Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10153

Geochemistry of the new submarine volcano next to Mayotte (Comoros Archipelago)

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In spring 2018, a new submarine volcano formed at about 50 km east of Mayotte in the Comoros Archipelago. Several scientific expeditions studied the submarine structure and determined that 5 km^3 of lavas erupted in a year [1]. Here we present a comprehensive set of geochemical and isotopic data characterizing this new volcano.

Samples have major elements typical of alkaline series with a bimodal suite of basanites and phonolites. The basanites have tightly clustered Sr, Nd, Hf and Pb isotopes similar to the least radiogenic data published for Mayotte. Phonolites are similar except for their Pb isotopes with lower $^{207}Pb/^{204}Pb$ at similar $^{206}Pb/^{204}Pb$. While the basanites isotopic compositions are common for ocean island basalts, their trace elements display striking features with Ba/Th>250 and Ce/Pb >60. To our knowledge, such values have never been reported for other OIB and although the origin of such peculiarities is unclear, it remains that high Ce/Pb is often found in basalts with HIMU characteristics. In contrast, the phonolites have much lower Ba/Th (<50) and Ce/Pb (<40), a difference that could be due to fractionation of mineral phases during the transition from basanites to phonolites.

The origin of the positive Ba anomaly in basanites could be suspected to be due to interactions between seawater and lavas during eruption. However, the combined Ba contents and Ba isotopic compositions of both basanites and phonolites suggest that the excess Ba cannot not be explained by water/rock interaction after emplacement. It must be present in the source of the lavas, potentially as barite in recycled oceanic crust.

The lack of age progression along the Comoros Archipelago, with both the oldest and the most recent volcanism present at Mayotte precludes a simple linear plume migration along the chain. However, it remains that the geochemical and isotopic characteristics of the new submarine volcano are similar to plume-induced volcanics. This suggests that magmas with deep origin find their way to the surface through an elongated lithospheric weak zone to produce an archipelago without age progression.

[1]: Feuillet et al., Nature Geoscience, 2021.