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Paul,

I encountered no problems submitting it. It was fun. Here's the final copy. I spelled out Be because the title had to be all caps. Our abstract # is50892

10-BERYLLIUM INDICATES SOME MIDWESTERN GLACIAL SURFACES ARE >150,000 YEARS OLD

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A propitious association of glacial striations, affected by minor wind erosion, on an indurated, mature quartzite allowed us to use cosmogenic isotopes to determine that a previously undated pre-Wisconsin glacial surface in southwestern Minnesota formed during or prior to isotope stage 6.

Sioux Quartzite forms highs in a dissected till plain outside the late-Wisconsin glacial limit and displays well-preserved striations, grooves, and crescentic fractures assumed to be coeval with the till. The quartzite was later wind-eroded. Sampled areas were minimally affected by wind; striated surfaces are polished and pitted without being obscured.

We collected 10 samples from two sites (43.50°N., 96.13°W., 540 masl). Initial replicate analyses of four samples from one site show up to 1,520,000 atoms/g of 10-Be. Using the altitude/latitude corrections for neutrons of Lal (1991) and the production-rate estimates of Nishiizumi et al. (1989), minimum effective surface exposure ages for samples on one outcrop are 145+/-6 and 158+/-6 ky (thousand years). Nearby samples on another outcrop yielded 92+/-4 and 90+/-4 ky. Uncertainties reflect only 10-Be abundance.

Ages are minima; cover histories of the outcrops are unknown and production rates of Nishiizumi may be too high. Agreement between replicated samples justifies the methodology. Differences between samples 100s of meters apart suggest cover history is important; forthcoming 26-Al data may indicate burial events.

Despite uncertainties, our data indicate these outcrops were probably ice-free for at least the last 150 ky.

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