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A new basal iguanodontian (Dinosauria, Ornithischia) from the Upper Cretaceous of Patagonia

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Abstract. We report the discovery of an almost complete skeleton of a new iguanodontian dinosaur, *Talenkauen santacrucensis* n. gen. et sp., from Maastrichtiano rocks of southwestern Patagonia. *Talenkauen* is odd in the presence of plate-like structures on both sides of the thorax, which are better interpreted as uncinate processes than dermal armor. *Talenkauen* and the also Maastrichtian *Thescelosaurus neglectus* Gilmore from North America, represent the only two ornithischians in which this peculiar feature is currently known. Some derived features unite *Talenkauen* with other Gondwanan ornithopods, but all the evidence does not offer enough support for an iguanodontian clade endemic from the Southern Hemisphere. Small- to medium-sized ornithischians appear to have been the dominant plant-eating dinosaurs in Antarctica and Australia during the Cretaceous, in contrast with the outstanding abundance of medium sized to giant sauropods in central Gondwana *(e.g.*, South America, Africa, India).

Resumen. UN NUEVO IGUANODONTE BASAL (DINOSAURIA, ORNITHISCHIA) DEL CRETÁCICO SUPERIOR DE LA PATAGONIA. Se reporta el descubrimiento de un esqueleto casi completo de un nuevo dinosaurio iguanodonte, *Talenkauen santacrucensis* n. gen. et sp., de rocas de edad Maastrichtiano del sudoeste de Patagonia. *Talenkauen* posee placas en ambos lados del tórax, las cuales son interpretadas como procesos uncinados en lugar de armadura dérmica. *Talenkauen* y *Thescelosaurus neglectus* (Maastrichtiano, América del Norte), son los únicos dos ornitisquios en los que se conoce esta peculiar característica. Algunos caracteres derivados unen a *Talenkauen* con otros ornitópodos gondwánicos, pero el conjunto de la evidencia disponible no ofrece sustento suficiente para reconocer un clado de iguanodontes endémico del Hemisferio Sur. Los ornitisquios de pequeño y mediano tamaño parecen haber sido los dinosaurios herbívoros dominantes en Antártida y Australia durante el Cretácico, contrastando con la gran abundancia de saurópodos de mediano a gran tamaño registrada en Gondwana central (p. ej., América del Sur, África, India).

Key words. Dinosauria. Ornithopoda. Patagonia. Cretaceous.

Palabras clave. Dinosauria. Ornithopoda. Patagonia. Cretácico.

Introduction

The list of Cretaceous ornithischians from South America rapidly increased in the last few years thanks to discoveries of bone remains belonging to stegosaurs, ankylosaurs, basal ornithopods and hadrosaurs (*e.g.*, Bonaparte, 1996; Salgado and Coria, 1996; Novas, 1997; Coria, 1999). Particularly, the Cretaceous record includes ornithopod dinosaurs referred as to hypsilophodontids (the Cenomanian *Notohypsilophodon comodorensis* from Bajo Barreal Fm.; Martínez, 1998) and basal iguanodontians (the Cenomanian *Anabisetia saldiviai*, from the Lisandro Fm., and the Campanian *Gasparinisaura cincosaltensis* from the Anacleto Fm.; Coria and Salgado, 1996; Coria, 1999; Garrido, 2000; Coria and Calvo, 2002). Such discoveries were interpreted by Coria (1999) as suggestive that a diverse evolutionary history of ornithopods took place in Gondwana prior to the faunal interchange proposed for the end of the Cretaceous (Bonaparte, 1986).

Here we report the discovery of an almost complete skeleton of a new iguanodontian dinosaur, *Talenkauen santacrucensis* n. gen. et sp. The specimen was recovered from Late Cretaceous beds exposed in the SW corner of Patagonia (figure 1.A), a region poorly explored for dinosaur remains (Novas *et al.*, 2002a). The new basal ornithopod is odd in the presence of plate–like structures on both sides of the thorax, whose anatomical meaning will be discussed below. Also, this new dinosaur provides evidence for an iguanodontian clade endemic to the Southern Hemisphere, when considered with specimens from other regions of Gondwana (*e.g.*, Africa, Australia,

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New Zealand). The new material helps to understand better the adaptive radiation of basal ornithopods in Gondwana and the paleobiogeography of dinosaur faunas at the end of the Mesozoic.

Abbreviations. MPM, Museo Padre Molina, Río Gallegos, Santa Cruz.

Systematic paleontology

Ornithischia Seeley, 1888
Ornithopoda Marsh, 1871
Iguanodontia Dollo, 1888
Euiguanodontia Coria and Salgado, 1996

Genus ***Talenkauen*** Novas, Cambiaso
and Ambrosio n. gen.

