BULLETIN

OF THE

FLORIDA STATE MUSEUM

BIOLOGICAL SCIENCES

Volume 10 Number 4

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Gainesville

1965

Numbers of the BULLETIN OF THE FLORIDA STATE MUSEUM 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 publication and all manuscripts should be addressed to the Managing Editor of the Bulletin, Florida State Museum, Seagle Building, Gainesville, Florida. 32601

Published January 3, 1966 Price for this issue $.50

A PLEISTOCENE AVIFAUNA FROM HAILE, FLORIDA

J. DAVID LIGON [1]

SYNOPSIS: A newly discovered fossil fauna near Haile, Alachua County, Florida, represents the Rancholabrean stage of the Pleistocene. The great concentration of small vertebrate remains, especially birds and mammals, is probably due to predatory birds. The avifauna of 72 species represents 12 orders and 26 families; 12 species are extinct. Five living species, *Tympanuchus cupido, Actitis macularia, Coccyzus americanus, Cistothorus platensis,* and *Vireo griseus* are new to the fossil record, and four others, *Clangula hyemalis, Numenius americanus, Recurvirostra americana,* and *Asio flammeus,* are new to the Pleistocene of Florida. The avifauna shows northern, western or southwestern, and Neotropical affinities; its composition indicates the close proximity of a lake or pond with accompanying marsh and wet meadow during the time of deposition, and that open prairie and scrub were also close at hand.

INTRODUCTION

Several fossil-bearing deposits of Pliocene and Pleistocene age have been found near Haile, in the western part of Alachua County, Florida, (Fig. 1), but relatively little has been published on their faunas. Amphibians from Pleistocene deposits have been reported by Tihen (1952) and by Goin and Auffenberg (1955). Pliocene amphibians have been recorded by Goin and Auffenberg (1955) and Auffenberg (1957). Reptiles from both epochs have been reported by Auffenberg (1954, 1955, 1956, 1963). Brodkorb (1953) listed a Pleistocene avifauna of seven species from one Haile locality and described an extinct rail of the genus *Porzana* from the same site (Brodkorb, 1954); he later (1963) described several new species of Pliocene birds from Haile localities. Though the Haile mammal fauna has not been reported in detail, several species listed in some of the above papers serve as chronological indicators.

Each of the Haile quarries is designated by a Roman numeral and areas of fossil concentration within a quarry are subdivided and

[1] This paper is based on a thesis presented to the Department of Biology of the University of Florida in partial fulfillment of the requirements for the degree of Master of Science. The study was supported by National Science Foundation grant G-19595 to Dr. Pierce Brodkorb. The author's present address is Museum of Zoology, University of Michigan, Ann Arbor, Michigan. Manuscript received 21 September 1964.—ED.

Ligon, J. David. 1965. A Pleistocene Avifauna from Haile, Florida. Bull. Florida State Mus., vol. 10, no. 4, pp. 127-158.

separated by letter (Fig. 1). The avifauna of Haile XI B forms the subject of this paper. The non-avian vertebrates have been studied by J. Howard Hutchison.

Haile is about 4 miles northeast of the town of Newberry, Alachua County, Florida. The fossil site is in a limestone quarry just east of Highway 235 and 3.4 miles north of the junction of Highways 235 and 26. It is in the SW½ of Sec. 13, T 9 S, R 17 E.

The 83.5 foot altitude of the nearby Newberry railroad station corresponds to that of the Wicomico terrace (70-100 feet), which has generally been considered to represent the Sangamon interglacial stage of the Pleistocene (Cooke, 1945: 248). However, the Haile XI B deposit is here assigned to the Rancholabrean period, following Hibbard *et al.* (1965). This term encompasses the Illinoian, Sangamon, and Wisconsin ages of the Pleistocene and is used for faunas not clearly correlated with the glacial and interglacial stages. The difficulties of dating Florida late Pleistocene localities are discussed comprehensively by Bader (1957) and Auffenberg (1963). Both these authors point out the problems involved in using the supposed marine terraces as indicators of interglacial periods. Recently Weigel (1962) has published radio-carbon datings that indicate the marine terraces may be one cycle older than previously thought. Thus the Wicomico terrace represents, under his scheme, the Yarmouthian interglacial period. This is unlikely and further illustrates the problems involved in assuming that these terraces are marine and that they do represent interglacial periods.

The bones reported on here were deposited in a cavity in the Ocala limestone which underlies almost all of Florida. The free circulation of water through this limestone has resulted in solution of the rock (Cooke, 1945: 54). Subterranean caves formed by solution occasionally collapse under the weight of overlying sediments. Limestone rubble, abundant in the matrix at Haile XI B, may indicate the collapse of a cave roof, as at Reddick I (Brodkorb, 1957).

The bones were deposited in what was apparently a drainage outlet or tunnel at the lowermost (southeast) corner of the collapsed cave (Fig. 2). This was completely filled with clay and sand until quarrying operations unplugged the outer end of the tunnel. As subsequent erosion has only partly emptied the solution cavity of soil, the exact size of the chamber is still indeterminable.

The bone-bearing matrix, consisting of sands and clays, occurred principally along the walls near the end of the tunnel opposite the collapsed cave. Stratified layers of soil indicate that the matrix was deposited by water, probably the runoff of heavy rains. The cross-

