

The Identity of the Fossil Raptor of the Genus *Amplibuteo* (Aves: Accipitridae) from the Quaternary of Cuba

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ABSTRACT.—One partial skeleton recorded as *Amplibuteo* sp., from a Quaternary cave deposit at Cueva de Sandoval, La Habana, Cuba, is identified as *Amplibuteo woodwardi* (L. Miller), previously known from North America (California and Florida). This is the first record of this species in the West Indies. It is the fourth large, extinct, buteonine hawk known at the specific level in the Antillean Subregion. The occurrence of this taxon in Cuba is probably the result of invasion from Florida during the late Pleistocene.

KEYWORDS.—Accipitridae, *Amplibuteo woodwardi*, colonization, Cuba, Quaternary

INTRODUCTION

Adding to the fossils of the family Accipitridae recorded in Quaternary deposits of the Greater Antilles, West Indies, an associated, partial skeleton of a large buteonine hawk was recovered from a cave deposit at Cueva de Sandoval, La Habana, Cuba, and identified as *Amplibuteo* sp. by Suárez and Arredondo (1997). It constituted the first record of this taxon outside the continental mainland. The extinct genus *Amplibuteo*, which maybe congeneric with the living *Harpyhaliaetus* (Emslie and Czaplewski 1999), was established by Campbell (1979) on the type species *Amplibuteo hibbardi* Campbell, from late Pleistocene asphalt deposits at Talara Tar Seeps, Peru, South America. The North American extinct species *Morphnus woodwardi* L. Miller, from Rancho La Brea, California, was transferred to this genus (Campbell 1979). One smaller species, *Amplibuteo concordatus*, was described from Florida and Arizona by Emslie and Czaplewski (1999), expanding the temporal range of the genus to the late Pliocene (late Blancan). Another undescribed species, also smaller than *Amplibuteo woodwardi*, was recognized from an early Pleistocene site in Florida (Emslie 1995, 1998).

Although the Cuban fossils under discussion represent the most substantial ma-

terial of Accipitridae ever recovered from the West Indies, and despite noting its resemblance in size to the two large, Pleistocene species, *Amplibuteo woodwardi* and *A. hibbardi* (W. Suárez pers. obs.), the specific status of the Cuban bird remained undetermined since 1997. A recent visit by the author to the George C. Page Museum of La Brea Discoveries, Los Angeles, California, made possible direct comparisons with the extensive fossil collection of accipitrids from asphalt deposits of Rancho La Brea, particularly *Amplibuteo woodwardi*. This allowed clarification of the specific identity of the Cuban material.

MATERIALS AND METHODS

Comparisons with skeletons of modern Accipitridae were conducted at the osteological collection of the Division of Birds, National Museum of Natural History, Smithsonian Institution (USNM), Washington D.C. Fossil material of Accipitridae from Rancho La Brea (RLB), examined at the George C. Page Museum of La Brea Discoveries included: *Buteogallus fragilis* (L. Miller), *Wetmoregyps daggetti* (L. Miller), *Amplibuteo woodwardi* (L. Miller), *Spizaetus grinnelli* (L. Miller), *Neogyps errans* (L. Miller) and *Neophrontops americanus* (L. Miller). Tarso-metatarsi of *Amplibuteo woodwardi* used for

