

A new genus for the Cuban teratorn (Aves: Teratornithidae)

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Abstract.—Study of the type series and much new fossil material of the Cuban teratorn, *Teratornis olsoni* Arredondo & Arredondo, shows that this species possessed unique characters within the family Teratornithidae, including a shorter and more flattened humerus and femur, and a tarsometatarsus with a long trochlea II. The differences are so great as to merit a new genus, *Oscaravis*, for the species. Some osteological characters of *Oscaravis* suggest that it was less derived than *Teratornis* and possibly more similar to *Argentavis*. As the only insular member of the Teratornithidae, *Oscaravis* shows that teratorns were capable of overwater dispersal, so that the expansion of the family into North America from the south need not have been dependent on the presence of a land bridge.

Resumen.—El estudio de la serie tipo y de nuevo material fósil del teratorno cubano, *Teratornis olsoni* Arredondo & Arredondo, muestran que este taxon presentó caracteres únicos dentro de la familia Teratornithidae, que incluyen húmero y fémur más cortos y aplanados, y tarsometatarso con tróclea II alargada. La magnitud de las diferencias existentes permite erigir un nuevo género, *Oscaravis*, para esta especie. Algunos caracteres osteológicos de *Oscaravis* indican que divergió menos que *Teratornis*, y por ello estuvo más cercano morfológicamente a *Argentavis*. Como único miembro insular en Teratornithidae, *Oscaravis* evidencia que los teratornos fueron capaces de dispersarse sobre barreras acuáticas, por lo que la expansión de la familia a Norte América, desde el sur, no dependió de la presencia de un puente terrestre.

The extinct family Teratornithidae L. Miller (1909), the ordinal affinities of which remain obscure, is known only from the New World and at present includes five genera: *Teratornis* L. Miller (1909), *Cathartornis* L. Miller (1910), *Argentavis* Campbell & Tonni (1980), *Aiolornis* Campbell et al. (1999), and *Taubatornis* Olson & Alvarenga (2002). With the exception of *Teratornis*, all are monotypic (see Campbell & Stenger 2002). *Cathartornis*, the most problematic

of the genera, was long known only from two tarsometatarsi from Rancho La Brea, California, that were regarded as belonging to the Vulturidae (L. Miller 1910, 1925), although the genus was later assigned to the Teratornithidae (L. Miller & Howard 1938). Campbell et al. (1999) considered the grounds for separating *Cathartornis* from *Teratornis* to be weak, although additional specimens of *C. gracilis* L. Miller from Rancho La Brea were recently reported by Campbell & Stenger (2002:3). Additional elements continue to be identified, although it is

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uncertain whether their differences from *Teratornis* warrant separate generic status (K. E. Campbell, Jr., pers. comm.).

The Teratornithidae appears to have originated in South America and was thought to have colonized North America during the Great American Faunal Interchange in the late Pliocene (Campbell & Tonni 1981) or perhaps earlier (Olson & Alvarenga 2002). *Taubatornis campbelli* Olson & Alvarenga (2002), from deposits of the Tremembé Formation (Upper Oligocene or Lower Miocene, ca. 25 mya), Taubaté Basin, São Paulo, Brazil, is the oldest and smallest known teratorn (Olson & Alvarenga 2002). It was followed temporally by the largest known flying bird, *Argentavis magnificens* Campbell & Tonni (1980), from four localities of late Miocene age (Huayquerian, ca. 6 mya) in Argentina (Campbell & Tonni 1980, Campbell 1995). In addition, a fragmentary tarsometatarsus apparently related to *Teratornis* was reported from La Carolina, Ecuador (Campbell & Tonni 1980), which is the only evidence of the family in the Quaternary of South America.

Apart from three specimens referred to *Aiolornis incredibilis* (Howard 1952) from late Pliocene (Blancan) deposits (Campbell et al. 1999), the North American record of Teratornithidae is entirely Pleistocene in age. Our knowledge of the morphology of the family is based mainly on remains of *Teratornis merriami* L. Miller from the asphalt deposits at Rancho La Brea, although the osteology of this species is still only incompletely described. All other taxa of Teratornithidae are known from much less complete material that usually can be interpreted only through comparisons with *Teratornis*.

That teratorns existed outside of the continental Americas was shown by Suárez & Arredondo (1997), who recorded seven specimens that were tentatively identified as *Teratornis* sp. from Quaternary cave deposits in western Cuba (Fig. 1).

A subset of those fossils was later named as a new species, *Teratornis olsoni* Arredondo & Arredondo (2002), which was described in comparison with *T. merriami*. Additional material of *T. olsoni* was collected in Cuba, or identified in collections by WS, always in association with remains of the Cuban condor *Gymnogyps varonai* (Arredondo, 1971) and with large, extinct members of the Accipitridae (see Suárez 2000a, b, 2004). Comparison of *T. olsoni* with other teratorns, especially *T. merriami*, shows that it should be referred to a new genus, described herein. This brings to six the number of genera in the Teratornithidae and provides additional information on the evolution and biogeography of the family.

