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How the differential load induced by normal fault scarps controls the distribution of monogenic volcanism

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Understanding shallow magma transfer and the related vent distribution is crucial for volcanic hazard. In the present study we investigate the link between the stress induced by topographic scarps and the distribution of monogenic volcanoes at divergent plate boundaries. With a numerical model of dyke propagation we show that vertical dykes beneath a normal fault scarp tend to deflect towards the footwall side of the scarp. This effect increases with the scarp height, is stronger for dykes propagating underneath the hanging wall side, and decreases with the distance from the scarp. A comparison to the East African Rift System, Afar and Iceland shows that: 1) the inner rift structure, which shapes the topography, controls shallow dyke propagation; 2) differential loading due to mass redistribution affects magma propagation over a broad scale range (10^0 - 10^5 m). Our results find application to any volcanic field with tectonics- or erosion-induced topographic variations.