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NOTES ON FOSSIL AND SUBFOSSIL BIRDS

By
ALEXANDER WETMORE
Research Associate, Smithsonian Institution



(PUBLICATION 4502)

CITY OF WASHINGTON
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NOTES ON FOSSIL AND SUBFOSSIL BIRDS

By ALEXANDER WETMORE

*Research Associate
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The following pages cover several studies on fossil and subfossil birds, based mainly on material in the U.S. National Museum. The collection from the Pleistocene of Augusta County, Va., has come through the kindness of John E. Guilday of the Carnegie Museum. The bones from Bermuda were collected for the Smithsonian Institution by David B. Wingate.

I. AN UPPER CRETACEOUS BIRD RELATED TO THE IBISES

In the summer of 1958, Dr. Shelton P. Applegate, now at State College, Arkansas, collected a broken humerus of a bird in Greene County, west-central Alabama, that appears related to the storks and ibises of the order Ciconiiformes. According to data supplied by Dr. Applegate, the specimen came from Hewletts farm, 3 miles northeast of the town of Boligee, where it was found in the farther side of a series of gullies that lie to the west of the county road, before this reaches the farmhouse entrance. The location, in the Mooreville formation of the Selma chalk, was about 10 feet below the Arcola limestone.

The form of the humerus indicates a species about half the size of the living white ibis *Eudocimus albus*.

PLEGADORNIS gen. nov.

Diagnosis.—A fossil storklike bird, with the distal end of the humerus flattened, ectepicondyle long, and the brachial depression shallow and relatively large. Characters in detail those of the only known species, *Plegadornis antecessor*, the type of the genus.

PLEGADORNIS ANTECESSOR sp. nov.

Characters.—Known from a fragmentary left humerus that is generally similar to living species of the suborder Ciconiae; much smaller than the smallest of living forms of the suborder (half the

size of *Plegadis*, or less). Outline of distal end of the humerus (fig. 1) somewhat similar to that of species of the family Threskiorn-

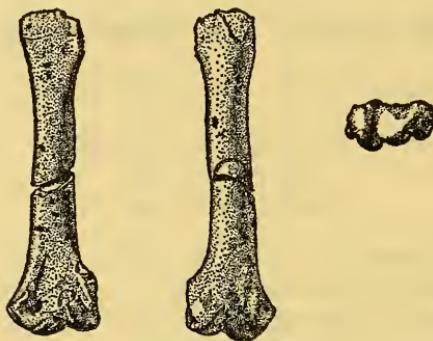


FIG. 1.—Type of *Plegadornis antecessor* from the Upper Cretaceous of Alabama.
Natural size.

nithidae, but with the ectepicondyle elevated above the level of the internal condyle at a slightly greater angle; attachment of anterior articular ligament relatively much larger; internal condyle relatively longer and slightly narrower; external condyle slightly less angular on upper end, with more separation from the ectepicondyle on its outer margin; the ectepicondyle much larger, so that one-fourth of its length extends up the shaft above the level of the upper end of the external condyle; brachial depression large and only slightly depressed; a slight expansion from the side of the shaft at the lower end of the deltoid crest, below the actual articular area, like that in modern species of Threskiornithidae, particularly of the subfamily Plataleinae.

Transverse breadth across distal end 10.5 mm.; transverse breadth of shaft near center 4.9 mm.

Type.—Distal end of left humerus, with part of the shaft from the upper end, U.S.N.M. No. 22820, from the Mooreville formation of the Selma chalk, Upper Cretaceous, 3 miles northeast of Boligee, Greene County, Ala., collected by Shelton P. Applegate about June 20, 1958.

Remarks.—The important part of the specimen is the distal end, which is somewhat worn, but where sufficient character is present to allow indication of relationship. The upper segment shows a trace of the curvature characteristic of the suborder in which it is allocated, and an indication of the form at the extreme lower end of the deltoid crest, but has lost other details. A section of the shaft between the upper and lower portions is missing.

The fossil is important because of its indication, slight though that may be, of the occurrence of ibislike birds at this early period, and in its general similarity to species of this group that still exist. It is the first fossil bird recorded from Alabama.

