

Interactive comment on “Greenland ice core evidence of the 79 AD Vesuvius eruption” by C. Barbante et al.

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The authors present chemistry and glass analyses of a volcanic event recorded at GRIP in Greenland at around the time of the historic eruption of Vesuvius in Italy (79 AD). The suggested attribution of the ice core signal to the historic event would help refine chronologies and synchronization between ice core and marine sediment records. The 79 AD Vesuvius eruption may be the oldest volcanic eruption with detailed historic records that can be dated to an exact year. Therefore an ice core link has strong implications for assessing dating uncertainties and the underlying data should certainly be published. Figure 1-3 clearly shows the volcanic nature of the ice core signals in 429.1 m depth at GRIP. In Table 2 the authors present potential alternative eruptions that could have caused the signal recorded in the ice, among them large eruptions in

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Alaska (Churchill VEI 6+), Azores (Furnas VEI 5). Volcanic eruptions from Alaska (e.g. Katmai 1912) are known to have deposited sulfate in Greenland in the past [Bigler et al., 2002]. Also Iceland which lacks for detailed historical accounts in the 1st century, could be a potential source area, given its proximity to the Greenland ice sheet. Figure 4 and Table 1 display the data used for the source attribution of the signal to Vesuvius: In Table 1 average concentrations of SiO₂, TiO₂, Al₂O₃, CaO, K₂O determined for the particles in the ice are within their errors different to the average composition of the 10 volcanic glasses from the known 79 AD Vesuvius eruption. Concentrations of FeO, MgO, Na₂O are not different, but vary largely in the ice core analysis. Figure 4 shows that the average elemental composition is well within the variability of other volcanic glasses from Vesuvius. It also shows that there is a large variability among the different eruptions and deposits. With no expertise in tephra analysis I am wondering how unique the elemental composition is to attribute a single source volcano. I would find the attribution more convincing if I could see that tephra from alternative eruptions (e.g. from Churchill, Furnas, Iceland) are significantly different in elemental composition than those from the analyzed glass shards at GRIP. I would therefore suggest that the authors provide additionally evidence that the signal could not have been from another eruption. Also I would welcome a comment on how other large historic volcanic eruptions of Vesuvius (e.g. 1631, 472 AD) are recorded in Greenland ice. Clarification is also needed about the shift of the dating that puts the microparticles at 429.3m containing the glass into summer 79 AD – a few months before(!) the eruption (Oct) occurred. At the current stage, the evidence provided points to a possible Vesuvius source, but I suggest adding more evidence when using this event as time marker with zero error uncertainties in ice core dating.

Bigler, M., D. Wagenbach, H. Fischer, J. Kipfstuhl, H. Millar, S. Sommer, and B. Stauffer (2002), Sulphate record from a northeast Greenland ice core over the last 1200 years based on continuous flow analysis, *Annals of Glaciology*, Vol 35, 35, 250-256, doi:10.3189/172756402781817158.

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