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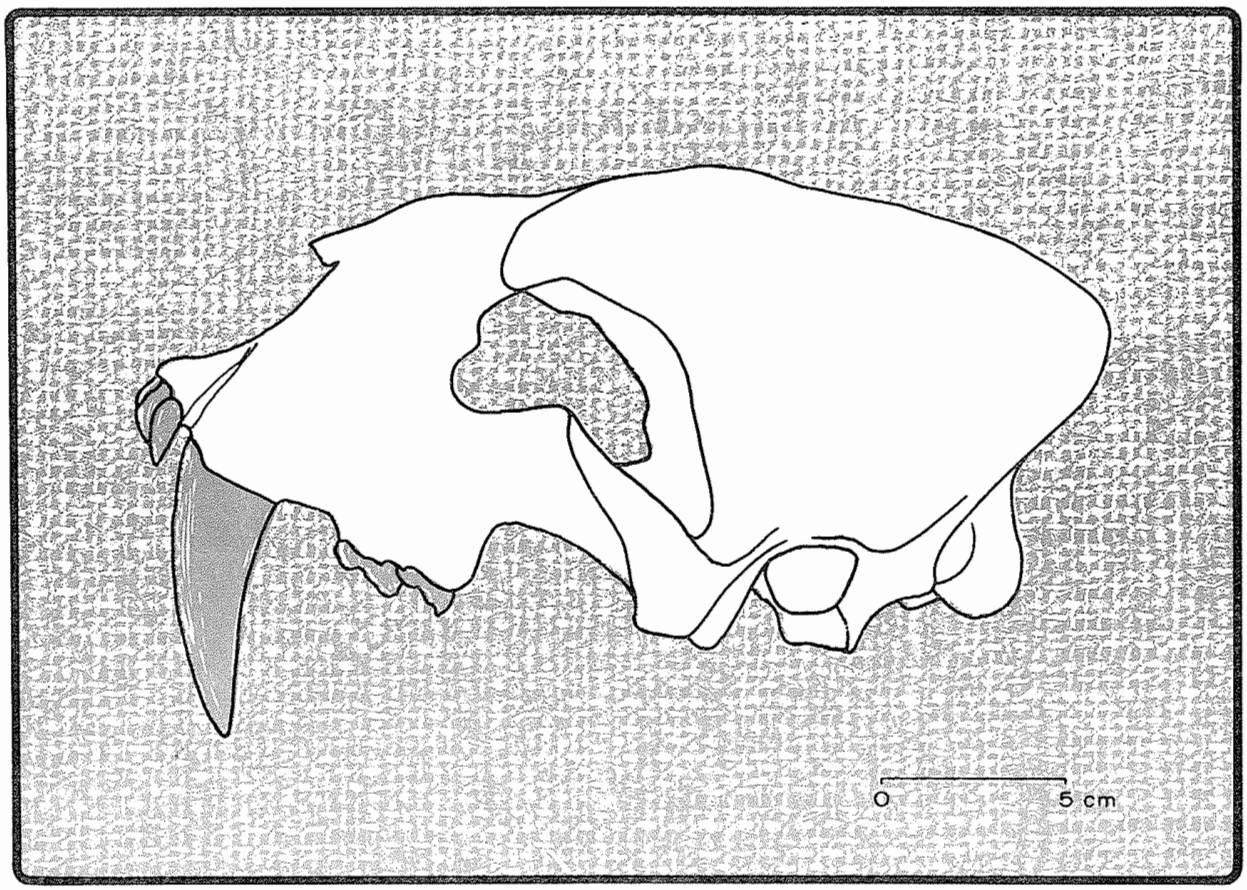
THE DELMONT LOCAL FAUNA, BLANCAN OF SOUTH DAKOTA

by Robert A. Martin and J. C. Harksen



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The Delmont Local Fauna, Blancan of South Dakota

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Abstract. *Fossil mammals are reported from the Hieb Sand Pit* (Delmont local fauna), *Douglas County, South Dakota. The fauna includes* Procastoroides, *(cf)* Ischyrosmilus, Equus, Titanotylopus, Tanupolama, *and* Stegomastodon. *These remains are relegated to Blancan time, and were deposited in an eastward flowing stream of presumably Black Hills origin prior to development of the Missouri River.*

INTRODUCTION

The present state of knowledge of the late Cenozoic history of South Dakota is sketchy. During the late Tertiary the area between the Black Hills and the James River was a flat depositional plain controlled by streams flowing in an eastward direction. Although minor erosional fluctuations occurred, there was a general thickening of this blanket of sediments throughout Oligocene, Miocene, and most of Pliocene time. A reconstruction of this surface as it probably appeared in late Pliocene time was presented by Harksen and Macdonald (1969).