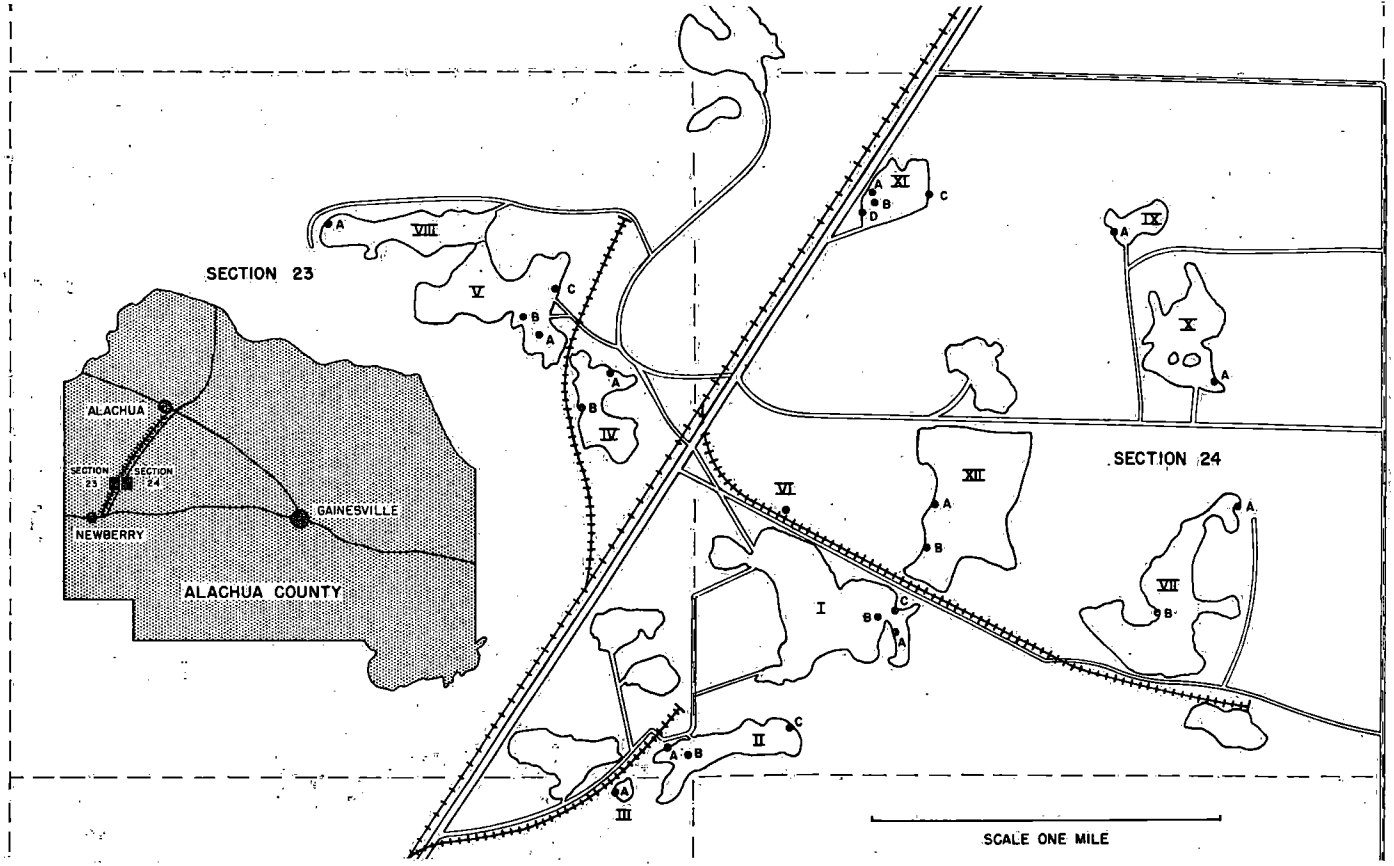

FIGURE 1. Map of Haile fossil localities.

bedding of the soil layers indicates that the water flowed at least principally in only one direction, outward and downward from the cave (H. K. Brooks, personal communication).

All classes of vertebrates except the fishes are well represented in the fauna. The almost complete absence of fish (only one vertebra) indicates that no permanent body of water existed in the immediate area of deposition. Except for one or two small elements of deer, large mammals are not present at Haile XI B. Their rarity is an unusual aspect of the Haile XI B fauna, as they are common in other Pleistocene localities of north central Florida (Gut, 1939; Bader, 1957; Holman, 1959). Large mammals have also been found at other Haile sites. The only other large vertebrate at Haile XI B is the extinct giant land tortoise, *Geochelone crassicutata.*

The avian bones are a nearly uniform light brown. Many of the specimens washed out of the tunnel when it was unsealed by the quarrying operations are badly abraded; others hand-picked at the site or obtained by washing the matrix are generally in better condition.

The 936 elements identified specifically represent about one-third

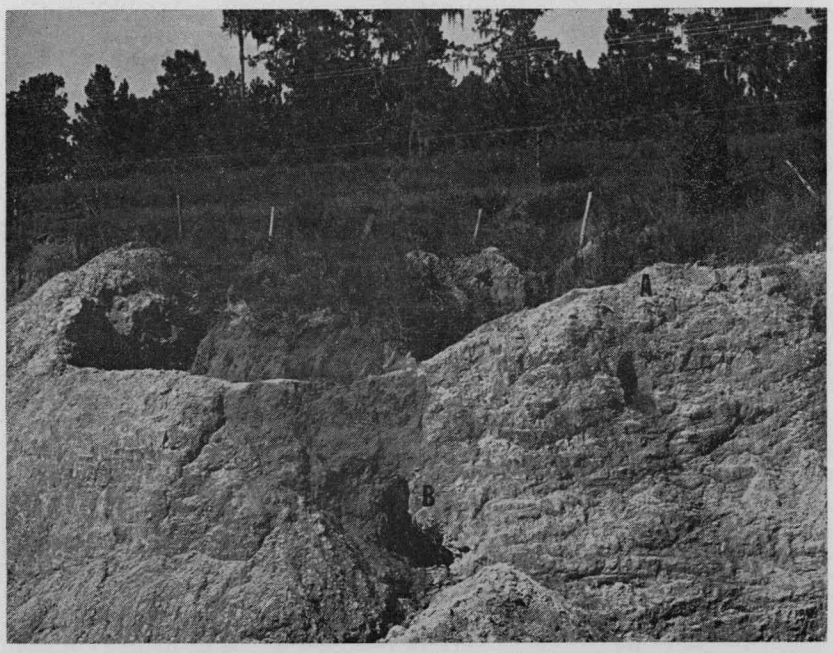

FIGURE 2. Haile XI site. A indicates surface of the Ocala limestone, B marks outer end of the tunnel from which the bones were removed.

of the avian material. Much of the unidentified material consists of shafts of limb bones, vertebrae, phalanges, and small passerine elements. Most of the identified specimens are fragmentary, consisting of one end of a limb element. Table 1 lists the number of elements for each species, and the least number of individuals these represent, determined by the greatest number of a single element from one side. Extinct taxa are indicated by daggers. All measurements given are in millimeters. Terminology follows that of Howard (1929). The Florida State Museum is the repository of the material.

TABLE 1. LIST OF AVIAN SPECIES IN THE HAILE XIB FAUNA

Species	Number of Elements	Least Number of Individuals
Podilymbus podiceps	54	9
Butorides virescens	1	1
Leucophoyx thula	5	1
Botaurus lentiginosus	11	2
Branta canadensis	1	1
Anas platyrhynchos	14	3
Anas acuta	9	2
Anas carolinensis	11	2
Anas discors	31	2
Spatula clypeata	5	2
Aix sponsa	14	3
Aythya collaris	9	3
Aythya affinis	3	1
Bucephala albeola	1	1
Clangula hyemalis	1	1
Lophodytes cucullatus	20	4
Coragyps †occidentalis	1	1
Accipiter cooperii	4	2
Buteo platypterus	1	1
Polyborus †prelutosus	8	2
Falco peregrinus	3	2
Falco sparverius	33	4
Tympanuchus cupido	26	4
†Neortyx peninsularis	3	2
Colinus †suilium	157	12
Rallus elegans	57	5
Rallus limicola	14	3
Porzana †auffenbergi	6	2
Porzana carolina	34	4
Coturnicops noveboracensis	16	4
Laterallus †guti	7	3

TABLE 1 (Continued)

Species	Number of Elements	Least Number of Individuals
Porphyrula martinica	1	1
Gallinula chloropus	8	2
Fulica americana	9	2
†*Dorypaltus prosphatus*	6	2
Charadrius vociferus	5	1
Philohela minor	13	3
Capella gallinago	15	3
Numenius americanus	5	1
Actitis macularia	1	1
Totanus melanoleucus	5	1
Limnodromus sp.	3	1
Recurvirostra americana	1	1
Ectopistes migratorius	6	2
Zenaidura macroura	13	4
Coccyzus americanus	2	1
Tyto alba	2	1
Otus asio	4	1
Speotyto cunicularia	77	10
Asio flammeus	5	1
Colaptes auratus	36	6
Melanerpes erythrocephalus	2	1
Tachycineta †*speleodytes*	16	6
Aphelocoma coerulescens	2	2
†*Protocitta dixi*	3	1
Corvus brachyrhynchos	1	1
Corvus ossifragus	1	1
Troglodytes aedon	1	1
Cistothorus platensis	2	2
Mimus polyglottos	3	2
Toxostoma rufum	6	2
Vireo griseus	1	1
Geothlypis trichas	5	3
Sturnella magna	29	6
Quiscalus quiscula	2	1
Molothrus ater	1	1
†*Cremaster tytthus*	1	1
†*Pandanaris floridana*	50	8
Richmondena cardinalis	4	2
Pipilo erythrophthalmus	26	9
Ammodramus savannarum	2	1
Passerherbulus henslowii	1	1
Totals	936	187

SYSTEMATIC LIST

Family Podicipedidae

Podilymbus podiceps (Linnaeus) Pied-billed Grebe

Material.—Elements identified include maxilla, coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus, and tarsometatarsus.

