RUN-UP TO THE 1999 SUB-PLINIAN ERUPTION OF SHISHALDIN VOLCANO UNVEILED USING PETROLOGIC AND SEISMIC APPROACHES

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On April 19, 1999 Shishaldin volcano had its largest eruption in 200 years, which released 43 million m^3 of basaltic ash. InSAR images reveal a lack of long-term deformation related to the eruption, which is behavior characteristic of Shishaldin and other open-conduit volcanoes in the region. One explanation for the absence of observable geodetic response at Shishaldin is that deep (>10 km bsl) magma ascends to shallow depths within months of the eruption (Moran et al., 2006 JVGR). Here we test this idea and investigate the run-up to this eruption by determining the locations of magmas and timing of recharge with petrologic and seismic approaches with the goal of informing interpretation of precursory signals used to evaluate volcanic risks and aiding our understanding of open-conduit volcanism. We uncover magma storage depths using the pressures melt inclusion entrapment. Vapor saturation pressure modeling of Raman-reconstructed volatile contents of inclusions suggests most formed at <6 km depth, implying magmas resided within (or just below) the edifice prior to eruption. EMP-calibrated backscattered electron images of olivines distinguish two populations: a dominant population of evolved olivines (Fo_{60-70}) that are reversely zoned and a second population containing more primitive olivines (Fo_{70-80}) that are normally zoned. We recover mixing-to-eruption timescales through modeling Fe-Mg interdiffusion. Preliminary results show a wide range of timescales (days to months), but the majority are consistent with a significant mixing event in early 1999. We further investigate the timing of recharge by analyzing regional earthquakes for shear-wave splitting. We find that an increase in delay times between the fast and slow split S-wavelets had occurred between September 1998 and February 1999, accompanied by a ~90° change in the polarization of fast S-wavelets, indicating magma intrusion by February 1999. These results indicate that, in this case, the repeat interval of InSAR measurements was not short enough to capture deformation that may have accompanied the eruption. This supports the idea that some open-conduit volcanoes have rapid recharge, and probably little long-term shallow storage.