Number 70 January 15, 1996

OCCASIONAL PAPERS OF THE
MUSEUM OF NATURAL SCIENCE

LOUISIANA STATE UNIVERSITY

BATON ROUGE, LOUISIANA 70803

A MIOCENE HEDGEHOG (MAMMALIA: ERINACEIDAE) FROM FORT POLK IN WESTERN LOUISIANA

By Judith A. Schiebout[1]

Exposures of the Castor Creek member of the Fleming Formation on Fort Polk, Vernon Parish, Louisiana (Fig. 1), have yielded a single tooth of a hedgehog as part of a Miocene fauna, including eight orders of mammals, recovered since 1993 through surface search and bulk screening. Only a single Miocene mammalian fossil, a gomphothere mandible fragment, had been reported from Louisiana before the discovery of this fauna, and although the collection locality for that specimen is uncertain, it could have come from the Castor Creek member on Fort Polk (Arata, 1966). The member is 92 m (300 ft) thick at Fort Polk, where its outcrops are 10-13 km (6-8 mi) wide (Rogers and Callandro, 1965). The fossiliferous exposures are fluvial, and most small vertebrates have been recovered from conglomerates formed when soil-formed calcium carbonate nodules were concentrated in small streams or gullies on the Miocene floodplain (Schiebout, 1994; Jones *et al.*, 1995). Small animal specimens, mainly individual teeth and bones, are recovered in a bulk-screening program in which 10% acetic acid is used to disaggregate the conglomerate.

Preliminary study of the fauna indicates an early late Barstovian age (Schiebout, 1994), and that it is most similar to the Cold Spring local fauna in the Texas coastal plain sequence of Miocene faunas (Wilson, 1956; Tedford *et al.*, 1987). Small mammals recovered, in addition to the hedgehog, include six species of rodent, a shrew, and a bat. Large mammal remains include a fragment of gomphothere tooth, and specimens of *Prosynthetoceras francisi*

[1] Museum of Natural Science, 119 Foster Hall, Louisiana State University, Baton Rouge, LA 70803

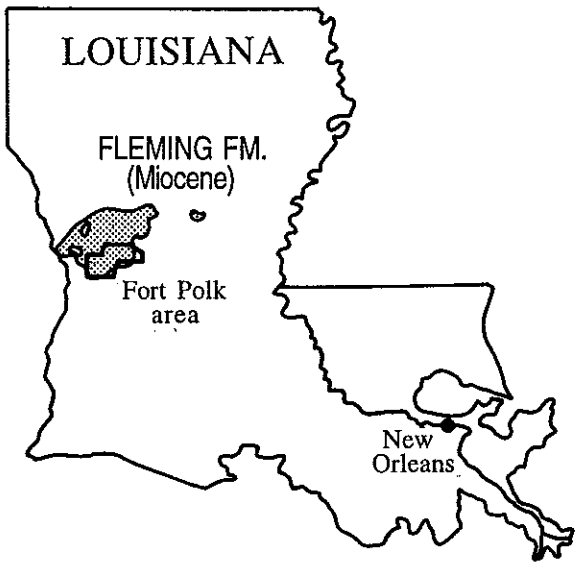

Figure 1. Location of Fort Polk and outcrops of the Fleming Formation in Louisiana. Modified from Jones et al. (1995).

and a merychippine horse. Lower vertebrate material includes gar, catfish, alligator, snake, and lizard remains.

Figure 2 illustrates taxonomic distribution of the 347 mammalian molar teeth from TVOR site, which yielded the hedgehog. TVOR, the most productive of the five Fort Polk Miocene sites from which conglomerates have been acid-treated and screened, was named after a nearby terminal very-high frequency (VHF) omni-range radar tower. A total of 506 mammalian molar teeth have been recovered from all five sites. Rodentia make up 97.8% of the Fort Polk Miocene small mammal fauna, Insectivora (mainly shrews) make up 1.8%, and Chiroptera make up 0.4%. The total material processed so far is approximately 2.5 tons (2, 268 kg).

