

FOSSIL IBISES FROM THE REXROAD FAUNA OF THE UPPER PLIOCENE OF KANSAS

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THE extensive fossil collections made by Claude W. Hibbard and his field assistants since 1936 from the Upper Pliocene deposits of Meade County, Kansas have made the Rexroad fauna, Rexroad Formation, Blancan age, perhaps the most completely known fauna from the High Plains. In this fossil material of both invertebrates and vertebrates there has been a wealth of bird material, some of which has been previously identified by Wetmore (1944) and Tordoff (1951, 1959).

Among the elements described by Wetmore (loc. cit.) was part of a coracoid of a small ibis which could not be definitely identified. Miller and Bowman (1956) described an extinct species of small ibis, *Plegadis gracilis*, from deposits of slightly later age in Cita Canyon, Randall County, Texas. They felt that *gracilis* perhaps represented the same species previously encountered by Wetmore. Since that time additional ibis remains have been recovered from the Rexroad fauna and form the basis of this paper.

METHODS AND MATERIALS

The skeletal collection of The University of Michigan Museum of Zoology was supplemented by material borrowed from the United States National Museum and the Chicago Natural History Museum through the kindness of Philip S. Humphrey and Dwight D. Davis, respectively. The type tarsometatarsus of *Plegadis gracilis* was loaned by the University of California Museum of Paleontology through the kindness of R. A. Stirton. Skeletal material of twelve of the seventeen genera recognized by Peters (1931) were examined in the course of this study. Skins of the remaining genera, *Pseudibis*, *Geronticus*, *Nipponia*, *Lampribus*, and *Cercibis*, were examined with regard to overall size and bill shape.

The classification of Peters (1931) is used except for the New World species, where the changes of Hellmayr and Conover (1948) are followed. Names of bone structures are those used by Howard (1929). Catalogue numbers, unless otherwise indicated, refer to the collections of The University of Michigan Museum of Paleontology.

FOSSIL LOCALITIES

The fossil material of the Rexroad local fauna has been collected at several separate localities in Meade County, Kansas: Locality No. 3 (Hibbard, 1950: 173; Taylor, 1960:29), Fox Canyon Locality (UM-K1-47) (Hibbard, 1950:

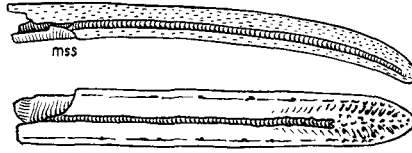


FIG. 1. *Mesembrinibis cayennensis*. Upper mandible. Two times natural size. Drawn by Margaret Skeels Stevens.

120, pl. 5, Fig. 1), and Wendel Fox Pasture Locality (Oelrich, 1952:301; Woodburne, 1961:64, Fig. 1). Dr. Hibbard's most recent views on these deposits are that the Fox Canyon and Wendel Fox Pasture localities represent stream deposits while Locality No. 3 represents a marsh deposit supported by seepage from a large artesian spring.

DESCRIPTION OF MATERIAL

Mesembrinibis cayennensis.—Two elements of this species have been recovered to date: the distal 27 mm of an upper mandible (U.M.M.P. 41286) (Fig. 1) from Fox Canyon, and the distal half of a right coracoid (U.M.M.P. 45731) from Locality No. 3. The mandible which is quite small for an ibis, 3.5 mm wide, 2.0–2.3 mm in depth, lacks the lateral swelling of the bill near the tip found in many genera of ibises, as, for example, *Eudocimus*. This fossil mandible also has a distinctive midventral groove which ends 6 mm from the tip. The combination of uniform width, small size, and the midventral groove ending short of the tip will serve to differentiate this species from all other New World species of ibis and all Old World forms except *Pseudibis* of which no skeletal material was available. This element is a bit wider than in the available skeletons (3) but within the range of expected variation as determined from skins of this species. *Theristicus caudatus* is extremely similar in most respects but the midventral groove stops farther back from the tip (15 mm) and the bill has fewer perforations in the ventral surface than in *Mesembrinibis*. The coracoid in *Mesembrinibis* is quite stocky and has a distinctively depressed coracohumeral surface which places this surface at a greater angle with respect to the glenoid facet. There is also a distinctive patterning to the triossial canal in the region of the pneumatic foramina.

Phimosus infuscatus.—Two elements of this species have been recovered from Locality No. 3: a 15-mm fragment of a lower mandible (U.M.M.P. 45735) and a worn proximal phalanx of right digit two (U.M.M.P. 45734). The section of the lower mandible was judged to have been located about 10 mm proximal to the tip. Aside from the midventral groove which distinguishes it as being from an ibis, and its extreme small size, 2.5 mm in width, 1.4–1.7 mm in depth, there is little that is distinctive about this fragment. Its small size can be matched by but one species, *Phimosus infuscatus*, of those for which skeletons were observed. The South African species *Lampribus rara* seemed, from examination of skins, to possibly approximate it in bill size. The proximal phalanx of digit two is also slightly smaller than in most species. The distinctive posterior curvature and the more heavily ossified medial region with a less prominent anterior–posterior bar serve best to distinguish this species from *Plegadis chihi*, which most closely approximates it in size.

