converted to the peroxide, twenty-five per cent remained unchanged and thirty per cent could not be accounted for. A small amount of a high-boiling liquid, which contained halogen and possessed phenolic properties, was recovered. This latter substance, not yet identified, is our only clue to the manner in which the bromine produced by photo-dissociation is removed from the solution.

The light source used in the experiments was a Pyrex mercury arc, 16 mm. in diameter, operated at 3 amperes. The solutions were placed in 16-mm. Pyrex test tubes, at a distance of 15 cm. from the lamp. The absorption spectra of the solutions, before and after radiation, were obtained with a Hilger Judd-Lewis sector photometer and Hilger quartz spectrograph, using a high frequency discharge between tungsten electrodes under water as the light source.[2]

[1] Bates and Spence, *J. A. C. S.*, **53**, 1689 (1931).
[2] Anderson and Gomberg, *Ibid.*, **50**, 203 (1928).

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## *AN AMYNODONT SKULL FROM THE SESPE DEPOSITS, CALIFORNIA*

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The Perissodactyla known to occur in the Sespe deposits, north of the Simi Valley, California, include representatives of the Brontotheriidæ and Rhinocerotoidea. The Equidæ remain as yet absent from the record. Within the rhinocerotid division are at present recognized members of both the cursorial and aquatic groups. The collections include a fairly large number of specimens belonging to the Amynodontidæ, among which is the fine skull here described.

Amynodontopsis bodei, n. gen. and n. sp.

*Type Specimen.*—Skull with cheek-tooth Series $P\underline{3}$-$M\underline{3}$, No. 1087 C. I. T. Vert. Pale., figure 1.

*Locality.*—Sespe Upper Eocene, north of Simi Valley, Ventura County, California; Locality 150 C. I. T. Vert. Pale.

*Generic and Specific Characters.*—Larger than *Amynodon antiquus*, *A. advenus* and *A. erectus*, but less robust than *A. intermedius*. Skull dolichocephalic. Nasals short, with anterior ends situated considerably behind level of anterior ends of premaxillaries. Facial fossae extend well back-

ward and form deep recesses which extend to the inner sides of and behind the anterior orbital rims. Dentition $\frac{3}{3}$, $\frac{1}{1}$, $\frac{3}{3}$, $\frac{3}{3}$. Length of molar series, relative to length of cheek-tooth series $P\frac{3}{3}$-$M\frac{2}{2}$, greater than in *Amynodon*. I take pleasure in naming this species for Mr. Francis D. Bode, who has rendered valuable assistance in the exploration of the Sespe deposits.

*Description.—Dorsal view* (Fig. 1, *C*). The narrowness of skull is strikingly apparent in this view. Taking into account the amount of lateral crushing which has occurred in this specimen, the relation of width to length still emphasizes the dolichocephalic character of the skull. In this respect *Amynodontopsis* appears to express an accentuation of the character of dolichocephaly seen in *Amynodon*.

The nasals are short and narrow and their anterior ends have receded with reference to the anterior border of the premaxillaries. In the skull of *Amynodon* (No. 14601 Amer. Mus.) from the Uinta of Beaver Divide, Wyoming, a specimen which in a number of measurements is smaller than the Simi type, the nasals are distinctly longer and broader. The recession of the anterior ends of the nasals in No. 1087 exposes in dorsal view a much larger expanse of the anterior floor of the nasal chamber than in *Amynodon*. This lower region is characterized by a crest which first extends back along the median line from the front end of the skull and then diverges to form the lateral border of the external nares. The diverging crests outline a V-shaped notch, with apex directed forward.