Materials and Methods

Specimens of the Cuban teratorn described herein are housed in the following institutional and private collections in La Habana, Cuba: Museo Nacional de Historia Natural de Cuba (MNHNCu); Instituto de Ecología y Sistemática (CZACC: Colecciones Zoológicas de la Academia de Ciencias de Cuba); Oscar Arredondo collection (OA); Osvaldo Jiménez collection (OJ); William Suárez collection (WS). We examined all the Cuban specimens previously described or referred to Teratornithidae, including the holotypical right femur (CZACC 400-649) of *Teratornis olsoni*. Comparisons with skeletons of large modern members of the Vulturidae (*Vultur* and *Gymnogyps*) were made in the skeletal collections of the National Museum of Natural History, Smithsonian Institution (USNM), Washington, D.C. Comparisons were made with extensive material of *Teratornis merriami* in the collections of the George C. Page Museum, a branch facility of the Natural History Museum of Los Angeles County, including the following specimens sent on loan: left quadrate LACM HC F3452; left coracoid LACM K3303;

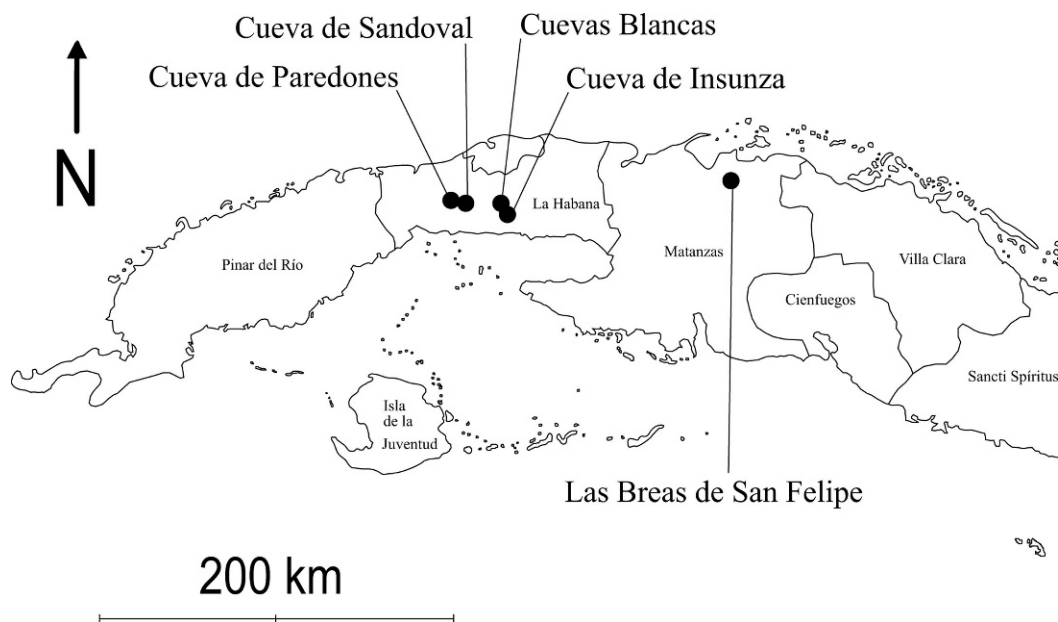


Fig. 1. Map of western Cuba showing Quaternary fossil localities in which the Cuban teratorn *Oscaravis olsoni* has been recovered.

right scapula LACM B103; left humerus LACM B261; right tibiotarsus LACM B1044; left tarsometatarsus LACM B566. A cast of right femur LACM B788 was used for Fig. 7. We also examined the holotypical distal end of right tibiotarsus (MHNT-VT 5154) of *Taubatornis campbelli* from the Museu de Historia Natural de Taubaté, São Paulo, Brazil. Comparisons with *Cathartornis gracilis* (L. Miller 1910), *Argentavis magnificens* (Campbell & Tonni 1980, Campbell 1995), and *Aiolornis incredibilis* (Howard 1952, Campbell et al. 1999) relied on published descriptions and illustrations. Osteological terminology follows Baumel et al. (1979) and Howard (1929), with some necessary modifications. Measurements were taken with digital calipers to the nearest 0.1 mm.

Systematic Paleontology

Order Incertae Sedis

Family Teratornithidae L. Miller, 1909

The Cuban fossils differ from comparable bones of Vulturidae (*Vultur* and

Gymnogyps) and agree with *Teratornis* in the following characters. Quadrate larger and massive, with L-shaped mandibular articulation; socket for quadratojugal much larger. Coracoid with procoracoid process projecting more dorsad (rather than laterad); procoracoid foramen larger and more sternally placed (not true of *Argentavis*, however). Scapula with longer and more pointed acromion; shorter and curved furcular articulation; shaft straighter “in both planes” as noted by L. Miller (1925:90). Humerus with long, straight, deep ligamental furrow; pectoral crest “a thick, lumpy ridge with almost no [distal] tubercle” that “overhangs the bicipital furrow” (L. Miller 1925:90); shaft straighter and very concave anteroproximally. Ulnare with attachment for lig. ulno-ulnocarpale long, diagonal, and ridge-like, located close to the external prominence (Howard 1952:51). Femur with head relatively larger and very indistinctly set off from the shaft; trochanter weakly developed without a deep depression at its base; pneumatic openings (proximal end) small and not aligned

in a large oval depression below the trochanter; anterior surface of shaft with a distinct anterior intermuscular line near the midline; shaft much more robust, with flat posterior face of the proximal end. Tibiotarsus with shaft above condyles wider; distal articular surface of the external condyle flatter with the intercondylar groove wider and less distinct; internal condyle (anterior view) much shorter or reduced. Tarsometatarsus with outer extensor groove leading into the distal foramen much deeper; metatarsal facet located entirely posteriorly (not extending onto the medial face of shaft); trochlea III less visible in lateral or medial view (trochleae II and IV are more proximal and rotated posteriorly in *Vulturidae*, so that much more of trochlea III is visible in lateral or medial view than in *teratornis*); area between metatarsal facet and trochlea III, and between trochlea IV and the distal foramen, excavated, creating a ridge that extends proximally from trochlea III (versus flat in *Vulturidae*).