Derivatio nominis. "*Talenk*", small, "*kauen*", skull, in Aonikenk Indian language (Moreno, 1997), in reference to the proportionally small head of the animal.

Type species. *Talenkauen santacrucensis* Novas, Cambiaso and Ambrosio n. sp.

Diagnosis. Same as species.

Talenkauen santacrucensis Novas, Cambiaso
and Ambrosio n. sp.
Figures 1.B, C and 2.A, B

Diagnosis. Autapomorphies diagnosing *Talenkauen santacrucensis* include: well–developed epipophysis on cervical 3, and plate–like uncinate processes on the rib cage. The following reversals emerge from the cladistic analysis: lacrimal and premaxilla not in contact, and dentaries convergent rostrally.

Derivatio nominis. *Santacrucensis*, referring to the southern Argentine province of Santa Cruz.

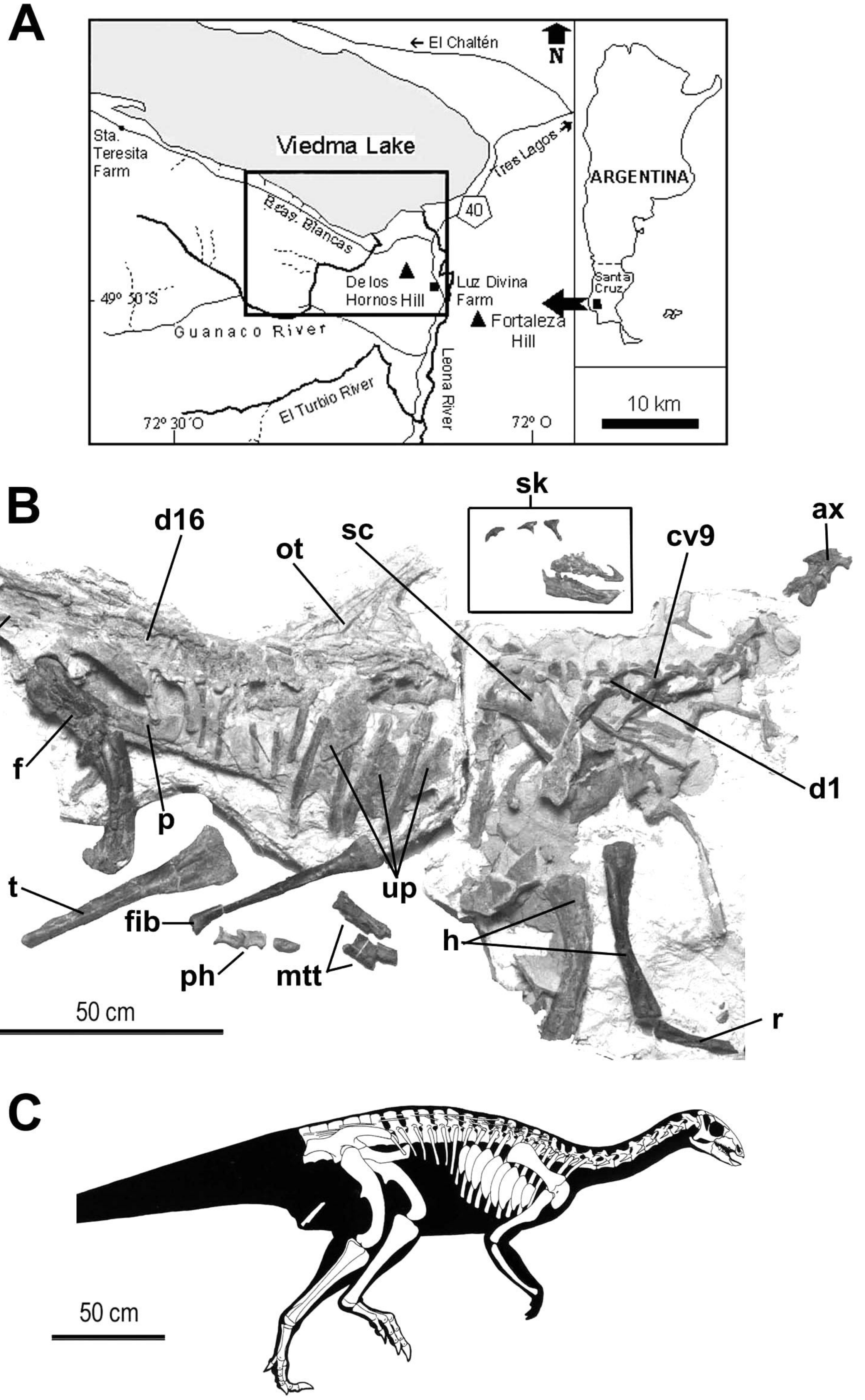
Holotype. MPM–10001, partially articulated specimen preserving rostrum, jaws, and teeth, precaudal vertebral column and ribs, pectoral and pelvic girdles, and fore– and hind limb bones (figures 1.B,C). The specimen was found articulated in a cross–bedded, fining–upward, medium–grained sandstone, interpreted as a fluvial channel body. The material was collected in February 2000.

