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The September to November 2024 Fentale dike in the Ethiopian rift

Derek Keir^{1,2}, Alessandro La Rosa³, Carolina Pagli³, Hua Wang⁴, Atalay Ayele⁵, Elias Lewi⁵, Fernando Monterroso⁶, and Martina Raggiunti⁷

¹University of Southampton, Southampton, United Kingdom (d.keir@soton.ac.uk)

²University of Florence, Florence, Italy

³University of Pisa, Pisa, Italy

⁴South China Agricultural University, Guangzhou, China

⁵Addis Ababa University, Addis Ababa, Ethiopia

⁶Institute for Electromagnetic Sensing of Environment (IREA), National Research Council (CNR), Naples, Italy

⁷National Institute for Geophysics and Volcanology (INGV), Rome, Italy

Dikes can contribute to rifting, but the space-time behavior and role of magma in young and slowly extending continental rifts is unclear. We use observations and modelling of InSAR and seismicity during the September to November 2024 Fentale intrusion in the Main Ethiopian rift (MER) to understand magma-assisted rifting at slow extension rates (5 mm/yr). From 2021 to mid-2024, the Fentale Volcanic Complex (FVC) uplifted up to 6 cm. From mid-September 2024, upper crustal diking started northwards along the rift, initially with subdued seismicity. From late-September to early November, dike opening increased to ~2m and propagated a total of ~14km north, causing increased seismicity from normal faulting. The dike made ~90% of the total geodetic moment, with the rest from faulting. The character of the event is similar to rifting episodes at mid-ocean ridges and demonstrates that episodic diking can occur in young, slow extending continent rifts but must be more infrequent. This marks the start of a major rifting episode.