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BAENID (BAENIDAE: TESTUDINES) LOWER JAWS FROM THE LATE CRETACEOUS AND PALEOCENE OF THE SAN JUAN BASIN, NEW MEXICO

STEVEN E. JASINSKI[1,2,3], ROBERT M. SULLIVAN[4], ASHER J. LICHTIG[4], SPENCER G. LUCAS[4] and PETER DODSON[2,5]

[1]State Museum of Pennsylvania, Section of Paleontology and Geology, 300 North Street, Harrisburg, PA 17120-0024; [2]University of Pennsylvania, Department of Earth and Environmental Science, Philadelphia, PA 19104-6316; [3]Don Sundquist Center of Excellence in Paleontology, Johnson City, TN 37614-1709, email:sejasinski@gmail.com; [4]New Mexico Museum of Natural History, 1801 Mountain Road N. W. Albuquerque, NM 87104; [5]School of Veterinary Science, University of Pennsylvania, Philadelphia, PA 19104-6316

Abstract—Two isolated lower jaws belonging to different baenid turtles are identified as cf. *Boremys grandis* from the upper Campanian (Late Cretaceous) Kirtland Formation (De-na-zin Member) and cf. *Neurankylus torrejonensis* from the Paleocene Nacimiento Formation (Puercan). Cf. *Boremys grandis* is the first lower jaw of a baenid to be documented from the Late Cretaceous (Kirtlandian) of New Mexico and may represent a temporal extension for this taxon. Cf. *Neurankylus torrejonensis* may be the oldest record of this taxon, which may suggest evidence for anagenesis. As turtle skull material, including lower jaw and cranial remains, are rare from the Cretaceous and Paleocene of New Mexico, these specimens provide new morphological information and potential extensions of the respective biostratigraphic ranges of these turtles. They also help us further understand the composition of turtle faunas during the Cretaceous/Paleogene transition in New Mexico and the southern United States. Durophagy may not have been as important to survival of the baenid turtles at the end-Cretaceous extinction as previously thought, at least in the southern United States, because durophagous turtles appear to be absent during the Late Cretaceous in this region. In addition, the percentage of non-durophagous turtle genera in the Paleocene of North America is larger than previously believed. Turtle paleoecology was obviously distinct in northern and southern North America during the Late Cretaceous, at least regarding the major niches held by turtles. This paleoecological separation became less distinct following the Cretaceous-Paleogene extinction event, with durophagous taxa present, potentially through migration or evolutionary events, to the south.

INTRODUCTION

Turtle fossils have been known from the San Juan Basin (SJB), New Mexico for well over a hundred years. However, most of the specimens are incomplete carapaces and plastra, whereas the remains of skulls and lower jaws are extremely rare (e.g., Hay, 1908; Jasinski et al., 2011a, b). Hay (1905) named the first SJB fossil turtle, the trionychid (Trionychidae) *Conchochelys admirabilis*, based on an isolated skull (AMNH 6090) recovered from the Paleocene (Danian) Nacimiento Formation (Puercan North American Land-Mammal "Age" [NALMA]), however, no lower jaw was recovered. The trionychid *Aspideretoides* (=*Aspideretes*) *singularis* was later named by Hay (1907) based on material recovered from the Paleocene Nacimiento Formation (Torrejonian NALMA) in the San Juan Basin. The holotype (AMNH 1028) consists of a nearly complete skeleton, including a complete skull and pair of lower jaws (Hay, 1908), although the lower jaws are conjoined to the maxillae and maxillary portions of the skull, thus concealing some of their morphology.

The baenid (Baenidae) *Palatobaena bairdi* was named based on an incomplete skull (YPM PU 16839) from the Fort Union Formation (early Tiffanian) in the Bighorn Basin, Wyoming, although no lower jaw were present with the specimen (Gaffney, 1972). Lower jaw material has been identified as *P. bairdi* (LACM 124006 and LACM 124007) from the Nacimiento Formation (Puercan) in the San Juan Basin by Sullivan and Lucas (1986) based on features reported by Archibald and Hutchison (1979) and Gaffney (1979, 1982a, b). However, this material needs to be re-assessed in light of advances in our knowledge of Paleocene turtles, particularly those from the San Juan Basin (e.g., Jasinski et al., 2011a; Lyson et al., 2016). Recently, a new species of *Neurankylus*, *N. torrejonensis*, was described from the Torrejonian interval of the Nacimiento Formation based on a nearly complete skull, pair of lower jaws, associated postcrania and an incomplete carapace and plastron (NMMNH P-9049: Joyce and Lyson, 2015; Lyson et al., 2016; Lichtig and Lucas, 2018 [this volume]).

