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Postilla Number 182
30 November 1980

**Taxonomic Status
of *Eohyus* Marsh, 1894**

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(Received 30 October 1979)

Abstract

In 1977 Marsh mentioned *Eohyus* as the oldest known artiodactyl but failed to describe or illustrate a type specimen, and thus *Eohyus* was for many years a *nomen nudum*. The validity of its two species, *E. distans* and *E. robustus*, both named by Marsh in 1894, has been the subject of numerous and often conflicting opinions. Reexamination of the type specimens reveals that *E. distans* is a subjective synonym of *Phenacodus primaevus* Cope, 1873, and *E. robustus* is a subjective synonym of *Periptychus carinidens* Cope, 1881. The type of *E. distans* is from early Eocene (Wasatchian) age strata of the San Jose Formation, San Juan Basin, New Mexico; that of *E. robustus* is from middle Paleocene (Torrejonian) age strata of the Nacimiento Formation, also in the San Juan Basin.

Introduction

In his Vice-Presidential Address to the American Association for the Advancement of Science, Marsh (1877, p. 362) stated that "in the *Coryphodon* beds of New Mexico, occurs the oldest Artiodactyle [sic] yet found, but it is at present known from only fragmentary speci-

mens. These remains are clearly Suilline in character, and belong to the genus *Eohyus*." Seventeen years later Marsh (1894, p. 259–261) designated two species of *Eohyus*: *E. distans* and *E. robustus*. *E. distans*, the type species of the genus, was based on an M³, figured by Marsh (1894, fig. 1:1) but not described, as "the characters of its crown are well shown in the figure" (p. 260). *E. robustus*, "a larger species, which may be referred provisionally to the genus *Eohyus*" (Marsh, 1894, p. 260) was described as being "portions of a pair of lower jaws with imperfect teeth, and fragments of other specimens" (p. 260) but was not figured. A family of artiodactyls, the Eohyidae, was proposed by Marsh, and *Periptychus* Cope, 1881 was claimed by Marsh to be preoccupied, though not explicitly by *Eohyus*.

Since Marsh's original papers on *Eohyus* there have been numerous and often conflicting opinions on its taxonomic status. Because neither the type of *E. distans* nor that of *E. robustus* has ever been adequately described or illustrated, it has been difficult to assess unequivocally the validity of these taxa. In order to put an end to the taxonomic confusion surrounding *Eohyus*, this paper reviews its checkered history and redescribes Marsh's original type specimens.

Abbreviations

The following institutions are referred to in the text:

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|------|---|
| AMNH | Department of Vertebrate Paleontology, The American Museum of Natural History |
| YPM | Peabody Museum of Natural History, Yale University |

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History

Cope (1894) quickly responded to Marsh's second paper on *Eohyus*, especially his assertion that *Periptychus* was a preoccupied name. Cope (1894, p. 867) pointed out that as a name originally published without description, *Eohyus* had "no authority." He also criticized Marsh's brief descriptions of *E. distans* and *E. robustus* and rejected the proposed preoccupation of *Periptychus* as unexplained. Four years later, in a footnote Wortman (1898, p. 101) stated that Cope's "*Pantolestes etsagicus*" (= *Bunophorus etsagicus*; see Sinclair, 1914, p. 273-4) was "very probably synonymous" with *E. distans*, and thus *E. distans* was correctly placed in the Artiodactyla. Matthew (1899, p. 32), however, disagreed with Wortman, claiming that "*Eohyus* Marsh (*nom. nud.*, 1877) is perhaps a synonym of *Phenacodus*; *E. distans* (figured 1894) might be taken for the very uncharacteristic M³ of that genus, and the description of *E. robustus* (1894) corresponds as far as it goes to the lower jaw of *P. primaevus*." Nevertheless, Matthew (1909, p. 94) later listed both species of *Eohyus* as valid, though he did place them in the Phenacodontidae.

In a review of the North American early and middle Eocene artiodactyls, Sinclair (1914, p. 267) regarded *E. distans* as of "uncertain systematic position" and *E. robustus* as "unquestionably, referable to *Periptychus*." The next year, Granger (1915, pp. 347-8) discussed the type of *E. distans* in some detail and concluded that it was "a somewhat abnormal tooth of *Phenacodus*" that "agrees most closely with the smaller variety of *P. primaevus*" (i.e., the "*hemiconus*" subspecies of Granger, 1915). Granger also stated that Sinclair had correctly referred *E. robustus* to *Periptychus*.

