Warming Earth, Shrinking Mammals

A Graduate Student and Her Professor Connect Ancient Dots

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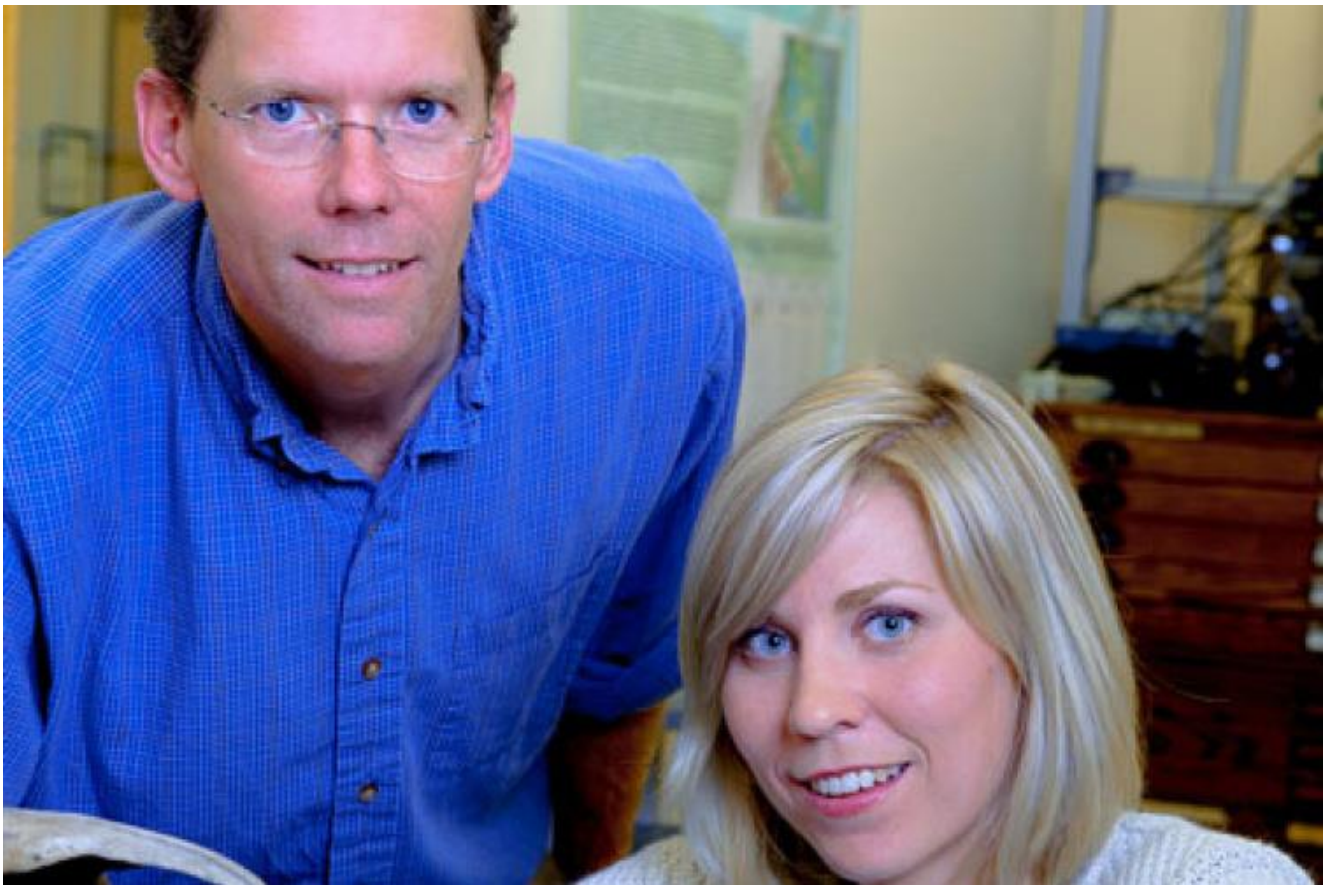

Graduate student Abigail D'Ambrosia (at right) and geology professor Will Clyde

When the Earth heated up about 50 million years ago in a series of extreme global warming events, early mammals shrank in response. While this mammalian dwarfism had been previously linked to the largest of these events, UNH doctoral student Abigail D'Ambrosia and colleagues connected this dwarfism to a second, smaller, so-called hyperthermal, indicating an important pattern that could inform our understanding of current human-caused climate change.