The bothremydid (Bothremydidae) *Chedighaii hutchisoni* was named by Gaffney et al. (2006) based on an incomplete skull (KUVP 14765) collected from the upper Campanian (Kirtlandian Land-Vertebrate "Age" [LVA]) Kirtland Formation (Hunter Wash Member) (Sullivan et al., 2013). Jasinski et al. (2011b) described an isolated turtle parietal (SMP VP-2517) from the Maastrichtian Ojo Alamo Formation (Naashoibito Member) in the San Juan Basin of New Mexico. This parietal was referred to cf. *Plastomenus* indeterminate species, partly due to comparisons with equivalent elements in *Plastomenus thomasi* illustrated by Gaffney (1979), and because *Plastomenus* is the only trionychid in which the parietal extends into the orbit and makes up part of the orbital rim.

Here, we report on lower jaws from two different baenid turtles from the SJB that provide new morphological, biostratigraphic, and paleoecological information on fossil turtles.

Institutional Abbreviations: **AMNH**, American Museum of Natural History, New York, New York, USA; **BYU**, Brigham Young University Museum of Paleontology, Provo, Utah, USA; **KUVP**, University of Kansas, Lawrence, Kansas, USA; **LACM**, Los Angeles County Museum of Natural History, Los Angeles, California, USA; **NMMNH**, New Mexico Museum of Natural History, Albuquerque, New Mexico, USA; **SMP**, State Museum of Pennsylvania, Harrisburg, Pennsylvania, USA; **TMP**, Royal Tyrrell Museum of Paleontology, Drumheller, Alberta, Canada; **YPM PU**, Yale Peabody Museum (formerly Princeton Museum Collection), New Haven, Connecticut, USA.

SYSTEMATIC PALEONTOLOGY
ORDER TESTUDINES BATSCH, 1788
INFRAORDER PARACRYPTODIRA Gaffney, 1975
SUPERFAMILY BAENOIDEA (COPE, 1882) Williams, 1950
FAMILY BAENIDAE Cope, 1873
BOREMYS Lambe, 1906
BOREMYS GRANDIS Gilmore, 1935
cf. *Boremys grandis*
Figs. 1, 2B

Material—SMP VP-2014; nearly complete set of lower jaws (Figs. 1, 2B).

Locality—SMP locality 388a, Alamo Wash (north fork), San Juan Basin, northwestern New Mexico. Precise locality information is available to qualified researchers.

Horizon and Age—De-na-zin Member, Kirtland Formation; Late Cretaceous (late Campanian; [Kirtlandian]).

Description—SMP VP-2014 consists of a complete pair of lower jaws. The mandibles (or lower jaw) are gracile, with each dentary comprising most of the mandible, measuring 61.8 mm with a maximum depth of 7.0 mm anterior to the coronoid process (=processus coronoideus). There is no anterior hook or projection to the anterior-most portion of the lower jaw. The anteromedial symphysis is broad. The lower triturating surfaces are thin (labiolingually narrow) and gracile. They project farther lingually than labially, creating a slight overhang lingually, and are more prominent dorsally than anterolaterally, creating a gentle sloping surface from the anterior-most point to the mediolingual area. The coronoid processes are low with a slight medial curvature toward their dorsal extremity. The Meckelian fossae (=fossae meckelii) are small but distinct. The medial articular surface of the articular is larger than the lateral articular surface. There is little morphological distinction between the regions of the articular surface with the quadrate and the retroarticular process. In addition to being pronounced, the retroarticular process is oriented horizontally. The prearticular is somewhat reduced and elongate, whereas the splenial is missing, revealing a deep and distinct Meckelian groove. There is no distinct lingual ridge for the caudal portion of the triturating surface at the median symphysis. A V-shaped suture is present between the dentary and surangular (Fig. 2B). The entire dentary-surangular suture is sinusoidal and contacts the dentary-coronoid suture dorsally. The surangular is barely exposed lingually just caudal to the coronoid process. The coronoid is small labially on the coronoid process and extends slightly farther by 1–2 mm on the lingual surface. It extends ventrally to the Meckelian fossae on