The hedgehog, known from a single molar, is one of the rarest mammals in the Fort Polk Miocene small mammal fauna. Shaw (1964) calculated the total number of specimens which must be identified in a sample so that there will be a 0.99 probability that one or more individuals of a given species will be found, assuming that that species makes up a particular percentage of the fossil assemblage. If a species comprises 2% of the fossil population, a total of 228 specimens would yield at least one specimen of that species 99% of the time, and if it comprises 0.9% of the total, 510 specimens would yield the species 99% of the time. Therefore, hedgehogs could have comprised 2% or

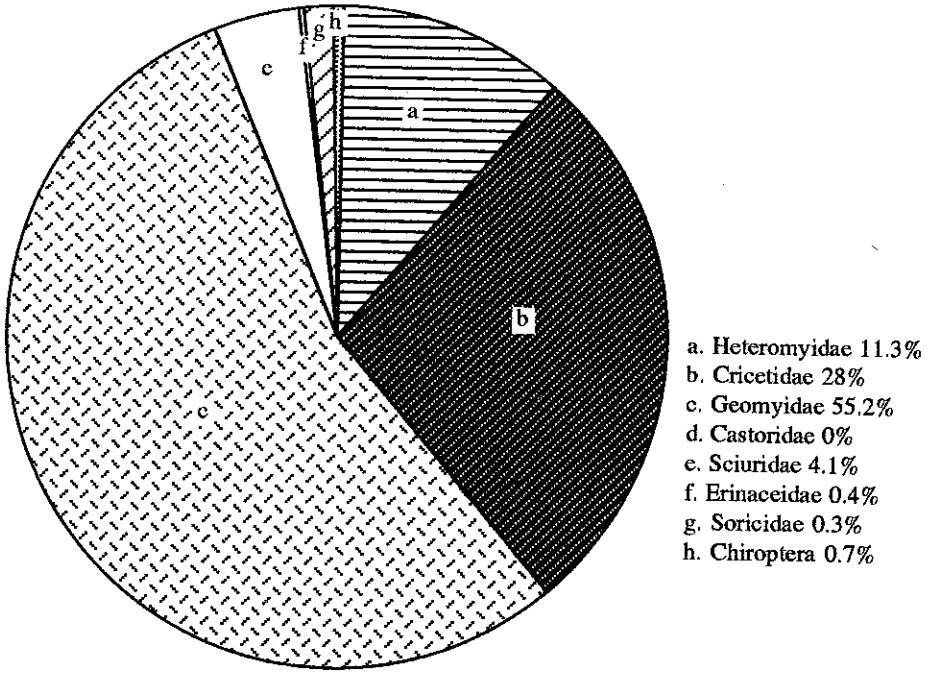

Figure 2. Taxonomic distribution of mammalian molar teeth recovered from acid treatment and screening at TVOR site, Fort Polk Miocene, as of September 1995.

less of the actual fossil population and the living Miocene small mammals in the region.

Rationale for the taxonomic placement of the Fort Polk hedgehog is outlined in the discussion below. I have elected to use the terminology and characters outlined in the last major relevant revision (Rich, 1981) for these discussions. However, preliminary results by Gina G. Gould (1995, pers. comm.) suggest that dental morphology may have no phylogenetic signal at the species- or generic-level among the Erinaceidae. In addition, Gould's revision will probably result in considerable redefinition of taxa and possibly preclude recognition of a genus or species on the basis of a loose tooth like the Fort Polk Miocene specimen. However, her work is unfinished and much remains to be published in addition to Gould (1995), in which dental characters such as the size of cusps or presence or absence of cuspules were not discussed. Gould (1995, pers. comm) agrees that the specimen under discussion herein is a brachyerine hedgehog.

In this discussion, institutional abbreviations are as follows: LSUMG, Louisiana State University Museum of Geoscience (a division of the LSU

Museum of Natural Science); and F:AM, Frick Collection of the American Museum of Natural History.

Family ERINACEIDAE

Subfamily BRACHYERICINAE

BRACHYERIX Matthew 1933 (in Matthew and Mook 1933)

BRACHYERIX cf. *B. INCERTIS* Rich and Rich, 1971

Figure 3

REFERRED SPECIMEN.-- LSUMG 3380, R M1.

LOCALITY.--TVOR site, Fort Polk, Vernon Parish, Louisiana, from the Castor Creek Member of the Fleming Formation.

