First evidence of a dinosaur from Upper Cretaceous levels of the Dorotea Formation, Sierra Baguales, southernmost Chile

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Introduction

Upper Cretaceous dinosaur remains from southern South America have been recorded exclusively from Argentinean Patagonia (Coria and Salgado, 1996; Coria and Calvo, 2002; Calvo et al., 2007; Martínez, 1998; Novas et al., 2004, and references therein). With the exception of Upper Jurassic records in Aysén (Salgado et al., 2008) no dinosaur records were known in the Chilean Patagonia. This contribution presents the first remains of a dinosaur recovered in the Magallanes Region, southernmost Chile. Although fragmentary, the material has narrow morphologic affinities with the Ornithopoda. This is one of the few bony remains referable to the Ornithopoda found in Chile and extends latitudinally the record of the group previously reported from the Upper Cretaceous of southern Argentina.

Locality and Geologic Setting

The W-E profile exposed at latitude 50°44'S, between the 72°33'W and 72°23'W includes a thick sedimentary section ranging from the Late Cretaceous to the Neogene, with older levels exposed to the W becoming younger to the E. The studied section is exposed in the western part of the Sierra Baguales (Fig. 1), about 40 km NE from Torres del Paine National Park. Lower levels include frequent ammonoids of the species *Hoplitoplacenticeras plasticum*. The dinosaur sample here studied was recovered together with abundant but non-diagnostic bone remains, all of them slightly transported. Its stratigraphic provenance is interpreted from a level comprised by reddish to grey sandstones, with intercalated lenses containing marine fauna of the bivalvian *Panopea* sp. and ichnofossils referred to *Teredolites* isp., as well as teeth of the cartilaginous fish *Carcharias* sp. Beds with similar lithology are better exposed in upper levels of the section that crops out 2.7 km to the S, hosting frequent teeth of *Carcharias* sp., rostral spines of the sclerorhynchid fish *Ischyrhiza chilensis* (Philippi), and isolated teeth of marine reptiles. The roof of the unit is covered by a basaltic level, overlaid by a fine conglomerate with scarce, badly preserved casts of bivalves. The section belongs to the Dorotea Formation (Katz, 1963) assigned by this author to the Maastrichtian based on fossil invertebrates.

Systematic Paleontology

REPTILIA Laurenti, 1768

ARCHOSAURIA Cope, 1869
DINOSAURIA Owen, 1842
ORNITHISCHIA Seeley, 1888
ORNITHOPODA Marsh, 1881

cf. ORNITHOPODA INDET.
(Fig. 1)

Material—SGO.PV. 6582. Isolated middle caudal vertebra centrum.

Locality, Horizon and Age—Upper slopes of Sierra Baguales. Dorotea Formation, early? Maastrichtian.

Description—Vertebral centrum lacking the neural arch; the centrum being longer than broad and slightly amphycoelous, having subcircular articular surfaces, the latter with a medial cross-section of oval contour, being broader than high; the centrum is spool-shaped, concave ventrally and slightly compressed laterally, without a ventral keel or groove; articular facets for chevrons are eroded; in lateral view, a small foramina is observed, therefore giving a left orientation to the observed side, while on the other side the foramina is covered by hard sediment. The base of the peduncles of the neural arch reaches the total length of the centrum, leaving a narrow, slightly concave neural channel. In ventral view, there are numerous slight striations in the periosteal tissue. Near the articular faces, these become thicker and reduced in number.