In accordance with the opinions of Sinclair and Granger, the fourth edition of Zittel's *Grundzüge* (Zittel et al., 1923, p. 523) listed *Eohyus* as a synonym of both *Phenacodus* and *Periptychus*. But in Hay's (1930, p. 604) bibliography, both species of *Eohyus* were still listed as distinct and placed in the

Phenacodontidae. *Eohyus* was mentioned by Scott (1937, p. 227) as one of the "earliest pig-like animals", but the genus did not appear, even as a synonym, in Simpson's (1945) classification of mammals.

In his review of the North American upper Eocene artiodactyls, Gazin (1955, p. 10) stated that "the genus *Eohyus* (Marsh, 1894) is omitted from consideration in this study, as I am unable to determine its relationships or add any information to that brought forth by Sinclair (1914, p. 267), since the type materials are so very incomplete." Simons (1963, pp. 8-9) discussed *Eohyus* in some detail and illustrated for the first time part of the type of *E. robustus*. In a curious statement he noted that "whatever '*Eohyus distans*' is (the specimen cannot now be located), if from the '*Coryphodon* beds' as stated by Marsh, it cannot take priority over *Periptychus*, for the latter genus does not range into the Eocene" (Simons, 1963, p. 9). Simons also cited Sinclair's (1914) opinion that *E. robustus* was a synonym of *Periptychus* and further asserted that its type "may be assigned with some confidence to *Periptychus rhabdodon*, a Torrejonian Paleocene species." Romer (1966, p. 388R), however, listed ?*Eohyus* under the Diacodectidae, a family of primitive artiodactyls. Most recently, West (1976, p. 4) stated that *E. distans* "is probably an M³ referable to *P. [Phenacodus] primaevus* (Granger, 1915)" and listed *Eohyus* as a synonym of *Phenacodus*.

Redescription and Status of *Eohyus*

As Cope and Matthew indicated, *Eohyus* Marsh, 1877 was for many years a *nomen nudum*. The first published usage of the name *Eohyus* was not accompanied by a description or an illustration nor does Marsh's mention of it (quoted above) constitute an "indication" as defined by the *International Code of Zoological Nomenclature* (Stoll et al., 1964, Article 16).

The type of *E. distans*, YPM 11889 (Fig. 1A) is an isolated slightly worn left M³ which is three-rooted, relatively large (width = 11.0

mm, length = 10.1 mm) and possesses well-developed and distinct paracone and hypocone. There is a strong anterior cingulum, and the cusps are all bulbous and inflated. In Marsh's (1894, fig. 1:1) illustration of this tooth he oriented it incorrectly, turning it so that the anterior end was buccal and thus mistaking the homologies of the cusps.

Because of its large size and cusp configuration, YPM 11889 is assigned here to *Phenacodus primaevus* Cope, 1873 though it is peculiar for that species in having a relatively weak parastyle and essentially no mesostyle (although a small rugosity is present on the buccal cingulum between the paracone and metacone). The absence of a mesostyle might argue for assignment to *Phenacodus grangeri* in which a mesostyle is often absent on M^3 (West, 1976), but the lack of a metacone on YPM 11889, which is present in *P. grangeri* (West, 1976), argues against this.¹ My examination of *P. primaevus* specimens in the AMNH and YPM reveals that the presence or absence of a mesostyle as well as the degree of development of the parastyle on the M^3 of *P. primaevus* are variable (cf. discussion in Granger, 1915, p. 348).

The markedly distinct and large hypocone of YPM 11889, worn to form an anomalous "pit," and the grossly inflated cusps are also somewhat unusual for *P. primaevus*. However, these are also variable characters in *P. primaevus* as examination of the AMNH and YPM collections reveals. The similarity of YPM 11889 to *P. primaevus* "hemiconus" (Granger, 1915, fig. 3), first pointed out by Granger, also confirms assignment of the type of *E. distans* to *P. primaevus*.

The packing label with YPM 11889 indicates that it was collected by David Baldwin on 15 August 1876, in the San Juan Basin in New Mexico. As letters from Baldwin to Marsh dated 4 August and 17 September 1876 (preserved in Yale University Archives, Yale University) indicate, Baldwin at that time was collecting from what he described as the "two horseshoes" of badlands just north of Gallinas Creek. The San Jose Formation is exposed extensively throughout this area

(Simpson, 1948), and it is thus almost certain that YPM 11889 came from the San Jose. In this area the San Jose is early Eocene (Wasatchian) in age and *Phenacodus primaevus* is a well-known constituent of its fauna. (Van Houten, 1945).