Remarks.—As the Haile XI B specimens are not larger than Recent *P. podiceps*, they are assigned here rather than to the large extinct *P. magnus* (Shufeldt, 1913).

Family Ardeidae

Butorides virescens (Linnaeus) Green Heron

Material.—Distal portion of a right tarsometatarsus.

Leucophoyx thula (Molina) Snowy Egret

Material.—Elements identified include coracoid, tibiotarsus, and tarsometatarsus.

Remarks.—The Snowy Egret is so similar to the Little Blue Heron (*Florida caerulea*) osteologically that I was able to distinguish between the two only on the basis of the distal end of the tibiotarsus. The area proximal to the anterior termination of the external condyle is swollen in *Florida*, a thin ridge in *Leucophoyx*.

Botaurus lentiginosus (Rackett) American Bittern

Material.—Elements identified include coracoid, humerus, sternum, carpometacarpus, tibiotarsus, and tarsometatarsus.

Remarks.—Size separates *Botaurus* from all other local herons except *Nyctanassa* and *Nycticorax*, from which it differs in the following characters:

Coracoid: (1) the bicipital attachment is slender and tapering in *Botaurus*, thick and rounded in the others; (2) the posterior sternal facet is situated more anteriorly on the shaft in *Botaurus*.

Sternum: (1) the ventral lip of the left coracoidal sulcus turns downward in *Botaurus*, while it extends antero-dorsally in the others; (2) the coracoidal sulcus is deepest in *Botaurus*.

Family Anatidae

Osteological characters described by Woolfenden (1961) were useful in identifying the subfamilies and often the genera of this group.

Size groupings such as occur in the Anatinae lessen the problems of specific identification of the fossils.

Subfamily Anserinae

Branta canadensis (Linnaeus) Canada Goose

Material.—Proximal portion of a right femur.

Remarks.—Measurements of the specimen (proximal width, 14.3; proximal depth, 12.0) agree with those of the subspecies *hutchinsii*, previously listed from the Florida Pleistocene by Wetmore (1931) and McCoy (1963).

Subfamily Anatinae

In this subfamily four size-groups were considered: the large *Anas platyrhynchos-rubripes-fulvigula* complex, the medium-sized *Anas acuta* and *A. strepera*, the smaller *Spatula clypeata* and *Aix sponsa*, and the smallest *A. carolinensis*. Osteological characters separating members of each size group are given where pertinent below.

Anas platyrhynchos Linnaeus Mallard complex

Material.—Elements identified include coracoid, humerus, ulna, sternum, femur, tibiotarsus, and tarsometatarsus.

Remarks.—I was unable to separate elements of *Anas platyrhynchos, rubripes,* and *fulvigula,* and am therefore following Phillips' (1959) and Johnsgard's (1961) conclusions that these three types are conspecific and should be considered subspecies of *A. platyrhynchos*.

Anas acuta Linnaeus Pintail

Material.—Elements identified include coracoid, humerus, ulna, carpometacarpus, and femur.

Remarks.—*A. acuta* is closest in size and characters to *A. strepera* but differs from it as described below.

Carpometacarpus: *A. acuta* has a deep, well-marked notch on the posterior side of the external carpal trochlea, which is less distinct in *A. strepera*.

Ulna: (1) the ligamental attachment is pointed in *A. acuta* and is relatively blunt in *A. strepera*; (2) a groove is present on the lateral distal side of the ulna between the internal condyle and the ligamental attachment in *A. acuta,* but it is weak or absent in *A. strepera*.

Humerus: (1) the olecranon fossa is deep in *A. acuta* and is shallow in *A. strepera;* (2) the attachment of the pronator brevis is more proximal to the attachment of the anterior articular ligament in *A.*

strepera than in *A. acuta*; (3) the proximal side of the internal condyle is flattened in *A. acuta* and is less so in *A. strepera*.

Coracoid: the neck is longer in *A. strepera* and the anterior portion of the furcular facet is at a greater angle to the neck.

The proximal portions of the femora could not be separated but were assigned to this species on the basis of the above specimens.

Anas carolinensis Gmelin Green-winged Teal

MATERIAL.—Elements identified include coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus, and tarsometatarsus.

REMARKS.—In addition to qualitative differences such as those found in the anterior carpal fossa of the carpometacarpus (Wetmore, 1944; Brodkorb, 1958), *A. carolinensis* can usually be separated from *A. discors* on size. The measurements of the humeri of 4 Recent *A. discors* (2 of each sex) and 7 Recent *A. carolinensis* (5 males, 2 females) show no overlap in lengths or distal widths. One *A. discors* (an immature male) fell within the range of the proximal widths of *A. carolinensis*.

Anas discors Linnaeus Blue-winged Teal

MATERIAL.—Elements identified include coracoid, humerus, ulna, carpometacarpus, tibiotarsus, and tarsometatarsus.

REMARKS.—I could not separate this species from *A. cyanoptera* and base the specific identification on geographical grounds.

Spatula clypeata (Linnaeus) Shoveler

MATERIAL.—Elements identified include coracoid, humerus, and ulna.

REMARKS.—Many of the elements of *Spatula* are similar in size to those of *Aix sponsa*. Differences between the two are:

Coracoid: (1) *Aix* has the head rounded and thickened (Woolfenden, 1961: 52) which *Spatula* lacks; (2) *Aix* often has a pneumatic fossa underneath the brachial tuberosity, lacking in *Spatula*.

Humerus: (1) the ectepicondyle of *Aix* extends distad of the entepicondyle while in *Spatula* the epicondyles are at the same level; (2) the attachment of the anterior articular ligament is more proximal in *Aix*; (3) the attachment for the pronator brevis is shallow in *Spatula* and deep in *Aix*.

Ulna: (1) the lip of the external cotyla extends farther proximal on the shaft in *Aix*; (2) *Spatula* has a groove on the internal side of the olecranon process, absent in *Aix*.

Aix sponsa (Linnaeus) Wood Duck

MATERIAL.—Elements identified are coracoid, humerus, ulna, and tarsometatarsus.

REMARKS.—The proximal part of the humerus is closest to that of *Spatula* but differs from it in the following features: (1) in *Aix* the scar of the pectoral attachment is elongate and swept back to a point towards the deltoid crest, but it is shorter in *Spatula* and not swept back; (2) in *Aix* the head extends farther into the capital groove, and the capital groove is narrower than in *Spatula*.

Tarsometatarsus: (1) the element is shorter and more robust in *Aix* than in *Spatula*; (2) in *Aix* the ridges of the middle trochlea form a point at the postero-lateral termination of the ridges, in *Spatula* the two ridges meet medially.

Subfamily AYTHYINAE

Aythya collaris (Donovan) Ring-necked Duck

MATERIAL.—Elements identified include coracoid, carpometacarpus, femur, and tarsometatarsus.

REMARKS.—*A. collaris* is very similar to *A. affinis* but differs in the following characters:

Coracoid: (1) the glenoid facet of *A. collaris* is more concave and its external edge is more strongly recurved than that of *A. affinis*; (2) the triosseal canal is nearly flat in *A. collaris*, deep in *A. affinis* (Brodkorb, MS.).

Carpometacarpus: (1) the origin of M. extensor pollicis brevis near the outer edge of the pollical facet is shallow in *A. collaris* and deep in *A. affinis*; (2) metacarpal one is square at the tip in *A. collaris* and rounded in *A. affinis*.

Femur: Compared with *A. affinis* (1) the neck is less constricted anteriorly; (2) viewed from the posterior side the neck is shorter and more thickened; (3) the shaft just distal to the base of the neck is shallower; (4) the popliteal area tends to be shallower; (5) the ridge of the external condyle does not extend so far posteriorly.

Aythya affinis (Eyton) Lesser Scaup

MATERIAL.—Elements identified include coracoid, carpometacarpus, and femur.

