



## ***Low diversity Selachian assemblage from the Upper Cretaceous Greenhorn Limestone, Socorro County, New Mexico***

Spencer G. Lucas and Justin A. Spielmann

2009, pp. 311-314. <https://doi.org/10.56577/FFC-60.311>

in:

*Geology of the Chupadera Mesa*, Lueth, Virgil; Lucas, Spencer G.; Chamberlin, Richard M.; [eds.], New Mexico Geological Society 60<sup>th</sup> Annual Fall Field Conference Guidebook, 438 p. <https://doi.org/10.56577/FFC-60>

---

*This is one of many related papers that were included in the 2009 NMGS Fall Field Conference Guidebook.*

---

### **Annual NMGS Fall Field Conference Guidebooks**

Every fall since 1950, the New Mexico Geological Society (NMGS) has held an annual [Fall Field Conference](#) that explores some region of New Mexico (or surrounding states). Always well attended, these conferences provide a guidebook to participants. Besides detailed road logs, the guidebooks contain many well written, edited, and peer-reviewed geoscience papers. These books have set the national standard for geologic guidebooks and are an essential geologic reference for anyone working in or around New Mexico.

### **Free Downloads**

NMGS has decided to make peer-reviewed papers from our Fall Field Conference guidebooks available for free download. This is in keeping with our mission of promoting interest, research, and cooperation regarding geology in New Mexico. However, guidebook sales represent a significant proportion of our operating budget. Therefore, only *research papers* are available for download. *Road logs*, *mini-papers*, and other selected content are available only in print for recent guidebooks.

### **Copyright Information**

Publications of the New Mexico Geological Society, printed and electronic, are protected by the copyright laws of the United States. No material from the NMGS website, or printed and electronic publications, may be reprinted or redistributed without NMGS permission. Contact us for permission to reprint portions of any of our publications.

One printed copy of any materials from the NMGS website or our print and electronic publications may be made for individual use without our permission. Teachers and students may make unlimited copies for educational use. Any other use of these materials requires explicit permission.

*This page is intentionally left blank to maintain order of facing pages.*

# LOW DIVERSITY SELACHIAN ASSEMBLAGE FROM THE UPPER CRETACEOUS GREENHORN LIMESTONE, SOCORRO COUNTY, NEW MEXICO

SPENCER G. LUCAS AND JUSTIN A. SPIELMANN

New Mexico Museum of Natural History and Science, 1801 Mountain Rd. NW, Albuquerque, NM, 87104

**ABSTRACT**—We document a selachian assemblage from the Bridge Creek Member of the Greenhorn Limestone near the town of Carthage in Socorro County, New Mexico (sec. 8, T5S, R2E). This fossil assemblage occurs within the *Sciponoceras gracile* ammonite zone of late Cenomanian age. Specimens of *Ptychodus* dominate the assemblage, with a single blade-shaped tooth that can be identified as *Squalicorax* sp. *Ptychodus* specimens belong to *P. occidentalis* and *P. anonymous* and further confirm their presence in upper Cenomanian strata. The low diversity and *Ptychodus* domination of the Carthage selachian assemblage may reflect a relatively deep water, offshore paleoenvironment, though the allochthonous nature of the assemblage hinders definitive paleoenvironmental interpretation.

## INTRODUCTION

Fossil selachians (mostly shark teeth) have a diverse record in Upper Cretaceous strata in New Mexico (Williams, 2006). Most of the fossil localities are in north-central and northwestern New Mexico, and few Cretaceous selachian localities have been reported south of Albuquerque. In Socorro County, only one locality has been described—a selachian assemblage from the Turonian Atarque Member of the Tres Hermanos Formation (Baker, 1981; Wolberg, 1985a, b). Here, we document a second Cretaceous selachian site in Socorro County, from the upper Cenomanian Bridge Creek Member of the Greenhorn Limestone (Fig. 1).

## PROVENANCE

In 2006, Alan Erickson discovered isolated selachian teeth near the ghost town of Carthage; the locality is now NMMNH (New Mexico Museum of Natural History and Science) locality 6932 in sec. 8, T05S, R02E (Fig. 1). The collections made by Erickson and by one of us (SGL) now constitute 18 cataloged lots/specimens in the NMMNH collection. Locality 6932 is in a 0.3- to 0.6-m-thick bed of sandy limestone/calcarene, near the base of the Bridge Creek Member of the Greenhorn Limestone (e.g., Hook, 1983). This locality is within the *Sciponoceras gracile* ammonite zone of latest Cenomanian age (Hook, 1983). The selachian assemblage is dominated by teeth of *Ptychodus*; one fragment of a blade-like tooth has coarse serration and may belong to *Squalicorax*.

