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Younger Dryas and Holocene oceanography of the western Labrador Sea region based on foraminifera and sediment proxies from Placentia Bay, Newfoundland

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Benthic foraminiferal assemblages and geochemical analyses from three marine sediment cores from Placentia Bay on the southwest coast of Newfoundland captured the evolving surface and subsurface environment of the eastern Labrador Sea during the late glacial and Holocene. The area, which is today located in the boundary zone between the Arctic Labrador current and the warm Gulf Stream in the eastern margin of the Labrador Sea was during the early part of the Younger Dryas (13.0-12.3 cal. kyr BP) dominated by cold, Arctic conditions and heavy sea-ice cover linked to a strong Polar Water component of the Inner Labrador Current. In the later part of the Younger Dryas (12.3-11.5 kyr BP) the influence of the Labrador Current (LC) became less pronounced resulting in more unstable conditions with varying sea-ice cover and increased influence of Gulf Stream water, presumably linked to an increased strength of the Atlantic Meridional Overturning Circulation (AMOC). The earliest Holocene (11.5-10.4 kyr BP) saw slightly warmer subsurface conditions in Placentia Bay and increased productivity, presumably caused by a decreased southward transport of Polar Water via the LC. The onset of a strong AMOC caused the northward movement of the frontal zone between the Subpolar Gyre and the North Atlantic Subtropical Gyre in the western North Atlantic region to closer proximity to the southern coast of Newfoundland compared to previously. From ca. 10.4-9.65 kyr BP increased bottom-current speeds and the presence of species often found in connection to oceanic fronts, suggest a further strengthening of the AMOC causing inflow of Atlantic-source water into Placentia Bay. This tendency was further strengthened at 9.65-7.3 kyr BP, which saw a relatively strong inflow of Atlantic-source Gulf Stream water into Placentia Bay, evidenced by high frequencies of Cassidulina neoteretis. This inflow of Atlantic was however temporarily halted around 8.2 kyr BP, when a short-lived, extreme peak in Globobulimina auriculata arctica suggests reduced bottom-water stratification. This may have been caused by an increased freshwater release from the Canadian Arctic, linked to the well-known 8.2-kyr event. Around 7.3 kyr BP, the inflow of warmer subsurface waters decreased, when subsurface waters of Placentia Bay returned to relatively cold, subarctic conditions. An enhanced influx of lower-saline water is inferred both by the presence of Elphidium bartletti, indicating an increased flux of meltwater from the Arctic entering Placentia Bay. This fresher water was likely transported by the Labrador Current and strong northerly winds. This scenario was again interrupted around ca 4.4 kyr BP, when higher C. neoteretis again suggest increase influx of Gulf Stream water, a tendency that continued until today, although with possibly slightly better mixing of LC and GS water after $\sim$2.7 kyr BP. This decrease in the strength of the LC, may be linked to a decreased southward flow of LC water due to decreased meltwater release from the Canadian Arctic or due to a shift to a generally more negative Northern Annular Mode.