While it appears allied to species now classified in the suborder Ciconiae, which includes the families of the hammerhead (*Scopus*), the storks (family Ciconiidae), and the ibises (Threskiornithidae), its differences, as indicated in the diagnosis, are such that it requires a separate family, Pelagodornithidae, to be allocated in a superfamily Pelagodornithoidea, adjacent to the superfamily Threskiornithoidea.

The generic name for this interesting species is formed from the Greek root for *Plegadis*, a widely distributed modern genus of ibises, viz., πλεγάς, *aδος*, and ὄρνυς, bird. The specific name, the Latin word "antecessor," signifies a forerunner (or ancestor).

II. A RECORD OF THE COMMON LOON, *GAVIA IMMER* (BRÜNNICH), FROM THE PLEISTOCENE OF MARYLAND

The cranium of a loon found in December 1959 on the shore between Chesapeake Beach and Plum Point, on Chesapeake Bay, in Calvert County, Md., has been presented to the U.S. National Museum by Miss Alice H. Howe of Arlington, Va. The specimen (U.S.N.M. No. 22552) is stained dark brown in color and still retains a film of fine clay silt in the deeper impressions. Its appearance, both in color and in the clay deposit, is indication of ancient age and is typical of the Pleistocene deposits that lie above the Miocene beds in the earthen cliffs that line this section of Chesapeake Bay. There is no reason therefore against listing the bone as of that age.

The bone (fig. 2) includes the upper surface of the cranium from the base of the premaxilla to the foramen magnum, except that the ridge immediately above the foramen is missing, and there are minor breaks in the posterior area of the frontal. Below, the basioccipital area has been lost.

The bone obviously is representative of an adult of a large species of the genus *Gavia*. On comparison of 10 skulls of *Gavia immer* with 6 of *G. adamsii*, all of adult age, I find that the cranial section in the former averages less massive in form. The angle of the anterior end of the frontals, immediately posterior to their junction with the nasals, in most is less abrupt, and the transverse width through the heavy postorbital processes is less. In *G. adamsii* the cranium is more massive, the anterior end of the frontals slopes more abruptly, and

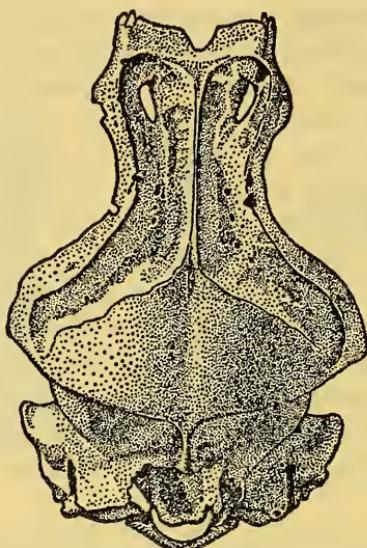


FIG. 2.—Dorsal view of the cranium of a common loon, *Gavia immer*, from the Pleistocene of Maryland. Natural size.

the transverse width indicated is greater. While the largest skulls of *immer* are close to *adamsii* the smaller ones appear distinct. The specimen under identification agrees with the medium-sized and smaller samples of *immer* and is identified as that species.

The occurrence on Chesapeake Bay is an additional Pleistocene record for *Gavia immer*, which has been reported previously from deposits of that age in California and Florida.

III. THE WHOOPING CRANE, *GRUS AMERICANA*, IN MICHIGAN

In a recent visit to the Chicago Natural History Museum I noted a Pleistocene bone identified tentatively as this species, which Dr. Rainer Zangerl has kindly placed in my hands for study. The specimen is a left tarsometatarsus of a juvenile individual which apparently had developed the full length of this segment of the bone, but in which the upper end was not fully ossified, as the surface of the articulation is not completely formed. The shaft also is slender with its outlines rounded, less angular than in adult specimens, and the entire bone presents the slightly roughened spongy appearance that marks an immature stage. The distal trochlea and the talon both are broken and missing, but it is possible to ascertain the length from the anterior end to the distal foramen, which equals that of modern adult tarsometatarsi in the U.S. National Museum Collections. It is

identified, without question, as *Grus americana* (Linnaeus), the whooping crane.

