A Global Study of Ridge Belt Morphology and Morphometry on Venus. Zachary W. Williams[1], Paul K. Byrne[1], and Jeffrey A. Balcerski. [1]Planetary Research Group, North Carolina State University, Raleigh, NC 27695 (zwwillia@ncsu.edu), [2]Ohio Aerospace Institute, Cleveland, OH 44142.

Introduction: Ridge belts are linear, positive-relief systems of shortening structures widely distributed across Venus. Previous studies concluded that ridge belts are surface expressions of spatially concentrated crustal shortening accommodated by thrust faulting and folding, akin to fold and thrust belts on Earth [1–7]. Despite assessment in previous studies [1–6], the morphological characteristics of these globally distributed systems have yet to be fully established. With the recent availability of topographic data at resolutions greater than the Magellan altimetry dataset [8], it is now possible to gain a more comprehensive understanding of the morphological properties of these shortening structures. Here, we aim to acquire detailed morphometric data for a globally distributed set of ridge belts.

Data and Methods: We utilized global Magellan synthetic aperture radar full-resolution radar map (SAR FMAP) 75-meter-per-pixel (m/px) left- and right-look mosaics. For topographic measurements, we used stereo-derived digital elevation models (DEMs) produced by Herrick et al. [7], which offer ~20% global coverage at 1–3 km/px resolution. We conducted a global survey with ArcGIS to identify ridge belts on the basis of morphological descriptions from existing studies [e.g., 1, 4–7, 9]. This survey yielded 398 discrete landforms as potential study structures. We downselected 24 candidates for further analysis that have a well-preserved morphology and are not obviously kinematically associated with neighboring systems. Of these 24 structures, 12 are within the Herrick DEM coverage. Outlines of the selected ridge belts were manually traced and recorded within ArcGIS. We developed a Python routine to automatically record the strike of each landform from the mapped outline and to take width measurements (representing the distance across strike to opposing boundaries of the landform) at regular intervals along the structure, orthogonal to the strike at the point of collection. For those ridges covered by the Herrick DEMs, we extracted cross-sectional profiles at each point where we recorded a width measurement (**Fig. 1a**).

Results and Discussion: Average relief values were determined from the range of the cross-sectional profiles for each of the subset of DEM-covered ridge belts (**Fig. 1b**). For these 12 structures, we found an average relief value of 597 m (with maximum and minimum values of 938 m and 232 m, respectively). Values for strike, width, and location for all 24 structures were extracted from the global SAR FMAP (**Fig. 1a**). The average width of the 24 ridge belts was 81 km, with a maximum width value of 207 km and minimum width value of 9 km. The standard deviation of width ranged from 59 to 4 km, with an average variance of 19 km, for all 24 structures.

Their relatively low relief indicates that these shortening systems may feature thrust faults that penetrate only to shallow depths in the Venus lithosphere. Such a scenario is consistent with yield strength envelopes that suggest a relatively thin brittle lithosphere as a function of the high surface temperature [12]. This possibility can be tested with forward modeling of ridge belt morphology [13].

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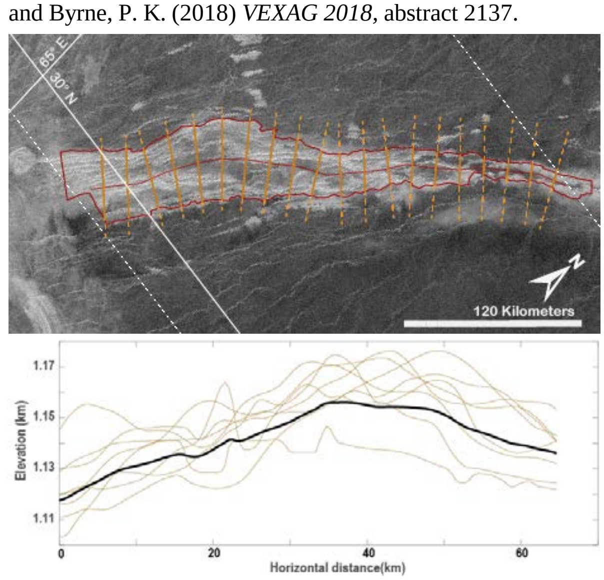

Fig. 1. ***a.*** *Example of mapping and data extraction for a ridge belt centered at 30.8° N, 66.8° E. Width measurements (solid orange lines) and cross-sectional profiles (dashed orange lines) are shown.* ***b.*** *Cross-sectional profile of the ridge. Solid black line is the average of 20 extracted profiles (light grey). Relief is 386 m with a standard deviation of 105 m.*