
CONTRIBUTIONS TO PALÆONTOLOGY

II

DISTRIBUTION AND DESCRIPTION OF SKULL REMAINS
OF THE PLIOCENE ANTELOPE SPHENOPHALOS
FROM THE NORTHERN GREAT BASIN
PROVINCE

By EUSTACE L. FURLONG

With five plates and one text-figure

[Preprinted from Carnegie Institution of Washington Publication No. 418,
Pages 27 to 36, February 1931]

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Contribution No. 50

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DISTRIBUTION AND DESCRIPTION OF SKULL REMAINS OF THE PLIOCENE ANTELOPE SPHENOPHALOS FROM THE NORTHERN GREAT BASIN PROVINCE

INTRODUCTION

With the progress of paleontological explorations in the later Tertiary deposits of the northern Great Basin Province by the California Institute of Technology in cooperation with Carnegie Institution of Washington additional materials of the antilocaprid genus *Sphenophalos* have been found. Of particular interest is the discovery of remains of this mammal in new Pliocene faunas of eastern Oregon, thus extending the known range of *Sphenophalos*. While no complete skull is available, the specimens collected include a number of horn-cores whose structure is of considerable significance in a determination of the genetic relationships of the genus.

ACKNOWLEDGMENTS

In the comparative studies of the *Sphenophalos* remains, frequent reference has been made to the original specimens collected in the Thousand Creek beds of northwestern Nevada. The loan of this material has been kindly permitted by Professor W. D. Matthew of the University of California. Dr. Joseph Grinnell of the Museum of Vertebrate Zoology has likewise permitted the loan of skulls of the modern pronghorn for examination. The special study of the occurrence and relationships of *Sphenophalos* was supported by funds from Carnegie Institution of Washington, generously granted by Dr. J. C. Merriam. The illustrations are the work of Mr. John L. Ridgway.

OCCURRENCE AND DISTRIBUTION OF SPHENOPHALOS

Originally described by J. C. Merriam¹ from the Thousand Creek beds of northwestern Nevada, this genus was later recognized as occurring also in the Rattlesnake deposits of the John Day basin, north central Oregon. While both horizons have been referred to the Pliocene, it has been generally regarded that the Thousand Creek fauna

¹J. C. Merriam, *The Occurrence of Strepsicerine Antelopes in the Tertiary of Northwestern Nevada*, Univ. Calif. Pub. Bull. Dept. Geol., vol. 5, No. 22, 319-330, Dec. 1909; *Tertiary Mammal Beds of Virgin Valley and Thousand Creek in Northwestern Nevada*, Univ. Calif. Pub. Bull. Dept. Geol., vol. 6, Part 1, No. 2, 21-53, 1920, vol. 6, Part 2, No. 11, 1911.

is at least slightly later in stage of development than that represented by the Rattlesnake mammalian assemblage. Moreover, from the known information regarding related forms it has been assumed that the prevalent antelopine types of the early Pliocene and late Miocene are the merycodonts, while those of the Pleistocene are principally of the genera *Capromeryx* and *Antilocapra*. Thus the genus *Sphenophalos* has come to be regarded as particularly characteristic of the middle Pliocene, but apparently ranging somewhat farther back in this period.

At the two new localities in eastern Oregon where *Sphenophalos* has been found, the associated types appear likewise to indicate a Pliocene age. Thus near Harper in northern Malheur County horn-cores of this genus were found in association with remains of rhinoceros (possibly *Teleoceras*), *Plihippus*, a camel, proboscidean and canidæ. The mammalian assemblage was collected several miles northeast of Harper in loosely consolidated sands, gravels and ash overlying a thin sheet of basalt. The deposits appear to be stratigraphically distinct from a thick series of diatomite locally widespread and presumably of Miocene age.

The second occurrence in Malheur County was found along the Crooked Creek drainage, tributary to the Owyhee River, five miles southwest of Rome. The fauna from the later Tertiary beds in this region includes a rhinoceros, *Plihippus*, peccary, camel, carnivora and mylagaulid rodents.

The fauna secured near Harper is at present perhaps too incompletely known to determine its relationship to the Thousand Creek and Rattlesnake mammalian assemblages. The fauna from the Pliocene deposits at Rome is sufficiently complete to permit, with more detailed study, a determination of its relationship to the known Pliocene assemblages of the Great Basin province.

DESCRIPTION OF MATERIAL FROM PLIOCENE DEPOSITS NEAR HARPER AND ROME, MALHEUR COUNTY, OREGON

The Harper specimens consist of a right and left horn-core. The right horn-core, No. 17 Calif. Inst. Coll., is more completely preserved than that (No. 16) of the left side. Specimen No. 16 (Plate I, figs. 1 to 4), comprising the anterior proximal portion and the horn-core, is practically complete to its distal extremity; the base is somewhat broken posteriorly immediately above the orbit. In No. 17 (Plate I, figs. 5 to 8) that portion of the base absent in No. 16 is present, but the anterior basal region is missing. However, the posterior tine is broken away just above the point of bifurcation.

