

THE HUMERUS OF A HATCHLING LAMBEOSAURINE (DINOSAURIA: HADROSAURIDAE) REFERABLE TO CF. *PARASAUROLOPHUS TUBICEN* FROM THE UPPER CRETACEOUS KIRTLAND FORMATION (DE-NA-ZIN MEMBER), SAN JUAN BASIN, NEW MEXICO

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Abstract—A small left humerus of a lambeosaurine (Hadrosauridae), measuring 41 mm in length, is identified as a hatchling individual that probably belongs to the taxon *Parasaurolophus tubicen*. The specimen was discovered in the Kirtland Formation (De-na-zin Member), in the same stratigraphic horizon, and close to the locality, where the skull of *Parasaurolophus tubicen* (NMMNH P-25100) was found. This is the first recognized hatchling dinosaur from the Upper Cretaceous of New Mexico and it is the first known to be referable to *P. tubicen*. The presence of this hatchling suggests that the nearby area probably was a breeding ground for these lambeosaurine dinosaurs.

INTRODUCTION

Late Cretaceous dinosaur fossils have been collected in the Fruitland and Kirtland formations of the San Juan Basin, New Mexico for more than a century. Most of these fossils are hadrosaurids and ceratopsids, as is characteristic of Late Cretaceous dinosaur-fossil assemblages throughout the North American Western Interior. Yet, few of the dinosaur fossils from the San Juan Basin Upper Cretaceous pertain to juvenile individuals (a well-documented exception is provided by Sullivan and Bennett, 2000; see also Hall, 1993). Even less common are the remains of very young, hatchling dinosaurs. Here we document the first hatchling dinosaur fossil from the Upper Cretaceous of the San Juan Basin. This hatchling humerus (SMP VP-2202) is identified as pertaining to the taxon *Parasaurolophus tubicen*. SMP VP-2202 resides in the collections of the State Museum of Pennsylvania, Harrisburg (SMP).

PROVENANCE AND STRATIGRAPHIC OCCURRENCE

The hatchling lambeosaurine humerus, SMP VP-2202 (Fig. 1), was collected by Jim Murphy in 2007 at SMP locality 319a (east branch of Hunter Wash) in the Bisti/De-na-zin Wilderness, San Juan County, New Mexico. This locality is in the De-na-zin Member of the Kirtland Formation, strata of Kirtlandian (late Campanian) age, ~73 Ma (Sullivan and Lucas, 2006). Precise locality data are on file at the State Museum of Pennsylvania.

DESCRIPTION

SMP VP-2202 is a nearly complete left humerus (Fig. 1); measurements are maximum length = 41 mm, maximum proximal width = 13 mm and maximum distal width = 15 mm. The proximal half of the bone is dominated by the broad, splayed out deltopectoral crest, which has a broken and incomplete edge. The proximal end is long, narrow and its articular surface is covered with roughened, pitted bone suggestive of an unfused epiphysis. Distal to the deltopectoral crest, the shaft narrows to a minimum diameter (9 mm) then expands to a broader, triangular distal end. Like the proximal end, the distal articular surface is rough and pitted, suggestive of an unfused epiphysis. The distal end has a polygonal cross-section and is slightly curved (recurved) caudally.

The humerus has a prominent right angle to the ventral margin of the deltopectoral crest (character 221 of Prieto-Márquez, 2010) despite the fact that the lateral edge of the deltopectoral crest is broken for its entire length. A comparison of ratios given for other humerus characters identified by Prieto-Márquez (2010) are presented in Table 1.

DISCUSSION

We identify SMP VP-2202 as a lambeosaurine humerus based on its similarity to other juvenile and adult humeri of lambeosaurines (e.g.,

Lull and Wright, 1942; Brett-Surman, 1975; Guenther, 2009). Particularly significant features are the broad, splayed deltopectoral crest and the relatively robust distal end, features which suggest a lambeosaurine rather than a hadrosaurine identification. Estimated humerus ratios (Table 1) derived for SMP VP-2202 are consistent with those derived for *Parasaurolophus cyrtocristatus* and *P. walkeri* given by Prieto-Márquez (2010). *Parasaurolophus tubicen* is the only known lambeosaurine from the De-na-zin Member (Sullivan and Williamson, 1999), although we note that *P. cyrtocristatus* is known from lower in the section, in the upper Fruitland/Kirtland interval (Wiman, 1931; Ostrom, 1961, 1963; Sullivan and Williamson, 1999). We note, too, that the hatchling humerus was recovered approximately 200 meters from, and at the same stratigraphic horizon within the De-na-zin Member, as the skull of *Parasaurolophus tubicen* (NMMNH P-25100) described by Sullivan and Williamson (1999). We suggest that SMP VP-2202 is probably a hatchling of *P. tubicen* based on stratigraphic congruence. Therefore, we refer the hatchling humerus to cf. *Parasaurolophus tubicen*.

This small humerus compares favorably in size and general morphology with the smallest humeri known from some other hadrosaurids such as *Maiasaura* and *Hypacrosaurus* (Guenther, 2009, fig. 12). Based on comparison to “neonatal” specimens of the lambeosaurine *Hypacrosaurus*, in which humerus length is 50 mm and the total skull and body length is about 500 mm (Horner and Currie, 1994, fig. 21.29), SMP VP-2202, with a total humerus length of 41 mm, probably had a total skull and body length somewhat less than 500 mm. In other words, this small humerus represents a lambeosaurine about the size of a common squirrel.

