Fossil Birds From Manix Lake California

By HILDEGARDE HOWARD

A SHORTER CONTRIBUTION TO GENERAL GEOLOGY

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Descriptions of late Pleistocene bird remains, including a new species of flamingo

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ABSTRACT

Sixty fossil bird bones have been recovered from the Manix Lake deposits in the Mohave Desert. These can be assigned to 12 species of which 3 are extinct. One of the extinct species is a small flamingo, new to science, here described as *Phoenicopterus minutus* Howard.

Ecologically, the avifauna is in keeping with the lacustrine origin of the Manix deposits, and compares favorably with that of the upper Pleistocene beds of Fossil Lake, Oregon, though of less varied content. The species, with the exception of the newly described form, are all known from upper Pleistocene deposits on the west coast.

INTRODUCTION

Through the courtesy of D. Foster Hewett, of the United States Geological Survey, a collection of fossil bird bones from the Manix Lake beds has been deposited at the Los Angeles County Museum for study and recording. The bones were collected as a part of the Survey's project of mapping the entire Mohave Desert area, studying its structural problems, and determining the distribution of saline deposits. This work was begun in 1947 under the direction of Mr. Hewett. Several collectors have aided in this undertaking, but most of the bird remains were collected in 1952 by Herbert Winters; two of the specimens were contributed by Dwight Taylor. To the Geological Survey specimens have been added two others collected in October 1953 by Theodore Downs and Leonard Bessom of the Los Angeles County Museum.

The Manix basin is in San Bernardino County, Calif., about 30 miles east of Barstow. The fossiliferous localities lie in an area of some 200–300 square miles. The localities were first described by Buwalda (1914) who obtained a collection of mammal and bird bones and fresh-water mollusks. Six mammals, including *Equus*, were listed but not specifically defined.

The bird bones collected by Buwalda were described by Compton (1934) who recorded two species of water birds, *Pelecanus erythrorhynchos* and *Aechmophorus occidentalis*, based on four well-preserved bones.

In the course of the Geological Survey's more recent undertaking, both bird and mammal bones have been collected. The mammal bones are on deposit at the California Institute of Technology, and are being studied by Herbert Winters.[1] The Institute records the mammalian fossils under three locality numbers, 540, 541, and 542. All the bird bones are from 540, which also bears the Los Angeles County Museum locality number 1093. At the time of excavation, collection numbers were assigned to each bone occurrence (see map, fig. 42). According to Winters (personal communication) those that yielded avian remains fall into four groups in point of lithology and vertical occurrence, as follows:

Unit[2]	*Depth*	*Collection numbers*
1	1–16 feet	T10 and W1.
4	21–23 feet	W12, W21, W2?.
16	81–85 feet	W16, W17, W19, W29, TD316.
17	86–111 feet	W5, TD318?.

Unit 17 is underlain by a "bouldery conglomerate" in which no fossils were found in place. One bone was collected by the Los Angeles County Museum on the surface of the conglomerate (TD 318), and was possibly derived from Unit 17.

Sixty identifiable bird bones have been collected, representing twelve species. The distribution of the species is shown in the table below.

[1] Winters, Herbert, The fauna of the Pleistocene Manix beds in the Mojave Desert, California. (Report in preparation.)

[2] Unit numbers correspond to those listed by Winters (manuscript) with full lithologic descriptions. Individual collectors are indicated by letters preceding the numbers, as follows: T, Dwight Taylor; W, Herbert Winters; TD Theodore Downs.

