RECENT VOLCANISM ON VENUS: A POSSIBLE VOLCANIC PLUME DEPOSIT ON NISSABA CORONA, EISTLA REGIO. A. H. Treiman. Lunar and Planetary Institute, 3600 Bay Area Boulevard, Houston TX 77058. <treiman#lpi.usra.edu>

Introduction: The surface of Venus is geologically young, and there is considerable interest in the possibility of recent or active volcanism. Active volcanism is suggested by rapid influxes of SO_2 into the Venus atmosphere [1,2], and possible hot areas on the surface [3,4]. Recent (but inactive) volcanism is consistent with several types of remote sensing data [5-10e]. Similarly, volatile constituents in Venus' lavas are of interest; Venus is incompletely degassed [11,12], suggesting the possibility of pyroclastic eruptions [13-18], and such eruptions seem necessary to loft excess SO_2 into Venus's middle atmosphere [1,2].

Here, I describe a long, radar-dark streak on Venus and evidence that it represents airfall deposits from a pyroclastic (Plinian) eruption in relatively recent times.

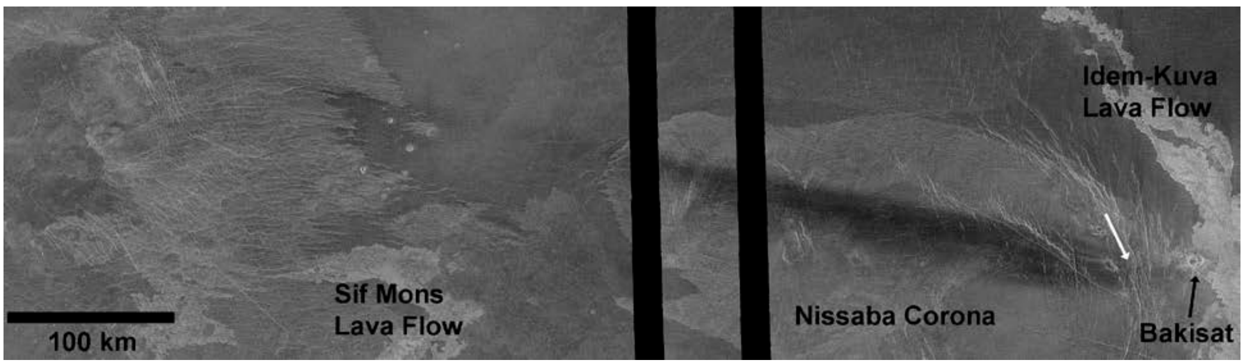

Figure 1. Radar-dark streak headed in Nissaba Corona (Magellan SAR, left-look; cylindrical projection; 24.4-27.4N, 350-357E). Head of streak is near a depression on eastern Nissaba, and tail in the ridged plains to WNW. The double crater Bakisat is to east; note radar-brighter stripe (white arrow) from Bakisat onto the dark streak (Fig. 2).

Geology: On Nissaba Corona (Eistla Regio) is a linear streak of low radar-backscatter, beginning at the eastern edge of Nissaba, and extending WNW for ≥650 km (Fig. 1). Nissaba and the streak are in the Sedna Planitia 1:10M and 1:5M quadrangles (V-19); the latter map is still in preparation. The streak is NE of Sif Mons and NW of Gula Mons. Nissaba and adjacent Idem-Kuva coronae have been mapped [19-23], but with limited discussion.

The radar-dark streak is prominent in Magellan SAR left and stereo images (Fig. 1), and in Aricebo radar [13,21]. It has the lowest radar circular polarization ratio in the area, and very low radar cross-section (0.004) [22]. The streak appears in Magellan emissivity maps as a weakly darker band, and is not apparent in Magellan altimetry. The head of the radar-dark streak is centered on an irregular depression in Nissaba Corona (26.4N, -3.7E), Fig. 2, and is W of the double-crater Bakisat (7.4 km diam.; 26.4N, -3.2E). The two Bakisat craters overlap E-W, have a 'butterfly' of ejecta (symmetrical around a line of ~NNE-SSW) which overlaps a young rough lava flow from the adjacent Idem-Kuva corona. Bakisat shows a faint radar-dark patch extending WSW from the craters, and radar-brighter stripes running W, which appear superimposed on the radar-dark streak and the depression at its head (Fig. 2).

The radar-dark streak is composed of three or more parallel dark 'stripes' (Fig. 1). The southern ones fade out (moving WNW) across Nissaba, and only the northern crosses Nissaba completely. Continuing WNW, the streak is indistinct as it crosses the regional lowland plains, and is apparent again as darker patches among ridges in a 'bright mottled plains' unit [20].

Interpretation: Although this Nissaba dark streak is prominent on radar images of Venus, it has not been studied. In early works, the streak was mapped as a tongue of dark plains material among later flows [21,23]; later it was interpreted as a impact crater ejecta [22].

