

AVIAN FOSSILS FROM THREE PLEISTOCENE SITES IN CENTRAL MEXICO

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ABSTRACT: A small collection of avian bones from Chapala, Tequixquiatic and San Marcos represents more than twenty species, 17 of which had no previous fossil record in Mexico. Of nine extinct forms, five relate to the Pleistocene of Rancho La Brea, California or San Josecito Cave, Nuevo Leon; one (from Chapala) is referred to a Late Pliocene species; and three are undescribed.

Since Loye Miller's report (1943) on the large avifauna from San Josecito Cave, in Nuevo León, there have been but few records of birds from the Pleistocene of Mexico. A Pied-billed Grebe was reported by Wetmore (1949) from Tepexpan, State of Mexico. An Ocellated Thrasher was tentatively identified by Robert Storer (1954) from Tequixquiatic, State of Mexico. A summary by Downs (1958) of vertebrates from the Chapala Formation in Jalisco included "probable Mexican Cormorant and flamingo." Brodkorb (1963) noted the Band-tailed Pigeon and Mourning Dove from Barranca Seca, in Veracruz.

The present report concerns additional avian remains from Tequixquiatic and Chapala, as well as specimens from San Marcos, about 25 miles west of Chapala in the state of Jalisco (see Fig. 1). The material from the three localities, totalling 44 unassociated bones, is in the collections of the Los Angeles County Museum of Natural History (LACM). A preliminary report on this material, plus a collection from Lago de Atotonilco, was presented at the annual meeting of the Geological Society of America in Mexico City (Howard, 1968). The larger collection from Atotonilco is still under study.

With the exception of coracoids of the Pliocene *Pliolymbus baryosteus* loaned by the University of Michigan Museum of Paleontology (UMMP), and three modern skeletons of *Phalacrocorax olivaceus* from the University of California Museum of Vertebrate Zoology, Berkeley, (MVZ), all comparative material is from the LACM collections.

CHAPALA

Reports on the geology and vertebrate paleontology of the Lake Chapala area, in eastern Jalisco, have been published by Palmer (1926), Downs (1958) and Clements (1963). Briefly, the combined results of their studies indicate that the fossils in the tilted sediments of the Chapala Formation, which occur along the north shore of the present Lake Chapala, were deposited earlier,

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and in a larger lake bed, than those recovered from the bottom of the existing lake. An Early Pleistocene or Plio-Pleistocene age is suggested for the Chapala Formation (Clements, 1963: 47).

Collections of vertebrate fossils in the Lake Chapala area were made by the California Institute of Technology and the Los Angeles County Museum of Natural History in cooperation with the Seminario para Estudios Cenozoicos sponsored by the Instituto de Geologia, Universidad Nacional de Mexico. No avian fossils were recovered from the bottom sediments of the present lake. But 14 bird bones were obtained from the Chapala Formation at LACM localities 1129 (type section, 1.3 miles north of the town of Chapala) and 1176 (near the west edge of the type beds). Other vertebrates from the Chapala Formation include fish, crocodylian, turtle, mastodont (*Cuvieronius*), peccary, and horse (*Equus and Nannipus*) (Downs, 1958: 77).

Ten of the bird bones are specifically assigned to three species, as follows:

Pliolymbus baryosteus Murray, Extinct Grebe, 1 bone

Phalacrocorax olivaceus (Humboldt), Mexican Cormorant, 7 bones

Phoenicopterus ruber Linnaeus?, American Flamingo, 2 bones

The remaining four fragments are too poorly preserved for even generic identification. They represent a large goose, a duck, an egret or small heron, and a coot or rail.