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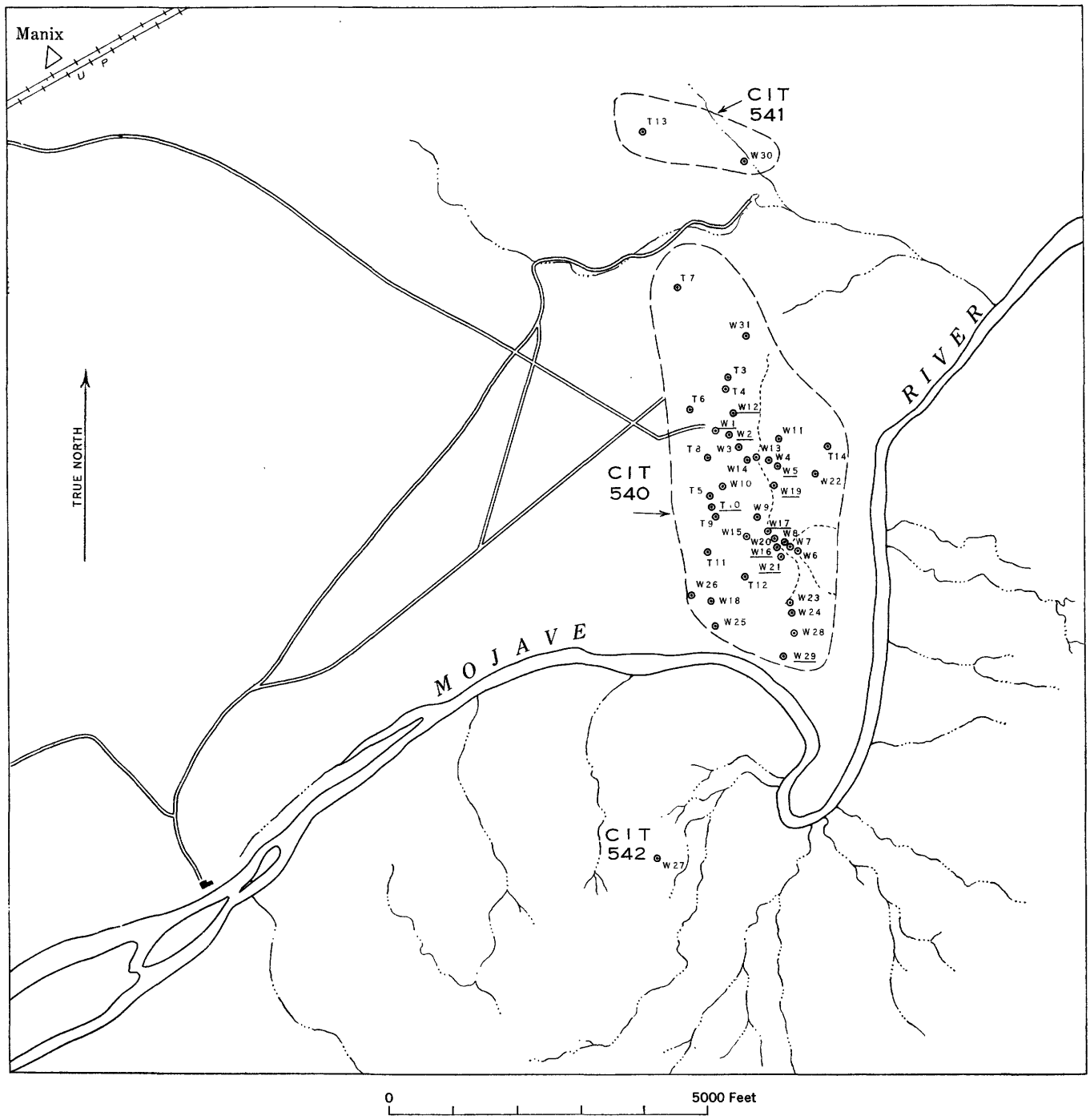

FIGURE 42.—Map showing U. S. Geological Survey collecting sites at Manix Lake, San Bernardino County, Calif. Numbers underlined indicate localities that yielded avian remains. Los Angeles County Museum collecting sites that yielded avian remains were in the general vicinity of W24 (TD 316) and W25 (TD318).

T3, etc., Dwight W. Taylor collecting sites.

W6, etc., Herbert W. Winters collecting sites.

CIT 540-541-542, California Institute of Technology locality numbers. (CIT 540=L. A. Co. Mus. 1093.)

Species of birds from the Manix Lake deposits

[Los Angeles County Museum locality 1093, California Institute of Technology locality 540]

	Unit												No data
	1		4			16					17		
	T10	W1	W2	W12	W21	W16	W17	W19	W29	TD316	W5	TD318?	
Aechmophorus occidentalis (Lawrence)		× ?			×	× ?		×					×
Pelecanus erythrorhynchos Gmelin							×		×		× ?		
Phalacrocorax auritus (Lesson) ?	×												
Ciconia maltha Miller						×							
Phoenicopterus copei Shufeldt ?				×									
Phoenicopterus minutus Howard, n. sp								×	× ?			×	
Branta canadensis (Linnaeus)													×
Nyroca valisineria (Wilson) ?										×			×
Erismatura jamaicensis (Gmelin)													×
Aquila chrysaëtos (Linnaeus)													×
Grus ?			×										
Family Phalaropodidae								×					

DESCRIPTION OF SPECIMENS

Genus AECHMOPHORUS

Aechmophorus occidentalis (Lawrence)

The bones of Western Grebe include complete tarsometatarsi, femora, nearly complete tibiotarsi, and fragments of several other skeletal elements of one individual (LACM 2457) from W21, and a separate coracoid (LACM 2465 from W19) and proximal end of tarsometatarsus (LACM 2458, with no field data). A complete humerus (LACM 2469 from W19) and fragments of vertebrae and tarsometatarsus (from W1 and W16 respectively) are tentatively identified.

