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Original article

# *Gargantuavis philoinos*: Giant bird or giant pterosaur?

## *Gargantuavis philoinos : oiseau géant ou ptérosaure géant ?*

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**Abstract**

*Gargantuavis philoinos* was described as a giant terrestrial bird on the basis of various postcranial elements (synsacrum and pelvis, femur) from Late Cretaceous (Campanian-Maastrichtian) localities in Southern France. It has recently been suggested that these remains in fact belong to giant pterosaurs. A detailed comparison between bones referred to *Gargantuavis* and the corresponding skeletal elements of pterosaurs reveals considerable differences and confirms the avian nature of *Gargantuavis*. The broad pelvis of *Gargantuavis* is similar to that of various extinct graviportal terrestrial birds.


*Keywords:* *Gargantuavis*; Aves; Pterosauria; Late Cretaceous; France

**Résumé**

*Gargantuavis philoinos* a été décrit comme un oiseau géant terrestre à partir de divers éléments postcrâniens (synsacrum et bassin, fémur) de plusieurs gisements du Crétacé supérieur (Campanien-Maastrichtien) du Sud de la France. Il a récemment été suggéré que ces restes appartiennent en fait à des ptérosaures géants. Une comparaison détaillée entre les os rapportés à *Gargantuavis* et les éléments squelettiques correspondants de ptérosaures révèle des différences considérables et confirme la nature avienne de *Gargantuavis*. Le bassin élargi de *Gargantuavis* est similaire à celui de divers oiseaux terrestres éteints de type graviporteur.


*Mots clés :* *Gargantuavis* ; Aves ; Pterosauria ; Crétacé supérieur ; France

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## 1. Introduction

The presence of a giant bird in the Late Cretaceous of Southern France was first reported by Buffetaut et al. (1995) on the basis of a synsacrum fragment from Fox-Amphoux, in Provence. Subsequently, Buffetaut and Le Loeuff (1998) described a new taxon, *Gargantuavis philoinos*, on the basis of a pelvis and a referred femur from two Late Cretaceous localities (Campagne-sur-Aude and Villespassans) in Languedoc. All currently known *Gargantuavis* specimens are from localities of Late Campanian to Early Maastrichtian age. *Gargantuavis philoinos* was described as an ostrich-sized bird showing various primitive characters suggesting that it was a relatively basal, non-ornithurine form.

Although the avian nature of *Gargantuavis* has been accepted by various authors (e.g. Feduccia, 1999; Donaire and López-Martínez, 2009; Paul, 2002; Sarjeant and Currie, 2001), Mayr (2009, p. 21) quoting a personal communication from Worthy, suggested "a possible pterosaurian identity of *Gargantuavis*". This suggestion is discussed in the present paper.

## 2. Purported pterosaur characters in *Gargantuavis*

The main supposedly pterosaur-like character in *Gargantuavis*, according to Worthy and Mayr, is the "cranially positioned acetabular foramen" (Mayr, 2009, p. 21). *Gargantuavis philoinos* indeed has an acetabulum that is located relatively far forward relative to the fused vertebrae of the synsacrum. As noted by Buffetaut and Le Loeuff (1998), the acetabulum is in an anterior position relative to the synsacrum, being placed at the level of the 3$^{rd}$ and 4$^{th}$ synsacral transverse processes. However, this cannot be considered as a pterosaurian character, as pterosaurs do not show a particularly forward-located acetabulum. For instance, in the large Late Cretaceous genus *Pteranodon*, which, like *Gargantuavis*, has a synsacrum consisting of 10 fused vertebrae, the acetabulum is located in a very posterior position, at the level of the 7$^{th}$ synsacral vertebra (Eaton, 1910; Bennett, 2001). In the nyctosaurid *Muzquizopteryx* (Frey et al., 2006), the acetabulum is apparently in a somewhat more anterior position, being described as being at the level of the 4$^{th}$ or 5$^{th}$ synsacral vertebra, the synsacrum containing at least 8 vertebrae. Nevertheless, the acetabulum of *Muzquizopteryx* is in a posterior position relative to the pelvis as a whole, as shown by the figures in Frey et al. (2006). Generally, pterosaurs thus have a posteriorly located acetabulum, relative to both the synsacrum and to the pelvis in general, because the ilium has a long anterior blade (see Wellnhofer, 1978, for illustrations of pterosaur pelves and synsacra showing this condition). This is very different from the condition in *Gargantuavis* (Fig. 1).

Mayr (2009), p. 21 drew attention to the fact that *Gargantuavis* remains come from sites which also contain pterosaur remains and noted that "the locality [of *Gargantuavis*] also yielded remains of very large azhdarchid pterosaurs, whose femur and pelvis are still unknown". In fact, the Bellevue locality which has yielded the type synsacrum and associated pelvis of *Gargantuavis philoinos* has provided only very poorly preserved pterosaur material (Buffetaut, 1998, 2008), which does not indicate very large forms. An azhdarchid humerus (Buffetaut et al., 2006) is known from the locality at Fox-Amphoux which yielded the first specimen of a giant bird from the Late Cretaceous of France, but again this humerus does not indicate a giant form. The only really huge azhdarchid specimen (a cervical vertebra suggesting a 9 m wingspan) hitherto reported from France comes from a younger, Late Maastrichtian locality at Mérigon, in Ariège (Buffetaut et al., 1997).

Mayr (2009) contention that the femur and pelvis of very large azhdarchids are still unknown is only partly correct. A femur of a very large pterosaur from the Maastrichtian of Romania, probably