TABLE 1. Comparison of humerus ratios for *Parasaurolophus walkeri*, *P. cyrtocristatus* and SMP VP-2202 (cf. *P. tubicen*). The ratios provided for SMP VP-2202 are estimates (due to erosion/breakage of the specimen) and are consistently below the ratio values given for *P. cyrtocristatus* and *P. walkeri* (Prieto-Márquez, 2010). Ratios for *P. walkeri* and *P. cyrtocristatus* are from Prieto-Márquez (2010), his characters 219, 220 and 222.

TAXON	219	220	222
<i>Parasaurolophus cyrtocristatus</i>	0.58	1.84	3.82
<i>Parasaurolophus walkeri</i>	0.60	2.05	3.42
SMP VP-2202 (cf. <i>P. tubicen</i>)	0.52	1.80	3.10

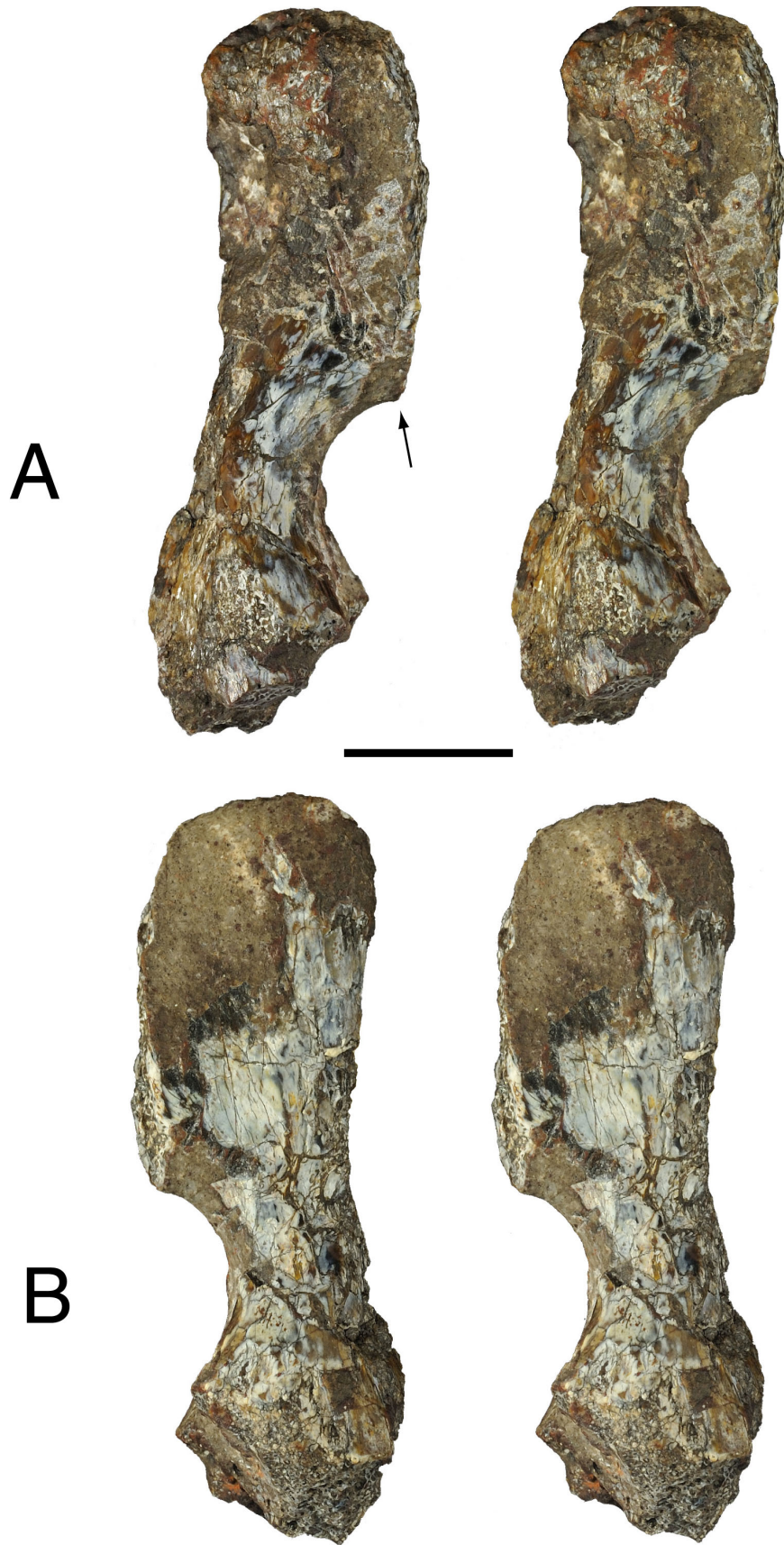


FIGURE 1. cf. *Parasaurolophus tubicen*, SMP VP-2202, nearly complete left humerus of a hatchling. **A**, medial view (stereo pair); **B**, lateral view (stereo pair). Arrow indicates a prominent angle along the ventral margin of the deltopectoral crest (character 221 of Prieto-Márquez, 2010, see text). Scale bar = 1 cm.

The specimen suggests that the hatchling came from a nearby breeding ground or rookery. Indeed, this horizon of the De-na-zin Member has also produced juvenile and near hatchling specimens of the alligatoroid *Brachychampsia montana* (Sullivan and Lucas, 2003). Although no egg shells fragments have been recovered from the site, the general area may have been ideal breeding grounds and for crocodylians as well as lambeosaurines and possibly other dinosaurs 73 million years ago.

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