**GLOBAL DISTRIBUTION OF "UNDEFORMED" CHANNELS ON VENUS: FIRST LOOK AND THOUGHTS.** N.P. Lang[1], and B.J. Thomson[2], [1]Department of Geology, Mercyhurst University, Erie, PA 16546 (nlang@mercyhurst.edu); [2]Department of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN 37996 (bthom@utk.edu).

**Introduction:** One factor that complicates constraining venusian channel formation is the occurrence of post-formation deformation, specifically long-wavelength deformation [e.g., 1-2]. Identifying channels that may be undeformed could provide unique insight into formation conditions for at least some of them [3]. To elaborate, [3] examined the seemingly undeformed and concave-up longitudinal profiles of Tawera Vallis and an unnamed channel and concluded that changing gradients along the channels' lengths led to changes in their morphologic properties (e.g., sinuosity, width, depth). Understanding these relationships between channel gradient and morphology can provide additional constraints on future modeling of channel formation. Extending the work of [3], we have performed a global survey to identify any additional potentially undeformed channels on Venus. Our results provide qualitative insight into the temporal occurrence and possible longevity of venusian channels.

**Approach:** 74 channels (or valles) were analyzed as part of this study. 72 channels were taken from the IAU Gazetteer of Planetary Nomenclature for Venus; two unnamed channels were also examined as part of this work and included the unnamed channel examined by [3] and an additional unnamed channel observed during the survey (Unnamed 2, **Table 1**). Each channel was examined in JMars using Magellan left and right look images (~75 m/pxl) and altimetry data. Reconnaissance mapping was performed for each channel to identify the source and terminus and to place it into a regional context; channels were categorized as "inconclusive" where an origin could not be identified or inferred or if it most of its length occurred in an altimetry data gap; those channels are not listed here. Longitudinal profiles were constructed for each of the remaining channels using Magellan altimetry data in JMars. Profiles were then examined for their overall trend to determine if they are undeformed – an undeformed channel is defined as one where the channel's longitudinal profile exhibits (qualitatively) minimal to no long-wavelength deformation.

**Results:** 15 of the 74 analyzed channels (~20%) exhibit evidence of not being deformed (**Table 1**). Longitudinal profiles are predominantly convex and are mostly simple channels [4] or sinuous rilles; multiple profiles appear to exhibit knickzones. Four of the channels are located along the margins of highland regions while six channels are located in lowlands situated between Aphrodite Terra on the east and Beta, Phoebe, and Thetis regiones on the west (**Figure 1**).

**Discussion:** Not all channels in **Table 1** are completely absent of deformation. Multiple channels and/or their origin have been fractured. Morongo and Kallistos valles exhibit minimal to no deformation along their first half, but their second half exhibits a slope direction opposite that of the first. It is possible warping of the second half of the channel impacted the first half such that it no longer reflects the original profile.

Two channels show evidence of channel migration. At 54.4° S, 170.4° E, Nahid Vallis diverges into two southeast-trending segments where the northern-most segment appears to be incised, but its longitudinal profile shows it to traverse uphill; the second segment to the south is not as clearly defined as the first (possibly incised?) and also appears to traverse uphill. At 55.6° S, 170.2° E the second segment breaks into a third segment that trends southwest; this segment is more subdued in radar images, appears to be constructional, and trends downhill. Based on channel branching, changing flow directions, and degree of incision, it is possible that deformation SE of Nahid Vallis occurred while the channel was active and caused the channel to migrate west. Bayara Vallis at 45.8° N, 16.3° E shows similar evidence for migration. If channels are volcanic in origin, the synchroneity of some channels with deformation suggests channels may be active for long time periods and may therefore not require high eruption rates or rapid formation [e.g., 5].

Although most channels appear to have distinct origins, both Bayara and Unnamed Channel 1 appear to have multiple sources. This is interesting and suggests at least some channels may be fed at different times and/or different compositions or types of material could be involved in their use and formation.

**Concluding remarks:** Given gaps in Magellan altimetry data and an inability to confidently identify the flow directions of some channels, it is possible channels presented here underrepresent the total number of undeformed channels – it is possible other unnamed channels were missed; additionally, channels associated with impact crater outflow ejecta were not included here. Overall, the total number of undeformed channels appears to be small compared to the number of identified channels on Venus. The fact some channels provide evidence of post-emplacement deformation while others do not, however, suggests channel formation is asynchronous and widespread in time.

**References:** [1] Komatsu, G. and Baker, V.R. (1994) Icarus, 110, 2, 275-286. [2] Conrad, J.W. et al. (2021), *52nd LPSC*, Abstract 1636.pdf. [3] Lang, N.P., and Thomson, B.J. (2021), *GSA Abs w/ Programs*, 53, 6, doi: 10.1130/abs/2021AM-365954. [4] Baker, V.R. et al. (1992) *JGR*, 97(E8), 13421-13444. [5] Basilevsky, A.T., and Head, J.W. (1996), *GRL*, 23, 12, 1497-1500.