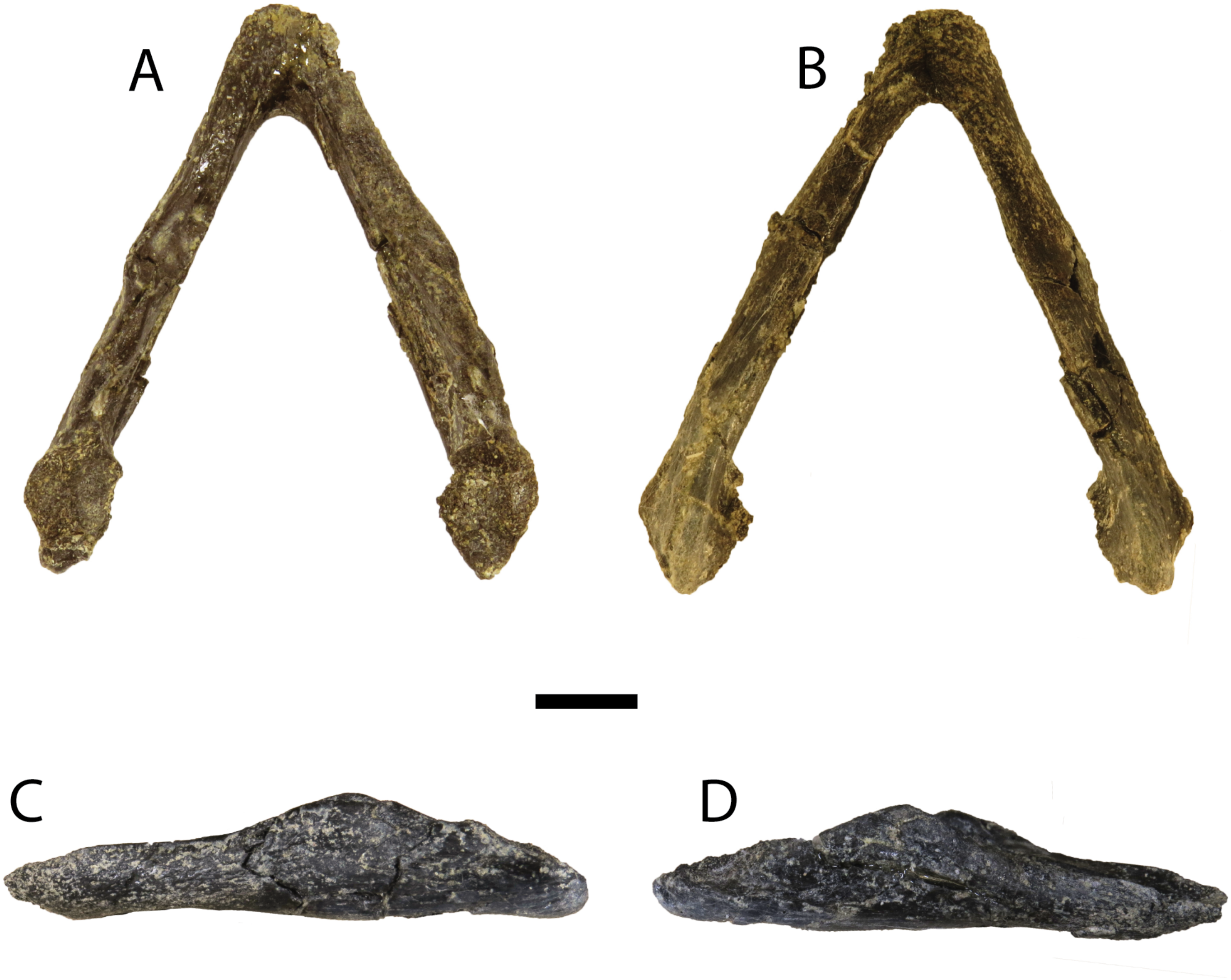

FIGURE 1. SMP VP-2014, cf. *Boremys grandis*, nearly complete set of lower jaws. **A**, dorsal; **B**, ventral, **C**, left lateral; and **D**, right lateral views. Bar scale = 1 cm.

