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# Who discovered the Phorusrhacidae? An episode in the history of avian palaeontology

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**Abstract** — Remains of giant predatory ground birds were first discovered in the Tertiary of Argentina at the end of the 1880s, within the context of a bitter competition between Florentino Ameghino (and his brother Carlos) and Francisco Pascasio Moreno, then director of the newly founded Museo de La Plata. The early stages in the discovery and description of the Phorusrhacidae were characterised by misidentifications, hurried publications, undue multiplication of taxa and a general climate of mutual distrust and hostility. One of the few positive points of the feud between Ameghino and Moreno was that it led to several palaeontological expeditions to southern Argentina, which resulted in the discovery of large quantities of important fossils. In many respects, the competition between the Argentinian palaeontologists parallels the well-known feud between E.D. Cope and O.C. Marsh, which took place in the United States at roughly the same time.

**Key words:** Phorusrhacidae, History, Argentina, Ameghino, Moreno, Mercerat

## Introduction

At the end of the 19th century, the discovery of giant predatory flightless birds in the Cenozoic of South America attracted much attention in the palaeontological community and beyond, and can be considered as an important episode in the history of avian palaeontology. These birds are now generally known as Phorusrhacidae, although other names (*e.g.*, Stereornithes) were once used. They are mainly known from South America, with a record ranging from the Palaeogene to the Pleistocene (Alvarenga & Höfling 2003; Agnolin 2009; Alvarenga *et al*. 2011; Tambussi & Degrange 2013), and have also been reported from the Plio-Pleistocene of North America (Brodkorb 1963) and the Eocene of Africa (Mourer-Chauviré *et al*. 2011); they appear to be present in the Eocene of Europe as well (Angst & Buffetaut 2012). Reports of phorusrhacids from Antarctica were considered as unfounded by Cenizo (2012) and Tambussi & Degrange (2013). The first specimens were discovered in southern Argentina at the end of the 1880s, under rather peculiar circumstances. At that time, Argentine palaeontology was marked both by remarkably successful expeditions in various parts of the country, notably Patagonia, which revealed hitherto completely unknown vertebrate faunas, and by an acute feud between two of the leading Argentine researchers of the time, Florentino Ameghino and Francisco Pascasio Moreno. The discovery of the phorusrhacid birds is part of this wider story. Although its main outlines have been discussed in various reviews of the Phorusrhacidae (Alvarenga & Höfling 2003; Agnolin 2009), an examination of publications and correspondence by the protagonists



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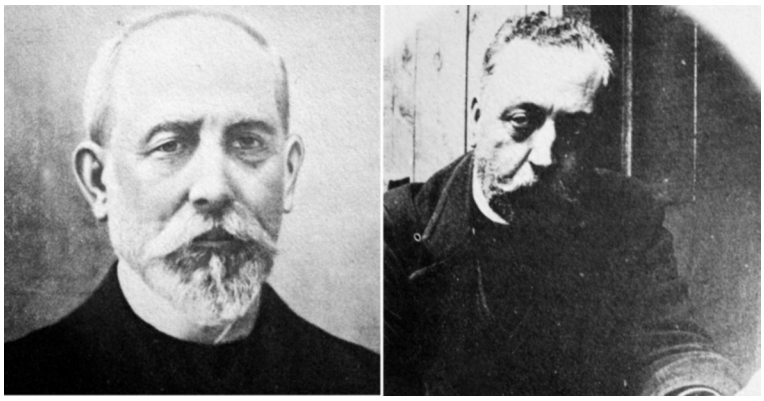

**FIGURE 1.** Florentino Ameghino (left) and Carlos Ameghino (right).

revealed various hitherto overlooked interesting points which are the topic of the present paper. For easier reading, quotations of papers in Spanish or French have been translated into English by the author.

## The institutional and personal background

The palaeontological potential of southern Argentina had been revealed by Charles Darwin during the voyage of the Beagle, when, in 1833, he discovered important fossil vertebrate localities in the vicinity of Bahía Blanca (Darwin 1839). However, although subsequent travellers did occasionally collect fossils in Patagonia, it was not until the 1880s that systematic palaeontological research began to be carried out in what was then a remote and only partly explored part of Argentina.

