Mineral-scale geochemistry of primitive lavas from Bufumbira, Uganda: implications for rift magmatism

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Magmatism in the Western Branch of the East African Rift System is characterized by low volume, alkaline mafic melts, which are derived from metasomatized lithospheric mantle and lack evidence of mantle plume input. We focus on the Bufumbira (Uganda) cinder cones in the Virunga Volcanic Province, where bulk geochemistry suggests that primitive lavas are derived from a deep metasomatized SCLM source (garnet + phlogopite-bearing pyroxenite). Source isotopic and mineralogical compositions vary on a short spatial scale due to heterogeneity of metasomes in the lithospheric mantle. We explore the role of this metasomatic heterogeneity in magma petrogenesis, and the relationship between rift magmatism and lithospheric strength and stability. Crystal cargo found in Bufumbira lavas reveals a complex history of magmatic evolution: clinopyroxenes show disequilibrium textures and zoning, with multiple distinct core compositions interpreted as xenocrysts/antecrysts, and rim/ phenocryst compositions enriched in ITE, particularly LREE. Xenoliths from these lavas contain cpx with compositions similar to phenocrysts. Olivine phenocrysts reflect early melt compositions and display trace element enrichments (e.g. Li, Zn, Sc) that suggest control on trace element partitioning by metasomatic phases (e.g. phlogopite). We propose that variably metasomatized lithosphere in the Western Branch plays a significant role in magmatism, as well as in the mechanical facilitation of lithospheric rifting.