Oscaravis, new genus

Type and only included species.—*Teratornis olsoni* Arredondo & Arredondo, 2002:16.

Distribution.—Known only from Cuba (Fig. 1).

Etymology.—Oscar plus Latin feminine *avis*, bird. Dedicated to the memory of our esteemed colleague and friend Oscar Arredondo (Fig. 2), a mailman by profession, who laid the foundation for the study of vertebrate paleontology in Cuba from 1945 to 2001 (C. Arredondo 2007). The genus is not to be confused with *Oscarornis* Mathews, 1928 (type *Lalage sharpei*, Campephagidae).

Diagnosis.—Quadrate more massive and relatively larger than in *Teratornis* with many striking qualitative differences (Fig. 3). In characters 1 and 2 of Campbell & Tonni (1980:62) the Cuban bird appears to be more like *Argentavis* than *Teratornis*. In lateral view, the socket for

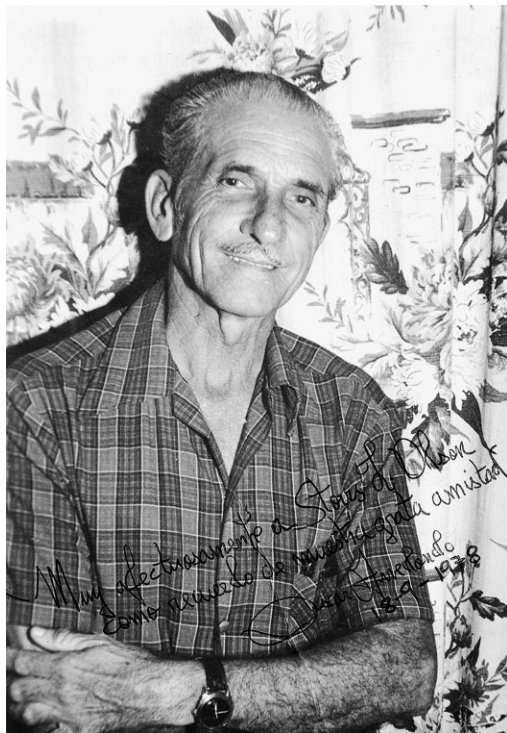


Fig. 2. Oscar Arredondo de la Mata (1918–2001), father of avian paleontology in Cuba. Photograph taken about 1978.

the quadratojugal is proportionately much larger and oriented much more posteriorly, as opposed to laterally in *Teratornis*. In ventral view, the condylus lateralis is more robust and angled more laterally as opposed to somewhat posteriorly in *Teratornis* or *Argentavis*, and the lateral portion (which bears the socket for the quadratojugal) has a large bony anterior projection, being proportionately much wider anteroposteriorly. The pedicel for the otic process in medial view is proportionately wider and not as high and the medial portion of the articulation (the lateral is missing) bears a much more distinct facet than in *Teratornis*.

Coracoid (Fig. 4) with ventral aperture of procoracoid foramen much larger than in *Teratornis* or *Argentavis*, and not set in a distinct depression as in *Teratornis*. Agrees with *Teratornis* and differs from *Argentavis* in the characters of the cora-

