

## Methane burps disproved?

Gassy emissions no longer in suspect dock for melting the last ice age.

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Strange ice: no evidence that melting methane triggered global warming after the last ice age.

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Methane escaping from the sea floor to the atmosphere has been a popular suspect for causing rapid climate changes during and at the end of the last ice age. But new data derived from a Greenland ice core have delivered a killer blow to the idea.

Methane (CH<sub>4</sub>) is a much stronger greenhouse gas than carbon dioxide. It is usually released from swamps or through biomass burning. But it is also trapped in huge amounts in some ocean-floor sediments, where it lies buried in a strange kind of ice known as 'methane clathrate'. These clathrates are stable only within a certain range of temperatures and pressures; when brought to the surface, they melt rapidly and release burnable gas to the air.

A catastrophic release of trillions of tonnes of methane is thought to have triggered a temperature jump some 55 million years ago in an already warm climate at the Palaeocene/Eocene boundary (see '[Gas leak!](#)'). But some scientists suspect that similar methane bursts, triggered perhaps by submarine landslides, sea-level drops or changes in water temperature, may also have caused a number of rapid warming episodes during and at the end of the last glacial period.

The theory has been popularized as the 'clathrate gun hypothesis'<sup>1</sup>. But now an isotope analysis of methane trapped in bubbles of a Greenland ice core seems to disprove the idea.

### No sign of a burp

Todd Sowers, a palaeoceanographer at Pennsylvania State University in Philadelphia, measured hydrogen isotopes of atmospheric methane from three distinct warming

episodes, 38,000, 14,500 and 11,500 years ago. Methane from clathrates contains more deuterium (the heavy form of hydrogen) than methane from land-based sources, thanks in part to the bacteria that create the gas on the sea floor, and the material they consume.

He found no evidence whatsoever in the data for increased amounts of methane from marine clathrates. "This means that seafloor methane reservoirs must have been stable at these times, or at least that no significant amounts of methane escaped the ocean," says Sowers, whose study is published in *Science* this week<sup>2</sup>.

"The data are convincing," says Kai-Uwe Hinrichs, a geochemist at the University of Bremen in Germany. "They won't exactly increase the attractiveness of the clathrate gun hypothesis." At least for the three periods Sowell has looked at in high resolution, they may even be a "killer argument", adds Jerome Chappellaz, a geochemist at the CNRS Laboratory of Glaciology and Geophysics of the Environment in Grenoble, France.

### Controversial killer

The clathrate gun hypothesis has been controversial from the onset. All Quaternary warming episodes seem to have been accompanied by increased abundance of atmospheric methane. But many climate scientists think this is an effect, rather than the trigger, of warming climates. In most cases, there is evidence that the methane values only began to rise several decades after the temperature started to climb.

None of this means that marine methane hydrates don't occasionally erupt, however. Hinrichs has used fossil remnants of bacteria that flourish only under high methane concentrations to show that large quantities of the gas must have been released in the Santa Barbara Basin off California during an event some 44,000 years ago<sup>3</sup>. This gas didn't necessarily escape to the atmosphere, he says, but it did come from underwater ice.

Researchers are now exploring the isotopic values of gas bubbles trapped in ice cores going back some 900,000 years, to find out where methane came from in the past.

How the world's methane hydrates will respond to future global warming and other disturbances is uncertain. Seafloor reservoirs currently contain twice as much methane as all known conventional fossil-fuel reserves. This makes them a target for the energy industry, but mining the gas could cause a runaway greenhouse effect, says Sowers.

*Geophysical Union, Special Publication,*

Methane Hydrates in Quaternary Climate Change: The Clathrate Gun Hypothesis.

**54**, (2003).

2. Sowers T. *Science*, **311**. 838 - 840 (2006).

3. Hinrichs K.U., Hmelo L. & Sylva S. *Science*, **299** . 1214 - 1217 (2003).