LATE CRETACEOUS SELACHIANS AND ASSOCIATED MARINE VERTEBRATES FROM THE DAKOTA ROSE GRANITE QUARRY, GRANT COUNTY, SOUTH DAKOTA

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ABSTRACT

Marine fossils have been recovered from Cretaceous deposits nonconformably overlying Precambrian granites as a result of a number of quarry operations to extract granite in northeastern South Dakota. Only incidental references to the selachians have been previously published. Through the efforts of Ms. Gerralynn Thomas, a sample of selachians and associated marine vertebrates from the Late Cretaceous Dakota Rose Granite Quarry was made available to us for study. Newly recognized selachian taxa from the quarry include: *Ptychodus whipplei* Marcou, 1858, *Cretoxyrhina mantelli* (Agassiz, 1843), *Cretolamna appendiculata* (Agassiz, 1843), *Cretodus crassidens* (Dixon, 1850), *Leptostyrax compressidens* (Herman, 1975), *Scapanorhynchus rhaphiodon* (Agassiz, 1844), *Ptychotrygon triangularis* (Reuss, 1844), and *Pseudohypolophus mcnultyi* (Thurmond, 1971). *Squalicorax falcatus* (Agassiz, 1843) was previously mentioned; the *Isurus* of two previous papers has been reidentified as *Cretoxyrhina mantelli*. Additional investigation of the teleosts indicates that previous reference to a specimen of *Cimolichthys nepaholica* (Cope, 1872) should be amended to *Pachyrhizodus minimus* Stewart, 1899. A few tooth fragments of a pliosaurid plesiosaur, provisionally referred to *Brachauchenius* Williston, 1903, were discovered.

The evolutionary stage of the selachian assemblage approximates that of the Codell Sandstone in Kansas and of the basal part of the Austin Chalk in Texas. A medial or late Turonian date is most probable for the Cretaceous deposits yielding those fossils in the Dakota Rose Granite Quarry.

INTRODUCTION

As noted by Witzke (1981), relatively little is known of the Cretaceous marine vertebrates of the eastern margin of the Western Interior epicontinental sea. One area where a number of taxa have been collected is in the Ortonville-Milbank area of Grant County, South Dakota. Zangerl and Sloan (1960) identified a number of taxa from sedimentary deposits unconformably overlying the Precambrian granites which are actively quarried in the region. They described a partial skeleton of the cheloniid, *Desmatochelys lowi*, and mentioned the occurrences of the selachians, *Isurus*, *Squalicorax*, and *Ptychodus janewayii*, and the teleost, *Ichthyodectes*. In his revision of the North American ichthyodectids, Bardack (1965) listed *Gillicus* and *Ichthyodectes* as occurring in these rocks. After a twenty-year hiatus, attention was again focused on the vertebrate fossils of the Ortonville-Milbank quarries by the University of Minnesota, Morris, and the Museum of Geology, South Dakota School of Mines and Technology. Through the efforts of Dr. James Van Alstine and his students, particularly Ms. Gerralynn Thomas, specimens were made available for study. Based on part of their collections, Fahrenback and Martin (1986) added *Squalicorax falcatus*, *Gillicus arcuatus*, and *Cimolichthys nepaholica* to the paleofauna. Additional collections and study indicate that the last taxon is actually a species of *Pachyrhizodus* and that the references to *Isurus* should be considered as *Cretoxyrhina mantelli*. Ms. Gerralynn Thomas graciously donated a portion of her collection of selachian teeth; they constitute the bulk of this contribution and comprise nine species of selachians and one reptile.

SYSTEMATIC PALEONTOLOGY

All specimens described below were collected from Cretaceous deposits in the Dakota Rose Granite Quarry, South Dakota School of Mines (SDSM) locality V8612 and repose in the systematic collections of the Museum of Geology.

