A NEW FOSSIL HERON (AVES: ARDEIDAE) FROM THE OMO BASIN OF ETHIOPIA, WITH REMARKS ON THE POSITION OF SOME OTHER SPECIES ASSIGNED TO THE ARDEIDAE

By Pierce Brodkorb[1]

ABSTRACT: *Ardea howardae* new species, from the Pliocene/Pleistocene of Shungura, Ethiopia, is the largest known fossil heron. Changes are made in the systematic position of some other fossils assigned to the Ardeidae. *Goliathia andrewsi* Lambrecht of the Paleogene of Egypt is transferred to Balaenicipitidae as the earliest member of that family. *Ardea lignitum* Giebel from the Miocene of Germany is transferred to the family Strigidae, order Strigiformes, as *Bubo lignitum* (Giebel), new combination. *Ardea brunhuberi* Ammon from the Miocene of Germany is transferred to the family Phalacrocoracidae, order Pelecaniformes, as *Phalacrocorax brunhuberi* (Ammon), new combination; *Phalacrocorax praecarbo* from the same locality is synonymized with it. *Ardeacites molassicus* Haushalter from the Miocene of Germany is placed with the Aves Incertae Sedis.

RESUMEN: *Ardea howardae,* especie nueva del plioceno/pleistoceno de Etiopía, es la mas grande de todas las garzas fósiles conocidas hasta la fecha. Además necesitan cambios en la posición sistemática de unos miembros o miembros presuntos de la familia Ardeidae. *Goliathia andrewsi* Lambrecht del eoceno/oligoceno egipciano se refiera a la familia Balaenicipitidae. *Ardea lignitum* Giebel del mioceno de Alemania está traspasada a los buhos del órden Strigiformes con denominación de *Bubo lignitum* (Giebel), combinación nueva. *Ardea brunhuberi* Ammon también del mioceno alemán no es garza, es corbejón (pato coche) del órden Pelecaniformes; denóminole con la combinación nueva *Phalacrocorax brunhuberi* (Ammon). En conformidad de la ley de prioridad *Phalacrocorax praecarbo* de la misma formación debe ser sinónima del precedente. *Ardeacites molassicus* Haushalter, también del mioceno alemán, está colocado con las Aves Incertae Sedis.

The Omo River rises in the Ethiopian highlands and flows southward to discharge into Lake Rudolf (elevation 370 m) along the border between Ethiopia and Kenya. The Lake Rudolf trough and its extension up the lower Omo Valley are part of the Kenya Rift. Repeated volcanic episodes began in the early Miocene (Butzer 1971), providing sediments suitable for radiometric dating.

The littoral, alluvial, and deltaic beds in the Omo Basin have been extensively studied by the international Omo Research Expedition because of the presence of early hominid remains (Brown, Heinzelin, and Howell 1970). The Omo Group includes four formations. The eroded uppermost basalt of the Mursi Formation has K/Ar dates of 4.05–4.25 million years and is unconformably overlain by the Nkalabong Formation (3.90–3.99 million years). The Shungura Formation includes many dates between 3.75 and 1.84 million years; its upper members are thus contemporaneous with the classic Bed I of Olduvai Gorge. The Kibish Formation has dates of Middle (130,000 B.P.) and Upper (30,000 B.P.) Pleistocene and Holocene (9,500–3,250 B.P.).

Although great progress has been made in our knowledge of the evolution of man in Africa, it remains the least known continent in regard to its present-day unique and rich avifauna. Nevertheless, many thousands of avian fossils from East Africa are now at hand and include members of nearly all the nonpasserine families that occur in Africa today, as well as a rich representation of the Passeriformes. This paper is the first in a projected series on the Pliocene/Pleistocene birds from African hominid localities. Reports on other taxa are planned to appear at frequent intervals.

SYSTEMATICS

Order Ardeiformes (Wagler)
Family Ardeidae Vigors

The new heron is referable to the family Ardeidae by the following characters: (1) upper portion of coracoid very wide; (2) acrocoracoid (caput) slightly elevated; (3) coracohumeral groove deep; (4) brachial tuberosity with very slight posterior

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Table 1. Measurements (mm) of the coracoid of several species of *Ardea*.