The specimen, Chicago Natural History Museum No. P25538, found one-half mile northwest of Ferry, Oceana County, Mich., in what was reported to be a Pleistocene marl, was presented to the Museum by George W. Bowen. The record is of particular interest since it is not only a new fossil locality for this species, but also is the first report of this crane from the State of Michigan.

The species has been recorded previously as a fossil from the Upper Pliocene of Idaho, and from the Pleistocene of California and Florida.

IV. BIRDS OF LATE PLEISTOCENE AGE FROM AUGUSTA COUNTY, VIRGINIA

Through the kindness of John E. Guilday of the Carnegie Museum a collection of bird bones from small caves and fissures at the bases of the rock columns known as the Natural Chimneys, a mile north of Mount Solon, Va., has come to me for study. According to data supplied by Mr. Guilday, the presence of bones at this site was reported first in 1949 by Theodore B. Ruhoff, who has collected the bulk of the material. Parties from the Carnegie Museum, directed by J. LeRoy Kay, curator emeritus of the section of vertebrate paleontology, also participated, until 1961. The work was possible through the kind permission and assistance of Mr. and Mrs. Gordon E. Brown, owners of the property.

The bird remains were associated with abundant bones of mammals and a smaller representation of reptiles and amphibians. Most of the specimens are of such size and condition as to indicate the probability that the deposit was accumulated through pellets regurgitated by ancient owls. It must be stated, however, that no bones of owls are included. The casual intrusion of fragments of larger birds is assumed to have come through predators that sheltered in the caves, or through the activities of wood rats, abundantly represented among the small mammals.

A complete report on the site prepared by Mr. Guilday (in press) will contain a list of all the vertebrates, a detailed account of the mammals, and a discussion of the entire fauna and its significance. In the present account it is sufficient to state that the mammalian remains include a number of boreal forms foreign to the area in historic times, as well as four extinct species of the Pleistocene. These indicate the probable age as near the end of Wisconsin time. The birds support this assignment, as among them the spruce grouse and

the gray jay today are inhabitants of northern coniferous forests, and the sharp-tailed grouse and the magpie also are northern and northwestern in modern distribution. None of the birds may be regarded as typically southern since all the others identified are species that, while found today as residents or migrants in Virginia, range widely to the north. The presence of all at the end of the Pleistocene in what Mr. Guilday has named the Natural Chimneys local fauna is definitely of outstanding interest since this is the first extensive avian fossil deposit reported for the State. The list includes 38 species, with 2 others identified to genus. Fragmentary bits that could not be named include several additional small passeriform species.

The bird bones are pale ivory to nearly white in color, except for a few that are gray or blackish gray, due apparently to staining, as none are mineralized. All are well preserved, only occasional ones being friable or brittle. A few come from juvenile individuals, some of them probably from young grouse, though this is not certain.

ANNOTATED LIST OF SPECIES

Family ANATIDAE: Ducks

Anas discors Linnaeus: Blue-winged Teal.

At least two individuals: Central section of right ramus of a mandible, from the anterior end of the surangular forward to include somewhat more than half of the dentary; proximal ends of two right humeri; left tarsometatarsus with the head missing.

Difference in size in the fragmentary wing bones indicates that male and female birds may be represented. The part from the lower leg is one with maximum development of the sculptured lines marking the location of tendons and their attachment found in individuals more than a year old.

This teal is recorded from several Pleistocene localities in Florida.

Bucephala albeola (Linnaeus): Bufflehead.

One individual: A left carpometacarpus, with the shaft of metacarpal III missing. This agrees in the details of length of the distal symphysis, angle of anterior slope of metacarpal I, form of the facet for articulation of the pollex, and angular compression of the inner margin of the shaft of metacarpal III, with modern specimens.

The several Pleistocene records for the bufflehead include reports from Oregon, California, and Florida.

Oxyura jamaicensis (Gmelin): Ruddy Duck.