Locality and horizon. Los Hornos Hill, southern coast of Viedma Lake, Santa Cruz Province, Argentina (Lat. 49° 51' 16.2" S, Long. 72° 06' 26.3" W) (figure 1.A). Pari Aike Fm., Upper Cretaceous, Maastrichtian (Kraemer and Riccardi, 1997; Ambrosio, 2003). This Maastrichtian age is also supported by recently collected samples with foraminifera and dinoflagellates from beds underlying the Pari Aike Formation (Ambrosio, 2003; Ottone and Ronchi, pers. com.), thus superceding previous assumptions for an older age (Novas *et al.*, 20002a). The Pari Aike Fm. also yielded titanosaurid remains of medium to gigantic sizes, as well as fragmentary bones of theropods, crocodiles, and turtles.

Description. The holotype specimen of *Talenkauen santacrucensis* n. gen. et n. sp. (figures 1.B,C) measures no more than 4 meters long, thus representing one of the first large, non–hadrosaurian euornithopod bone remains reported from South America. The head looks comparatively small with respect to body size, being slightly larger than in *Dryosaurus*. The premaxilla (figure 2.A.) is dorsally concave, and defines much of the external nares. Two empty alveoli are indicative of the presence of premaxillary teeth, a plesiomorphic character for an iguanodontian. The posterior process of the premaxilla is elongate, but it does not contact the lacrimal, in contrast with more derived iguanodontians. The maxilla is triangular, with a single dorsal process almost centrally positioned, resembling *Dryosaurus* (Galton, 1983). Worn maxillary teeth are rhomboid in side view, each with a prominent primary ridge on the labial crown surface, representing an euiguanodontian synapomorphy (Coria and Salgado, 1996). The V–shaped predentary bears, as in most iguanodontians, a pair of elongate tapering processes and a bilobate ventral process for articulation with the dentaries. The dentary is primitive in possessing anteriorly tapering dorsal and ventral margins.

The presacral vertebral column of *Talenkauen* is composed of 9 cervicals and 16 dorsals, a normal count for a basal iguanodontian. A net of ossified tendons extends along both sides of the neural spines from the first dorsal through at least the first four preserved sacral vertebrae. Cervical vertebrae exhibit moderately developed neural spines and slightly down–curved postzygapophyses, characters that are less derived than in dryomorph ornithopods. However, cervical 3 exhibits prominent epipophysis, a feature uncommon in ornithischian dinosaurs. As a whole, the neck of *Talenkauen* looks elongate compared to those of *Hypsilophodon* and *Dryosaurus* (Sues and Norman, 1990).

Figure 1. **A,** Map indicating fossil locality. **B, C,** ***Talenkauen santacrucensis*** n. gen. et n. sp. MPM 10001 (holotype). **B,** Partially articulated skeleton in right lateral aspect. **C,** Reconstructed skeleton. **Abbreviations: ax,** axis; **cv 9,** ninth cervical vertebra; **d**, dentary; **d1**, first dorsal vertebra; **d16**, sixteen dorsal vertebra; **f**, femur; **fib**, fibula; **h**, humerus; **il**, ilium; **mtt**, metatarsals II-IV; **mx**, maxilla; **ot**, ossified tendons; **p**, pubis; **pd**, predentary; **ph**, pedal phalanges; **pmx**, premaxilla; **sc**, scapula-coracoid; **sk**, skull; **r**, radius; **t**, tibia; **up**, uncinate processes / ***A,*** *Mapa indicando la localidad del hallazgo.* ***B, C, Talenkauen santacrucensis*** n. gen. et n. sp. *MPM 10001 (holotipo).* ***B,*** *Esqueleto parcialmente articulado en vista lateral derecha.* ***C,*** *Esqueleto reconstruído.* ***Abreviaturas: ax****, axis;* ***cv 9****, novena vértebra cervical;* ***d****, dentario;* ***d1****, primera vértebra dorsal;* ***d16****, dieciséisava vértebra dorsal;* ***f****, fémur;* ***fib****, fíbula;* ***h****, húmero;* ***il****, ilion;* ***mtt****, metatarsos II-IV;* ***mx****, maxilar;* ***ot****, tendones osificados;* ***p****, pubis;* ***pd****, predentario;* ***ph****, falanges del pie;* ***pmx****, premaxilar;* ***sc****, escápula-coracoides;* ***sk****, cráneo;* ***r****, radio;* ***t****, tibia;* ***up****, procesos uncinados.*


