

**The extraterrestrial impact at the Paleocene-Eocene boundary Carbon Isotope Excursion**

Morgan F. Schaller<sup>1</sup> Megan K. Fung<sup>1</sup> Brent D. Turrin<sup>2</sup>

<sup>1</sup>Earth and Environmental Sciences, Rensselaer Polytechnic Institute, Troy, NY

<sup>2</sup>Earth and Planetary Sciences, Rutgers University, Piscataway, NJ

We have identified clear evidence of an extraterrestrial impact in the onset of the carbon isotope excursion (CIE) that defines the Paleocene-Eocene boundary (P-E, ~56 Ma) from several sites on the eastern Atlantic Coastal plain and offshore. This evidence includes shocked quartz and impact spherules. We report an  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  age of  $55.4 \pm 4$  Ma for the spherules, demonstrating a cooling age indistinguishable from the depositional age, and establishing the ejecta horizon as the only truly isochronous stratigraphic indicator at the P-E boundary CIE. Immediately above the ejecta in the coastal plain Marlboro Clay unit, we identify a sharp ~24-fold increase in charcoal abundance coincident with dramatic increase in magnetic nanoparticles of soil-pyrogenic origin. We therefore revisit the observed sequence of events through the P-E on the coastal plain, showing that an extraterrestrial impact lead to widespread wildfires, landscape denudation and deposition of the thick Marlboro Clay, whose base coincides with the spherule horizon and CIE onset. The Sr/Ca ratio of the spherules indicates that the carbon responsible for the onset may be vaporized  $\text{CaCO}_3$  target rock mixed with isotopically light carbon from the impactor or elsewhere. Crucially, we do not argue that the impact was responsible for the full manifestation of the CIE observed globally (onset-recovery ~170 kyr), rather that a rapid onset was triggered by the impact and followed by additional carbon from other processes such as the eruption of the North Atlantic Igneous Province.