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Arthur R. Sweet

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Reflections on the Cretaceous–Tertiary Boundary Plant Record According to W.A.S. Sarjeant

Comment on

Dinosaur Extinction, Sudden or Slow, Cataclysmic or Climatic?
By William A.S. Sarjeant
Geoscience Canada, 1996, v. 23, n. 3, p. 161-164

By Arthur R. Sweet
Geological Survey of Canada
3303 33rd Street NW
Calgary, Alberta T2L 2A7

Sarjeant (1996) opportunistically took the occasion of an essay review of Archibald's (1996) book to intertwine his eminently literate, but uncritical, commentary on the Cretaceous–Tertiary (K–T) boundary extinction event. In discussing the plant record, Sarjeant relied heavily on two papers, Sweet and Braman (1992) and Srivastava (1994). Unanalytically, Sarjeant accepts Srivastava's contention that flora changes associated with the K-T boundary "mirror the environmental shifts caused by a marine regression and consequent climatic deterioration" (Sarjeant, 1996, p. 162) and implicitly links Sweet and Braman to this contention, compounding the perpetuation of misinformation with misrepresentation.

What of the misrepresentation? Sweet and Braman (1992) did not infer any direct linkage between marine regression and short term floristic change at the K-T boundary as implied by Sarjeant (1996, p. 162, 163). Given the exclusively terrestrial setting of the K–T boundary in western Canada and the mid-western United States, such conjecture would be completely unfounded as an explanation of short-term floristic changes in association with the K–T boundary.

Now to the perpetuation of misinformation. The linkage Sarjeant makes between marine regression and the K–T boundary floristic events is the perpetuation of misinformation in Srivastava (1994). Based on sections in the Red Deer Valley, central Alberta, Srivastava (1994) presented, albeit somewhat inconsistently, an argument inferring a relationship between land vacated by receding seas and fern spore abundances (FSAs) in the Nevis coal, which directly overlies the K–T boundary and occurs midway through the Scollard Formation. To quote Srivastava (1994, p. 150) "Out of all coal seams, the FSA occurs only in the Drumheller and Nevis coal seams. These abundances may represent primary fern colonization of land vacated by receding seas, thus their occurrence in coal seams of a regressive facies.". The Drumheller coal occurs low in the Horseshoe Canyon Formation, below the Drumheller Marine Tongue and may well have been deposited within a paralic depositional environment. The Drumheller Marine Tongue is the youngest documented marine incursion in the vicinity of the Red Deer Valley. The best estimated absolute age of this early Maastrichtian transgressive-regressive event is about 70 Ma (Lerbekmo and Coulter, 1985) or 5 million years before the K–T boundary at 65 Ma. Below the Nevis coal and the underlying K–T boundary the lower Scollard Formation is composed of well drained floodplain deposits and fluvial sandstones and contains a species-rich terrestrial pollen and spore assemblage as reported by Srivastava (1970, 1994).

The reality then is that the fluvial and associated environments of the lower Scollard were well removed in time and space from a marine influence. The lower Scollard landscape was not barren of plants, as shown by the presence of species-rich palynological assemblages comparable to similar aged palynofloras throughout mid-continental North America (Nichols and Sweet 1993). These late Maastrichtian terrestrial floras were found by Srivastava (1994, fig. 4) and Sweet and Braman (1992) to be relatively consistent until immediately below the K–T boundary when a regional floristic shift preceded the profound changes that take place across the boundary interval. Given this floristic stability in the late Maastrichtian, high frequency floristic changes associated with the K–T boundary must be considered completely disassociated from the early Maastrichtian regressive event.

Furthermore, the direct association between fern spore abundances and the K–T boundary in the Red Deer River Valley is consistent with observations of a linkage between abundances and K–T boundary event(s) elsewhere in North America (Fleming and Nichols 1990 and included references). There is, however, a major mid Maastrichtian floristic change in central Alberta (Srivastava, 1970) as well as at higher latitudes (Sweet et al. 1989; Nichols and Sweet, 1993) that may well reflect continental, long term climatic adjustment to seaway regression.

In reflection: My heart lies with the gradualists and not with those who consider all biotic changes at the K–T boundary to be attributable to a single catastrophic impact event. However, the position of gradualists in the K–T boundary debate is not enhanced by the perpetuation of distortions in logic. All works need to be critically evaluated. It is therefore regrettable that even the widely admired intellect of W.A.S. Sarjeant succumbed to his contention that the extinction of the dinosaurs is the "one scientific topic which, it seems, causes us to cast aside logical analysis and allow our imaginations to take flight" (Sargeant, 1996, p. 161).

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