Petrological, geochemical and isotopic characterization of kamafugites from East-Central Africa, Italy and Brazil: a review

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Table of contents

2. Data Description

Kamafugites are 'exotic igneous rocks' with mineralogical and chemical compositions that differ from those observed in common magmas.

Despite their importance, kamafugites are still a poorly constrained topic and they lack a general petrological model due to their variable petrographic, geochemical and isotopic features. A detailed comparison among kamafugites is necessary to obtain a deeper understanding of the processes involved in their petrogenesis and of their strongly metasomatised mantle sources. Therefore, this data publication doesn't only provide new data from kamafugites, but a comprehensive data compilation for kamafugite samples in the Western branch of the East Africa Rift (WEAR) in Uganda and Democratic Republic of Congo, the Intra-Apennine Province (IAP), as well as for the Alto Paranaiba (APIP) and Goiás (GAP) provinces in Brazil. 97 kamafugite whole-rock data for the WEAR, 42 for IAP and 51 for APIP and GAP have been collected and compared to highlight similarities and differences, aiming to reconstruct their petrogenesis.

2.1. Analytical procedures

Laboratory: Laboratory of Geochronology and Radiogenic Isotope Geochemistry - Pisa1 (IGG-CNR, IT)

In this section we only refer to the new isotopic data acquired on Italian and Brazilian kamafugites.

- Polished thin sections (28 mm × 48 mm) were prepared at the Dipartimento di Scienze della Terra of the Sapienza University of Rome, after a macroscopic selection. Petrographic analyses have been carried out using a Zeiss Axiophot transmitted polarized light microscope, under plane-polarized light and crossed polars. Micrographs were acquired by means of a digital camera.
- New isotopic data (Sr-Nd-Pb) have been measured for five Brazilian kamafugites to provide a coherent dataset. The isotope ratios are corrected for in-situ decay using an age of ~80 Ma. We have also performed seven new boron isotope ratios on Italian samples.
- Sample preparation for the isotopic geochemistry was performed in clean rooms, class 100 for Sr and Pb, and class 1000 for Nd, at the Laboratory of Geochronology and Radiogenic Isotope Geochemistry - Pisa1 (IGG-CNR, Italy). Specific resin (Eichrom for Sr; BioRAD AG MP-50 resin for REE and then Eichrom Ln resin for Nd; Bio-Rad 200-400 mesh AG50W-X8 exchange resin for Pb; ion-exchange resin, 20-50 mesh amberlite, and AG 50 W-X8 cation-exchange resin, 200-400 mesh, for B), in a multi-stage process were used to separate the elements of interest from the matrix. Isotopic analyses (Sr-Nd-Pb and B systematics) were conducted at the Laboratory of Geochronology and Radiogenic Isotope Geochemistry - Pisa1 (IGG-CNR, Italy) using a ThermoFisher Neptune Plus MC-ICP-MS. Measurements were carried out on 2% HNO_3 solutions, which include ~20-200 ng/g of analyte. Full analytical details can be found in Agostini et al. (2021, 2022).

3. File description

3.1.File inventory

- **2025-025_Innocenzi-et-al_Kamafugite-geochemistry**: The file provides whole-rock geochemical and isotopic data compiled from literature for all the studied kamafugite samples: 97 for samples from the Toro Ankole and Virunga (Western branch of the East Africa Rift. Uganda and Democratic Republic of Congo), 42 for Intra-Apennine Province (Italy) and 51 for Alto Paranaiba and Goiás provinces (Brazil).

- **2025-025_Innocenzi-et-al_Diagrams**: The file contains classification diagrams (as TAS and K_2O vs Na_2O, used to classify 'normal' and exotic rocks) and Harker diagram for all the different volcanic provinces, to highlight similarities and differences, but also evolution trends.
- **2025-025_Innocenzi-et-al_03_Partial-melting-model**: The file contains simple mass-balance calculation model for partial melting of the mantle source, developed using the Microsoft Excel Solver routine for three primitive kamafugite compositions.

Table 1: Files

File name	Format	File description
2025-025_Innocenzi-et-al_01_Kamafugite-geochemistry	xlsx	Whole-rock geochemical and isotopic compositions of kamafugites from Toro Ankole, Virunga, Alto Paranaiba, Goiás and Intra-Apennine provinces. Each reference is associated to the laboratory used and the relative method.
2025-025_Innocenzi-et-al_02_Diagrams	xlsx	Classification diagrams and Harker diagrams for whole-rock geochemical and isotopic compositions of kamafugites.
2025-025_Innocenzi-et-al_03_Partial-melting-model	xlsx	Partial melting model for the primitive kamafugite magmas, reconstructing the melting assemblage of each province.
2025-025_Innocenzi-et-al_04_References	xlsx	List of references and lookup table for the reference codes used in the data tables.

3.2. Description of data tables

2025-025_Innocenzi-et-al_01_Kamafugite-geochemistry

The file 2025-025_Innocenzi-et-al_Kamafugite-geochemistry.xlsx contains geochemical compositions and isotope ratios for kamafugites from Africa, Italy and Brazil. All the literature data available have been collected for a full comparison. The rock samples are taken from: WEAR (Western branch of the East Africa Rift; Uganda and Democratic Republic of Congo), IAP (Intra-Apennine Province; Italy), APIP (Alto Paranaiba Igneous Province; Brazil) and GAP (Goiás Alkaline Province; Brazil). Each worksheet represents the results for the specified study areas. Bold data are the one authors directly studied, both in previous manuscripts and in the present work.