Species	Length	Width of Head	Depth of Head	Width through Glenoid Facet	Width through Scapular Facet and Procoracoid	Maximum Width of Glenoid Facet
A. goliath (3)	86.3–95.5	14.7–15.3	8.3–8.8	14.9–17.3	13.3–14.1	10.7–11.3
A. howardae (type)	(80)[1]	12.8	6.4	12.3	10.3	9.4
A. sumatrana (2)	73.6–73.8	11.9–12.4	5.4–5.6	11.4–11.9	9.5–10.3	7.2–7.8
A. cinerea (9)	56.4–63.4	10.3–11.9	5.5–5.9	10.3–11.9	8.9–9.6	7.2–7.8
A. melanocephala (3)	59.7–60.5	10.5–11.2	5.2–5.9	10.5–11.0	8.2–8.7	6.0–6.9
A. pacifica (3)	47.3–48.1	10.3–10.4	4.8–5.2	9.2–9.5	8.3 (1)	6.1–6.2
A. purpurea (2)	54.7–55.4	9.0–9.2	4.1–4.6	8.7–9.8	6.9–7.7	5.4–6.7

[1] Estimate; length as preserved 40.4.

overhang; (5) glenoid facet almost flat; (6) scapular facet a deep, round cup; (7) procoracoid well developed, curved, imperforate, and unnotched; (8) triosseal canal almost flat.

Genus *Ardea* Linnaeus

As I have been unable to find generic characters in the upper part of the coracoid in the Ardeidae, the species is referred to *Ardea* Linnaeus on the basis of its very large size, which exceeds that of all known herons except the living *Ardea goliath* Cretzschmar of Africa and India (see Table 1).

Ardea howardae **new species**

Figure 1

HOLOTYPE: Upper (cephalic) half of left coracoid, University of California Department of Anthropology, No. F504-27.

TYPE LOCALITY: Shungura, Omo Basin, southwestern Ethiopia. Shungura Formation, Member G, unit 27; age about 1.94 million years.

DIAGNOSIS: Differs from *A. goliath* as follows: (1) size about 20 percent less; (2) head less swollen but relatively wider, extending laterally almost to level of scapular facet (narrower in *A. goliath,* occupying only the medial two-thirds of the width of the bone); (3) scapular facet with lower margin horizontal, then swinging upward to glenoid facet, where it forms a prominent notch (in *A. goliath* the anterior margin of the scapular facet forms a smooth arc that continues to the glenoid facet, where it cuts only a slight notch); (4) procoracoid much less developed; (5) triosseal canal shallower.

Differs from Recent *Ardea sumatrana* Raffles of southeast Asia to Australia as follows: (1) size larger; (2) head more swollen, and relatively and absolutely wider; (3) notch separating scapular and glenoid facets much larger; (4) triosseal canal shallower.

Differs from Recent *Ardea cinerea* Linnaeus of Eurasia and Africa as follows: (1) size larger; (2) head more swollen; (3) coracohumeral groove shallower; (4) glenoid facet nearly flat (more concave in *A. cinerea*); (5) brachial tuberosity reduced, merging gradually with shaft (forms a swollen lip that overhangs posterior face of shaft in *A. cinerea*); (6) procoracoid less developed and less recurved.

Differs from Recent *Ardea melanocephala* Vigors and Children of Africa as follows: (1) size larger; (2) head of coracoid more swollen although of about the same relative width; (3) scapular facet much wider with its lateral margin curved (almost vertical in *A. melanocephala*); (4) notch separating glenoid and scapular facets much larger.

Differs from Recent *Ardea pacifica* Latham of Australia as follows: (1) size very much greater; (2) head more swollen but of similar lateral extent; (3) inner corner of head merging gradually with shaft (inner corner of head forms a swollen lip overhanging shaft in *A. pacifica*); (4) scapular facet much wider and rounder (laterally compressed in *A. pacifica,* with lateral and medial edges nearly vertical); (5) notch separating glenoid and scapular facets much more developed; (6) procoracoid less developed and slightly curved (well developed and straighter in *A. pacifica*).