The grebe bone is an upper end of a right coracoid (LACM 2891) which falls between *Podiceps dominicus* and *P. caspicus* in the dimension of distance from scapular facet to head. However, in distance across the triosseal canal, below the furcular facet, it is relatively broader than in either of the living species. In both size and proportions it agrees with coracoids of *Pliolymbus baryosteus* Murray, from the Late Pliocene of Kansas and Idaho (UMMP 27173 and 49577). A further, qualitative character, not noted in Murray's (1967) description of *Pliolymbus*, is also observed, *i.e.*, all of the fossil specimens, including the Chapala coracoid, have a more blunt brachial tuberosity than does *P. dominicus* or *P. caspicus*. The Mexican coracoid, is therefore, referred to *Pliolymbus baryosteus*. This occurrence considerably extends the geographic range of that species, and tends to corroborate the age determination of the Chapala beds as Plio-Pleistocene.

The seven cormorant bones represent different elements (coracoid, humerus, ulna, carpometacarpus, femur, tibiotarsus and tarsometatarsus), but they were not associated and probably represent at least four individuals. The coracoid (LACM 2778) was compared with the type of *Phalacrocorax goletensis* Howard (LACM 4632) from the Pliocene of Michoacan. In each of the characters that distinguish the Pliocene form from the living Mexican Cormorant, *P. olivaceus* (see Howard, 1965), the Chapala coracoid differs from *P. goletensis* and resembles the living species. In fact, except for a slightly

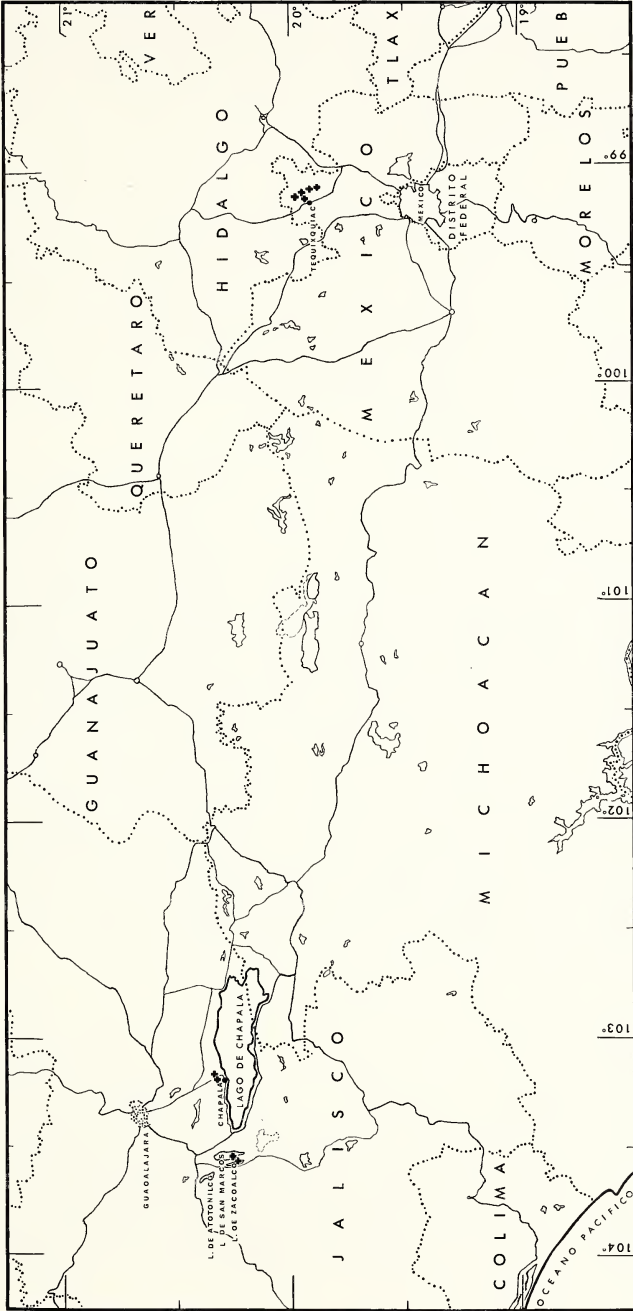


Figure 1. Map of central Mexico, showing location of fossil sites, marked +.

longer tarsometatarsus (1 mm), and straighter, more medially placed anterior intermuscular line on the femur, all of the elements can be matched in size and qualitative characters in the four skeletons of *P. olivaceus* available for comparison. As the position of the intermuscular line varies within the Recent series, this character does not seem to be significant, and the Chapala bones are referred to *P. olivaceus*.