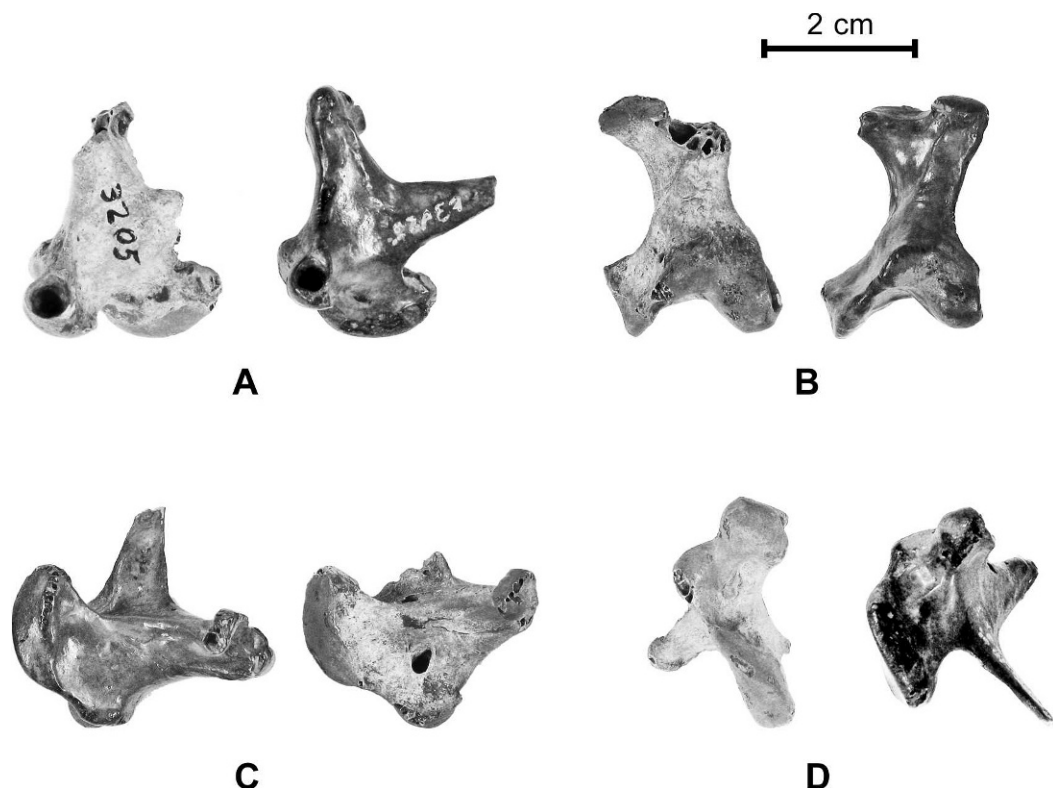


Fig. 3. Right quadrate of *Oscaravis olsoni* OA 3205 (on the left in A, B, D) compared with *Teratornis merriami* LACM HC F3452 (on the left in C). Images of *Teratornis* are reversed to facilitate comparison. A, lateral view; B, posterior view; C, medial view; D, ventral view.

coid given by Campbell & Tonni (1980: 62–63).

Shaft of scapula flatter and relatively wider than in *Teratornis*; bone more dorso-ventrally compressed in anterior view; acromion longer and narrower; glenoid facet shorter, more rounded and less oval than in *Teratornis*; a fairly large pneumatic opening is present on the ventral surface of the scapula ventrodistal to the glenoid facet in *Oscaravis* (this might be individually variable).

The humerus (Figs. 5, 6) differs greatly from *Teratornis* in being much shorter in the portions preserved and in having the anterior (palmar) surface of the shaft very flat, head lower and much less bulbous, and the margin bordering the capital groove is not undercut, the pectoral crest is short, more bulbous, with the main muscle attachments facing more ventrally

rather than anteriorly (Fig. 5). The distal extension of the pectoral crest beyond the thickest area is much shorter and thicker, not curving ventrad as a sharp ridge onto the anterior surface of the shaft (this was given as a character of the Teratornithidae in the diagnosis of *Aiolornis* (Campbell et al. 1999:170) but actually serves to separate that genus and *Teratornis* from *Oscaravis*); in ventral view, the shaft is much more compressed and the edge leading distad from the bicipital crest is much sharper; and the pectoral crest is lower. In posterior (anconal) view, the attachment for *M. latissimus dorsi* is not placed as close to the midline as in *Teratornis*, but it is much less dorsally situated than in *Aiolornis*. A transverse section of the shaft through the nutrient foramen would be very flat on the anterior surface but rounded posteriorly,

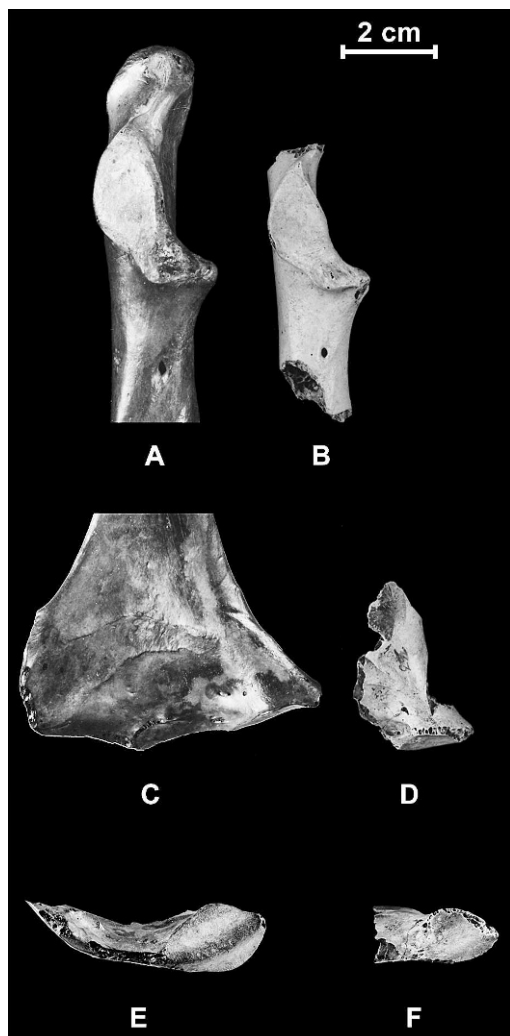


Fig. 4. Fragmentary coracoid of *Oscaravis olsoni* WS 363 (B, D, F) compared with *Teratornis merriami* LACM K3303 (A, C, E). A, B, scapular ends in dorsal view; C, D, sternal ends in dorsal view; E, F, sternal ends in sternal view.

and would thus be unlike any of the other genera of teratorns (Campbell et al. 1999:172, fig. 3). *Oscaravis* differs further from *Argentavis* in having the shaft of the humerus in anterior (palmar) view markedly straighter, not sigmoid (Campbell & Tonni 1980).