A
← El Chaltén
N
Viedma Lake
Sta. Teresita Farm
Tres Lagos
ARGENTINA
40
Bras. Blancas
De los Hornos Hill
Luz Divina Farm
Santa Cruz
49° 50´S
Fortaleza Hill
Guanaco River
Leona River
El Turbio River
10 km
72° 30´O
72° O
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The humerus is slender, weakly expanded at its extremities, and the deltopectoral crest is extremely reduced, differing from the remaining ornithopods in which this crest is more developed *(e.g.*, *Thescelosaurus*, *Dryosaurus*, *Camptosaurus*, *Iguanodon*). This peculiar morphology is shared with the hypsilophodontid *Notohypsilophodon* (Martínez, 1998) and the iguanodontian *Anabisetia* (Coria and Calvo, 2002), both from the Cenomanian of Patagonia.

The ilium is slender, dorsoventrally low, and shorter than the femur. The dorsal margin is sigmoidal in outline, as is usual in iguanodontians (Coria and Salgado, 1996; Coria and Calvo, 2002). The prepubic process of the pubis is cranially elongate, ending at the level of the 13th dorsal. It is lateromedially flat and dorsoventrally deep, a condition shared with derived iguanodontians (Norman and Weishampel, 1990; Coria, 1999). The femur and tibia are massive, the latter being shorter than the femur (tibia/femur ratio: 0.94), as is usual for graviportal ornithopods. The anterior trochanter of the femur is appressed, but not fused, to the greater trochanter. Metatarsal III of *Talenkauen* is a robust bone (3.3 cm wide), whereas metatarsal II is notably narrow transversely (1.9 cm wide), thus departing from the more robust proportions of metatarsal II seen in most ornithopods (*e.g.*, *Tenontosaurus*, *Hypsilophodon*, *Dryosaurus*, *Camptosaurus*, *Iguanodon*).

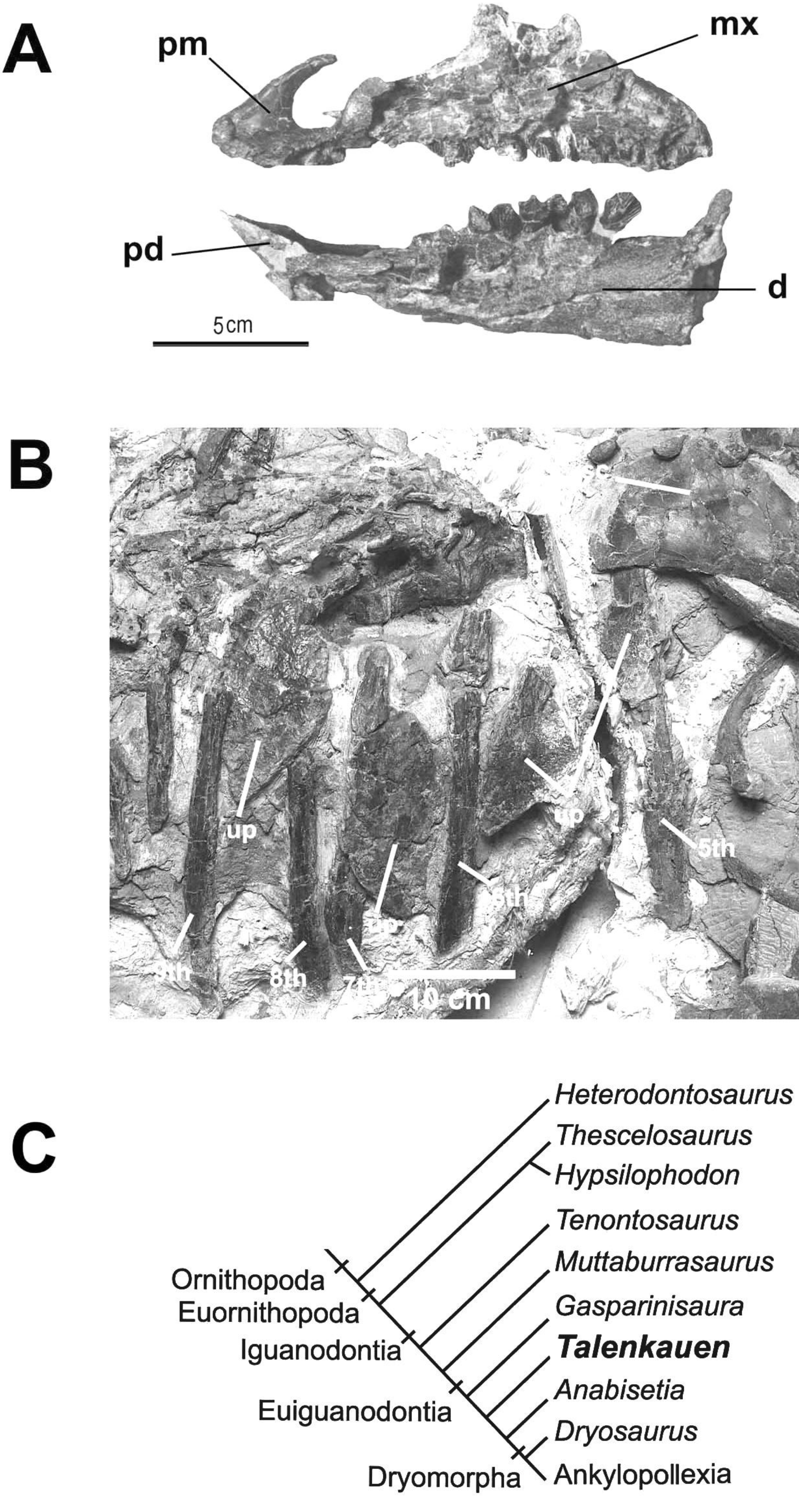
An outstanding feature of *Talenkauen* is the presence of plate–like, polygonal structures on both sides of the thorax (figure 2.B). The plates are thin (no more than 3 mm thick) and dorsoventrally elongate (the major diameter is 180 mm). The external surface of the plates is smooth, lacking foramina or grooves, and no muscle scars are apparent. The plates are located mid–length on dorsal ribs 1 through 8, but are not fused to the ribs.

