

BRIGHAM YOUNG UNIVERSITY

GEOLOGY

S T U D I E S

V O L U M E 4 7 • 2 0 0 3

BRIGHAM YOUNG UNIVERSITY GEOLOGY STUDIES

Volume 47, 2003

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A Publication of the
Department of Geology
Brigham Young University
Provo, Utah 84602

Editor

Scott Ritter

Brigham Young University Geology Studies is published by the Department of Geology. This publication consists of graduate student and faculty research within the department as well as papers submitted by outside contributors. Each article submitted is externally reviewed by at least two qualified persons.

ISSN 0068-1016
10-2003 500 15318-15681

A Fossil Feather from the Oligocene of Central Mexico

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ABSTRACT

From the sedimentary sequence of the Los Ahuehuetes Locality (Oligocene) near Tepexi de Rodríguez, Puebla, Mexico, a fossil contour feather was collected. It is well preserved as a carbonaceous compression, oval in outline, and measures 33.6 mm in length by 17 mm in width. The fossil feather seems to represent a dorsal surface. Barbs are filamentous, cohesive, and form nearly symmetrical outer and inner vanes. Although microstructure is not well preserved, a distinction between proximal barbules and the shorter distal barbules is possible. In Mexico, this fossil represents the first report of a fossil feather from the country and it is among the oldest record of the Class Aves only younger than the skeletal elements of an enanthiornithine bird and some neognathus eggshells from the Late Cretaceous of the State of Baja California.

INTRODUCTION

The sedimentary sequence of the Los Ahuehuetes Locality in the southern part of the State of Puebla, Central Mexico (Fig. 1) has yielded a diverse and important fossil flora. See Cevallos-Ferriz and Martínez-Hernández (2000) for a review of this paleobotanical diversity.

In regard to its faunal content, the locality has yielded few invertebrate remains as well as some small fish skeletons. In addition to these remains a fossil feather has been collected, to describe and comment upon this specimen is the main purpose of this paper.

Feathers are well represented in the fossil record and known since the Mesozoic. In the Tertiary, fossil feathers are common and have been reported from several localities (Davis and Briggs, 1995).

MATERIAL AND METHOD

The fossil feather was collected in the Los Ahuehuetes locality (Fig. 1) which has been interpreted as the lowermost member of the Pie de Vaca Formation. During a field season in 1991 the fossil feather object of this study, was found by students of the Facultad de Ciencias, U.N.A.M., led by M. Montellano from the Instituto de Geología, U.N.A.M., unfortunately only one part of the compression was recovered. The information presented here comes from this sample. According to stratigraphic position, as well as ostracod and palynological content, an Oligocene age has been suggested

(Magallón-Puebla and Cevallos-Ferriz, 1994, Cevallos-Ferriz and Martínez-Hernández, 2000). However, studies to date some of the ash horizons in the locality are currently underway using the fission track method (Cevallos-Ferriz and Martínez-Hernández, 2000).

The Los Ahuehuetes locality (Fig. 1) is situated at 18° 35' N, 97° 55' W and 4.5 km north-northwest of the town of Tepexi de Rodríguez in the southern part of the State of Puebla (Magallón-Puebla and Cevallos-Ferriz, 1994). It is composed of alternating layers of volcanic ash, fine-grained sandstones and shales. A lacustrine or low-energy fluvial environment is represented in this sedimentary sequence (Magallón-Puebla and Cevallos-Ferriz, 1994).

The sediment that covered part of the feather was removed physically with a needle. Measurements of the feather were taken with the aid of a vernier caliper. The microstructure was observed with an Olympus BH-2 light microscope. Microphotographs were taken with an Olympus photographic system, model PM-10ADS, and an Olympus C-35AD-4 camera, using reflexed light with an INDUMEX, LFS-200 fibre optic lamp. The fossil was prepared in the Instituto de Geología, U.N.A.M., and it is housed in the paleobotanical collection under the catalogue number IGM-PB-14206.

SYSTEMATIC PALEONTOLOGY

Class Aves Linnaeus, 1758

(Fig. 2)

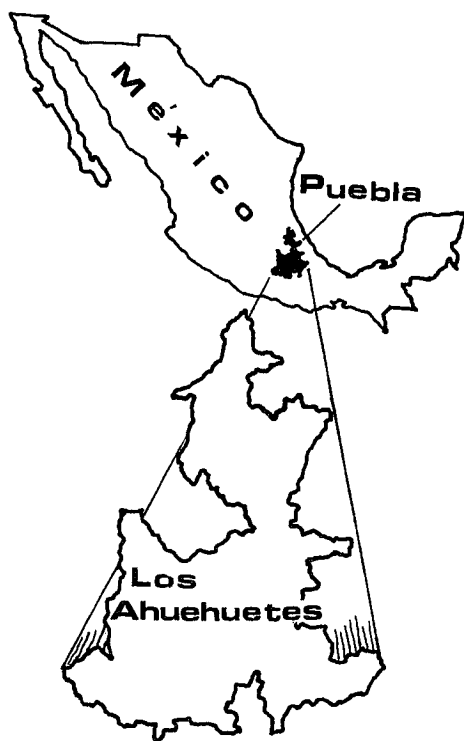


Figure 1. Geographic location of the Los Ahuehuetes Locality in south-central Puebla, México.

