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A 73,000 Year Time-Series of Volcanism from the Reykjanes Ridge and Iceland from Sediment-Hosted Glasses

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Marine sediment hosted glasses (SHGs) provide a valuable record of temporal variations in submarine volcanism permitting exploration of potential links to glacial cycles[1,2]. More than 2000 major and trace element single SHGs from a sediment core recovered during cruise MSM119 close to the southern Reykjanes Ridge at 57.6°N provide the first high-resolution, continuous volcanic time series extending from the present to 73 ka with a resolution of <2 ka, based on age models from radiocarbon and benthic oxygen isotope stratigraphy. Glass compositions show a 15-20% increase in incompatible elements and ratios during Glacial Termination 1 (14–8 ka), consistent with a decrease in melting rate caused by sea level rise. Average MgO contents of SHGs reach a maximum between 20 and 40 ka during the Last Glacial Maximum, perhaps reflecting increased magma flux during this time. Around 46 ka, a pulse of compositions distinctly enriched in highly incompatible elements and ratios occur. These compositions are similar to those of a large near axis seamount 6-10 km south of the core[3]. Prior to 10 ka, about half the glass shards are subaerial and not from the Reykjanes Ridge. Three distinct clusters corresponding to Katla, Grímsvötn and Veiðivötn volcanic systems can be distinguished. The temporal distribution of these shards aligns with North Atlantic volcanic ash zones and ice-rafted debris known from previous marine studies, suggesting transport by icebergs along paleo-ocean currents[4,5]. Their absence in the core's uppermost section may reflect a decline in both subglacial volcano eruptions on Iceland and iceberg transport. High-resolution time-series data of marine SHGs combined with further observations such as bathymetry and crustal thickness will for the first time enable investigations of temporal change of volcanism both beneath the ridge and nearby ocean islands over thousand to million year time scales, as well as constraints on paleo ice extent and ocean currents.

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