This new development was largely a consequence of the establishment of the Museo de La Plata, a modern scientific institution that was launched in the then recently founded capital of Buenos Aires province thanks to an initiative of Francisco Pascasio Moreno (1852–1919), an active scientist, explorer and administrator, who had travelled extensively in Patagonia in the 1870s. Palaeontological research at the Museo de La Plata really started in 1886, when Moreno hired Florentino Ameghino (1854–1911) as subdirector and secretary of the museum. Although largely self-taught, Ameghino was a brilliant palaeontologist who had already made a name for himself internationally through his work on the fossil mammals of Argentina — although some of his interpretations were markedly idiosyncratic (for a recent biography of Florentino Ameghino, see Casinos, 2012). Throughout his scientific career, Florentino Ameghino was seconded by his younger brother Carlos Ameghino (1865–1936), who from 1887 to 1903 conducted a total of 15 expeditions to Patagonia, in the course of which he collected a huge number of fossil vertebrate specimens which were described by his elder brother.

Carlos Ameghino had been employed by Moreno at the same time as his brother, as "travelling naturalist" for the Museo de La Plata. In that capacity, he was sent to southern Patagonia in January, 1887, to collect fossils, notably from localities that had been found by Moreno during some of his earlier visits to the Santa Cruz area (Ameghino 1887). Carlos's trip was enormously successful in terms of the number of fossils, mostly representing completely new taxa, that he collected. By the time he came back to La Plata in September, 1887, however, relations between his brother and Moreno had begun to deteriorate, for reasons involving both bureaucratic problems and a clash of personalities that have been discussed by various authors (Fernicola 2011; Casinos 2012). In January 1888, Florentino Ameghino resigned from his position at the Museo de La Plata, and in February of the same year, he was officially dismissed from it. In addition, access to the palaeontological collections was denied him, although he had provided a large part of them.

From then on, and until he finally became director of the Museo Argentino de Ciencias Naturales in Buenos Aires in 1902, Florentino Ameghino

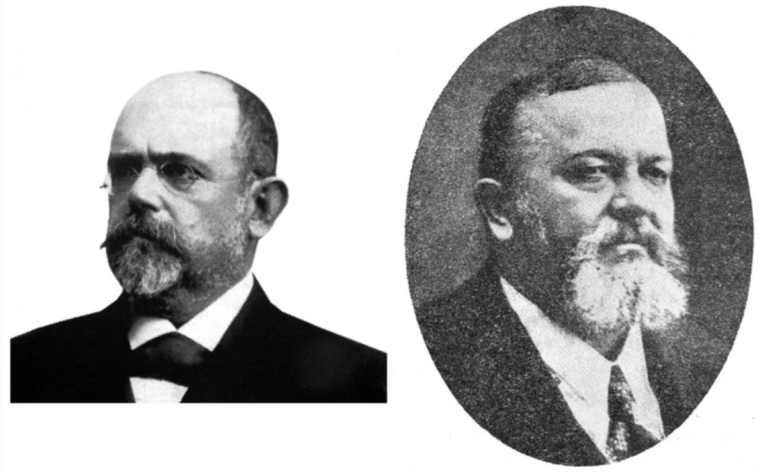

**FIGURE 2.** Francisco Pascasio Moreno (left) and Alcides Mercerat (right).

carried out his palaeontological researches without any permanent official support, which did not prevent him from sending his brother Carlos (who had left the Museo de La Plata together with him) on new collecting expeditions to Patagonia. Funding for them was provided by the book and stationary shop Florentino and his brother Juan ran in La Plata, supplemented by the occasional sale of fossil collections to European institutions (Casinos 2012). Meanwhile, competing expeditions were sent from the Museo de La Plata to Patagonia by Moreno, each trying to collect and describe as many new fossils as possible, before the hated competitor could do so (a situation rather reminiscent of the well-known feud between E.D. Cope and O.C. Marsh in North America at roughly the same time). It is within this peculiar scientific framework of intense competition that the discovery of the Phorusrhacidae took place.

### *Phorusrhacos*, an edentulous mammal?

When Carlos Ameghino came back from his first expedition to Patagonia in September 1887, he brought with him a considerable collection of fossil vertebrates, mainly from the Santa Cruz beds (now known to be Miocene in age, at that time considered as Eocene by Florentino Ameghino). In his own words, Florentino Ameghino worked "day and night" to produce preliminary descriptions of more than 120 species of fossil mammals collected by his brother, which were ready by 18th November, 1887 (Ameghino 1887). Possibly his relations with Moreno had already deteriorated and he wished to establish priority for the new taxa as quickly as possible — in any case he was in the habit of publishing very preliminary descriptions at a fast rate. Among the specimens described as new taxa was an incomplete large, edentulous lower jaw, which Ameghino placed among the Edentata under the heading "genera incertae sedis". He called the new taxon *Phorusrhacos longissimus* and stressed its considerable size and complete lack of teeth.

