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RED-SHOULDERED HAWK AND APLOMADO FALCON FROM QUATERNARY ASPHALT DEPOSITS IN CUBA

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**KEY WORDS:** *Aplomado Falcon*; *Falco femoralis*; *Red-shouldered Hawk*; *Buteo lineatus*; *Antilles*; *Cuba*; *extinctions*; *fossil birds*; *Quaternary*; *West Indies*.

MATERIAL EXAMINED

Fossils are from the collections of the Museo Nacional de Historia Natural, La Habana, Cuba (MNHNCu). Modern comparative skeletons included specimens of all of the species of *Buteo* and *Falco* in the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM). The following specimens were used for the tables of measurements: *Buteo lineatus* 16633–16634, 17952–17953, 18798, 18846, 18848, 18965, 19108, 19929, 290343, 291174–291175, 291197–291200, 291216, 291860–291861, 291883, 291886, 296343, 321580, 343441, 499423, 499626, 499646, 500999–501000, 610743–610744, 614338; *Falco femoralis* 30896, 291300, 319446, 622320–622321.

The fossil avifauna of Cuba is remarkable for its diversity of raptors, some of very large size, both diurnal and nocturnal (Arredondo 1976, 1984, Suárez and Arredondo 1997). This diversity continues to increase (e.g., Suárez and Olson 2001a, b, 2003a) and many additional species are known that await description. Not all of the raptors that have disappeared from Cuba in the Quaternary are extinct species, however. We report here the first records for Cuba of two widespread living species that are not known in the Antilles today.

Family Accipitridae  
Genus *Buteo* Lacepede  
Red-shouldered Hawk *Buteo lineatus* (Gmelin)  
(Fig. 1 A–C)

These fossils were obtained during recent paleontological exploration of an asphalt deposit, Las Breas de San Felipe, which is so far the only “tar pit” site known in the West Indies. Two fossiliferous localities known as San Felipe I and II occur among extinct and active tar seeps in the floor of the San Felipe Valley, Matanzas Province, 5.5 km west of the town of Martí (ca. 22°57'N, 80°58'W; sheet Martí 4084-IV, 1:50 000 map, X502, Y347; map published in 1986 by the Instituto Cubano de Geodesia y Cartografía). The age of the deposits is Quaternary, probably late Pleistocene and early Holocene (Iturralde-Vinent et al. 1999, 2000). Although the fossil record of birds in Cuba has hitherto been biased by the fact that almost all specimens have come from cave deposits, the tar seeps of San Felipe provide a much better sample of open-country and aquatic birds that seldom or never are preserved in caves. The list of taxa is extensive and includes among other taxa cranes (*Grus*), thick-knees (*Burhinus*), storks (Ciconiidae), waterfowl (Anatidae), crows (*Corvus*), with a diverse variety of raptors and scavengers being especially abundant (Iturralde-Vinent et al. 2000, Suárez 2000, Suárez and Olson 2003a, b, Suárez unpubl. data).

REFERRED MATERIAL

Proximal end of right femur (MNHNCu P4614), distal halves of right and left tibiotarsi (MNHNCu P4615, MNHNCu P4616), distal end of left tibiotarsus (MNHNCu P4617) and distal halves of right and left tarsometatarsi (MNHNCu P4618, MNHNCu P4619). Collected in November 1988 by Manuel Iturralde-Vinent, Reinaldo Rojas-Consuegra, and Stephen Diaz-Franco at San Felipe II.

COMPARISONS

In size and proportions, these specimens agree with the Red-shouldered Hawk (*Buteo lineatus*) (Table 1), being larger than the Broad-winged Hawk (*B. platypterus*) and smaller than the Red-tailed Hawk (*B. jamaicensis*), the only two species of *Buteo* that are year-round residents in Cuba today (Garrido and García Montaña 1975). As was the case with fossils from the Bahamas, we took pains to compare the specimens with skeletons of Gray Hawk (*B. nitidus*), a widespread species of open country that is of approximately similar size and that might be expected to have occurred in the West Indies. But skeletal elements of *B. nitidus* are consistently more robust than in *B. lineatus*.