The Owyhee specimen No. 395 (Plate 2, figs. 3, 4, 5) is a left horn-core that lacks the distal ends of the tines. A right horn-core specimen No. 396 (Plate 2, figs. 1, 2) lacks the anterior tine and part of the shaft. Specimen No. 399 (Plate 2, figs. 6, 7) is a frontlet that consists of the basal parts of the right and the left horn-cores and superior wall of the orbits.

The new specimens show characters not present in the materials from the University of California collection originally described by Merriam and further suggest a rather close relationship between *Sphenophalos* and *Antilocapra americana*. It is desirable to incorporate in Merriam's generic description the characters now seen in the more complete specimens.

BOVIDÆ

Sphenophalos nevadanus Merriam

GENERIC CHARACTERS

BASED BY MERRIAM ON UNIVERSITY OF CALIFORNIA SPECIMENS

"Frontals not cavernous at the base of the horns. Horns situated on the upper posterior region of the orbits, sloping backward, slightly outward, and tilted upward at an angle between 25° and 30° from the plane of the frontals above the orbits. A short distance above the base, the horn-cores flare or widen slightly in the direction of greatest diameter in cross-section. Outer anterior edge of the horn-core arising over the upper posterior region of the orbit and swinging backward with a suggestion of a twist. Surface of the horn-core comparatively smooth, with a few pits or irregularities. Texture of the outer portion of the horn-core solid. Supraorbital foramina present in front of the middle of the antero-medial side of the base of the horn-cores."

CHARACTERS BASED ON SPECIMENS OF CALIFORNIA INSTITUTE OF TECHNOLOGY

Nos. 16, 17, 395, 396, 399

Position of supraorbital foramen as in *A. americana*. Longitudinal axis of horn-core in relation to basicranial axis as in *A. americana* skull. Position of horn-core above orbit at an angle oblique to the sagittal axis of skull. Distal anterior half of horn flares outward. Anterior margin of horn above anteroposterior expansion produced in a postero-concave line to a distal anterior prong. Horn-core bifurcate with low, anterior blunt prong and higher posterior prong. Bifurcation in the form of an anteroposterior elongate saddle. Distal half of horn-core surface with pitted texture as in *A. americana*.

DISCUSSION OF MORPHOLOGY

In specimen No. 17 (Plate 1, fig. 5) the anterior part of the roof of the orbit is present and shows a portion of the supraorbital foramen. The area of supraorbital rim that remains is slightly abraded.

The longitudinal axis of the horn-core centers above the middle of the orbit and is at right angles to the orbit. The horn-core held in position to

conform with the position of the horn-cores in *A. americana* (Univ. Calif. specimen No. 8298) shows that its attitude in relation to the basicranial axis of *A. americana* is approximately the same.

In specimen No. 16 the postero-proximal part of the horn-core is present just above the orbit (Plate 1, fig. 1) with a small part of the roof of the orbit present. This region of the orbit in conjunction with that seen in specimen No. 17 (Plate 1, figs. 6, 7) confirms the view that the horn-cores in *Sphenophalos* have an attitude in relation to the skull like that in *A. americana*.

The apparent twisting observed in the fragmental parts of the Thousand Creek specimens, Univ. Calif. Coll. Nos. 11887-11888-22427 (Plate 5, fig. 4 and Plate 4, figs. 1, 2, 3), is due to the flaring outward of the anterior distal third of the horn-core.

Specimen No. 17 (Plate 1, fig. 7), viewed anteriorly, shows that portion of the horn-core above the proximal expansion and extending to the anterior prong to be flared outward. The flare occurs in advance of the median longitudinal axis of the horn-core and throws the front prong *en echelon* to the rear prong.

In both specimens, Nos. 16 and 17 (Plate 1, figs. 4 and 8), the posterior surfaces of the horns rise rather abruptly above the cranium and are broad transversely and but slightly rounded near the base. Toward the upper half the cores broaden transversely before converging to the tip of the posterior prong.

Both the median and lateral faces of the horn-core No. 17 (Plate 1, figs. 1 to 6) present a peculiar topography. The surface is pitted, like in *A. americana*, particularly along the anterior margin and over the distal third, including the prongs. The outer surface in specimen No. 17 (Plate 1, fig. 6) is sculptured by two broad, shallow depressions.

University of California specimen No. 22427 (Plate 4, fig. 2) has a shallow pit above the posterior margin of the supraorbital rim from which a relatively deep sulcus extends distally. The pit occurs in advance of a point where the temporal ridge becomes confluent with the base of the horn-core. A similar nutrient canal is present in specimen No. 17 (Plate 1, fig. 6). The temporal ridge and shallow pit have been broken away, but what remains of the canal can be interpreted as having the same basal characters as occur in the University of California specimen No. 22427.

