CURRENT RATE OF CO_2 EMISSIONS UNPRECEDENTED IN EARTH'S PAST

A new study of carbon dioxide levels during a previous period of rapid warming suggests the rate of carbon dioxide release today is unprecedented.

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>
> — Lee Kump, Penn State University

The past is the prelude to the future, which is why paleoclimatology plays such an important role in the study of modern climate change. But what happens when there's no analog from geologic history that matches what's happening currently? That's exactly the case, according to a new study that indicates that even the most extensive and rapid global warming events of the past do not match current trends. In fact, the study found, the current rate of carbon emissions is now up to 10 times faster than during periods of rapid warming in the past.

Researchers often look to a time period known as the Paleocene-Eocene Thermal Maximum (PETM) as an analog to modern-day global warming. During the PETM, which occurred 56 million years ago, global temperatures quickly increased an average of 5 degrees Celsius and remained elevated for roughly 170,000 years. How and why the change occurred is a matter of debate. Researchers know that carbon dioxide levels spiked during that time. But the sources of carbon, the rate at which carbon was emitted to the atmosphere and the total amount released are poorly constrained. Eruptions of volcanoes on the seafloor likely triggered the initial release of greenhouse gases such as carbon dioxide and methane to the oceans and atmosphere, says Lee Kump, a geologist at Penn State University and a co-author of the new study in Nature Geoscience.

To get a better idea of how much carbon was released during the PETM (and how it compares to the present), Kump and his colleagues analyzed core samples from areas near Spitsbergen, Norway, that were part of the Arctic seafloor during the PETM. The Norwegian cores provide a more intact record of the Paleocene-Eocene boundary than cores of deep-sea sediments, which have traditionally been used to study the PETM.

To quantify how quickly carbon entered the atmosphere, researchers first looked for carbon isotope ratios that would indicate a massive release of the gas. Once they determined the change in the carbon-13 to carbon-12 isotope ratio in the core and the length of time over which it occurred in the geologic record, they used a climate model to show that the peak rate of carbon addition during the PETM was 0.3 to 1.7 petagrams of carbon per year. That's four to 10 times slower than the present rate of carbon dioxide emissions, they reported.

Though other studies have examined the magnitude of past warming events, "this study is unique in its analysis of the rate of emissions that caused the event," says Jeff Kiehl, a climate scientist at the National Center for Atmospheric Research in Boulder, Colo., who was not involved in the study. The findings provide a valuable context for comparison of how current warming trends differ from anything we've seen in the past, Kiehl says.

The magnitude of total warming during the PETM falls within the range of the Intergovernmental Panel on Climate Change prediction for global temperature increase by the end of the century, though the current rate is what sets the present scenario apart from the PETM. "We are really stressing Earth systems in ways that they haven't been stressed before," Kump says. "It's an unprecedented experiment in geology."

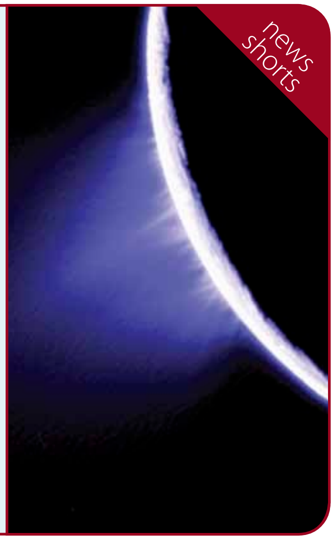
Lindsey Konkel

Enceladus hiding huge salty ocean

news shorts

Samples analyzed by the Cosmic Dust Analyzer aboard the Cassini spacecraft show that the composition of freshly ejected plume grains is salty ice — the best evidence yet for a saltwater-rich liquid ocean beneath the icy exterior of Saturn's moon Enceladus. Cassini's instruments collected the sample data when the spacecraft flew through the icy plume off Enceladus in 2008 and 2009. Finding liquid water on a body so far from the sun could have implications for finding life on other planets, the research team said.

Postburg et al., Nature, June 23, 2011.



Bottom: NASA/JPL/Space Science Institute; top: University Corporation for Atmospheric Research