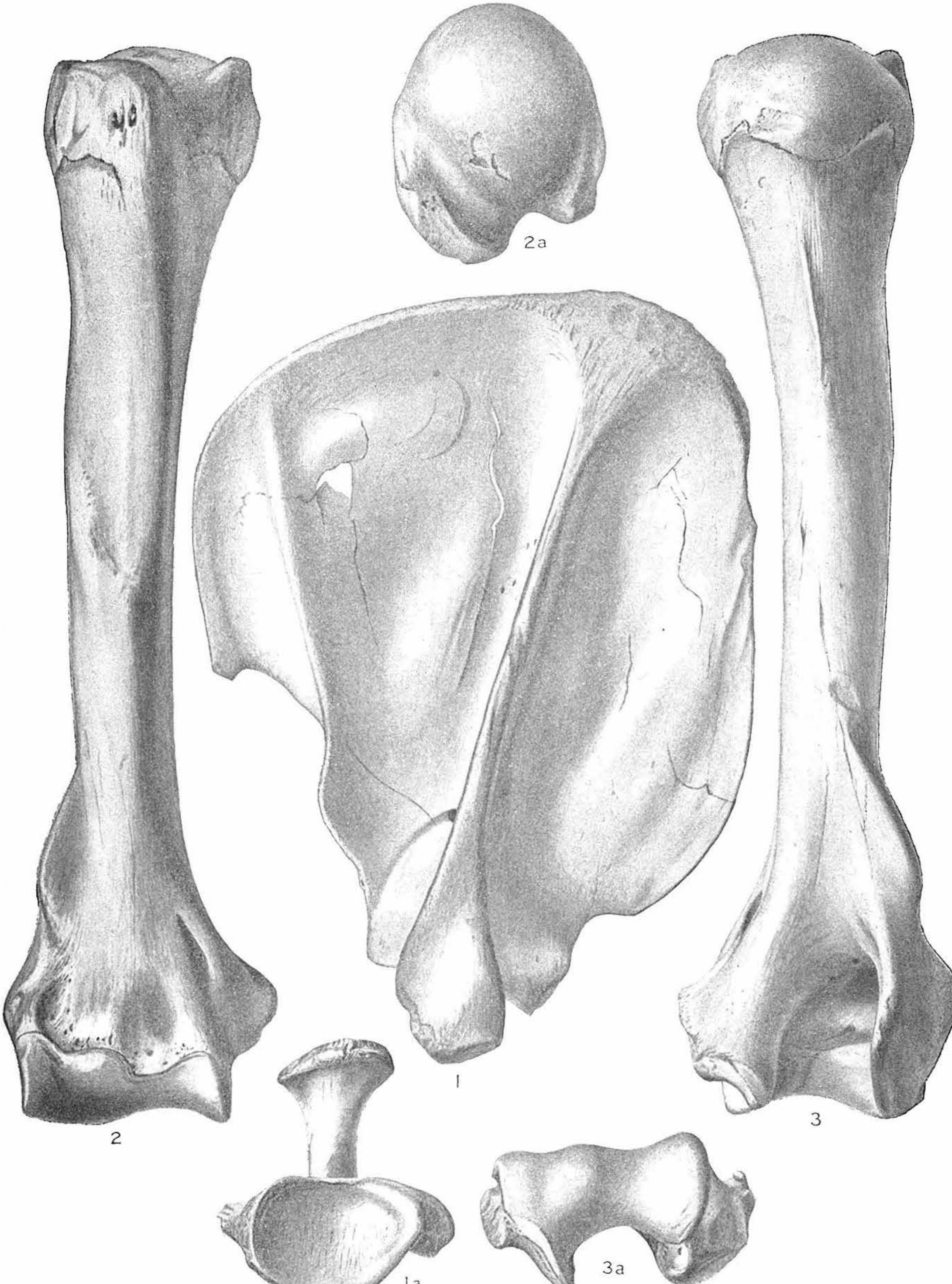


1. *Tremarctos ornatus* (Cuvier). Superior dentition, No. 171011, U. S. Nat. Mus. Recent, South America.
2. *Arctotherium californicum* Merriam. Superior dentition, No. Z 1, L. A. M. C. Pleistocene, California.
3 and 4. *Indarctos? oregonensis* Merriam, Stock, and Moody. $P\underline{4}$, and $M\underline{2}$, No. 22362, U. C. C. Pliocene, Oregon.
