
III

**OREODONTS FROM THE SESPE DEPOSITS OF SOUTH
MOUNTAIN, VENTURA COUNTY, CALIFORNIA.**

By **CHESTER STOCK**

With two plates and 2 text-figures

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OREODONTS FROM THE SESPE DEPOSITS OF SOUTH MOUNTAIN, VENTURA COUNTY, CALIFORNIA

INTRODUCTION

The Sespe deposits, a thick series of beds regarded as of non-marine origin, occupy a stratigraphic position in the Tertiary sequence of the Pacific Coast region between the Tejon marine Eocene and the Vaqueros marine Miocene. As mapped by W. S. W. Kew the Sespe beds are seen to possess an extensive distribution in southern California, occurring not only at the type locality on Sespe Creek, but are exposed also over broad areas along the borders of the Santa Clara Valley in Ventura County and in adjacent regions. Since their earliest study and description, these deposits have exhibited among other peculiarities an apparent absence of fossil remains. Because of the lack of palæontological materials, determination of the age of the Sespe has depended upon its stratigraphic position and upon the recognition of the faunal stages of the marine invertebrate assemblages known from deposits which immediately underlie and overlie this accumulation. Since the Tejon is generally regarded as of Upper Eocene age and the Vaqueros as belonging to the Lower Miocene, various ages ranging from Eocene to Lower Miocene have been ascribed to the Sespe. The view has also been entertained that the period of accumulation of the Sespe accounts for much of geologic time that has elapsed since the Upper Eocene and prior to the Temblor stage of the Miocene.

In recent years attention has been directed to the Sespe beds as exposed on the south side of the lower Santa Clara Valley near Santa Paula, California, as a result of the discovery of mammalian remains in these deposits by Dr. Nicolas L. Taliaferro. Following this discovery, further search in the area has brought to light additional material. The occurrence of mammalian remains is of considerable interest and importance since it affords an opportunity to present noteworthy data on the age of the Sespe and on the correlation of this accumulation with early Tertiary continental deposits of the Great Basin and Great Plains provinces.

Furthermore, the materials available represent two distinct genera of oreodonts related to *Promerycochoerus* and *Leptauchenia*. This occurrence therefore records for the first time the presence of a type allied to the former genus west of the John Day region in north-central Oregon and of a member of the *Leptauchenia-Cyclopidius* group west of the Great Plains.

OCCURRENCE

In a recent bulletin¹ on the geology and oil resources of southern California, W. S. W. Kew has discussed in detail the Sespe deposits as exposed in the region of South Mountain near Santa Paula, California. There appears to be no reason for hesitancy in the correlation of the beds called Sespe at South Mountain with the Sespe as represented at the type locality on Sespe Creek north of the Santa Clara Valley, in view of the close proximity of the two regions and in view of the similarity of the sedimentary materials of the two areas, despite the fact that there is in general a difference in type of induration of the deposits. Moreover, at the type locality the Sespe rests with apparent unconformity on the Tejon Eocene but is conformable with the overlying marine Miocene, determined as the Vaqueros horizon on the basis of invertebrate fossils. On the north side of South Mountain, south of the Santa Clara Valley, the base of the Sespe is not exposed. At the top of the section the Sespe is, however, again conformable with the marine Miocene, here also determined as the Vaqueros horizon.

A measured section of the basal portion of the Vaqueros and of the Sespe of South Mountain has been kindly furnished by Dr. N. L. Taliaferro. This is given as follows:

	FEET
Vaqueros	
Fossiliferous marine sandstone.....	100
Acid andesite intrusive.....	250
Sespe	
(1) Gray and greenish-gray sandy shale, gray sandstone, light conglomerates, red and brown sandy shale.....	650
(2) Finely laminated red and maroon shale, gray, green and red sandstone and thin layers of algal limestones.....	300
(3) Gray and red sandstone with minor amounts of shale.....	500
(4) Red, green, gray sandstone and maroon sandy shale; a greater proportion of shale than in (3).....	650
Bottom of Exposed Sespe	
(5) Lower divisions of Sespe as recognized in well borings: Alternating layers of red sandy shale, red clayey sand, blue-gray shale, and gray sandstone; logged in wells as "brown shales" but always with distinct maroon color; lower oil measures.....	4000±
Thickness of Sespe.....	6100±

The stratigraphic position of *Promerycochoerus*? occurred within division (1) 600 to 650 feet below the top of the Sespe. The skull and jaws of the leptauchenid were found somewhat lower in the section, occurring in division (4) approximately 2000 feet below the top of the Sespe. In view of the vertical difference of approximately 1400 feet between the positions of the two oreodonts, it should be noted that the original fragments discovered by Dr. Taliaferro, and which possibly belong also to a small leptauchenid known by more complete material from the lower level, were found approxi-

¹W. S. W. Kew, U. S. Geol. Surv. Bull. 753, 1924.

mately 100 feet below the position of *Promerycochærus*?. Furthermore, all of the vertebrate occurrences thus far noted lie within the upper third of the entire series recognized as Sespe on the north side of South Mountain. While the recognition of more than a single faunal unit in the upper 2000 feet at this locality may not be warranted, at least on the basis of the oreodont types now known, there may in reality be recorded within this thickness a replacement of the leptauchenid by *Promerycochærus*?. Increased collections will doubtless reveal more clearly the Sespe mammalian succession.