The flamingo is represented by a slightly crushed coracoid (LACM 2770) from locality 1176, and a right pedal phalanx (phalanx 1, digit 2, LACM 20867) from locality 1129. The coracoid is equal in size to that of large individuals of the existing American Flamingo. In qualitative characters, also, the specimen agrees with coracoids from Recent skeletons of this species except for possibly less clearly defined upper border of the furcular facet towards the posterior side. However, there is considerable variability in shape and extension of the facet among Recent skeletons, and the significance of the slight deviation found in the fossil bone is questionable.

Comparison was also made with the description of the coracoid of *Phoenicopterus copei* Shufeldt, from the Late Pleistocene of Fossil Lake, Oregon (Howard, 1946: 158). The two bones are very nearly the same length, but in *P. copei* the furcular facet is much broader in anteroposterior dimension, and the head is less thick. The coracoid is not represented in the other North American fossil flamingos. However, from other elements represented, the previously described Pliocene *Phoenicopterus stocki* Miller (1944) from the Pliocene of Chihuahua, was obviously a much smaller bird than the one represented at Chapala, and *P. minutus* Howard, from the Pleistocene of California, was even smaller than *P. stocki*. *P. floridanus* Brodkorb, from the Pliocene of Florida, was probably the equal of the Chapala bird in size. The characters of the leg bones, on which the description of the species is based (Brodkorb, 1953), seemingly present more evident distinctions from the Recent species than are observable in the Mexican bone, but the relationship is indeterminate. The assignment of the Chapala coracoid to *Phoenicopterus ruber* is made on a tentative basis in view of the possible significance of the character of the furcular facet. No flamingos are found in central Mexico today.

TEQUIXQUIAC

In the 1930's, the California Institute of Technology (CIT) collected fossil vertebrates from the fluvial deposits in the barrancas and limestone fissures near Tequixquiatic, in the northern part of the state of Mexico (Fig. 1). The specimens are now included in the collections of the Los Angeles County Museum of Natural History. The 15 bird bones were obtained from the following five localities, which bear LACM (CIT) locality numbers: 268, fissure deposit in travertine quarry near El Tajo; 308, Barranca del Muerto; 309, Barranca del Rio Grande; 310, 61 kilometers del Gran Canal; and 311, La Cantera Vieja.

Hibbard (1955) recorded the mammalian fauna of the Tequixquiac area, based largely on the collection in the Instituto de Geologia, Universidad Nacional Autonoma de Mexico, and reviewed previous studies of the deposits. He states that the beds are referred to the Upper Becerra Formation, and may represent two stages of Late Pleistocene deposition, the fissure deposits possibly being slightly older than the overlying horizontal beds. The mammalian fauna that he records includes such typical Pleistocene forms as glyptodont, *Tremarctotherium*, *Mammuthus*, *Equus*, *Camelops*, *Bison*, and *Euceratherium*. He also notes remains of frogs or toads, turtles, and two gophers. A single bird bone from one of Hibbard's localities was tentatively referred to the thrasher, *Toxostoma ocellatum* (Storer, 1954: 144).

From the fissure deposits, Furlong (1925) listed *Capromeryx*, *Platygonus*, and *Canis* (*Aenocyon*).

Eleven of the avian bones from the five LACM (CIT) localities are assigned as follows (extinct forms marked †):

- †*Ciconia* ? sp., Extinct stork, 1
- Anas acuta* Linnaeus, Pintail Duck, 1
- Anas cyanoptera* Viellot ?, Cinnamon Teal, 2
- Aythya americana* (Eyton) ?, Redhead, 1
- Aythya collaris* (Donovan) ?, Ring-necked Duck, 1
- †*Breagyps clarki* (Miller), La Brea Condor, 1
- Aquila chrysaetos* (Linnaeus), Golden Eagle, 2
- †*Spizaetus grinnelli* (Miller) ?, Grinnell Eagle, 1
- †*Caracara prelutosa grinnelli* (Howard), Extinct Caracara, 1

The other four fragments represent a swan, a hawk, and two passerines.

