

Marine Transgression as the Likeliest Mechanism for Environmental Change at the K-Pg Boundary (Montana, USA)

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The Cretaceous-Paleogene (K-Pg) Boundary of the Upper Great Plains of North America is generally accompanied by a unique change in sedimentary facies, which characterizes the Hell Creek – Fort Union formation contact. Environmentally, these deposits represent a distinct shift from low gradient meandering streams to an abruptly flooded landscape. This study sought to determine the mechanism behind the environmental change by examining K-Pg deposits in Makoshika State Park, near Glendive, Montana. Of particular interest was the sudden appearance of “variegated” siltstones, which are common in the Fort Union but absent in the Hell Creek. Two hypotheses were examined: 1) the flooded landscape was sparked by instantaneous asteroid impact, which devastated vegetation, thereby destabilizing river banks and clogging channels with sediment; and 2) the flooded landscape was caused by gradual base level changes, particularly the transgression of the Cannonball Seaway.

Fieldwork was conducted at five localities in Makoshika State Park. Sedimentological analysis indicated that the earliest Fort Union environments were anastomosing river valleys, lakes, and mires. Sequence stratigraphy was then applied to these deposits, and periods of base level highstand and lowstand were identified. The variegated facies appeared genetically linked to periods of base level highstand. Furthermore, their reappearance above an incised valley, and therefore after one base level cycle, indicates that their deposition occurred long-term, and was not temporally restricted to the time of the asteroid impact. The application of sequence stratigraphy to these continental strata therefore indicates that marine transgression is the likeliest mechanism for K-Pg environmental change.