Discussion

Among the anatomical features of *Talenkauen*, the presence of polygonal plates on both sides of the thorax is outstanding. This character is shared with the Maastrichtian hypsilophodontid *Thescelosaurus neglectus* from North America (Fischer *et al.*, 2000), and these are the only two ornithopods in which such plates are documented. At first glance, the shared presence of plate–like structures on the chest raised the possibility that *Talenkauen* and *Thescelosaurus* were closely related. However, no other derived characters uniting these ornithopods were recognized. Moreover, several iguanodontian features present in *Talenkauen* are absent in *Thescelosaurus*. As well, many features distinctive of the latter taxon are lacking in the Patagonian genus. The presence of plate–like structures in the hypsilophodontid *Thescelosaurus* and the iguanodontian *Talenkauen* implies that such plates may have been independently acquired. However, because ossification depends on maturity, size, and sex, their presence among ornithopods may be more widespread than thought.

The plate–like structures of *Talenkauen* are dismissed as defensive devices because of their fragility and their arrangement in a restricted portion of the thorax. This contrasts with the thick and profusely ornamented dermal ossifications of armored dinosaurs (*e.g.*, ankylosaurs, stegosaurs, titanosaurids). The absence of vascular grooves on their surfaces, their proximity to the caudal margin of ribs, as well as their serial arrangement on the thorax, support their homology with the uncinate processes present in living and extinct diapsids (*e.g.*, *Sphenodon*, crocodiles, basal maniraptorans, and most birds; Heilmann, 1926; Paul, 2002). It is remarkable, however, that the supposed uncinate processes of *Talenkauen* and *Thescelosaurus* are considerably expanded and widely overlap each other, representing a condition not yet recorded in other extinct diapsids, in which such processes are modest, strip–like projections. The presence and development of uncinate processes is far from being functionally understood (Paul, 2002). As far as birds are concerned, uncinate processes participate in thoracic movements for lung ventilation (Fedde, 1987). Because the length of the uncinate processes in birds is proportional to the effectiveness of the external intercostal muscles to set the ribs into motion, a particularly well–developed

Figure 2. ***Talenkauen santacrucensis*** n. gen. et n. sp. MPM 10001 (holotype). **A,** Rostrum in left lateral aspect. **B,** Detail of uncinate processes on ribs corresponding to 5th through 9th dorsal vertebrae. **C,** Cladogram depicting phylogenetic relationships of *Talenkauen santacrucensis* within Ornithopoda. Most parsimonious tree generated by NONA (Goloboff, 1993) using exact solutions (L= 82, CI= 63, RI= 74). For characters and taxa see: Coria and Salgado (1996), Winkler *et al.* (1997) and Sereno (1999). Data matrix and character list is in the Appendix. Topology of the present cladogram differs from that obtained by Coria and Calvo (2002), in which *Gasparinisaura*, *Anabisetia*, and Dryomorpha form an unresolved polytomy. **Abbreviations**: **d**, dentary; **mx**, maxilla; **pd**, predentary; **pm**, premaxillary; **r**, ribs; **up**, uncinate processes. / ***A, B, Talenkauen santacrucensis*** n. gen. et n. sp. *MPM 10001 (holotipo).* ***A,*** *Rostro en vista lateral izquierda.* ***B,*** *Detalle de los procesos uncinados en las costillas correspondientes a las vértebras dorsales 5ta a 9na.* ***C,*** *Cladograma que ilustra las relaciones filogenéticas de* ***Talenkauen santacrucensis*** *dentro de Ornithopoda. El resultado (consistente en un único árbol) fue generado por NONA (Goloboff, 1993) usando soluciones exactas (L= 82, CI= 63, RI= 74). Para los caracteres y taxones ver: Coria y Salgado (1996), Winkler et al. (1997) y Sereno (1999). La matriz de datos y la lista de caracteres se muestra en el apéndice.* ***Abreviaturas: d****, dentario;* ***mx****, maxilar;* ***pd****, predentario;* ***pm****, premaxilar;* ***r****, costillas;* ***up****, procesos uncinados.*