DISCUSSION OF RELATIONSHIPS AND AGE OF UPPER SESPE OF SOUTH MOUNTAIN

COMPARISON OF UPPER SESPE WITH JOHN DAY AND LOWER ROSEBUD

Fortunately the two types of mammals thus far recorded from the upper Sespe of South Mountain belong to groups found elsewhere in Miocene and Oligocene assemblages. As previously mentioned the occurrence of *Promerycochærus*? and a leptauchenid on the Pacific Coast extends considerably the known geographic distribution of these groups of oreodonts.

In the Tertiary sequence of the John Day region of north-central Oregon the genus *Promerycochærus* makes a sudden appearance in the upper John Day. The absence of this oreodont in the middle division of the John Day and the prevalence of the type in the upper deposits, early led Wortman to designate the latter as the *Merycochærus* (*Promerycochærus*) beds. Further palæontological explorations in this region have tended to emphasize this distinction. Curiously enough, while much intensive collecting has been conducted in the John Day, members of the *Leptauchenia-Cyclopidius* group have been conspicuously absent from the entire assemblage.

Originally regarded as Miocene by Cope, Marsh and others, the John Day on further study of its stratigraphic and faunal relationships by Merriam and by Merriam and Sinclair was referred to the upper Oligocene. In recent years the critical studies of the Tertiary formations and faunas of the John Day area, under the leadership of Dr. John C. Merriam, have served to emphasize the noteworthy differences existing between the John Day and the later Tertiary deposits and faunas in this region. The Mascall mammalian assemblage is distinctly removed from that of the John Day and is clearly much more advanced. The Mascall is currently regarded as middle Miocene in age. The disparity in age between the Mascall and John Day is further indicated by the length of time involved in the extravasation of the great Columbia lava series lying below the Mascall and by the marked hiatus separating the Columbia lavas from the John Day beneath.

The absence of representatives of the *Leptauchenia-Cyclopidius* group in the John Day fauna appears hardly to be accounted for on the basis of fortuitous collecting. Rather does it suggest, perhaps, that the distribution of these oreodonts never extended into the region of the John Day basin during the period of accumulation of the John Day deposits.

Matthew in describing the lower Rosebud fauna of South Dakota recognized its relationship to the John Day, particularly the upper division of the latter, as shown by the presence of similar types. Matthew points out that the majority of the species from the lower Rosebud and many of those from the upper Rosebud are to be referred to John Day genera. He remarks, furthermore, that whenever comparisons are made on adequately preserved material, the Rosebud species show a considerable advance beyond those in the John Day fauna. It should be stated also that the lower Rosebud assemblage includes both *Promerycochærus* and *Leptauchenia*.

Matthew regards the lower Rosebud fauna as of lower Miocene age. While this fauna is clearly related to that of the John Day there is considerable difference in thickness of the formations in which these assemblages occur. The Great Plains deposits referred to the lower Miocene are relatively thin, although the difference in thickness of the Rosebud and John Day may be due, as Matthew suggests, to a difference in type of material accumulated and in the rapidity with which the sediments were laid down. In thickness of deposits the upper Sespe resembles more closely the John Day than the Rosebud.

The presence of *Promerycochærus* ? and a leptauchenid in the upper Sespe suggests a correlation with the lower Rosebud. The leptauchenid occurring in the Sespe is, however, smaller than and differs in certain structural characters from any described representative of the *Leptauchenia-Cyclopidius* group from the Great Plains region. In view of the known geologic range of the group the occurrence in California would presumably not be older than upper Oligocene or younger than middle Miocene. Were the occurrence to be regarded as older than upper Oligocene it would necessitate recognition of an earlier appearance of true leptauchenids and *Promerycochærus* ? on the Pacific Coast than elsewhere on the North American continent. The occurrence of these two types of oreodonts in a conformable series of deposits having a thickness of approximately 2000 feet suggests that the period of accumulation includes that represented by the deposits containing the lower Rosebud fauna.

In the Great Plains region the lower Rosebud appears to be stratigraphically continuous with the White River, and the beds which lie between the characteristic faunal zones of these deposits have yielded almost exclusively remains of *Leptauchenia*. A some-

what similar relationship may prevail within the upper Sespe if it is ultimately shown that the range of the leptaucheniid extends from a level 2000 feet below the Vaqueros contact to a level approximately 1400 feet higher in the section and the downward range of *Promerycochoerus*? does not extend much below its present recorded level of 600 to 650 feet below the Vaqueros.

