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Younger Dryas thermohaline circulation in the N-Atlantic: Irminger Sea versus Norwegian Sea Basin

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Oceanographic observations from the early 1990's show a marked cooling and freshening of the Nordic Seas due to eastward expansion of East Greenland Current derived Polar Waters under influence of strong zonal atmospheric circulation(1). For the cold Younger Dryas (YD) period, ca 12,900 – 11,600 years ago, the impact of Northern Hemisphere late glacial melt water pulses on N- Atlantic thermohaline circulation has been discussed as a likely mechanism for cooling. Melt water discharge sources have been a matter of much debate, but recent evidence point to important melt water pulses emanating from the Arctic region (2, e.g. MacKenzie Valley discharge). The largest volume of these fresh water masses reached the North Atlantic via Fram Strait, less through the Canadian archipelago. During preceding Bølling-Allerød warming, the size of the Laurentide Ice Sheet may have been still large enough to have influenced atmospheric planetary waves resulting in a more zonal Atlantic jet axis(3). In addition, Northern Hemisphere high summer insolation favored a northward displaced west wind belt forcing surface waters away from the Greenland coast. Hence, in analogue to recent observations, ice-loaded meltwater masses in the western Greenland Sea were forced eastward, creating a pool of cold,low salinity (ice-loaded) surface water masses in the Norwegian Sea(4), while transport of cold Polar Water via Denmark Strait to the Irminger Sea would be suppressed. Our own sediment core data from offshore Iceland, Greenland and Davis Strait(5,6,7)together with results from lake studies in southern Greenland(8) point to an active Irminger Current and well-developed Irminger Sea Water subsurface transport towards Davis Strait. Subsequent incorporation of the latter water mass into the south-flowing Labrador Current may have contributed to tidewater glacier melting in eastern Canada and eventually triggering of the H0 meltwater pulse. The sediment core data indicate Irminger Sea deep ventilation (well) over 1900 m, which contrasts with more limited convection conditions in the Nordic Seas as signaled by Norwegian Sea Deep Water Overflow records from the Faroe-Shetland Channel gateway(9).We conclude that during the YD a steep SST gradient must have existed between the Irminger and Norwegian Sea basin, having resulted in an intensification of (zonal) atmospheric circulation and increased (westerly) storminess, which is documented as a characteristic European YD feature(10).

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