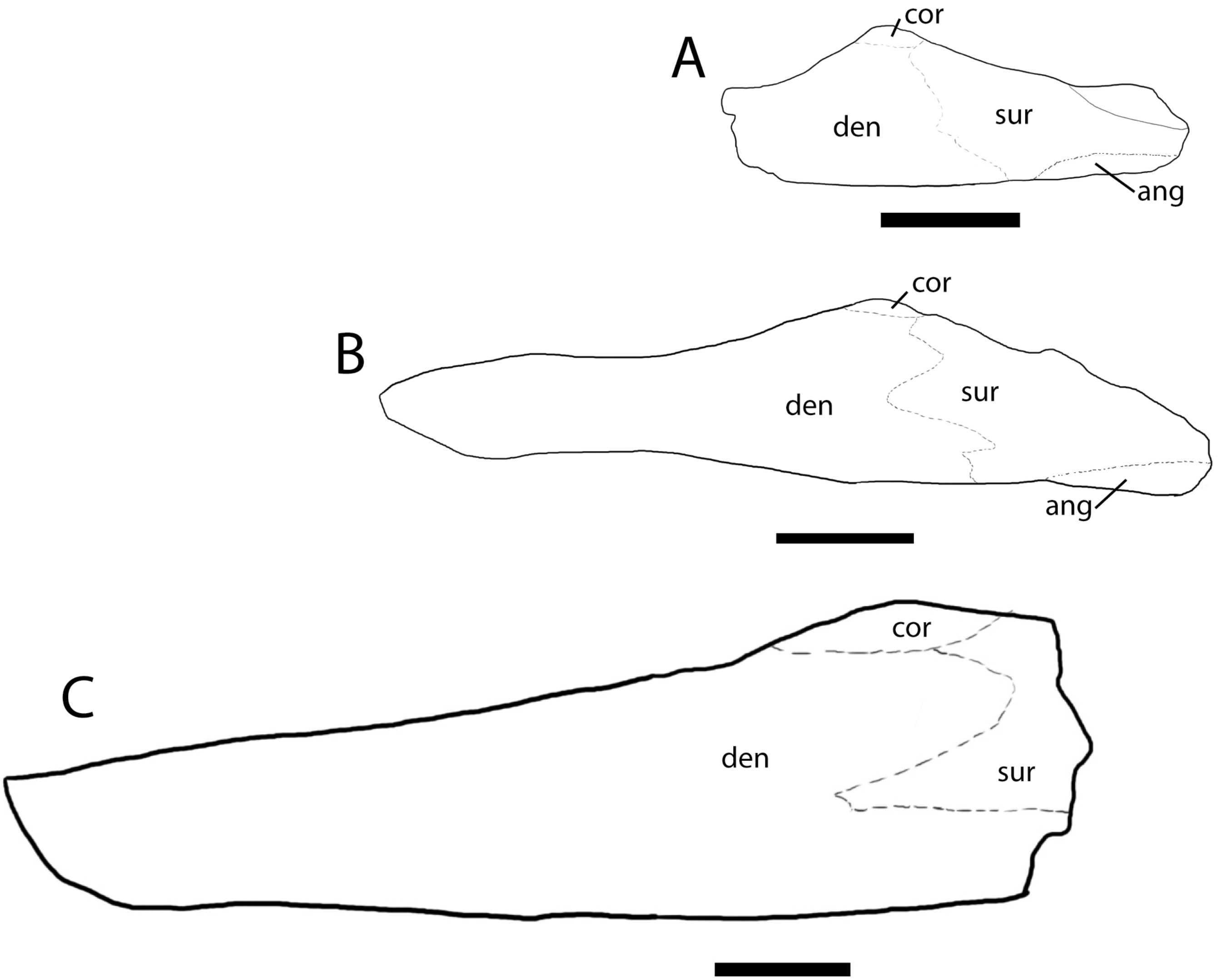

FIGURE 2. Lower jaws of selected baenid turtles with focus on the dentary-surangular sutures, in lateral view. **A**, *Denazinemys nodosa* (BYU 19123); **B**, cf. *Boremys grandis* (SMP VP-2014); **C**, *Boremys pulchra* (TMP 79.8.535). Abbreviations: **ang**, angular; **cor**, coracoid; **den**, dentary; **sur**, surangular. Bar scales = 1 cm.

the lingual surface, but these fossae would be contacted by the splenial if it were preserved. The angular is shortened labially and does not contact the dentary, whereas it is elongate and shallow lingually.

NEURANKYLUS Lambe, 1902
NEURANKYLUS TORREJONENSIS Lyson, Joyce, Lucas, and Sullivan, 2016
cf. *Neurankylus torrejonensis*
Fig, 3

Material—SMP VP-717; nearly complete set of lower jaws (Fig. 3).

Locality—SMP locality 211, South De-na-zin Wash, San Juan Basin, New Mexico. Precise locality information is available to qualified researchers.

Horizon and Age—Nacimiento Formation; Paleocene (Puercan).

Note—While *Neurankylus torrejonensis* was named by Lyson et al. (2016), it was first mentioned by name by Joyce and Lyson (2015, pp. 149, 151, 158, 161–162, 179) as to be named in a manuscript "in press." This makes the name a *nomen nudum* in 2015 that was validated in 2016 by Lyson et al. (2016).

Description—SMP VP-717 is a nearly complete pair of lower jaws (Fig. 3). The mandibles (lower jaw) are fairly robust, with a thin concretionary veneer covering their entire surface. The caudal articular surfaces are preserved but broken and small segments of both sides are not preserved. Each dentary is estimated to be about 62.8 mm long (maximum length) and 18.2 mm deep (maximum depth) to the coronoid process. The concretionary veneer obscures many of the individual elements of the mandibles, making description difficult. The extent of the coronoid process is uncertain due to breakage of the specimen, although it is inferred they would not have been excessively high due to the morphology of the portion preserved. Part of the anterior symphyseal region is not preserved, in addition to the region just anterior to the articulars. However, some characteristic features are evident. There probably would have been a slight anterior hook on the anteromedial-most portion of the lower jaw based on the anterior curvature of the preserved portions. The triturating surfaces are thin (labiolingually narrow) with a slight lingual overhang caudally. The lingual portion of the triturating surface is distinctly higher than the labial portion, which is especially evident anteriorly. Both the lingual and labial ridges are thin but distinct. As both the ridges project dorsally, there is a depression or trough between them that runs the length of the two segments, especially prominent caudally

