Double reservoirs imaged below Great Sitkin Volcano, Alaska, explain the migration of volcanic seismicity

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Volcanic seismicity provides essential insights into the behavior of an active volcano across multiple time scales. However, to understand how magma moves as an eruption evolves, better knowledge of the geometry and physical properties of the magma plumbing system is required. In this study, using full-wave ambient noise tomography, we image the 3-D crustal shear-wave velocity structure below Great Sitkin Volcano in the central Aleutian Arc. The new velocity model reveals two low-velocity anomalies, which correlate with the migration of volcanic seismicity. With a partial melt of up to about 2.5%-9%, these low-velocity anomalies are characterized as mushy magma reservoirs. We propose a hypothesis of a six-stage eruption cycle to explain the migration of seismicity and the alternating eruption of two reservoirs with different recharging histories. The findings in this study have broad implications for the dynamics of magma plumbing systems and the structural control of eruption behaviors.

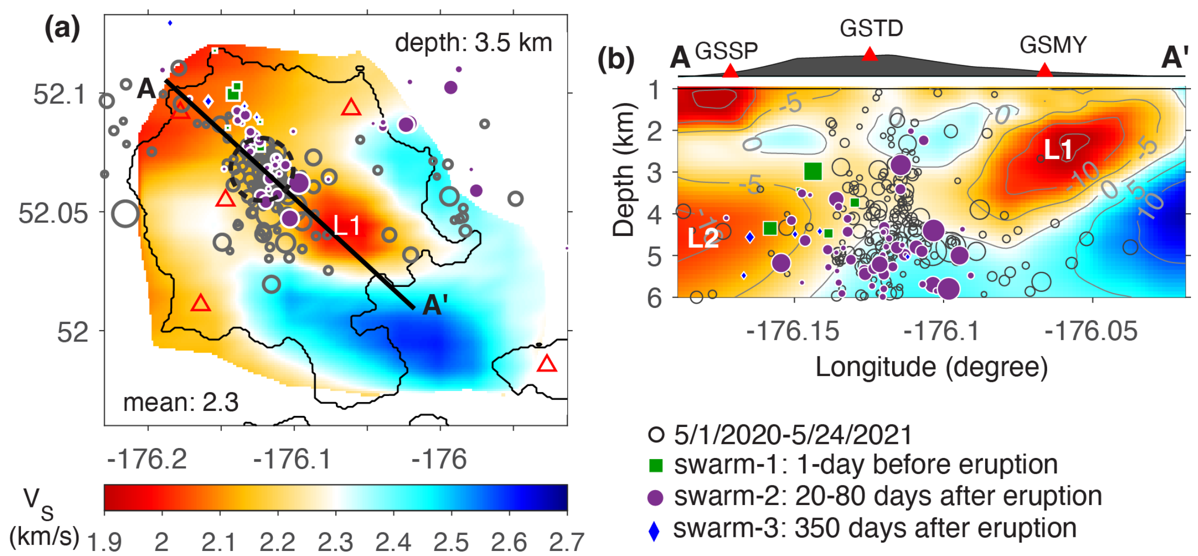

Figure 1. Shear-wave velocity model of Great Sitkin. *(a) Velocity at the depth of 3.5 km. The triangles are the seismic stations. Earthquakes are projected about 1 km away from the slice depth, scaled by magnitudes. (b) Vertical cross-section of the shear-wave velocity model at 1-6 km below sea level, showing the velocity perturbations relative to the average velocity at each depth. L1 and L2 label the two low-velocity features.*