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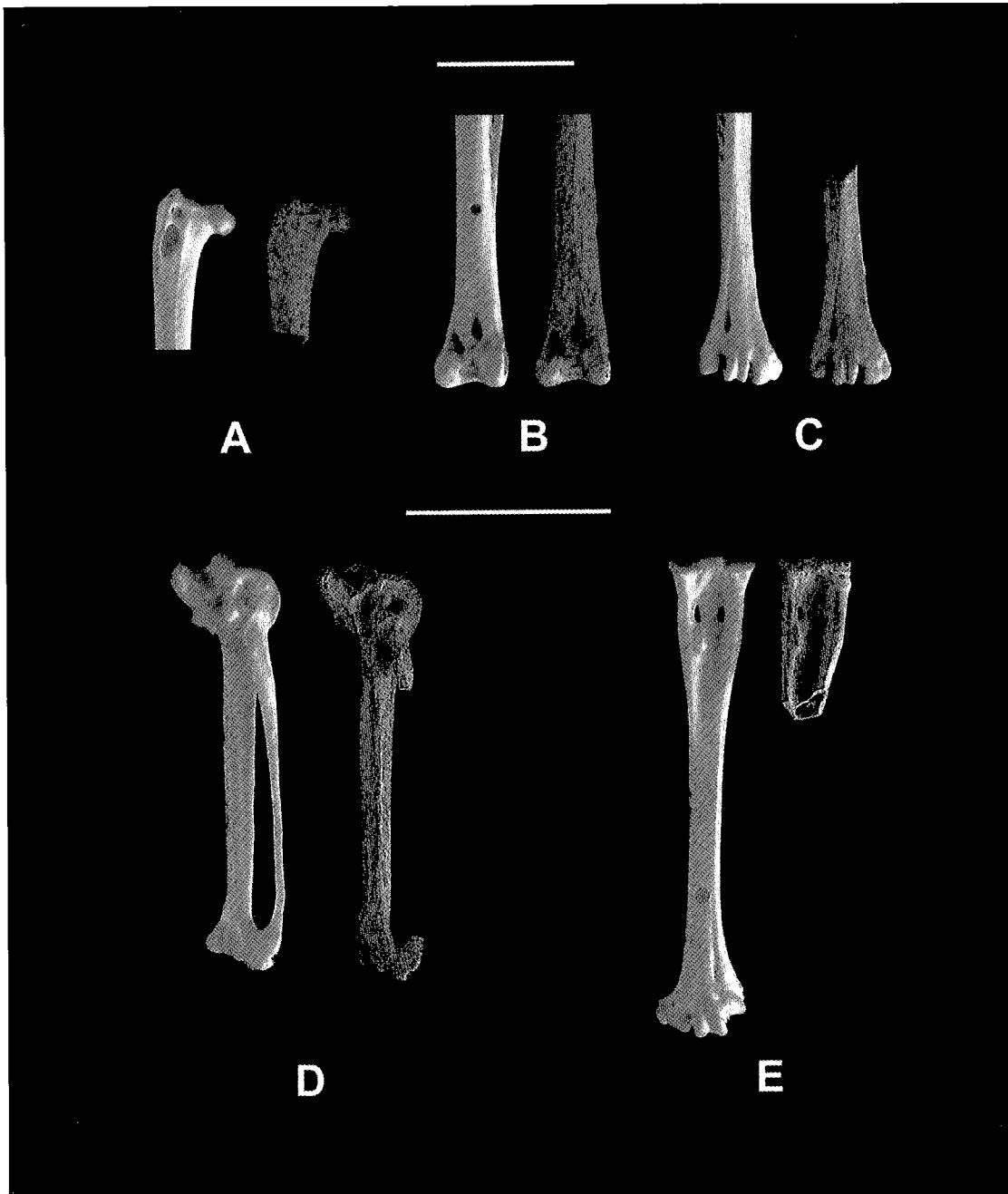


Figure 1. A–C, modern Red-shouldered Hawk, *Buteo lineatus* (USNM 17953, on the left in each pair) compared with Cuban fossils of the same species (A, MNHNCu P4614; B, P4615; C, P4618). D–E, modern Aplomado Falcon, *Falco femoralis* (USNM 291300, on the left in each pair) compared with Cuban fossils of the same species (D, MNHNCu P4606; B, P4609). A, proximal end of right femur in anterior view; B, distal end of left tibiotarsus in anterior view; C, distal end of right tarsometatarsus in anterior view; D, right carpometacarpus in internal view; E, left tarsometatarsus in anterior view. Scale bars = 2 cm.

Table 1. Skeletal measurements (mm) of Cuban fossil and modern Red-shouldered Hawk (*Buteo lineatus*).

MEASUREMENT	CUBAN FOSSILS			MODERN		
	RANGE	MEAN	N	RANGE	MEAN	N
<b>Femur</b>						
Depth of head	4.9		1	4.5–5.7	5.1	33
<b>Tibiotarsus</b>						
Least width of shaft at midpoint	5.6		1	4.8–6.1	5.5	33
Distal width through condyles	9.9–10.9	10.4	2	9.5–11.7	10.9	33
<b>Tarsometatarsus</b>						
Least width of shaft at midpoint	4.9		1	3.7–5.0	4.4	31
Width of shaft proximal to metatarsal facet	5.1–5.3	5.2	3	4.1–5.8	5.1	32
Depth of shaft proximal to metatarsal facet	4.2–4.4	4.3	2	3.4–4.4	3.9	32
Distal width	12.3		1	11.2–13.3	12.3	32
Depth of middle trochlea	4.9		1	4.4–5.3	4.9	32

## REMARKS

Although the Red-shouldered Hawk now has an entirely continental distribution, it has previously been known in the West Indies from a few fossils from cave deposits in the Bahamas (Olson 2000), where it first was described as an endemic genus and species *Calohierax quadratus* (Wetmore 1937, but see Olson and Hilgartner 1982, Olson 2000). Thus, its occurrence in Cuba might have been predicted. The Bahaman population was probably derived from that of Cuba, as has been the case with many other birds (Brodkorb 1959, Olson and Hilgartner 1982).