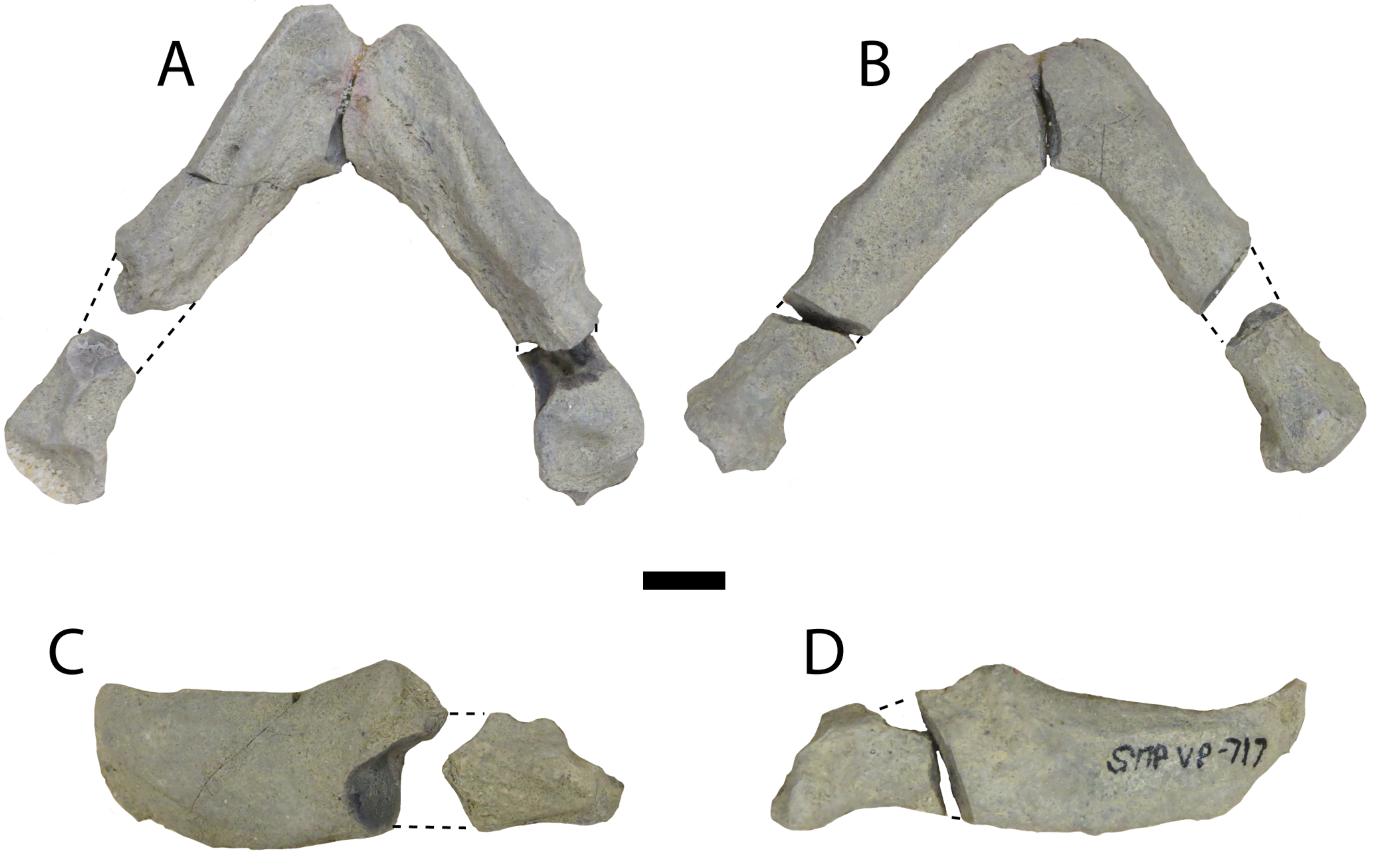

FIGURE 3. SMP VP-717, cf. *Neurankylus torrejonensis*, nearly complete set of lower jaws. **A**, dorsal; **B**, ventral, **C**, left lateral; and **D**, right lateral views. Bar scale = 1 cm.

on the dentaries. The articular surface of the articular does not show any distinctions between the medial and lateral extents and is oriented nearly vertical (angle ~25° from vertical in SMP VP-717 compared to ~72° in VP-2014). The retroarticular process is poorly developed.

DISCUSSION

SMP VP-2014 and VP-717 add to a sparse record of lower jaw and skull material of turtles from the Late Cretaceous and Paleocene of New Mexico. SMP VP-2014 represents the first fossil turtle mandibles to be reported from the Late Cretaceous of New Mexico. The occurrence of these mandibles, assigned to the baenid cf. *Boremys grandis*, adds to previous reports of bothremydid and trionychid cranial material to expand the record of fossil turtle skull material from the Late Cretaceous of New Mexico. Baenids are among the most common turtles present in the Late Cretaceous and, in particular, the late Campanian of New Mexico (Sullivan et al., 2013; Lichtig and Lucas, 2015; Sullivan and Lucas, 2015; Lichtig and Lucas, 2016). Most of the lower jaws known of baenids are characterized by a relatively large splenial, a well-developed coronoid process, an absence of ridges or pits on the triturating surface, and relatively small dorsal openings of the fossae meckelii (Gaffney, 1982b). Whereas the splenials are not preserved in SMP VP-2014, the latter two features of baenids agree with features present in the specimen. While most baenids possess a well-developed coronoid process, some taxa do not, notably *Plesiobaena antiqua*, *Boremys pulchra*, and *Denazinemys nodosa* (Gaffney, 1982b; Brinkman and Nicholls, 1991; Lively, 2015, 2016). Lively (2016, p. 908) mentioned that *D. nodosa* (BYU 19123) possesses a straight suture between the dentary and surangular (Fig. 2A) (Lively [2016] mistakenly listed it as "squamosal"), whereas *B. pulchra* possesses a V-shaped suture (Brinkman and Nicholls, 1991). Indeed, the V-shaped suture in *B. pulchra* is deep and pronounced (Fig. 2C). SMP VP-2014 possesses a reduced, but still clearly visible, V-shaped suture (Fig. 2B), similar to, but distinct from, *B. pulchra* (see Brinkman and Nicholls, 1991), with the sutural surface of the former more sigmoidal and relatively shorter craniocaudally. Additionally, the point of contact between the dentary-surangular-coronoid occurs at a different location in regard to its placement along the suture of the coronoid with the other two bones. In SMP VP-2014, this contact is located caudally, near the caudal-most extent in lateral view, while in *Boremys pulchra* (and *Denazinemys nodosa*), this contact is more anterior (see Fig. 2).

