A NEW EARLY TERTIARY PERISSODACTYL, *HYRACOTHERIUM SEEKINSI*, FROM BAJA CALIFORNIA

By William J. Morris[1]

Abstract: *Hyracotherium seekinsi*, a new Paleocene species from Baja California, is described as being closely related to *H. angustidens*. Rectangularity of the upper molars suggests a morphological difference between *H. angustidens*, *H. seekinsi*, and *Desmatoclaenus*. On the basis of rectangularity, *Desmatoclaenus* appears to be ancestral to *H. seekinsi*, but not directly ancestral to *H. angustidens*.

A sequence of red mudstone and siltstone capped by coarse conglomerate forms two small but topographically prominent buttes between Punta Prieta and Rancho Rosarito approximately 325 miles south of Ensenada in Baja California, Mexico. Five poorly preserved but significant vertebrate fossils were found at this locality during 1965 and 1966 by field parties from the Los Angeles County Museum of Natural History (LACM). In 1965 four upper molars were collected and referred to *Hyracotherium* (Morris, 1966). These molars were associated with barylambdid pantodonts and *Esthonyx* sp. The pantodonts were found approximately 20 feet above and the specimen of *Esthonyx* 30 feet below the horizon containing the molars. Since *Hyracotherium* has not been reported before as occurring with or stratigraphically below barylambdid pantodonts, it seems pertinent to stress the vertical continuity of the section. Structural complications are lacking and the strata are not overturned or faulted.

Terrestrial vertebrate fossils are rare at the Punta Prieta-Rancho Rosarito locality and, aside from the *Hyracotherium* molars, the collection includes only a partial skeleton of a barylambdid pantodont, a barylambdid pantodont scapula, various teeth of *Esthonyx* (?), and a partial skeleton of an immature creodont.

A few fresh water gastropods were collected and hackberry seeds are common.

Acknowledgments

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Abbreviations used in this contribution include LACM, Los Angeles County Museum of Natural History, and AMNH, American Museum of Natural History.

GEOLOGIC AGE OF THE PUNTA PRIETA-RANCHO ROSARITO DEPOSITS

Heim (1922) named the sequence of conglomerates, siltstones, and mudstones, outcropping near the now abandoned Rancho Tepetate, the Tepetate Formation. Later Beal (1948) extended the geographic and stratigraphic limits to include the oldest Tertiary rocks in Baja California belonging to the Paleocene and Eocene series and extending along the western side of the peninsula from San Ysidro to the latitude of La Paz. The unit is not continuous. The Punta Prieta-Rancho Rosarito outcrop is approximately 10 miles long and separated from adjacent outcrops by Late Tertiary volcanics or deep arroyos.

Invertebrates collected from a sequence lithologically similar to Punta Prieta-Rancho Rosarito, but occurring about 12 miles south of the vertebrate locality, include the gastropod, *Turritella pachecoensis,* a species characteristic of the Lower Martinez Formation considered Paleocene in the west coast invertebrate chronology.

Outcrops 60 to 70 miles north and south of the Punta Prieta-Rancho Rosarito locality have yielded Early to Middle Eocene invertebrates (Darton, 1921; Vaughn, 1929; and Beal, 1948).

Most published information, including Beal (1948), is of a preliminary nature and only gross stratigraphic units were defined.

The Baja California pantodont will be described in a later paper. Though poorly preserved, it certainly belongs in the family Barylambdidae as defined by Simons (1960). Details of the skeleton and scapula are remarkably similar to *Barylambda faberi* (Patterson, 1937) from Tiffanian Debeque Formation of Colorado. It does not resemble the Asiatic Early Eocene barylambdid, *Haplolambda planicanum.*

In a preliminary report (Morris, 1966), the Punta Prieta-Rancho Rosarito vertebrates were considered probably of Clarkforkian age. Recently Wood (1967) reviewed the evidence for a Clarkforkian fauna and found it inconclusive. He stated (p. 28), "Such evidence scarcely warrants recognition of the Clark Fork as a provincial age, faunal zone, or member of the Polecat Bench Formation." If the Clarkforkian is not valid, then the Punta Prieta-Rancho Rosarito vertebrates could be either Wasatchian or Tiffanian. The primitive nature of the *Hyracotherium* and the presence of barylambdids favor a Tiffanian Age but future discoveries may alter this conclusion.

