

Interactive comment on “Direct linking of Greenland and Antarctic ice cores at the Toba eruption (74 kyr BP)” by A. Svensson et al.

Anonymous Referee #1

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This paper uses ice core and other data to address one of the most intriguing environmental events in recent earth history, the Toba supereruption. The authors synchronize Antarctic and Greenland ice cores with decadal precision in order to search for Toba and examine interhemispheric climate coupling. The authors are expert ice core geochronologists, and ice cores are certainly a vital resource for understanding both Pleistocene climate change and volcanism. The scientific quality, significance and presentation are all excellent. My main complaint is about the interpretations and conclusions of Svensson et al. In my view, their conclusions about the climatic significance of Toba are strained.

Several of the authors of this paper were also coauthors on a recently published paper highlighting some of the perils of assessing volcanic events using ice cores, Coulter et

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al., 2012. These include:

- 1) the erratic spatial distribution of volcanic products, both acid and tephra, on ice sheets
- 2) that multiple eruptions can contribute to a given acid signal, confounding estimation of stratospheric loading
- 3) that many volcanic eruptions, particularly the most powerful ones, may be underrepresented in ice cores and detectable only through tephra.

Based on the available evidence, then, the authors would seem to have a predilection for dismissing the long-term climatic importance of Toba, and volcanism in general. This seems far-fetched, and some of their conclusions are surely overstated:

"...the Toba eruption did not initiate a long term cold period."

"...the initiation of all of the other DO-events was independent of major volcanic events."

Really? The authors explain that even after decades of trying, we are still unable to find the largest volcanic eruption of the last 2 million years in an ice core. Yet they have basically concluded that we can now put to rest the long-term impacts of Toba, and that there were no other consequential volcanic events in the last 100,000 years.

I'm not sure what the urgent need is to close the books on prolonged volcanic cooling, but could we leave open the question of the role of explosive volcanic events in millennial climate change, again, based on the available evidence?

One point on methodology. These records have been synchronized by experts, and the reader is left to stare at figures to try and judge for herself whether the matches the authors have chosen are good ones. But is it possible to assign some sort of objective figure of merit, a statistical significance, to these choices?

An interesting aspect of this study is the variability of the sulfate signals, which the authors have uncovered, even among relatively nearby sites. There is a persistent

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view that ice core sulfate levels are a reliable metric for eruption intensity. This analysis clearly calls this assumption into question, I'm pleased to see this point developed in the paper and I suggest it be further emphasized.

References:

Ambrose, Late Pleistocene human population bottlenecks, volcanic winter, and differentiation of modern humans, *J. Hum. Evol.* 34(6) (1998).

Coulter et al., Holocene tephtras highlight complexity of volcanic signals in Greenland ice cores, *JGR* 117 (2012).

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