Past climate of the northern Antarctic Peninsular informs global warming debate

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The American icebreaker RV/IB Nathanial B. Palmer is shown off the South Shetland Islands. The drilling rig is clearly seen on the rear deck. Credit: S. Bohaty

The seriousness of current global warming is underlined by a reconstruction of climate at Maxwell Bay in the South Shetland Islands of the Antarctic Peninsula over approximately the last 14,000 years, which appears to show that the current warming and widespread loss of glacial ice are unprecedented.

"At no time during the last 14 thousand years was there a period of climate warming and loss of ice as large and regionally synchronous as that we are now witnessing in the Antarctic Peninsula," says team member Dr Steve Bohaty of the National Oceanography Centre, Southampton (NOCS), home of the University of Southampton's School of Ocean and Earth Science (SOES)."

The findings are based on a detailed analysis of the thickest Holocene sediment core yet drilled in the Antarctic Peninsula. "By studying the climate history of the past and identifying causes of these changes, we are better placed to evaluate current climate change and its impacts in the Antarctic," says Dr Bohaty.

As part of a 2005 research cruise aboard the American icebreaker RV/IB Nathanial B. Palmer, the scientists drilled down through the sediments at Maxwell Bay, a fjord at the northwest tip of the Antarctic Peninsula. They drilled down as far as the bedrock, obtaining a nearly complete 108.3-metre sediment core.

Back in the lab, they performed a battery of detailed sedimentological and geochemical analyses on the core. Radiocarbon dating showed that the oldest sediments at the bottom of the core were deposited between 14.1 and 14.8 thousand years ago, and sedimentation rates at the site varied from 0.7 to around 30 milimetres a year through the Holocene; that is, the geological period that began around 11,700 years ago, continuing to the present.

They conclude that ice was grounded in the fjord during the Last Glacial Maximum - the height of the last ice age - and eroded older sediments from the fjord. Later, the grounded ice retreated, leaving a permanent floating ice canopy.

The evidence points to a period of rapid glacial retreat from 10.1 to 8.2 thousand years ago, followed by a period of reduced sea-ice cover and warm water conditions occurring between 8.2 and 5.9 thousand years ago. An important finding of the study is that the mid-Holocene warming interval does not appear to have occurred synchronously throughout the region, and its timing and duration was most likely influenced at different sites by local oceanographic controls, as well as physical geography.

Following the mid-Holocene warming interval, the climate gradually cooled over the next three thousand years or so, resulting in more extensive sea-ice cover in the bay. But the researchers find no evidence that the ice advanced in Maxwell Bay during the so-called Little Ice Age in the sixteenth to mid-nineteenth century.

The Antarctic Peninsula area has warmed 3°C in the past five decades, with increased rainfall and a widespread retreat of glaciers. "Atmospheric warming trends linked to global climate change are an obvious culprit for the observed regional climate changes," say the researchers.

More information: Milliken, K. T., et al. High-resolution Holocene climate record from Maxwell Bay, South Shetland Islands, Antarctica. *Geological Society of America Bulletin* 121, 1711-1725 (2009). gsabulletin.gsapubs.org/content/121/11-12/1711

Source: National Oceanography Centre, Southampton