COMPARISON OF DATA SETS (TOPOGRAPHY, GEOLOGY, GEOPHYSICS, CRATERING) FOR MARS' WESTERN EQUATORIAL TRANSITION ZONE; Randall D. Forsythe, Dept. Geog. & Earth Sci., UNCC, Charlotte, N.C. 28223; James R. Zimbelman, CEPS/NASM, Smithsonian Institution, Washington, D.C. 20560; and N. G. Barlow, NASA, SN21, Johnson Space Center, Houston, TX 77058.

The equatorial dichotomy boundary zone to the west of Tharsis has a number of anomalous characteristics. Geologically, the area has been variably interpreted to expose: a) ignimbrites(1), b) paleopole deposits(2), or c) an exhumed chemical boundary layer (e.g. a sub-regolith paleowater table(3)). The geomorphology of the the area is controlled by a series of NW trending fault zones, two of which have been interpreted as major left-lateral transcurrent faults (4,5). Crater statistics suggest extensive erosional resurfacing (3,6 and below), and crater densities are anomalous for the areas' elevation. From a geophysical vantage point the area contains the equatorial belt that returned little, if any, radar signal during the 1988 Goldstone synthetic aperture radar imaging experiment (6). The 'stealth' characteristics remains enigmatic.

The combined data sets were gridded into 5x5 degree bins for spatial correlation. Parameters included Mariner-, and Viking-, based topography (8,9), IRTM thermal inertia (10,11), crater densities (12), radar 'stealth' character (13), and the distribution of the structurally controlled "Medusae Fossae Formation"(14,15). Three interesting correlations have emerged. First, when one looks at a difference between Mariner- and Viking-based topography the transition zone from 160 to 190 degrees W. has a large negative difference, ranging from -1 to -2.5 km; (Fig 1a). This area, which overlaps with the E-W oriented belt of 'stealth'(asterisks in fig. 1a), has elevations which were greatly underestimated in the Mariner-based data set. Second, there is a strong spatial correlation of the structurally controlled province (Medusae Fossae Fm.) with the distribution of 'stealth' (Fig. 1b). 74% of the bins of the Medusa Fossae Fm. have a 'stealth' characteristic, and approximately 69% of the 'stealthy' bins have the structurally-controlled surface morphology. The correlation may improve as the radar data is published in a more detailed and comprehensive manner. Lastly, there is also a strong spatial correlation of the prior two parameters with a crater frequency vs elevation ratio. Apart from the centers of volcanism, elevation is positively correlated with age on a planet-wide basis. In this area however, crater diameter vs frequency data show strong evidence for differential erosional resurfacing from both N to S (fig. 2a) as well as from local low to high areas (fig. 2b). Thus the ratio of crater density to elevation can be used here to provide a region index to the likely extent of resurfacing. This interpretation is inappropriate in the Tharsis Montes and Elysium Planitia regions due to younger constructive volcanism.

The spatial correlations between geology, radar character, and the 'resurfacing index' along this segment of the dichotomy boundary is a compelling arguement for a commonality in cause.

MARS' DICHOTOMY BOUNDARY: Forsythe, R. D. & Zimbelman, J. R.

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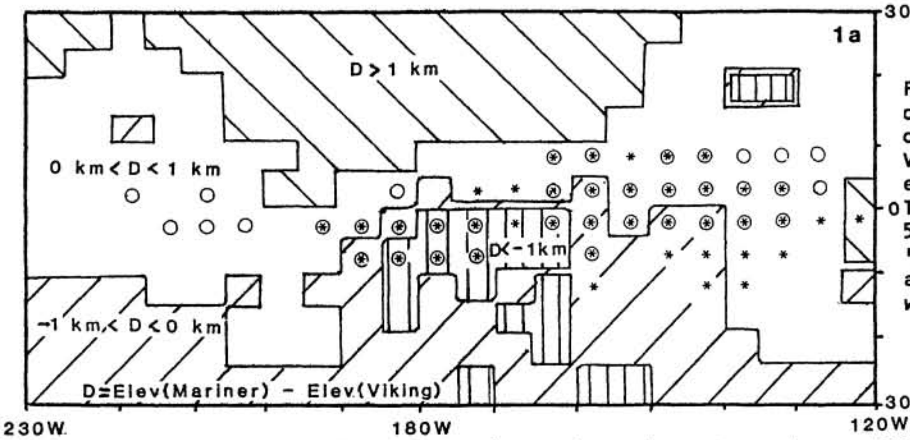

Figure 1a. Map showing the difference of elevations determined from Mariner and Viking data for the equatorial region west of Tharsis. Asterisks are the 5x5 degree bins with radar 'stealth' characteristics, and circles are those bins with Medusae Fossae Fm.

