Geophysical Research Abstracts, Vol. 9, 01462, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01462

Holocene evolution of deep circulation pathways and current strength in Labrador Sea and adjacent basins: coupling mineralogy and grain-size data

N. Fagel (1), L. Colin (1), R. Brasseur (1), C. Hillaire-Marcel (2)

(1) URAP Clay and Paleoclimate, Université de Liège, Geology Department, B18, Allée du 6 Août, B-4000 Liège, Belgium, (2) GEOTOP, UQAM, Montréal, Canada (nathalie.fagel@ulg.ac.be / Phone: +32-4-3662209)

The production rate of Deep North Atlantic Water (DNAW) is a critical component of the high-latitude ocean-climate system. Here we analyse the mineralogy and the grain-size distribution of four sediments cores collected in Labrador Sea and adjacent basins as a means to document its variability during the Holocene. The cores are located along gyres of DNAW components in the NW North Atlantic. In the Iceland basin, cores MD99-2254 (2440 m deep, on the eastern side of the Bight Fracture Zone) and HU91-045-091 (3870 m deep on the western side of the Charlie Gibbs Fracture Zone) are used to document water outflow originating from the Norwegian Sea. In the Labrador and Irminger seas, cores MD99-2227 (3460 m deep, off Southern Greenland) and HU91-045-080 (3024 m deep, on the western side of the Charlie Gibbs Fracture Zone) illustrate conditions along the pathway of the Western Boundary UnderCurrent that carries DNAW masses in their deep Labrador Sea gyre. The studied interval encompasses the Holocene and the Late Glacial period, based on AMS 14C-chronologies. Sub-sampling at 10 cm- intervals provides a 300 to 500 years time resolution, in MD99-2227 and HU91-045-080, respectively. In core MD99-2254 the resolution ranges from 500 years during the Late Glacial, to 1000 years throughout the Holocene. Core HU91-045-091 is characterized by much lower sedimentation rate (44 cm $\sim$ 18 kyr cal. BP) thus yields a much lower resolution. Mineralogical assemblages are determined from X-ray diffraction on powder (bulk mineralogy) and fine fraction ($<$ 2 microns) oriented mounts (clay mineralogy). Grain-size is measured by laser particle analyser on decalcified sediment fractions. We use the mean of the sortable silt fraction (i.e., 10-63 microns defined by Mc Cave et al., 1995) as a proxy for current

strength (e.g., Revel et al., 1996), whereas information on the origin of the particles driven by water masses is provided by the mineralogical parameters (e.g., Fagel et al., 1997). Except for an increase in the calcite content from the Late Glacial (20%) to the Holocene ($>$60%), the bulk mineralogy remains quite constant throughought the studied interval. Each site is characterized by a given clay mineral fingerprint. The shallowest core MD99-2254 is dominated by illite (60%) associated with a significant contribution of kaolinite (20%) and low amount of smectite ($<$10%). Core MD99-2227 is characterized by abundant chlorite and interstratified minerals (40% cumulated). Similar proportions of smectite and kaolinite are seen in the two cores located east and west of the Charlie Gibbs Fracture Zone, but core HU91-045-091 contains less clays ($<$30%), more quartz (20%) and illite (40%) than its easternmost counterpart. The grain-size distribution also is peculiar in core HU91-045-091 : the mean of the sortable silt fraction increases from 15 to $\sim$25 microns towards the surface. Otherwise, other cores present similar grain-size patterns. Three units are identified: the bottom one is marked by the highest mean values; the intermediate unit shows the lowest ones and the upper unit shows some increase in the mean size of sortable silt. However, these units do not correlate straightforwardly, but the grain-size distribution still suggests as overall reduced WBUC velocity during early to middle Holocene. This intermediate interval starts at 10 kyr cal. BP in core HU91-045-080 but only at 8 kyr BP in core MD99-2254 and MD99-2227. It ends earlier in the eastern area (6 kyr BP) than in the Labrador Sea (3 kyr BP in core MD99-2227).

References

Mc Cave et al., 1995. Nature 374, 149-151.

Fagel et al., 1997. Paleoceanography 12, 79-96.

Revel et al., 1996. Marine Geology 131, 233-249.