While the large oreodont from the Sespe is presumably referable to *Promerycochoerus*, a more detailed determination of relationship of this type to the several species known from the upper John Day is difficult on the basis of the material now available. Occurrence of closely related types at the California and eastern Oregon localities is of considerable importance, particularly in view of the relatively short geologic range of the genus. Loomis¹ states that the range of *Promerycochoerus* extends from lower to middle Miocene.

The time relations of the oreodonts from the upper Sespe to those recorded from the John Day and lower Rosebud are expressed in the following table:

	PACIFIC COAST	COLUMBIA RIVER BASIN	GREAT PLAINS
Lower Miocene	Vaqueros { Marine Conformity Upper { <i>Promerycochoerus</i> { <i>Leptauchenia</i>	John Day Columbia Lavas Unconformity Upper { <i>Promerycochoerus</i> Middle { <i>Eporeodon</i> Lower Clarno	Upper Rosebud
			Lower Rosebud { <i>Promerycochoerus</i> { <i>Leptauchenia</i>
Oligocene	Sespe Middle Lower		White River Brule { <i>Leptauchenia</i> Zone { Oreodon Zone Chadron { <i>Titanotherium</i> Zone
Upper Eocene	Tejon { Marine		

FIG. 1.—Comparative table showing position of Miocene and Oligocene oreodonts in Tertiary faunal provinces of western North America.

AGE RELATIONS OF UPPER SESPE AND VAQUEROS

Determination of age of the upper Sespe is necessarily influenced by the fact that the land-laid sediments of this formation grade upward without structural break into Miocene strata recognized as the Vaqueros horizon. According to Kew,² the Vaqueros in the region mapped by him possesses a characteristic assemblage of marine mollusks of which the commonest type is *Turritella inezana*. On the basis of this fauna a fairly safe correlation can be made with the Vaqueros at the type locality on Vaqueros Creek, Monterey County,

¹ F. B. Loomis, Miocene oreodonts in the American Museum, Bull. Amer. Mus. Nat. Hist., vol. 51, pages 1-37, 1924.

² W. S. W. Kew, *ibid.*, page 46, 1924.

California. In west coast Tertiary sequence of marine formations, the Vaqueros has been generally regarded as lower Miocene in age.

In a comprehensive review of the stratigraphic and palæontologic correlation of the Monterey series of the Coast Ranges of California with special reference to the occurrence of the Merychippus fauna of the North Coalinga region, Merriam¹ discussed the stratigraphic and faunal relationships of the Temblor and the Vaqueros horizons. Within the Temblor, which name Merriam was inclined tentatively to use for deposits containing the *Turritella ocoyana* fauna, occurs the Merychippus zone. This vertebrate assemblage was regarded as not older than the stage of the middle Miocene as represented by the Mascall and Virgin Valley faunas of the Great Basin region.

The Vaqueros fauna distinguished particularly by the marine gastropod *Turritella inezana* has been regarded by a number of investigators as distinct from the Temblor assemblage and indicative, at least in part, of an earlier stage in the Miocene. The occurrence of *Promerycochærus?* and a leptachenid in beds continuous with marine strata containing the *T. inezana* fauna is strongly suggestive of a difference in age between the Vaqueros of the South Mountain region and the Temblor as recognized in the North Coalinga area. If the Merychippus zone, featured particularly by the presence of *Merychippus californicus*, approximates middle Miocene in age and if the Vaqueros is not far removed in time from the upper Sespe, then the Vaqueros certainly represents a stage distinctly older than middle Miocene. In the region mapped by Kew, the Vaqueros is followed upward by the Topanga marine formation referred to the middle Miocene and this in turn by the Modelo marine formation referred to the upper Miocene.

RELATION OF THE UPPER SESPE TO THE TECUYA

A small vertebrate fauna including a hypertragulid, a rhinoceros, and a sciurid, was described by Stock² from the Tecuya red beds of Tecuya Canyon, California. This assemblage was recognized as older than any Tertiary mammalian fauna described from the Coast Ranges, and related to that of the John Day and lower Rosebud. The Tecuya beds were correlated tentatively with the Sespe. Clark³ states that beds containing a Vaqueros fauna are found immediately below the land-laid deposits, and that marine beds immediately above are believed to represent the same horizon. Clark has therefore referred the Tecuya beds to the lower Miocene.

Unfortunately a comparison of the mammals known from the Tecuya with those from South Mountain must await larger collections

¹ J. C. Merriam, Trans. Amer. Philos. Soc., vol. 22, pt. 3, n. s., pages 4-26, 1915.

² C. Stock, Univ. Calif. Publ., Bull. Dept. Geol., vol. 12, pages 267-276, 1920; H. W. Hoots (U. S. G. S. Bull. 812-D, p. 263, 1930) has indicated that the correct spelling of the name of these deposits is Tecuya, not Tecuja.

