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Microorganisms May Be Predictors of Future Climate

SAN FRANCISCO-- Microbial activity may be the crystal ball through which atmospheric scientists might gaze to predict future climate change, according to a paper presented today at the annual American Geophysical Union meeting here.

"Microorganisms contribute many trace gases to the present atmosphere and consume others," report Penelope J. Boston and Starley L. Thompson, who are with the National Center for Atmospheric Research (NCAR) in Boulder, Colorado.

The balance of consumption and production depends upon the specific metabolic properties of individual species, but it also depends on how those species are distributed in nature, point out the NCAR researchers. This, they emphasize, may partly be controlled by the climate.

"Emerging evidence for the effects of microbes on climate centers largely on nitrogen, carbon and sulfur chemical species," explains Boston, an environmental microbiologist.

"Because microorganisms have been so important in the evolution of Earth's atmosphere and oceans, they provide a powerful tool to analyze possible feedback mechanisms between biologically produced and consumed gases and the climate."

Tracking the activities of microorganisms as possible contributors of important atmospheric trace gases is a new approach that Boston and Thompson suggest atmospheric scientists use as a possible indicator of future climatic changes.

According to Boston, if the one-celled organisms called plankton that float on the oceans' surfaces are included, the total population of microbes probably outweighs all other organisms on earth.

"Microorganisms have so many chemical talents that other organisms don't possess," says the NCAR scientist. "They can transform cellulose inside the gut of a cow or termite to methane, producing millions of tons of the greenhouse gas per year.

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"They also eat pesticides, asphalt, rocket fuel and plastics. Industries have had to spend millions to develop biocides to put in rocket fuel to kill the microbial populations. There are even microorganisms which live in acid pools in mine tailings, breaking down hydrogen sulfide to other sulfur compounds to make sulfur deposits.

"Their physiological capabilities, for example, generating methane and using hydrogen sulfide, were present at least 3.5 billion years ago, before there was any multicellular life on earth."

The activities of modern microorganisms may be clues to the past history of the climate and the evolution of the atmosphere, explains Boston.

"When we find a microbial species that is linked to certain trace gases, e.g. the rise of oxygen in the early atmosphere, it may be a clue to the past history of climate and the evolution of the atmosphere.

"Sulfur, phosphorus, manganese, iron, and titanium, can all be used by microorganisms as energy sources. As a result, geologically important deposits of all these materials have been formed by microbes.

"So, we know that microorganisms have been important in the history of the planet's geology, and now with the atmosphere as well, and that all these systems are linked to an extent."

The goal of Boston's research is to couple what she knows about the chemical makeup of the atmosphere and how that is linked with the biosphere. Some of this may be very important to the evolution of climate.

Boston and Thompson's report will be presented at 2:00 p.m., Tuesday, December 9, as part of a special session on Biogeochemical Cycles and Climate II in the Emerald Room of the Holiday Inn Golden Gateway on Van Ness Avenue.

For further information, contact Boston or Thompson at the National Center for Atmospheric Research (NCAR), (303) 497-1607 or 1628, respectively, or by calling Joan Vandiver Frisch at NCAR, (303) 497-8721.

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