In 1889, Florentino Ameghino published a huge monograph on the fossil mammals of Argentina, partly based on material collected by Carlos in Patagonia in 1887, which should have been deposited in the Museo de La Plata, but apparently was appropriated by Florentino, and ultimately found its way into the Museo Argentino de Ciencias Naturales in Buenos Aires (Fernicola 2011). In that work, Ameghino (1889) described in more detail the mysterious toothless jaw. He emended the generic name to *Phororhacos* (however, the original spelling *Phorusrhacos* has priority and must be used, see Brodkorb 1963) *Phorusrhacos longissimus* was placed in a family of its own, the Phororhacosidae (later emended to Phorusrhacidae by Brodkorb 1963), itself placed among the Edentata and considered as completely extinct. Ameghino noted that the toothless tip of the jaw must have been covered by a horny sheath, similar to the beak of birds and turtles. No illustration was provided. On the basis of the first specimen discovered by Carlos

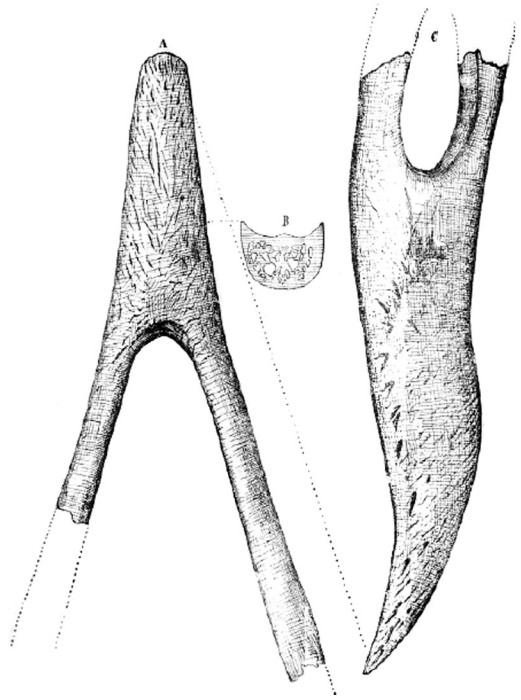


**FIGURE 3.** The type specimen of *Phorusrhacos longissimus* Ameghino, 1887: a lower jaw in ventral view (A), cross-section (B) and left lateral view (C), after Ameghino (1891a). The specimen was found in the Santa Cruz Formation of southern Patagonia by Carlos Ameghino in 1887.

Ameghino, the Phorusrhacidae were thus first interpreted by his brother Florentino as edentulous mammals.

It should be added that as late as June 1891, in a paper describing the characters of fifty new species of fossil mammals from Argentina, Florentino Ameghino described and figured a jaw fragment collected by Carlos in Patagonia as belonging to a new ground sloth, which he called *Tolmodus inflatus* (Ameghino 1891a). Only two months later, he reinterpreted it as a giant bird.

## Moreno's large birds from Monte Hermoso and southern Patagonia

As noted above, after Florentino and Carlos Ameghino left the Museo de La Plata at the beginning of 1888, Moreno continued the palaeontological exploration of Argentina by sending parties from the museum to various fossil-bearing areas. Thus was accumulated a vast collection which in many ways paralleled that brought together by Carlos Ameghino from Patagonia. Moreno was fully aware of Carlos's continuing collecting activities, and in order to gain priority over his rivals, between 1888 and 1891 he published a number of brief reports on the development of the Museo de La Plata and especially the new palaeontological discoveries made by its teams of field researchers. Thus, in 1888, he published a preliminary report on the activities of the museum during the first semester of 1888. In it, he emphasized the discoveries made at Monte Hermoso, a locality on the south-eastern coast of Buenos Aires province (therefore not properly speaking in Patagonia) that had already been visited by Darwin, and more recently by Florentino Ameghino in 1887. There, fossiliferous beds now known to be Pliocene in age yielded an abundant vertebrate fauna. In his 1888 report, Moreno described in some detail the mammal assemblage and simply noted (Moreno 1888: p. 8) that 'large birds' ('grandes pájaros') were also present. This seems to be the first mention of giant birds in the Tertiary of South America.

