PRELIMINARY CORRELATION OF FLORIDA AND CENTRAL GREAT PLAINS PLIOCENE AND PLEISTOCENE MAMMALIAN LOCAL FAUNAS BASED ON RODENT BIOSTRATIGRAPHY

Robert A. Martin

A preliminary attempt is made to correlate the late Pliocene and Pleistocene mammalian local faunas of peninsular Florida with those of the central Great Plains. Critical taxa among the rodents are the cotton rats, genus *Sigmodon*, and the arvicolids, especially *Ondatra* and *Microtus*. The dense rodent fossil record and accompanying radiometric dates of the Meade Basin of southwestern Kansas provide a chronological template for North American rodent faunas, and suggest that mammalian local faunas from the late Blancan Haile 15A through Rancholabrean of Florida may be fit into five of Martin’s Great Plains rodent zones.

Key Words: Florida; rodent; biostratigraphy; correlation; Pliocene; Pleistocene

INTRODUCTION AND METHODS

Florida’s late Pliocene and Pleistocene mammalian record is one of the richest in North America. More than 50 local faunas (l.f.s), from cave, sinkhole, estuarine, and possibly freshwater lacustrine sediments, span late Blancan through late Rancholabrean time. Most are less than 2.0 million years (my) old, but a few extend into the period of 2.0-2.5 Ma (million years ago). Absence of land mammalian fossils from the period representing most of the Pliocene (a period from about 4.5-2.5 Ma; Morgan & Hulbert 1995) probably results from a high stand of sea level that either covered Florida or reduced it to an island archipelago. Various high stands of sea level are known throughout the later Pliocene in Florida; indeed even the Blancan Haile 15A l.f. from north-central Florida, now 30 m above sea level and 80 km inland from the Gulf of Mexico, represents a time of high sea level, as evidenced by an accompanying fish fauna that includes estuarine and marine species (Robertson 1976). Because of an almost universal absence of stratigraphic superposition, Florida’s mammalian assemblages have been sequenced primarily on hypotheses of vertebrate history, augmented by a limited amount of geological information based on presumed eustatic changes in sea level (e.g., Webb 1974; Webb & Wilkins 1984; Lundelius et al. 1987). Although early attempts at correlation tried to fit Florida l.f.s into the then standard four continental glacial sequence, this approach was abandoned by the 1990’s (e.g., Morgan & Hulbert 1995). Also, more sophisticated methods, including magnetic polarity and strontium isotope stratigraphy, are now being applied where appropriate (Jones et al. 1995; MacFadden 1995). This work, in concert with an increasingly dense mammalian record, enabled Morgan and Hulbert (1995) and Morgan and White (1995) to develop a chronological hypothesis for Florida mammalian assemblages. They suggested a sequence of eight mammalian horizons, including the following: late Blancan (2.5-2.0 Ma), latest Blancan (ca. 2.0 Ma), earliest Irvingtonian (2.0-1.6 Ma), late early Irvingtonian (1.6-1.0 Ma), middle Irvingtonian (1.0-0.6 Ma), late Irvingtonian (0.6-0.3 Ma), early Rancholabrean (0.3-0.13 Ma), and late Rancholabrean (0.13-0.01 Ma). With the revised definition of the beginning of the Irvingtonian by Bell et al. (2004), the earliest Irvingtonian faunas of Morgan and Hulbert (1995) are now latest Blancan.

During the later 1990’s, a team of paleontologists coordinated from Murray State University began a new period of fieldwork in the Meade Basin of southwestern Kansas, from where the late C. W. Hibbard and his students from the University of Michigan had recovered a series of mammalian microfaunas spanning the past five million years (reviewed by Zakrzewski 1974, 1988; Martin et al. 2000). Many new localities were discovered, and the geology of the region was re-mapped,
resulting in a revised stratigraphic hypothesis (Izett & Honey 1995; Martin et al. 2000, 2002b, 2003; Fig. 1). The combination of radiometric calibration points, stratigraphic superposition, some paleomagnetic data, and a dense rodent record, makes the Meade Basin a strong reference sequence for the later Cenozoic. In concert with information from studies of small mammal fossils from other localities in the Great Plains states and nearby Indiana (e.g., L. Martin 1974, 1979; Voorhies 1988; R. Martin et al. 2000, 2002a), Martin (2003) developed a regional rodent zonation, proposing 15 horizons covering the Pliocene and Pleistocene. This paper attempts a preliminary correlation of the Florida sequence of mammalian local faunas with that of the central Great Plains, relying especially on evolutionary and dispersal patterns of the rodents.

![Figure 1. Biochronologic correlation chart between Pliocene and Pleistocene local faunas of Florida and the Great Plains using the Rodent Zones (RZ) of Martin (2003). LMA, land mammal ages; MPTS, magnetic polarity time scale; LCB, Lava Creek B ash; CTB, Cerro Toledo B ash; HR, Huckleberry Ridge ash.](image)

Species lists of Florida Pliocene and Pleistocene rodents from Martin (1974), Webb and Wilkins (1984), Morgan and Hulbert (1995), and Morgan and White (1995) were compared to those generated from local faunas of the Meade Basin of Kansas (Martin et al. 2000) and to the index rodent taxa for Great Plains local faunas suggested by Martin (2003). A detailed review of these species and the faunas from which they were
recovered was presented by Martin (2003), and will not be repeated here. A primary assumption for this study is that rodent dental evolution progressed at roughly equivalent rates in Florida and on the Great Plains. Given the geologically instantaneous dispersal of introduced modern muskrats throughout Eurasia and the relative temporal consistency of North American muskrat dental features at a given time horizon throughout its fossil record (Martin 1996), this assumption seems reasonable, and is further supported by other studies on a variety of rodent taxa (Martin 1993; Martin et al. 2000). Following Martin et al. (2002b), the Blancan is informally broken into three intervals of roughly equal duration: late Blancan = 1.8-3.0 Ma (million years ago), middle Blancan = 3.0-4.0 Ma, and early Blancan = 4.0-5.0 Ma.