In specimen No. 22427 (Plate 4, figs. 2, 3) a part of the wall of the cranial vault and the dorsal curvature of the junction of this part of the frontal with the base of the horn-core is present. This dorsal curvature is also present in specimen No. 16 (Plate 1, figs. 1, 2), though only a small part of the frontal remains at the posterior base of the horn-core. This region is like the corresponding part in specimen No. 22427. The presence in these specimens of the part of frontal bone just anterior to, and in places apparently broken along, the fronto-parietal suture line gives information which tends to confirm the belief that the attitude of the horn in *Sphenophalos* is not unlike that in *A. americana*.

The two specimens, Nos. 395 and 396 (Plate 2, figs. 1 to 5) from the Owyhee region, Oregon, conform very closely in character to those described above. They differ, however, somewhat in proportion and are relatively shorter. Both the lateral and median surfaces are more uniformly pitted, a character that may point to youth in the individuals. A further study and accession of more complete material from the Owyhee localities may demonstrate the presence of specific characters in these smaller forms other than those recognized in *S. nevadanus*.

The frontlet, specimen No. 399 (Pl. 2, figs. 6, 7), shows in the basal parts of the right and left horn-cores, and in the region of the orbit characters comparable to those exhibited in specimens described by Merriam from Thousand Creek, Nevada, and in the fragmentary horn-core (Univ. Calif. No. 22428) figured and described by Merriam and Stock.¹

In 1928 Merriam and Stock² described and figured a peculiar horn-core, Univ. Calif. specimen No. 22430, from the Thousand Creek Pliocene beds. The horn-core has every appearance of being that of a young fawn. The specimen is perfectly formed for an immature individual and forecasts in the position of the distal prongs the position attained by growth in the adult animals. The apparent twist foreshadows the ultimate arrangement of the adult prongs and is probably not to be correlated with the spiral twist in the antilocaprid *Ilingoceros*.

The *Ilingoceros schizoceras* specimen figured by Merriam³ exhibits characters that may lead to the hypothesis that *Ilingoceros* and *Sphenophalos* were derived from a common ancestor not very far removed in geological time.

Relations of *Sphenophalos nevadanus* to Quaternary Representatives of *Antilocapra*

Sphenophalos nevadanus Merriam, Univ. Calif. No. 22431 (Plate 5, fig. 2) from Thousand Creek, Nevada, is a frontlet that consists of the basal parts of the right and left horn-cores; also that portion of the frontal bone between the horns and extending to the fronto-parietal suture. Anteriorly it extends to the fronto-lachrymal suture. The supraorbital foramina are present.

A recent skull of *A. americana* collected in Virgin Valley, Nevada, Univ. Calif. M. V. Z. specimen No. 8298 (Plate 5, fig. 1) when studied with *Sphenophalos*, specimen 22431, is seen to resemble in a number of characters the Pliocene genus. The surfaces of *Sphenophalos* specimen 22431 are somewhat abraded by weathering. However, a cross-section through the stumps of the horns (Plate 5, fig. 2) gives one similar to that in *Antilocapra americana*. The horns in specimen 22431 occupy, as in *A. americana*, a position above the supraorbital rim and their position in relation to the longitudinal and to the basicranial axes of the skull is similar. From the apex of the frontal bone between the horns, the plane of the cranial roof posteriorly and anteriorly indicates a basicranial axis like that in the pronghorn antelope. The frontals are depressed forward between the supraorbital foramina to the dorsal margin of the cribriform plate, as in *A. americana*. The supraorbital foramina in *A. americana* are sometimes double as in specimen No. 8298 or may be single as in Calif. Inst. Tech. specimen *A. cf. americana* No. 46 (Plate 5, fig. 3). In *S. nevadanus*, Univ. Calif. specimen No. 22431, they are single; the right foramen, however, shows an incipient division.

The outer margin of the supraorbital rim in No. 22431 is broken away, but a sufficient portion of the roof of the orbit is present to show that its contour is like that in *A. americana* (specimen No. 8298) and in *A. cf.*

¹ J. C. Merriam, C. Stock and C. L. Moody, *The Pliocene Rattlesnake Formation and Fauna of Eastern Oregon with Notes on the Geology of the Rattlesnake and Mescal Deposits*, Contrib. to Paleontology, Carnegie Inst. Wash. Pub. No. 347, 1925.

² J. C. Merriam and C. Stock, *A Further Contribution to the Mammalian Fauna of the Thousand Creek Pliocene, Northwestern Nevada*, Carnegie Inst. Wash. Pub. No. 393, 1928.

