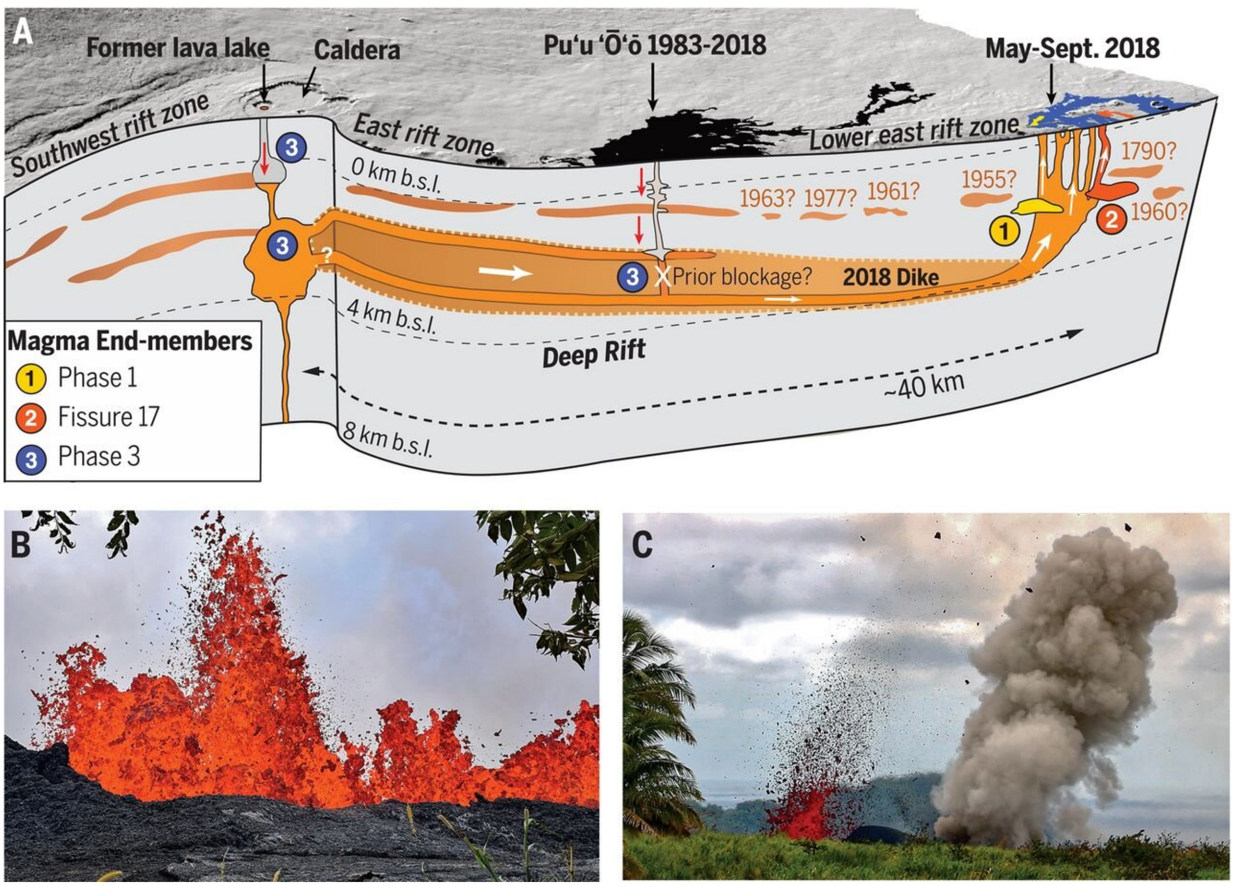
Three studies describe different parts of the 2018 Kīlauea caldera collapse

December 6 2019, by Bob Yirka



The 2018 lower east rift zone eruption of Kīlauea Volcano with inferred magma sources and pathways. (A) Simplified model of Kīlauea's magma system feeding the 2018 lower east rift zone eruption and locations of hypothesized magma end-members (b.s.l., below sea level). (B) Fluid basalt erupting from fissure 20 on 20 May 2018. (C) Fissure 17 erupting andesite more explosively 800 m away. Photos by U.S. Geological Survey. Credit: *Science* 06 Dec 2019: Vol. 366, Issue 6470, eaaz0147, DOI: 10.1126/science.aaz0147

Three separate teams working independently have learned more about what happens during a slow-moving volcanic caldera collapse by studying the 2018 Kīlauea eruption in Hawaii. Each has published their findings in the journal *Science*. Freysteinn Sigmundsson with the University of Iceland has published a companion piece in the same journal issue giving an overview of caldera collapse, and outlining the work by the three teams.

Caldera collapse occurs when the crater formed after a volcanic eruption collapses down into the ground below it. In the case of the Kīlauea eruption, the collapse involved drainage of the lava lake that was sitting in its crater—many described it as looking like a bucket of water draining into a hole in its bottom. Some calderas collapse quickly, while others collapse slowly. In the case of the Kīlauea eruption, the collapse occurred over a three-month span, giving scientists ample time to study it in detail.

All three studies were carried out by researchers from institutions across the U.S. and two in Japan—in the first, a group from the U.S. Geological Survey reported that the eruption led to the collapse and not the other way around, as some had suggested. They also found that it took surprisingly little released magma during the initial stages of the collapse to instigate the larger collapse that followed—just 3.5 to 4 percent of the magma in the lava lake.

A second team from the University of Hawaii, with assistance from the U.S. Geological Survey, found that pockets of different types of magma from the collapse helped build what they describe as an advancing dike that played a role in the formation of a new underground system. They also found that sensor data could be used to forecast the appearance of hotter magma flows as they shifted from slower-moving, highly-viscous flows—a find that could prove useful for advanced warnings near similar volcanoes in the future.

The third team, with members from the U.S. Geological Survey, Hiroshima University and Kanazawa University found that swiftly moving magma surges far from the caldera had ties to changes in pressure from the collapsing caldera—though longer-term changes were more closely related to the amount of magma that was drained from the caldera.

More information: Cheryl Gansecki et al. The tangled tale of Kīlauea's 2018 eruption as told by geochemical monitoring, *Science* (2019). DOI: 10.1126/science.aaz0147

M. R. Patrick et al. Cyclic lava effusion during the 2018 eruption of Kīlauea Volcano, *Science* (2019). DOI: 10.1126/science.aay9070

Kyle R. Anderson et al. Magma reservoir failure and the onset of caldera collapse at Kīlauea Volcano in 2018, *Science* (2019). DOI: 10.1126/science.aaz1822

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