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Rapid Younger Dryas – Holocene transition recorded in marine sediments offshore Newfoundland

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Coastal waters off southern Newfoundland are mostly characterized by the Inner Labrador Current bringing cold water from the North, but are partly also influenced by Gulf Stream-derived warmer waters flowing up from the South. Although in this region several records of the Younger Dryas – Holocene transition are available from the terrestrial realm, marine records spanning this interval at high resolution are so far rare. In this study we present results from a multi-proxy reconstruction of sea surface conditions and sea ice variability at the onset of the Holocene.

During a 2007 research cruise of RV 'A. Ioffe', a sediment gravity core (AI07-14G) was taken from 239m water depth in Placentia Bay off the south coast of Newfoundland. Based on 8 radiocarbon dates, the 510 cm core spans the age interval from 12.7 to 9.8 cal. kyrs. BP. Despite relatively large uncertainties regarding the marine reservoir age in this period and possible dating offsets from using suspension feeders for radiocarbon dating, the changes in the core show a very good correlation with both nearby terrestrial and Greenland ice core records. With an average accumulation rate of 5.7 years/cm, the core provides a high resolution record of the transition from the Younger Dryas stadial into the Holocene. After X-ray fluorescence (XRF) core scanning, the core was subsampled and analyzed for diatoms, benthic foraminifera, grain size distribution, calcium carbonate content, total organic carbon content, and the geochemical sea ice proxy IP25.

The transition from the Younger Dryas into the warmer Holocene is clearly reflected in the record as a sudden increase in productivity of both foraminifera and diatoms, with a relative increase in warmer water diatom species, and is further characterized by a steep rise in both calcium and organic carbon content. Based on the calcium record from the XRF core scan, the entire transition took place in only 55 years. Following this initial short-lived warming, the diatom record shows a gradual return to cooler conditions. The timing of the onset of this cooling correlates well with the Pre Boreal Oscillation (PBO), but the duration of the cold period extends well beyond the PBO.