

THE TYPE LOCALITY OF *BELODON BUCEROS* COPE, 1881, A PHYTOSAUR (ARCHOSAURIA: PARASUCHIDAE) FROM THE UPPER TRIASSIC OF NORTH-CENTRAL NEW MEXICO

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Abstract—Here we establish the stratigraphic and geographic provenance of the “*Belodon*” *buceros* Cope. The holotype, originally collected by David Baldwin in 1881, is an incomplete phytosaur skull discovered near “Huerfano Camp” in north-central New Mexico. This skull is the first phytosaur skull described from the American West, and its precise provenance has never been established. Baldwin’s use of the term Huerfano Camp may refer to Orphan Mesa, an isolated butte just south of Arroyo Seco. Fossils collected by Baldwin, and our subsequent collections from Orphan Mesa, are from a fossiliferous interval high in the Petrified Formation of the Chinle Group. These strata yield a tetrapod fauna including the aetosaur *Typothorax coccinarum* and the phytosaur *Pseudopalatus*, both index taxa of the Revueltian (early-mid Norian) land-vertebrate faunachron. “*Belodon*” *buceros* is correctly referred to *Pseudopalatus buceros* (Cope) and is an index taxon of the Revueltian land-vertebrate faunachron.

Keywords: phytosaur, *Belodon*, *Pseudopalatus*, Revueltian

INTRODUCTION

In the Fall of 1874, Edward Drinker Cope (1840-1897) traveled through parts of north-central New Mexico and the San Juan Basin, collecting vertebrate fossils of Late Triassic, Late Cretaceous and early Eocene age (Simpson, 1951). The Triassic vertebrates he collected were the first fossils of that age collected in the American West, even though Marcou (1858) had earlier posited the presence of Triassic strata in New Mexico. More specifically, Cope collected Triassic vertebrate fossils in an area just north of Gallina (Fig. 1) that was relocated by Lucas and Hunt (1992). Cope’s collections included the holotype of the aetosaur *Typothorax coccinarum*, described by Cope (1875).

Subsequently, Cope’s hired fossil collector, David Baldwin, obtained Triassic vertebrate fossils in north-central New Mexico. Among the fossils Baldwin sent Cope is an incomplete phytosaur skull, the holotype of *Belodon buceros* Cope, 1881 (Figs. 2-3). This skull is the first phytosaur skull described from the American West,

and its exact provenance has never been ascertained. Here, we establish the geographic and stratigraphic provenance of the holotype of *Belodon buceros* and discuss its taxonomic position and biostratigraphic significance.

Abbreviations: AMNH = American Museum of Natural History, New York; NMMNH = New Mexico Museum of Natural History and Science, Albuquerque; UCMP = University of California Museum of Paleontology, Berkeley; USNM = Smithsonian Institution, Washington D.C.

PROVENANCE

When naming *Belodon buceros*, Cope (1881, p. 922) merely noted it as “in my New Mexican collections” and provided no precise locality data. Huene (1915, p. 490-492, fig. 11) redescribed and illustrated the holotype of *Belodon buceros* (Fig. 3), reassigning it to *Phytosaurus*, but provided no locality data other than New Mexico. More recent authors have also only stated that the fossil is from New Mexico or have ventured to state that it is from Rio Arriba County (e.g., Hunt and Lucas, 1989, 1993a; Lucas and Hunt, 1992; Hunt, 1993, 1994; Long and Murry, 1995).

Ironically, the records that establish the precise provenance of the holotype of *Belodon buceros* have always been with the fossil, and in the AMNH archives. Indeed, the holotype skull, AMNH 2318, has a packing slip written by David Baldwin that indicates it was “Sack 5. Box 5” shipped to Cope on 21 June 1881. The shipping manifest written by Baldwin, in AMNH archives, states the following for fossils shipped that date:

Sack 5. Box 5.

Large reptile head, southeastern side of Rincon, Huerfano Camp, Arroyo Seco, end of snout or jaw dug out showing some front teeth, June 1881.

The large reptile head clearly refers to the holotype skull, and the locality, Arroyo Seco, is one discussed at length by Sullivan et al. (1996). Thus, the Arroyo Seco drainage is near Ghost Ranch in Rio Arriba County (Fig. 1), and Baldwin evidently collected some of the syntypes and referred specimens of the dinosaur *Coelophysis* here in 1881. Furthermore, Baldwin’s use of the term