Order Perissodactyla Owen, 1848
Family Equidae Gray, 1821

Hyracotherium Owen, 1840

Hyracotherium seekinsi, new species

Holotype: LACM 15349. Left M^2, M^3, and right M^2, M^3 from single maxillary. Collected by W. J. Morris field party, 1965.

Locality and horizon: LACM Locality No. 65155, approximately 25 kilometers south of Punta Prieta, Baja California. Locality characterized by two prominent buttes. Specimen found approximately one hundred and fifty feet below conglomerate capping most northern butte.

Diagnosis: M^1 and M^2 considerably smaller than those of *Hyracotherium angustidens*. Length and width of M^3 is within the range of *H. angustidens*, but length and width of M^1, M^2 outside the range (Fig. 3). M^1 and M^2 more rectangular than M^3, the greatest dimension being from the labial to lingual margins. M^1 and M^2 more rectangular than in *H. angustidens*. The principal cusps are closely appressed toward the midline, forming deep valleys between the protocone-paracone and hypocone-metacone. This feature is most conspicuous on M^1 and M^2 when compared with M^3.

The angle formed between the paracone and metacone margin and the posterior border is more obtuse than in specimens of *H. angustidens*, although this characteristic is notably variable among hyracotheres.

M^1 lacks about one-third of the labial side but a well developed protoloph and metaloph are present on the lingual side. These lophs are noticeably parallel and point towards the anterior margin of the tooth. Neither protocone nor hypocone are prominent as these two cusps form an integral part of the lophs.

Lophs are not well developed on M^2. The ectoloph is barely discernible between the closely appressed paracone and metacone. Both the paraloph and metaloph are sharp ridges diminishing rapidly from the paracone and metacone to the labial margin. The four major cusps are sharply pointed and stand well above the lophs. The protocone and hypocone are conical and separated by a deep depression. The labial side of both metacone and protocone slopes less steeply than the lingual side. The two cusps, geometrically, form a piercing, almost shearing blade. The parastyle of M^2 is compressed and crowded against the paracone.

The sharp definition of the principal cusps and the lack of loph development on M^2 and M^3 is very different from the semi-parallel strong loph development on P^4. M^2 and M^3 resemble *H. angustidens* and condylarths much more than does M^1.

It is difficult to assess the taxonomic significance of the cusps on M^3, as in *Hyracotherium* these are variable in geometry and position. The number and arrangement of cusps on the posterior lingual margin of M^3 of *H. seekinsi*,

