Southwestern Africa on the burner: Pleistocene carbonatite volcanism linked to mantle upwelling in Angola

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The origin of intra-plate carbonatitic to alkaline volcanism in Africa is controversial. A tectonic control is suggested by correlation with lithospheric sutures, repeated magmatic cycles in the same areas over several Myr, synchronicity across the plate, and lack of clear age progression patterns. Conversely, a role for mantle convection in triggering intra-plate magmatism is supported by the coincidence of Cenozoic volcanism with regions of lithospheric uplift, positive gravity anomalies and slow surface-wave velocities. To improve constraints on the genesis of African volcanism, here we report the first radiometric and isotopic results for the Catanda complex, which hosts the only extrusive carbonatites in Angola. Apatite (U-Th-Sm)/He and phlogopite $^{40}Ar/^{39}Ar$ ages of Catanda lavas indicate eruption at ~500–800 ka, some 100 Ma after emplacement of abundant kimberlites and carbonatites in this region. The lavas share similar HIMU-like Sr-Nd-Pb-Hf isotope compositions with other young mantle-derived volcanics from Africa (e.g., East Africa Rift; Cameroon Line). The position of the Catanda complex at the intersection between the Lucapa corridor, a long-lived extensional structure, and the Atlantic Hinge line, suggests a possible tectonic control for the volcanism. The complex is also located on the Bié Dome, a broad region of fast Pleistocene uplift attributed to mantle upwelling. Seismic tomography models indicate convection of deep hot material beneath regions of active volcanism in Africa including a large area encompassing Angola and northern Namibia. This is strong evidence that intra-plate late-Cenozoic volcanism, including the Catanda complex, resulted from the interplay between mantle convection and pre-existing lithospheric discontinuities.