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Volcanic glass in surface sediments offshore southern Iceland: Can eruptions such as Eyjafjallajökull 2010 be traced in the marine archive?

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Explosive volcanic eruptions on Iceland even of small to intermediate magnitude can cause significant economic loss and health risk to humans in the North Atlantic region. This was strikingly revealed by the recent eruptions of Eyjafjallajökull in 2010 and Grímsvötn in 2011, disrupting European and intercontinental air traffic. We are using the North Atlantic marine archive to reconstruct the Icelandic eruption record with the aim to refine and improve the hazard assessment associated with explosive volcanism.
Thirteen giant box corers were obtained during RV Poseidon Cruise 457 in August 2013, at < 100 to 1,600 m water depths and distances between 40 and 400 km southwest, south and east of Iceland. Volcanic glass shards from the uppermost 1 cm of the surface sediment were analysed by electron microprobe for their major element composition. Our analytical setup included a spatially systematic approach to facilitate the determination of modal proportions of the different shard populations in two size fractions, <32 μm and >32 μm. In total, $\sim$900 tephra particles were analysed. More than 80 % have mafic compositions. Most of them are derived from the Katla and Veiðivötn-Bárðarbunga volcanic systems as well as Grímsvötn-Lakagígar, where the eruptions of Grímsvötn in 2011 and Laki 1783/84 are the only possible sources. A few particles of felsic to intermediate composition correlate with those of Hekla and Snæfellsjökull volcanoes. The occurrence of tephra particles from the historic rhyolitic eruptions of Askja 1875 and Öræfajökull 1362 displays that the record covers at least the past 650 years and yields information about the tephra distribution and dimension of these eruptions. Unexpectedly, we found only two particles that correlate with the 2010 Eyjafjallajökull eruption, sourced from its trachydacitic portion.
According to simple sedimentation chronology, this most recent eruption should be well represented in the surface sediment. Its distribution pattern was expected to provide a means to evaluate how the ash cloud as monitored by remote sensing techniques and observations is preserved in the seafloor deposits. We discuss the influence of weather conditions, ocean currents, sedimentary processes such as jökulhlaups, or bioturbation as explanations for the scarcity of the Eyjafjallajökull 2010 particles and the joint occurrence of shard assemblages representing more than six centuries of explosive Icelandic volcanism.
This study contributes to a better understanding of depositional processes of tephra particles from the source to the marine sediment archive. Our results raise the question of the traceability of medium-size eruptions such as that of Eyjafjallajökull 2010 in the marine sedimentary archive, suggesting that the frequency of such events in the past could have been higher than previously thought.