DESCRIPTION.--LSUMG 3380, R M1 is a moderately worn, roughly quadrate tooth with anterior, posterior, and labial sides convex and lingual side concave. The tooth has four principal cusps (the metacone being the most prominent), a very faint protoconule and a faint metaconule, a prominent anterior cingulum which connects the anterolabial corner and the anterolingual side of the protocone, a posterior cingulum that is well developed except across the posterior faces of the hypocone and metacone, and a lingual cingulum that is absent across the lingual faces of the cusps. There is no ectocingulum, but this edge appears to have undergone some breakage and/or erosion. A very small cuspule lies between the labial end of the anterior cingulum and a small cusp at the posterolabial end of a low, indistinct paracrista. Cristae from the protocone and hypocone merge lingual to the small metaconule and are confluent with the postmetaconule crista which connects the metaconule and metacone. Wear is strong on the top of the paracone and the anterolabial side of the protocone, forming a comma-shaped wear surface along the crista, with the comma head being the protocone. Enamel is also worn thin along the metastyle. The paracone and protocone are very close to exactly anterior to the metacone and hypocone, respectively. The lingual roots are fused for the 0.7 mm from the crown to where broken off.

DISCUSSION.--Hedgehogs belong to the Family Erinaceidae, which contains four subfamilies: the Tupaiodontinae, Erinaceinae, Galericinae, and Brachyericinae (Gould, 1995). Modern forms are found in Asia, Europe, and Africa and are members of the Erinaceinae and the Galericinae (Rich, 1981; Gould, 1995). The Erinaceinae are also found in the North American fossil record from approximately 23-10 million years ago (Rich and Rasmussen, 1973), and Miocene North American members of the Galericinae are known

