Kīlauea Volcano is more complicated than we used to think

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In the past 25 years, remarkably challenging concepts about Kīlauea have both clarified and complicated our view of the volcano. Many researchers contributed to the new ideas; Mike Garcia is among the most prolific. This session focuses on geochemical advances, but I deal with other aspects of the 'Kīlauea revolution.'

Geologic cross sections using structural and petrologic data from seafloor studies indicate that the core of Kīlauea is ~3 km thick and rests on ≥4 km of Mauna Loa pillow basalt [1, 2]. A seismogenic detachment fault separates Mauna Loa from the old seafloor, and a shallower less seismogenic detachment may separate Mauna Loa and Kīlauea.

Arguably, Kīlauea began erupting alkalic lava about 300 ka and entered its tholeiitic stage 100-125 ka, when the east rift zone likely began to form [3]. Thereafter, the active east rift zone migrated SE ~6.5 km away from the summit caldera, necessitating formation of a southeast-trending 'connector' that carries magma from summit storage into the rift zone.

Temporally varying isotopic compositions [4, 5] suggest varying magma supply rates, defined as the rate at which magma reaches shallow storage or erupts. Analysis of geodetic data indeed found that supply rates vary over months to centuries [6]. Whether this variance is caused by changes in melting rate, pathway dynamics, or both is one of the challenging problems facing workers at Kīlauea.

In the past 2,500 years, Kīlauea had two dominantly explosive periods and three dominantly effusive periods, each lasting several centuries [7]. The magma supply rate during explosive periods was only a few percent of that during effusive periods. Explosive periods are associated with a deep caldera. Trying to relate these different observations into a coherent model is a hot research topic today.

[1] Lipman *et al.* (2006) *JVGR* **151**, 73-108 [2] Coombs *et al* (2006) *JVGR* **151**, 19-49 [3] Lipman & Calvert (2013) *Geosphere* **9**, 1348-1383 [4] Pietruszka & Garcia (1999) *J Pet* **40**, 1321-1342 [5] Pietruszka *et al.* (2018) *J Pet* **59**, 2311-2352 [6] Dzurisin & Poland (2018) *Geol Soc Am Spec Pap* **538**, 275-295 [7] Swanson *et al* (2014) *Geol* **42**, 631-634