

UC SANTA BARBARA

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The Big Burn

Some 13,000 years ago, a cataclysmic event occurred on Earth that was likely responsible for the collapse of the Clovis people and the extinction of megafauna such as mammoths and mastodons.

That juncture in the planet's geologic history — marked by a distinct layer called the Younger Dryas Boundary — features many anomalies that support the theory of a cometary cloud impacting Earth. The collision triggered a massive biomass burning event, and the resulting soot, ash and dust in the global atmosphere blocked out the sun, which prevented photosynthesis — a phenomenon called impact winter.

For more than a decade, UC Santa Barbara professor emeritus [James Kennett](#) has studied elements found at the Younger Dryas Boundary (YDB). He has collaborated with scientists around the globe, providing evidence at the YDB for a platinum peak as well as for spherules, melt glass, nanodiamonds and other exotic materials that can be explained only by cosmic impact.

Kennett and his colleagues have now published [new research](#) in the [Journal of Geology](#). In two papers, they analyze existing published scientific data from ice, glacier, lake, marine and terrestrial sediment cores, finding evidence for an extensive biomass burning episode at the YDB layer representing one the most extreme events — if not the most extreme — ever experienced by our own species, anatomically modern humans. Recent extreme climate and burn events like those in California pale by comparison, Kennett said.

The group's theory posits that a cometary cloud — a single broken-up comet broader than Earth's diameter — entered Earth's atmosphere, causing impacts and aerial explosions that sparked fires around the globe. Co-author William Napier, a British astrophysicist and leading expert on cometary impacts, contributed an updated section on impact theory in one of the two papers featured in the journal.

"The ice cores are the most persuasive because they are so well dated," explained Kennett, a professor emeritus in the Department of Earth Science. "What's more, they provide sound geochemical results that point to a large biomass burning event precisely coinciding with the YDB layer formed when this major comet impacted Earth."

The investigators studied byproducts of biomass burning and found a peak in ammonium. They also found other peaks in combustion aerosols such as nitrate, acetate, oxalate and formate. According to Kennett, collectively these elements reflect the largest biomass burning episode in the past 120,000 years of the Greenland ice sheet.

The scientists also examined the record of atmospheric carbon dioxide entrained in Antarctic ice, which also shows an increase in CO₂ at the YDB. "With extensive biomass burning, you'd expect an increase in CO₂," Kennett explained. "We used the CO₂ data to estimate that about 10 percent of the Earth's terrestrial biomass burned during this event." Independent calculations of soot concentrations performed by lead author Wendy Wolbach, a professor of chemistry at DePaul University, and Adrian Melott, professor emeritus at the University of Kansas, confirmed that estimate, which equals approximately 10 million square kilometers — a phenomenal area to burn in just a few days to weeks.

The primary biomass burning proxy recorded in lake, marine and terrestrial sediment cores is charcoal, which was found at the YDB in 129 lake core records around the globe. "The biomass burning was so extensive and voluminous — we have evidence of it over North America, South America, Western Europe and the western part of Asia — that it blocked out the sun, causing an impact winter, with profound effects on life on Earth, particularly large animals and humans," Kennett said. "The impact winter itself was also part of what triggered the Younger Dryas cooling in the Northern Hemisphere."

About UC Santa Barbara

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