## SELACHIANS

### *Ptychodus anonymous*

Teeth of *Ptychodus anonymous* from NMMNH locality 6932 (Fig. 2A-B) are characterized by a broad crown with a knoblike cusp that has 8-12 fine transverse ridges that extend down the cusps then divide and curl around to enter the marginal area of the tooth. The marginal area around the cusp base has a reticulate enamel sculpture. The roots are broad, trapezoidal and short. Crown widths range from 8 to 13 mm, and the maximum tooth

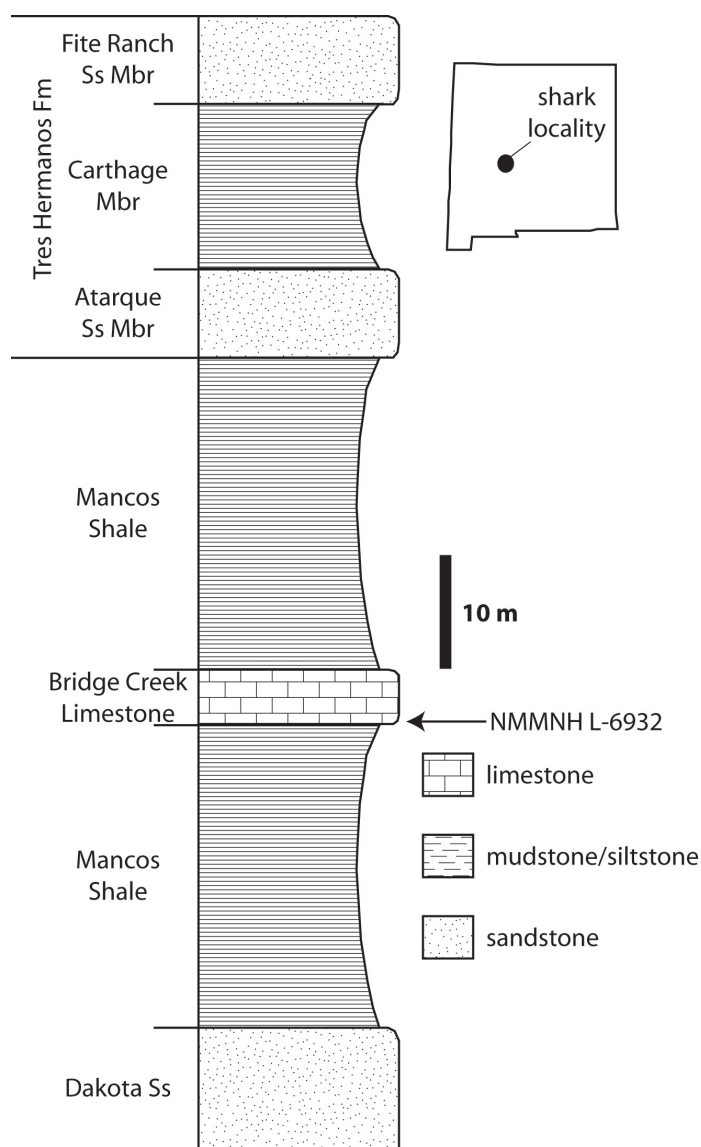


FIGURE 1. Cretaceous section near Carthage, New Mexico with NMMNH L-6932 highlighted. Section modified from Hook (1983).