In the distal end of the humerus (Fig. 6), the dorsal epicondyle is much better developed and in distal view seems to have a large articulating surface that

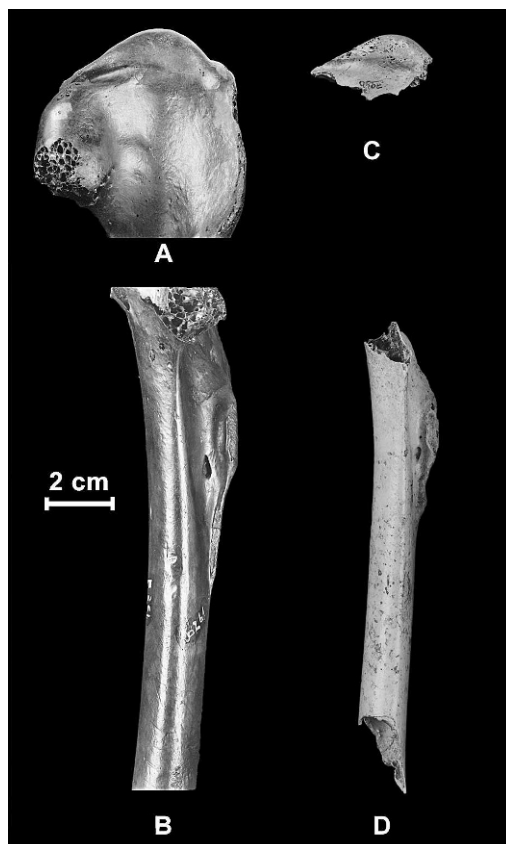


Fig. 5. Fragmentary humerus of *Oscaravis olsoni* WS 936E (C, D,) compared with *Teratornis merriami* LACM B261 (A, B). A, C, proximal ends in anterior (palmar) view; B, D, shafts in ventral view.

gives it the appearance of a third condyle separated from the radial condyle by a deep trough. Among all other birds, we found a similar condition only in a cast of the distal end of a humerus (LACM 50660) of an unidentified genus and species of the pelecaniform family Pelagornithidae (the pseudodontorns) from the Miocene (Barstovian) of California. The distal ends of the humeri in *Teratornis* and *Gymnogyps* are much more similar to each other than either is to *Oscaravis*, which is markedly flattened and becomes particularly thin in the area proximal to the ventral epicondyle. In distal view the ulnar condyle is proportionately smaller and much less bulbous,

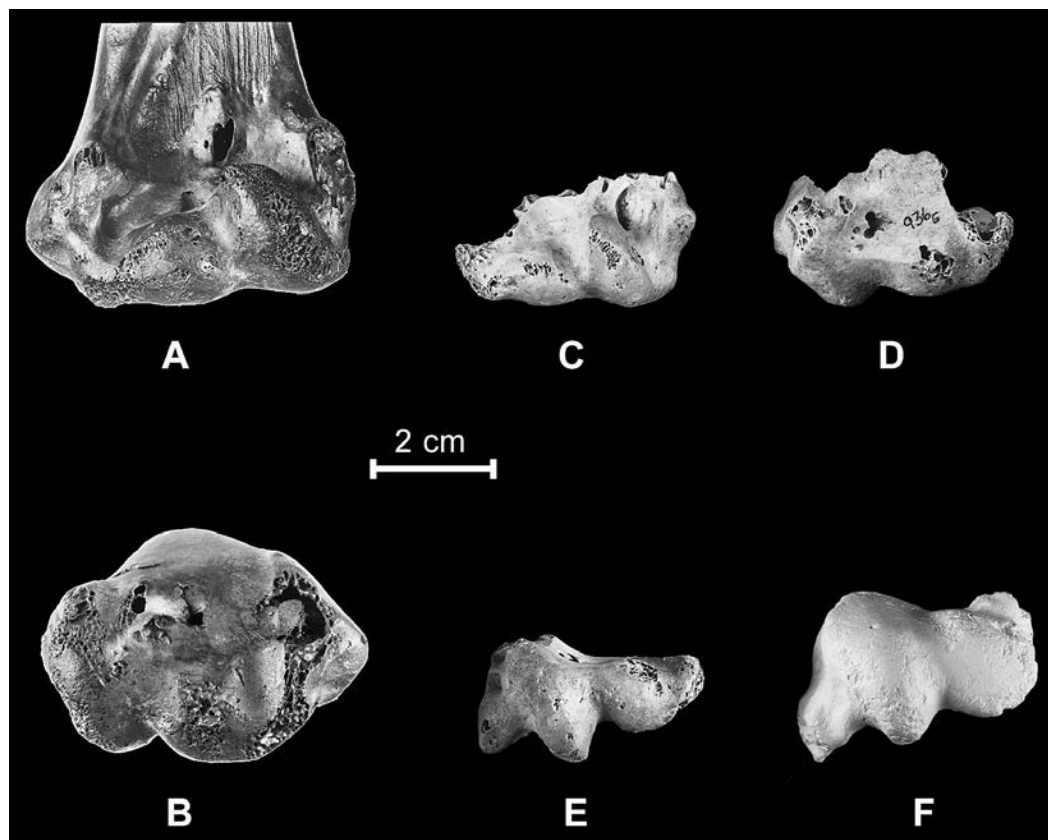


Fig. 6. Distal end of humerus of *Oscaravis olsoni* WS 936E (C, D, E) compared with *Teratornis merriami* LACM B261 (A, B) and Pelagornithidae genus and species indeterminate LACM 50660 (F, figure is reversed to facilitate comparison). A, C, anterior (palmar) view; D, posterior (anconal) view; B, E, F, distal view.