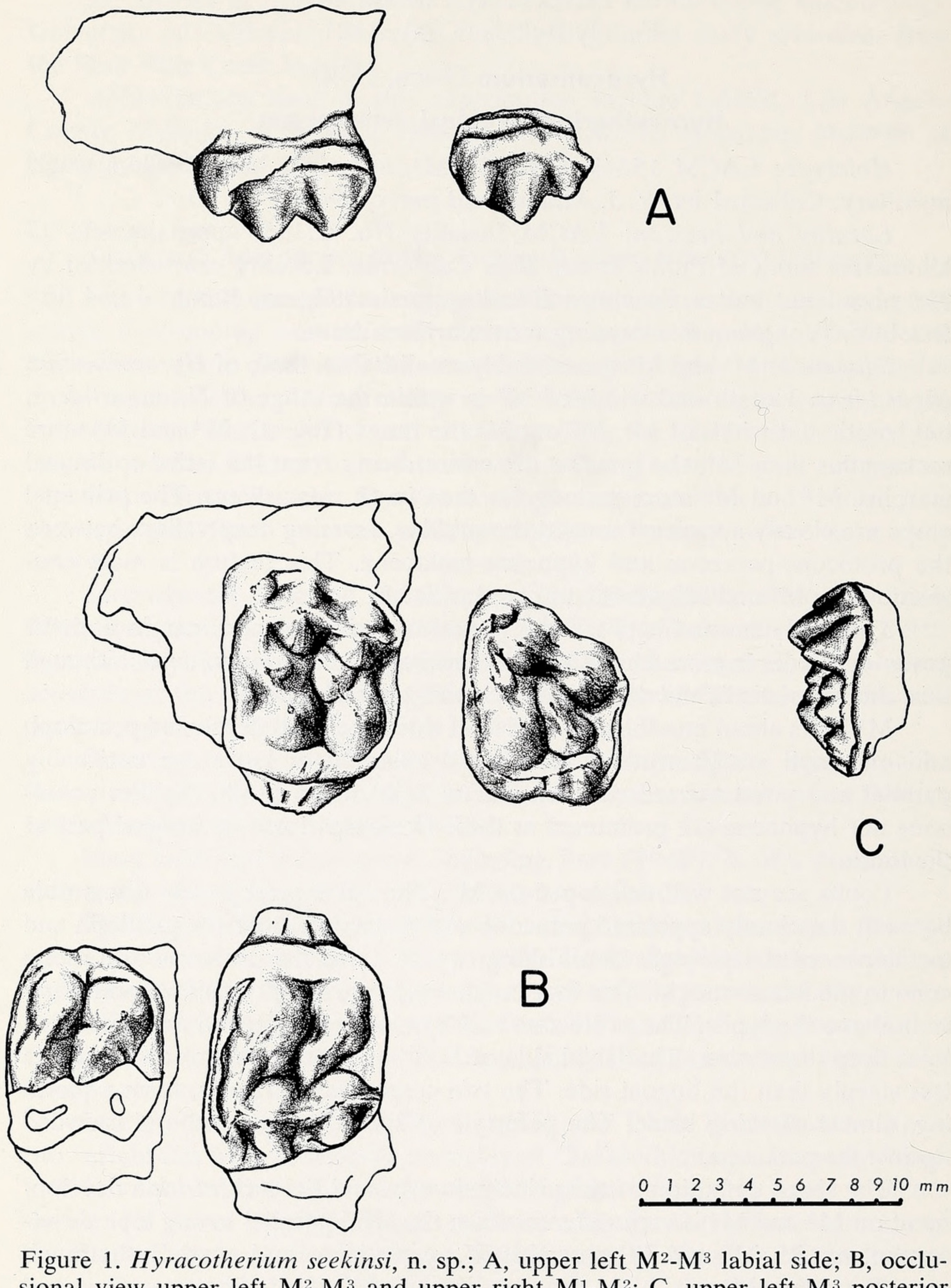

Figure 1. *Hyracotherium seekinsi*, n. sp.; A, upper left M^2-M^3 labial side; B, occlusional view upper left M^2-M^3 and upper right M^1-M^2; C, upper left M^3 posterior view.

