# Revisiting the K-Pg boundary in western Kentucky Jarred Asselta, Gary E. Stinchcomb, William E. Lukens

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## Abstract

This study revisits a Cretaceous-Paleogene (K-Pg) sedimentary section in western Kentucky to determine the nature of this boundary and the depositional environments. Although previous pollen work identified the boundary over four decades ago, to our knowledge no work has been carried out at this important K-Pg boundary site. A combination of stratigraphy and sedimentology were used to characterize the section in detail. Bulk and oriented samples were collected for grain-size, geochemical, and petrographic analysis. We relocated the site and measured 1.5m of section that includes the K-Pg boundary. Four distinct units were identified and from base to top of section are (I) bioturbated black lignitic clay, (II) bioturbated brownish gray mud, (III) gray laminated mud with interlaminated quartz and micaceous sand, and (IV) red and yellow mud with laminated sand. The K-Pg boundary is a 5mm thick Fe-sulfide concretion layer, where these concretions commonly have a mammillary fabric. Preliminary geochemistry shows an iridium anomaly near the boundary. Petrographic analysis shows the presence of deformation features in quartz within the section at the boundary. Fossil wood and amber droplets occur throughout the section. The presence of fossil wood, amber droplets, and root traces below the K-Pg boundary suggest the presence of a paleosol weathering in a marsh environment. Above the boundary, the presence of leaf impressions, along with fossil wood, and cyclic deposition of mud and sand suggests delta plain or prodelta environment. These depositional environments are consistent with the site being situated in a transitional zone along the Mississippi Embayment.

# **Research Questions**

1) What is the depositional environment of the late Cretaceous and early Paleogene deposits in western KY?

2) Does evidence of the K/Pg impact exist in western KY?

# Materials & Methods

Late Cretaceous paleogeographic map modified from Goderis et al. (2021)



We attempted to relocate the Independence School K/Pg site (Olive, 1980) Tschudy, 1970) (see map above). We measured the stratigraphy of the outcrop and designated units based on color, grain size, and sedimentary structures.

We collected oriented samples and sent them to Wagner Petrographic for thin sections. We examined these thin sections for evidence of deformation features in quartz (planar deformation features - pdf; planar fractures - pf) (French, 1988).

We collected bulk samples and sent them to ALS Chemex for geochemical analysis. Platinum group elements (PGEs) were measured using nickelsulfide fire assay and ICP-MS. Trace elements were measured using lithium borate fusion and ICP-MS.

<u>Stratigraphy</u>



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sites. (LEFT) Polarizing light microscope images of quartz with planar deformation features (pdf).

#### Environment







The stratigraphic succession of lignite, sandy paleosol, and organic-rich muds is consistent with previous fluvio-deltaic interpretations (Olive, 1980) and deposition in a delta plain and possibly prodelta.

These K/Pg deltaic deposits host a wealth of untapped paleobiology and evidence of the Chicxulub impact event. See quartz and Ir anomaly plot below.

#### Discussion

The Ir anomaly (11 ng/g) in sample IS-10 of this study is similar to Ir concentrations from other K-Pg sections in the Raton Basin in the Western Interior, USA (Goderis et al., 2013). Raton Basin Ir values range from 0.25 to 15.98 ng/g in a 1-10 cm thick boundary event unit found in the Raton Formation (Izett, 1970), a succession of coal and sandstone deposited in siliciclastic alluvial environments (Flores, 1987).

Despite the presence of two key impact indicators, the Ir anomaly and the deformation features in quartz, we have not yet observed a prominent boundary clay unit at the Independence School K-Pg site. No boudary clay units have been documented at nearby K-Pg sites such as Moscow landing in AL (Savrda, 2018) and Crowley's Ridge in MO (Campbell et al., 2008). The lack of a boundary clay in the Mississippi Embayment could be associated with a strong erosional event (i.e., mega-tsunami) or diagenetic alteration of the claystone.

### Conclusions

The Independence School (K/Pg) site was situated along a delta plain. Our Ir and petrographic data suggest evidence of the Chicxulub impact is present along the eastern edge of the Mississippi Embayment.

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#### Works cited

Flores, R.M., 1987, Sedimentology of Upper Cretaceous and Tertiary siliciclastics and coals in the Raton Basin, New Mexico and Colorado, Northeastern New Mexico; New Mexico Geological Soc Guidebook 38, 255–264

French, B. M., 1988. Traces of catastrophe: A handboook of shock-metamorphic effects in terrestrial meteorite impact structures. Lunar and Planetary Institute

Schmitz, B., Burney, D., Kaskes, P., Vellekoop, J., Wittmann, A., Schulz, T., Chernonozhkin, S.M., 2021, Globally distributed iridium laver preserved within the Chicxulub impact structure, Sci. Adv. 7. eabe36

oderis, S., Tagle, R., Belza, J., Smit, J., Montanari, A., Vanhaecke, F., Erzinger, J., Claeys, P., 2013. Reevaluation of siderophile element abundances and ratios across the Cretaceous-Paleogene (K–Pg) boundary: Implications for the nature of the projectile. Geochim. Cosmochim. Acta 120, 417–446.

Izett, G.A., 1987. The Cretaceous-Tertiary (KT) boundary interval, Raton Basin, Colorado and New Mexico, and its content of shock-metamorphosed minerals: Implications concerning the KT boundary impact-extinction theory

Olive, W.W., 1980, Geologic maps of the Jackson Purchase region, Kentucky,

Savrda, C.E., 2018. Revisiting the origins of Clayton sand bodies at the K–Pg transition, Moscow Landing, western Alabama: stratigraphic relations, sedimentology, and ichnology. Palaios 33, 555–567.

Tschudy, R.H., 1970. Palynology of the Cretaceous-Tertiary boundary in the northern Rocky Mountain and Mississippi Embayment regions, in: Symposium on Palynology of the Late Cretaceous and Early Tertiary. Geological Society of America Special Paper. pp. 65–111.