Differs from Recent *Ardea purpurea* Linnaeus of southern Eurasia and Africa as follows: (1) size very much greater; (2) head more swollen with its inner corner gradually merging with shaft; (3) notch between glenoid and scapular facets larger; (4) procoracoid less developed and less recurved.

Ardea howardae is very much larger than the known Pliocene herons. These are *Ardea polkensis* Brodkorb (1955) and *Nycticorax fidens* Brodkorb (1963) from the early Pliocene of Florida, *Nyctanassa kobdoenus* Kurochkin (1976) from the early Pliocene of Mongolia, and *Botaurus hibbardi* Moseley and Feduccia (1975) from the late Pliocene of Kansas.

Ardea rupeliensis Van Beneden (1873) from the Oligocene of Belgium barely escapes being a nomen nudum and has been relegated to the Aves Incertae Sedis (Brodkorb 1978).

ETYMOLOGY: On the occasion of the 52nd anniversary of her association with the Natural History Museum of Los Angeles County, I dedicate this species to my friend Dr. Hildegarde Howard, in recognition of her many contributions to our knowledge of the fossil birds of the Pliocene/Pleistocene.

COMMENTS ON SOME OTHER FOSSILS ASSIGNED TO THE ARDEIDAE

My conclusions on the proper systematic position of some other fossils described in the family Ardeidae are presented below.

Goliathia andrewsi Lambrecht

Lambrecht (1930:30, Fig. 7) described *Goliathia andrewsi* as a new genus and species of heron based on a very large ulna from an unknown locality in the Upper Eocene/Lower Oligocene Faiyûm series of Egypt. Earlier in the same paper he erected a new genus and species of large stork, *Palaeoephip-*