and the radial condyle longer, narrower and much more distinctly set off from the ulnar condyle than in either *Teratornis* or *Gymnogyps*. *Oscaravis* also differs from the other taxa in having the area proximal and dorsal to the radial condyle excavated, with a narrow longitudinal pneumatic opening. There is also a complex pneumatic opening in the olecranal fossa, variably present in *Teratornis*, which is much shallower and flatter than in *Teratornis* and quite unlike the narrow, deep olecranal fossa in *Gymnogyps*. None of the humeral distinctions of *Oscaravis* described above were mentioned by Campbell & Stenger (2002:3) as occurring in the humeri of *Cathartornis* or *Teratornis*.

Ulnare closer to *Teratornis* than to *Aiolornis* in general morphology but slightly more massive, especially the ramus ventralis. Ulnar articulation larger than in *Teratornis*. In distal view, the ramus dorsalis meets the body of the bone at a more open angle than in *Teratornis* or *Aiolornis*.

The femur (Fig. 7) is relatively shorter and stouter, with the trochanter less massive; anterior intermuscular line situated more medially (towards the midline), the proximal portion terminating in a very distinct, nearly vertical ridge (less distinct and angled more laterad in *Teratornis*). The shaft is compressed antero-posteriorly so that the cross section would be oval rather than round as



Fig. 7. Holotypical femur of *Oscaravis olsoni* CZACC 400-649 (on the left in each pair) compared with a cast of *Teratornis merriami* LACM B788 (on the right in each pair). A, anterior view; B, posterior view; C, proximal view; D, distal view.

in *Teratornis*. The attachment of the ligamentum teres is much larger and deeper. At the distal end, the rotular groove, in anterior view, is narrower than in *Teratornis* (see Arredondo & Arredondo 2002:16–17).

Tibiotarsus (Fig. 8) with tendinal groove and proximal tendinal opening wider, and the intercondylar fossa is also wider, at least proximally, than in *Teratornis*.

The tarsometatarsus (Fig. 8) is distinctive in having trochlea III shorter so that trochlea II extends farther distad than the former, instead of being shorter as in *Teratornis* (in this respect *Oscaravis* again recalls some pelecaniform birds). In distal view, the intertrochlear notches are much wider than in *Teratornis*, and trochlea IV is not as deep but has a distinct wing on the externo-posterior corner that is scarcely evident in *Teratornis*. The con-

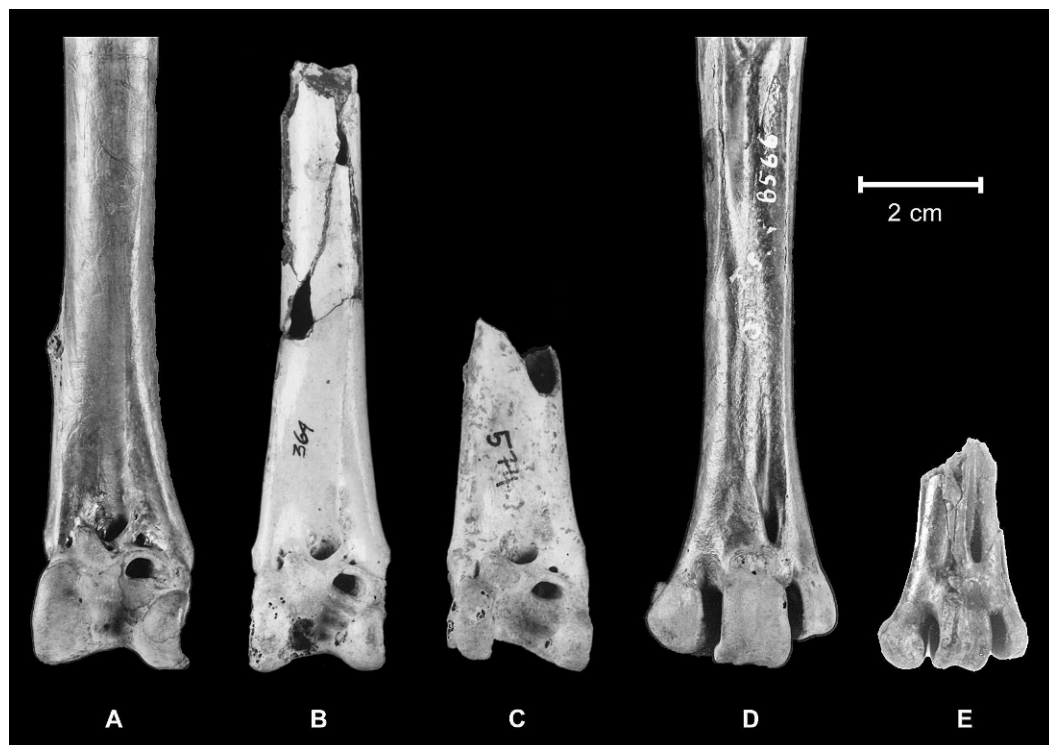


Fig. 8. Distal ends of right tibiotarsi (A-C) and distal ends of left tarsometatarsi (D, E) in anterior view: A, *Teratornis merriami* LACM B1044; B, *Oscaravis olsoni* WS 364; C, *Oscaravis olsoni* WS 574; D, *Teratornis merriami* LACM B566; E, *Oscaravis olsoni* MNHNCu 75.4661.

figuration of the trochleae in *Cathartornis gracilis* as described and illustrated by L. Miller (1910, 1925) is as in *Teratornis* and therefore unlike *Oscaravis*.

