

Methane seepage from Arctic seabed occurring for millions of years

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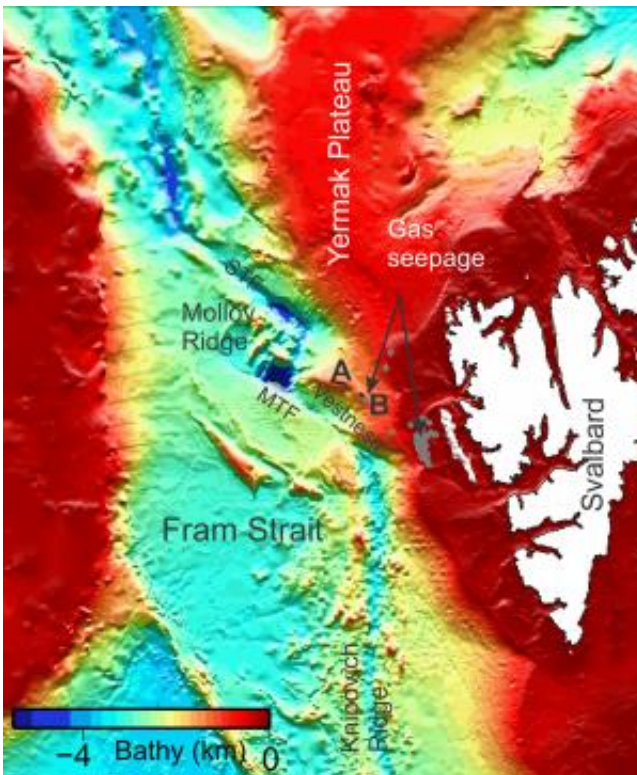


Illustration of the ocean floor offshore West-Svalbard, including the Vestnesa Ridge. Credit: Andreia Plaza Faverola/CAGE

Natural seepage of methane offshore the Arctic archipelago Svalbard has been occurring periodically for at least 2,7 million years. Major events of methane emissions happened at least twice during this period, according to a new study.

We worry about greenhouse [gas methane](#). It's lifetime in the atmosphere is much shorter than CO₂'s, but the impact of methane on climate change is over 20 times greater than CO₂ over a 100-year period.

60 percent of the methane in the atmosphere comes from emissions from human activities. But methane is a natural gas, gigatonnes of it trapped under the ocean floor in the Arctic.

And it is leaking. And has been leaking for the longer time than the humans have roamed the Earth.

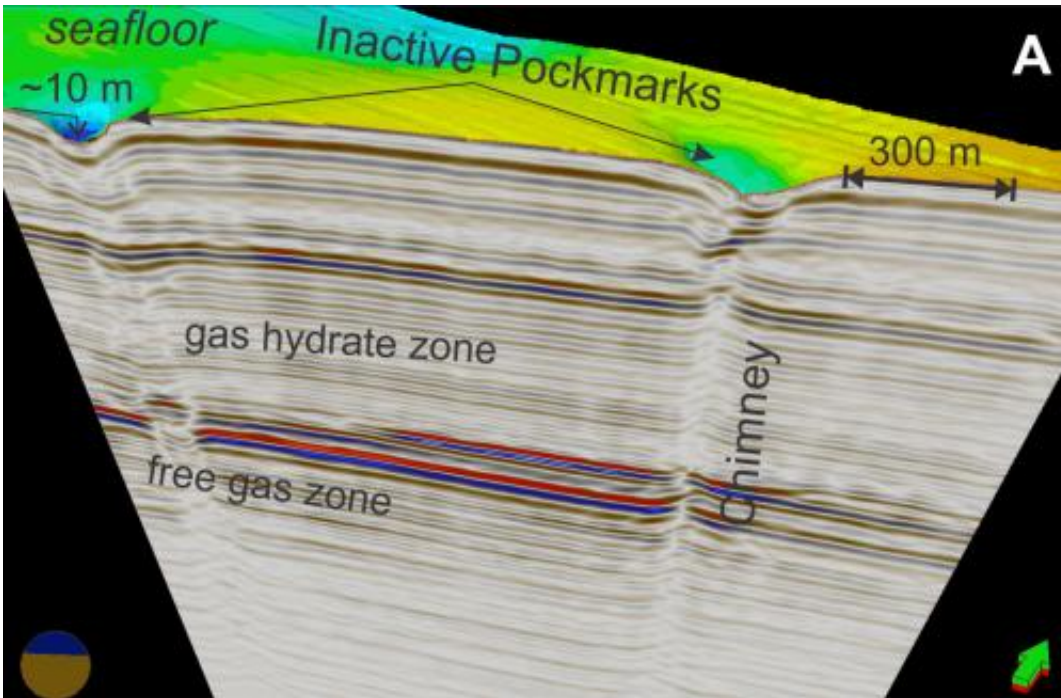
" Our planet is leaking [methane gas](#) all the time. If you go snorkeling in the Caribbean you can see bubbles raising from the ocean floor at 25 meters depth. We studied this type of release, only in a much deeper, colder and darker environment. And found out that it has been going on, periodically, for as far back as 2,7 million years." says Andreia Plaza Faverola the primary author behind a new paper in Geophysical Research Letters.

