ABSTRACT

Benthic foraminiferal census and geochemical data from 836 core samples from Ocean Drilling Program (ODP) Holes 991A, 995A and 995B were used to understand deep-sea paleoceanographic changes in the northwest Atlantic Ocean during 6.6 to the Recent. Factor and cluster of analyses of the highest-ranked benthic foraminiferal species identified seven biofacies at Hole 991A and eight biofacies at Holes 995A&B, characterizing distinct deep-sea environments during the studied interval. The gas hydrate and free methane zone is dominated by intermediate to high organic carbon biofacies (Uper-Upro, Gcs-Ou, Au-Mb, Pa-Cc, Uc-Gco biofacies at Hole 991A, Gbp-Gbn, Gcp-Ms, Gc-Ou, Gco-Esp, Mp-Au, Qql-Ms, Upro-Uper biofacies at Hole 995A and Gcp-Ck, Mb-Au, Pa-Qml, Mp-Cw, Pb-Dn biofacies at Hole 995B). These biofacies and high total organic carbon (TOC) content during this period indicate increased productivity, the so-called “biogenic bloom”. At Hole 995A, the number of species (S) and Sanders’ values remain low, species diversity (H) is moderately low and equitability (E) is high in free methane and gas hydrate zone (6.6-2.9 Ma). At 2.9 Ma these values begin to increase/decrease with more abrupt changes in the younger interval. At Hole 991A, all the diversity parameters are significantly low in the latest Miocene. A major increase in the Northern Hemisphere glaciation (NHG) during ~3.2 to 2.4 Ma may have influenced the deep-water circulation in the North Atlantic by lowering the production of the North Atlantic Deep Water (NADW). Although this study could not identify any species of benthic foraminifera endemic to the methane seeps, it provides useful information about the transport of organic carbon rich sediments by the Deep Western Boundary Undercurrent (DWBUC) to the Blake Ridge which might have provided source material for the production of methane hydrates in the region. The sediment delivery to the Blake Ridge was closely related to the intensity of the DWBUC driven by increased production of the NADW. The faunal composition at Blake Ridge ODP holes suggest major paleoceanographic changes during 5-2.9 Ma, 3.2-2.4 Ma and 1.8-1.0 Ma marked by high delivery of terrigenous organic matter by the DWBUC that transports materials from the continental margin of Canada to the Blake Ridge.

Keywords: Benthic foraminifera, NW Atlantic, total organic carbon, gas hydrate, Blake Ridge, Deep Western Boundary Undercurrent, North Atlantic Deep water and Northern Hemisphere galciation