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**Supplementary information**

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**Atlantic circulation change still uncertain**

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In the format provided by the  
authors and unedited

Supplemental Table 1: These are the locations and citations to the available highly-time-constrained paleoceanographic data in the northern North Atlantic in Figure 1. The figure was made with open-source projects matplotlib<sup>1</sup> (<https://matplotlib.org/>), cartopy (<https://scitools.org.uk/cartopy>) and xarray<sup>2</sup> (<http://xarray.pydata.org/en/stable/>). The bathymetry contours are from GEBCO bathymetry (<http://www.gebco.net/>).

Core name	Latitude Decimal Degrees	Longitude Decimal Degrees	Proxy*	References
<b>SUBPOLAR N ATLANTIC</b>				
<b>SURFACE</b>				
MD99-2322	67.1363	-30.8278	diatom assemblage	3
RAPiD-35-COM	57.5042	-48.7223	SS, foraminifera assemblages and $\delta^{18}\text{O}$	4,5
RAPiD-35-25B	57.5078	-48.7233	Mg/Ca temperatures, foraminiferal assemblages and $\delta^{18}\text{O}$	6,7
RAPiD-21-12B	57.4515	-27.9088	foraminiferal $\delta^{18}\text{O}$ and Mg/Ca, SS	8,9
RAPiD-21-12B and 3K	57.2715	-27.5488	diatom assemblages, alkenones and SS	5,10,11
RAPiD-17-5P	61.4817	-19.5360	foraminiferal $\delta^{18}\text{O}$ and Mg/Ca and SS	4,6
LO09-14 and D37-2P	58.2605	-30.2075	diatom assemblages	12
GS06-144-04	58.9122	-31.2542	foraminifera, alkenones, $\delta^{18}\text{O}$	13
ENAM9606/MD200309	55.6503	-13.9850	foraminiferal $\delta^{18}\text{O}$ and Mg/Ca	14
AI07-04BC/3G	48.7333	-53.4833	Alkenones	15
AI07-11BC/12G	47.1333	-54.5500	Alkenones	15
AI07-06G	47.8500	-53.5800	benthic foraminifera and dinoflagellate assemblages	16
CR02-23&MD99-2220	48.6387	-68.6322	foraminiferal $\delta^{18}\text{O}$	17
GS06-144-03	57.2900	-48.3700	$\delta^{18}\text{O}$ foraminifera and Ice rafted debris	18
PO175GKC	66.2040	-31.9850	IRD and biomarkers	19
MD04-2832 & PM06- MC01C	56.6698	-5.8687	foraminiferal $\delta^{18}\text{O}$	20
KNR140_2_59GGC	32.9770	-76.3160	foraminiferal Mg/Ca	21
MD99-2209 and RD-98	38.8863	-76.3947	$\delta^{18}\text{O}$ and Mg/Ca ostracod and foraminiferal	22
MD03-2661	38.8868	-76.3982	$\delta^{18}\text{O}$ and Mg/Ca ostracod and foraminiferal	22
PTXT-2	38.3263	-76.3925	$\delta^{18}\text{O}$ and Mg/Ca ostracod and foraminiferal	22
MD99-2203	34.9772	-75.2017	foraminiferal Mg/Ca and $\delta^{18}\text{O}$	23
MC13A	43.0833	-55.8000	%Nps	24
MC25A	43.4500	-54.8167	%Nps	24

KNR158-10MC/09GGC	44.8333	-54.9000	%Nps	25
OCE-326-MC-29D	45.8850	-62.7950	Mg/Ca and $\delta^{18}\text{O}$ benthic foraminifera, %Nps, alkenone, planktonic foraminiferal $\delta^{18}\text{O}$	26
HU89-038-BC-004A and HU89-038-BC-004D	33.6933	-57.6117	carbonate content, sediment magnetic variables, foraminifera, stable isotopes	27
Red Algae	56.0332	-5.6022	red algae Mg/Ca	28
Long-lived bivalve	56.6292	-6.4000	bivalve growth increments	29
Long-lived bivalve	54.0917	-4.8333	bivalve growth increments	30,31
Long-lived bivalve	43.6870	-69.7990	$\delta^{18}\text{O}$ , <i>Arctica islandica</i>	32
BB 001	32.1667	-64.5000	coral Sr/Ca and d18O	33
Ki1, Ki2 Moore et al., 2017	55.3983	-59.8467	Mg/Ca, growth coralline algae	34
Gamboa et al., 2010/Halfar et al., 2011	47.3083	-52.7892	Mg/Ca coralline algae	35,36
Gamboa et al., 2010/Halfar et al., 2012	51.5856	-55.4248	Mg/Ca coralline algae	35,36
Gamboa et al., 2010/Halfar et al., 2013	50.0250	-55.8833	Mg/Ca coralline algae	35,36
Halfar et al., 2013	55.4352	-59.8654	Mg/Ca, growth coralline algae	37,38
Hu2006-40	59.2640	-62.4478	SS	39
<b>DEEP</b>				
CH77-02	52.7000	-36.0830	magnetism	40,41
MD08-3182Cq	52.6990	-35.9360	magnetism	40
RAPiD-35-COM	57.5042	-48.7223	SS, foraminifera assemblages and $\delta^{18}\text{O}$	4,5
RAPiD-21-12B and 3K	57.4515	-27.9080	Diatom assemblages, alkenones and SS	5,10,11
RAPiD-17-5P	61.4817	-19.5360	foraminiferal $\delta^{18}\text{O}$ and Mg/Ca and SS	4,6
GS06-144-09MC-D&GS06-144 08GC	60.3167	-23.9667	SS	42,43
MD99-2251	57.4478	-27.9078	magnetism and SS	40,44,45
KNR-178-48JPC	35.7667	-74.4500	mean sortable silt	25
KNR-178-56JPC	35.4667	-74.7167	mean sortable silt	25
KNR158-10MC/09GGC	44.8333	-54.9000	benthic foraminiferal Mg/Ca and $\delta^{18}\text{O}$	46
<b>NORDIC SEAS</b>				