The congeneric *Boremys grandis* is known from the Late Cretaceous of the San Juan Basin (Gilmore, 1935; Brinkman and Nicholls, 1991; Sullivan et al., 2013; Lucas et al., 2016), and the Campanian Kaiparowits Formation of southern Utah (e.g., Hutchison et al., 2013; Lively, 2016). It represents a relatively rare component of the late Campanian (Kirtlandian) vertebrate fauna of the San Juan Basin of New Mexico (Sullivan and Lucas, 2003, 2006; Sullivan et al., 2013) and the Kaiparowits Formation of Utah, and is not known from Maastrichtian or Paleocene strata in New Mexico or Utah (Jasinski et al., 2011a, b). Indeed, the holotype (USNM 12979) was found in the upper Campanian Hunter Wash Member of the Kirtland Formation (Sullivan et al., 2013). We note here that while the holotype was correctly referred to the Hunter Wash Member in the text, Sullivan et al. (2013) mistakenly referred the type to the De-na-zin Member in the Appendix of the same paper. Thus far, *B. grandis* has only been definitely recovered from the older Hunter Wash Member, so if our identification is correct, SMP VP-2014 may represent a temporal range extension into the slightly younger De-na-zin

Member. It could also, however, represent a closely related but younger species. While some studies have mentioned that skull material of *Eubaena cephalica* and *Boremys pulchra* are quite similar (e.g., Lyson et al., 2011; Lively, 2015), their lower jaws show several distinctions, including the width of the triturating surface (significantly wider in *E. cephalica*), the lateral overhang of the triturating surface (larger in *E. cephalica*), and the development of the coronoid process (significantly higher in *E. cephalica*). Regardless, gracile lower jaws in turtles are often associated with carnivorous or piscivorous diets (e.g., Dalrymple, 1977; Hutchison, 1980; Gaffney, 1982; Lindeman, 2003; Claude et al., 2004; Ernst and Lovich, 2009; Jones et al., 2012; Marshall et al., 2012; Jasinski, 2018). The gracile form of the lower jaw of SMP VP-2014 may imply that this turtle was carnivorous or piscivorous, eating smaller prey such as fish that would not have required crushing (i.e., durophagy), the grinding of plant material, or the slicing up of larger prey.

The poor preservation of SMP VP-717 makes identification more difficult due to the concreted nature of the specimen. More skull and lower jaw materials are known from turtles of Paleocene New Mexico compared to those from the Late Cretaceous. Two of the taxa with cranial material are trionychids, including *Conchochelys admirabilis* and *Aspideretoides singularis* (Jasinski et al., 2011a; Vitek and Joyce, 2015). The lower jaws of trionychids tend to be enlarged caudally with a well-developed and high coronoid process, a clear ridge around the entire triturating surface (specifically at the dorsocaudal region of the median symphysis), a robust caudal portion of the lower jaw, and gracile anterior portions with the anterior-most region tapering significantly (specifically in lateral view) (e.g., Sheil, 2003; Vitek and Joyce, 2015). These features, specifically the gracile anterior portion of the dentary, are distinct from the morphology of SMP VP-717, which can thus be distinguished from trionychids (e.g., Hay, 1908; Gardner et al., 1995; Joyce and Lyson, 2011; Vitek, 2011, 2012; Jasinski, 2013; Li et al., 2015; Cadena, 2016). While the lower jaw of the bothremydid *Chedighaii hutchisoni* (KUVP 14765) are unknown (Gaffney et al., 2006), based on those of similar bothremydids, it seems probable that the lower jaw would have been distinct from SMP VP-717, with the former probably possessing an enlarged coronoid process, a gracile and low anterior portion of the lower jaw near the median symphysis, and an enlarged and greatly widened triturating surface.

