BULLETIN

of the
FLORIDA STATE MUSEUM
Biological Sciences

Volume 26 1980 Number 1

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Numbers of the BULLETIN OF THE FLORIDA STATE MUSEUM, BIOLOGICAL SCIENCES, are published at irregular intervals. Volumes contain about 300 pages and are not necessarily completed in any one calendar year.

Communications concerning purchase or exchange of the publications and all manuscripts should be addressed to: Managing Editor, Bulletin; Florida State Museum; University of Florida; Gainesville, Florida 32611.

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Publication date: December 22, 1980 Price: 1.60

TWO MID-PLEISTOCENE AVIFAUNAS FROM COLEMAN, FLORIDA

THOMAS L. RITCHIE[1]

SYNOPSIS: Avifaunas from two sites near Coleman, Florida, are Irvingtonian in age and contain a total of 38 species. The two sites, Coleman IIA and Coleman IIIC and D, are probably related temporally, but they are analyzed separately. Ten species (*Anhinga* cf. *A. grandis*, *Buteo lagopus*, *Aquila chrysaetos*, *Falco columbarius*, *Bubo virginianus*, *Protocitta* cf. *P. ajax*, *Dendroica* sp., *Pheucticus ludovicianus*, *Pooecetes gramineus*, and *Aimophila aestivalis*) are new to the Pleistocene of Florida. *Pheucticus ludovicianus* and *Aimophila aestivalis* are new to the fossil record. New material of two populations of *Colinus suilium*, one early to middle Pleistocene in age (from the Inglis IA site in Citrus County, Florida) and the other middle Pleistocene in age (from Coleman IIA), is analyzed, and indicates *C. suilium* underwent a gradual size increase throughout the Pleistocene. This is the opposite of what was previously thought and suggests that *C. suilium* was not derived from *Colinus hibbardi* as has been hypothesized.

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[1] The author is currently a Naturalist/Guide on board the M.S. Lindblad EXPLORER, as well as a professional wildlife artist based in Palm Beach, Florida. This study was performed while he was a Graduate Assistant in the Department of Zoology, University of Florida, Gainesville 32611. It represents, in part, a thesis prepared in partial fulfillment of the requirements for the degree Master of Science.

RITCHIE, THOMAS L. 1980. Two Mid-Pleistocene Avifaunas from Coleman, Florida. Bull. Florida State Mus., Biol. Sci. 26(1): 1-36.

INTRODUCTION

Two fossil deposits collected near Coleman, Sumter County, Florida, have proved important in the study of middle Pleistocene birds and mammals of Florida. The first, Coleman IIA, was discovered in 1966 during limestone mining operations at the Coleman II mine of the Dixie Lime and Stone Corporation. The site was collected by Norm Tessman, S. David Webb, Robert Allen, Charles Collins, and Sue Hirschfeld (Webb 1974) and was destroyed that same year by the ensuing mining operations.

The deposit represents a sinkhole filling that extended into late Eocene Ocala limestone; it was deposited during the late Illinoian Glacial Stage (Webb 1974). Allen (*in* Martin 1974) gave the following description of the site:

> The opening of the paleosink was approximately 30 yards long and 25 yards wide. Only the upper 8 to 10 feet of sediments filling the sink were exposed. Thin alternating beds of two different types appeared: a wet orange-brown clay and a coarse gray-white sand. Although the clay facies appeared homogeneous, the sand facies were filled with pebble-to-boulder-sized limestone rubble. Bones found in the clay were characteristically colored white or tan, with all gradations in between; the bone found in gray-white sand was characteristically black, but in a few instances, white. Bones often transgressed these lithologic units and are characteristically colored half tan and half black, testifying to relatively rapid accumulation of successive lithologic units.

A study by Tessman (Martin 1974) indicated a large number of the bigger mammalian bones have "green breaks," meaning breaks that occurred before fossilization. No evidence indicates carnivores caused these breaks, so it is assumed that fossil remains from some of the larger mammals were accumulated by their falling a considerable distance into the sinkhole. To verify this hypothesis he made comparisons of the Coleman IIA fossils with freshly broken bones and bones recently fallen into a sinkhole 65 feet deep.

Martin (1974) reported on the mammalian fauna of Coleman IIA, and noted that bat remains, especially *Myotis* cf. *M. austroriparius*, indicated the sink was "extensive and not filled with water." Martin identified 37 mammalian species, including 5 species (*Dasypus bellus, Pampatherium septentrionalis, Palaeolama mirifica, Platygonus cumberlandensis*, and *Arctodus pristinus*) indicative of a late Irvingtonian age.

In 1968 Robert Martin and H. Kelly Brooks discovered and collected another site near Coleman, Coleman III. According to Brooks (pers. comm.) this site was approximately 300 meters due north of Coleman IIA, in the Coleman III mine of the Dixie Lime and Stone Corporation.

Unlike the karst deposit of IIA, Coleman III was a small spring deposit that has been dry since the middle Pleistocene (Brooks, pers. comm.). The site was divided into four horizontal sections, A, B, C, and D. A sample from IIIA (the spring mouth) yielded a light gray, fine-grained marl with freshwater snail shell fragments. IIIB (*Viviparus* zone) consisted of a brownish-gray, fine grained sandstone with slightly darker silt stringers throughout, and many snail shell fragments, mostly of *Viviparus georgianus*. IIIC is identical to IIIA. Unfortunately no substrate samples were collected from IIID. This site, too, was later destroyed by mining operations.

The bird fossils of Coleman III were found only in IIIC and IIID. Fourteen non-avian vertebrates (*Amia calva, Micropterus* sp., *Rana* sp., *Chelydra* sp., *Trionyx ferox, Terrapene carolina, Chrysemys concinna, Alligator mississipiensis, Crotalus adamanteus, Pampatherium septentrionalis*, Proboscidea, *Hemiauchenia* cf. *H. macrocephala, Tapirus* sp., and *Equus* sp.) are identified from IIIC. The non-avian vertebrates identified from IIID are *Chrysemys scripta, Chrysemys concinna, Chrysemys* cf. *C. floridanus*, and *Sigmodon* sp.

Both Coleman IIA and Inglis IA, a more recently discovered Pleistocene site of central Florida, have yielded large samples of the extinct quail *Colinus suilium*. Holman (1961) made a thorough study of the osteology of the New World quails, and the samples of these two populations of *C. suilium* have added to the knowledge of evolution of *Colinus* in North America.

Inglis IA has been dated to both the late Blancan age (Klein 1971) and the early Irvingtonian age (Webb 1974). No matter which assessment of its age is correct, Inglis IA is considerably older than Coleman IIA. Inglis IA is located along the Gulf Coast near Inglis, Citrus County, Florida, at about the present sea level. Jean Klein and Robert Martin discovered this extremely fossiliferous sandy fissure-fill deposit (Webb 1974), and Klein (1971) made a thorough study of its geology, paleoecology, and ferungulates.

Material from the three localities (Coleman IIA, Coleman IIIC and D, and Inglis IA) is presented below. Osteological terminology follows that of Howard (1929). All specimens are in the Florida State Museum. Table 1 lists the bird species from Coleman, Florida.

ACKNOWLEDGMENTS

I wish to express my deepest thanks to Pierce Brodkorb for his invaluable advice and supervision during this study. H. Kelly Brooks answered numerous questions concerning the two Coleman sites and was especially helpful in describing Coleman III. Jon Baskin assisted in the description of the geology of Coleman IIIA, B, and C, and S. David Webb, H. Gregory McDonald, and Michael Frazier provided much helpful aid and technical advice.

Financial support was provided through Teaching Assistantships with the Department of Zoology, University of Florida. Essential comparative skeletal material was studied on loan from Pierce Brodkorb of the Department of Zoology, University of Florida, and Storrs L. Olson of the Smithsonian Institution.

Table 1.—Pleistocene birds from Coleman, Florida.

COLEMAN IIA:

Podilymbus podiceps
Botaurus lentiginosus
Ixobrychus sp.
Ciconia maltha weillsi
Anas platyrhynchos
Branta canadensis cf. *B. c. hutchinsii*
Coragyps occidentalis
Buteo platypterus
Buteo jamaicensis
Buteo lagopus
Aquila chrysaetos
Falco columbarius
Colinus suilium
Agriocharis anza
Rallus elegans
Coturnicops noveboracensis
Philohela minor
Zenaida macroura
Bubo virginianus
Otus asio
Colaptes auratus
Progne subis
Protocitta cf. *P. ajax*
Dendroica sp.
Agelaius phoeniceus
Pandanaris floridana
Pheucticus ludovcianus
Pipilo erythrophthalmus
Passerculus sandwichensis
Pooecetes gramineus
Aimophila aestivalis
Spizella pusilla
Spizella sp.
Emberizinae, genus and species indeterminate

COLEMAN IIIC:

Anhinga cf. *A. grandis*
Ardea herodias
Aythya affinis
Aythya sp.
Gallinula chloropus

COLEMAN IIID:

Agriocharis anza

SYSTEMATIC LIST

COLEMAN IIA

ORDER PODICIPEDIFORMES

FAMILY PODICIPEDIDAE

Podilymbus podiceps (Linnaeus), Pied-billed Grebe

MATERIAL —Tarsometatarsus (UF 11816).

REMARKS—*Podilymbus* is distinguished from *Podiceps* by the narrower and deeper proximal end of the tarsometatarsus; ridges surrounding both cotylae less pronounced; shaft wider and stouter, with the ridge on the internal side of anterior metatarsal groove not as well developed; calcaneal ridges shorter, with inner and outer proximal foramina aligned approximately side by side (in the tarsometatarsus of *Podiceps* the outer proximal foramen is much lower than the inner one).

