

## EVIDENCE OF A FOSSIL STORK (AVES: CICONIIDAE) FROM THE LATE MIOCENE OF THE PISCO FORMATION, PERU

### EVIDENCIA DE UNA CIGÜEÑA FÓSIL (AVES: CICONIIDAE) DEL MIOCENO TARDÍO DE LA FORMACIÓN PISCO, PERÚ

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#### ABSTRACT

The family Ciconiidae is represented in Peru by three modern species. The only Peruvian fossil material comes from Late Pleistocene beds of Talara (North coast). Herein a Ciconiidae indet. is reported for the Pisco Formation (South central coast of Peru) belonging to the Aguada de Lomas vertebrate locality with an age of 8.8 - 7 Ma corresponding to the Late Miocene. These fossils increase the temporal range of the family in Peru. Additionally, the number of families of Aves reported in the Pisco Formation increases at eleven: Spheniscidae, Diomedeidae, Procellaridae, Sulidae, Phalacrocoracidae, Pelagornithidae, Pelecanidae, Laridae, Scolopacidae, Vulturidae and Ciconiidae.

**Keywords:** Aves, Ciconiidae, stork, Late Miocene, Pisco formation, Peru.

#### RESUMEN

La familia Ciconiidae está representada en el Perú por tres especies actuales. El único material fósil peruano reportado anteriormente proviene del Pleistoceno de Talara, en la costa norte del país. En la presente nota, se da a conocer material correspondiente a un tarsometatarso de cigüeña, procedente de la localidad fosilífera de Aguada de Lomas (8.8 – 7 Ma) de la formación Pisco, expuesta en la costa centro-sur del Perú. Este fósil es el primer registro de la familia Ciconiidae para esta formación y a su vez es el más antiguo para el Perú. Su escasa presencia y las condiciones climáticas de la costa durante este período, indicarían que se trató de un visitante ocasional de las costas, como ocurre con algunos miembros de su familia en la actualidad. Hasta el momento son once las familias de Aves reportadas para la Formación Pisco: Spheniscidae, Diomedeidae, Procellaridae, Sulidae, Phalacrocoracidae, Pelagornithidae, Pelecanidae, Laridae, Scolopacidae, Vulturidae y Ciconiidae.

**Palabras Clave:** Aves, Ciconiidae, cigüeña, Mioceno Tardío, Formación Pisco, Perú.

#### INTRODUCTION

The storks (Ciconiidae) are a group of long-legged wading birds with near cosmopolitan distribution. Representatives are found on five continents (Elliot, 1992). The oldest fossil record of this family comes from the Late Eocene of Egypt

(Miller *et al.*, 1997). In South America, the earliest reported fossil is *Ciconiopsis antarctica* Ameghino 1895 from the Early Oligocene of Argentina; however, this fossil has been questioned by Olson (1985), who indicates that can not be considered as a stork without a restudy.

Currently, three Ciconiid species inhabit South America, *Jabiru mycteria* Lichtenstein, 1819, *Mycteria americana* Linnaeus, 1758 and *Ciconia maguari* Gmelin, 1789. All three species occur in Peru inhabiting the Amazon lowlands east of the Andes and rarely they are seen in the high-Andean areas (Puna) an occasionally along the coast of the north

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of Peru, (Clements & Shany, 2001). *Jabiru mycteria* and *M. americana* have also been reported from the Late Pleistocene of Talara, northern of the Peru (Campbell, 1979).

The new material here described comes from the Pisco Formation (South-central coast) (Fig. 1), a marine sedimentary sequence formed since the Middle Miocene to the Late Pliocene. This Formation has been described with six vertebrate localities: Cerro la Bruja (14-12 Ma), El Jahuay (9.5-9 Ma), Aguada de Lomas (8.8-7 Ma), Montemar (6 Ma), Sud Sacaco (5 Ma) and Sacaco (3.9-3 Ma), and the ciconiid material proceeds specifically from the Aguada de Lomas vertebrate locality (Muizon & DeVries, 1985).