³ J. C. Merriam, Univ. Calif. Pub. Bull. Dept. Geol., vol. 6, 293, figs. 73a, 73b.

americana (Calif. Inst. Tech. specimen No. 46) from McKittrick. The small depression, sometimes a deep pit, just back of the orbit at the outer base of the horn-core near the fronto-parietal suture, found in *A. americana*, is present also in *S. nevadanus*, specimens Nos. 22427 and 22431. The individual, No. 22431, though only the base of the horns is present, affords an approximately correct position and attitude of the horn-cores in relation to the axis of the skull of *Sphenophalos*. Like in *A. americana*, the horns of *S. nevadanus* are broad posteriorly and narrow uniformly to the relatively sharp, anterior margin (Plate 5, figs. 1 to 4). The horns incline outward at an angle from the sagittal plane of the skull, so that the distal end, if it were present, would terminate laterally beyond and above the posterior border of the orbit.

The type specimen of *S. nevadensis*, Univ. Calif. No. 11887 from Thousand Creek, Nevada, figured by Merriam, closely approximates in size specimen No. 17 from Malheur County, Oregon. The superior rim of the orbit (Plate 4, fig. 8) is present, and like that in *A. americana* No. 8298 (Plate 4, fig. 7) is tubular and has a notch or depressed area at the apex of its dorso-ventral diameter. The eye socket is deep, the entire roof of the orbit being surmounted by the horn-core. The horn-core is broader transversely than in *A. americana* No. 8298 and in *S. nevadanus* specimen 17 from Oregon. The area lying between the postero-superior orbital rim and the anterior part of the temporal ridge is slightly depressed, but has no deep pit as in *A. americana* 8298, though it closely approximates the same region in a younger individual of *A. americana*. The temporal ridge is produced dorsally, anteriorly to the base of the horn. In *A. americana* it curves laterally around and below the base of the horn. The posterior base of the horn-core in *A. americana* and *A. cf. americana* Nos. 8298 and 209 is developed as a rather prominent boss just above the anterior margin of the temporal ridge, and the broad posterior base of the horn is oblique to the longitudinal plane of the skull.

A right horn-core of *A. cf. americana* (Plate 4, fig. 5) Calif. Inst. Tech., specimen No. 46, from the McKittrick Pleistocene beds, has all the parts under discussion. It is similar in many characters to *S. nevadanus*, Univ. Calif. No. 11888 (Plate 5, fig. 4), Thousand Creek beds. It is relatively broader at the base, posteriorly, than *A. americana* No. 8298 and is approximately as broad as in *S. nevadanus* No. 11888. The antero-posterior diameter just above the orbit is close to that in specimen No. 11888.

The horn-core of the Pleistocene pronghorn is slender as compared with the recent skull No. 8298, and the anterior appressed prong is more distally placed (Plate 4, fig. 5). The distal anterior projection in the specimens of *A. americana* and *A. cf. americana* can be considered as homologous with the anterior prong characteristic of *S. nevadanus*. The forward distal projection varies in longitudinal position on the shaft in the skulls of *A. americana* which have been examined.

The horn-core in *S. nevadanus* No. 17 is a heavier element than that in *A. americana* No. 8298—thicker in proportion to its height, which is less by approximately 20 mm. than specimen No. 8298.

The Rancho La Brea Pleistocene *A. cf. americana*, Los Angeles Museum specimen Z885, consists of the cranial part of the skull with a fairly complete left horn-core. The horn is somewhat broken anteriorly, the anterior superior part of the orbital rim being also absent.

In *S. nevadanus*, Univ. Calif. specimen No. 11887, a rather pronounced ridge extends from the postorbital region of the supraorbital rim posteriorly

and distally to merge into the shaft of the horn. In *A. cf. americana*, specimen Z885, a ridge approximately like this in character is present. In the Pleistocene specimen it gives rise to a rather deep pit, more or less pronounced in the existing pronghorn antelopes. Likewise a deep sulcus in advance of the ridge which is present in this type is found to be absent in *S. nevadanus* and in specimens of *A. americana* examined.

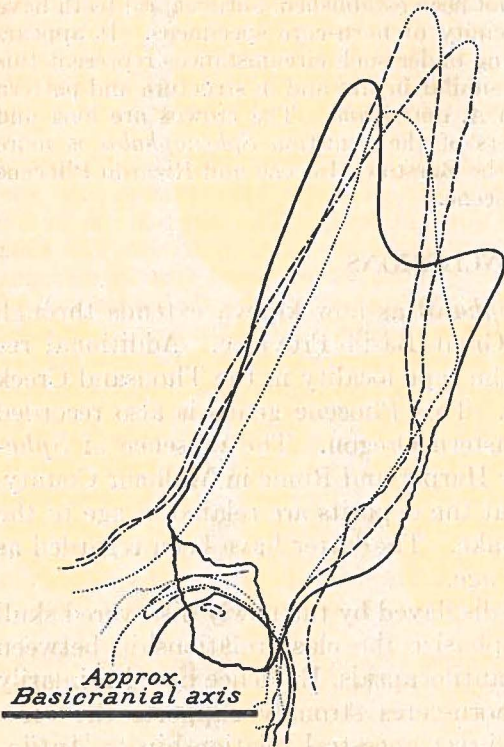


FIG. 1.—Profile views of the right horn-core in Pliocene and Quaternary antelopes.

