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A FOSSIL MOTMOT (AVES: MOMOTIDAE) FROM THE LATE MIOCENE OF FLORIDA[1]

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Abstract. A fossil motmot, known from the proximal end of a humerus, from the late Miocene (early Hemphillian, approximately 8 MYA) Haile XIXA locality, Alachua County, Florida, is morphologically indistinguishable from that of living species of *Electron, Momotus,* and *Eumomota.* This is the first fossil record of the family Momotidae in the Tertiary of the New World. The presence of a motmot in Florida prior to the land connection between North and South America provides evidence for the Momotidae being widely distributed in the southern part of North America during the late Tertiary, then invading South America during the "Great American Interchange."

Key words: Aves; Coraciiformes; Momotidae; Florida; Miocene; Haile XIXA; zoogeography; Great American Interchange.

INTRODUCTION

The Momotidae is a distinctive family of Coraciiformes whose modern distribution is restricted to Central and South America. The fossil record of this family is meager, as until now the only Tertiary record of a motmot was *Protornis glarniensis* from the Oligocene of Switzerland (Olson 1976). Living species are known from a few prehistoric sites in the Yucatán Peninsula and Brazil (Brodkorb 1971).

MATERIAL AND METHODS

Humeri of each species of momotid were examined: *Hylomanes momotula, Aspatha gularis, Electron platyrhynchum, E. carinatum, Eumomota superciliosa, Baryphthengus ruficapillus, B. martii, Momotus mexicanus,* and *M. momota.* Representative humeri of all other families of Coraciiformes and other "higher non-passerines" were also examined.

Anatomical terminology follows Baumel et al. (1979). Measurements, defined in Table 1, were taken using dial calipers accurate to the nearest 0.05 mm and then rounded to the nearest 0.1 mm. Abbreviations: MYA = million years ago, UF = Florida State Museum, UK = University of Kansas, UM = University of Michigan, USNM = National Museum of Natural History, Smithsonian Institution.

SYSTEMATIC PALEONTOLOGY

ORDER CORACIIFORMES: FAMILY MOMOTIDAE

The proximal end of the humerus of Momotidae may be distinguished from all other Coraciiformes in having the following combination of characters: 1) attachment of the dorsal head of the M. humerotriceps expanded dorsally, causing the margo caudalis (i.e., capital-shaft ridge of Bock 1962) to be directed toward the tuberculum dorsale and 2) attachment of the M. pectoralis primarily restricted to a small triangular area on the crista pectoralis (see Fig. 1).

MOMOTIDAE, GENUS AND SPECIES INDETERMINATE

Material. Proximal end of left humerus, UF 61400, Vertebrate Paleontology collection of the Florida State Museum. Collected on 21 January 1984 by Mr. Phillip M. Whisler of Venice, Florida (original number PMW 1517) and donated to the Florida State Museum. The specimen is light brown in color and is permineralized. The preservation is similar to that of other early Hemphillian taxa from this locality.

Locality. The Haile XIXA locality was exposed in a limestone quarry 4 km northeast of Newberry, Alachua County, Florida (NE ¼, Sec. 26, T. 9 S., R. 17 E., Newberry Quadrangle, U.S. Geologic Survey 7.5 min series topographical map, 1968). Sediments are fluvial and include both "gar-scale" and phosphatic gravels. Fossil mammals from the same stratigraphic level as the above specimen, include *Pliometanastes, Osteoborus* cf. *validus,* Geolocidae, *Pediomeryx hamiltoni,* at least five species of Equidae, cf. *Hypolagus,* Gomphotheriidae, *Teleoceras, Aphelops, Procamelus,* and *Aepycamelus* (G. S. Morgan, pers. comm. 1985). The co-occurrence of these mammalian taxa, and that of the crocodylian *Gavialosuchus,* indicate an early Hemphillian North American Land Mammal Age, approximately 8 MYA. Other avian taxa known from this locality include an undetermined species of cormorant *Phalacrocorax* sp., an extinct species of anhinga *Anhinga grandis,* and a few specimens of indeterminate anatids. Additional in-