In a later paper, Moreno (1889) provided more details about the large birds from Monte Hermoso. He mentioned that he had some remains of an enormous bird which he considered as "the largest to have taken flight in the South American region" (Moreno 1889: p. 29), and comparable only with *Gastornis* from Meudon (a giant flightless bird, at that time known mainly from fragmentary specimens from the Early Tertiary of Europe: see Buffetaut 1997). The available material consisted of part of a tibiotarsus, a fibula, parts of the femur and humerus and a cervical vertebra. The fragmentary tibiotarsus was 37 cm long and similar in size to that of an African ostrich. Moreno thought that these bones belonged to a "palmipedo lemelirostro" [*sic*] ("palmipèdes lamellirostres" was the name used by, among others, the French zoologist Alphonse Milne-Edwards (1835–1900) for the group comprising ducks and swans). For this giant bird, he coined the name *Mesembriornis Milne Edwardii* [sic], in honour of Milne-Edwards, the author of a monumental work on French fossil birds. That material from Monte Hermoso was described and figured two years later by Moreno & Mercerat (1891). In addition, Moreno (1889) reported a second new bird taxon from Monte Hermoso,

based on an incomplete tarsometatarsal, which he called *Palaeociconia australis* and considered as a ciconiid. Alvarenga & Höfling (2003) consider *Palaeociconia* as a junior synonym of *Mesembriornis*.

Although Moreno was mistaken about both the flight capabilities and the systematic position of the giant birds from Monte Hermoso, he was the first to clearly identify giant birds in the vertebrate faunas from the Tertiary of Argentina. Furthermore, in a report on the acquisitions and scientific results of the Museo de La Plata in 1889, Moreno (1890–1891) briefly mentioned that from October 1888 to August 1889 a party from the museum, led by Santiago Pozzi and Clemente Onelli, had explored fossil localities discovered by himself along the Rio Santa Cruz, in southern Patagonia. Among their most extraordinary finds were remains of giant birds. One of them, according to Moreno, was larger than the largest living bird, the African ostrich. Another one was even larger and apparently had affinities with the dinornithids of New Zealand, being as large as or larger than them. It therefore appears that by the end of 1889, Moreno had obtained phorusrhacid remains not only from Monte Hermoso, but also from southern Patagonia and soon thereafter had identified them as belonging to giant birds.

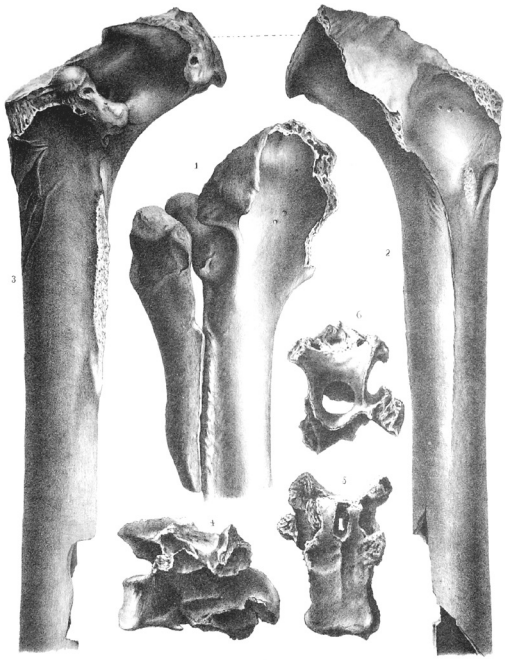

**FIGURE 4.** Bones of the giant bird *Mesembriornis* (tibiotarsus, fibula and vertebra) from Monte Hermoso, first reported by Moreno (1888, 1889), as figured by Moreno & Mercerat (1891).

### *Phorusrhacos* as a bird?

Although Florentino Ameghino tried to hide this fact as much as possible in the papers he published in the early 1890s, the Ameghino brothers were at first much puzzled by Moreno's announcement of the discovery of giant birds in the Tertiary of Argentina. This is clearly shown by passages from the correspondence between Florentino and Carlos during some of the latter's early trips to Patagonia (Torcelli 1935a, b; Chiarelli 2006). A letter sent by Carlos from Rio Gallegos on 23rd December, 1890, during his long fourth expedition, is especially revealing. In it, Carlos first reflected on the position of *Phororhacos*, of which he had found an additional, more complete beak, and concluded that it was "an enigmatic animal". He clearly had read Moreno's 1889 paper, and went on to note (Torcelli 1935a: p. 181; Chiarelli 2006: p. 86):

