

A new species of albanerpetontid amphibian from the Cloverly Formation (Lower Cretaceous) of the western USA

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INTRODUCTION

The Albanerpetontidae is a clade of salamander-like lissamphibians known from Middle Jurassic through Pliocene times. The family comprises four genera—*Albanerpeton*, *Anoualerpeton*, *Celtedens*, and *Wesserpeton*—which in turn included 14 species over this 165-million-year period.

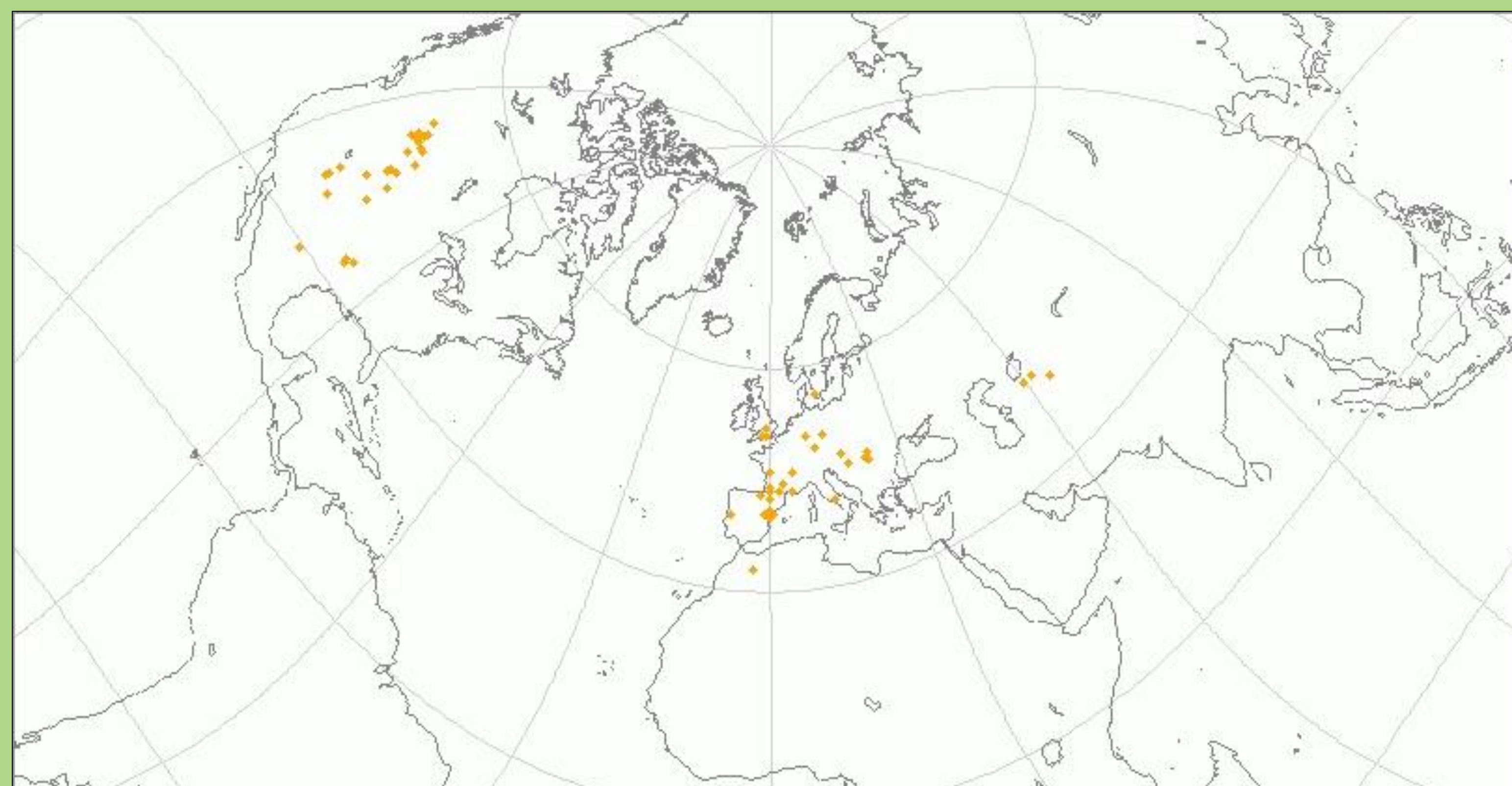
This group has an unusual biogeographic distribution. Jurassic taxa are known only from Europe, but Cretaceous forms are found across Europe, central Asia, northern Africa, and North America. By the late Cenozoic, the group is again restricted to Europe. This pattern suggests both extensive dispersal and regional extinction, but a clear pattern has yet to emerge.

