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Rheological variability of the 2018 Kilauea eruption

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The rheology of lava exerts a first-order control on flow dynamics. Major influences on lava rheology are exerted by thermal, compositional, and textural state. Deciphering their relative contributions in the highly dynamic regime of active lava flows is a major challenge.
During the four month-long 2018 Kilauea eruption, a wide range of effusion temperatures, bulk compositions, and textures was documented for the 18 ephemerally-active eruptive fissures. Using a representative sample suite spanning the compositional range (basalt to andesite) and variety of the erupted lavas, we have initiated a systematic experimental investigation the effects of composition, crystallinity and temperature on lava rheology. High temperature viscosities are being determined using concentric cylinder viscometry. Preliminary results from a distal 'a'a flow sample of the Fissure 18 episode indicate a range of melt viscosity from 2 Pa s at 1500 ºC to 40 Pa s at 1200 ºC. Liquid+crystal rheology measurements are currently being conducted at appropriate magmatic temperatures (1020 ºC – 1140 ºC).
This rheological study will be innovative in its comprehensive treatment of the variability of rheology from this event series. Our goal is to set a new standard for future rheological investigations of multi-episode effusive eruptions. It is anticipated that quantification of the inter-episode variability of lava rheology will enhance our ability to evaluate the sensitivity of observed flow speeds and emplacement dynamics to viscosity variations, greatly improving models of the latter for the future.