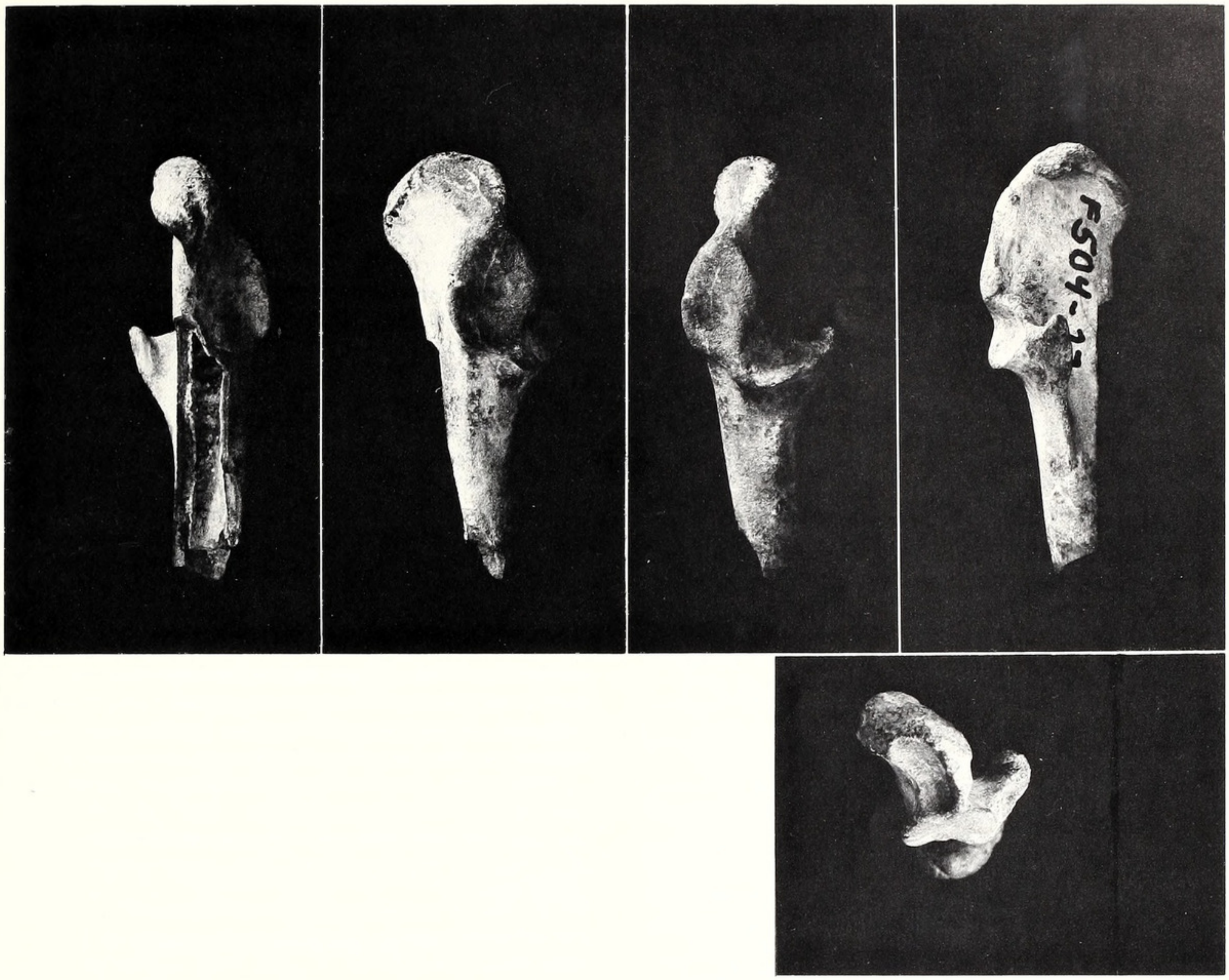

Figure 1. *Ardea howardae* new species. From left to right, anterior, lateral, posterior, medial, and below, cranial views of coracoid. Length as preserved, 40.04 mm.

piorhynchus dietrichi, based on a skull and mandible from "Kasr el Querun" (=Kafr el Qeren?) in the Faiyûm. He correctly thought the ulna too small to go with the skull of the stork. He further stated that the olecranon, internal cotyla, and cubital tubercles were all weakly developed as in herons, rather than prominent as in Ciconiidae. Andrews (1907) had previously remarked that the ulna was somewhat smaller and notably stouter than that of the Recent *Ardea goliath,* but the muscle scars were similar.

It is not possible to judge the depth of the internal cotyla from Lambrecht's drawing, but it clearly shows the reduction of the olecranon and cubital tubercles. These characters are not found in species of the family Ciconiidae, but they are shared by and are even more pronounced in the Recent *Balaeniceps rex* Gould (Ardeae: Balaenicipitidae) than they are in Ardeidae.

The stoutness of the bone mentioned by Andrews is apparent in the drawing, and this too more closely resembles that of *Balaeniceps* than it does the slender ulna of Ardeidae. In respect to the muscle scars I see no trenchant differences between *Balaeniceps* and Ardeidae.

In view of the above considerations I believe that *Goliathia andrewsi* should be placed in the family Balaenicipitidae. The only previous fossil record for the family is the tentative referral of the distal end of a tibiotarsus from the Miocene of Tunisia (Rich 1974).

Ardea lignitum Giebel

This species was based on the distal half of a left femur from the Brown Coal of Rippersroda in Thuringia, Germany (Giebel 1860:152, Pl. 1, Fig. 2, erroneously called Fig. 3 in his text). He attributed the site to the Pliocene, but the formation is now placed in the Sarmatian, i.e., Upper Miocene (Thenius 1959).

Lambrecht (1933) was unable to locate any of Giebel's types so we must rely on published sources. Giebel wrote of the type (in my translation), "This so strikingly resembles the femur of the Gray Heron, *Ardea cinerea,* that comparison with other genera seems completely superfluous. Still it is not identical." He then described several differences and illustrated anterior and posterior aspects of the type.

Table 2. Measurements (mm) of the femur of several species of *Ardea* and large owls.

