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Greenland's 'good news' methane finding

Ice core research has revealed that a vast, potential source of the potent greenhouse gas, methane, is more stable in a warming world than previously thought.

Based on international research published today in *Science,* the finding includes Australian contributions from CSIRO and the Australian Nuclear Science and Technology Organisation (ANSTO)

Wetlands in the tropics and emerging from under receding Northern Hemisphere glaciers have been considered the primary source of rising atmospheric methane in a warming world. But scientists have known of another potential source.

Massive quantities of methane are locked away in permafrost and in the ocean floors as methane clathrate – an ice-like material which can return to gas if temperatures increase or pressures drop. Just a 10 per cent release of methane would have the equivalent impact on global warming of a ten-fold increase in carbon dioxide concentration.

So began a US, New Zealand and Australian research project to understand ice core records spanning hundreds of thousands of years, profiling periods of high-methane increase and focusing on the Younger Dryas period. The cause of the large increase in methane 12,000 years ago as the Earth warmed and the Younger Dryas ended has been a source of much debate among scientists.

"The result is a good news outcome for climate scientists monitoring greenhouse gases and investigating the likely sources of methane in a warming world," says CSIRO's Dr David Etheridge, from the Centre for Australian Weather and Climate Research who helped show how the air could be extracted from polar ice to measure past methane changes and identify their causes.

"There are vast stores of methane clathrates beneath the ocean and in permafrost and there is evidence that millions of years ago release from these storages caused significant climate change, although none in more recent times.

"The objective of the research was to determine how stable the clathrate methane stores were as the Earth warmed rapidly from its last glacial state and whether clathrates might be a source of future climate change as global temperatures rise."

Dr Andrew Smith, from ANSTO, studied the source of methane by using a technique called accelerator mass spectrometry to detect individual radiocarbon atoms from ancient atmospheric methane samples over the Younger Dryas period.

"Radiocarbon provided the key insight to decide whether the extra methane was derived from clathrates or from wetlands," Dr Smith says.

"A multi-disciplinary team of scientists from the US Scripps Institution of Oceanography, New Zealand's National Institute of Water and Atmosphere, and from Australia's ANSTO and CSIRO combined their resources to tackle this challenging project."

The project involved years of field-work in West Greenland where scientists accessed samples located in 'outcropping' ice, a cross-section of ice formed over tens of thousands of years that is exposed at the surface. A tonne of ice was excavated to provide sufficient air from trapped bubbles for each measurement of the methane carbon isotopes.

Extremely sensitive analysis was required because of the low concentration of methane in air and because only about one trillionth of that methane contains radiocarbon – the carbon-14 isotope that is the key indicator of clathrate emissions. The analysis was undertaken at ANSTO in southern Sydney.

The methane isotope change accompanying the jump in concentration confirmed that the emission was not from clathrates, but from ecological sources such as wetlands.

“We know that emissions of methane are increasing now and that some sources might emit even more with warming, causing a positive climate feedback, or amplification. But this finding suggests that the clathrate source is less susceptible than recently feared,” Dr Smith says.

The Centre for Australian Weather and Climate Research is a partnership between CSIRO and the Bureau of Meteorology.

Image available at: http://www.scienceimage.csiro.au/mediarelease/mr09-??.html

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