The Arctic: Interglacial period with a break

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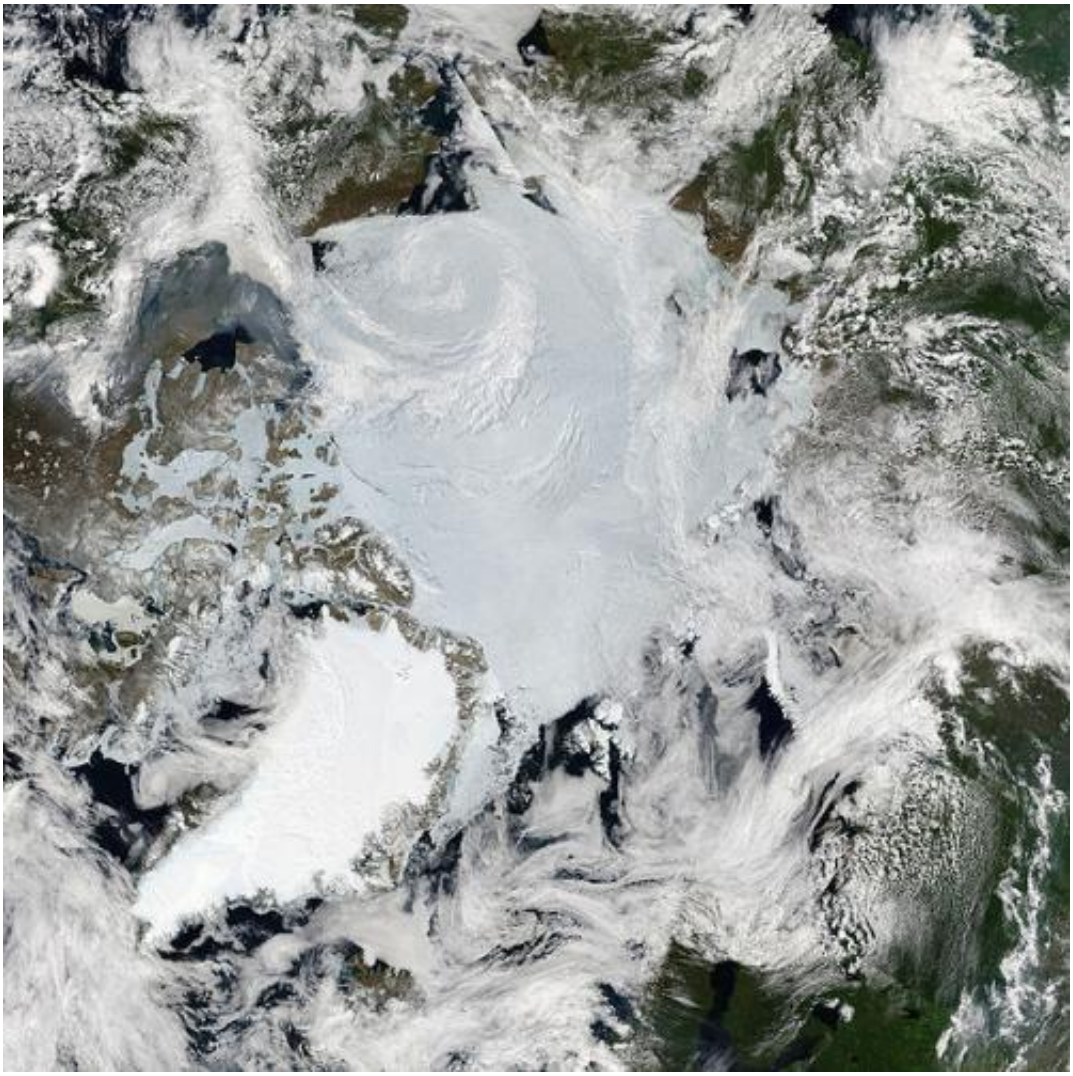

Mosaic of images of the Arctic by MODIS. Credit: NASA

Scientists at the Goethe University Frankfurt and at the Senckenberg

Biodiversity and Climate Research Centre working together with their Canadian counterparts, have reconstructed the climatic development of the Arctic Ocean during the Cretaceous period, 145 to 66 million years ago. The research team comes to the conclusion that there was a severe cold snap during the geological age known for its extreme greenhouse climate. The study published in the professional journal *Geology* is also intended to help improve prognoses of future climate and environmental development and the assessment of human influence on climate change.

The Cretaceous, which occurred approximately 145 million to 66 million years ago, was one of the warmest periods in the history of the earth. The poles were devoid of ice and average temperatures of up to 35 degrees Celsius prevailed in the oceans. "A typical greenhouse climate; some even refer to it as a 'super greenhouse' ", explains Professor Dr. Jens Herrle of the Goethe University and Senckenberg Biodiversity and Climate Research Centre, and adds: "We have now found indications in the Arctic that this warm era 112 to 118 million years ago was interrupted for a period of about 6 million years."

In cooperation with his Canadian colleague Professor Claudia Schröder-Adams of the Carleton University in Ottawa, the Frankfurt palaeontologist sampled the Arctic Fjord Glacier and the Lost Hammer diapir locality on Axel Heiberg Island in 5 to 10 metre intervals. "In so doing, we also found so-called glendonites", Herrle recounts. Glendonite refers to star-shaped calcite minerals, which have taken on the crystal shape of the mineral ikaite. "These so-called pseudomorphs from calcite to ikaite are formed because ikaite is stable only below 8 degrees Celsius and metamorphoses into calcite at warmer temperatures", explains Herrle and adds: "Thus, our sedimentological analyses and age dating provide a concrete indication for the environmental conditions in the cretaceous Arctic and substantiate the assumption that there was an extended interruption of the interglacial period in the Arctic Ocean at that time."

In two research expeditions to the Arctic undertaken in 2011 and 2014, Herrle brought 1700 rock samples back to Frankfurt, where he and his working group analysed them using geochemical and paleontological methods. But can the Cretaceous rocks from the polar region also help to get a better understanding of the current climate change? "Yes", Herrle thinks, elaborating: "The polar regions are particularly sensitive to global climatic fluctuations. Looking into the geological past allows us to gain fundamental knowledge regarding the dynamics of climate change and oceanic circulation under extreme greenhouse conditions. To be capable of better assessing the current man-made climate change, we must, for example, understand what processes in an extreme greenhouse climate contribute significantly to climate change." In the case of the Cretaceous cold snap, Herrle assumes that due to the opening of the Atlantic in conjunction with changes in oceanic circulation and marine productivity, more carbon was incorporated into the sediments. This resulted in a decrease in the carbon dioxide content in the atmosphere, which in turn produced global cooling.

The Frankfurt scientist's newly acquired data from the Cretaceous period will now be correlated with results for this era derived from the Atlantic, "in order to achieve a more accurate stratigraphic classification of the Cretaceous period and to better understand the interrelationships between the polar regions and the subtropics", is the outlook Herrle provides.

More information: Jens O. Herrle, Claudia J., Schröder-Adams, William Davis, Adam T. Pugh, Jennifer M. Galloway, and Jared Fath: Mid-Cretaceous High Arctic stratigraphy, climate, and Oceanic Anoxic Events, in: *Geology*, 19 Mai 2015, 10.1130/G36439.1 Open Access geology.gsapubs.org/cgi/conten … /abstract/G36439.1v1

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