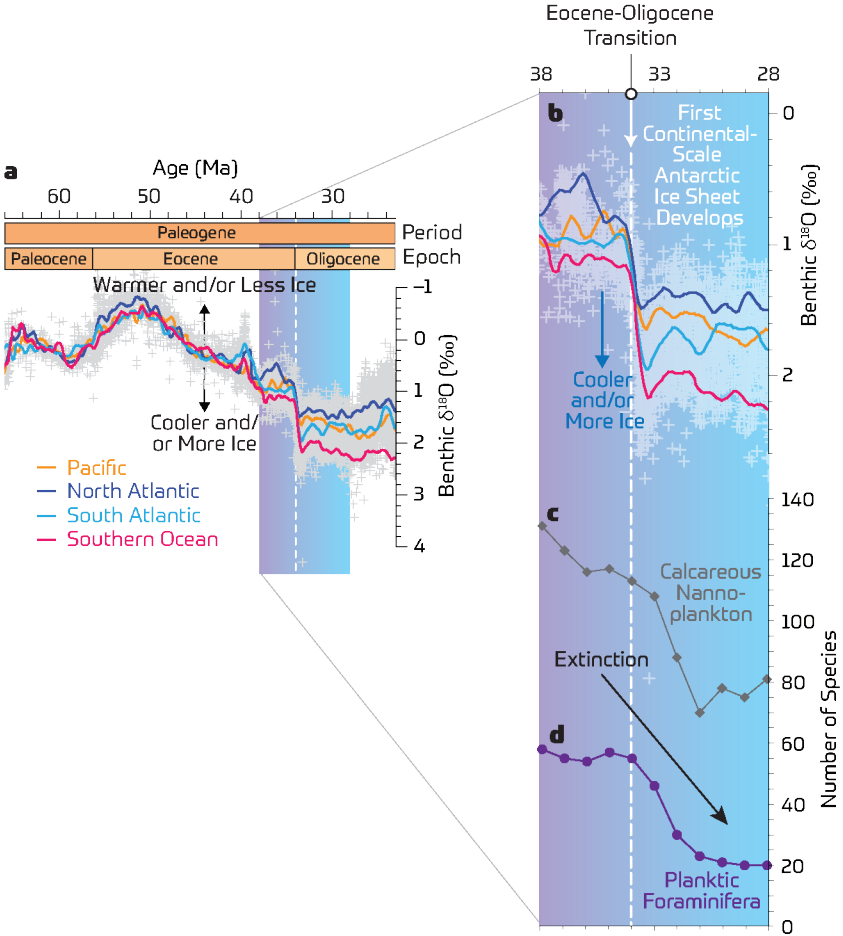


Scientific ocean drilling cores have revealed the details of a stepped global tipping point event at the Eocene-Oligocene boundary. (a) The oxygen isotopic composition ($\delta^{18}O$) of benthic foraminifera reveals a general cooling trend through the late Eocene. (a and b) A major positive oxygen isotope shift at the Eocene-Oligocene transition indicates more abrupt cooling and ice sheet growth, due to tipping point behavior. The Eocene-Oligocene transition resulted in major changes in the global ocean. The carbonate compensation depth deepened by about a kilometer and North Atlantic Deep Water began to form, marking a major reorganization of ocean circulation as reflected in the divergence of benthic foraminiferal $\delta^{18}O$ values of the different ocean basins. These changes resulted in a severe and protracted loss of species in groups that had evolved in a fundamentally different greenhouse ocean, including (c) calcareous nannoplankton and (d) planktic foraminifera. *Sources: (a and b) Cramer et al. (2009), https://doi.org/10.1029/2008PA001683. (c and d) Lowery et al. (2020), https://doi.org/10.1146/annurev-earth-081619-052818*