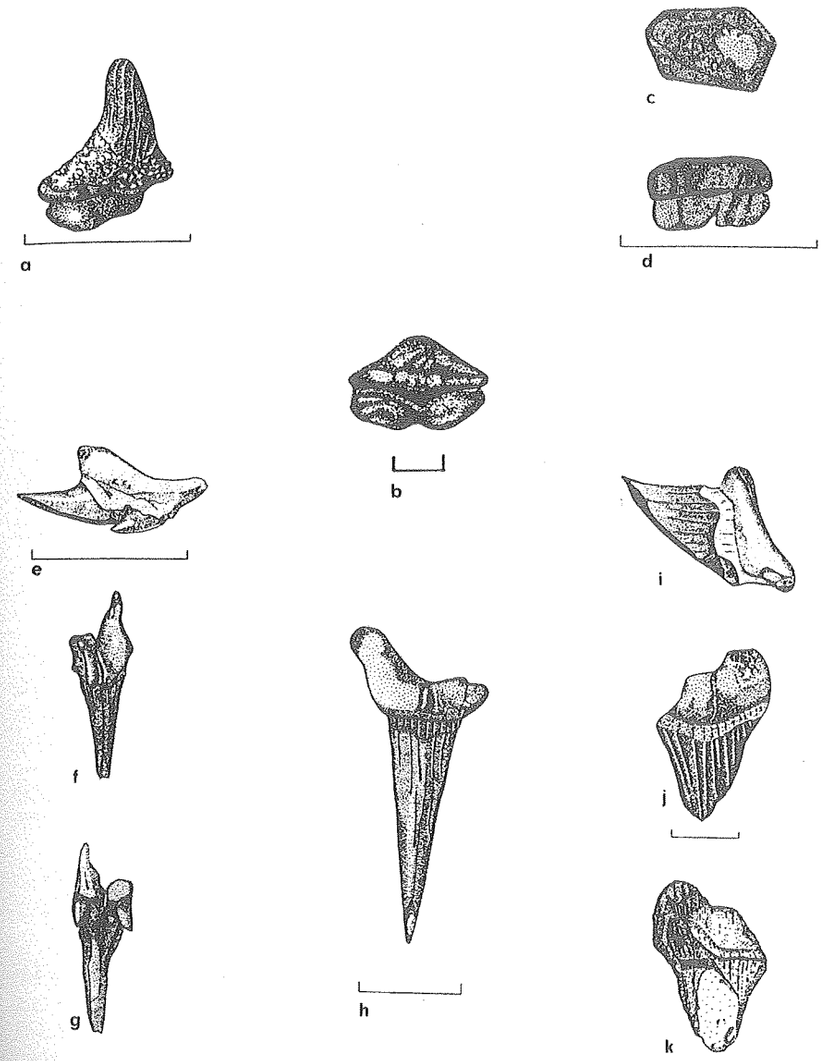

Figure 1. (Facing page) *Ptychodus whipplei*, SDSM 25897: a) lateral view; *Ptychotrygon triangularis*, SDSM 25902: b) labial view; *Pseudohypolophus mcnultyi*, SDSM 25900: c) dorsal view, d) lingual view; *Leptostyrax compressidens*, SDSM 25903: e) distal view, f) lingual view, g) labial view; *Scapanorhynchus raphiodon*, SDSM 25906: h) lingual view; *Cretodus crassidens*, SDSM 25931: i) distal view, j) lingual view, k) labial view. Scale equals 1cm on all drawings except b, on which the scale equals 1mm.

Chondrichthyes
Ptychodontidae
Ptychodus whipplei Marcou, 1858
Referred specimens. SDSM 25897-25899, isolated teeth.

Numerous species of *Ptychodus* have been reported from the Upper Cretaceous rocks of North America. Extremely high-crowned teeth with distinct occlusal ridges indicate *P. whipplei*. In Texas and Kansas, two morphs bear the specific name of *P. whipplei*. The medial Turonian morph has a high central cusp with an oval cross-section; the late Turonian morph, which includes the holotype, exhibits a central cusp with a circular cross-section. SDSM 25897-25899 clearly possess a circular cross-section (Figure 1a). This species is indigenous to North America, and its temporal range is Turonian to Coniacian (Meyer, 1974; Williamson *et al.*, 1993).

Sclerorhynchidae
Ptychotrygon triangularis (Reuss, 1844)
Referred specimen. SDSM 25902, isolated tooth.

This exceedingly small tooth (Figure 1b; 2.5mm in width) resembles teeth of this species in having three prominent ridges trending across the crown. This species was also noted in the Turner Sandy Member of the Carlile Formation from Fall River County, South Dakota (Cappetta, 1973).

Incertae sedis
Pseudohypolophys mcnultyi (Thurmond, 1971)
Referred specimens. SDSM 25900-25901, isolated teeth.

The two teeth representing this species are low-crowned with a deeply split, bilobate root. The occlusal outline of the crown of SDSM 25900 (Figure 1c; width of 5.9mm) is irregularly hexagonal; that of SDSM 25901 (width of 4mm) is more reniform, but overall hexagonal.

Cretoxyrhinidae
Cretoxyrhina mantelli (Agassiz, 1843)
Referred specimens. SDSM 25934, 8 broken teeth.

All of the specimens of this taxon at our disposal are fragmentary teeth. Nonetheless, one shows the wide band separating the root from the crown and the absence of a lateral cusplet. The tips of several of the fragments are biconvex.

cf. *Cretolamna appendiculata* (Agassiz, 1843)
Referred specimen. SDSM 25938, partial root with lateral cusp.