> *"Moreno's large fossil birds, which so much puzzled us (Mesembriornis, etc.) have also appeared. They are indeed gigantic birds, some of them perhaps as large as the Gastornis. Could not the beak of Phororhacos belong to one of these birds?"*

Carlos, whose knowledge of anatomy and palaeontology was far from negligible, as shown by many of his letters to his brother, was thus the first to suggest that the mysterious *Phorusrhacos* was not a mammal, but a bird. However, he at first failed to convince his elder brother. In a reply sent from La Plata on 30th January, 1891 (Torcelli 1935b: p. 10), the latter wrote:

> *"The possibility that the beak of Phororhacos belongs to a gigantic bird seems unlikely to me; because if it was so, they would be birds from groups completely distinct from those we presently know and without any relationship with the gigantic birds from Madagascar and New Holland. Personally, I tend to believe*

*that it may well belong to an extinct giant monotreme".*

It is difficult to decide what exactly led Florentino to change his mind, but he obviously did so during the first few months of 1891. A new discovery made by Carlos later during his fourth trip to Patagonia may have contributed to this change of interpretation. In a letter sent from Santa Cruz on 28th April, 1891 (Torcelli 1935b: p. 19), he mentioned:

*"A complete beak of Phororhacos, with which the head was also present, but could not be preserved. As measured in the field, it was 3 spans [about 69 cm] long".*

This is clearly the specimen of *Phorusrhacos longissimus* described in detail by Florentino Ameghino in 1895, about which he mentioned that "the skull which accompanied that mandible could not be preserved; it fell into small pieces" (Ameghino 1895: p. 12).

The complete mandible, with its fairly well preserved articular regions, was clearly avian and could not be mistaken for that of a mammal. However that may be, in several papers published in 1891 in the *Revista Argentina de Ciencias Naturales*, a journal he co-edited and which served as a convenient outlet for his abundant scientific production, Florentino Ameghino not only mentioned his brother's discovery of giant bird remains in Patagonia, but also completely revised his interpretation of both *Phorusrhacos* and *Tolmodus* (see below).

Carlos's discovery was mentioned in the "correspondence, travels and explorations" section of the *Revista Argentina de Ciencias Naturales*. In it, Florentino published (supposedly on 1st April, 1891) excerpts from the above-mentioned letter sent to him by Carlos on 23rd December, 1890 (C. Ameghino 1891), dealing with the "exploration of the fossiliferous deposits of southern Patagonia". While the section about the enigmatic nature of *Phororhacos* was reproduced almost *verbatim*, the part about fossil birds was printed with revealing changes (C. Ameghino 1891: p. 121), as follows:

*"The large fossil birds that so much puzzled me have also appeared. They are indeed gigantic birds, some of them perhaps as large as the Epiornis [sic]".*

As can be seen, all mention of Moreno and his *Mesembriornis* had been deleted, as well as the question about *Phorusrhacos*. One can only suspect that Florentino Ameghino thus tried to deny Moreno any role in the discovery of the giant fossil birds of Argentina and to deflect attention from his misidentification of the *Phorusrhacos* jaw (perhaps the fact that his brother had been right about its avian nature, while he himself doubted it, was not a pleasant memory. Replacing "us" by "me" may reflect this). Why he chose to replace *Gastornis* by *Aepyornis* is unclear. Perhaps the huge recently extinct bird from Madagascar was more impressive than the poorly known *Gastornis*. Having tampered with Carlos's letter, Florentino later used it to claim priority for the discovery of the giant birds. In 1895, in a review of the fossil birds from Patagonia, he wrote that the first mention of the giant birds had been published by his brother Carlos in the above-mentioned 1891 note in the *Revista Argentina de Ciencias Naturales* (Ameghino 1895). Ameghino was rather disingenuous about this, since Moreno's mentions of the giant bird *Mesembriornis* from Monte Hermoso (Moreno 1888, 1889) and of huge fossil birds from southern Patagonia (Moreno 1890–1891) antedated the publication of Carlos's discoveries in southern Patagonia — as clearly shown by Carlos's December 1890 letter in which he mentioned Moreno's work.