5. *Tremarctos ornatus* (Cuvier). Inferior dentition, No. 171011, U. S. Nat. Mus. Recent, South America.
6. *Arctotherium simum* Cope. Inferior dentition, No. 3001, U. C. C. Pleistocene, California.
7. *Agriotherium (Hyaenarctos) schneideri* Sellards. Inferior dentition, No. 6856, Fla. Surv. Coll. Pliocene, Florida.

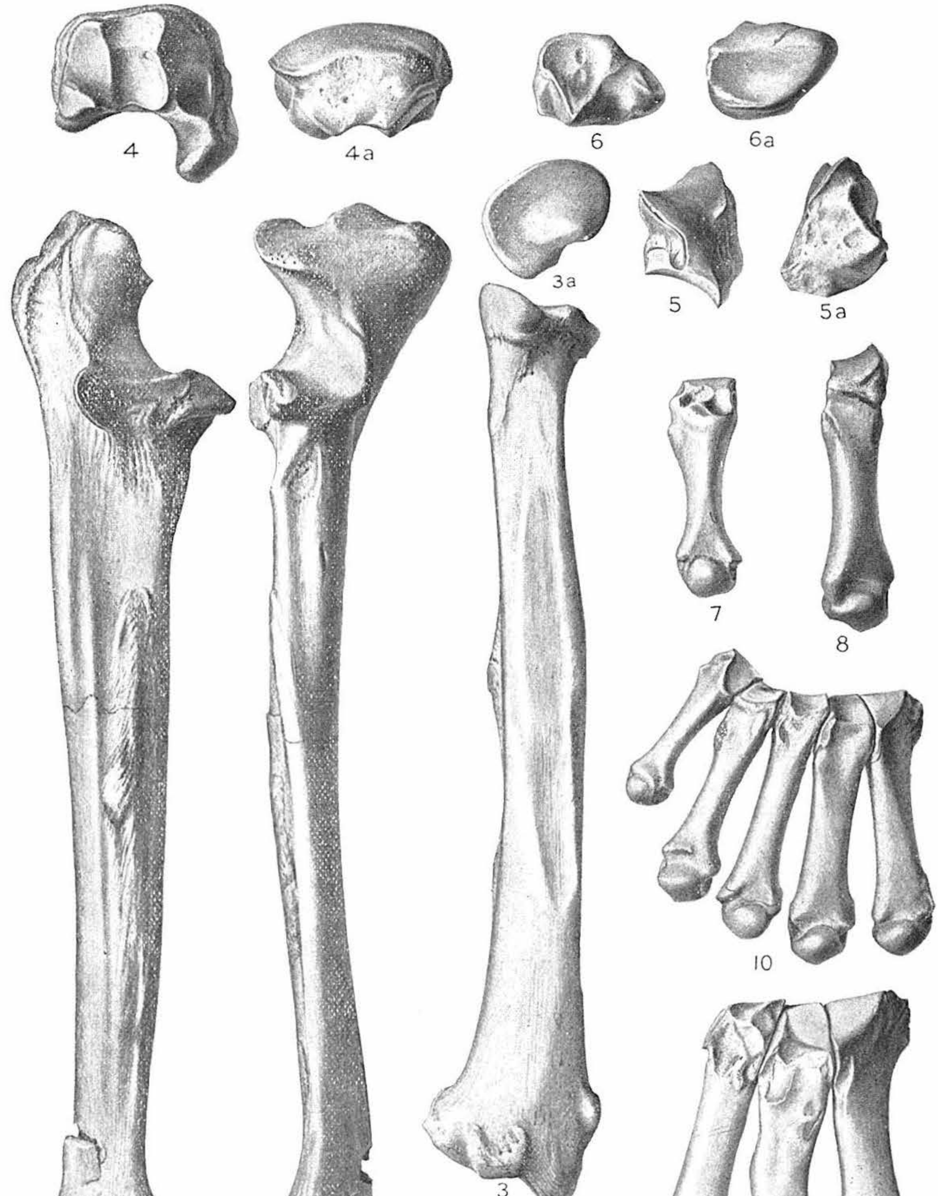
All figures are occlusal views, ×0.873 (approximate).



