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High magma flux beneath Corbetti caldera (Ethiopia) accommodated by a ductile and compressible reservoir

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Large silicic magma reservoirs preferentially form in the upper crust of

extensional continental environments. However, our quantitative understanding of the link between mantle magmatism, silicic reservoirs and surface deformation during rifting is very limited. Here, we focus on Corbetti, a peralkaline caldera in the densely-populated Main Ethiopian Rift, which lies above a focused zone of upper mantle partial melt and has been steadily uplifting at ≤6.6±1.2 cm yr−1 for more than ten years. We show that a concomitant residual gravity increase of ≤9±3 μGal yr−1 by the intrusion of mafic magma at 7 km depth into a compressible and inelastic crystal mush best explains the uplift. The derived magma mass flux of 10^11 kg yr−1 is anomalously high

and at least one order of magnitude greater than the mean long-term mass

eruption rate. We demonstrate that periodic and high-rate magmatic rejuvenation of upper-crustal mush is a significant and rapid contributor to mature continental rifting.