

# **Tuya Compositions as Probes for Coupled Glacial-Mantle Dynamics during the Waning Stages of Deglaciation in Iceland**

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Recent and active volcanism in deglaciating landscapes illustrate links between Earth surface processes and those operating deep in its mantle. Tuyas in the Western and Northern Volcanic Zones (WVZ and NVZ, respectively) in Iceland afford a natural laboratory to investigate the rich history of feedbacks between glaciers and volcanic processes. Here we report chemical and isotopic data on tuyas formed during the waning stages of the most recent glaciation. Major and trace element data are consistent with other studies suggesting initiation of melting in the garnet stability field during the most recent glacial-deglacial cycle. Generally we find that tuyas forming in closest proximity to the inferred locus of the Iceland plume head can be explained by a shoaling average depth of melting over time, with increasing degrees of melting of more depleted endmembers during the latest stages of glaciation. As deglaciation proceeded, tuya geochemical and isotopic signatures record a rapid shoaling of the melt region, preceding the abrupt glacial termination in both the WVZ and NVZ. Tuya geochemical data support the observation that heterogeneities in the sublithospheric mantle manifest themselves in spatial clusters and weak temporal trends apparent within the WVZ and NVZ as lithologies mix during melt generation. Finally, temporal trends in geochemical and isotopic signatures, together with those in the literature, are consistent with the notion that tuyas in the WVZ proceed to tap more depleted endmembers at earlier time periods than those in the NVZ, suggesting that the pace and pathways of deglaciation also influence melting dynamics regionally beneath Iceland.