

25 Correlation of continental Late Triassic and Early Jurassic sediments, and patterns of the Triassic–Jurassic tetrapod transition

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Introduction

The Late Triassic–Early Jurassic boundary is frequently cited as one of the thirteen or so episodes of major extinctions that punctuate Phanerozoic history (Colbert 1958; Newell 1967; Hallam 1981; Raup and Sepkoski 1982, 1984). These times of apparent decimation stand out as one class of the great events in the history of life.

Renewed interest in the pattern of mass extinctions through time has stimulated novel and comprehensive attempts to relate these patterns to other terrestrial and extraterrestrial phenomena (see Chapter 24). The Triassic–Jurassic boundary takes on special significance in this light. First, the faunal transitions have been cited as even greater in magnitude than those of the Cretaceous or the Permian (Colbert 1958; Hallam 1981; see also Chapter 24). Second, like the Cretaceous–Tertiary boundary, the Triassic–Jurassic boundary heralded a new, long-lasting regime of dominant animals, the dinosaurs. Third, but unlike the Cretaceous, a definite bolide impact structure is known in the Late Triassic. The 70 km Manicouagan crater in Québec, Canada has been dated at 210 ± 4 MY (Grieve 1982), which is within the margin of error of the currently accepted dates for the Triassic–Jurassic boundary. Despite considerable uncertainty, scenarios of asteroid impact have already been proposed to explain the Triassic–Jurassic extinctions, much as they have been for the Cretaceous–Tertiary extinctions (Raup and Sepkoski 1984; Rampino and Stothers 1984); but as such attempts at explanation proceed, the pattern itself must be continually examined. Experts on the patterns of each of the supposed mass extinction events must define the terms and taxa involved, and ask whether each “event” is real or artificial.

Olsen and Galton (1977) previously asked this question of the Triassic–Jurassic extinctions. The ap-

parent answer was that the supposed mass extinctions in the tetrapod record were largely an artifact of incorrect or questionable biostratigraphic correlations. On reexamining the problem, we have come to realize that the kinds of patterns revealed by looking at the change in taxonomic composition through time also profoundly depend on the taxonomic levels and the sampling intervals examined. We address those problems in this chapter. We have now found that there does indeed appear to be some sort of extinction event, but it cannot be examined at the usual coarse levels of resolution. It requires new fine-scaled documentation of specific faunal and floral transitions.

Stratigraphic correlation of geographically disjunct rocks and assemblages predetermines our perception of patterns of diversity, extinctions, and originations. This poses an especially difficult problem for the Early Mesozoic because there are virtually no unquestioned Early Jurassic continental vertebrate assemblages. Correlations are of such paramount importance to any study of change during the Early Mesozoic that we devote the first part of this chapter to a summary description of the rationale for correlating various continental sequences with those of the Late Triassic and Early Jurassic type areas of Europe.

The second part of this chapter details the taxonomic changes through the Early Mesozoic based on these correlations. We examine the skeletal record of continental tetrapods by looking at the global record at the family and stage levels. Unfortunately, the family and stage levels are too coarse a level of analysis for these kinds of questions. We try to circumvent this problem by examining two subsets of the world data, data from the Newark Supergroup (Froelich and Olsen 1984) and data from the European Early Mesozoic.

The unique periodic lacustrine cycles of the

