

THE RACCOON (*PROCYON*) IN THE PLEISTOCENE OF  
NORTH AMERICA

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## ABSTRACT

Three fossil forms of raccoons (*Procyon priscus* Leidy, 1856, *P. simus* Gidley, 1906, and *P. nanus* Simpson, 1929) are considered synonyms of *P. lotor* (Linnaeus), the only species known from the Pleistocene of North America.

Localities from which fossil *Procyon* have been reported are mapped, along with unpublished records of the genus.

## I. INTRODUCTION

The earliest known *Procyon* is *P. rexroadensis* Hibbard, 1941, from the Rexroad formation, Meade Co., Kansas. Hibbard (1950; 1954) considers this Upper Pliocene, others (Moore, 1949; Leonard, 1950; Frye and Leonard, 1952) would assign this fauna to Lower Pleistocene. Another specimen (*Procyon* sp.) from Cita Canyon Locality

(Johnson and Savage, 1949) may be of a similar age (Moore, *op. cit.*), but again there is no general agreement as to the age of such Blancan faunas.

The remaining North American fossil records of the genus are clearly Pleistocene, and are accommodated under four specific names. Numerous deposits have yielded remains of the extant species, *P. lotor*. The other three, supposedly extinct fossil species are each known from a single specimen. Several references in paleontological literature are to Recent nominal species currently included in the synonymy of *P. lotor* (e.g., *P. psora* as used by Stock, 1918).

Throughout continental North America all Recent raccoons *Procyon* (*Procyon*) have been ascribed to *P. lotor* (Goldman, 1950; Hall and Kelson, 1959; Miller and Kellogg, 1955). The remaining five species of the

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subgenus are insular. The specific status of at least one of these forms, *P. maynardi* of the Bahamas, has been questioned (Koopman, *et al.*, 1957) and human introduction suspected (McKinley, 1959). Twenty-five subspecies of *P. lotor* are recognized (Hall and Kelson, *op. cit.*).

Considerable geographic variation in both size and color is evident in Recent *P. lotor*. Raccoons are largest in the colder, northern regions and smallest in the south, especially east of the Mississippi River. The largest are found in the Pacific northwest (Stains, 1956) the smallest in the Florida Keys. Stains (*op. cit.*) reports an unusually large female from Meade Co., Kansas, 1180 mm in total length; the mean total length of 4 adult females from the Florida Keys is 688 mm (660 mm-720 mm), only 58 percent of that of the Kansas specimen (Goldman, *op. cit.*). An average total skull length of 102 mm (100 mm-106 mm) of 5 individuals from the Florida Keys contrasts strongly with that of a specimen measuring 145 mm from Colusa Co., California (Goldman, *op. cit.*).

## II. MATERIALS

The holotypic material of *P. priscus* (Academy of Natural Sciences, Philadelphia—ANSP 11629 and 11630), *P. simus* (United States National Museum—USNM 2634), and *P. nanus* (American Museum of Natural History—AMNH 2329) were examined. Approximately 100 skulls of Recent *P. lotor* were examined, chiefly in the Recent mammal collections of the University of Florida (UF) and Tulane University (TU).

Florida and Louisiana *Procyon* fossils reported for the first time herein are deposited in the vertebrate paleontological collections of the University of Florida (UF-VP), Flor-

ida Geological Survey (FGS) and Tulane University (TU-VP).

The authors express their appreciation to the individuals in charge of these collections for permission to examine specimens in their care. Special thanks are due to Dr. Clayton E. Ray (United States National Museum) for suggestions and constructive criticism during the initial stage of this work at the Florida State Museum.

## III. DISCUSSION

Fossil remains of *Procyon* from the unglaciated area of northwestern Illinois near the town of Galena, Jo Daviess Co., were described by LeConte (1848) as a new species of raccoon, *P. priscus*.

The material upon which this form is based is cataloged in two lots that represent what appears to be the remains of a single animal. One lot (ANSP 11629) contains a left mandibular fragment with roots of  $M_3$ , a right posterior mandibular fragment (probably the posterior element of a corresponding anterior fragment in the second lot) and 15 elements consisting of five metatarsals and assorted fragments of long bones. The second lot (ANSP 11630) contains left  $P_3$ , right  $C^1$ , a left maxillary fragment containing  $P^4 - M^1$ , and the right anterior mandibular fragment (mentioned above) with  $C_1$  and  $P_4$ .