The Red-shouldered Hawk is ordinarily a species of mesic bottomland forests, so its withdrawal from Cuba and the Bahamas is difficult to understand in light of the fact that ecological conditions in these islands presumably have become more mesic since the end of the last glacial period. Potential sources of food were much greater in Cuba than in the Bahamas, making the disappearance of this hawk from Cuba even more enigmatic.

The Red-tailed Hawk and the Broad-winged Hawk, each represented by supposedly endemic subspecies (*B. jamaicensis solitudinis* Barbour and *B. platypterus cubanensis* Burns), are common on Cuba today (Raffaele et al. 1998, Garrido and Kirkconnell 2000) and both have been recorded from Quaternary cave deposits on Cuba (Jiménez 1997, Suárez and Arredondo 1997), with the latter being found in the San Felipe II asphalt deposits as well (Suárez unpubl. data.). It hardly seems likely that the disappear-

ance of the intermediate-sized Red-shouldered Hawk from Cuba could be related to the disappearance of prey, which would presumably have affected the other species of *Buteo* as well.

Ridgway's Hawk (*Buteo ridgwayi*), endemic to Hispaniola, is now believed to be a small derivative of *B. lineatus* (Olson 2000). The prehistoric occurrence of the latter in Cuba suggests that the ancestral stock of Ridgway's Hawk was probably derived from insular populations of *B. lineatus*, and most likely from Cuba.

## Family Falconidae

Genus *Falco* Linnaeus, 1758

Aplomado Falcon *Falco femoralis* Temminck, 1822  
(Fig. 1 D–E)

## REFERRED MATERIAL

Right carpometacarpus lacking minor metacarpal (MNHNCu P4606), right carpometacarpus lacking distal end and minor metacarpal (MNHNCu P4607), distal end of left tibiotarsus (MNHNCu P4608), proximal end of left tarsometatarsus (MNHNCu P4609), collected 25 February 2001 by Stephen Díaz-Franco and William Suárez at San Felipe I, area C.

## COMPARISONS

These specimens agree perfectly in size and characters with the Aplomado Falcon (*Falco femoralis*) (Table 2). They are much too large for American Kestrel, Merlin, or Bat Falcon (*F. sparverius*, *F. columbarius*, *F. rufigularis*)

Table 2. Skeletal measurements (mm) in fossil and modern Aplomado Falcon (*Falco femoralis*).

MEASUREMENT	CUBAN FOSSILS			MODERN		
	RANGE	MEAN	N	RANGE	MEAN	N
<b>Carpometacarpus</b>						
Total length	41.8		1	37.7–42.5	40.8	4
Proximal width	4.6*		1	4.4–5.1	4.7	4
Proximal depth	10.8		1	9.1–11.6	10.7	4
Width of major metacarpal at midpoint	3.5–3.6	3.5	2	2.9–3.6	3.3	4
<b>Tibiotarsus</b>						
Distal width	7.5 <sup>a</sup>		1	7.0–8.7	7.9	5
<b>Tarsometatarsus</b>						
Width at level of proximal foramina	6.4		1	5.7–7.0	6.5	5

<sup>a</sup> Estimated.

or for the extinct Cuban species *F. kurochkini* (Suárez and Olson 2001a), and too small for a Peregrine (*F. peregrinus*) or Prairie falcon (*F. mexicanus*). No skeletons were available for Orange-breasted Falcon (*F. deiroleucus*), but this species has very different proportions from *F. femoralis*, with a proportionately shorter and much more robust tarsometatarsus.

#### REMARKS

That the Aplomado Falcon once occurred in Cuba is perhaps not unexpected. It is a partially migratory species with an extremely wide range extending from the southwestern United States to Tierra del Fuego and the Falkland Islands. It inhabits shrub grasslands and savanna and there is increasing evidence of various species of birds adapted to such conditions in the Quaternary of Cuba. This is the first indication of the species anywhere in the West Indies.

RESUMEN.—Procedentes de depósitos cuaternarios de asfalto en San Felipe, al norte de la Provincia de Matanzas, se registran por primera vez para Cuba dos especies de rapaces que viven hoy en el continente: *Buteo lineatus* y *Falco femoralis*; este último constituye la primera evidencia de ese taxon en la Subregión Antillana.

[Traducción de los autores]

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fossil specimens to the Smithsonian Institution from Cuba. Photographs are by John Steiner, Smithsonian Photographic Services, and the figure was arranged by Brian Schmidt, Division of Birds.

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