

LATE TRIASSIC AETOSAUR BIOCHRONOLOGY REVISITED

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Abstract—Eleven years ago Lucas and Heckert (1996) proposed five biochrons based on aetosaur genus-level occurrences in the Upper Triassic Chinle Group of the southwestern U.S.A., another for *Stegomus* in the eastern U.S.A., and a Greenlandic-European *Aetosaurus* biochron. While some have embraced this biochronological framework, others have challenged it on taxonomic, stratigraphic, and evolutionary grounds, while additional discoveries have further modified the underlying taxonomic framework. Here, we take this opportunity to evaluate the past decade’s progress in aetosaurian systematics and distribution to critically reevaluate the biochronological potential of aetosaurian taxa. No fewer than nine genera of aetosaurs provide biostratigraphic correlations within the Chinle Group, and five of these reliably correlate Chinle Group strata to other strata across Pangea. Thus, it is clear that aetosaurs remain robust biochronological tools for the subdivision of Late Triassic time.

INTRODUCTION

Lucas and Heckert (1996) documented five biochrons based on the occurrence of five aetosaur genera in the Upper Triassic Chinle Group of the southwestern U.S.A. Our current assessment of the aetosaurian record documents that at least 11 genera of aetosaurs are present in the Chinle Group: *Longosuchus*, *Coahomasuchus*, *Stagonolepis*, *Adamasuchus*, *Desmatosuchus*, *Tecovasuchus*, *Paratyphorax*, *Typothorax*, *Rioarribasuchus*, *Aetosaurus*, and *Redondasuchus* (Fig. 1), a number based not only on our own work, but on the consensus of others (Heckert and Lucas, 1999, 2000; Lucas et al., 2002; Martz and Small, 2006; Parker, 2007). Of these, all but *Coahomasuchus* and *Adamasuchus* are known from multiple localities, and therefore have biochronological utility. Most taxa are monospecific, with the exceptions of *Typothorax* (*T. antiquum*, *T. coccinarum*), *Redondasuchus* (*R. reseri*, *R. rineharti*), *Aetosaurus* (*A. ferratus*, *A. crassicauda*, *A. arcuatus*), *Stagonolepis* (*S. robertsoni*, *S. wellsi*), and possibly *Desmatosuchus* (*D. haplocerus*, *D. smalli*). Additional taxa we do not consider valid include *Lucasuchus* (= *Longosuchus*) and *Acaenasuchus* (= *Desmatosuchus*), although, if proved valid, both have their own biostratigraphic utility as putative occurrences of each are restricted to narrow stratigraphic intervals (Fig. 1).

BIOCHRONOLOGY

Accordingly, it is now possible to recognize no fewer than nine genus-level aetosaur biochrons in the Chinle Group:

- (1) *Longosuchus* (= *Lucasuchus*) biochron of Otischalkian age.
- (2) *Stagonolepis* biochron of Adamanian (St. Johnsian) age.
- (3) *Tecovasuchus* biochron, also of Adamanian (St. Johnsian) age.
- (4) *Desmatosuchus* biochron of Adamanian-Revueltian (Barrancoan) age.
- (5) *Typothorax* biochron of Adamanian (Lamyian)-Revueltian age.
- (6) *Paratyphorax* biochron of Adamanian (Lamyian)-Revueltian (possibly Apachean) age.
- (7) *Aetosaurus* biochron of Revueltian-Apachean age.
- (8) *Rioarribasuchus* biochron of Revueltian age.
- (9) *Redondasuchus* biochron of Apachean age.

With the recognition of multiple species of *Desmatosuchus*, *Typothorax*, and *Aetosaurus*, several of these biochrons can be subdivided still further: *D. haplocerus* = Adamanian. *D. smalli* (if valid) = Revueltian (Barrancoan). *T. antiquum* = Adamanian (Lamyian). *T. coccinarum* = Revueltian. *A. arcuatus* = Revueltian. *A. ferratus* = Revueltian-Apachean. The first appearance datum (FAD) of *T. antiquum* defines the Lamyian sub-lvf.

