PRESS RELEASE

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Ice sheets controlled deep sea Arctic methane emissions

Scientists from the UK and Norway have produced a 160 000 year timeline of methane emissions from the Arctic seabed and linked them to changing ice volumes in the Arctic.

The new research from the Geological Survey of Norway (NGU), the Arctic University of Tromsø and the British Geological Survey (BGS) reveals that methane was released from the deepest parts of the seabed on three occasions: following the end of the last ice age around 23 000 years ago; 40–50 000 years ago, and 150 000 years ago. Each methane release episode lasted 10 000 to 20 000 years.

The scientists took samples and cores from Vestnesa Ridge, a remote spot in the Arctic Ocean off Svalbard, the archipelago between Norway and the North Pole, at a water depth of 1200 m.

It is the first time that deep-sea methane emissions in the Arctic, known as seeps, have been linked to changing continental ice volumes.

Dr Tobias Himmler, researcher at NGU, said: 'During ice sheet growth, the extra weight of the ice presses the Earth's crust downward. Following the melting of the ice, the crust rises again.

'Our data indicate that methane off western Svalbard emanated from the seabed primarily when ice sheet movements activated the faults. How much methane was emitted, however, we don't know.'

Expeditions to Vestnesa Ridge collected samples of seep carbonates, rocks that act as geological archives of past methane emissions, which were tested at the BGS's geochronology and tracers facility.

Dr Diana Sahy, an isotope research scientist with the BGS, said: 'We were able to calculate the ages of the carbonate pieces by measuring the ratio between uranium, which is incorporated into the carbonate from sea water, and its decay product, thorium.

'The youngest samples, collected from the seabed using a remotely operated vehicle, confirmed what we've known from previous work on shallow methane seeps on the Norwegian shelf — they began forming as the last glacial maximum was ending 23 000 years ago.

'The middle episode, 40–50 000 years ago, identified in a shallow drill core, also happened when the ice was retreating. In these two cases it is the removal of pressure that caused the methane to seep.

'The oldest methane release episode 160 000 years ago happened while the ice was either growing or at its maximum extent, which is when the ice would have put pressure on the continental crust and effectively squeezed out the methane.'

Sahy said next steps could include sampling at other locations across the Arctic. 'This is just one spot in the Arctic and we need to know if this matches what happened at a regional level.'

The research project 'Norwegian margin fluid systems and methane-derived carbonate crusts' (NORCRUST) is funded by the Norwegian Research Council through the Petromaks2 program. The BGS is a NORCRUST research partner.

The study was published in the scientific journal Science Advances.

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NOTES TO EDITORS

Seep carbonates

Seep carbonates are sedimentary rocks made of carbonate-cemented seabed sediment. Calcium carbonate ($CaCO_3$) is the mineral that mainly constitutes limestone and marble. Seep carbonates are geological archives used for reconstructing the chronology of past seabed methane emissions.

Methane

Methane (CH_4) is a natural gas that potentially contributes to climate change. Most methane is the product of the decomposition of organic matter. It can originate from many sources, both from the seabed and permafrost areas on land, and from animals and agriculture.

Methane seeping into the Arctic Ocean at water depth in excess of 100 m does not make its way into the atmosphere; it is consumed in the water column.

The British Geological Survey

The British Geological Survey (BGS), a component body of the Natural Environment Research Council (NERC), is the nation's principal supplier of objective, impartial and up-to-date geological expertise and information for decision making for governmental, commercial and individual users. The BGS maintains and develops the nation's understanding of its geology to improve policy making, enhance national wealth and reduce risk. It also collaborates with the national and international scientific community in carrying out research in strategic areas, including energy and natural resources, our vulnerability to environmental change and hazards, and our general knowledge of the Earth system. More about the BGS can be found at https://www.bgs.ac.uk/.

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