A
pm
mx
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5cm
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up
9th
8th
7th
6th
5th
10 cm
C
Heterodontosaurus
Thescelosaurus
Hypsilophodon
Tenontosaurus
Muttaburrasaurus
Gasparinisaura
Talenkauen
Anabisetia
Dryosaurus
Ankylopollexia
Ornithopoda
Euornithopoda
Iguanodontia
Euiguanodontia
Dryomorpha

musculature would be expected in *Talenkauen*. This suggests an important participation in rib cage dynamics through well–developed intercostal muscles.

The available fossil record clearly shows that during the Cretaceous, ornithopod dinosaurs were diverse on southern landmasses (Taquet, 1976; Bartholomai and Molnar, 1981; Rich and V.–Rich, 1989; Hooker *et al.*, 1991; Coria, 1999; Novas *et al.*, 2002b), including a wide array of Mid– to Late Cretaceous hypsilophodontids (*e.g.*, *Fulgurotherium*, *Notohypsilophodon*, Antarctic hypsilophodontid; Rich and V.–Rich, 1989; Hooker *et al.*, 1991; Martínez, 1998) and basal iguanodontians (*e.g.*, *Gasparinisaura*, *Anabisetia*, *Talenkauen*, *Muttaburrasaurus*, *Ouranosaurus*, *Kangnasaurus*, *Lurdusaurus*, Antarctic iguanodontian; Taquet, 1976; Bartholomai and Molnar, 1981; Cooper, 1985; Coria and Salgado, 1996; Salgado *et al.*, 1997; Coria, 1999; Taquet and Russell, 1999; Coria and Calvo, 2002; Novas *et al.*, 2002b).

Although documentation of ornithopod diversity in the southern continents has considerably increased in the last years, the recognition of an iguanodontid clade endemic to Gondwana has not been possible. Some features emerged in the present study as potential synapomorphies uniting *Talenkauen* with some of these Gondwanan iguanodontians. For example, the greatly reduced deltopectoral crest on the humerus is shared with *Anabisetia* (Coria and Calvo, 2002) and *Notohypsilophodon* (Martínez, 1998), and a transversally compressed second metatarsal is shared with the Patagonian *Anabisetia* and *Gasparinisaura* (Salgado *et al.*, 1997), the South African *Kangnasaurus* (Cooper, 1985), and an unnamed Late Cretaceous iguanodontian from the Antarctic Peninsula (Novas *et al.*, 2002b). However, in the context of all anatomical data no support currently exists for the identification of a clade of southern iguanodontians (figure 2.C). Moreover, the South American *Anabisetia*, *Talenkauen*, and *Gasparinisaura* constitute succesively more remote outgroups of the globally distributed Dryomorpha.

Paleobiogeographical isolation between Gondwana and Laurasia has been postulated for most of the Cretaceous (Bonaparte, 1986). Some dinosaur clades with outstanding autapomorphies (*e.g.*, abelisaurid theropods) have been considered as the result of this prolonged endemism (Bonaparte, 1986; Novas, 1997). Notably, the effects of such physical isolation are weakly manifested in the morphology of the southern ornithopods. With the exception of some bizarre features such as the developed cranial bulla of the Australian *Muttaburrasaurus* (Bartholomai and Molnar, 1981), the elongate neural spines of the African *Ouranosaurus* (Taquet, 1976), and possibly the expanded uncinate processes of *Talenkauen*, the anatomy of basal iguanodontians from Gondwana resembles that of their Jurassic and Cretaceous relatives from Laurasia.

