



# Cranial osteology and phylogenetic relationships of a Late Triassic parareptile from the Chinle Formation of the American Southwest



REU Site, EAR-1062692

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## Introduction

Procolophonidae, a family of small to medium-sized parareptiles, emerged in the Permian, survived the Permian-Triassic mass extinction, and diversified until the Triassic-Jurassic extinction. This group was very widespread, with fossils known from every continent. Typical procolophonids are recognized by their small size, elongated orbits, and bulbous or bicuspid molariform teeth.

MCZ 9312 and 9313 are two specimens of a highly derived procolophonid that were found in the Owl Rock Member of the Chinle Formation in the American Southwest, dating to the Late Triassic.

57 cranial, dental, and skeletal characteristics from Cisneros (2008) were coded in 25 taxa of Procolophonidae. Only 26 of these cranial and dental characteristics could be applied to and coded for the MCZ specimens.



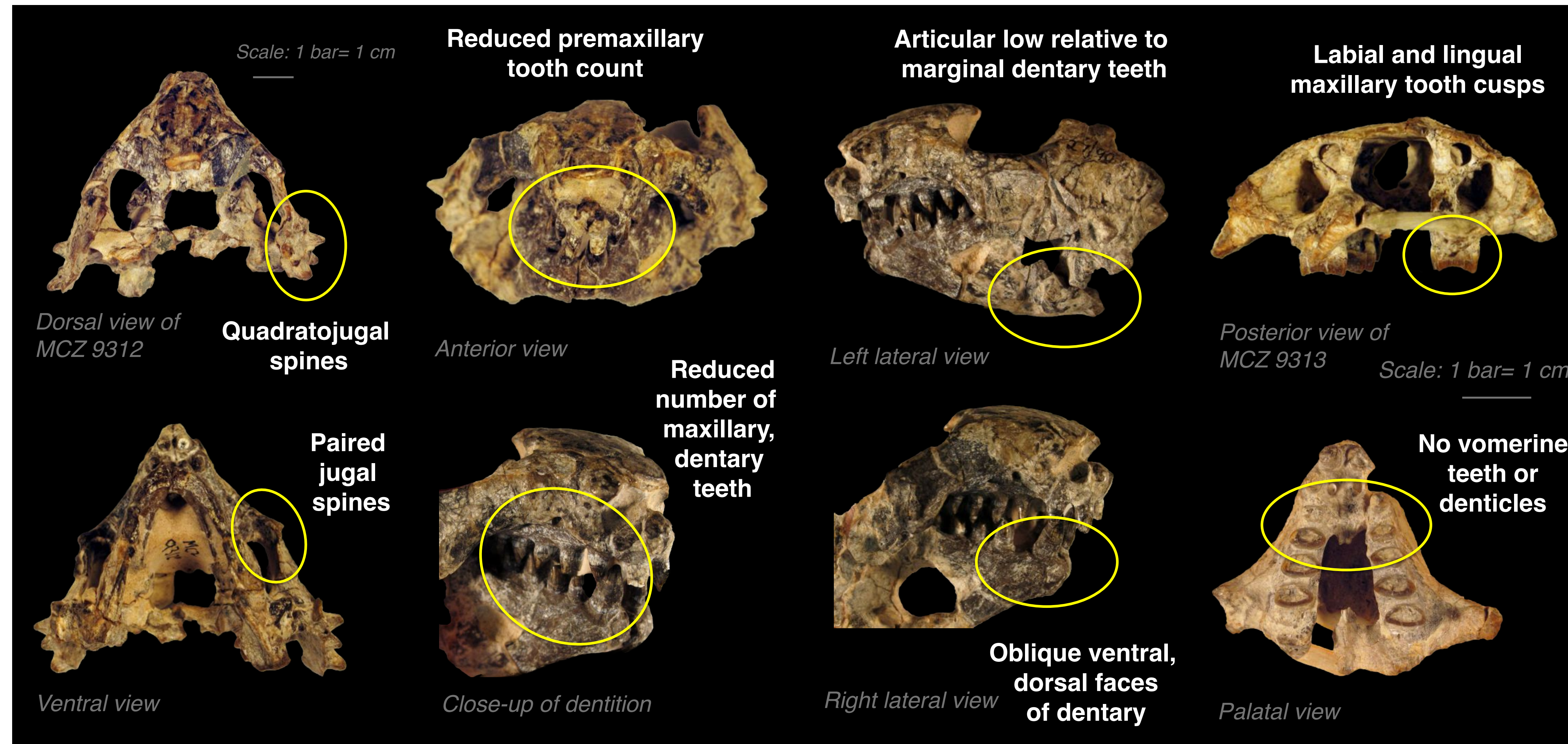
Procolophonid of the Leptopleuroninae subfamily in its habitat. Reconstruction by Douglas Henderson.