This specimen is somewhat abraded, but resembles *Cretolamna appendiculata* in having a lateral cusplet, wide dental band, and no coronal striae.

Cretodus crassidens (Dixon, 1850)
Referred specimens. SDSM 25931-25932, broken teeth.

SDSM 25931 (Figure 1i-k) is a partial tooth that has a height of 3cm and might have been as large as 4 or 5cm when complete. The root is massive with a high lingual protuberance, and somewhat of a notch occurs between this protuberance and the tip of the root. The lateral cusplet is broken off but was not connected to the primary cusp. There are indications of some folding on the labial surface of the crown base, and coronal striae occur lingually.

cf. *Cretolamna* or *Cretodus* indet.
Referred specimens. SDSM 25939-25942,
broken teeth and lateral cusps.

Leptostyrax compressidens (Herman, 1975)
Referred specimens. SDSM 25903-25905, isolated teeth.

SDSM 25903 and 25904 possess a laterally compressed root with a prominent lingual protuberance. The pair of lateral cusplets diverge from the primary cusp. A few striae occur on the labial side of the primary cusp as well as several short striae at the base of the lingual side (Figure 1e-g). SDSM 25905 is more abraded but conforms to this description to the extent that its preservation permits. Herman (1975) described this taxon as the type species of *Pseudoscapanorhynchus*, but Cappetta (1987) referred the species to *Leptostyrax*.

Anacoracidae
Squalicorax falcatus (Agassiz, 1843)
Referred specimens. SDSM 25943-25952, isolated teeth.

Four of the largest specimens (25944-25947) measure between 11 and 13mm in width and are higher than wide. The mesial cutting edge of the anterior teeth is linear to slightly concave. The lateral groove is somewhat less deep than that of the species occurring later. The species is also known from the Turonian of western South Dakota (Cappetta, 1973), Texas (Bilelo, 1969; Welton and Farish, 1993), New Mexico (Hunt and Lucas, 1993), and Arizona (Williamson *et al.*, 1993).

Mitsukurinidae
Scapanorhynchus raphiodon (Agassiz, 1844)
Referred specimens. SDSM 25906-25923, isolated teeth.

Most of these specimens (Figure 1h) bear lingual striae, and those with preserved roots possess a prominent nutrative groove. Although some specimens preserve lateral cusplets, many have been broken away. In the limited collection in hand, this taxon is the most common, comprising approximately 30 percent of the sample. However, Ms. Gerralynn Thomas indicates that *Squalicorax falcatus* appeared more commonly in the field.

Reptilia
Plesiosauria
Pliosauridae
cf. *Brachauchenius* sp. indet.

Referred specimens. SDSM 25953, 3 broken tooth fragments.

These three fragments possess distinct, robust ridges which radiate from the tip and are characteristic of a pliosaurid. *Brachauchenius lucasi* is the only Late Cretaceous pliosaurid known from the epicontinental seaway, suggesting these teeth could be referred to that taxon. However, based upon tooth fragments, we hesitate to make this assertion. Although these teeth represent the first published notice of the occurrence of this taxon in South Dakota, we have observed other more complete teeth from the Turner Sandy Member of the Carlile Shale collected by Mr. J. Foster Sawyer and the second author in Fall River County, southwestern South Dakota.

DISCUSSION

These fossil teeth were collected from arkosic sediments reworked from the underlying Precambrian granite. The rock is a very well indurated grus, interbedded with limestone and siltstone. The unit has been described as Carlile Shale by a number of authors, based principally upon the occurrence of *Collingnoniceras woollgari*, which suggests not only the correlation with the Carlile Shale but also a medial Turonian age (Cobban, 1983; Merewether, 1983; Shurr and Cobban, 1979). Based purely upon lithostratigraphic evidence, the deposits do not appear identical to rocks typical of the Carlile Shale. At most, the deposits may represent a local expression of the Carlile Shale or may represent a different lithostratigraphic entity. Although the ammonite evidence suggests a medial Turonian age, the specimens of *Ptychodus whipplei* appear to be the late Turonian morph. Resolution of this apparent contradiction may be that the selachians were derived from a unit overlying those of the ammonites mentioned by Cobban. However, most of the specimens were collected just above the granite, and in some cases, between spheroidally weathered granitic boulders which do not appear to have been displaced. Another possibility is that the temporal distinction between morphologies of *Ptychodus* is artificial, and the morphologies represent ecomorphs, perhaps related to water depth or other habitat preference. Resolution of the temporal differences between the selachian assemblage and the ammonite evidence may be resolved when our study of the teleosts is completed.

ACKNOWLEDGEMENTS

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