新しいドームふじ浅層コア年代による超新星の痕跡シグナル再検討

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Supernova footprints revisited with newly-derived chronology of Dome Fuji shallow ice core

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Recently, Motizuki *et al.* [1)] found extremely good synchronization of volcanic eruption signals between a shallow ice core drilled at Dome Fuji in 2001 (DF01 core) and the B32 shallow ice core from Dronning Maud Land, East Antarctica. The authors then applied volcanic signature matching to transfer the B32 chronology constructed by annual layer counting to a portion of the DF01 core for which annual layer counting was difficult because of the low precipitation rate. Matching was done by careful comparison of non-sea-salt sulfate (nss SO_4^{2-}) data, which have a temporal resolution of about 1 year, between the DF01 and B32 cores. In total, 31 volcanic eruptions were synchronized from AD 1900 back to AD 187, the earliest volcanic eruption date in the B32 core. They further used the B32-correlated EDML1/EDC3 chronology obtained from the top part of the EPICA Dronning Maud Land (EDML) deep ice core to date the DF01 core from AD 1170 back to AD 1. The newly obtained chronologies were called DFS1 (Dome Fuji Shallow ice core 1; transferred from the B32 chronology) and DFS2 (Dome Fuji Shallow ice core 2; transferred from EDML1/EDC3 chronology). Because the EDML1/EDC3 ages were determined by adopting the B32 chronology back to AD 1170, DFS1 and DFS2 dates are identical between AD 1170 and 1900.

Using these newly obtained chronologies, we will present the past 1900 year record of nitrate ion (NO_3^-) concentrations for the DF2001 core. We found that the dates of at least several, out of nine, historically known galactic supernovae between AD 1 and 1900 correspond to NO_3^- spikes within dating uncertainty. We will examine these remarkable correspondences from the viewpoints of: data reproducibility, comparison with other anion and cation concentration variations, snow deficit probability after deposition at the Dome Fuji site, and the chance occurrence of spikes to occur in the uncertainty rages of the expected supernova dates. We will also mention an 11-year periodicity obtained by time-series analyses to the measured NO_3^- concentration variations from the 10^{th} and the 11^{th} century, which can be explained by solar modulation.

References

Y. Motizuki, Y. Nakai, K. Takahashi, M. Igarashi, H. Motoyama, and K. Suzuki, Dating of a Dome Fuji (Antarctica) shallow ice core by volcanic signal synchronization with B32 and EDML1/EDC3 chronologies, submitted to the Cryosphere