measurements in Table 1, and Fig. 3, are: C2375, C6372, C6644, D158, D1071, D1073-74, D1968, D1970-71, D1975, D2350-51, D2407, D2417, D3168, D4486, D4625, D4679, D4800, D4828, D4836, D4868, D7004, G2861, J9869-70, K5409. A cast of the holotypical left tarsometatarsus of *Amplibuteo hibbardi* (Royal Ontario Museum, Toronto, Canada; ROM 16905), as well as descriptions and illustrations from Campbell (1979), were used for comparison with this species. Emslie and Czaplewski's (1999) original description of *Amplibuteo concordatus* was used also for comparisons with that taxon. Direct comparisons with West Indian fossil taxa were made: holotypical tarsometatarsus of *Titanohierax glovealleni* Wetmore, lent from the Museum of Comparative Zoology (MCZ 2257), Harvard University, Massachusetts; holotypical complete femur (Museo Nacional de Historia Natural de Cuba, La Habana; MNHNCu P574), and the paratypical fragmentary tarsometatarsus (William Suárez collection, La Habana; WS 80120.E) of *Gigantohierax suarezi* Arredondo and Arredondo; and a large sample of the extinct eagle "*Aquila*" *borrasi* Arredondo, stored in several Cuban collections. Measurements were taken with a vernier caliper to the nearest 0.1 mm. Osteological terminology follows Howard (1929).

SYSTEMATICS

Class Aves

Family Accipitridae

Genus *Amplibuteo* Campbell 1979

Amplibuteo woodwardi (L. Miller 1911)

(Figs. 1 and 2)

Amplibuteo sp. Suárez and Arredondo
1997:100.

Referred material and age.—Cueva de Sandoval, Sandoval III low deposit (see Suárez 2000b), about 4 km south of Vereda Nueva, Municipality of Caimito, La Habana, Cuba: Partial skeleton, collection of William Suárez (WS 365; formerly with catalog numbers for each specimen, see Suárez and Arredondo 1997), composed of one cervical (axis) and three thoracic vertebrae, seven fragments of ribs, fragmentary pelvis,



FIG. 1. Left tarsometatarsus (WS 365) of *Amplibuteo woodwardi* (L. Miller) from Cueva de Sandoval, La Habana, Cuba (A), compared with specimens D1970 (B), and G 2861 (C), from Rancho La Brea, California, USA, in anterior views. Note the individual variation of the trochleae. Scale bar = 1 cm.

proximal fragmentary right humerus, distal fragments of left humerus, segment of shaft of left ulna, left fragmentary femur without distal end, proximal and distal fragmentary ends of right femur, shaft of left tibiotarsus, proximal right fibula, left tarsometatarsus (lacking the inner calcaneal ridge, wing of the trochlea for digit II, and posterior surface of trochlea for digit III), left hallux and its respective ungual phalanx, second and third pedal phalanges of left digit III, ungual phalanx of right digit III, fourth pedal phalanx of right digit IV; collected by William Suárez on 2 March 1995. Quaternary, probably late Pleistocene, but not dated.

Description and comparisons.—The elements of the partial skeleton WS 365 are white-beige in color, well mineralized and mostly fragmentary. Only the left tarsometatarsus is nearly complete and well preserved (Figs. 1 and 2). These bones fall



FIG. 2. Some elements of the partial skeleton (WS 365) referred to *Amplibuteo woodwardi* (L. Miller) from Cueva de Sandoval, La Habana, Cuba. A, proximal right humerus in palmar view; B, same, anconal view; C, distal half of left fragmentary humerus in palmar view; D, shaft of left ulna in palmar view; E, fragmentary pelvis in lateral view; F and F', proximal and distal fragmentary ends of right femur in anterior view; G, left fragmentary femur without distal end in anterior view; H, proximal right fibula in internal view; I, shaft of left tibiotarsus in posterior view; J, left tarsometatarsus in anterior view; K and L, same, superior and posterior views, respectively; M, left hallux in dorsal view; N, ungual phalanx of left digit I in lateral view; O, ungual phalanx of right digit III in lateral view. Scale bar = 1 cm.

within the size range and variation of the equivalent elements of *Amplibuteo woodwardi* from western United States; only the middle trochlea of the tarsometatarsus is slightly smaller proportionally. Although the series of tarsometatarsi from RLB ($n = 31$) show a high degree of individual variation, especially in proportions and shape of the shaft and trochleae, no specimen agrees with the Cuban one in this small detail. It also differs from the tarsometatarsus of *Amplibuteo hibbardi* (cast of the holotype), from Peru, and agrees with *A. woodwardi* in characters described by Campbell (1979: 86). The Cuban skeleton represents a large

individual of *Amplibuteo woodwardi* (Fig. 3, Table 1). Thus disagrees in size with *Amplibuteo concordatus*, which is smaller than *A. woodwardi* (Emslie and Czaplewski 1999).

