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TITLE: Response of deep?sea biodiversity to abrupt deglacial and Holocene climate changes in the North Atlantic Ocean

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ABSTRACT:

Abstract Aim Little is known about how marine biodiversity responds to oceanographic and climatic changes over the decadal to centennial time?scales which are most relevant for predicted climate changes due to greenhouse gas forcing. This paper aims to reveal decadal?centennial scale deep?sea biodiversity dynamics for the last 20,000 years and then explore potential environmental drivers. Location The North A tlantic O cean. Methods We investigated deep?sea benthic microfossil records to reveal biodiversity dynamics and subsequently applied comprehensive ecological modelling to test possible environmental factors (i.e. surface productivity, seasonality of productivity or deepwater circulation related to bottom?water temperature) that may have influenced deep?sea biodiversity over these time?scales. Results Deep?sea biodiversity changed synchronously with stadial?interstadial climate changes over the last 20,000 years across a large area of the N orth A tlantic in both ostracod crustaceans and foraminiferan protozoa (in spite of their different dispersal abilities). Species diversity rapidly increased during abrupt stadial events during the last deglacial and the H olocene interglacial periods. These include the well?known H einrich 1, the Y ounger D ryas and the 8.2 ka events when the strength of A tlantic M eridional O verturning C irculation (AMOC) decreased. There is also evidence for quasi?cyclic changes in biodiversity at a c . 1500?year periodicity, consistent with the well?known ?1500?year climatic cycle?. Statistical analyses revealed that AMOC variability (probably specifically the variability in AMOC ?driven bottom?water temperature) is correlated with deep?sea biodiversity. Main conclusions Our finding of a significant AMOC ?diversity relationship may indicate pervasive control of the diversity of deep?sea benthic species by rapidly changing climate, specifically bottom?water temperature, over decadal to centennial time?scales. Our results, based on highly resolved fossil records, may portend pervasive, synchronous and sudden ecosystem responses to human?induced changes to climate and ocean circulation in this century.

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