To: Ed Cook, Climate Center Committee

Title: Investigating the Provenance of the Hematite-stained Grains in the North Atlantic
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Abstract:

The hematite-stained grain record from North Atlantic cores extends from the glacial period through the Holocene (Bond and Lotti, 1995; Bond et al., 1997), showing differing periods of cyclicity. During the glacial period, lithic peaks are seen in cores from VM23-81 and DSDP 609 every 2000-3000 years, indicating an increase in iceberg discharges during these intervals (Bond and Lotti, 1995). Bond et al. (1997) developed a record for percent of hematite-stained grains from the glacial into the Holocene in cores VM 28-14 and VM 29-191, and discovered that they recorded a ~1470 year cycle. This cycle is explained by either cooling sea-surface temperatures, allowing for greater advection of icebergs to the south (Bond et al., 1997), or by changes in surface-wind patterns (Bond et al., 2001). While the actual source of these grains has not been tested geochemically to ascertain their provenance, inferences have been made based upon other marine sediment cores pointing to possible source areas including the Gulf of St. Lawrence, northeast Greenland, Svaalbard and Norway. Here we propose to perform $^{40}$Ar/$^{39}$Ar dating of feldspars from several red bed locations around the North Atlantic as an important step towards investigating the provenance of these grains.

Proposal:

Bond and Lotti (1995) reported peaks in lithic grain abundance in a high-resolution core study, spanning 38-10 ($^{14}$C) kyrs and occurring every 2000-3000 years. These peaks coincide with all but one of the Dansgaard-Oeschger events recorded in the GRIP $\delta^{18}$O record. A further investigation into the abundance of 15 different types of lithic grains yielded a record showing distinct peaks in three grain types: basaltic glass, hematite-stained grains, and detrital carbonate. The source regions of the volcanic glass and the carbonated are attributed to Iceland and northeastern Canada, respectively, indicating synchronous, increased discharge of icebergs during these time intervals.

A definitive source area for the hematite-stained grains, which are mostly quartz and feldspars, has yet to be identified, though the geologic source(s) is almost certainly from one of many Proterozoic/Phanerozoic Red Beds that ring the North Atlantic (see figure). Bond and Lotti (1995) looked at the % hematite-stained grains in cores near the Gulf of St. Lawrence, the Labrador Sea, and the Denmark Strait. While samples from the latter two locations showed relatively low percentages of hematite-stained grains (~10%), samples from the Gulf of St. Lawrence showed extremely high percentages of ~95%, leading Bond and Lotti (1995) to argue that this was the most likely source of the hematite-stained grains, though they do not exclude northeast Greenland, Svaalbard and Norway as possible source areas.

Bond et al. (1997) extended the hematite-stained grain record through the Holocene using cores VM 28-14 and VM 29-191, noting that the Holocene, which was previously viewed as a period of climatic stability, no longer appeared to be so. The new record contains peaks in lithic grains (especially the basaltic glass and the hematite-