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Holocene Atlantic Water temperature reconstruction in the Nordic Seas based on foraminiferal Mg/Ca ratios

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In this study Mg/Ca-ratios have been used to reconstruct Holocene sea temperature variability along the route of north flowing Atlantic Water in outer Andfjorden, Northern Norway and on the West Spitsbergen Slope, eastern Fram Strait. The northbound flow of warm and saline Atlantic Water to the Nordic seas is an integral part of Atlantic Meridional Overturning Circulation (AMOC). Some of the Atlantic Water mass cools and sinks forming part the North Atlantic Deep Water (NADW). Other parts of the water mass are transported to the Arctic Ocean via the Fram Strait and the Barents Sea.

The investigated study sites are both situated under the core of northwards flowing Atlantic water. The record from the eastern Fram Strait is based on Mg/Ca-ratios measured on the planktic foraminifer *Neogloboquadrina pachyderma*. The Andfjorden record is based on Mg/Ca-ratios measured on the benthic foraminifer *Melonis barleanus* and stable isotopes measured on the benthic foraminifer *Cassidulina leavigata*. In the Andfjorden bottom water temperatures ($BWT_{Mg/Ca}$) show a strong influence from cold coastal and melt waters during the deglaciation. In the early Holocene at 11,500 cal kyr B.P. $BWT_{Mg/Ca}$ increased markedly to ca. 11˚C, when Atlantic Water influx into Andfjorden increased. Both stable oxygen isotope and $BWT_{Mg/Ca}$ values remained relatively stable throughout the Holocene, but a significant $BWT_{Mg/Ca}$ decrease of $\sim$1˚C was observed around 3,500 cal yr B.P. In the eastern Fram Strait the reconstructed sea surface temperatures ($SST_{Mg/Ca}$) only show minor fluctuations during the Late Glacial - Holocene transition. A temperature decline was initiated in the early Holocene showing the lowest values around 2.8˚C from ca. 5,200 to 2,700 cal yr B.P. followed by increasing $SST_{Mg/Ca}$ towards the present. After 2,700 cal yr B.P. sea surface temperatures gradually increased reaching the highest values around 5˚C at ca. 1,100 cal yr B.P. to present. The paleo records were governed by different forcing factors like insolation, fluctuations of North Atlantic Deep Water formation intensity, and changes of the atmospheric pressure systems changing the northwards Atlantic Water advection. Furthermore, the calcification period and/or the habitat depth of *N. pachyderma* may have changed through the studied time interval influencing the reconstructions of $SST_{Mg/Ca}$ in the eastern Fram Strait.