# Deep sea algae connect ancient climate, carbon dioxide and vegetation

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Assistant Professor Mark Pagani in the Department of Geology and Geophysics at Yale and his colleagues mapped the first detailed history of atmospheric carbon dioxide between 45 - 25 million years ago based on stable isotopes of carbon in a National Science Foundation study reported in *Science Express*.

"Through the energy we consume, each of us makes a contribution to increasing greenhouse gasses, such as carbon dioxide and methane, in the Earth's atmosphere," said Pagani. "To understand the implications of these actions for the future, scientists look to the past to gain a better understanding of Earth's climate system under high greenhouse gas conditions." The findings were based on calibration of carbon-containing compounds produced by ancient sea surface algae that were recently isolated in deep sea drill cores.

The data indicates that between 45 - 34 million years ago the atmospheric carbon dioxide level was up to five times greater than today, with a sharp decrease and then stabilization to near modern day levels between 34 - 25 million years ago.

During the early part of the Paleogene Period, from 65 - 34 million years ago, global climates were much warmer than today with very little ice present at the poles. The boundary of the Oligocene and Eocene Epochs 33.7 million years ago was marked by rapid global cooling and the formation of large continental ice sheets on the Antarctic.

"Before this study, the relationship between the global climate and the concentration of carbon dioxide in the atmosphere during the late Eocene and Oligocene was largely unknown," said Pagani, who is recognized for his reconstruction of past atmospheric carbon dioxide levels between 25 million and eight million years ago.

They also present intriguing evidence that the sharp drop in carbon dioxide level, between 33 - 25 million years ago, prompted the origin of economically important land plants that are sensitive to atmospheric carbon dioxide levels, such as corn and sugarcane.

"The onset and stabilization of ice sheets at the same time as a decline in carbon dioxide illustrates the importance of atmospheric carbon dioxide as an agent of both climate and biological change," Pagani said.

Collaborators were Brett Tipple from Yale, James C. Zachos and Stephen Bohaty at University of California, Santa Cruz and Katherine Freeman at Pennsylvania State.

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Source: Yale University