SMP VP-717 is one of the rare specimens with skull material referable to the Baenidae from the Paleocene of New Mexico. Aside from the cranial and lower jaw material referred to *Palatobaena bairdi* (LACM 124005, 124006, and 124007) by Sullivan and Lucas (1986), recent skull material from the New Mexican Paleocene (NMMNH P-9049) has been referred to a new species of *Neurankylus*, *N. torrejonensis* (Lyson et al., 2016). As demonstrated by Gaffney (1979, 1982a, b), the lower jaw of *P. bairdi* has significantly wide triturating surfaces with a wide angle between the pair of dentaries, as does the congeneric *P. coheni* (see Lyson and Joyce, 2009a). Based on the slight concave curvature and general lack of width (or narrowness) of the triturating surfaces, and the potentially relatively low coronoid process, SMP VP-717 is similar to the Wasatchian-Uintan (Lyson and Joyce, 2010) taxon *Baena arenosa*. If SMP VP-717 is referable to *B. arenosa*, it would represent the oldest record of that taxon by at least 10 million years. However, there are some notable differences between SMP VP-717 and *B. arenosa*, with the former having a thinner triturating surface, a finer and thinner posterior extremity of the triturating surface, lacking a lateral overhang of the triturating surface, and having a significantly reduced retroarticular process, which suggest a species distinct from *B. arenosa*. SMP VP-717 is also distinctly older than any other known specimens of *B. arenosa*, which are found in the Eocene of Wyoming and Utah (Leidy, 1870, 1873; Hay, 1908; Gaffney, 1972; Joyce and Lyson, 2015), further suggesting SMP VP-717 is not referable to this taxon. It seems more likely that SMP VP-717 represents a closely related taxon or a potential ancestor of *B. arenosa*. While the Nacimiento Formation in New Mexico has had a large number of turtle taxa named over the last century or so (e.g., Jasinski et al., 2011a; Joyce and Lyson, 2015; Vitek and Joyce, 2015; Lichtig and Lucas, 2018 [this volume]), new taxa are still being discovered (e.g., Lyson et al., 2016). The new species of *Neurankylus* (*N. torrejonensis*) described by Lyson et al. (2016) does preserve a pair of lower jaws, which are also similar to those of *B. arenosa*. SMP VP-717 is also similar to *Neurankylus torrejonensis*, especially in regard to its robust nature, general proportions, deepness, relatively thin triturating surface, and vertical orientation of the articular surface. However, there are also several distinctions between SMP VP-717 and *N. torrejonensis*, including SMP VP-717 possessing a smaller angle between the rami, a smaller or potentially absent anterior symphyseal "hook," an absent or highly reduced lingual ridge, and lacking posterior serrations or indentations on the labial ridge. We believe these represent interspecific (rather than individual or intraspecific) variation, with SMP VP-717 representing a possible Puercan precursor to the Torrejonian *N. torrejonensis*. More material, particularly other skull and shell material (preferably associated) is needed before determining if these two taxa are distinct enough to warrant separate species. The similarity in the lower jaw morphology of the Paleocene New Mexican *Neurankylus* (both SMP VP-717 and *N. torrejonensis* [holotype NMMNH P-9049]) and the younger *B. arenosa* may be due to similarities in paleobiology, feeding, and diet among these fossil turtles. However, similarities in the lower jaw morphology of these turtles may also imply an evolutionary lineage. The narrow and laterally sharp triturating surface of SMP VP-717 suggests slicing and its deep and robust form implies large jaw muscles for a strong bite. It is noted, however, that a deep and robust lower jaw does not necessarily mean a strong bite due to large jaw musculature. Instead, it only suggests the bone itself is strong, although having larger jaw muscles giving rise to the larger and more robust bones is inferred. Indeed, another potential indicator of a strong bite force in the lower jaws of turtles is a prominent fossa on the surangular for insertion of the *m. adductor mandibulae* (see *Palatobaena*, Lyson and Joyce, 2009a), although SMP VP-717 does not possess a large fossa at the caudal end of the dentary. Regardless, these features suggest this turtle (represented by SMP VP-717) was carnivorous or piscivorous and may have fed upon larger fish and prey than did the baenid represented by SMP VP-2014.

Baenids have been noted as having a diversity of dietary habits (e.g., Lyson and Joyce, 2009a, b), and both SMP VP-2014 and VP-717 show morphologies that suggest distinct dietary preferences. Lyson and Joyce (2009b) noted the majority of baenid turtle lineages that survived from the Cretaceous into the Paleocene were durophagous. However, it is noted here that after Lyson et al. (2011) reported *Boremys* from the Paleocene (in addition to the Cretaceous), only half of the linages that survived the Cretaceous-Paleogene (K-Pg) extinction were durophagous. Lyson and Joyce (2009b) suggested that taxa with a more specialized diet survived into the Paleocene, while those more generalist did not. The lower jaw of SMP VP-2014 does not suggest it had a durophagous diet, which would agree with the assessment of Lyson and Joyce (2009b) of diverse feeding ecologies in the Cretaceous.

