Argon Concentrations of Fine-Grained Marine Sediments near Wilkes Land, Antarctica: Source Characterization and Implications for Ice Sheet Behavior during the Middle Miocene

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Mineralogical and geochemical studies of terrigenous sediments have been instrumental in deciphering aspects of Antarctica's glacial history. The characterization of sediment source areas around the Antarctic continent using the $^{40}Ar/^{39}Ar$ ages of individual hornblende and biotite sand grains and the Nd composition of the terrigenous fine (<63 μm) fraction has set the stage for ice sheet behavior to be reconstructed through sediment provenance (i.e., place of origin) studies. These studies have demonstrated that the varied geologic history around Antarctica allows using this approach to identify contributions from different ice sheet sectors. However, the establishment of additional provenance proxies is needed to reconstruct past ice sheet behavior with greater certainty, particularly during intervals where there is a contrast in apparent provenance from the sand grains and fine fractions. Here, we characterize the terrigenous fine fraction of different sources near Wilkes Land, Antarctica, by estimating K-Ar ages from argon concentration measurements. We show that the estimated K-Ar ages of fine-grained sediments from IODP Site U1356 indicate changing provenance during ice-rafted detritus (IRD) abundance maxima at ~13.8 and ~13.0 Ma. We found that the K-Ar ages from IODP Site U1356 sediments, deposited within and shortly after the Middle Miocene Climate Transition (~14.2–13.8 Ma), concur with previously obtained εNd values and indicate significant contributions from relatively young sources. This indication of changing fine-sediment provenance contrasts with the unchanging dominant IRD provenance inferred from hornblende $^{40}Ar/^{39}Ar$ ages and may reflect rapid erosion of the Ferrar Group ($^{40}Ar/^{39}Ar$ and K-Ar age of ~180 Ma) during glacial outburst floods (a.k.a. jökulhlaups). Our results demonstrate that the K/Ar system can be a valuable proxy for the provenance of fine-grained sediments in the Southern Ocean and a useful tool in studies of Antarctica's glacial history.