Available evidence suggests that Cretaceous dinosaur faunas of South America were dominated by the herbivorous Sauropoda, represented by abundant skeletal remains belonging to diplodocimorphs and titanosauriforms (Novas, 1997). Even in southern Patagonia, including the fossil locality where *Talenkauen* was found, remains of titanosaurs are quite abundant. Contrary to expectations, the Cretaceous record of Antarctic dinosaurs does not include at the moment any sauropod remains, but it does ornithischians. A remarkable disparity in the relative abundance and taxonomic diversity of sauropods and ornithischians is apparent in the Gondwanan realm: whereas in South America, Madagascar and India the Cretaceous record of sauropods overwhelms that of ornithischians, in southern Gondwana (*e.g.*, Antarctica, Australia, and New Zealand; Bartholomai and Molnar, 1981; Gasparini *et al.*, 1987; Rich and V.–Rich, 1989; Hooker *et al.*, 1991; Wiffen, 1996; Rich *et al.*, 1999; Case *et al.*, 2000; Novas *et al.*, 2002b) the sauropod record is sparse. Instead, ornithischians of different affiliation (*e.g.*, iguanodontians, hypsilophodontids, nodosaurids) have been frequently found in the higher paleolatitudes of Gondwana. It is concluded that herbivorous dinosaurs were not evenly distributed on the Gondwanan landmasses, but a certain degree of provincialism is apparent.

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Appendix

List of characters and data matrix used to analyze the phylogenetic relationships of *Talenkauen santacrucensis* n. gen. et n. sp. The list of characters is modified from the following sources: Winkler *et al.* (1997), Coria and Salgado (1996), and Sereno (1999). The data matrix was analyzed cladistically using the NONA (ver. 1.8) software package (Goloboff, 1993), available from http: //www.cladistics.org. *Lesothosaurus*, *Scutellosaurus*, and Marginocephalia were employed as outgroups, and the tree was rooted on *Lesothosaurus*. One tree was obtained, which has the following values: L = 82, Ci = 63, Ri = 74 / *Lista de caracteres y matriz de datos utilizados para analizar las relaciones filogenéticas de* Talenkauen santacrucensis. *La lista de caracteres ha sido modificada de las siguientes fuentes: Winkler* et al. *(1997), Coria y Salgado (1996) y Sereno (1999). La matriz de datos fue analizada cladísticamente utilizando el software de NONA (ver. 1.8) (Goloboff, 1993), disponible en http: //www.cladistics.org.* Lesothosaurus, Scutellosaurus *y Marginocephalia fueron utilizados como grupos externos, y el árbol fue enraizado en* Lesothosaurus. *Se ha obtenido un solo árbol, el cual presenta los siguientes valores: L = 82, Ci = 63, Ri = 74.*

List of characters / Lista de caracteres

1. Contact of lacrimal / premaxilla: (0) absent; (1) present.
2. Premaxillary teeth: (0) present; (1) absent.

3. Eversion of premaxilla: (0) absent; (1) present.
4. Anterior processes on maxilla: (0) 1 process; (1) 2 processes.
5. Tooth ridges connect to denticles: (0) absent; (1) present.
6. Strong central ridge on maxillary tooth: (0) absent; (1) present.
7. Denticles on predentary: (0) absent; (1) present.
8. Ventral processes on predentary: (0) single; (1) double; (2) wedge–shaped predentary.
9. Size of antorbital fenestra or fossa: (0) large; (1) small.
10. Quadratojugal size: (0) large; (1) reduced.
11. Ossified sternal ribs: (0) absent; (1) present.
12. Ossified hypaxial tendons: (0) present; (1) absent.
13. Humerus/scapula lenght ratio: (0) <1; (1) >=1.
14. Number of phalanges on manus digit III: (0) 4; (1) 3.
15. Number of vertebrae in sacrum (ordered): (0) 5; (1) 6; (2) >6.
16. Prepubic process (ordered): (0) absent; (1) short; (2) long rod; (3) long shallow blade; (4) deep anteriorly.
17. Femur–distal anterior intercondylar groove (ordered): (0) none, (1) shallow = <10% of anterior–posterior width; (1) deep = >10% anterior–posterior width.
18. Metatarsal V/III length ratio: (0) > 0.3; (1) < 0.3; (2) MT V absent.
19. Relative size of the palpebral: (0) 80% or more of the maximal anteroposterior width of the orbit; (1) 70% or less of the maximal anteroposterior width of the orbit.
20. Antorbital fossa shape: (0) triangular; (1) circular or ovate.
21. Dorsal and ventral margins of the dentary: (0) rostrally convergent; (1) parallel.
22. Dorsal margin of iliac blade: (0) convex; (1) sinuous.
23. Size of the external nares relative to the basal skull length: (0) less than 15%; (1) 20% or more.
24. Enamel of the medial side of maxillary tooth: (0) present; (1) absent.
25. Participation of the jugal in the antorbital fenestra: (0) included; (1) excluded.
26. Jugal–postorbital articulation: (0) medially–faced; (1) laterally–faced.
27. Brevis shelf: (0) reduced; (1) well developed.
28. Metatarsal I: (0) present; (1) reduced or absent.
29. Maxillary tooth crowns: (0) low; (1) high.
30. Foot on the distal ischial shaft: (0) absent; (1) present.
31. Ischial shaft: (0) laterally flattened; (1) rounded in cross section.
32. Caudal process of jugal: (0) well developed; (1) reduced.
33. Relative position of the ventral margin of the infratemporal fenestra: (0) below the base of the orbit; (1) above the base of the orbit.
34. Position of the obturator process on the ischial shaft: (0) proximal; (1) distal.
35. Deltopectoral crest, form: (0) projecting from shaft; (1) low or rounded in lateral or medial view.
36. Premaxilla, orientation of lower rim: (0) ventrolateral; (1) lateral.
37. Quadrate, free portion of shaft: (0) 10% or less; or (1) 30% or more of quadrate height.
38. Maxillary crown, anteroposterior width: (0) equal; or (1) narrower than dentary crowns.
39. Maxillary crown, shape: (0) subtriangular; (1) diamond–shaped; (2) lanceolate.
40. Maxillary primary ridge strength: (0) less; or (1) more prominent than dentary primary ridge.
41. Postaxial cervicals, neural spine height: (0) prominent; (1) rudimentary.
42. Cervicals 4–9, form of central surfaces: (0) slightly amphicoelous; (1) slightly opisthocoelous; or (2) strongly opisthocoelous.
43. Manual digit I ungual, length: (0) shorter; or (1) longer than manual digit II ungual.
44. Premaxilla–maxilla diastema: (0) absent ; (1) present.
45. Ischial obturator process: (0) absent; (1) present.
46. MT II transverse compression: (0) absent; (1) present.
47. Deltopectoral crest: (0) well developed; (1) less developed.