The facial fossae are extraordinarily well defined and deep. In their backward extent these fossae reach well behind the anterior borders of the orbits, in which respect there is a noticeable difference from the development seen in *Amynodon antiquus*, *A. erectus* and in No. 14601. In the latter the facial fossa, while deep, does not incise the skull behind and to the inner side of the anterior border of the orbit. The pronounced depth of this fossa and the extent to which it is carried backward causes the surface above the anterior portion of the orbit to be noticeably contracted laterally, forming a narrow rim in No. 1087 from the Sespe. Among the amynodont rhinoceroses known from the American Eocene, the nearest approach to the type of facial fossa present in *Amynodontopsis* is seen in *Amynodon intermedius*. The type specimen of this species, No. 10309 Prin. Univ. Coll., although lacking entirely the upper and posterior regions of the skull, fortunately shows a portion of the anterior end, as well as the palate and upper dentition. In depth of fossa and in its backward extent to the inner side of the orbit, as well as in the prominence of the orbital border, No. 10309 is similar to the Simi form.

It appears improbable that the differences between *Amynodontopsis* and *Amynodon* in depth and extent of the facial fossae can be interpreted as due entirely to individual age. The Simi skull, as shown by the wear of the teeth and by the closing of a number of the cranial sutures evidently

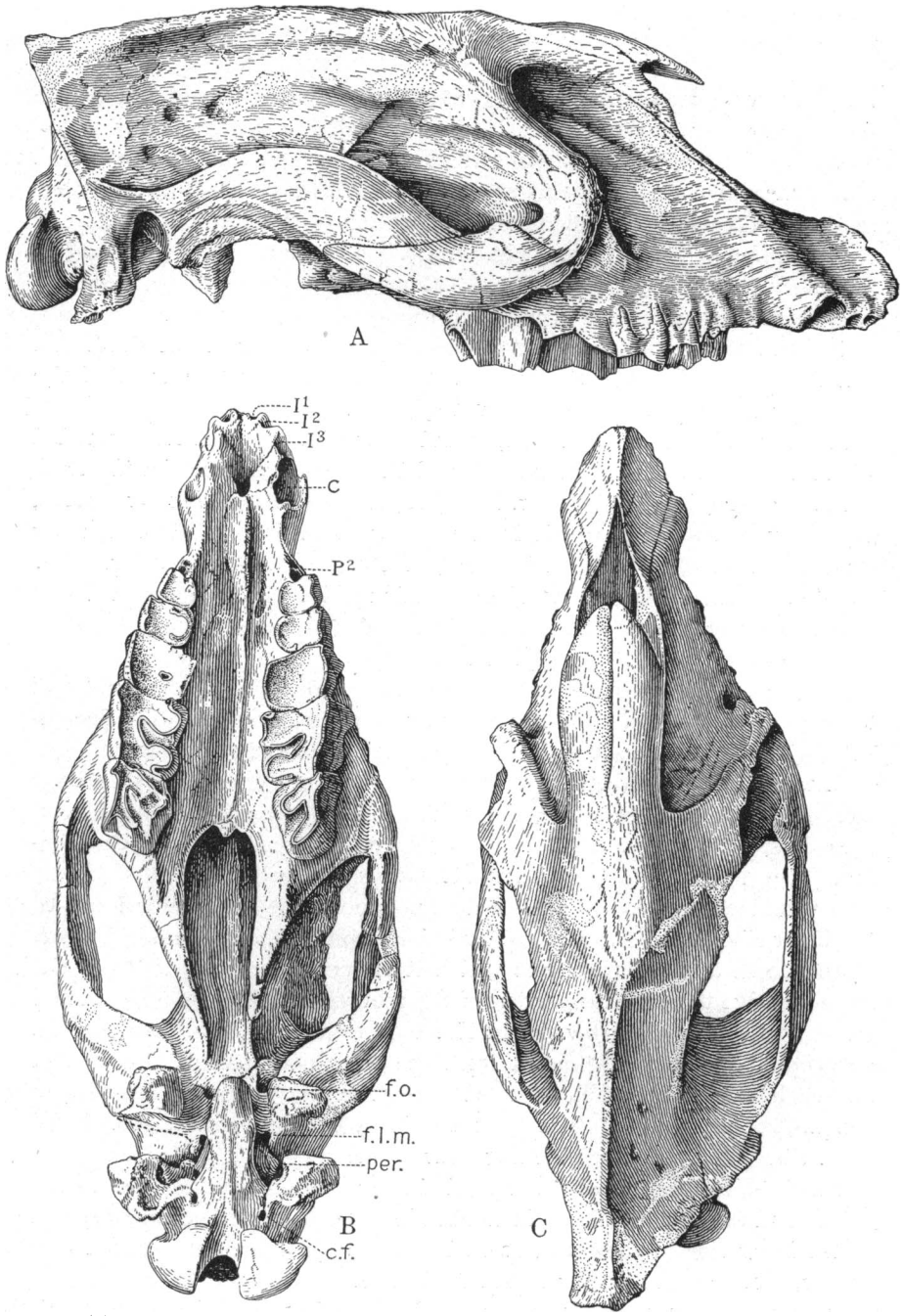


FIGURE 1

*Amynodontopsis bodei*, n. gen. and n. sp. Type specimen, Skull, No. 1087 C.I.T. Coll. Vert. Pale.; × 1/4. *A*, lateral view; *B*, ventral view; *C*, dorsal view. Sespe Upper Eocene, California. J. L. Ridgway, *del.*

belonged to an old individual. The type of *Amynodon intermedius* represents, however, a mature but younger individual than No. 1087. No. 14601 represents a younger but nevertheless a fully adult individual. The type specimen of *A. erectus* likewise represents a fully mature individual.

The zygomatic arches are relatively narrow transversely as in *Amynodon*, differing from the heavy arches displayed by *Metamynodon*. The anterior border of the base of the zygomatic arch is farther forward, with reference to the posterior border of the condyle, in *Amynodontopsis* than in *Amynodon*.

