For the first time scientists have directly observed living bacteria in polar ice and snow

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The research team positioned themselves away from polar wildlife to limit contamination, but one persistently curious character meant a testing site had to be abandoned Credit: James Chong

For the first time scientists have directly observed living bacteria in polar ice and snow - an environment once considered sterile. The new evidence has the potential to alter perceptions about which planets in the universe could sustain life and may mean that humans are having an even greater impact on levels of CO2 in the Earth's atmosphere than accepted evidence from climate history studies of ice cores suggests.

Gases captured and sealed in snow as it compresses into ice can provide researchers with snapshots of the Earth's atmosphere going back hundreds of thousands of years. Climate scientists use ice core samples to look at prehistoric levels of CO2 in the atmosphere so they can be compared with current levels in an industrial age.

This analysis of ice cores relies on the assumption that there is limited biological activity altering the environment in the snow during its transition into ice. Research reported today in the *Journal of the Royal Society Interface*, which has directly observed microbial activity in Antarctic and Arctic snow, has revealed that the composition of these small samples of gas trapped in the ice may have been affected by bacteria that remain active in snow while it is being compressed into ice - a process that can last decades.

Lead author of the research Dr Kelly Redeker from the Department of Biology at the University of York said "As microbial activity and its influence on its local environment has never been taken into account

when looking at ice-core gas samples it could provide a moderate source of error in climate history interpretations. Respiration by bacteria may have slightly increased levels of CO2 in pockets of air trapped within polar ice caps meaning that before human activity CO2 levels may have been even lower than previously thought".

"In addition, the fact that we have observed metabolically active bacteria in the most pristine ice and snow is a sign of life proliferating in environments where you wouldn't expect it to exist. This suggests we may be able to broaden our horizons when it comes to thinking about which planets are capable of sustaining life," Redeker added.

Research conducted in laboratories has previously shown that bacteria can stay alive at extremely cold temperatures, but this study is the first time that bacteria have been observed altering the polar snow environment in situ.

The researchers looked at snow in is natural state, and in other areas they sterilised it using UV sterilising lamps. When they compared the results the team found unexpected levels of methyl iodide - a gas known to be produced by marine bacteria - in the untouched snow.

Cutting-edge techniques enabled the researchers to detect the presence of gases even at part-per-trillion levels, one million times less concentrated than atmospheric CO2 concentrations.

The researchers worked on sites in the Arctic and Antarctic and took precautions to limit the impact of sunlight and wind, using tarpaulins to protect their sample sites and positioning themselves on the middle of a glacier away from soil and other forms of polar wildlife which might contaminate the snow.

The results of the study also suggest that life can be sustained even in

remote, cold, nutrient poor environments, offering a new perspective on whether the frozen planets of the universe could support microorganisms.

With more research, astrobiologists working to identify planets in the universe with temperature levels that could allow for the presence of liquid water may be able to expand the zones they consider potentially habitable to include planets where water is found as ice.

"We know that bacteria have the potential to remain viable and metabolically active at low temperatures for hundreds to thousands of years," said Redeker. "The next step is to look further down to see if we can observe active bacteria deep in the ice caps," "Microbial metabolism directly affects trace gases in (sub) polar snowpacks" is published in the *Journal of the Royal Society Interface*.

More information: Microbial metabolism directly affects trace gases in (Sub) Polar snowpacks. *Journal of the Royal Society Interface*. ISSN 1742-5662 (In Press)

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