Bucephala albeola (Linnaeus) Bufflehead

MATERIAL.—The proximal part of a left humerus.

Clangula hyemalis (Linnaeus) Oldsquaw

MATERIAL.—Proximal part of a right carpometacarpus.

REMARKS.—This is the first record of the Oldsquaw for the Pleistocene of Florida.

Subfamily MERGINAE

Lophodytes cucullatus (Linnaeus) Hooded Merganser

MATERIAL.—Elements identified include coracoid, humerus, ulna, carpometacarpus, tibiotarsus, and tarsometatarsus.

Family CATHARTIDAE

Coragyps †occidentalis (L. Miller) Extinct Vulture

MATERIAL.—Distal portion of a right tibiotarsus (Fig. 3a).

REMARKS.—Measurements are: distal width, 13.5; depth of internal condyle, 13.3; depth of external condyle, 13.0. Both condyles are somewhat abraded.

Family ACCIPITRIDAE

Accipiter cooperii (Bonaparte) Cooper's Hawk

MATERIAL.—Elements identified include coracoid, ulna, and tarsometatarsus.

REMARKS.—These elements may be distinguished on several characters from those of the Broad-winged Hawk, *Buteo platypterus*, which are similar in size.

Coracoid: (1) procoracoidal foramen absent in *A. cooperii*, present in *B. platypterus*; (2) pneumatic foramina deeper and relatively larger in *A. cooperii*, a greater amount of variation in *B. platypterus*; (3) the procoracoid terminates in a point in *B. platypterus*, but is somewhat square-shaped in *A. cooperii*.

Ulna: (1) ligamental attachment rounded in *A. cooperii*, pointed in *B. platypterus*; (2) external condyle more strongly defined and more rounded in *A. cooperii*.

Tarsometatarsus: (1) shaft relatively more slender in *A. cooperii*; (2) inner trochlea more proximal than middle one in *B. platypterus*, at the same level or slightly lower in *A. cooperii*; (3) wing of the inner trochlea more pointed in *B. platypterus*.

Buteo platypterus (Viellot) Broad-winged Hawk

MATERIAL.—Upper part of a right coracoid.

Family FALCONIDAE

Polyborus †prelutosus Howard Extinct Caracara

MATERIAL.—Elements identified are ulna, femur, tibiotarsus, and tarsometatarsus.

REMARKS.—Measurements of the above specimens were compared with those of four species of *Polyborus* given by Howard (1938). Except for the proximal portion of one tarsometatarsus, all of the Haile XI B specimens fall into Howard's range of measurements for *P. prelutosus*. She states that of 14 specimens from Florida available to her, at least 6 were definitely similar to *P. prelutosus*.

Falco peregrinus Tunstall Peregrine Falcon

MATERIAL.—Three tarsometatarsi represent at least two individuals, probably a male and a female from their sizes.

Falco sparverius Linnaeus Sparrow Hawk

MATERIAL.—Elements identified include coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus, and tarsometatarsus.

TABLE 2. MEASUREMENTS OF RECENT AND FOSSIL *Falco sparverius* FROM HAILE XI B.

	Recent[1]		Fossil	
Element	Range	Mean	Range	Mean Number
Humerus:				
Distal width	7.0– 8.0	(7.36)	8.0– 8.2	(8.10, *n* 2)
Depth of head	2.4– 2.9	(2.55)	2.5– 2.9	(2.63, *n* 3)
Ulna:				
Proximal width	4.7– 5.4	(4.95)	5.1– 5.4	(5.33, *n* 3)
Carpometacarpus:				
Length	25.8–29.7	(27.30)	27.7–28.9	(28.25, *n* 2)
Length of first metacarpal	4.1– 5.7	(4.63)	4.4– 5.3	(4.78, *n* 6)
Height through metacarpal I	6.5– 7.8	(7.04)	7.2– 8.0	(7.63, *n* 6)
Femur:				
Length	34.5–38.0	(35.80)	39.1	(39.10, *n* 1)
Proximal width	5.5– 6.6	(5.92)	6.0– 6.7	(6.35, *n* 2)
Distal width	5.7– 6.8	(6.11)	6.2– 6.5	(6.37, *n* 3)
Tibiotarsus:				
Distal width	4.8– 5.8	(5.16)	5.6	(5.60, *n* 1)
Depth of external condyle	3.8– 4.5	(4.02)	4.2	(4.20, *n* 1)
Tarsometatarsus:				
Distal width	5.2– 6.2	(5.57)	5.7– 6.1	(5.90, *n* 2)

[1] Measurements based on 2 male and 8 female *F. s. sparverius*.

REMARKS.—Table 2 shows the fossil Sparrow Hawks to be large compared to the Recent *F. s. sparverius*, which is larger than the subspecies that breeds in Florida today, *F. s. paulus*.

Family TETRAONIDAE

Tympanuchus cupido (Linnaeus) Greater Prairie Chicken

MATERIAL.—Elements identified include maxilla, coracoid, humerus, ulna, carpometacarpus, and tarsometatarsus.

REMARKS.—This is the first fossil record of the Prairie Chicken, *T. cupido*.

Comparative measurements were taken of the Haile XI B specimens, two male and one complete and one partial female *T. c. pinnatus*, and two unsexed *T. c. cupido* (Table 3). The Haile XI B specimens are smaller than Recent ones in most measurements, and larger

TABLE 3. MEASUREMENT OF RECENT AND FOSSIL *Tympanuchus cupido* FROM HAILE XI B.

Element	*T. c. cupido*	*T. c. pinnatus*	Fossil	*T. ceres* [1]
Coracoid:				
Head through scapular facet	18.0–18.0	16.9–18.8	16.5–17.0 (*n* 4)	
Depth through glenoid facet	5.5– 5.7	5.3– 6.0	5.0– 5.4 (*n* 6)	
Humerus:				
Length	66.6–66.8	68.0–72.3	67.2 (*n* 1)	59.7–60.5
Proximal width	19.1–19.7	18.7–20.6	17.3–18.7 (*n* 2)	
Distal width	13.2–13.6	13.3–13.7	12.3–12.9 (*n* 4)	
Ulna:				
Proximal width	8.2– 8.3	7.9– 9.2	7.7– 8.7 (*n* 2)	
Distal width	8.5– 8.7	8.5– 9.6	8.4– 8.5 (*n* 2)	
Carpometacarpus:				
Length	37.0–38.5	38.2–42.3	37.2 (*n* 1)	33.1–34.7
Height through metacarpal one	10.5–11.4	11.0	10.5–11.1 (*n* 2)	
Height of metacarpal one	6.4– 6.6	6.7– 7.0	6.6 (*n* 1)	
Tarsometatarsus:				
Length	47.3–48.0	50.7–53.0	48.6 (*n* 1)	44.9–45.4
Proximal width	9.5– 9.5	9.2–10.3	9.0– 9.3 (*n* 2)	
Distal width	10.3–10.4	10.6–11.9	10.2–10.7 (*n* 2)	

[1] Measurements from Wetmore (1959).

than those of *Tympanuchus †ceres* (Shufeldt) from the Pleistocene of Arkansas. No specimens of *T. c. attwateri* were compared.

Family Phasianidae

†Neortyx peninsularis Holman Extinct Quail

Material.—Elements identified include a complete left coracoid, and proximal portions of two left ulnae.

Colinus †suilium Brodkorb Extinct Quail

Material.—Elements identified include coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus, and tarsometatarsus.

Remarks.—Measurements of the Haile XI B specimens agree with those of other Pleistocene localities given by Holman (1961).

