

A Comparison of Rift-Associated Volcanic Fields in LIPs on Earth and Venus

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Rift-associated volcanic fields have been observed on both Earth and Venus, with strong morphological analogues between Venusian rift-dominated rises (Atla Regio) and rifted LIPs on Earth (East Africa) [1]. Earth-based geospatial methodologies can therefore be applied to Venus, with scope for interplanetary comparisons on the structure, controls and formation of volcanic fields [2]. Based on previous studies in the Ethiopian rift [3], a series of volcanic fields associated with a rift-arm of Atla Regio were analysed in order to make inferences on the nature of the Venusian subsurface. Field shape, the spatial distribution of vents, and volcanic alignments at several scales were charted and correlated to fault sets in the studied area. The results of these analyses reveal scale-dependent controls on field formation, with competition between rift-kinematics, magmatic flux and plume activity.

On Venus, field-scale alignments, such as elongation directions, are disparate to intrafield volcanic alignments, suggesting a decoupled crustal stress regime. Intrafield alignments appear to be strongly controlled by brittle upper-crustal stresses and correspond to cogenetic fault sets; coupling this data to stratigraphic analyses allows a progression in σ_3 to be tracked over time. One volcanic field evidences radial dyking under differential stress, with updoming diameters of 340km. On Earth, at this scale, the source might be attributed to focused upwelling of a mantle plume beneath a lithosphere of variable thickness [4]. On Venus, this has been suggested to result from stalled plumes at depth which give rise to smaller, secondary plumes that impinge on the base of the lithospheric lid [5,6].

Further investigation into Venusian rift-volcanic fields and the application of robust numerical methods will shed light onto the role of small-scale intraplate magmatism. Comparison to Earth-based studies will allow constraints to be placed on how strain is accommodated in Venusian rift settings.

References:

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