The original text of LeConte (*op. cit.*), an abstract of an apparently unpublished paper presented at a meeting of the Association of American Geologists and Naturalists the previous year (1847), reads as follows: "The author then alluded to a new species of raccoon, *Procyon priscus*, of which several teeth and phalanges have been procured. The differences between this and *P. lotor* are very minute and would not be intelligible

TABLE I.  
COMPARISON OF LENGTH AND WIDTH OF  $P^4$  AND  $M^1$  OF *P. PRISCUS* LEIDY 1856, TO THE SAME MEASUREMENTS IN RECENT *P. LOTOR*.

	$P^4$ (length x width) (4th upper molar of Leidy, 1856)	$M^1$ (length x width) (5th upper molar of Leidy, 1856)
<i>P. priscus</i>	9.2 x 9.1 mm	9.9 x 10.6 mm
<i>P. lotor ssp.</i> (TU 619)	9.2 x 9.3 mm	9.9 x 10.9 mm
<i>P. lotor megalodous</i> * (data from Lowery, 1943)	7.4 - 9.6 x 7.1 - 9.3 mm	7.9 - 10.2 x 8.4 - 10.3 mm

\* 39 specimens

without plates." This cannot be considered a diagnosis or description, and the name *Procyon priscus* is here a *nomen nudum*.

*Procyon priscus* enters zoological nomenclature when Leidy (1856) published illustrations of the fragments bearing teeth and commented that the molars were "... the same form as the corresponding teeth of *Procyon lotor*, but are about one sixth larger."

In a large series of *P. lotor* the size of the elements considered to be diagnostic of *P. priscus* may be matched (Table I). Similarly, the supposedly diagnostic characters of the mandibular teeth of *P. priscus* lie within the range of variation of a representative series of *P. lotor*.

Oelrich (1953) stated that *P. priscus* was probably not distinct from *P. lotor* but did not indicate that he had examined the type material and compared it with *P. lotor*. Our examination of the material indicates that *P. priscus* is conspecific with *P. lotor*.

Cranial fragments (USNM 2634) collected in "Cave Bear" Cave, McCloud River, California in 1881 were described by Gidley (1906) as an extinct species of raccoon, *P. simus*. The form was distinguished from Recent *P. lotor psora* of California on the massiveness of the lower jaws, the size of, and breadth between, the upper canines and the more squarely set incisors.

These are, however, essentially the characters of Recent *P. lotor excelsus* of northern California and adjacent Oregon and Nevada. Most of the characters of *P. simus* are concerned with the breadth of the rostrum and depth of the lower jaw, or measurements that are functions thereof, and fall within the range of *P. lotor*, especially *P. lotor excelsus* (see Goldman, 1950; especially plates 6A, p. 117, and 12A, p. 129). Whereas we do not mean to imply that *P. simus* is synonymous with this race (*P. lotor excelsus*), we do feel that the specimen in question is merely a large *P. lotor*.

The premolars are less crowded in smaller, southeastern *P. lotor* than in the holotype of *P. simus*, and the elongation of the mandible of *P. simus* is due chiefly to the distance between the  $P_2$  and  $C_1$ . The anteroposterior measurement of  $P_3 - M_2$  is but 33.5 mm, as compared to a mean total length of 34.0 mm (33.6-35.6 mm) for 10 specimens of *P. lotor megalodous*, a rather large-molared Recent raccoon from southern Louisiana.