The findings created a buzz when D'Ambrosia presented them at the Society of Vertebrate Paleontology's annual meeting in Los Angeles earlier this month.

Scientists have known that during the largest of these hyperthermals, known as the Paleocene-Eocene Thermal Maximum (PETM), temperatures rose an estimated 9 to 14 degrees Fahrenheit and mammal size shrank. D'Ambrosia wanted to build on this knowledge, which her advisor, UNH professor of geology Will Clyde, put forth in his doctoral dissertation.

"We wanted to find out if this was a repetitive pattern," says D'Ambrosia. "If we knew that, maybe it would help us predict what would happen in a warming event today."

AN ARTIST'S RENDERING OF *HYRACOTHERIUM* (RIGHT) AND ITS MODERN ANCESTOR, THE HORSE. RESEARCHERS FOUND THAT *HYRACOTHERIUM* BODY SIZE DECREASED 19 PERCENT DURING A GLOBAL WARMING EVENT APPROXIMATELY 50 MILLION YEARS AGO. CREDIT: DANIELLE BYERLY, UNIVERSITY OF FLORIDA

The repeat warming-and-shrinking cycle gives scientists greater confidence that this phenomenon is in fact cause and effect, and that this decrease in mammals' body size might have been in result to the warming.

The researchers collected teeth and jaw fossils of two early hoofed mammals – *Hyracotherium*, an early horse the size of a small dog, and *Diacodexis*, an ungulate – and the primate *Cantius* in the fossil-rich Bighorn Basin region of Wyoming. "To paleontologists, the Bighorn Basin is littered with fossils. If you walk around with a keen eye, you start seeing all these little tiny teeth," says D'Ambrosia, who has done field work there since she came to UNH in 2010.

Using the size of molar teeth as a proxy for body size, the researchers found that the mammals' body size diminished during a second smaller hyperthermal, called the ETM2. *Hyracotherium* decreased about 19 percent in size, *Diacodexis* about 20 percent, and *Cantius* about 8 percent.

"Interestingly, the extent of mammalian dwarfism may be related to the magnitude of the hyperthermal event," D'Ambrosia says. During the ETM2, which lasted 80,000 to 100,000 years, about half as long as the PETM, temperatures rose an estimated 5 degrees Fahrenheit. During the warmer PETM, which occurred about 2 million years earlier than the ETM2, *Hyracotherium* had a body size decrease of approximately 30 percent.

Body sizes rebounded following both hyperthermal events.

Because both the PETM and the ETM2 hyperthermals coincided with increased levels of carbon dioxide in the atmosphere, this work could have implications for current climate change study.

"Developing a better understanding of the relationship between mammalian body size change and greenhouse gas-induced global warming during the geological past may help us predict ecological changes that may occur in response to current changes in Earth's climate," says Clyde.

For D'Ambrosia, this work and the attention it's drawing is the realization of childhood fantasies. "I knew I wanted to be a paleontologist ever since I was a kid," she says. The Easthampton, Massachusetts, native took a route to UNH that let her sample collegiate styles: She began at her local Greenfield Community College, finished her undergraduate degree at Smith College, then came to UNH for her master's and doctoral degrees.

"It turns out that Clyde's research interests perfectly matched my own, including topics in paleontology, stratigraphy, and climate," she says of her decision to come to UNH after several years in the workplace. The many opportunities for travel and fieldwork that Clyde's research offered were an additional draw. "My time as a master's degree student at UNH was so fulfilling that I have stayed on for my Ph.D." she adds.

In addition to D'Ambrosia, Clyde, and Gingerich, researchers on the project are Henry C. Fricke of Colorado College and Kathryn Snell of the California Institute of Technology. The research was funded by the National Science Foundation (EAR0958821), the Geological Society of America, the Paleontological Society, and Sigma Xi.

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