One individual: Proximal two-thirds of a left humerus. The small

size indicates that the bird, which appears to have been adult, was a female.

The ruddy duck has been identified in Pleistocene deposits in Oregon, California, and Florida.

Family ACCIPITRIDAE: Hawks

Accipiter striatus Vieillot: Sharp-shinned Hawk.

One individual: A right carpometacarpus, complete, is from a bird of small size that agrees in dimension with males.

The sharp-shinned hawk has been identified from the Pleistocene of California and Florida, and from pre-Columbian cave deposits of ancient but uncertain age on Great Exuma in the Bahama Islands.

Buteo jamaicensis (Gmelin): Red-tailed Hawk.

One individual: A left femur, with broken shaft and some wear on the proximal end.

The red-tail, widely distributed in modern time from northern Canada to western Panamá, has been found in several Pleistocene localities in California and Florida.

Buteo lineatus (Gmelin): Red-shouldered Hawk.

One: Distal end of a right humerus, small in size.

The red-shouldered hawk, found in eastern North America from Minnesota and southern Quebec to central México and Florida, and west of the Rocky Mountains in California and Baja California, is known from Pleistocene time in Florida and California.

Buteo platypterus (Vieillot): Broad-winged Hawk.

One individual: Distal third of a right tarsometatarsus, with the trochlea intact. The specimen has the size of male birds.

Broad-wings nest in eastern North America from southern Canada to Texas and Florida, and in the West Indies. There is one report of the species from the Pleistocene of Florida.

Family TETRAONIDAE: Grouse

Canachites canadensis (Linnaeus): Spruce Grouse.

One individual, possibly more: Distal third of left humerus; distal two-thirds of left ulna; right tarsometatarsus complete. The humerus in this species in length is similar to that of the ruffed grouse, but the shaft is more slender, the internal condyle and the ectepicondyle are slightly smaller, and the impression for the brachialis anticus is less clearly outlined. The ulna is more slender, with the external condyle smaller. The slightly shorter tarsometatarsus has the trochleæ some-

what narrower, with the outer one swung more toward the center line, so that support for the toes is narrower. Also the facet for the articulation of the hind toe is of lesser size, and on the anterior face the excavation below the head is smaller, with the tubercle for the tibialis anticus shorter and less prominent.

This species definitely represents a boreal element in the fauna, as in its modern distribution it is widely spread through the Canadian zone forests from Alaska across Canada, south in the eastern half of the United States only to northern Wisconsin, northern New York, northern Vermont, northern New Hampshire, and Maine. The present record is the first report south of these limits, as well as the first from ancient time.

Bonasa umbellus (Linnaeus) : Ruffed Grouse.

Three or more individuals: Two premaxillae; proximal end of two left humeri, and shaft and distal end of another; a left ulna; one left coracoid, and the proximal end of another; one right carpometacarpus, and two others nearly complete; distal half of a left tarsometatarsus. The carpometacarpus is heavier than that of *Canachites canadensis*, especially in the shaft of metacarpal III, and the intermetacarpal tuberosity is larger.

The ruffed grouse, common today in western Virginia, is known from deposits of Pleistocene age in California, Tennessee, Maryland, Pennsylvania, and Florida.

Pedioecetes phasianellus (Linnaeus) : Sharp-tailed Grouse.

Four or more individuals: One partial premaxilla; a fragment from the anterior end of a sternum; one right coracoid, somewhat worn, head of another from the left side; heads of three left and one right humeri, with distal ends of two from the left side, and one from the right; one right carpometacarpus with the shaft of metacarpal III missing; and a fragment of the distal end of a right tarsometatarsus. The head of the left humerus is distinctly larger than any of the three from the right-hand side, so that it is certain that it came from a fourth individual.