Family Rallidae

The three large rallids from this fossil site, *Rallus elegans, Gallinula chloropus,* and *Fulica americana,* are fairly similar in osteological characters. The Coot (*Fulica*) is considerably larger than the Gallinule (*Gallinula*), and the measurements do not overlap; *Fulica* is also larger than the King Rail (*Rallus*), but measurements occasionally overlap, as do those of *Rallus* and *Gallinula.* Characters separating the elements at hand are:

Coracoid: (1) furcular facet curves medially from the shaft in *Gallinula* and *Fulica,* but forms a straight extension of the shaft in *Rallus*; (2) procoracoid process points dorsally in *Rallus,* at almost right angles to shaft in others.

Humerus: (1) *Rallus* has the pectoral attachment of the external tuberosity at right angles to the shaft in anconal view, but in the others it blends in gradually to the shaft and deltoid crest; (2) bicipital crest short and round in *Rallus,* longer and joining shaft in a gradual slope in the others; (3) external and internal condyles more slender in *Rallus* than in the others; (4) external condyle an S-shaped curve in *Rallus,* less so in *Gallinula,* short and stubby in *Fulica*; (5) ectepicondyle extends distad to internal condyle in *Gallinula,* at about same level in others.

Ulna: (1) a groove between the olecranon and external cotyla in *Rallus,* absent in others; (2) internal cotyla deepest in *Rallus*; (3) internal condyle with strong palmar projection in *Rallus,* none in *Fulica,* less pronounced in *Gallinula*; (4) palmar ridge of external condyle joins shaft sharply and at right angles in *Rallus,* joins shaft gradually and forms a semi-circle in others.

Carpometacarpus: *Fulica* has an indentation on the posterior ridge of the external carpal trochlea, lacking in *Rallus*.

Femur: (1) neck in *Rallus* much constricted just proximal to head, others have thick, non-constricted necks; (2) *Rallus* has head smaller than others; (3) a deep depression in the posterior medial side of the external condyle in *Fulica*, less pronounced or absent in others; (4) a slender ridge continuing from the postero-lateral side of the internal condyle onto shaft in *Rallus*, much thickened or absent in others; (5) scar of M. flexor cruris lateralis distinct in *Gallinula* and *Fulica*, less so in *Rallus*, comparatively widely separated from the external condyle in *Fulica*, close to or touching external condyle in others.

Tibiotarsus: (1) ridge of inner cnemial crest rises from internal articular surface at a sharp angle in *Fulica* and *Gallinula*, at a gentler slope in *Rallus*; (2) cnemial crest rises to a proportionately greater height in *Fulica* than in *Rallus* or *Gallinula*; (3) intercondylar area proportionately larger in *Fulica*; (4) internal ligamental prominence larger and more prominent in *Fulica*, also large and protruding in *Gallinula*, small and flattened in *Rallus*; (5) condyles more compressed in *Rallus* than in *Gallinula*.

Tarsometatarsus: (1) intercotylar prominence elongate and pointed laterally in *Rallus* and *Gallinula*, short and thick in *Fulica*; (2) dorsal surface completely flattened in *Gallinula*, but not in *Rallus*; (3) outer trochlea more proximal and medial in *Rallus* than in others; (4) shaft relatively narrower and trochlea less bulky in *Rallus*.

The medium sized rails, the Virginia Rail (*Rallus limicola*), and the Sora (*Porzana carolina*), are also close both in size and osteological characters. The Pleistocene *Porzana auffenbergi* is larger than either of the other two. Differences between *R. limicola* and *P. carolina* are given below.

Coracoid: (1) furcular facet two-lobed in *Porzana* in dorsal view; (2) in *R. limicola* the furcular facet rises to head symmetrically; (3) shaft relatively wider in *Porzana* and scapular facet generally larger and deeper.

Humerus: (1) head and external tuberosity more clearly outlined in *Porzana*; (2) bicipital crest relatively larger in *Porzana*; (3) entepicondyle more distally produced in *Porzana*; (4) brachial depression shallow in *Porzana*; (5) attachment of M. pronator brevis more proximal in *Porzana*.

Ulna: (1) strongly bowed in *R. limicola*, more nearly straight in *Porzana*; (2) ligamental attachment and internal condyle almost perpendicular in *Porzana*, forming a semicircle in *R. limicola*.

Carpometacarpus: (1) external carpal trochlea more flattened and more sharply pointed in *R. limicola*; (2) metacarpals two and three proximally fused a greater distance in *Porzana*; (3) *R. limicola* shorter than the shortest *Porzana* examined.

Femur: (1) shaft more slender in *R. limicola*; (2) insertion for M. flexor ischiofemoralis more pronounced in *Porzana*; (3) intercondylar area deeper in *Porzana*; (4) a ridge perpendicular to shaft on postero-proximal internal condyle extends to external condyle in *Porzana*, separated by a groove in *R. limicola*.

Tibiotarsus: (1) intercondylar area greater in *Porzana*; (2) internal ligamental prominence more prominent in *Porzana* than in *R. limicola*; (3) external condyle extends more proximally on shaft in *R. limicola* to about the level of the mid-supratendinal bridge.

Tarsometatarsus: (1) outer trochlea of *R. limicola* extends almost to middle trochlea, more nearly equal to the inner trochlea in *Porzana*; (2) distal foramen nearer outer intertrochlear notch in *R. limicola* than in *Porzana*.

Rallus elegans Audubon King Rail

MATERIAL.—Elements identified include maxilla, coracoid, humerus, ulna, carpometacarpus, sternum, femur, tibiotarsus, and tarsometatarsus.

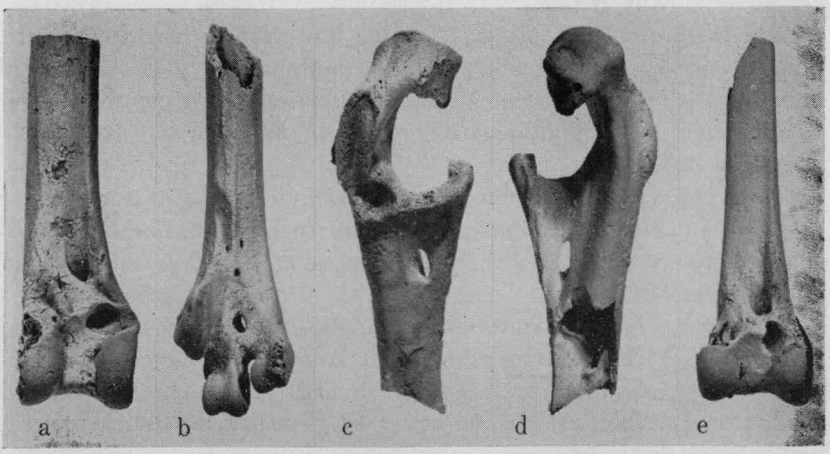

FIGURE 3. a. *Coragyps occidentalis*, UF 7012, right tibiotarsus, anterior view. b. *Porzana auffenbergi*, UF 7144B, left tarsometatarsus, posterior view. c. *Dorypaltus prosphatus*, UF 7174, left coracoid, posterior view. d. *Dorypaltus prosphatus*, UF 7174, left coracoid, anterior view. e. *Dorypaltus prosphatus*, UF 7177A, right tibiotarsus, anterior view.

Rallus limicola Vieillot Virginia Rail

MATERIAL.—Elements identified include coracoid, humerus, femur, tibiotarsus, and tarsometatarsus.

Porzana fauffenbergi Brodkorb Extinct Rail

MATERIAL.—Elements identified include the proximal parts of a left and a right ulna and distal portions of two left and two right tarsometatarsi (Fig. 3b).

REMARKS.—The distal portion of the tarsometatarsus of *P. auffenbergi* differs from that of *R. limicola* and *P. carolina* in the following features: (1) it is larger and more robust; (2) inner trochlea less medial to the shaft; (3) distal foramen closer to the outer intertrochlear notch than in *P. carolina*. Table 4 gives comparative measurements of the distal tarsometatarsus.