The stork bone is a poorly preserved distal end of a tibiotarsus (LACM 4645) from the fissure deposit (LACM (CIT) Loc. 268). The few diagnostic features discernible indicate relationship to the extinct *Ciconia maltha* Miller or the existing Maguari Stork, *Euxenura maguari*, rather than to either of the members of the family recorded from Mexico in Recent time, *i.e.*, the Wood Ibis and Jabiru. It is also dissimilar to the Pliocene *Dissouroides milleri* as described by Short (1966). The size is less than the one available specimen of the existing *Euxenura maguari* or a minimum specimen of *Ciconia maltha* from Rancho La Brea. The bone is too fragmentary for accurate determination. In view of the probability of closer relationship to the widely distributed Pleistocene stork of the United States than to the living South American Maguari, the specimen is tentatively referred to *Ciconia*.

The most significant specimen in the collection is an axis vertebra (LACM 4638) of a condor. The specimen matches in all details an axis in the Rancho La Brea collection assigned to the extinct *Breagyps clarki* (Miller) (LACM G9346). The *Breagyps* axis is distinguished from that of *Gymnogyps* (both

Recent and Pleistocene forms) by the position of the postzygapophyses. The Mexican fossil resembles *Breagyps* in having the articular facets parallel to the anteroposterior line of the vertebra. In *Gymnogyps* they are tipped in toward the centrum anteriorly, and are also much more deeply cup-shaped. *Gymnogyps*, but not *Breagyps*, was present in San Josecito Cave.

A fragment of the distal end of a left tarsometatarsus (LACM 4646), lacking the internal trochlea and all but the proximal tip of the middle trochlea, agrees in general size with some specimens of *Aquila chrysaetos* and the extinct *Spizaetus grinnelli*. It resembles the latter as distinguished from *Aquila* in the relatively shorter and more rounded external trochlea, deeper extensor groove above the distal foramen, and more proximally extended middle trochlea. In view of the fragmentary condition of the specimen, the assignment to *Spizaetus grinnelli* is tentative.

The identification of the caracara is based on an incomplete humerus (LACM 4641), lacking the proximal end above the distal contour of the bicipital crest. Distally the bone has a sharp ridge distal to the ectepicondylar prominence, characteristic of the type of *Caracara prelutosa* (Howard, 1938: 226). The assignment to the Mexican race, *C. prelutosa grinnelli*, described from San Josecito Cave (Howard, 1940), is based on the short, broad proportions of the bone. A slight comparison with five humeri from San Josecito Cave shows the Tequixquiac specimen to be shorter than the minimum cave bone. The range in the cave series is, however, only 3 mm, and the minimum is only 1.5 per cent shorter than the mean. In a series of 67 humeri of the larger race, *C. prelutosa prelutosa* from Rancho La Brea, the range is 15 mm and the minimum is 9 per cent shorter than the mean. A similar range for the Mexican race should include even shorter humeri than the one from Tequixquiac.

Inasmuch as swans are of rare occurrence in Mexico today, the presence of the swan bone in the fossil collection is significant. The specimen is a fragment of the distal end of a carpometacarpus that could belong either to *Cygnus* or to *Olor*. Both genera are recorded in the Pleistocene of the United States.

The Tequixquiac avifauna reflects the Late Pleistocene age of the deposit. All four of the identified raptorial species occur at Rancho La Brea and, except for *Breagyps clarki*, were also found at San Josecito Cave.