During the late Pliocene streams in South Dakota became rejuvenated and began to cut downward through previously deposited beds. Maximum downcutting of 460 meters has been computed in the Big Badlands area (Harksen, 1968). Prolonged periods of erosion have resulted in a very meager geological record during this extended cycle. In addition, several cycles of Pleistocene glaciation in eastern South Dakota have complicated matters by burying earlier deposits beneath glacial sediments. Further, continental glaciation has revamped the drainage patterns of the state (see Harksen and Macdonald, 1969).

In the late 1960's Lynn Hedges of the South Dakota Geological Survey mapped the geology of Charles Mix County. Stream deposits indicative of a Black Hills origin were noted. They extend into Douglas County, where, in *sec. 23, T. 97 N., R. 62 W.* (approximately 7 kilometers south of Delmont), Albert Hieb had established an extensive sand quarrying operation (Figs. 1 and 2). Approximately 10 meters of bedded to massively crossbedded gravelly arkosic sand with some pebbles of igneous and metamorphic rock occur at the Hieb Sand Pit. Individual layers and lenses are well sorted and the sand is unconsolidated. The sand is overlain by 11 meters of late Wisconsin till and underlain by as much as 16 meters of undated silt which lies between the sand and the Cretaceous Pierre Shale. The sand was deposited by an eastward flowing stream at some time before the formation of the modern drainage pattern of the state.

Figure 1. Map showing location of some major late Pliocene and early Pleistocene local faunas of western North America (modified from Hibbard, 1972). Grandview (1), Hagerman (2), Java (3), Delmont (4), Sand Draw (5), Broadwater (6), Dixon (7), Rexroad Loc. 3 (8), Cita Cayon (9), Blanco (10).

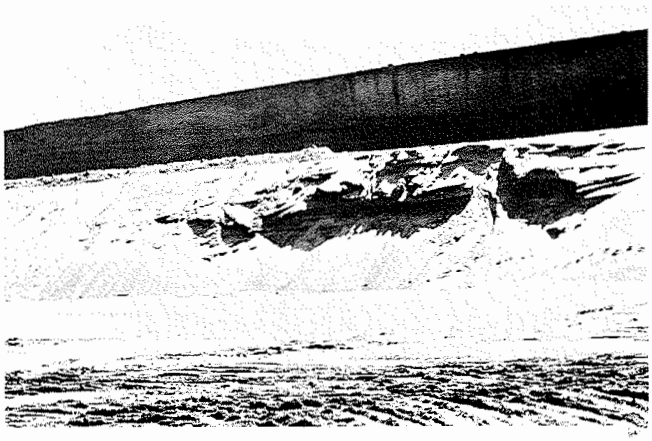

Figure 2. The Hieb Sand Pit, source of the Delmont local fauna. Photo courtesy of Mr. Lynn Hedges.

Sands of the Hieb Pit have long been a source of vertebrate fossils. Since Albert Hieb and his family began collecting in 1920 a considerable number of fossils has been discovered. While the sand is only moderately fossiliferous persistent collecting over half a century has produced an interesting fauna.

Over the years the Hieb family has allowed collecting of fossils in the sand pit and has given many isolated finds to non-professionals. Their generosity has maintained the size of the collection at a rather modest level. In the post World War II period the material was examined by members of the Nebraska State Museum staff. Identifications made by Schultz and Frankforter are listed by Flint (1955). Fossils examined by Schultz and Frankforter were returned to Albert Hieb and most have been retained in his collection. During the summer of 1969 a large part of the collection was sent to one of us (J.C.H.) for identification and age determination. Since the collection has never been formally catalogued and curated, and since some specimens reported by Flint (1955) were not present in the 1969 collection and are presumed lost, we cannot rely upon either Schultz's and Frankforter's identifications or Flint's faunal list. Although we do not inherently question the identifications made earlier, the absence of material and lack of proper curation disallow a combined faunal list purely on the grounds of proper scientific jurisprudence.

In the spring of 1970 the junior author and Merlin Tipton of the South Dakota Geological Survey returned the specimens to the Hieb family. At this time the Hieb family donated many specimens to the State of South Dakota. They were then sent to the Museum of Geology of the South Dakota School of Mines and Technology (SDSM). These specimens and plaster casts of others form the basis for this report. Superscript numbers indicate upper dentition. Subscript numbers indicate lower dentition. American Museum of Natural History specimens are abbreviated by AMNH.

SYSTEMATIC PALEONTOLOGY

Order Rodentia

Family Castoridae

Procastoroides cf *P. sweeti* Barbour and Schultz

Specimens examined: SDSM 703, pair of upper incisors; SDSM 704, right lower incisor (Figs. 3 and 4).