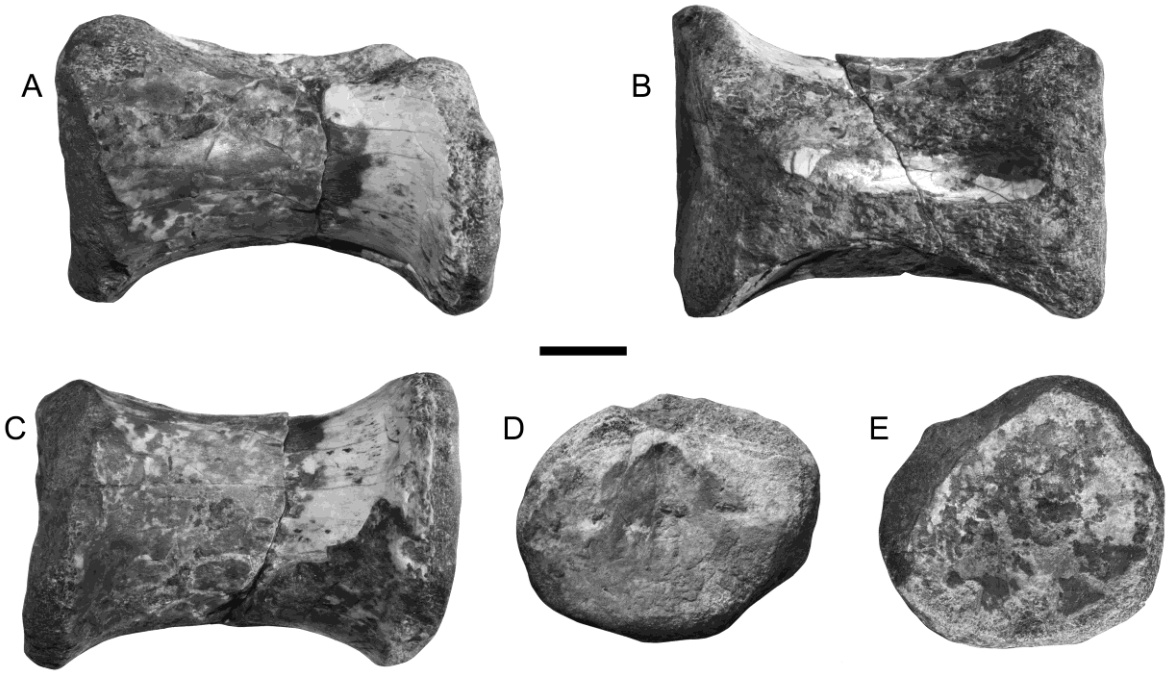

Fig. 1. SGO.PV.6582. cf. Ornithopoda indet. middle caudal centrum. A), lateral view; B) dorsal view; C) ventral view; D, E) articular views. Upper slopes of Sierra Baguales, Magallanes Region. Dorotea Formation, Maastrichtian. Scale bar equals 100 mm.

Discussion

The age of the beds with dinosaur bones at Sierra Baguales can be constrained by the presence of *H. plasticum* in basal levels of the studied section, indicating a late Campanian age. Additionally, the presence of rostral spines of *I. chilensis* in upper levels of the section indicates a minimal Maastrichtian age for these beds based on its stratigraphic occurrence on central Chile (Suárez and Cappetta, 2004).

It is very difficult to refer this material to a more exclusive taxon within Ornithopoda. Longitudinal striations in the lateral and ventral surface near to the articular faces in the centrum are observed in several ornithopods (Ibiricu et al., 2010). The morphology and proportions of the SGO.PV.6582 resembles to the middle caudal centra of basal ornithopods (Forster, 1990; Gilmore, 1915). The absence of a hexagonal outline in the articular faces allows discard the assignation to a Hadrosauridae (Prieto-Márquez and Salinas, 2010). The concave ventral surface of the centrum, its length with respect to its width and the presence of articular facets for the haemal arch suggest that it corresponds to the middle portion of the tail (Norman et al., 2004).

The Ornithopoda are well represented in the Cretaceous of Argentina, including taxa such as the basal ornithopods *Gasparinisaura cincosaltensis* Coria and Salgado (1996), *Anabisetia saldiviai* Coria and Calvo (2002), *Macrogryphosaurus gondwanicus* Calvo et al., (2007), *Notohypsilophodon comodorensis* Martínez (1998), *Talenkauen santacrucensis* Novas et al., (2004), and the hadrosaurs *Secernosaurus koerneri* (Brett-Surman, 1979; Prieto-Márquez and Salinas, 2010), *Willinakaqe salitralensis* (Juárez Valieri et al., 2010) and *Lapampasaurus cholioni* (Coria et al., 2012). The Chilean specimen lacks a ventral groove as that observed in the anterior caudal vertebrae of *Notohypsilophodon* and *Gasparinisaura*. Regarding to the other Weddellian forms, the centrum resembles in shape the posterior caudal vertebrae of *Macrogryphosaurus* from the Coniacian of the Portezuelo Formation in northwest Patagonia but is impossible establish a more specific comparison for the absence of the middle caudals. A similar morphology has been described in the middle caudals of the Antarctic ornithopod *Trinisaura santamartaensis* from the Maastrichtian of Santa Marta Formation, Jame Ross Island (Coria et al., 2013). Interesting in similar age (Maastrichtian) and geographical latitudes (Santa Cruz, Argentina) is the genus *Talenkauen*, however, for this taxon the caudal vertebrae are unknown.

Conclusions

The studied specimen, although fragmentary, it represents the first record of a dinosaur in the Magallanes Region, and a new record of an indeterminate ornithopod in the southernmost part of South America. The age of the fossil-bearing levels is constrained to a Maastrichtian age based on the presence of the sclerorhynchid *Ischyrhiza chilensis* Philippi, which is a frequent taxon in the upper Maastrichtian of central Chile. The occurrence of dinosaurs associated to shallow-water cartilaginous fishes as well as driftwood, suggest proximity to the coast during the deposition. The abundant but fragmentary bone remains found in the locality indicate good conditions for further findings.

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