Be that as it may, Florentino went on to reinterpret *Phorusrhacos* and *Tolmodus* in the light of the recent discoveries of giant bird remains. In a paper on new discoveries and reinterpretations of fossil mammals and birds, published in August, 1891 (Ameghino 1891a), he admitted that he had erroneously referred both to the Edentata, but that his brother's discoveries in Patagonia had convinced him of his error. He gave a longer description of *Phorusrhacos longissimus* (as "*Phororhacos*"), including the original mandible, which was figured for the first time, and various other bones such as several post-cranial elements (as well as the above-mentioned skull that had crumbled before it could be collected).Two addi-

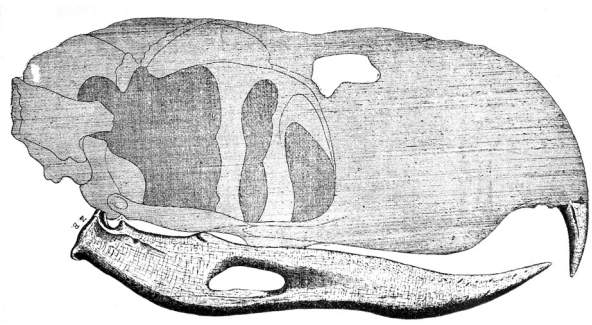

**FIGURE 5.** The *Phorusrhacos longissimus* specimen discovered by Carlos Ameghino in 1891, as illustrated by Florentino Ameghino (1895: Fig. 8). Except for the hook-like tip of the beak, the skull crumbled before it could be collected and was thus shaded on Ameghino's figure.

tional species of the genus (*P. Shenensis* and *P. delicatus*) were briefly described, and *Tolmodus inflatus* was referred to it, too, as *Phororhacos inflatus*. Ameghino added that these birds belonged to a family (previously considered by him as mammalian), the Phororhacosidae, which he was unable to place more precisely in avian classification. As to their size, he considered that by comparison with them the *Dinornis* from New Zealand were "dwarfs". Clearly, Florentino Ameghino was in a hurry to claim priority for as many giant bird taxa as possible, and he had good reason for that, as Moreno at that time was working on an ambitious editorial project concerning fossil birds.

### Moreno and Mecerat's *magnum opus* and Ameghino's counter-attack

To replace Florentino Ameghino as subdirector and secretary of the Museo de La Plata, Moreno had hired a Swiss geologist, by the name of Alcides Mercerat (Vignati 1936). Although many aspects of his life remain obscure (including his date of birth; he died in 1934), both his personality and his contributions to the geology and palaeontology of Argentina have generally not been highly regarded (see Simpson 1984 and Casinos 2012 for details). Having been replaced at the Museo de La Plata by Santiago Roth in 1895, he eventually stopped his scientific activities to become a surveyor. In 1891, Moreno & Mercerat published in the *Anales del Museo de La Plata* a catalogue of the fossil birds of the Republic of Argentina, in the form of a large bilingual (Spanish and French) monograph, notable among other things for the huge size of its plates, which show the bones of various giant birds at their natural size (Moreno & Mercerat 1891). Moreno and Mercerat seized the opportunity to comment unfavourably on Florentino Ameghino's work, and did not fail to note that the latter had misidentified *Phororhacos* as a mammal. Although various types of fossil birds, including penguins and rheas, were described, much of the volume was devoted to phorusrhacids (for which the authors used the name "Stereornithes"). Besides a few already published taxa (including Ameghino's *Phorohacos longissimus*, with the type dentary incorrectly interpreted as a premaxilla) the catalogue included a large number of new ones, many of which based on very fragmentary material and of doubtful validity — a fact Ameghino was quick to point out, although he also was wont to erect new taxa on the basis of rather flimsy evidence. The fact that Moreno & Mercerat's large monograph was published hardly two years after Moreno's first mention of giant birds (from Monte Hermoso) shows that within that short time interval the collectors from the Museo de La Plata (including, for a time, Carlos Ameghino) had been very successful in their quest for avian fossils, mainly in Patagonia.

