POTENTIAL PALEOCIRCULATION IMPLICATIONS BY COUPLING Pb AND Nd ISOTOPE ANALYSES ON DIFFERENT GRAIN-SIZE FRACTIONS FROM LABRADOR SEA SEDIMENTS

Fagel Nathalie and Robert Brasseur

Research Unit Clay and Paleoclimate, Department of Geology, University of Liège
Allée du 6 Août, Bât. 18, B-4000Liège, Belgium
E-mail: Nathalie.fagel@ulg.ac.be

The production of deep water in the North Atlantic is one of the puzzle in understanding oceanic influence in climate changes. In this work, Nd and Pb isotopes were measured on the fine fraction of Labrador Sea sediments. Our aim is to record the relative contribution of fine particle supplies carried by the North Atlantic deep components into Labrador Sea. Based on characterization of potential geographical sources of particles, three main sources contribute to sediment mixture at core location: an old Precambrian crustal material from Canada, Greenland and Scandinavia (NAS), a Paleozoic or younger crustal material from East Greenland, Europa, and Scandinavia (YC) and a volcanic source from Iceland, Faeroe and Reykjanes Ridge (MAR). For the last 12 kyr, clay isotope signatures indicate two mixtures of sediment sources. The first mixture is composed of proximal material from Labrador Sea margins and distal deep current-driven crustal source. From 6.5 kyr onward, the mixture is characterized by the crustal and volcanic components. Since the significant decrease in proximal deglacial supplies, the evolution of the relative contributions of sediment sources suggests major changes in relative contributions of the deep water masses carried by the Western Boundary Undercurrent (WBUC) over the past 8.4 kyr. The progressive intensification of WBUC was associated mainly with the transport of North East Atlantic Deep Water mass until 6.5 kyr and with Denmark Strait Overflow Water thereafter. The establishment of the modern circulation at 3 kyr suggests a reduced influence of the Denmark Strait Overflow Water, synchronous with the full appearance of the Labrador Sea Water mass. Our isotopic dataset emphasizes several changes in the relative contribution of the two major components of North Atlantic Deep Water throughout the Holocene. However, if the clay-size fraction gives informations about the inception and presence of a deep current, it does tell nothing about the strength of this current. Moreover, clays are not likely to be deposited in case of high-strength deep current, resulting in an uncomplete and/or biased reconstruction of deep current evolution. To overcome this problem, it is necessary to look also at coarser fractions. Pb and Nd isotope compositions were thus analysed by MC-ICP-MS on different grain-size fractions (clay-size < 2 `μm, cohesive silt 2-10 μm, fine silt 10-30 μm and coarse silt 30-60 μm) on Late Glacial and Holocene sediments. Four grain-size fractions were investigated for a set of 12 samples from core MD99-2227:. Our results show a clear variation of Pb concentration and isotopic signatures according to grain-size (Nd data still in progress). The observed shifts are interpreted in terms of changes in deep current strength. This approach allows to monitor deep current changes through time, whatever the strength of paleocurrent.

Acknowledgement

This work has been made in collaboration with N. Mattielli, ULB; C.Hillaire-Marcel, GEOTOP, UQAM, Montreal,Canada; D. Weis, UBC, Vancouver, Canada. Analyses have been partly supported by FNRS.