New albanerpetontid specimens from the Cloverly Formation (Aptian–Albian) of Montana and Wyoming document the oldest North American form, and likely represent a new species. The research presented here seeks to:

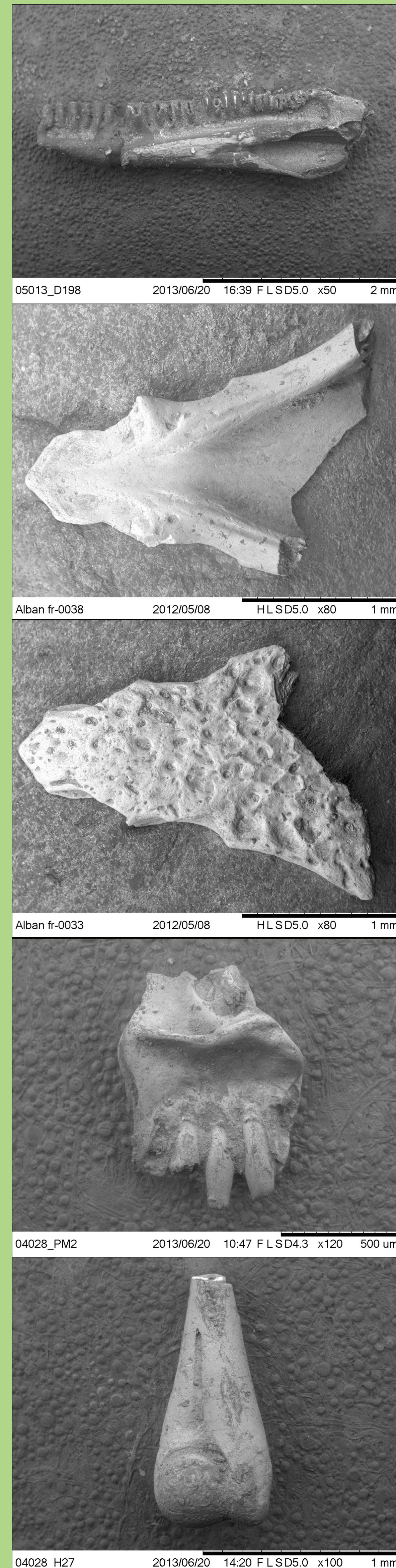
1. Establish the morphology of this taxon
2. Determine its relationships to other albanerpetontids
3. Apply the results to the group's biogeographic history



← **Figure 1** – Representatives of typical albanerpetontids; from left to right, scanning electron microscope image of *Celtedens ibericus* (McGowan, 2002) with scale bar representing 1 cm; an artist's rendering of a typical albanerpetontid (© N. Tamura).



↑ **Figure 2** – Geographic distribution of albanerpetontid specimens, retrieved from the Paleobiology Database.