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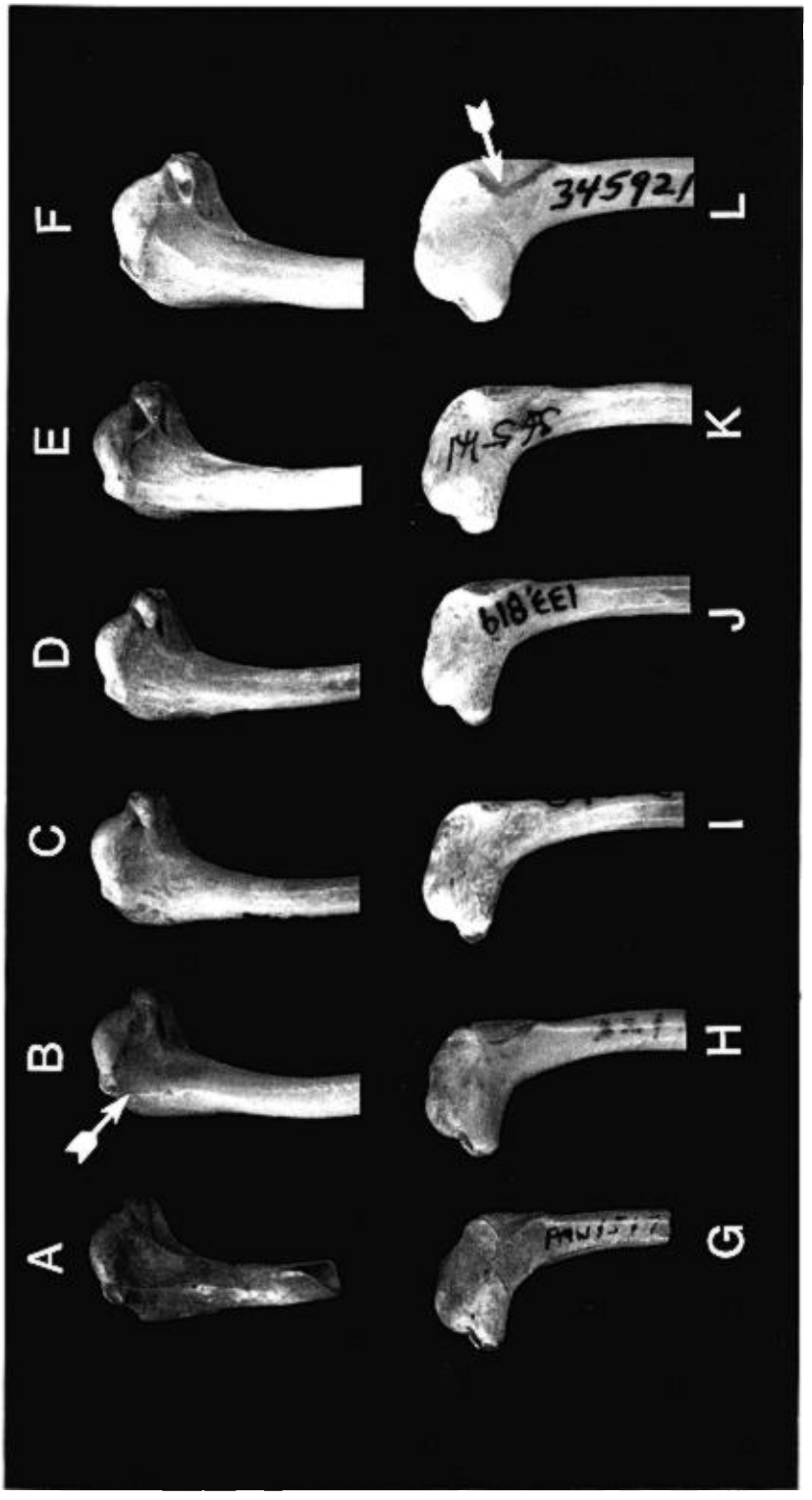