The type of *E. robustus*, YPM 11887 (Fig. 1B-E), consists of a badly damaged right mandibular fragment extending from the symphysis through the broken M_3 ; two fragments of the left ramus, one containing part of a P_4 ; and various tooth and bone fragments including the trigonid of the right M_3 which I have been able to fit onto the right ramus. Marsh's (1894, p. 260) description of the specimen as "a pair of lower jaws with imperfect teeth" in which the "lower jaws are very short and robust, with a strong symphysis" containing "four lower premolars and three molars, forming a continuous series, measuring about three inches in length" and having a depth "below the first true molar [of] one inch" is accurate. His description combined with the evidence from packing labels with the specimen and YPM records indicate that YPM 11887 is without question the type of *E. robustus*. The preservation of the assorted fragments of YPM 11887 is the same and it is likely, though not certain, that they pertain to one individual.

YPM 11887 is readily assignable to *Periptychus carinidens* Cope, 1881² for the following reasons:

1) The right ramus (Fig. 1B-C) conforms in size to that of *P. carinidens* and clearly bore four premolars and three molars as in *Periptychus*

¹ Whether *E. distans* should be assigned to *P. primaevus* or *P. grangeri* may not be an issue if Van Valen's (1978, p. 58) recent but unsubstantiated claim that *P. grangeri* Simpson, 1935 is a synonym of *P. primaevus* Cope, 1873 is correct.

² As Matthew (1937, pp. 110-111) pointed out, *Periptychus carinidens* was first based on a juvenile dentition by Cope who, not realizing this, later named the adult dentition of the same species "*Catathlaeus*" (= *Periptychus*) *rhabdodon*. Thus *Periptychus carinidens* has priority over *P. rhabdodon*, and the continued use of the later name, as in, for example, Simons (1963), is incorrect.



Fig. 1

Type specimens of *Eohyus distans* (A) and *Eohyus robustus* (B-E). **A** YPM 11889, left M³, stereophotograph of occlusal view, anterior is towards the left ($\times 2$). **B** YPM 11887, right lower jaw from symphysis to broken M₃, occlusal view ($\times 1$). **C** YPM 11887, same as (B), buccal view ($\times 1$). **D** YPM

11887, left lower jaw fragment with damaged P₄, buccal view ($\times 1$). **E** YPM 11887 right M₃ trigonid, stereophotograph of occlusal view ($\times 2$). Note that this tooth fragment can be fitted onto the jaw shown in (B) and (C).

tychus. Moreover, the remnants of the M_3 indicate that it was a much smaller tooth than M_1 and M_2 , and the P_4 alveoli indicate that P_4 was a very large, two-rooted tooth; both conditions are characteristic of *Periptychus* (Matthew, 1937).

2) One of the left ramus fragments possesses a badly damaged P_4 (Fig. 1D) whose buccal face still bears some enamel with faint traces of striae, an unmistakable characteristic of *Periptychus*. This P_4 was clearly large and bulbous as in *Periptychus* (Matthew, 1937).

3) The trigonid of the right M_3 (Fig. 1E) is indistinguishable from that of *P. carinidens* (Matthew, 1937, fig. 20). Large size and the morphology of this trigonid, particularly the subequal height of the metaconid and protoconid, distinguish YPM 11887 from *P. coarctatus* (Matthew, 1937).

YPM 11887 was collected by David Baldwin on 21 June 1879 "near Cox's Ranch" on the west side of the Animas River in the San Juan Basin, New Mexico, as indicated by packing labels with the specimen (Simons, 1963). In this area there are extensive exposures of the

Paleocene Nacimiento Formation that have yielded remains of *P. carinidens* (Granger, 1917). The only horizons thus far located here are middle Paleocene (Torrejonian) in age, and one of the canyons in this area is now called "Cox Canyon" (Aztec, New Mexico: U.S. Geological Survey Topographic Quadrangle Map), possibly based on the "Cox's Ranch" of Baldwin's time. It is thus almost certain that the type of *E. robustus* came from Torrejonian age strata of the Nacimiento Formation west of the Animas River, possibly from Cox Canyon.

Acknowledgments

I would like to thank J. H. Ostrom, J. D. Archibald, and P. D. Gingerich for helpful criticism of an earlier draft of this paper and W. K. Sacco for taking the photographs for Figure 1. Funds for the publication of this paper were provided by the O. C. Marsh Fund of the Division of Vertebrate Paleontology, Peabody Museum of Natural History, Yale University, and I would like to thank Professor Ostrom for making these funds available.

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