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Long-term, deep-mantle support of the Ethiopia-Yemen Plateau: implication for mantle dynamics

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Ethiopia is a key site to investigate the interactions between mantle dynamics and surface processes because of the presence of the Main Ethiopian Rift (MER), Cenozoic continental flood basalt volcanism, and plateau uplift. The role of mantle plumes in causing Ethiopia's flood basalts and tectonics has been commonly accepted. However, the location and number of plumes and their impact on surface uplift are still uncertain. Here, we present new constraints on the geological and topographic evolution of the Ethiopian Plateau (NW Ethiopia) prior to and after the emplacement of the large flood basalts (40-20 Ma). Using geological information and topographic reconstructions, we show that the large topographic dome that we see today is a long-term feature, already present prior the emplacement of the flood basalts. We also infer that large-scale doming operated even after the emplacement of the flood basalts. Using a comparison with the present-day topographic setting we show that an important component of the topography has been and is presently represented by a residual, non-isostatic, dynamic contribution. We conclude that the growth of the Ethiopian Plateau is a long-term, probably still active, dynamically supported process. Our arguments provide constraints on the processes leading to the formation of one of the largest igneous plateaus on Earth.