***Oscaravis olsoni*, new combination**

Figs. 3–8

Emended diagnosis.—As for the genus.

Holotype.—Right femur CZACC 400-649, Cueva de Paredones, Municipality of Caimito, La Habana Province, Cuba. Apparently collected in 1969 by members of the Instituto de Geología y Paleontología (see Arredondo & Arredondo 2002:15).

Paratypes.—Topotypical fragment of medial condyle of left femur, OA 3151, collected in 1959 by Oscar Arredondo. Cuevas Blancas (Galería de los Huesos), Municipality of Quivicán, La Habana Province, Cuba: Distal half of right

femur, OJ P-8 (now at the Instituto de Ecología y Sistemática, with the same number), collected 19 January 1990, by Osvaldo Jiménez. Cueva de Insunza (sumidero de la Dolina de los Espejuelos), Municipality of Quivicán, La Habana Province, Cuba: Right quadrate, OA 3205, collected 5 March 1994, by William Suárez and Viviana Vasallo (mistakenly attributed to Cueva del Túnel in OA Collection).

Newly referred material.—Topotypical right scapula lacking posterior third WS 930, collected 14 June 1996, by William Suárez.

Cueva de Sandoval (Sandoval III low; see Suárez 2000b), Municipality of Caimito, La Habana Province, Cuba: left coracoid lacking head and most of the sternal end WS 363; fragmentary left humerus (shaft with pectoral crest and

fragments of proximal and distal ends) WS 936E; distal half of right tibiotarsus WS 364. These three specimens may come from a single individual and were collected in 1995 by William Suárez. Distal end of right tibiotarsus lacking posterior portions of condyles WS 574, collected 31 March 1999, by William Suárez.

Las Breas de San Felipe (see Iturralde-Vinent et al. 2000), Municipality of Martí, Matanzas Province, Cuba: (San Felipe I) right ulnare MNHNCu 75.4663; fragmentary distal half of left tibiotarsus lacking portions of the external and internal condyles MNHNCu 75.4659; distal end of right tibiotarsus lacking part of the external condyle MNHNCu 75.4660; distal end of right tibiotarsus without condyles MNHNCu 75.4858; distal end of right tarsometatarsus MNHNCu 75.4662. (San Felipe II) fragmentary distal end of left femur MNHNCu 75.4857; distal end of left tarsometatarsus MNHNCu 75.4661; collected 22–25 February 2001, and 25–27 December 2002, by William Suárez and Stephen Díaz.

Measurements (mm): Quadrate (see Table 1).—Coracoid: depth of shaft at midpoint of glenoid facet 21.0; width and depth of shaft at level of dorsal procoracoid foramen 14.4×16.2 ; distal depth of articulation 12.7. Scapula: anterior width 31.0; length and width of glenoid facet 12.0×8.8 ; width and depth of shaft at base of anterior expansion 13.8×6.2 . Humerus: depth through head 15.3; length and width of pectoral crest 42.8×9.2 ; width and depth of shaft at distal end of pectoral crest 22.9×15.5 ; distal width 39.6; distal width through dorsal epicondyle 43.3; greatest distal depth (through radial condyle) 24.2; length of radial condyle 16.6; depth of ulnar condyle 12.0. Ulnare: greatest diameter 26.6+; greatest diameter of ulnar articulation 14.6. Femur (OJ P-8 in parentheses): total length 137.6; proximal width 35.3; depth of head 16.4; least width and depth of shaft 20.6×18.0 ; distal width

through condyles 36.9; depth through internal condyle 21.3+; depth through external condyle $31.9 + (32.0)$. Tibiotarsus: least width and depth of shaft at midpoint 14.5×13.1 . Tarsometatarsus (MNHNCu 75.4662 in parentheses): depth of shaft at level of distal end of distal foramen (anterior view) 8.2 (8.6); width and depth of trochlea IV 6.1×12.8 (6.8×13.8); depth of trochlea III 15.4 (16.7); width and depth of trochlea II 8.7×12.6 (9.3×15.4); distal depth through trochleae 16.5 (18.1). For comparative measurements of *Oscaravis olsoni* with other teratorns see Table 1.

Discussion

The only occurrences of *Teratornis merriami* outside western North America (see Brodkorb 1964, Lundelius et al. 1983, Arthur Harris pers. comm. in Campbell & Tonni 1981) are bones from late and early Pleistocene localities in Florida (Wetmore 1931, Emslie 1995, 1998). From the size of these specimens and the configuration of the trochleae of the tarsometatarsi illustrated in publications, these bones are clearly referable to *Teratornis*, not *Oscaravis*, so despite the proximity of Florida to Cuba, so far as is known, *Oscaravis* is endemic to Cuba.