FIGURE 1. Caudal (A—F) and cranial (G—L) views of the proximal ends of humeri of Momotidae. A, G. Momotidae, genus and species indet., UF 61400. B, H. *Electron platyrhynchum*, USNM 321526. C, I. *Electron carinatum*, UK 34812. D, J. *Eumomota superciliosa*, UM 133819. E, K. *Momotus mexicanus*, UK 36541. F, L. *Momotus momota*, USNM 345921. All photos 2×. Arrows indicate the triangular shape of attachment of M. pectoralis (cranial view) and the position of the margo caudalis (caudal view), characteristic of this family.

TABLE 1. Measurements of the proximal end of the humeri of species of Motmotidae. Data are mean, standard deviation, and observed range. Measurements are W-SHAFT, transverse width of midshaft; D-SHAFT, depth of midshaft; W-PROX, transverse width of proximal end from the external tuberosity (*Tuberculum dorsale*) to the most ventral face of the bicipital crest (*Crista bicipitalis*); D-PROX, depth of proximal end, from the bicipital surface (*Facies bicipitalis*) to the internal tuberosity (*Tuberculum ventrale*), measured at right angles to the long axis of the shaft; D-HEAD, depth of head, measured parallel to the axis of the head; L-DELTOID, length of deltoid crest (*Crista pectoralis*), measured from the external tuberosity to the most distal extension of the deltoid crest. Number of specimens equals 1 for all except *Baryphthengus ruficapillus* ($n = 7$), *M. mexicanus* ($n = 3$), and *M. momota* ($n = 15$). *B. ruficapillus* includes specimens of both *B. ruficapillus martii* and *B. ruficapillus semirufus*.

Species	W-SHAFT	D-SHAFT	W-PROX	D-PROX	D-HEAD	L-DELTOID
Momotid, UF 61400	2.8	2.5	9.1	3.6	2.7	8.7
Hylomanes momotula	2.1	1.8	6.8	2.5	2.0	6.2
Aspatha gularis	2.4; 2.6	1.9; 2.2	7.7; 8.2	3.3; 3.5	2.3; 2.4	7.9; 8.2
Electron platyrhynchum	2.9; 2.9	2.4; 2.6	9.0; 9.2	3.5; 3.6	2.8; 2.9	8.9; 9.8
E. carinatum	2.8	2.3	9.1	3.8	2.7	9.0
E. superciliosa	2.7; 2.9	2.6; 2.4	8.8; 9.2	3.5; 3.7	2.7; 2.7	9.2; 9.1
Baryphthengus ruficapillus	4.23	3.80	13.04	5.61	4.26	13.19
	0.21	0.20	0.57	0.35	0.24	0.50
	4.0–4.6	3.5–4.1	12.6–13.5	5.3–6.3	4.0–4.7	12.5–13.9
Momotus mexicanus	3.34	2.80	10.05	4.13	3.00	10.19
	0.38	0.23	0.40	0.35	0.24	0.55
	3.0–3.4	2.6–3.0	9.7–10.5	3.9–4.5	2.8–3.3	9.8–10.8
M. momota	3.60	3.17	11.06	4.86	3.60	11.48
	0.32	0.21	0.74	0.35	0.25	0.90
	3.2–4.2	2.8–3.6	9.9–12.6	4.4–5.5	3.3–4.1	10.1–13.2

formation on this and other coetaneous localities in Florida is found in Becker (in press).