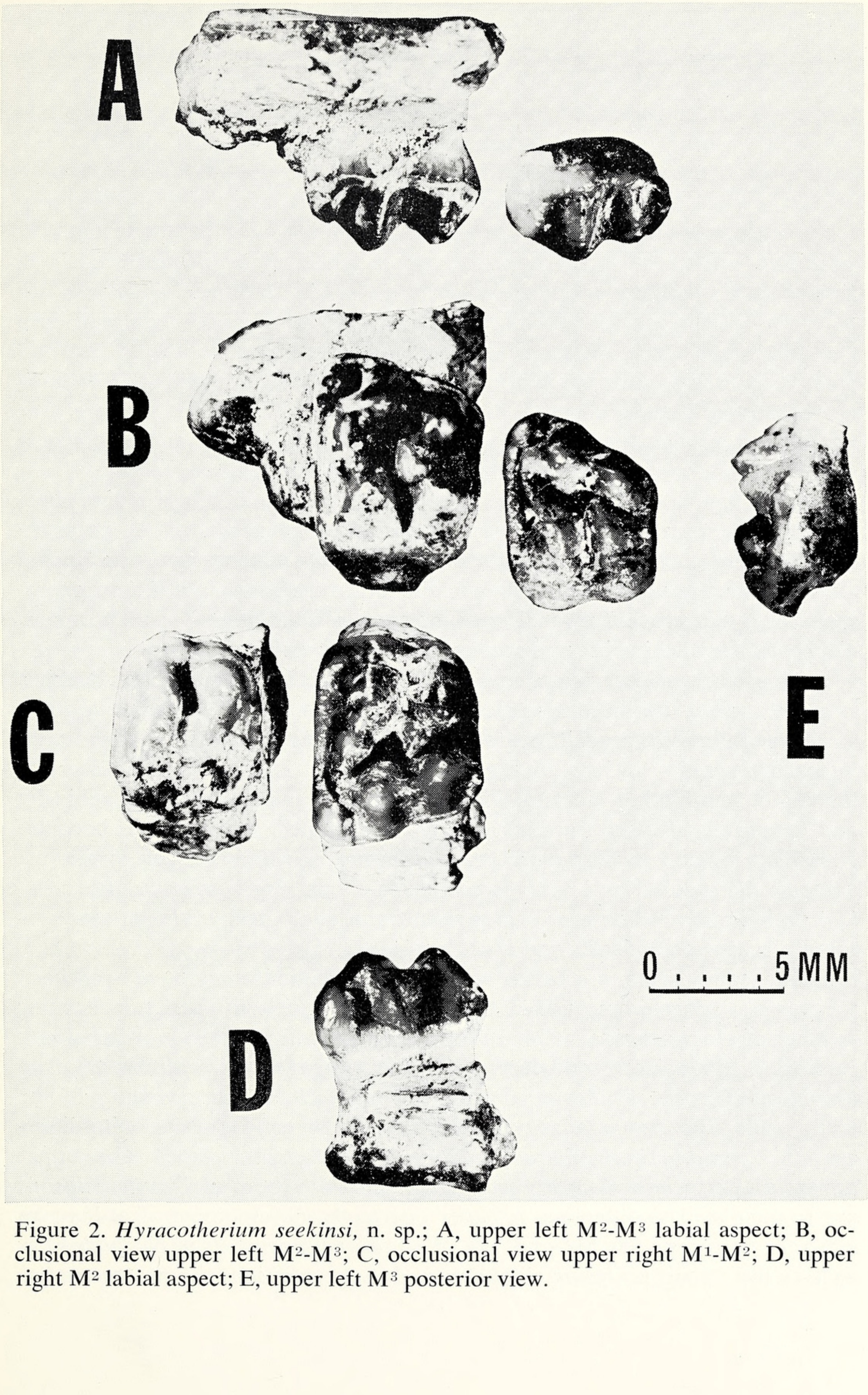

Figure 2. *Hyracotherium seekinsi,* n. sp.; A, upper left M^2-M^3 labial aspect; B, occlusional view upper left M^2-M^3; C, occlusional view upper right M^1-M^2; D, upper right M^2 labial aspect; E, upper left M^3 posterior view.

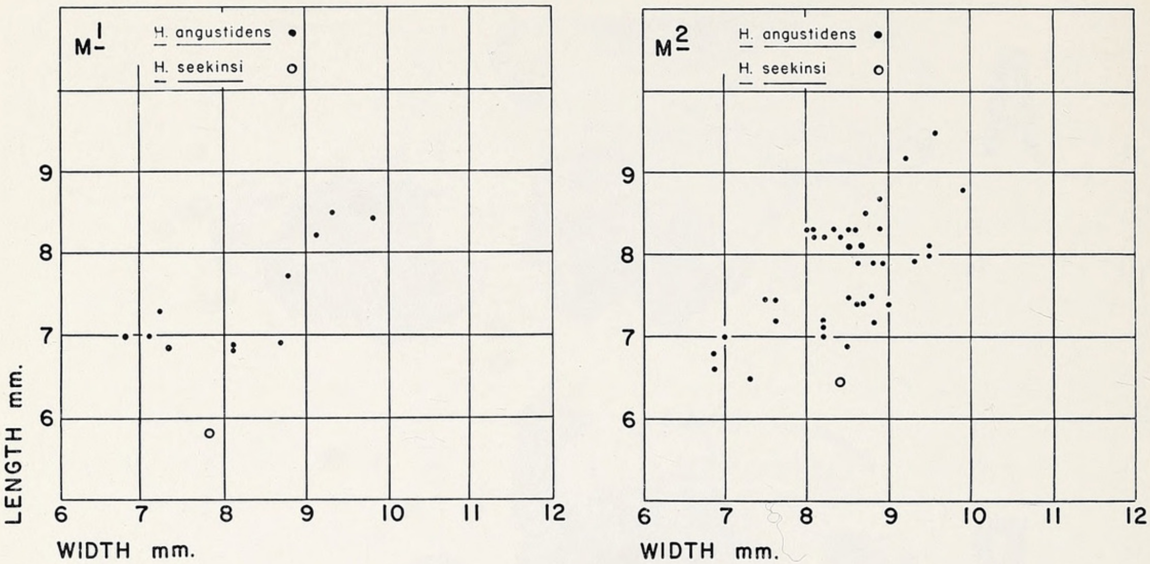

Figure 3. Scatter diagram comparing individual upper molar length-width ratios of *Hyracotherium seekinsi*, n. sp., with *H. angustidens* (Four Mile Creek).

