EMPLACEMENT OF THE HENWEN FLOW FIELD, VENUS. J. Lee[1], R. E. Ernst[1,2], C. Samson[1,3] and B. Cousens[1], [1]Dept. of Earth Sciences, Carleton University, Ottawa, ON, Canada; jenniferlee4@cmail.carleton.ca, [2]Faculty of Geology and Geography, Tomsk State University, Tomsk, Russia. [3]Dept. of Construction Engineering, École de technologie supérieure, Montréal, QC, Canada.

Introduction: The Henwen flow field ('fluctus') is a ~219 000 km^2 region of lava flows (central coordinates: 20.5°S, 179.9°E) in the Diana Chasma (V-37) and Stanton (V-38) quadrangles, south of a segment of the Dali Chasma rift zone. It contains lava flows of varying morphologies, expressed as dark-to-bright backscatter on radar images, with individual flow lengths reaching up to 750 km [1,2]. The flows resemble terrestrial basalt flows (e.g. Columbia River Basalts (CRB) and Hawaiian basaltic flows); more evolved compositions may also be present.

Our study aims to analyze the factors controlling lava flow features and reconstruct the emplacement history of the Henwen flow field through detailed mapping of spatio-temporal variations in flow styles, internal and external lava flow structures (e.g. channels, levees and deltas) and other features influencing variations in flow surface-roughness properties. Identification of possible source vents also plays a key role in understanding the overall flow field emplacement history. The flow patterns can also be a useful indication of the region's paleotopography.

Surface properties of lava flow units: Spatial correlations between overlapping lava flows and associated fracture systems are useful in establishing a relative chronology in sub-regions of the flow field. Due to Venus' lack of erosional processes, variations in surface roughness are unlikely to represent progressive degradation of the original state of the flows. Inspection into lobe margin geometry and surface texture variations provides insights to the emplacement history of flow units.

Using the highest resolution Magellan synthetic aperture radar (SAR) images (75 m/pixel), we are able to observe the morphology of the flow units which can be classified as a great lava flow field (>50 000 km^2) with a radar-bright sub-parallel (digitate) and radar-dark sheet morphology [1,2]. Great lava flow fields are most commonly produced in zones of lithospheric extension and thinning [1], consistent with the inferred rift tectonic setting of this study area [3].

Radar-bright flows have relatively rougher surface textures than their radar-dark counterparts. The most extensive radar-bright flows emplaced in the Henwen flow field (Fig. 1A) exhibit a lobate morphology with varying radar-backscatter intensities that tend to increase (reflecting increasing surface roughness) towards the margins of lobes. These flow margins feature many areas of inferred breakout or accidentally-breached lobes, which protruded from the main flow-feeding channels during the advancement of the flow front, indicative of cooling-limited flow emplacement [4]. It is common to observe smoothed or "scalloped" boundaries for these more extensive, earlier emplaced, radar-bright flow units. This texture is thought to be the result of flooding of the margins of the (radar-bright) lobate flows by the younger low-viscosity (radar-dark) flood basalts. The emplacement of these later (radar-dark) flood basalts is commonly associated with lower effusion and longer eruption rates [5], forming a compound flow field with diffuse margins in contact with earlier plains units, and scalloped margins in contact with the radar-bright units (as mentioned above). Within the radar-dark flows there are streaks of increased radar-brightness. These are typically located adjacent to the boundaries with the earlier flows, and are interpreted as localized areas of flow inflation/flow deflation. The elongation of these streaks is consistent with the southward sloping topography.

Tectonic setting and emplacement history: The region's topography has been influenced by an extensive rift system (Dali Chasma) in the north and east and also by a large corona (Atahensik) to the west of Figure 1A [6]. Graben-fissure systems associated with the rifting are considered to have supplied the vast majority of fissure-fed lava for the Henwen flow field. Cross cutting relationships indicate that the multiphasic flow field is broadly synchronous with the evolution of Dali Chasma [6]. Although many of the radar-bright flow units have been buried by subsequent radar-dark lava flows, source vents are inferred to include NE-trending fractures (graben-fissures) and other localized vents within the central flow field. Generally all flow units trend from the north to the south-central region, where the topography becomes flatter. Lava flows erupted in a staggered manner, starting with the radar-bright flow units that reach medial to distal regions of the flow field ~420 km away, while simultaneously producing a major tributary and distributary channel system with levees (Fig. 1B-1). The younger low-viscosity (radar-dark) lavas flooded this channel system (especially in the northern region), and reached the furthest distance away from source vents (up to approximately 750 km). After passing the central region, the radar-dark lava eventually pooled into a topographic low where it is seen to infill local grabens of Flidais Corona (located immediately south of Fig 1A). Lava tubes, which provide thermal insulation, are considered a probable mode of lava transport and could have greatly extended the travel distance of the radar-dark lava flows [7]. As lava supply becomes depleted, radar-bright flow lengths are limited to close proximity to their associated source vents. While temporal relationships of the radar-dark flows are still unconstrained, both radar dark-and-bright flow units (in the northern region) succumb to deformation associated with Dali Chasma evolution.