Parsimony analysis in TNT (Tree Analysis Using New Technology) was utilized to create a phylogenetic tree for this family (Goloboff et al. 2003). Implicit Enumeration, a branch-and-bound algorithm that provides exact trees, was used in the analysis, and all characters were equally weighted. Collapsing rule 1 was employed, which collapses all branches that are ambiguous or unsupported.

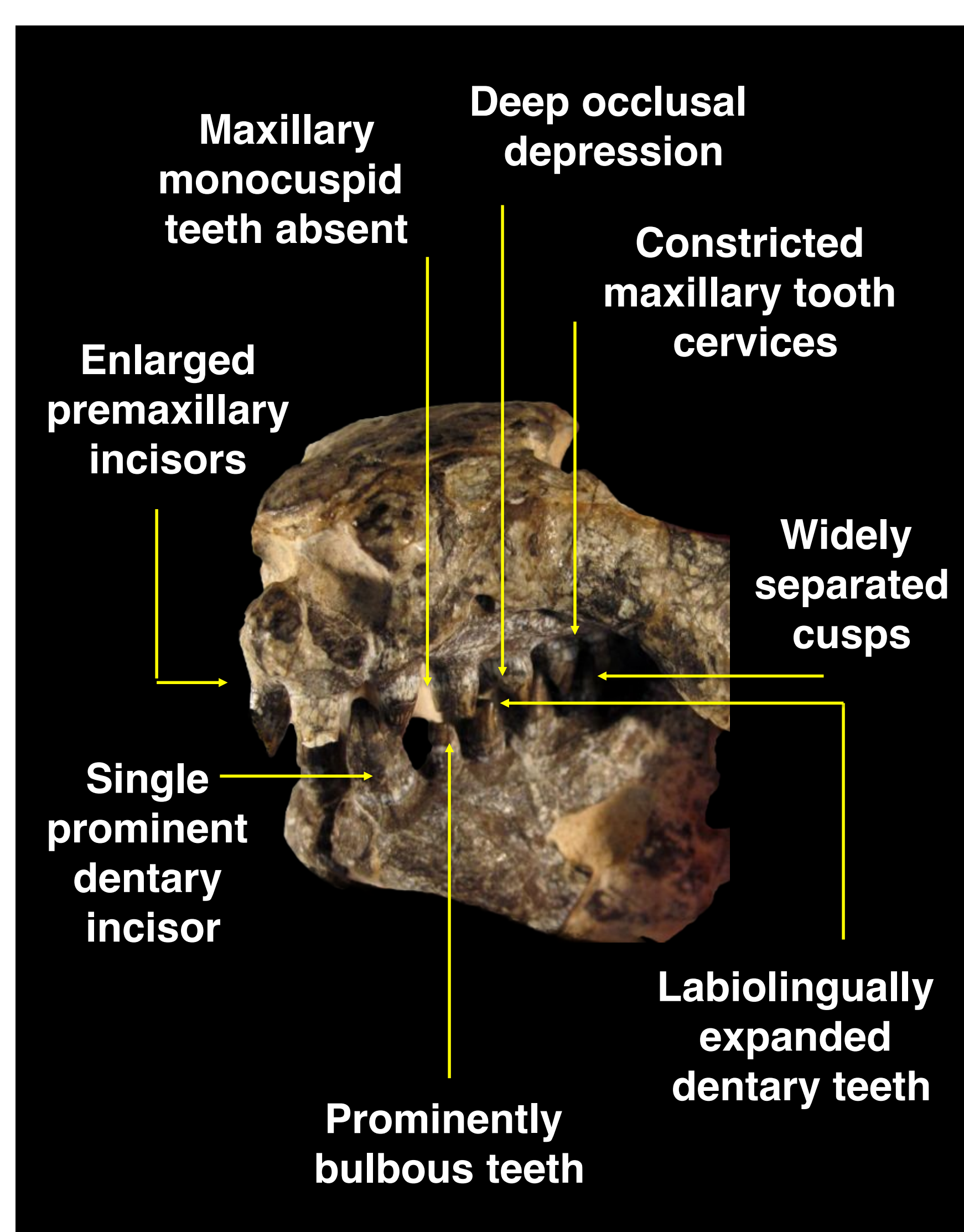
## Research Questions

1. To which subfamily do these skulls belong?
2. What characteristics support this classification?
3. What are these specimens' relationships to other procolophonids?
4. What do the dentition and cranial features suggest about its lifestyle and diet?

