SNOWLINE ELEVATIONS AND DISCORDANCE OF ELEVATION & REFLECTANCE ON VENUS'S MAXWELL MONTES. A. Strezoski[1, 2] (astrezoski@alaska.edu) and A. H. Treiman[1] (treiman@lpi.usra.edu), [1]Lunar and Planetary Institute, 3600 Bay Area Blvd, Houston, TX 77058. [2]University of Alaska Anchorage, Department of Geological Sciences, 3211 Providence Dr, Anchorage, AK 99508.

Introduction: Our best knowledge of Venus' surface comes from radar observations by the Magellan spacecraft. One of its oddest finds is that Venus' highest mountains, Maxwell Montes (60–68°N), has much stronger radar returns (i.e., lower radar emissivity) from its highest elevations than its lower slopes, and that the transition in radar properties is sharp (a 'snow line') at ~4.5 km elevation [1-3]. The cause of the snowline has been hotly debated [4-9]. In one hypothesis, a radar-reflective substance (e.g., pyrite) forms by reaction between atmosphere and rock; in another idea, rock surfaces are coated with metallic frosts (e.g, Te, or chalcogenides with Pb, Bi, etc.) that precipitate directly from the atmosphere [4, 6, 8, 10]. Here, we test these hypotheses by studying the spatial arrangement of the changes in radar properties across Maxwell Montes.

Methodology: We used SAR left-look imagery (spatial resolution as great as 75 m per pixel), Fresnel reflectivity, emissivity, and altimetry, from the Magellan spacecraft mission (1990-1994) [11].

Results: We traced out the 'snow line' on the Magellan SAR mosaic, tracking its elevation around Maxwell (Figure 1a), and similarly tracked the elevation of a trace of constant Fresnel reflectivity (~0.35). Both traces show that the elevation of the snow line is not constant; it ranges from ~4.2 km above the datum in the SE, and to ~8km at the NW (Figure 1b). There are local variations to this general trend, the greatest of which are on Maxwell's steep west slope.

Implications: The range of snowline elevations and its variation with latitude are not expected from either standing hypothesis of the 'snow line's' origin. If the snowline represents an isotherm (implicit in both hypothesis [4-7]), then temperatures on northern Maxwell are higher by ~30 K, assuming that the mean lapse rate of ~7.7 K/km is applicable [12]. There is no evidence to support this hypothesis, as the Pioneer Venus north probe (which impacted just south of Maxwell) showed the same lapse rate as other probes. If the 'snow' is an atmospheric precipitate, the higher snow line to the north could represent a sort of 'snow shadow' if the dominant winds are from the SE or S. This wind direction may be consistent with recent general circulation models [13]. If the 'snow' represents atmosphere-rock chemical reaction, the 'snow shadow' concept could also apply, or there could be different rock types across Maxwell.

Similarly, the local variations in snow line elevation could represent outcroppings of different rock types. The local variations could also be artefacts caused by radar interactions with steep slopes, or misregistration of elevation and SAR locations.

None of these hypotheses can be excluded at this point, but all imply that physical/chemical conditions at Venus' surface (at least to the far north) are poorly understood.

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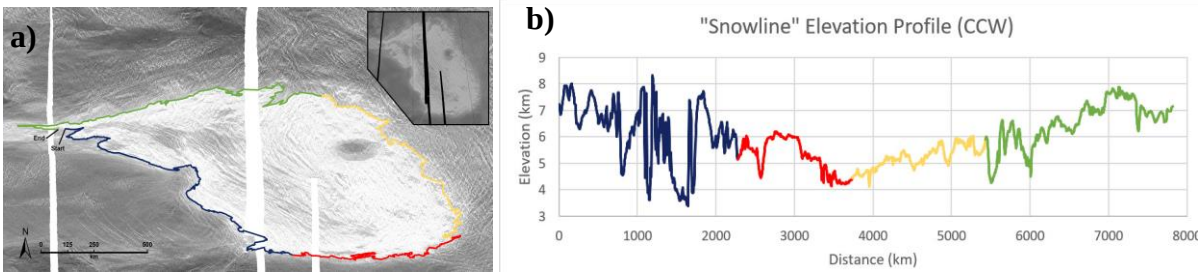

Figure 1. (a) Left-look SAR image of general study area on Maxwell Montes. Blue, red, yellow, and green lines represent individual sections of the snowline edge. Each line segment has a corresponding section in profile graph (b), respectively. North is up. (b) Profile graph of the snowline on Maxwell Montes. Elevation is plotted against distance. *Distances in ArcMap are about twice the actual distance.