However, *Boremys* is known to survive into the Paleocene (see Lyson et al., 2011), and while the Paleocene species does not yet include skull material, based on similarities with Cretaceous *Boremys*, particularly *B. pulchra*, they would have presumably also possessed a thinner and more gracile set of mandibles similar to *B. pulchra* (and *B. grandis*, although no cranial material is yet definitively known for this latter species). This suggests a non-durophagous feeding ecology for the Paleocene *Boremys*. *Neurankylus torrejonensis* also had narrower triturating surfaces, indicating that it was also not durophagous (see Lyson et al., 2016), but still survived into the Paleocene. The Puercan SMP VP-717 is also not interpreted as a durophage, instead it probably exhibited a piscivorous or carnivorous feeding ecology.

We also note that clearly durophagous turtles, at least those with short skulls (and lower jaws) and wide triturating surfaces, are not as widespread and common south (e.g., New Mexico and Utah) compared to localities farther north (e.g., Montana, North Dakota, South Dakota) during the Late Cretaceous. Presumably durophagous taxa such as *Palatobaena*, *Cedrobaena*, and *Stygiochelys* are not known from the Late Cretaceous of the southern United States (e.g., Case, 1939; Gaffney and Hiatt, 1971; Gaffney, 1972, 1982a, b; Archibald and Hutchison, 1979; Hutchison and Archibald, 1986; Holroyd and Hutchison, 2002; Brinkman, 2003; Lyson and Joyce, 2009a, b; Holroyd et al., 2014; Joyce and Lyson, 2015), although *Palatobaena* has been identified from the Paleocene in New Mexico (Sullivan and Lucas, 1986; Jasinski et al., 2011a). In addition, *Stygiochelys* (Hutchison and Holroyd, 2003) and *Palatobaena* (Archibald and Hutchison, 1979; Hutchison and Holroyd, 2003) have been identified from the Paleocene of the Denver Basin in Colorado. While this implies a biostratigraphic range extension of these presumably durophagous turtles just after the end-Cretaceous extinction, we also infer a change in the paleoenvironment at this time, potentially allowing some of these turtles to move farther south. This could also be due to open niches after the potentially devastating ecological impacts of the extinction event, with new turtles filling the niches formerly held by other animals (i.e., non-turtles). Another possibility is that exhibiting a morphology that makes durophagy possible does not mean these animals were obligate durophages or molluscivores. Indeed, a similar jaw morphology could be used for eating things such as seeds (e.g., Moll and Jansen, 1995), which can also require crushing. Other dietary types, including herbivory, could also use a similar morphology for grinding rather than crushing. Nevertheless, these morphologies provide clues to the dietary preferences of these fossil turtles and, except for extreme or abnormal cases, jaw morphology corresponds with dietary preferences (and environment).

Regardless, baenid survival at the end of the Cretaceous is more complicated than previously believed. Although some specialists did survive into the Paleocene and some generalists did die out, not all baenids followed this pattern. *Boremys* and *Neurankylus*, both not considered durophagous, survived the Late Cretaceous into the Paleocene. SMP VP-2014 and VP-717, both believed to not be durophagous, follow the patterns shown by *Boremys* and *Neurankylus*. More specimens may show that diet was not as significant a factor to survival after the Cretaceous/Paleogene extinction, and/or they may show that local conditions played a larger and more important role than general dietary preferences and feeding ecologies.

CONCLUSIONS

SMP VP-717 and VP-2014 add to our knowledge of fossil turtles from the San Juan Basin, New Mexico. SMP VP-2014 represents the first recovered turtle fossil lower jaw from the Late Cretaceous of the San Juan Basin and is referred to the taxon cf. *Boremys grandis*, a taxon known only from New Mexico and Utah. In addition, the only previously known definitive *B. grandis* specimens are from the Hunter Wash Member (Kirtland Formation) and the Kaiparowits Formation of Utah, so the new record may extend the temporal range of this taxon into the younger De-na-zin Member of the Kirtland Formation, although associated cranial and post-cranial material is needed for more certainty. The gracile build of this lower jaw suggests that this turtle would probably have been carnivorous or piscivorous, eating smaller prey such as fish that would not have required crushing (i.e. durophagy) or the slicing up of larger prey or plant material.

SMP VP-717 represents additional lower jaw material from the Paleocene (Puercan) of New Mexico and is referred to cf. *Neurankylus torrejonensis*. Some differences with *N. torrejonensis* may imply this turtle is ancestral to the Torrejonian-age species and thus provides evidence of an anagenetic lineage. Associated cranial, lower jaw, carapace, and plastron material are needed to determine how these New Mexican *Neurankylus* specimens compare and whether they represent the same, or distinct, species. The narrow and laterally sharp triturating surface of SMP VP-717 suggests slicing and we infer its deep and robust form to mean it possessed large jaw muscles for a strong bite. Being carnivorous or piscivorous, this may have been for eating larger fish and prey than SMP VP-2014. Similarities with the lower jaw of *Baena arenosa* suggests similarities in the feeding habits and diet of these two turtles. Durophagy may not have been as important to the survival of baenid turtles after the Cretaceous/Paleogene extinction as previously thought. Durophagous turtles are seemingly absent from the southern United States in the Late Cretaceous, and only begin to show up after the K-Pg extinction. This has paleoecological implications for this region during a critical time in its biological history.

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