A previous comparison (Howard, 1946, p. 148–151) between Recent grebe bones and those from Fossil Lake, Oregon, revealed certain differences between the living and the Pleistocene forms. Although measurements of the two series overlapped, the fossil grebe (assigned to *A. occidentalis lucasi*) tended to have longer legs, with tarsometatarsi relatively broader and deeper of shaft, but narrower proximally.

Measurements of the Manix Lake fossils are given in the table below. The humerus (from W19) is shorter than the minimum for either of the previously recorded series. It is not, however, small enough to be considered with *Colymbus parvus*, and the physical characters of the bone are similar to *Aechmophorus* rather than to *Colymbus*. Possibly a new species of *Aechmophorus* is represented, but it seems inadvisable to erect it on the basis of a small size difference of a single bone. In length, the leg bones from W21 (LACM 2457) fall in the zone of overlap of the Fossil Lake and Recent specimens, although all are equal to or greater than the average for *A. o. lucasi*. Except for breadth of proximal end, the proportions of the two complete tarsometatarsi suggest this chronocline. This is particularly true of the breadth of the intercotylar tubercle, which is considerably narrower with respect to the breadth of shaft than in the Recent Western Grebe. The same is true of the separate specimen of proximal end of tarsometatarsus (LACM 2458).

Measurements (in millimeters) and proportions of Western Grebe bones

[Recent and Fossil Lake specimen data from Howard (1946, p. 148–150. Figures in parentheses are means.]

	Recent	Fossil Lake	Manix Lake
Length of humerus	108–128 (116)	110–125 (119)	106.5
Length of coracoid	40–49 (44)	40–50 (46)	40
Length of tarsometatarsus	68–81 (74)	68–86 (77)	79
Length of tibiotarsus	111–127 (119)	119–130 (125)	125
Length of femur	41–47 (44)	42–50 (46)	46
Proportions of tarsometatarsus relative to length (in percent):			
Breadth, shaft	4.3–5.0 (4.6)	4.6–5.6 (4.9)	5.5
Breadth, proximal end	16.5–18.2 (17.3)	15.4–18.1 (16.9)	17.3
Depth, shaft	8.2–9.3 (8.7)	8.6–9.8 (9.2)	9.2
Breadth, intercotylar tubercle of tarsometatarsus, to breadth of shaft (percent)	146–170 (154)	123–162 (140)	123–125

Genus PELECANUS

Pelecanus erythrorhynchos Gmelin

An anterior end of left coracoid and distal end of right femur agree with bones of large individuals of Recent White Pelican. A fragment of proximal end of a very large radius is tentatively assigned to this species.

Genus PHALACROCORAX

Phalacrocorax auritus (Lesson)?

A distal half of left and proximal fragment of right ulna are tentatively assigned to this cormorant. The bones are similar to those of *P. auritus* and *P. penicillatus*. These species are difficult to distinguish on the basis of the ulna. The small size of the specimens precludes the possibility of identification as the large extinct *P. macropus* described from Fossil Lake, Oreg.

Genus CICONIA

Ciconia maltha Miller

One distal end of right humerus (LACM 2463) is indistinguishable from specimens of humerus of this stork found at Rancho La Brea.

Genus PHOENICOPTERUS

Phoenicopterus copei Shufeldt?

Two species of flamingo are clearly represented, one large and the other very small. The large one is represented by a single tarsometatarsus of a young bird (LACM 2448). The well ossified tarsal section is not fused to the spongy proximal part of the metartarsals, but is preserved separately. The distal end seems to be completely ossified, but owing to fracture, cannot be precisely restored. When the tarsal section is held in place, the complete element is approximately 328 mm long. This measurement falls within the size range of both *Phoenicopterus ruber* and *P. antiquorum*. It probably does not, however, represent the actual length which this element would have attained in maturity. The breadth across the proximal articular surface exceeds the maximum of available specimens of both *P. ruber* and *P. antiquorum* (see table below). The intercotylar tubercle of the proximal end is relatively high and pointed as in *P. ruber*, but is broader both in actual measurement and in proportion to the breadth of the proximal end.