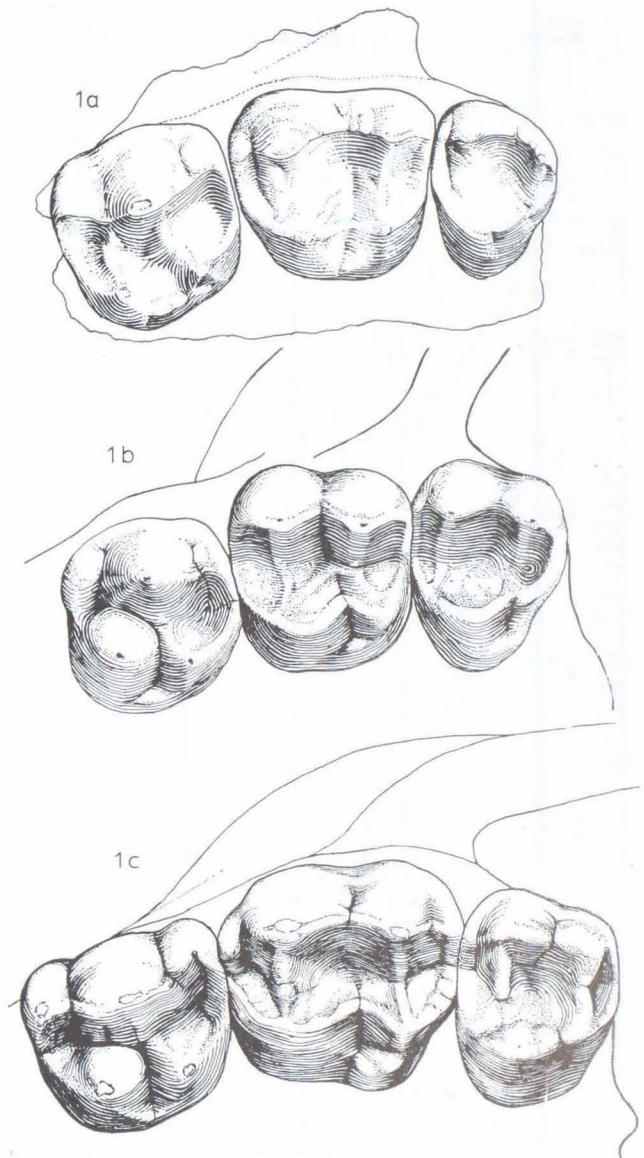


Figure 1a. Holotype of *P. nanus* Simpson 1929, (AMNH 23529) from Seminole Field, Pinellas Co., Fla. (2.6 x)

Figure 1b.  $P^4 - M^2$ , *P. lotor*, ad. ♂ (UF 1593), Big Pine Key, Fla. (2.6 x)

Figure 1c.  $P^4 - M^2$ , *P. lotor*, ad. ♂ (UF 1915), North Key Largo, Fla. (2.6 x)

Similarly, the second molars, upper and lower, are not relatively larger than are those in some races of *P. lotor*.

Simpson (1929) described a new species of raccoon, *P. nanus*, on the basis of a fragmentary maxilla (AMNH 2329) with three teeth ( $P^4 - M^2$ ) from Seminole Field, Pinellas Co., Florida. This new form was distinguished from *P. lotor* on the basis of the  $P^4 - M^2$  length, the length-width ratios of the two molars and the vestigial nature of the postero-external cusp of the last premolar.

Examination of a large series of Recent *P. lotor* from Florida and of other *Procyon* specimens from the same deposit (referred to *P. lotor* by Simpson, *op. cit.*) reveals that