In modern time the sharp-tailed grouse has been a species of the north and west, with a range that extends from north-central Alaska across to central Quebec, south to eastern Oregon, in the mountains to northern New Mexico, and east to Nebraska, Minnesota, and northern Michigan. Formerly it ranged a little farther south to northeastern California, western Kansas, and northern Illinois, areas from which it has disappeared with agricultural use of the land, and increase in hunting. The only previous report of the species east of this modern

range is from bones of late Wisconsin age found by John E. Guilday and his associates in Lloyd's Rock Sinkhole in the New Paris Sinkholes of Bedford County, western Pennsylvania. The present record, about 120 miles to the south, is indication of a former range in the late Pleistocene, and the period immediately following, through the valleys of the northern Appalachian region.

The bird is known also from deposits of Pleistocene age at Fossil Lake, Ore.

Family PHASIANIDAE: Pheasants, Quails

Colinus virginianus (Linnaeus): Bobwhite.

One individual: Head of a left humerus; a right femur, nearly complete.

The bobwhite, of wide range in eastern North America, has been found in the Pleistocene in Tennessee, and at several localities in Florida.

Family MELEAGRIDIDAE: Turkeys

Meleagris gallopavo Linnaeus: Turkey.

Two individuals: The shaft of a left coracoid; the broken distal end of a left tarsometatarsus. The two differ so definitely in size that it is evident they are from separate birds.

Turkey bones have been recorded widely from Pleistocene time in New Mexico, Illinois, Indiana, Tennessee, Arkansas, and Florida.

Family GRUIDAE: Cranes

Grus americana (Linnaeus): Whooping Crane.

One: Shaft and proximal end of a left coracoid. The bone is fragmentary, with indications of the tooth marks of rodents, but enough remains to indicate clearly that it is a crane, while the large size identifies it as from the whooping crane.

This species, now much reduced in numbers, was reported in eastern United States in the early days of European settlement from New York, New Jersey, and South Carolina. The present record is the first from ancient time north of Florida, where bones have been found in Pleistocene deposits at three localities. It is also the only report of this bird within the boundaries of present-day Virginia.

Family CHARADRIIDAE: Plovers

Charadrius vociferus Linnaeus: Killdeer.

One: Distal end of a right humerus.

The killdeer has been recorded from the Illinoian stage of the Pleistocene in Florida.

Family SCOLOPACIDAE: Snipe, Sandpipers

Philohela minor (Gmelin): American Woodcock.

One individual, possibly two: Proximal half of a left humerus; a complete left tarsometatarsus. The leg bone appears to be from a slightly smaller individual than the humerus.

The woodcock, found locally throughout Virginia, is reported from a Pleistocene cave deposit in Florida.

Bartramia longicauda (Bechstein): Upland Plover.

One: Right and left coracoids. These are identical in size and color and may be from the same individual.

The upland plover, formerly common in Virginia, is now much reduced in number. It has been found in late Pleistocene deposits in Kansas.

Catoptrophorus semipalmatus (Gmelin): Willet.

One: Distal half of a right tarsometatarsus. The modern skeletons at hand include a pair each of the two geographic races currently recognized in this species. The humeri in these show the same differences in size that separate the birds in the flesh, or when preserved as museum skins, the females in each being larger than the males. It is significant to record that the humerus in the female of the subspecies *Catoptrophorus semipalmatus semipalmatus* is appreciably smaller than that of the male *C. s. inornatus*. The bone from Natural Chimneys has the size of male *inornatus* and is identified as that race. In modern times this subspecies nests through the western part of our continent, but is common in migration and winter along the eastern seaboard.

The only previous ancient record for the willet is from Pleistocene deposits on the Newport Bay Mesa near the coast of southern California.

Erolia minutilla (Vieillot): Least Sandpiper.

One: A complete right humerus, typical of this bird.

This is the first ancient report for the species, which now nests in the north and spreads widely in migration, as far as Perú and central Brazil.

Family COLUMBIDAE: Pigeons, Doves

Ectopistes migratorius (Linnaeus): Passenger Pigeon.

