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Organic geochemical evidences for smoke clouds induced by an asteroid impact at the Cretaceous-Paleogene boundary

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An asteroid impacted the continental shelf of Mexico 66 Myr ago. Although the resulting ejecta containing asteroidal and terrestrial materials in the stratosphere caused acid rain, darkness, and a mass extinction, the mechanisms of the extinction remain under debate. We demonstrate that the impact caused the ejection of combusted fossil oil into the stratosphere, forming a smoke plume that remained for several years. The absorption of solar radiation by the smoke led to the devastation of plants, causing the extinction of the dinosaurs and some marine invertebrates at the end of the Cretaceous. Combusted organic molecules containing coronene are concentrated in the microspherule-dominated coarse deposits and the superjacent fine layer containing iridium derived from the asteroid in Haiti. The coronene percentage in the completely combusted organic molecules and δ^{13}C values in the ejected layers show similar values in the coarse deposits and the iridium layer in the proximal site and also in the iridium layer in a distal site (Spain) for the impact crater, implying that the combusted organic molecules remained in the stratosphere globally for several years. The carbon preference index values of *n*-alkanes in the coarse ejected layers indicate that the *n*-alkanes were primarily sourced from oil. The stable carbon isotope ratio values of short-chain n-alkanes in Haiti show devastation of marine life occurred within a year after the impact. The δ^{13}C profile of long-chain *n*-alkane implies devastation of land vegetation by darkness. Therefore, we suggest that these smoke clouds contributed to the mass extinction.

Keywords: coronene, Cretaceous, Paleogene, smoke clouds, stable carbon isotope ratio