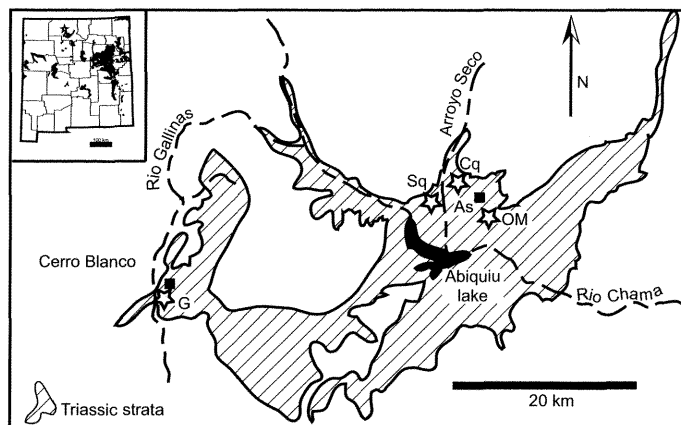


FIGURE 1. Map of part of north-central New Mexico showing distribution of Upper Triassic strata of the Chinle Group (after Dane and Bachman, 1965) and locations mentioned in the text. As = Arroyo Seco; Cq = Canjilon quarry; G = Gallina; GR = Ghost Ranch; OM = Orphan Mesa; Sq = Snyder quarry.

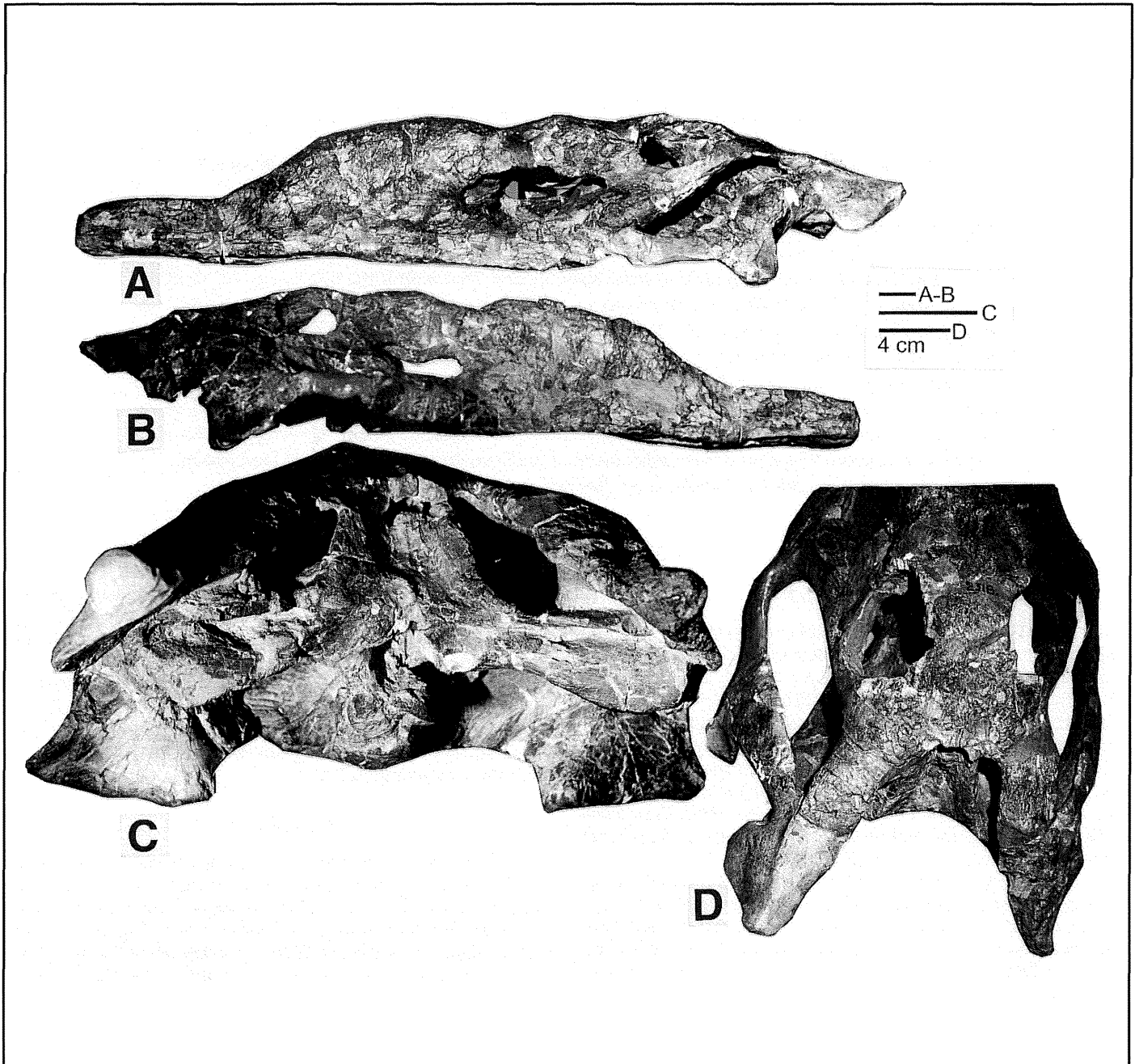


FIGURE 2. AMNH 2318, holotype skull of the phytosaur *Belodon buceros* Cope, 1881, from the Petrified Forest Formation in the Chama basin, northern New Mexico. **A-B**, Lateral views; **C**, Occipital view; **D**, Dorsal aspect of posterior end of skull.

