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# A REGIONAL PERSPECTIVE ON THE PALYNOFLORAL RESPONSE TO K-T BOUNDARY EVENT(S) WITH EMPHASIS ON VARIATIONS IMPOSED BY THE EFFECTS OF SEDIMENTARY FACIES AND LATITUDE

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Palynological studies are unique in that they deal with fossil reproductive bodies that were produced by fully functioning plants, whereas most faunal studies are based on death assemblages. Therefore, changes in pollen and spore assemblages cannot be used directly as evidence of catastrophic mass killings but only to indicate changes in ecological conditions. In this study the impact of the Cretaceous-Tertiary boundary event on terrestrial plant communities is illustrated by the degree, rate and selectivity of change. As in most classical palynological studies, the degree of change is expressed in terms of relative abundance and changes in species diversity. It is recognized that sampling interval and continuity of the rock record within individual sections can affect the perceived rate of change. Even taking these factors into account, a gradual change in relative abundance and multiple levels of apparent extinctions, associated with the interval bounding the K-T boundary, can be demonstrated. Climatic change, which locally exceeds the tolerance of individual species, and the possible loss of a group of pollinating agents are examined as possible explanations for the selectivity of apparent extinctions and/or locally truncated occurrences.

The above aspects of change are demonstrated with data from four different K-T boundary localities in Western Canada between paleolatitudes 60° and 75° north. In the most northerly locality (Police Island Section, 64°53'N, 125°15'W) the K-T boundary occurs 0.85 m above the base of an 11 m thick coal bounded by tuffs and tuffites. A drop in species diversity is recorded within a mudstone 10 m below the boundary and again in association with the K-T boundary. The pre-boundary drop in species diversity corresponds with an extinction (?) event above which a few species new to the locality appear.

In the Judy Creek coal field (54°30'N, 115°20'W) in north-central Alberta, 1300 km (800 miles) to the south of the Police Island Section, the K-T boundary occurs immediately below a major coal zone. The occurrence of additional thin coals and coaly shales within a 3 m interval below the K-T boundary allows a comparison to be made between latest Maastrichtian and earliest Paleocene coal swamp assemblages. Both are similar in that *Laevigatosporites* is prominent but the older assemblage has a greater abundance of morphologically exotic angiosperm pollen. In the Judy Creek 313A corehole a progressive change is seen in the relative abundance of individual angiosperm pollen species, independent of lithological change. This occurs in an interval that includes a 0.26 m thick brown mudstone underlying the K-T boundary through to 0.21 m above the boundary. The 0.21 m interval includes a basal 0.03 m coaly mudstone in abrupt contact with an overlying vitrinitic coal. The dominant angiosperm species above the boundary is *Syncolporites minimus* Leffingwell 1971 (up to 73% of the total assemblage) whereas the dominant species below the boundary shift from *Orbiculapollis lucida* Chlonova 1961, *Kurtzipites trispissatus* Anderson 1960 and *K. circularis* (Norton) Srivastava 1981 through to *S. minimus* and *K. circularis* immediately below the boundary.

In the Red Deer Valley Section (51°50'N, 113°05'W) of central Alberta the K-T boundary section occurs at the base of a coal following an interval barren of coal. The species diversity in the 0.15 m mudstone directly underlying the boundary is significantly lower than the usually high diversity throughout the underlying 40 m of late Maastrichtian strata. In this section, as well as in coreholes from Judy Creek, a high relative abundance of angiosperm pollen (dominantly one or two species at any one locality) occurs immediately above the palynologically and geochemically defined K-T boundary, demonstrating the continuation, across the boundary, of the late

Maastrichtian angiosperm-dominated flora. This aspect of the palynofloral succession in central Alberta has been previously discussed (1). In contrast, a 'fern spore spike' succeeding the K-T boundary and in apparent discontinuity with the underlying angiosperm dominated flora, occurs at most localities within the midcontinental region of the United States (2). If nothing else, these observations mean there was no single, continent-wide, floral response to the boundary event. Whether the inferred ecological disturbance allowing for the invasion of opportunistic fern species was the direct result of a catastrophic event, or an indirect consequence resulting from a factor such as rapid flooding of a swamp or incipient swamp is a separate question.

In the Castle River Section (49°30'N, 114°02'W) of southwestern Alberta, the K-T boundary occurs within a caliche-bearing interval. In this semiarid paleoenvironmental setting (3) the palynomorph assemblage recovered from the entire late Maastrichtian is sparse and of low diversity. Most notable is the near absence from the assemblage of the triprojectate complex and its allies. A prolific flora was recovered only from the immediate post-boundary interval represented by a 3 cm carbonaceous shale and an overlying 1.2 m interval of lacustrine mudstone and siltstone. This flora is similar to early Paleocene palynofloras from other localities.

Together, the four localities discussed above allow changes imposed by latitude (or temperature) and differences in the depositional environment (degree of wetness) to be isolated from the boundary event itself which is reflected by the truncated ranges (extinctions ?) of several species throughout the region of study. What must be recognized is that variations in the response of vegetation to the K-T boundary event(s) occurred throughout the Western Interior basin. Additionally, the component of change related to extraordinary causes appears to be less catastrophic when it is isolated from the effects of facies and taken within a regional perspective.

1. Lerbekmo, J.F., Sweet, A.R. and St. Louis, R.M. (1987) Geological Society of America Bulletin, v. 99, p. 325-330.

2. Fleming, R.F. and Nichols, D.J. (1988) The Third International Conference on Global Bioevents: Abrupt Changes in the Global Biota, May 16-22, University of Colorado, Boulder, p. 16.

3. Jerzykiewicz, T. and Sweet, A. R. (in press) Sedimentary Geology.