## MATERIAL AND METHODS

The fossil remains were described following the terminology of Baumel & Witmer (1993) and Howard (1980). The measurements were taken with a Vernier caliper. The fossil material belong to the collection of the Departamento de Paleontología de Vertebrados, Museo de Historia Natural de la Universidad de San Marcos, Lima, Perú (MUSM) and the comparison extant species of the Field Museum of Natural History, Chicago, USA (FMNH).

## Comparison Material

Ardeidae: *Ardea herodias* FMNH 429092, 429095, 431046; *Bubucus ibis* FMNH 339297, 342328, 379029; *Butorides striatus* FMNH 339311, 375536, 375540; *Egretta thula thula* FMNH 339285, 342322, 368679; *Nycticorax nycticorax* FMNH 291243, 339325, 342340; Ciconiidae: *Anastomus lamelligerus* FMNH 368769, 368770; *Ciconia abdimii* FMNH 368771; *C. ciconia* FMNH 105326, 105490, 339238; *C. episcopus* FMNH 339236; *Ephippiorhynchus senegalensis* FMNH 347517, 348120; *Jabiru mycteria* FMNH 104641; *Leptoptilos crumeniferus* FMNH 104722, 339240, 339242; *Mycteria americana* FMNH 339223, 339227, 339229; Scopidae: *Scopus umbretta* FMNH 313094, 339244, 339245; Threskiornithidae: *Ajaia ajaja* FMNH 104676; *Plegadis falcinellus* FMNH 104701, 339209, 339211; *Threskiornis aethiopicus* FMNH 290001, 330191, 360126.

## SYSTEMATIC PALEONTOLOGY

Order Ciconiiformes Bonaparte, 1854

Family Ciconiidae Gray, 1840

Gen. et sp. indet. (Fig. 2)

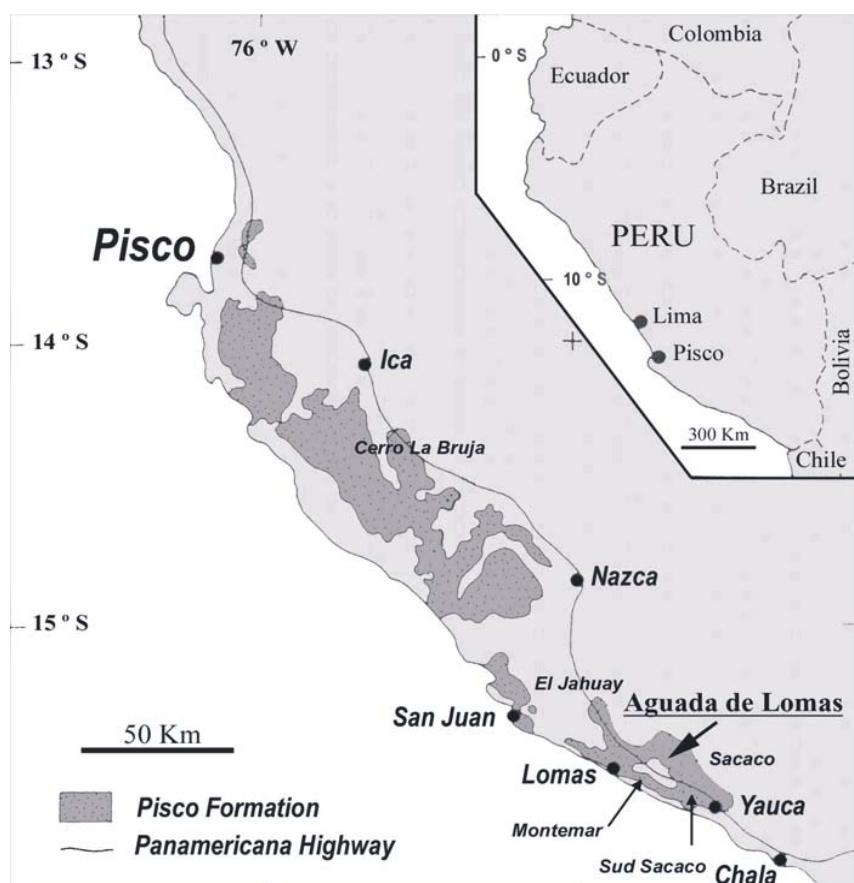


Figura 1.- The Pisco Formation. After Muizon & DeVries (1985)