Eudocimus sp.—Two proximal phalanges from the right alar digit two were recovered:

TABLE I
MEASUREMENTS OF THE DISTAL END OF THE TIBIOTARSUS IN *PLEGADIS*

	Width at condyles	Anteroposterior depth
<i>Plegadis gracilis</i>	7.1 mm	7.8 mm
	7.5 mm	8.2 mm
<i>Plegadis chihi</i>	7.7 mm	9.0 mm
(North America)	7.6 mm	8.4 mm
<i>Plegadis chihi</i>	8.1 mm	8.9 mm
(South America)	8.3 mm	8.8 mm

(U.M.M.P. 45733) complete and unworn from Locality No. 3, and (U.M.M.P. 45417) distal two-thirds, unworn, from Fox Canyon. These are comparable in size and conformation to recent species of the genus *Eudocimus* but the intraspecific variation is too great to separate *E. ruber* and *E. albus*.

Plegadis gracilis.—The distal ends of two tibiotarsi have been recovered: a badly broken fragment of a left tibiotarsus having both condyles present but little of the shaft, from Locality No. 3 (U.M.M.P. 45737), and a well-preserved portion of a right tibiotarsus (U.M.M.P. 45736) 14 mm long from Wendel Fox Pasture. In the genus *Plegadis* the groove for the peroneus profundus is located much farther laterally than in any other New World species. The anterior portions of the intercondylar fossa are also particularly deep and the proximal edge is raised into a definite crest. As indicated in Table I these elements are slightly smaller than the corresponding elements of the recent species *P. chihi*. The smaller of these two fossils articulates perfectly with the type tarsometatarsus of *P. gracilis* (Univ. Cal. Mus. Paleo. 45088).

Plegadis sp.—The distal portion of a left coracoid broken through the proximal portion of the glenoid facet was recovered from Locality No. 3. This fragment (U.M.M.P. 45732) agrees exactly in size and conformation with a right coracoid previously recovered from this deposit (Kans. Univ. Mus. Vert. Paleo. 4741). This earlier element was described by Wetmore (1944) as being "from an ibis smaller than *Plegadis* and *Guara* [= *Eudocimus*] . . . [and] . . . it represents an unknown species probably allied to *Plegadis*." These elements have conformations similar to that of *Plegadis* and there is no difference in size between them and specimens of *P. chihi* used in this study. However, until we have more definite information on the size of the body elements of *P. gracilis*, identification of these elements as belonging to the recent species *chihi* seems unjustified.

PALEOECOLOGY

The ecology and food habits of ibises of the genera *Eudocimus* and *Plegadis* are quite similar to that recorded for *Eudocimus albus*, which occurs "in the muddy shallow waters of small lakes, ponds, and bayous, or on the fresh or salt marshes or meadows, where crawfish and fiddler crabs abound" (Bent, 1926:30) and feed mostly on cutworms, grasshoppers, crayfish, and small snakes (Baynard, 1913). *Plegadis* species are, however, less often found in tidal or brackish areas than *Eudocimus* species. In Venezuela (Phelps and Phelps, 1958) and Surinam (Penard and Penard, 1908) *Mesem-*