Table 2.—Tarsometatarsal measurements (in mm), with mean and range, of Recent *Podilymbus podiceps podiceps* (Brodkorb Collection) and fossil *Podilymbus podiceps* from Coleman IIA (UF 11816).

	Proximal Width	Proximal Depth
RECENT		
female (5)	7.1 (6.9-7.5)	6.2 (5.8-6.8)
male (3)	7.9 (7.8-8.1)	6.8 (6.3-7.3)
overall	7.4 (6.9-8.1)	6.4 (5.8-7.3)
FOSSIL		
UF 11816	9.1	7.5

The single tarsometatarsus was not completely ossified before fossilization took place, which shows it was from an immature bird. In spite of this, the specimen is considerably larger than the tarsometatarsi of all recent *P. podiceps* specimens it was compared with (Table 2). Storer (1976) demonstrated that *P. p. magnus*, a supposedly large Pleistocene subspecies, is totally untenable, for its size falls within the normal size variation for living *P. p. podiceps*. The poor state of the fossil does not permit comparing its overall size with the measurements Storer (1976) published.

ORDER ARDEIFORMES

FAMILY ARDEIDAE

Botaurus lentiginosus (Rackett), American Bittern

MATERIAL.—Tibiotarsus, distal end (UF 11821).

REMARKS.—The tibiotarsus of *Botaurus* differs from that of *Nycticorax* by having shaft stouter and less round in cross section; flange overlap on both internal and external condyles better developed; internal condyle, when viewed medially, more round; anterior intercondylar fossa narrower; internal condyle projecting approximately even with external edge of tendinal groove (the condyle is located more externally in that of *Nycticorax*); depression just proximal to anterior articulating surface of external condyle less excavated; depression on internal condylar half of anterior intercondylar fossa more excavated; internal ligamental prominence more proximally located, generally.

Ixobrychus sp.

MATERIAL.—Tibiotarsus, distal end (UF 22101).

REMARKS.—The tibiotarsus of *Ixobrychus* is separated from that of *Butorides* by having flange overlap of condyle poorly developed along outer edges of both condyles; tuberosity on ridge forming internal boundary of tendinal groove located closer to supratendinal bridge; flange forming posterior ridge of internal condyle less extended, resulting in a narrower posterior intercondylar sulcus; ridge separating anterior intercondylar fossa from posterior intercondylar sulcus depressed along external half (this ridge is straighter and more defined in *Butorides*).

The fossil was compared with Recent skeletal material from six species of *Ixobrychus: exilis, involucris, minutus, sinensis, sturmii,* and *cinnamomeus*. It differs from the tibiotarsi of all six species by having the anterior intercondylar fossa more excavated. The fossil is most similar to the tibiotarsi of the first four *Ixobrychus* species listed above, but is further separated as follows: In *I. exilis* the tibiotarsus has less distance between the condyles; condyles relatively thinner; smaller size (Table 3). In *I. involucris* and *I. minutus* the tibiotarsi have both condyles (anterior view) wider; internal condyles extended in antero-posterior plane (the internal condyle of the fossil extends more medially). In *I. sinensis* the tibiotarsus has more excavation on external face of external condyle; both condyles (anterior view) wider; relatively greater distance between condyles.

Table 3.—Measurements (in mm) of the tibiotarsus of fossil *Ixobrychus* sp. from Coleman IIA, Recent *I. exilis* and *I. minutus* (Brodkorb Collection), and Recent *I. involucris, I. sinensis, I. sturmii,* and *I. cinnamomeus* (Smithsonian Institution).

Species	Distal Width	Greatest Depth External Condyle	Greatest Depth Internal Condyle
I. sp.	5.6	4.7	5.4
I. exilis			
mean	5.0	4.5	4.8
range (6)	4.9-5.2	4.2-4.6	4.5-5.0
I. minutus	5.9	5.1	5.3
I. involucris	5.5	4.8	5.1
I. sinensis	5.3	4.5	4.4
I. sturmii	5.9	5.3	5.8
I. cinnamomeus	5.8	5.5	5.8

This fossil tibiotarsus possibly represents a new species, but more material is necessary for an accurate diagnosis. The fossil is most similar to the tibiotarsus of *I. exilis* in overall characters, and may be simply an aberrant form referable to *exilis* (Fig. 1).

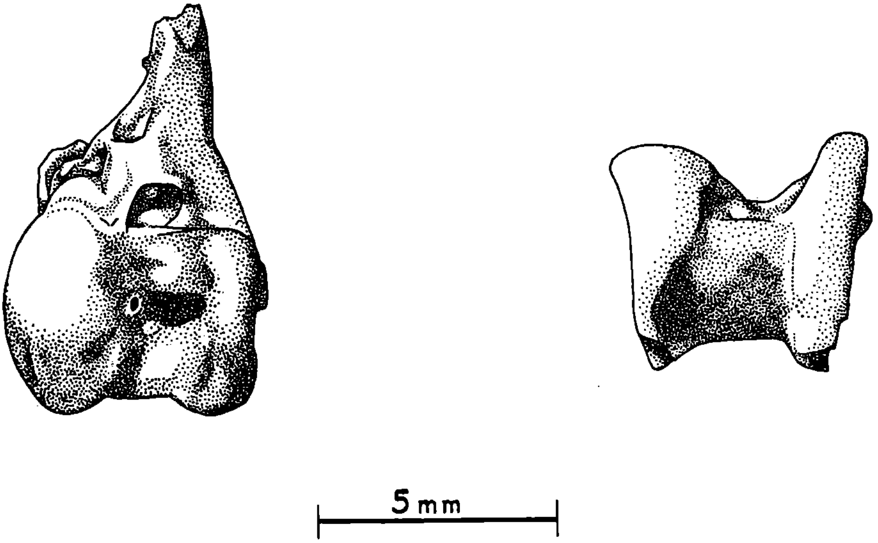

Figure 1. (A) Anterior and (B) distal views of the tibiotarsus of *Ixobrychus* sp. from Coleman IIA (UF 22101).

FAMILY CICONIIDAE

Ciconia maltha weillsi (Sellards)

MATERIAL.—Carpometacarpus, proximal end (UF 11619).

REMARKS.—*Ciconia* is separated from *Mycteria* by having metacarpal I larger and more robust with shorter process; carpal trochlea wider through lateral extension of external face of trochlea; region just posterior to external ligamental attachment more depressed; anterior carpal fossa located more anteriorly and more deeply excavated; ligamental attachment of pisiform process less prominent; flexor attachment longer and more raised from metacarpal II shaft.

ORDER ANSERIFORMES

FAMILY ANATIDAE

Anas platyrhynchos Linnaeus, Mallard

MATERIAL.—Tibiotarsus, lacking the proximal end (UF 11642).

REMARKS.—*Anas rubripes*, *Anas diazi*, and *Anas fulvigula* are here considered subspecies of *A. platyrhynchos*, following Johnsgard's (1961) suggested classification. Woolfenden (1961) made a thorough study that is useful in separating the various genera within this family, and Ligon (1965) separated *A. platyrhynchos* from other species of *Anas* by its larger size.

The slimness of the shaft shows it is that of a female. The fossil record of this species is well documented from Pleistocene and prehistoric sites around the world, including about a dozen sites in Florida alone (Brodkorb 1964).

Branta canadensis cf. *B. c. hutchinsii* (Richardson), Canada Goose

MATERIAL.—Carpometacarpus, proximal end (UF 22103).

REMARKS.—The specimen was compared to carpometacarpi of *Branta*, *Anser*, *Anabernicula*, and *Brantadorna* species, and found to be most similar to those of *Branta* and *Anser*. The fossil agrees with *Branta* in having a large pollical facet; internal edge of pollical facet extends more mediad; external edge of pollical facet extends more distad (the carpometacarpus of *Anser* has a shorter and narrower pollical facet, with the external edge of the facet blunter).

The size of the fossil is identical to that of Hutchins' Canada goose, which is among the smallest subspecies of *B. canadensis*. This subspecies has been recorded from three other Pleistocene sites in Florida: Seminole Field, Melbourne, and Itchtucknee River (Wetmore 1931).

ORDER ACCIPITRIFORMES

FAMILY VULTURIDAE

Coragyps occidentalis (L. Miller)

MATERIAL.—Coracoid (UF 11799), 2 humeri (UF 11591T, 22102), radius (UF 11593), ulna (UF 22096), 2 tarsometatarsi (UF 11800A, 11800B), and hallux (UF 22097).

REMARKS.—Most of the fossils are fragmentary, so only a few measurements (Tables 4 and 5) could be compared with those published

Table 4.—Tarsometatarsal measurements (in mm) of *Coragyps occidentalis* from seven Pleistocene sites. * indicates mean measurements of Howard (1968).

Locality	Distal Width	Trochlea for Digit II Width	Trochlea for Digit III Width	Trochlea for Digit IV Width
Coleman IIA	16.8	4.8	7.2	4.1
Reddick				
mean	16.9	4.8	6.7	4.1
range (8)	(16.7-17.3)	(4.5-5.2)	(6.5-6.9)	(3.9-4.3)
Rancho La Brea	17.5*	——	——	——
McKittrick	18.5*	——	——	——
Carpinteria	17.65*	——	——	——
Smith Creek	17.8*	——	——	——
San Josecito	16.8*	——	——	——

by Howard (1968). Because of the broken nature of the specimens, measurements other than those used by Howard were also made and compared with measurements of specimens from the Brodkorb Collection of both *C. occidentalis* from Reddick, Florida, and Recent *Coragyps atratus* (Tables 5 and 6).

There appear to be no diagnostic characteristics, other than size, (elements of *C. occidentalis* are larger and/or stouter than those of *C. atratus*) and intermembral proportions (the wing bones are longer in *C. occidentalis*, but the leg bones are about the same length in both species) that can be used to separate *C. occidentalis* from *C. atratus*. *C. occidentalis* was obviously a larger and heavier bird with longer wings and comparatively shorter legs than *C. atratus* (Howard 1968).