— *Sphenophalos nevadanus* Merriam. Harper, Oregon, Pliocene.

--- *Antilocapra cf. americana*, Rancho la Brea, California, Pleistocene.

— *Antilocapra americana*, Northwestern Nevada, Recent.

..... *Antilocapra cf. americana*, McKittrick, California, Pleistocene.

The boss at the posterior base of the horn in the recent skull 8298, before mentioned, is present in an appressed form in the Pleistocene specimen Z885 but is absent in some recent skulls and in the McKittrick Pleistocene horn-core No. 46.

In view of the present more complete information concerning the horn-core in *Sphenophalos*, the fragmentary specimen from Thousand Creek which resembled *Neotragoceros*¹ and *Aploceros* may now be regarded as the terminal part of the posterior prong of *Sphenophalos*.

Merriam in discussing the systematic position of *Sphenophalos* recognized in the study of the incomplete horn-cores, then available, characters that indicate a close relationship to the pronghorn antelopes.

This relationship is rather strongly supported by the comparisons which are now possible on the basis of more complete material. When the profiles of the horn-cores of *Sphenophalos* and of Quaternary representatives of *Antilocapra* are super-imposed (fig. 1), the principal difference appears in the region of the anterior prong. The latter structure has evidently suffered

¹ W. D. Matthew and H. Cook, Bull. Amer. Mus. Nat. Hist., vol. 26, 413-414, 1909.

a gradual reduction in size during the evolution of this stem of the antilocaprid group in later Cenozoic time.

It is interesting to note that the sheath covering the horn-cores in skulls of the Recent pronghorn occasionally lacks the anterior prong and gradations in size of prong are also to be seen in the living animals.

While complete skulls of *Sphenophalos* are lacking and a definite association of teeth and horn-cores has not been established, antilocaprid teeth have been found in the immediate vicinity of horn-core specimens. It appears safe to assume that teeth occurring under such circumstances represent this Pliocene genus. These teeth are similar in size and in structure and pattern of crown to comparable teeth in *A. americana*. The crowns are long and possess open roots. In characters of the dentition *Sphenophalos* is more advanced than *Merycodus* from the Barstow Miocene and Ricardo Pliocene and *Capromeryx* from the Pleistocene.

CONCLUSIONS

The distribution of *Sphenophalos* as now known extends through the northern portion of the Great Basin Province. Additional remains have been collected at the type locality in the Thousand Creek beds of northwestern Nevada. This Pliocene genus is also recorded from two localities in southeastern Oregon. The presence of *Sphenophalos* in Tertiary beds near Harper and Rome in Malheur County, Oregon, furnishes evidence that the deposits are related in age to the Thousand Creek and Rattlesnake. The latter have been regarded as middle and lower Pliocene in age.