Remarks: The three incisors are referable to *Procastoroides*, and are within the size range for *P. sweeti* (Woodburne, 1961; Martin, 1969; Shotwell, 1970). They are faintly striated, lack distinct crenulations, and thus more closely resemble *P. sweeti* from the Sand Draw fauna of Nebraska and Rexroad fauna of Kansas (Woodburne, 1961) than *P. idahoensis* from the Jackass Butte locality of the Grand View fauna (Shotwell, 1970). The latter possesses distinctly crenulated incisors characteristic of *Castoroides*.

Greatest width of the lower incisor is 14.0 millimeters. Since the uppers are clearly a matched pair, only the left was measured. The greatest width is 20.7 millimeters.

Martin (1969) reported the earliest known record of *Castoroides* from the Santa Fe River 1B Blancan deposit of Florida, and postulated a *Procastoroides* ancestry for *Castoroides*. Martin (1969, p. 1039) also considered a theory mentioned by Woodburne (pers. comm.) that

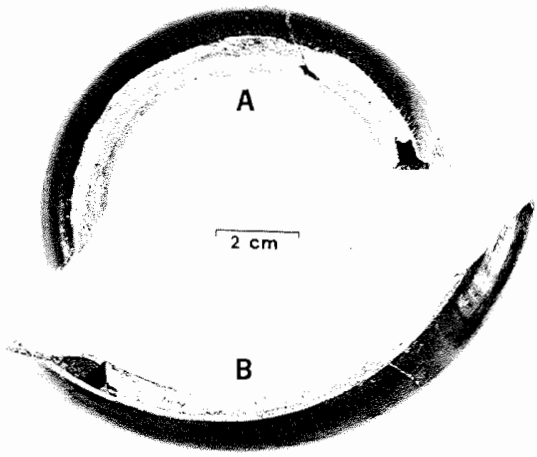

Figure 3. *Procastoroides* cf *P. sweeti*, SDSM 703. Upper left (A) and SDSM 704, lower right (B) incisors.

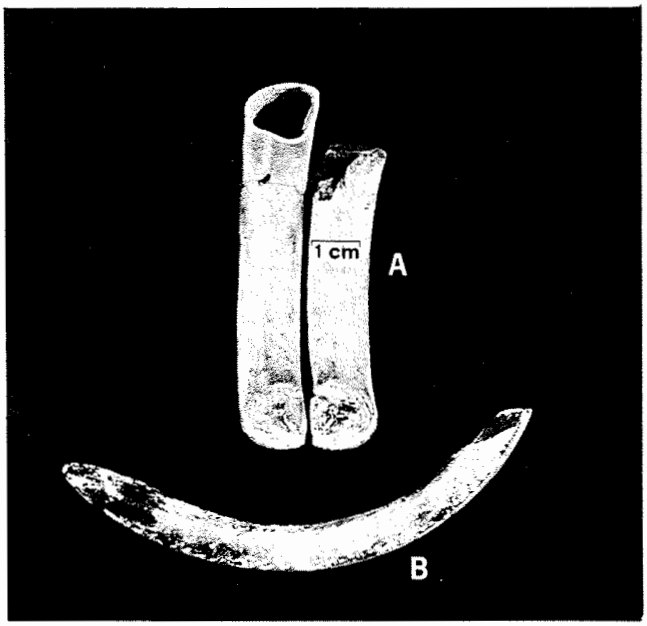

Figure 4. *Procastoroides* cf *P. sweeti*. SDSM 703. Internal, occlusal view (A) of upper incisors and lingual view (B) of lower right incisor.

" . . . . *Procastoroides* evolved from an earlier, unknown ancestor which ultimately gave rise to *Castoroides* . . .". Considering that *Procastoroides idahoensis* from the Grand View fauna is of Blancan age (exact correlation unknown; see Bjork, 1970) and that *P. idahoensis* has crenulated incisors, it seems probable that *Procastoroides* gave rise directly to *Castoroides.* Although it is conceivable that a single population of *P. idahoensis* gave rise to *Castoroides,* it is also conceivable that crenulated incisors developed independently throughout the range of *Procastoroides* during Blancan time. A multiple origin of one extinct mammalian species from another has been suggested recently (Coon, 1962; Freudenthal, 1965; Martin, 1970), and is compatible with the fossil evidence.

Order Carnivora
Family Felidae
Subfamily Machairodontinae
Tribe Homotheriini
cf *Ischyrosmilus* sp. Merriam

Specimens examined: AMNH 95297, skull; SDSM 706, posterior half of a left metatarsal (Figs. 5, 6, and 7).

Remarks: Perhaps the most outstanding specimen in the Delmont collecton is the skull of a homotheriine machairodont. Since this skull is now being studied by C. H. Cain (Fairleigh Dickinson University), and since further reconstruction is being accomplished at the American Museum of Natural History, only perfunctory notes will be provided here. Although part of the orbital series and delicate portions of the palate have been destroyed, the skull is in excellent condition and virtually all major contacts between broken pieces are intact.