The proximal end of the tarsometatarsus of *Phoenicopterus copei* from the Pleistocene of Fossil Lake, Oreg., is not known, but its size is indicated by the dimensions of the distal end of tibiotarsus which articulates with it. The distal end of tibiotarsus in *P. copei* is broader than in *P. ruber* or *P. antiquorum:* the width between the condyles is broad, suggesting that the intercotylar tubercle of the tarsometatarsus, which fits into this space when the bones are articulated, was also broad (Howard, 1946, p. 158), as noted above for the Manix Lake specimen. Therefore, a tentative assignment of the Manix Lake tarsometatarsus to this known fossil species seems reasonable.

Phoenicopterus minutus Howard, n. sp.

A small flamingo is represented by a nearly complete tibiotarsus with associated proximal portion of tarsometatarsus and an additional proximal fragment of tarsometatarsus. These leg bones show that the bird not only was smaller than any known flamingo but also differed in other respects.

Type.—Nearly complete right tibiotarsus and proximal ⅔ of tarsometatarsus found together and undoubtedly representing the same individual (articulation exact). Los Angeles County Museum number 2445. Collected by Herbert Winters.

Locality.—Approximately 2½ miles ESE of town of Manix, San Bernardino County, California; depth 81–85 feet from surface; Los Angeles County Museum locality 1093, equivalent to California Institute of Technology locality 540; collection number W19.

Referred material.—Proximal end of left tarsometatarsus, Los Angeles County Museum number 2473, collected by Theodore Downs and Leonard Bessom. Collection number TD318, Los Angeles County Museum locality 1093.

Diagnosis.—Very small flamingo; approximately 13 mm shorter in tibiotarsus than smallest available

Measurements of (in millimeters) Phoenicopterus *tarsometatarsi*

	Manix Lake specimen LACM 2448	P. antiquorum	P. ruber	P. chilensis
Breadth, proximal articular surface	19.0	18.1–18.7	15.5–17.6	16.3–16.8
Breadth, intercotylar tubercle	12.0	11.7–12.3	9.1–11.0	9.8–10.7
Height, intercotylar tubercle	6.8	5.2–6.2	5.4–5.9	4.8–5.3
Ratio, height to breadth of tubercle (in percent)	56.6	43.5–50.4	53.6–61.5	49.0–49.5
Ratio, breadth tubercle to breadth proximal articular surface (in percent)	63.2	64.6–65.7	55.5–62.5	60.1–63.7

P. chilensis; 0.2 mm narrower and 1.0 mm less in depth of distal end than in *P. stocki.* Breadth between distal condyles of tibiotarsus narrow; intercotylar tubercle of tarsometatarsus narrow and high.

Discussion.—Through the courtesy of the California Institute of Technology, the type tibiotarsus of *P. stocki* (Miller, 1944), a very small form from the Pliocene of Mexico, was made available for comparison. *P. minutus* is not only smaller than *P. stocki,* but other distinctions may be noted as follows: 1, Relatively, as well as actually less deep through distal end; *P. stocki* resembles *P. ruber* in this proportion, whereas *P. minutus* agrees more closely with *P. antiquorum* (see table below). 2, The position of the notch on the distal border of the internal condyle is well behind the center of the condyle in *P. minutus,* as in *P. ruber;* in *P. stocki* this notch is almost exactly in the center. 3, The anterior intercondylar area is 0.6 mm narrower in *P. minutus* than in *P. stocki,* though both fossil flamingos are relatively narrower in this area than any of the living forms. No comparison of tarsometatarsus can be made with *P. stocki.* Compared with Recent flamingos, the tarsometatarsus of *P. minutus* has a very narrow, high intercotylar tubercle. In the type specimen the height relative to the breadth of this tubercle is greater even than in *P. ruber.*

Measurements of Phoenicopterus *bones*

[Measurements in millimeters, ratios in percent. Asterisks indicate measurements of type specimen.]

