

No gap in the Middle Permian record of terrestrial vertebrates

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Benton (2012) claims that there is no gap in the Middle Permian tetrapod fossil record, in contrast to my (2004) conclusion that a gap exists between the youngest pelycosaur-dominated tetrapod assemblages and the oldest therapsid-bearing tetrapod assemblages. I referred to this as Olson's Gap and concluded that it is equivalent to most of the Roadian Stage. Instead, Benton (2012, his figure 1) correlates the youngest pelycosaur assemblages from Texas-Oklahoma with the oldest therapsid assemblages of Russia. However, in advocating this correlation, Benton does not address an extensive marine biostratigraphic database detailed by me (2004). The critical points are:

1. In Texas-Oklahoma, the youngest Permian tetrapod-fossil-bearing intervals of the Chickasha, Flowerpot, and San Angelo Formations are overlain by the marine Blaine Formation, which contains Early Permian (late Leonardian) ammonites. Furthermore, the San Angelo Formation contains late Leonardian fusulinids. Therefore, the youngest Permian tetrapods from Texas-Oklahoma are of Early Permian age. Benton's (his figure 1) assignment of these tetrapods to the Middle Permian (early Roadian) thus runs counter to ammonoid- and fusulinid-based correlations.

2. The oldest therapsid-bearing tetrapod assemblage in Russia is the Golyusherma site in the lower part of the Kazanian, equivalent to the marine Baitugen horizon. *Sweetina triticum*, a conodont taxon with a stratigraphic range of upper Roadian-lower Wordian, is present in the Baitugen horizon, so Golyusherma is late Roadian in age. Ammonoid data from the lower Kazanian (Leonova, 2007) indicate a Roadian age, but not an early Roadian age.

These marine biostratigraphic data are critical to correlation of the Texas-Oklahoma and the Russian tetrapod assemblages, and run counter to the correlation suggested by Benton (his figure 1). In this correlation, Benton brings the Kazanian base down to the base of the Roadian. He does this, in part, following the decision of the All Russian Stratigraphic Commission to place the Ufimian Stage entirely in the Early Permian, a decision being debated (e.g., Leven and Bogoslovskaya, 2006). However, even if this correlation is correct, the Middle Permian therapsid assemblages of the Russian section are still younger (though only by a fraction of a stage) than the Texas-Oklahoma pelycosaur assemblages, which are of Early Permian age. Olson's Gap still exists.

Benton (p. 339) states that "if 'Olson's Gap' exists, then paleontologists will be *forever* unable to document a remarkable terrestrial faunal replacement" (italics added by me). "Forever" excludes the possibility that fossils will be found that fill Olson's Gap. However, rather than ignore well-founded marine biostratigraphic correlations that indicate the presence of Olson's Gap, the search should continue in the field to find fossils that fill the gap.

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