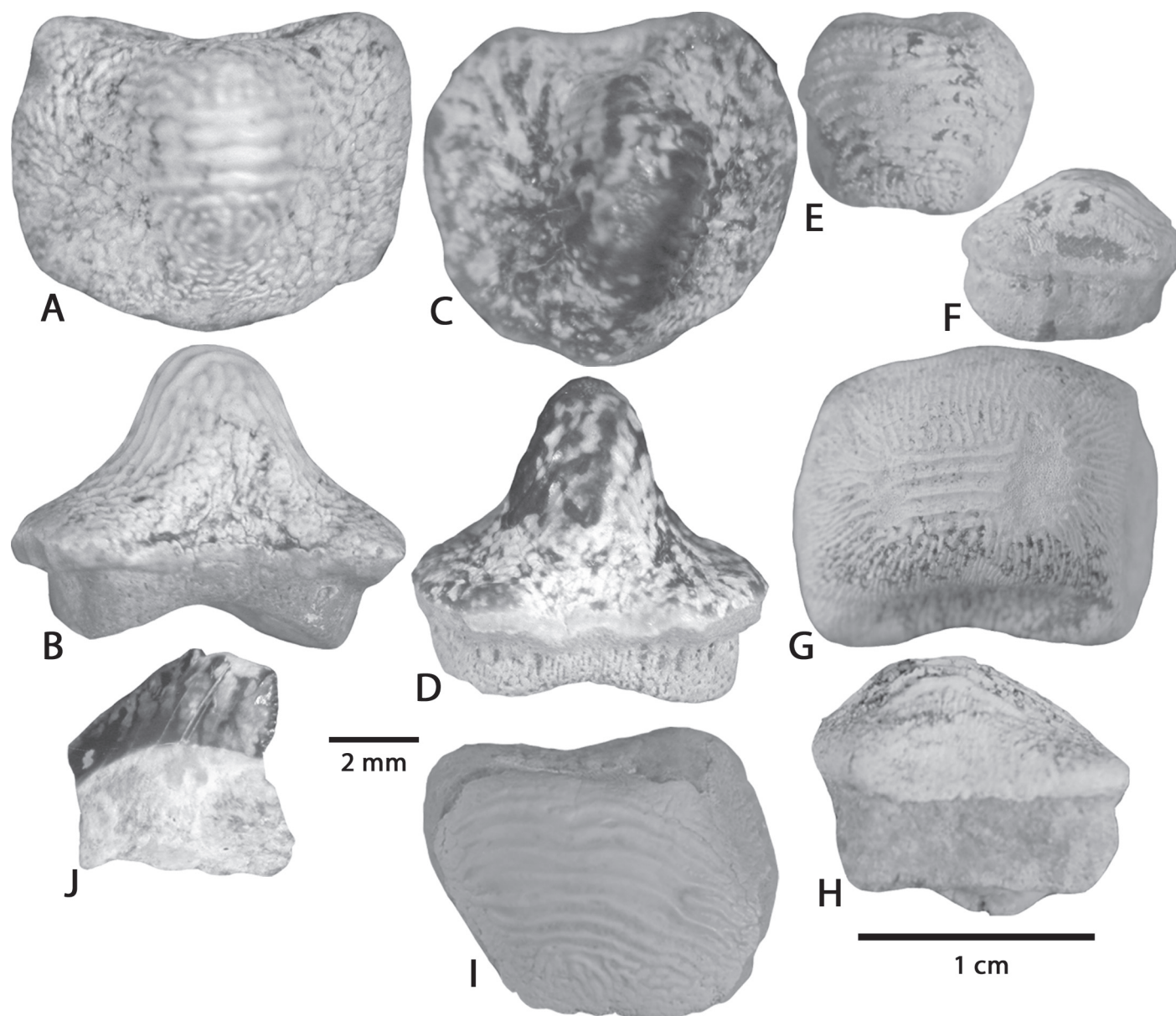


FIGURE 2. Selachian teeth from NMMNH locality 6932. **A-B**, *Ptychodus anonymus*, NMMNH P-54598, juvenile tooth in **A**, occlusal and **B**, in lingual view. **C-D**, *Ptychodus anonymus*/*Ptychodus whipplei*, NMMNH P-54604, tooth in **C**, occlusal and **D**, lingual view. **E-F**, *Ptychodus occidentalis*, NMMNH P-54615, tooth in **E**, occlusal and **F**, lingual view. **G**, *Ptychodus occidentalis*, NMMNH P-54612, tooth in occlusal view. **H**, *Ptychodus occidentalis*, NMMNH P-54611, tooth in lingual view. **I**, *Ptychodus occidentalis*, NMMNH P-54608, tooth in occlusal view. **J**, *Squalicorax* sp., NMMNH P-54597, tooth in lingual view. Left scale bar applies to **A-D**, **J** and right scale bar applies to **E-I**.

height (root plus crown) is 11 mm. These teeth have similar morphology to *P. anonymus*, as described by Welton and Farrish (1993), but have higher crowns.