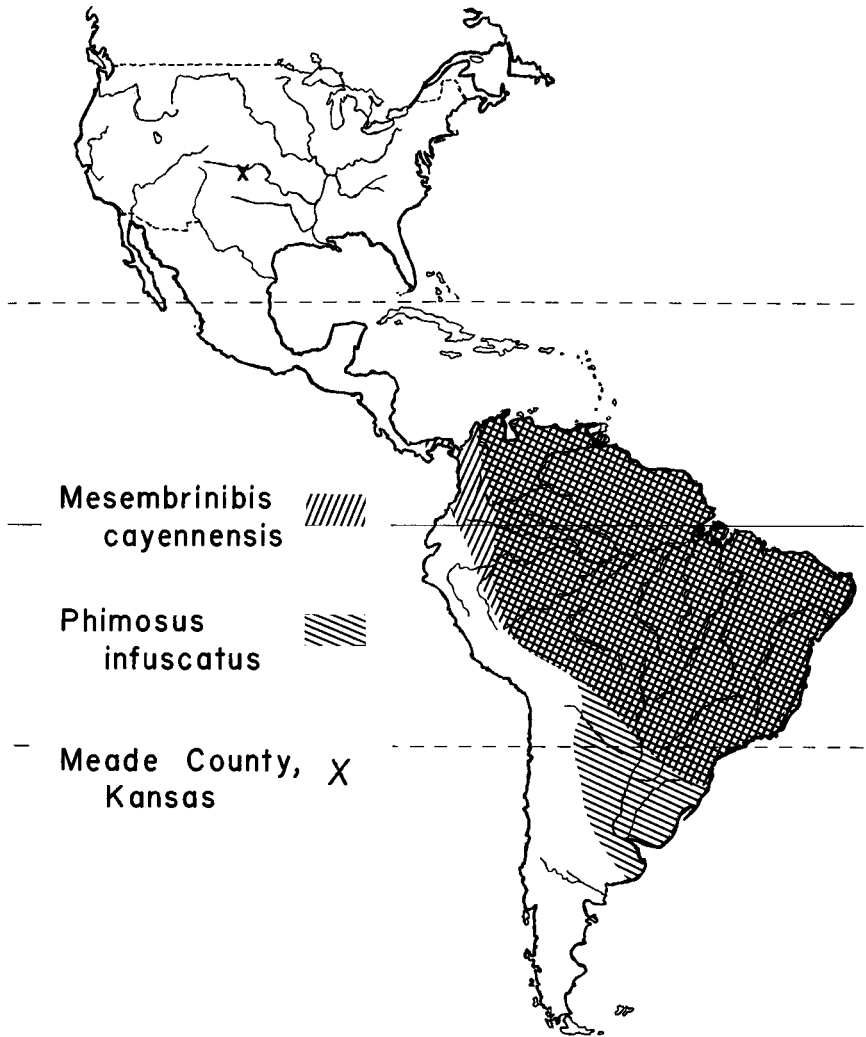


FIG. 2. Present range of *Mesembrinibis cayennensis* and *Phimosus infuscatus*.

brinibis and *Phimosus* are found in this same sort of freshwater situation and their food habits are also similar. In Surinam *Mesembrinibis* has additionally been recorded from "wet forests and neglected coffee plantations" (Haverschmidt, 1955) and "swamp-like savannahs of the uplands during the rainy season" (translated from, Penard and Penard, loc. cit.). Although *Eudocimus* and *Plegadis* are well represented in the subtropical and temperate regions of

North and South America, *Mesembrinibis* and *Phimosus* are entirely confined to the tropical areas of South America from Panama to Argentina as shown in Fig. 2.

Hibbard (1941) felt that the fossils identified up to that date indicated the following communities to be present in the area encompassed by the Rexroad fauna: upland grass community, semiaquatic community, meadow and marsh community, forest community, and valley slope community. Since then additional mammals (Hibbard, 1950), birds (Wetmore, 1944), amphibians (Taylor, 1942), turtles (Oelrich, 1952), fish (Smith, 1962), and mollusks (Taylor, 1960) have been identified and greatly increase our knowledge of the paleoecology of these deposits. A crayfish and numerous snake remains representing the genera *Natrix* and *Thamnophis* have also been recovered and these are among the principal food items of the ibises described in this paper. By 1950 the overall conclusion from these fossils was that "the climate of the Upper Pliocene was more equable than at present, without extremely cold winters or severely hot summers, and that there was a greater degree of humidity in the region than there is now" (Hibbard, 1950).

These extensive vertebrate and invertebrate collections in addition to supporting Hibbard's early views on the community structure have provided bits of detailed ecological information about these deposits. On the basis of the amphibian material Taylor (1942:220) felt that "so large a number of ranid frogs warrants the postulation that the climate was such as to supply a much heavier rainfall, in order to provide sufficient moisture for these water loving frogs." Also, the large tortoises found in these deposits (Oelrich, loc. cit.) could not endure freezing temperatures and since there is no indication that they burrowed or had cave or fissure refugia, "it is assumed that they lived at a time when freezing conditions did not exist" (Hibbard, 1960:16). These observations offer the additional interpretation that this area had a warm, wet, tropical climate similar to that found at present in parts of northern South America, the only region today where the genera *Mesembrinibis*, *Phimosus*, *Eudocimus*, and *Plegadis* are sympatric.

In addition to the ibises the fossil toad from the Rexroad fauna, *Bufo suspectus* (Tihen, 1962b:22), which was "tentatively referred to the Caribbean section of the *Valliceps* group" (see Tihen, 1962a:171), may have Caribbean or South American faunal affinities. Also indicative of tropical conditions is the presence in the Rexroad fauna of a medium-sized parrot (Wetmore, 1944) which was unfortunately too fragmentary for accurate identification.

Mesembrinibis cayennensis and *Phimosus infuscatus* are new to the fossil record while Recent species in the genera *Eudocimus* and *Plegadis* have been recorded from several Pleistocene deposits and prehistoric sites (Brodkorb,

1963). Prior to this *Plegadis gracilis* has only been recorded from the type locality in Cita Canyon, Texas.

SUMMARY

Among the extensive vertebrate and invertebrate fossils recovered from the Rexroad local fauna of the Upper Pliocene of Meade County, Kansas are remains of the Recent species of ibis *Mesembrinibis cayennensis* and *Phimosus infuscatus*. The extinct species *Plegadis gracilis* and an ibis of the genus *Eudocimus* were also identified from this fauna. Ecological information derived from these ibises and previous work indicate that this area probably had a warm, moist, frost-free, tropical climate as is found today in parts of northern South America where ibises of these genera are sympatric.

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