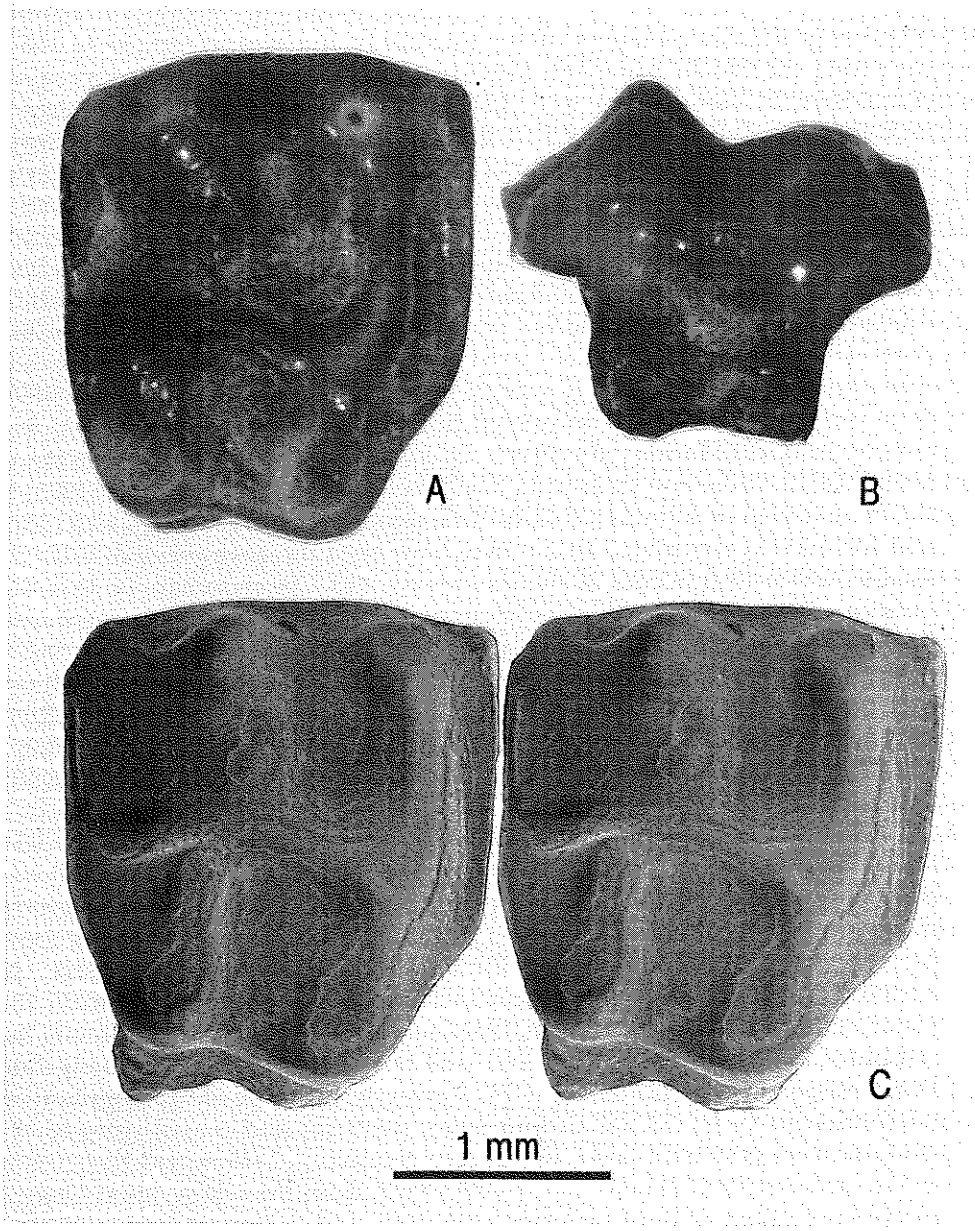

Figure 3. LSUMG 3380, *Brachyerix* cf. *B. incertis*, RM1, A. Crown view, B. Lingual View, C. Crown view stereopair. A and B are light microscopy and C stereopair are scanning electron micrographs. Scale=1 mm.

(Rich, 1981; Gould, 1995). The common name "hedgehog" is applied commonly also to members of the Subfamily Brachyericinae (Rich, 1981), including the North American Miocene genera, *Brachyerix* and *Metechinus* (considered by Gould, 1995, to be sister taxa), but this should not be taken as an indication that the lifestyles of these animals are hedgehog-like or even well understood. The Subfamily Brachyericinae in North America originated in the Hemingfordian and became extinct in the Clarendonian (Rich, 1981). It also includes two Eurasian genera, *Exallerix* and *Metaexallerix*, known only from fragmentary material such as teeth and jaws (Gould, 1995). In North America, no member of the Subfamily Brachyericinae has been reported from east of the Mississippi River or any part of the Gulf Coast (Rich, 1981). The only member of the Family Erinaceidae from this region is a single m2 reported by Rich and Patton (1975) from the Buda local fauna, recovered from a sinkhole near Buda in Alachua County in north Florida. *Brachyerix incertis*, known from the Barstovian of Nebraska, Nevada, and California, was discussed by Rich and Rich (1971) as the culmination of a lineage that became steadily smaller in body size. Rich and Rich (1971) speculated that it may have been the ancestor of *Metechinus amplior* which also occurs in the Barstovian and Clarendonian, or that this pattern of occurrence is ". . .an example of ecological displacement, one lineage becoming slowly smaller and conservatively retaining the ancestral basicranial condition and the other rapidly evolving into a larger form, *Metechinus*, with a radically modified basicranial region" (Rich and Rich, 1971, pp. 50-51). *Brachyerix incertis* and *Metechinus amplior* have overlapping geographic ranges, but they never occur at the same locality (Rich and Rich, 1971).

Size, low cusp height, and quadrate outline in crown view of the Fort Polk Miocene specimen suggest that the tooth is a hedgehog M1. Small size (see below) is the primary characteristic applicable to LSUMG 3380 among those used by Rich and Rich (1971) to separate the genus *Brachyerix* from *Metechinus* and from the fossil Eurasian hedgehog genus *Exallerix*. In addition, in *Metechinus* the postmetaconule crista is separated from the metaconule by a sharp notch (Rich, 1981) not seen in LSUMG 3380. Among the attributes that distinguish *Brachyerix* and the European Miocene hedgehog *Dimylechinus* are ". . . shortening of M1 metastyle; presence of M1 cingulum on buccal margin only, not on all four sides; posterior and buccal sides of M1 straight or slightly excavated, not deeply concave. . ." (Rich and Rich, 1971, p. 11). A *Metechinus amplior* M1, F:AM 74922, from the Observation Quarry in Nebraska, has a faint anterior cingulum and a lingual and posterior cingulum similar to those of LSUMG 3380, so the cingulum development should not be used as a basis for suppositions regarding particular European links for the Fort Polk Miocene hedgehog.