The canines alone characterize this skull as that of a scimitar cat. They are serrated both anteriorly and posteriorly, are laterally compressed, and taper immediately to fine tips (Fig. 5).

A further indication of probable homothere affinity is the vestigial protocone on P^4 (Fig. 6). However, unlike *Homotherium* (*Dinobastis*), the tiny protocone retains a well-developed root (Fig. 7). In general, these are features shared also by a number of early Pleistocene Old World genera and *Ischyrosmilus johnstoni* (Mawby, 1965) from the Cita Canyon (Blancan) deposit of Texas. Further study of some unusual features will determine the proper relationships of this specimen, but whatever the results, the skull is undoubtedly the best preserved of its evolutionary grade in North America.

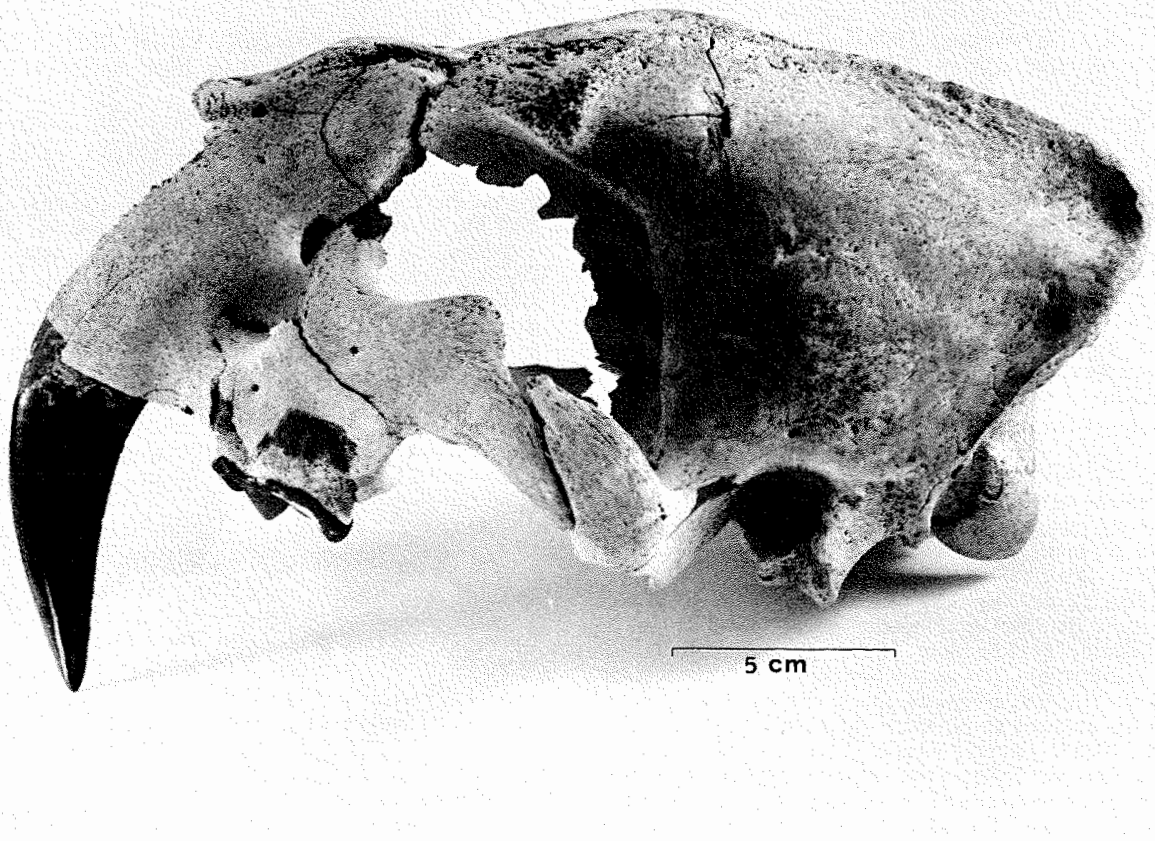

Figure 5. cf *Ischyrosmilus.* AMNH 95297, left lateral view of skull.