however, do seem significant. Posterior from the protocone are two cusps located on the platform of the tooth. A third cusp, arising from the lingual cingulum, is also well developed. It is difficult to decide which of these represents the hypocone, but regardless of the cusp selected the hypocone is appreciably smaller than in observed specimens of *H. angustidens*.

This new species is named in honor of its discoverer, Mr. William Seekins.

Discussion: It is becoming increasingly apparent that Early Tertiary perissodactyls and their progenitors among the Paleocene condylarths are morphological intergrades, at least as regards dentition. It is impossible to ascertain the degree and kind of morphological overlap until many more geographically and temporally isolated samples have been examined. As a result it becomes extremely difficult to formulate precise parameters of diagnostic taxonomic value at the species level. This is particularly valid for *Hyracotherium seekinsi,* which may well be representative of a morphological grade between certain Paleocene condylarths and *H. angustidens.*

The condylarths, *Tetraclaenodon* and *Desmatoclaenus,* have each been proposed as progenitors of *Hyracotherium.* Apparently neither geometry nor number of cusps precludes either from this ancestral possibility (Kitts, 1956; Radinsky, 1966). Both condylarth genera have the necessary primary cusps to provide a morphological ancestor for *Hyracotherium.* The geometry of the teeth, aside from rectangularity (to be discussed later), appears quite different in *Hyracotherium, Tetraclaenodon,* and *Desmatoclaenus.* The upper molars of *Tetraclaenodon* are broadly ovate, while those of *Desmatoclaenus* are triangular. The difference is partly due to the development of at least an incipient hypocone on M^1 and M^2 of some samples of *Tetraclaenodon,* as well as the strong posterior cingulum of M^3. In addition, the protocone has developed directly labial to the paracone so that lines drawn through paracone-protocone crests and metacone-hypocone crests are parallel. This is not the case in the more triangular molars of *Desmatoclaenus,* particularly in *D. hermaeus,* as the protocone is located at the V formed by the three principal cusps. The geometry of *Tetraclaenodon* is in this respect more like *Hyracotherium* than is that of *Desmatoclaenus. Hyracotherium seekinsi* shows the characteristic development of parallelism of the principal cusps on M^1 and M^2, but the teeth are much more rectangular than in *Tetraclaenodon.*

Aside from the geometry of the principal cusps, *H. seekinsi* has many morphological features suggestive of desmatoclaenid affinities. *Desmatoclaenus hermaeus* has a respectable parastyle on M^2 that is closely appressed against the paracone and connected to it by an anterior spur of the ectoloph. This is almost a duplicate of the morphological condition in M^2 of *Hyracotherium seekinsi.* In addition, M^2 of both *Desmatoclaenus hermaeus* and *Hyracotherium seekinsi* have protoconules and metaconules less developed than in primary cusps, paracone and metacone appressed towards the midline, and slight development of the ectoloph between paracone and metacone. Another feature common to the two genera is the similarity of the protoloph, which trends in an anterior direction towards the parastyle, gradually diminishing in height and interrupted midway by a modestly developed protoconule. M^3 of *Hyracotherium seekinsi* has three weakly developed cusps or cuspules on the hypocone portion. Were these not present, the tooth would show a striking resemblance to the M^3 of *Desmatoclaenus hermaeus.* It is feasible that the hypocone of the *Hyracotherium* lineage arose from a strong posterior labial cingulum similar to the one present on M^3 of *Desmatoclaenus hermaeus.*

COMPARATIVE RECTANGULARITY OF TEETH

Hyracotherium seekinsi is morphologically similar to *H. angustidens* and temporally near this species. The problem of whether *H. seekinsi* is ancestral to the later *H. angustidens* or is representative of a variant population of early perissodactyls cannot be solved from a few teeth. Kitts (1956) demonstrates that *H. angustidens* consists of several intergrading populations closely related but not of proven contemporaneity. Aside from central measurements of size frequency, definitive molar characteristics have not been recognized for these populations. Molar comparison of *H. seekinsi* with *H. angustidens* shows a marked difference in rectangularity. That may reasonably be of phylogenetic importance as well as of diagnostic value.

