Paleoecology of Late Triassic Metoposaurid Amphibians: Evidence from Petrified Forest National Park

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The Late Triassic (235 to 208 million years ago) was a time of major change in the terrestrial ecosystem. Archaic animals, that had dominated the land during the Late Paleozoic and earlier Triassic (e.g. therapsids, temnospondyls), dwindled or became extinct and the major groups preeminent in the later Mesozoic and Tertiary (e.g. dinosaurs, mammals, pterosaurs) evolved and diversified. In North America, the last of the temnospondyl amphibians are members of the family Metoposauridae (Figure 1). The paleoecology of this family has received little study.

One of the best places to study the paleoecology of metoposaurids is at Petrified Forest NP (PEFO). Abundant specimens collected in the park can be studied to determine the paleoecological context of these ancient amphibians. Metoposaurids at PEFO are found in the Blue Mesa (lower) and the Painted Desert (upper) members of the Petrified Forest Formation.

Buettneria perfecta is a large species (2 meters long) with deep otic notches, a lacrimal that borders the orbit and short intercentra. *Apachesaurus gregorii* is a small species (less than 1 meter long) with shallow otic notches and elongate intercentra. *Buettneria* is common in the lower stratigraphic sections of the park and becomes rarer in the upper member, whereas *Apachesaurus* is rare in the lower member and is relatively more common in the upper member.

Paleoecologic information regarding the Late Triassic metoposaurs is derived from three primary sources: sedimentology of the deposits in which metoposaurs are preserved; morphological characteristics; and taphonomic associations with other fossil remains. Evaluation of the data available from these three sources suggest that *Apachesaurus* probably was more terrestrial than *Buettneria*.

The sedimentary deposits containing *Apachesaurus* vary considerably from those sediments in which *Buettneria* remains are preserved. *Buettneria* occurs predominately in near stream facies. Those depositional environments include fluvial overbank and lacustrine deposits. *Apachesaurus* occurs frequently in more terrestrial sediments formed as distal floodplain deposits. Paleosol (fossil soil) analysis provides supporting data associating wetter near-stream facies and drier terrestrial facies.

Comparing the morphology of these two metoposaurs reveals a number of differences that indicate *Apachesaurus* was more terrestrial than *Buettneria*. First, the deeper acetabulum (pelvis) of *Apachesaurus* provided a more effective transmission of hindlimb force, which is important for terrestrial locomotion. Second, the vertebrae of *Apachesaurus* are elongate compared to other metoposaurs. This elongation, coupled with a possible reduction in number of vertebrae, would have given this animal a rigid backbone. This pattern is characteristic of terrestrial vertebrates where weight support is necessary. Third, the lateral line system (pressure receptors sensitive to vibrations in water) is reduced in *Apachesaurus* compared to *Beuttneria*. Cranial and dental characteristics, however, indicate that *Apachesaurus* probably was an aquatic feeder. The low cranial profile is suited to rapid jaw closure, but the jaw muscles could not have generated much force after closure. This feeding pattern is characteristic of fish-eaters. Homodont dentition, as seen in *Apachesaurus* and other metoposaurs, also is commonly associated with fish-eating.

The taphonomic associations which co-occur with *Buettneria* are predominantly composed of semiaquatic and aquatic fauna (phytosaurs, lungfish). *Apachesaurus* often is found in association with more terrestrial assemblages of vertebrates (dinosaurs, rauisuchians, sphenosuchians). These associated fossil forms provide additional information on the paleoecology of these ancient amphibians.

The Petrified Forest metoposaurs provide useful information for interpreting the Late Triassic environment in this region. The oldest strata in the park were laid down during wet periods resulting in larger lacustrine and fluvial systems. This environment provided *Buettneria* with suitable open water habitat to accommodate a highly aquatic, large-size amphibian. The younger strata in the park indicate a drier environment with more restricted shallow pools of water. The morphological characteristics of *Apachesaurus* were better adapted for movement over land in this drier and more patchy environment.

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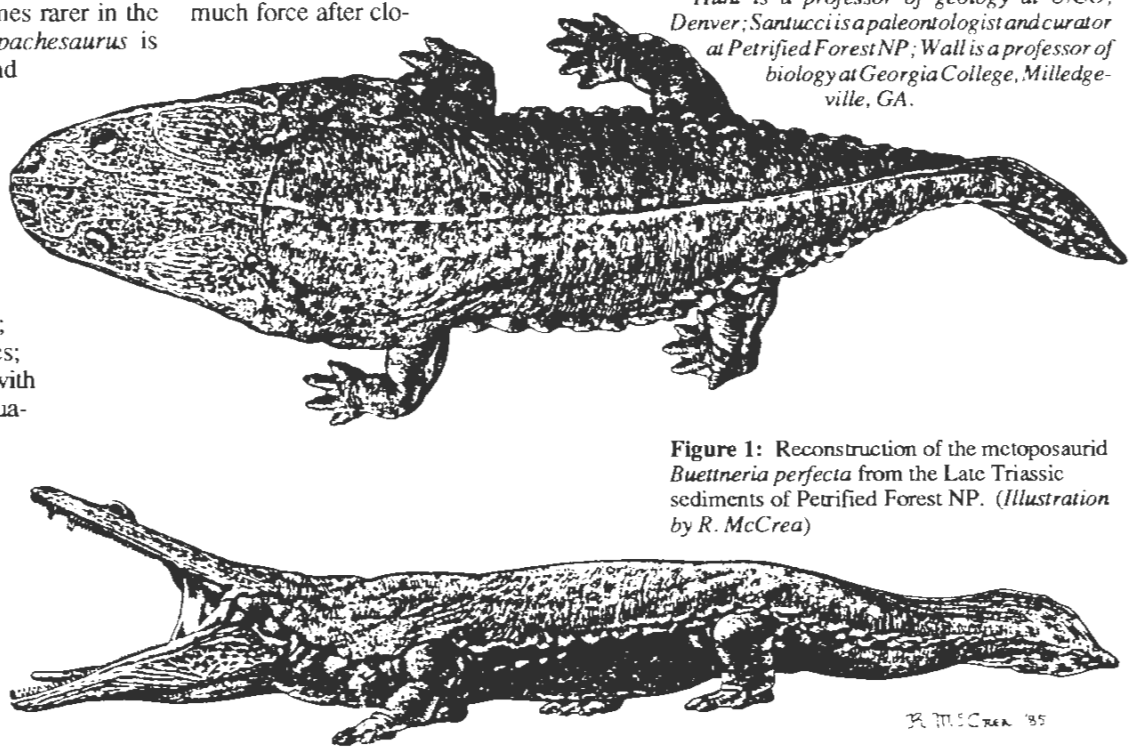


Figure 1: Reconstruction of the metoposaurid *Buettneria perfecta* from the Late Triassic sediments of Petrified Forest NP. (*Illustration by R. McCrea*)