Terrigenous marine sediment tracers of ice sheet history

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Understanding the behavior of past ice sheets through changing climatic conditions is important to informing an understanding the future condition of Greenland and Antarctic ice. Ice sheets with margins terminating at the ocean margin calve icebergs into the ocean with sediment particles that have ages and compositions that reflect the geology of their catchments. In both the circum-Antarctic and North Atlantic ice sheets and former ice sheets cover(ed) continental terrains with enough variation in their geological histories that sediments derived from icebergs provide natural tracers of their sources that allows coarse distinction of domains within the ice sheets. The flux and composition of these tracers thus allows understanding what parts of the ice sheets have contributed icebergs. My introduction to ice rafted detritus, and to paleoclimate and paleoceanography in general, was through post-doc research on the North Atlantic Heinrich Events with Wally Broecker and Gerard Bond as mentors. Heinrich Events are episodes of extreme fluxes of ice rafted detritus to the North Atlantic. They are associated with extreme climate anomalies in Greenland and throughout the northern hemisphere and possibly globally. The layers in the North Atlantic contain almost 100% polar foraminifera, light oxygen isotopes, high concentrations of detrital carbonate and old provenance ages. While it still remains an open question what are the causes and effects of these iceberg “armadas” in the North Atlantic, the sediment provenance clearly points to a source from Hudson Strait and thus any explanation must accommodate that observation. Near Antarctica there is evidence for significant episodes of ice rafting from the East Antarctic margin of Wilkes Land during the Pliocene, with ice rafted detritus from that margin found as much as 3000 km away from their source- perhaps these events are comparable to the North Atlantic’s Heinrich Events. I will present an overview of the geochemical approaches we have used to trace iceberg sources, including some highlights from the North Atlantic and circum-Antarctic regions.