In comparison with the extinct taxa of the West Indies, the material is far smaller than the known elements of the gigantic Cuban species *Gigantohierax suarezi*, and similar in size to *Titanohierax gloveralleni* and "*Aquila*" *borrasi*. The material at hand differs from *Gigantohierax suarezi* by qualitative characters such as: femur with long neck, head thinner, rounder, with attachment of round ligament smaller and orientated antero-laterally (short neck, not well defined, head broad and expanded, wide attachment of round ligament with a more vertical orientation in *G. suarezi*); iliac facet wide (thin in *G. suarezi*), poorly developed pneumaticity, the largest of the two pneumatic foramina being ovoid (great pneumaticity, semi-triangular pneumatic foramen in *G. suarezi*); anterior intermuscular line running at center of shaft (running lateral in *G. suarezi*); shaft straight, nearly circular in cross section and not twisted proximally (greatly curved antero-posteriorly, greatly compressed and twisted in *G. suarezi*); proximal and distal end not expanded (ends greatly compressed and expanded in *G. suarezi*); rotular groove shallow (deep in *G. suarezi*); reduced and deeper popliteal area (ex-

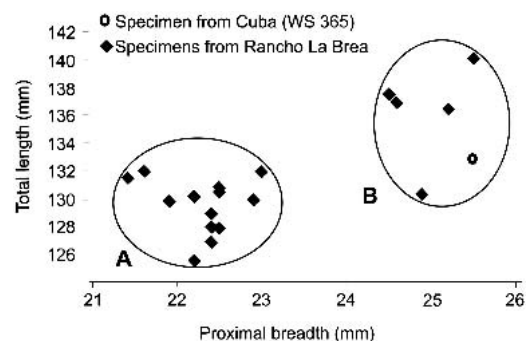


FIG. 3. Scatter diagram showing segregation in size, probably sexual, in a series of tarsometatarsi of *Amplibuteo woodwardi* (L. Miller). Group A should represent males, and B females, according to standards of sexual dimorphism among living Accipitridae (excluding Old World Vultures). Note the Cuban specimen (WS 365) inside group B.

TABLE 1. Measurements (mm) on tarsometatarsi of *Amplibuteo woodwardi* from Cueva de Sandoval, La Habana, Cuba (WS 365), and Rancho La Brea, California, USA. Sequence is: range (mean) n.

Character	<i>A. woodwardi</i> (WS 365)	<i>A. woodwardi</i> (Rancho La Brea)
Total length	132.7	125.6-140.2 (131.6) 20
Proximal width	25.5	21.4-25.5 (23.0) 20
Least width of shaft	11.3	8.9-11.9 (10.1) 28
Least depth of shaft at proximal end of metatarsal facet	9.3	7.7-10.0 (8.7) 28
Distal width	26.3*	23.1-28.8 (26.1) 25
Depth of trochlea for digit II	13.1*	12.5-15.5 (14.0) 27
Depth of trochlea for digit III	8.1	6.8-8.4 (7.4) 28
Depth of trochlea for digit IV	12.3	11.3-13.7 (11.7) 24

*Abraded

panded, much shallower in *G. suarezi*); shaft of tarsometatarsus more triangular in cross section (greatly compressed, flatter, less triangular in *G. suarezi*); external proximal half of tarsometatarsus with a nearly flat surface (convex in *G. suarezi*).

