

Helium isotopes at Rungwe Volcanic Province, Tanzania, and the origin of East African Plateaux

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Abstract

We report helium isotope ratios ($^3\text{He}/^4\text{He}$) of lavas and tephra of the Rungwe Volcanic Province (RVP) in southern Tanzania. Values as high as 15RA (RA = air $^3\text{He}/^4\text{He}$) far exceed typical upper mantle values, and are the first observation of plume-like ratios south of the Turkana Depression which separates the topographic highs of the Ethiopia and Kenya domes. The African Superplume - a tilted low-velocity seismic anomaly extending to the core-mantle boundary beneath southern Africa - is the likely source of these high $^3\text{He}/^4\text{He}$ ratios. High $^3\text{He}/^4\text{He}$ ratios at RVP together with similarly-high values along the Main Ethiopian Rift and in Afar provide compelling evidence that the African Superplume is a feature that extends through the 670-km seismic discontinuity and provides dynamic support - either as a single plume or via multiple upwellings - for the two main topographic features of the East Africa Rift System as well as heat and mass to drive continuing rift-related magmatism.