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Dyke swarm history of northeastern margin of Central Ovda Regio, Venus: Detailed mapping and Geological History.

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On Venus, the stratigraphically oldest geological units, known as tesserae, cover approximately 8% of the planet's surface. These terrains are tectonically complex, characterized by high radar backscatter and multiple intersecting structural elements, including wrinkle ridges, grabens, fractures, and folds. Tesserae commonly form elevated crustal plateaus, suggesting a distinctive geodynamic history relative to surrounding plains.

This study focuses on the largest of these plateaus, Ovda Regio, specifically the northeastern portion of its central region, which spans approximately 800,000 km².

Ovda Regio represents a large tessera terrain with intra-tesserae basins, fracture (shear) zones and fold belts. Using full-resolution Magellan SAR imagery of NE Central Ovda, we mapped and interpreted widespread sets of extensional features (grabens, fissures and fractures) at a scale of 1:500,000.

In NE Central Ovda Regio, the mapped 33,830 extensional lineaments comprise 26 distinct sets: 10 radiating, 12 circumferential, and 4 linear systems. Radiating and circumferential swarms are spatially associated with 22 inferred magmatic centres. Their distribution is concentrated along broad, elongate topographic depressions, which we interpret as failed rift arms of triple-junction rifting event.

Cross-cutting relationships among dyke swarms and rift zones support the following sequence: (1) emplacement of a ~300 km-radius mantle plume; (2) radiating dyke set during domal uplift; (3) development of triple-junction rifting; (4) flooding of central and rifted regions by radar-dark material, interpreted as lava flows or possible sedimentary accumulations; (5) establishment of a secondary magmatic centre ~300 km south, reflecting renewed plume activity and lithospheric or plume migration; and (6) emplacement of younger radiating and circumferential graben systems aligned with rift arms. Their localization suggests plume melting focused by crustal thinning within pre-existing rift zones.

These observations support plume-driven tectonomagmatic reactivation of tesserae during Venus' late geological evolution.