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Eruption of the Tajogaite Volcano (La Palma, 2021): Deciphering its Temporal Magmatic Evolution

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La Palma is the most volcanically active island in the Canary Archipelago (Spain), with seven eruptions since AD 1585. The most recent eruptions occurred in the southern region of the island, along the Cumbre Vieja rift, include those of 1949 (San Juan), 1971 (Teneguía), and 2021 (Tajogaite), with the 2021 and 1949 eruptive centers located in close proximity to one another. The Tajogaite eruption, although similar in many respects to the two previous eruptions (all started with a basanitic magma bearing amphiboles and pyroxenes and evolved to a basanitic-tephritic magma with pyroxenes and olivines), has raised concerns regarding its longer duration (85 days) and its higher explosivity. In this study we collected a suite of lavas and tephras spanning the duration of the 2021 eruption, which we have analyzed for whole-rock major and trace elements compositions, Sr-Nd-Pb-Hf isotopic ratios, and $^{210}Pb/^{226}Ra$ activity ratios to better constrain the temporal-geochemical evolution and petrogenetic processes. The lavas and tephras follow similar compositional trends: both exhibit a small range in major element abundances (e.g., MgO = 6-8 wt.%; SiO_2 ~43.8-44.8 wt.%), with MgO slightly increasing in the first stage of the eruption (September-early October) but stabilizing by late October-early November. SiO_2 and FeO vary inversely with one another and show somewhat more complex variations through time, with SiO_2 increasing slightly in the early stage, followed by a slight decrease by November, and ending with a small increase in the last stage (December). Incompatible trace element abundances and ratios (e.g., Ba, La, Zr, La/Yb) show a general decrease through time and with increasing MgO, but exhibit more complex variations with SiO_2, collectively indicating the involvement of multiple magma batches. Variations in Sr, Nd, Pb, and Hf isotopes indicate that these magmas were produced by melting of a heterogeneous mantle source, similar in composition to that of the 1949 and 1971 eruptions. Additionally, preliminary $^{210}Pb/^{226}Ra$ data suggest that early erupted magmas may be in radioactive equilibrium, followed by eruption of magmas with lower $^{210}Pb/^{226}Ra$ activity ratios (to ~0.75), potentially consistent with involvement of both newly generated magma(s) and a preexisting magma that experienced prolonged crustal storage.