Rather than using scatter diagrams to portray rectangularity, a more direct method of comparison has been used (Figs. 4, 5). Linear measurements were made for each specimen and the mean length and mean width computed when warranted by the size of the sample. A line from the origin to a point determined by the coordinates of mean length and width was drawn

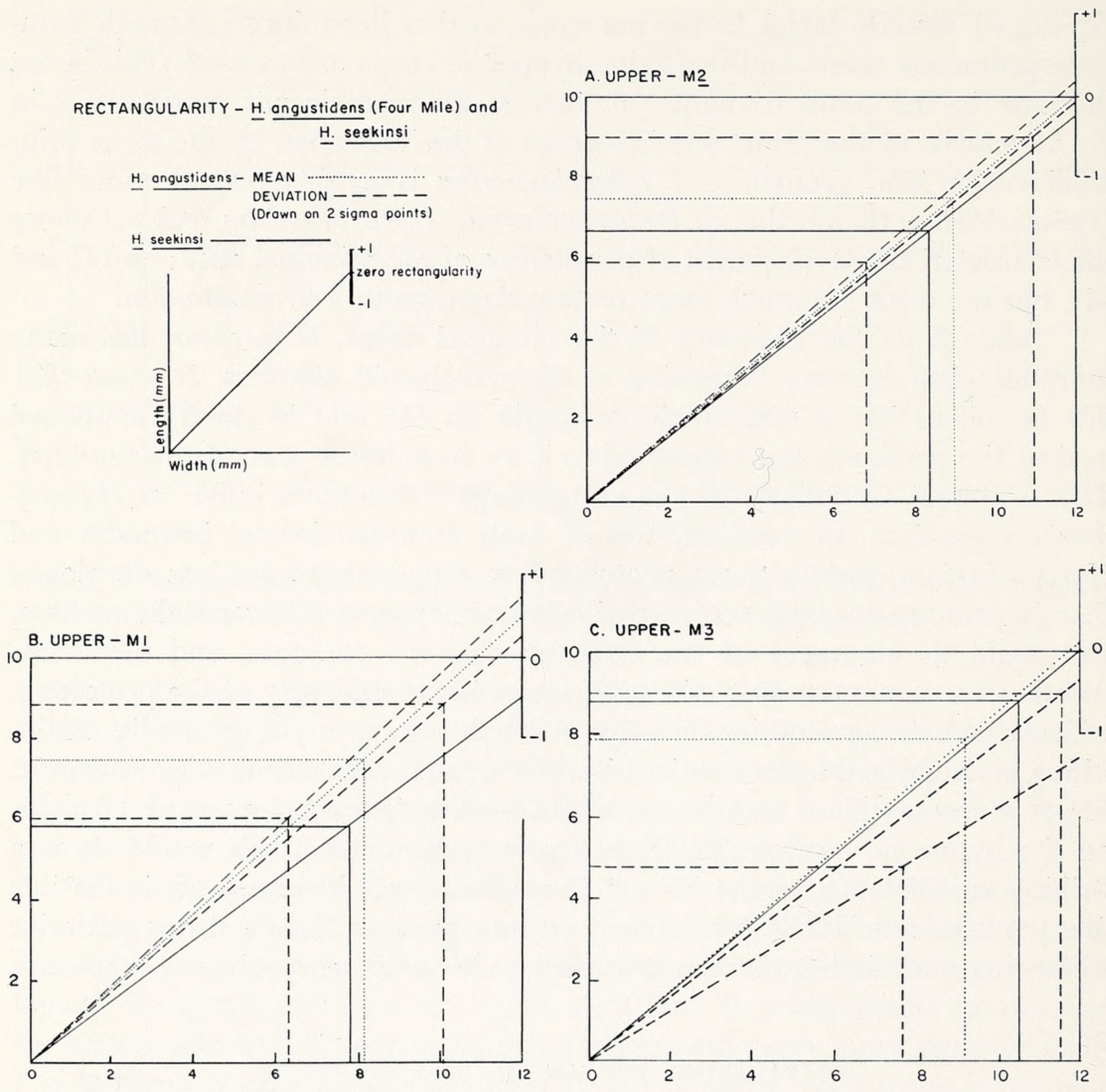

Figure 4. Diagram illustrating graphic method of compiling comparative rectangularity measures as presented in Figure 5. Upper molars of *Hyracotherium seekinsi* (solid line) are compared with *H. angustidens* (dashed and dotted lines) from the Four Mile Creek localities; for *H. angustidens*, M^1 N = 7, M^2 N = 34, M^3 N = 32. Upper left diagram shows parameters for diagram A-C. Figure 5 contains only the rectangularity scale. The measure of rectangularity adopted is comparative only when the same scale is used for all included teeth.

