



## **The Svalbard climate transformed rapidly from Younger Dryas climate to warmer-than-present by 11.0 cal ka BP**

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A compilation of about 130 radiocarbon ages shows early Holocene ages from four species of “warm-water” molluscs that later became extinct from Svalbard (77-80 °N) due to colder climate. These species survived the Younger Dryas south of Scotland, possibly even south of England. *Mytilus edulis* (blue mussel) arrived Svalbard already at 11.0 cal ka and by 10.6 ka it inhabited the north coast, showing that the Arctic sea-ice limit was far north of the last year’s northern records. In 2004 this species reappeared on the west coast of Spitsbergen in response to the ongoing warming of the Arctic.

We present for the first time dates of *Zirfaea crispata*, the most warmth-demanding of the molluscs that lived in this Arctic region. At present *Zirfaea* has its northern limit near the city of Tromsø, some 1000 km farther south. The six ages that were obtained from *Zirfaea* shells range from 10.2 to 9.7 cal ka BP, indicating a climate 7 °C warmer than at present and an early Thermal Optimum. Svalbard is presently the warmest place on Earth at such high latitude, caused by northwards Atlantic Ocean currents and large-scale atmospheric circulation. Intensification of these processes and stronger high-latitude insolation were the major drivers of the Thermal Optimum.