Impact Plume Deposit? It seems reasonable to interpret the dark streak on Nissaba as impact crater ejecta [22], because its head is near an impact crater (Bakisat) and because similar radar-dark streaks extend westward of other impact craters on Venus [24]. The radar-dark streak of Unitkak crater [25] is similar, in that it is also: ~650 km long, offset from the crater itself, and associated with radar-bright ejecta 'rays'.

However, some data are seemingly inconsistent with Bakisat crater being the source of the dark streak. (1) Bakisat has nearly no radar-dark halo (FH-type of [24]), and such craters typically do not have dark streaks (degradation state 'D' of [26]). (2) Radar-bright stripes emanating from Bakisat are apparently superposed on the dark streak (Fig. 1), suggesting that the crater post-dates the streak. (3) The radar-dark streak is

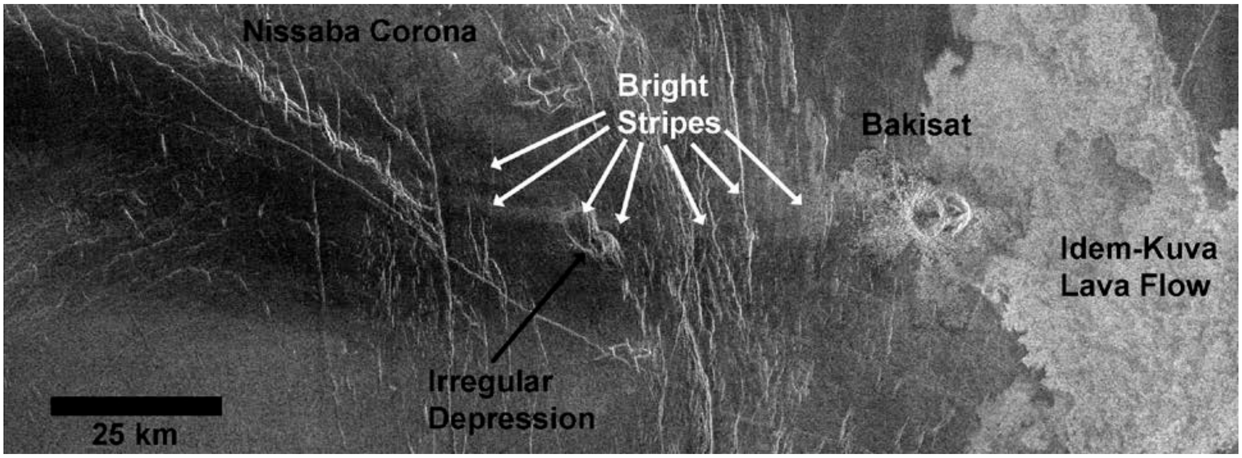

Figure 2. Head area of Nissaba dark streak (Full resolution Magellan SAR, left-look; cylindrical projection; 25.7-26.2N, 355.5-357.2E). Note bright stripes emanating W from Bakisat crater (white arrows), which superpose the dark streak and the irregular depression at its head. A dark patch extends from Bakisat WSW, merging in radar tone with the main dark streak.

strongest ~5 crater-diameters away from Bakisat, which is farther than comparable streaks elsewhere on Venus. (4) The radar-dark streak is quite linear and continuous, and does not show the undulations and discontinuities typical of other crater-deposit streaks, e.g. Unitkak [25], Patimat [27] (ascribable to turbulence in the impact-induced plume).

Volcanic Plume Deposit? On the other hand, the dark streak on Nissaba could represents airfall deposits from a pyroclastic eruption. Nissaba and Idem-Kuva coronae sourced many lava flows, and an irregular depression that could be a caldera [28] is at the apparent focus of the streak (Figs. 1,2). This depression is near the source of mapped lava flows [20]. Under consistent winds, vulcanian- or peléan-style eruptions (like Eyjafjallajökull [29]), or a point-source like a nuclear explosion or plinian eruption can produce linear deposits of ejecta [30].

If the dark streak is a volcanic plume deposit, then the nearby presence of Bakisat crater is merely a coincidence. Although most similar dark streaks on Venus are associated with impact craters (e.g., Unitkak, Patimat), Venus has radar-dark linear streaks without impact craters (e.g.: 2S, 189E; 24.55N, 342E; 19S, 354.5E), which could be interpreted as volcanic.

Conclusions: Although this Nissaba dark streak is prominent on radar images of Venus, it has not been studied in detail and its origin is unclear. If it is from a volcanic plume, i.e. a pyroclastic deposit, it was among the most recent events in the area as it superposes both Nissaba eruptions [20] and regional dark plains (Fig. 1). Radar-bright stripes from Bakisat crater superpose the dark streak, and thus appear younger than it.

However, arguments that the streak is a volcanic deposit are not compelling, and it remains possible that the streak represents merely ejecta from Bakisat [22].

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