## REFERRED MATERIAL

MUSM 255 left tarsometatarsus broken into three fragments, from the Aguada de Lomas vertebrate locality, Pisco Formation, Department of Arequipa, South-central coast of Peru. Collected by M. Urbina.

## MEASUREMENTS

Proximal width: 20 mm.; width at half shaft: near 9.1 mm. The three fragments together have a length of 210 mm, but the bone was longer.

## REMARKS

The specimen (Fig. 2) consists on an incomplete left tarsometatarsus broken into three fragments, with the epiphyses partially eroded. In the proximal region, calcaneal ridges of the hypotarsus are damaged. In the distal region, the trochleas for metatarsi II and IV are missing; the trochlea for metatarsi III only possesses its dorsal side. The tarsometatarsus of Ciconiids is diagnosed by the presence of the following characters: (1) A furrow in the external side of the intercotylar prominence (Fig. 2A); (2) A high intercotylar prominence, with a rounded region facing to the external side; (3) A very marked tuberculum for the *fibularis brevis* muscle (Fig. 2C); (4) The foramen vasculare distale is at the same level or very near of the proximal end of the trochlea III; (5) Distal region flared with the trochlea III anterior to the II and IV. The specimen MUSM 255 possesses all the preceding diagnostic characters of Ciconiidae with the exception of the fourth. MUSM 255 possesses a distal foramen that is far from the proximal end of the trochlea III. The *fibularis brevis* muscle tuberculum is more developed than in the other members of the family. Due to the fragmentary nature of the specimen, it was impossible to place it in a lower taxonomic category than family or to give some hint about its relationships with the extant members of the family. It is possible through measurement of the epiphysis width to say that MUSM 255 appears to have medium to large sized stork. It is difficult to estimate the total length of this tarsometatarsus (and also the size of the bird), since there is no direct relationship between both dimensions.