The worksheets in this file are structured as shown in table 2.

Table 2: Common variables in worksheets WEAR, IAP, APIP and GAP

Column header(s)	Unit	Description
Series Name	-	Area of origin of the samples
Series N°	-	Series number as reported on the diagrams
Locality	-	Specific volcanic province or district
References	-	Reference identifiers, citation and link to resource to be found in worksheet "References"
Rock Type	-	Classification of the rock
Age	Ma	Age of the rock
SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, L.O.I., CO_2, Total	Mass %	Major oxides and L.O.I. for each sample.
$^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$, $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, $^{208}Pb/^{204}Pb$, $^{208}Pb/^{206}Pb$, $^{207}Pb/^{206}Pb$, D7/4, D8/4, $\delta^{11}B$	-	Isotopic ratio (Sr-Nd-Pb-B) for each sample
Mg#	-	Mg number of each sample
Ti, K, P	ppm	Ppm values for some major oxides
Na_2O+K_2O, K_2O/Na_2O, Na_2O/K_2O, CaO/Al_2O_3, K_2O/Al_2O_3, PI, 1/PI, ASI, R1, R2, K_2O/SiO_2, K/Al	-	Classification parameter used in the diagrams to identify the rock type
Rb, Sr, Ba, Cs, Sc, V, Cr, Co, Ni, Cu, Zn, Y, Zr, Nb, Hf, Ta, La, Ce, Pr, Nd, Sm, Eu,	ppm	Trace elements for each sample

Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Pb, Th, U, Ga		
LaN, CeN, PrN, NdN, SmN, EuN, GdN, TbN, DyN, HoN, ErN, TmN, YbN, LuN	-	Rare Earth Elements normalised for comparison
Ba/Nb, Ba/La, La/Nb, Ti/Nb, Ce/Pb, Nb/U, Rb/Sm, Zr/Nb, Ba/Th, Th/Ta, Ta/Yb, Th/Yb, Nb/Y, K/La, Nb/Nb*, La/Lu, (La/Lu)N, (La/Sm)N, La/Yb, Hf/Nd, Sm/Yb, Sr/Yb, Sr/Nd, Sr/Eu*, Eu/Eu*, 1/Sr, Zr/Y, Nb/Ta, DNb, Nb*100/Zr, Th*, 100/Zr, CaO*100/Sr, Cs/La, Th/Nb, Pb/Pb*	-	Discrimination ratios useful to highlight different petrological processes
SiO_2(LOI free), TiO_2(LOI free), Al_2O_3(LOI free), Fe_2O_3(LOI free), MnO(LOI free), MgO(LOI free), CaO(LOI free), Na_2O(LOI free), K_2O(LOI free), P_2O_5(LOI free), Sum	Mass %	Major oxides recalculated to 100%, not considering L.O.I. values

2025-025_Innocenzi-et-al_02_Diagrams

Table 3: Description of classification and Harker diagrams reported in the file 2025-025_Innocenzi-et-al_Diagrams

Worksheet	Description
TAS	Total alkali vs. silica diagram (Le Maitre, 2002)
Classification diagrams	Other classification diagrams for alkaline rocks
Major vs CaO	Harker diagrams for major oxides vs. CaO
Majors vs CaO	Harker diagrams for major oxides vs. CaO. In this sheet all the different sampling localities have been divided on the diagrams to highlight the differences.
Major vs MgO	Harker diagrams for major oxides vs. MgO
Trace vs CaO	Harker diagrams for trace elements vs. CaO
Traces vs CaO	Harker diagrams for trace elements vs. CaO. In this sheet all the different sampling localities have been divided on the diagrams to highlight the differences.
Trace vs MgO	Harker diagrams for trace elements vs. MgO
Isotope	Harker diagrams for Sr-Nd-Pb-B ratios
Isotopes	Harker diagrams for Sr-Nd-Pb-B ratios. In this sheet all the different sampling localities have been divided on the diagrams to highlight the differences.
PM normalized	primitive mantle normalized diagrams for worldwide kamafugites
CI normalized	CI chondrite normalized diagrams for worldwide kamafugites

2025-025_Innocenzi-et-al_03_Partial-melting-model

Partial melting model: blue for WEAR, green for IAP and red for APIP.

Table 4: Description of the different factors considered in the partial melting model from this study.

Column header	Unit	Description
SiO_2, TiO_2, Al_2O_3, FeO, MgO, CaO, Na_2O, K_2O, P_2O_5	Mass %	Major oxide composition of the main mineral phases
Sum	Mass %	Total for each mineral phase
Melting %	%	Percentage of melting of each phase, estimated in the model
ΣR2	-	The sum of residual squared values
Toro Ankole	Mass %	Major oxides composition of the chosen starting sample
Melt	Mass %	Calculated composition of the melt
Difference	Mass %	Difference between the sample and the melt compositions

2025-025_Innocenzi-et-al_04_Kamafugite-References

Table 5: References

Column header(s)	Description
Reference Code	Reference identifiers as mentioned in “References” columns of WEAR, IAP, and APIP and GAP
Reference (short citation)	Short citation of the resource
DOI/URL	Link to resource
Reference	APA formatted citation of the resource

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Editorial note: all references are grouped according to regions and sorted alphabetically for each region. Both regions in Brazil are combined.

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