SAN MARCOS

Mr. Harold E. Smith, of the Sociedad de Ciencias Naturales de Lago de Chapala, is responsible for the discovery of fossils in the lacustrine deposits near San Marcos (Fig. 1). The occurrence was brought to the attention of the Los Angeles County Museum of Natural History and collecting was carried on by the museum in 1964-1965. Vertebrate fossils were obtained at two sites: LACM locality 1952, on the east side of El Tecolote Island, in Laguna de San Marcos; and LACM locality 1953, on the west side of the island, in

Laguna de Zacoalco. Dr. Reid Macdonald, who directed the field work, found that deposits on both sides of the small island are part of the same lake bed, and the fossils occurred in undisturbed material in the bottom of the lake, which was then dry.

At this writing, the large mammalian fauna from San Marcos has not yet been recorded, but, according to Dr. Macdonald, it is typical of the Late Pleistocene. Fifteen bird bones represent nine species, two of which can be assigned only generically. The taxa identified are as follows (extinct forms marked †):

- Pelecanus erythrorhynchos* Gmelin, White Pelican, 4
- †*Phalacrocorax* sp., Cormorant, 1
- †*Mycteria wetmorei* Howard ?, Wood Ibis, 1
- Ardea herodias* Linnaeus, Great Blue Heron, 1
- †*Phoenicopterus* sp., Flamingo, 2
- Chen hyperborea* (Pallas), Snow Goose, 1
- Anas acuta* Linnaeus, Pintail Duck, 1
- Aythya affinis* (Eyton), Lesser Scaup Duck, 3
- †*Buteogallus fragilis* (Miller), Extinct Eagle, 1

The cormorant bone is a proximal fragment of a humerus (LACM 18501) lacking both deltoid and bicipital crests. The short, broad pectoral attachment on the external tuberosity relates the specimen to *Phalacrocorax auritus* and *P. olivaceus* in contrast to *P. penicillatus* and *P. pelagicus*, in which the attachment is long and narrow. As far as size can be determined on the fragment, it appears to fall between *P. auritus* and *P. olivaceus*, possibly closer to the latter. Presumably an extinct species is represented.

A proximal end of a Wood Ibis carpometacarpus (LACM 9741) is comparable in size to Rancho La Brea specimen LACM K3529, tentatively assigned to *Mycteria wetmorei* (Howard, 1935: 253). Both fossils are equalled by Recent specimens of *M. americana* in depth from the tip of the process of metacarpal 1 to the internal crest, but exceed the existing species in other measurements of the proximal end. This similarity in proportions suggests specific identity of the La Brea and Mexican forms. However, the San Marcos bone has a shorter proximal symphysis than have any of the other specimens (Recent or fossil) compared. The assignment to *M. wetmorei* is, therefore, tentative.

A proximal and a distal fragment of a left humerus (LACM 9738 and LACM 18505, respectively), possibly from the same individual, represent a large flamingo. Neither fragment provides qualitative details, but both are obviously larger than humeri of Recent flamingos. Measurements of breadth and depth of the head and depth of the external distal condyle are 19 to 24 per cent greater than in the largest of eight available skeletons of the existing

Phoenicopterus ruber (LACM 235). The largest of the North American fossil flamingos, *P. copei* Shufeldt, is not represented by a humerus. The measurements of other elements (see Howard, 1946: 158) compared with the above-noted large skeleton of *P. ruber* (LACM 235), show a maximum of only ten per cent greater size than in the Recent species. Of three *P. copei* tarsometatarsi, two are slightly narrower than the *P. ruber* specimen, although the third is seven per cent broader. The tibiotarsus is ten per cent broader proximally, the coracoid four per cent broader. These figures suggest that the San Marcos flamingo was larger than *P. copei*, and is probably an undescribed species. The humeral fragments are inadequate for a proper description.

A distal end of a left humerus (LACM 9740) represents a small eagle, referred to *Buteogallus fragilis* (Miller). In qualitative characters it resembles humeri of this species from the three California asphalt deposits. The bone is slightly narrower than specimens from Rancho La Brea, but is closely matched by humeri from McKittrick and Carpinteria.

The San Marcos avian representation agrees with the concept of a Late Pleistocene age for these deposits. Two species, *Mycteria wetmorei* and *Buteogallus fragilis*, are typical of Rancho La Brea.