Importantly, the *Longosuchus*, *Stagonolepis*, *Paratyphorax*, and

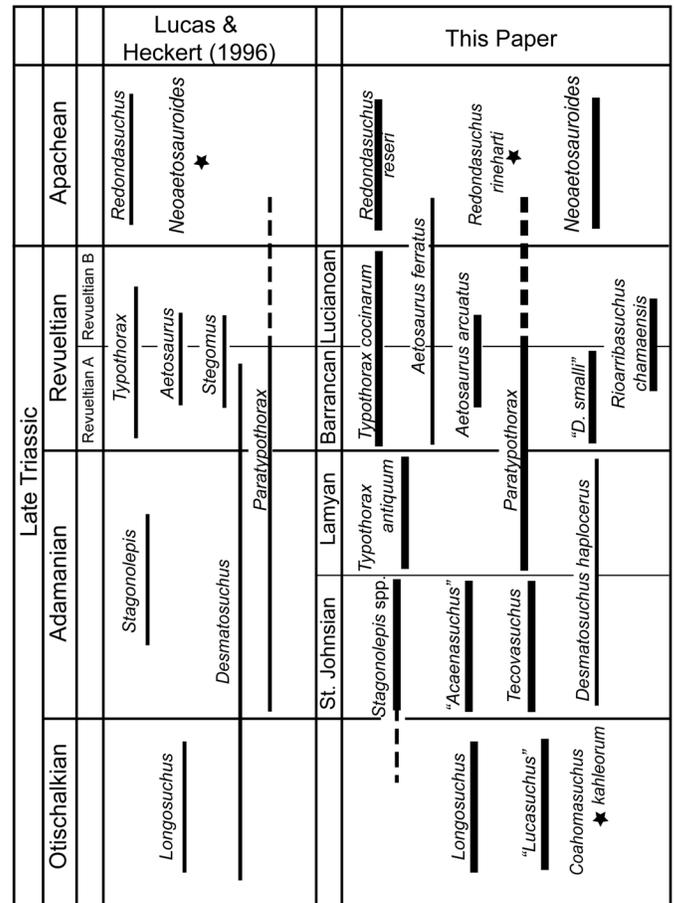


FIGURE 1. Revised biochronological hypothesis of Lucas and Heckert (1996) showing increased resolution provided by advances in aetosaurian taxonomy in the past decade. Taxa in quotation marks are those we do not recognize as valid, but whose occurrences are stratigraphically restricted. Taxa denoted with a star are (were) known from single occurrences.

Aetosaurus biochrons can all be correlated with aetosaur occurrences outside the Chinle Group. Specifically, additional records of *Longosuchus*(=*Lucasuchus*) are known from the eastern U.S.A. and North Africa. *Stagonolepis* records include *S. robertsoni* from North America, Argentina, Brazil, and Scotland and *S. wellsi* and *S. cf. S. wellsi* from North and South America, respectively. *Stagonolepis* records we are not yet able to assign to species are known from Poland and

Germany and appear to extend the *Stagonolepis* biochron into the Otischalkian. *Paratypothorax* is known from North America, Greenland, and Germany. *Aetosaurus arcuatus* is known from the eastern and southwestern U.S.A., and *A. ferratus* is known from Germany, Italy, and the southwestern U.S.A. There are records of aetosaurs from India, but published descriptions are inadequate to assign them to genus, but they resemble descriptions of *Longosuchus* and *Paratypothorax*.

CONCLUSIONS

This brief review demonstrates that aetosaurs remain a robust biochronological tool for the subdivision of Late Triassic time. Since 1996, discoveries of both new taxa and new records of previously known taxa have modified the biochronological hypotheses of Lucas and Heckert

(1996), but the net effect, seen in Figure 1, is a greatly improved biochronological framework that now recognizes not only the same major faunachrons, but also subdivisions of those faunachrons postulated by others (Hunt, 2001; Hunt et al., 2005). Consequently, the number of Chinle aetosaur biochrons based on genus-level taxonomy has grown from five to nine, and the precision of correlation, especially within previously long-ranging taxa such as *Paratypothorax* and *Desmotosuchus*, has improved with a better understanding of new- and previously poorly-known taxa such as *Tecovasuchus* and *Rioarribasuchus*.

ACKNOWLEDGMENTS

Our parent institutions support our research on Upper Triassic tetrapods.

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