Material.—IGM-PB-14206, a small rock block containing the feather as carbonaceous compression.

Description.—The fossil feather presented in this paper (Fig. 2) is in general well preserved as a carbonaceous compression. It represents a good portion of the rachis and vane of a contour feather; neither the calamus nor the plumaceous portion of the vane are preserved.

The preserved portion of the feather is suboval in outline, it measures 33.6 mm in length and 17.6 mm in width. The feather seems to represent the dorsal aspect. The lack of ventral ridges and groove of the rachis support this observation (Fig. 2). The rachis is thin and slightly curved, it is 0.27 mm in width proximally and 0.05 mm distally (mean 0.15 mm).

Barbs are filamentous, cohesive, and form the nearly symmetrical outer and inner vanes. Barbs diverge from the rachis at an angle of 27.4° . The angle decreases to 12° for those barbs near the apex of the feather. The barbs are slightly curved upwards, 19.6 mm (7.7–22.7 mm) in length by $312\ \mu\text{m}$ (200–400 μm) in width, and have a shortening toward the feather apex being 7.7 mm in length and having a similar thickness. In some parts of the feather the barbs show loss of cohesion due, perhaps, to the damage of their microstructure or to the wet conditions in the depositional environment (Fig. 2A).

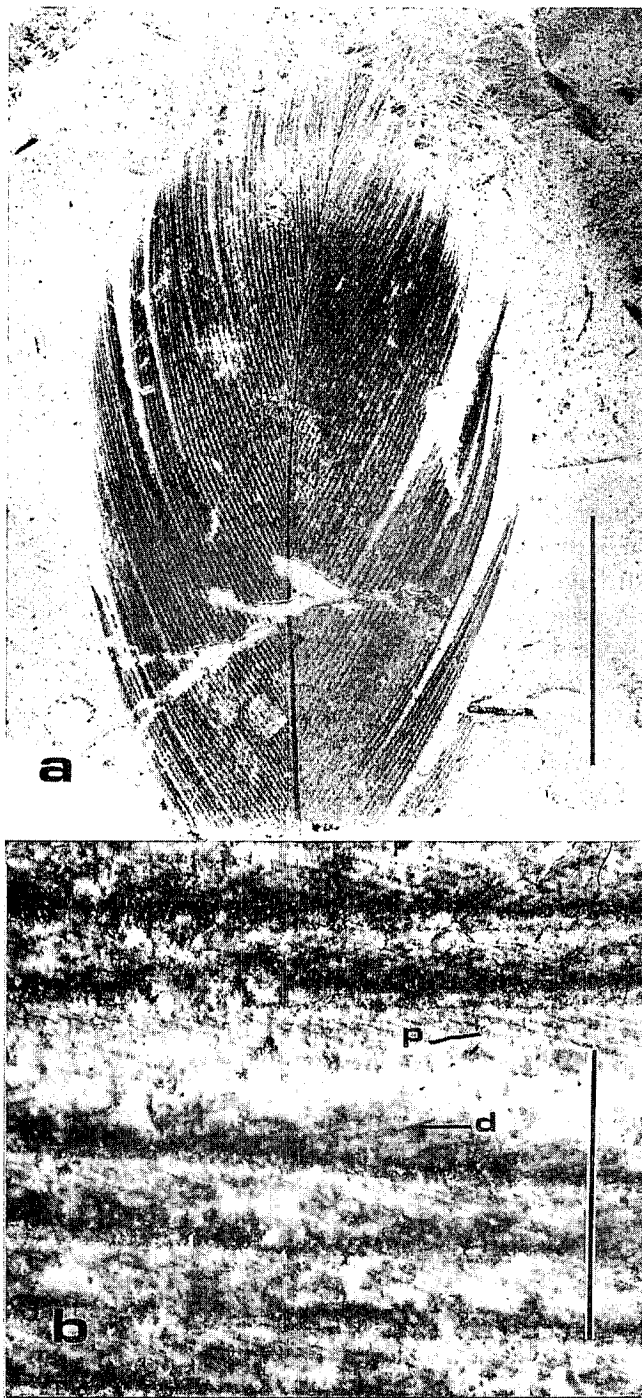


Figure 2. Contour feather from the Los Ahuehuetes Locality. A, IGM-PB-14206; B, magnification of a portion of the vane showing lack of cohesion among proximal (p) and distal (d) barbules. Scale bars equal 1 cm (a) and 1 mm (b).