RESULTS AND DISCUSSION
Figure 1 portrays a tentative correlation of Florida l.f.s with those from the Great Plains. As suggested by Morgan and Hulbert (1995) and Morgan and White (1995), the Florida assemblages likely span a period of about 2.5 my. North American late Blancan mammalian local faunas older than this, presumably deposited within the period 2.6-3.0 Ma, include Ondatra zibethicus / meadensis, a more primitive muskrat lacking cementum in the molar re-entrant folds than those first recorded from Florida Blancan sites. Example localities include Deer Park A, Kansas (Martin et al. 2002b), Sand Draw, Nebraska (Hibbard 1972), and Boyle Ditch, Wyoming (Barnosky 1985). Local faunas in Florida with the diminutive cotton rat Sigmodon minor (= S. medius) are considered Blancan. Morgan and White (1995) first reported the presence of two S. minor size classes in Florida. This species was shown to dwarf simultaneously in Kansas and Arizona at the close of the Blancan (Martin 1970). In Kansas, this event is closely associated with deposition of the Huckleberry Ridge ash at 2.10 Ma (Izett & Honey 1995). Martin et al. (2002b) referred the larger, earlier morph, to S. m. medius, and the dwarf form to S. m. lminor. This taxonomy is applied to Florida assemblages, and on this basis the De Soto Shell Pit l.f. (with S. m. lminor) is assumed to be younger than that from Haile 15A (with S. m. medius), the former possibly deposited about 2.0-2.1 Ma. Morgan and White (1995:85) included the De Soto Shell Pit l.f. in their early Irvingtonian zone, with the Inglis 1A l.f., but Inglis 1A does not include S. minor. This is not likely an artifact of sampling, as Inglis 1A is a very rich locality. It seems probable that S. minor was extinct in Florida by Inglis 1A time. Inglis 1A and 1C are considered here as late Blancan, rather than early Irvingtonian, because they include Ondatra zibethicus lidahoensis and lack Microtus. In Kansas Sigmodon curtisi is associated with Microtus cf. pliocenicus. The Inglis l.f.s apparently existed prior to the dispersal of Microtus to North America, and they are therefore considered to represent a late segment of Blancan time not exactly contemporaneous with the Borchers l.f. This is consistent with the large mammals, a number of which are more typically considered as Blancan indicators and the absence of Mammutus (Bell et al. 2004; Morgan 2005). The De Soto Shell Pit and Inglis 1A and 1C l.f.s are therefore assigned to RZ (Rodent Zone) 12.

The first appearance data (FADs) for Microtus australis, Sigmodon libitius, and Ondatra zibethicus / annectens characterize RZ 13 in Florida, but they are not likely contemporaneous with Great Plains l.f.s that lie between the Huckleberry Ridge (2.1 Ma) and Cerro Toledo B (1.23-1.47 Ma) ashes that were used to define RZ 13. These assemblages, such as Java, Nash 72, and Aries A, include Microtus cf. pliocenicus, which has a considerably less advanced dental morphology than M. australis from Haile 16A and Leisey (Martin 1995). Fortunately, however, the advanced muskrat O. z. / annectens is found in all these assemblages, and with Microtus can be used as an effective marker for RZ 13.

Another wave of arvicolid dispersal/evolution is represented in Kansas by the RZ 14 Cudahy Microtus, with M. paroperarius, M. meadensis, and M. ochrogaster /lanensis. The Cudahy rodents were recovered directly below the Lava Creek B ash radiometrically dated at 0.67 Ma. In Florida, this general time period in the Irvingtonian appears to be represented by the Coleman 2A and McLeod Mine l.f.s (Martin 1974; Morgan & White 1995; Bell et al. 2004), which include Microtus aratai and Sigmodon bakeri, both advanced over their RZ 13 predecessors. Morgan and Hulbert (1995) suggest that McLeod is somewhat older than Coleman 2A, both falling in the time period 1.0-0.3 Ma.

Predominantly modern rodent faunas are represented by a host of latest Irvingtonian and early Rancholabrean l.f.s from the Great Plains (reviewed by Davis 1987) and Florida (Webb 1974; Morgan and Hulbert 1995). Two of the common rodent indicators in Florida for RZ 15 are Microtus pinetorum and Sigmodon hispidus, although Sigmodon bakeri extends into the early part of RZ 15. Oryzomys palustris also first appears during RZ 15.
In both the Great Plains and Florida, the rodent zones may be broken down into regional horizons. For example, in Florida RZ 12 could be split into RZ 12A and RZ 12B based on the differences discussed above. At least two subzones exist in the Florida RZ 15. The earliest faunas (e.g., Williston 3A, Haile 7A) include *Microtus pinetorum hibbardi* and *Sigmodon bakeri*. Middle RZ 15 l.f.s include those with *Sigmodon hispidus* and *Microtus pinetorum parvulus*, such as Reddick 1A, Seminole Field, Vero, and Devil’s Den. Although originally developed primarily as a Great Plains regional biostratigraphic tool, the 15 rodent zones may have some utility to form the basis of a new North American rodent biochronology.

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