SUMMARY

Twenty-eight avian species are represented in the Los Angeles County Museum of Natural History collections of fossil vertebrates from three central Mexican Pleistocene localities—Chapala, Tequixquiac, and San Marcos. Eight of the species, however, cannot be generically assigned. Eleven still occur in Mexico today, although the most westerly record of the flamingo is from the state of Veracruz (Lowery and Dalquist, 1951).

COMBINED AVIFAUNAS OF CHAPALA, TEQUIXQUIAC AND SAN MARCOS

†*Pliolymbus baryosteus* Murray

**Pelecanus erythrorhynchos* Gmelin

**Phalacrocorax olivaceus* (Humboldt)

†*Phalacrocorax* sp.

Indeterminate egret or small heron

**Ardea herodias* Linnaeus

**Phoenicopterus ruber* Linnaeus ?

†*Phoenicopterus* sp.

†*Mycteria wetmorei* Howard ?

†*Ciconia* ? sp.

Indeterminate swan

Indeterminate large goose

**Chen hyperborea* (Pallas)

**Anas acuta* Linnaeus

**Anas cyanoptera* Viellot ?

**Aythya americana* (Eyton) ?

**Aythya collaris* (Donovan) ?

**Aythya affinis* (Eyton)

Indeterminate duck

†*Breagyps clarki* (Miller)

+**Aquila chrysaetos* (Linnaeus)

††*Spizaetus grinnelli* (Miller) ?

†*Buteogallus fragilis* (Miller)

Indeterminate hawk

††*Caracara prelutosa grinnelli* (Howard)

Indeterminate coot or rail

Indeterminate small passerines (2)

†—Extinct

†+—Also recorded from San Josecito Cave

*—Occurs in Mexico today

Nine extinct species are represented, five of which are assigned, at least tentatively, to forms described from the Late Pleistocene of the United States; three of these are recorded also from San Josecito Cave, Nuevo León, Mexico. The grebe found at Chapala relates to the Late Pliocene of the United States. Its occurrence is in keeping with the assumption that the Chapala Formation was deposited earlier in the Pleistocene than the deposits at the other localities. Three specimens, assigned only to genus, appear to represent undescribed species, but are too fragmentary for description.

At least 17 of the birds from these localities have no previous fossil record elsewhere in Mexico. San Josecito Cave, from which nearly all Mexican Pleistocene avian records have come, represents a largely terrestrial environment, with cave-nesting and predatory birds predominating, and bones of water birds comprising less than one per cent of the collection. The central Mexican localities have added birds of the lakes and streams. At Tequiquiac about 50 per cent of the bones found represent aquatic species, and at Chapala and San Marcos, over 90 per cent are so assigned. Including all forms identified at least to genus, the resulting avifauna for the Pleistocene of Mexico now totals 58 species.

ACKNOWLEDGMENTS

For the fossil and Recent skeletons loaned for this study, I am grateful to the University of Michigan, Museum of Paleontology, and the University of California, Museum of Vertebrate Zoology, Berkeley, and to Dr. Claude W. Hibbard, Bertram G. Murray, Jr., and Ned Johnson, who arranged the loans. I want to express my appreciation also to Drs. Theodore Downs and Reid Macdonald of the Los Angeles County Museum of Natural History, for helpful discussions concerning the field work in Chapala and San Marcos, and to them

and to Dr. Herbert Friedmann, Director of the Museum, for continuing to place the collections of the Museum at my disposal and provide most congenial surrounding in which to work. A special thank you goes to my husband, Henry Anson Wylde, who prepared the map of the central Mexican localities.

SUMARIO

Una pequeña colección de huesos de Aves procedentes de Chapala, Tequixquiác y San Marcos, representan más de veinte especies, de las cuales 17 no han sido encontradas en el record de fósiles en México. De nueve formas extintas cinco están relacionadas con el Pleistoceno del Rancho La Brea en California o Cueva de San Josecito en Nuevo León; una especie (de Chapala) se refiere al Plioceno superior; y tres más que no han sido descritas.

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Accepted for publication June 20, 1969.