Species	Length	Least Width of Shaft	Distal Width
Ardea goliath (2♂♀)	126.8–135.0	10.2–10.4	23.1–23.9
A. herodias (17♂♀)	100.0–114.2	6.7–7.9	17.1–18.8
A. cinerea (9♂♀)	79.1–92.8	6.4–7.1	14.4–16.0
A. purpurea (2♂♀)	84.3–93.4	5.5–6.1	12.5–14.0
"*Ardea*" *lignitum* (1)[1]	(100)	8	18
Bubo bubo (1♀)	100.2	9.6	21.2
B. bubo (19)[2]	99.9	9.0	20.7
B. b. davidi (2–5)[3]	106.0	9.5	22.6
B. binagadensis (1)[4]	98.8	9.2	—
B. lacteus (1♀)	88.8	8.6	20.1
B. virginianus (11♂♀)	78.9–85.5	7.1–8.4	16.2–18.0
B. africanus (9♂♀)	65.0–69.6	5.3–6.0	12.4–13.8
Nyctea scandiaca (4♂♀)	82.6–90.9	7.6–8.6	16.8–20.1
N. s. gallica (2–3)[5]	92.4	8.5	19.3
Strix nebulosa (2♂♂)	83.9–84.4	5.7–6.1	15.5–15.9
S. uralensis (3)[6]	—	6.3	14.9
S. brea (4)[7]	75.6–76.6	—	—
S. varia (13♂♀)	69.6–77.2	5.6–6.2	13.1–14.7
S. intermedia (1)[8]	—	5.0	12.5
S. aluco (1♂)	59.3	4.1	10.6
S. aluco (7)[9]	—	4.6	11.2

[1] Holotype, Miocene, Germany, length estimated (Giebel 1847).
[2] Mean of Recent specimens (Mourer-Chauviré 1975:165).
[3] Mean of paratypes, Mindel stage, France (Mourer-Chauviré 1975:165).
[4] Holotype, Upper Pleistocene, Azerbaijan (Burchak-Abramovich 1965:453).
[5] Mean of paratypes, Mindel stage France (Mourer-Chauviré 1975: 162).
[6] Mean of 3 Recent specimens (Mourer-Chauviré 1975:172).
[7] Paratypes, Upper Pleistocene, California (Howard 1933:68).
[8] Referred specimen, Mindel stage, France (Mourer-Chauviré 1975:172); the holotype is a coracoid, Middle Pleistocene, Czechoslovakia (Jánossy 1972:53).
[9] Mean of Recent specimens (Mourer-Chauviré 1975:172).

For some unexplained reason the femora and some other bones of herons and owls are rather similar. Pertinent differences in the distal half of the femora of owls (both Strigidae and Tytonidae) are enumerated below.

In anterior view, (1) the external side of the external condyle of owls flares strongly laterad from the edge of the shaft (more so in *Bubo* and *Nyctea* than in *Strix* and *Tyto*), whereas in *Ardea* the condyle is more compressed and lies more nearly in line with the shaft; (2) in owls the distal notch of the external condyle is quite hidden, but it is visible in *Ardea*; (3) the lateral edge of the shaft is concave above the condyle (most so in *Bubo*), contrasting with a marked prominence in the same area in *Ardea*; (4) the intercondylar sulcus is deep and wide (especially in *Bubo* and *Nyctea*), narrow and shallow in *Ardea*; (5) the distal end of the intermuscular line shows some individual variation, but in owls it usually terminates far above the internal condyle (especially in *Bubo*), whereas in *Ardea* it continues to the proximal rim of the internal condyle.

In posterior view of the femora of owls (6) the internal condyle is relatively narrow, especially in *Bubo* (wide and long in *Ardea*); (7) the shelf of the external condyle swings gradually toward the shaft in both strigid and tytonid owls, but in *Ardea* the shelf bulges laterad before swinging to the shaft; (8) the two intermuscular lines show some individual variation in owls, but they usually merge about half way up the shaft; they remain separate in *Ardea*.

In medial and lateral views, (9) the femur is more strongly curved in owls than in *Ardea*.

Giebel's plate clearly shows characters 1–8 enumerated above, and the ninth is mentioned in his text. They were used by him to differentiate his fossil from the living *Ardea cinerea* Linnaeus, but they really prove he had an owl. In both quantitative (see Table 2) and qualitative characters the Brown Coal species is closest to the living Eagle Owl, *Bubo bubo* (Linnaeus). It must be removed from Ardeidae and placed in Strigidae as *Bubo lignitum* (Giebel), new combination.