³ B. L. Clark, Jour. Geol., vol. 29, pages 598-599, 1921.

from both localities. If the Tecuya beds are intercalated in the Vaqueros, their age, while possibly slightly younger than that of the upper Sespe of South Mountain, may not differ greatly from that of the latter locality.

SIGNIFICANCE OF CORRELATION OF UPPER SESPE WITH REFERENCE TO EUROPEAN
TIME SCALE

A noticeable feature of the Tertiary record in the Coast Ranges of California is the total thickness of the marine formations referred to the Miocene. It is inconceivable that further shifting of position of west coast deposits situated near the boundaries of the Miocene may not occur in future, thereby making this period either more or less inclusive in so far as its stratigraphic record is concerned. While the relative length of the Miocene with reference to the entire Tertiary record as established on the Pacific Coast compares favorably with that of the European standard scale, this comparison does not apparently prohibit the inclusion of a further sedimentary record within the lower boundary of the Miocene.

Much remains to be known concerning the time relations of particular Miocene marine faunal horizons in California to those of the Old World. In recent years, however, some information has been secured which furnishes at least a suggestion as to the correlation of individual divisions of the Miocene. Thus Woodring¹ has discussed the significance of certain mollusks in the Bowden fauna of the Caribbean referable apparently to the *Turritella ocoyana* phylum of the Temblor of California. Obviously a correlation of the Bowden and the Temblor is clearly in need of further substantiation based on evidence other than that drawn from relationships within a single group of marine invertebrates. This has been fully recognized by Woodring. The Bowden stage, according to Woodring, is definitely related to the Vindobonian of Europe. The Vindobonian is regarded as middle Miocene. Since this division is followed below by the Burdigalian and the Aquitanian before the base of the Miocene is reached as at present determined, it appears possible that not only the Vaqueros but also some portion of the Sespe may be assigned to the Miocene. Matthew,² in discussing the problem of correlation of the Cenozoic formations of the Great Plains and particularly the European equivalents of the North American vertebrate faunal horizons, pointed out that the evidence as it appeared at that time tends to depress the North American Cenozoic column, thereby necessitating the correlation of particular zones with older European horizons than those generally accepted. If in the present instance we include a portion or all of the upper 2000 feet of Sespe occurring at

¹W. P. Woodring, Carnegie Inst. Wash. Pub. No. 385, pages 97-99, 1928.

²W. D. Matthew, Bull. Geol. Soc. Amer., vol. 35, pages 743-754, 1924.

South Mountain in the Miocene, not only is a considerable addition made to the sedimentary record of this period but the transfer would apparently tend to elevate somewhat the Vaqueros from its present position. On the other hand, the Vaqueros marine stage may be in part at least the equivalent of the upper portion of the Sespe, thus obviating the necessity for any considerable change in position in the lower Miocene.

SUMMARY STATEMENT OF AGE AND RELATIONSHIPS OF UPPER SESPE

In recapitulating, the following facts appear of special significance:

(1) Within the upper 2000 feet of the Sespe formation as exposed at South Mountain, Ventura County, California, occur two oreodont genera related to *Promerycochærus* and *Leptauchenia*.

(2) The presence of these forms suggests a correlation of the upper Sespe deposits or at least of the uppermost division of these beds with those of the lower Rosebud of the Great Plains and with those of the upper John Day of north-central Oregon.

(3) Taking into account all evidence at present available relating to the age of the upper portion of the Sespe, the conclusion seems warranted that the period of accumulation of the deposits containing *Promerycochærus* ? falls within the lower Miocene.

(4) The position and relationships of the upper Sespe with reference to the Vaqueros formation do not preclude the lower Miocene age of a portion of the former deposits. It follows that the change from land-laid to marine-laid sediments occurred within the Miocene rather than at the beginning of this period in the South Mountain region.

ENVIRONMENTAL CONDITIONS DURING UPPER SESPE TIME

The lithologic characters of the deposits referred to the Sespe of southern California present interesting problems relating to the conditions under which the sediments accumulated. A striking feature is a prevailing red color, although locally this may be subject to some variation. The presence of a red color has been regarded by several investigators as indicative of arid conditions during the period of deposition of the Sespe. Recently, Reed¹ has summarized all available information regarding the distribution, primary structures and physical features of the Sespe with a view to further recognition of the conditions under which the sediments were laid down. Reed concludes that the climate during Sespe time was certainly not more than semiarid and that the degree of weathering of the sediments

¹ R. D. Reed, Bull. Amer. Assoc. Petrol. Geol., vol. 13, pages 489-507, 1929.

derived from adjacent land areas suggests warmth and humidity. He remarks, furthermore, that the basin of deposition may have been less humid with possibly an alternation of wet and dry seasons.

Obviously whatever inferences may be drawn from the presence of mammals in the Sespe as to the environmental conditions under which these forms existed, their value may be augmented or diminished as the vertebrate life of the whole of Sespe time becomes more completely known. Our knowledge of the fauna is still restricted to that secured from the upper portion of the Sespe and is furthermore dependent upon two forms now extinct. The presence, however, of types similar to those associated with relatively large faunas elsewhere furnishes a basis for obtaining certain suggestions as to the conditions under which these forms existed in the Californian region.