"Huerfano Camp" may refer to Orphan Mesa (huerfano is Spanish for orphan), an isolated butte just south of Arroyo Seco (Sullivan et al., 1996, fig. 2). Baldwin's stratigraphic observations, also in the AMNH archives, indicate that his "Arroyo Seco" localities are approximately 400 ft (~123 m) below the "gypsum stratum," known now as the Middle Jurassic Todilto Formation (Sullivan et al., 1996). Throughout the Chama basin, rocks 100+ m below the Todilto Formation are part of the Petrified Forest Formation (Lucas and Hunt, 1992; Hunt and Lucas, 1993a; Sullivan et al., 1996).

Fossils collected by Baldwin (especially some of the syntypes of the dinosaur *Coelophysis*), and subsequent NMMNH collections from the Orphan Mesa area, are from a fossiliferous interval high in the Petrified Formation of the Chinle Group (Fig. 4; Sullivan et al., 1996; Sullivan and Lucas, 1999). It is thus highly likely that

this is the stratigraphic provenance of AMNH 2318, the holotype of *Belodon buceros*. Indeed, the preservation of the specimen is similar to that of other vertebrate fossils from this horizon. Furthermore, other fossils of "*Belodon*" *buceros* occur at this horizon, and only at this horizon (see below). In fact, a skull of "*Belodon*" *buceros* has just been collected near Orphan Mesa at this horizon by a field party from Ghost Ranch (A. Downs, oral commun., 2002).

Therefore, we conclude that David Baldwin certainly collected the holotype of *Belodon buceros* in the Arroyo Seco drainage near Orphan Mesa in Rio Arriba County, New Mexico (in, or near, T24N, R4E). The fossil almost certainly was collected from a horizon in the upper part of the Petrified Forest Formation of the Chinle Group. This is in part because the bulk of the accessible strata in this region are in the upper half of the Petrified Forest Formation and because we and others have recovered additional

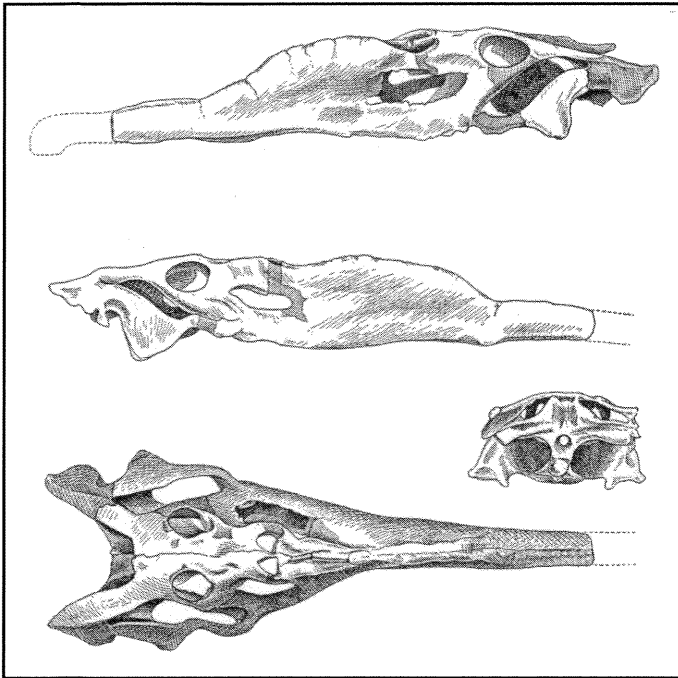


FIGURE 3. Illustrations of the holotype skull, AMNH 2318, of *Belodon buceros*, from Huene (1915).

fossils from this interval and had little success collecting above or below it (Sullivan et al., 1996; Sullivan and Lucas, 1999).

REDESCRIPTION AND TAXONOMY

AMNH 2318 (Figs. 2-3) is a poorly preserved skull of a *Pseudopalatus*-grade phytosaur. We assign this skull to *Pseudopalatus* (= *Arribasuchus*) because the supratemporal fenestrae are narrow and slit-like in dorsal view, the squamosals are generally rod-shaped with hook-like processes, the occipital region is u-shaped, and the external nares are at approximately the same level as the skull roof.

The skull is approximately 745 mm long, but is missing the anterior end of the snout. The specimen is 277 mm wide across the quadrates and 150 mm high at the orbits. The ventral aspect of the specimen is in poor condition, but its morphology is similar to other *Pseudopalatus*-grade phytosaurs. The rostral crest is 130 mm tall and 270 mm long, and because this crest is very robust, we consider this skull to be a male morphotype of *Pseudopalatus* (Zeigler et al., 2002, 2003).

