GENERAL NOTES

A new species of anhinga (Anhingidae) from the Upper Pliocene of Nebraska.—Among the fossils collected in recent years by the University of Nebraska State Museum at Lincoln (U.N.S.M.) are bones of a varied Upper Pliocene avifauna representing the Kimballian Land Mammal Age. Already reported have been a small turkey, *Proagriocharis kimballensis* (Martin and Tate 1970), and a gooselike swan, *Paracygnus plattensis* (Short 1969). We here describe a new anhinga from the same locality, U.N.S.M. Collecting locality Ft-40, the "*Amebelodon fricki* Quarry," Frontier County, Nebraska. For a more complete description of this locality and discussion of related mammal faunas see Schultz et al. (1970).

The anhinga is represented by the distal half of a left humerus. Among Recent pelecaniform birds the humeri of anhingas and cormorants (Phalacrocoracidae) most nearly resemble one another, but in every character considered the fossil more nearly resembles anhingas than cormorants, decidedly so in most.

We compared the humeri of 27 specimens representing 6 species of Recent cormorants with 16 humeri of *Anhinga anhinga* and found various more or less consistent differences between them besides several already listed by Miller (1966: 315–316). In Recent *Anhinga anhinga* the humerus differs from that of Recent cormorants as follows: (1) distal end relatively broader in relation to shaft, as noted also by Miller; (2) external condyle, in palmar view, relatively thick and short, and inclined towards internal side (in cormorants elongate and parallel to long axis of shaft; fossil somewhat intermediate in this regard); (3) external border of external condyle more deeply and extensively undercut by a groove, and the small shelf just below proximal margin of external condyle better developed; (4) external aspect of ectepicondylar prominence usually less rounded (more oblong); (5) olecranal fossa shallower and less clearly defined; (6) distal margin of impression of *brachialis anticus* muscle not undercut (often undercut in cormorants), the proximal-external border of this impression deeply depressed so as to form a very distinct ridge along external side of humerus; (7) impression of *brachialis anticus* relatively larger, forming a single elongate scar instead of a bipartite impression; (8) attachment of *flexor carpi ulnaris posticus* on the distal end of humerus smaller, more rounded (less elongate), and less distal, as pointed out by Owre (1967, Fig. 13A, 13B). (9) Finally, in the anhinga a wide, shallow groove extends along the internal side of the internal condyle to a point just distal to the entepicondylar prominence. Cormorants lack this groove; instead a short, thick ridge extends proximally from the internal condyle to the attachment of the anterior articular ligament and the palmar border of the depression distal to the entepicondylar prominence is a thick and not very pronounced ridge (neither ridge present in anhingas).

We assign this fossil to the Anhingidae and designate it as

Anhinga grandis, new species

HOLOTYPE: Distal end and about one-half of shaft of left humerus (Fig. 1), U.N.S.M. 20070 from U.N.S.M. Collecting locality Ft-40, south of Lime Creek, E½, SW¼, SE¼, Sec. 15, T5N, R26W, 8 miles N and 8½ miles W of Cambridge, Frontier County, Nebraska, from Sidney Gravel Member, Kimball Formation, Ogallala Group, Pliocene Epoch.

DIAGNOSIS: Humerus differs from that of *Anhinga anhinga* as follows: external condyle not so deeply undercut; depression proximal to internal condyle rounded rather than nearly rectangular; attachment for articular ligament more bulbous; ridge above entepicondylar process continuous, more robust, and extending farther anconally; ectepicondylar prominence very well developed; shaft relatively robust and its palmar surface relatively flat; distal part of shaft curves slightly more in palmar direction. Size that of a small goose (e.g., *Chen caerulescens*), about one-fourth larger than *Anhinga anhinga* in linear dimensions and much to somewhat larger than all other known anhingas, fossil or Recent.

MEASUREMENTS: Greatest width of humerus at distal end (line a, Fig. 1, right), 19.7 mm; least depth at same point, 12.9 mm; least width of existing shaft (probably distal to narrowest point), 9.6 mm. The comparable greatest widths of the distal ends of the humeri of 8 *Anhinga anhinga* from the University of Miami Department of Biology average 15.6 mm (15.2–16.0), least depths average 9.6 mm (9.3–9.9), least widths of shafts average 6.5 mm (6.1–6.8).

ETYMOLOGY: The Latin adjective *grandis*, *-is*, *-e*, meaning large, seems an appropriate name for this robust anhinga.

DISCUSSION: The average weight of 16 *Anhinga anhinga* from Florida studied by Owre (1967: 8) was 1214 g. If we assume the proportions of *grandis* and *anhinga* to be similar, we may estimate the weight of the former. Taking greatest widths of humeri at distal end, $19.7/15.6 = \sqrt[3]{\text{weight of fossil}}/\sqrt[3]{1214}$. The estimated weight of the fossil then equals 2428 g. This is about 5.4 pounds, or twice as much as *Anhinga anhinga.*

