Geophysical Research Abstracts
Vol. 18, EGU2016-16724-1, 2016
EGU General Assembly 2016

Tephra in marine sediment cores offshore southern Iceland: A 68,000 year record of explosive volcanism

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Explosive volcanic eruptions on Iceland, even of intermediate magnitude have far-reaching impacts. Their far-distal deposits have been found up to Northern Continental Europe and Greenland. On Iceland, the harsh environment and strongly erosive conditions limit the preservation of volcanic deposits and their accessibility on land. The area offshore southern Iceland preserves information about the depositional fans at medial distance from the volcanic source. Here we use this sedimentary archive to reconstruct the Icelandic eruption record in greater detail. This high resolution geological record allows us to infer eruption frequencies and explosiveness in great detail and contributes to the assessment of Icelandic volcanic hazards, volcano-climate interaction, stratigraphy and palaeoceanographic reconstructions.
Eight gravity cores were obtained during RV Poseidon Cruise 457, at 260 to 1,600 m water depths and distances of 130 to 400 km west to southeast of Iceland. The ∼4 to 10 m long sediment cores reach back to the Late Pleistocene (∼68 ka BP; dated by 14C and sedimentation rates), mostly excluding the Holocene. Potential tephra layers were identified by visual inspection and color scans. Volcanic glass shards were analyzed for their major element composition by electron microprobe and assigned to their eruptive source by geochemical fingerprinting. More than 50 primary tephra layers and nearly as many reworked layers were identified, several of which were correlated across the cores. The mostly basaltic tephra shards are derived from the Katla, Grímsvötn-Lakagígar, Bárðarbunga-Veiðivötn, and Hekla volcanic systems. Primary and mixed layers with particles of unique bimodal composition identical to the ∼12 ka BP Vedde-Tephra from the Katla Volcanic System, including rhyolitic particles, were identified in nearly all cores and used as time marker and for inter-core correlation. Tephra layers of unique unknown composition were also identified and stratigraphically assigned across some of the cores. Intercalated dropstones from Heinrich events provide additional age constraints. The core and tephra correlations are supported by color scans, of which the *b-values tie in with the δ^{18}O Greenland Ice-core record.
The marine tephrostratigraphy offshore southern Iceland extends the eruption record further back in time than currently inferred from terrestrial Iceland and in more detail than far-distant deposits. It provides depositional evidence for previously unrecognized eruptions and demonstrates that Icelandic volcanoes erupted more often than previously thought. The depositional time frame of the tephra layers in the cores facilitates to integrate climatically-induced variations in sedimentation rates and conditions at the different sites around Iceland with changes in eruption frequency.