From "*Aquila*" *borrasi*, also from Cuba, it differs in having the humerus larger and more robust, head less projected, ligamental furrow larger, capital groove wider and deeper (smaller and thin, with head greatly projected, ligamental furrow reduced and capital groove thin and shallow in "*A. borrasi*"); the preserved segment of ulna is more robust, with better development of papillae of secondary (thin and gracile, less development of papillae of secondary in "*A. borrasi*"); femur with large and oval pneumatic foramen (very small and round in "*A. borrasi*"); attachment of round ligament deep and restricted (more extended, shallow and with vertical orientation in "*A. borrasi*"); shaft not compressed antero-posteriorly at proximal and distal ends (more compressed at ends in "*A. borrasi*"); anterior intermuscular line prominent, extending distally and running in center of shaft (not well developed and restricted to proximal half of shaft, more laterally located in "*A. borrasi*"); large condyles (short condyles in "*A. borrasi*"); proximal portion of shaft of tibiotarsus robust with fibular crest short and greatly projected (more gracile, with fibular crest larger and less projected in "*A. borrasi*"); tarsometatarsus with shorter and stouter shaft (very slender and gracile shaft in "*A. borrasi*"); trochleae less flared at distal end, especially trochlea

for digit II, which is less projected distally (flaring greatly, trochlea for digit II greatly projected distally in "*A. borrasi*"); anterior and posterior metatarsal grooves shallow (both grooves much deeper in "*A. borrasi*"); hallux shorter, robust, and less curved downward (more slender, less robust, and more curved downward in "*A. borrasi*"); ungual phalanges slightly curved (greatly curved in "*A. borrasi*").

In comparison with the holotypical tarsometatarsus of *Titanohierax gloveralleni* (MCZ 2257), from the Bahamas, the equivalent element of the Cuban skeleton differs in being smaller and shorter, with shaft at distal end less compressed antero-posteriorly, narrower, the metatarsal facet not as highly placed, or proximal (see Wetmore 1937:430), and posterior metatarsal groove shallow (much deeper in *T. gloveralleni*). In addition, the material under discussion differs from other fossil buteonine accipitrids represented at Rancho La Brea (*Buteogallus fragilis* and *Wetmoregyps daggetti*), by characters described by Howard (1932) for *Morphnus* (= *Amplibuteo*) *woodwardi*.

Measurements (mm).—Humerus: depth of head, 11.9. Ulna: least width and depth of preserved segment of shaft, 10.9 × 9.7. Femur: depth of head, 11.3; width and depth of shaft at midpoint, 12.6 × 11.8. Tibiotarsus: length of fibular crest, 36.4; width and depth of shaft at distal end of fibular crest, 14.6 × 10.5. Fibula: proximal depth, 13.6. Tarsometatarsus: see Table 1. Hallux: total length, 39.5; least width and depth at midpoint, 9.1 × 6.7; distal width, 10.2. Ungual phalanx of digit I: proximal

width, 9.7. Ungual phalanx of digit III: proximal width, 7.5.

Remarks.—The small differences observed in the single tarsometatarsus from Cuba are not sufficient to erect a new species, considering the high degree of individual variation in *Amplibuteo woodwardi* (see Jollie 1976-1977 for variation of the trochleae in other members of Accipitridae).

Amplibuteo woodwardi was originally known from Rancho La Brea, California (L. Miller 1911, Howard 1932, Campbell 1979), later from sites in Florida (Emslie 1995, 1998), and now from Cuba, extending its distribution to the West Indies. The occurrence of *Amplibuteo* in Florida since the late Pliocene (Emslie and Czaplewski 1999), and of *A. woodwardi* there during the middle to late Pleistocene (Emslie 1995, 1998), indicate that this taxon probably colonized Cuba from Florida. The palaeoecology of this extinct large hawk is not well understood (Steadman and Martin 1984), but the aridity in Cuba during part of the late Pleistocene (Curtis et al. 2001), as well as the abundance of reptiles and small to medium sized mammals, seem to offer the necessary environment for the presence of *A. woodwardi*. In contrast with the abundance of remains of "*Aquila*" *borrasi* in fossil localities of Cuba (W. Suárez pers. obs.), *A. woodwardi* is a very rare taxon, recorded only from one deposit at Cueva de Sandoval (Suárez and Arredondo 1997). The partial skeleton was recovered in a small area less than 1m², in association with specimens of other Cuban diurnal and nocturnal raptors (e.g. "*Aquila*" *borrasi* Arredondo, *Tyto noeli* Arredondo, *Ornimegalonyx oteroi* Arredondo, *Gymnogyps varonai* [Arredondo] and "*Teratornis*" *olsoni* Arredondo and Arredondo), including a small species of vulture (see Suárez 2001), and extinct reptiles and mammals.