	P. minutus	*P. stocki*	*P. chilensis*	*P. ruber*	*P. antiquorum*
Tibiotarsus:					
Length	222.2	-------	235.0–297.2	285.6–304.3	300.5–363.7
Breadth, distal end	12.7	12.9	14.2–15.4	13.3–15.5	16.5–16.6
Depth, distal end	15.0	16.0	15.7–17.5	17.5–19.4	17.8–19.6
Breadth between distal condyles	8.1	8.7	9.7–11.2	9.7–11.3	11.6–11.7
Distance from anterior end of internal condyle to notch on distal margin	9.3	8.2	9.3–10.1	10.4–11.7	11.1–11.3
Ratio, depth to breadth distal end	118	124	110–114	123–131	107–119
Ratio, breadth between condyles to breadth distal end	63.6	67.4	68.3–73.2	71.4–73.0	70.4–70.5
Ratio, distance to notch relative to depth distal end	62.0	51.2	56.6–59.3	59.2–62.9	56.5–63.5
Tarsometatarsus:					
Breadth, proximal articular facet	13.8–14.6*	-------	16.3–16.8	15.5–17.6	18.1–18.7
Breadth, intercotylar tubercle	8.2–8.4*	-------	9.8–10.7	9.1–11.0	11.7–12.3
Height, intercotylar tubercle	5.0–5.2*	-------	4.8–5.3	5.4–5.9	5.2–6.2
Ratio, breadth intercotylar tubercle to breadth proximal end	57.5*–59.4	-------	60.1–63.7	55.5–62.5	64.6–65.7
Ratio, height to breadth intercotylar tubercle	60.9–61.9*	-------	49.0–49.5	53.6–61.5	43.5–50.4

Two scapulae and a fragment of coracoid of flamingo are probably assignable to *P. minutus.* The scapulae are of about equal size and do not seem to differ markedly in this respect from modern species of *Phoenicopterus.* The slight variations in contour that are normal within a species in the genus *Phoenicopterus* make difficult the taking of comparative measurements even among Recent specimens. The two fossils differ in their contours; in one (LACM 2446) the glenoid area rises gradually from the shaft, whereas in the other (LACM 2474) the area juts out abruptly; variation within the modern species includes the condition noted in LACM 2446 but not that of LACM 2474. The fossil scapulae resemble each other and differ from all modern forms at hand in having a smaller, more inflated glenoid facet. Recent specimens indicate that this latter character is more significant than the contour noted above.

The coracoid seems to belong to a bird larger than that represented by the scapulae. It is, however, too fragmentary to base any conclusions thereon. The coracoid and both scapulae were found at the same general level as the type of *P. minutus.* Scapula LACM 2446 is similar in coloration and preservation to the type bones; scapula LACM 2474 and the coracoid are considerably whiter and smoother of texture.

Genus BRANTA

Branta canadensis (Linnaeus)

Proximal and distal ends of right femur are assignable to this species. The head of the femur seems to be somewhat smaller than the specimens of Canada Goose (*B. canadensis canadensis*) at hand, but the fossil bone is considerably worn in this area. Otherwise the bone equals in size this large race of *Branta canadensis.*

Genus NYROCA

Nyroca valisineria (Wilson)?

A distal end of left humerus and a nearly complete scapula represent the genus *Nyroca.* As *N. valisineria* and *N. marila* are not readily distinguished, the assignment to *valisineria* is tentative.

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Genus ERISMATURA

Erismatura jamaicensis (Gmelin)

An anterior end of sternum is assignable to the Ruddy Duck.

Genus AQUILA

Aquila chrysaëtos (Linnaeus)

One incomplete right distal end of tibiotarsus is very poorly preserved, yet distinguishable as Golden Eagle. Detailed field data are lacking on this specimen, but the adhering matrix appears to be that of Unit 16.

Genus GRUS?

A badly fragmented distal end of humerus should, perhaps, not be even tentatively assigned. Breakage has occurred in most of the diagnostic areas. Merely by way of recording it for size and general characters, the specimen may be said to suggest the Lesser Sandhill Crane, *Grus canadensis canadensis*.

Family PHALAROPODIDAE

An incomplete tibiotarsus closely resembles bones of *Phalaropus fulicarius*, but could possibly represent one of the other living genera and species of phalarope.

SUMMARY AND CONCLUSIONS

Twelve species of birds are represented in the Manix Lake material at hand. Two of these had previously been recorded from the area (Compton, 1934). Three extinct species are listed, one of which is described as new.

