SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
UNIVERSITY OF HAWAI'I AT MĀNOA

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Absence of evidence for a meteorite impact event 13,000 years ago as a trigger for the Younger Dryas abrupt cooling and the Megafauna extinction

Honolulu, HI – An international team of scientists led by researchers at the University of Hawaii at Manoa have found no evidence supporting an extraterrestrial impact event at the onset of the Younger Dryas ~13000 years ago.

The woolly mammoth was one of the large mammals that became extinct in North America at the onset of the Younger Dryas ~13000 years ago. Image of Woolly Mammoth at the Royal BC Museum, Victoria, British Columbia courtesy Wikipedia Commons

The Younger Dryas is an abrupt cooling event in Earth's history. It coincided with the extinction of many large mammals including the woolly mammoth, the saber toothed jaguar and many sloths. This cooling period is generally considered to be the result of the complex global climate system, possibly spurred on by a reduction or slowdown of the thermohaline circulation in North America. This paradigm was challenged two years ago by a group of researchers that reported finding high iridium concentrations in terrestrial sediments dated during this time period, which led them to theorise that an impact event was instead the instigator of this climate shift. A team led by François Paquay, a Doctoral graduate student in the Department of Geology and Geophysics at the University of Hawaii at Manoa (UHM) decided to also investigate this theory, to add more evidence to what they considered a conceptually appealing theory. However, not only were they unable to replicate the results found by the other researchers, but additional lines of evidence failed to support an impact theory for the onset of the Younger Dryas. Their results will be published in the December 7th early online edition of the prestigious journal the Proceedings of the National Academy of Sciences.

The idea that an impact event may have been the instigator for this cooling period was appealing because of several alleged impact markers, especially the high iridium concentrations that the previous team reported. However, it is difficult for proponents of this theory to explain why no impact crater of this age is known. "There is a black mat layer across North America which is correlated to the Younger Dryas climatic shift seen in Greenland ice cores dated at 13 thousand years ago by radio carbon," explains Paquay. "Initially I thought this type of layer could be associated with an impact event because concentration in the proxies of widespread wildfires are sky high. That plus very high levels of iridium (which is one indicator used to indicate extraterrestrial impact events). So the theory was conceptually appealing, but because of the missing impact site, the idea of one or multiple airburst arose."

To corroborate the theory, Paquay and his colleagues decided to take a three-pronged approach. The first was to replicate the original researchers data, the second step was to look for other tracers,

specifically osmium isotopes, of extraterrestrial matter in those rocks, and the third step was to look for these concentrations in other settings. “Because there are so many aspects to the impact theory, we decided to just focus on geochemical evidence that was associated with it, like the concentration of iridium and other platinum group elements, and the osmium isotopes,” says Paquay. “We also decided to look in very high resolution sediment cores across North America, and yet we could find nothing in our data to support their theory.”

The team includes American, Belgian and Canadian researchers. Analysis of the sediments was done both at UHM and in Belgium, using the same sediments from the same interval and indepedently did the analysis work and got similar results. Both the marine and terrestrial sediment records do not indicate that an impact event was the trigger for the transition into the Younger Dryas cold period. “The marine and terrestrial record both complement each other to support this finding,” concludes Paquay. “That’s what makes the beauty of this study.”

This project was supported by the Geological Society of America and the National Science Foundation. Sediment samples were provided by the Integrated Ocean Drilling Program.

The other authors from this paper are Greg Ravizza (also from UHM), Steven Goderis and Philippe Claeys from Vrije Universiteit Brussel, Frank Vanhaeck from the Universiteit Ghent, Matthew Boyd from Lakehead University, Todd A. Surovell from the University of Wyoming at Laramie, and Vance T. Holliday and C. Vance Haynes, Jr. from the University of Arizona at Tucson.

This research will be presented at the American Geophysical Union Fall 2009 Meeting in San Francisco. Wednesday December 16th, 2:52 PM - 3:04 PM, Room 2006 Moscone West
Session Title: PP33B. “Younger Dryas Boundary: Extraterrestrial Impact or Not? II”

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Absence of geochemical evidence for an impact event at the Bølling–Allerød/Younger Dryas transition. François S. Paquay, Greg Ravizza (University of Hawaii at Manoa), Steven Goderis, Philippe Claeys (Vrije Universiteit Brussel), Steven Goderis, Frank Vanhaeck (Universiteit Ghent), Matthew Boyd (Lakehead University), Todd A. Surovell (University of Wyoming at Laramie), Vance T. Holliday, C. Vance Haynes, Jr. (University of Arizona at Tucson)

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