Geophysical Research Abstracts
Vol. 18, EGU2016-11112, 2016
EGU General Assembly 2016

Greenland ice sheet initiation and Arctic sea ice coincide with Eocene and Oligocene CO_2 changes

Aradhna Tripati (1) and Dennis Darby (2)

(1) UCLA, Institute of the Environment, Atmospheric and Oceanic Sciences & Department of Earth, Planetary, and Space Sciences, Los Angeles, United States (aradhna.tripati@gmail.com), (2) Old Dominion University, Department of Ocean, Earth, and Atmospheric Sciences, Norfolk, United States, ddarby@odu.edu

Earth's modern ocean-climate system is largely defined by the presence of glacial ice on landmasses in both hemispheres. Northern Hemisphere ice was previously thought to have formed no earlier than the Miocene or Oligocene, about 20-30 million years after the widespread onset of Antarctic glaciation at the Eocene-Oligocene boundary. Controversially, the episodic presence of seasonal Arctic sea ice and glacial ice in the Northern Hemisphere beginning in the early Oligocene to Middle Eocene has been inferred from multiple observations. Here we use precise source determinations based on geochemical measurements of ice-rafted debris (IRD) from an ODP core in the Greenland Sea (75° N) to constrain glacial ice and sea ice-rafting in the Northern Hemisphere during the middle Eocene through early Oligocene. The chemical fingerprint of 2,334 detrital Fe oxide grains indicates most of these grains are from Greenland with >98% certainty. Thus the coarse IRD in the Greenland Sea originates from widespread areas of east Greenland as far south as the Denmark Strait area (~68° N), with additional IRD sources from the circum-Arctic Ocean. This is the first definitive evidence that mid-Eocene IRD in the Greenland Sea is from Greenland. Episodic glaciation of different source regions on Greenland is synchronous with times of ice-rafting in the western Arctic and ephemeral perennial Arctic ice cover. Intervals of bipolar glacial ice storage in the middle Eocene through early Oligocene coincide with evidence for periods of reduced CO_2, associated with carbon cycle perturbations.