Loomis¹ in discussing the structural features and adaptations of members of the family Oreodontidæ makes the following statement:

Throughout the whole group there is great uniformity in the character of the dentition and the feet. There is none of the progressive adaptation and change characteristic of the grazing types, and I feel that this is probably due to a constancy in the type of food and feeding-ground. I should take the food to be leaves, seeds and fruit; and the feeding-ground the more or less wooded valleys along the streams. One feature characteristic of the group tends to confirm this, and that is the distinctness of the faunas from the different localities. The genera are widely distributed, but the species are local. It would seem that of the various river valleys each had its group of oreodonts, and, when there was a change in climate or other living conditions, the fauna of any given valley was either exterminated or replaced by a new immigration.

Loomis² has also remarked that the extremely light-limbed and short-headed *Leptauchenia* and *Cyclopidius* represent some special adaptation which is very difficult to interpret.

The remains of *Promerycochaerus*? found in the upper Sespe occurred in a rather poorly consolidated, medium-grained sandstone, green in color but mottled with red. The characters possessed by this type do not exclude it from occupying an environment such as that postulated for the Oreodontidæ by Loomis. It is conceivable that *Promerycochaerus*? frequented more or less wooded regions adjacent to stream courses in upper Sespe time. The habits and habitat of the much smaller leptauchenid still remain obscure. It may be doubted whether these mammals existed in a region characterized by a climate more severe than semiarid.

¹ F. B. Loomis, Bull. Amer. Mus. Nat. Hist., vol. 51, page 17, 1924.

² F. B. Loomis, *ibid.*, pages 15 and 17, 1924.

DESCRIPTION OF MATERIAL

Leptauchenia ? (*Sespia*) *californica* n. subgen. and sp.

Type specimen—Facial and palatal portions of skull and portions of horizontal rami of lower jaw, No. 27720 Univ. Calif. Pale. Collections.

Subgeneric characters—Skull with large antorbital vacuities; nasals long and narrow; ramus of mandible relatively deep. External styles on upper molars less developed than in *Leptauchenia*. Styles on inner walls of lower molars feebly developed or absent. M $\bar{3}$ with inner wall of posterior lobe projecting but slightly past the inner wall of the middle lobe. No overlapping of inner enamel wall of middle lobe by inner wall of anterior lobe in M $\bar{3}$.

Specific character—Extremely small size, the Sespe type being considerably smaller than *Leptauchenia nitida*.

Sespia appears to belong unquestionably to the *Leptauchenia-Cyclopidius* group. This is clearly shown by the presence of a large antorbital vacuity, compressed nasals, hypsodont dentition, and by the structural characters of the premolars. The palate is relatively wide in No. 27720. In relative depth of lower jaw *Sespia* resembles *Cyclopidius*. A remarkable character is the diminutive size of this form. *Sespia* resembles in size *Oreonetes anceps* and is smaller than *Limnenetes platyceps* of the lower Oligocene.

Unfortunately in the specimen from the upper Sespe, the orbital and cranial portions of the skull are not preserved and the face has suffered some crushing. The nasals are narrow slender elements which may expand anteriorly as in *Cyclopidius*. The enlargement of the antorbital vacuity may be due in part to lack of preservation of the facial wall. The upper border of the vacuity is rather well defined by the nasal, but the remaining borders are not so clearly outlined. An antorbital foramen is situated above the anterior end of Pm $\bar{4}$.

The upper incisors are not preserved. The canines are relatively long slender teeth, slightly recurved. The cheek-teeth have extremely long crowns. The upper premolars appear to have an oblique position in the jaw as in *Leptauchenia*. In Pm $\bar{1}$, Pm $\bar{2}$ and Pm $\bar{3}$ the enamel pattern is comparatively simple, due in a measure to the worn condition of the teeth. As in *Leptauchenia* and *Cyclopidius* these teeth possess a prominent external wall of enamel and a postero-internal expansion of the tooth-crown. Loomis has remarked that the peculiar appearance of the anterior premolars in *Leptauchenia* is due to the suppression of the anterior basin.

In the molars, of which only M $\bar{1}$ and M $\bar{2}$ are present in No. 27720, the external styles are seemingly not so well developed as in *Leptauchenia decora*. Furthermore, the external enamel surfaces of the outer crescents in M $\bar{2}$ are flatter than in the latter genus. The proportions of the anterior and posterior pair of crescents in this tooth are somewhat unlike those in *Leptauchenia*.

Crowns of the lower canines and incisors are lacking. The latter teeth were presumably of minute size. Whether or not the complement of incisors consisted of three or two teeth on each side can not be satisfactorily determined because of the incomplete preservation of the alveolar border of the anterior end of the ramus. It is possible that only two incisors were present on each side of the lower jaw as in *Cyclopidius*.