The two species have not been found together in any excavation sites, and it has been suggested that *C. occidentalis* gave rise to *C. atratus* (Fisher 1944). Most authorities, including Howard (1968) and Brodkorb (pers. comm.), agree with this hypothesis. It is interesting to note that the two species overlap temporally, but not spatially, in the late Pleistocene and Recent. In western North America, *C. occidentalis* was displaced, at least in an ecological sense, not by *C. atratus*, but rather by *Cathartes aura* (Howard 1968). This apparently did not occur in Florida, because *C. atratus* and *C. aura* have been recovered together from several sites of Pleistocene and Recent ages (Brodkorb 1964).

FAMILY ACCIPITRIDAE

Buteo platypterus (Vieillot), Broad-winged Hawk

MATERIAL.—Ulna (UF 11823).

REMARKS.—The ulna of *B. platypterus* is separated from that of *Buteo lineatus* by having internal cotyla rounder; external cotyla smaller; prominence for anterior articular ligament larger and more pronounced; olecranon shorter and rounder; impression of brachialis anticus deeper and better developed distally along shaft; external condyle rounder (external view) with its edge forming obtuse angle with shaft (the ulna of *B. lineatus* has the external condyle extending more proximally, forming an acute or right angle with the shaft); ligamental attachment at proximal end of external condyle much more excavated; carpal tuberosity rising much less abruptly from shaft and not projecting as far.

Buteo jamaicensis (Gmelin), Red-tailed Hawk

MATERIAL.—Tibiotarsus, lacking proximal end (UF 11621), and tarsometatarsus (UF 11622).

REMARKS.—Sexual dimorphism is considerable within this species, so the elements were compared with bones from both *B. j. umbrinus* and *B. j. borealis* to try to determine sex. The two fossils are definitely not from

Table 5.—Measurements of humerus (in mm) of *Coragyps occidentalis* from seven Pleistocene sites and Recent *C. atratus* (Brodkorb Collection). * indicates mean measurements of Howard (1968).

Species	Distal Width	Width at Upper End of Brachial Scar	Width of Shaft above Ectepi-Condylar Process	Height of Brachial Scar through Internal Condyle	Midshaft Width
C. atratus					
mean	24.6	13.4	16.9	27.3	10.8
range	23.1-26.3	12.4-15.0	16.3-19.0	25.7-30.3	10.4-11.1
C. occidentalis					
UF 11591, Coleman IIA	26.6	14.4	18.7	29.6	——
UF 22102, Coleman IIA	——	——	——	——	11.8
933-1601, Tex. Mem. Mus., Friesenhahn Cave, Texas	28.0	14.4	19.0	30.8	——
PB 9003 (juv.), Reddick, Florida.	25.1	14.3	18.2	28.8	——
Rancho La Brea, California.	27.4*	——	——	——	11.5*
McKittrick, California.	——	——	——	——	11.0*
Conkling Cavern, California.	27.5*	——	——	——	11.4*
San Josecito Cave, California.	26.4*	——	——	——	11.5*

Table 6.—Measurements of the ulna, radius, and tarsometatarsus (in mm) comparing *Coragyps atratus* (Brodkorb Collection) to *C. occidentalis* from Coleman IIA. These unconventional measurements of the tarsometatarsus were made to facilitate fragmental material.

	Ulna Midshaft	Radius Midshaft	
Species	Width	Width	Depth
C. atratus			
mean (11)	8.2	5.1	4.9
range	7.2-8.8	4.4-5.9	4.4-5.4
C occidentalis			
(UF 11593)	——	5.5	5.9
(UF 22096)	8.2	——	——

	Tarsometatarsus Distal	Distal End of Ridge Extending from Hypotarsus		Proximal End of Metatarsal Facet	
Species	Width	Width	Depth	Width	Depth
C. atratus					
mean (11)	16.3	7.8	5.5	8.1	5.1
range	(14.9-17.7)	(7.1-8.3)	(5.6-6.0)	(7.5-8.8)	(4.6-5.5)
C. occidentalis					
(UF 11800A)	16.8	——	——	8.8	5.8
(UF 11800B)	——	8.6	5.8	——	——

the same individual, because the tibiotarsus corresponds in size to a small male and the tarsometatarsus is from a much larger bird, most likely a female.

Buteo lagopus (Pontoppidan), Rough-legged Hawk

Material.—Humerus, distal end (UF 11823).

Remarks.—The fossil is badly worn, but agrees with the humerus of *B. lagopus*, and differs from that of *B. jamaicensis*, by having distal portion of shaft flatter and straighter (ventral view); olecranal fossa more excavated; internal tricipital groove better excavated; external tricipital groove wider. This is the first fossil record of *B. lagopus* from Florida.

Aquila chrysaetos (Linnaeus), Golden Eagle

Material.—Femur, distal end (UF 22095).

Remarks.—The femur of *A. chrysaetos* is distinguished from that of *Haliaeetus leucocephalus* by having fibular groove more deeply excavated; fibular condyle extends more laterally and distad, causing distal portion of fibular condyle to be more extensive and pointed; external condyle narrower (distal view); depression just anterior to distal-most point of external condyle tends to be more deeply excavated.

The size of the specimen suggests it is a male. More importantly, this is the earliest record of the genus from the New World, and the first fossil record of *A. chrysaetos* from Florida.

FAMILY FALCONIDAE

Falco columbarius Linnaeus, American Merlin

MATERIAL.—Humerus, distal end (UF 16704), and ulna, distal half (UF 22099).

REMARKS.—Wing elements of *F. columbarius* are very similar to those of *Falco sparverius*, but are larger (Tables 7 and 8). Although both species exhibit sexual dimorphism, Recent specimens show no size overlap in wing elements. The fossils are slightly smaller than Recent male *F. columbarius*, but are considerably larger than Recent female *F. sparverius*.

The humerus of *F. columbarius* differs from that of *F. sparverius* by having olecranal fossa less excavated near external condyle; attachment site on ectepicondylar prominence larger, more dorsal (external) and proximal in its location on shaft; attachment of pronator brevis larger and more ventral; internal ridge of external tricipital groove less pronounced. The fossil humerus has a narrow shaft like that of *F. sparverius*, but this character is probably variable in *F. columbarius*. The ulna agrees with *F. columbarius* in having trochlea wider; small groove just proximal and anterior to internal condyle more apparent.

Table 7.—Measurements of the humerus (in mm) of Recent *Falco sparverius sparverius* (Brodkorb Collection), fossil *F. columbarius* from Coleman IIA, and Recent *F. columbarius* (Brodkorb Collection).

Species	Distal Width	Shaft Width just Proximal to Ect-epicondylar Pro.	Depth of External Condyle	Depth of Internal Condyle
F. sparverius				
Male				
mean	6.7	4.5	4.2	2.0
range (5)	6.4-7.1	4.2-4.7	4.0-4.5	1.9-2.1
Female				
mean	7.5	4.9	4.3	2.2
range (5)	6.9-7.3	4.5-5.3	4.2-4.3	2.1-2.2
Overall				
mean	6.9	4.7	4.2	2.1
range (10)	6.4-7.3	4.2-5.3	4.0-4.3	1.9-2.2
F. columbarius				
Fossil	8.1	5.3	4.8	2.5
Recent				
Male	8.4	5.4	5.3	2.6
Male	8.6	5.6	5.3	2.7

It is of interest to note that Ligon (1965) demonstrated that *F. sparverius* from the Haile XIB Pleistocene was as large or larger than Recent *F. sparverius*, while the Coleman IIA *F. columbarius* specimens are, for the most part, smaller than those of the modern *F. columbarius*. This is the first fossil record of *F. columbarius* from Florida. The species was previously known from only two Pleistocene sites in North America: Rancho La Brea (L. Miller 1921) and McKittrick (L. Miller 1925), both in California.

ORDER GALLIFORMES

FAMILY PHASIANIDAE

Colinus suilium Brodkorb

MATERIAL.—Cranium (UF 11604), 2 mandibles (UF 11810, 11811), 3 cervical vertebrae (UF 11604), 2 furculae (UF 11605), 7 scapulae (UF 11610), 13 coracoids (UF 11609), 2 sterna (UF 11606), 18 humeri (UF 11611), 16 ulnae (UF 11814), 4 radii (UF 11613), 9 carpometacarpi (UF 11614, 11813), 5 fused thoracic vertebrae (UF 11615, 11815), 2 synsacra (UF 11608, 11818), 16 femora (UF 11616), 17 tibiotarsi (UF 11617), 9 tarsometatarsi (UF 11618), 5 ribs, 2 ulnares, 3 proximal phalanges, hallux, and 2 pes terminal digits.

REMARKS.—Holman (1961) made a thorough study of the New World quails, including both fossil and living species. He compared 94

Table 8.—Measurements of the ulna (in mm) of Recent *Falco sparverius sparverius* (Brodkorb Collection), fossil *F. columbarius* from Coleman IIA, and Recent *F. columbarius* (Brodkorb Collection).

Species	Distal Width	Shaft Width just Proximal to External Condyle	Depth of External Condyle
F. sparverius			
Male			
mean	4.4	2.9	3.8
range (5)	4.1-4.7	2.8-3.2	3.6-3.8
Female			
mean	4.6	3.1	3.9
range (5)	4.4-4.7	2.9-3.3	3.8-4.1
Overall			
mean	4.5	3.0	3.9
range (10)	4.1-4.7	2.8-3.3	3.6-4.1
F. columbarius			
Fossil	5.1	3.4	4.3
Recent			
Male	5.3	3.4	4.5

osteological characters and 15 intermembral proportions for each of the living genera and included as many as possible for the fossil genera. He also listed qualitative characters useful in separating both fossil and living species of *Colinus* (*C. hibbardi*, *C. suilium*, *C. virginianus*, *C. leucopogon*, *C. cristatus*, and *C. nigrogularis*) and included measurements of all species of *Colinus* except *C. cristatus*.

