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Bering Sea Was Ice-Free and Full of Life During Last Warm Period, Study Finds

Deep sediment cores retrieved from the Bering Sea floor indicate that the region was ice-free all year and biological productivity was high during the last major warm period in Earth's climate history.

Christina Ravelo, professor of ocean sciences at the University of California, Santa Cruz, will present the new findings in a talk on December 13 at the fall meeting of the American Geophysical Union (AGU) in San Francisco. Ravelo and co-chief scientist Kozo Takahashi of Kyushu University, Japan, led a nine-week expedition of the Integrated Ocean Drilling Program (IODP) to the Bering Sea last summer aboard the research vessel JOIDES Resolution. The researchers drilled down 700 meters through rock and sludge to retrieve sediments deposited during the Pliocene Warm Period, 3.5 to 4.5 million years ago.

"Evidence from the Pliocene Warm Period is relevant to studies of current climate change because it was the last time in our Earth's history when global temperatures were higher than today," Ravelo said.

Carbon dioxide levels during the Pliocene Warm Period were also comparable to levels today, and average temperatures were a few degrees higher, she said. Climate scientists are interested in what this period may tell us about the effects of global warming, particularly in the polar regions. Current observations show more rapid warming in the Arctic compared to other places on Earth and compared to what was expected based on global climate models.

Ravelo's team found evidence of similar amplified warming at the poles during the Pliocene Warm Period. Analysis of the sediment samples indicated that average sea surface temperatures in the Bering Sea were at least 5 degrees Celsius warmer than today, while average global temperatures were only 3 degrees warmer than today.

Samples from the expedition showed evidence of consistently high biological productivity in the Bering Sea throughout the past five million years. The sediments contain fossils of plankton, such as diatoms, that suggest a robust ecology of organisms persisting from the start of the Pliocene Warm Period to the present. In addition, samples from the Pliocene Warm Period include deep-water organisms that require more oxygenated conditions than exist today, suggesting that the mixing of water layers in the Bering Sea was greater than it is now, Ravelo said.

"We usually think of the ocean as being more stratified during warm periods, with less vertical movement in the water column," she said. "If the ocean was actually overturning more during a period when it was warmer than today, then we may need to change our thinking about ocean circulation."

Today, the Bering Sea is ice-free only during the summer, but the sediment samples indicate it was ice-free year-round during the Pliocene Warm Period. According to Ravelo, the samples showed no evidence of the pebbles and other debris that ice floes carry from the land out to sea and deposit on the seafloor as they melt. In addition, the researchers didn't find any of the microorganisms typically associated with sea ice, she said.

"The information we found tells us quite a bit about what things were like during the last period of global warming. It should benefit the scientists today who are sorting out how ocean circulation and conditions at the poles change as the Earth warms," Ravelo said.

The expedition led by Ravelo and Takahashi was part of an ongoing program conducted by the IODP with funding from the National Science Foundation and support from the United States, Japan, and the European Union. The JOIDES Resolution is the only ship operated by the United States capable of taking undisturbed core samples at the depths required to study conditions during the Pliocene Warm Period. The current program will end in 2013, and planning for the next phase of ocean drilling is now under way.

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