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ORIGIN OF CENTRAL GREENLAND LAST GLACIAL DUST: NEW CLAY MINERALOGY AND SR-ND-HF ISOTOPIC DATA FROM NORTHERN HEMISPHERE LOESS DEPOSITS

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Dust in Greenland ice cores is used to reconstruct the activity of dust emitting regions and atmospheric circulation for the last glacial period. However, the source dust material to Greenland over this period is the subject of considerable uncertainty. Here we use new clay mineral and Sr-Nd isotopic data from eleven loess samples collected around the Northern Hemisphere and compare the $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ isotopic signatures of fine (<10 μm) separates to existing Greenland ice core dust data (GISP2, GRIP; [1]; [2]).

Smectite contents and kaolinite/chlorite (K/C) ratios allow exclusion of continental US dust emitting regions as potential sources, because of the very high (>3.6) K/C ratios and extremely high (>~70%) smectite contents. At the same time, Sr-Nd isotopic compositions demonstrate that ice core dust isotopic compositions can be explained by East Asian (Chinese loess) and/or Central/East Central European dust contributions. Central/East Central European loess Sr-Nd isotopic compositions overlap most with ice core dust, while the Sr isotopic signature of Chinese loess is slightly more radiogenic. Nevertheless, an admixture of 90–10 % from Chinese loess and circum-Pacific volcanic material would also account for the Sr–Nd isotopic ratios of central Greenland LGM dust. At the same time, sourcing of ice core dust from Alaska, continental US and NE Siberia seems less likely based on Sr and Nd isotopic signatures. The data demonstrate that currently no unique source discrimination for Greenland dust is possible using both published and our new data [3]. Thus, there is a need to identify more diagnostic tracers.

Based on initial Hf isotope analyses of fine separates of three loess samples (continental US, Central Europe, China), an apparent dependence of Hf isotopic signatures on the relative proportions of radiogenic clay minerals (primarily illite) was found, as these fine dust fractions are apparently zircon-free. The observed difference between major potential source regions in $^{176}Hf/^{177}Hf$ that reach several εHf units and the first order clay mineralogy dependence of Hf isotopic signatures means there is strong potential for distinguishing between the two hypothesized Greenland dust sources using Hf isotopes [3].

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