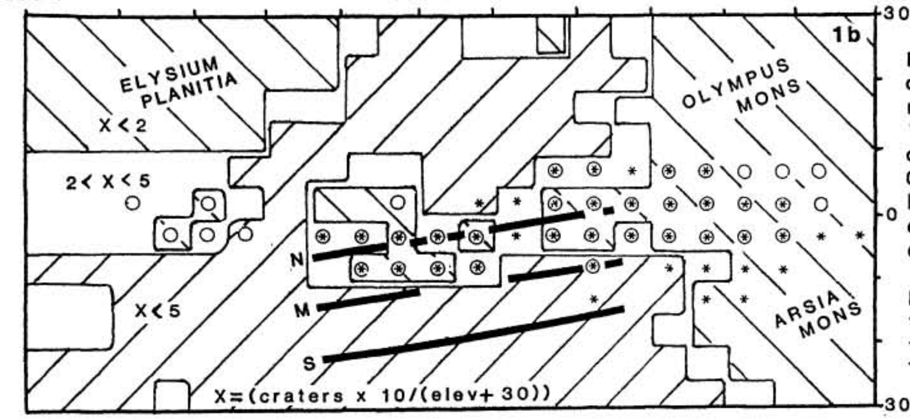

Figure 1b. Map showing the distribution of value ranges determined for a 'resurfacing index' (crater density x 10/(elev. + 30)). Only craters greater than 8 km. used. Asterisks and circles are as in 1a. The correlation of radar 'stealth', Medusae Fossae Fm., and ratio values less than 2 is high away from the volcanic regions of Tharsis and Elysium.

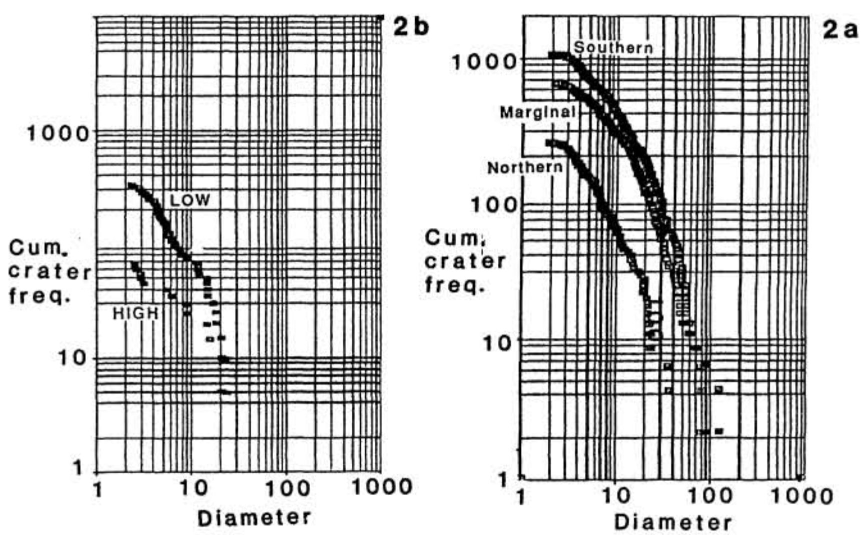

Figure 2a & 2b. Cummulative crater frequency vs diameter plots (normalized to 1 million square km.). 2a. data comes from topographically high and low exposures of Medusae Fossae Fm., and 2b. data from the three belts shown in Fig. 1b. These curves, and other morphologic features, support erosional resurfacing throughout the Medusae Fossae Fm. and fringing Highlands.

Medusae Fossae Fm.: High Elev. (D>3km, A=20,000 sq.km, n=17)
Medusae Fossae Fm.: Low Elev. (D>3km, A=20,000 sq.km, n=54)

(N) Northern: Medusae Fossae Fm. (D>3km, A=45,000, n=114)
(M) Marginal: Fringing Highlands (D>3km, A=45,000, n=250)
(S) Southern: Intrahighlands (D>3km, A=45,000, n=499)