EGU22-8881
https://doi.org/10.5194/egusphere-egu22-8881
EGU General Assembly 2022

New Tricks for Old Tephra

Meredith Helmick[1,2], Andrei Kurbatov[1,2], Martin Yates[2], Nelia Dunbar[3], Nels Iverson[3], and Dominic Winski[1,2]

[1]Climate Change Institute, University of Maine, Orono, Maine, USA
[2]School of Earth and Climate Sciences, University of Maine, Orono, Maine, USA.
[3]New Mexico Tech, New Mexico Bureau of Geology and Mineral Resources, Socorro, USA

Ice cores serve as archives of the Earth's past atmosphere and are invaluable to improving our understanding of past climate. These cores preserve regional and global volcanic histories. Traditionally, the chemical components associated with volcanic aerosols measured in ice have been used to identify volcanic deposits in ice. However, only a handful of studies have identified sources of low concentration ultra-fine volcanic ash (cryptotephra) layers associated with chemically identified horizons. A pioneering study by Palais et al., [*Annals of Glaciology*, 14, 216-220 (1990)], identified five cryptotephra intervals in the PS1 firn core from South Pole, Antarctica. Now, some 30 years later and armed with improved technology, refined methodologies, and the recently drilled South Pole Ice Core (SPC14), we revisit these tephra-bearing volcanic intervals. Guided by high-resolution glaciochemical time series data, we were able to extract cryptotephra particles from ice intervals corresponding to the eruptions of Tambora (1815 CE); the unknown 1809 CE event; Huaynaputina (1600 CE); Nevado Del Ruiz (1595 CE); and Samalas (1257 CE) at much finer sampling resolutions than was previously possible. Each sample was prepared using recently developed sample mounting techniques tuned to maximize particle recovery, and analyzed using scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). Both the Tambora and 1809 intervals comprise small (< 2µm) particles ranging in composition from trachyandesitic to rhyolitic. As a whole, cryptotephra particles from the Huaynaputina interval represent largely homogenous rhyolitic particles with minor occurrences of trachyte. The composition of cryptotephra from the Nevado Del Ruiz interval ranges from basaltic trachyandesite to trachyte. Lastly, cryptotephra compositions of the Samalas interval include both rhyodacitic and trachytic particles. We captured a wider range of cryptotephra compositions than previously presented for the selected volcanic intervals and many contain subtropical particles (dacite-rhyolite) and local particles (trachytes). These findings will be informative for understanding volcanic eruption dynamics and atmospheric transport of local and distal tephra. This material is based upon work supported by the USA National Science Foundation under Grants No. PLR-1543454 and 1543361.