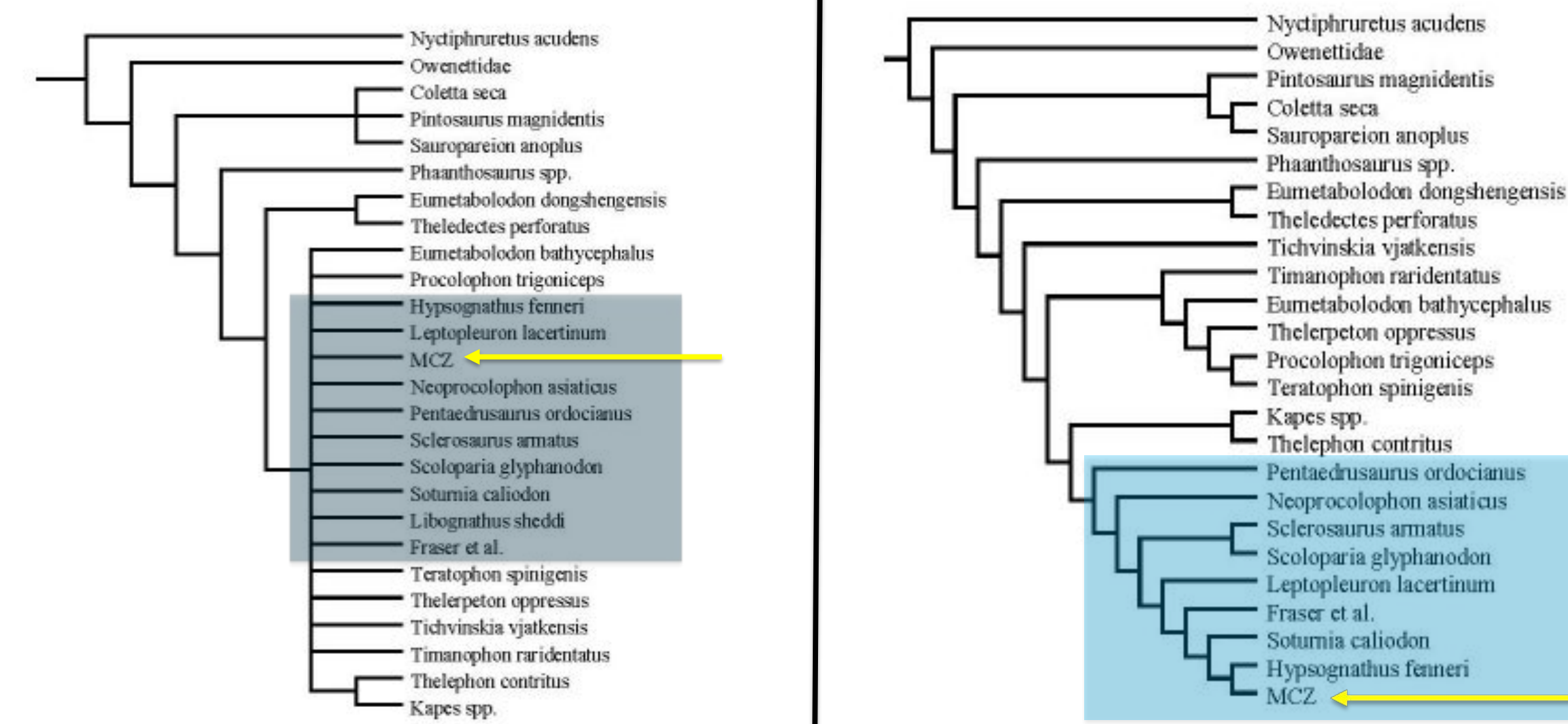
## Results



Photographs of MCZ 9312 and 9313, highlighting the most derived characteristics found in members of the subfamily Leptopleuroninae



Photograph of unique dental features in MCZ 9312



<b>Procolophonidae</b> Family	Only synapomorphy is postfrontal contact with both the frontal and parietal
<b>Leptopleuroninae</b> Subfamily	Synapomorphies include absence of vomerine teeth or denticles, oblique ventral and dorsal surfaces of the dentary, and articular situated well below the alveolar margin of the dentary

## Conclusions

### Subfamily

The MCZ specimens belong to Leptopleuroninae, due to the absence of vomerine teeth, oblique ventral and dorsal surfaces of the dentary, and the articular situated well below the dentary.