1 and 1*a*. *Arctotherium simum* Cope. Atlas, No. 3035, superior and posterior views, × 0.333. University of California Collections, Potter Creek Cave.
2 and 2*a*. *Arctotherium californicum* Merriam. Axis, No. Z 39, anterior and lateral views, × 0.333.
3. Second dorsal vertebra, No. Z 33, anterior view, × 0.333.
4. Third dorsal vertebra, No. Z 34, anterior view, × 0.333.
5. Dorsal vertebra, No. Z 35, anterior view, × 0.333.
6. Last dorsal vertebra, No. Z 36, anterior view, × 0.333.
7. Anterior lumbar vertebra, No. Z 37, anterior view, × 0.333.
8. Posterior lumbar vertebra, No. Z 38, anterior view, × 0.333.
9 to 9*a*. Sacrum, No. Z 113, inferior and anterior views, × 0.333.
Figs. 2 to 9_a are of specimens in the Los Angeles Museum Collections, Rancho La Brea Beds.



Arctotherium californicum Merriam. Los Angeles Museum Collections. Rancho La Brea Beds.
1 and 1*a* Scapula, No. Z 30, views of outer side and of glenoid articulation, × 0.333.
2 and 2*a*. Humerus No. Z 30, anterior and proximal views, × 0.333.
3 and 3*a*. Humerus No. Z 30, posterior and distal views, × 0.333.



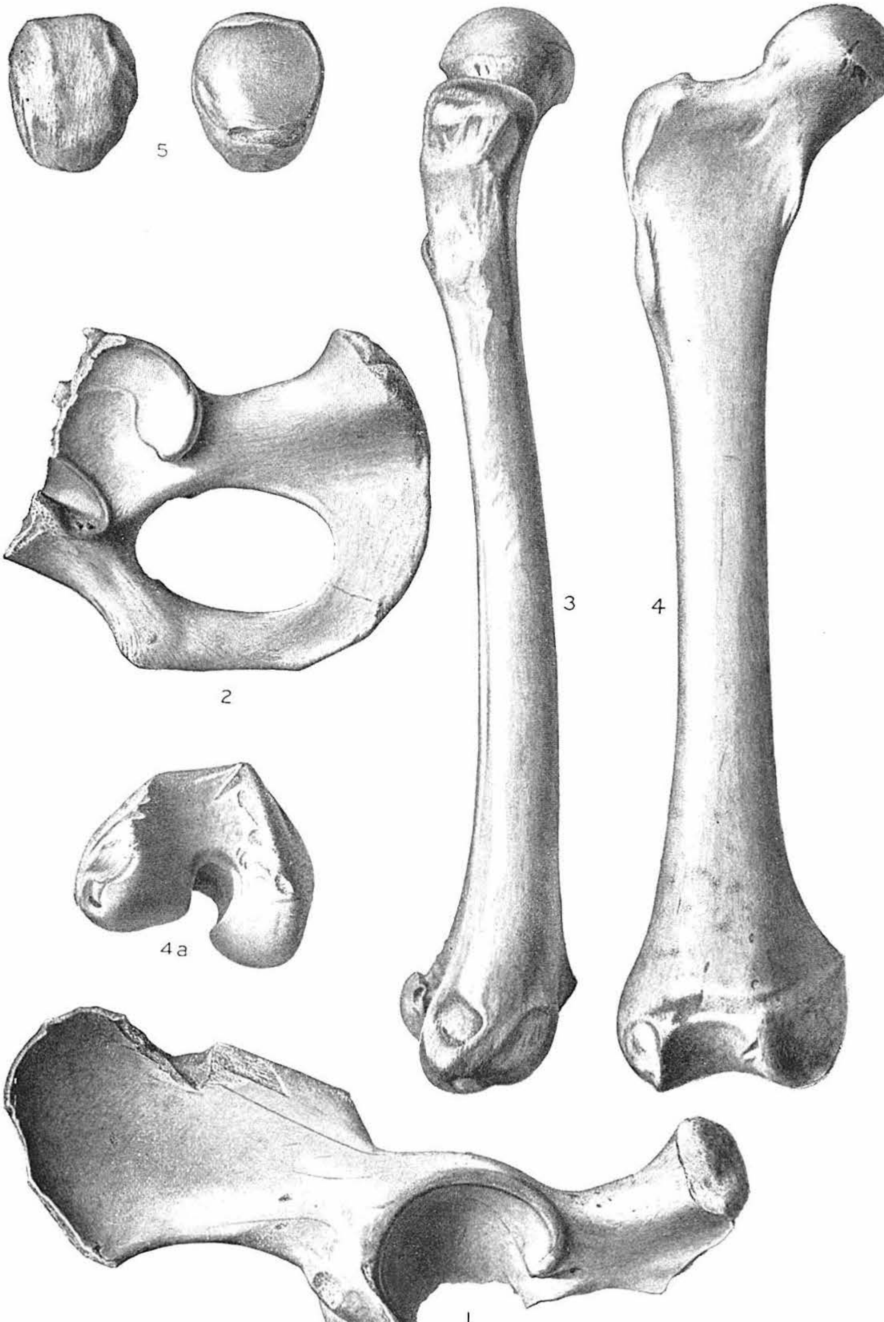
Arctotherium californicum Merriam:

