New source of ocean methane discovered

Scientists searching for an explanation for high levels of the potent greenhouse gas methane in the oceans have discovered a new means of production, which could explain the source of previously unaccounted for methane. The discovery has great significance for understanding the ocean’s role in global warming.

Methane is a potent greenhouse gas that has contributed approximately 20 per cent to the Earth’s warming since pre-industrial times. Now scientists have found that the decomposition of an organic, phosphorus-containing compound called methylphosphonate, when it is in contact with dissolved oxygen, may be responsible for the high levels of methane in ocean surface waters.

Although there is less methane than CO₂ in the atmosphere, methane is a more potent greenhouse gas. Today it is responsible for around 20-30 per cent of radiative forcing (a measure of the energy trapped in the atmosphere’s upper layers). Natural gas extraction and fermenting organic matter are known terrestrial sources of methane, but these are not sufficient to account for the high methane levels in the atmosphere.

Methylphosphonates are unusual organic (carbon-based) compounds discovered in the 1960s. They are derived from a range of organic matter including marine phytoplankton. In the laboratory, bacteria grown on methylphosphonate can produce methane. But before now this process of methylphosphonate degradation had not been suggested as a possible means of aerobic methane production in the ocean.

In the sea, methane concentrations vary depending on location and water depth. This gave scientists a clue that methane was not inert – lower concentrations in deep waters suggested it was being used by microbes. Levels at the surface were much higher than in the air above, which suggests that methane was being produced at sea. This came as a surprise because methane is usually produced in areas without oxygen, unlike the surface of the ocean.

The scientists now need to combine approaches from oceanography, microbial ecology and genomics. Growing databases of marine microbial genomic and metagenomic data will help to identify which organisms and genes are responsible for driving important nutrient and elemental cycles in the sea, including the newly discovered aerobic methane generation.

Researchers also need to find out how and when microbial communities turn on and off their methane production genes, in response to the methane precursors, like methylphosphonate, in their natural environment. The full implications for the global climate are still being studied, but it seems likely that the warming and stratification of the ocean will have an effect on the newly discovered methane pathway, leading to even higher methane levels.


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Theme(s): Climate change & energy, Marine ecosystems