She is talking about Vestnesa Ridge in Fram Strait, a thousand meters under the surface of the Arctic Ocean, offshore West-Svalbard. Here, enormous, 800 meters high gas flares rise from the seabed. That's the size of the tallest manmade structure in the world - Burj Khalifa in Dubai.

"Half of Vestnesa Ridge is showing very active seepage of methane. The other half is not. But there are obvious pockmarks on the inactive half, cavities and dents in the ocean floor, that we recognized as old seepage features. So we were wondering what activates, or deactivates, the seepage in this area.," says Plaza Faverola.

Why 2.7 million years?

She, and a team of marine geophysicists from CAGE, used the P-Cable technology, to figure it out. It is a seismic instrument that is towed behind a research vessel. It recorded the sediments beneath these pockmarks. P-Cable renders images that look like layers of a cake and enables scientists to visualize deep sediments in 3D.



Gas chimneys appear as vertical disturbances in the layer of sediments at Vestnesa Ridge. Credit: Andreia Plaza Faverola/CAGE

" We know from other studies in the region that the sediments we are looking at in our seismic data are at least 2.7 million years old. This is the period of increase of glaciations in the Northern Hemisphere, which influenced the sediment. The P-Cable helped us to see features in this sediment, associated with gas release in the past. "

"These features can be buried pinnacles, or cavities, that form what we

call gas chimneys in the seismic data. Gas chimneys appear like vertical disturbances in the layers of our sedimentary cake. This enabled us to reconstruct the evolution of gas expulsion from this area, for at least 2,7 million years." says Andreia Plaza Faverola.

The seismic signal penetrated into 400 to 500 meters of sediment to map this timescale.

How is the methane released?

By using this method, scientists were able to identify two major events of gas emission throughout this time period: One 1,8 million years ago, the other 200 000 years ago.

This means that there is something that activated and deactivated the emissions several times. Plaza Faverola's paper gives a plausible explanation: It is the movement of the tectonic plates that influences the gas release. Vestnesa is not like California though, riddled with earthquakes because of the moving plates. The ridge is on a so-called passive margin. But as it turns out, it doesn't take a huge tectonic shift to release the methane stored under the ocean floor.

"Even though Vestnesa Ridge is on a passive margin, it is between two oceanic ridges that are slowly spreading. These spreading ridges resulted in separation of Svalbard from Greenland and opening of the Fram Strait. The spreading influences the passive margin of West-Svalbard, and even small mechanical collapse in the sediment can trigger seepage." says Faverola.

Where does the methane come from?

The methane is stored as gas hydrates, chunks of frozen gas and water,

up to hundreds of meters under the seabed. Vestnesa hosts a large gas hydrate system. There is some concern that global warming of the oceans may melt this icy gas and release it into the atmosphere. That is not very likely in this area, according to Andreia Plaza Faverola.

" This is a deep water gas hydrate system, which means that it is in permanently cold waters and under a lot of pressure. This pressure keeps the hydrates stable and the whole system is not vulnerable to global temperature changes. But under the stable hydrates there is gas that is not frozen. The amount of this gas may increase if hydrates melt at the base of this stability zone, or if gas from deeper in the sediments arrives into the system. This could increase the pressure in this part of the system, and the free gas may escape the seafloor through chimneys. Hydrates would still remain stable in this scenario[IS8] ."

Historical methane peaks coincide with increase in temperature

Throughout Earth's history there have been several short periods of significant increase in temperature. And these periods often coincide with peaks of methane in the atmosphere, as recorded in ice cores. Scientists such as Plaza Faverola are still debating about the cause of this methane release in the past.

" One hypothesis is that massive gas release from geological sources, such as volcanos or ocean sediments may have influenced global climate. What we know is that there is a lot of methane released at present time from the [ocean floor](#). What we need to find out is if it reaches the atmosphere, or if it ever did."

Historical events of [methane release](#), such as the ones in the Vestnesa Ridge, provide crucial information that can be used in future climate

modeling. Knowing if these events repeat, and identifying what makes them happen, may help us to better predict the potential influence of methane from the oceans on future climate.

More information: "Role of tectonic stress in seepage evolution along the gas hydrate-charged Vestnesa Ridge, Fram Strait." A.Plaza Faverola, S.Bünz, J.E.Johnson, S. Chand, J. Knies, J. Mienert and P. Franek. *Geophysical Research Letters*. 2015. DOI: 10.1002/2014GL062474

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