Differences of LSUMG 3380 from *Brachyerix*, as described by Rich and Rich (1971), are the presence of conules, which are very faint, and the fact that the metacone, and not the paracone, is the largest cusp. It may be that

when hedgehog tooth morphology is fully analyzed no characters observable on this M1 will be among the synapomorphies of particular brachyerine genera or species. However, at present there is no other reasonable candidate among known fossil hedgehog genera, so this specimen is here assigned to the most similar genus, *Brachyerix*.

LSUMG 3380 measures 2.09 mm in A-P diameter and 2.34 mm in transverse diameter, making it the smallest M1 of *Brachyerix* yet reported. The differences between the two species of *Brachyerix, B. macrotis* and the smaller *B. incertis*, in addition to size, are features of P3 (Rich and Rich, 1971), a tooth which is not yet available from the Fort Polk Miocene sites. Rich (1981) provided measurements for three *B. incertis* M1's, which have an A-P diameter of 2.1-2.5 mm and a transverse diameter of 2.6-2.9 mm. Storer (1975) described m2 and a broken M1 (A-P diameter 2.29 mm) of a small *Brachyerix*, ascribed to *Brachyerix* cf. *B. incertis*, from Saskatchewan. Although the M1 measurement was called unreliable by Storer (1975), it does suggest the presence of animals on the low side of the *B. incertis* size range, not much larger than LSUMG 3380.

According to Rich and Rich (1971), *Brachyerix* has a short face, auditory bullae extremely large, inflated, and completely ossified, with ". . .vessels and some nerves in tympanic cavity enclosed in bony tubes. . ." (Rich and Rich, 1971, pp. 2, 11), like the living hedgehog *Hemiechinus* (sensu Frost *et al.*, 1991). It may be that *Brachyerix's* ear morphology represents adaptations that in part control its distribution. Further study of the Fort Polk sites' paleoenvironment, and recovery of more specimens of *Brachyerix*, may shed light on what these adaptations are and how they relate to these particular sites. Many of the Fort Polk Miocene small rodents are smaller than previously described congeneric specimens, so the small size of LSUMG 3380 may be ascribed in part to some factor affecting many small mammals of the local environment. The fact that small *Brachyerix* occur in both Louisiana and Saskatchewan suggests that a north-south size gradient is unlikely.

ACKNOWLEDGMENTS

I wish to thank individuals at Fort Polk, especially Director of Public Works, Rory A. Salimbene, LTC, EN, and his environmental staff, including Dr. Charles Stagg, James Grafton, Bob Hays, and James Hennigan, for the help and cooperation which made this research possible. I appreciate being allowed to study specimens in the Frick Collection of AMNH. Xiaogang Xie took the scanning electron micrographs, assisted by Suyin Ting. Use of Dominique Homberger's photography equipment is appreciated. Timothy Dalbey, Louis Jacobs, S. David Webb, Walter Dalquest, Gina Gould, Ruth Hubert, and an anonymous reviewer provided helpful comments on the manuscript.

Work is currently supported by U. S. Army FORSCOM, on a contract administered and managed by Timothy S. Dalbey, Fort Worth District, U. S. Army Corps of Engineers, issued under Contract No. DACW64-94-D-0008, Delivery Order No. 006, entitled "Paleofaunal Field Survey, Collection, Processing, and Documentation at Two Locations on Fort Polk, Louisiana" to Prewitt and Associates, Inc. Parts of this discussion were presented in a report of the same title to the U. S. Army Corps of Engineers, submitted for review in August, 1995. Support has also been provided by the LSU Museum of Natural Science.

LITERATURE CITED

ARATA, A. A. 1966. A Tertiary proboscidian of Louisiana. Tulane Studies in Geol. (4): 73-74.

FROST, D. R., W. C. WOZENCRAFT, AND R. S. HOFFMAN. 1991. Phylogenetic relationships of hedgehogs and gymnures (Mammalia: Insectivora: Erinaceidae). Smithsonian Contrib. Geol. (515): 1-69.