1 and 2. L. A. M. Ulna, No. Z 30, radial and inner views.
4 and 4*a*. Univ. Cal. Scaphoid-lunar, No. 24253, inferior and anterior views.
5 and 5*a*. Univ. Cal. Unciform No. 24067, inner and anterior views.
6 and 6*a*. L. A. M. Cuneiform, No. Z 107, inferior and superior views.
7. Univ. Cal. Metacarpal 1, No. 17751, anterior view.
8. Univ. Cal. Metacarpal 2, No. 14816, anterior view.
9. Univ. Cal. Metacarpals 3, 4, and 5, No. 17755, anterior view.

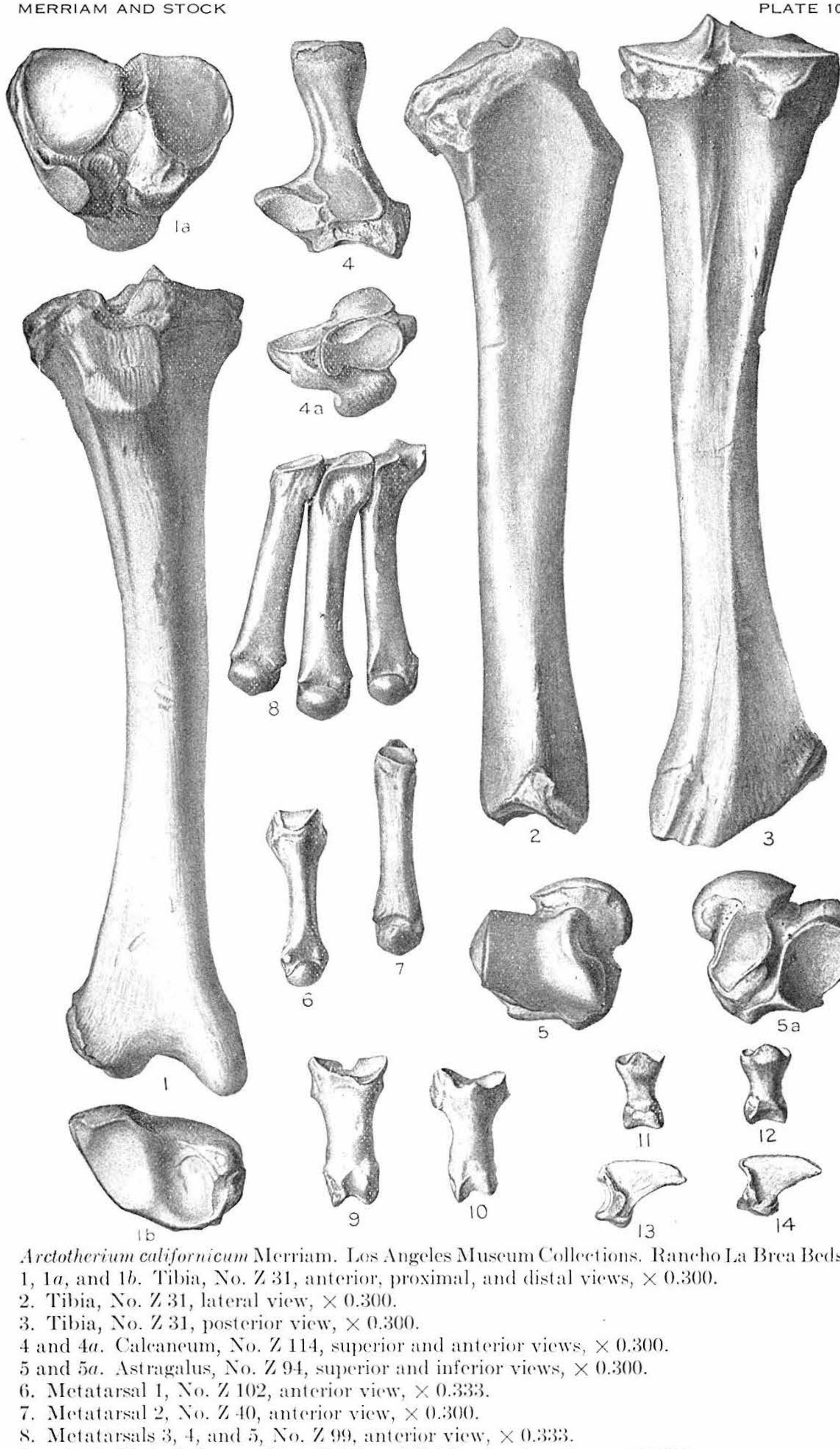
Arctotherium simum Cope:

3, 3*a* and 3*b*. Univ. Cal. Radius, No. 3427, lateral, proximal, and distal views.
10. Univ. Cal. Metacarpus, No. 3040, anterior view.

All figures one-third natural size. Figs. 3, 3*a*, 3*b*, and 10 from Potter Creek Cave; all others from Rancho La Brea Beds.



Arctotherium californicum Merriam.
1 and 2. Innominate bones, Nos. Z 49 and Z 48, lateral views, × 0.285 (approximate).
3. Femur, No. 20082, lateral view, × 0.285 (approximate).