While Carlos was continuing his explorations in Patagonia, Florentino lost no time in launching a counter-attack against Moreno & Mercerat. At the end of 1891, he published in the *Revista Argentina de Ciencias Naturales* an "enumeration of the fossil birds from the Republic of Argentina" (Ameghino 1891b), which began with a fierce criticism of Moreno & Mer-

cerat's work. According to Ameghino, that work was completely worthless and merely illustrated Moreno's megalomania. Most of the illustrations were of poor quality and the descriptions were "an innumerable succession of mistakes". Ameghino went on to provide a list of fossil birds from Argentina, never missing an opportunity to remind the reader that specimens described by Moreno & Mercerat were part of his "old collection" (which he had sold to the Museo de La Plata) or had been collected by his brother Carlos when he was working for the museum. A large part of the enumeration was devoted to phorusrhacids (which were placed among the ratites), Ameghino claiming that several of the taxa erected by Moreno & Mercerat in fact were junior synonyms of genera and species he had erected in several of his earlier publications. Thus, *Mesembriornis* and *Patagornis* were considered as junior synonyms of "*Phororhacos*", etc. As to the smaller form called *Psilopterus* by Moreno & Mercerat, Ameghino claimed that the name was preoccupied and proposed *Pelecyornis* as a substitute. With this paper, Florentino Ameghino clearly tried both to reassert his position as the leading expert on the fossil birds of Argentina and to demonstrate the utter lack of scientific significance of Moreno & Mercerat's work.

Curiously enough, there was no immediate reaction from Moreno & Mercerat to Ameghino's attack on their bird monograph. In 1895, Florentino Ameghino published one more paper on the topic, viz. a long bilingual (Spanish and French) review of the fossil birds of Patagonia, in which he provided more complete descriptions of the various taxa he had briefly mentioned in his 1891 papers, illustrated with accurate drawings of many specimens (Ameghino 1895). In the introduction to this work, he noted that the first mention of the existence of these giant birds had been made by his brother Carlos in his note of 1st April, 1891 in the *Revista Argentina de Historia Natural* (based on a letter which had been seriously tampered with by Florentino — see above). In fact, as noted above, Moreno had reported giant birds from Monte Hermoso as early as 1888, and had mentioned the discovery of enormous birds in southern Patagonia in a report on the activities of the Museo de La Plata for 1889, dated 1890–1891 (see above). Carlos had indeed found phorusrhacid remains in Patagonia as early as 1887, but, as mentioned above, Florentino had misinterpreted them as mammalian. He went on to claim that he had been the first to give descriptions and an illustration of some of these giant birds in his 1891 paper (Ameghino 1891a), which, according to him, had been published on 1st August, 1891. According to Ameghino's interpretation of publication chronology, Moreno & Mercerat's catalogue had appeared only "toward the end of the month" (August). Therefore, that catalogue not only was of poor scientific value (as Ameghino was pleased to remind his readers), it had also been published *after* Ameghino's own descriptions and names of giant birds, which therefore had priority over the names given by Moreno & Mercerat. This, as Ameghino noted, had already been pointed out in his December, 1891 paper on fossil birds (Ameghino 1891b).

This new paper by Florentino Ameghino eventually prompted a reaction by Mercerat, who in 1897 published a paper on fossil birds in which he thoroughly disagreed with the publication dates provided by Ameghino in his 1895 paper (Mercerat 1897). According to him, the text of the catalogue of fossil birds by Moreno & Mercerat had been published in May 1891, and the plates on 5th August. As to Ameghino's paper, it had been published on 11th August, not 1st August as claimed by its author. Mercerat even claimed that Ameghino had been seen perusing the text and plates of the catalogue at the Museo Argentino de Ciencias Naturales in Buenos Aires a few days before his own paper appeared in print. According to this chronology, Moreno & Mercerat clearly had priority over Ameghino. The dates provided by Mercerat have been accepted by some recent authors (*e.g.*, Alvarenga & Höfling 2003). Independent evidence would be useful to confirm Mercerat's assertions, as there is some evidence of unethical behaviour (including swindling) on his part (Simpson 1984; Vizcaíno *et al*. 2012).

**The end of the controversy**

The feud about giant fossil birds between Ameghino and Moreno & Mercerat seems to

