Surface Collection of Late Cretaceous Shark and Fish Remains from Sandoval County, New Mexico

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Abstract

During the Late Cretaceous, a shallow marine seaway covered a portion of the western United States that includes present-day New Mexico. A diverse assemblage of marine vertebrates including sharks, fish, and marine reptiles inhabited this seaway. Little consensus exists on the taxonomy and chronology of reported species from that area. Our fieldwork and research aims to address gaps in previous studies through detailed field collection, laboratory analysis, museum visitation, and primary literature review. Numerous species of shark, ray teeth and bony fishes were collected, identified, and may overlap with the third order eustatic sea level cyclicity that may have resulted in their concentration into lag deposits. These findings can corroborate previous studies and map the occurrence of New Mexico's Late Cretaceous shark and fish deposits and correlate them to other contemporaneous locations in the Western Interior Seaway and elsewhere globally.

Figure 1: Western Interior Seaway from the Late Turonian, roughly 90 Mya.

Introduction

- The study area is within the Late Cretaceous Gallup Sandstone (kg), Mulatto Tongue of the Mancos Shale (kmm), and Lower Mancos Shale (kml) and is also adjacent to the Cenozoic volcanic deposit of Cerro Cochino (Tim).
- Late Cenozoic volcanic necks have intruded through vast exposures of Late Cretaceous shallow marine sediments.
- Most teeth are taphonomically worn because they were tossed around due to sea level fluctuations in a shallow marine environment; sea level fluctuations concentrated the teeth into these lag deposits.
- The teeth demonstrate an absence of terrestrial influence.
- There is a potential to correlate rock units based on fossil assemblages in other contemporaneous areas of the Western Interior Seaway.

Figure 2: Geologic Map of New Mexico showing the location of the study area outlined in red.

Materials and Methods

We were granted access to surface collect our site in Sandoval County through the Bureau of Land Management. The research area was prospected, and sediment was collected and sifted through using a layer of sieves, separating by particle size. Samples of each particle size were then analyzed through a binocular microscope and forceps were used to collect shark, ray, and fish teeth. The teeth were then identified through anatomical identification and known sources on chondrichthyan literature.

Results

Rays

Pseudohypolophus mcnultyi

Bony Fish

Pycnodontiformes indet.

Ptychotrygon triangularis

Ischyrhiza cf. *I. mira*

Onchosaurus sp.

Enchodus sp.

Protosphyraena sp.

Sharks

Cretalamna appendiculata

Cretodus crassidens

Credotus semiplicatus

Hybodus sp

Ptychodus anonymus

Ptychodus mammillaris

Scindocorax novimexicanus

Squalicorax falcatus

Scapanorhyncus raphiodon

Scapanorhyncus puercoensis

Carcharias sp.

Protolamna sp.

Figure 3: (a)*Scapanorhyncus puercoensis* and (b) *Scapanorhyncus raphiodon*
Scale bar= 1cm

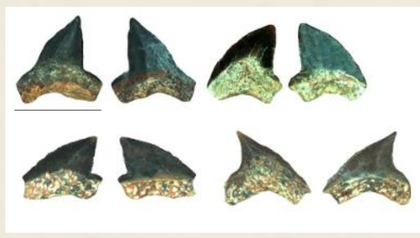

Figure 4: *Squalicorax falcatus*
Scale bar= 1cm

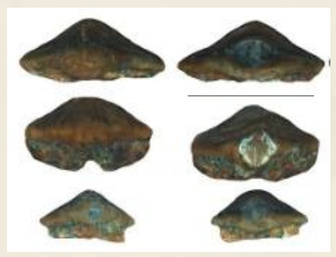

Figure 5*: Ptychotragon triangularis*
Scale bar= 5 mm

Figure 6: *Carcharias* sp.
Scale bar=5 mm

Figure 7: *Pseudohypolophus mcnultyi*
Scale bar = 5 mm

Figure 8: *Cretalamna appendiculata*
Scale bar=2 cm

Figure 9: A group picture of the team in the field in Sandoval County, New Mexico, June 2019

Acknowledgements

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Literature Used

[1] Becker *et al* 2002; [2] Becker*et al* 1998; [3] Becker *et al* 2012; [4] Cappetta, H. 2012; [5] Cappetta, H. and G. Case. 1999; [6] Cappetta, H. and G. Case. 1975; [7] Cicimurri, D. 2004; [8] Haq, B. 2014; [9] Haq et *al*. 1988; [10] Eaton et *al* 1999; [11] Edwards, P. 1976; [12] Hook, S. 1983; [13] Hook *et al* 1983

Conclusions / Future Directions

- Sequence stratigraphy created the lag deposits at the transition of geologic age from the Turonian to the Coniacian approximately 90 million years ago.
- Teeth will be sent out for testing to determine a refined geologic age. We will obtain Repository Catalogue Numbers from the Academy of Natural Sciences of Philadelphia for shark and fish remains collected from our proposed study area.
- Shark and fish teeth collected from our study will be compared to teeth elsewhere in New Mexico and adjacent states that were impacted by the Western Interior Seaway throughout its transformation to the Late Cretaceous in the Atlantic and Gulf Coastal Plains.
- The role of sea level cyclicity will be identified with regards to the fossil shark and fish assemblages concentrated within the exposures of the Gallup Sandstone and Mancos Shale by comparing sea level curves (Haq et al.)
- Identify which third order sea level cycles created lag deposits in previous studies on NM fossil shark and fish assemblages.
- The global nature of sea level cycles can be correlated to associated shark tooth lag deposits across the Western Interior Seaway, Atlantic and Gulf Coastal Plains, and globally.