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Intermediate Water links to Deep Western Boundary Current variability in the subtropical NW Atlantic during Marine Isotope Stage 5

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The Deep Western Boundary Current (DWBC) in the North Atlantic is an important component of the climate system as it couples the ocean interior to the global atmospheric climate. Changes in the production of its constituent water masses, formed by high latitude convection, have been previously linked to changes in atmospheric temperature over Greenland, with decreased production during glacial times and during the cool Younger Dryas.

Here we present results from ODP Sites 1057 and 1059 (2584 m and 2985 m water depth respectively) that have been used to reconstruct the behaviour of the DWBC on the Blake Outer Ridge (BOR) focussing on the time interval from 60 to 130 kyr (marine isotope stage (MIS) 5). Site 1057 lies on the boundary between Labrador Sea Water (LSW), a water mass which is still relatively poorly understood, and Lower North Atlantic Deep Water (LNADW), while Site 1059 lies within LNADW. Sortable silt mean (SS) grain size and benthic carbon isotope records were analyzed with centennial- to millennial-scale resolution and changes in the vertical position and intensity of the DWBC were inferred. During MIS 5e (the last interglacial) the core of the DWBC was located close to its modern depth, below 3500 m, and there is little evidence of chemical stratification of the water column suggesting an absence of LSW production at Site 1057, and replacement by a water mass characterised by a δ^{13}C of $\sim$0.7 per mil. The absence of LSW at Site 1057 is further supported by the SS, which suggests slower relative flow speeds at the shallower site consistent with a reduction

in the vigour/absence of the LSW sourced shallower limb of the DWBC that is present at these depths today. After $\sim$111 kyr BP the SS mean at the Site 1057 increases and the flow speeds converge for the remainder of MIS 5. The increase in the SS mean at the shallow site is suggested to result from the initiation of Glacial North Atlantic Intermediate Water (GNAIW) above Site 1057. This coincides with a divergence in the δ^{13}C records with Site 1057 values increasing to $\sim$ 1.2 per mil consistent with GNAIW. During the cold substages 5d, 5b and MIS 4 SS record millennial scale increases at both sites suggesting the DWBC shoaled to depths proximal to the study sites. The lighter δ^{13}C data at both sites during these intervals suggest incursions of Antarctic Bottom Water (AABW) to increasingly shallow depths.