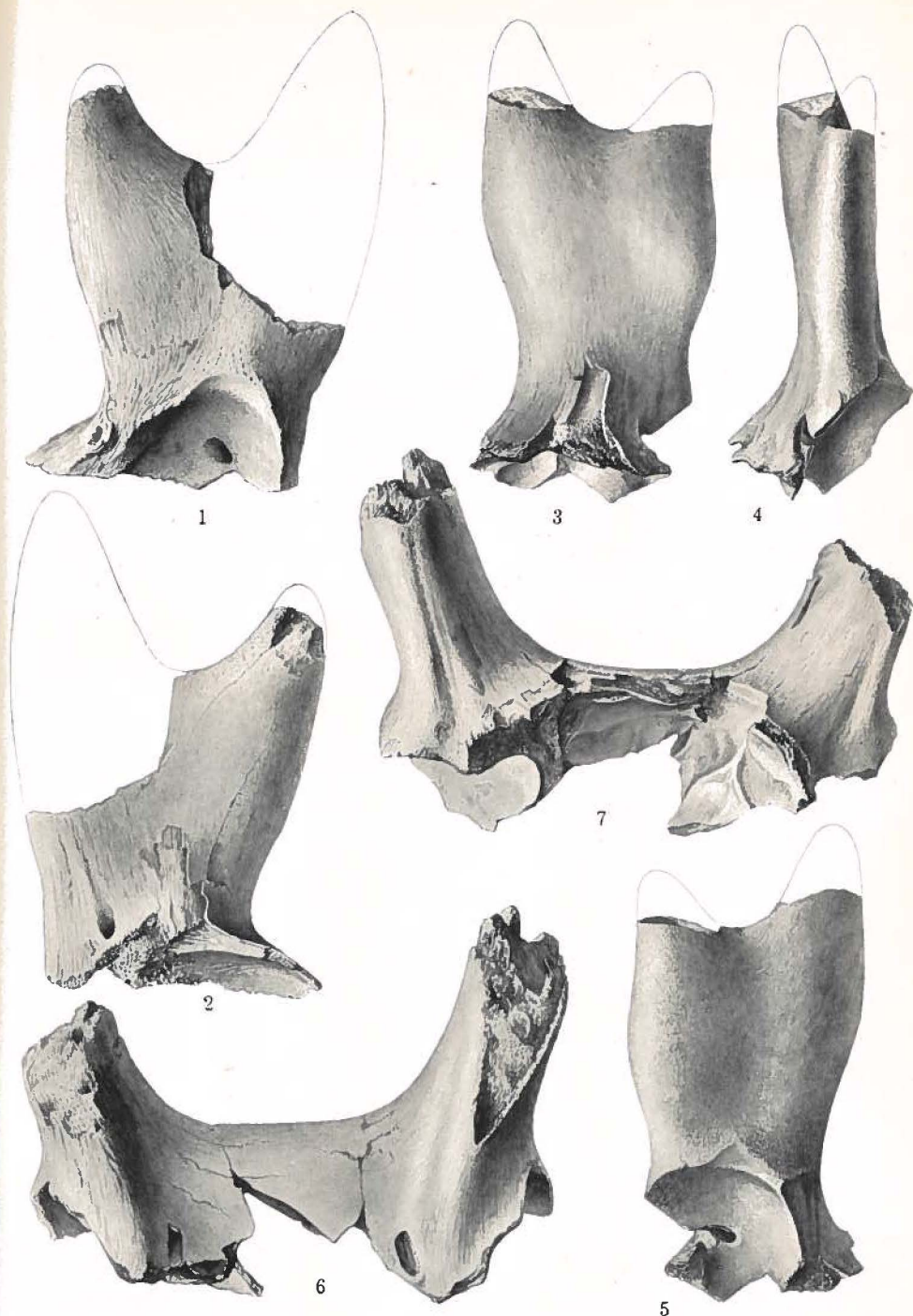
The morphologic characters displayed by the newly discovered skull material of *Sphenophalos* emphasize the close relationship between this genus and later Cenozoic antilocaprids. Evidence based primarily on the frontlet region and horn-cores strongly supports the view that *Sphenophalos* stands in direct ancestral relationship to *Antilocapra americana*. The region under discussion may well be in or near the center of origin of the modern pronghorn antelope.



Sphenophalos nevadanus Merriam. California Institute of Technology specimens No. 16 and No. 17. Locality 42, vicinity of Harper, Malheur County, Oregon.

FIGS. 1 to 4. Specimen No. 16 left horn-core, outer side, inner side, front and rear views respectively.

FIGS. 5 to 8. Specimen No. 17 right horn-core, views correspond to those in specimen No. 16.