4 and 4*a*. Femur, No. 20082, anterior and distal views, × 0.285 (approximate).
5. Patella, No. Z 97, anterior and posterior views, × 0.285 (approximate).
Los Angeles Museum Collections. Rancho La Brea Beds.



Arctotherium californicum Merriam. Los Angeles Museum Collections. Rancho La Brea Beds
1, 1*a*, and 1*b*. Tibia, No. Z 31, anterior, proximal, and distal views, × 0.300.
2. Tibia, No. Z 31, lateral view, × 0.300.
3. Tibia, No. Z 31, posterior view, × 0.300.
4 and 4*a*. Calcaneum, No. Z 114, superior and anterior views, × 0.300.
5 and 5*a*. Astragalus, No. Z 94, superior and inferior views, × 0.300.
6. Metatarsal 1, No. Z 102, anterior view, × 0.333.
7. Metatarsal 2, No. Z 40, anterior view, × 0.300.
8. Metatarsals 3, 4, and 5, No. Z 99, anterior view, × 0.333.
9 and 10. First phalanges, Nos. Z 130 and Z 137, superior views, × 0.333.
11 and 12. Second phalanges, Nos. Z 139 and Z 138, superior views, × 0.333.
13 and 14. Third phalanges, Nos. Z 141, and Z 140, lateral views, × 0.333.