Campbell & Tonni (1980) considered that *Argentavis* was less derived than *Teratornis* in many characters. The same appears to be true for *Oscaravis* (see Diagnosis), which may have descended from an older lineage with more pelecaniform characteristics than the more derived forms of the Quaternary of North America, which appear to have evolved some convergent similarities to the Vulturidae. Many living components of the West Indian vertebrate fauna are relicts of continental forms that became extinct elsewhere during the Tertiary, the Todidae (Olson 1976, 1978) and Solenodontidae (Whidden & Asher 2001, Silva et al. 2008) being prime examples. *Oscaravis* doubt-

Table 1.—Measurements (mm) of *Oscaravis olsoni* compared with other teratorns. Sequence of *T. merriami* is: range (mean) sample size.

Element and Character	<i>Oscaravis olsoni</i>	<i>Teratornis merriami</i>	<i>Cathartornis gracilis</i>	<i>Atalapha incredibilis</i>	<i>Argentavis magnificens</i>	<i>Taubatornis campbelli</i>
Quadrates						
Anteroposterior ventral length	27.5*	24.2–28.5 (26.4) 5 ^c	—	—	46 ± 3 ^c	—
Center of socket for quadratojugal to anterior end of mandibular articulation	27.3*	25.5–28.3 (26.8) 5 ^c	—	—	53 ± 2 ^c	—
Length through condylus lateralis	17.4	15.1–17.6 (16.3) 7 ^f	—	—	—	—
Coracoid						
Maximum width of glenoid facet	14.1	17.9–18.8 (18.3) 5 ^c	—	—	26.1 ^d , 31.0 ^c	—
Length of glenoid facet	30.9	36.9–41.1 (38.6) 13 ^b	—	—	—	—
Dorsal end of glenoid facet to ventral end of procoracoid	32.7*	39.1–42.6 (40.5) 5 ^c	—	—	78.0 ^c	—
Least width below procoracoid	16.0	15.4–20.4 (18.3) 13 ^b	—	—	—	—
Humerus						
Least width of shaft	21.1	22.9–26.7 (24.6) 5 ^c	—	—	49.0 ^b	—
Width of shaft at level of nutrient foramen	21.3	23.2–28.9 (24.9) 16 ^c	—	37.8 ^c	52.2 ^c	—
Depth of shaft at level of nutrient foramen	16.1	18.3–23.0 (19.9) 16 ^c	—	~22.0 ^c	32.8 ^c	—
Tibiotarsus						
Distal width	23.1–25.3 (24.0) 3	25.6–29.5 (27.7) 8 ^f	—	—	—	19.6 ^g
Depth through external condyle	22.1*	24.7–29.0 (25.9) 8 ^f	—	—	—	18.8 ^g
Depth through internal condyle	22.1*, 22.2*, 22.6*	25.1–25.6 (25.3) 4	—	—	—	20.0 ^g
Shaft width proximal to tendinal bridge	23.5–24.6 (24.2) 5	26.7–27.4 (27.0) 4	—	—	—	14.2 ^g
Tarsometatarsus						
Distal width	26.9–28.3 (27.6) 2	31.0–34.7 (33.0) 27 ^b	—	—	—	—
Width of middle trochlea	9.5–10.3 (9.9) 2	12.1–13.3 (12.7) 27 ^b	11.6 ^a	—	—	—
Width at distal end of distal foramen	17.8–18.7 (18.2) 2	20.8–23.4 (22.0) 5 ^c	—	—	42.0 ^c	—

^a L. Miller (1910).
^b Fisher (1946).
^c Campbell & Tonni (1980).
^d Campbell (1995).
^e Campbell et al. (1999).
^f Campbell & Stenger (2002).
^g Olson & Alvarenga (2002).
* Broken.

less originated during the Tertiary, but in the absence of much diagnostic material of teratorns from South America, we cannot be sure which aspects of its morphology may have evolved prior to its colonization of Cuba and which evolved in response to the unique environmental conditions and food sources of its insular home.

Oscaravis shows, however, that teratorns were more diverse in their morphology than previously known. The humerus has a relatively shorter shaft (as preserved from distal end of pectoral crest to near the proximal end of brachial depression) than in any other teratorn for which this element is known, with many particular features indicating some differences in the manner of flight. The Cuban species seems to be smaller than *Cathartornis gracilis* but larger than *Taubatornis campbelli* (Table 1). *Oscaravis* also provides evidence that teratorns were capable of overwater dispersal (Olson & Alvarenga 2002), so that the family need not have required a land bridge to enter North America from the south. Thus, although the only fossils of teratorns in North America are from the Quaternary and latest Tertiary, so that they superficially appear to have been part of the Great American Faunal Interchange (Campbell & Tonni 1981), this may be a result of sampling bias.

Campbell & Tonni (1981) suggested that teratorns were predaceous carnivores rather than having been scavengers, as in the classical interpretation of the paleobiology of these birds (L. Miller 1909, 1925; Fisher 1945, Howard 1950). To the contrary, Palmqvist & Vizcaíno (2003) suggested on several ecological and reproductive parameters of the largest known teratorn, *Argentavis magnificens*, that the species was a scavenger rather than an active raptor and they proposed that kleptoparasitism of marsupial predators may have played an important part economy of this huge teratorn. If kleptoparasitism played an important role in the

ecology of teratorns, then in Cuba, where there was a complete absence of carnivorous mammals (Arredondo 1976, Silva et al. 2008), piracy must have been practiced on some other taxa.

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