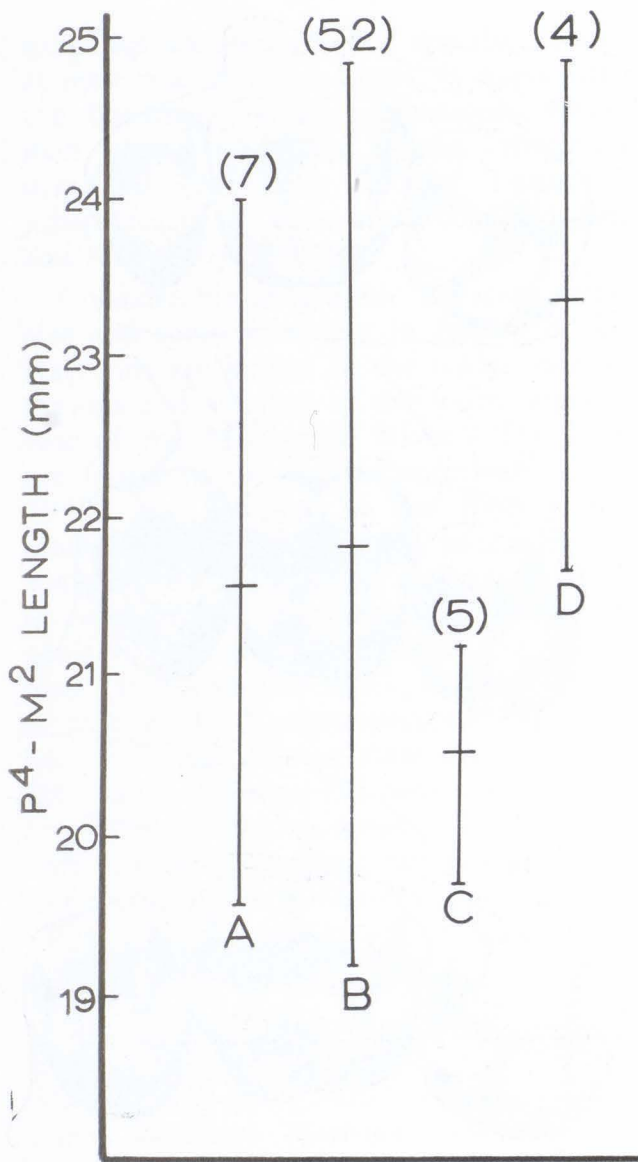


Figure 2.  $P^4 - M^2$  length in *Procyon*: A. Pleistocene *Procyon* from Seminole Field, Pinellas Co., Florida; B. Recent *P. lotor* from Florida (several subspecies included); C. *P. lotor incautus*, Florida, Monroe Co., Big Pine Key; D. *P. lotor marinus*, Florida, Collier Co. (Number of specimens examined in parentheses).

the specimen in question is a small *P. lotor*. The holotype of *P. nanus* (the only specimen referred to this species) is a strikingly small specimen (Fig. 1a). Simpson (*op. cit.*) recorded a  $P^4 - M^2$  length of 19 mm: our measurement of the specimen is 19.6 mm, and was taken in the same manner on all Recent specimens examined. We did not include very young individuals of *P. lotor* in our comparative series, as the alignment of the molariform series is different (more lingually convex) and measurements so taken are not directly comparable to those of older, longer-snouted animals. The smallest Recent individuals (two) encountered

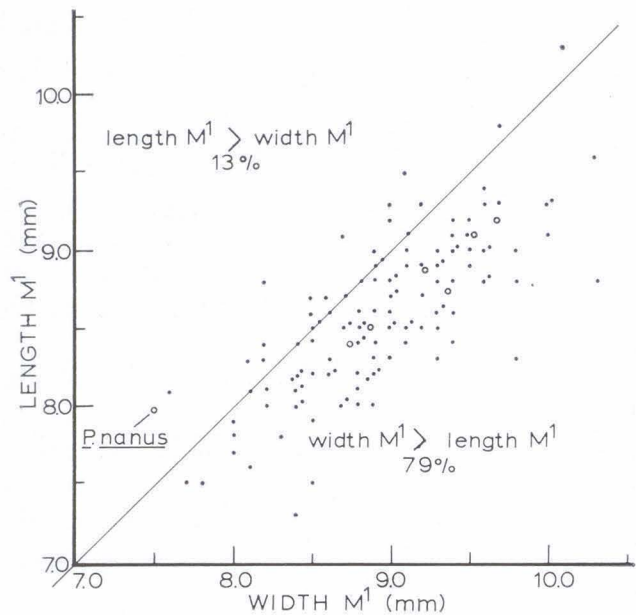


Figure 3. Comparison of length  $M^1$ /width  $M^1$  in 120 specimens of Recent *P. lotor* to the same ratio for Pleistocene specimens (open circles) from Seminole Field, Pinellas Co., Florida.

measured 19.2 mm, the largest, 24.8 mm; 29% greater than the smallest specimens.

Six of the referred *P. lotor* from Seminole Field are represented by maxillary fragments bearing  $P^4 - M^2$ . Grouping these specimens with the holotype of *P. nanus* reveals that the Seminole Field population corresponds closely with a large Recent series from Florida (Fig. 2). Small samples of two of the six recognized Recent races of *P. lotor* are more distinct from one another in this character than is the fossil form when compared to any of the modern races.

The fact that  $M^1$  of *P. nanus* is longer than broad was given as a diagnostic character of the species. Generally  $M^1$  of *P. lotor* is not as long as broad, but this is not the case in all specimens. Combining data on Louisiana specimens (Lowery, 1943) with our measurements of Florida specimens, we find that in 13% (of 120 Recent animals)  $M^1$  is longer than broad (Fig. 3). The ratio (length  $M^1$ /width  $M^1$ ) for 120 Recent specimens of *P. lotor* is 0.85-1.07, mean 0.96. The same ratio for 7 *Procyon* specimens from Seminole Field (including the holotype of *P. nanus*) is 0.93-1.07, mean 0.96. The holotype of *P. nanus* is the only Seminole Field specimen in which  $M^1$  is longer than broad.

The  $M^2$  of the holotype of *P. nanus* is relatively small and narrow, but in this char-

acter is more like many specimens of *P. lotor* than are other specimens of *P. lotor* (Fig. 1b and c). The reduction of  $M^2$  is most often evident in series of the small

insular raccoons from the Florida Keys (e.g., *P. lotor incautus*).