Cope (1881) did not illustrate the holotype of his *Belodon buceros*. McGregor (1906, pl. 9) was the first to illustrate the specimen, also referring the specimen to *Belodon buceros*. Jaekel (1910) erected the genus *Metarhinus* for this species, but this name was preoccupied by a Paleogene mammal (a brontothere). Mehl (1915) placed the species in the genus *Lophoprosopus*. Huene (1915, fig. 11) illustrated this specimen and placed *buceros* in the genus *Phytosaurus*, whereas Mehl et al. (1916) placed this species in his new genus *Machaeropsopus*. Subsequently, Gregory (1962a,b) placed the species in *Rutiodon*, and Ballew (1989) in *Pseudopalatus*. Hunt and Lucas (1993a) and Hunt (1994) considered *buceros* to be a valid species of *Nicrosaurus*.

Historically, workers have distinguished *Nicrosaurus* from *Pseudopalatus* principally by the presence of external nares elevated above the level of the skull roof in the latter (e.g., Ballew, 1989; Hunt, 1994; Long and Murry, 1995; Hungerbühler and Hunt, 2000).

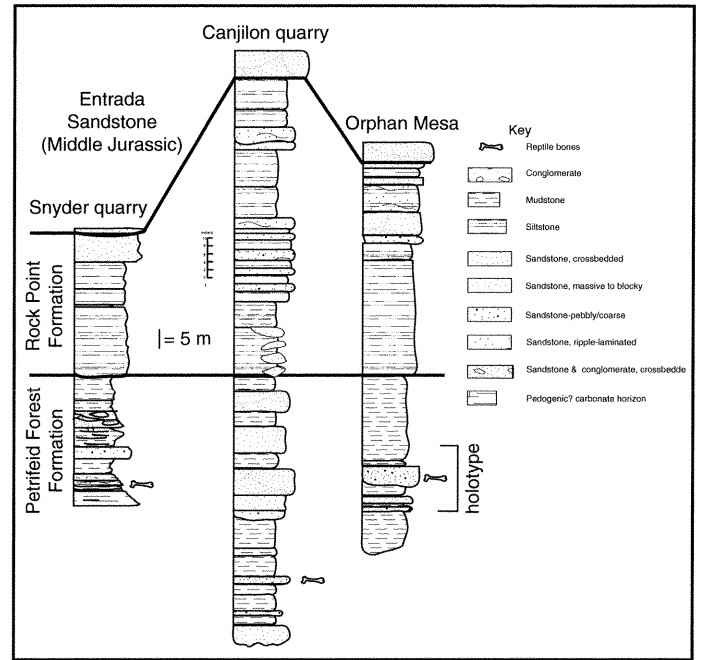


FIGURE 4. Measured stratigraphic sections of Upper Triassic strata in the Chama basin showing the distribution of *Pseudopalatus buceros* (modified from Lucas and Hunt, 1992; Sullivan et al., 1996).

We note here that this feature is often difficult to interpret, as phytosaur skulls are often distorted and crushed, altering the apparent profile of the skull. Our assignment of *B. buceros* to *Pseudopalatus* is based on the derived features of *Pseudopalatus* listed above that are evident in AMNH 2318.

Note also that we do not accept Long and Murry's (1995) synonymy of *Redondasaurus* with *Pseudopalatus*. *Redondasaurus* is a distinct phytosaur known from younger strata in Oklahoma, New Mexico, and Utah, including the Ghost Ranch *Coelophysis* quarry in the Rock Point Formation, approximately 60 m above the *Pseudopalatus* occurrences in the Chama basin (Hunt and Lucas, 1993a,b; Lucas et al., 1997a,b; Heckert et al., 2001).

BIOSTRATIGRAPHY

Fossils of *Pseudopalatus buceros* occur in the Chama basin at three localities (Fig. 1):

1. The type locality of *P. buceros*, discussed above.
2. The Canjilon phytosaur quarry north of Ghost Ranch (Lawler, 1974; Long et al., 1989; Hunt and Lucas, 1993a; Long and Murry, 1995; Zeigler et al., 2003).
3. The Snyder quarry, near the Canjilon quarry (Zeigler et al., 2002).

All three of these occurrences are at essentially the same stratigraphic level: uppermost part of the Petrified Forest Formation of the Chinle Group (Fig. 4). This level is of Revueltian (Norian) age, as it yields fossils of *Pseudopalatus* and the aetosaur *Typhothorax coccinarum* (Lucas, 1998). *P. buceros* thus has an extremely restricted stratigraphic range in the Chama basin indicative of Revueltian time.

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