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The Mauna Loa 2022 Eruption: Do Unusually Evolved Compositions Signify a Decline in Mauna Loa Magma Supply Rates?

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In late 2022 (Nov. - Dec.) Mauna Loa erupted approximately 150 x 10^6 m^3 of lava in 11 days from vents above 3300 m elevation. Spanning a distance of 17 km, these vents included fissures from the summit and south caldera, and four vents on the northeast rift zone. The samples (water-quenched lava flows, spatter, tephra) derived from all vents are remarkably uniform in composition through space and time. They are the most evolved Mauna Loa lavas (MgO = 6.25 wt.%: Mg-value = 0.5207) since before 1843, with those of the preceding 1984 eruption having average MgO of 6.69 wt.% (Mg-value = 0.5504). Lavas from 2022, and similarly homogenous 1984 lavas, are representative of magmas stored in the shallow (2 - 4 km) summit magma reservoir.

Neither the 1984 or 2022 magmas show any whole-rock geochemical evidence of mixing with more primitive magmas through recharge, or with evolved magmas residual from prior eruptions. We can reconstruct the 2022 magma composition through cooling and ~9 % total crystallization of the 1984 magma. One possibility is that there has not been significant recharge from a more primitive magma into the shallow reservoir. Or there may have been recharge, but its signal is masked by assimilation with the stored magmas. Since 1950, the repose times of eruptions are 25, 9, and 38 years, and the accompanying order of magnitude decline in lava accumulation rates (6.5 x10^6 m^3/yr compared with a pre-1950 average of 40 x10^6 m^3/yr). These factors indicate a diminishing magma supply to the summit reservoir over the last 72 years. A major question remains: what has happened to the magma that is thought to be responsible for Mauna Loa's slow but steadily continuing inflation immediately following the 1984 eruption? More work is needed to distinguish between episodic recharge, consistent with geophysical data, and simple fractionation for the compositions erupted.