

Interactive comment on
“Atmospherically-produced beryllium-10 in
annually laminated late-glacial sediments of the
North American Varve Chronology” by Greg Balco
et al.

Anonymous Referee #2

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General comments:

The manuscript by Balco et al. titled ‘Atmospherically produced beryllium-10 in annually laminated late-glacial sediments of the North American Varve Chronology’ presents an important study of multiple ^{10}Be time-series from pro and paraglacial varved sediments of the NAVC at seasonal to multi-decadal resolution. Major aim is to investigate the mechanisms of ^{10}Be deposition in this, for this purpose, complicated archive and synchronize the new ^{10}Be records to those from Greenland ice cores. The efforts undertaken are methodologically comprehensive and of high interest for the

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geochronology community. The authors provide crucial information on the extraction and measurement of ^{10}Be from sediment samples as well as aim to separate fallout (atmospheric) ^{10}Be from inherited (redeposited) ^{10}Be using a linear model. Therefore, I support publication of the paper in Geochronology. However, before publication one major point should be discussed and clarified.

Major point: Environmental influences on ^{10}Be deposition in NAVC sediments:

All calculated bi-annual and decadal ^{10}Be and ^9Be flux time-series from the NAVC sediments strongly resemble changes in the mass accumulation rate (MAR) and not the variability in the originally measured ^{10}Be and ^9Be time-series. This is a common feature when ^{10}Be flux time-series are calculated from sediment records (e.g. Berggren et al., 2013 J. Paleolim., Czymzik et al., 2015, EPSL). However, comparing the MAR with the measured ^{10}Be and ^9Be time-series indicates that major changes in MAR are most often not accompanied by comparable anti-phased changes in ^{10}Be or ^9Be (e.g. Figs. 11 and 16), suggesting that influences of changes in MAR on sedimentary ^{10}Be or ^9Be contents are assumedly rather small. Based on the above assumptions there might be a substantial environmental signal in the calculated ^{10}Be flux and, consequently, ^{10}Be fallout time-series. Please discuss this subject.

Considering the possible presence of a substantial environmental signal in the calculated ^{10}Be fallout records questions the robustness of the synchronization of NAVC ^{10}Be with Greenland ice core ^{10}Be . Prerequisite for such studies is a reliable production rate signal in all applied ^{10}Be records. This should be considered in the discussion of the synchronization and paleoclimate comparison. In addition, it would be also interesting to see how the originally measured ^{10}Be concentration and $^{10}\text{Be}/^9\text{Be}$ -ratio time-series compare with Greenland ice core ^{10}Be fluxes, e.g. to evaluate how much common variability is incorporated.

Specific comments:

(1) Calendar year time-scale: The Greenland ice core chronology includes its own

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uncertainties (e.g. Muscheler et al., 2014, QSR). Therefore, in my opinion the NAVC is not synchronized to the calendar year time-scale, but to the Greenland ice core GICC05 time-scale.

(2) Page 2/28-31: In addition to the atmospheric fallout, please also mention weather and catchment effects on ^{10}Be deposition.

(3) Pages 22/11 to 23/2: Please shortly discuss these two contradictory results, and their implications for the calculation of ^{10}Be fallout variability.

Detailed comments:

Page 1/Line 4: proglacial and 'paraglacial'? Page 3/15-16: Only one 'Ridge, 2012'? Page 3/17-24: Please provide references. Page 5/1: Please shortly describe the composition of the 'glacial sediment'. Page 5/3-8: Provide references. Page 8/2: Provide reference. Page 9/31: Provide reference. Page 18/1: Add 'and discussion' after 'results'. Figure 1: Caption: Define the abbreviations in the caption. Add information about the meaning of the long black line. Figure 14: Caption (line 2): Correct 'tallout'.

Interactive comment on Geochronology Discuss., <https://doi.org/10.5194/gchron-2020-16>, 2020.