P $\bar{1}$ projects distinctly above the level of the tooth-row. The enamel pattern exhibited by the occlusal surfaces of the lower premolars resembles that in *Leptauchenia*. In the posterior premolars the posterior crest is

widened transversely as in the latter genus. In $Pm\bar{3}$ a slight fold is present on the inner side of the anterior crest, but no evidence of this fold remains on $Pm\bar{4}$. In *Sespia* the development of the fold is less advanced than in *L. decora*.

The inner surface of $M\bar{3}$ is flat, lacking the presence of a ridge or fold in the region between the two major lobes of this tooth. The inner wall of the posterior or third lobe projects but slightly beyond the inner wall of the middle lobe. The external crescents are rounded. The ramus appears relatively deep, more so than in *Leptauchenia*. The masseteric fossa extends forward to a point below the posterior end of $M\bar{3}$.

Sespia appears in some respects less advanced than either *Leptauchenia* or *Cyclopidius*. The Sespe form is distinctly smaller than any described species of the *Leptauchenia-Cyclopidius* group. In size of antorbital vacuity, slenderness of nasals and relative depth of lower jaw, *Sespia* may approach *Cyclopidius*. Possibly *Sespia* represents an early division of the *Leptauchenia* group tending toward *Cyclopidius*.

The writer is greatly indebted to Dr. W. J. Sinclair and to Dr. F. B. Loomis for expressions of opinion as to the relationships of the Sespe leptauchenid and for specimens of Great Plains species of *Leptauchenia* presented to the California Institute of Technology.

Measurements (in millimeters) of No. 27720 U. C. Coll.

Width measured between outer surfaces of skull above $M\bar{1}$	24.2
Width of nasals at middle (approximate).....	5.
Width of palate between fourth upper premolars.....	12.2
Length from anterior end of $Pm\bar{1}$ to posterior end of $M\bar{2}$	28.7
Length from anterior end of $Pm\bar{1}$ to posterior end of $Pm\bar{4}$	15.6
Length from anterior end of $Pm\bar{1}$ to posterior end of $M\bar{3}$ (approximate).....	36.
Length from anterior end of $Pm\bar{1}$ to posterior end of $Pm\bar{4}$	14.3
Anteroposterior diameter of $M\bar{3}$	10.7
Greatest transverse diameter of $M\bar{3}$	4.1

Promerycochærus ? hesperus n. sp.

Type specimen—A fragmentary lower jaw, No. 27003 Univ. Calif. Pale. Coll.

The type is smaller than the species *Promerycochærus macrostegus* and *P. superbus* from the John Day. The molar teeth lack a pronounced development of cingular cusps between the walls of the external crescents. Teeth slightly less hypsodont than in *Promerycochærus*, in which respect No. 27003 may approach *Mesoreodon* more closely. In $Pm\bar{4}$, the internal extension of the posterior crest appears bifurcate, with a spur projecting forward and inward.

Loomis¹ in a critical examination of the structure and relationship of oreodont genera places considerable reliance on the structural characters of the premolar teeth of these forms. In view of the incompleteness of the material of the large oreodon available from the upper Sespe, determination of this type is of necessity largely dependent upon a comparison of the enamel pattern of the lower premolars. Fortunately these teeth are preserved and are in a moderate state of wear in No. 27003. Seemingly the structural features of the premolars, particularly $Pm\bar{3}$ and $Pm\bar{4}$, are sufficiently diagnostic to permit recognition of generic relationship. The Sespe

¹ F. B. Loomis, Bull. Amer. Mus. Nat. Hist., vol. 51, pages 1-37, 1924.

species is presumably most closely related to *Promerycochærus* and *Mesoreodon*. It is interesting to note that the former genus, according to Loomis,