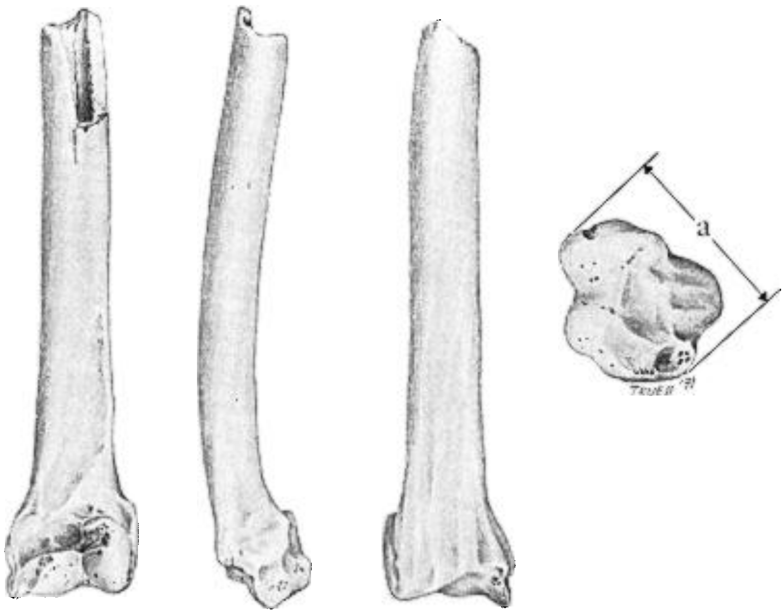

Fig. 1. Distal portion of the humerus of *Anhinga grandis*. From left to right: palmar view, internal view, anconal view, distal view (line a = greatest width at distal end). Approximately × 1.

Anhingas have a long history but are poorly represented in the fossil record. The earliest known is the small *Protoplotus beauforti* Lambrecht from the Eocene of Sumatra, whose bill was already long and narrow as in living anhingas (Lambrecht 1933: 298–302, Figs. 105, 106). Only two more anhingas are known from the Tertiary, *Anhinga grandis* being the first from the Western Hemisphere. The other is *Anhinga pannonica* (Lambrecht), described from the Lower Pliocene of Hungary and reported also from the Upper Miocene of Tunisia by Rich (1972). It is the size of a large *Anhinga anhinga* (Rich 1972: 46) but its known elements—cervical vertebrae, carpometacarpus, proximal end of humerus—do not permit direct comparison with *Anhinga grandis*.

The several extinct Pleistocene anhingas are from Australia, Madagascar, and Mauritius (Brodkorb 1963: 256–257; Miller 1966), and none is nearly as large as *A. grandis*.

It is extremely improbable that the type of *Anhinga grandis* was a vagrant. Thus the climate of the type locality, well to the north of the present normal range of *Anhinga anhinga* (Fig. 2) probably was considerably warmer than at present. A hot, dry climate and a savannalike parkland biota is also suggested by the Kimballian mammalian fauna and associated plant fossils (Schultz et al. 1970). The known fossil and prehistoric specimens of *Anhinga anhinga* (which occasionally wanders north of its regular range) are all from the Pleistocene and Holocene of Florida (Brodkorb 1963: 257).

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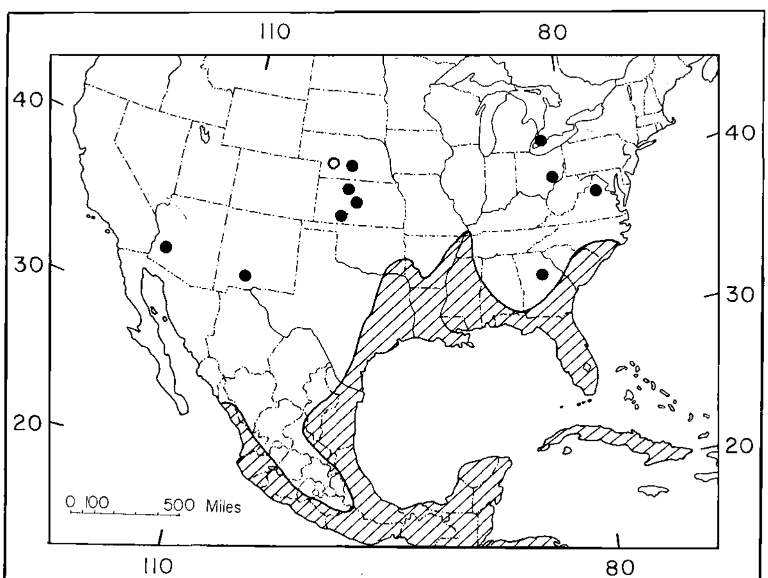

Fig. 2. Normal breeding range of *Anhinga anhinga* in North America (hatched area). Black circles are records of vagrant *Anhinga anhinga*. Open circle: type locality of *Anhinga grandis*. Map adapted from Palmer (1962).

tonal drawing of the fossil. Marion A. Jenkinson improved upon our manuscript and provided varied additional assistance.

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Responsiveness of young Herring Gulls to adult "mew" calls.—Responsiveness of young, parentally naive nidifugous birds to parental calls has received emphasis recently in studies of species identification by voice (Gottlieb 1971, 1973). In general it has been found that parentally naive young tend to approach preferentially to the parental calls of their own species. Although tests conducted with parentally naive young are of considerable ontogenetic interest, it is important to note that they do not necessarily reflect the response tendencies of young reared under more natural conditions: in many species, including gulls, adults commonly vocalize over the young before the latter hatch (e.g. Evans 1970a, Impekoven and Gold 1973, Hess 1973). It is therefore of considerable biological significance that moderate amounts of auditory stimulation of late embryos or newly hatched young have been found to facilitate post-hatch responsiveness to species—typical parental calls (Gottlieb 1965, 1966). In the Laughing Gull (*Larus atricilla*), stimulation of embryos with adult "crooning" (= "mew") calls for periods of up to about 1 h per day has similarly been shown to enhance embryonic and post-hatch responsiveness to parental calls of that species (Impekoven and Gold 1973).

Young Herring Gulls (*L. argentatus*) appear to differ from the more commonly studied precocial species (cf. Gottlieb 1971) in that parentally naive young approach and vocalize more to the parental mew call of a closely related, sympatric