Title: **The Timing of Early Magmatism and Extension in the Southern East African Rift: Tracking Geochemical Source Variability with $^{40}Ar/^{39}Ar$ Geochronology at the Rungwe Volcanic Province, SW Tanzania**

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Abstract

The Rungwe Volcanic Province is the southernmost expression of volcanism in the East African Rift System. Rungwe magmatism is focused in a transfer zone between two weakly extended rift segments, unlike more developed rifts where magmatism occurs along segment axes (e.g. mid-ocean ridges). Rungwe was selected as the site of the multinational SEGMeNT project, an integrated geophysical, geochronological and geochemical study to determine the role of magmatism during early stage continental rifting. Argon geochronology is underway for an extensive collection of Rungwe volcanic rocks to date the eruptive sequence with emphasis on the oldest events. The age and location of the earliest events remains contested, but is critical to evaluating the relationship between magmatism and extension. Dated samples are further analyzed to model the geochemistry and isotopic signature of each melt's source and define it as lithospheric, asthenospheric, or plume. Given the goals, the geochronology focuses on mafic lavas most likely to preserve the geochemical signature of the mantle source. Groundmass was prepared and analyzed at the LDEO AGES lab. Twelve preliminary dates yield ages from 8.5 to 5.7Ma, consistent with prior results, supporting an eruptive episode concurrent with tectonic activity on the Malawi and Rukwa border faults (Ebinger et al., JGR 1989; 1993). Three additional samples yield ages from 18.51 to 17.6 Ma, consistent with the 18.6 ±1.0 Ma age obtained by Rasskazov et al. (Russ. Geology & Geophys. 2003). This eruptive episode is spatially limited to phonolite domes in the Usangu Basin and a mafic lava flow on the uplifted Mbeya Block. These eruptions predate the current tectonic extensional structure, suggesting magmatism predates extension, or that the two are not highly interdependent. No Rungwe samples dated yet can be the source of the of 26Ma carbonatitic tuffs in the nearby Songwe River Basin sequence (Roberts et al., Nature Geoscience 2012). Isochron ages from mica separates of two carbonatite complexes upstream in the drainage basin were dated and yield Jurassic ages of 165.7 ±1.3 Ma for Panda Hill and 154.2 ±0.9 Ma for Mbalizi, older than prior age estimates (Bowden, Nature 1962; Pentel'kov & Voronovskly, Doklady Akad Nauk 1977). These results leave the source of tuffs in the Songwe River Basin unresolved.