*Lateral View* (Fig. 1, *A*).—The shortened nasals and prominence of the premaxillary portion of the snout, with consequent tapir-like aspect of this portion of the skull, are clearly apparent in this view. These elements appear to curve abruptly downward in their lateral extent and the lateral walls come in contact principally with the maxillaries. At the forward end the lower prong of the nasal appears to overlap the upward extension of the premaxillary, but the relationships between the two are not entirely clear in the Simi specimen due to imperfect preservation of this portion of the skull.

The backward extent of the great facial fossa or trough behind the anterior rim of the orbit likewise is well shown in side view. The lateral wall of the maxillary in front of the orbit is noticeably narrower anteroposteriorly in *Amynodontopsis* than in the Beaver Divide skull of *Amynodon*, in the skull of *A. erectus* Troxell (No. 11453 Type, Yale Peabody Mus.) from the Uinta, and in the skull fragment of *A. intermedius* (No. 10309 Type, Prin. Univ.), also from the Uinta.

Although the upper outer face of the orbital rim is damaged, the forward and lower portions of the orbit are spread out farther on the face and more of the inside of the eye-socket comes to view. Doubtless some of this spreading is due to the lateral crushing to which the skull has been subjected. The entrance to the short infra-orbital canal can be seen within the orbit (Fig. 1, *A*). The orbital area with the maxillary fossa in front and toward the inner side presents a marked contrast to that in *Amynodon*. An approach to the characters seen in the Simi specimen is made in the type of *A. intermedius*.

While the sagittal crest is prominently developed, its dorsal profile is not so pronouncedly convex upward as in *Amynodon*. Several nutrient foramina are seen to penetrate the posterior portion of the lateral wall of the cranium.

*Ventral View* (Fig. 1, *B*).—A full complement of upper incisors characterized this species, as shown by alveoli. The alveolus for the canine is situated immediately behind that for $I\frac{3}{-}$. A longer post-canine diastema is present than in No. 14601 or in the type of *A. intermedius*.

The cheek-teeth show considerable wear. $P\underline{2}$ is not preserved although the alveolus for this tooth is clearly shown.

