

Tracing North Atlantic Continental Erosion during the Mid-Pleistocene Transition: K-Ar geochronology and mineralogical analyses of Ice Rafted Debris

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The Mid-Pleistocene Transition (MPT), which occurred between 1.2 and 0.7 Mya, is characterized by changes in the periodicity and intensity of glacial-interglacial cycles. Early research into this event found that it was not triggered by changes in orbital forcing, but rather by internal climate processes. Previous studies have constrained a probable two-step mechanism, in which erosion of regolith under ice sheets increased glacial volumes and contributed to increased carbon sequestration in the Southern Ocean. Additional research has built on this, suggesting that increased glacial erosion of cratons surrounding the North Atlantic preceded a major weakening of the Atlantic Meridional Overturning Circulation (the “AMOC disruption”) between MIS-25 and MIS-21 (~950-860 ka) (Yehudai et. al., PNAS, 2021; Kim et al. QSR, 2021). To better understand the evolution of regolith erosion in the North Atlantic, we present complementary K/Ar detrital provenance ages, ice-rafted debris (IRD) census counts, and mineralogical/textural analyses of IRD from 25 sediment samples spanning MIS 38-16 (1250-627.7 ka) from DSDP site 607 (41°00’N, 32°58’W; 3,427m). Initial data show increasingly older K/Ar ages in the detritus leading up to the AMOC disruption, thus indicating increased erosion of material from older areas of the Canadian shield. This is consistent with IRD census counts, which reveal an increase in IRD deposition during glacial intervals between MIS 30-23. Comparison of our census counts and K/Ar ages shows a correlation between provenance age and IRD accrual during this interval, supporting the removal of regolith by ice sheets, leading up to the AMOC disruption. Following the AMOC disruption, our data indicate younger detrital sources during glacials in the 100-kyr world. Through ongoing SEM analyses of IRD, we will create a record of changes in mineral abundances and microtextures during MIS 38-16 to better constrain the progression of erosional events across the MPT interval. This in-depth detrital chronology will provide further insight into the origin of the MPT.