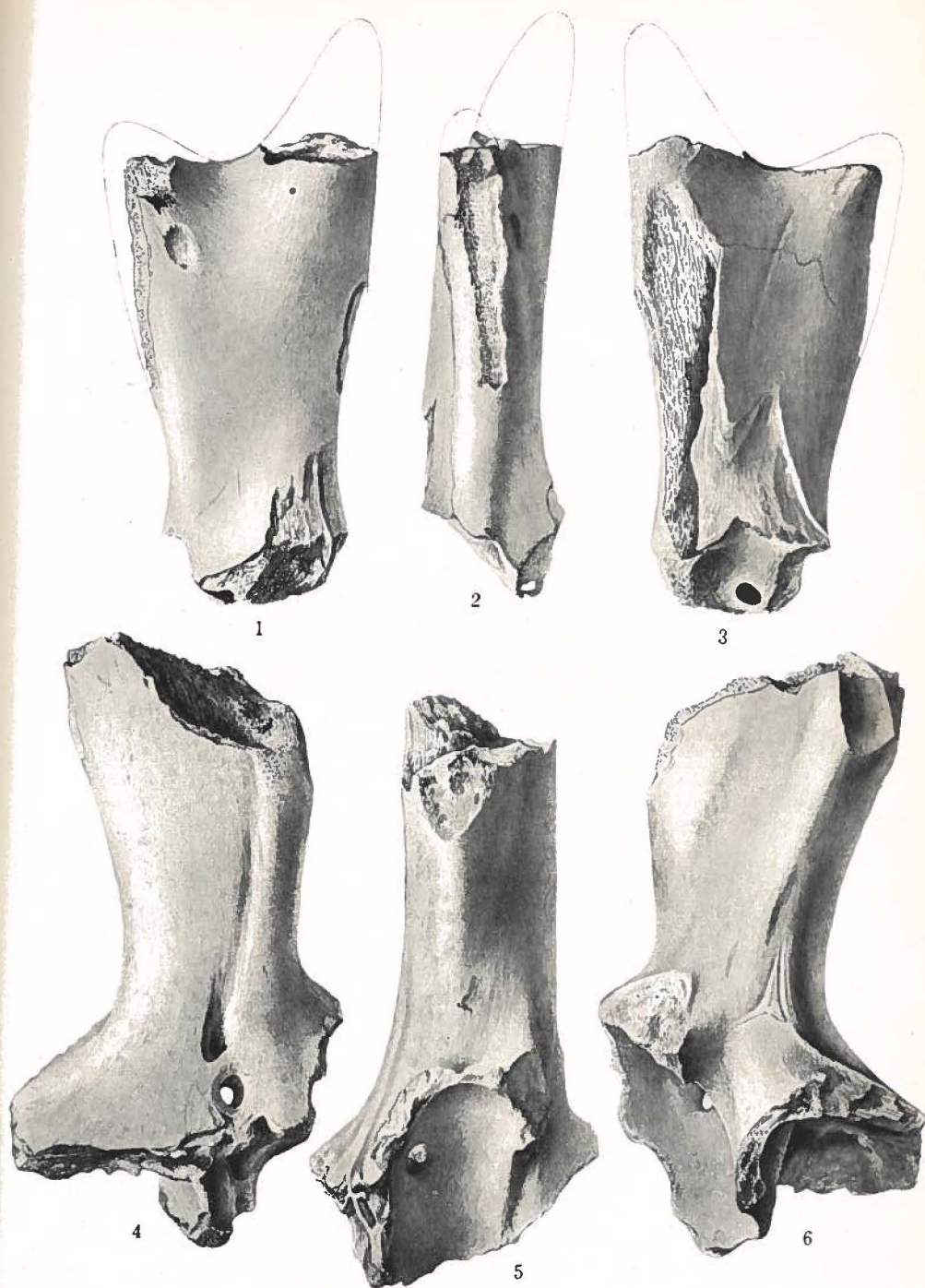


Sphenophalos nevadamus Merriam. California Institute of Technology specimens from vicinity of Rome, Oregon.

FIGS. 1 and 2. Outer side and inner side views of right horn-core. Probably young adult individual.

FIGS. 3, 4, 5. Inner side, front, and outer side views of right horn-core. Probably young adult individual.

FIGS. 6 and 7. Anterior and posterior views of frontlet of mature adult.



Sphenophalos nevadanus Merriam. California Institute of Technology specimens from Thousand Creek, Nevada.

FIGS. 1, 2, 3. Inner side, front and outer side views of right horn-core. Mature individual.

FIGS. 4, 5, 6. Same views as above of left horn-core of larger adult.

DESCRIPTION OF PLATE 4

- FIGS. 1, 2, 3, 4. *Sphenophalos nevadanus* Merriam. University of California specimen 22427 from Thousand Creek locality.
FIG. 1, inner side and basal part of right horn-core; fig. 2, outer side showing part of supraorbital rim; fig. 3, front view showing part of supraorbital rim; fig. 4, rear view showing curvature from frontal bone near base of horn-core.
- FIG. 5. *Antilocapra cf. americana*. California Institute of Technology specimen 46 from McKittrick Pleistocene, California, inner side view of horn-core.
- FIG. 6. *Sphenophalos nevadanus* Merriam. University of California specimen 11888 from Thousand Creek, Nevada, inner side view of horn-core. For posterior view see plate 5, figure 4.
- FIG. 7. *Antilocapra americana*. University of California Museum of Vertebrate Zoology specimen 8298 from Northwestern Nevada. View of orbit showing orbital rim and notch in supraorbital part.
- FIG. 8. *Sphenophalos nevadanus* Merriam. University of California specimen 11887 from Thousand Creek beds, Nevada. View showing supraorbital part of rim and median notch near base of horn-core.



