

Circulation of eastern subpolar North Atlantic water into the western North Atlantic: role of the Charlie Gibbs Fracture Zone

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The Charlie Gibbs Fracture Zone (CGFZ) is a well-documented location for westward flow of deep and bottom water, including the Iceland-Scotland Overflow Water, from the eastern subpolar Atlantic the Irminger Basin. CTD, oxygen and nutrient profiles in the CGFZ from WOCE cruises in fall, 1996 and summer, 1997 show the expected large difference in properties between CGFZ deep waters and those to the north and south of the CGFZ, marking this westward flow. Geostrophic velocity and transport in the CGFZ show the strong westward flow below the CGFZ sill depth in both years. Lowered ADCP (*ALDCP) profiles just 3 nm apart in the CGFZ from the summer, 1997 cruise match the westward geostrophic velocity profile on the south side in the CGFZ and also show eastward flow below 2000 m on the north side.

The westward flow associated with the CGFZ extends to the sea surface, with the center axis of westward flow shifting northward towards the surface and sitting over the southern end of the Reykjanes Ridge. The westward flow in fall, 1996, was broken into two segments horizontally. Properties such as salinity show that this westward flow is dominated by eastern subpolar North Atlantic water, principally that found in the western Iceland Basin and including returning Labrador Sea Water. This westward flow interrupts the usual sense of large-scale eastward flow in the North Atlantic Current. The net westward transport from top to bottom, relative to the ocean bottom, was 9.4 Sv and 9.8 Sv in fall, 1996 and summer, 1997 respectively. The Labrador Sea Water and deep water layers carried 6.4 Sv and 6.6 Sv for the two cruises. Maximum westward geostrophic velocities relative to the bottom were 3 to 8 cm/sec; LADCP velocities peaked at about 10 cm/sec including the westward flow within the CGFZ.