

## **Venusian canali: searching for ‘starts’ and ‘stops’.**

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Since the Magellan Mission in the early 90s showed the presence of canali on Venus, they have remained a geological mystery. Morphologically Venusian canali resemble terrestrial fluvial systems [4], retaining a constant width along unusually long distances [1] and tend to be concentrated on some of the plain regions of Venus [6]. To explain these unique features hypotheses for canali origin include carbonatite and sulphur-rich flows, in addition to komatiite and anhydrous lunar-type basalt [1, 3, 5].

The only known active carbonatite volcano on Earth is Oldoinyo Lengai in northern Tanzania. The carbonatite lavas are rich in Na and have the lowest measured eruptive temperatures of any terrestrial magmas (500-600°C). They also have viscosities, thermal diffusivities, specific heat capacities and latent heats of fusion considerably lower than those of basaltic lavas [2]. The viscosity and temperature of sulphur flows under Venus conditions would resemble terrestrial water and hence could be another possible means of producing canali. Other problems that involve canali are the nature of the flows, i.e. the number of pulses (one or many), the degree of erosion of the substrate, and the present location of lava that formed the canali (spread out at the end, and/or breached from the sides, and/or remained in the channel). To help answer the above questions we examined canali terminations (‘starts’ and ‘stops’), their morphology, and their relationships to nearby lava fields. Using Magellan Mission radar images, we mapped nine canali of Rusalka and

Llorona Planitia including the longest, Baltis Vallis, identifying two definite and one possible ‘start’, two definite and two possible ‘stops’ and we also examined two ‘middles’.

The first definite ‘stop’ we examined is located at the northern end of Baltis Vallis. Based on a topographic study along the full length of the canali, this must be the distal (from source) end [1]. This canali can now be tracked for an additional 300 km further than previously mapped, and it stops against the topographic uplift associated with Nijole Mons (Fig.1.). A wrinkle ridge obscures the connection between the previously mapped termination and the newly discovered ‘stop’. The continuation of the canali discovered by our team has also been recognized by E.B. Grosfils during his current mapping of V14. The previously proposed end of Baltis Vallis [6], we consider to be a breached lava flow. It extends for 150 km to the south (covering an area of 1,313 km<sup>2</sup>) and is broader than the normal width of about 3 km for Baltis Vallis.

Another ‘stop’ was determined in a canali from the northwest part of Llorona Planitia, and a ‘stop’ is proposed for the Martuv Vallis; both exhibit a braided pattern which is similar to a terrestrial river delta.

Jutrzenka Vallis, located at the northeast end of Oya Dorsa, meanders through the high topography. A graben-like feature in the southwestern part of this canali could be interpreted as either the ‘start’ or the ‘stop’. Near the northern end of Ikhwezi Vallis [8] we found a previously unknown canali with

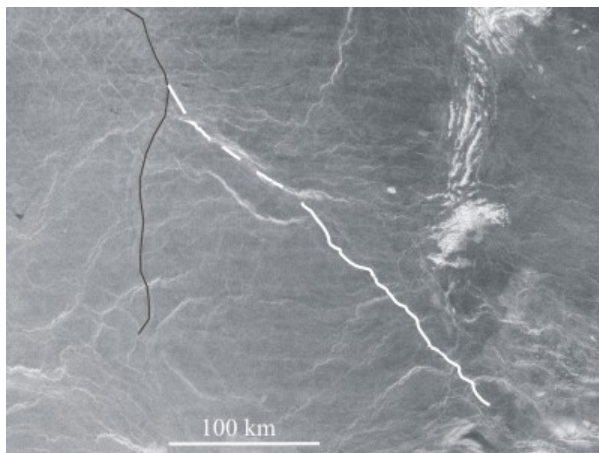
a less distinctive trough. Ikhwezi Vallis appears to terminate at the younger lava field that could represent 'start' or 'stop'. However, a previously unknown canali could be a continuation of Ikhwezi Vallis.

A branch of a canali, located in the southwestern part of Rusalka Planitia, was discovered during our mapping. This branch begins from the northwest at the volcano-dominated topographic high and joins a known canali approximately 24 km from its start. In addition, we discovered a continuation of the northern end of Taipei Valles located in the western part of Rusalka Planitia [8]. A graben-like feature is proposed to be a new 'start' for the canali as it merges into the canali which trends to the southeast. A continuation of the canali appears to be filled by a later stage lava flow.

Two 'middles' of Ikhwezi Vallis were examined. The canali runs through Rusalka Planitia from northwest to southeast, exhibiting meandering, river-like morphology. The first examined 'middle' portion of the canali is located near its southern end, showing bifurcation and merging. The width of the canali changes from 1.5-3 km. The second examined 'middle' is located near the northern part of the Ikhwezi Vallis. This remarkable canali meanders through high topography similar to rivers on Earth. The morphology of the canali's trough has a constant width, 0.9 km to 1.2 km.

Our findings confirm that the canali follow topographic features, can bifurcate, can be braided, and generally have a constant width along their length. Sometime canali are filled with lava and in some cases, such as Baltis Vallis, the canali-producing lava escaped by breaching a wall of the channel. We conclude that graben-like features are related to both 'starts' and 'stops' as previously hypothesized [7]. In addition to graben, 'starts' can be associated with volcano-dominated regions and lava fields, and 'stops' are related to topographic highs (tesserae). Some 'stops' exhibit a delta-like feature, explained by decrease in topographic gradient [4] or possibly by multiple pulses. It has been observed that wrinkle ridges, in all cases, are younger geological events.

References: [1] Baker, V.R., Komatsu, G., Gulick, V., and Parker, T., 1997, in: Venus II: Geology, Geophysics, Atmosphere and Solar Wind Environment, 757-793. [2] Bell, K., and Keller, J. (eds), 1995, Carbonatite Volcanism: Oldoinyo Lengai and the Petrogenesis of Natrocarbonatites; 210 p. [3] Gregg, T.K.P., and Greeley, R., 1993, *LPSC XXIII*, 449-450. [4] Jones, A.P., and Pickering, K.T., 2003, *J.Geol. Soc.*, 319-327. [5] Kargel, J.S., Kirk, R.L., Fegley, B., and Treiman, A.H., 1994, *Icarus* 112, 219-252. [6] Komatsu, G., Baker, V.R., Gulick, V.C., and Parker, T.J., 1993, *Icarus* 102, 1-25. [7] Williams-Jones, G., William-Joens, A.E., and Stix, J., 1998, *J.Geophys.Res.* 103, 8545-8555. [8] Young, D.A., and Hansen, V.L., Geological Map of Rusalka Planitia Quadrangle (V-25), Venus, Geological Investigations Series I-2783, USGS, 2003.



**Fig.1.** Radar image of Baltis Vallis. Black line represents the previous end. White line represents a newly discovered end. Dotted line traces the wrinkle ridge.