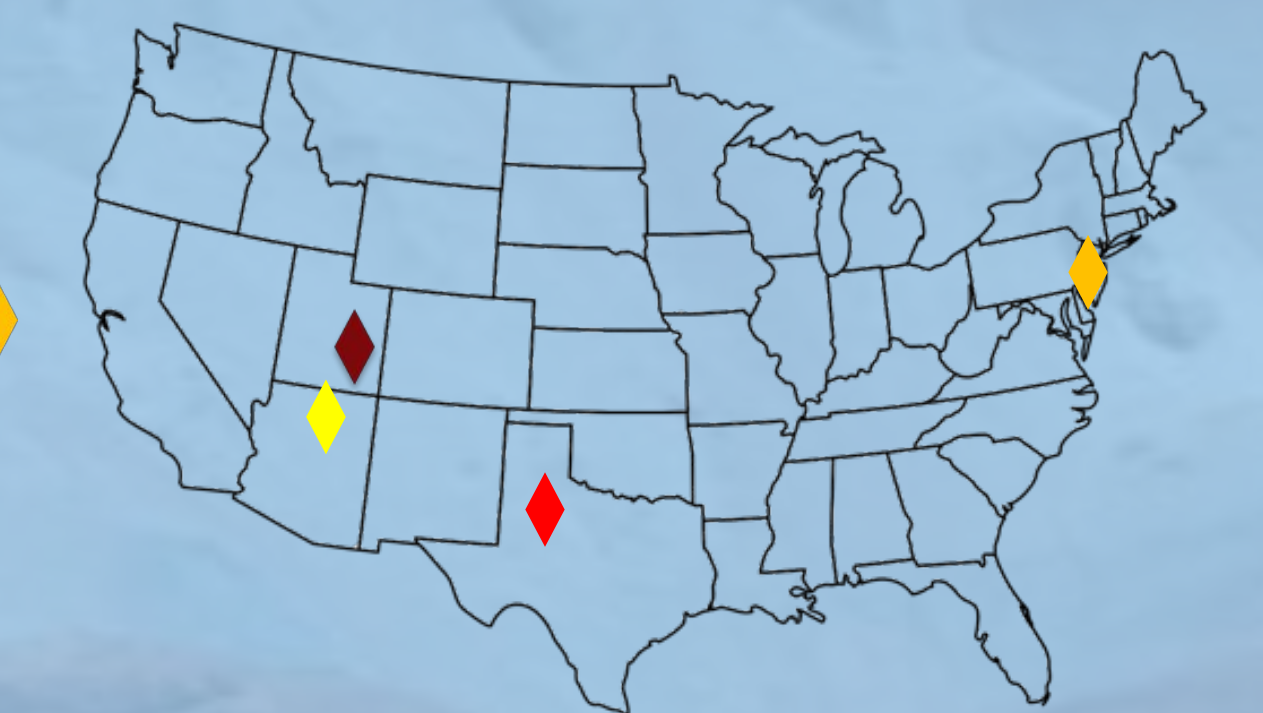
### Diet

The deep dentary and pronounced coronoid process allowed for attachment of large jaw adductor muscles. Uniquely cusped teeth allowed for chopping, while occlusal surfaces between maxillary and dentary teeth provided a large area for crushing and shearing. These features suggest a diet of primarily high-fiber plant material.

### Phylogenetic Relationships

MCZ was most closely related to *Hypsognathus* from the Newark Supergroup in eastern North America. Their only difference is in the presence of maxillary monocuspid teeth in *Hypsognathus* which are absent in MCZ specimens. This shows a rare link between the east and west of present-day North America that is rarely displayed in the fossil record.

MCZ ♦  
*Hypsognathus* ♦  
*Libognathus* ♦  
Abajo ♦



### Geographic Relationships

Two leptopleuronines, *Libognathus*, from the Dockum Group (Texas), and the Abajo skull, from the Owl Rock Member of the Chinle Formation (Utah), are related to the MCZ specimens. Only one dentary of *Libognathus* was found, but it shares a deep dentary and large coronoid process with MCZ specimens. The Abajo skull shares a lack of maxillary monocuspid teeth and a flattened snout.

### References

Cisneros, J. 2008. Phylogenetic relationships of procolophonid parareptiles with remarks on their geological record. *Journal of Systematic Palaeontology*, 6(3):345-366.  
Goloboff, P., J. Farris, and K. Nixon. 2003. TNT: Tree Analysis Using New Technology. Program and documentation, available from authors and [www.zmuc.dk/public/phylogeny](http://www.zmuc.dk/public/phylogeny).

### Acknowledgments

Thank you to Elizabeth Cottrell, Gene Hunt, and Virginia Power for coordinating the NHRE program, and to the National Science Foundation for its funding. Thank you to Farish Jenkins for collection of specimens and Harvard University's Museum of Comparative Zoology for loaning them to Hans Sues at NMNH.