Unfortunately all of Holman's specimens of *C. suilium* were late Pleistocene in age and revealed no physical changes or trends with respect to time. An early Pleistocene site, Inglis IA, contains a very large sample of *C. suilium*, and along with the specimen from Coleman IIA, has provided important data helpful in tracing a more complete study of the species development in Florida throughout the Pleistocene.

In the two populations of *C. suilium* presented here, the major variables (other than the ages of the deposits) are minimized. Both populations are from late in glacial stages, which would tend to decrease any differences that are due to effects of "Bergmann's principle." The two localities where the fossils were collected are near each other, separated by an east-west distance of about 60 kilometers, eliminating any possible north-south size gradient, such as that found today in *C. virginianus* (see Holman 1961). The removal of these two factors would make any differences between the two populations attributable to age, i.e. different stages of evolution.

Species of *Colinus* cannot be separated by intermembral proportions (Holman 1961:152, 206). Intermembral proportions calculated for the two populations of *C. suilium* showed no substantial differences, except for a difference of 7% in the tarsometatarsus/humerus ratios (Table 9). However other leg/wing ratios and wing/leg ratios showed no substantial proportional differences. Therefore the 7% difference in the tarsometatarsus/humerus ratios is considered to be insignificant. No reliable osteological characters can be used to separate the two populations, although some slight average differences in intramembral proportions are evident.

As mentioned earlier, a gradual size gradient occurs in *C. virginianus* from north to south. In the eastern United States, the largest specimens (*C. v. virginianus*) occur in Michigan and the smallest (*C. v. floridanus*) occur in southern Florida. Specimens of *C. suilium* from Arredondo, Williston, Orange Lake, Reddick, and Haile average as large or larger than Recent *C. v. virginianus* from Michigan in most measurements (Table 10, and Holman 1961:222-223). Specimens of *C. suilium* from Coleman IIA and Inglis IA are of interest because they are smaller than those of the later populations of *C. suilium*. The Inglis quail is about equal in size to *C. virginianus* of northern Florida, while the Coleman quail is about midway in size between the quail of northern Florida and *C. v. virginianus* of Illinois.

Table 9.—Intermembral proportions (in percent) of *Colinus suilium* from Coleman IIA and Inglis IA, and overall range for genus *Colinus* (from Holman 1961:152).

	Coleman IIA	Inglis IA	*Colinus* Overall
wing/leg	65	67	63-69
ulna/humerus	91	88	86-91
tarsometatarsus tibiotarsus	58	55	57-61
tarsometatarsus femur	79	77	73-83
humerus/femur	84	88	82-88
humerus tibiotarsus	62	63	62-66
ulna/femur	76	78	72-79
ulna tibiotarsus	56	56	53-59
ulna tarsometatarsus	97	101	92-104
carpometacarpus femur	45	46	43-47
carpometacarpus tibiotarsus	33	33	33-35
carpometacarpus tarsometatarsus	57	60	55-62
tarsometatarsus humerus	94	87	86-98

Table 10.—A chronological list comparing mean measurements (in mm) of *Colinus suilium* from eight Pleistocene sites of central Florida with the number of specimens (in parenthesis) for each. (Arredondo I and II, Orange Lake, and Reddick measurements from Holman 1961; Haile XIB measurements from Ligon 1965; Williston measurements from Holman 1969.)

	Humerus		
Locality	Length	Proximal Width	Distal Width
Orange Lake	36.40(1)	9.85(4)	7.58(3)[a]
Reddick	35.91(31)	9.75(66)	6.98(84)[a]
Arredondo I	37.75(2)	10.02(6)	7.45(2)[a]
Arredondo II	——	10.00(1)	7.10(3)[a]
Haile XIB	——	9.31(15)	6.52(14)
Williston	35.84(4)	9.83(4)	7.45(4)[b]
Coleman IIA	34.71(8)	9.35(15)	7.09(14)
Inglis IA	34.93(40)	9.07(70)	6.99(68)

[a] Holman (1961) published the distal width as "width below epicondyles". His measurements have been altered to conform to the greatest distal width published for the other sites, Coleman IIA, and Inglis IA. The alteration involved the addition of an average value of 0. 35 mm.

[b] Holman (1959) did not include the mean value for this measurement, but did give the overall range. From this, a median value was figured and substituted in place of a mean value.

Table 10 continued

Ulna

Locality	Length	Proximal width
Orange Lake	——	6.00(1)
Reddick	32.33(11)	6.11(23)
Arredondo I	33.05(2)	6.30(2)
Arredondo II	33.00(1)	5.90(1)
Haile XIB	32.42(4)	——
Williston	34.00(1)	6.60(1)
Coleman IIA	31.56(9)	5.99(11)
Inglis IA	30.89(12)	5.72(24)

Carpometacarpus

Locality	Length	Proximal height
Orange Lake	19.60(1)	5.90(1)
Reddick C	19.05(10)	5.63(10)
Reddick	18.93(16)	5.75(26)
Arredondo I	19.30(1)	5.50(1)
Arredondo II	——	——
Haile XIB	18.99(10)	5.87(15)
Williston	20.00(1)	5.90(1)
Coleman IIA	18.67(5)	5.65(9)
Inglis IA	18.22(20)	5.54(22)

Scapula

Locality	Proximal width
Orange Lake	7.13(3)
Reddick	6.94(7)
Arredondo I	——
Arredondo II	7.10(1)
Haile XIB	——
Williston	——
Coleman IIA	6.87(7)
Inglis IA	6.73(44)

Coracoid

Locality	Length	Distal width
Orange Lake	29.53(3)	9.00(2)
Reddick	28.99(16)	8.79(7)
Arredondo I	30.82(2)	9.00(2)
Arredondo II	29.80(1)	8.70(1)
Haile XIB	——	——
Williston	——	——
Coleman IIA	28.08(5)	8.75(6)
Inglis IA	27.21(49)	8.60(18)

Table 10 continued

Locality	Femur Length	Proximal width	Distal width
Orange Lake[c]	42.40(4)	——	7.07(7)
Orange Lake[d]	——	——	6.60(1)
Reddick	42.41(6)	——	7.00(30)
Arredondo I	——	——	——
Arredondo II	42.50(1)	——	6.90(1)
Haile XIB	——	7.39(8)	7.01(9)
Williston	43.60(1)	——	7.05(2)
Coleman IIA	41.27(7)	6.98(13)	6.84(11)
Inglis IA	39.61(12)	7.04(21)	6.68(21)

Locality	Tibiotarsus Length	Proximal width	Distal width
Orange Lake	58.50(3)	9.93(3)	5.65(4)
Reddick A	57.20(1)	9.23(12)	5.58(36)
Arredondo I	60.00(1)	9.65(2)	5.45(2)
Arredondo II	——	——	5.57(3)
Haile XIB	——	9.23(6)	5.33(12)
Williston	56.00(1)	8.90(1)	5.50(3)
Coleman IIA	56.29(1)	9.27(8)	5.35(7)
Inglis IA	55.42(2)	8.83(19)	5.21(21)

Locality	Tarsometatarsus Length	Proximal Width	Distal Width
Orange Lake	——	6.15(2)	6.00(3)
Reddick	32.87	5.88(24)	6.03(27)
Arredondo I	34.60(1)	6.20(2)	6.50(2)
Arredondo II	——	6.00(1)	——
Haile XIB	33.65(2)	5.80(7)	6.22(12)
Williston	——	——	——
Coleman IIA	32.48(4)	5.73(9)	6.02(7)
Inglis IA	30.46(10)	5.64(9)	5.84(19)

[c] Orange Lake, Arredondo clay.
[d] Orange Lake, Arredondo-Wicomico contact.

As Holman pointed out, *C. hibbardi*, from the upper Pliocene of Kansas, is the most distinctive species of the genus because of its large size and qualitative osteological characters (see Wetmore 1944). *C. suilium* is less distinct from *C. virginianus* than from *C. hibbardi* and, as Brodkorb (1960) noted, is probably a temporal equivalent to *C. virginianus*. The evolutionary trend of species in the genus *Colinus* has been thought to be simply a gradual size decrease through time, but the new material from

Coleman IIA and Inglis IA demonstrates this is not correct. It has been hypothesized that *C. suilium* was derived from *C. hibbardi*, but considering these new data, it is possible to hypothesize that a different species of *Colinus*, much smaller than *C. hibbardi*, gave rise to *C. suilium*. The important point to be made here is that *C. suilium* apparently underwent a gradual size increase, rather than a decrease as previously thought, throughout the Pleistocene of Florida.

Agriocharis anza Howard

MATERIAL.—3 skulls and premaxilla (UF 11588), 58 vertebrae (UF 11597), 18 coracoids (UF 11590), 12 sterna (UF 11589), 37 humeri (UF 11591), 6 scapulae (UF 11595), 23 ulnae (UF 11592), 9 radii (UF 11593), 12 carpometacarpi (UF 11594), 7 synsacra (UF 11598), 27 femora (UF 11599), 33 tibiotarsi and 2 fibulae (UF 11600), 35 tarsometatarsi (UF 11601), 4 manus phalanges, and 16 pes digits.