GOULD, G. C. 1995. Hedgehog phylogeny (Mammalia, Erinaceidae)--the reciprocal illumination of the quick and the dead. Amer. Mus. Novitates (3131): 1-45.

JONES, M. H., J. A. SCHIEBOUT, AND J. T. KIRKOVA. 1995. Cores from the Miocene Castor Creek Member of the Fleming Formation, Fort Polk, Louisiana: relationship to the outcropping Miocene terrestrial vertebrate fossil-bearing beds. Gulf Coast Assoc. Geol. Soc. Trans. 65: 293-301.

MATTHEW, W. D., AND C. C. MOOK. 1933. New fossil mammals from the Deep River Beds of Montana. Amer. Mus. Novitates (601): 1-7.

NOVACEK, M. J. 1985. The Sespedectinae, a new subfamily of hedgehog-like insectivores. Amer. Mus. Novitates (2855): 1-24.

RICH, T. H. V. 1981. Origin and history of the Erinaceinae and Brachyericinae (Mammalia, Insectivora) in North America. Amer. Mus. Nat. Hist. Bull. 171: 1-116.

RICH, T. H. V., AND T. H. PATTON. 1975. First record of a fossil hedgehog from Florida (Erinaceidae, Mammalia). J. Mammalogy 56: 692-696.

RICH, T. H. V., AND P. V. RICH. 1971. *Brachyerix*, a Miocene hedgehog from western North America, with a description of the tympanic regions of *Paraechinus* and *Podogymnura*. Amer. Mus. Novitates (2477): 1-58.

RICH, T. H. V., AND D. L. RASMUSSEN. 1973. New North American Erinaceine hedgehogs (Mammalia: Insectivora). Occas. Papers Mus. Nat. Hist. Univ. Kansas (21): 1-54.

ROGERS J. E., AND A. J. CALLANDRO. 1965. Water resources of Vernon Parish, Louisiana. Dept. of Conservation, Louisiana Geol. Surv. and Louisiana Dept. of Public Works, Water Resources Bull. (26): 1-104.

SCHIEBOUT, J. A. 1994. Fossil vertebrates from the Castor Creek Member, Fleming Formation, western Louisiana. Gulf Coast Assoc. Geol. Soc. Trans. 44: 675-680.

SHAW, A. B. 1964. *Time in Stratigraphy*. McGraw-Hill, New York, NY.

STORER, J. E. 1975. Tertiary mammals of Saskatchewan, Part III: the Miocene fauna. Life Sciences Contrib., Royal Ontario Mus. (103): 1-134.

TEDFORD, R. H., M. F. SKINNER, R. W. FIELDS, J. M. RENSBERGER, D. P. WHISTLER, T. GALUSHA, B. E. TAYLOR, J. R. MACDONALD, AND S. D. WEBB. 1987. Faunal succession and biochronology of the Arikareean through Hemphillian interval (late Oligocene through earliest Pliocene Epochs) in North America. Pp. 153-210 *in* Woodburne, M. O. (ed.). *Cenozoic Mammals of North America*. Univ. California Press, Berkeley.

WILSON, J. A. 1956. Miocene formations and vertebrate biostratigraphic units, Texas coastal plain. Amer. Assoc. Petrol. Geol. Bull. 40: 2233-2246.

THE OCCASIONAL PAPERS OF THE MUSEUM OF NATURAL SCIENCE (formerly THE MUSEUM OF ZOOLOGY and MUSEUM OF GEOSCIENCE), LOUISIANA STATE UNIVERSITY, begun in 1938, is intended for shorter papers dealing with any aspect of neontological or paleontological animal ecology, systematics, or zoogeography, or with anthropology or archaeology. All manuscripts are subject to critical review by the Museum's editorial staff and by no fewer than two extramural specialists. Final acceptance is at the discretion of the Museum Director, or his agent, who serves as Editor.

Individuals may request separate issues directly from the author(s). Institutional libraries interested in exchanging publications should address the Secretary to the Director, Museum of Natural Science, Louisiana State University, Baton Rouge, LA 70803-3216.

Editor: David A. Good