RIFT–ASSOCIATED CLUSTER VOLCANISM IN SW ATLA REGIO, VENUS. D. D. Cirium[1] and P. J. Mason[1]. [1]Imperial College London, Exhibition Rd, South Kensington, London, SW7 2BU, ddc17@ic.ac.uk, p.j.mason@imperial.ac.uk.

Introduction. Cluster volcanism in rift settings has been observed on both Earth and Venus, with strong analogues between Venusian rift–dominated rises (e.g. Atla Regio) and continental rifts on Earth (e.g. Afar) [1]. Earth–based methodologies can subsequently be applied on Venus, with scope for interplanetary comparison on field structure, controls and genesis [2]. In this study, Earth–based geospatial methods were applied to deduce the structure, evolution and genesis of rift–associated shield clusters, with comparisons drawn to Earth analogues to make inferences about the Venusian subsurface [3,4].

Study Area. An area south of the Atla Regio triple junction has been selected for mapping since it is the locus of multiple shield clusters of bimodal ages, three rift axes, and the only concentration of anemone volcanoes on Venus [1]. Shield clusters therein have been analysed, with specific attention given to the three youngest shield fields, to decipher the tectonic environments they were emplaced in, and whether they are candidates for recent volcanism.

Methods. The spatial distribution of vents in a volcanic field provides unique insights into subsurface stress, plumbing systems and magmatic flux, all of which can be inferred on a range of scales from vent elongation, vent alignment and volcano alignment [2,5]. Alignment mapping was conducted at intercluster, cluster, and intracluster scales. In the latter case, visual methods were employed to map the elongation axes and feature chains for volcanic edifices and pit craters, while cluster–scale trends were interpreted using field shape and volcanic chains >100km in length. Alignments were subsequently correlated to fault sets and a stratigraphy was established with respect to anemone volcanoes, which were found to occur in a temporally restricted window earlier in cluster sequences.

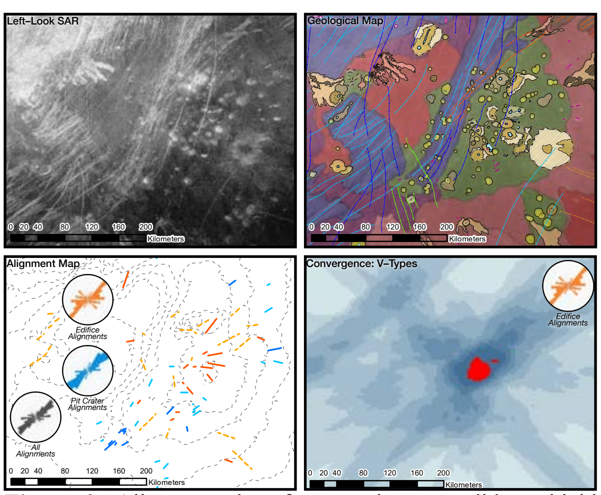

Figure 2: Alignment data from a plume–candidate shield field. Differential stress fields deform radial alignments consistent with plume–generated updoming.

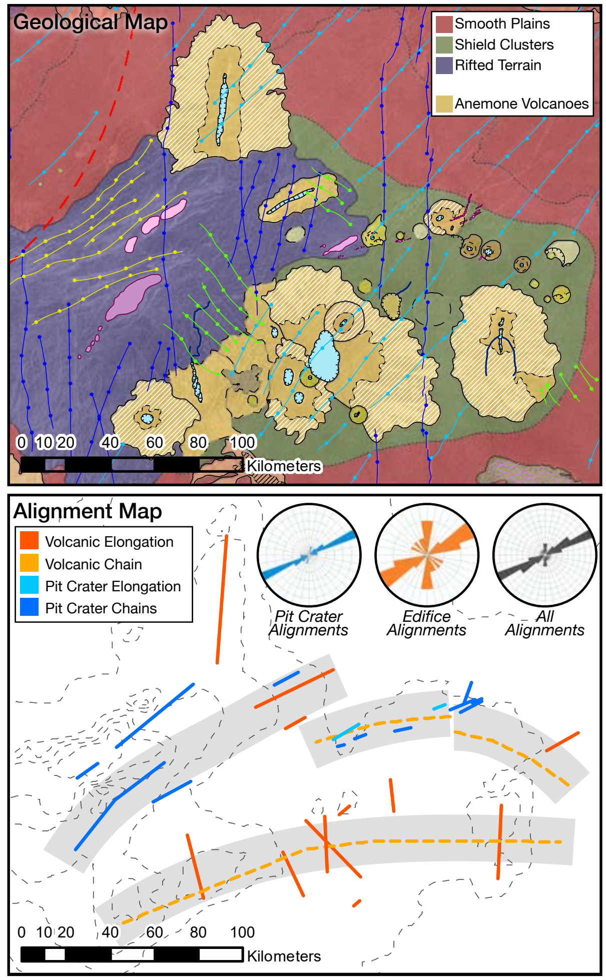

Figure 1: Top: Geological map of a young shield field associated with the SW rift arm of Atla Regio. Bottom: Corresponding volcano and pit crater alignments, with major trends in grey.