REMARKS.—A study by Steadman (1975) consisted of detailed osteological comparisons of both fossil and living turkeys, and included the specimens of *A. anza* from Coleman IIA. He made comparisons between *Proagricocharis kimballensis*, *Agriocharis progenes*, *A. ocellata*, *A. anza*. *Parapavo californicus*, and *Meleagris gallopavo*. Steadman concluded, on the basis of osteological similarities and because most of the qualitative osteological differences are only average ones, that the genera *Proagriocharis*, *Agriocharis*, and *Parapavo* should be synonymized with the genus *Meleagris*. Paynter (1955) found *Agriocharis* not deserving of a separate genus from *Meleagris*, and Steadman (1975) stated that there is little doubt *M. gallopavo* evolved from *A. anza* (or as he referred to it, *Meleagris anza*). This would certainly indicate that *Agriocharis*, at least, should be synonymized with *Meleagris*, but for the purposes of this paper the Coleman turkeys are still referred to *Agriocharis*.

ORDER RALLIFORMES

FAMILY RALLIDAE

Rallus eleganus Audubon, King Rail

MATERIAL.—Humerus, distal end (UF 16703), ulna, proximal end (UF 16702), femur, distal end (UF 11820).

REMARKS.—Ligon (1965) listed characters by which elements of the larger rails (*Rallus*, *Fulica*, and *Gallinula*) can be segregated, but he did not include elements of *Porphyrula*, which also overlaps these rails in size.

The humerus of *Rallus* is separated from that of *Porphyrula* by having the distal end narrower; entepicondyle more pointed and located more distally; intercondylar furrow and furrow between entepicondyle and internal condyle both wider; internal condyle less constricted ventrally; ectepicondyle less pointed.

The ulna of *Rallus* differs from that of *Porphyrula* by having depression just proximal to prominence for anterior articular ligament much more excavated; olecranon more pointed and extending more proximally.

The femur of *Rallus* is separated fom that of *Porphyrula* by having ridge connecting posterior articular surface of internal condyle to shaft better developed and connecting to shaft laterally; a deep depression on medial side of shaft just posterior to anterior ridge extending from internal condyle (this depression is absent in *Porphyrula)*; rotular groove wider; ligamental attachment just proximal to fibular groove larger.

The tibiotarsus of *Rallus* differs from that of *Porphyrula* by having ridge connecting anterior face of external condyle to shaft better developed, forming a more gradual anterior extension of condyle; shaft thicker where it meets with internal condyle; shaft more rounded in cross section; external condyle more pointed anteriorly.

Coturnicops noveboracensis (Gmelin), Yellow Rail

MATERIAL.—Tibiotarsus, distal end (UF 16709).

REMARKS.—Feduccia (1968) compared *Coturnicops noveboracensis* with *C. avita* from the Upper Pliocene of Idaho and concluded that *C. avita* is probably the ancestor of *C. noveboracensis. Laterallus exilis* occurred in Florida during the Pleistocene (Olson 1974), and its elements are similar in both size and characters to those of *C. noveboracensis.*

The tibiotarsus of *C. noveboracensis* is separated from that of *Laterallus* by having intercondylar fossa more narrow; ridges extending posteriorly from both condyles protruding farther from shaft, making posterior intercondylar sulcus more excavated; external and internal ligamental prominences both better developed; bridge over peroneus profundus groove located more proximally; external condyle more rounded (lateral view); a distinct furrow between medial connection of supratendinal bridge and medial ridge of tendinal groove (in that of *Laterallus* the supratendinal bridge connects directly to the medial ridge of the tendinal groove and forms no furrow).

C. noveboracensis previously was known as a fossil from the Reddick (Brodkorb 1957) and Haile (Ligon 1965) sites of Florida.

ORDER CHARADRIIFORMES

FAMILY SCOLOPACIDAE

Philohela minor (Gmelin), Woodcock

MATERIAL.—Mandible (UF 11796), humerus (UF 11798), 2 coracoids (UF 11797), and tibiotarsus, distal end (UF 16701).

REMARKS.—Ligon (1965) listed osteological characters that separate four genera, all of similar size, of the family Scolopacidae: *Philohela*, *Capella*, *Limnodromus*, and *Totanus*. This species was previously known from only three Pleistocene sites, including Haile and Eichelberger Cave (Brodkorb 1957) of Florida.

ORDER COLUMBIFORMES

FAMILY COLUMBIDAE

Zenaida macroura (Linnaeus), Mourning Dove

MATERIAL.—Humeri, proximal half and distal end, probably from a single bone (UF 16706), and tibiotarsus, proximal end (UF 22104).

REMARKS.—A fossil dove from the Upper Pliocene of Kansas, originally identified as *Z. macroura* by Wetmore (1944), was later described as a new species, *Zenaida prior*, by Brodkorb (1969). Brodkorb (1969) separated the two species and stated that *Z. prior* is allied and apparently ancestral to *Z. macroura*.

ORDER STRIGIFORMES

FAMILY STRIGIDAE

Bubo virginianus (Gmelin), Great Horned Owl

MATERIAL.—Tibiotarsus, external condyle (UF 22098).

REMARKS.—The fossil is separated from the tibiotarsus of *Strix* by having a well-defined depression just proximal to external condyle. The tibiotarsi of both *Bubo* and *Nyctea* have a ridge between the condyles separating the intercondylar fossa into two depressions, with one of them located just proximal to the external condyle (the fossil shows evidence of this). The fossil is separated from the tibiotarsus of *Nyctea* by having posterior ridge of external condyle wider; a convex medial side and a concave lateral side on external condyle (the external condyle of *Nyctea* has two flat sides converging at the ridge); external condyle less elongated in antero-posterior plane; more flange overlap on lateral face of external condyle.

The fossil is more robust than the tibiotarsus of Recent *B. virginianus* (Table 11). Husband (1924) demonstrated that the supposed large extinct *Bubo sinclairi* of late Pleistocene actually falls well within the size range of *B. virginianus* of Rancho La Brea, and Howard (1947) suggested *B. sinclairi* may simply be a geographical variant of *B. virginianus* from Rancho La Brea. *B. sinclairi* is probably not a viable taxon, so the Coleman specimen is referred to *B. virginianus*.

This fossil is particularly important because it represents (1) the first fossil record for *B. virginianus* in Florida, and (2) the earliest fossil record for the genus in the New World. The earliest known species of *Bubo* is *Bubo incertus* from the Upper Eocene or Lower Oligocene of France (Brodkorb 1971).

Otus asio (Linnaeus), Screech Owl

MATERIAL.—Synsacrum (UF 11608), and tarsometatarsus (UF 11623).

REMARKS.—*O. asio* is similar to *Aegolius funereus* in all elements except for the tarsometatarsus. The tarsometatarsus of *Otus* differs from that of *Aegolius* by having a relative length 1/3 longer; shaft much narrower. The neural spines of the fused sacral vertebrae are longer in *Otus*, giving the anterior dorsal surface a higher, arched appearance. The anterior neural spines are broken away in the fossil, but remnants of the iliac fossae indicate it had the same condition as in *Otus*.

O. asio has been recorded extensively from the North American Pleistocene (Brodkorb 1971).

ORDER PICIFORMES

FAMILY PICIDAE

Colaptes auratus (Linnaeus), Common Flicker

MATERIAL.—Humerus (UF 16708), and carpometacarpus (UF 16707).

REMARKS.—All North American flickers are now considered conspecific (Short 1965, Brodkorb 1971). The humerus of *Colaptes* is separated from that of *Melanerpes* by having pneumatic fossa deeper, with fewer and

Table 11.—Measurements (in mm) of the tibiotarsus of Recent *Bubo virginianus* (Brodkorb Collection, fossil *Bubo virginianus* from Coleman IIA (UF 22098), and Recent *Nyctea scandiaca* (Brodkorb Collection).

Species	Distal Width of External Condyle	Depth of External Condyle	Depth of Shaft just above External Condyle
B. virginianus			
Male			
mean	5.4	11.8	5.0
range (7)	5.0-5.7	11.2-12.3	4.5-5.3
Female			
mean	6.0	13.1	5.5
range (6)	5.9-6.2	12.6-13.9	5.4-5.7
(UF 22098)	6.6	13.8	6.0
N. scandiaca			
Male			
mean	5.65	12.3	4.85
range (2)	5.6,5.7	12.0,12.6	4.7,5.0
Female (1)	5.7	13.6	5.5

smaller foramina; region about attachment of infraspinatus thicker; deltoid crest larger; impression of brachial anticus larger; entepicondyle more extensive. The carpometacarpus of *Colaptes* differs from that of *Melanerpes* by having ligamental attachment of pisiform process larger and more extensive; intermetacarpal tuberosity larger and more distad; process of metacarpal I longer.

ORDER PASSERIFORMES

Hamon (1964) made a detailed study of osteological characters for those genera of each passerine family recovered from the Pleistocene deposits of eastern North America. The elements he studied are the humerus, ulna, carpometacarpus, coracoid, femur, tibiotarsus, and tarsometatarsus. Hamon's work proved of great value during the study of passerine birds from Coleman IIA.

FAMILY HIRUNDINIDAE

Progne subis (Linnaeus), Purple Martin

MATERIAL.—Humerus (UF 11625).

REMARKS.—The large size of the fossil (length: 2.2 cm) separates it from the humeri of all other North American swallows. *P. subis* was previously reported from the Pleistocene only from Reddick (Brodkorb 1957).

FAMILY CORVIDAE

Protocitta cf. *P. ajax* Brodkorb

MATERIAL.—Humerus, distal end (UF 16705).

REMARKS.—The specimen is most similar to the humeri of two extinct species of jays, *Protocitta dixi* and *Henocitta brodkorbi,* both known only from Pleistocene deposits of Florida. The Coleman IIA humerus differs from that of *H. brodkorbi* by having the internal condyle more spherical and the entepicondyle located less aconally. The Coleman IIA humerus differs from those of both *P. dixi* and *H. brodkorbi* by having ectepicondylar prominence more extensive and nearly perpendicular to shaft; external condyle wider; internal condyle smaller; external tricipital groove narrower; attachment of anterior articular ligament small; medial spur of ectepicondylar process longer; entepicondyle smaller and thinner; olecranal fossa less excavated into entepicondyle.