More than 21 individuals: 11 fragments of right humeri, and

2 entire and 8 fragments of the left side; 1 entire and 3 fragmentary ulnae from the right side, with 1 entire and 3 fragments from the left side; 1 entire and 6 broken right carpometacarpi, with 4 fragments from the left side; anterior ends of 11 sterna; 5 entire, 16 or more fragmentary right coracoids, and 4 entire and 10 fragments from the left side; anterior ends of 3 right and of 6 left scapulae; distal end of 1 right and of 2 left tibiotarsi; 1 entire and 3 partial right tarsometatarsi, and parts of 4 from the left size.

From the abundance of these remains the passenger pigeon must have been common and easily taken, probably from a roost, if the deposit of bones is accepted as an accumulation from cast pellets of night-feeding owls. All the bones are from fully adult birds which points to a gathering outside the nesting season. This species, now long extinct, was abundant during the period of settlement in Virginia, with extensive roosts recorded as late as 1872. It was last reported in the State definitely in 1890, uncertainly in 1892.

Passenger pigeon bones have been found frequently in Indian village sites of pre-Columbian age, and are recorded from the Pleistocene in California, Tennessee, and Florida.

Family ALCEDINIDAE: Kingfishers

Megacyrle alcyon (Linnaeus): Belted Kingfisher.

One: Proximal half of a left humerus.

There is one report of this kingfisher from the Pleistocene of Florida.

Family PICIDAE: Woodpeckers

Colaptes auratus (Linnaeus): Yellow-shafted Flicker.

One: Distal half of a right tarsometatarsus.

The occurrence at Natural Chimneys is listed under the name of the eastern species of the genus, following the modern geographical ranges of these woodpeckers. But it should be noted that in available skeletons there appear no trenchant characters on which the three species of *Colaptes* of the A.O.U. Check-list may be separated.

In the eastern region of North America flickers have been reported from three localities in the Pleistocene of Florida.

Centurus carolinus (Linnaeus): Red-bellied Woodpecker.

One: A left tarsometatarsus, complete.

The species is recorded from the Pleistocene of Florida.

Melanerpes erythrocephalus (Linnaeus): Red-headed Woodpecker.

Two individuals: A right humerus, complete, and another from the

left side without the head; a right tarsometatarsus, complete. The humeri are not a pair as they differ slightly in size.

There is one Pleistocene record for this species from Florida.

Dendrocopos pubescens (Linnaeus): Downy Woodpecker.

One: A right humerus with the distal end missing.

This is the first ancient record for this species.

Family TYRANNIDAE: Tyrant Flycatchers

Sayornis phoebe (Latham): Eastern Phoebe.

Three individuals: Two right humeri, and another from the left side, all complete. Slight differences in size indicate that each bone comes from a separate individual. The occurrence of this species is one that would be expected from its habit of placing its nest on sheltered projections on rock faces.

The record is the first one for this bird in ancient time.

Contopus virens (Linnaeus): Eastern Wood Pewee.

One: A complete left humerus. This agrees with the wood pewees, and is listed as above on geographic grounds.

It is the first report of this group in prehistoric time.

Family HIRUNDINIDAE: Swallows

Petrochelidon pyrrhonota (Vieillot): Cliff Swallow.

Eight or more individuals: A series of humeri that includes two complete and two fragments from the right side, and four complete and three additional segments from the left.

The humerus in this species is approached in size among our smaller swallows by the tree swallow, but has the head slightly larger and the shaft heavier. The other species concerned are all distinctly smaller.

The relative abundance of bones of this species compared to those of other of the small birds indicates a nesting colony, a supposition that appears to be verified by one bone with the porous structure of the head typical of immature individuals not fully grown.

Cliff swallow bones are reported from the Pleistocene of California.

Family CORVIDAE: Jays, Magpies, Crows

Perisoreus canadensis (Linnaeus): Gray Jay.

One: A right tarsometatarsus with the trochlea for the fourth digit missing, but otherwise complete. More slender form, greater outward slant of the external face of the talon, relatively smaller

trochleae, and more widely open groove on the anterior face of the head between the external and internal cotylae, identify this bone in the gray jays from species of similar size of the genera *Cyanocitta* and *Aphelocoma*.

This is another bird that is found in modern times in the coniferous forests of the north and northwest, with extension southward only along the higher mountains of the west. In much of this area it ranges in the same regions as the spruce grouse, also its companion in ancient Virginia.

