

## EOCENE AMYNODONTS FROM SOUTHERN CALIFORNIA

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*Introduction.*—Since the description<sup>1</sup> of a skull of *Amyndontopsis bodei* and of a lower jaw referred to this species from the uppermost Eocene, further dental parts have become available for study from localities in the Sespe. These furnish additional characters of value in recognizing the species represented in western Eocene deposits. Now also available is a fragment of skull with cheek-teeth from the Poway Eocene of San Diego County, California. This specimen possesses special significance because it permits a comparison with related forms in America and China. It is likewise of interest because it differs from the amynodonts of the Sespe and is clearly an earlier type.

***Amyndodon reedi*, n. sp.**

*Type Specimen.*—No. 2529, C. I. T. Vert. Pale. Coll., a fragment of the left side of the skull with  $P_4$ – $M_3$  inclusive, plate 1.

*Locality.*—Poway conglomerate and cross-bedded sandstones exposed at C. I. T. Vert. Pale. Loc. 314, San Diego, California.

*Specific Characters.*—Smaller than *Amyndodon advenus*, *A. antiquus* and *A. erectus* and resembling *A. sinensis* in size.  $P_4$  is narrow in anteroposterior diameter in comparison to its transverse width, more so than in *A. sinensis*. Principal axis of metaloph in  $P_4$  at right angles to external border of tooth. I take pleasure in naming this species for Dr. Ralph D. Reed, penetrating student of California geology.

*Description.*—This species is distinctly smaller than *Amyndontopsis bodei* from the uppermost Eocene Sespe. It is likewise smaller than *Amyndodon advenus* and related forms from the Uinta. Among American species nearest resemblance in size to *A. reedi* is found in a specimen, No. 1936A A. M. N. H. from the Uinta (Uinta B) of Utah. With regard to the latter it is interesting to record that its occurrence is the earliest among American amynodonts as at present known. No representatives of the group have thus far been uncovered in the Bridger Eocene. Presence of No. 1936A in Uinta B and its resemblance to No. 2529 from the Poway may be taken as evidence to indicate that the Poway is related in age to this stage of the Uinta.

Previously recorded mammalian species from the Poway suggest a faunal stage closely related to but slightly more advanced than the Bridger. Thus, *Yumanius woodringi* is a tarsiid primate more advanced than

*Anaptomorphus*. Presence of *Metarhinus(?)pater* suggests that the Poway is post-Bridger C and pre-Uinta C. The amynodont here described suggests again an age for the Poway comparable to that indicated by the titanotheres and points more specifically to a time relationship with Uinta B. Unfortunately, the fauna thus far known from Uinta A is a meager one. It contains, according to Dr. H. E. Wood, 2nd., an amynodont which he recognizes as of the species *Amynodon advenus* (No. 11983 Carnegie Mus.). Presence of a larger species in the Uinta A horizon makes less certain a direct correlation between the Poway and the Uinta B on the basis of the amynodonts. A consideration of the Poway fauna as a whole may emphasize a time stage comparable to that of the lower Uinta or possibly with one situated between the lower Uinta and the upper Bridger.

## COMPARATIVE MEASUREMENTS (IN MILLIMETERS)

	<i>A. reedi</i> , N. SP. NO. 2529 C. I. T. TYPE POWAY	<i>Amynodon</i> , SP. NO. 1936 A A. M. N. H. UINTA B	<i>A. sinensis</i> <sup>1</sup> TYPE CHINA	<i>A. antiquus</i> NO. 10047 PRIN. U. TYPE WASHAKIE
Length, anterior end of $P_4$ to posterior end $M_3$	103.8			
Length, anterior end of $M_1$ to posterior end $M_3$	85.8	86.2	73.5	93
$P_4$ , anteroposterior diameter	a12		14.8	23.1
$P_4$ , transverse diameter	24.7		22.1	
$M_1$ , anteroposterior diameter	25.1	28.2	a24.5	36.4
$M_1$ , transverse diameter	29.9	a31.5	25	
$M_2$ , anteroposterior diameter	29.5	29.7	29	
$M_2$ , transverse diameter	33.7	34.1	28.8	
$M_3$ , anteroposterior diameter	27.9	32.4	25.1	
$M_3$ , transverse diameter	31.1	34.2	27.8	

<sup>1</sup> Measurements after Zdansky.

a, Approximate.

***Amynodon* sp., possibly *advenus* Marsh**

A single, imperfect tooth,  $M_2$ , No. 2537 C. I. T. Vert. Pale. Coll., Plate 2, figures 6, 6a, comes from locality 202 in the Sespe. This site is situated stratigraphically from 600 to 800 feet below locality 150 in the Sespe deposits exposed north of the Simi Valley, Ventura County, California, and represents an earlier (Upper Eocene) faunal horizon than that known from locality 150 (Uppermost Eocene).

No. 2537 approximates in size comparable teeth that have been referred to *Amynodon advenus*. However, teeth are present in the collections from locality 150 that are actually smaller than No. 2537. In contrast to one of these teeth, also an  $M_2$ , from locality 150, No. 2537 exhibits a smooth wall lining the valley between protoloph and metaloph.