The projection of the ectepicondylar process and the well developed medial spur are similar to those found in *Pica*. The Coleman IIA humerus differs from that of *Pica* by having olecranal fossa less excavated; both tricipital grooves better developed; entepicondyle (ventral view) shorter and wider; attachment of anterior articular ligament smaller. Although very little of the shaft remains on the fossil specimen, it was apparently straighter (as in other jays) than that of the humerus of *Pica*.

Brodkorb (1972) described *Protocitta ajax* from a single tarsometatarsus and stated that it is stouter than that of *P. dixi*. Unfortunately no humeri were recovered. It is quite possible that the Coleman IIA *Protocitta* is referable to *P. ajax*. At this time it is inappropriate to describe a new species on the basis of this single element (Fig. 2).

Measurements of the specimen are: distal width 10.8 mm; depth external condyle 4.6 mm; length external condyle 4.1 mm; and length internal condyle 3.0 mm.

P. ajax has been reported from the late Pliocene of both Texas (Palo Duro Falls) and Kansas (Rexroad Ranch) (Brodkorb 1972).

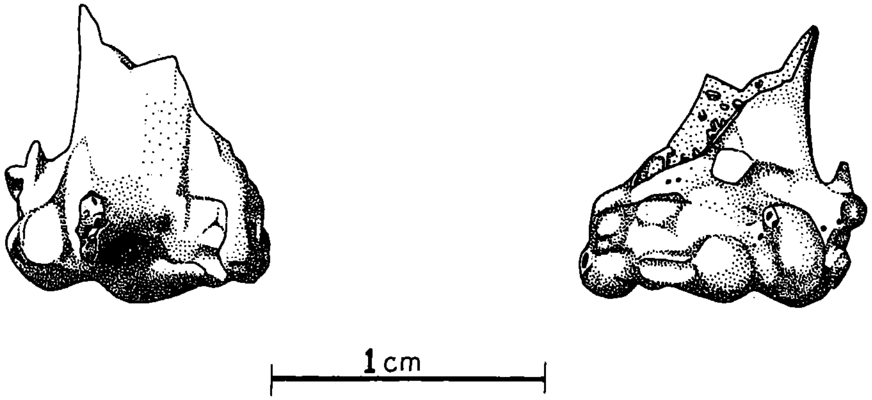

Figure 2. (A) Anconal and (B) palmar views of the humerus of *Protocitta* cf. *P. ajax* from Coleman IIA (UF 16705).

Family Parulidae

Dendroica sp., Wood Warbler

Material.—Tibiotarsus, distal end (UF 22107).

Remarks.—The tibiotarsus of *Dendroica* is very similar to that of *Geothlypis*, but differs by having supratendinal bridge wider; external condyle (external view) less round; protuberance located at external foot of bridge less developed; external ligamental prominence less developed. Similarity among the members of this genus prevents specific identification. This is the first fossil record for *Dendroica* in Florida.

Family Icteridae

Agelaius phoeniceus (Linnaeus), Red-winged Blackbird

Material.—Humerus (UF 11808), and tarsometatarsus (UF 11812).

Remarks.—Elements of *Agelaius phoeniceus* are similar to those of *Euphagus carolinus* and *E. cyanocephalus*. The humerus of A.

phoeniceus is separated from that of *E. carolinus* by having internal tricipital groove less excavated; brachial depression less excavated; no distinct ridge connecting internal condyle with attachment of anterior articular ligament: attachment of infraspinatus smaller; region of external condyle and ectepicondylar prominence (distal view) wider; depression on connection between attachment of infraspinatus and internal tuberosity more developed. The humerus of *A. phoeniceus* differs from that of *E. cyanocephalus* by having brachial depression less excavated and shorter; external ridge of brachial depression (ventral view) not straight, but bending where it meets with shaft; depression extending from external tuberosity onto head less developed.

The tarsometatarsus of *A. phoeniceus* is separated from those of both *E. carolinus* and *E. cyanocephalus* by having shaft more robust; metatarsal facet better excavated; trochlear region (internal view) bending more posteriorly.

A. phoeniceus in known extensively from the late Pleistocene. It has been reported from Ontario, California, possibly from New Mexico and Virginia, as well as Seminole Field, Itchtucknee River, Reddick, and Arredondo in Florida (Brodkorb 1978).

Pandanaris floridana Brodkorb

MATERIAL.—Femur, proximal end (UF 22108).

REMARKS.—The femur of *P. floridana* is separated from that of *Quiscalus mexicanus* by having a depression in distal surface of neck underneath head; depression on anterior face just medial to trochanteric ridge less excavated (this depression extends proximally underneath the iliac facet of the femur of *Q. mexicanus*); neck generally shorter.

The fossil was compared with a large number of specimens of *P. floridana* from Reddick, now in the Brodkorb Collection. Apparently, *P. floridana* had a considerable sexual size dimorphism, like that found in *Q. mexicanus*. The size of the fossil (proximal depth 4.1 mm and proximal width of shaft 3.1 mm) is rather small compared to the Reddick specimens, so it probably represents a female. Brodkorb (1957), in his description of the species, stated that its closest living relatives are probably the two cowbird genera, *Molothrus* and *Tanganavius*, but neither of these genera exhibit the size variation found in both *P. floridana* and *Q. mexicanus*. *P. floridana* was previously known only from Reddick and Haile XIB (Ligon 1965).

FAMILY FRINGILLIDAE

Pheucticus ludovicianus (Linnaeus), Rose-breasted Grosbeak

MATERIAL.—Ulna (UF 11806).

REMARKS.—The ulna of *P. ludovicianus* is separable from that of

Pheucticus melanocephalus by having depression between tricipital attachment and olecranon more excavated, with excavation extending into base of olecranon at region of humeroulnar depression narrower and ridged; ridge located ventrally to impression of brachialis anticus generally straight, extending from prominence for anterior articular ligament along shaft (this ridge is more curved in the ulna of *P. melanocephalus*); distal radial depression more smoothly excavated (it is pit-like in the ulna of *P. melanocephalus*, with a sharp edge along the distal border).

The ulna of *P. ludovicianus* differs from the ulna of *Cardinalis cardinalis* by having entire distal end, including distal end of shaft, comparatively wider; depression between tricipital attachment and olecranon much less excavated, giving base of olecranon a thicker appearance.

The ulna of *P. ludovicianus* is separated from that of *Cardinalis sinuata* by having external cotyla much larger; carpal tuberosity smaller.

This is the first fossil record for *P. ludovicianus*.

Pipilo erythrophthalmus (Linnaeus), Rufous-sided Towhee

MATERIAL.—2 ulnae, distal ends (UF 22100A and B), and tibiotarsus, distal end (UF 22100C).

REMARKS.—Hamon (1964) compared elements from *Pipilo* with those of *Passerculus*, *Ammodramus*, *Passerherbulus*, and *Spizella*. For each genus he described 13 given characters for the ulnae and 18 given characters for the tibiotarsi. *P. erythrophthalmus* has been previously reported from late Pleistocene sites in California and New Mexico, as well as Reddick, Arredondo, and Haile XIB (Brodkorb 1978).

Passerculus sandwichensis (Gmelin), Savannah Sparrow

MATERIAL.—Ulna, proximal end (UF 11809A), and femur (UF 11809B).

REMARKS.—Hamon (1964) compared 13 given characters for the ulnae and 15 given characters for the femora of *Passerculus*, *Ammodramus*, *Passerherbulus*, and *Spizella*. The ulna of *P. sandwichensis* is separated from that of *Melospiza melodia* by having tricipital attachment closer to proximal edge of external cotyla; prominence for anterior articular ligament more extensive; external cotyla more extensive at region of proximal radial depression, giving external cotylar edge a more concave shape.

The femur of *P. sandwichensis* differs from that of *M. melodia* by having attachment of adductor profundus less developed; attachment of gastrocnemius (external head) smaller and less extensive; internal condyle narrower (less extensive from shaft), making distal end relatively narrower; shaft slenderer; attachment of ischio-femoralis smaller; iliac facet narrower anteroposteriorly; trochanter less ridged, giving the proximal end region more rounded appearance; depression located on shaft at base of neck smaller.

P. sandwichensis has been previously reported as a Pleistocene species only from Reddick (Brodkorb 1978).

Pooecetes gramineus (Gmelin), Vesper Sparrow

MATERIAL.—Humerus (UF 11804A).

REMARKS.—The humerus of *P. gramineus* is separated from the humerus of *Chondestes grammacus* by having no well-developed pit between ectepicondylar prominence and shaft; longer and narrower brachial depression; olecranal fossa more excavated, extending entire length of internal condyle (the olecranal fossa only extends from intercondylar region to midway along internal condyle in the humerus of *C. grammacus*); proximal edge of pneumatic fossa I circular; deltoid crest closer to shaft; bone connection between head and internal tuberosity thicker, making capital groove longer.

The humerus of *P. gramineus* differs from that of *Passerella iliaca* by having distal end relatively narrower; ligamental attachment site just proximad to external condyle less developed; external condyle (external view) less round. The humeri of *P. iliaca* and *C. grammacus* are similar in that they are both separated from the humerus of *P. gramineus* by having medial spurs better developed; pneumatic fossae I and II larger; distal edges of articulating surfaces of heads better developed.

Dawson (1948) identified this species from Rancho La Brea; this is its first fossil record for Florida.

Aimophila aestivalis (Lichtenstein), Bachman's Sparrow

MATERIAL.—Humeri, proximal 3/4 and distal end (probably parts of the same bone) (UF 11803), and 2 carpometacarpi (UF 11801).