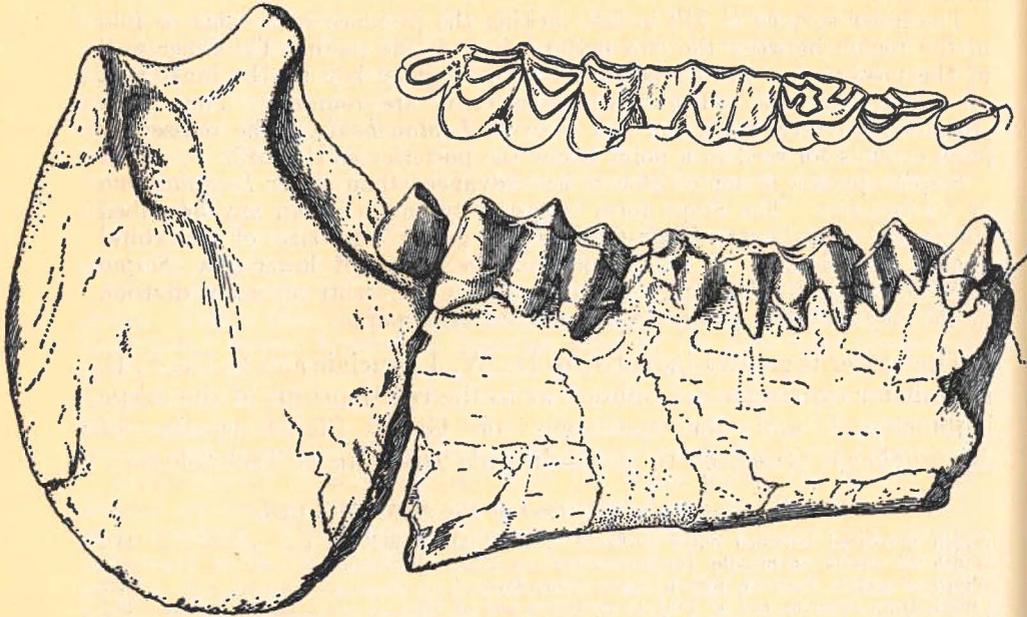


FIG. 2—*Promerycochærus? hesperus* n. sp. Ramus of mandible, No. 27003 U. C. Coll.; lateral view of ramus and occlusal view of teeth, x 0.50. Upper Sespe beds, South Mountain, Ventura County, California.

has a geologic range from lower to middle Miocene, while the latter form based upon the species *M. chelonyx* and *M. megalodon* occurs in the lower Miocene.

In the following table the characters listed in the first two columns are those given by Loomis for the genera *Mesoreodon* and *Promerycochærus*. In the third column are given the characters of the Sespe form.

The ramus of the mandible, No. 27003 U. C. Coll., is shown in figure 3. The comparisons made in the table apparently indicate a closer resemblance between the Sespe type and *Promerycochærus* than between the former and *Mesoreodon*. This is expressed also when the premolars are compared with the figures given by Loomis¹ for *Promerycochærus grandis* and *Mesoreodon megalodon*.

While the condyle of the lower jaw is not completely preserved in No. 27003, the notch on the posterior rim of the vertical ramus below the condyle is apparently not so well defined as in known species of the genus. A small but relatively deep depression lies below and in front of the condyle.

¹ F. B. Loomis, *op. cit.*, fig. 5, page 8, 1924.

Measurements (in millimeters) of No. 27003 U. C. Coll.

Depth of ramus from condyle to angle (approximate).....	120.
Depth of ramus from top of coronoid process to angle (approximate).....	122.
Depth of ramus below anterior end of M $\bar{3}$, measure normal to ventral border.....	45.7
Length from anterior end of PmI to posterior end of M $\bar{3}$ (approximate).....	147.6
Length from anterior end of PmI to posterior end of Pm $\bar{4}$ (approximate).....	69.3
Length from anterior end of M $\bar{1}$ to posterior end of M $\bar{3}$ (approximate).....	78.3
Pm $\bar{3}$, anteroposterior diameter.....	18.
Pm $\bar{3}$, greatest transverse diameter.....	9.3
Pm $\bar{4}$, anteroposterior diameter at base of crown.....	19.5
Pm $\bar{4}$, greatest transverse diameter.....	13.5
M $\bar{3}$, anteroposterior diameter.....	37.6
M $\bar{3}$, greatest transverse diameter.....	16.9