<b>JM97-948 2A&amp;MD95-2011</b>	66.9697	7.6393	diatom and foraminiferal assemblages, $\delta^{18}\text{O}$ and Mg/Ca foraminifera, current speed, alkenones	47–52
<b>P1_003MC, P1_003SC</b>	63.7622	5.2553	foraminiferal $\delta^{18}\text{O}$	53
<b>MD99-2275</b>	66.5517	-17.6998	alkenones, diatom assemblages, IP25, radiocarbon	11,54–62
<b>Long-lived bivalve</b>	66.5265	-18.1957	bivalve $\delta^{18}\text{O}$ and radiocarbon	63,64
<b>MD99-2269</b>	66.6314	-20.8544	diatom assemblage, IRD, coccolith counts, IP25	65–69
<b>HM107-03</b>	66.5025	-19.0722	foraminifera, stable isotopes, diatoms and ice rafted debris	70
<b>MSM5/5-712-1</b>	78.9157	6.7672	foraminiferal assemblages, Mg/Ca, SS, $\delta^{18}\text{O}$ benthic and planktic	71,72
<b>MD99-2273</b>	66.7630	-18.7503	foraminifera $\delta^{18}\text{O}$ , $^{14}\text{C}$	57,60
<b>JM-06-WP-04-MCB</b>	78.9155	6.7668	Dinocyst assemblage	73
<b>PS2641 BC/GC</b>	73.1550	-19.4817	Org Geochem (IP25), foraminifera assemblages, IRD	74,75
<b>JM96-1206/2GC</b>	68.1002	-29.4433	planktic and benthic foraminifera assemblages	76
<b>W GREENLAND</b>				
<b>M343300</b>	68.4719	-54.0017	diatom, benthic foraminifera, dinoflagellate assemblages, alkenone UK37	77–80
<b>M343310</b>	68.6477	-53.8248	diatom, benthic foraminifera, dinoflagellate assemblages, IP25, alkenones	78,79,81–85
<b>DA00-03P</b>	69.0000	-53.1333	diatom and dinoflagellate assemblages	66,86
<b>DA00-02P</b>	68.8647	-53.3287	diatom and dinoflagellate assemblages	86,87
<b>DA06-139G</b>	70.0913	-52.8930	benthic foraminifera, dinoflagellates, diatom assemblage	88,89
<b>GA306-BC/GC3</b>	66.6247	-54.2097	diatom benthic foraminiferal assemblages, foraminiferal $\delta^{18}\text{O}$	90–92
<b>GA306-BC/GC4</b>	66.7447	-53.9403	diatom benthic foraminiferal assemblages, foraminiferal $\delta^{18}\text{O}$	90–92
<b>PO243-451</b>	60.6993	-46.0333	benthic foraminifera and diatom assemblages	93,94
<b>MARINE RECORDS USED IN<sup>95</sup></b>				
<b>MC13A</b>	43.0833	-55.8000	%Nps	24
<b>COR05-37</b>	48.3333	-61.5000	$\delta^{18}\text{O}$	96

<b>OCE-326-MC-29D</b>	45.8850	-62.7950	foraminiferal $\delta^{18}\text{O}$ , %Nps, Benthic $\delta^{18}\text{O}$ , and Mg/Ca	26
<b>RAPID-21-12B</b>	57.4515	-27.9088	foraminiferal Mg/Ca	8
<b>RAPiD-17-5P spliced with RAPiD-12K</b>	61.4817	-19.5360	foraminiferal Mg/Ca	6,97
<b>ENAM9606</b>	55.6503	-13.9850	foraminiferal Mg/Ca	14
<b>GeoB6007-2&amp;OC437-7 24GGC</b>	30.8500	-10.2700	foraminiferal Mg/Ca	98,99
<b>KNR-178-48JPC</b>	35.7667	-74.4500	mean sortable silt	25
<b>KNR-178-56JPC</b>	35.4667	-74.7167	mean sortable silt	25
<b>16MC/RAPID-17-5P</b>	61.4820	-19.5360	% <i>T. quinqueloba</i>	100
<b>CR02-23&amp;MD99-2220</b>	48.6387	-68.6322	foraminifera $\delta^{18}\text{O}$	17
<b><math>\delta^{15}\text{N}</math> Sherwood 2011</b>	42.0	-65.6	$\delta^{15}\text{N}$ from deep corals	101

\*%Nps represents percent *Neogloboquadrina pachyderma* sinistral coiling, and SS represents percent sortable silt

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