TABLE 4. MEASUREMENTS OF TARSOMETATARSUS IN SOME PLEISTOCENE AND RECENT RAILS

Species	Distal Width		
	Mean	Range	No.
P. auffenbergi	5.32	5.1–5.7	4
P. carolina	4.39	3.8–4.6	8[1]
R. limicola	4.50	4.4–4.6	3[2]

[1] 4 fossil and 4 Recent (2 of each sex).
[2] 1 fossil and 2 Recent (1 of each sex).

Porzana carolina (Linnaeus) Sora

MATERIAL.—Elements identified include coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus, and tarsometatarsus.

Coturnicops noveboracensis (Gmelin) Yellow Rail

MATERIAL.—Elements identified are coracoid, humerus, carpometacarpus, tibiotarsus, and tarsometatarsus.

Laterallus fguti Brodkorb Extinct Black Rail

MATERIAL.—Seven pieces of humeri.

REMARKS.—These specimens were compared with the type humerus (Brodkorb, 1952) and are even more robust. The proximal widths

of these specimens range from 4.8 to 5.2, and distal widths are 3.4 and 3.5.

Porphyrula martinica (Linnaeus) Purple Gallinule

MATERIAL.—The proximal part of a right femur.

Gallinula chloropus (Linnaeus) Common Gallinule

MATERIAL.—Elements include humerus, ulna, femur, tibiotarsus, and tarsometatarsus.

Fulica americana Gmelin American Coot

MATERIAL.—Elements identified include coracoid, humerus, ulna, femur, tibiotarsus, and tarsometatarsus.

REMARKS.—According to Howard (1946) though *Fulica minor* Shufeldt tends to have smaller wings and possibly longer legs than *F. americana*, it is only subspecifically distinct. The limb elements of the Haile XI B material are within the size range of the living *F. americana*.

Family CHARADRIIDAE

†*Dorypaltus prosphatus* Brodkorb Extinct Lapwing

MATERIAL.—Elements identified include the upper portion of a left coracoid (Figs. 3c, 3d), the proximal portion of a right humerus, the left and right proximal portions of two femora, and the distal portions of two right tibiotarsi (Fig. 3e).

REMARKS.—This is the second record of this extinct genus. Brodkorb (1959) described the proximal and distal portions of the humerus. The Haile XI B humerus compares favorably with the humerus collected with the holotype. Descriptions of the additional elements are as follows:

Coracoid: the upper portion is smaller than in either *Belonopterus* or *Vanellus*, with the anterior portion of the furcular facet less well developed and the termination of the procoracoidal process blunt and thick; it is more slender and recurved in *Belonopterus* and *Vanellus*. Width of furcular facet, 5.1; width through glenoid facet, 6.2.

Femur: the proximal portion is smaller than in *Belonopterus* and slightly smaller than in *Vanellus*, and the trochanteric ridge is less well developed than in *Vanellus*. Proximal widths of the two specimens are 6.8 and 7.2.

Tibiotarsus: the distal portion is slightly smaller than in *Belanopterus* and larger than in *Vanellus*. The outer edge of the external con-

dyle extends proximally to the inner edge in *Dorypaltus,* in contrast to the others. The ridge extending from the external condyle to the supratendinal bridge is more strongly defined than in *Belonopterus.* Distal widths of the two specimens are 5.8 and 6.0.

Charadrius vociferus Linnaeus Killdeer

MATERIAL.—Elements identified include humerus, carpometacarpus, and tarsometatarsus.

REMARKS.—In *C. vociferus* a long groove extends from under the head of the humerus, the external tuberosity of the humerus is set well out, and the deltoid crest is more strongly developed than in the scolopacids.

Family SCOLOPACIDAE

The osteological characters used to separate genera of similar size found in the Haile XIB fauna are:

Coracoid: (1) *Philohela* is very distinctive with the brachial tuberosity short, thick, and rounded; the coraco-humeral surface is deeply concave; the procoracoid process is strongly hooked, almost reaching the brachial tuberosity; the shaft is thick, thus making the anterior part of the coracoid appear relatively smaller; (2) *Capella* has a depression on the proximal procoracoid process just medial to the scapular facet; *Limnodromus* lacks this and is heavier and more rugged on the brachial tuberosity, especially the anterior portion; (3) *Totanus* is much like *Limnodromus,* but has the anteriormost brachial tuberosity pointing up instead of down.

Humerus: (1) in *Philohela* the head is pointed and the capital groove is long; there is no hint of a second depression, and the external tuberosity is not very distinct; (2) *Limnodromus* is larger than *Capella* and has the bicipital crest joining the shaft at a right angle, while in *Capella* it enters the shaft smoothly without curves along its outer edge; (3) a projecting point on the distal portion of the head just above the capital groove in *Limnodromus* is absent in *Capella;* (4) the ectepicondylar process is weak in *Capella* and is practically gone in *Philohela;* (5) *Limnodromus* has the brachial depression deeply excavated all the way to the internal condyle; it is relatively shallow and flat in *Capella,* in *Totanus* it is deep but is filled in between the external condyle and the attachment of the anterior articular ligament.

Ulna: (1) the olecranon process is well developed, with the internal cotyla extending upon it in *Philohela;* it is short and stubby in *Limnodromus* and *Capella;* the olecranon process is relatively flattened with a well-marked depression on the external side in *Capella,* while

this is absent in *Limnodromus*; (2) *Philohela* has the external condyle intersecting the shaft proximally at a sharp angle, but it slopes into the shaft more gently in *Limnodromus*; (3) the ligamental attachment points slightly proximally in *Limnodromus* but not in *Philohela*; (4) the ulna of *Limnodromus* is larger than that of *Capella*.

Carpometacarpus: *Philohela* differs from the other scolopacids in that (1) the internal carpal trochlea is flattened on the proximal end with a thickened ridge alongside this flattened area; (2) the internal trochlea is rather square, rounded in the others; (3) the external carpal trochlea is distinctly pointed at the proximal extremity, less so in *Limnodromus* and *Capella*; (4) the pisiform process is more proximal than in the others. *Limnodromus* differs from *Capella* in the following ways: (1) the process of metacarpal I is much rounded, with no sharp angles at the terminal end; (2) the proximal end is larger than in *Capella*, with relatively larger condyles and a smaller process of metacarpal I.

Tarsometatarsus: (1) *Philohela* has a deep furrow on the anterior side of the tarsometatarsus, and the internal and external cotyla are at very differing heights; (2) in *Totanus* there is a depression at the proximal end posterior to the intercondylar process; (3) the shaft is thick in *Capella* relative to the proximal end, and there is no depression posterior to the intercotylar prominence.

Philohela minor (Gmelin) Woodcock

MATERIAL.—Elements identified include coracoid, humerus, ulna, carpometacarpus, and tarsometatarsus.

Capella gallinago (Linnaeus) Common Snipe

MATERIAL.—Elements identified include coracoid, humerus, ulna, and tarsometatarsus.

Numenius americanus Bechstein Long-billed Curlew

MATERIAL.—Upper portions of a left and right coracoid, the distal portions of a left and right humerus, and the proximal portion of a left femur were identified.

REMARKS.—The Long-billed Curlew is new to the Pleistocene of Florida.

Actitis macularia (Linnaeus) Spotted Sandpiper

MATERIAL.—Distal portion of a right humerus.

REMARKS.—This is the first fossil record of the Spotted Sandpiper. *Actitis* differs from species of *Erolia* of similar size in that the ectepi-

condyle process slopes out gradually, instead of jutting at a sharp angle to the shaft.

Totanus melanoleucus (Linnaeus) Greater Yellowlegs

MATERIAL.—Elements identified include coracoid, humerus, and tarsometatarsus.