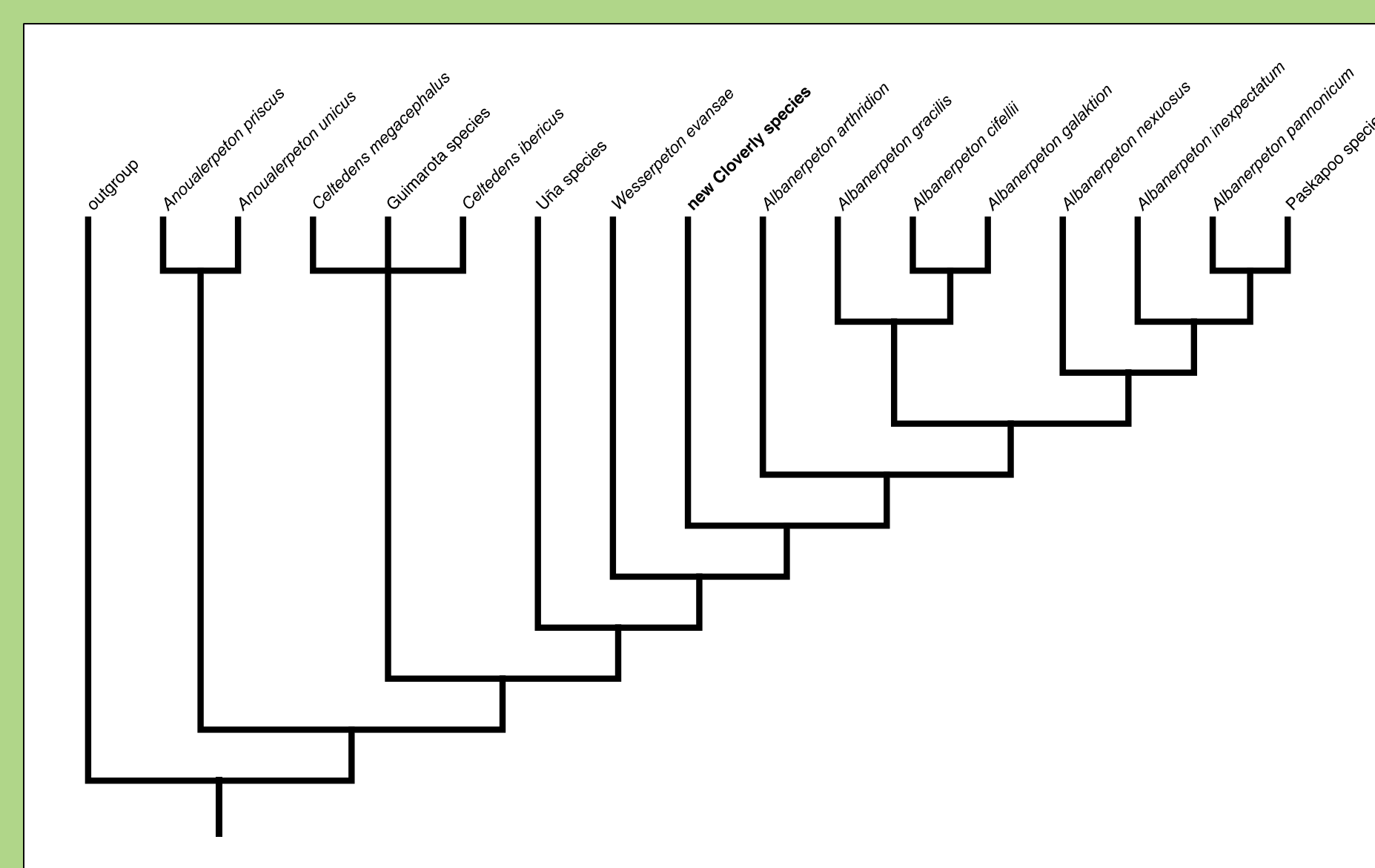
↑ **Figure 3** – Representative elements of new Cloverly amphibian; top to bottom: right dentary (medial), frontal (ventral), frontal (dorsal), right premaxilla (medial), right humerus (posterior).

MATERIALS AND METHODS

We scanned disarticulated fossil elements using a Hitachi TM3000 Tabletop Scanning Electron Microscope (SEM) and compared them to previously published specimens of related taxa. We constructed a 17-taxon/37-character matrix by modifying published examples and adding 7 new characters. The matrix was analyzed using the TNT software program under a driven search regime and the resulting tree(s) were stratigraphically calibrated using known distributions of taxa from the Paleobiology Database. We investigated biogeographic patterns by mapping geography onto the resulting tree(s) as a multistate character.

