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# Kamafugites and kamafugites: a comparison of the Ugandan, Brazilian and Italian variants

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The definition and origin of kamafugites (kalsilite-bearing volcanic rocks) remain a poorly constrained aspect of igneous petrology. Kamafugites occur in different geodynamic settings and are characterised by different geochemical and isotopic compositions. True kamafugites occur in Uganda (western branch of East African Rift), Brazil (Alto Paranaiba and Goiás Alkaline Provinces) and Italy (Intra-Apennine Province) only. For each of these areas different and often contrasting petrological models have been proposed.

Kamafugites from the three provinces show similar parageneses. The main difference is the olivine content, ranging from <1% (Cupaello, Italy) to ~25% (San Venanzo, Italy). Kamafugites are moderately ultrabasic/basic ($SiO_2$ = 33.7-46.8 wt%), with variable CaO (4.6-16.1 wt%) and alkali enrichment. Ugandan and Italian rocks show potassic to ultrapotassic affinity ($K_2O/Na_2O$ = 1.8-7.8 and 5.5-9.1, respectively), while Brazilian kamafugites have lower $K_2O/Na_2O$ (0.4-2.7). Ugandan and Brazilian kamafugites have similar major element compositions, with higher $TiO_2$ (3.6-5.8 wt% and 3.6-6.4 wt%) and MgO (6.4-22.2 wt% and 13.5-20.5 wt%) than the Italian variants ($TiO_2$ = 0.7-1.1 wt% and MgO = 9.9-14.0 wt%). Ugandan and Brazilian products share comparable trace element enrichments, with overlapping trends on diagrams, coupled with similar $^{87}Sr/^{86}Sr$ (0.7049-0.7056 and 0.7051-0.7057). $^{143}Nd/^{144}Nd$ values are generally lower in Brazil (0.51213-0.51227) than in Uganda (0.512531-0.512571). Also Pb isotopes are slightly different ($^{206}Pb/^{204}Pb$ = 19.19-19.93 in Uganda and 17.66-19.89 in Brazil). Italian kamafugites differ in geochemical (high Th, U-Pb, low Nb-Ta, Eu negative anomaly) and isotopic compositions (extremely radiogenic $^{87}Sr/^{86}Sr$ and $^{206}Pb/^{204}Pb$, unradiogenic $^{143}Nd/^{144}Nd$). These characteristics likely reflect the presence of subduction-modified mantle sources and sediment recycling beneath central Italy.

The data speak for metasomatized sources involving carbonate, with similar mantle parageneses (phlogopite, clinopyroxene), suggested by the samples affinities. The heterogeneities highlight variable contributions to the melt from clinopyroxene and phlogopite in the three provinces, and different amounts of accessory phases, such as apatite and Ti/Fe-bearing opaques, that play a key role for melt compositions. Brazilian kamafugites require a slightly different source, with stronger contribution of olivine from the former lherzolitic mantle.