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Synchronizing the North American Varve Chronology with Greenland ice core records during late MIS 2 using Meteoric 10Be Flux ()

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The North American Varve Chronology (NAVC) is a floating 5700-year sequence of glacial lake varves deposited in the Connecticut River Valley of the northeast US ~18,000-12,500 years ago. The NAVC is an annually resolved record of regional climate and ice-marginal processes at 40-45° N latitude, near the margin of the retreating Laurentide Ice Sheet (LIS). NAVC deposition occurred at the same time as rapid and abrupt Arctic and North Atlantic climate changes that took place during the last deglaciation. Age calibration estimates for the NAVC based on radiocarbon dated plant macrofossils in individual varves imply a relationship between ice-marginal events recorded by the NAVC and climate events recorded in Greenland ice cores. For example, the retreat rate of the LIS up the Connecticut River Valley increased during the Bolling warming in Greenland, a readvance of the LIS margin took place during the Older Dryas cold period, and a correlation between an outburst flood from glacial Lake Iroquois and the Intra-Allerod Cold Period supports the hypothesis that the flood affected North Atlantic thermohaline circulation. On the other hand, a doubling of the ice-margin retreat rate recorded by the NAVC around 16,000 years ago coincides with a relatively cold period in Greenland. Our goal is to investigate the precise time relationship between these two records by synchronizing the NAVC with the Greenland ice core time scale using atmospherically-produced 10Be. Existing 10Be flux records, including those from Greenland ice cores, exhibit solar variability on a range of time scales. Because this variability is globally synchronous, a 10Be flux record for the NAVC can, in principle, be used to align NAVC and ice core timescales. In the first phase of this research we tested this potential by generating 10Be flux records for two 80-year varve sequences and analyzing them using multi-taper spectral analysis for

determination of statistically significant periodicities. We were specifically looking to see if they record the 11-year Schwabe solar cycle, which is clearly expressed in 10Be flux records from Greenland ice cores. The results do not support the existence of a statistically significant 11-year periodicity, but the diagnostic El Nino Southern Oscillation (ENSO; ~4-6 yr) signaling was resolved with >99% confidence. We interpret these results to suggest that our measurements of 10Be flux are representative and that the multi-taper spectral analysis method is the appropriate tool for investigating harmonic signaling. The lack of the 11-year solar variability suggests that complex watershed processes influenced the retention and delivery of 10Be in the glaciated and freshly de-glaciated landscapes of the Connecticut River Valley so as to obscure the short-period 11-year variability. We use these results to guide sampling for a 1700-year record of 10Be flux record at decadal (15-year) resolution for comparison with Greenland ice core records at centennial timescales.

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