Higher wetland methane emissions caused by climate warming 40,000 years ago

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40,000 years ago rapid warming led to an increase in methane concentration. The culprit for this increase has now been identified. Mainly wetlands in high northern latitudes caused the methane increase, as discovered by a research team from the University of Bern and the German Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association. This result refutes an alternative theory discussed amongst experts, the so-called "clathrate gun hypothesis". The latter assumed that large amounts of methane were released from the ocean sediment and led to higher atmospheric methane concentrations and thus to rapid climate warming.

Earlier measurements on ice cores showed that the atmospheric methane concentration changed drastically in parallel to rapid climate changes occurring during the last ice age. Those climate changes - so-called Dansgaard-Oeschger events - were characterised by a sudden warming and an increase in methane concentration. However, it was not yet clear to what extent the climate changes 40,000 years ago led to the methane increase or vice versa. Climate researchers from the Universities in Bern and Copenhagen and from the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven now conclude that the methane increase at that time was largely due to higher methane emissions from wetlands.

As published by the researchers in the current issue of the magazine *Science*, these natural methane sources produced more methane especially in high northern latitudes in response to the warming. Through

their study the researchers also refute another controversial hypothesis, which claimed that large amounts of methane stored as clathrate in the ocean sediment along the continental margins was released and triggered the rapid warming.

The scientists stress, however, that the climate conditions 40,000 years ago are not comparable to the current climate evolution. "Our results do not imply that methane or other greenhouse gases play no role for climate change. Our study reflects natural climate conditions during the last ice age, long before mankind affected global climate by emitting greenhouse gases. At that time climate warming caused an increase in methane concentration, generating in turn a more substantial greenhouse effect. Nowadays, additional methane and carbon dioxide are artificially emitted into the atmosphere by human activities and are the main driver of the observed climate warming."

Ongoing studies of the Alfred Wegener Institute in Arctic permafrost regions take on greater importance in view of these research results.

In nature a few methane molecules (CH_4) have one more neutron in the carbon and hydrogen atoms they are made of and are therefore a little heavier. Methane from wetland sources has fewer molecules with the heavier hydrogen atom than methane produced in the ocean. Accordingly, the marine and terrestrial methane sources have unique "isotopic fingerprints". Using these fingerprints, it is possible to quantify the emission of both sources. Developing a novel analytical method at the University of Bern and the Alfred Wegener Institute to take these "fingerprints" allowed the international team of scientists to come up with the unambiguous results now published in *Science*.

More information: Bock, M.; Schmitt, J.; Möller, L.; Spahni, R.; Blunier, T. & Fischer, H. (2010), Hydrogen isotopes preclude marine hydrate CH4 emissions at the onset of Dansgaard-Oeschger events,

published in the scientific journal "Science" on 25th of June, 2010.

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