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Identifying the AD 1257 Salamas volcanic event from micron-size tephra composition in two East Antarctic ice cores

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A wealth of valuable data about the history of explosive volcanic history can be extracted from polar ice successions. Both the volatile by-products and the solid silicate (tephra) components of volcanic plumes can be incorporated into snow layers, providing tools for chronostratigraphic correlations and for interpretation of climate-volcanism interactions.

Volcanic events from low-latitude regions are of particular interest as the related sulphate aerosol travelling through the stratosphere can reach the polar sheets forming inter-hemispheric (Greenland and Antarctica) signals preserved in the ice. Within the glaciological record of globally significant volcanic markers, the AD1259 signal represents one of most prominent events over the last thousands years. Its source has been long debated. On the basis of recent field investigations (Lavigne et al., 2013; Vidal et al., 2015), it has been proposed that Mount Samalas on Lombok Island (Indonesia) represents the source responsible for the polar event.

With the goal of bringing distal tephrochronological evidence to source identification, we have attempted to identify volcanic ash associated to the AD 1259 sulphate pulse. To this purpose we used firn and ice-core samples from two East Antarctic Plateau sites: Concordia-Dome C (75°06′ S, 123°20′ E, 3233 m) and Talos Dome (72°49'S, 159°11'E, 2315 m). Our high-resolution studies included sample processing in a Class 100 clean room using established ultra-clean procedures for insoluble microparticle analyses, Coulter counter grain size measurements, scanning electron microscope observations and the geochemical (major elements) composition from the recently set ISTERRE Jeol JXA 8230 Superprobe and calibrated for small particles analysis. Despite the difficulty of studying such minute fragments, within both cores we located and characterised multiple tiny (micron-size) glass shards concomitant with the volcanic peak. We present preliminary results alongside comparison with geochemical analysis of juvenile volcanic materials from potential sources.