

Do tectonics influence an impact boundary? A perspective on the distal Cretaceous-Paleogene Boundary

*Shania James¹

1. University of Kerala

The concepts of space and all-things-extra-terrestrial has been a beautiful enigma to the human race. Terrestrial impact craters are the closest gateways for mankind to venture, visualize, appreciate, and explore the sites bearing witness to planetary events. The Chicxulub Impact Event at 66 Ma is an exemplification of the same, wherein the impact of a 10km asteroid in the region led to the Cretaceous-Paleogene Mass Extinction and a chronostratigraphic boundary. The Cretaceous-Paleogene Boundary (KPgB) is found globally and is popularly associated with the 'boundary clay'. The boundary clay is the ejecta associated to Chicxulub. The closest KPgB are reported from Haiti and Mexico, while the farthest ones are reported from India. Schulte et al. (2010) classified sites at paleodistances > 5000km from the impact point (66 Ma) as distal KPgB. Unlike the easily recognisable and well-established closer KPpB (< 1000km), the distal KPgB continue to remain highly diverse and dynamic. In the study, we shortlist 60 distal KPgB to decipher the potential role of tectonic boundaries in modification of the boundaries. The 60 KPgB were present at paleodistances of 6000-8000km from the impact point. The KPgB section at the 60 locations are well studied and bear convincing evidences of ejecta components such as Ir-anomaly, shocked minerals, and several others. The closest KPgB is Sopelana (~6460 km), whereas the farthest is Nasitów (~7990 km). The distance at the KPgB was reconstructed using GPLates. The 60 sites were correlated to the active tectonic boundaries observed today (Hasterok et al., 2022). The boundaries occurring nearest to the KPgB are collision zones, dextral transform, sinistral transform, extension zone, spreading centre and inferred boundary. The relative percent of different tectonic boundary types are depicted in Fig. 1. The distance recorded between the KPgB and the nearest tectonic boundary depict a large variation across the 60 sites. A total of 49 sites occurs at distances < 200km from the tectonic boundaries (Fig. 2). Zumaya is recorded at 135 m from the North Pyrenean Frontal Thrust (collision zone) while Poty Quarry is 1078 km from the Africa-South America Ridge (spreading centre). The North Pyrenean Frontal Thrust is also the nearest tectonic boundary to Bidart (2.09 km), Sopelana (57.35 km) and Albas (160.09 km) as well. In a similar fashion, different boundaries are related to the KPgB. The presence of the tectonic boundaries are indicative of the difference in the tectonic evolution across the different KPgB sites. It can be noted that even though, the tectonic boundaries run near the KPgB, the innate tectonic makeup at 66 Ma in the concerned region might be passive or dormant. Yet, in a tectonically active scenario at 66 Ma, the KPgB might have been destroyed or modified. Furthermore, the tectonic setup of the regions might have been highly influenced by the Cenozoic tectonics; which need to be accounted for in future studies. In tectonically active regions, material transport is an important component. The same might have aided the KPgB preservation or potentially the entire KPgB obliteration, owing to either material deposition or material transport respectively. Therefore, tectonics influence the KPgB and tectonic boundaries act as a link to decode the said tectonic influence.

Reference:

- 1.Hasterok, D., Halpin, J. A., Collins, A. S., Hand, M., Kreemer, C., Gard, M. G., & Glorie, S. (2022). New maps of global geological provinces and tectonic plates. *Earth-Science Reviews*, 231, 104069.
- 2.Schulte, P., Alegret, L., Arenillas, I., Arz, J. A., Barton, P. J., Bown, P. R., ... & Willumsen, P. S. (2010). The Chicxulub asteroid impact and mass extinction at the Cretaceous-Paleogene boundary. *Science*, 327 (5970), 1214-1218.

Keywords: Cretaceous Paleogene Boundary, Chicxulub Crater, Tectonic Boundary, Mass Extinction

