Geophysical Research Abstracts, Vol. 8, 06718, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06718
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The Paleocene-Eocene ("Greenhouse") Arctic Ocean paleoenvironment: Implications from organic-carbon and biomarker records (IODP-ACEX Expedition 302)

R. Stein (1), P. Weller (1) and H. Meyer (2)

(1) Alfred Wegener Institute for Polar and Marine Research, 27568 Bremerhaven, Germany (rstein@awi-bremerhaven.de), (2) Alfred Wegener Institute for Polar and Marine Research, Research Unit Potsdam, 14473 Potsdam, Germany

A major element in the global climate evolution during Cenozoic times has been the transformation from warm Eocene oceans with low latitudinal and bathymetric thermal gradients into the more recent modes of circulation characterized by strong thermal gradients, oceanic fronts, cold deep oceans and cold high-latitude surface waters. In this context, however, continuous sedimentary records to be used to establish chronologic (high-resolution) sequences of climate and environmental change through Cenozoic times, were missing for the Arctic Ocean. Now, the recovery of an about 420m thick sequence of late Cretaceous/Cenozoic sediments on Lomonosov Ridge/central Arctic Ocean during the IODP-ACEX Expedition 302 in 2004 allows for the first time a detailed reconstruction of the paleoclimatic history of the early preglacial Arctic Ocean. Our study of these unique ACEX sediments will focus on the Arctic Ocean organic carbon cycle and its relationship to the long- and short-term paleoenvironmental /paleoceanographic evolution during Paleocene-Eocene times. Applied methods include elemental analyses (TOC, C/N, C/S), Rock-Eval pyrolysis, biomarker studies using GC and GC/MS techniques, and stable carbon isotopes of the organic matter.

Whereas the Pleistocene to Miocene interval is characterized by low TOC contents ($<$ 0.4%) of terrigenous origin (very similar to numerous Late Quaternary organic carbon records known from the central Arctic Ocean), the Eocene - Paleocene interval displays high organic carbon contents of 1 to $>$ 6%. Elevated hydrogen index values of 150 to 350 mgHC/gC suggest increased amounts of (marine and/or freshwater) algae

material being preserved. Low C/S ratios of <1 indicate dominantly suboxic/anoxic conditions during the Eocene. Increased primary production, increased freshwater input, and/or increased preservation under suboxic/anoxic conditions have probably caused this organic carbon enrichment during Eocene/Paleocene times. Short-term events such a the Paleocene/Eocene Thermal Maximum (PETM) Event as well as the lowermost Eocene “Azolla Event“, are also obvious in the organic carbon data.