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Characterisation and Correlation of Visible Tephra Horizons in the Beyond EPICA Oldest Ice Core

Carys Thomas[1], Siwan Davies[1], Barbara Delmonte[2], Marco Rabassi[2], Paul Albert[1], William Hutchison[3], Sergio Andò[2], and Emma Watts[1]

[1]Department of Geography, Faculty of Science and Engineering, Swansea University, Wales, UK
[2]Department of Earth and Environmental Sciences (DISAT), University Milano-Bicocca, Piazza della Scienza, 20126 Milano, Italy.
[3]School of Earth & Environmental Sciences, University of St Andrews: St Andrews, Scotland, UK

Antarctic ice cores provide exceptional archives of past climates and volcanic activity. Advances in sampling and analytical techniques are now enabling the detection and characterisation of both visible and cryptotephra deposits across increasingly long climate records. The Beyond EPICA Oldest Ice (BE-OI) project recently recovered what is thought to be the longest continuous Antarctic ice core. This core likely reaches back to ca. 1.2 million years, offering a unique opportunity to refine the chronology of glacial–interglacial cycles and the Mid-Pleistocene Transition. Here we present six visible tephra horizons identified within the upper 1850 m of the BE-OI record, thought to be originating from volcanic sources across the Antarctic region and beyond. These tephra deposits have modelled ages of 10.3, 70.3, 89.8, 142, 189 and 200 ka. Within this study, we explore potential correlations to tephras in the EPICA Dome C record.

Grain-size measurements, obtained through Coulter Counter analysis, together with optical microscopy and high-resolution single grain mineralogical data, have established the physical characteristics of the six tephra layers. Major element compositions determined by electron microprobe analysis and trace element data generated by LA-ICP-MS provide geochemical fingerprints for each deposit and point towards volcanic sources such as the South Sandwich Islands and Marie Byrd Land. The combination of these datasets enables robust tephra characterisation and supports correlations with established Antarctic tephra horizons. This work directly contributes to the refinement of the Beyond EPICA Oldest Ice chronology and its integration with the EPICA Dome C record.