Between the time of emplacement of the main radar-bright and radar-dark pulses there are two unusual "delta-like" flows (Fig. 1B-2), with textures suggesting lower viscosity magma than the inferred basaltic magmatism elsewhere. The northern delta-like feature is partly overlapped by radar-dark lava which bifurcates into the underlying channels of the delta.

A younger pulse of flooding is associated with some ENE-trending fractures that extend largely across the medial portion of the flow field; these are graben-fissures (inferred to be underlain by dykes) emanating from the eastern region of the flow field. Vents within the graben-fissures produced localized areas of partial-graben flooding, burying a portion of the southern delta-like flow feature (Fig. 1B-3). Later stages of lava emplacement are also observed to originate from a graben-fissure system of the eastern region producing less extensive flows than those sourced from the northern fracture network.

Despite difficulties in identifying mappable subunits within radar-dark units, detailed mapping reveals that the radar-dark flows in the eastern region were emplaced from the east, in contrast to radar-dark flows dominating the northern half of the flow field (fed from the north).

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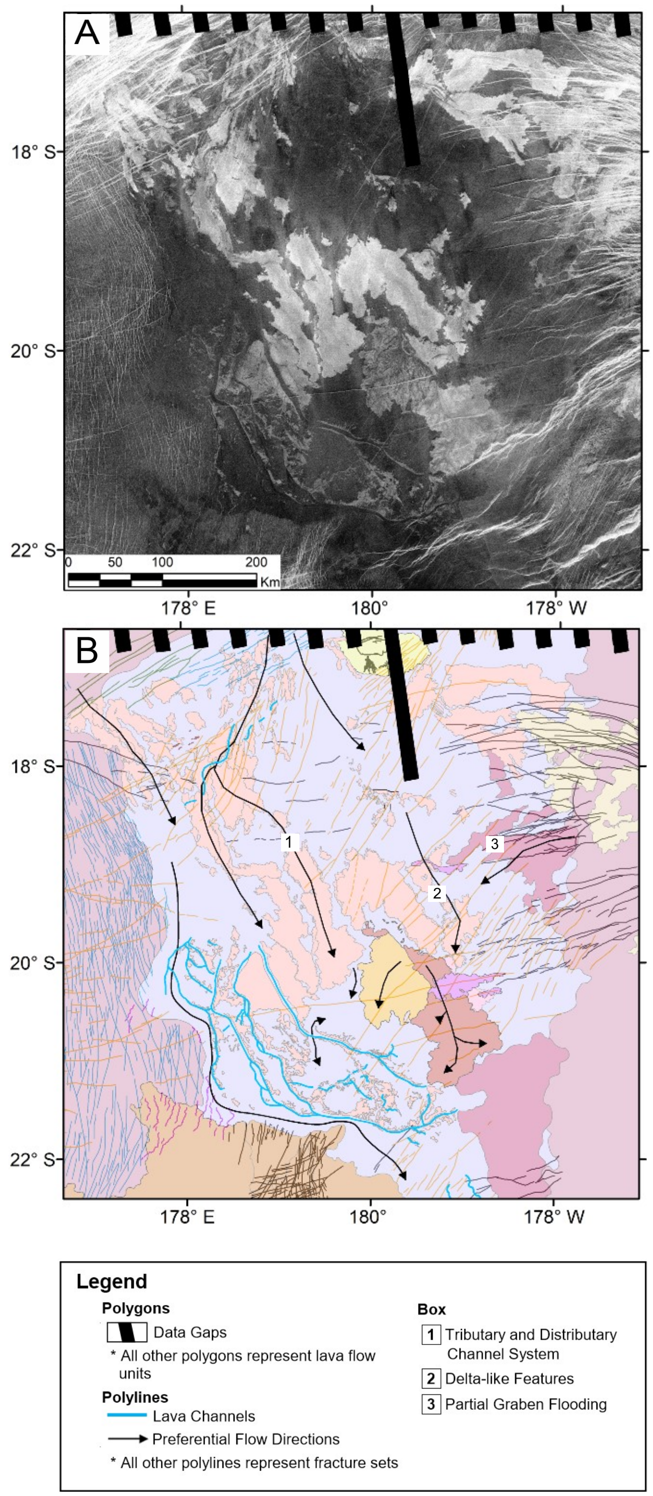

Figure 1: (A) Left-looking Magellan SAR image of the Henwen Fluctus. **(B)** Geologic map of the Henwen Fluctus distinguishing lava flow and tectono-magmatic structures. Numbers indicate locations of features mentioned in text.