Description. The humeri of the living species of *Momota, Eumomota,* and *Electron* are inseparable from one another by size or qualitative characters. The fossil specimen is morphologically identical with motmots of this size. It may be distinguished from the humerus of species of *Aspatha* and *Hylomanes* in having the attachment for the dorsal head of the M. humerotriceps less expanded dorsally and in having a deeper sulcus lig. transversus, and from that of *Baryphthengus* in being less pneumatic. Additionally, the fossil specimen is easily distinguished from the last three genera on the basis of size (*Aspatha* and *Hylomanes* smaller, *Baryphthengus* larger; Table 1).

DISCUSSION

Olson (1976a) noted the Old World origin of all Coraciiformes, with the possible exception of the Todidae. Recent work by Mourer-Chauviré (1982), documenting the presence of Todidae in the Eo-Oligocene Phosphorites du Quercy, France, confirm that the New World distribution of both the Momotidae and the Todidae is relictual.

When and how the families Momotidae and Todidae crossed from one continent to the other is not known, but dispersal possibly occurred during the Eocene across the North Atlantic land connection between Europe to North America (DeGeer route). At this time over one-half of the known genera of fossil mammals are shared between North America and Europe (McKenna 1975). The climate across this area was warm temperate as shown by the paleobotanical record and the presence of amphibians and reptiles (West et al. 1977, West and Dawson 1978).

During the Mid-Tertiary, the Gulf Coast and eastern North America retained its moist subtropical vegetation (Graham 1964, Webb 1977) and remained relatively unaffected by the development of a midcontinental savanna province that extended well south onto the Mexican Plateau. By the early Miocene, a "Gulf Coast Chronofauna" (Tedford et al. in press) developed in what is now the southern part of North America, reaching from Florida (Webb 1981), west across to Texas (Wilson 1956), and south to Panama (Whitmore and Stewart 1965). The middle Miocene saw the breakdown of this "Gulf Coast Chronofauna" and the establishment of a faunal continuity between localities in Texas, Florida, and the Great Plains. A savanna corridor had expanded eastward, reducing the subtropical forest and finally breaking the connection between the mesic forests of the southeastern United States and those of the tropics (Webb 1977).

The breakup of the mesic forests of the Gulf Coast is reflected in the distribution of living and fossil taxa. Several vertebrate groups presently restricted to the Neotropics are represented in the fossil record across the Gulf Coast in the late Miocene (Estes 1970, Savage 1966, Olson 1976b, Becker, in press).

The joining of the North and South American continents, and the biotic interchange that

took place between them is well-documented (Stehli and Webb 1985), generally under the rubric "Great American Interchange." Mammals provide the most informative fossil evidence for the timing of these events. Fossil mammals show two distinct waves of interchange in the Neogene between North and South America. A very limited overwater exchange occurred in the late Miocene (early Hemphillian) that included South American megalonychid and mylodontid sloths and a North American procyonid (Marshall et al. 1979). At this time, the distance between the two continents is estimated to have been 150 km or more (Webb 1978). Later, about three million years ago, the land connection between North and South America was completed, permitting a much greater exchange (Stehli and Webb 1985).

Motmots are nonmigratory, sedentary birds. They have a limited ability to cross large expanses of open water, as shown by their absence in both the fossil and recent record from all Caribbean islands except the two (Trinidad and Tobago) that were connected to South America during the Pleistocene. It is therefore unlikely they would have crossed the water barrier that existed between North and South America in the late Miocene.

The presence of a motmot in Florida during the late Miocene, the probable inability of this family to cross the water gap that existed at this time between North and South America, and the probable homogeneity of habitat between Mexico and Florida, all argue that the motmots were widely distributed across the southern part of North America at that time. It was probably not until a complete land bridge formed between the continents that momotids entered South America, much as Chapman (1923) proposed, based on his study of the distribution of living species and subspecies of the genus *Momotus*.

The family Momotidae probably diversified in the southern part of the North American continent, and then invaded South America after the closure of the Panamanian Seaway about three million years ago, providing an avian example of the "Great American Interchange."

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