Limnodromus sp. Dowitcher

MATERIAL.—Specimens identified include humerus, ulna, and carpometacarpus.

REMARKS.—The measurements of these fossils are within the size range of both *L. scolopaceus* and *L. griseus*.

Family RECURVIROSTRIDAE

Recurvirostra americana Gmelin American Avocet

MATERIAL.—Proximal portion of a right tibiotarsus.

REMARKS.—The Avocet is new to the Pleistocene of Florida.

Family COLUMBIDAE

†*Ectopistes migratorius* (Linnaeus) Passenger Pigeon

MATERIAL.—Specimens identified include the upper portions of two left coracoids, the proximal portions of two left ulnae, the proximal portion of a right carpometacarpus, the distal portion of a left tarsometatarsus.

Zenaidura macroura (Linnaeus) Mourning Dove

MATERIAL.—Elements identified include coracoid, humerus, ulna, tibiotarsus, and tarsometatarsus.

Family CUCULIDAE

Coccyzus americanus (Linnaeus) Yellow-billed Cuckoo

MATERIAL.—The anterior portion of a left coracoid and the distal part of a right tarsometatarsus.

REMARKS.—This is the first fossil record of the Yellow-billed Cuckoo.

Family TYTONIDAE

Tyto alba (Scopoli) Barn Owl

MATERIAL.—The proximal portion of a left ulna and the distal portion of a right femur.

Family Strigidae

Otus asio (Linnaeus) Screech Owl

Material.—Elements identified include ulna, tibiotarsus, and tarsometatarsus.

Remarks.—The elements listed above may be distinguished from those of *Speotyto cunicularia* in the following ways:

Ulna: *O. asio* is distinctly smaller than *S. cunicularia.*

Tibiotarsus: Distally the region just proximal to the condyles is more completely hollowed out in *S. cunicularia;* in *O. asio* this area is deeply excavated only along the medial side.

Tarsometatarsus: (1) relatively much thicker in the shaft; (2) proximal end compressed in *O. asio* and is thickened at the base in *S. cunicularia;* (3) the ridge along the distal portion of the outer trochlea is much thickened in *S. cunicularia,* but is not in *O. asio.*

Speotyto cunicularia (Molina) Burrowing Owl

Material.—Elements identified include maxilla, coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus, and tarsometatarsus.

Asio flammeus (Pontoppidan) Short-eared Owl

Material.—Elements identified include coracoid, ulna, and tarsometatarsus.

Remarks.—The Short-eared Owl is new to the Pleistocene of Florida.

The distal end of the ulna of *A. flammeus* has the groove between the external and internal condyles more pronounced than in *A. otus.*

A. flammeus has a short thickened ridge on the outer edge of the middle trochlea of the tarsometatarsus; the ridge is longer and more slender in *A. otus.*

Family Picidae

Colaptes auratus (Linnaeus) Flicker

Material.—Elements identified include coracoid, humerus, ulna, carpometatarsus, tibiotarsus, and tarsometatarsus.

Remarks.—Short (1965) has shown that the North American flickers are conspecific and should be united under the name *C. auratus.* In the absence of constant osteological differences among members of this group, these elements are referred to *C. auratus* in this broad sense.

Melanerpes erythrocephalus (Linnaeus) Red-headed Woodpecker

MATERIAL.—Ulna and tarsometatarsus identified.

REMARKS.—The tarsometatarsus of *M. erythrocephalus* is most similar to that of *Centurus carolinus* but differs from it in the following ways: (1) inner proximal foramen is more proximal to the point at which the ridge below the internal cotyla juts out; (2) the ridge juts out less sharply; (3) the distal foramen is larger.

Order PASSERIFORMES

Osteological characters listed by Hamon (1964) have been followed where pertinent to the identification of the Haile specimens.

Family HIRUNDINIDAE

Tachycineta †speleodytes Brodkorb Extinct Swallow

MATERIAL.—Elements identified include coracoid, humerus, and ulna.

REMARKS.—Brodkorb (1957) states that some of the bones of this swallow found at Reddick I were of birds too young to fly, but all the Haile material represents adult birds.

Famliy CORVIDAE

Aphelocoma coerulescens (Bosc) Scrub Jay

MATERIAL.—The distal portions of two left tibiotarsi.

†Protocitta dixi Brodkorb Extinct Jay

MATERIAL.—Elements identified include the distal portion of a right tibiotarsus and proximal and distal portions of a left tarsometatarsus.

REMARKS.—This is the only additional locality record for this extinct jay described from Reddick (Brodkorb, 1957).

Corvus brachyrhynchos Brehm Common Crow

MATERIAL.—Distal portion of a right ulna.

Corvus ossifragus Wilson Fish Crow

MATERIAL.—Distal portion of a left tarsometatarsus.

Family TROGLODYTIDAE

Troglodytes aedon Vieillot House Wren

MATERIAL.—Proximal part of a right humerus.

Cistothorus platensis (Latham) Short-billed Marsh Wren

MATERIAL.—Proximal portion of a right humerus, and a complete right humerus.

REMARKS.—These humeri are assigned to this extant species rather than to the extinct *C. brevis* (Brodkorb, 1957) on the basis of their well developed internal tuberosity and the length of the complete humerus as shown in Table 5.

TABLE 5. MEASUREMENTS OF THE HUMERUS OF *Cistothorus*.

Species	Length	No.
C. brevis (from Brodkorb, 1957)	12.2–12.3	2
C. platensis	12.3–12.8	5
Haile XIB specimen	12.6	1

C. platensis is previously unrecorded as a fossil.

Family MIMIDAE

Mimus polyglottos (Linnaeus) Mockingbird

MATERIAL.—Elements identified include the upper portions of two right coracoids and the distal portion of a right humerus.

REMARKS.—Previously recorded as a fossil only from Reddick (Hamon, 1961).

Toxostoma rufum (Linnaeus) Brown Thrasher

MATERIAL.—Elements identified include coracoid and humerus.

REMARKS.—Previously recorded as a fossil from Reddick I (Hamon, 1964), and Augusta County, Virginia (Wetmore, 1962).

Family VIREONIDAE

Vireo griseus (Boddaert) White-eyed Vireo

MATERIAL.—Complete right humerus.

REMARKS.—This is the first North American fossil record for this family and the first fossil record of this species.

Family PARULIDAE

Geothlypis trichas (Linnaeus) Yellowthroat

MATERIAL.—Elements identified include coracoid and humerus.

REMARKS.—Previously recorded as a fossil only from Reddick I (Brodkorb, 1957; Hamon, 1964).

Family ICTERIDAE

Sturnella magna (Linnaeus) Eastern Meadowlark

MATERIAL.—Elements identified include coracoid, humerus, carpometacarpus, and tibiotarsus.

REMARKS.—The humeri of S. *magna* tend to be smaller than those of S. *neglecta*, although measurements show some overlap in the 12 specimens of each examined. Because of the small size of the fossils, the associated fauna, and the present geographical distribution of the two species, these *Sturnella* elements are assigned to the species *magna*.

Quiscalus quiscula (Linnaeus) Common Grackle

MATERIAL.—Coracoid and humerus.

Molothrus ater (Boddaert) Brown-headed Cowbird

MATERIAL.—Proximal portion of a right humerus.

†*Cremaster tytthus* Brodkorb Extinct Hangnest

MATERIAL.—Proximal portion of a left humerus.

REMARKS.—This specimen compares favorably with the humerus from Arredondo described by Brodkorb (1959). This is the second occurrence of *Cremaster*.

†*Pandanaris floridana* Brodkorb Extinct Icterid

MATERIAL.—Elements identified include coracoid, humerus, carpometacarpus, tibiotarsus, and tarsometatarsus.