## PLATE 1

*Amynodon reedi*, n. sp.

Type specimen, No. 2529 Calif. Inst. Tech. Coll. Vert. Pale., a fragment of skull with P<sub>4</sub>-M<sub>3</sub>, inclusive, lateral and occlusal views, × 1.

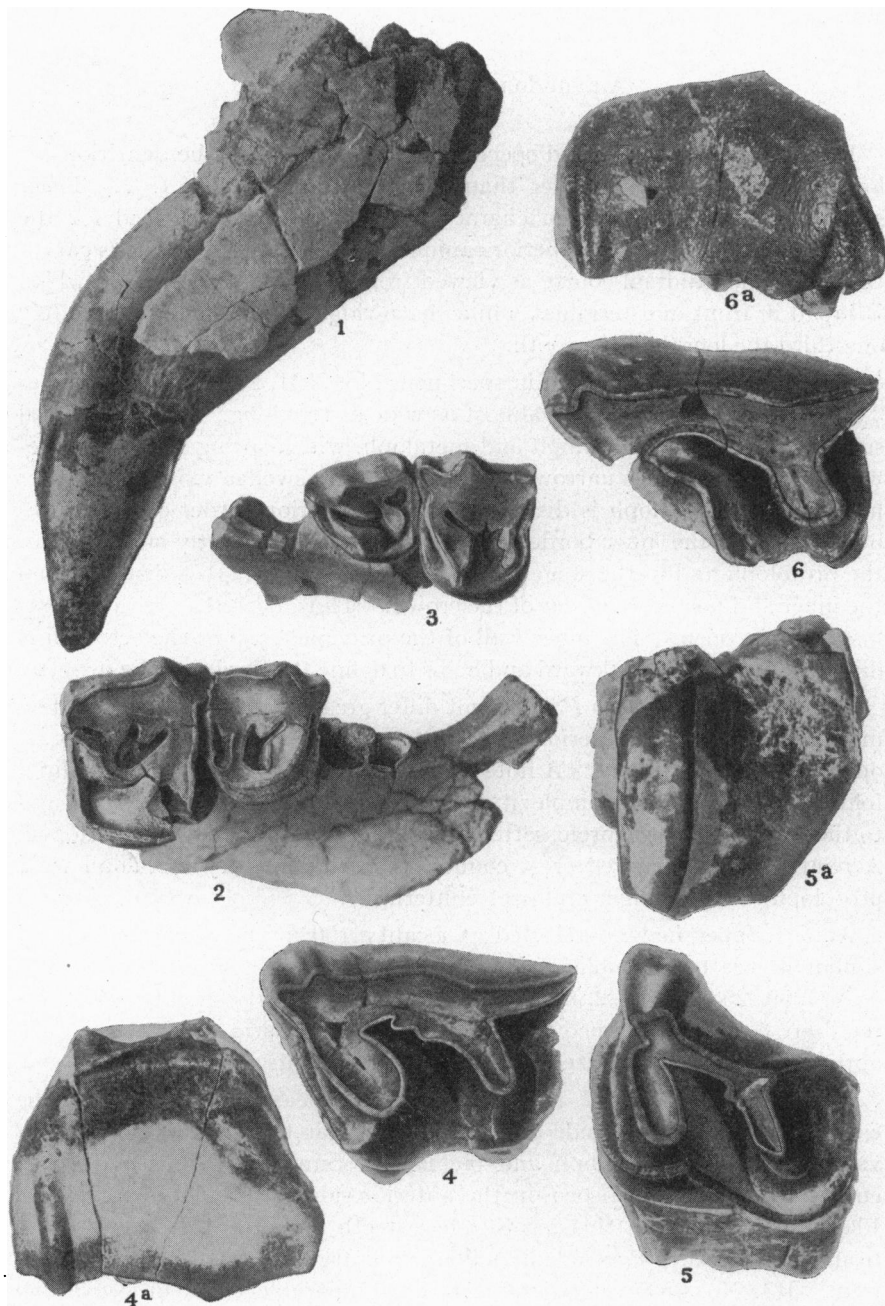
Poway Conglomerate, San Diego County, California. Upper Eocene.

## PLATE 2 (RIGHT)

Figures 1 to 5a. *Amynodontopsis bodei* Stock. Figure 1, left canine, No. 2530, lateral view; figure 2, maxillary fragment with P<sub>3</sub> and P<sub>4</sub>, No. 2532, occlusal view; figure 3, maxillary fragment with P<sub>2</sub> and P<sub>3</sub>, No. 2531, occlusal view; figures 4, 4a, M<sub>2</sub>, No. 1089, occlusal and lateral views; figures 5, 5a, M<sub>3</sub>, No. 2535, occlusal and lateral views; × 1. Sespe Uppermost Eocene, California.

Figures 6, 6a. *Amynodon*, sp., possibly *adventus* Marsh. M<sub>2</sub>, No. 2537, occlusal and lateral views; × 1. Sespe Upper Eocene, California.

All specimens in Calif. Inst. Tech. Coll. Vert. Pale.



Length of tooth, No. 2537, measured in millimeters along outer side, is 46.2.