Note that in *size*, as indicated by the dotted, dashed and solid outlined rectangles, the *H. seekinsi* molars fall within or close to two standard deviations of *H. angustidens*, whereas the measure of rectangularity more clearly expresses a difference between these teeth.

and extended a convenient distance. An arbitrary scale from plus 1 to minus 1 was adopted as a measure of rectangularity. Fig. 4 illustrates the graphic method used in establishing the measure of rectangularity. Comparisons of the rectangularity of taxa under consideration are presented in Fig. 5. When

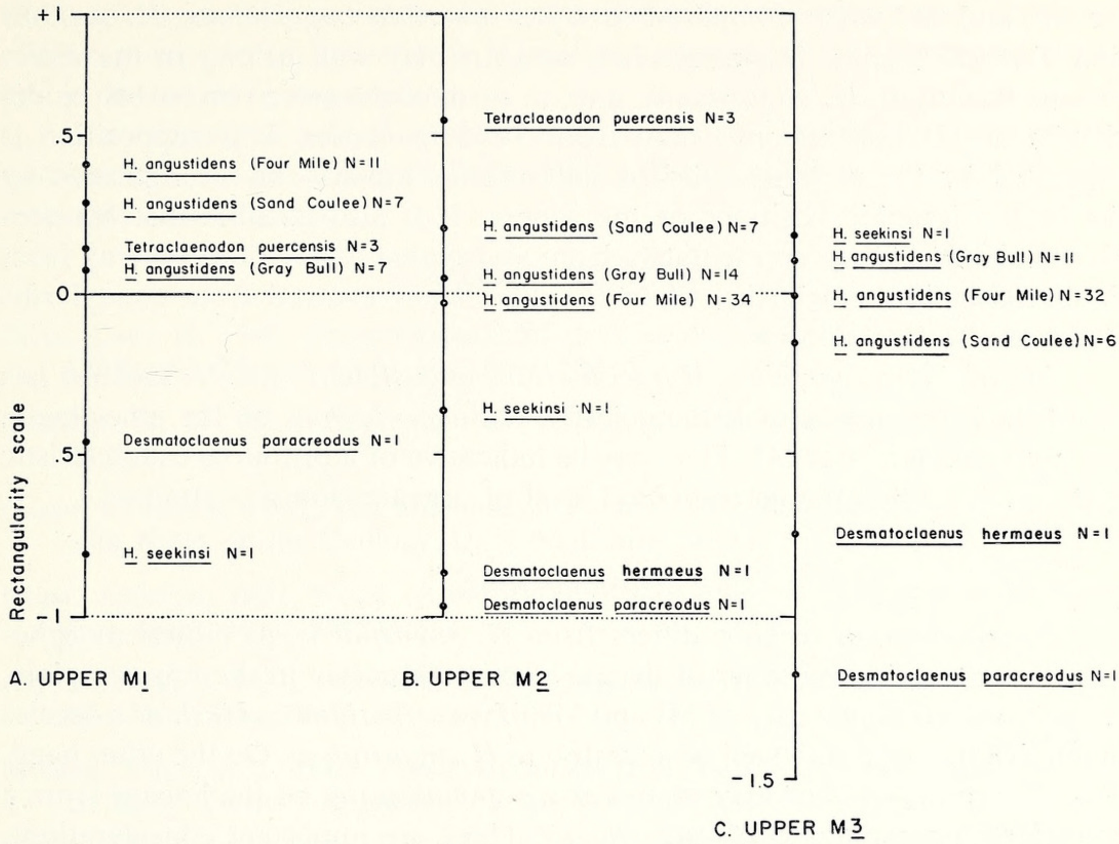

Figure 5. Relative rectangularity of selected species of Early Tertiary perissodactyls and condylarths. *Desmatoclaenus paracreodus* is included to show the closer morphological similarities of *D. hermaeus* to *Hyracotherium seekinsi.*

rectangularity is presented in this manner, it is independent of size as long as the same scale is used in the comparison.