REMARKS.—This extinct species, previously known only from Reddick I (Brodkorb, 1957; Hamon, 1964), was abundant there and is one of the more common species represented in the Haile XI B avifauna.

Family FRINGILLIDAE

Richmondena cardinalis (Linnaeus) Cardinal

MATERIAL.—Elements include the coracoid and humerus.

Pipilo erythrophthalmus (Linnaeus) Rufous-sided Towhee

MATERIAL.—Elements identified include coracoid, humerus, carpometacarpus, femur, and tarsometatarsus.

Ammodramus savannarum (Gmelin) Grasshopper Sparrow

MATERIAL.—Two complete humeri.

REMARKS.—The Grasshopper Sparrow has been recorded previously as a fossil only from Haile I (Brodkorb, 1953).

Passerherbulus henslowii (Audubon) Henslow's Sparrow

MATERIAL.—Complete right humerus.

DISCUSSION

MODE OF FOSSIL DEPOSITION

Apparently owls were largely responsible for the great accumulations of small vertebrates found at several Florida Pleistocene localities. Both the extremely rich Reddick I locality and Haile XI B have, along with plentiful remains of other small vertebrates, remains of several species of hawks and owls, including Barn Owl and Peregrine Falcon, the latter species also found at Arredondo (Pit 2).

It is highly probable that Barn Owls and possibly peregrine Falcons nested on the sides of the limestone sink or cave. The great concentrations of small vertebrates cannot be explained in any other way. The abundance of small mammals is strong evidence that owls were responsible for the accumulation of much of the fauna.

While Barn Owls prey primarily on small mammals, they also feed on birds to some extent. Recent birds known to have been preyed upon by Barn Owls include various sparrows, blackbirds, grackles, starlings, cowbird, Abert's Towhee, Bobolink, swallows, warblers, wrens, Red-shafted Flicker, Sora and Clapper Rails, meadowlark, Green Heron, Blue Jay, House Sparrow, Eastern Goldfinch, pigeon, Catbird, caprimulgids, Bob-white, Wilson's Snipe, Grasshopper Sparrow, Boat-tailed Grackle, and Red-winged Blackbird (Bent, 1938; Phillips, 1951; Parmalee, 1954; Trost and Hutchison, 1963). Although the percentage of birds remains from pellets of these owls is small, it can be seen that, given a long enough periods of time, Barn Owls are quite capable of gathering a large amount of bird material.

The Peregrine Falcon has been reported to have taken every type of bird present in the fauna (Bent, 1938). Those species that are less

likely to have been taken by the Barn Owl (grebes, ducks, grouse) may have been deposited by Peregrines.

The sinkhole may have served as a natural trap for certain animals, such as the giant tortoise, thus attracting large avion scavengers. The small deer elements could have been regurgitated by either the extinct vulture or caracara.

It is unlikely that the solution pipe became clogged and formed a pond that attracted waterfowl, which occasionally died and sank to the bottom. The duck remains and the remains of the land birds were evidently deposited at the same time, for duck elements are found intermixed with terrestrial forms throughout the matrix.

That the material has not been greatly reworked is indicated by the fact that several snake vertebrae were found still articulated in a clod of matrix. The bones probably were not moved more than a few feet from where they were originally dropped by the predatory birds. Water running through the cave during heavy rains may have washed the bones a short distance before depositing them as the slope and force of the underground streamlet lessened.

Zoogeography and Climatic Indicators

All the extant species in the fauna except the Prairie Chicken have been recorded from Florida in modern times. Many of these occur only as transients or winter visitants.

The Prairie Chicken suggests a more temperate climate than that found in Florida today. The Holarctic grouse family, Tetraonidae, is generally found in the temperate zone and northward. Most species are non-migratory. Attwater's Prairie Chicken (*T. c. attwateri*) of the coastal prairies of Texas and Louisiana is the southernmost living representative of the family and almost certainly represents a relict population. This form, the fossil Florida Prairie Chicken, and the Ruffed Grouse from Arredondo I (Brodkorb, 1959) possibly extended their ranges southward during one or more glacial periods, with only Attwater's Prairie Chicken surviving to the present.

The fact that the Prairie Chicken and *Geochelone* were found together indicates that the annual temperature extremes were less marked in the late Pleistocene than now. Hibbard *et al.*, (1965: 514) surmise that during the Rancholabrean period a maritime climate existed which was characterized by cooler summers and milder winters than those of today. Though the mean annual temperature might have changed little or not at all from that time to the present, *Geochelone* could not exist under the winter conditions found in Flor-

ida today (Hibbard, 1960), and possibly the grouse was unable to survive the higher temperatures of more recent summers.

The giant tortoise, the armadillo, *Dasypus bellus*, and certain tropical elements of the avifauna (*Protocitta dixi, Cremaster tytthus*) indicate that the fossils were deposited during an interglacial period. All the boreal elements of the avifauna except the Prairie Chicken are migratory and might be expected as winter visitants to the Florida peninsula.

Several species, both living and fossil (*Coragyps occidentalis, Polyborus prelutosus, Pandanaris floridana, Speotyto cunicularia, Aphelocoma coerulescens*), show affinities to the southwestern portion of North America. Neill (1957) summarizes several other lines of evidence (fossil mammals, distributions of several recent animals and plants, pollen profiles) that indicate invasions by western organisms during the Pleistocene. The affinities of Florida with the west are apparently of an even earlier origin (Auffenberg, 1957). Long periods of decreased rainfall supposedly caused eastern extensions of more xeric plant and animal communities, and several such invasions may have occurred.

Paleoecology as Indicated by the Avifauna

The countryside surrounding Haile XI B today is much modified by man. Where somewhat natural conditions still prevail, the predominant habitat is xeric hammock. The fossil avifauna suggests that several distinct habitat types existed during the Rancholabrean period that are not present today in the immediate vicinity.

Most of the Recent species suggest the proximity of a lake or pond with an accompanying marsh and wet meadow. Several others show that open, fairly dry prairie was also within the range of the predaceous birds that brought their prey to the sink. The Scrub Jay is restricted to scrub characterized by sand pine (*Pinus clausa*) and evergreen shrubs (Laessle, 1942: 27). The remaining species occupy various types of woodland or mixed habitats.

Evolutionary Aspects

The fossil remains of living species found in the Haile XI B fauna are, in most cases, identical to recent specimens, indicating either that the fossils were deposited relatively recently or that bird evolution has been slow in the late Cenozoic, as stated by Miller (1939).

Three extinct species (*Coragyps occidentalis, Colinus suilium*, and *Laterallus guti*) are here considered directly ancestral to the living

C. atratus, *C. virginianus*, and *L. jamaicensis*, respectively. These last are all somewhat smaller than their Pleistocene predecessors. The fossil Sparrow Hawks also show some indication of having been slightly larger than Recent *F. s. sparverius*, but the fossil sample is too small to determine this with certainty.

Although the percentage of extinction of this avifauna is lower (16.7%) than those of other Florida late Pleistocene localities, this does not necessarily mean a more recent date of deposition. The fact that it has 5 extinct species in common with Arredondo I and II and 10 with Reddick suggests the Haile XI B fauna was deposited at about the same time.

Acknowledgments

The interest and guidance shown me throughout the course of this study by Prof. Pierce Brodkorb of the Department of Zoology of the University of Florida is greatly appreciated. For technical advice or comments I also wish to thank H. K. Brooks, C. W. Hibbard, and C. E. Ray. For the loan of comparative material I am indebted to: Pierce Brodkorb of the University of Florida, Oliver L. Austin, Jr. of the Florida State Museum, George M. Sutton of the University of Oklahoma Museum of Zoology, Phillip S. Humphrey and George E. Watson of the United States National Museum.

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