Comparison of characters of lower premolars

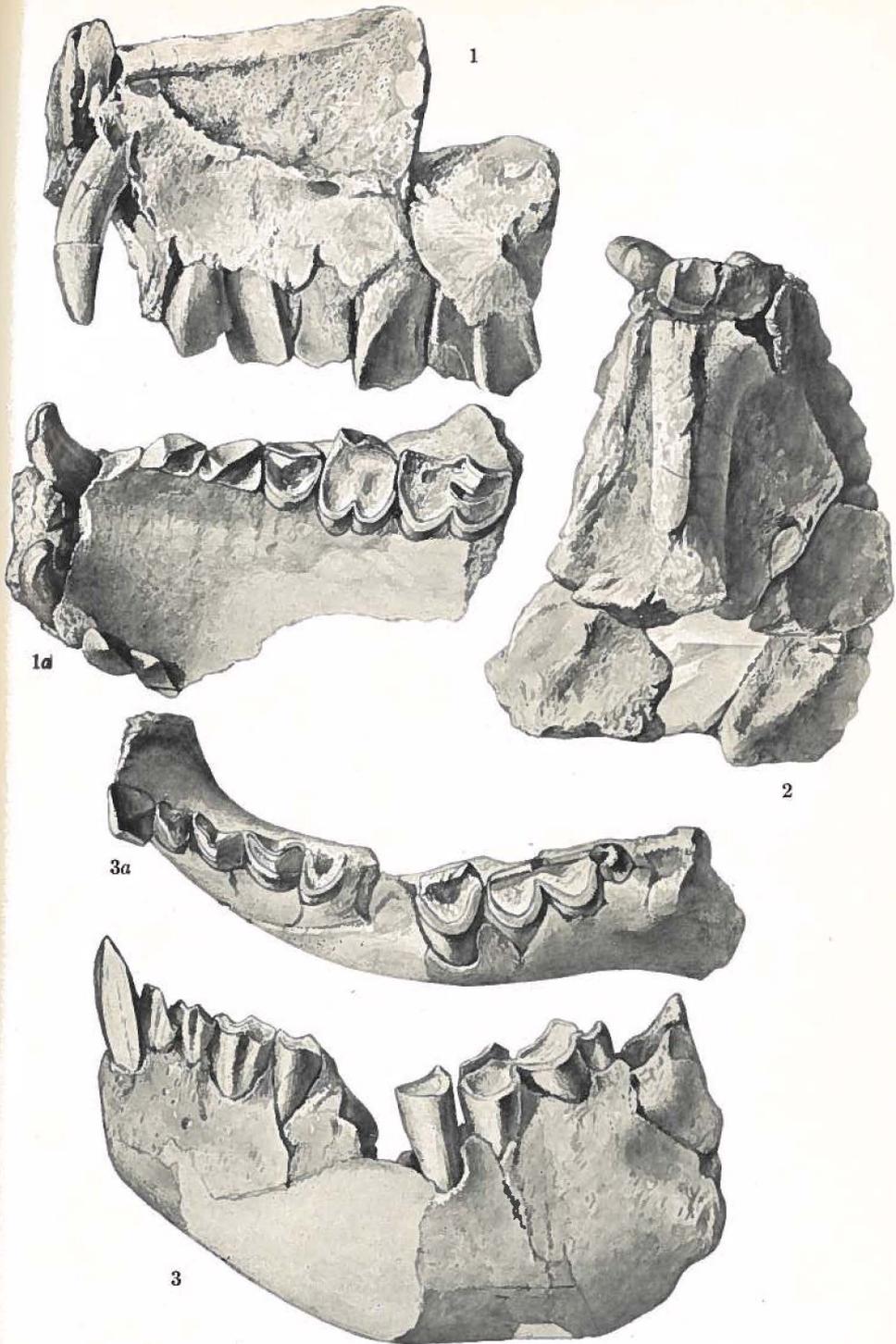
Mesoreodon	Promerycochærus	Promerycochærus ? hesperus, n. sp.
Pm $\bar{3}$: Only rear portion of posterior crescent developed; united with posterior intermediate crest.	Lower premolars narrow and compressed. Pm $\bar{3}$: No anterior crescent. Weak posterior crescent. Posterior intermediate crest well developed; completely divides posterior basin.	Anterior lower premolars compressed. Pm $\bar{3}$: No anterior crescent. Weak posterior crescent. Posterior intermediate crest extends obliquely backward and divides posterior basin.
Pm $\bar{4}$: Pillar-like cusp not so prolonged forward as in <i>Eporeodon</i> , but more distinct. Not so isolated as in <i>Promerycochærus</i> . Intermediate crests wanting. Posterior crescent well developed and confluent with pillar-like cusp.	Pm $\bar{4}$: Pillar-like cusp at junction of posterior crescent and median crest greatly enlarged. This cusp remains distinct from crescent and crest until tooth is well worn. Enlargement developed on posterior crest like a smaller cusp.	Pm $\bar{4}$: Pillar-like median internal cusp greatly enlarged; anterior end extends well in advance of median crest. Behind median internal cusp on inner edge of tooth is a second cusp which in worn condition of crown is connected with it. Second cusp not connected with internal extension of posterior crest. Internal extension of posterior crest bifurcate with small spur projecting forward and inward.

DESCRIPTION OF LOCALITIES

Univ. Calif. Coll. Loc.

No. 7305 NE $\frac{1}{4}$, Sec. 18, T 3 N, R 20 W, San Bernardino Base line. Occurrence in canyon locally called Gas Plant canyon. Locality N 3° E of Gas Plant and N 26° E of Santa Paula well No. 16. Lower jaw of *Promerycochærus*? found near base of cliff in a red and green sandstone, 3 feet stratigraphically below a 6-inch cemented layer of gray sandstone.

No. A725 NE corner of SE $\frac{1}{4}$, Sec. 13, T 3 N, R 21 W, San Bernardino Base line. Occurrence in Morgan Canyon approximately 75 feet NE of South Mountain well No. 2 of Oak Ridge Oil Co., in red sandstone bank of road cut, at base of the red sandstone approximately 3 to 4 feet above level of road.



Leptauchenia ? (*Sespia*) *californica* n. subgen. and sp.

Type skull and jaw, No. 27720 U. C. Coll.; x 2.0 Fig. 1, lateral view; fig. 1a, ventral view; fig. 2, dorsal view of skull; figs. 3, 3a, lateral and dorsal views of ramus.
Upper Sespe beds, South Mountain, Ventura County, California.