



Tephra in sediment cores offshore southeast Iceland: Refining Late Pleistocene North Atlantic marker horizons

Christina Bonanati (1), Heidi Wehrmann (1), Steffen Kutterolf (1), Kaj Hoernle (1,2)

(1) GEOMAR Helmholtz Centre for Ocean Research Kiel (cbonanati@geomar.de), (2) Christian-Albrechts University, Kiel, Germany

Using the North Atlantic marine sediment archive to accurately assess changes in paleo-climate and environmental conditions requires a reliable age control. An age precision as provided by the layer-counted Greenland Ice Core Chronology, however, cannot be obtained in the marine realm. Synchronizing the Greenland ice core- and marine sediment records is therefore necessary to resolve the rapid climate changes indicated in North Atlantic archives. Tephra of Icelandic explosive eruptions from the last glacial period has been found as far as Northern Continental Europe and Greenland, where it provides synchronous marker horizons over large areas and can serve as an independent tool to validate correlations between different geological archives. With this study we clear up confusion and show the limitation of these tephras as chronological markers in the North Atlantic marine realm. We report on a succession of ~40 tephra deposits in two marine sediment gravity cores obtained during RV Poseidon Cruise 457, ~180 km southeast of Iceland. Based on major element geochemistry and stratigraphy, they are correlated with tephra deposits in Greenland ice cores and in other sediment cores from the North Atlantic spanning Marine Isotope Stages (MIS)-3-4 (24-68 ka BP). We present the most proximal evidence of the widespread ~27 ka Fugloyarbanki tephra from Kverkfjöll volcanic system, and the highest resolution record of the associated Faroe Marine Ash Zone (FMAZ) II. Our record also reveals the Grímsvötn dominated FMAZ III (~35-40 ka BP) and IV (~42-46 ka BP) deposits. We suggest one new potential marker horizon of Katla composition at 25 ka BP.

The “ash zones” consist of several tephra layers emplaced within time intervals of up to 7 ka that are characterized by similar to identical geochemical compositions. Our findings reveal some restrictions on the use of ash zones as precise, high-resolution time markers in the sediments of the North Atlantic region. Only high-resolution records allow their repetitive internal geochemical stratigraphy to be used for unambiguous correlations. Based on our findings we recommend that the FMAZ III tephras should only be used as a stratigraphic ice marine tie-horizon that broadly indicates a time interval. Due to the problems of accurate correlation of marine tephras with the Greenland ice cores, the high precision of the ice core temporal records cannot necessarily be transferred to marine sediment records.