**Table 1:** Channels found to be undeformed on Venus (n = 15 out of 74 analyzed channels)

| Channel | Origin[1] | Length (km) | Incised?[2] | Profile shape[3] | Comments |
|---|---|---|---|---|---|
| Alajen | 3.8° S, 335.6° E | 203 | Y/N | Convex | Simple channel |
| Albys | 39.1° S, 29.2° E | 240 | Yes | Concave | Rille; becomes braided |
| Aphisuahts | 65.7° S, 13.7° E | 500 | Yes | Convex | Simple channel |
| Banumbirr | 7.2° S, 4.9° E | 400 | Yes | Convex | Extends from long lava flow |
| Bayara | 48.2° N, 21.1° E | 500 | Y/N | Convex | Multiple sources; NW migration of channel? |
| Kallistos | 47.7° S, 19.2° E | 900 | Yes | Concave | Second half is deformed |
| Lo Shen | 11.7° S, 89.7° E | 225 | Yes | Convex | Series of sinuous rilles |
| Lunang | 68° N, 310.8° E | 250 | Yes | Convex | Altimetry gap along middle |
| Morongo | 23° S, 114° E | 700 | Yes | Convex | Second half warped? |
| Nahid | 53.5° S, 170.3° E | 500 | Y/N | Convex | Channel migration to west? |
| Tawera | 10.8° S, 67.4° E | 375 | Yes | Concave | Contains knick zones |
| Utrenitsa | 58.3° N, 277.1° E | 700 | Yes | Convex | Inferred flow direction |
| Vaden-Ema | 15.3° S, 143.2° E | 300 | Yes | Convex | Fractured; origin deformed |
| Unnamed 1 | 22.2° S, 117.5° E | 450 | Y/N | Concave | Multiple sources |
| Unnamed 2 | 46.4° N, 16.1° E | 175 | No | Convex | Located NW of Bayara |

Table footnotes:
1: Location of the start of the channel
2: Does the channel appear to cut into its substrate?; Y/N indicates the channel contains both incised and constructional segments
3: Overall general shape of the longitudinal profile

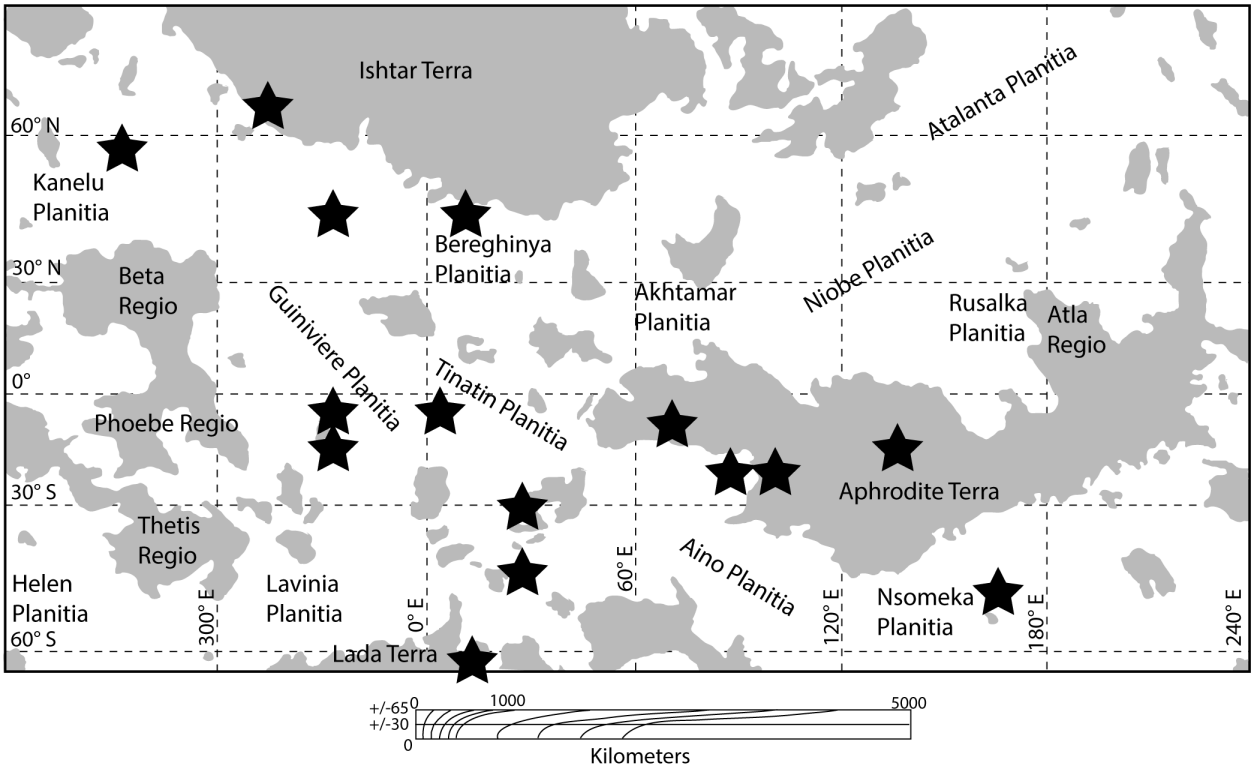


**Figure 1:** Map showing the distribution of undeformed channels (stars) on Venus. Shaded areas represent highlands.