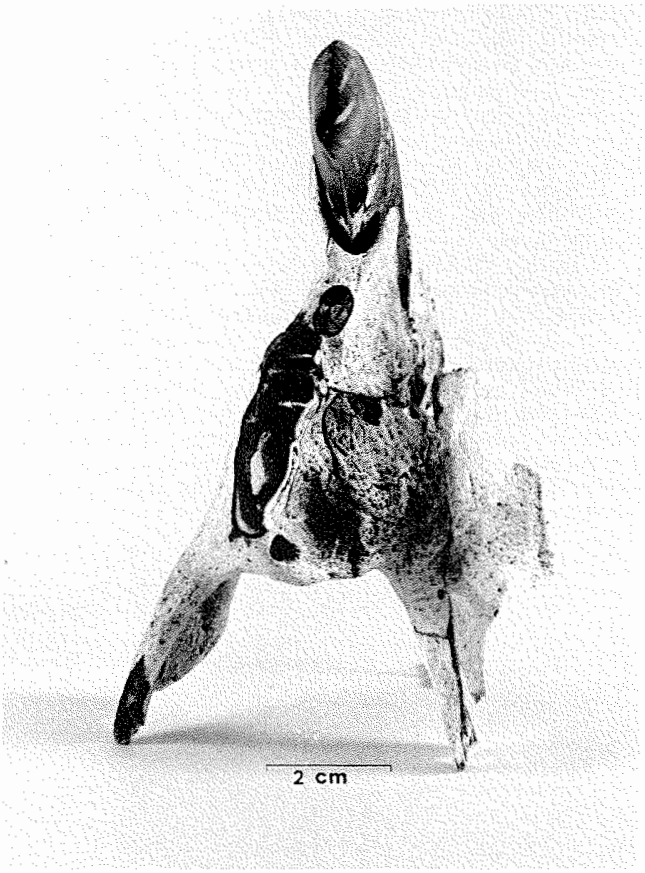

Figure 6. cf *Ischyrosmilus*. AMNH 95297. Right facial region of skull, ventral view. Note vestigial protocone on carnassial.

Figure 7. cf *Ischyrosmilus*. AMNH 95297. Left facial region of skull, lingual view. Note well developed root below protocone of carnassial.

Order Perissodactyla
Family Equidae
Equus (*?Dolichohippus*) sp.

Specimens examined: SDSM C-160, plaster casts of nine teeth: six upper permanent cheek teeth, two deciduous premolars, and one lower premolar (Fig. 8). The original specimens were returned to the Hieb family.

Remarks: We have reviewed the literature on Blancan equid remains, and cannot find a sure way to differentiate zebrines from caballines in certain areas of the country during the time in which caballines were evolving from their zebrine ancestors. We follow Hibbard (1972) in synonymizing *Plesippus* under *Dolichohippus*. Larger samples from the Delmont quarry would certainly have proved helpful, as the one lower premolar available (Fig. 8) demonstrates the round metastylid and metaconid of *Dolichohippus*, but possesses the U-shaped intermediate valley which appears to be more diagnostic of caballines (McGrew, 1944). Upper molars (Fig. 8) are equally enigmatic, ranging from quite complex types to those which cannot be separated from any typical Blancan *Dolichohippus* (*e.g.; D. idahoensis, D. shoshonensis, D. simplicidens*). It is further conceivable that more than one species is represented in the Delmont local fauna collections.

Considering the probable Blancan age of the fauna and the great amount of individual variation in Blancan zebrines, the authors tentatively refer the equid teeth to *Dolichohippus*. The following measurements were taken from the casts. Length (anterior-posterior) of six upper permanent cheek teeth ranged from 26.9 to 33.3 millimeters (mean 30.0 millimeters). Width ranged from 27.9 to 36.2 millimeters (mean 33.4 millimeters). Length of two upper deciduous premolars averaged 35.9 millimeters (35.6 to 36.2 millimeters range); width 30.5 millimeters (30.2 to 30.7 millimeters range). The single lower premolar (P_3 or P_4) measured 29.4 millimeters long by 19.0 millimeters wide.

Order Artiodactyla
Family Camelidae
Titanotylopus sp.

Specimens examined: SDSM 701; broken left mandible with P_4 to M_3 present. The alveolus for P_3 is present, and the coronoid, condyloid, and angular processes are all well preserved (Figs. 9, 10, and 11).

Remarks: Large Blancan camels are almost as difficult to identify as are horses, but review of the literature and personal observations of a cast of SDSM 701 by S. David Webb of the Florida State Museum, University of Florida, has firmly established the generic identity of this camel.

Characters which lead the authors and Dr. Webb to the conclusion that SDSM 701 represents *Titanotylopus* are as follows:

1) large size (rules out *Tanupolama*).
2) presence of P_3 (rules out *Camelops*).
3) P_4 with a broad, flat anterior face with an appression facet produced by P_3.
4) P_4 with a distinct posterior lobe (rules out *Camelops*).
5) Coronoid process short and blunt. According to Dr. Webb (pers. comm.) "This feature correlates well with the low, little flexed, cranium, and is therefore of considerable significance." We assume that this feature is at least one effective method for separation of *Titanotylopus* from *Megatylopus*.
6) Although the dentition is well-worn, the molars show strong stylids (generally rules out *Megatylopus*).

Further characters which allow a positive generic identification may be found in Hibbard and Riggs (1949) and Webb (1967). The only character which is supposedly limited to *Titanotylopus*, but which is not present in SDSM 701, is a distinct inflection of the angular process. However, Webb (pers. comm.) has recently informed us that he does not consider this as a critical feature.