Although the microstructure of the feather is not well preserved, a distinction between the proximal barbules and the shorter distal barbules is seen (Fig. 2B). The distal barbules are $97.1\text{ }\mu\text{m}$ ($75\text{--}105\text{ }\mu\text{m}$) in length, while the longer proximal barbules are $299\text{ }\mu\text{m}$ ($175\text{--}390\text{ }\mu\text{m}$) in length. Both the anterior and the proximal barbules are about $5\text{ }\mu\text{m}$ in width. In both cases the bases of the distal and the proximal barbules are seen, but no traces of the hooked barbicels or hamuli are found.

DISCUSSION

The fossil is thought to be a contour feather due to the presence of a moderate rachis and strongly cohesive barbs. An original pliability is suggested by the slightly curved rachis. The lack of cohesion between the barbs in some parts of the vane that give a wet appearance to the feather agree with the idea of a lacustrine or low energy fluvial environment represented in this sedimentary sequence (Magallón-Puebla and Cevallos-Ferriz, 1994).

It has been shown that feather microstructure has a taxonomical relationship (Chandler, 1916), and in some cases it has been possible to identify a fossil feather to a family and rarely to relate it to a species level. An example of this is a feather in amber from the Dominican Republic that was assigned to the family of the woodpeckers, the Picidae (Grimaldi and Case, 1995; Poinar, 1992). This was possible due to two main factors, the conspicuous microstructure of the plumaceous barbules of contour feathers of this family and the excellent preservation of the fossil. Unfortunately, the feather from Puebla cannot be placed within a particular order, due to the lack of information on microstructure.

However, it is well known that by the early Cenozoic most of the major bird lineages were well differentiated and by the Late Eocene or Oligocene many living families can be identified on the basis of isolated skeletal elements (e.g., Feduccia, 1996). In order to strengthen inferentially a taxonomical relationship and taking in account that the Los Ahuehuetes locality is thought to represents a lacustrine or low-energy fluvial environment (Magallón-Puebla and Cevallos-Ferriz, 1994), it is possible that the feather belonged to a group of aquatic- or semi-aquatic-dweller birds.

To date the only fossils associated to this feather are plant remains, among invertebrates are bivalves and elytra of Coleoptera (Ramírez-Garduño 1996 pers. comm.), vertebrates are represented by some poorly preserved small fishes. So this fossil represents the first record of the Class

Aves in the sedimentary sequence of the Los Ahuehuetes Locality.

Also it is the first report of a fossil feather from Mexico and it is among the oldest records of Aves from the Country younger than *Alexornis antecedens* Brodkorb (Enanthiornithines) and some eggshells belonging to neognathous birds, both findings from the Upper Cretaceous of the State of Baja California (Brodkorb, 1976; Chiappe, 1991; Rodríguez-de la Rosa, 1998). The continuing paleontological work at the Los Ahuehuetes locality may yield more feather specimens and or information about this kind of fossils in Mexico.

ACKNOWLEDGMENTS

Authors want to thank Antonio Altamira (Instituto de Geología, U.N.A.M.) and Héctor Hernández-Campos for photographic assistance. To CONACyT and DGAPA-U.N.A.M. for providing financial support, specially to Project IN205597. We also thank the kindly review of the manuscript by Wade E. Miller (Brigham Young University, Provo, Utah) and an anonymous reviewer.

REFERENCES CITED

- Brodkorb, P. (1976). Discovery of a Cretaceous bird, apparently ancestral to the orders Coraciiformes and Piciformes (Aves, Carinatae). *Smithsonian Contributions to Paleobiology*, 27: 67–73.
- Cevallos-Ferriz, S.R.S. and E. Martínez-Hernández (2000). Palynology and paleobotany of the Pie de Vaca Formation. *Society of Vertebrate Paleontology, Field Trips Guide, Special Publication*: 112–114.
- Chandler, A.C. (1916). A study of feathers, with special reference to their taxonomic significance. *University of California (Berkeley) Publications on Zoology*, 13 (11): 243–246.
- Chiappe, L.M. (1991). Cretaceous birds of Latin America. *Cretaceous Research*, 12: 55–63.
- Davies, P.G. and D.E.G. Briggs (1995). Fossilization of feathers. *Geology*, 23 (9): 783–786.
- Feduccia, A. (1996). The origin and evolution of birds. *Yale University Press*, 420 pp., New Haven.
- Grimaldi, D. and G.R. Case (1995). A feather in amber from the Upper Cretaceous of New Jersey. *American Museum Novitates*, 3126: 1–6.
- Magallón-Puebla, S. and S. R. S. Cevallos-Ferriz (1994). *Eucommia constans* n. sp. Fruits from the Upper Cenozoic strata of Puebla, Mexico: morphological and anatomical comparison with *Eucommia ulmoides* Oliver. *International Journal of Plant Sciences*, 155: 80–95.
- Poinar, G.O., Jr. (1992). *Life in amber*, 350 pp., Stanford University Press, California.
- Rodríguez-de la Rosa, R.A. (1998). Cáscaras de huevo avianas (Neognathae) y de Ornithopoda (Dinosauria) del Cretácico Tardío de Baja California, México. VI Congreso Nacional de Paleontología, Libro de Resúmenes: 59–60.