Diagnostic characters / Caracteres diagnósticos

Unambiguous character support for clades found in the analysis of the data set is presented below. The first number refers to the character on the list above, and the derived state is given in brackets. / *Se presentan a continuación los caracteres no ambiguos diagnósticos de cada nodo resultantes del análisis de datos. El primer número se refiere al carácter mientras que los estados derivados se expresan entre paréntesis.*

Ornithopoda 1(1), 44(1)
Euornithopoda 25(1), 45(1)
Hypsilophodontia 11(1), 15(0), 16(2), 32(1), 34(1)
Thescelosaurus 18(1)
Hypsilophodon 33(1)
Iguanodontia 3(1), 7(1), 9(1), 14(1), 17(1), 20(1), 21(1), 23(1), 36(1)
Tenontosaurus 24(1), 33(1), 42(1)
Muttaburrasaurus + Euiguanodontia 6(1), 10(1)
Euiguanodontia 37(1), 41(1), 46(1)
Gasparinisaura 16(2), 17(0), 28(1), 32(1)
Talenkauen santacrucensis + *Anabisetia saldiviai* + Dryomorpha 38(1)
Talenkauen santacrucensis 1(0), 21(0)
Anabisetia saldiviai + Dryomorpha 5(0), 39(1), 40(1)
Dryomorpha 28(1), 29(1), 46(0)
Dryosaurus 41(0)
Ankylopollexia 18(2), 43(1)

Data matrix / Matriz de caracteres

Lesothosaurus	00000	00000	00000	00000	00000	00000	000x0	0000x	00?00	00
Scutellosaurus	00000	00000	00000	000??	00?00	00000	000x0	0000x	00000	00
Marginocephalia	00001	10001	0?001	31000	00000	00000	000x0	00000	00000	00
Heterodontosaurus	1000?	00200	01001	10?00	00000	00000	00000	00000	00010	00
Talenkauen	00101	111??	??1??	3????	01?0?	??00?	????1	1?100	10?1?	11
Thescelosaurus	?0??1	0????	10100	2010?	01?0?	?0000	01011	??000	00?11	00
Hypsilophodon	10000	00000	10100	20010	00001	?0000	01111	00000	00111	00
Gasparinisaura	????1	1??11	????1	20101	11??1	11100	01000	?100?	1??11	10
Anabisetia	????0	1????	??1??	311??	11???	?1001	1??01	???11	????1	11
Muttaburrasaurus	1???1	1??11	????1	31??1	?1101	??00?	?00?1	1000x	00?11	00
Tenontosaurus	10100	01010	00011	31011	11111	00000	00100	10000	01011	00
Dryosaurus	11110	11111	01011	31111	11110	11111	10001	11111	01011	00
Ankylopollexia	11110	11111	01011	31211	11110	11111	10001	11111	12111	00