All of the characters on which *P. nanus* was distinguished from *P. lotor* can be

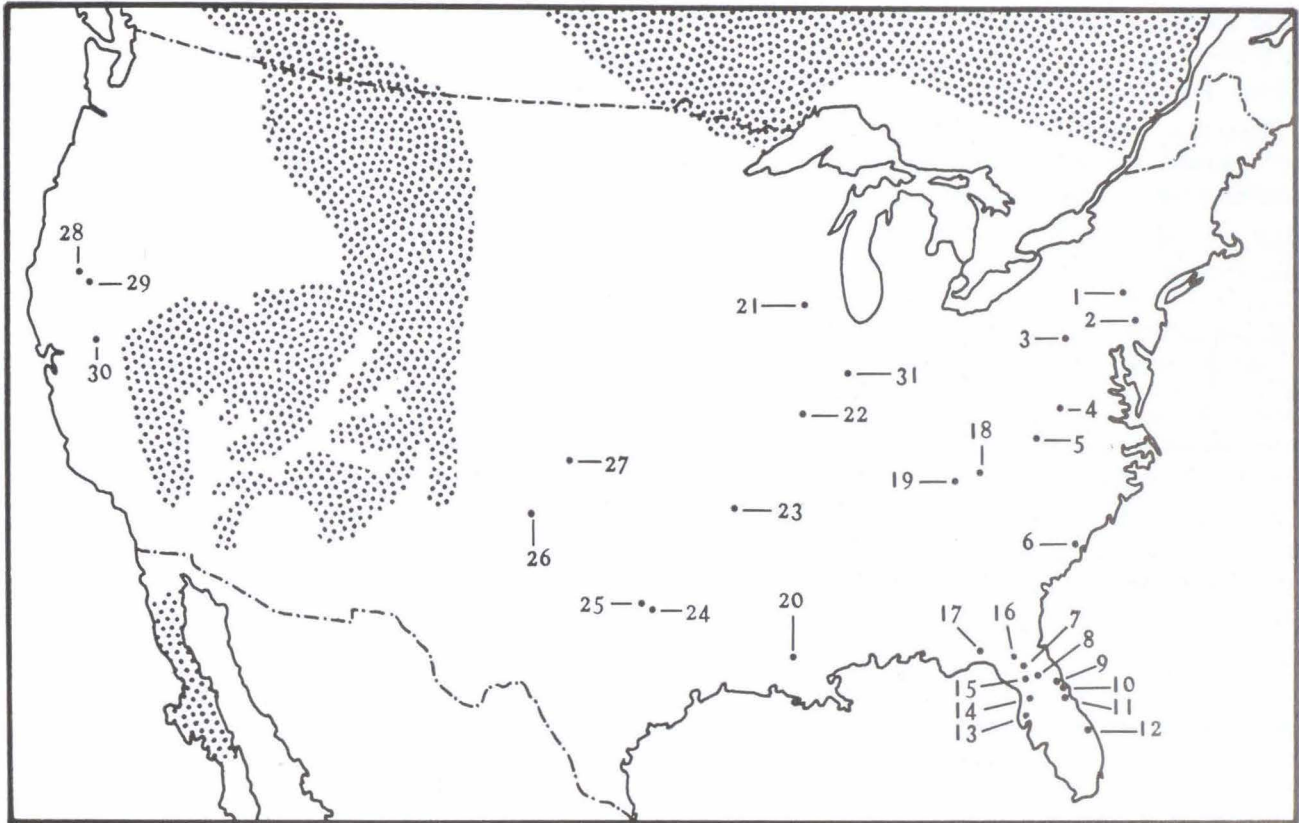


Figure 4. Localities from which fossil *Procyon* have been reported. Citations may be to major bibliographic sources (e.g., Hay, 1923, or Ray, 1957), or to the original reports. Areas in which *Procyon* is not found presently are shaded (after Hall and Kelson, 1959).