#### *Ptychodus anonymus*/*Ptychodus whipplei*

Some of the *Ptychodus* teeth appear to be a transitional form between *Ptychodus anonymus* and *P. whipplei* (Fig. 2C-D). These teeth have the prominent, cylindrical cusps of *P. whipplei* and the transverse ridges that extend down the sides of the cusp of *P. anonymus*. This transitional form between the two taxa has been

observed elsewhere in the Greenhorn Limestone of North Dakota (B. Schumacher, pers. commun., 2009). In all other features these *Ptychodus* teeth are identical to those described above.

#### *Ptychodus occidentalis*

Teeth of *Ptychodus occidentalis* from locality 6932 (Fig. 2E-I) are square in occlusal view and possess a low, robust crown. The root is short and trapezoidal, much as in *P. anonymus*. Transverse ridges run across the crown and bifurcate numerous times distally, grading into finer parallel to subparallel ridges. Crown widths in



our sample range from 11 to 26 mm, and maximum tooth height (root plus crown) is 19 mm. These teeth conform well to the morphology of teeth assigned to *P. occidentalis* by Welton and Farrish (1993) and by Shimada et al. (2006), among others.

### *Squalicorax* sp.

A single tooth fragment (Fig. 2J) from locality can be assigned to *Squalicorax* but is not complete enough for species-level identification. It is obviously a posteriorly-canted, coarsely serrated blade-like tooth with a large, thick root. The strong distal curve suggests it probably belongs to *S. falcatus* (cf. Welton and Farrish, 1993; Shimada et al., 2006) or *S. curvatus* (B. Schumacher, pers. commun., 2009), but without a complete crown (especially the distal heel), assignment to a species cannot be definite.

### DISCUSSION

The Greenhorn Limestone yields selachian teeth at several localities across New Mexico (Williams, 2006), but only two assemblages have previously been documented in print: (1) a small assemblage consisting of *Squalicorax falcatus*, *S. curvatus*, *Cretodus semiplicatus*, *Cretoxyrhina mantelli*, *Ptychodus anonymus* and *P. occidentalis* from the base of the Lincoln Member of the Greenhorn at Apache Canyon in Quay County (Lucas et al., 2000); and (2) a much richer assemblage, though still of relatively low diversity, consisting of *Squalicorax falcatus*, *Scapanorhynchus raphiodon*, an odontaspid, *Ptychodus anonymus*, *Ptychotrygon triangularis*, batoids and lamnoid centra, from the Bridge Creek Member in the southern Cooke's Range near Deming in Luna County (Lucas et al., 1988). Outside of New Mexico, the Greenhorn Limestone yields selachian teeth from various localities, most notably the Tobe locality at the base of the Lincoln Member of southeastern Colorado, an assemblage of at least 22 chondrichthyan, 15 osteichthyan and six aquatic reptile taxa (Shimada et al., 2006). The Carthage locality reported here stands out among Greenhorn selachian assemblages by its low diversity and almost total domination by teeth of *Ptychodus*.

The teeth of *Ptychodus* found at locality 6932 are, for Late Cretaceous selachian teeth, relatively large and durable. This may explain their great abundance, as all the teeth in the fossil assemblage were found isolated and therefore must have been transported. Therefore, taphonomic/hydraulic factors may explain the composition of the locality 6932 selachian assemblage when compared to other more diverse Greenhorn selachian assemblages.

Another possibility is that paleoenvironmental differences explain the differences in the composition of Greenhorn selachian fossil assemblages. Thus, Meyer (1974) noted different associations in selachian assemblages from the Upper Cretaceous strata of the Texas Gulf Coast (also see Williamson et al., 1993, for recognition of similar associations in the Upper Cretaceous of northeastern Arizona). What he termed the *Ptychodus-Cretoxyrhina* association encompasses assemblages like locality 6932, in which there are numerous teeth, low diversity and a dominance of the taxa *Ptychodus*, *Squalicorax* and *Cretoxyrhina*. These may be relatively deep water assemblages, and/or they may reflect facies

in which certain food items are abundant, such as inoceramid bivalves, an inferred prey item of *Ptychodus*.