have petered out after 1897. A final paper on Stereornithes by Mercerat (1899), who was soon to stop his palaeontological researches, was essentially a reply to a review of the giant birds from Patagonia by the German palaeontologist Andreae (1899), some parts of which he did not agree with. As to Ameghino, he no longer had much avian material to work on, because in 1896 he had sold most of his fossil bird collection to the British Museum (Natural History). It is a well-known fact that between his resignation/dismissal from the Museo de La Plata in 1888 and his appointment as director of the Museo Argentino de Ciencias Naturales in Buenos Aires, Florentino Ameghino's financial situation was precarious, since he lacked any permanent institutional support and had to pay for his brother Carlos's travels in Patagonia (Simpson 1984; Casinos 2012). His stationery and bookshop business can hardly have been sufficient to cover all expenses, and it was supplemented by the sale of fossils to various European institutions (Casinos 2012). As recounted in detail by Casinos (2012), in 1895 Ameghino wrote to the director of the British Museum (Natural History), William Henry Flower, explaining that he was now concentrating on fossil mammals and was ready to sell his fossil bird collection, in order to support further work in Patagonia, for which he was short of funds. After some discussion about the sum requested by Ameghino (he eventually received 350 £), the collection was purchased by the London museum and arrived there in 1896. A few years later, this resulted in a monograph on the partial skeleton of "*Phororhacos inflatus*" by Andrews (1899). As pointed out by Casinos (2012), ten years later, once he had become director of the Museo Argentino de Ciencias Naturales, Ameghino had cause to regret the sale of his fossil bird collection, when he had to be content with a cast of that skeleton sent by the British Museum (Natural History) as part of an exchange of specimens.

By the end of the 1890s, Moreno and Mercerat had virtually ceased their palaeontological activities (Moreno left the Museo de La Plata in 1906 because he disagreed with its incorporation into the University of La Plata and, as mentioned above, Mercerat had turned to surveying). Florentino Ameghino became director of the Museo Argentino de Ciencias Naturales in Buenos Aires in 1902, which relieved him of the financial difficulties he had had to cope with for many years, and he continued his palaeontological researches until his death in 1911, but fossil birds no longer were one of his main fields of interest (he had become increasingly obsessed with his conceptions about the South American origins of most mammal groups, including man — see Casinos 2012). The giant birds of Patagonia were still occasionally mentioned in some of his general papers and books about the palaeontology of Argentina, but he did not publish any original descriptions after his 1895 monograph. Carlos Ameghino went on collecting in Patagonia until 1903. However, except for a letter to his brother dated 28 February 1893 (Torcelli 1935b: p. 47), in which he mentioned the discovery of an intact skull of *Phororhacos* with its mandible (probably that figured by Ameghino 1895: Fig. 1, as *Phororhacos inflatus*, and later sold to the British Museum), there is no indication that he found especially significant phorusrhacid material during his later expeditions. By that time, phorusrhacids had lost much of their novelty, although these spectacularly large and carnivorous birds have remained popular with both palaeontologists and the general public.

## Conclusions

The main stages in the discovery of phorusrhacid birds can be summarised as follows:

Phorusrhacid bones were first discovered by Carlos Ameghino during his first trip to Patagonia, in 1887, but they were misinterpreted as remains of edentulous mammals by Florentino Ameghino.

The first published reports of giant birds from the Tertiary of Argentina were by Moreno in 1888–1889, with notably *Hermosiornis*, from the Pliocene of Monte Hermoso. Moreover, Moreno reported the discovery of giant birds in southern Patagonia as early as 1890–1891.

Carlos Ameghino was the first to realise, in 1890, that *Phorusrhacos* was not a mammal, but a bird, a conclusion that his brother Florentino did not accept until the following year. Florentino Ameghino's initial misinterpretation of phorus-

rhacids may reflect the fact that he was mainly interested in mammals and, at least at the beginning, had relatively little knowledge of fossil birds.

Whatever its shortcomings, the publication of Moreno & Mercerat's catalogue of fossil birds from Argentina in 1891 was a decisive element in the history of research on phorushacids, not only because it contained descriptions and illustrations of many new taxa, but also because it prompted Florentino Ameghino to quickly publish his own descriptions and interpretations of phorushacids.

In their fierce competition for Patagonian fossils, the Ameghino brothers on one side, Moreno and Mercerat on the other, sometimes resorted to rather dubious practices, one of them being the hurried publication of very preliminary and partial results in journals they completely controlled. Florentino Ameghino went even farther when he tampered with one of his brother's letters before he published it, and when he possibly manipulated publication dates to claim priority. All this is of course reminiscent of the feud between E.D. Cope and O.C. Marsh that was taking place in North America at roughly the same time (Shor 1974). As has been pointed out by many authors, the acrimonious competition between Cope and Marsh mostly had unpleasant aspects, but at least led to the discovery and description of large numbers of hitherto unknown fossil vertebrates. Similarly, the harsh competition between Ameghino and Moreno resulted in considerable progress in our knowledge of the extinct vertebrates of Argentina, including the hitherto unsuspected phorusrhacids. That this resulted in extremely tangled synonymy problems, some of which are still unresolved today, must be considered as one of the unwelcome consequences of this feud between two strong personalities.

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