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Tephra in marine sediment cores offshore southeast Iceland: A 68,000 year volcanic record

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Icelandic explosive volcanic eruptions such as the 2010 Eyjafjallajökull eruption have far-reaching impacts. Tephra has been found as far as Northern Continental Europe and Greenland. On Iceland, however, erosion and ice cover limit the preservation, particularly of pre-Holocene volcanic deposits. We use the marine sedimentary archive offshore southeast Iceland, which preserves information about the depositional fans at medial distances from the volcanic sources, to infer past eruption frequencies and geochemical characteristics of the volcanic systems, contributing to Icelandic volcanic hazard assessment and to the stratigraphic framework used for palaeoceanographic reconstructions. Here we report the analysis of four sediment gravity cores of ~5 to 10 m lengths, obtained during RV Poseidon Cruise 457, at distances of 60 to 180 km southeast of Iceland between 755 m and 1610 m water depths. In addition to prominent tephra layers, the inter-core correlation is supported by color-scans and tied in with the $\delta^{18}O$ Greenland Ice-core record, providing the age model. We analyzed major element compositions of volcanic glass by electron microprobe. Using geochemical fingerprinting and sedimentary observations, we identified ~50 basaltic primary ash layers. Background sediment includes <15% rhyolitic to basaltic-andesitic shards. Although reworking hampers tephrochronological interpretation in the Holocene part of the record, the high abundance of the bimodal Vedde-type tephra implies strong activity of the Katla volcanic system during this time period. Tephras of unknown composition and the "Faroe Marine Ash zones" II and III, including the ~27 ka Fugloyarbanki tephra, provide insight into the Late Pleistocene volcanic activity at the central part of the Icelandic rift zone. The deposits can be traced back 68 ka to the volcanic systems of Grímsvötn-Lakagígar, Kverkfjöll, Bárðarbunga-Veiðivötn, Katla and Hekla. Our results extend their eruption record further back in time than currently inferred from terrestrial Iceland and in more detail than the far-distant records.