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Enhanced North Atlantic deep convection preceding Heinrich 1 glacial ice sheet destabilization

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The Labrador Sea is a crucial center of action for North Atlantic meridional overturning circulation. This region is characterized in winter by strong cold and dry winds from land or ice surfaces inducing large heat and moisture fluxes at the ocean-atmosphere interface. Particularly in late winter these conditions favor deep-convection processes leading to the formation of a relatively homogeneous and oxygen-rich intermediate water mass (Labrador Sea Water, LSW) spreading to other parts of the North Atlantic at water depths between about 1,000 and 2,000 m. Sedimentary records from the Labrador Sea have previously indicated here the presence of North Atlantic Deep Water during periods in between glacial ('Heinrich') ice-rafting events.

The present sediment core investigation based on clay mineralogical analysis and study of the benthic foraminiferal fauna shows a significant oxygenation event at 18000 cal.yrs BP recorded both in the Labrador Sea and at the northern margin of Rockall Trough at 2381 m and 1286 m water depth, respectively.

We conclude this ventilation pulse to be related to a period of enhanced deep convection and formation of glacial North Atlantic Intermediate Water occupying those parts of the water column presently affected under conditions of strong LSW formation. This ventilation event implies an early, significant re-activation of North Atlantic meridional overturning circulation after the Last Glacial Maximum immediately prior to Heinrich 1 large-scale ice-sheet destabilization. This scenario points to an oceanic trigger mechanism for large-scale glacial iceberg surges around the northern North Atlantic, which involves enhanced northward ocean (sub)surface heat transport and subsequent enhanced bottom melting of floating outlet glaciers and ice shelves.