- 1) Pennsylvania, Monroe Co., Crystal Hill Cave (Hay, 1923)
- 2) Pennsylvania, Bucks Co., Durlam Cave (Hay, 1923)
- 3) Pennsylvania, Bedford Co. (Guilday and Bender, 1958)
- 4) Virginia, Augusta Co., Natural Chimneys (Guilday, 1962)
- 5) Virginia, Wythe Co. (Hay, 1923)
- 6) South Carolina, Ashley River (Hay, 1923)
- 7) Florida, Alachua Co., Haile XHIA (this report)
- 8) Florida, Marion Co., Reddick (this report)
- 9) Florida, Brevard Co., Merritt Island (this report)
- 10) Florida, Brevard Co., South Indian Field (Ray, 1957)
- 11) Florida, Brevard Co., Melbourne (Ray, 1958)
- 12) Florida, Indian River Co., Vero Beach (Ray, 1957)
- 13) Florida, Pinellas Co., Seminole Field (Simpson, 1929)
- 14) Florida, Citrus Co., Bone Cave (this report)
- 15) Florida, Levy Co., Devil's Den (this report)
- 16) Florida, Columbia Co., Itchtucknee River (this report)
- 17) Florida, Wakulla Co., Wakulla Spring (this report)
- 18) Tennessee, Hamblen Co. (Cahn, 1939)
- 19) Tennessee, Anderson Co. (Cahn, 1939)
- 20) Louisiana, West Feliciana Parish, Kimball Creek (this report)
- 21) Illinois, Jo Daviess Co., Galena (Le Conte, 1848)
- 22) Missouri, St. Louis Co., St. Louis (Simpson, 1949)
- 23) Arkansas, Newton Co., Conard Fissure (Brown, 1908)
- 24) Texas, Dallas Co., Trinity River (Slaughter, et al., 1962)
- 25) Texas, Denton Co., Clear Creek (Slaughter and Ritchie, 1963)
- 26) Texas, Cita Canyon Locality (Johnson and Savage, 1955)
- 27) Kansas, Meade Co., Rexroad formation (Hibbard, 1941)
- 28) California, Shasta Co., Samuel Cave (Stock, 1918)
- 29) California, Shasta Co. (?), Cave Bear Cave on McCloud River (Gidley, 1906)
- 30) California, Eldorado Co., Hawver Cave (Stock, 1918)
- 31) Illinois, Coles Co. (Galbreath, 1938)

matched within moderate series of the latter (Fig. 1a, b, c), and we have been unable to discover other distinguishing characters. Thus we consider the two to be conspecific.

All other specifically identifiable Pleistocene *Procyon* remains have been referred to *P. lotor*, and are included in at least 20 published Pleistocene faunal lists and probably others not listed here (Fig. 4). Previously unreported records (catalog number or disposition of at least one representative specimen in parentheses) are: Florida, Marion Co., Reddick<sup>1</sup> (UF 8814); Florida, Levy Co., Devil's Den<sup>2</sup> (UF uncatalogued); Florida, Columbia Co., Itchtucknee River, Tributary Locality (UF 2731); Florida, Alachua Co., Haile XIA (UF 3501); Florida, Brevard Co., Merritt Island (UF uncatalogued—Accession Number 50); Florida, Citrus Co., Bone Cave (UF uncatalogued); Florida, Wakulla Co., Wakulla Spring (FGS V-4807a); Louisiana, West Feliciana Parish, Kimball Creek, tributary of Little Bayou Sara (TU-VP uncatalogued).

Hibbard (1958) lists *P. lotor* only from the Wisconsin, although specimens are also reported from the Conard Fissure, Arkansas (Brown, 1908; Hay, 1924), which he considers to be Illinoian or Sangamon. Subsequently, Slaughter, *et al.* (1962) and Slaughter and Ritchie (1963) report *P. lotor* from two Sangamon deposits in Texas. Most of the remaining records are from cave, sink hole, spring and stream bed deposits generally considered to be late Pleistocene but not assigned to a particular stage (Fig. 4).

No fossil *P. lotor* have been recorded from areas outside of the modern range of the species (Fig. 4).

#### IV. CONCLUSION

The first known *Procyon* is *P. rexroadensis* from the upper Pliocene (according to Hibbard, 1941).

Three Pleistocene forms (*P. priscus* Leidy, 1856, *P. simus* Gidley, 1906, and *P. nanus* Simpson, 1929) are included in the synonymy of *P. lotor* (Linnaeus). All North American Pleistocene records of *Procyon* are to this species. The degree of variation in Pleistocene raccoons seems comparable to that observed in the modern animals.

<sup>1</sup> A paper, recently received, by Gut and Ray (1963) also cites this locality.

<sup>2</sup> This, as well as Itchtucknee and Wakulla, should be referred to as Quaternary.

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