Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20494

The Atlantic Meridional Overturning Circulation and erosional events across the Mid-Pleistocene Transition

JOOHEE KIM[1], CECILIA BOWE[2], LEOPOLDO D. PENA[3], MARIA JAUME-SEGUÍ[3], MAAYAN YEHUDAI[4], KARLA P. KNUDSON[1], ALLISON M. FRANZESE[1], YUE CAI[5], LOUISE BOLGE[1], SIDNEY R HEMMING[1], BESS G. KOFFMAN[2] AND STEVEN L. GOLDSTEIN[1]

[1]Lamont-Doherty Earth Observatory of Columbia University
[2]Colby College
[3]Universitat de Barcelona
[4]Max-Planck Institut für Chemie
[5]Nanjing Institute of Geology and Palaeontology and Center for Excellence in Life and Paleoenvironment, Chinese Academy of Sciences

Presenting Author: jk3652@columbia.edu

The dominant interglacial-glacial periodicity shifted from ~41 to 100 kyr between ~1250-700 ka, marking the Mid-Pleistocene Transition (MPT). Recent studies of the Atlantic Meridional Overturning Circulation (AMOC) across the MPT have suggested a significant "MPT-AMOC disruption" between ~960-860 ka. Afterward, interglacial AMOC slowly returned to its 41-kyr world vigor over a 200-kyr period of "lukewarm interglacials", while increased incursions of southern sourced waters have characterized the AMOC of the 100-kyr world during glacials. Recent studies have shown that the AMOC-disruption was preceded by major Northern Hemisphere glacial erosional events during MIS38-26 (~1250-960 ka). We report new authigenic Nd isotope data from DSDP Site 607 (41°00'N, 32°58'W; 3427m) through this critical MPT interval. We also aim to provide new Nd-Sr-Pb isotope data, major and trace element concentrations, and K-Ar ages of fine-grained (<63 μm) terrigenous detritus from interglacials and glacials during MIS38-16.

Preliminary results show highly negative authigenic ε_{Nd}-values (<~-15) across multiple transitional intervals between interglacial-glacial peaks during MIS38-17. The trend approaching the AMOC-crisis consists of increasingly negative ε_{Nd}-values from MIS 38 to 25 during glacials and transitional intervals. In particular, extreme negative ε_{Nd} excursions (~-17) are observed between MIS30-29, MIS28-27, and MIS26-25 outside the ε_{Nd}-ranges of present-day NADW (~-13 to -14) and typical interglacials at Site 607, indicating intense glacial erosion of the North Atlantic cratonic shields. An initial IRD census count shows increases during glacial intervals across MIS 30-24, further confirming erosional events across this critical MPT interval.

K/Ar provenance ages of interglacial and glacial detritus from MIS 38-26 show increasingly older K/Ar ages leading up to the AMOC-disruption during glacials, indicating intensifying ice-sheet erosion of old continental crust areas. Younger detrital K/Ar ages during and after the AMOC-crisis suggest a shift in the area eroded by ice sheets. Our results support the regolith hypothesis for the MPT, where removal of regolith via ice-sheet erosion during MIS 38-26 exposed crystalline bedrock, resulting in greater icesheet-bedrock friction that facilitated thicker ice sheets, large inputs of freshwater to the North Atlantic, a major AMOC disruption, and stabilization of the 100-kyr interglacial-glacial cycles.