Although this avifauna is small, the presence of two species of flamingos immediately marks it as significant. Only one other record of this group is known in California, an extinct genus (not a true flamingo) recorded by Miller (1950 and 1952) from the Barstow, upper Miocene. The Manix occurrence, however, is the first record of the genus *Phoenicopterus* for the state. The ever-increasing fossil record of flamingoid forms points more and more clearly to the past importance of this group of water birds; following is a list of the species now known from fossil deposits in North America:

Megapaloelodus connectens A. Miller.	Lower Miocene, South Dakota Upper Miocene, California
Phoenicopterus floridanus Brodkorb	Middle Pliocene, Florida
Phoenicopterus stocki L. Miller	Pliocene, Chihuahua, Mexico
Phoenicopterus copei Shufeldt	Upper Pleistocene, Oregon Pleistocene, California?
Phoenicopterus minutus Howard	Pleistocene, California

The Manix Lake avifauna parallels that recorded from Fossil Lake, Oreg. (Howard, 1946). The grebes, pelicans, cormorants, flamingos, ducks and geese from both areas reflect the lacustrine nature of the deposits. With the exception of the grouse at Fossil Lake, which would not be expected so far south, many of the other species that occur at the northern locality may in time be found at Manix Lake. Two birds are listed for the Manix deposits that are not recorded from Fossil Lake. One (the fragment listed as *Grus?*) is too fragmentary to be accorded any importance; the other is the new species of small flamingo. Like the grouse of the northern locality, this species may have had a limited distribution, although the possibility of an age difference between the two deposits cannot be overlooked.

The age of the Manix was originally (Buwalda, 1914, p. 451) given as Pleistocene, without specification of the stage represented. Later, Compton (1934, p. 167), influenced by the presence of small horse bones which he believed to be of Pliocene age, concluded that the beds were early Pleistocene, or even late Pliocene in age. However, the avian species he recorded are both still extant.

Most of the avian fossils here reviewed suggest the late Pleistocene. However, in view of the fact that the bones were collected at different levels, a careful study was made to determine the possibility of representation of more than one geologic age. This study proved inconclusive. The cormorant and grebe from the uppermost beds can be only tentatively assigned, but appear to be similar to living forms. From the 21–23 foot level, the large flamingo is an extinct species, apparently the same as that from the late Pleistocene of Fossil Lake; the grebe belongs to a living species, though possibly an extinct chronocline of that species known in the late Pleistocene; and the bone tentatively assigned to *Grus* is uncertain. From the 81–85 foot zone, the small flamingo and the stork are extinct, the stork being the same as that from the upper Pleistocene deposits of Rancho La Brea, the flamingo heretofore unknown; the grebe humerus is notably small, which fact may be of significance, but without further material is inconclusive evidence of difference from the grebe of the higher level. All other specimens apparently represent species that are still living.

Very little is known of lower or even middle Pleistocene birds in the United States. The few finds that have been recorded do not appear to differ markedly from those of the upper Pleistocene. Pliocene avifaunae, however, show a predominance of forms which are distinct from those now living. Contrasted with the upper Pleistocene deposits of Fossil Lake and Rancho La Brea, in which 25–30 percent of the avian species are extinct (Howard, 1946, p. 194), upper Pliocene avifaunae of Arizona, Idaho and Kansas have

from 60 to 66 percent extinct species (based on listings by Wetmore, 1924, 1933, and 1944, respectively), and the middle Pliocene avifauna of San Diego, California is entirely extinct (Howard, 1949, p. 198). With so few species represented from each level in the Manix deposits, and at least three species present for which the level is not known, no accurate percentage of extinct to living species can be calculated for the separate levels. Considering the entire avifauna, 25 percent of the species are definitely extinct. Should the small grebe humerus prove to represent an extinct form, the percentage would be raised to 33. Although these figures are too indefinite to give an accurate age determination, at least they serve to indicate that the Manix avifauna is entirely Pleistocene. This indication is, of course, borne out by the species themselves. It is also strongly indicated that the avifauna of at least the upper 23 feet is of the upper Pleistocene. Whether the lower beds represent the same stage of the Pleistocene cannot definitely be determined on the basis of these fossils.

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PLATE 50

PLATE 50

FIGURES 1–7.—*Phoenicopterus minutus* Howard, new species (p. 202). Type, Los Angeles County Museum 2445. 1 and 2, Tarsometatarsus, anterior and external views, respectively. 3–7, Tibiotarsus: 3, internal view of distal end enlarged to show contour; 4, internal view; 5, posterior view; 6, external view; 7, anterior view. All views × 1 except fig. 3, × 2.

PHOENICOPTERUS MINUTUS HOWARD, NEW SPECIES