Measurements of the Delmont *Titanotylopus* are found in Table 1.

Tanupolama sp.

Specimens examined: SDSM 707; two phalanges and a calaneum (Fig. 12).

Remarks: The small size of the specimens (Table 1) rules out reference to *Titanotylopus*, and the form of these elements is decidedly characteristic of *Tanupolama*. There are numerous Blancan and Irvingtonian species of this genus; thus without more material a species allocation is impossible.

Table 1. Measurements of mandibular and post-cranial elements of *Titanotylopus* and *Tanupolama* from the Delmont local fauna.

Titanotylopus (mandible	SDSM 701)
alveolar length (P_4-M_3)	177 mm
tooth row (P_4-M_3)	172
length P_4	28.5
width P_4	17.1
length M_1	40.3
width M_1	25.5
length M_2	46.6
width M_2	28.0
length M_3	58.5
width M_3	22.4
Tanupolama (calcaneum	SDSM 707)
greatest length	119.7 mm
greatest width	52.8
Tanupolama (phalanges	SDSM 707)
greatest length	90.2 mm
	96.3
greatest width, proximal end	28.7
	29.3
distal end	22.1
	24.3
medial shaft width	14.9
	17.0
medial shaft depth	19.1
	19.1

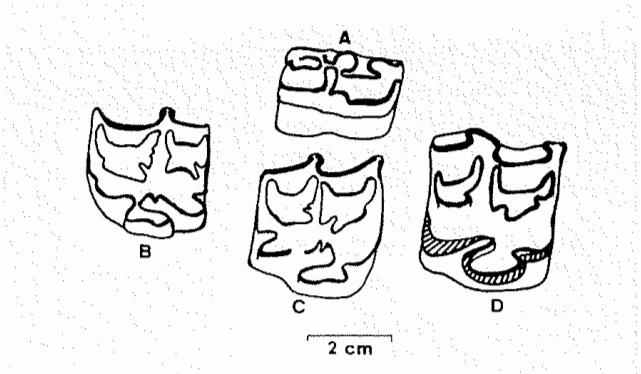

Figure 8. *Equus* (*?Dolichohippus*). SDSM C-160. Lower premolar (A) and three upper cheek teeth (B,C,D).

Family Cervidae

Cervidae; gen. and sp. indeterminate

Specimens examined: SDSM 702; basal portion of an antler (Fig. 13).

Remarks: The authors cannot find anything diagnotic on the antler fragment. The rugose nature of the base does not appear characteristic of extant American cervids, but *Palaeodocoileus* antlers as pictured by Frick (1937) are certainly quite rugose, and reference to *Sangamona* cannot be ruled out.

Order Proboscidea

Family Gomphotheriidae

Stegomastodon sp.

Remarks: A fragmentary molar of a proboscidean was examined by the junior author when the Delmont specimens were present for study at the South Dakota School of Mines and Technology. This tooth was returned to the Hieb family some years ago and a cast is not available for further examination. However, allocation to the Gomphotheriidae is secure, and the nature of the fossil record suggests that reference to *Stegomastodon* is highly probable. Since three species of *Stegomastodon* are presently recognized (Woodburne, 1961) a species allocation was not attempted.

DISCUSSION

The paucity of the large mammalian remains and the absence of a microfauna disallows precise correlation of the Delmont local fauna at this time. The Java local fauna of northern South Dakota (Martin, 1973a, b), relegated to late early Pleistocene time may eventually aid in interpretation, but this fauna is almost exclusively a microfauna and has no genera or species in common with the Delmont fauna.

Yet the presence of *Procastoroides*, *Ischyrosmilus*, *Dolichohippus*, *Titanotylopus*, and *Stegomastodon* suggest a time range of late Pliocene (early Blancan) through earliest middle Pleistocene (early Irvingtonian). On the basis of the fossil record of these genera (Hibbard *et al.*, 1965) and on the basis of correlation of some of the faunas which contain these genera (Bjork, 1970) the Delmont local fauna appears to fit best in Blancan time.

The impoverished nature of the collection indicates that we cannot rely heavily upon negative evidence for correlative purposes, but nonetheless 1) the absence of hipparionines from a fairly well represented collection of horse teeth and 2) the absence of any elements of typical large Hemphillian mammals such as the rhinos (*Aphelops*, *Teleoceras*) appears significant. The presence of *Procastoroides* is also indicative of a post-Hemphillian age. Although *Dipoides* species are encountered with

