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Landforms and structures associated with volcano spreading

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The gravitational load of a volcanic edifice is recognised to cause modifications to the underlying substrate and ductile intrusive complexes, producing lateral motion away from the centre and in turn resulting in the development of structures and deformation fields on the volcano. Previous work has concentrated on laterally homogenous systems, resulting in relatively simple structures, which although clear are not necessarily comparable to real-life settings. We use a series of analogue models to show the structures and deformation fields deriving from variations in both the edifice shape and the weak substrate dimensions.

There are significant differences in the structure and deformation fields of central volcanoes (e.g. Mount Etna; Concepción) compared to “ridge-like” volcanic complexes (e.g. Poas, Kilauea). Single volcanoes with realistic topography have a system of summit grabens and conjugate strike-slip faults at the base, which relay the deformation away from the volcano. “Ridge-like” edifices present a straight deformation front, which forces the formation of basal thrusts, which in turn act as the limit for deformation. The form of structures and deformation on the edifice is also influenced by the slope of the underlying substrate, and may cause a situation where spreading is confined to a sector of the cone, increasing the potential of catastrophic collapse of the volcano flank. We use morpho-structural comparisons with the global SRTM dataset to show that the features developed in the models are present on numerous volcanoes in differing tectonic settings, and as such volcano spreading should be considered one of the dominant modifying processes at volcanoes.