REMARKS.—The humerus of *A. aestivalis* differs from that of *Melospiza melodia* by having less distance between shaft and ectepicondylar prominence; entepicondyle larger; ectepicondylar prominence smaller; brachial depression shallower; articulating surface of head larger, causing opening of fossa I to be more constricted; internal tuberosity less extensive. The humerus of *A. aestivalis* is separable from that of *Junco* by having entire element less robust; proximal and distal ends narrower; shaft lighter; ectepicondylar prominence smaller; brachial depression shallower. The humerus of *A. aestivalis* differs from that of *Aimophila cassinii* by having both pneumatic fossae smaller; brachial depression less excavated; external condyle smaller; capital groove longer; entepicondyle shorter; less distance between medial spur and shaft. The humerus of *A. aestivalis* is separable from that of *Aimophila ruficeps* by having entire proximal end less robust; attachment of infraspinatus less developed; brachial depression less excavated; external condyle smaller; entepicondyle shorter. The humerus of *A. aestivalis* differs from that of *Ammospiza* *maritima* by having pneumatic fossae I and II larger and deeper; head larger; entepicondyle smaller; brachial depression larger and deeper.

The carpometacarpus of *A. aestivalis* is separable from that of *M. melodia* by having intermetacarpal tuberosity much larger; depression at proximal end of shaft of metacarpal II (internal view) more excavated; depression at proximal end of metacarpal III connection with internal condyle more excavated. The carpometacarpus of *A. aestivalis* differs from that of *Junco* by having intermetacarpal tuberosity larger; entire element more robust; facet for digit III shorter; flange midway along tendinal groove better developed. The carpometacarpus of *A. aestivalis* is separable from that of *A. cassinii* by having proximal end less robust; external carpal trochlea less extensive; external carpal trochlea (external view) rounder. The carpometacarpus of *A. aestivalis* differs from that of *A. ruficens* by having entire element comparatively more robust; metacarpal III more parallel with metacarpal II; facet for digit III shorter. The carpometacarpus of *A. aestivalis* is separable from that of *A. maritima* by having intermetacarpal tuberosity larger; facet for digit III more robust; depression between carpal trochlea and metacarpal II (external view) more excavated.

This is the first fossil record for *A. aestivalis*.

Spizella pusilla (Wilson), Field Sparrow

MATERIAL.—Humerus (UF 22109).

REMARKS.—Hamon (1964) compared the humeri of *Spizella*, *Passerculus*, *Ammodramus*, and *Passerherbulus*. The humerus of *S. pusilla* differs from that of *Spizella passerina* by having region between attachment of infraspinatus and internal tuberosity thicker, making pneumatic fossa II smaller; head comparatively smaller; brachial depression shorter. The humerus of *S. pusilla* is separable from that of *Spizella arborea* by having entire element less robust; brachial depression smaller and shallower; pneumatic fossae I and II smaller; ectepicondylar prominence less developed. The humerus of *S. pusilla* differs from that of *Spizella pallida* by having region between attachment of infraspinatus and internal tuberosity thicker; ectepicondyle smaller; brachial depression shallower.

S. pusilla has been recorded as a fossil only from the Pleistocene of Arredondo (Brodkorb 1978).

Spizella sp.

MATERIAL.—Carpometacarpus, lacking metacarpal III (UF 11805).

REMARKS.—The broken nature of the specimen and the great amount of similarity within the various species of *Spizella* make specific identification impossible.

Genus and species indeterminate

MATERIAL.—Ulna, proximal half (UF 11804B), and ulna, proximal and distal halves to same bone (UF 11807).

REMARKS.—The specimens are from two different species of sparrows, but because they are both broken more accurate identification is impossible.

COLEMAN III

ORDER PELECANIFORMES

FAMILY ANHINGIDAE

Anhinga cf. *A. grandis* Martin and Mengel

MATERIAL.—Pit C; ulna, distal half (UF 16664).

REMARKS.—The ulna of *Anhinga* is separable from that of *Phalacrocorax* by having trochlea comparatively longer and narrower; distal articulating surfaces less raised from shaft; radial depression smaller and shallower; internal condylar process and carpal tuberosity less extensive; external condylar ridge less round; carpal tuberosity extending nearly parallel to the shaft (in the ulna of *Phalacrocorax* the carpal tuberosity extends almost perpendicular to the shaft); tuberosity at proximal end of internal condyle (internal face) less developed; shaft straighter. In *Phalacrocorax*, the anconal and inner papilae at each secondary feather region of the ulna are separated by a distance nearly twice that found in *Anhinga*, which causes the inner papillae to be located on the flat internal surface of the shaft.

The specimen differs from the ulna of *A. anhinga* by size (Table 12) and by having tuberosity on external face of external condyle extending more proximad, making most distal papilla closer to tendinal pit; ridge of external condyle attachment to shaft in shape of smooth curve, giving external condyle a more elongated shape (in the ulna of *A. anhinga* the external condylar ridge attaches to the shaft at an angle approaching 90°); articulation surface of external condyle extends more proximad, to most proximal point of ligamental attachment; projection of external condylar ridge (internal face) more anterior and less curved; internal condylar process less developed; carpal tuberosity longer with more anterior projection, forming an acute angle between internal condylar process and carpal tuberosity (this angle is obtuse in the ulna of *A. anhinga*); ligamental attachment (ventral surface) better developed and more excavated; tuberosity at proximal end (internal face) of internal condyle less developed; distal radial depression better excavated, and its extension more external (Fig. 3).

Anhinga grandis, from the late Pliocene of Nebraska, is about the same size as the *Anhinga* from Coleman, but is known only by the distal

Table 12.—Measurements of the ulna (in mm) of Recent *Anhinga anhinga* (Brodkorb Collection) and fossil *Anhinga* cf. *A. grandis* (UF 16664) from Coleman IIA.

Species	Greatest Distal Width	Height of External Condyle	Height of Internal Condyle	Width through Trochlea
A. anhinga				
mean	10.6	7.8	5.5	6.3
range (11)	10.0-11.3	7.6-8.1	5.2-5.8	5.7-6.6
UF 16664	11.8	9.1	6.2	7.6

Species	Length of Tendinal Pit	Length of Carpal Tuberosity Ridge from Intermuscular Line	Central Height of Shaft
A. anhinga			
mean	4.8	6.3	5.1
range (11)	4.3-5.1	5.8-6.5	4.7-5.6
UF 16664	5.9	8.5	5.4

Species	Length from Distal Point of Internal Condyle to Distal Part of Carpal Tuberosity	Central Width of Shaft
A. anhinga		
mean	3.9	6.2
range (11)	3.5-4.2	5.7-6.6
UF 16664	3.6	6.7

Species	Length from Proximal Edge of Ligamental Attachment to Center of Trochlea
A. anhinga	
mean	9.7
range (11)	8.6-10.5
UF 16664	11.1

portion of a single humerus (Martin and Mengel 1975). The distal width of the humerus of *A. grandis* is 1.2 times as large as that of *A. anhinga*. This compares favorably to some of the proportions between the *Anhinga* from Coleman and Recent *A. anhinga* (Table 13). Rather than describe this fossil as being that of a new species, it is here referred to *A. grandis*.

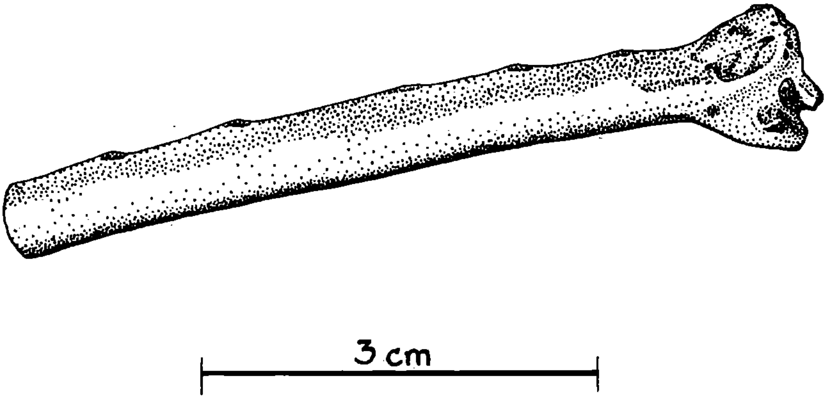

Figure 3. Palmar view of the ulna of *Anhinga* cf. *A. grandis* from Coleman IIIC (UF 16664).

Table 13.—A comparison of the ratio Coleman IIA *Anhinga* cf. *A. grandis*/*A. anhinga* for the ulnar measurements (from Table 11), showing the inconsistency of the various ratios.

	Mean	Range
Distal Width	1.07	1.04-1.18
Height of External Condyle	1.04	1.11-1.20
Height of Internal Condyle	1.13	1.07-1.19
Width of Trochlea	1.21	1.13-1.29
Length of Tendinal Pit	1.23	1.16-1.37
Length of Carpal Tuberosity	1.36	1.31-1.46
Length from Internal Condyle to Carpal Tuberosity	0.92	0.86-1.03
Length from Ligamental Attachment to Trochlea	1.14	1.06-1.29
Width of Shaft	1.08	1.02-1.17
Height of Shaft	1.06	0.96-1.15

ORDER ARDEIFORMES

FAMILY ARDEIDAE

Ardea herodias Linnaeus, Great Blue Heron

MATERIAL.—Pit C; tibiotarsus, distal end (UF 15160).

REMARKS.—*Ardea herodias* (including what was formerly *Ardea occidentalis*) is separable from all other North American herons by the much larger size of its elements. *A. herodias* has previously been reported from Pleistocene sites in California and Oregon,and from Seminole Field, Itchtucknee River, Melbourne, Bradenton, and Rock Spring in Florida, as well as numerous prehistoric sites (Brodkorb 1963).