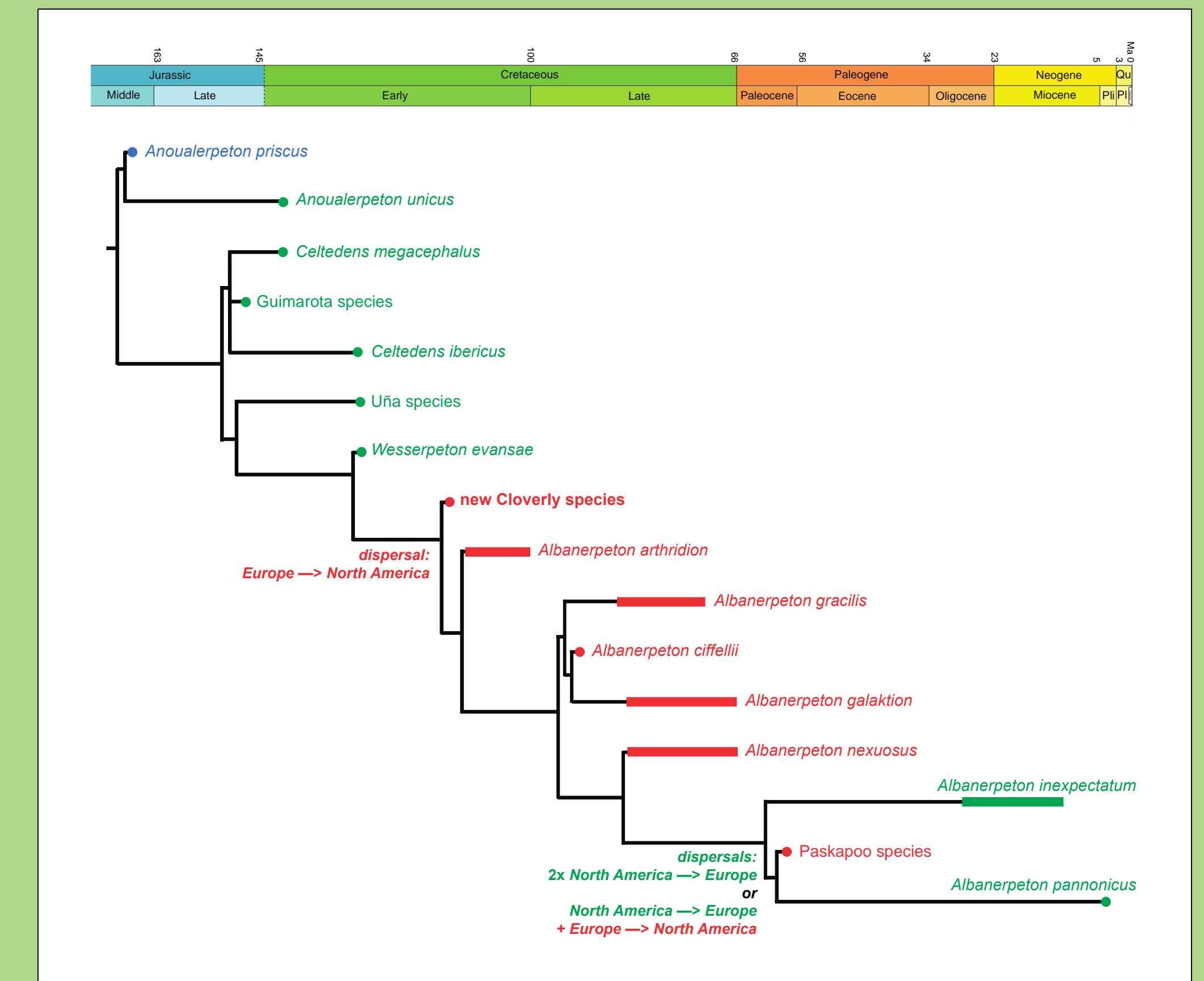
RESULTS

1. The Cloverly specimen is distinct from other known albanerpetontids in presenting a unique combination of characteristics, including a pronounced fossa cubitus ventralis on the humerus, an unusually blunt internasal process on the frontal, and a more distinct frontal orbital margin.
2. The phylogenetic analysis produced 4 most parsimonious trees of step length 87. All trees agree that the Cloverly specimen is most closely related to, but more primitive than the genus *Albanerpeton*.
3. The biogeographic distribution of albanerpetontids is consistent with a primarily European radiation, followed by dispersal to North America (and Asia). The Cloverly form appears to represent the first and most primitive member of the newly dispersed North American lineage.



↑ **Figure 4** – Phylogenetic tree illustrating the relationships among known albanerpetontids, including the Cloverly species.

→ **Figure 5** – Stratigraphically calibrated phylogenetic tree of albanerpetontids, including the Cloverly species. Colors indicate geographic distribution of species.



CONCLUSION

The results of our analysis indicate that the Cloverly specimen is distinct, but more closely related to *Albanerpeton* than to *Celtedens* or *Anoualerpeton*. This species is significant both evolutionarily and chronologically; it is the most primitive form of *Albanerpeton* in North America, as well as the oldest.

ACKNOWLEDGEMENTS

We wish to thank Matthew Oreska for research support and assistance, along with Scott Whitaker and the staff of the NMNH Lab for Analytical Biology for instruction and help with SEM use. AM is supremely grateful for the support of the Smithsonian Institution and the National Science Foundation for the opportunity and resources to conduct this research. Finally, we thank Gene Hunt, Liz Cottrell, and Virginia Power for their logistic, professional, and moral support.

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 The Paleobiology Database (<http://www.pdb.org/>)

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