Results. Analysis reveals scale–dependent controls on cluster formation, with competition between rift kinematics, magmatic flux and plume activity. East-west cluster–scale trends reflect weaknesses in the lower crust and are orthogonal to the elongation axes of volcanoes within, suggesting a decoupled crustal stress regime. Intracluster alignments are strongly controlled by brittle upper–crustal stress fields and correspond to cogenetic fault sets. Additionally, the correlation of volcanic alignments to cluster stratigraphy offers insight into the evolution of stress fields over time;

an NW/SE–N/S–NE/SW progression in σ3 has been derived, and appears consistent across all three fields.

Plume signatures are also present in one field, which evidences updoming diameters of 340 km and radial dyking under differential stress. This is consistent with the secondary upwelling model of Senske et al [6] with sources analogous to mini–plumes on Earth [7]. Similar origins may be consistent across associated shield clusters where plume signatures are not present, despite morphological similarities. Here, rift associated tectonism may enact stronger controls on upper–crustal dyking pathways than plume activity. In addition, shield fields evidence waning activity consistent with the plume freezing model of Head and Wilson [4]. Therefore, while small–scale activity may continue to the present from residual magmatic systems, clusters in this study are not considered candidates for recent volcanism.

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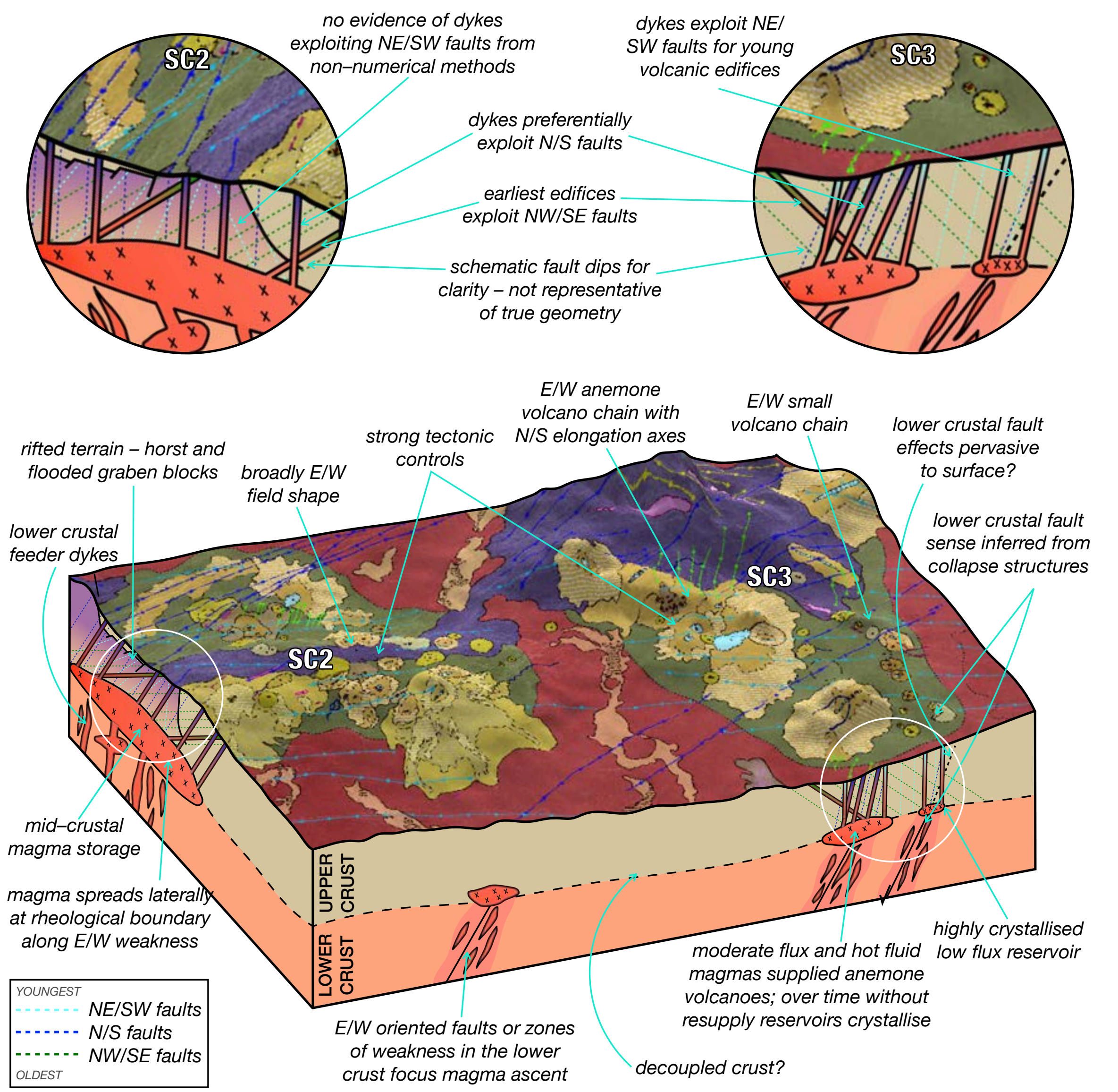

Figure 3: Conceptual model on the tectonic evolution of shield fields. The integration of stratigraphic observations with alignment mapping methods allowed inferences to be made on crustal stress evolution. Here, field shapes are governed by lower crustal weaknesses while intracluster alignments reflect rift–associated stress fields in the upper crust.