ORDER ANSERIFORMES

FAMILY ANATIDAE

Aythya affinis (Eyton), Lesser Scaup

MATERIAL.—Pit C; humerus (UF 15160).

REMARKS.—The humerus of *A. affinis* differs from that of *Aythya collaris* by having pectoral attachment larger with more distal extension; internal tuberosity more robust; bicipital crest less curved; angle at which bicipital crest connects to shaft generally obtuse (in *A. collaris* the angle of this connection is approximately 90°); attachment of anterior articular ligament larger.

A. affinis is usually smaller than *A. collaris* (Johnsgard 1975), but it tends to have longer wing elements. *A. affinis* has been reported extensively from Pleistocene sites all over North America (Brodkorb 1964).

Aythya sp.

MATERIAL.—Pit C; humerus, shaft and partial distal end (UF 22110), carpometacarpus, distal end (UF 22112), and tibiotarsus, distal half (UF 22111).

REMARKS.—Ducks show a tremendous amount of intraspecific variation, and many characters are not constant enough to separate closely related species with certainty. The slender shafts of the humerus and tibiotarsus separate these specimens from other genera of ducks. Woolfenden (1961) listed characters by which different genera of ducks are separated.

ORDER GALLIFORMES

FAMILY PHASIANIDAE

Agriocharis anza Howard

MATERIAL.—Pit D; femur, proximal half (UF 15151).

REMARKS.—*A. anza* is the only avian species recovered from both Coleman II and Coleman III. The fossil is identical to the femora of *A. anza* identified from Coleman IIA. *A. anza* has been reported from the middle Pleistocene of California and Texas (Brodkorb 1964). It is also known from Inglis IA, but until now that recovery was unpublished.

ORDER RALLIFORMES

FAMILY RALLIDAE

Gallinula chloropus (Linnaeus), Common Gallinule

MATERIAL.—Pit C; carpometacarpus, lacking metacarpal I and metacarpal III (UF 22113).

REMARKS.—Olson (1974) synonymized *Gallinula brodkorbi* with *G. chloropus*, but noted that *G. chloropus* in the Pleistocene was larger and heavier than the modern form. This specimen, 35.0 mm in length, falls within the measurements for both Recent and fossil specimens of *G. chloropus* published by Olson (1974).

G. chloropus has been recorded extensively from Pleistocene deposits in Europe, the Middle East, Brazil, Cuba, Idaho, and possibly Arizona, as well as six sites in Florida (Brodkorb 1967).

PALEOECOLOGY

Martin (1974) stated that Coleman IIA was probably more open and xeric than it is today, and predominantly a savanna. He cited several species of mammals that would indicate this, such as *Peromyscus floridanus* (sandpine scrub/turkey oak sandhill), *Cryptotis parva* (pine flatwoods, grass and sedge fields, and *Lepus alleni* and *Platygonus* sp. (open and semi-arid = xeric habitats). Many of the birds, especially the sparrows *Passerculus sandwichensis, Pooecetes gramineus, Aimophila aestivalis, Spizella pusilla,* and *Spizella* sp., are savanna dwellers, thus bolstering Martin's conclusion. The two most common bird species, *Colinus suilium* and *Agriocharis anza,* if one assumes they preferred the habitats of their living counterparts, give no reason to dispute this. *Colinus virginianus (C. suilium's* modern counterpart) inhabits open pinelands and fields, and *Meleagris gallopavo (A. anza's* modern counterpart) can be found in virtually any type of habitat in Florida (swamps, open woodlands, particularly oak and hickory forest, and clearings). Also, most of the birds of prey *(Buteo jamaicensis, Buteo lagopus, Aquila chrysaetos,* probably *Coragyps occidentalis,* and *Falco columbarius)* prefer open country for hunting.

The presence of *Podilymbus podiceps, Botaurus lentiginosus, Ixobrychus* sp., *Ciconia maltha, Anas platyrhynchos, Branta canadensis, Rallus elegans, Coturnicops noveboracensis,* and *Agelaius phoeniceus* suggests a freshwater marsh or pond community must have been nearby. Martin reported finding remains of *Sciurus carolinensis* and *Ochrotomys nuttalli,* which indicates that a more mesic habitat was also sampled. Several avian species, most notably *Buteo platypterus, Philohela minor,* and *Pheucticus ludovicianus,* support this conclusion.

Disregarding extinct species, the avifauna from the Pleistocene of Coleman IIA is very similar to that of central Florida today. Two birds of prey, *Buteo lagopus* and *Aquila chrysaetos,* do not normally range as far south as central Florida today, but their overall ranges, especially in eastern North America, are not very different from those of several other species of birds recovered from Coleman IIA. Their presence is not sufficient to base any significant climatic differences on. One extinct species, *Agriocharis anza*, has previously been reported only from the Pleistocene of western America. However, this species has a modern counterpart that ranges all across North America, including central Florida, so its presence does not necessarily indicate any affinity to environmental conditions of western America.

The paleoecology of Coleman III is more obvious. It was apparently a small, sluggish spring run. All of the avian fossils are of aquatic species, with the exception of a single turkey bone from IIID. Most of the non-avian species (see Introduction for list of non-avian species) are also aquatic, but the presence of *Crotalus adamanteus*, *Hemiauchenia macrocephala*, and *Equus* sp. suggest that a drier, more open savanna habitat was nearby.

Both Coleman IIA and Coleman IIIC and D contained species that indicate dry, open savanna habitats were nearby, and both contained numerous aquatic species. The two sites were probably contemporaneous, judging from the extinct species of mammals, *Pampatherium septentrionalis*, *Equus* sp., and possibly *Sigmodon* sp., and the one extinct species of bird, *Agriocharis anza*, common to both. If so, the spring of Coleman III was probably the habitat from which many of the aquatic species of birds of Coleman II came. A relatively complete picture of the middle Pleistocene habitat of Coleman can be reconstructed. The area was probably predominantly a savanna or open pineland habitat in which a freshwater spring gave rise to a small sluggish stream that probably had a marsh and river swamp habitat along its run. Farther from the stream was mesic forestland that in turn gave way to the open pineland or savanna. A short distance from the spring, 300 meters south, a sinkhole opened into the underlying limestone of the Ocala group. Whether it formed in the mesic forest or open land is impossible to determine.

If this reconstruction is accurate, the Coleman area during the middle Pleistocene was very similar to many of the freshwater spring habitats of central Florida today.

EVOLUTIONARY TRENDS

It is well documented that Pleistocene representatives of modern species are often characterized by larger size. *Gallinula chloropus* of Coleman III is large compared to its modern representative, and *Podilymbus podiceps* and *Bubo virginianus* of Coleman II are larger than their modern representatives in Florida. Several extinct species, *Coragyps occidentalis* and *Colinus suilium* of Coleman II, *Agriocharis anza* of Coleman II and III, and *Anhinga* cf. *A. grandis* of Coleman III, are large compared to their modern counterparts. *Ixobrychus* sp. of Coleman II is larger than a modern species that is closely related or conspecific. Olson (1974) gave other examples of this phenomenon. The one exception to the trend is *Falco columbarius* of Coleman II, which is smaller than its modern representative of Florida.

Two species, *Protocitta* cf. *P. ajax* from Coleman II and *Anhinga* cf. *A. grandis* from Coleman III, show affinities to the late Pliocene, but neither identification is definite because of a lack of referred material.

Analysis of two large samples of *Colinus suilium*, from Coleman IIA and from the earlier deposit of Inglis IA, has demonstrated that the species underwent an overall increase in size throughout the Pleistocene in Florida. Until now, it was hypothesized that *C. suilium* was derived from *Colinus hibbardi,* a large species from the late Pliocene of Kansas, and gradually decreased in size until the late Pleistocene. *C. suilium* was probably not derived from *C. hibbardi,* but from some as yet unknown species, and then increased in size until the late Pleistocene, at which time it most likely gave rise to *Colinus virginianus* and underwent a size decrease.

MODE OF FOSSIL DEPOSITION

The mode of fossil deposition for Coleman IIA is unclear. It is possible that roosting or nesting birds of prey were a major source of small animals in this fauna. A significant portion (24%) of the avifauna in this deposit is comprised of birds of prey. *Buteo platypterus* and *Falco columbarius* prey almost exclusively on small birds, *Bubo* preys commonly on birds of all sizes, and *Aquila chrysaetos* preys heavily on large birds. *Coragyps occidentalis* may have scavenged bird remains.

It is improbable that birds would have fallen into a large sinkhole and not have been able to escape, unlike many of the large mammals. Food remains from predators seem to be a plausible explanation for the concentration of avian fossils recovered from Coleman IIA. *Bubo virginianus* was perhaps most responsible for the extremely varied sample of birds, especially the larger species, because owls commonly roost in caves in Florida and can create tremendous stockpiles of animal bones from their regurgitated pellets. *C. occidentalis* probably nested on the side of the sink, as some of the recovered fossils of this species are from immature, probably nestling birds, and may also have been a source of animal remains. It should be noted that the two most common species from this avifauna, *Agriocharis anza* and *Colinus suilium,* are the Pleistocene representatives of two modern species, *Meleagris gallopavo* and *Colinus* *virginianus*, which are known to be prey species of *Bubo virginianus* (Bent 1938).

No evidence indicates the water birds of Coleman IIA were deposited separately during a time when the sinkhole contained water, because their fossilized bones were recovered in both sand and clay facies along with the remains of other birds and mammals and vary considerably in color. Martin (1974:36) stated the sinkhole was "quite extensive and not filled to the top with water during most of its depositional history" as evidenced by the presence of a relatively large quantity of bat remains.

The fossils of Coleman III were not in a single concentration, but spread throughout the area of excavation. Apparently deposition occurred quite randomly along the course of the postulated spring run.

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