Measurements made of the dentition in eight skulls including the Simi specimen and representing members of the Amynodontidæ from the American Eocene and Oligocene, gave the following values for the ratio:

$$\frac{\text{Length } M\underline{1} - M\underline{3} \times 100}{\text{Length } P\underline{2} - M\underline{3}}:$$

| Species | Number | Horizon | |
|---|---|---|---|
| *Amynodon*, sp. | No. 13189 A. M. N. H. | Washakie | 65.25 |
| *Amynodon*, sp. | No. 14601 A. M. N. H. | Beaver Divide | 65.82 |
| *A. ? intermedius* | No. 1960 A. M. N. H. | Uinta | 64.91 |
| *A. erectus*, type | No. 11453 Y. P. M. | Uinta | 66.34 |
| *A. intermedius*, type | No. 10309 Prin. Univ. | Uinta | 67.12 |
| *Amynodontopsis bodei*, type | No. 1087 C. I. T. | Sespe | 69.48[a] |
| *Metamynodon rex*, type | No. 10274 Y. P. M. | White River | 69.40 |
| *Metamynodon*, sp. | No. 547 A. M. N. H. | White River | 70.61 |

[a] Approximate.

Thus the molar series in the Simi specimen is seen to be relatively long and in this character *Amynodontopsis* exhibits a greater resemblance to the Oligocene *Metamynodon* than does the genus *Amynodon*. It is interesting to note that among the several specimens of *Amynodon* listed above, the type of *A. intermedius* makes the nearest approach to the Sespe type in molar index.

The forward portion of the palate has been constricted, due to lateral pressure, and the right side has moved over the left. As measured transversely between the inner walls of the third upper molars the palate is seen to be narrower than in No. 14601 and in the type of *A. intermedius*. The postnarial notch, with median tubercle on its anterior border, extends forward to a level approximately opposite the middle of the third molars. In No. 10309 it extends farther forward, reaching a level opposite the posterior portion of $M\underline{2}$. The ventral surface of the palate is continued posteriorly for a considerable distance on a shelf which flanks the postnarial passage. Tapering posteriorly, this shelf gives way to a border which extends upward, curving outward toward the foramen ovale.

The postglenoid process is tuberous and appears to be stouter than in *Amynodon*. The auricular fossa is broad. The post-tympanic process is also enlarged. Its antero-internal surface is broadly concave. The periotic (*per.*) is exposed in ventral view. On the right side a small knob-like process projects forward and downward from the inner anterior end of the post-tympanic process. The position of the foramen ovale (*f. o.*) is opposite the postglenoid fossa and well in advance of the foramen lacerum

medius (*f. l. m.*). Situated near the postero-internal face of the post-tympanic process is the condylar foramen (*c. f.*).

*Relationships.*—The structural features displayed by the skull and dentition of *Amynodontopsis* indicate a type less advanced than *Metamynodon* beyond the stage represented by *Amynodon*. The relationships of the Simi form are on the whole much closer to *Amynodon* than to the Oligocene genus. Among the several species of *Amynodon* described from the American Eocene, *A. intermedius* makes the nearest approach to *Amynodontopsis bodei*. Both types differ from recorded species of the Uinta and earlier horizons in depth and backward extent of the facial fossa. Possibly the type of *A. intermedius* should be referred to *Amynodontopsis*.

MEASUREMENTS (IN MILLIMETERS)

| | Amynodontopsis bodei, n. gen. and n. sp. Type No. 1087 |
|---|---|
| Length from anterior end of premaxillary to posterior end of occipital condyle | 479 |
| Basilar length | 456 |
| Length from anterior end of premaxillary to posterior end of occiput | 494 |
| Length from anterior end of premaxillary to level of posterior ends of third upper molars | 249 |
| Length from anterior end of premaxillary to median point on border of postnarial notch | 236 |
| Greatest transverse width of snout across outer walls of canines (approx.) | 73.2 |
| Greatest width across zygomatic arches (approx.) | 218 |
| Greatest width across condyles | 85.5 |
| Least width between inner surfaces of third upper molars | 52.7 |
| Length of post-canine diastema | 31.4 |
| Greatest length of tooth row, anterior border of $P\underline{2}$ to posterior border of $M\underline{3}$ (approx.) | 160.6 |
| Greatest length of tooth row, anterior end of $P\underline{3}$ to posterior end of $M\underline{3}$ | 147.7 |
| Length from anterior end of $P\underline{2}$ to middle posterior border of $P\underline{4}$ (approx.) | 47 |
| Length through middle: $M\underline{1} - M\underline{3}$ | 111.6 |