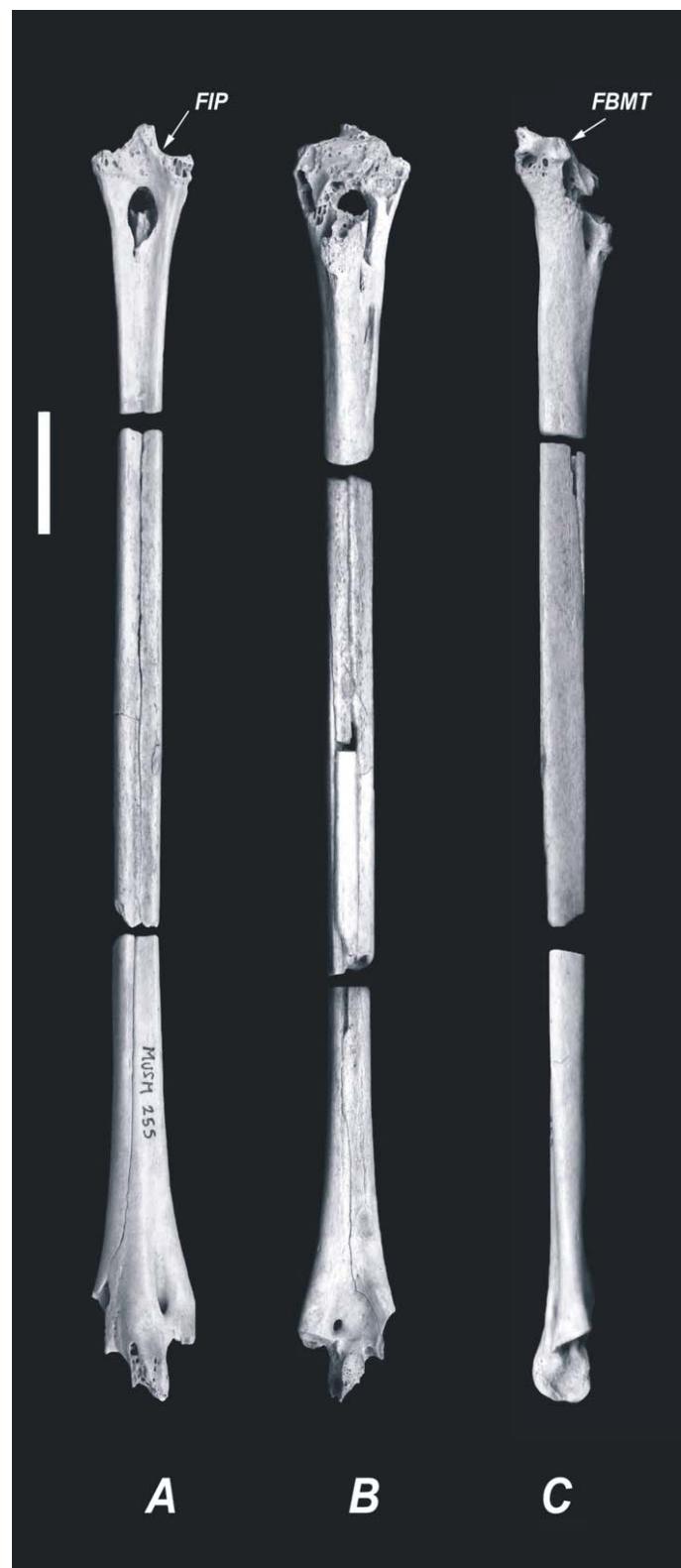


Figura 2.- Tarsometatarsus of Ciconiidae indet. (MUSM 255) of the Pisco formation, Peru. Scale bar: 20 mm. A: dorsal aspect; B: plantar aspect; C: lateral aspect. FIP: Furrow in the external side of the intercotylar prominence; FBMT: Fibularis brevis muscle tuberculum

## DISCUSSION

This is the first report of a Ciconiidae for the Pisco Formation, where ten avian families had previously been registered: Sulidae, Spheniscidae, Phalacrocoracidae, Procellariidae, Pelagornithidae, Pelecanidae, Diomedeidae, Vulturidae, Laridae and Scolopacidae (Stucchi & Urbina, 2005). For the Aguada de Lomas locality, where the MUSM 255 was found, only the first four families were previously mentioned. Marocco & Muizon (1988) proposed that this locality represent a paleoenvironment of open sea and turbulent beach. This is supported by the presence of broken mollusks shells, dissociated skeletons and smooth and isolated bones, like MUSM 255. Little is known about the coastal environment of Peru during the Miocene. It is probable that due to the ancestral Humboldt Current (Alpers & Brimhall, 1988) and to the uplift of the Andes, the climate conditions may have been as arid and desert-like than at the present.

It is under such environmental conditions that Ciconiids could occur in Aguada de Lomas. However, these birds travel widely and occur today in a wide ability of habitats, including savannas, forests and deserts. They forage in shallow water for a wide variety of prey (usually small vertebrates such as fish, frogs, snakes, some birds and invertebrates like mollusks and arthropods in not very deep waters). The South American species will also occasionally scavenge around carcasses, like it is the case of the

maribous of the genus *Leptotilos* of Africa and Asia, which can steal scraps from vultures or other carrion feeders, or snatches up morsels that plows dropped (Elliot, 1992).

Based on these arguments and to their scarce presence in the paleontological record, we suggest that this bird was a solitary occasional visitor (as its current relatives) and that discharge the high offer of fish and carcasses coming from the remains of birds, seals and cetaceans that lived in that area. Also, we can suggest that in the past the distribution of the Ciconiidae in the Peruvian territory was wider, like it is possible to appreciate in the fossil record of the Pisco Formation and Talara tar seeps.

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