M^1 and M^2 of *Hyracotherium seekinsi* are more rectangular than those of *H. angustidens,* although in both species the teeth are short and wide. This difference in rectangularity appears to be a consistent one, as shown in *H. angustidens* samples from Four Mile Creek (University of California, Berkeley, V5365E, V5350, V5396, V5424, V5421, V5422, V5357), Sand Coulee and Graybull populations (measurements taken from Kitts, 1956). There is no significant difference in rectangularity between M^3 of *Hyracotherium seekinsi* and *H. angustidens.*

Three specimens of *Tetraclaenodon* from the upper Nacimiento Formation (AMNH 15927), one of *Desmatoclaenus hermaeus,* and one of *D. paracreodus* (Gazin, 1941), were plotted. While certainly not conclusive, the plots provide interesting comparisons with *Hyracotherium seekinsi* (Fig. 3).

Rectangularity exhibited in M^1 and M^2 of *Tetraclaenodon* does not differ from that of *Hyracotherium angustidens.* It does differ considerably from the rectangularity of M^1 and M^2 of *H. seekinsi.*

Desmatoclaenus hermaeus and *D. paracreodus* have the most rectangular M^1 and M^2 when compared to *Hyracotherium angustidens, H. seekinsi* and *Tetraclaenodon. Hyracotherium seekinsi* may well belong in the direct lineage leading to *H. angustidens,* and, in turn, could more reasonably be derived from *Desmatoclaenus* than from *Tetraclaenodon.* This supposition is suggested by the rectangularity of the anterior molars and strengthened by the biostratigraphic positions of the genera. It is also possible that *Hyracotherium seekinsi* is a representative from an isolated population evolving from desmatoclaenid condylarths, while *H. angustidens* evolved from condylarths closer to tetraclaendontids.

M^3 of *Tetraclaenodon, Hyracotherium angustidens,* and *H. seekinsi* has about the same degree of rectangularity. *Desmatoclaenus,* on the other hand, has a very rectangular M^3. This may be indicative of a primitive characteristic that was lost when the perissodactyl level of organization was attained.

CONCLUSIONS

Hyracotherium seekinsi differs from *H. angustidens,* its closest morphological relative, in a number of details of cusp geometry in the upper molars, as well as in rectangularity of M^1 and M^2. *Hyracotherium seekinsi,* or a species much like it, could very well be ancestral to *H. angustidens.* On the other hand, *Hyracotherium seekinsi* may represent a population not on the lineage from a condylarth progenitor to *H. angustidens.* These are important considerations, as *Hyracotherium seekinsi* is certainly, morphologically, more like *Desmatoclaenus* than like *Tetraclaenodon.* If *Hyracotherium seekinsi* is ancestral to *H. angustidens,* then *Desmatoclaenus* is a more satisfactory morphological ancestor for these Early Tertiary perissodactyls than is *Tetraclaenodon.*

Radinsky (1966, p. 408) states that if ". . . protoperissodactyls and *Tetraclaenodon* were independently derived from a still more primitive common ancestor, [this hypothesis] requires an additional complicating factor–an independent acquisition of molar hypocones by perissodactyls and phenacodontids." Gazin (1941) however, does regard *Desmatoclaenus hermaeus* as having a weak hypocone, but not well developed when compared to that of *Tetraclaenodon.*

Hyracotherium angustidens is morphologically more like *Tetraclaenodon,* and *Hyracotherium seekinsi* more like *Desmatoclaenus hermaeus.* Either the hypothesis of a desmatoclaenid-*H. seekinsi-H. angustidens* lineage is tenable or independent derivation of *H. seekinsi* and *H. angustidens* appears necessary.

RESUMEN

Un nuevo perisodáctilo encontrado en depósitos que pertenecen a inicios del Terciario se describe como una nueva especie, *Hyracotherium seekinsi.* Este está relacionado de cerca con *H. angustidens.* La rectangularidad de los molares superiores sugiere diferencias morfológicas entre *H. angustidens, H. seekinsi* y