Certainly localities in the Bridge Creek Member are deeper water localities than those in the Lincoln Member. The Bridge Creek represents a highstand of the Western Interior Seaway across the Cenomanian-Turonian boundary (e.g., Kauffman and Caldwell, 1993). Furthermore, the Bridge Creek selachian assemblage near Deming documented by Lucas et al. (1988) is more landward and more diverse than the Bridge Creek selachian assemblage documented here. This provides some support for the idea that the low diversity and *Ptychodus* domination of the Carthage selachian assemblage could reflect a relatively deep water, offshore paleoenvironment. Nevertheless, this conclusion, and all conclusions about the paleoecological significance of Upper Cretaceous selachian tooth assemblages, need to be tempered by the observation that all of these assemblages have been to some degree transported or hydraulically sorted. These selachian assemblages are all allochthonous to the rock they are found in, so their paleoecological interpretation remains somewhat problematic.

### ACKNOWLEDGMENTS

We are grateful to Allan Erickson for finding the Carthage selachian assemblage and bringing it to our attention. Jim Murphy helped with the initial phases of this research. Bruce Schumacher and Bruce Welton provided helpful reviews that improved the manuscript.

### REFERENCES

- Baker, B.W., 1981, Geology and depositional environments of Upper Cretaceous rocks, Sevilleta Grant, Socorro County, New Mexico [M.S. thesis]: Socorro, New Mexico Institute of Mining and Technology, 159 p.
- Hook, S. C., 1983, Stratigraphy, paleontology, depositional framework, and nomenclature of marine Upper Cretaceous rocks, Socorro County, New Mexico: New Mexico Geological Society, 34<sup>th</sup> Fall Field Conference Guidebook, p. 165-172.
- Kauffman, E.G. and Caldwell, W.G.E., 1993, The Western Interior basin in space and time; in Caldwell, W.G.E. and Kauffman, E.G., eds., Evolution of the Western Interior basin: Geological Association of Canada, Special Paper 39, p. 1-30.
- Lucas, S.G., Estep, J.W., Pence, R. and Hunt, A.P., 2000, Upper Cretaceous outlier in Quay County, New Mexico: stratigraphy and lithostratigraphy: New Mexico Museum of Natural History and Science, Bulletin 16, p. 121-127.
- Lucas, S.G., Kues, B.S., Hayden, S.N., Allen, B.D., Kietzke, K.K., Williamson, T.E., Sealey, P. and Pence, R., 1988, Cretaceous stratigraphy and biostratigraphy, Cooke's Range, Luna County, New Mexico: New Mexico Geological Society, 39<sup>th</sup> Fall Field Conference Guidebook, p. 143-167.
- Meyer, R.L., 1974, Late Cretaceous elasmobranchs from the Mississippi and East Texas embayments of the Gulf Coastal Plain [Ph.D. dissertation]: Dallas, Southern Methodist University, 419 p.
- Shimada, K., Schumacher, B.A., Parkin, J.A. and Palermo, J.M., 2006, Fossil marine vertebrates from the lowermost Greenhorn Limestone (Upper Cretaceous: middle Cenomanian) in southeastern Colorado: The Paleontological Society, Memoir 63, 45 p.
- Welton, B.J. and Farrish, R.F., 1993, The collector's guide to fossil sharks and rays from the Cretaceous of Texas: Lewisville, Before Time, 204 p.
- Williams, S.C., 2006, Late Cretaceous selachian biostratigraphy in New Mexico [M.S. thesis]: Albuquerque, University of New Mexico, 117 p.
- Williamson, T.E., Kirkland, J.I. and Lucas, S.G., 1993, Selachians from the Greenhorn cyclotherm ("Middle" Cretaceous: Cenomanian-Turonian), Black Mesa, Arizona, and the paleogeographic distribution of Late Cretaceous selachians: Journal of Paleontology, v. 67, p. 447-474.

Wolberg, D.L., 1985a, Late Cretaceous (Turonian) selachians from the Atarque Sandstone Member of the Tres Hermanos Formation, Sevilleta Grant, Socorro County, New Mexico: New Mexico Geology, v. 7, p. 1-7.

Wolberg, D.L., 1985b, Selachians from the Atarque Sandstone Member of the Tres Hermanos Formation (Upper Cretaceous: Turonian), Sevilleta Grant near La Joya, Socorro County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Circular 195, p. 7-19.