### ***Amynodontopsis bodei* Stock**

Referred to this genus and species are several parts of the dentition belonging to individuals smaller than the type, No. 1087 C. I. T. These specimens display additional characters not heretofore recorded for the Sespe amynodonts. The superior canine, No. 2530, shows a sinuous curvature in its longitudinal course as viewed from in front. The crown, which is broad in front and terminates in a sharp ridge behind, is approximately one-third the length of the tooth.

Premolars  $\underline{1}$  to  $\underline{3}$  are shown in specimens No. 2531, 2532, Plate 2, figures 3 and 2. In  $P\underline{2}$  the crown is almost as wide as it is long. On the occlusal surface are seen the protoloph and metaloph, which spring from the inner wall of the ectoloph as narrow bands but become swollen along their inner halves. The protoloph is distinct from the anterior border of the tooth, but fuses with the inner border. The metaloph is distinctly smaller than the protoloph and in the stage of wear shown by No. 2531 is distinct from the inner and posterior border of the crown. Thus, both the pre- and post-fossettes are open. The inner wall of the principal cusp of the ectoloph is directed inward and backward and helps to define the border of the fossette.

The occlusal pattern in  $P\underline{3}$  may not differ greatly from that in  $P\underline{2}$ . The metaloph has a more posterior position than in  $P\underline{2}$ ; the prefossette may be open or closed internally. A noteworthy feature is the small longitudinal folds which give added complexity to the forward side of the metaloph and to the inner wall of the prefossette. In  $P\underline{4}$  the protoloph is well developed. A relatively thin, curved crest connects the rudimentary metaloph with protoloph, thus closing a prefossette internally.

Among upper molars collected at locality 150 in the Sespe are several similar in size to the molars in the type of *A. bodei*. At least two teeth, Nos. 1089, 2535, Plate 2, figures 4 and 5, are distinctly smaller. If these teeth are correctly assigned to *A. bodei*, they demonstrate the existence of appreciable variation in size among individuals of this amynodont.

$M\underline{2}$ , No. 1089, Plate 2, figure 4, exhibits at least two wrinkles of the enamel lining the inner side of the ectoloph near the head of the median valley separating protoloph and metaloph. Similar modification of the enamel surface may be seen on the anterior side of the metaloph in  $M\underline{3}$ , Plate 2, figure 5. In this respect these teeth of the Sespe species differ from those of other Eocene amynodonts and are presumably more specialized.  $M\underline{3}$ , No. 2535, in contrast to the comparable tooth in *Amynodon reedi*, possesses a higher crown.

MEASUREMENTS (IN MILLIMETERS) OF TEETH OF *Amyndontopsis bodei*

Superior canine, No. 2530, anteroposterior diameter at base of crown	19.4; width 15.1
<i>P</i> <sub>2</sub> , No. 2531, anteroposterior diameter on outer side	15.2; width 15.1
<i>P</i> <sub>3</sub> , No. 2531, anteroposterior diameter on outer side	16.6; width 20.7
<i>P</i> <sub>3</sub> , No. 2532, anteroposterior diameter on outer side	16.4; width 21.1
<i>P</i> <sub>4</sub> , No. 2532, anteroposterior diameter on outer side	20 ; width 26.2
<i>M</i> <sub>2</sub> , No. 1089, anteroposterior diameter on outer side	42.8; width 31.4
<i>M</i> <sub>3</sub> , No. 2535, anteroposterior diameter on outer side	38.1; width 36.5

<sup>1</sup> Stock, C., *Proc. Nat. Acad. Sci.*, **19**, 762-767 (1933); **22**, 263-265 (1936).

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 THE ACTIVE UPTAKE OF IONS INTO CELLS AND ORGANISMS

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It is well known that the ionic composition of the protoplasm in animal cells differs significantly from that of the surrounding lymph or blood, potassium and phosphate being generally preponderant in the former and sodium and chloride in the latter. Since there is practically always osmotic equilibrium the ions within the cells must be largely free and in aqueous solution. Generally the actual concentrations are not well known, and only in the case of certain eggs has it been possible to show that certain ions are absorbed and concentrated from quite dilute outside solutions.

In the large plant cells studied by Osterhout, Collander<sup>1</sup> and others, active absorption of ions into the cell sap has been repeatedly observed and mechanisms, especially for the active absorption of potassium ions, have been suggested.

In plant roots Lundegårdh<sup>1</sup> has demonstrated an active transport of anions from very dilute external solutions into the much more concentrated sap rising in the stems. He finds that both monovalent and divalent anions can be so absorbed, but that the absorption requires a large expenditure of energy, provided probably by catabolism of carbohydrate. The CO<sub>2</sub> produced seems to act as part of the absorption machinery and the whole process is intimately bound up with the growth of the roots.

In a number of freshwater animals we have in my laboratory studied much more specialized mechanisms for absorbing and concentrating certain ions. These mechanisms come into play when the salt content of the body fluid has been depleted, e.g., by prolonged treatment with distilled water, and their biological significance is the maintenance of a more or less constant concentration in the body fluids round about a hundred times higher than that of the surrounding fresh water. In all the cases more