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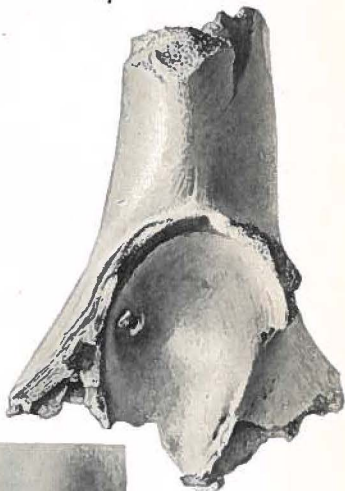
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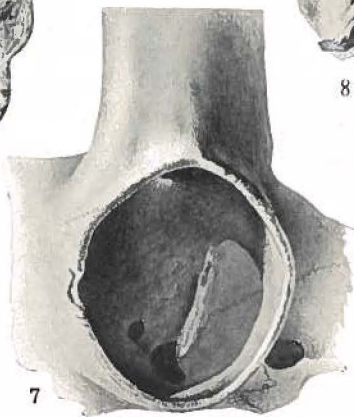
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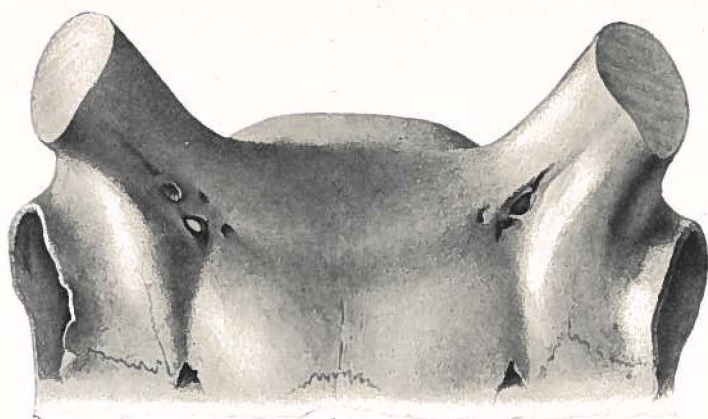
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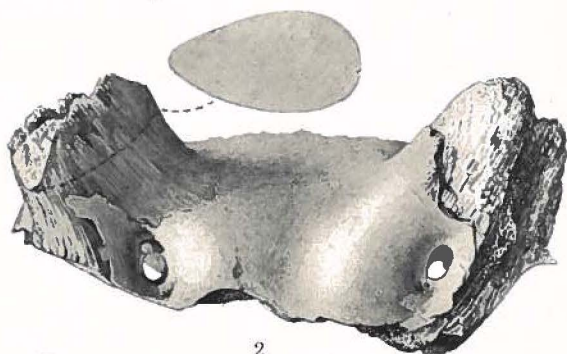
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DESCRIPTION OF PLATE 5

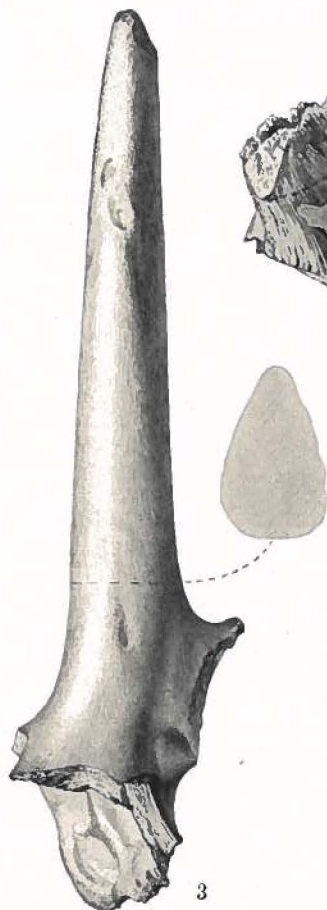
- FIG. 1. *Antilocapra americana*. University of California Museum of Vertebrate Zoology specimen 8298 from Northwestern Nevada. Anterior view of the frontlet region of the cranium showing attitude of horn-cores in position normal to basicranial axis of skull. Also shows cross-section through horn-cores.
- FIG. 2. *Sphenophalos nevadanus* Merriam. University of California Palæontological Collection, specimen 22431 from Thousand Creek Beds, Nevada. Anterior view of frontlet in position comparable to that shown in figure 1. Position of horn-cores and section through right horn-core shown.
- FIG. 3. *Antilocapra cf. americana*. California Institute of Technology, specimen 46 from McKittrick Pleistocene, California. Posterior view showing attitude of right horn-core above frontal bone with section through horn-core.
- FIG. 4. *Sphenophalos nevadanus* Merriam. University of California specimen 11888 from Thousand Creek beds, Nevada. Posterior view of horn-core showing characters illustrated in figure 3.



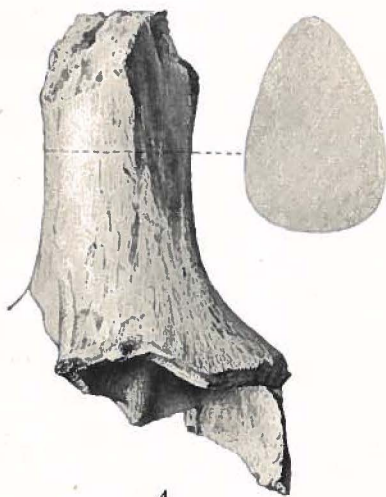
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