The present record is the first report of the gray jay in the prehistoric period.

Cyanocitta cristata (Linnaeus) : Blue Jay.

One: A complete left humerus.

The widely ranging eastern blue jay is reported from the Pleistocene of Florida.

Pica pica (Linnaeus) : Black-billed Magpie.

One: Proximal half of a left humerus.

This record is one of particular interest since, though the magpie in the Old World is spread from western Europe across northern Siberia, in North America it has been restricted to the western half of the continent. The find in Virginia indicates an early distribution to the eastward, with subsequent withdrawal westward, a circumstance without apparent explanation. Many magpie bones have been found in caves and other ancient deposits throughout Europe, but the present find is the first report from America, since Dr. Brodkorb informs me that a record for it from the lower Pleistocene of Randall County, Tex., refers to another species.

Family SITTIDAE: Nuthatches

Sitta canadensis Linnaeus: Red-breasted Nuthatch.

One: A left humerus, complete.

This nuthatch is present in Virginia now as a breeding species wherever spruce forest remains on the higher mountains, and as a winter visitor from the north.

It is recorded from deposits of late Pleistocene age in California.

Family MIMIDAE: Mockingbirds, Thrashers

Toxostoma rufum (Linnaeus) : Brown Thrasher.

One: A complete right humerus.

This is the first report of this bird in the prehistoric period.

Family TURDIDAE: Thrushes, Bluebirds

Turdus migratorius Linnaeus: Robin.

One or more: A premaxilla; a complete right humerus, and one from the left side with the head missing. The wing bones are of maximum size for this species.

The only other ancient record for the robin is from the late Pleistocene of California.

Hylocichla sp.: Thrush.

One: A left humerus complete. This comes from one of the smaller species of this group. It is not the wood thrush, which is larger, but except for this, it is not practicable to indicate relationship, since the related species may not be separated from one another on the basis of this single bone.

Family ICTERIDAE: Meadowlarks, Blackbirds, Orioles

Agelaius phoeniceus (Linnaeus): Red-winged Blackbird.

Two individuals: Right and left humeri with the heads broken. These differ in size so that they come from two individuals.

The species is known from the Pleistocene of Ontario and Florida.

Molothrus ater (Boddaert): Brown-headed Cowbird.

One or more: Right and left humeri of such similar size that they may be a pair.

This is the first ancient record for the species.

Family FRINGILLIDAE: Grosbeaks, Finches, Sparrows, Buntings

Junco sp.: Junco.

One: A complete right humerus.

While this agrees with the slate-colored junco it is not practicable to make a specific identification among the several species of similar size in this genus.

Zonotrichia albicollis (Gmelin): White-throated Sparrow.

One: A complete left humerus.

This is the first ancient record for this species.

Passerella iliaca (Merrem): Fox Sparrow.

One: The symphysis of a lower mandible. This agrees in full detail with modern skeletons. The form of the thickened inner margin of the anterior end of the dentary, smooth and rounded when viewed from above, and shelflike when seen from below, is characteristic of this species. The bone is similar to that of the small-billed eastern subspecies.

Fox sparrows have been recorded from two Pleistocene localities in California.

Melospiza melodia (Wilson): Song Sparrow.

One: A right humerus.

The widely ranging song sparrow is reported from the Pleistocene of California.

V. BONES OF BIRDS FROM COCKROACH ISLAND, BERMUDA

In November 1958, David B. Wingate forwarded a considerable collection of bones from Bermuda, collected on Cockroach Island, located in Harrington Sound off the base of Abbott's Cliff. Most of these specimens were dug from about 4 cubic feet of sandy soil and rubble, some of them from near the surface where they were among roots of plants. Many are of young birds, ranging from nearly adult to half or even one-third grown indicating a breeding colony. In careful digging no associated skeletons were encountered, so that the site was one where separate bones had accumulated.

