Ring fault creep induces volcano-tectonic seismicity during caldera collapse of Kīlauea in 2018

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Basaltic caldera collapses are episodic, producing very-long-period (VLP) earthquakes up to M_w 5.4, with prolific volcano-tectonic (VT) seismicity between collapse events. During the 2018 caldera collapse of Kīlauea volcano, VT seismicity ceased following each collapse, and then accelerated to a steady rate prior to the next collapse. This temporal pattern is distinct from typical foreshock/aftershock sequences; however, the source mechanism that generates VT seismicity is unclear. Here we demonstrate that, inter-collapse ring fault creep was the main driver of VT seismicity at Kīlauea in 2018. This is evidenced by: 1) correlation between cumulative number of VT events and GNSS-derived ring fault creep; 2) agreement between repeating earthquake and GNSS derived creep rates; and 3) consistency between the time dependence of mechanically-modeled, creep-driven seismicity and observations. We further show that, ring fault creep can be explained by a combination of velocity strengthening friction and/or viscous shear zone rheology. The simultaneous occurrence of creep and seismicity highlights the spatially heterogeneous velocity weakening/strengthening friction on the ring fault. If this correlation between VT seismicity and creep occurs at other basaltic volcanoes, it would suggest that VT seismicity can be used as a proxy for ring fault creep in the absence of GNSS measurements on subsiding caldera blocks.