In the West Indies three other large, extinct buteonine hawks are known at the specific level (Cuello 1988, Arredondo and Arredondo 1999 [2002]). Of these, *Titanohierax gloveralleni* is known from a few fragmentary specimens from the Bahama Islands (Wetmore 1937, Olson and Hilgartner 1982), and is apparently closely related to the living genus *Geranoaetus* (Olson and

Hilgartner 1982). "*Aquila*" *borrasi* was described from western Cuba, based on a composite type series of two different-sized taxa (Arredondo and Arredondo 1999 [2002], see also Olson and Hilgartner 1982). The holotype of "*A.*" *borrasi* is a tarsometatarsus without distal end (Arredondo 1970, 1976), that is more gracile and longer than in species of *Aquila*. This specimen was referred to *Titanohierax* by Olson and Hilgartner (1982), a combination used later by other authors (e.g. Cuello 1988, Suárez 2000a, b, Suárez 2001). New and well preserved material at hand proves that *borrasi* is a valid species, but not referable to the genus *Titanohierax*. Further aspects of its anatomy and systematic position will be presented in a separate paper (Suárez and Olson, in prep.). *Gigantohierax suarezi*, also from Cuba, is the largest American species of Accipitridae, living or extinct (Arredondo and Arredondo 1999 [2002]), but its relationship within the family remains unresolved. In addition to these large hawks, spring deposits at the Baños de Ciego Montero, Cienfuegos Province, Cuba, have also yielded fossils of the living, smaller species *Geranoaetus melanoleucus* (Vieillot) (Wetmore 1928).

Fossil remains of large accipitrids are also known in the West Indies from Hispaniola, Jamaica, and Grand Cayman (summarized by Olson and Hilgartner 1982). The present record of *Amplibuteo woodwardi* from Cuba opens the possibility that remains of this taxon can be elsewhere in the West Indies. Together with *Ciconia maltha* and *Mycteria wetmorei* (Suárez and Olson 2003), *Amplibuteo woodwardi* represents another element in the extinct avifauna of Cuba that is shared with the fossil record of Florida and western United States.

Acknowledgements.—Visits to the National Museum of Natural History, Smithsonian Institution, and to the George C. Page Museum of La Brea Discoveries, were made possible by the Alexander Wetmore Endowment Fund of the Division of Birds, Smithsonian Institution. I express my gratitude to Kenneth Campbell, Jr., Los Angeles County Museum, for his assistance during

revision of collections from Rancho La Brea; to Fritz Hertel, University of California, Los Angeles, for his help and kindness during my visit to Los Angeles. Julie Craves, University of Michigan-Dearborn, kindly reviewed the first English version of the manuscript. My special thanks go to my former teacher, Storrs L. Olson, Smithsonian Institution, for his help during my visit to the United States of America. Photographs are by Steven J. Parry, Bird Group, The Natural History Museum, United Kingdom, and Angel Rojas, Photographic Services of the Museo Nacional de Historia Natural de Cuba. Plates were composed by Yadira Alegre, of the latter institution. Two referees, Storrs Olson and David Steadman, greatly improved the manuscript with their criticism. This contribution is dedicated to the memory of one of my best friends and colleagues, Professor Oscar Arredondo (1918-2001), who made possible my first steps in paleontology.

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