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Cosmogenic radionuclides at Law Dome, East Antarctica,record the 774/5 AD and 993/4 AD Miyake Events.

Content

This project investigates evidence for increased atmospheric production of cosmogenic radionuclides in ice core records at Law Dome, East Antarctica, during three extreme events. These events are the Carrington Event (CE) of 1859 AD [1], the largest solar storm of modern times, and two recently discovered cosmic radiation events of even greater magnitude, the Miyake Events (ME) of 774/5 AD [2] and 993/4 AD [3]. Our intention is to determine 14C, 10Be and 36Cl profiles, with the highest sub-annual temporal resolution to date, across these events to better understand the nature of these phenomena. Understanding the origin, magnitude and frequency of these events is essential for future-proofing modern communication infrastructure. A further motivation is that identification of these events provides chronological markers to compare with the independently dated Law Dome ice core.

Ice samples for 10Be and 36Cl analysis were taken from ice cores drilled near the summit of Law Dome, East Antarctica. This is the first time these radionuclides have been measured at the same site for these events, allowing a direct comparison of ME774, ME993 and CE1859 under similar transport conditions. Both ME samples were taken from sections of the Dome Summit South (DSS) main core where the amount of available ice was limited, and the CE samples were taken from a newer core drilled at the same site (DSS0506) where more ice was available.

A survey of 10Be at annual resolution spanning 30 years allowed an exact location of the events in the ice cores. We clearly identified the expected ME774 and ME993 10Be peaks, which were ~ 4 years earlier and ~ 2 years earlier, respectively, than the layer-counted DSS ice core chronology, but within the margin of error. Accordingly, a further set of 10Be samples at bi-monthly resolution were taken over the peaks to better define the fine structure and amplitude of the signal. These sub-annual results confirm the survey results, showing additional structure and higher 10Be concentrations. Finally, we will be combining the mobile phases from the sub-annual and annual 10Be processing to yield sufficient sample for 36Cl AMS analysis across these two Miyake Events. No discernible 10Be peak or 36Cl peak was found for CE1859 at annual resolution.

Primary authors: Dr MOY, Andrew (Australian Antarctic Division); Dr SCIFO, Andrea (Centre for Isotope Research, University of Groningen, Netherlands); Dr SMITH, Andrew (ANSTO); CURRAN, Mark (Australian Antarctic Division and Australian Antarctic Program Partnership); Dr DEE, Michael (Centre for Isotope Research, University of Groningen, Netherlands); Dr FINK, David (Australian Nuclear Science & Technology Organisation); Dr KUITEMS, Margot (Centre for Isotope Research, University of Groningen, Netherlands); Dr LEVCHENKO, Vladimir (Australian Nuclear Science & Technology Organisation); Ms SIMON, Krista (Australian Nuclear Science & Technology Organisation); Dr WILCKEN, Klaus (Australian Nuclear Science & Technology Organisation)

Presenter: Dr SMITH, Andrew (ANSTO)

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