Bivalves, ostracods and foraminifers were studied in four AMS $^{14}$C dated sediment cores from the Laptev Sea: one from the upper continental slope with a date of 15.8 cal. ka in its basal part, and three from river palaeovalleys on the outer-middle shelf aging back to 12.7–11.2 cal. ka. At the continental margin, high relative proportions of *Cassidulina neoteretis*, planktic foraminifers and ostracods with North Atlantic affinities provide evidence on past inflows of Atlantic-derived waters, whereas freshwater inputs, downslope sediment movements and ice rafting are documented by the presence of euryhaline, brackish-water and freshwater ostracods and low planktic/benthic ratio. Atlantic-derived subsurface waters reached the studied site by ca. 16 cal. ka, i.e. prior to the establishment of the pathway across the Barents Sea shelf further west. The strongest Atlantic influence occurred prior to 12 cal. ka and after 3 cal. ka. A cold, low-nutrient marine environment with a coastal polynya setting is reconstructed for the time 16–14 cal. ka, whereas between 12.7 and 11.2 cal. ka freshwater influence reached its maximum during a time when the outer shelf was flooded and brackish-water assemblages inhabited the estuarine parts of palaeovalleys. Following the temporal and spatial pattern of sea-level rise, these fluvially affected assemblages rapidly transformed into shallow-marine faunas. After ca. 3.5–3 cal. ka, well-pronounced changes in the benthic communities indicate a general climate cooling characterized by a more intensified surface and bottom water circulation regime.