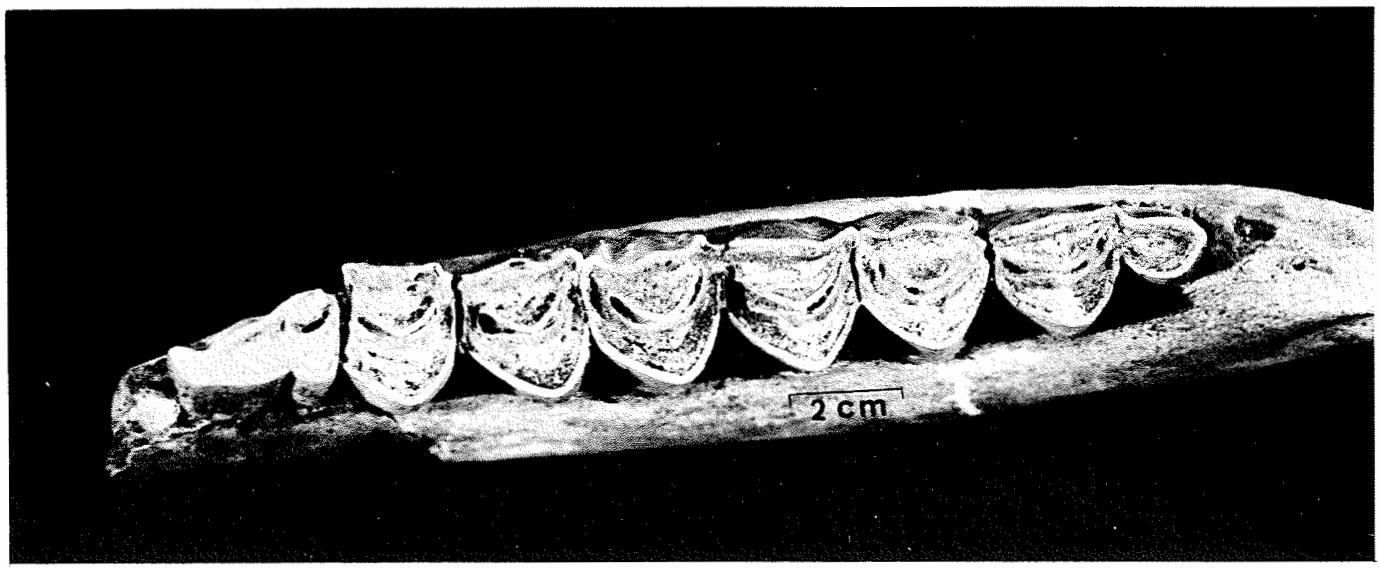

Figure 9. *Titanotylopus*. SDSM 701. Occlusal view of partial left mandible with P_4-M_3. Note alveolus for P_3.

Procastoroides in Blancan faunas (Hibbard *et al.*, 1965), the latter genus has not been recorded from faunas of Hemphillian age. The standard Hemphillian beavers are species of *Dipoides* (Shotwell, 1955; Martin, 1969). Further some of the equid teeth, although probably primarily *Dolichohippus*, appear to be considerably advanced in crown patterns; so much so that reference of a few of the teeth to the subgenus *Equus* cannot be ruled out. These data, though suspect even to the authors, prompt us to suggest that it is highly unlikely that the Delmont local fauna is of Hemphillian age.

It may be slightly easier to rule out Irvingtonian time on the basis of new evidence regarding evolution within the *Procastoroides-Castoroides* line. As noted previously, *Castoroides* has been recovered from late Blancan beds (Martin, 1969) and the development of crenulated incisors in a large *Procastoroides* occurs in the (?) late Blancan Grand View fauna (Shotwell, 1970). Since the Delmont giant beaver is obviously a *Procastoroides* and lacks crenulated incisors, it could only be of Irvingtonian age if a relict population. We consider this quite improbable.

In conclusion, faunal and geological evidence points to a Blancan age for the Delmont local fauna. Without further vertebrate remains we cannot assign the fauna to either early or late Blancan time.

ACKNOWLEDGEMENTS

We thank Mr. Albert Hieb, Delmont, South Dakota, for his generosity in providing us with this most interesting fauna. We further acknowledge the helpful comments on this manuscript provided by Dr. Robert W. Wilson, South Dakota School of Mines and Technology. Dr. Richard Tedford of the American Museum of Natural History, New York allowed the senior author and Mr. Cristopher H. Cain to compare the Delmont felid with fossils in his care; particularly those of the Frick Collection. We further thank Dr. Tedford for his kind offer to reconstruct this specimen. Photographs of the Delmont cat were provided by Mr. R. Merritt Brown, Department of Biology, Fairleigh Dickinson University. This research was partially funded by NSF grant GB-29208 and a faculty research grant awarded to Dr. Martin by Fairleigh Dickinson University.