While the age of these specimens is unknown, the material probably is Recent, though, with one exception from the pre-Columbian period. The few remains of the white-tailed tropicbird obviously are of modern age. The uniform pale brownish-white cast in all the other material indicates a deposit of some antiquity, though whether this is of hundreds of years or of a longer period remains uncertain. A few molluscan shells that accompanied the bones have been identified by Dr. J. P. E. Morrison of the National Museum as *Poecilonzonites bermudensis* Pfeiffer, a living species that in time ranges back to deposits of Pleistocene age.

There have been several reports of bones of birds from caves in the Bermudas but usually without identification, the earliest account that I have seen being that of Nelson (1840, p. 113). In view of the small amount of definite information on such deposits in Bermuda, I have prepared the brief account of the collection made by Mr. Wingate which follows.

Family PROCELLARIIDAE: Shearwaters, Fulmars

PUFFINUS LHERMINIERI Lesson: Audubon's Shearwater

Puffinus [sic] *lherminieri* Lesson, Rev. Zool., vol. 2, No. 3, April (May), 1839, p. 102. (Guadeloupe, Lesser Antilles.)

Puffinus parvus Shufeldt, Ibis, ser. 10, vol. 4, No. 2, Oct. 2, 1961, p. 632. (Recent deposits in the bone caves of Bermuda.)

The few bones of this species include humeri, radii, ulnae, meta-

carpals, coracoids, a femur, tibiotarsus, tarsometatarsi, a sternum, and parts of a skull, that probably represent half a dozen individuals. While the wing and leg bones may be sorted in two groups one of which is slightly smaller than the other, it is seen on close scrutiny that the specimens of lesser size all are obviously immature, some of them quite young. It is my opinion therefore that the smaller size in these is due to their not having attained full growth.

Shufeldt (1916, p. 632) in study of a collection of cave bones from Bermuda noted two apparent size groups and named the smaller one *Puffinus parvus*. While I have not had opportunity as yet to examine his material, the plates that he published in a later account (Shufeldt, 1922) do not appear to substantiate his claims, particularly since at the time he had available only one skeleton of *Puffinus lherminieri* in the U. S. National Museum for comparison. This individual is near the maximum size for the species. His smaller specimens as illustrated show no differences in size from the range of variation found in the series now available, particularly when it is understood that all Shufeldt's illustrations are not natural size, though so indicated in the legends. I regard *parvus*, therefore, as a synonym of *lherminieri*.

Puffinus mcgalli Shufeldt (1916, p. 630; 1922, p. 354), based on a nearly complete sternum, appears to be an example of *Puffinus puffinus*, as the figures agree exactly with a sternum of a female *Puffinus puffinus puffinus*, No. 227465 in the U. S. National Museum collections.

PTERODROMA CAHOW (Nichols and Mowbray): Bermuda Petrel

Aestrelata cahow Nichols and Mowbray, Auk, vol. 33, No. 2, April (March 31), 1916, p. 194. (Southeast side of Castle Island, Bermuda.)

Aestrelata vociferans Shufeldt, Ibis, ser. 10, vol. 4, Oct. 2, 1916, p. 633. (Bermuda.)

The greater part of the bones in the present collection are those of this species, including abundant representation of wing and leg bones, parts of 12 skulls, 12 sterne, 23 furculae, several coracoids, scapulae and parts of more than 14 pelvis. The indication is that more than 25 individual birds are represented. About one-half come from young birds that range from one-third grown to full size, but the latter with the ends of some of the long bones still spongy. The indication is clear that the site where the bones were found was a breeding colony of this petrel, formerly abundant in Bermuda.

The adult bones all agree in detail with the modern skeletons of the cahow in the U. S. National Museum.

Family PHAËTHONTIDAE: Tropicbirds

PHAËTHON LEPTURUS Daudin: White-tailed Tropicbird

Phaëton lepturus Daudin, in Buffon, Hist. Nat., ed. Didot, Quadrupédes, vol. 14, 1802, p. 319. (Mauritius.)

The right and left ulna, right and left radius, carpometacarpus, and scapula that represent this species are obviously modern in appearance, and are believed to represent an intrusion in the older deposit. It is probable that all come from one individual as the duplicate elements are paired.

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