Heinrich events 3 and 6 as events of increased ice-rafted depostion

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The long-term climatic deterioration during the last glacial was interspersed with two types of abrupt/millennial-scale climate change - Dansgaard-Oeschger events and Heinrich events. Heinrich events are primarily manifested in ice-rafted debris (IRD) in pelagic deep-sea sediments, which can be used to reconstruct ancient ice calving. Broecker et al. [1] first popularized Heinrich event studies, hypothesizing that Heinrich layers are the result of decreased foraminifera productivity, foraminifera dissolution, increased IRD deposition, or some combination of those influences.

Traditional IRD studies calculated IRD concentration but cannot differentiate changes in vertical settling rate or dissolution. Other studies calculated IRD flux based on mass accumulation rates (MAR), but this method does not account for the syndepositional redistribution of sediments. $^{230}Th_{xs}$-based flux reconstructions overcome these problems. Previously, the only $^{230}Th_{xs}$-based IRD flux in North Atlantic is measured at V28-82 by McManus et al. [2]. The results of V28-82 showed that Heinrich event 1, 2, 4, and 5 are at least in part increased ice-rafting events, but left open the question for the other two events.

In this study, $^{230}Th_{xs}$-based IRD flux is measured for the last glacial period in a core from the western North Atlantic (EW9303-JPC37, 43.68°N, 46.28°W, 3981 m). This core is close to Hudson Strait, a leading candidate for the conduit of these icebergs from the Laurentide ice sheet (LIS). Our new results from JPC37 reaffirms the conclusion in [2], showing increased IRD flux for the four typical Heinrich events. Additionally, here we show for the first time that, at least in the western North Atlantic, the other two of the original Heinrich events, 3 and 6, were also the result of increased ice-rafted deposition, rather than solely the result of reduced productivity in the sea surface or enhanced foraminifera dissolution on the seafloor.

[1] Broecker et al (1992) *Clim Dynam* **6**, 265-273. [2] McManus et al (1998) *EPSL* **155**, 29-43.