Giebel (1847) also described eight supposedly extinct birds from the late Pleistocene in the then widely held belief that all remains from the "Diluvium" represented species that failed to survive the Noachian Flood. All appear to be synonyms of living species.

Ardea brunhuberi Ammon

This species was based on the proximal half of a left carpometacarpus from the Upper Miocene Brown Coal Formation in the clay works of Mayer and Reinhard between Deckbetten and Prüfening in Württemburg, Germany. The detailed description and photograph (Ammon 1911:33, Fig. 5) are repeated in a later and more accessible paper (Ammon 1918:30, Fig. 4).

Although the author compared it with the Recent Purple Heron, *Ardea purpurea* Linnaeus, a glance at the illustration suffices to show that this is a cormorant, not a heron. The alular metacarpal (metacarpal I) is thrust proximad, with its tip obliquely truncate as in *Phalacrocorax,* in contrast with the condition in *Ardea,* in which it is thrust less proximad and has a pointed tip. The facet for the alular digit (digit I) is very

Table 3. Measurements (mm) of the carpometacarpus of three species of *Phalacrocorax*.

Measurement	*P. brunhuberi*	*P. carbo* (n = 2)	*P. miocaenus*
Length	75 (estimate)	73.8–74.3	43.2
Height through alular metacarpal	15	14.6–14.9	9.6
Length of inner rim of trochlea	10	10.4–11.5	—
Height of alular metacarpal	5	4.0–5.0	—
Width of proximal articulation	7	6.9–7.2	5.0
Length of pisiform process	3	3.3–3.5	—

Table 4. Measurements (mm) of the coracoid of four species of *Phalacrocorax*.

Measurement	*P. praecarbo*	*P. carbo* (2)	*P. miocaenus*	*P. littoralis*
Length	75–80 (estimate)	75.0–78.3	52	54
Length of furcular facet	9	11.0–11.5	—	—
Width of furcular facet	6	7.6–8.1	—	—
Width of glenoid facet	10	10.4–10.8	—	—
Width below glenoid facet	—	10.7–11.4	6.7	8.2
Head to tip of procoracoid	20	21.1–22.5	—	—

large and deeply excavated, but in *Ardea* it is small and only slightly excavated. Furthermore, the trochlea is large (small in *Ardea*), and the external rim extends much farther proximad than in *Ardea*. It is therefore necessary to refer to this species as *Phalacrocorax brunhuberi* (Ammon), new emendation.

In his later paper Ammon (1918:28, Fig. 3) erected *Phalacrocorax praecarbo,* based on the upper half of a left coracoid from the same locality. Tables 3 and 4 show that the types of both names under discussion agree in size with the corresponding elements of European specimens of Recent *Phalacrocorax carbo* (Linnaeus). As it is unproven and highly unlikely that two species of cormorants of the same size class occurred at this site, I place *Phalacrocorax praecarbo* in synonymy with *Phalacrocorax brunhuberi.*

Phalacrocorax intermedius (Milne-Edwards 1867) from the Orléanais Sand, known only from an incomplete humerus, is slightly smaller than *P. carbo*. It is also somewhat older than *P. brunhuberi,* so I hesitate to synonymize the latter with Milne-Edward's species.

Ardeacites molassicus Haushalter

This species was based on a right humerus from the railroad cut through Miocene/Pliocene sands, between Augsburg and Landau in the former district of Algäu, southwestern Bavaria (Haushalter 1855:11, Pl. 2, Fig. 1). The type was formerly in the Munich Museum, but according to Lambrecht (1933) it has been lost. Haushalter compared it with the living European Bittern, *Botaurus stellaris* (Linnaeus), but his description is practically useless. The type is shown in palmar view, with most of the deltoid crest and the condyles badly damaged. The published measurements are length 140 mm, mid-width 7 mm. My measurements from the plate are length 140, mid-width of shaft 8, and least width of shaft 7 mm.

If the drawing is accurate, this is not a heron. The head of the humerus is too long and pointed. The deltoid crest is too long, the bicipital crest much too narrow, and the distal end is too narrow. It obviously represents a water bird of some sort, but I am unable to get it in an order, much less a family. Therefore I assign it to the Aves Incertae Sedis.

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