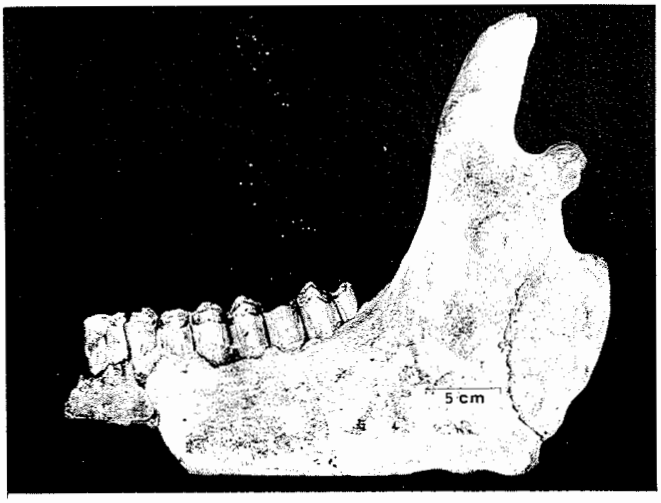

Figure 10. *Titanotylopus*. SDSM 701, labial view.

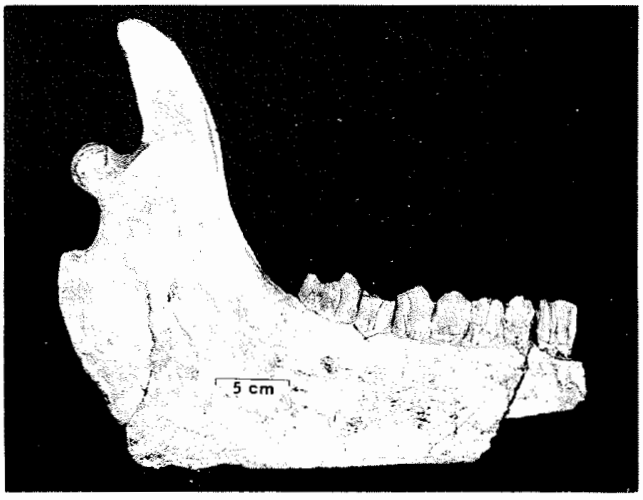

Figure 11. *Titanotylopus*. SDSM 701, lingual view.

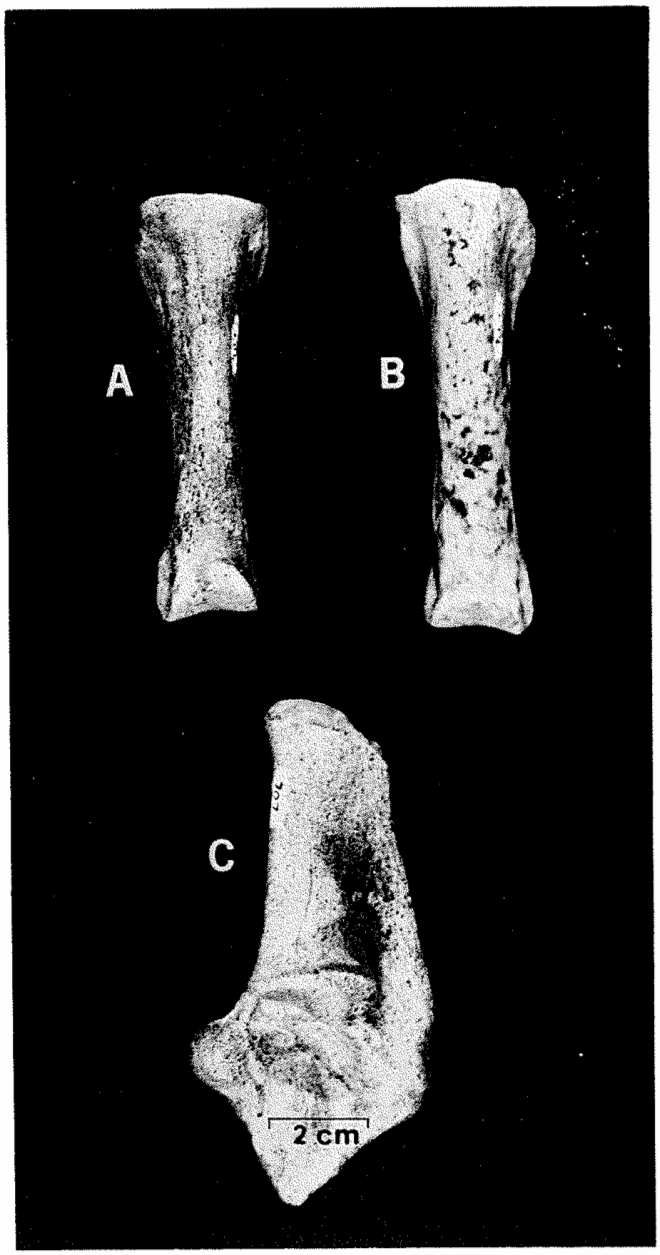

Figure 12. *Tanupolama*. SDSM 707. Phalanges (A,B) and calcaneum (C).

Figure 13. Cervidae. SDSM 702. Antler fragment.

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