Study Pushes Appearance of Northern Hemisphere Ice Sheets Back By 22 Million Years

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(PhysOrg.com) -- Climatologist Robert DeConto of the University of Massachusetts Amherst and colleagues at four institutions are reporting in the Oct. 2 issue of the journal Nature that their latest climate model of the Northern Hemisphere suggests conditions would have allowed ice sheets to form there for the last 25 million years, or about 22 million years earlier than generally assumed. Their research has implications for the evaluation of global climate change.

When climate and ice sheet models of the past closely match other information, in this case sea-level data, climate scientists gain more precise tools for predicting future trends. “There’s a lot of mysterious sea-level variability over the last 25 million years that is difficult to explain with Antarctic ice alone,” DeConto says. “But if ice sheets and glaciers were present earlier in the Northern Hemisphere, as we think they might have been, they might provide the answer.”

With future CO2 levels expected by the year 2100 to approach levels not seen in the last 25 million years, understanding past conditions is crucial for predicting possible implications for Earth’s ice sheets and sea levels. “It’s important that we get this right,” DeConto says. “If we are correct, we are rewriting the history of the cryosphere over the past 34 million years and calling a lot of things into question. It’s a challenge to geologists.” The cryosphere is the planet’s total amount of snow, ice and frozen ground.

The new model, accounting for atmospheric CO2 and changes in Earth's orbit around the sun among other variables, shows that the threshold of atmospheric CO2 at which large ice sheet development in the Northern Hemisphere is possible, is much lower than for Antarctica. The work, supported by the National Science Foundation, also suggests that climate, ice sheets and sea level may be far more sensitive to CO2 levels than generally accepted.

"The last time CO2 levels were as high as they are expected to reach in coming centuries, there was no big ice sheet on Antarctica because the planet was too warm," DeConto says. "This is not to say that we'll see the great East Antarctic Ice Sheet melt, because its large size and high elevations are self-sustaining. But it is alarming. We are trying to understand exactly what the effect of those high CO2 levels will be. It appears there will be an associated rise in sea level because much of the rest of the world's ice cover could be affected."

In addition to DeConto, the team includes climate researchers from Penn State University and Yale University in the United States and the University of Southampton and Cardiff University in Great Britain. Their paper published today is accompanied by an invited commentary by geologist Stephen Pekar of Queens College, New York, an expert on ancient sea level variation over the same period. He notes that DeConto and colleagues' results not only address the long-standing debate among geologists about the cause of ancient sea level fluctuations, but they are "relevant to today's discussions about climate change."

In an earlier paper, DeConto and colleagues had showed that global cooling which began about 34 million years ago during the "greenhouse to icehouse transition" was probably related to declining greenhouse gas levels and less to ocean currents around Antarctica as once believed.

Provided by University of Massachusetts Amherst